TECHNICAL SPECIFICATIONS

FOR

WEST STREET DRAINAGE IMPROVEMENTS

CITY OF BEAUFORT, SOUTH CAROLINA

PREPARED FOR:

CITY OF BEAUFORT

OWNER

WE Project No.: 130215C

August, 2014

SECTION 01 00 00

GENERAL REQUIREMENTS

TABLE OF CONTENTS

Article 1.1 SPECIFICATION CONVENTIONS
Article 1.2 APPLICATION FOR PAYMENT
Article 1.3 CHANGE PROCEDURES
Article 1.4 UNIT PRICES
Article 1.5 COORDINATION
Article 1.6 FIELD ENGINEERING
Article 1.7 PRECONSTRUCTION MEETINGS
Article 1.8 PROGRESS MEETINGS
Article 1.9 SUBMITTAL PROCEDURES
Article 1.10 CONSTRUCTION PROGRESS SCHEDULES
Article 1.11 QUALITY CONTROL
Article 1.12 REFERENCES
Article 1.13 TESTING LABORATORY SERVICES
Article 1.14 TEMPORARY UTILITIES
Article 1.15 MAINTENANCE AND REMOVAL OF TEMPORARY FACILITIES
Article 1.16 PROGRESS CLEANING AND WASTE REMOVAL
Article 1.17 PROTECTION OF INSTALLED WORK
Article 1.18 WATER CONTROL
Article 1.19 POLLUTION AND ENVIRONMENTAL CONTROL
Article 1.20 PRODUCT DELIVERY, HANDLING, STORAGE
Article 1.21 SUBSTITUTIONS
Article 1.22 AS-BUILT DRAWINGS
Article 1.23 CLOSEOUT PROCEDURES
Article 1.24 FINAL CLEANING

PART 1 GENERAL

1.1 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

1.2 APPLICATIONS FOR PAYMENT

A. Submit four (4) copies of each application on form approved by the Engineer.

B. Content and Format: Utilize “Schedule of Bid Prices” included as an attachment to the Agreement for listing items in Application for Payment.

C. Payment Period: Monthly.

1.3 CHANGE PROCEDURES

A. Authorized Changes to the Work: Pursuant to written direction to Contractor from the Engineer or the Owner in the form of a Change Order or Field Order.

B. Change Order: Issued for changes in quantities of Work, Contract Price or Contract Time.

C. Field Order: Issued for minor changes for which there is no change in Contract Price or Contract Time.

D. Changes in Contract Price or Contract Time will be determined in accordance with Article 12 of the General Conditions.

1.4 UNIT PRICES

A. Unit Price Schedule: The “Schedule of Bid Prices” is contained in the Bid Form, included as an attachment to the Agreement.

B. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies and appurtenances; bonds, insurance, providing all construction plant, equipment and tools; transportation, testing and performing all necessary labor and supervision to fully complete the Work shall be included in the unit prices bid for each item.

C. All work not specifically set forth as a pay item in the Schedule of Bid Prices in the Bid Form shall be considered a subsidiary obligation of the contractor and all costs in connection therewith shall be included in the prices bid.

D. All items of Work shall be measured in the units indicated in the Schedule of Bid Prices.

1.5 COORDINATION

A. Coordinate scheduling, submittals, and Work by subcontractors under the various sections of the specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.

1.6 FIELD ENGINEERING

A. Employ experienced instrument technician to locate reference datum and protect survey control and reference points.

B. Establish elevations, lines, and levels and certify elevations and locations of the Work conform to Contract Documents.

C. Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.

1.7 PRECONSTRUCTION MEETINGS

A. The requirements for preconstruction meetings are outlined in the General Conditions and the Supplementary Conditions.

B. Engineer will coordinate preconstruction meetings with affected parties.
   1. Time and place: As determined by Owner or other affected agencies.
   2. Attendees: As specified in the General Conditions and in the Supplementary Conditions and as directed by the Owner or the Engineer.

1.8 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at intervals to be determined at the preconstruction meeting.

B. Preside at meetings, record minutes, and distribute copies within three days to those affected by decisions made.

1.9 SUBMITTAL PROCEDURES

A. Within 15 days after the date established in the Notice to Proceed, submit preliminary Schedule of Submittals in duplicate for Engineer's review. Include Product data, Shop Drawings, samples and certifications as required by Technical Specification Sections.

B. Submit at least five copies of each submittal. The Engineer will retain four copies and return the remainder to the Contractor.

C. Attach each submittal to a submittal form that identifies the Project, Contractor, subcontractor or supplier, and applicable Contract Document references.

D. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

E. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of completed Work.

F. Revise and resubmit submittals as required; identify changes made since previous submittal.

1.10 CONSTRUCTION PROGRESS SCHEDULES

A. Within 15 days after the date established in the Notice to Proceed, submit preliminary Progress Schedule in duplicate for Engineer’s review. Revise and resubmit as required.

B. Submit revised schedules with each Application for Payment, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.

1.11 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturer’s instructions.

C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.12 REFERENCES

A. Conform to referenced standards, specifications and details of construction by date of issue current as of date for receiving bids.

B. When referenced standards, specifications or details of construction conflict with Contract Documents, request clarification from Engineer before proceeding.

1.13 TESTING LABORATORY SERVICES

A. All testing, including re-testing due to failure of acceptance tests, will be paid for by the Contractor.

B. Contractor will appoint, employ, and pay for specified services of an independent testing laboratory, acceptable to the Owner, to perform all testing required by the Technical Specifications.

C. Testing laboratory shall operate in accordance with ASTM C1077, ASTM D3740, ASTM D3666 and ASTM E329.

D. Cooperate with independent firm; furnish samples as requested.

E. Furnish five (5) copies of all test reports to Engineer.

1.14 TEMPORARY UTILITIES

A. Provide and pay for temporary electricity and power outlets for construction operations; connections, branch wiring, distribution boxes and flexible power cords as required.

B. Provide and maintain temporary lighting for construction operations if required.

C. Provide, maintain and pay for suitable quality water service required for construction operations.

D. Provide and maintain required sanitary facilities and enclosures.
   1. Maintain in clean and sanitary condition.
   2. Strictly enforce their use.

1.15 MAINTENANCE AND REMOVAL OF TEMPORARY FACILITIES

A. Maintain temporary utilities and facilities as long as needed for safe and proper completion of Work.

B. Remove temporary utilities, equipment, facilities, materials prior to Substantial Completion.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.16 PROGRESS CLEANING AND WASTE REMOVAL

A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Deposit waste material, trash, construction debris in securely lidded metal containers and remove from site on a regular basis.

C. Waste storage containers shall meet all local and state solid waste management regulations.

D. Dispose of waste material and trash at a location offsite designated to receive such material.

E. No waste material, trash or construction debris of any kind will be buried on the site.

F. All hazardous waste shall be disposed of in accordance with state and local regulations and the manufacturer's recommendations.

1.17 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification sections.

1.18 WATER CONTROL

A. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

1.19 POLLUTION AND ENVIRONMENTAL CONTROL

A. Implement the Storm Water Pollution Prevention Plan (SWPPP) upon commencement of construction activities and comply with all provisions of the SWPPP throughout the construction period.

B. Periodic site inspections required by the SWPPP, along with all required inspection reports shall be provided by the [Owner][Contractor].

1.20 PRODUCT DELIVERY, HANDLING, STORAGE

A. Deliver, handle, store, and protect Products in accordance with manufacturer's instructions.

B. Store only enough product on site to complete the Work under this project.

C. Keep products stored in neat, orderly manner in appropriate containers and, where applicable, protected from the weather.

D. Do not place materials on private property without written permission from property owner.

E. During loading, transporting and unloading, exercise care to prevent damage to materials.

F. Store products in their original containers with original manufacturer's labels and safety data.

G. Follow manufacturer's instructions as well as all state and local regulations and recommendations for disposal of unused or waste product.

H. Mix substances only in accordance with manufacturer's instructions.

I. Contain spills and leakage and perform spill or leakage clean up immediately and in accordance with manufacturer's instructions as well as all state and local regulations and recommendations.

1.21 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only after the effective date of the Agreement.

B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

C. Submit five copies of request for Substitution for consideration. Limit each request to one proposed Substitution.

1.22 AS-BUILT DRAWINGS

A. Water Distribution and Sanitary Sewer Systems.
   1. Maintain on site one set of Contract Drawings to be annotated for As-Built Drawings.
   2. Record in red on the As-built Drawings all deviations from the Contract Drawings, including, but not limited to, the following data for the water distribution and sanitary sewer systems:
      a. Horizontal location:
         1) Underground pipelines
         2) Fittings
         3) Valves
         4) Fire hydrants
         5) Manholes
         6) Clean-outs
         7) Service laterals
         8) Service lateral terminations
         9) Pump stations
      b. Depth of cover on all valves and fittings if greater than 3-ft.
      c. Type, size, material, joint type and manufacturer of all valves
      d. Linear feet of water line, sanitary sewer or force main
      e. Size, type (material) and class of pipe
      f. Slope of gravity sewer lines
      g. Average bury depth of pipe
      h. Identification of fittings type, material, size and joint type
      i. Elevations at manholes: Rim and inverts
      j. Elevation on top of force main connection to manhole or force main manifold
   3. Record in red on the As-Built drawings for water and sanitary sewer systems, the following data for locations at which the newly installed pipe lines cross existing pipe lines or culverts:
      a. Horizontal location of point of crossing

b. Elevation of top and bottom of existing pipe line or culvert at point of crossing
c. Elevation of top and bottom of newly installed pipe line at point of crossing
d. Fittings used at crossing:
1) Type, size, joint type
2) Horizontal location
3) Elevation of top of fittings

4. Location and dimensional data may be obtained by field measurements or by generally accepted survey methods.
a. Field measurements:
1) All measurements shall be from permanent above-ground structures, monuments or other identifiable reference objects approved by the Engineer.
2) The location of elements by field measurements shall be defined by measurements to at least two reference objects.
b. Location by survey methods:
1) Survey must be based on the USA South Carolina State Plane, RNAD 83 Coordinate System (Map code SC83F).
2) Elevations must be based on the 1929 USGS datum.
3) Furnish data as Point Files in AutoCAD or ASCI format.

B. Storm Drainage System:
1. The Contractor shall engage the services of a registered South Carolina Professional Land Surveyor to conduct a field survey of the completed storm drainage facilities and to prepare as-built drawings for the storm drainage system. The following data shall be obtained by the Surveyor and included in the as-built drawings for the storm drainage system:
a. Horizontal location of pipe ends, drainage inlets, catch basins, junction boxes, manholes, headwalls and pond inlet/outlet structures
b. Elevation of frame, grate or lid, throat, and sump (bottom) at all drainage inlets, catch basins manholes and junction boxes
c. Invert elevation of all pipe ends
d. Identification of pipe diameter and material
e. Identification of inlet or catch basin type.
f. Size and type of manhole or junction box.
g. Elevations at storm water pond:
1) Top of bank elevation
2) Bottom elevation
3) Top of embankment/berm elevation
4) Littoral shelf elevation (if applicable)
5) Invert elevation of pond emergency spillway (if applicable)
6) Weir/invert elevation(s) and dimensions of pond outlet control structure(s)

2. Data appearing on the as-built drawling for the storm drainage system shall be obtained by accepted field survey methods.
a. Horizontal information shall be based on NAD 83.

b. Vertical information shall be based on NGVD 29.

3. The as-built drawings for the storm drainage system shall be signed and sealed by the SC PLS who prepared them.

C. In the event deviations are made from approved shop drawings, a copy of the shop drawings, annotated in red showing the changes and as-built data, shall be included as part of the As-Built Drawings.

1.23 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Deliver the following documents to the Engineer:
1. As-built drawings
2. Executed Contractor’s General Guarantee
3. Executed Certificate of Non-Litigation

C. Submit final Application for Payment identifying total adjusted Contract Sum/Price, previous payments, and amount remaining due.

1.24 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean debris from drainage systems.

C. Remove waste and surplus materials, rubbish and construction facilities from site.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 31 10 00

SITE CLEARING AND MINOR DEMOLITION

PART 1 GENERAL:

1.1 SUMMARY:

A. This Section includes the following:
   1. Protection of existing trees that are to remain.
   2. Removal of designated trees and other vegetation.
   3. Clearing and grubbing.
   4. Removal of drainage and utility pipes and structures.
   5. Abandoning existing pipes and structures in place.
   6. Removal of designated paving, curbs, gutters and sidewalks
   7. Removal of debris and all unusable material from the site

B. Related Documents:
   1. Section 31 20 00 – Earthwork
   2. Section 31 25 00 – Erosion Control

PART 2 PRODUCTS

2.1 Flowable Fill: SCDOT Standard Specifications, Section 210.

PART 3 EXECUTION

3.1 PREPARATI0N

A. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

   1. Protect improvements on adjoining properties and on Owner's property;

   2. Restore damaged improvements to their original condition, as acceptable to property owners.

C. Tree Protection
   1. Protect existing trees and other vegetation indicated to remain in place to prevent damage resulting from unnecessary cutting, breaking or skinning

of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line or any other acts which may be harmful to the continued growth of the trees to be protected.

2. Install tree protection fencing where indicated on the plans and in accordance with the details on the Drawings. Maintain tree protection during length of construction activities. Remove tree protection only after all construction operations are complete and only when permitted by the Engineer.
3. Comply with local tree ordinances.
4. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
5. Provide protection for roots over 1-1/2 inch diameters 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.
6. Repair or replace trees and vegetation indicated to remain, which are damaged by operations, in a manner acceptable to Engineer. Employ a licensed arborist to repair damages to trees and shrubs. All tree repair work shall be done in accordance with the most recent revision of the International Society of Arboriculture practices.
7. Replace trees which, in the opinion of the arborist cannot be repaired and restored to full-growth.
8. Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

3.2 SITE CLEARING

A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions required to permit installation of new construction. Remove similar items elsewhere on premises as specifically indicated. "Removal" includes digging out and off-site disposing of stumps and roots.

1. 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.

B. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface;

2. Use only hand methods for grubbing inside drip line of trees indicated to remain;

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated;

   a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

C. Open burning on the site shall only be allowed if authorized in writing by Owner. Burning must comply with all state Air Pollution Regulations with regard to open burning as well as all local ordinances and regulations. Any permits required by state and local agencies for open burning shall be obtained by the Contractor.

D. Remove all debris and waste material from Owner's property.

3.3 MINOR DEMOLITION AND ABANDONMENT

A. Pavement Removal
1. Neatly saw cut pavement, including curb, gutter and sidewalk, at right angle to surface. Use of power driven impact tools for cutting pavement at juncture with pavement to remain is not allowed.
2. Remove pavement to the limits indicated on the Drawings.

B. Pipe Removal
1. Remove pipe at the locations and to the limits indicated on the Drawings.
2. Dispose of all removed pipe off the site of the Work.
3. Backfill in accordance with Section 02324 – Trenching, Backfilling For Utilities

C. Removal of Drainage and Utility Structures
1. When directed by the Owner or the Engineer, remove and salvage castings to Owner at location directed.
2. Remove complete structure, including base and foundation, at locations indicated on the Drawings.
3. Dispose of all removed and unsalvaged material off site.
4. Backfill with suitable material.

D. Abandoning Pipes In Place
1. Existing pipes to be abandoned in place are indicated on the Drawings.
2. Install plug in accordance with the details shown on the Drawings at locations indicated.
3. Where specifically called for on the Drawings, fill abandoned pipes with flowable fill for their entire length.

E. Abandoning Minor Structures In Place
1. Where indicated on the Drawings manholes, inlets, vaults and other minor below ground structures will be abandoned in place.
2. Remove top castings that are not cast into top slab.
3. Remove top slab.

4. Remove top portion of walls to a depth of 2-feet below finished grade.
5. Plug all pipes entering and leaving structure.
6. Fill structure to 2-feet below finished grade with a well graded granular material. Material may contain stones up to 6-inches in diameter provided there are adequate fines to completely fill all voids.
7. Backfill to finished grade with suitable material, including topsoil where appropriate, and restore to match surrounding area.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation of subgrade for building slabs, walks, and pavements;
2. Performing all grading, excavation, filling and compaction operations;
3. Remove and replace topsoil;
4. Finish grading, including shoulders and banks.

B. Excavation and backfilling of trenches for water, sewer, storm drains and other utility lines is not included in this section but may be found in Section 31 23 23, Trenching, and Backfilling for Utilities.

C. Related Sections:
1. Section 31 10 00 – Site Clearing
2. Section 31 23 23 – Trenching, Backfilling For Utilities
3. Section 31 25 00 – Erosion Control
4. Section 32 11 23 – Aggregate Base Course
5. Section 32 12 16 – Hot Mixed Asphalt Pavement
6. Section 32 13 13 – Portland Cement Concrete Pavement, Sidewalk, Curb, and Gutter

1.2 REFERENCES

A. American Society of Testing and Materials (ASTM):
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base course, subbase course, drainage fill, structure foundations or topsoil materials.

B. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.4 SUBMITTALS

A. Section 01001- General Requirements: Submittal Procedures:.

B. Samples: Furnish samples of fill material to testing laboratory.

C. Materials Source: Furnish information to Engineer identifying source for all fill materials. Include location of borrow areas.

D. Test Reports:
   1. Laboratory test reports for all materials proposed for use in embankments or backfill.
      a. sieve analysis
      b. moisture/density curves
      c. optimum moisture analysis
   2. Field test reports:
      a. In-place density tests
      b. Moisture content

PART 2 PRODUCTS

2.1 SOILS

A. Satisfactory soil materials are defined as those complying with ASTM D2487-00 soil classification groups GW, GP, GM, SM, SW, and SP. Soils classified as SM-SP with not more than 15% passing the #200 sieve may be considered acceptable.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT. Clays, silts and organic soils will be considered unsatisfactory.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate topsoil to the depths indicated on the plans and place in stockpile on site.

B. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations shown on the Drawings or directed by the Engineer.
   1. Material removed by unauthorized excavation shall be replaced with suitable material.
   2. No payment will be made for unauthorized excavation or the replacement of material removed by unauthorized excavation.

D. Satisfactory excavated material may be transported directly to and placed in fill areas within the limits of the work, subject to the requirements for moisture control as specified in subsequent sections of this specification. Stockpiling of satisfactory excavated material for later placement in fill areas on the site may be permitted subject to approval by the Engineer. No additional payment will be made for moving satisfactory material into or out of stockpiles. No satisfactory material shall be removed from the site without the express permission of the Owner.

D. Unsatisfactory material shall be transported directly off-site to a suitable disposal area.

E. Additional Excavation:
   1. Unsatisfactory material encountered at subgrade in areas to be paved shall be excavated to a minimum of 2 feet below finished subgrade and replaced with satisfactory material from on-site or borrow excavations.
   2. When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer.

F. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.2 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.3 STORAGE OF EXCAVATED MATERIALS

A. When the Contractor's operations necessitate stockpiling acceptable excavated materials for later placement in fills, locate stockpiles at a location acceptable to Owner. Grade, and shape stockpiles for proper drainage.

B. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

3.4 PLACEMENT

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

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

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

D. 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 same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification. Correct improperly compacted areas or lifts as directed by Engineer.

3.5 COMPACTION

A. Moisture Control:
   1. Moisture tempering of the soils used for embankment/fills/backfill shall be the responsibility of the Contractor. No additional payment will be made for moisture tempering of soils.
   2. Embankment/fill material shall be within +/- 4 percent of optimum moisture content before rolling to obtain the prescribed compaction. In

order to achieve uniform moisture content throughout the layer, wetting or drying of the material and manipulation shall be required when necessary.

3. The Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content in order to achieve the correct density.

B. Compaction Requirements: Compact soil to not less than the following percentages of maximum density as determined in accordance with ASTM D1557 (modified effort) in the areas indicated:

1. Under structures, building slabs and steps, curbs/gutters, and pavements, compact top 24 inches of subgrade to 98 percent of maximum density. Compact soils below the top 24 inches to a density of 95 percent of maximum density.
2. Under lawn or unpaved areas (lagoon banks), compact top 12 inches of subgrade in cut areas and each layer of backfill or fill material to 90 percent maximum density;
3. Under walkways, compact top 12 inches of subgrade to 98 percent maximum density. Layers below the top 12 inches may be compacted to 95 percent maximum density;

3.6 FINISH GRADING

A. General: Finish grading includes the placing of topsoil in areas outside the building lines or paved areas as indicated on the drawings.

B. Uniformly grade areas within limits of grading, including adjacent transition areas and any areas disturbed by Contractor's operations. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

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

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

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

E. Topsoil Placement:

1. Place topsoil on all finish graded areas outside building lines and outside of paved or other surfaced areas

2. Loosen subgrade to a minimum depth of 4 inches. Remove stones measuring over 1 1/2 inches in any dimension. Remove sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted after preparation.
3. Spread top soil to minimum depth of 4” or as indicated on the plans over all disturbed areas and lightly roll.

3.7 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
1. Perform field density tests in accordance with ASTM D1556 or ASTM D2922.
2. Building Pads: Perform at least two field density tests for every 2,000 square feet (SF) or portion thereof for each layer placed and for finished subgrade.
3. Streets and roadways: Perform at least one field density test for every 200 linear feet, alternating lanes, for each layer placed and for finished subgrade.
4. Parking fields: Perform at least one field density test for every 4800 square feet , or portion thereof, for each layer placed and for finished subgrade.
5. Curb and Gutter: Perform at least one field density tests for every 300 linear feet (LF) or portion thereof for each layer placed and for finished subgrade.
6. If in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.8 PROTECTION AND MAINTENANCE OF FINISHED WORK

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

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

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

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.9 DISPOSAL OF WASTE MATERIAL

A. Remove waste materials, including unsatisfactory excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION

SECTION 31 23 23

TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for water, sanitary sewer, storm drains and other utilities.
2. Backfilling and compaction in utility trenches.

B. Work under this section includes backfill above the pipe embedment zone (top of initial backfill). Pipe bedding and initial backfill are specified in other sections of the Technical Specifications for each type of pipe and utility.

C. Related Sections.
1. Section 33 11 00 – Water System
2. Section 33 31 00 – Sewer System
3. Section 33 41 00 – Storm Utility Drainage Piping

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. SCDOT Standard Specifications for Highway Construction.

1.3 SUBMITTALS

A. Section 01001 - Submittal Procedures

B. Materials Source: Submit information identifying source and location of imported backfill material.

C. Certification: Certify Products and materials meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. 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.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

PART 2 PRODUCTS

2.1 BACKFILL AND FOUNDATION MATERIALS

A. Select Backfill:
   1. Soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2 inches in greatest dimension.
   2. Acceptable material: Soil material complying with ASTM D2487 soil classification groups GW, GP, GM, GC, SC, SM, SW, and SP.
   3. Unacceptable soil materials are those complying with ASTM D2487 soil classification groups, ML, MH, CL, CH, OL, OH, and PT. Silts and organic soils will be considered unacceptable.
   4. Select backfill material shall be obtained first from acceptable material excavated from the trench, second from acceptable material excavated elsewhere within the construction site and last from off-site borrow sources when approved by the Engineer.

B. Flowable Fill: SCDOT Standard Specifications for Highway Construction, Section 210.

C. Foundation Stabilization Material: Processed, graded aggregate; SCDOT #57 stone, SCDOT Standard Specifications for Highway Construction.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Notification Of Intent To Excavate:
   1. Comply with South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978). Notification of intent to excavate may be given by calling this toll free number: 1-800-922-0983.

C. Approximate location of certain underground lines and structures are shown on the plans for information only and additional underground lines or structures may exist that are not shown.
   1. Call Palmetto Utility Protection Service at 1-888-721-7877 between the hours of 7:00 AM and 7:00 PM Monday thru Friday at least three working days before commencing construction. Request underground utilities to be located and marked within and surrounding construction areas.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect existing above and below grade utilities indicated to remain.
   1. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
   2. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
   3. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.

F. Protecting Trees, Shrubbery and Lawns:
   1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Engineer.

G. Removing and Resetting Fences:
   1. Where existing fences must be removed to permit construction of utilities; remove such fences and, as the Work progresses, reset the fences in their original location and condition.
   2. Provide temporary fencing when required for animal control or as required by Owner.

H. Restoration Of Disturbed Areas:
   1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.

2. This requirement does not include replacement of trees and undergrowth in undeveloped sections of the rights-of-way.

I. Initiate and maintain protective measures to minimize silting and bank erosion of creeks and rivers adjacent to the work.

J. Work located within streets or highways:
1. Comply with SC Department of Highways and Public Transportation "Encroachment Permit" issued for the Work;

K. Keep at least one lane open to traffic at all times where utility pipeline is in or alongside the traveled street or highway. Where pipelines cross the street of highway, excavate only half the street or highway, install the pipe and backfill before excavating the other half of the street.

L. Maintain access to properties adjacent to the construction at all times.

M. Protection Of Persons and Property:
1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
4. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

3.2 Dewatering:

A. Keep trenches and site construction area free from water.

B. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.

3.3 CUTTING EXISTING PAVEMENT

A. Use concrete saw for cutting concrete pavement.

B. Cut pavement to a neat straight line.

C. Pavement cut to extend 12-inches beyond top edge of excavation.

3.4 TRENCHING

A. Excavation for trenches is unclassified and includes all material of whatever substance encountered.

B. Perform excavation near existing utility services in accordance with utility's requirements.

C. Do not advance open trench more than 200 feet ahead of installed pipe.

D. Trench Width: Measured at the top of the pipe, adequate width to place and compact bedding material around pipe and for shoring. (See, also, other sections of these specifications.)

E. Excavate bottom portion of trench with vertical or near vertical (within 10°) side walls to a point one foot above top of pipe.

F. Excavation beyond the depths indicated on the plans or specified in other sections of these specifications in soils that are stable and that provide acceptable support for the pipes and embedment material will be considered unauthorized excavation. Unauthorized excavation shall be replaced with select material compacted to the densities specified for trench backfill. Angular stone material may be used for replacement of over excavated areas. Angular stone, when used, shall be completely wrapped in filter fabric to prevent the migration of fine grained soils from adjacent portions of the trench. No additional payment will be made for replacement of unauthorized excavation.

G. Provide uniform and continuous bearing and support for bedding material and pipe.
   1. Rock: Rock or unyielding material shall be removed to a depth of at least 6 inches below the bottom of the pipe. (See other sections of these Specifications for specific utility lines.)
   2. Unstable foundation: When unstable soils are encountered, excavation shall be continued to a depth to be determined by soil conditions or as directed by the Engineer. Foundation stabilization material shall be placed as specified in other sections of these specifications. (See other sections of these Specifications for specific utility lines.)

H. Excess and unacceptable excavated material not used in trench backfill shall be removed and used in other areas of the project, if applicable, or removed from the project site. No acceptable trench backfill material shall be removed from trench-side until the trench has been completely backfilled and compacted.

3.5 TRENCH PROTECTIVE SYSTEMS

A. Provide trench protective system in compliance with OSHA Standards, 29 CFR - 1926 Subpart P.

B. Sheeting and shoring shall be removed during the backfilling process in accordance with the requirements in 29 CFR – 1926 Subpart P unless specifically noted on the plans to be left in place.

C. Maintain the integrity of the trench protective system until its removal from the trench or until completion of backfilling in the case of shoring left in place.

D. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate trench protective system.

3.6 BACKFILLING

A. Backfill trenches to contours and elevations indicated on the drawings with unfrozen fill materials.

B. Employ placement method that does not disturb or damage pipe or pipe coating.

C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place backfill material in continuous layers, 6-inches compacted depth, and compact as follows:

Location	Compaction Per Cent Maximum Dry density (ASTM D1557, Modified Effort)
Top 24-inches beneath paved areas, curb and gutter, sidewalks, building slabs & within 10-ft. of buildings	98
Area below the top 24-inches beneath paved areas, curb and gutter, sidewalks, building slabs & within 10-ft. of buildings	95

E. Moisture Control:
1. Backfill soils shall be within +/- 4 percent of optimum moisture content before being placed in the trench and compacted to the prescribed density.
2. In order to achieve uniform moisture content throughout the layer, wetting or drying of the material, shall be required when necessary. Moisture tempering may require spreading and manipulation of the soil excavated from the trench to accomplish the necessary wetting or drying. Moisture tempering of the soils used for backfill, either by drying or wetting, shall be the responsibility of the Contractor. No additional payment will be made for moisture tempering of soils.
3. The Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content in order to achieve the correct density.

F. For trenches under existing pavement, place pavement base course material at the time the trench is backfilled. Type and thickness of base course material is shown on the drawings.

3.7 FIELD QUALITY CONTROL

A. Section 01001 – General Requirements: Testing and Inspection Laboratory Services

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

E. Frequency of Tests:
   1. Under pavement, curb, sidewalk, lawns, building slabs, within 10 feet of building: Each 200 linear feet or fraction thereof for each 6-feet of depth above top of pipe or fraction thereof.
   2. All other areas: Each 500 linear feet or fraction thereof for each 6-feet of depth above top of pipe or fraction thereof.

3.8 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 25 00

EROSION CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Silt fence, hay bales, filter fabric, stone rip-rap, gravel

B. Related Sections:
1. Section 31 10 00 – Site Clearing
2. Section 31 20 00 – Earth Moving
3. Section 22 11 13 – Water System
4. Section 33 31 00 – Sanitary Sewer System
5. Section 32 92 19 – Seeding

1.2 REFERENCES

A. American Society of Testing and Materials (ASTM):
1. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction

B. South Carolina Department of Transportation Standard Specifications For Highway Construction

1.3 SUBMITTALS

A. Section 01001 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's technical product data and installation instructions for soil erosion control materials and products.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of soil erosion control systems products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with soil erosion control similar to that required for project.

C. Codes and Standards: Comply with all applicable Local, State and Federal Standards pertaining to soil erosion control.

PART 2 PRODUCTS

2.1 Grass seed, fertilizer, mulch: As specified in Section 02924

2.2 Hay Bales: Standard size, densely baled straw or hay, wrapped with synthetic or wire bands (two minimum per bale).

2.3 Stone Rip-Rap: Class B, South Carolina Department of Transportation Standard Specifications For Highway Construction, Section 804.02

2.4 Gravel: Stone size in accordance with ASTM D 448 size No. 1 (1.5 inch to 3.5 inch diameter).

2.5 Filter Fabric Under Rip-Rap: Comply with Section 804.11 of South Carolina Department of Transportation Standard Specifications For Highway Construction

2.6 Silt Fence:

A. Posts: Steel

B. Fabric: Comply with Section 815.06 of South Carolina Department of Transportation Standard Specifications For Highway Construction.

C. Woven Wire Backing: Comply with Section 815.06 of South Carolina Department of Transportation Standard Specifications For Highway Construction.

PART 3 EXECUTION

3.1 GENERAL

A. Grade and provide erosion protection for all disturbed areas outside structure lines by seeding or other erosion control devices. Provide sediment barriers in storm water conveyance systems at all entrances, intersections, change in direction, discharge points and other locations as shown on the drawings.

3.2 STABILIZATION BY SEEDING:

A. As specified in Section 02924 – SEEDING AND MULCHING.

3.3 SEDIMENT BARRIERS

A. Straw Bales For Sheet Flow Applications:
1. Excavate a 4 inch deep trench the width of a bale and length of the proposed barrier. The barrier should be parallel to the slope. Place barrier 5 to 6 feet away from toe of slope, unless otherwise indicated;
2. Place bales in the trench with their ends tightly abutting. Corner abutment is not acceptable. A tight fit is important to prevent sediment from escaping through spaces between the bales;
3. Install and anchor as indicated in the construction drawings;
4. Backfill the trench with the previously excavated soil and compact it. The backfill soil should conform to the ground level on the downhill side of the

barrier and should be built up to 4 inches above the ground on the uphill side of the bales;

5. Inspect and repair or replace damaged bales promptly. Remove the straw bales when the uphill sloped areas have been permanently stabilized.

B. Silt Fence For Sheet Flow Applications:

1. Excavate a 4 inch deep, 4 inch wide trench on the uphill side of the silt fence to entrench bottom portion of geotextile filter fabric;
2. Secure fence to steel post which are set at least 1.5 feet in the ground. Install as shown on detail;
3. Backfill the trench with the previously excavated soil and compact it;
4. Silt fence should generally follow the contour except in channel applications Where silt fence should continue up the bank to prevent flow around the end of fence;
5. Inspect and repair or replace damaged silt fence or fence that is undermined; Remove silt fence when the areas above the fence have been permanently stabilized.

C. Straw Bales For Channel Flow Applications:

1. Install straw bales as described for sheet flow with the following exceptions:
   a. Place bales in a single row, lengthwise, oriented perpendicular to the flow, and with ends of adjacent bales tightly abutting one another;
   b. Extend the barrier to such a length that the bottoms of the end bales are at a higher elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it. Place rock below the middle bale to dissipate the energy of the falling water and reduce downstream erosion.

D. Silt Fence For Channel Flow Applications:

1. Install silt fence as described for sheet flow with the following exceptions:
   a. Silt fence in drainage channels must be backed with wire or steel mesh. Other locations on drawings may specify reinforced silt fence;
   b. Extend silt fence up banks to prevent water flow around ends of fence.

3.4 INLET CONTROL SEDIMENT BARRIERS

A. Straw bales

1. Excavate a 4 inch deep trench around the inlet. Make the trench as wide as a straw bale;
2. Orient straw bales with the bindings around the sides of the bales rather than over and under the bales;
3. Place bales lengthwise around the inlet and press ends of adjacent bales together;
4. Drive two 2 inch by 2 inch by 4 feet wood stakes through each bale to anchor the bale securely in place;

5. Backfill the excavated soil and compact it against the bales;
6. Wedge loose straw between bales to prevent water from flowing between bales.

B. Silt fence
1. Excavate a 4 inch deep, 4 inch wide trench around inlet to entrench bottom portion of geotextile filter fabric;
2. Secure fence to steel post which are set at least 1.5 feet in the ground around inlet;
3. Backfill the trench with the previously excavated soil and compact it.

3.5 RIP-RAP

A. Install quantity shown on the drawings.

B. Place by hand on undisturbed material or compacted soil covered by Filter Fabric. Form a compact layer approximately 12" in thickness. Rip-rap should be laid on the filter fabric leaving no visible fabric.

3.6 SITE ENTRANCE/EXIT

A. Install a 6 inch layer of gravel the full width of the vehicle ingress and egress area and for a length of 50 feet minimum, periodically add additional stone to maintain the proper functioning of the pad.

3.7 INSPECTION AND MAINTENANCE

A. Inspect all erosion control features at least once every seven days and within 24 hours following any storm that is 0.5 inches or greater.

B. Repair and maintain erosion control measures as needed and as directed by the Engineer and Owner.

C. Maintain required records of inspections on site and make them available to SCDHEC inspectors when required.

D. Cooperate with inspectors from SCDHEC, EPA, and Beaufort County and make modifications and repairs to erosion control devices as instructed by those agencies.

E. Maintain erosion control measures in place until all disturbed areas outside pavements are stabilized as determined by the permitting agency.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aggregate base course placed over prepared subgrade and beneath flexible or rigid paving.
2. Aggregate base course placed over prepared subgrade and used as wearing surface with no added paving material.
3. Prime coat

B. Related Sections:
1. Section 31 20 00 – Earth Moving
2. Section 32 12 16 – Asphalt Paving
3. Section 32 13 13 – Concrete Paving

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. South Carolina Department of Transportation Standard Specifications for Highway Construction:

1.3 SUBMITTALS

A. Section 01001 – General Requirements: Submittal Procedures

B. Materials Source: Furnish data identifying source of materials.

C. Test Reports:
   1. Laboratory tests: Gradation and specified properties.
   2. Field tests: Compaction

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Graded aggregate base course meeting the requirements for Macadam Base Course or Recycled Portland Cement Concrete Base Course in Subsections 305.02, 305.03, 305.04 and 305.05 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

B. When recycled concrete aggregate is selected for use by the Contractor, the source of the material shall be identified and the Engineer shall inspect the crushing facilities as well as the stockpile of material proposed for inclusion in the Work. Recycled concrete aggregate containing metal, wood, brick, wire, rubber, plastic or other objectionable material will not be approved for inclusion in the Work.

2.2 BITUMINOUS MATERIAL

A. Bituminous material for prime coat in accordance with subsection 305.06 and section 406 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify subgrade gradients and elevations are correct, and subgrade is dry.

B. Correct irregularities in subgrade by scarifying, reshaping, and re-compacting.

C. Do not place base course on soft, muddy, or frozen surfaces.

3.2 BASE COURSE PLACEMENT

A. When the required compacted thickness is 8-inches or less, the base course may be placed in one layer. When the required compacted thickness is greater than

8-inches, place base course in two or more layers. Compacted thickness of any single layer not to exceed 8-inches.

B. Grade surfaces to elevations and gradients indicated.

C. Prevent segregation of fine from coarse aggregates during handling, spreading and shaping.

D. Compact each layer using equipment capable of obtaining the required density.

E. Compact each layer to not less than 100 percent of maximum laboratory density as determined by AASHTO T 180 (Method D).

F. Maintain optimum moisture content of base course materials to obtain required density.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

H. Fines may be added only to the extent necessary to fill voids after initial compaction.

I. In areas where subgrade appears to be unstable after placing base course, remove base course, repair subgrade, replace and compact base course.

3.3 TOLERANCES

A. Smoothness: Maximum variation from flat surface not to exceed 3/8-inch when measured with 10 foot straight edge. Correct any surface irregularities that exceed the specified limits.

B. Thickness: One measurement for each 500 square yards. Excavate test holes thru compacted base course at randomly selected locations to determine thickness. Where the base course thickness is deficient by more than one-half inch, correct by scarifying, adding material and re-compacting.

C. Elevation: Maximum variation not to exceed 1/2 inch below or 0-inches above design elevation.

3.4 FIELD QUALITY CONTROL

A. Sample and test each layer of material for gradation and other requirements after placement but before compaction. Extract one full depth sample for each 500 square yards at random locations.

B. Perform compaction testing in accordance with ASTM D1556 or ASTM D2922 and at a frequency of 1 every 500 square yards of material placed.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.5 PRIME COAT

A. Preparation:
   1. Repair all irregularities in base course
   2. Assure base course density is approved by the Engineer
   3. Clean base course of all mud, dirt, dust and caked or loose material of any kind by brooming, blowing or other methods so as to expose the coarse aggregate in the base course.

B. Application rate: 0.25 – 0.30 gallons per square yard

C. Method of application: As prescribed in subsection 401.4.18 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

END OF SECTION

SECTION 32 12 16

HOT MIXED ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hot Mix Asphalt Intermediate Courses and Hot Mix Asphalt Surface Courses.
2. Pavement marking

B. Related Sections:
1. Section 31 20 00 - Earth Moving
2. Section 32 11 23 - Aggregate Base Course
3. Section 32 13 13 - Concrete Paving

1.2 REFERENCES

A. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.

B. ASTM International:
1. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
2. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
4. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
5. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

C. South Carolina Department of Transportation (SCDOT)
1. Standard Specifications for Highway Construction
2. Supplemental Specifications

1.3 SUBMITTALS

A. Section 01001 – General Requirements: Requirements for submittals.

B. Product Data:
1. Aggregates
2. Bituminous Material

3. Mix Design

C. Job Mix Formula

D. Manufacturer's Certificate: Certify all Products meet or exceed specified requirements

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with South Carolina Department of Transportation standards except where otherwise directed in this section of the specifications.

PART 2 PRODUCTS

2.1 GENERAL: Hot mix asphalt mixes and materials shall comply with the requirements contained in the applicable sections of the South Carolina Department of Transportation Standard Specifications for Highway Construction cited herein along with the following SCDOT Supplemental Specifications:

A. Standard Specifications for Hot-Mix Asphalt Material Properties SCDOT Designation: SC-M-402 (06), dated July 1, 2006.

2.2 SOURCE QUALITY CONTROL AND TESTS

A. Section 01001 – General Requirements: Testing and Inspection Laboratory Services:

B. Submit proposed mix design for each class of mix for review prior to beginning of Work.

2.3 MATERIALS

A. Binder and Additives: In accordance with Subsection 401.2.1 of South Carolina Department of Transportation Standard Specifications for Highway Construction. Performance grade binder, PG64-22.

B. Aggregates: In accordance with Subsection 401.2.2 of South Carolina Department of Transportation Standard Specifications for Highway Construction

C. Composition of Mixture:
1. Mix Design: Prepare mix design in laboratory approved by the Engineer. Job mix formula to indicate a single definite percentage of aggregate passing each required sieve and a single definite percentage of asphalt binder to be contained in the mixture. This percentage of asphalt binder being the percentage recovered by SC-T-64 or SC-T-75 and will not include any asphalt binder that may be absorbed in the aggregates. If an anti-stripping agent or other additives are required, the percentage of

each to be incorporated into the mixture will also be indicated in the job mix formula.

2. Submit intended source of materials and job mix formula in writing to the Engineer. Do not commence any asphalt paving work or accept any asphalt materials until Engineer has approved source of material and job mix formula.
3. Comply with the requirements in the following Subsections of the South Carolina Department of Transportation Standard Specifications for Highway Construction:
   a. 401.2.3.2
   b. 401.2.3.3
   c. 401.2.3.4
   d. 401.2.3.5
   e. 401.2.3.6
   f. 401.2.3.7

D. Hot Mix Asphalt Intermediate Course: In accordance with Section 402 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

E. Hot Mix Asphalt Surface Course: In accordance with Section 403 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

2.4 EQUIPMENT

A. Comply with the requirements in Subsection 401.3 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted base course or sub base course is dry and ready to support paving.

B. Verify gradients and elevations of base are correct.

C. Verify gutter drainage grates and frames, manhole frames and valve boxes are installed in correct position and elevation.

3.2 PRIME AND TACK COATS

A. Apply prime and tack coats in accordance with Subsection 401.4.18 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

3.3 PLACING ASPHALT PAVEMENT

A. Spreading and Finishing: In accordance with Subsection 401.4.19 of South Carolina Department of Transportation Standard Specifications for Highway Construction and as specified herein.

B. Compaction:
   1. Contractor may select the equipment for spreading and compacting the mixture, except that intermediate rolling is to be accomplished with a pneumatic roller.
   2. The Contractor is responsible for monitoring the compaction process and will be responsible for making adjustments in equipment or roller patterns so that the finished asphalt pavement will meet the specified in-place density requirement.
   3. Any patching and traffic control required during compaction monitoring and acceptance testing procedures will be furnished by the Contractor.

C. Joints: In accordance with Subsection 401.4.23 of South Carolina Department of Transportation Standard Specifications for Highway Construction.

3.4 TOLERANCES

A. Surface Smoothness:
   1. Binder Course: Maximum variation of 1/4 inch using 10 foot straight edge.
   2. Surface Course: Maximum variation of 1/8 inch using 10 foot straight edge.

B. Compacted Thickness: Binder Course and Surface Course: Within 1/4 inch.

C. Areas of pavement outside the tolerance limits for smoothness and thickness shall be removed and replaced by the Contractor and re-tested.

3.5 FIELD QUALITY CONTROL

A. Section 01001 – General Requirements: Quality Control:

B. All nuclear gage tests and cores required for compaction monitoring and acceptance testing procedures will be obtained by the Contractor using equipment and procedures approved by the Engineer.

C. Core sample locations shall be repaired by the contractor.

D. The Contractor is responsible for monitoring the lay down and compaction operations to assure that the final pavement is in compliance with the requirements specified herein. Nuclear gage testing may be used for quality control during the lay down process.

E. Acceptance testing: Acceptance of each type of hot mix asphalt pavement will be based on the following:

1. Each day's production of hot mixed asphalt will be considered a lot.
2. One bulk sample will be collected from each 250 tons, or portion thereof, of asphalt produced each day. The following tests and procedures will be performed on the material from each bulk sample collected:
   a. Asphalt extraction
   b. Aggregate gradation
   c. Marshall specimens (3)
      1) Bulk density determination
      2) Stability
      3) Plastic flow
3. The average daily field laboratory density shall be the average of the bulk densities for all the samples taken from the production for that day.
4. Marshall Specimens used for compaction control must meet required air void criteria.
5. Core samples:
   a. Frequency: One core for each 250 tons of hot mix asphalt placed each day.
   b. Utility trench patches: Core samples not required.
   c. Location: As determined by the Engineer.
   d. Each core sample will be tested for;
      1) Density
      2) Thickness
6. The average core density for a lot shall be at least 96% of the average daily field laboratory density as determined by the Marshall method of test. Individual core densities shall not be less than 95% of the average field laboratory density.

F. When an asphalt mixture is rejected, additional cores will be taken and tested by the Contractor at locations selected by the Engineer in order to determine the extent of the material to be removed and replaced.

G. Pavement that is removed and replaced shall be re-tested by coring at the frequency indicated above, but not less than one core for each separate area of replaced pavement.

3.6 PROTECTION OF FINISHED WORK

A. Protection of Finished Work: The newly constructed surfaces shall be protected from traffic until the mixture has hardened sufficiently to prevent distortion. The surface shall be kept clean and free from foreign material.

3.7 PAVEMENT MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping Paint: Use fast dry waterborne paint meeting the requirements of Subsection 625.2.2 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.

C. Color: As specified on the Drawings. Where color is not specified, provide color as directed by the Engineer.

D. Do not apply traffic and lane marking paint until layout and placement has been verified with Engineer.

E. Apply paint with mechanical equipment to produce uniform straight edges.

F. Apply at manufacturer's recommended rates.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVEMENT, SIDEWALK, CURBS AND GUTTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete paved roadways and parking areas
2. Concrete sidewalks.
3. Concrete curbs and gutters.

B. Related Sections:
1. Section 31 20 00 - Earthwork
2. Section 32 12 16 – Hot Mixed Asphalt Pavement

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

B. ASTM International:
1. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
2. ASTM A 497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
3. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM C 33 - Standard Specification for Concrete Aggregates.
5. ASTM C 39 – Standard Specification Compressive Strength of Cylindrical Concrete Specimens.
6. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C 150 - Standard Specification for Portland Cement.
8. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
9. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
10. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
11. ASTM C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
12. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants.
13. ASTM C 1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

14. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
15. ASTM D 1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
16. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
17. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

A. Section 01001 – General Requirements: Submittal Procedures

B. Product Data:
1. Joint filler
2. Admixtures
3. Curing compounds

C. Manufacturer's Certification: Cement

D. Test reports: Coarse aggregate and Fine aggregate

E. Concrete mix design

1.4 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout project.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when air temperature in the shade and away from artificial heat is 40 degrees F or lower, or when surface is wet or frozen. Concrete shall not be placed when the temperature is expected to fall below 32 degrees F during the early stages of curing.

PART 2 PRODUCTS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.

D. Dowels: ASTM A 615; 40 ksi yield grade, plain steel, galvanized finish.

E. Concrete Materials:
   1. Portland Cement: ASTM C 150, Type 1. Use only one brand cement throughout the project.
   2. Concrete Aggregates: Natural aggregates, free from deleterious coatings conforming to ASTM C 33, together with all referenced ASTM Standard Specifications.
   3. Fine Aggregates: Conform to ASTM C 33. Materials finer than the 200 sieve not to exceed 4 percent. Use only clean, sharp natural sand.
   4. Course Aggregates: Use only natural gravels, a combination of gravels and crushed gravels, crushed stone, or a combination of these materials containing no more than 15% flat or elongated particles (long dimension more than five times the short dimension). Materials finer than the 200 sieve not to exceed 0.5%.

F. Preformed Expansion Joint Materials: Bituminous fiber type conforming to ASTM D 1751.

G. Wood Dividers: Redwood, Construction Heart Grade.

H. Anti-spalling Compound: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

I. Liquid-Membrane Forming and Sealing Curing Compound: Comply with ASTM C 309, Type I, Class A. Moisture loss to be no more than .055 gr./ sq. cm. when applied at 200 sq. ft. / gal.

J. Bonding Compound: Polyvinyl acetate or acrylic base, re-wettable type.

K. Epoxy Adhesive: ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements in accordance with manufacturer's instructions. .

2.2 CONCRETE MIX DESIGN

A. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (super plasticizer), air-entraining admixture, and water in accordance with ASTM C 94, Option A, to produce the following properties:
   1. Compressive Strength: 3000 psi, minimum at 28 days.
   2. Slump Limits: 3 inches (8 inches after the addition of high-range water-reducing admixture, i.e. super plasticizer).
   3. Air Content: 4 to 8 percent by volume.
   4. Water cement ratio: not more than 0.53 (6 gal. per bag).

2.3 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design to Engineer for review prior to commencement of Work.

B. Provide manufacturer's certification that cement meets all specified requirements.

C. Sample and test aggregates in accordance with ASTM C33.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Remove loose material from compacted sub-base surface immediately before placing concrete.

B. Proof-roll prepared sub-base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

D. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.2 FORM CONSTRUCTION

A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

C. Check completed formwork for grade and alignment to following tolerances:
   1. Top of forms not more than 1/8 inch in 10 feet.
   2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.
   3. Slope step treads at 1/4 inch per foot to drain.

3.3 REINFORCEMENT

A. Locate, place and support reinforcement as indicated on the construction plans.

3.4 CONCRETE PLACEMENT

A. Do not place concrete until sub-base and forms have been checked for line and grade. Moisten sub-base if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

C. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

E. Curbs and Gutters: Shall be uniform in appearance and true to grade and cross-section. Any variation will not be permissible if it causes water ponding or alters the direction of flow. Face forms shall be removed as soon as possible and the exposed surfaces finished with a wood float. Straight-edging done along the edge of the gutter and top of curb and median shall conform to those requirements for the adjacent pavement, but with no irregularities to exceed 1/4" in 10 feet.

3.5 JOINTS

A. General: Concrete work shall be jointed as shown on the project drawings. If not indicated on the drawings, a jointing plan shall be prepared by the contractor and approved before paving begins. Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

Joints should be laid out to aid construction and to control cracking. A square panel pattern is preferable but a dimensional ratio of 1-1/2 x 1 is permissible. Joint spacing shall not exceed 10 feet. Place joints to approximate the cracking that would occur without joints. When placing new concrete adjacent to existing or previously placed concrete, align joints with those in the existing or previously placed concrete whenever possible.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
2. Sawed Joints: Form weakened-plane joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

C. Construction Joints: Place construction joints in accordance with the details shown on the drawings at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints.

D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.
1. Vehicular pavement lanes: Transverse expansion joints 50 feet on center, each lane.
2. Sidewalks: Transverse expansion joints 50 feet on center.
3. Curb and gutter: Transverse expansion joints 50 feet on center, coincident with pavement joints.
4. Where sidewalk is placed adjacent to curb and against building structure on other side, place expansion joint between sidewalk and back of curb.
5. Where sidewalk is adjacent to curb, place expansion joint between sidewalk and back of curb at intersection radius returns.
6. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
7. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
8. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

3.6 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
   1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer. Finish tool joints and edges to a smooth finish by hand after broom finish is applied.
   2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

3.7 CURING

A. Protect and cure finished concrete paving using membrane-forming curing and sealing compound or approved moist-curing methods.

B. Anti-spalling Treatment: Apply treatment to concrete surfaces no sooner than 28 days after placement, to clean, dry concrete free of oil, dirt, and other foreign material. Apply curing and sealing compound at a maximum coverage rate of 300 s.f. per gallon. Apply anti-spalling compound in 2 sprayed applications. First application at rate of 40 sq. yds. per gal.; second application, 60 sq. yds. per gallon. Allow complete drying between applications.

3.8 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete, as directed by Engineer.

B. Drill test cores where directed by Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

3.9 FIELD QUALITY CONTROL

A. Section 01001 – General Requirements: Testing Laboratory Services

B. Three concrete test cylinders will be taken for every 100 or less cu yds of concrete placed each day. Test cylinders will be broken at 7 and 28 days with the third cylinder held in reserve and broken at the Engineer's discretion.

C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken. For concrete containing a high-range water-reducing admixture (super plasticizer), take slump test before the admixture is added at the job site.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

END OF SECTION

SECTION 02924

SEEDING AND MULCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding and mulching all disturbed areas.

B. Related Sections:
   1. Section 31 20 00: Earthwork
   2. Section 31 25 00: Erosion Control

1.2 SUBMITTALS

A. Section 01001 – General Requirements: Submittal Procedures:

B. Product Data: All items proposed to be provided under this Section.

C. Manufacturer's Certificate: Certificate of compliance with these Specifications.

1.3 QUALITY ASSURANCE

A. 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.

B. Seed: Conform to all State laws and to all requirements and regulations of the S.C.Department of Agriculture.
   1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, origin and lot number.

C. Fertilizer: Conform to State fertilizer law.

PART 2 PRODUCTS

2.1 PRODUCT HANDLING

A. Section 01001: General Requirements: Product Delivery, Handling, Storage

B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.

C. Immediately remove from the site materials which do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

2.2 FERTILIZER

A. Provide commercial balanced 10-10-10 fertilizer delivered to the site in sealed bags labeled with the manufacturer's guaranteed analysis.

2.3 GRASS SEED

A. Provide grass seed which is:
   1. Free from noxious weed seeds, and re-cleaned;
   2. Grade A recent crop seed;
   3. Treated with appropriate fungicide at time of mixing;
   4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

2.4 LIME

A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.

B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

2.5 EMULSIFIED ASPHALT (ANIONIC)

A. Grade EA-P Special meeting the requirements of S.C. Highway Department Specifications, Subsection 406.05, Edition of 2000.

B. If necessary for satisfactory spraying, material may be diluted with water at the manufacturing plant.

2.6 WOOD CELLULOSE FIBER

A. Provide wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer.

B. Material to be heat processed so as to contain no germination or growth inhibiting factors.

C. It shall be dyed (non-toxic) an appropriate color to facilitate metering.

2.7 STRAW MULCH

A. Provide straw or hay material.
   1. Straw to be stalks of wheat, rye, barley or oats;

2. Hay to be timothy, pea vine, alfalfa, or coastal Bermuda.

B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nut grass, Wild Onion and other noxious weeds.

2.8 EXCELSIOR FIBER MULCH

A. To consist of 4 to 6 inches, average length, wood fibers cut from sound, green timber.

B. Make cut in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood.

PART 3 EXECUTION

3.1 GENERAL

A. Seed following areas immediately upon completion of their construction:
1. Slopes greater than four horizontal to one vertical;
2. Utility rights-of-way adjacent to stream banks.

B. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover in accordance with Schedule No. 2. At the acceptable seasons for planting under Schedule No. 1, the turf previously seeded under Schedule No. 2 shall be destroyed by reworking the soil and re-seeded in accordance with Schedule No. 1 as specified herein.

3.2 SEEDING SCHEDULES

A. Mixtures of different types of seed for the various schedules shall be weighed and mixed in proper proportions in the presence of the Engineer.

B. Schedule No. 1 - Permanent Seeding

Permanent Seeding - Coastal

Species	Lbs/Ac	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sandy, Droughty Sites													
Browntop Millet Bahiagrass	10 lbs./ac. 40 lbs./ac.												
Browntop Millet Bahiagrass Sericea Lespedeza	10 lbs./ac. 30 lbs./ac. 40 lbs/ac.												
Browntop Millet Atlantic Coastal Panicgrass	10 lbs./ac. 15 lbs./ac. PLS												
Browntop Millet Switchgrass (Alamo) Little Bluestem Sericea Lespedeza	10 lbs./ac. 8 lbs./ac. PLS 4 lbs./ac. 20 lbs./ac.												
Browntop Millet Weeping Lovegrass	10 lbs./ac. 8 lbs./ac.												
Well drained, clayey/loamey Sites													
Browntop Millet Bahiagrass	10 lbs./ac. 40 lbs./ac.												

C. Schedule No. 2 - Temporary Seeding

Temporary Seeding – Coastal

Species	Lbs/Ac	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sandy, Droughty Sites													
Browntop Millet	40 lbs./ac.												
Rye, Grain	56 lbs./ac.												
Ryegrass	50 lbs./ac.												
Well drained, clayey/loamey Sites													
Browntop Millet or Japanese Millet	40 lbs./ac.												
Rye, Grain or Oats	56 lbs./ac. 75 lbs./ac.												
Ryegrass	50 lbs./ac.												

3.3 PREPARATION

A. Bring all areas to proper line, grade and cross section indicated on the plans.

B. Repair erosion damage prior to commencing seeding operations.

C. Loosen seed bed to minimum depth of 3 inches.

D. Remove all roots, clods, stones larger than 2 inches in any dimension, and other debris.

3.4 APPLICATION OF FERTILIZER

A. Spread uniformly over areas to be seeded at:
   1. Rate of 1,000 lbs per acre;
   2. Use approved mechanical spreaders.

B. Mix with soil to depth of approximately 3 inches.

3.5 SEEDING AND MULCHING

A. General:
   1. Perform seeding during the periods and at the rates specified in the seeding schedules;
   2. Do not conduct seeding work when ground is frozen or excessively wet;
   3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.

B. Seeding, slopes steeper than four horizontal to one vertical:
   1. Conform to Methods EA, WF or WCF as specified hereinafter;
   2. Method EA (Emulsified Asphalt):
      a. Sow seed not more than 24 hours after application of fertilizer;
      b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills;
      c. Cover seed and lightly compact with cultipacker if seed drill does not compact soil;
      d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.
   3. Method WF (Excelsior Fiber Mulch):
      a. Sow seed as specified for Method EA.;
      b. Within 24 hours following covering of seeds, uniformly apply excelsior fiber at the rate of 100 pounds per 1000 square feet;
      c. Material may be applied hydraulically or dry. If applied dry, it shall be thoroughly wetted immediately following placing;
      d. Seeded areas to be lightly rolled to form a tight mat of the excelsior fibers.
   4. Method WCF (Wood Fiber Mulch):

a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment;
b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water;
c. Minimum capacity of slurry tank: 1000 gallons;
d. Apply fiber mulch at rate of 35 pounds per 1000 sq. ft.;
e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts;
f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other;
g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.

C. Seeding, slopes equal to or flatter than four horizontal to one vertical:
1. Sow seed as specified for Method EA, steps a thru c;
2. Apply straw or hay mulch at the rate of 100 pounds per 1000 square feet uniformly to the seeded area. Mulch may be applied by hand, by mechanical spreaders, or by blowers;
3. Hold mulch in place with a tack coat of emulsified asphalt, applied at the rate of 0.2 gallons per square yard.

3.6 MAINTENANCE

A. Maintain all seeded areas in satisfactory condition until final acceptance of the Work.

B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or mulched.

C. Repair any eroded areas.

D. Mow as necessary to maintain healthy growth rate until final acceptance of the Work.

3.7 ACCEPTANCE

A. Permanently seeded areas under Schedule No. 1 will be accepted when the grass attains a height of two inches.

B. No acceptance will be made of temporary seeded areas under Schedule No. 2. Re-work and re-seed those areas in accordance with Schedule No. 1.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm drainage piping.
2. Accessories.
3. Catch basins
4. Inlets
5. Manholes and Junction Boxes
6. Bedding and cover materials.

B. Related Sections:
1. Section 31 23 23 – Trenching, Backfilling for Utilities

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 300-to 900-mm (12- to 36-in.) Diameter.

B. ASTM International:
1. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
2. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
3. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
4. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
5. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
6. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures
7. ASTM C1478 - Standard Specification for Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes and Laterals
8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
9. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

10. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
11. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
13. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
15. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
16. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
17. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
19. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
20. ASTM F2306/F2306M - Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

1.3 SUBMITTALS

A. Section 01001 – General Requirements: Submittal Procedures

B. Product Data: Submit manufacturer’s product data for:
1. Pipe, pipe accessories, gaskets, joint lubricants.
2. Inlet grates
3. Manhole frames and covers
4. Precast drainage structures.

C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. 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.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Reinforced Concrete Pipe: ASTM C76, with Wall Type A, B, or C, bell and spigot joints.
   1. Fittings: fabricated from reinforced concrete pipe
   2. Joints: ASTM C443, rubber compression gasket.
   3. Pipe Class: Class III unless otherwise indicated on the drawings.

B. Concrete Pipe: ASTM C14, unreinforced, bell and spigot joints.
   1. Fittings: Fabricated from concrete pipe.
   2. Joints: ASTM C443, rubber compression gasket.
   3. Pipe Class; As indicated on the drawings.

C. Thermoplastic Pipe:
   1. High Density Polyethylene (HDPE): ASTM F 2306, Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
      a. Fittings: Corrugated Polyethylene (HDPE)
      b. Joints: Bell and spigot.
   2. Polyvinyl Chloride (PVC): ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; bell and spigot style rubber ring sealed gasket joint.
      a. Fittings: PVC.
      b. Joints: ASTM F477, elastomeric gaskets.

2.2 STORM DRAIN STRUCTURES

A. Cast-in-place structures:
   1. Concrete: 28 day compressive strength – 3000 psi.
   2. Reinforcing: ASTM A615/A 615M, grade 60

B. Precast structures:
   1. Round manholes: ASTM C478
      a. Top: Precast concrete, concentric cone, eccentric cone, or flat slab type, as indicated on drawings.
      b. Base: Precast concrete, with base riser section and separate base slab, or base riser section with integral floor, as indicated on drawings.
      c. Steps: Ductile-iron or aluminum, integrally cast into manhole sidewalls.
   2. Square and rectangular structures: Design must meet or exceed the design requirements in ASTM C890 or ASTM C913.

3. Precast reinforced concrete box with knock-out panel: Comply with the requirements on SCDOT standard drawing number 719-17 except for limitations contained herein.
   a. Precast R.C. box with knock-out panel may be used for catch basins, drop inlets, shallow junction boxes and manholes.
   b. Maximum depth from finished grade to top of box – 2'-0".
   c. Minimum inside dimensions of box – 4' x 4' x 4'.
   d. Maximum inside dimensions of box – 5' x 5' x 6'.
   e. Maximum bury depth, i.e. finished grade to floor of box, - 8'-0".
4. Precast reinforced concrete box with solid wall: Comply with the requirements on SCDOT standard drawing number 719-17A except for limitations contained herein.
   a. Precast R.C. box with solid walls may be used for catch basins, drop inlets, ,junction boxes and manholes.

2.3 FRAMES, GRATES AND COVERS:

A. Material: ASTM A48, Class 30, gray cast iron.

B. Bearing surfaces of circular medium and heavy duty manhole frames, covers and grates shall be machined to insure proper fit and prevent rattling.

C. Unless otherwise indicated on the drawings, all frames grates and lids shall be classified heavy duty, designed for a 16,000 lb. wheel load.

D. Watertight manhole covers, where indicated on the drawings, shall be bolted and gasketed.

2.4 PIPE CONNECTORS

A. Resilient, ASTM C1478.

2.5 EMBEDMENT MATERIALS

A. Angular stone material: Processed, graded aggregate; SCDOT #57 stone, ¾" maximum size, SCDOT Standard Specifications for Highway Construction.

B. Select material: Acceptable soil material free of rocks, debris, frozen earth or foreign matter and free of excessive moisture.

C. In general, soils from the following soil groups, as defined in ASTM D2487, are acceptable for use as pipe embedment: GW, GM, GC, GP, SM, SC, SW, SP, GW-GC, SP-SM, ML, CL, except that groups GM, GC, SM and SC soil material may only be used in dry trench conditions. Acceptability of soil material for use as pipe embedment is subject to the approval of the Engineer.

D. Materials from the following soil groups as defined by ASTM D2487 are unacceptable for pipe embedment: MH, CH, OL, OH, and PT.

E. Select material shall be obtained first from acceptable material excavated from the trench, second from acceptable material excavated elsewhere within the construction site and last from off-site borrow sources when approved by the Engineer.

F. Soil material used for pipe embedment shall be placed at or near optimum moisture content. Moisture tempering of the soils used for embedment shall be the responsibility of the Contractor. No additional payment will be made for moisture tempering of soils.

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

A. Excavate pipe trench in accordance with Section 02324 – Trenching, Backfilling For Utilities.

B. Excavate to lines and grades indicated on the Contract Drawings or required to accommodate installation.

C. Trench Width: Trench width at or below the top of the pipe shall be adequate to allow proper placement and consolidation of embedment material. The minimum trench width at or below the top of the pipe shall be the greater of either the pipe O.D. plus 16 inches or the pipe O.D. multiplied by 1.25 plus 12 inches.

D. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.

E. Protect and support existing sewer lines, utilities and appurtenances.

F. Maintain profiles of utilities. Coordinate with other utilities to eliminate interferences. Notify Engineer where crossing conflicts occur.

3.2 INSTALLATION OF PIPE

A. General
1. Lay pipe to slope and alignment indicated on Contract Drawings. Begin at downstream end and progress upstream. Lay bell and spigot pipe with bells upstream.
2. Assemble and handle pipe in accordance with manufacturer's instructions except as modified on the Contract Drawings or by Engineer.
3. Keep pipe and fittings clean until work is completed and accepted. Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. In large, accessible piping, brushes and brooms may be used for cleaning. Flush lines between manholes if required to remove collected debris.

4. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
5. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
6. Install gaskets in accordance with manufacturer's recommendations for use of lubricants and other special installation requirements.
7. Joint Adaptors: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose.

B. Concrete Pipe:
1. Install Concrete Pipe in accordance with American Concrete Pipe Association (ACPA) "Concrete Pipe Installation Manual".
2. Foundation for Pipe: Support pipe and bedding on firm foundation. When a firm foundation is not encountered at the required grade, remove unstable material to a depth to provide adequate support for the pipe or as directed by the Engineer. Replace the excavated material with select material in 6” maximum layers compacted to 95% Modified Proctor, ASTM D1557 up to the bottom of the bedding.
3. Pipe Bedding:
   a. Use select material, well-graded sand or gravel. Angular stone may be used for pipe bedding. When angular stone is used, completely wrap bedding with filter fabric for drainage filtration to prevent soil migration into open voids.
   b. Ensure that trenches are free of water when placing bedding.
   c. Support the pipe by placing loose bedding material for a depth of the pipe O.D./24 or 3” minimum. When rock or unyielding material is encountered, extend the depth of the bedding to the pipe O.D./12 or 6” minimum.
   d. Excavate bedding material at pipe bells and projected hubs to prevent excess loading and to provide uniform support for the full length of the pipe barrel.
   e. Compact bedding material that is outside of the middle third of the pipe diameter in order to ensure proper support for the pipe. Ensure that bedding material outside the middle third of pipe is compacted to a minimum of 90% of the maximum dry density, Modified Effort, ASTM D1557. Ensure that compaction of bedding material does not cause the pipe to move.
   f. Do not use Controlled Low Strength Material (CLSM), flowable fills or concrete for pipe bedding.
4. Haunching
   a. Following placing and joining of pipe, place select material or angular stone to the spring line of the pipe. When angular stone has been used for pipe bedding, the angular stone shall also be used for haunching and the entire stone bedding and haunching envelope shall be completely wrapped with filter fabric for drainage filtration to prevent soil migration.
   b. Place select material in layers not exceeding 6 inches of compacted material and thoroughly compact to 90% of the

maximum dry density, Modified Effort, ASTM D1557. The first lift must be sufficiently below the spring line such that the material can be worked into the haunch zone of the pipe. Perform compaction by the use of mechanical tampers with the assistance of hand tamps when necessary. Thoroughly compact the material under the haunches of the pipe and ensure that the backfill soil is in continuous uniform contact with the side and joints of the pipe. Exercise sufficient care to prevent damaging or misaligning the pipe with the compaction equipment. Place and compact material on both sides of pipe for its full length before adding the next lift of material. Ensure that trenches are free of water when placing and compacting haunching material. Ensure that backfill process does not cause joint separation or displacement of the installed pipe.

5. Initial Backfill: Place initial backfill, consisting of select material, in 6-inch maximum layers to 1-foot above top of pipe. Carefully consolidate and compact each layer to the density specified for the remainder of the trench backfill (Section 02324 – Excavation, Backfilling for Utilities).
6. Trench Backfill: Place and compact remainder of backfill in accordance with Section 02324. Do not displace or damage pipe when compacting.

C. Thermoplastic Pipe:
1. Install PVC sanitary sewer pipe in accordance with ASTM D2321, Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications, and the details included in the Contract Drawings.
2. Pipe Embedment:
   a. In stable soils, extend trench excavation to a point 4” below the bottom of the pipe (6” in rock or unyielding material). Install pipe bedding consisting of angular stone to provide uniform support for the full length of the pipe. Excavate for pipe bells at joints. After pipe is installed to line and grade, place angular stone material in 6-inch maximum layers to spring line of pipe. Carefully consolidate each layer to completely fill space below and around pipe, taking care not to disturb the pipe.
   b. Where soft or unstable soils incapable of supporting the pipe are encountered at the bottom of the trench, extend trench excavation to the depth necessary for the soil conditions or as directed by the Engineer. Install foundation stabilization and pipe bedding consisting of angular stone material, placed and consolidated to provide uniform support for the full length of the pipe. Excavate for pipe bells at joints. After pipe is installed to line and grade, continue placing and consolidating the angular stone to the spring line of the pipe, taking care not to disturb the pipe.
   c. Completely wrap angular stone material in filter fabric to prevent migration of adjacent soils.
   d. Initial Backfill: Place initial backfill, consisting of select material, in 6-inch maximum layers to 1-foot above top of pipe. Carefully

consolidate and compact each layer to 95% modified Proctor, ASTM D1557.

3. Trench Backfill: Place and compact remainder of backfill in accordance with Section 02324. Do not displace or damage pipe when compacting.

3.3 INSTALLATION – DRAINAGE STRUCTURES

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place Cast-In-Place Concrete base pad, with provision for storm drain pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount cover/grate and frame level in grout, secured to top and at elevation indicated. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 3" above finish surface, unless otherwise indicated.

F. Provide rubber joint gasket complying with ASTM C 443-98 at joints of precast structure sections.

G. Apply bituminous mastic coating at joints of sections.

3.4 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing initial backfill.

B. Compaction Testing:
1. Laboratory density and moisture content: ASTM D698
2. Field density; ASTM D2922
3. Field moisture content: ASTM D3017.

C. When tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Compaction Tests: One test for each 500 linear feet of storm drain pipe or fraction thereof.

3.5 PROTECTION OF FINISHED WORK

A. Protect pipe and initial backfill from damage or displacement until backfilling operation is in progress.
1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.

2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION