

SECTION 02 3700 - SEDIMENTATION AND EROSION CONTROL

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. The extent of soil erosion and sedimentation control work is shown on the Drawings and by the requirements of this section.
- B. Soil erosion and sedimentation control measures shall include all temporary and permanent means of protection and trapping soils on the construction site during land disturbing activities to include.
 - 1. Construction of temporary site gravel construction entrance
 - 2. Installation, and subsequent removal, of temporary perimeter silt fencing.
 - 3. Removal of temporary inlet protection.
 - 4. Temporary Grassing and maintenance (watering and mowing) of disturbed areas.

1.3 REFERENCES

- A. South Carolina Stormwater Management and Sedimentation Control Handbook for Land Disturbance Activities, by SCDHEC.
- B. South Carolina Department of Highways and Public Transportation, "Standard Specifications for Highway Construction", latest Edition, hereinafter referred to as SCDOT Specifications.

1.4 SUBMITTALS

- A. Product Data: Provide manufacture's technical product data and installation instructions for soil erosion and sedimentation control materials and products.
- B. Schedule of Operations: Submit schedule of proposed operations, including program for erosion control measures, maintenance of control facilities, and vegetative practices. Show anticipated starting and completion dates for land-disturbing activities, including excavation, filling and rough grading, finish grading, construction of temporary and permanent erosion control measures, and disposition of temporary erosion control measures.
- C. Contractor shall sign "Co-Permittee Agreement" and return to Architect/Engineer before beginning any construction activities.

1.5 PROJECT CONDITIONS

- A. Prior to extensive use of the site, the Contractor shall construct the site gravel construction entrance. The intent of the site gravel construction entrance is to provide for minimal transportation of sediments into the public right-of-way.
- B. Construct and maintain temporary erosion control measures until such time as permanent paving, plantings, and grassing of landscape areas is effective in controlling erosion/sediment from the site. Extent of sedimentation/erosion control construction shall be the responsibility of the Contractor, based on actual site conditions at the project.
- C. Protect and monitor adjacent and downstream properties from siltification resulting from erosion of project graded areas.
- D. The Contractor shall comply with all requirements of the approved permits from Lexington County, SCDHEC and SCDOT.

PRODUCTS

1.6 SILT FENCING

- A. General: Provide silt fence specifically manufactured for the application intended and as follows:
- B. Silt Fence Fabric:
 - 1. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work includes but are not limited to the following:
 - a. AMOCO Fabrics and Fibers Co.
 - b. Mirafi Inc.
 - c. Nicolon Corp.
 - d. TNS Advanced Technologies, Inc.
 - 2. Characteristics:
 - a. Type: Woven, polypropylene, geotextile fabric; 30-inch minimum width.
 - b. Apparent Opening Size (AOS): #20 to #40 U.S. Standard Sieve; ASTM D4751.
 - c. Grab Tensile Strength: Minimum 110 lbs.; ASTM D4632.
 - d. Grab Elongation: Maximum 30%; ASTM D4632.
 - e. Bursting Strength: Minimum 275 psi; ASTM D3786.
 - f. Filter Efficiency: Minimum 85%.
 - g. Slurry Flow Rate: Maximum 0.3 gpm/sf; ASTM D4491.
 - h. Permeability: Maximum 20 gpm/sf; ASTM D4491.
- C. Wire Fabric:
 - 1. Support standard strength silt fence fabric with wire fence of the following properties:
 - a. Wires: Minimum 14 gauge.
 - b. Mesh Spacing: Maximum 6-inches.
- D. Posts: Either 1.33-lbs/lf steel, minimum 4-feet in length. Make sure that steel posts have projections to facilitate fastening of the fabric.

1. Space posts for silt fence fabric with wire mesh support at a maximum of 8-feet apart. Support posts should be driven securely into the ground to a minimum of 18-inches.
2. Space posts for silt fence fabric without wire mesh support to a maximum of 6-feet apart. Support posts should be driven securely into the ground to a minimum of 18-inches.

1.7 OTHER MATERIALS

- A. Stone Rip-Rap: Crushed Stone with weight gradation of 20 to 200 lbs. per piece and a median diameter of 8-inches. Meet SCDOT Specifications.
- B. Filter Stone: Stone size in accordance with ASTM D448 size No. 1 {1-1/2 to 3-1/2 inch diameter}. Meet SCDOT Specifications.
- C. Gravel: #57 Stone per SCDOT Specifications.
- D. Filter Fabric: Conform to ASTM E1682 & E1683.

1.8 TEMPORARY GRASSING MATERIALS

- A. Grass Seed:
 1. General: All grass seed shall be free from noxious weeds, grade A recent crop, recleaned and treated with appropriate fungicide at time of mixture. Deliver to site in original sealed containers with dealer's guarantee as to the year grown, percentage of purity, percentage of germination, and the date of the test by which the percentages of purity and germination were determined. All seed sown shall have a date of test within six months of the date of sowing.
- B. Fertilizer:
 1. Regular Type:
 - a. Nitrogen content derived from organic or inorganic sources, bearing manufacturer's statement of analysis.
 - b. Minimum requirements: 12%-nitrogen, 4%-phosphoric acid, and 8%-potash.
 2. Slow Release Type:
 - a. 50% of nitrogen content to be slow-release form, content derived from organic or inorganic sources, bearing manufacturer's statement of analysis.
 - b. Minimum requirements: 10%-nitrogen, 10%-phosphoric acid, and 10%-potash.
 3. Commercial Mixed Type:
 - a. Nitrogen content derived from organic or inorganic sources, bearing manufacturer's statement of analysis.
 - b. Minimum requirements: 10%-nitrogen, 10%-phosphoric acid, and 10%-potash.
- C. Mulch: Clean, seed-free straw of hay, wheat, rye, oats or barley.
- D. Hydromulch: Wood cellulose fiber containing no germination-inhibiting or growth-inhibiting agents. Characteristics shall be as follows:

1. Percent Moisture Content: 9.0% ($\pm 3.0\%$).
2. Percent Organic Matter: 99.2% ($\pm 0.8\%$).
3. Percent Ash Content: 0.8% ($\pm 0.2\%$).
4. pH: 4.8 (± 0.5).
5. Water holding capacity: Minimum 40-oz. water/3.5-oz. fiber.

E. Hydraulically Applied Growth Medium:

1. Minimum Mass / Unit Area: 12 oz/yd² (ASTM D6566).
2. Minimum Thickness: 0.22 in (ASTM D6525).
3. Minimum Wet Bond Strength: 9 lb/ft (ASTM D6818).
4. Minimum Ground Cover: 99% (ASTM D6567).
5. Minimum Water-Holding Capacity: 1700% (ASTM D7367).
6. Material Color: Green.
7. Biodegradability: 100% (ASTM D5338).
8. Functional Longevity: Approximately 18 months (ASTM D5338).
9. Vegetation Establishment: >800% (ASTM D7322).

F. Seeding Recommendations:

1. For Late Winter and Early Spring Seeding:

- a. Seeding mixture: Rye (grain) seed at 220-lbs./acre and Unhulled Bermuda seed at 80-lbs/acre.
 - 1) Omit Bermuda seed when duration of temporary cover is not to extend beyond June.
- b. Soil Amendments: Follow recommendations of soil tests or apply 2,000-lbs/acre ground agricultural limestone and 750-lbs/acre 10-10-10 fertilizer.
- c. Mulch: Apply 4,000-lbs/acre of straw. Anchor straw by tacking with asphalt, netting or a mulch-anchoring tool. A disk with blades set nearly straight can be used as a mulch-anchoring tool.
- d. Maintenance: Re-fertilize if growth is not fully adequate. Re-seed, re-fertilize, and mulch immediately following erosion or other damage.

2. For Summer Seeding:

- a. Seeding mixture: Hulled Bermuda seed at 80-lbs./acre.
- b. Soil Amendments: Follow recommendations of soil tests or apply 2,000-lbs/acre ground agricultural limestone and 750-lbs/acre 10-10-10 fertilizer.
- c. Mulch: Apply 4,000-lbs/acre of straw. Anchor straw by tacking with asphalt, netting or a mulch-anchoring tool. A disk with blades set nearly straight can be used as a mulch-anchoring tool.
- d. Maintenance: Re-fertilize if growth is not fully adequate. Re-seed, re-fertilize, and mulch immediately following erosion or other damage.

3. For Fall Seeding;

- a. Seeding mixture: Rye (grain) seed at 220-lbs/acre.
- b. Soil Amendments: Follow recommendations of soil tests or apply 2,000-lbs/acre ground agricultural limestone and 1,000-lbs/acre 10-10-10 fertilizer.
- c. Mulch: Apply 4,000-lbs/acre of straw. Anchor straw by tacking with asphalt, netting or a mulch-anchoring tool. A disk with blades set nearly straight can be used as a mulch-anchoring tool.

- d. Maintenance: Re-fertilize if growth is not fully adequate. Re-seed, re-fertilize, and mulch immediately following erosion or other damage. Top-dress with 50-lbs/acre of nitrogen in March. If it is necessary to extend temporary coverage beyond June 15, overseed with 80-lbs/acre of Unhulled Bermuda seed in late February or early March. Water as necessary to establish stand of grass. Cut grass as necessary to maintain max 2" height. Do not allow temporary grass to blanket/hamper any permanent grass seed from establishment.

PART 2 - EXECUTION

2.1 GENERAL

- A. All disturbed soil areas, except those to support structures, shall be graded and protected from erosion by grassing or other protection measures. Stormwater conveyance systems shall have sediment barriers installed at all entrances, intersections, changes in direction, discharge points, and other locations as indicated on the drawings.
- B. Schedule grading operations to minimize exposure of graded surfaces prior to installation of permanent construction.
- C. Maintain large graded areas as flat as possible to minimize runoff.

2.2 SEQUENCE OF WORK

- A. The Contractor shall coordinate work with the Construction Manager and shall follow phasing instructions per the Construction Manager.
- B. The intent of the Work of this Section is to provide for the orderly installation of preventative measures to control the migration of sediments and the damage caused by erosion from stormwater events. The Contractor shall be cognizant of the goals to be achieved and shall organize his work to effectively accomplish the goals.

Whenever specified measures, properly constructed and maintained, are not providing the degree of control of sediments and erosion that is deemed satisfactory, the Contractor shall notify the Architect/Engineer and shall propose any additional measures which may be justified.

- C. Inspect all sediment and erosion control devices at least weekly and after each rain event. Repair any damaged portions immediately and remove any new sediment that has entered said device or collection basin. Regrade/regrass any 'washed out' areas. All inspections shall be recorded in the Stormwater Pollution Prevention binder and kept on-site.

2.3 INSTALLATION OF TEMPORARY GRASSING

- A. Verify soil surface is ready to receive temporary grassing. A good seedbed is well-pulverized, loose, and uniform. Where hydro-seeding methods are used, the surface may be left with a more irregular surface or large clods. However, areas must be in mowable condition for performance of required maintenance events.
- B. Apply Temporary Seeding per seeding recommendations listed for the appropriate time of year. Should the initially installed temporary grassing die due to seasonal change, the contractor shall

reseed, at no additional cost, using the previously prescribed seasonal temporary grass type. This process may occur several times throughout the entire construction process. The contractor shall refer to the construction schedule to determine the number of times temporary seeding shall occur prior to the installation of permanent grassing as indicated on the construction documents.

1. Liming: Apply lime according to soil test recommendations. If the pH (acidity) of the soil is not known, an application of ground agricultural limestone at the rate of 1 to 1-1/2 tons/acre on coarse-textures soils and 2 to 3 tons/acre on fine-textured soils is usually sufficient. Apply limestone uniformly and incorporate into the top 4 to 6-inches of soil. Soils with a pH of 6 or higher do not need lime additive.
2. Fertilizer: Base applications rates on soil tests. When these are not possible, apply a 10-10-10 grade fertilizer at 700 to 1,000 lbs/acre. Both fertilizer and lime should be incorporated into the top 4 to 6-inches of soil. If a hydraulic seeder is used, do not mix seed and fertilizer more than 30-minutes before application.
3. Surface Roughening: If recent tillage operations have resulted in a loose surface condition, additional roughening may not be required except to break up large clods. If rainfall causes the surface to become sealed or crusted, loosen soil just prior to seeding by disking, raking, harrowing, or other suitable methods. Groove or furrow slopes steeper than 3-horizontal to 1-vertical (3:1) on the contour before seeding.
4. Evenly apply seed using a cyclone seeder (broadcast), drill, cultipacker seeder, or hydro-seeder. Use seeding rates per recommendations given previously in this section. Broadcast seeding and hydro-seeding are appropriate for steep slopes where equipment cannot be driven. Hand broadcasting is not recommended because of the difficulty of achieving uniform distribution.
 - a. Small grains should be planted not more than 1-inch deep, and grasses and legumes not more than 1/2-inch deep. Broadcast seed must be covered by raking or chain dragging, and then lightly firmed with a roller or cultipacker. Hydro-seeded mixtures should include wood-fiber (cellulose) mulch.
5. Mulching: The use of an appropriate mulch will help ensure grass establishment under normal conditions and is essential to seeding success under harsh site conditions. Harsh site conditions include:
 - a. Seeding in fall for winter cover (wood-fiber mulches are not acceptable for this use).
 - b. Slopes steeper than 3:1.
 - c. Excessively hot or dry weather.
 - d. Adverse soils (shallow, rocky, or high in clay or sand content).
 - e. Areas receiving concentrated flow.
6. If the area to be mulched is subject to concentrated water flow, as in a channel, anchor mulch with netting.
7. Shall supply sufficient water (1.5" per week, typ.), at no additional cost to the owner, to establish required coverage.
8. Shall Maintain: Regrade (rake) and reseed & mulch areas where seedling emergence is poor, or where erosion occurs, within 7 days. Mow as necessary to maintain 3' maximum height. Protect from traffic as much as possible. Continue maintenance process for each seeding re-installation due to seasonal change.

2.4 INSTALLATION OF SEDIMENT BARRIERS

A. Silt Fencing for Sheet Flow Applications:

1. Install the silt fencing in the locations indicated on the Drawings. Adjust fencing as directed by the Architect/Engineer to allow for proper functioning.
2. Silt fencing sections shall be installed along a constant contour elevation as much as practical. Avoid concentration of flows through fencing caused by installation at varying elevations.
3. Follow the manufacturer's instructions for proper installation procedures of overlapping sections, as well as depth of bury for posts.
4. Install per the following general directions:
 - a. Excavate a 6-inch deep, 8-inch wide trench on the upstream side of the desired fence line location along the entire length of the proposed barrier.
 - b. Unroll the silt fence fabric material (or pre-assembled assembly) and attach to posts, position the posts behind the trench (downhill side), and hammer the posts at least 18-inches in the ground.
 - c. Ensure that the height of the silt fence does not exceed 36-inches above the ground surface. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)
 - d. Lay a minimum 6-inches of the bottom portion of the silt fencing fabric into the bottom of the trench to prevent undermining by stormwater runoff.
 - e. Backfill the trench with stone and compact. Compaction is necessary to prevent runoff from eroding the backfill.
 - f. Inspect and repair or replace damaged silt fencing promptly. Remove silt fencing when the uphill sloped areas have been permanently stabilized.

B. Gravel Check Dams for Channel Flow Applications:

1. Shall install gravel check dams per the Construction Details on the Drawings and as follows:
 - a. Place the stone to the lines and dimensions shown in the Drawings, on a filter fabric foundation.
 - b. Keep the center stone section at least 9-inches below natural grade level where the dam abuts the channel banks.
 - c. Extend stone at least 1-1/2 feet beyond the ditch banks to keep overflow water from undercutting the dam as it re-enters the channel.
 - d. Set spacing for the dam to assure that the elevation at the top of the lower dam is the same as the toe elevation of the upper dam.
 - e. Protect the channel downstream from the lowest check dam, considering that water will flow over and around the dam.
 - f. Make sure that the channel reach above the most upstream check dam is stable.
 - g. Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blocking from displaced stones.
 - h. Inspect check dams and channels for damage after each rain event.
 - i. Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the check dam. Shall correct all damage immediately. If significant erosion occurs between check dams, install a protective rip-rap liner in that portion of the channel.
 - j. Remove sediment accumulated behind check dams as needed to prevent damage to channel vegetation, allow the channel to drain through the check dam, and prevent large flows from carrying sediment over the check dam. Add stone to dams as needed to maintain design height and cross section. Should dam become 'choked' with sediment, remove and replace sections as necessary to promote designed flow rates.

- k. Spray herbicide to control any weed growth adjacent to and on intrusion onto check dams.
 - l. Protect dam from sediment buildup or infiltration which impedes flow through. Clean/replace gravel as necessary to maintain this flow and proper functioning of system.
- C. Silt Fence Inlet Sediment Barriers:
 - 1. Install per the Construction Details on the Drawings.
 - 2. Provide herbicide weed control adjacent to silt fence and other sediment barriers. Do not allow unsightly appearance of uncontrolled weed growth during construction.

2.5 STORM DRAINAGE SYSTEM

- A. Construct storm drainage system as expediently as possible as a permanent erosion control measure. Surface water may be directed into complete portions of drainage system as soon as practicable.
- B. Maintain temporary sediment barriers around drainage structures until all areas have been permanently stabilized, to prevent washing of sediment into storm drainage system or off site.
- C. Flush drainage lines between drainage structures as required during construction and after establishment of permanent erosion control measures to remove collected debris. Do not allow sediment to buildup in or around any structures. Remove buildup, etc. immediately to allow for proper functioning of system.

2.6 GROUND COVER

- A. Protect exposed soils having a slope of 3:1 or greater with ground cover, except as otherwise specified herein.
- B. Ground cover may consist of any effective erosion prevention treatment such as straw mulch, stone base, plastic sheeting, hydro-seeding, or installation of temporary or permanent grassing or plantings, as indicated on the drawings.
- C. All grassing and planting operations shall include mulching as stabilization, reseeding, watering and mowing until ground cover planting is effective.
- D. Prior to grassing operations, areas must be free of existing groundcover.

2.7 REMOVAL OF TEMPORARY EROSION CONTROL DEVICES

- A. As soon as permanent erosion control devices are established, and SCDHEC (NOT) approval has been received, the Contractor shall remove temporary devices, including, sediment barriers and other devices. This shall include redistributing collected amounts of silt over the project site.
- B. Remove all debris, silt fence, gravel, etc. resulting from temporary erosion control from the project site.

- C. Check and clean adjacent existing drainage structures of material introduced during construction, pull grates and manhole lids to confirm. Confirm all existing systems are free flowing and functioning as designed.

2.8 POLLUTION PREVENTION

- A. The Contractor shall conduct all operations and shall instruct his Sub-Contractors, if any, to conduct their operations in a safe and pollution free manner.
- B. The Contractor shall establish dedicated areas for the parking and servicing of all vehicles. Any petroleum products that are deposited on the ground, for any reason, shall be promptly excavated along with any contaminated soils and disposed of at a permitted disposal site.
- C. No containers, bags, cans, rubbish, litter or other debris of any sort will be allowed to remain on the site. Any debris resulting from the Contractor's operations, shall be removed daily and disposed of off-site.
- D. Concrete washout shall occur only in SCDHEC approved/controlled areas and cleaned out at regular intervals.
- E. Laydown yards shall be organized, secured and neatly maintained providing control of access. Establish and maintain pollution control within said laydown yards. Do not allow adjacent areas to deteriorate in regards to erosion control measures, i.e mowing, weed control or sediment buildup. Continue maintenance on all stormwater and erosion control appurtenances located within and surrounding laydown yard.

END OF SECTION 02 3700

SECTION 31 1000 - SITE CLEARING

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. Section Includes:
 - 1. Protection of existing trees and vegetation to remain.
 - 2. Removal of surface debris.
 - 3. Grubbing.
 - 4. Removal of sod and grassing.
 - 5. Removal of indicated pavements and other above-grade improvements.
 - 6. Removal of indicated below-grade improvements.

1.3 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.4 SUBMITTALS

- A. Record drawings according to Division 1 Specification Sections.
 - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions which will remain.

1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts that are completely familiar with the specified requirements and methods needed for the proper performance of the Work of this Section.
- C. Use equipment adequate in size, capacity and numbers to accomplish the Work in a timely manner.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable regulations relating to environmental requirements, disposal of debris, burning debris on-site, use of herbicides, and Lexington County requirements for sedimentation and erosion control.
- B. Coordinate clearing work with utility companies.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 - 3. Repair any damage to walks, streets, etc incurred due to rerouting during the construction process at no additional cost to the owner.
- B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 1. DO NOT BEGIN TRENCH/PIT EXCAVATION BEFORE CALLING 'PALMETTO UTILITY PROTECTION SERVICE' AT 811 or (888) 721-7877. Call 72-hours before any planned excavation activities. Utilities within Public Properties or Easements will be located by P.U.P.S. Failure to notify P.U.P.S. will result in the Contractor being liable for any repairs to utilities that are damaged.
 - 2. Protect existing improvements and utilities on adjoining properties and on the Owner's property.
 - 3. Restore damaged improvements or utilities to their original conditions, as acceptable to the property owner.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning or roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within the drip line, excess foot or vehicular traffic, or parking of vehicles with the drip line or any acts which may be harmful to the continued growth of the trees to be protected. Provide temporary guards to protect trees and vegetation to be left standing. For the purposes of tree protection, the drip line is defined as 1-1/2 times the diameter of the tree measured 4-feet above existing grade.
 - 1. Water trees and other vegetation to remain within the limits of contract work as required to maintain their health during the course of construction operations.
 - 2. Provide protection for roots over 1-1/2 inches in diameter that are cut during construction operations. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible or cut off cleanly below grade.
 - 3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner acceptable to the Architect/Engineer. Employ a licensed arborist to repair damages to trees and shrubs. All tree work shall be done in accordance with the most recent revision of the International Society of Arboriculture practices.

4. Replace trees that cannot be repaired and restore to full-growth status, as determined by arborist.
 - a. If a tree identified to remain is damaged, remove tree and replace with a tree of the same or similar species, 2-inch caliper or larger, from balled and burlapped nursery stock when construction activities in the vicinity are completed.
- D. Install tree protection barrier where indicated on the plans using metal tee for posts and orange construction fence, spacing posts no less than 8-feet on center. Height to be a minimum of 3-feet above grade.
 1. Place tree protection fencing in a manner to prevent the approach of equipment within the drip line of trees to remain.
- E. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.
- F. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- G. Notify utility locator service for area where Project is located before site clearing. Mark for easy recognition identified objects.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 312000 – Earth Moving.
 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

2.2 ACCESSORIES

- A. Herbicide: Contractor's choice of legal and appropriate chemical formulation for selective weed control for the specific season of year as approved by applicable regulatory agency.
- B. Tree Wound Paint: Bituminous based paint of standard manufacture specifically formulated for tree wounds.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Locate and identify utilities to remain.

- B. Protect and maintain benchmarks and survey control points from disturbance during construction.
- C. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- D. Locate and clearly flag trees and vegetation to remain.
- E. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.
- F. Identify a temporary storage area for placing removed materials.

3.2 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect/Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect/Engineer's written permission.

3.3 CLEARING AND GRUBBING

- A. Remove obstructions, grass, and other vegetation as indicated and to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove surface rock, stumps, roots, obstructions, and debris extending to a depth of 18-inches below exposed subgrade.
 - a. Remove roots 1-1/2 inches or smaller.
 - b. Clear undergrowth and deadwood without disturbing topsoil.
 - c. Apply herbicide to remaining stumps to inhibit growth.
 - 4. Use only hand methods for grubbing within drip line of remaining trees.
 - 5. Remove existing sod and grassing without disturbing topsoil.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding 6-inch loose depth, and compact each layer to a density equal to adjacent original ground.

C. Selective Clearing:

1. Shall be performed in areas designated by Architect/Engineer.
2. Selective clearing shall consist of remove all vegetation, brush, stumps, etc. within the designated area. Grubbing will not be required within these areas. Grub areas, as directed, using by-hand methods only.
3. Selected trees shall be left standing and care shall be taken not to damage remaining trees.

D. Tree Pruning: Where existing trees are to remain, and branches encroach with the areas of new construction, prune individual trees as necessary.

1. Trim trees designated to remain of dead branches of 1-1/2 inches in diameter or greater.
2. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branch.
3. Paint cuts greater than 1-1/4 inches in diameter with approved tree wound paint.

3.4 TOPSOIL STRIPPING

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1-inch in diameter; and free of weeds, roots, and other deleterious materials. If necessary, topsoil requirements shall be met by offsite sources at no additional cost to project.
- B. See Section 312000 – Earth Moving.

3.5 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove portions of slabs, pavements, curbs, gutters, aggregate bases, and other above-grade improvements as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.6 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.
- B. Burning is NOT permitted on the Owner's Property.

END OF SECTION 31 1000

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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. Section Includes:

1. Topsoil stripping, stockpiling, resspreading, and removal.
2. Rough Grading and preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
3. Finish Grading for slabs-on-grade, walks, pavements, lawns, and plantings.
4. Dressing of shoulders and banks.

1.3 Not used.

1.4 REFERENCES

- A. ANSI/ASTM D698 – Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures, using 5.5 lbs. Rammer and 12-inch drop.
- B. ANSI/ASTM D1556 – Test Method for Density of Soil in Place by Sand-Cone Method.
- C. SCDOT – Standard Specifications for Highway Construction, South Carolina Department of Transportation; 2000 Edition.

1.5 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

- F. Excavation: Removal of material encountered above subgrade elevations indicated.
1. Unauthorized Excavations: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be at the Contractor's expense.
 2. Additional Excavations: Excavation below subgrade elevations as directed by the Architect/Engineer.
 - a. When excavations have reached required subgrade elevations, notify the Architect/Engineer and Testing Agency, who will make an inspection of conditions. If the Architect/Engineer and Testing Agency determine that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated materials by the Architect/Engineer and Geotechnical Engineer.
 - b. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 1) Removal of unsuitable material and its replacement, as directed, will be paid on basis of Conditions of Contract relative to changes in Work. Notify the Architect/Engineer prior to removal of any unsuitable materials.
 3. Muck: Materials unsuitable of carrying loads due to high organic content or saturation to the extent that it is somewhat fluid and must be removed by dragline, dredge or other special equipment, are designated as Muck.
 4. Bulk Excavation: Excavations more than 10-feet in width and pits more than 30-feet in either length or width.
- G. Fill: Soil materials used to raise to subgrade elevations indicated.
- H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1-c.y. for bulk excavation or $\frac{3}{4}$ -c.y. for trench and pit 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 Trenches and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbs. and stick-crowd force of not less than 18,700 lbs.; measured according to SAE J-1179.
 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbs. breakout force; measured according to SAE J-732.
- I. Structures: Buildings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

- L. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2-inches in diameter; and free of weeds, roots, and other deleterious materials.
- M. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.6 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curves according to ASTM D698 for each on-site or borrow soil material proposed for fill and backfill.
 - 3. Laboratory compaction curves according to ASTM D1557 for each on-site or borrow soil material proposed for fill and backfill.
- B. Project Record Documents: Accurately record actual locations and make as as-built drawing of all utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.7 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Perform Work in accordance with State of South Carolina Highway Department Standard Specifications.
 - 1. Maintain one copy on site.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- D. Geotechnical Testing and Inspection Service: The Owner will employ and pay for a qualified independent Geotechnical Testing Agency to perform soil testing and inspection services during earthwork operations. The Contractor shall schedule his work in such a manner to permit a reasonable amount of time for testing to be performed before placing succeeding lifts of fill material and shall keep the Testing Agency informed of all progress.
 - 1. The Owner shall pay for the cost of initial testing, subsequent tests, which are required as a result of a test failure, shall be paid for by the Contractor.
- E. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock-definition testing, as documented according to ASTM D3740 and ASTM E548.
- F. Use of Explosives: Use of explosives is NOT permitted on the Owner's property.

- G. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.

1.8 PROJECT CONDITIONS

- A. 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. DO NOT BEGIN ANY TRENCH/PIT EXCAVATION BEFORE CALLING 'PALMETTO UTILITY PROTECTION SERVICE' AT 800 or (888) 721-7877. Call 72-Hours before any planned excavation activities. Utilities within Public Properties and Easements will be located by P.U.P.S. Failure to notify P.U.P.S., will result in the Contractor being liable for any repairs to utilities which are damaged.
 - 2. In the event uncharted, or incorrectly charted, piping or other utilities are encountered during excavation, consult utility owner immediately for directions. Cooperate with the Owner and utility companies in keeping respective services in operations. Repair damaged utilities to the satisfaction of the utility owner.
 - 3. Do not interrupt existing utilities serving facilities occupied by the Owner or others, during occupied hours, except when permitted in writing by the Architect/Engineer and then only after acceptable temporary utilities have been provided.
 - 4. Provide a minimum of 48-hours notice to the Architect/Engineer, and receive written notice to proceed before interrupting any utility.
- B. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
 - 1. Operate warning lights as recommended by authorities having jurisdiction.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 3. 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 conditions for root system and cover exposed roots with moistened burlap.
- C. Dust Control: Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to others working on or near the site.
- D. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.
- E. Protect benchmarks, survey control points, existing structures, fences, sidewalks, pavements, curbs, gutters, and other structures from excavation equipment and vehicular traffic.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Soil materials used as fill, backfill, subgrades for structures or pavements, embankments, or grading shall consist of suitable materials as found available on site until such supply of on-site material is depleted.
 - 1. Provide suitable materials free of organic matter and deleterious substances, containing no rocks or lumps over 6-inches in the largest dimension, and with not more than 15% of rocks or lumps larger than 2-1/2 inches in the greatest dimension.
 - 2. Do not permit rocks having a dimension greater than 1-inch in the upper 6-inches of fill or embankment.
- B. In the event that the quantity of suitable on-site materials is insufficient to complete the Work, suitable borrow materials, as approved by the Architect/Engineer, shall be provided by the Contractor at no additional expense to the Owner.
- C. Satisfactory Soils used to build up for structures and pavements meet the following minimum requirement: have less than 5% organic matter, have a plasticity index (PI) less than 15 and a maximum dry density, determined by laboratory Proctor testing (Standard Proctor, ASTM D698) of at least 85 pounds per cubic foot (pcf). This may include soils from the following ASTM D2487 soil classification groups: SW, SP, SC, and SM-SC, ML and CL (low plasticity). However, not all soils in these groups will comply with the plasticity and fines content requirements. Contractor shall sample each fill material that they proposed to use and submit it to the Geotechnical Engineer for determination of its suitability, and measurement of the maximum dry density, optimum moisture content and natural moisture content.
- D. Unsatisfactory Soils: ASTM D2487 soil classification groups CH, MH, OL, OH or a combination of these group symbols. All highly organic soils will be considered unsuitable.
 - 1. Excess water in soil materials will cause soil to be determined unsuitable regardless of normal classification. Unsatisfactory soils also include satisfactory soils not maintained within 2-percent of optimum moisture content at time of compaction.
 - 2. The acceptability of composite sand-clay, sand-silt, and silt-clay soils will be determined by the Geotechnical Engineer.
- E. Subsoil Materials: Excavated material, graded free of lumps larger than 6-inches and rocks larger than 3-inches and debris.
- F. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2-inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- G. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90-percent passing a 1-1/2-inch sieve and not more than 12-percent passing a No. 200 sieve.
- H. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95-percent passing a 1-1/2-inch sieve and not more than 8-percent passing a No. 200 sieve.
- I. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100-percent passing a 1-inch sieve and not more than 8-percent passing a No. 200 sieve.

- J. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; 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.
- K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100-percent passing a 1- inch sieve and 0 to 5-percent passing a No. 4 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6-inches wide and 4-mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inches wide and 4-mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30-inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sanitary and Storm Sewer systems.
- C. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to SCDOT Standard Specifications Section 804.11 (2000), ASTM D4759, and referenced standard test methods:
 - 1. Grab Tensile Strength: 90 lbs.; ASTM D4632.
 - 2. Tear Strength: 40 lbs.; ASTM D4533.
 - 3. Puncture Resistance: 40 lbs.; ASTM D4833.
 - 4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D4491.
 - 5. Apparent Opening Size: No. 50; ASTM D4751.
 - 6. Acceptable Products (or equal):
 - a. AMOCO Fabrics and Fibers Co.
 - b. Mirafi, Inc.
 - c. Reemay Inc., Typar Geotextile Fabric.
- D. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to SCDOT Standard Specifications Section 804.11 (2000), ASTM D4759, and referenced standard test methods:
 - 1. Grab Tensile Strength: 200 lbs.; ASTM D4632.
 - 2. Tear Strength: 80 lbs.; ASTM D4533.
 - 3. Puncture Resistance: 80 lbs.; ASTM D4833.
 - 4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D4491.
 - 5. Apparent Opening Size: No. 30; ASTM D4751.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that survey benchmarks, existing grades and contours, and intended elevations for the Work are as indicated.
- B. Examine the areas and conditions under which the Work of this Section will be preformed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- C. All site preparation work, topsoil and subsoil excavation, and filling work shall be performed in strict accordance with this specification and in accordance with the subsurface investigation report. The strictest requirements shall apply if discrepancies occur.

3.2 PREPARATION

- A. Verify that grubbing operations are completed before commencing the Work of this Section.
- B. Complete any demolition and/or removal work as may be required prior to grading operations.
- C. Identify required lines, levels, contours, and datum.
- D. Stake and flag locations of known utilities.
- E. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- F. Protect plant life, lawns, and other features remaining as a portion of final landscaping..
- G. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- H. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- I. Establish and maintain the gravel Construction Entrance.
- J. Sampling and Preliminary Testing:
 - 1. Prior to beginning any grading operations, the Contractor shall submit to the Architect/Engineer a proposed sequence of excavation operations.
 - 2. Based upon the sequence of excavations, samples of the anticipated fill materials will be obtained as excavations proceed and tested for grain size, permeability, and moisture-density relationships using the Standard Proctor Method (ASTM D698, Method A).
 - 3. Allow sufficient time for completion of laboratory tests of the soils being tested before beginning any fill operations with the soil in question.

3.3 DEWATERING

- A. Prevent surface water and subsurface or groundwater 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.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.4 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.5 GENERAL EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Suitable excavation material shall be transported to and placed in fill areas within the limits of the Work.
- C. Unsuitable materials encountered under the building pad must be excavated to the extent as directed by the Architect/Engineer and replaced with suitable materials from on-site or off-site borrow excavations.
- D. Unsuitable materials encountered in areas to be paved shall be excavated to a minimum of 2-feet below finish grade and replaced with suitable materials from on-site or off-site borrow excavations.
- E. Unsuitable and surplus excavation materials, not required for subsequent fill or backfill, shall be disposed of off-site.

3.6 STABILITY OF EXCAVATIONS

- A. General: Comply with all local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope side 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 materials excavated. Maintain sides and slopes of excavations in safe condition until completion of backfill.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross bracing, in good serviceable condition. Maintain shoring and bracing in excavations during the entire time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.7 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials and stockpile for latter use.
 - 1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable materials.
 - 2. Where existing trees are indicated to remain, leave existing topsoil in-place within the drip line to prevent damage to root systems.
- B. Stockpile in areas designated on site.
- C. Do not remove topsoil when wet.
- D. Stockpile topsoil to height not to exceed 8-feet. Cover to protect from erosion.
- E. Do not allow topsoil to be mixed with subsoils.

3.8 SOIL EXCAVATION (CUTS)

- A. Perform excavating of every type or material encountered, within the limits of the Work, to the lines, grades, and elevations indicated and specified.
- B. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- C. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- D. When excavating through roots, perform work by hand and cut roots with a sharp axe.
- E. Benching Slopes: Horizontally bench existing slopes greater than 4:1 (4-horizontal to 1-vertical) to key fill material to slope for firm bearing.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- G. Rock Excavation:
 - 1. Notify the Architect/Engineer upon encountering rock or similar materials that cannot be removed or excavated by conventional earth moving or ripping equipment.
 - 2. Do not use explosives on the Owner's Property without written permission from the Architect/Engineer.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile 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.

- B. Stockpile excavated materials acceptable for backfill and fill where directed.
- C. Stockpile excavated topsoil to be reused on-site; remove remainder from site.
- D. Stockpile excavated subsoil, not placed directly into fill areas and to be reused at a later time, on-site; remove remainder from site.

3.10 BACKFILL AND FILL

- A. Use fills consisting of suitable materials placed in loose lifts of 8 to 10-inches and rolled and/or vibrated with suitable equipment until compacted (limited to 4-inches if using small, hand-operated equipment).
- B. Do not place materials containing rocks or clumps that will pass through a 6-inch diameter ring within the top 12-inches of the surface of the completed fill. Do not place materials containing rocks that will not pass through a 1-inch ring within the top 6-inches of the completed fill.
- C. Fill materials containing broken concrete or broken asphaltic pavements will not be acceptable.
- D. General: Place and compact 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 grass and planted areas; use satisfactory excavated or borrow soil material.
 - 2. Under walks and pavements; use satisfactory excavated or borrow soil material and appropriate subbase material.
 - 3. Under steps and ramps; use satisfactory excavated or borrow soil material and appropriate subbase material.
 - 4. Under building slabs; use satisfactory excavated or borrow soil material and appropriate granular drainage fill subbase material.
 - 5. Under footings and foundations; use satisfactory excavated or borrow soil material.

3.11 PLACEMENT AND COMPACTION

- A. Fill area to contours and elevations with unfrozen, dry materials.
- 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 4-horizontal to 1-vertical (4:1) such that fill materials will bond with existing surface.
- C. When existing ground surface has a density less than that specified under "Compaction" for a particular area classification, break up ground surface, pulverize, moisture-condition to within 3-percent of optimum moisture content, and compact to required depth and percentage of maximum density.

- D. Place backfill and fill materials in layers not more than 8-inches loose depth or material to be compacted by heavy compaction equipment, and not more than 4-inches loose depth for material to be compacted with hand-operated tampers.
- E. Before compaction, moisten or aerate each layer as necessary to within 2-percent of 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, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately the same elevation in each lift.
- G. Control soil and fill compaction, providing a minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by the Architect/Engineer if soil density tests indicate inadequate compaction.
- H. Percentage of Maximum Density Requirements: Compact soils to not less than the following percentages of maximum density per Standard Proctor.
 - 1. Under structures, building slabs, steps, and pavements; compact top 12-inches of existing subgrade and each subsequent layer of backfill or fill material to 95-percent maximum dry density. Structural fill shall extend at least 10-feet laterally beyond the edge of buildings, foundations and pavements.
 - 2. Under walkways; compact top 6-inches of existing subgrade and each subsequent layer of backfill or fill material to 95-percent maximum dry density.
 - 3. Under lawn or unpaved areas; compact top 6-inches of existing subgrade and each subsequent layer of backfill or fill material to 90-percent maximum dry density.
 - 4. Under existing pavements to be removed and replaced for utility installation; compact top 24-inches of existing subgrade and each subsequent layer of backfill or fill material to 95-percent maximum dry density.
- I. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantities as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - 1. Remove and replace, or scarify and air dry, soil materials that are wet to permit compaction to specified density.
 - 2. Stockpile or spread soil materials that have been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.
- J. Slope grades away from buildings a minimum of 3-inches in 10-feet, unless noted otherwise.
- K. Make grade changes gradual. Blend slopes into level areas.

3.12 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

- B. Remove debris, roots, branches, and stones in excess of 1" inch in size. Remove soil contaminated with petroleum products.
- C. Site Grading Outside Building Lines: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Shape surfaces to receive topsoil to within not more than 0.1-foot.
 - 2. Walks: Shape surface of areas under walks to line, grade, and cross-section to within not more than 0.1-foot.
 - 3. Pavements: Shape surface of areas under pavements to line, grade, and cross-section to within not more than 1/2-inch.
- D. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- E. Compaction: After grading, compact subgrade surfaces to depth and indicated percentage per "Placement and Compaction."
- F. Surface Roughening:
 - 1. Where topsoil is to be placed, scarify surface to depth of 4-inches.
 - 2. In areas where vehicles or equipment have compacted soils, scarify surface to a depth of 6-inches.
 - 3. Cuts, Fills, and Graded Areas that will be Mowed:
 - a. Make slopes to be mowed no steeper than 3-horizontal to 1-vertical (3:1).
 - b. Roughen these areas with shallow grooves by normal tilling, disking, harrowing, or use of cultipacker-seeder. Make the final pass of any such tillage implement on the contour.
 - c. Make grooves formed by such implements close together (less than 10-inches and not less than 1-inch deep).
 - d. Excessive roughness is undesirable for areas to be mowed.
 - 4. Roughening with Tracked Machinery:
 - a. Limit roughening with tracked machinery to sandy soils to avoid undue compaction of the soil surface. Tracking is generally not as effective as the other roughening methods described.
 - b. Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during final grading operations.

3.13 FINISH GRADING

- A. General: Finish grading consists of preparation of all disturbed areas outside of structures, paving and other surfaces for the establishment of lawn areas.
- B. Before Finish Grading:
 - 1. Verify building and trench backfilling has been inspected.
 - 2. Verify subgrade has been contoured and compacted.

- C. Degree of finish shall be that ordinarily obtainable from a blade-grader, supplemented with hand raking and finishing.
- D. Loosen subgrade of lawn areas to minimum depth of 4-inches. Remove stones measuring over 1" inch in any dimension. Remove sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas that will be planted promptly after preparation.
- E. Spread topsoil to minimum depth required to meet lines, grades, and elevations shown, after light rolling and natural settlement.
- F. Place topsoil in areas where seeding, sodding, planting, and other landscaped areas are indicated.
- G. Place topsoil to the following compacted thickness:
 - 1. Areas to be Seeded with Grass: 6-inches or as otherwise noted on plans.
 - 2. Areas to be Sodded with Grass: 4-inches or as otherwise noted on plans.
- H. Place topsoil during dry weather.
- I. Remove roots, weeds, rocks, and other foreign material while spreading. Remove foreign material from site.
- J. Near existing plants, buildings and other features spread topsoil manually to prevent damage.
- K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contours of subgrade.

3.14 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.1-foot from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 1/2-inch from required elevation.

3.15 SUBBASE AND BASE COURSES

- A. General: Subbase courses consist of placing subbase material, in layers of specified thicknesses, over subgrade surfaces to support a pavement base course.
 - 1. Base courses, subbase courses, and drainage base courses are specified in Section 32 11 23 - Aggregate Base Courses.
- B. Excavation for Pavements: Cut surface under pavement to comply with cross-section, elevations, and grades as indicated.
- C. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- D. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12-inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.
- B. Allow Testing Agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Testing Agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2922, and ASTM D2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three (3) tests.
- D. 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 to depth required; recompact and retest until specified compaction is obtained.
- E. Proofrolling: The Contractor shall proofroll subgrade areas that will receive paving, structures on fill or impervious lining material.
 - 1. Make at least three (3) passes with a 25 to 50-ton rubber tired vehicle over the entire area.
 - 2. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory materials and compacted as specified.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by the Architect/Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. This shall include 'late' installation of electrical, telephone or fiber lines.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 2000

SECTION 32 1123 - AGGREGATE BASE COURSE

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. Section Includes:
 - 1. Aggregate Base Course under Pavements.

1.3 REFERENCES

- A. SCDOT – South Carolina State Highway Department Standard Specifications for Highway Construction, latest Edition.
- B. AASHTO M 147 – Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials; 1965 (1996).
- C. AASHTO T 180 – Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10 lbs) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 1997.
- D. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Course Aggregates; 1996a.
- E. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbs/ft³); 1991 (Re-Approved 1998).
- F. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in-Place by the Sand-Cone Method; 1990 (Re-Approved 1996).
- G. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/ft³); 1991 (Re-Approved 1998).
- H. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in-Place by the Rubber Balloon Method; 1994.
- I. ASTM D2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System); 1998.
- J. ASTM D2922 - Standard Test Method for Density and Unit Weight of Soil in-Place by Nuclear Methods (Shallow Depth); 1994.
- K. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.

- L. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 1998.

1.4 DEFINITIONS

- A. Base Course: Layer placed between the subbase course and asphalt paving.
- B. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- D. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- E. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

1.5 SUBMITTALS

- A. See Division 1 Specification Sections for submittal procedures.
- B. See Section 312000 Earth Moving for additional requirements.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D2487 of each proposed type of aggregate material.
 - 2. Laboratory compaction curves according to ASTM D698 for each proposed type of aggregate material.
 - 3. Laboratory compaction curves according to ASTM D1557 for each proposed type of aggregate material.
 - 4. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Materials Sources: Submit name of imported materials sources if import material is required.

1.6 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Perform Work in accordance with State of South Carolina Highway Department Standard Specifications.
 - 1. Maintain one copy on site.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

- D. Geotechnical Testing and Inspection Service: The Owner will employ and pay for a qualified independent Geotechnical Testing Agency to perform soil testing and inspection services during earthwork operations. The Contractor shall schedule his work in such a manner to permit a reasonable amount of time for testing to be performed before placing succeeding lifts of fill material and shall keep the Testing Agency informed of all progress.
 - 1. The Owner shall pay for the cost of initial testing, subsequent tests, which are required as a result of a test failure, shall be paid for by the Contractor.
- E. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock-definition testing, as documented according to ASTM D3740 and ASTM E548.
- F. Use of Explosives: Use of explosives is NOT permitted on the Owner's property.
- G. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.

1.7 PROJECT CONDITIONS

- A. Provide sufficient quantities of aggregate to meet project schedule and requirements. When necessary, store materials on-site in advance of need.
- B. When aggregate materials need to be stored on-site, locate stockpiles as directed by the Architect/Engineer and or Construction Manager.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey benchmarks and intended elevations of Work are as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use locally available materials and gradations which exhibit a satisfactory record of previous installations.
- B. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90-percent passing a 1-1/2-inch sieve and not more than 12-percent passing a No. 200 sieve.
- C. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95-percent passing a 1-1/2-inch sieve and not more than 8-percent passing a No. 200 sieve.

- D. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; 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.
- E. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100-percent passing a 1- inch sieve and 0 to 5-percent passing a No. 4 sieve.
- F. Macadamized Aggregate Base Course for Pavements:
 - 1. In accordance with SCDOT Standard Specifications, Section 305.

2.2 SOURCE QUALITY CONTROL

- A. See Division 1 Specification Sections for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to project site.
- C. Where aggregate materials are specified using ASTM D2487 classification, testing and analysis of samples for compliance will be provided before delivery to project site.
- D. If tests indicate materials do not meet specified requirements, change material and retest.
- E. Provide materials of each type from same source throughout the Work.

2.3 ACCESSORIES

- A. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to SCDOT Standard Specifications Section 804.11 (2000), ASTM D4759, and referenced standard test methods:
 - 1. Grab Tensile Strength: 200 lbs.; ASTM D4632.
 - 2. Tear Strength: 80 lbs.; ASTM D4533.
 - 3. Puncture Resistance: 80 lbs.; ASTM D4833.
 - 4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D4491.
 - 5. Apparent Opening Size: No. 30; ASTM D4751.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

- A. The subgrade shall be brought to the line and grade necessary to accommodate the base and pavement at the required finish grades. All subgrade shall be proof-rolled before base course is placed on the subgrade. Proof-rolling should be performed with a loaded tandem dump truck

(15-cuyd heaped) or as specified in SCDOT Standard Specifications. Test rolling shall be performed parallel to the centerline at speeds between 2 and 5-miles per hour.

- B. The surface of the base course will be inspected by the Architect/Engineer for adequate compaction and surface tolerances. Any ruts or soft yielding spots that may appear in the base course, any areas having inadequate compaction, and any deviations of the surface from the requirements specified for the base course shall be corrected by loosening the affected areas, removing unsatisfactory materials, adding approved materials where required, and by reshaping and re-compacting to line and grade to the specified density requirements.
- C. Compaction of the base course materials shall be performed by conventional means using a 30,000 to 40,000 lbs vibratory roller or other means of obtaining the required compaction.
- D. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- E. Do not place aggregate on soft, muddy, or frozen surfaces.

3.3 INSTALLATION

- A. Spread aggregate base course over prepared subgrade to a total compacted thickness as indicated in the Construction Details, per pavement section type, of the Drawings.
- B. The aggregate shall be spread on the subgrade with a mechanical spreader capable of placing the material to uniform loose depth and without segregation of aggregate, except for areas inaccessible to a mechanical spreader. The aggregate material may be placed by other methods approved by the Architect/Engineer.
- C. Place aggregate base course in the following layer thicknesses and roller compact.
 - 1. If total thickness is 8-inches or less, place aggregate in one (1) layer.
 - 2. If total thickness is greater than 8-inches, place aggregate in two lifts of approximately equal thickness.
- D. No base course material shall be placed on frozen or wet subgrade or base. Hauling equipment shall not be operated on subgrade.
- E. Utilize methods of handing, hauling, and placing aggregate which will minimize segregation and contamination of aggregate materials.
- F. Aggregate which is contaminated with foreign materials to the extent that the base course will not adequately serve its intended use shall be removed and replaced with acceptable materials by the Contractor at no additional cost to the Owner.
- G. Level and contour surfaces to elevations and gradients indicated.
- H. Add small quantities of fine aggregates to coarse aggregates as appropriate to assist in compaction.
- I. Compact placed aggregate materials to achieve compaction as specified in Section 312000 Earth Moving.
- J. Add water to assist in compaction, if necessary. If excess water is apparent, remove aggregate and aerate to reduce moisture.

- K. Use manual tamping equipment in areas inaccessible to roller compaction equipment.
- L. Apply primer coat to finished surfaces under roads and parking areas in conformance with SCDOT Standard Specifications Sections 401.28. See Section 32 12 16 – Asphalt Paving to addition requirements.

3.4 TOLERANCES:

- A. Flatness: Maximum variation of 1/4-inch measured with a 10-foot straight edge.
- B. Scheduled Compacted Thickness: Plus or minus 1/4-inch from required thickness.
- C. Variation from Design Elevation: Plus or minus 1/2-inch from required elevation.

3.5 FIELD QUALITY CONTROL

- A. See Division 1 Specification Sections for general requirements for field inspection and testing.
- B. Testing Agency: The Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.
- C. Allow Testing Agency to inspect and test subgrades. Proceed with aggregate base course placement only after test results for previously completed work comply with requirements.
- D. Testing Agency will test compaction of aggregate base course in place according to ASTM D1556, ASTM D2167, ASTM D2922, and ASTM D2937, as applicable and to the current edition of SCDOT Standard Specifications. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted aggregate base course layer, at least one (1) test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three (3) tests.
- E. Testing Agency will test compaction of aggregate base course in place according to the current edition of SCDOT Standard Specifications. Tests will be performed at the following locations and frequencies:
 - 1. Roadway Areas: At subgrade and at each compacted aggregate base course layer, at least one (1) test for every 3,600 sq. ft. or less of paved area, but in no case fewer than two (2) tests.
- F. If test indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.
- G. Proof roll compacted aggregate base courses at surfaces that will be under slabs-on-grade, pavers, and pavements.

3.6 CLEAN-UP

- A. Remove unused stockpiled materials; leave area in a clean and neat condition. Grade stockpile area to prevent standing water.

END OF SECTION 32 1123

SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 GENERAL

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - 1. Hot-mix Asphalt Concrete Paving.
 - 2. Hot-mix Asphalt Concrete Patching.
 - 3. Hot-mix Asphalt Concrete Paving Overlayment.
 - 4. Pavement-marking Paint.

1.4 REFERENCES

- A. South Carolina State Department of Transportation (SCDOT) Standard Specification for Highway Construction, latest Edition.
- B. AI MS-2 – Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994, Sixth Edition.
- C. AI MS-19 – A Basic Asphalt Emulsion Manual; The Asphalt Institute; Second Edition.
- D. ASTM D946 – Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Re-Approved 1993).

1.5 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.6 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of SCDOT.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 PERFORMANCE REQUIREMENTS

- A. Design thicknesses of pavements, bases, and subbases are shown in the Details of the Construction Drawings.

1.8 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job Mix Formula:
 - 1. Meet SCDOT Standard Specification Sections 401 and 403 for Type C Hot Laid Asphalt Concrete Surface Course.
- C. Job-Mix Designs: Certification, by authorities having jurisdiction and SCDOT, of approval of each job mix proposed for the Work.
- D. Qualification Data: For manufacturer.
- E. Material Test Reports: For each paving material.
- F. Material Certificates: Provide copies of material certificates signed by material producer and Contractor certifying that each material item complies with, or exceeds, specified requirements.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Obtain materials from same source throughout Work.
- C. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated, as documented according to ASTM E 548.
- D. Regulatory Requirements: Comply with Standard Specifications of SCDOT and local authorities having jurisdiction for asphalt paving work.
- E. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of subgrade and preparatory work.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 - a. Apply in conformance with SCDOT Standard Specifications Sections 401.28.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
 - a. Install in conformance with SCDOT Standard Specifications Section 401.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.
- C. Place bituminous mixture only when temperature of mixture is not more than 15 deg F below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use locally available materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20-percent by weight of the total aggregate mass.

- D. Mineral Filler: ASTM D242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP 1.
- B. Asphalt Cement: ASTM D3381 for viscosity-graded material, ASTM D946 for penetration-graded material.
- C. Prime Coat: ASTM D2027, medium-curing cutback asphalt, MC-30 or MC-70.
- D. Prime Coat: Asphalt emulsion prime complying with SCDOT requirements.
- E. Tack Coat: ASTM D977 or AASHTO M 140, emulsified asphalt or ASTM D2397 or AASHTO M 208, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- F. Water: Potable.
- G. Undersealing Asphalt: ASTM D3141 or AASHTO M 238, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D1073 or AASHTO M 29, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Joint Sealant: ASTM D3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.
- E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type II or AASHTO M 248, Type F. Used for public road traffic markings.
 - 1. Colors: White, Yellow, and Blue, as indicated.
 - 2. Color of paint is white unless indicated otherwise.
 - 3. All handicapped pavement markings shall be blue.
- F. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes. Used for parking lot and non-public road traffic markings.
 - 1. Colors: White, Yellow, and Blue as indicated.
 - 2. Color of paint is white unless indicated otherwise.
 - 3. All handicapped pavement markings shall be blue.
- G. Glass Beads: AASHTO M 247, Type 1.

- H. Handicapped Parking Signs: Provide handicapped parking signs at locations shown on the Drawings. Type of signs and methods of mounting are shown on the Drawings.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by SCDOT and local authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D3515.
 - 3. Binder Base Course: Per SCDOT Standard Specifications Section 402, Type 1.
 - 4. Surface Course: Per SCDOT Standard Specifications Sections 403, Type 1 or 1B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade and aggregate base course is dry and in suitable condition to support paving and imposed loads.
- B. Verify gradients and elevations of aggregate base are correct.
- C. Proof-roll prepared aggregate base course using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- D. Notify Architect/Engineer of unsatisfactory conditions. Do not begin paving work until deficient base course areas have been corrected and are ready to receive paving.

3.2 AGGREGATE BASE COURSE

- A. See Section 321123 – Aggregate Base Course for the base construction for work of this section.

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12-inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Re-compact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
 - 1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.

2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.4 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72-hours minimum.
 1. If prime coat is not entirely absorbed within 24-hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
3. Apply tack coat to contact surfaces of curbs, gutters, and other paved contact surfaces.
4. Coat surfaces of manhole covers, catch basin grates, and other grates and frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.6 PLACING ASPHALT PAVEMENT – SINGLE COURSE

- A. Install Work in accordance with SCDOT Standard Specifications and requirements of local authorities having jurisdiction.
- B. Place asphalt with 24-hours of applying primer or tack coat.
- C. Place to compacted thickness as shown on the Construction Details of the Drawings per pavement type.
- D. Verify that the installation of storm drainage grates and frames, manhole covers and frames, and other grates and frames are in correct position and elevation.
- E. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
1. Place hot-mix asphalt surface course in single lift.
 2. Spread mix at minimum temperature of 250 deg F.
 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- F. Place paving in consecutive strips not less than 10-feet wide unless infill edge strips of a lesser width are required, unless otherwise acceptable to the Architect/Engineer.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
- G. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 PLACING ASPHALT PAVEMENT – DOUBLE COURSE

- A. Install Work in accordance with SCDOT Standard Specifications and requirements of local authorities having jurisdiction.
- B. Place asphalt with 24-hours of applying primer or tack coat.

- C. Place base course to compacted thickness as shown on the Construction Details of the Drawings per pavement type.
- D. Place surface wearing course to compacted thickness as shown on the Construction Details of the Drawings per pavement type.
- E. Verify that the installation of storm drainage grates and frames, manhole covers and frames, and other grates and frames are in correct position and elevation.
- F. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- G. Place paving in consecutive strips not less than 10-feet wide unless infill edge strips of a lesser width are required, unless otherwise acceptable to the Architect/Engineer.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
 - 2. Complete a section of asphalt base course before placing asphalt surface course.
- H. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- I. Remove excess asphalt from all manhole, cleanout and valve lids. Lids shall be operable and clean.

3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6-inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24-inches.
 - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2-percent of specified course density.

3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96-percent of reference laboratory density according to AASHTO T 245, but not less than 94-percent nor greater than 100-percent.
 - 2. Average Density: 92-percent of reference maximum theoretical density according to ASTM D2041, but not less than 90-percent nor greater than 96-percent.
- D. Finish Rolling: Finish rolling paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Wearing Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Wearing Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.11 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect/Engineer.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
- E. Public Roadway Traffic Striping: Use chlorinated rubber base traffic lane marking paint, factory-mixed, quick-drying and non-bleeding.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will engage a qualified independent Testing and Inspecting Agency to perform field tests and inspections and to prepare test reports.
 - 1. The Testing Agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979 or AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 1216