

PROJECT SPECIAL PROVISIONS**ROADWAY****CLEARING AND GRUBBING – METHOD III:**

(4-6-06) (Rev 3-18-08)

SP2 R02

Perform clearing on this project to the limits established by Method “III” shown on Standard No. 200.03 of the *2006 Roadway Standard Drawings*.

Revise the *2006 Standard Specifications* as follows:

Page 2-2, Article 200-3, Clearing, add the following as the 6th paragraph:

At bridge sites, clear the entire width of the right of way beginning at a station 3 feet back of the beginning extremity of the structure and ending at a station 3 feet beyond the ending extremity of the structure.

DRY DETENTION BASIN:**Description**

Construct Dry Detention Basins at the locations indicated in the plans, in accordance with the details in the plans and as directed by the Engineer. Excavate basin, furnish and place material in embankments, backfills, and earth berms in accordance with the applicable provisions of Sections 226 and 230 of the *Specifications* and in conformity with the lines, grades, and typical cross sections shown on the plans.

Construction

Construct the masonry drainage structure in accordance with the detail in the plans and the applicable requirements of Section 840 of the *Specifications*.

Perform sodding in accordance with the special provision entitled *Sodding* elsewhere in these contract documents. The Contractor may elect to furnish and place native grass in lieu of sodding at locations indicated on the plans. The types of native grass and method of planting shall be submitted to the Engineer for approval at the pre-construction conference.

Install pipe in accordance with the contract documents.

Perform earthwork in accordance with Section 226 and 230 of the *Specifications*.

Materials

Geotextile Fabric shall be a woven silt film geotextile and will meet the following Minimum Average Roll Values (MARV) when tested in accordance with the methods listed below. The mat shall have the following physical properties:

| Property | Test Method | Value | Unit |
|--|--------------------|--------------|---------------------|
| Tensile Strength (Grab) | ASTM D4632 | 200 | lbs |
| Elongation | ASTM D4632 | 15 | % |
| Puncture | ASTM D4833 | 95 | lbs |
| Mullen Burst | ASTM D3786 | 460 | psi |
| Trapezoidal Tear | ASTM D4533 | 75 | lbs |
| UV Resistance | ASTM D4355 | 70 | % |
| Apparent Opening Size (AOS) ³ | ASTM D4751 | 40 | US Std. Sieve |
| Permittivity | ASTM D4491 | 0.05 | Sec ⁻¹ |
| Water Flow Rate | ASTM D1682 | 4 | Gpm/ft ² |

Submit a certification (Type 1, 2, or 3) from the manufacturer showing:

- (A) The chemical and physical properties of the mat used, and
- (B) conformance of the mat with this specification.

Polypropylene Woven Monofilament Geotextile Fabric shall be a woven polypropylene geotextile and will meet the following Minimum Average Roll Values (MARV) when tested in accordance with the methods listed below. The mat shall have the following physical properties:

| Property | Test Method | Value | Unit |
|--|----------------------------|--------------|---------------------|
| Tensile Strength (Grab) | ASTM D4632 | 370 x 220 | lbs |
| Elongation | ASTM D4632 | 25 x 15 | % |
| Puncture | ASTM D4833 | 115 | lbs |
| Mullen Burst | ASTM D3786 | 470 | psi |
| Trapezoidal Tear | ASTM D4533 | 115 x 75 | lbs |
| UV Resistance | ASTM D4355 | 90 | % |
| Apparent Opening Size (AOS) ³ | ASTM D4751 | 30 | US Std. Sieve |
| Percent Open Area (POA) | CW-02215 Mod. ⁴ | 11 | % |
| Permittivity | ASTM D4491 | 1.10 | Sec ⁻¹ |
| Water Flow Rate | ASTM D1682 | 110 | Gpm/ft ² |

Submit a certification (Type 1, 2, or 3) from the manufacturer showing:

- (A) The chemical and physical properties of the mat used, and
- (B) conformance of the mat with this specification.

Class B Rip Rap and Class II Rip Rap shall meet the requirements of Section 1042 of the *Standard Specifications*.

Washed #57 Stone shall meet the requirements of Section 1005 of the *Standard Specifications*.

Sand used in the Engineered Soil Mix shall meet the requirements for washed ASTM C33 or AASHTO M-6 Fine Aggregate Concrete Sand.

Measurement and Payment

HDPE pipe, caps & elbows shall be measured and paid for as provided elsewhere in the contract documents.

Masonry drainage structures shall be measured and paid for in accordance with Section 840 of the *Specifications for Masonry Drainage Structures*. No separate payment shall be made for trash racks as the cost of such will be considered incidental to the price paid for *Masonry Drainage Structures*.

Drainage Pipe shall be measured and paid for as ___ "*Drainage Pipe* as provided elsewhere in the contract documents.

Dry Detention Basins shall be paid for at the contract lump sum price for "*Dry Detention Basin Sta. _____*". Such price and payment shall be considered full compensation for all labor, materials and incidentals necessary to satisfactorily complete the work covered by this provision.

Payment will be made under:

| Pay Item | Pay Unit |
|--------------------------------------|-----------------|
| Dry Detention Basin Sta. _____ | Lump Sum |

SODDING:

General

Sod shall be placed in accordance with the detail in the plans and as directed by the Engineer. The sodding shall be prepared in accordance with all applicable requirements of Section 1664 of the Standard Specifications and the following provisions:

The Contractor shall obtain a certificate or limited permit issued by The N.C. Department of Agriculture (1-800-206-9333) or (919-733-6932) stating that the sod has been found to be free of injurious plant pests.

Materials

Only "approved sod" (trade designation) consisting of centipede(tifblair) grass shall be used. The sod, machine cut to the suppliers standard width and length, shall be 5/8 inch minimum,

excluding top growth and thatch, at the time of cutting. Before cutting, the sod shall be uniformly mowed at a height of 1/2-3/4 inches. Standard sod sections shall be sufficiently strong to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section.

Sod shall be delivered on site within 24 hours of being cut and be covered by acceptable means during delivery. A certificate from the sod producer stating the date and time of sod cutting shall accompany the sod when it arrives at the project site.

Soil Preparation

Remove litter and other debris. Mow and satisfactorily dispose of weeds or other unacceptable growth on the areas to be sodded.

Prior to beginning preparation of the soil to receive sod, all eroded, uneven and rough areas shall be contour graded and/or filled with soil as directed by the Engineer. The soil shall be scarified or otherwise loosened to a depth of not less than 5 inches with a maximum width of 48 inches. Clods shall be broken and the top 2 to 3 inches of soil shall be worked into an acceptable soil bed by the use of soil pulverizers, drags, or harrows.

The Contractor shall be responsible for taking sufficient soil samples for testing by The Department Of Agriculture, Soil Testing Division, to determine the soil pH. Samples shall be taken in the presence of the Engineer. Results shall be received by the Engineer directly from the North Carolina Department of Agriculture and Consumer Services.

Limestone: Based on these results the Contractor shall add limestone, if required, to bring the soil pH to 5.0 to 6.0 (opt. 5.5). The amount of limestone to be applied will be approved by the Engineer prior to application. Application of limestone will be considered incidental to the work of "Sodding" and no direct payment will be made for such.

Sulfur: Based on these results the Contractor shall add sulfur if the pH is greater than 7.0, to bring the soil pH to 5.0 to 6.0 (opt. 5.5). The amount of sulfur to be applied will be approved by the Engineer prior to application. Application of sulfur will be considered incidental to the work of "Sodding" and no direct payment will be made for such.

After soil preparation, lime or sulfur (if necessary), shall be uniformly distributed by mechanical means and thoroughly mixed with the top five inches of the soil by discing, harrowing, or other approved methods.

The area shall then be harrowed, dragged, raked, or prepared by other approved methods which will give a lawn type finish. All trash, debris and stones larger than 1-1/2 inch in diameter or other obstructions that could interfere with the placing of the sod shall also be removed. The finished surface shall be moistened with water prior to placing the sod as directed by the Engineer.

Placement

Sod handling and placement shall be a continuous process of cutting, transporting and installing including repairing seams and voids. Sod shall always be installed within 48 hours after being cut. Sod shall be watered within 2 hours of installation.

Any sod or portions of sod rejected by the Engineer during the initial placement shall be removed from the project and replaced with acceptable sod immediately. The Contractor shall cease any and all other placement of sod on the project until rejected sod has been replaced. Failure to replace and repair damaged or dead sod as directed by the Engineer may result in sanctions under Article 108-7 or Article 108-8.

After sod has been placed, and staked where necessary, according to Section 1664, it shall then be rolled or tamped carefully and firmly by means acceptable to the Engineer to ensure proper soil contact. If rolled, roller shall weigh 150#/ft of roller width. Use of rubber tired equipment to roll shall not be allowed. Metal staples, 12 inches long unless otherwise approved, shall be made of 11 gauge new steel wire so as not to bend when pinned or driven through the sod. Extreme care shall be taken to prevent the installed sod from being torn or displaced. After rolling or tamping the sod, it shall be watered uniformly and thoroughly with a minimum of 1 inch of water (5.6 gallons per square yard) applied immediately after installation of sod. In no case shall the time interval between sod placement and initial watering exceed 2 hours. Water shall be placed to the required quantity through sequential passes to insure proper coverage and to prevent runoff. A minimum of ¼ inch should be placed on each pass.

Maintenance:

The Contractor shall be responsible for all watering and other maintenance required to maintain the livability and health of the sod from installation until final acceptance. Additional water shall be applied as needed and as directed by the Engineer to maintain the livability of the sod. Each additional watering event shall be a minimum of 0.5 inch of water (2.8 gallons per square yard) uniformly applied over the sodded area and may be placed in a series of passes to prevent runoff, with a minimum of ¼ inch on each pass.

The Contractor shall be responsible year round for all watering and other maintenance required to maintain the livability of the sod from installation until final acceptance including monitoring the sod to ensure all watering and other maintenance is performed as required.

The sod shall be weed free at time of final acceptance.

Measurement and Payment:

No separate measurement and payment shall be made for sodding as the cost of such will be included in the lump sum price paid for *Dry Detention Basin Sta* _____.

LUMP SUM GRADING

(8-17-10)

SP2 R16

Lump sum grading shall be performed in accordance with Section 226 Comprehensive Grading of the *2006 Standard Specifications* except as follows:

Delete all references to Section 230, Borrow Excavation.

EMBANKMENTS:

(5-16-06) (Rev 10-19-10)

SP2 R18

Revise the *Standard Specifications* as follows:

Page 2-22, Article 235-3 MATERIALS, amend as follows:

Add the following as the second sentence of the first paragraph:

Do not use material meeting the requirements of AASHTO M145 for soil classification A-2-5 and A-5 with a plasticity index (PI) of less than 8 within 12” of the subgrade.

Add the following as the second sentence of the second paragraph:

Aerate and dry material containing moisture content in excess of what is required to achieve embankment stability and specified density.

Page 2-22, Subarticle 235-4(B) Embankment Formation, add the following:

- (16) Do not place rock or broken pavement in embankment areas where piles or drilled shaft foundations are to be constructed. This shall include but not be limited to piles and foundations for structures, metal signal poles, overhead sign structures, and high mount lighting.

AGGREGATE SUBGRADE:

(9-18-07) (Rev 3-16-10)

SP2 R35

Description

Construct aggregate subgrades in accordance with the contract or as directed by the Engineer. Undercut as needed in cut areas. Install fabric for soil stabilization and place Class IV Subgrade Stabilization at locations shown on the plans.

Materials

Refer to Division 10 of the *Standard Specifications*.

| Item | Section |
|---------------------------------------|----------------|
| Select Material, Class IV | 1016 |
| Fabric for Soil Stabilization, Type 4 | 1056 |

Use Class IV Select Material for Class IV Subgrade Stabilization. If Class IV Subgrade Stabilization does not meet the requirements of Article 1010-2 of the *Standard Specifications*, the Engineer may consider the material reasonably acceptable in accordance with Article 105-3 of the *Standard Specifications*.

Construction Methods

When shallow undercut is required to construct aggregate subgrades, undercut 6 to 24 inches as shown on the plans or as directed by the Engineer. Perform undercut excavation in accordance with Section 225 of the *Standard Specifications*. Install fabric for soil stabilization in accordance with Article 270-3 of the *Standard Specifications*. Place Class IV Subgrade Stabilization (standard size no. ABC) by end dumping ABC on the fabric. Do not operate heavy equipment on the fabric until it is covered with Class IV Subgrade Stabilization. Compact ABC to 92% of AASHTO T180 as modified by the Department or to the highest density that can be reasonably obtained.

Maintain Class IV Subgrade Stabilization in an acceptable condition and minimize the use of heavy equipment on ABC in order to avoid damaging aggregate subgrades. Provide and maintain drainage ditches and drains as required to prevent entrapping water in aggregate subgrades.

Measurement and Payment

Shallow Undercut will be measured and paid for in cubic yards. Shallow undercut will be measured in accordance with Article 225-7 of the *Standard Specifications*. The contract unit price for *Shallow Undercut* will be full compensation for excavating, hauling and disposing of materials to construct aggregate subgrades.

Class IV Subgrade Stabilization will be measured and paid for in tons. Class IV Subgrade Stabilization will be measured by weighing material in trucks in accordance with Article 106-7 of the *Standard Specifications*. The contract unit price for *Class IV Subgrade Stabilization* will be full compensation for furnishing, hauling, handling, placing, compacting and maintaining ABC.

Fabric for Soil Stabilization will be measured and paid for in accordance with Article 270-4 of the *Standard Specifications*.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------------|-----------------|
| Shallow Undercut | Cubic Yard |
| Class IV Subgrade Stabilization | Ton |

FALSE SUMPS:

(7-1-95)

SP2 R40

Construct false sumps in accordance with the details in the plans and at locations shown in the plans or at other locations as directed by the Engineer.

Payment for the work of construction of the false sumps will be made at the contract unit price per cubic yard for *Unclassified Excavation* or *Borrow Excavation* depending on the source of material, or included in *Grading-Lump Sum*.

SHOULDER AND FILL SLOPE MATERIAL:

(5-21-02)

SP2 R45 B

Description

Perform the required shoulder and slope construction for this project in accordance with the applicable requirements of Section 560 and Section 235 of the *2006 Standard Specifications* except as follows:

Construct the top 6 inches of shoulder and fill slopes with soils capable of supporting vegetation.

Provide soil with a P.I. greater than 6 and less than 25 and with a pH ranging from 5.5 to 6.8. Remove stones and other foreign material 2 inches or larger in diameter. All soil is subject to test and acceptance or rejection by the Engineer.

Obtain material from within the project limits or approved borrow source.

Measurement and Payment

Where the material has been obtained from an authorized stockpile or from a borrow source, measurement and payment will be made as provided in Section 230 of the *2006 Standard Specifications*, "Borrow Excavation".

GEOGRID REINFORCED SLOPE**(SPECIAL)****1. DESCRIPTION**

This work consists of furnishing and installing geogrid reinforcement for stabilizing the steepened embankment slopes in accordance with these provisions and the plans and as directed by the Engineer.

Geogrid reinforcement shall be used to stabilize the fill slope. Permanent turf reinforcement matting will be required on the face of the reinforced slope at this location as shown on the plans.

A preconstruction conference shall be scheduled with representatives of the Contractor, Resident Engineer, Roadside Environment Unit, and Geotechnical Engineering Unit to discuss construction details and quality control measures.

2. MATERIALS

2.1 Geogrid

The geogrid (primary and secondary) shall be composed of polypropylene, high density polyethylene or polyester. The geogrid shall be a regular network of integrally connected elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the soil being reinforced and shall also have a high continuity of tensile strength through all of its elements. The geogrid shall be dimensionally stable and able to retain its geometry under construction stresses. The material shall have high resistance to ultraviolet degradation and to all forms of chemical and biological degradation encountered in the soil being reinforced.

The Contractor shall furnish a Type 2 Typical Certified Mill Test Report for the primary and secondary geogrid in accordance with Section 106-3 of the NCDOT Standard Specifications; however, the material shall be subject to inspection, test, or rejection by the Engineer at any time. The Contractor shall furnish all test reports necessary to justify RF_{ID} , RF_{CR} , and RF_D values for primary grid, if default values are not used.

2.1.1 Primary Geogrid

Primary geogrid shall provide a minimum long-term design tensile strength (T_a) of 800 lb/ft at five (5) percent strain. T_a is computed based on the following formula:

- Ultimate Tensile Strength (T_{ULT})

Ultimate tensile strength shall be determined in accordance with ASTM D 4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method or GRI:GG1 Geogrid Single Rib Tensile Strength (GRI refers to Geosynthetic Research Institute). The test procedure used for determining ultimate strength must be the same used to define RF_{CR} .

- Partial Factor of Safety for Installation Damage, RF_{ID}

This value shall be determined from construction damage tests in accordance with GRI:GG4. The fill material and compaction methods used for testing shall be equal to or more severe than those for the proposed construction. If testing according to this criterion has not been conducted, a default RF_{ID} value of 3.0 shall be used. In no case shall RF_{ID} less than 1.1 be used.

- Partial Factor of Safety for Creep Deformation, RF_{CR}

This value is the ratio of T_{ULT} to the creep limited strength (or creep reduced strength) at five percent strain determined in accordance with ASTM D 5262. Formulation of RF_{CR} is defined in GRI:GG3. The test results shall be extrapolated for a 75 year design life using elevated temperature testing for 10,000 hours or room temperature testing for 80,000 hours per GRI:GG4.

Creep performance testing at a given temperature is limited to one order of magnitude in extrapolation. Creep testing shall have been performed on representative samples of the product and not on a single component of the geogrid. Default values for RF_{CR} will not be accepted.

- Partial Factor of Safety for Durability, RF_D

This value is the combined partial factor of safety for potential chemical and biological degradation. RF_D shall be determined from polymer specific durability testing covering the range of expected soil environments per EPA 9090 method. RF_D shall not be less than 1.1 for any case. In the absence of adequate durability testing, a default RF_D value of 2.6 shall be used.

2.1.2 Secondary Geogrid

Secondary Geogrid shall provide a minimum cross-machine direction (i.e., cross-roll direction) tensile strength of 600 lb/ft at five (5) percent strain and a minimum ultimate tensile strength of 1200 lb/ft determined in accordance with ASTM D 4595.

Secondary geogrid shall provide a minimum machine direction tensile (i.e., along roll direction) strength of 400 lb/ft at five (5) percent strain and a minimum ultimate tensile strength of 800 lb/ft determined in accordance with ASTM D 4595.

2.2 Permanent Turf Reinforcement Matting

The product shall be a permanent erosion control reinforcement mat and shall be constructed of synthetic fibers evenly distributed throughout the mat between a bottom UV stabilized netting and a heavy duty UV stabilized top net. The matting shall be stitched together with UV stabilized polypropylene thread to form a permanent three dimensional structure. The mat shall have the following minimum physical properties:

| Property | Test Method | Value | Unit |
|--|------------------|-------|--------------------|
| Light Penetration | ASTM D6567 | 15 | % |
| Thickness | ASTM D6525 | 0.5 | in |
| Mass Per Unit Area | ASTM D6566 | 0.625 | lb/sy |
| Tensile Strength | ASTM D6818 | 385 | lb/ft |
| Elongation (Maximum) | ASTM D6818 | 49 | % |
| Resiliency | ASTM D6524 | >70 | % |
| UV Stability * | ASTM D4355 | >80 | % |
| Porosity (Permanent Net) | Calculated | >85 | % |
| Minimum Filament | Measured | 0.03 | in |
| Maximum Permissible Shear Stress (Vegetated) | Performance Test | >8 | lb/ft ² |
| Maximum Allowable Velocity | Performance Test | >16 | ft/sec |

*ASTM D1682 Tensile Strength and % strength retention of material after 1000 hours of exposure.

Submit a certification from the manufacturer showing:

- (A) the chemical and physical properties of the mat used, and
- (B) conformance of the mat with this specification.

2.2.1 Anchors

Stakes, reinforcement bars, or staples shall be used as anchors.

Wooden Stakes:

Provide hardwood stakes 1 ft. to 2 ft. long with a 2 in. x 2 in. nominal square cross section. One end of the stake must be sharpened or beveled to facilitate driving through the turf reinforcement mat and down into the underlying soil. The other end of the stake needs to have a 1 in. to 2 in. long head at the top with a 1 in. to 2 in. notch following to catch and secure the coir fiber mat.

Steel Reinforcement Bars:

Provide uncoated #3 steel reinforcement bars 2 ft. nominal length. The bars shall have a 4 in. diameter bend at one end with a 4 in. straight section at the tip to catch and secure the coir fiber mat.

Staples:

Provide staples made of 0.1 in. diameter new steel wire formed into a *u* shape not less than 1 ft. in length with a throat of 1 in. width.

2.3 Borrow Material

Borrow material incorporated into the slopes reinforced with geogrid shall meet the criteria for Coastal Plain Borrow outlined in Section 1018 of the NCDOT Standard Specifications with a maximum P.I. of 15.

3. CONSTRUCTION

During all periods of shipment and storage, the geogrid shall be protected from temperatures greater than 140° F, direct sunlight, mud, wet cement, epoxy, or other materials which may alter its physical properties. At the time of installation, the geogrid shall be rejected if it has defects, tears, punctures, flaws, deterioration or damage incurred during manufacturing, transportation or storage. Any geogrid damaged during storage or installation shall be replaced by the Contractor at no additional cost to the Department.

The proper geogrid shall be placed and pulled tight at the proper location and orientation as shown on the plans and as directed by the Engineer. Correct orientation (machine direction) of the geogrid shall be verified by the Contractor. The geogrid shall be secured in-place to prevent movement during fill operations. The geogrid shall be secured with staples, pins, sandbags, or fill, or as directed by the Engineer. Tolerance in spacing of geogrid layers shall be within 2 in. at any place unless otherwise noted in the plans.

Soil meeting the requirements for Coastal Plain Borrow as required by the plans and this specification is required on top of each geogrid layer to the limits shown on the plans. Placement and compaction of borrow material fill shall conform to all applicable requirements of the NCDOT Standard Specifications. The entire embankment should be constructed simultaneously with the geogrid reinforced slopes. The fill shall be placed, spread, and compacted in a manner that prevents the development of wrinkles or movement of the geogrid. No equipment shall be allowed to operate directly on the geogrid. A minimum fill thickness of 6 in. is required prior to operation of any equipment or vehicle over the geogrid. Turning of vehicles shall be kept to a minimum, and sudden braking and sharp turning shall be avoided. Damaged geogrids shall be replaced at no cost to the Department.

The first layer of the primary geogrid shall be placed on the existing ground surface with a length as specified in the plans and with the machine direction (roll direction) perpendicular to the toe of slope. Subsequent layers of primary geogrid shall be placed horizontally as shown on the plans and as directed by the Engineer. The vertical spacing between primary geogrid layers shall be no more than 4.0 ft. as shown on the plan typical section.

Primary geogrid shall be placed in continuous strips in the direction specified in the plans. No overlaps or connections shall be permitted in the machine direction of the primary geogrid layers. Adjacent rolls of primary geogrid, in the direction perpendicular to the toe of the slopes, shall be rolled out and butted up against each other (side to side).

Secondary geogrid shall be placed between the layers of primary geogrid with the machine direction (roll direction) parallel to the toe of slope. The vertical spacing between secondary geogrid layers shall be no more than 16 in. as shown the plan typical section. Rolls of secondary geogrid shall be butted up next to each other (end to end) as shown on the plans and as directed by the Engineer.

4. FACE OF SLOPE

Face the geogrid reinforced slope with permanent turf reinforcement matting as shown on the plans. Permanent turf reinforcement matting must be anchored on a 4 ft. by 4 ft. square spacing.

Matting shall be installed in accordance with Subarticle 1631-3(B) of the *Standard Specifications*. All areas to be protected with the mat shall be brought to final grade and seeded in accordance with Section 1660 of the *Standard Specifications*. The surface of the soil shall be smooth, firm, stable and free of rocks, clods, roots or other obstructions that would prevent the mat from lying in direct contact with the soil surface. Areas where the mat is to be placed will not need to be mulched.

5. MEASUREMENT AND PAYMENT

Geogrid Reinforcement to be measured and paid for will be the total number of square yard of geogrid correctly placed in the completed embankment as shown on the plans or as directed by the Engineer. No measurement will be made of geogrid reinforcement installed lengths longer than that shown on the plans. No separate measurement will be made of overlapping geogrid for payment purposes.

The quantity of primary and secondary geogrid, measured as provided above, will be paid for at the contract unit price per square yard for "Primary Geogrid Reinforcement" and "Secondary Geogrid Reinforcement", respectively. Such prices and payments will be full compensation for all the work required by this provision including but not limited to: furnishing all materials, labor, equipment, and tools; placing and installing geogrids; hauling, placing and compacting fill; and all incidentals necessary to complete the work.

Permanent Turf Reinforcement Mat will be measured and paid for as the actual number of square yard measured along the surface of the ground over which Permanent Turf Reinforcement Mat is installed and accepted. Overlaps will not be included in the measurement, and will be considered as incidental to the work. Furnishing and installing turf reinforcement matting anchors is incidental to the cost of the matting. Such payment shall be full compensation for furnishing and installing the mat, including overlaps, and for all required maintenance.

Pay Items:

| | |
|---------------------------------------|-------------|
| Primary Geogrid Reinforcement..... | Square Yard |
| Secondary Geogrid Reinforcement..... | Square Yard |
| Permanent Turf Reinforcement Mat..... | Square Yard |

BORROW EXCAVATION:

(SPECIAL)

The work of furnishing and placing borrow material shall be in accordance with Section 230 of the Standard Specifications and the following.

For backfill of undercut areas and other areas as directed, furnish and place borrow material meeting the requirements for select granular material, class III in accordance with the contract.

Materials

Refer to Division 10 of the *Standard Specifications*.

| Item | Section |
|----------------------------|----------------|
| Select Material, Class III | 1016 |

Construction Methods

Use select granular material, class III over fabric for soil stabilization, for backfill in water and for backfill of undercut areas.

Place select granular material to 3 ft above fabric and water level.

Measurement and Payment

Select granular material, class III will be included in the measurements made and will be paid for as "*Borrow Excavation*".

Borrow Excavation will be measured by in place measurement in accordance with Article 230-5 of the *Standard Specifications* or by weighing material in trucks in accordance with Article 106-7 of the *Standard Specifications* as determined by the Engineer. When *borrow excavation* is weighed in trucks, a unit weight of 135 pcf will be used to convert the weight of borrow material to cubic yards. At the Engineer's discretion, truck measurement in accordance with Article 230-5 of the *Standard Specifications* may be used in lieu of weighing material in trucks.

The contract unit price for *Borrow Excavation* as described above will be full compensation for furnishing, hauling, handling, placing, compacting and maintaining the material.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------|-----------------|
| Borrow Excavation | Cubic Yard |

FLOWABLE FILL:

(9-17-02) (Rev 8-21-07)

SP3 R30

Description

This work consists of all work necessary to place flowable fill in accordance with these provisions, the plans, and as directed.

Materials

Provide flowable fill material in accordance with Article 340-2 of the *2006 Standard Specifications*.

Construction Methods

Discharge flowable fill material directly from the truck into the space to be filled, or by other approved methods. The mix may be placed full depth or in lifts as site conditions dictate. The Contractor shall provide a method to plug the ends of the existing pipe in order to contain the flowable fill.

Measurement and Payment

At locations where flowable fill is called for on the plans and a pay item for flowable fill is included in the contract, *flowable fill* will be measured in cubic yards and paid for as the actual number of cubic yards that have been satisfactorily placed and accepted. Such price and payment will be full compensation for all work covered by this provision including but not limited to the mix design, furnishing, hauling, placing and containing the flowable fill.

Payment will be made under:

| | |
|----------------------------------|-------------------------------|
| Pay Item Flowable Fill | Pay Unit Cubic Yard |
|----------------------------------|-------------------------------|

PIPE TESTING:

4-17-07

SP3 R33

Revise the *2006 Standard Specifications* as follows:

Page 3-3, Article 300-6, add the following as a new paragraph before (A):

The Department reserves the right to perform forensic testing on any installed pipe.

DRAINAGE PIPE:

(7-18-06) (Rev 3-16-10)

SP3 R37

Description

Where shown in the plans the Contractor may use Reinforced Concrete Pipe, Aluminum Alloy Pipe, Aluminized Corrugated Steel Pipe, HDPE Pipe, or PVC pipe in accordance with the following requirements.

Material

| Item | Section |
|--|----------------|
| Corrugated Aluminum Alloy Pipe | 1032-2(A) |
| Aluminized Corrugated Steel Pipe | 1032-3(A)(7) |
| Corrugated Polyethylene Pipe (HDPE) | 1032-10 |
| Reinforced Concrete Pipe – Class II or III | 1032-9(C) |
| Polyvinyl-Chloride (PVC) | 1032-11 |
| Elbows | 1032 |

Corrugated Steel Pipe will not be permitted in counties listed in the contract documents.

Only pipe with smooth inside walls will be allowed for storm drain systems. Storm drain systems are defined as pipe under curb and gutter, expressway gutter, and shoulder berm gutter that connects drainage structures and is not open ended.

Construction Methods

Pipe Culverts shall be installed in accordance with the contract documents.

Where allowed by the plans, use any of the several alternate pipes shown herein, but only one type of pipe and elbow will be permitted between drainage structures or for the entire length of a cross line pipe.

Measurement and Payment

___ " *Drainage Pipe* will be paid for as the actual number of linear feet installed and accepted. Measurement will be in accordance with the contract documents.

___ " *Drainage Pipe Elbow* will be measured and paid for in units of each.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------|-----------------|
| ___ " Drainage Pipe | Linear Foot |
| ___ " Drainage Pipe Elbow | Each |

PIPE INSTALLATION AND PIPE CULVERTS:
(1-19-10)

SP3 R40 B

Revise the *Standard Specifications* as follows:

Replace Section 300 and Section 310 with the following:

**SECTION 300
PIPE INSTALLATION**

300-1 DESCRIPTION

Excavate, undercut, provide material, condition foundation, lay pipe, joint and couple pipe sections, and furnish and place all backfill material as necessary to install the various types of pipe culverts and fittings required to complete the project.

Install pipe in accordance with the detail in the plans.

Do not waste excavation unless permitted. Use suitable excavated material as backfill; or in the formation of embankments, subgrades, and shoulders; or as otherwise directed. Furnish disposal areas for the unsuitable material. The Engineer will identify excavated materials that are unsuitable.

Where traffic is to be maintained, install pipe in sections so that half the width of the roadway is available to traffic.

300-2 MATERIALS

Refer to Division 10:

| Item | Section |
|--------------------|----------------|
| Flowable Fill | 1000 |
| Select Materials | 1016 |
| Joint Materials | 1032-9(G) |
| Engineering Fabric | 1056-1 |

Provide foundation conditioning material meeting the requirements of Article 1016-3 for Class V or VI as shown in the contract documents.

Provide bedding material meeting the requirements of Article 1016-3 for Class II (Type 1 only) or Class III as shown in contract documents.

Provide backfill material meeting the requirements of Article 1016-3 for Class II (Type 1 – for Flexible Pipe) or Class III material as shown in the contract documents.

Do not use corrugated steel pipe in the following counties:

Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Currituck, Dare, Gates, Hertford, Hyde, Jones, Martin, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington.

300-3 UNLOADING AND HANDLING

Unload and handle pipe with reasonable care. Do not roll or drag metal pipe or plates over gravel or rock during handling. Take necessary precautions to ensure the method used in lifting or placing the pipe does not induce stress fatigue in the pipe. Use a lifting device that uniformly distributes the weight of the pipe along its axis or circumference. Repair minor damage to pipe when permitted. Remove pipe from the project that is severely damaged or is rejected as being unfit for use. Undamaged portions of a joint or section may be used where partial lengths are required.

300-4 PREPARATION OF PIPE FOUNDATION

Prepare the pipe foundation in accordance with the applicable method as shown in the contract documents, true to line and grade, and uniformly firm.

Camber invert grade an amount sufficient to prevent the development of sag or back slope in the flow line. The Contractor shall determine the amount of camber required and submit to the Engineer for approval.

Where material is found to be of poor supporting value or of rock and when the Engineer cannot make adjustment in the location of the pipe, undercut existing foundation material within the limits established on the plans. Backfill the undercut with foundation conditioning material, Class V or VI select material. Encapsulate the foundation conditioning material with Type 4 engineering fabric prior to placing bedding material. Overlap all transverse and longitudinal joints in the fabric at least 18 inches.

Maintain the pipe foundation in a dry condition.

300-5 INVERT ELEVATIONS

The proposed pipe culvert invert elevations shown on the Drainage Summary Sheets are based upon information available when the plans were prepared. If proposed invert elevations are adjusted during construction based upon actual conditions encountered, no claim for an extension of time for any reason resulting from this information will be allowed.

When a pipe culvert is to be installed in a trench and the average actual elevation of the pipe between drainage structures deviates from the average proposed elevation shown on the Drainage Summary Sheets by more than one foot a pay adjustment will be made as follows:

Pay Adjustment (per linear foot) = [(APE-AAE)± 1 foot] (0.15 X CUP)

Where: CUP = Contract Unit Price of Pipe Culvert

AAE = Average Actual Elevation $\frac{(\text{Actual Inlet elev.} + \text{Actual Outlet elev.})}{2}$

APE = Average Plan Elevation $\frac{(\text{Plan Inlet elev.} + \text{Plan Outlet elev.})}{2}$

When the actual location of a pipe culvert is changed from the location shown on the plans, the Engineer will make a pay adjustment deemed warranted based upon the relation of the pipe culvert as shown on the plans to the finished roadway and the relation of the pipe culvert as constructed to the finished roadway.

The top elevation column on the drainage summary sheet indicates the flow elevation at the top of structures intended to collect surface water.

The top elevation column on drainage structures not intended to collect surface water indicates the elevation at the top of the cover.

300 -6 LAYING PIPE

The Department reserves the right to perform forensic testing on any installed pipe.

(A) Rigid Pipe

Concrete and welded steel pipe will be considered rigid pipe. Lay pipe on prepared foundation, bell or groove end upgrade with the spigot or tongue fully inserted. Check each joint for alignment and grade as the work proceeds.

Use flexible plastic joint material except when material of another type is specified in the contract documents. Joint material of another type may be used when permitted.

Repair lift holes in concrete pipe, if present. Thoroughly clean and soak the lift hole and completely fill the void with an approved non-shrink grout. Submit alternate details for repairing lift holes to the engineer for review and approval.

For all pipes 42 inches in diameter and larger, wrap filter fabric around all pipe joints. Use Type 3 Class B fabric. Extend fabric at least 12 inches beyond each side of the joint. Secure the filter fabric against the outside of the pipe by methods approved by the Engineer.

(B) Flexible Pipe (Except Structural Plate Pipe)

Corrugated steel, corrugated aluminum, corrugated polyethylene (HDPE), and polyvinylchloride (PVC) pipe will be considered flexible pipe. Place flexible pipe carefully on the prepared foundation starting at the downstream end with the inside circumferential laps pointing downstream and with the longitudinal laps at the side or quarter points.

Handle coated corrugated steel pipe with special care to avoid damage to coatings.

Join pipe sections with coupling band, fully bolted and properly sealed. Provide coupling bands for annular and helical corrugated metal pipe with circumferential and longitudinal strength sufficient to preserve the alignment, prevent separation of the sections, and prevent backfill infiltration. Match-mark all pipe 60 inches or larger in diameter at the plant for proper installation on the project.

At locations indicated in the plans, corrugated steel pipe sections shall be jointed together with rod and lug coupling bands, fully bolted. Sleeve gaskets shall be used in conjunction with rod and lug couplings and the joints properly sealed. Coupling bands shall provide circumferential and longitudinal strength sufficient to preserve the alignment, prevent separation of the sections and prevent infiltration of backfill material.

300-7 BEDDING AND BACKFILLING

Loosely place bedding material, in a uniform layer, a depth equal to the inside diameter of the pipe divided by 6 or 6 inches, whichever is greater. Leave bedding material directly beneath the pipe uncompacted and allow pipe seating and backfill to accomplish compaction. Excavate recesses to receive the bells where bells and spigot type pipe is used.

Place fill around the pipe in accordance with the applicable method shown on the plans in layers not to exceed 6 inches loose unless otherwise permitted. Compact to the density required by Subarticle 235-4(C). Approval of the backfill material is required prior to its use. Use select material as shown in the contract documents.

Take care during backfill and compaction operations to maintain alignment and prevent damage to the joints. Keep backfill free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material.

Grade and maintain all pipe backfill areas in such a condition that erosion or saturation will not damage the pipe foundation or backfill.

Excavatable flowable fill may be used for backfill when approved by the Engineer. When using excavatable flowable fill, ensure that the pipe is not displaced and does not float during backfill. Submit methods for supporting the pipe and material placement to the Engineer for review and approval.

Do not operate heavy equipment over any pipe until it has been properly backfilled with a minimum 3 feet of cover. Place, maintain, and finally remove the required cover that is above the proposed finished grade at no cost to the Department. Remove and replace, at no cost to the Department, pipe that becomes misaligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations.

300-8 INSPECTION AND MAINTENANCE

Prior to final acceptance, the Engineer will perform random video camera and or mandrel inspections to ensure proper jointing and that deformations do not exceed allowable limits. Replace pipes having cracks greater than 0.1 inches or deflections greater than 7.5 percent. Repair or replace pipes with cracks greater than 0.01 inches, exhibiting displacement across a crack, exhibiting bulges, creases, tears, spalls, or delamination. Maintain all pipe installations in a condition such that they will function continuously from the time the pipe is installed until the project is accepted.

300-9 MEASUREMENT AND PAYMENT**General**

No measurement will be made of any work covered by this section except as listed below. Removal and disposal of existing pavement is a part of the excavation for the new pipe culvert installation. Repair of the pavement will be made in accordance with Section 654.

Foundation Conditioning**Using Local Material**

Undercut excavation is all excavation removed by undercutting below the bottom of the trench as staked. *Undercut Excavation* will be measured as the actual number of cubic yards of undercut excavation, measured in its original position and computed by the average end area method, that has been removed as called for in the contract and will be paid for at double the contract unit price for *Unclassified Excavation* as provided in Article 225-7.

Local material used for conditioning the foundation will be measured and paid for in accordance with Article 225-7 for *Unclassified Excavation* or in accordance with Article 230-5 for *Borrow Excavation* depending on the source of the material.

Local material used to replace pipe undercut excavation will be measured and paid for in accordance with Article 225-7 or Article 230-5.

Using Other Than Local Material

No measurement and payment will be made for *Undercut Excavation*. The material used to replace pipe undercut excavation will be classified as foundation conditioning material.

Foundation Conditioning Material, Minor Structures will be measured and paid for as the actual number of tons of this material weighed in trucks on certified platform scales or other certified weighing devices.

No direct payment will be paid for undercut excavation. Payment at the contract unit price for *Foundation Conditioning Material, Minor Structures* will be full compensation for all work of pipe undercut excavation.

Foundation Conditioning Fabric

Foundation Conditioning Fabric will be measured and paid for in square yards. The measurement will be based on the theoretical calculation using length of pipe installed and two times the standard trench width. No separate measurement will be made for overlapping fabric or the vertical fabric dimensions required to encapsulate the foundation conditioning material.

Bedding and Backfill - Select Material

No measurement will be made for select bedding and backfill material required in the contract documents. The select bedding and backfill material will be included in the cost of the installed pipe.

Where unclassified excavation or borrow material meets the requirements for select bedding and backfill and is approved for use by the Engineer, no deductions will be made to these pay items to account for use in the pipe installation.

Payment will be made under:

| | |
|--|-----------------|
| Pay Item | Pay Unit |
| Foundation Conditioning Material, Minor Structures | Ton |
| Foundation Conditioning Fabric | Square Yard |

**SECTION 310
PIPE CULVERTS**

310-1 DESCRIPTION

Furnish and install drainage pipe at locations and size called for in the contract documents. The work includes construction of joints and connections to other pipes, endwalls, and drainage structures.

310-2 MATERIALS

Refer to Division 10:

| Item | Section |
|--|----------------|
| Plain Concrete Pipe Culvert | 1032-9(B) |
| Reinforced Concrete Pipe Culvert | 1032-9(C) |
| Precast Concrete Pipe End Sections | 1032-9(D) |
| Concrete Pipe Tees and Elbows | 1032-9(E) |
| Corrugated Aluminum Alloy Pipe Culvert | 1032-2(A) |
| Corrugated Aluminum Alloy Pipe Tees and Elbows | 1032-2(B) |
| Corrugated Steel Culvert Pipe and Pipe Arch | 1032-3(A) |
| Prefabricated Corrugated Steel Pipe End Sections | 1032-3(B) |
| Corrugated Steel Pipe Tees and Elbows | 1032-3(C) |
| Corrugated Steel Eccentric Reducers | 1032-3(D) |
| HDPE Smooth Lined Corrugated Plastic Pipe | 1032-10 |
| Polyvinylchloride (PVC) Pipe | 1032-11 |

Suppliers that provide metal pipe culverts, fittings, and all other accessories covered by this section shall meet the requirements of the Department's Brand Certification program for metal pipe culverts, and be listed on the Department's pre-approved list for suppliers of metal pipe culvert.

Do not use corrugated steel pipe in the following counties:

Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Currituck, Dare, Gates, Hertford, Hyde, Jones, Martin, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrell, and Washington.

310-3 PIPE INSTALLATION

Install pipe, pipe tees, and elbows in accordance with Section 300.

310-4 SIDE DRAIN PIPE

Side drain pipe is defined as storm drain pipe running parallel to the roadway to include pipe in medians, outside ditches, driveways, and under shoulder berm gutter along outside shoulders greater than 4 feet wide.

Where shown in the plans, side drain pipe may be class II reinforced concrete pipe, aluminized corrugated steel pipe, corrugated aluminum alloy pipe, HDPE pipe, or PVC pipe. Corrugated steel pipe is restricted in the counties listed in Article 310-2. Install side drain pipe in accordance to Section 300. Cover for side drain pipe shall be at least one foot.

310-5 PIPE END SECTIONS

Choose which material to use for the required end sections. Both corrugated steel and concrete pipe end sections will work on concrete pipe, corrugated steel pipe, and HDPE smooth lined corrugated plastic pipe.

310-6 MEASUREMENT AND PAYMENT

Pipe will be measured and paid for as the actual number of linear feet of pipe that has been incorporated into the completed and accepted work. Measurement of pipe will be made by counting the number of joints used and multiplying by the length of the joint to obtain the number of linear feet of pipe installed and accepted. Measurements of partial joints will be made along the longest length of the partial joint to the nearest 0.1 of a foot. Select bedding and backfill material will be included in the cost of the installed pipe.

Pipe end sections, tees, elbows, and eccentric reducers will be measured and paid for as the actual number of each of these items that have been incorporated into the completed and accepted work.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| __ " R.C. Pipe Culverts, Class ____. | Linear Foot |
| __ x __ " x __ " R.C. Pipe Tees, Class ____ | Each |
| __ " R.C. Pipe Elbows, Class ____. | Each |
| __ " C.A.A. Pipe Culvert, __ " Thick | Linear Foot |
| __ x __ " x __ " C.A.A. Pipe Tees, __ " Thick | Each |
| __ " C.A.A. Pipe Elbows, __ " Thick | Each |
| __ " C.S. Pipe Culverts, __ " Thick | Linear Foot |
| __ x __ " C.S. Pipe Arch Culverts, __ " Thick | Linear Foot |
| __ x __ " x __ " C.S. Pipe Tees, __ " Thick | Each |
| __ " C.S. Pipe Elbows, __ " Thick | Each |
| __ x __ " C.S. Eccentric Reducers, __ " Thick | Each |
| __ " HDPE Pipe | Linear Foot |
| __ " PVC Pipe | Linear Foot |
| __ " Side Drain Pipe | Linear Foot |
| __ " Side Drain Pipe Elbows | Each |
| __ " Pipe End Section | Each |

BRIDGE APPROACH FILLS:

(10-19-10)

SP4 R01

Description

Construct bridge approach fills in accordance with the contract. Bridge approach fills include bridge approach fills for sub regional tier bridges and reinforced bridge approach fills. Geotextiles include engineering fabrics and geomembranes.

Materials

Refer to Division 10 of the *Standard Specifications*:

| Item | Section |
|-----------------------------------|----------------|
| Portland Cement Concrete, Class B | 1000 |
| Select Material | 1016 |
| Subsurface Drainage Materials | 1044 |
| Engineering Fabrics | 1056 |

Use Class III or V Select Material for reinforced approach fills and only Class V Select Material (standard size no. 78M stone) for bridge approach fills for sub regional tier bridges. Provide polyvinyl chloride (PVC) plastic drainage pipes, fittings and outlet pipes for subsurface drainage materials for all bridge approach fills. For bridge approach fills for sub regional tier bridges, use Type 1 Engineering Fabric for filter fabric to encase no. 78M stone. For reinforced bridge approach fills, use Type 5 Engineering Fabric for woven fabrics and Type 2 Engineering Fabric and no. 78M stone for drains.

Load, transport, unload and store geomembranes such that they are kept clean and free of damage. Geomembranes with defects, flaws, deterioration or damage will be rejected. Do not unwrap geomembranes until just before installation and do not leave geomembranes exposed for more than 7 days before covering geomembranes with woven fabrics.

Use either polyvinyl chloride (PVC), high density polyethylene (HDPE) or linear low density polyethylene (LLDPE) geomembranes. For PVC geomembranes, provide grade PVC30 geomembranes meeting the requirements of ASTM D7176. For HDPE and LLDPE geomembranes, use geomembranes with a nominal thickness of 30 mils meeting the requirements of Geosynthetic Research Institute Standard Specifications GM13 or GM17, respectively.

Construction Methods

Excavate as necessary for bridge approach fills in accordance with the contract. Notify the Engineer when foundation excavation is complete. Do not place geomembranes or filter fabrics until obtaining approval of the excavation depth and foundation material.

Attach geomembranes or filter fabrics to back of end bent caps and wing walls with adhesives, tapes or other approved methods. Use wire staples as needed to hold filter fabrics in place until covered. Overlap adjacent fabrics a minimum of 18" such that overlaps are parallel to the roadway centerline. Glue or weld geomembrane seams to prevent leakage. Contact the Engineer when existing or future structures such as foundations, pavements, pipes, inlets or utilities will interfere with geotextiles.

For reinforced bridge approach fills, place woven fabrics within 2" of locations shown on the plans and in slight tension free of kinks, folds, wrinkles or creases. Place first layer of woven fabric directly on geomembranes with no void or material in between. Install woven fabrics with the machine direction (MD) parallel to the roadway centerline. The MD is the direction of the length or long dimension of the roll. Do not splice or overlap woven fabrics in the MD such that splices or overlaps are perpendicular to the roadway centerline. Install woven fabrics with the orientation, dimensions and number of layers shown on the plans. Wrap woven fabrics as shown on the plans or as directed by the Engineer.

For reinforced bridge approach fills, construct 1 ft by 1 ft drains consisting of 4" diameter perforated PVC pipes surrounded by no. 78M stone wrapped in type 2 fabric. For bridge approach fills for sub regional tier bridges, install 4" diameter perforated PVC drainage pipes as shown on the plans.

Firmly connect PVC pipes together as needed. Connect perforated pipes to outlet pipes near the back faces of wing walls. Provide drains with positive drainage towards outlets. Place pipe sleeves in or under wing walls for outlet pipes such that positive drainage is maintained. Use sleeves of sufficient strength to withstand wing wall loads.

Place select material in 8 to 10 inch thick lifts. Compact Class III Select Material in accordance with Subarticle 235-4(C) of the *Standard Specifications*. Do not displace or damage fabrics or drains when placing and compacting select material. End dumping directly on fabrics and drains is not permitted. Do not operate heavy equipment on woven fabrics or drains until they are covered with at least 8" of select material. Replace any damaged fabrics and drains to the satisfaction of the Engineer.

Use only hand operated compaction equipment for bridge approach fills for sub regional tier bridges and within 3 ft of end bent cap back or wing walls for reinforced bridge approach fills. At a distance greater than 3 ft for reinforced bridge approach fills, compact select material with at least 4 passes of an 8 – 10 ton vibratory roller. Smooth wheeled or rubber tired rollers are also acceptable for compacting select material. Do not use sheepsfoot, grid rollers or other types of compaction equipment with feet.

Use solvent cement for connecting outlet pipes and fittings such as wyes, tees and elbows. Provide connectors for outlet pipes and fittings that are watertight and suitable for gravity flow conditions. Cover open ends of outlet pipes with rodent screens as shown on the plans.

Connect drains to concrete pads or existing drainage structures at ends of outlet pipes as directed by the Engineer. Construct concrete pads and provide an Ordinary Surface Finish in accordance with Subarticle 825-6(B) of the *Standard Specifications*.

Measurement and Payment

Reinforced Bridge Approach Fill, Station _____ will be paid at the contract lump sum price. Such price and payment will be full compensation for all reinforced bridge approach fills at each bridge for excavating and furnishing, transporting and placing geotextiles, select material, drains, pipe sleeves and concrete pads, compacting select material, connecting pipes to existing drainage structures and providing any labor, tools, equipment and materials to complete the work.

Bridge Approach Fill – Sub Regional Tier, Station _____ will be paid at the contract lump sum price. Such price and payment will be full compensation for all bridge approach fills at each sub regional tier bridge for excavating and furnishing, transporting and placing filter fabrics, no. 78M stone, drainage pipes, pipe sleeves and concrete pads, compacting no. 78M stone, connecting pipes to existing drainage structures and providing any labor, tools, equipment and materials to complete the work.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Reinforced Bridge Approach Fill, Station _____ | Lump Sum |
| Bridge Approach Fill – Sub Regional Tier, Station _____ | Lump Sum |

FINE GRADING SUBGRADE, SHOULDERS AND DITCHES:

(7-21-09)

SP5 R01

Revise the *Standard Specifications* as follows:

Page 5-1, Article 500-1 Description, replace the first sentence with the following:

Perform the work covered by this section including but not limited to preparing, grading, shaping, manipulating moisture content, and compacting either an unstabilized or stabilized roadbed to a condition suitable for placement of base course, pavement, and shoulders.

AGGREGATE BASE COURSE:

12-19-06

SP5 R03

Revise the *2006 Standard Specifications* as follows:

Page 5-11, Article 520-5 Hauling and Placing Aggregate Base Material, 6th paragraph, replace the first sentence with the following:

Base course that is in place on November 15 shall have been covered with a subsequent layer of pavement structure or with a sand seal. Base course that has been placed between November 16 and March 15 inclusive shall be covered within 7 calendar days with a subsequent layer of pavement structure or with a sand seal.

ASPHALT PAVEMENTS - SUPERPAVE:

(7-18-06)(Rev 11-16-10)

SP6 R01

Revise the *2006 Standard Specifications* as follows:

Page 6-2, Article 600-9 Measurement and Payment, delete the second paragraph.

Page 6-12, Subarticle 609-5(C)(2), Required Sampling and Testing Frequencies, first partial paragraph at the top of the page, delete last sentence and replace with the following:

If the Engineer allows the mix to remain in place, payment will be made in accordance with Article 105-3.

Page 6-12, Subarticle 609-5(C)(2), Quality Control Minimum Sampling and Testing Schedule, first paragraph, delete and replace with the following:

Sample and test the completed mixture from each mix design per plant per year at the following minimum frequency during mix production:

Second paragraph, delete the fourth sentence and replace with the following:

When daily production of each mix design exceeds 100 tons and a regularly scheduled full test series random sample location for that mix design does not occur during that day's production, perform at least one partial test series consisting of Items A and B in the schedule below.

Page 6-12, Subarticle 609-5(C)(2)(c) Maximum Specific Gravity, add after (AASHTO T 209):

or ASTM D 2041

Page 6-13, last line and on page and Page 6-14, Subarticle 609-5(C)(2)(e) Tensile Strength Ratio (TSR), add a heading before the first paragraph as follows:

(i) Option 1

Insert the following immediately after the first paragraph:

(ii) Option 2

Mix sampled from truck at plant with one set of specimens prepared by the Contractor and then tested jointly by QA and QC at a mutually agreed upon lab site within the first 7 calendar days after beginning production of each new mix design.

Second paragraph, delete and replace with the following:

Test all TSR specimens required by either option noted above on either a recording test press or a test press that maintains the peak load reading after the specimen has broken.

Subarticle 609-5(C)(3) Control Charts, delete the second sentence of the first paragraph and replace with the following:

For mix incorporated into the project, record full test series data from all regularly scheduled random samples or directed samples that replace regularly scheduled random samples, on control charts the same day the test results are obtained.

Page 6-15, Subarticle 609-5(C)(3) Control Charts, first paragraph on this page, delete the last sentence and substitute the following:

Denote the moving average control limits with a dash green line and the individual test limits with a dash red line.

Page 6-15, Subarticle 609-5(C)(3)(a), (b) and (c), replace (a) (b) and (c) with the following:

(a) A change in the binder percentage, aggregate blend, or G_{mm} is made on the JMF, or,

- (b) When the Contractor elects to stop or is required to stop production after one or two moving average values, respectively, fall outside the moving average limits as outlined in Subarticle 609-5(C)(6) or,
- (c) If failure to stop production after two consecutive moving averages exceed the moving average limits occurs, but production does stop at a subsequent time, re-establish a new moving average beginning at the actual production stop point.

Page 6-15, Subarticle 609-5(C)(4) Control Limits, replace the first paragraph and the CONTROL LIMITS Table on page 6-16 with the following:

The following are established as control limits for mix production. Apply the individual limits to the individual test results. Control limits for the moving average limits are based on a moving average of the last 4 data points. Apply all control limits to the applicable target source.

CONTROL LIMITS

| Mix Control Criteria | Target Source | Moving Average Limit | Individual Limit |
|--|------------------|----------------------|------------------|
| 2.36 mm Sieve | JMF | ±4.0 % | ±8.0 % |
| 0.075 mm Sieve | JMF | ±1.5 % | ±2.5 % |
| Binder Content | JMF | ±0.3 % | ±0.7 % |
| VTM @ N _{des} | JMF | ±1.0 % | ±2.0 % |
| VMA @ N _{des} | Min. Spec. Limit | Min Spec. Limit | -1.0% |
| P _{0.075} / P _{be} Ratio | 1.0 | ±0.4 | ±0.8 |
| %G _{mm} @ N _{ini} | Max. Spec. Limit | N/A | +2.0% |
| TSR | Min. Spec. Limit | N/A | - 15% |

Page 6-16, Subarticle 609-5(C)(5) Warning Bands, delete this subarticle in its entirety.

Pages 6-16 through 6-19, Subarticle 609-5(C)(6), delete the word "warning" and replace with the words "moving average".

Page 6-16, Subarticle 609-5(C)(6) Corrective Actions, first paragraph, first sentence, delete and replace with the following:

Immediately notify the Engineer when moving averages exceed the moving average limits.

Page 6-17, Subarticle 609-5(C)(6) Corrective Actions, delete the third full paragraph and replace with the following:

Failure to stop production when required due to an individual mix test not meeting the specified requirements will subject all mix from the stop point tonnage to the point when the next individual test is back on or within the moving average limits, or to the tonnage point when production is actually stopped, whichever occurs first, to being considered unacceptable.

Sixth full paragraph, delete the first, second, and third sentence and replace with the following:

Immediately notify the Engineer when any moving average value exceeds the moving average limit. If two consecutive moving average values for any one of the mix control criteria fall outside the moving average limits, cease production of that mix, immediately notify the Engineer of the stoppage, and make adjustments. The Contractor may elect to stop production after only one moving average value falls outside the moving average limits.

Page 6-18, Subarticle 609-5(C)(6) Corrective Actions, second full paragraph, delete and replace with the following:

If the process adjustment improves the property in question such that the moving average after four additional tests is on or within the moving average limits, the Contractor may continue production with no reduction in payment.

Page 6-18, Subarticle 609-5(C)(6) Corrective Actions, delete the third and fourth full paragraphs, including the Table for Payment for Mix Produced in the Warning Bands and substitute the following:

If the adjustment does not improve the property in question such that the moving average after four additional individual tests is outside the moving average limits, the mix will be evaluated for acceptance in accordance with Article 105-3. Reduced payment for or removal of the mix in question will be applied starting from the plant sample tonnage at the stop point to the sample tonnage when the moving average is on or within the moving average limits. In addition, any mix that is obviously unacceptable will be rejected for use in the work.

Page 6-19, Subarticle 609-5(C)(6) Corrective Actions, first paragraph, delete and replace with the following:

Failure to stop production and make adjustments when required due to two consecutive moving average values falling outside the moving average limits will subject all mix produced from the stop point tonnage to the tonnage point when the moving average is back on or within the moving average limits or to the tonnage point when production is actually stopped, whichever occurs first, to being considered unacceptable. Remove this material and replaced with materials that comply with the Specifications at no additional costs to the Department, unless otherwise approved. Payment will be made for the actual quantities of materials required to replace the removed quantities, not to exceed the original amounts.

Page 6-20, Subarticle 609-5(D)(1) General, delete the third full paragraph, and replace with the following:

Perform the sampling and testing at the minimum test frequencies as specified above. Should the density testing frequency fail to meet the minimum frequency as specified above, all mix without the required density test representation will be considered unsatisfactory. If the Engineer allows the mix to remain in place, payment will be made in accordance with Article 105-3.

Page 6-22, Subarticle 609-5(D)(4) Nuclear Gauge Density Procedures, third paragraph, insert the following as the second sentence:

Determine the Daily Standard Count in the presence of the QA Roadway Technician or QA Nuclear Gauge Technician on days when a control strip is being placed.

Page 6-23, Subarticle 609-5(D)(5) Limited Production Procedure, delete the first paragraph including (a), (b), (c) and substitute the following:

Proceed on limited production when, for the same mix type and on the same contract, one of the following conditions occur (except as noted in the first paragraph below).

- (a) Two consecutive failing lots, except on resurfacing*
- (b) Three consecutive failing lots on resurfacing*
- (c) Two consecutive failing nuclear control strips.

* Resurfacing is defined as the first new uniform layer placed on an existing pavement.

Page 6-25, Article 609-6 QUALITY ASSURANCE, DENSITY QUALITY ASSURANCE, insert the following items after item (E):

- (F) By retesting Quality Control core samples from control strips (either core or nuclear) at a frequency of 100% of the frequency required of the Contractor;
- (G) By observing the Contractor perform all standard counts of the Quality Control nuclear gauge prior to usage each nuclear density testing day; or
- (H) By any combination of the above.

Page 6-28, Subarticle 610-3(A) Mix Design-General, delete the fourth and fifth paragraphs and replace with the following:

Reclaimed Asphalt Pavement (RAP) or Reclaimed Asphalt Shingles (RAS) may be incorporated into asphalt plant mixes in accordance with Article 1012-1 and the following applicable requirements.

Reclaimed asphalt pavement (RAP) may constitute up to 50% of the total material used in recycled mixtures, except for mix Type S 12.5D, Type S 9.5D, and mixtures containing reclaimed asphalt shingle material (RAS). Reclaimed asphalt shingle (RAS) material may constitute up to 6% by weight of total mixture for any mix. When both RAP and RAS are used, do not use a combined percentage of RAS and RAP greater than 20% by weight of total mixture, unless otherwise approved. When the percent of binder contributed from RAS or a combination of RAS and RAP exceeds 20% but not more than 30% of the total binder in the completed mix, the virgin binder PG grade shall be one grade below (both high and low temperature grade) the binder grade specified in Table 610-2 for the mix type, unless otherwise approved. When the

percent of binder contributed from RAS or a combination of RAS and RAP exceeds 30% of the total binder in the completed mix, the Engineer will establish and approve the virgin binder PG grade. Use approved methods to determine if any binder grade adjustments are necessary to achieve the performance grade for the specified mix type.

For Type S 12.5D and Type S 9.5D mixes, the maximum percentage of reclaimed asphalt material is limited to 20% and shall be produced using virgin asphalt binder grade PG 76-22. For all other recycled mix types, the virgin binder PG grade shall be as specified in Table 610-2A for the specified mix type.

When the percentage of RAP is greater than 20% but not more than 30% of the total mixture, use RAP meeting the requirements for processed or fractionated RAP in accordance with the requirements of Article 1012-1.

When the percentage of RAP is greater than 30% of the total mixture, use an approved stockpile of RAP in accordance with Subarticle 1012-1(C). Use approved test methods to determine if any binder grade adjustments are necessary to achieve the performance grade for the specified mix type. The Engineer will establish and approve the virgin asphalt binder grade to be used.

Page 6-34, Subarticle 610-3(C) Job Mix Formula, delete Table 610-2 and associated notes and replace with the following:

**TABLE 610-2
SUPERPAVE MIX DESIGN CRITERIA**

| Mix Type | Design ESALs Millions (a) | Binder PG Grade (b) | Compaction Levels No. Gyration @ | | Max. Rut Depth (mm) | Volumetric Properties (c) | | | |
|-------------------------|---|---------------------|----------------------------------|------------------|---------------------|---------------------------|------------|-----------------|-------------------------------------|
| | | | N _{ini} | N _{des} | | VMA % Min. | VTM % | VFA Min. - Max. | %G _{mm} @ N _{ini} |
| S-4.75A(e) | < 0.3 | 64 -22 | 6 | 50 | ----- | 20.0 | 7.0 - 15.0 | ----- | ----- |
| SF-9.5A | < 0.3 | 64 -22 | 6 | 50 | 11.5 | 16.0 | 3.0 - 5.0 | 70 - 80 | ≤ 91.5 |
| S-9.5B | 0.3 - 3 | 64 -22 | 7 | 65 | 9.5 | 15.5 | 3.0 - 5.0 | 65 - 80 | ≤ 90.5 |
| S-9.5C | 3 - 30 | 70 -22 | 7 | 75 | 6.5 | 15.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.5 |
| S-9.5D | > 30 | 76 -22 | 8 | 100 | 4.5 | 15.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.0 |
| S-12.5C | 3 - 30 | 70 -22 | 7 | 75 | 6.5 | 14.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.5 |
| S-12.5D | > 30 | 76 -22 | 8 | 100 | 4.5 | 14.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.0 |
| I-19.0B | < 3 | 64 -22 | 7 | 65 | ----- | 13.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.5 |
| I-19.0C | 3 - 30 | 64 -22 | 7 | 75 | ----- | 13.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.0 |
| I-19.0D | > 30 | 70 -22 | 8 | 100 | ----- | 13.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.0 |
| B-25.0B | < 3 | 64 -22 | 7 | 65 | ----- | 12.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.5 |
| B-25.0C | > 3 | 64 -22 | 7 | 75 | ----- | 12.5 | 3.0 - 5.0 | 65 - 78 | ≤ 90.0 |
| Design Parameter | | | | | | Design Criteria | | | |
| All Mix Types | 1. Dust to Binder Ratio (P _{0.075} / P _{be}) | | | | | 0.6 – 1.4 | | | |
| | 2. Retained Tensile Strength (TSR) (AASHTO T283 Modified) | | | | | 85% Min. (d) | | | |

- Notes:
- (a) Based on 20 year design traffic.
 - (b) When Recycled Mixes are used, select the binder grade to be added in accordance with Subarticle 610-3(A).
 - (c) Volumetric Properties based on specimens compacted to N_{des} as modified by the Department.
 - (d) AASHTO T 283 Modified (No Freeze-Thaw cycle required). TSR for Type S 4.75A, Type B 25.0B, and Type B 25.0C mixes is 80% minimum.
 - (e) Mix Design Criteria for Type S 4.75A may be modified subject to the approval of the Engineer.

Page 6-34, Insert the following immediately after Table 610-2:

**TABLE 610-2A
SUPERPAVE MIX DESIGN CRITERIA**

| Mix Type | Percentage of RAP in Mix | | |
|--|--------------------------|------------------------------------|----------------------------|
| | Category 1 % RAP ≤20% | Category 2 20.1% ≤ %RAP ≤ 30.0% | Category 3 %RAP > 30.0% |
| All A and B Level Mixes, I19.0C, B25.0C | PG 64 -22 | PG 64 -22 | TBD |
| S9.5C, S12.5C, I19.0D | PG 70 -22 | PG 64-22 | TBD |
| S 9.5D and S12.5D | PG 76-22 | N/A | N/A |

- Note: (1) Category 1 RAP has been processed to a maximum size of 2 inches.
 (2) Category 2 RAP has been processed to a maximum size of 1 inch by either crushing and or screening to reduce variability in the gradations.
 (3) Category 3 RAP has been processed to a maximum size of 1 inch, fractionating the RAP into 2 or more sized stockpiles

Page 6-35, Table 610-3 delete and replace with the following:

**TABLE 610-3
ASPHALT PLACEMENT- MINIMUM TEMPERATURE REQUIREMENTS**

| Asphalt Concrete Mix Type | Minimum Air Temperature | Minimum Surface Temperature |
|-------------------------------------|-------------------------|-----------------------------|
| ACBC, Type B 25.0B, C, B 37.5C | 35°F | 35°F |
| ACIC, Type I 19.0B, C, D | 35°F | 35°F |
| ACSC, Type S 4.75A, SF 9.5A, S 9.5B | 40°F | 50°F* |
| ACSC, Type S 9.5C, S 12.5C | 45°F | 50°F |
| ACSC, Type S 9.5D, S 12.5D | 50°F | 50°F |

* 35°F if surface is soil or aggregate base for secondary road construction.

Page 6-45, Article 610-8 SPREADING AND FINISHING delete the third paragraph on page 6-45 and replace with the following:

Use a Material Transfer Vehicle (MTV) when placing all asphalt concrete plant mix pavements which require the use of asphalt binder grade PG 76-22 and for all types of OGAFc, unless otherwise approved. Use a MTV for all surface mix regardless of binder grade placed on Interstate facilities. Where required above, utilize the MTV when placing all full width travel lanes, collector lanes, ramps, and loops.

Page 6-44, Article 610-8 SPREADING AND FINISHING, third full paragraph, replace the first sentence with the following:

Use the 30 foot minimum length mobile grade reference system or the non-contacting laser or sonar type ski *with at least four referencing stations mounted on the paver at a minimum length of 24 feet* to control the longitudinal profile when placing the initial lanes and all adjacent lanes of all layers, including resurfacing and asphalt in-lays, unless otherwise specified or approved.

Page 6-50, Article 610-13 DENSITY ACCEPTANCE, delete the second paragraph and replace with the following:

As an exception, when the first layer of mix is a surface course and is being placed directly on an unprimed aggregate or soil base, the layer will be included in the "Other" construction category.

Page 6-50, Article 610-13 DENSITY ACCEPTANCE, delete the formula and description in the middle of the page and replace with the following:,

Where: PF = $100 - 10(D)^{1.465}$
 PF = Pay Factor (computed to 0.1%)
 D = the deficiency of the lot average density, not to exceed 2.0%

Page 6-53, Article 620-4 MEASUREMENT AND PAYMENT, sixth paragraph, delete the last sentence and seventh paragraph, delete the paragraph and replace with the following:

The adjusted contract unit price will then be applied to the theoretical quantity of asphalt binder authorized for use in the plant mix placed during the partial payment period involved, except that where recycled plant mix is used, the adjusted unit price will be applied only to the theoretical number of tons of additional asphalt binder materials required by the job mix formula.

Page 6-54, Article 620-4 MEASUREMENT AND PAYMENT, add the following pay item:

| Pay Item | Pay Unit |
|--|----------|
| Asphalt Binder for Plant Mix, Grade PG 70-28 | Ton |

Page 6-59, Article 650-5 CONSTRUCTION REQUIREMENTS delete the second paragraph from the bottom of the page beginning "Use a Material Transfer Vehicle (MTV)..." and replace with the following:

Use a Material Transfer Vehicle (MTV) when placing all asphalt concrete plant mix pavements which require the use of asphalt binder grade PG 76-22 and for all types of OGAFc, unless otherwise approved. Use a MTV for all surface mix regardless of binder grade placed on Interstate facilities. Where required above, utilize the MTV when placing all full width travel lanes, collector lanes, ramps, and loops.

Page 6-69, TABLE 660-1 MATERIAL APPLICATION RATES AND TEMPERATURES, add the following:

| Type of Coat | Grade of Asphalt | Asphalt Rate gal/yd ² | Application Temperature °F | Aggregate Size | Aggregate Rate lb./sq. yd. Total |
|--------------|------------------|----------------------------------|----------------------------|----------------|----------------------------------|
| Sand Seal | CRS-2 or CRS-2P | 0.22-0.30 | 150-175 | Blotting Sand | 12-15 |

Page 6-75, Subarticle 660-9(B) Asphalt Seal Coat, add the following as sub-item (5)**(5) Sand Seal**

Place the fully required amount of asphalt material in one application and immediately cover with the seal coat aggregate. Uniformly spread the fully required amount of aggregate in one application and correct all non-uniform areas prior to rolling.

Immediately after the aggregate has been uniformly spread, perform rolling.

When directed, broom excess aggregate material from the surface of the seal coat.

When the sand seal is to be constructed for temporary sealing purposes only and will not be used by traffic, other grades of asphalt material meeting the requirements of Articles 1020-6 and 1020-7 may be used in lieu of the grade of asphalt required by Table 660-1 when approved.

Page 6-76, Article 661-1 DESCRIPTION, add the following as the 2nd paragraph:

Provide and conduct the quality control and required testing for acceptance of the UBWC in accordance with *Quality Management System for Asphalt Pavements (OGAFC, PADL, and Ultra-Thin HMA Version)*, included in the contract.

Page 6-76, Article 661-2 MATERIALS, add the following after Asphalt Binder, Grade 70-28:

| Item | Section |
|-----------------------------|----------------|
| Asphalt Binder, Grade 76-22 | 1020 |
| Reclaimed Asphalt Shingles | 1012 |

Page 6-78, Subarticle 661-2(E), Asphalt Binder For Plant Mix, Grade PG 70-28, rename as ASPHALT BINDER FOR PLANT MIX and add the following as the first paragraph:

Use either PG 70-28 or PG 76-22 binder in the mix design. Where PG 76-22 is being used in the production of Ultra-thin, the grade of asphalt binder to be paid for will be PG 70-28, unless otherwise approved.

Page 6-79, Subarticle 661-2(G) Composition of Mix, add the following as the third sentence of the first paragraph.

The percent of asphalt binder contributed from the RAS shall not exceed 20% of the total binder in the completed mix.

Page 6-80, Article 661-2(G) Composition of Mix, replace Table 661-4 and associated notes with the following:

| Standard Sieves | | 1/2 in. Type A | 3/8 in. Type B | 1/4 in. Type C |
|-----------------|-------|-----------------------|----------------|----------------|
| ASTM | mm | (% Passing by Weight) | | |
| 3/4 inch | 19.0 | 100 | | |
| 1/2 inch | 12.5 | 85 - 100 | 100 | |
| 3/8 inch | 9.5 | 60 - 80 | 85 - 100 | 100 |
| #4 | 4.75 | 28 - 38 | 28 - 44 | 40 - 55 |
| #8 | 2.36 | 19 - 32 | 17 - 34 | 22 - 32 |
| #16 | 1.18 | 15 - 23 | 13 - 23 | 15 - 25 |
| #30 | 0.600 | 10 - 18 | 8 - 18 | 10 - 18 |
| #50 | 0.300 | 8 - 13 | 6 - 13 | 8 - 13 |
| #100 | 0.150 | 6 - 10 | 4 - 10 | 6 - 10 |
| #200 | 0.075 | 4.0 - 7.0 | 3.0 - 7.0 | 4.0 - 7.0 |

| | 1/2 in. Type A | 3/8 in. Type B | 1/4 in. Type C |
|---------------------------------------|----------------------|----------------------|----------------------|
| Asphalt Content, % | 4.6 - 5.6 | 4.6 - 5.8 | 5.0 - 5.8 |
| Draindown Test, AASHTO T 305 | 0.1% max. | | |
| Moisture Sensitivity, AASHTO T 283* | 80% min. | | |
| Application Rate, lb/ yd ² | 90 | 70 | 50 |
| Approximate Application Depth, in. | 3/4 | 5/8 | 1/2 |
| Asphalt PG Grade, AASHTO M 320 | PG 70-28 or PG 76-22 | PG 70-28 or PG 76-22 | PG 70-28 or PG 76-22 |

NOTE: *Specimens for T-283 testing are to be compacted using the SUPERPAVE gyratory compactor. The mixtures shall be compacted using 100 gyrations to achieve specimens approximately 95 mm in height. Use mixture and compaction temperatures recommended by the binder supplier.

Page 6-80, Subarticle 661-3(A) Equipment, add the following as the first paragraph:

Use asphalt mixing plants in accordance with Article 610-5 of the *Standard Specifications*.

Page 6-82, Subarticle 661-3(C), Application of Ultra-thin Bonded Wearing Course, delete the first paragraph and add the following as the first and second paragraphs.

Use only one asphalt binder PG grade for the entire project, unless the Engineer gives written approval.

Do not place Ultra-thin Bonded Wearing Course between October 31 and April 1, when the pavement surface temperature is less than 50°F or on a wet pavement. In addition, when PG 76-22 binder is used in the JMF, place the wearing course only when the road pavement surface temperature is 60°F or higher and the air temperature in the shade away from artificial heat is 60°F or higher.

Page 10-40, Subarticle 1012-1(A) General, add the following at the end of the last paragraph, last sentence:

or ultra-thin bonded wearing course.

Page 10-41, Table 1012-1, delete the entries for OGAFC and add new entries for OGAFC and a row for UBWC with entries:

| Mix Type | Coarse Aggregate Angularity ^(b) ASTM D5821 | Fine Aggregate Angularity % Minimum AASHTO T304 Method A | Sand Equivalent % Minimum AASHTO T176 | Flat & Elongated 5:1 Ratio % Maximum ASTM D4791 Section 8.4 |
|----------|---|--|---------------------------------------|---|
| S 9.5 D | 100/100 | 45 | 50 | 10 |
| OGAFC | 100/100 | N/A | N/A | 10 |
| UBWC | 100/85 | 40 | 45 | 10 |

Delete Note (c) under the Table 1012-1 and replace with the following:

(c) Does not apply to Mix Types SF 9.5A and S 9.5B.

Page 10-42, Subarticle 1012-1(B)(6) Toughness (Resistance to Abrasion), add as the last sentence:

The percentage loss for aggregate used in UBWC shall be no more than 35%.

Page 10-43, Subarticle 1012-1(F) Reclaimed Asphalt Shingle Material (RAS), insert the following immediately following the first paragraph:

(1) Mix Design RAS

Incorporate RAS from stockpiles that have been tested for uniformity of gradation and binder content prior to use in an asphalt mix design.

(2) Mix Production RAS

New Source RAS is defined as acceptable material which was not included in the stockpile when samples were taken for mix design purposes. Process new source RAS so that all materials will pass a 1/2" sieve prior to introduction into the plant mixer unit.

After a stockpile of processed RAS has been sampled and mix designs made from these samples, do not add new source RAS to the original stockpile without prior field testing to insure gradation and binder uniformity. Sample and test new source RAS before blending with the existing stockpile.

Store new source RAS in a separate stockpile until the material can be sampled and tested for comparison with the original recycled mix design data. New source RAS may also be placed against the existing stockpile in a linear manner provided it is sampled for mix design conformity prior to its use in the recycled mix.

RAS contamination including but not limited to excessive dirt, debris, clean stone, concrete will not be allowed.

Field approval of new source RAS will be based on the table below and volumetric mix properties on the mix with the new source RAS included. Provided these tolerances are met, volumetric properties of the new mix will then be performed. If all volumetric mix properties meet the mix design criteria for that mix type, the new source RAS may continue to be used.

If the gradation, binder content, or any of the volumetric mix properties are not within the allowable tolerances of the table below, do not use the new source RAS unless approved by the Engineer. The Contractor may elect to either not use the stockpile, to request an adjustment to the JMF, or to redesign the mix.

NEW SOURCE RAS GRADATION and BINDER TOLERANCES
(Apply Tolerances to Mix Design Data)

| 0-6% RAS | |
|------------------|-----------|
| P _b % | ±1.6% |
| Sieve Size (mm) | Tolerance |
| 9.5 | ±1 |
| 4.75 | ±5 |
| 2.36 | ±4 |
| 1.18 | ±4 |
| 0.300 | ±4 |
| 0.150 | ±4 |
| 0.075 | ±2.0 |

Page 10-43 through 10-45, Subarticle 1012-1(G), delete this in its entirety and replace with the following:

(G) Reclaimed Asphalt Pavement (RAP)

(1) Mix Design RAP

Incorporate RAP from stockpiles or other sources that have been tested for uniformity of gradation and binder content prior to use in an asphalt mix design. Use reclaimed asphalt pavement that meets all requirements specified for *one of the following two* classifications.

(a) Millings

Existing reclaimed asphalt pavement (RAP) that is removed from its original location by a milling process as specified in Section 607. Millings should be such that it has a uniform gradation and binder content and all materials will pass a 2" sieve prior to introduction into the plant mixer unit.

(b) Processed RAP

RAP that is processed in some manner (possibly by crushing and/or use of a blending method) to produce a uniform gradation and binder content in the RAP prior to use in a recycled mix. Process RAP so that all materials have a uniform gradation and binder content and will pass a 1" sieve prior to introduction into the plant mixer unit.

(c) Fractionated RAP

Fractionated RAP is defined as having two or more RAP stockpiles, where the RAP is divided into coarse and fine fractions. Grade RAP so that all materials will pass a 1" sieve. The coarse RAP stockpile shall only contain material retained on a 3/8" screen, unless otherwise approved. The fine RAP stockpile shall only contain material passing the 3/8" screen, unless otherwise approved. The Engineer may allow the Contractor to use an alternate to the 3/8" screen to fractionate the RAP. The maximum percentages of fractionated RAP may be comprised of coarse, fine, or the combination of both. Utilize a separate cold feed bin for each stockpile of fractionated RAP used.

(d) Approved Stockpiled RAP

Approved Stockpiled RAP is defined as fractionated RAP which has been isolated and tested for asphalt content, gradation, and asphalt binder characteristics with the intent to be used in mix designs with greater than 30% RAP materials. Fractionate the RAP in accordance with Subarticle 1012-1(G)(1)(c). Utilize a separate cold feed bin for each approved stockpile of RAP used.

Perform extraction tests at a rate of 1 per 1000 tons of RAP, with a minimum of 5 tests per stockpile to determine the asphalt content and gradation. Separate stockpiles of RAP material by fine and coarse fractions. Erect and maintain a sign satisfactory to the Engineer on each stockpile to identify the material. Assure that no deleterious material is allowed in any stockpile. The Engineer may reject by visual inspection any stockpiles that are not kept clean, separated, and free of foreign materials.

Submit requests for RAP stockpile approval to the Engineer with the following information at the time of the request:

- (1) Approximate tons of materials in stockpile
- (2) Name or Identification number for the stockpile
- (3) Asphalt binder content and gradation test results
- (4) Asphalt characteristics of the Stockpile.

For the Stockpiled RAP to be considered for approval, the gradation and asphalt content shall be uniform. Individual test results, when compared to the target, will be accepted if within the tolerances listed below:

APPROVED STOCKPILED RAP GRADATION and BINDER TOLERANCES
(Apply Tolerances to Mix Design Data)

| P_b % | ±0.3% |
|------------------------|------------------------|
| Sieve Size (mm) | Percent Passing |
| 25.0 | ±5% |
| 19.0 | ±5% |
| 12.5 | ±5% |
| 9.5 | ±5% |
| 4.75 | ±5% |
| 2.36 | ±4% |
| 1.18 | ±4% |
| 0.300 | ±4% |
| 0.150 | ±4% |
| 0.075 | ±1.5% |

Note: If more than 20% of the individual sieves are out of the gradation tolerances, or if more than 20% of the asphalt binder content test results fall outside the appropriate tolerances, the RAP shall not be used in HMA unless the RAP representing the failing tests is removed from the stockpile.

Do not add additional material to any approved RAP stockpile, unless otherwise approved by the Engineer.

Maintain at the plant site a record system for all approved RAP stockpiles. Include at a minimum the following: Stockpile identification and a sketch of all stockpile areas at the plant site; all RAP test results (including asphalt content, gradation, and asphalt binder characteristics).

(2) Mix Production RAP

During mix production, use RAP that meets the criteria for one of the following categories:

(a) Mix Design RAP

RAP contained in the mix design stockpiles as described above may be used in all applicable JMFs. These stockpiles have been pretested; however, they are subject to required QC/QA testing in accordance with Subarticle 609-5(C)(2).

(b) New Source RAP

New Source RAP is defined as any acceptable material that was not included in the stockpile or other source when samples were taken for mix design purposes. Process new source RAP so that all materials have a uniform gradation and binder content and will pass a 2" sieve prior to introduction into the plant mixer unit.

After a stockpile of millings, processed RAP, or fractionated RAP has been sampled and mix designs made from these samples, do not add new source RAP to the original stockpile without prior field testing to insure gradation and binder uniformity. Sample and test new source RAP before blending with the existing stockpile.

Store new source RAP in a separate stockpile until the material can be sampled and tested for comparison with the original recycled mix design data. New source RAP may also be placed against the existing stockpile in a linear manner provided it is sampled for mix design conformity prior to its use in the recycled mix.

Unprocessed RAP is asphalt material that was not milled and/or has not been processed to obtain a uniform gradation and binder content and is not representative of the RAP used during the applicable mix design. Unprocessed RAP shall not be incorporated into any JMFs prior to processing. Different sources of unprocessed RAP may be stockpiled together provided it is generally free of contamination and will be processed prior to use in a recycled mix. RAP contamination in the form of excessive dirt, debris, clean stone, concrete, etc. will not be allowed. Incidental amounts of dirt, concrete, and clean stone may be acceptable. Unprocessed RAP may be processed and then classified as a new source RAP as described above.

Field approval of new source RAP will be based on Table 1012-2 below and volumetric mix properties on the mix with the new source RAP included. Provided the Table 1012-2 tolerances are met, volumetric properties of the new mix will then be performed. If all volumetric mix properties meet the mix design criteria for that mix type, the new source RAP may continue to be used.

If the gradation, binder content, or any of the volumetric mix properties are not within the allowable tolerances of Table 1012-2, do not use the new source RAP unless approved by the Engineer. The Contractor may elect to either not use the stockpile, to request an adjustment to the JMF, or to redesign the mix.

| TABLE 1012-2 NEW SOURCE RAP GRADATION and BINDER TOLERANCES (Apply Tolerances to Mix Design Data) | | | | | | | | | |
|--|------------------|---------------|--------------|--------------------------------|---------------|--------------|-----------------------------|---------------|--------------|
| Mix Type | 0-20% RAP | | | 20⁺-30 % RAP | | | 30⁺ % RAP | | |
| Sieve (mm) | Base | Inter. | Surf. | Base | Inter. | Surf. | Base | Inter. | Surf. |
| P_b % | ± 0.7% | | | ± 0.4% | | | ± 0.3% | | |
| 25.0 | ±10 | - | - | ±7 | - | - | ±5 | - | - |
| 19.0 | ±10 | ±10 | - | ±7 | ±7 | - | ±5 | ±5 | - |
| 12.5 | - | ±10 | ±10 | - | ±7 | ±7 | - | ±5 | ±5 |
| 9.5 | - | - | ±10 | - | - | ±7 | - | - | ±5 |
| 4.75 | ±10 | - | ±10 | ±7 | - | ±7 | ±5 | - | ±5 |
| 2.36 | ±8 | ±8 | ±8 | ±5 | ±5 | ±5 | ±4 | ±4 | ±4 |
| 1.18 | ±8 | ±8 | ±8 | ±5 | ±5 | ±5 | ±4 | ±4 | ±4 |
| 0.300 | ±8 | ±8 | ±8 | ±5 | ±5 | ±5 | ±4 | ±4 | ±4 |
| 0.150 | - | - | ±8 | - | - | ±5 | - | - | ±4 |
| 0.075 | ±4 | ±4 | ±4 | ±2 | ±2 | ±2 | ±1.5 | ±1.5 | ±1.5 |

ASPHALT PAVEMENTS - WARM MIX ASPHALT SUPERPAVE:

(5-19-09) (Rev 10-20-09)

SP6 R02

Warm Mix Asphalt (WMA) is defined as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed.

Notify the Engineer at least 2 weeks before producing the Warm Mix so the Engineer can arrange a preconstruction meeting. Discuss special testing requirements necessary for warm mix asphalt at the pre-pave meeting. Included at the pre-pave meeting the Contractor's QC manager, Paving Superintendent, and manufacturer's representative for the process or additive used for producing warm mix asphalt, the Department's Roadway Construction Engineer, Resident Engineer, State Pavement Construction, and Quality Assurance Supervisor.

Require a manufacturer's representative for the process or additive used to be present on site at the plant during the initial production and on the roadway during the laydown of the warm mix asphalt.

Revise the *2006 Standard Specifications* as follows:

Page 6-8, Article 609-1 Description, insert the following as the second paragraph.

Warm Mix Asphalt (WMA) is defined as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed. WMA is allowed for use at the Contractor's option when shown in the contract documents.

Page 6-9, Article 609-4 Field Verification of Mixture and Job Mix Formula Adjustments,

Second paragraph, insert the following immediately after the first sentence.

When producing a WMA, field verification testing will also consist of performing a Tensile Strength Ratio (TSR) testing in accordance with AASHTO T283 as Modified by the Department.

Third paragraph, delete the third sentence and replace with the following:

Verification is considered satisfactory for HMA when all volumetric properties except $\%G_{mm}@N_{ini}$ are within the applicable mix design criteria, and the gradation, binder content, and $\%G_{mm}@N_{ini}$ are within the individual limits for the mix type being produced. Verification is considered satisfactory for WMA when all volumetric properties except $\%G_{mm}@N_{ini}$ are within the applicable mix design criteria, the TSR is equal to or above the minimum design criteria, and the gradation, binder content, and $\%G_{mm}@N_{ini}$ are within the individual limits for the mix type being produced.

Page 6-12, Subarticle 609-5(C)2(d) Bulk Specific Gravity of Compacted Specimens, add after (AASHTO T 312):

When producing Warm Mix Asphalt, gyrate specimens to specified N_{des} compaction effort without reheating mix other than to desired compaction temperature. Record time needed to reheat samples (if any).

Page 6-14, Subarticle 609-5(C)(2)(e) Tensile Strength Ratio, insert the following immediately after the third paragraph:

When producing WMA, perform TSR testing at

- i. Beginning of production for each JMF
- ii. Monthly thereafter

Page 6-27, Article 610-1 Description, insert the following as the third paragraph:

Warm Mix Asphalt (WMA) is defined as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed. Use WMA at the Contractor's option unless otherwise shown on the plans.

Page 6-27, Article 610-2 Materials, insert the following at the end of this Article:

Use only WMA additives or processes listed on the Department's approved list maintained by the Materials and Tests Unit.

Page 6-31, Subarticle 610-3(B) Mix Design-Criteria, add the following as the fifth paragraph:

When WMA is used, submit the mix design without including the WMA additive.

**Page 6-32, Subarticle 610-3(C) Job Mix Formula,
Add the following as the second paragraph:**

When WMA is used, document the additive or process used and recommended rate on the JMF submittal. Verify the JMF based on plant produced mixture from the trial batch.

Immediately following PG 76-22 335°F, add the following paragraph:

When WMA is used, produce an asphalt mixture within the temperature range of 225°F and 275 °F.

ASPHALT BINDER CONTENT OF ASPHALT PLANT MIXES:

(11-21-00)

SP6 R15

The approximate asphalt binder content of the asphalt concrete plant mixtures used on this project will be as follows:

| | | |
|--------------------------------------|---------------|------|
| Asphalt Concrete Base Course | Type B 25.0__ | 4.3% |
| Asphalt Concrete Intermediate Course | Type I 19.0__ | 4.7% |
| Asphalt Concrete Surface Course | Type S 4.75A | 7.0% |
| Asphalt Concrete Surface Course | Type SF 9.5A | 6.5% |
| Asphalt Concrete Surface Course | Type S 9.5__ | 6.0% |
| Asphalt Concrete Surface Course | Type S 12.5__ | 5.5% |

The actual asphalt binder content will be established during construction by the Engineer within the limits established in the *2006 Standard Specifications*.

PRICE ADJUSTMENT - ASPHALT BINDER FOR PLANT MIX:

(11-21-00)

SP6 R25

Price adjustments for asphalt binder for plant mix will be made in accordance with Section 620 of the *2006 Standard Specifications*.

The base price index for asphalt binder for plant mix is \$ 455.00 per ton.

This base price index represents an average of F.O.B. selling prices of asphalt binder at supplier's terminals on **October 1, 2010**.

MASONRY DRAINAGE STRUCTURES:

(10-16-07)

SP8 R01

Revise the *2006 Standard Specifications* as follows:

Page 8-31, Article 840-4 Measurement and Payment, add the following at the end of the second paragraph:

For that portion of *Masonry Drainage Structure* measured above a height of 10.0 feet, payment will be made at 1.3 times the contract unit price per linear foot for *Masonry Drainage Structure*.

BORROW EXCAVATION AND SHPO DOCUMENTATION FOR BORROW/WASTE**SITES:**

(12-18-07) (4-15-08)

SP8 R02

Revise the *2006 Standard Specifications* as follows:

Division 2 Earthwork

Page 2-16, Subarticle 230-1(D), add the words: *The Contractor specifically waives* as the first words of the sentence.

Page 2-17, Article 230-4(B) Contractor Furnished Sources, first paragraph, first sentence replace with the following:

Prior to the approval of any borrow sources developed for use on any project, obtain certification from the State Historic Preservation Officer of the State Department of Cultural Resources certifying that the removal of the borrow material from the borrow sources(s) will have no effect on any known district, site building, structure, or object, architectural and/or archaeological that is included or eligible for inclusion in the National Register of Historic Places.

Division 8 Incidentals

Page 8-9, Article 802-2 General Requirements, add the following as the 1st paragraph:

Prior to the removal of any waste from any project, obtain certification from the State Historic Preservation Officer of the State Department of Cultural Resources certifying that the deposition of the waste material to the proposed waste area will have no effect on any known district, site building, structure, or object, architectural and/or archaeological that is included or eligible for inclusion in the National Register of Historic Places. Furnish a copy of this certification to the Engineer prior to performing any work in the proposed waste site.

Page 8-10, Article 802-2, General Requirements, 4th paragraph, add the following as the 2nd sentence:

The Department’s borrow and waste site reclamation procedures for contracted projects is available on the NCDOT website and shall be used for all borrow and waste sites on this project.

CONCRETE TRANSITIONAL SECTIONS FOR CATCH BASINS AND DROP INLETS:
(1-20-09) SP8 R03

Revise the *Standard Specifications* as follows:

Page 8-32, Article 840-4 Measurement and Payment, delete the eighth full paragraph and replace with the following:

No separate payment will be made for Concrete Aprons as shown in Standard Drawings 840.17, 840.18, 840.19, 840.26, 840.27 and 840.28 and will be incidental to the other work in this section.

Page 8-38, Article 852-4, Measurement and Payment, add the following as the fourth paragraph:

Concrete Transitional Section for Catch Basin will be measured and paid for in units of each.

Concrete Transitional Section for Drop Inlet will be measured and paid for in units of each.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Concrete Transitional Section for Catch Basin | Each |
| Concrete Transitional Section for Drop Inlet | Each |

Revise the *Roadway Standard Drawings* as follows:

On page 852.04, delete the statement: *CONCRETE APRON IS INCIDENTAL TO CONSTRUCTION OF THE DRAINAGE STRUCTURE and change *Pay Limits for Concrete Apron for Drop Inlets in two places on the drawing to *Pay Limits for Concrete Transitional Section for Drop Inlet*.

On page 852.05, delete the statement: *CONCRETE APRON IS INCIDENTAL TO CONSTRUCTION OF THE DRAINAGE STRUCTURE and change *Concrete Apron for Catch Basin on the drawing to *Concrete Transitional Section for Catch Basin*.

On page 852.06, delete the statement: *CONCRETE APRON IS INCIDENTAL TO CONSTRUCTION OF THE DRAINAGE STRUCTURE and change *Pay Limits for Concrete Apron for Drop Inlets in two places on the drawing to *Pay Limits for Concrete Transitional Section for Drop Inlet*.

SUBSURFACE DRAINAGE:

(7-20-10)

SP8 R05

Revise the *Standard Specifications* as follows:

Page 8-13, Delete Section 815 SUBSURFACE DRAINAGE and replace it with the following:

Description

Construct subsurface drains, underdrains, blind drains and other types of drains in accordance with the contract or as directed by the Engineer. Install markers to locate concrete pads for drains as shown on the plans. This provision does not apply to shoulder drains.

Materials

Refer to Division 10 of the *Standard Specifications*.

| Item | Section |
|---|----------------|
| Portland Cement Concrete, Class B | 1000 |
| Select Material, Class V | 1016 |
| Subsurface Drainage Materials | 1044 |
| Filter Fabric for Subsurface Drains, Type 1 | 1056 |
| Steel Markers | 1072-4 |
| Steel Marker Paint | 1080-14 |
| Pavement Marker Paint | 1087 |

Use Class B Concrete for concrete pads and Class V Select Material for subdrain coarse aggregate. Provide subdrain coarse aggregate for subsurface drains and subdrain fine aggregate for underdrains and blind drains.

Construction Methods

Do not leave filter fabrics uncovered for more than 7 days. Excavate trenches as necessary in accordance with the contract or as directed by the Engineer. For subsurface drains, line trench with filter fabric and overlap fabric ends a minimum of 6" on top of subdrain coarse aggregate.

Install blind drains at a depth of 4 to 6 ft below subgrade elevation. Install subdrain pipes for subsurface drains and underdrains at a depth of 4 to 6 ft below subgrade elevation unless the subgrade will be proof rolled. For subsurface drains and underdrains in subgrades that will be proof rolled, install subdrain pipes at a depth of 6 ft below subgrade elevation. Firmly connect subdrain pipes together as needed. Place perforated subdrain pipes with perforations down except for pipes in dry materials, in which case turn perforations up or use non-perforated pipes. For concrete pipes in dry materials, construct mortar joints in accordance with Subarticle 300-6(A) of the *Standard Specifications*.

Place subdrain aggregate beneath, around and over subdrain pipes such that pipes are covered by at least 6" of aggregate unless shown otherwise on the plans. Do not displace or damage subdrain pipes while placing and compacting subdrain aggregate. Lightly compact backfill material such that settlement is minimized.

Use solvent cement for connecting polyvinyl chloride (PVC) outlet pipes and fittings such as wyes, tees and elbows. Provide connectors for outlet pipes and fittings that are watertight and suitable for gravity flow conditions. Cover open ends of outlet pipes with rodent screens as shown on the plans.

Connect drains to concrete pads or existing drainage structures at ends of outlet pipes. Construct concrete pads and provide an Ordinary Surface Finish in accordance with Subarticle 825-6(B) of the *Standard Specifications*. Furnish and install steel and pavement markers at concrete pads as shown on the plans.

Allow drains to function for up to 30 days or a sufficient time as determined by the Engineer before undercutting, proof rolling or constructing embankments over drains.

Measurement and Payment

Subdrain Excavation will be measured and paid for in cubic yards. Excavation will be measured based on the trench width shown on the plans or as directed by the Engineer and the actual trench depth as determined by the Engineer. The contract unit price for *Subdrain Excavation* will be full compensation for excavating trenches and backfilling above subdrain aggregate.

Filter Fabric for Subsurface Drains will be measured and paid for in square yards. Filter fabric in a trench will be measured in place based on the subdrain aggregate width shown on the plans or as directed by the Engineer and the actual aggregate depth as determined by the Engineer. No additional payment will be made for overlapping fabric. The contract unit price for *Filter Fabric for Subsurface Drains* will be full compensation for supplying, transporting and installing filter fabric.

Subdrain Fine Aggregate and *Subdrain Coarse Aggregate* will be measured and paid for in cubic yards. Subdrain aggregate in a trench will be measured in place based on the aggregate width shown on the plans or as directed by the Engineer and the actual aggregate depth as determined by the Engineer. When subdrain aggregate is not placed in a trench, aggregate will be measured in place based on the aggregate dimensions shown on the plans or as determined by the Engineer. The contract unit prices for *Subdrain Fine Aggregate* and *Subdrain Coarse Aggregate* will be full compensation for furnishing, hauling, handling, placing, compacting and maintaining subdrain aggregate.

 " *Perforated Subdrain Pipe* and " *Outlet Pipe* will be measured and paid for in linear feet. Pipes will be measured in place as the pipe length, including fittings, to the nearest 0.1 foot with no deduction for fittings. The contract unit prices for " *Perforated Subdrain Pipe* and " *Outlet Pipe* will be full compensation for supplying, transporting and installing pipes, fittings and rodent screens and making joint connections.

Subdrain Pipe Outlets will be measured and paid for in units of each. Outlets will be measured as the number of concrete pads or connections to existing drainage structures. The contract unit price for *Subdrain Pipe Outlets* will be full compensation for concrete pads including furnishing concrete, constructing pads and providing and placing markers and connecting pipes to existing drainage structures including cutting into structures, removing existing paved ditches and grouting around connections.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------------------|-----------------|
| Subdrain Excavation | Cubic Yard |
| Filter Fabric for Subsurface Drains | Square Yard |
| Subdrain Fine Aggregate | Cubic Yard |
| Subdrain Coarse Aggregate | Cubic Yard |
| <u> </u> " Perforated Subdrain Pipe | Linear Foot |
| <u> </u> " Outlet Pipe | Linear Foot |
| Subdrain Pipe Outlets | Each |

HDPE PIPE, CAPS & ELBOWS:

Furnish and install HDPE pipe, caps, & elbows in accordance with the *2006 Standard Specifications*, the contract plans, and as directed by the Engineer.

Material

| Item | Section |
|----------------------------|----------------|
| HDPE Pipe, Caps and Elbows | 1032-10 |

Measurement and Payment

___" *HDPE Pipe*, ___" *Perforated HDPE Pipe*, to be paid for will be the actual number of linear feet installed and accepted. Measurement will be in accordance with Section 310-6 of the *2006 Standard Specifications*.

___" *HDPE Elbows* to be paid will be the actual number per each installed and accepted.

___" *HDPE Caps* to be paid will be the actual number per each installed and accepted.

| Pay Item | Pay Unit |
|---------------------------|-----------------|
| ___" HDPE Pipe | Linear Foot |
| ___" Perforated HDPE Pipe | Linear Foot |
| ___" HDPE Caps | EA |
| ___" HDPE Elbows | EA |

NARROW DROP INLET FRAME AND GRATE:

Narrow Drop Inlet Frame and Grate shall be in accordance with the detail in the plans and the applicable requirements of Section 840 of the *Standard Specifications*.

Narrow Drop Inlet Frame and Grate will be measured and paid for in units of each for actual number of assemblies that have been incorporated into the completed work. No separate measurement will be made of grates, hoods and covers that are part of the assembly, as the grates, hoods, and covers will be considered to be part of the complete assembly.

| Pay Item | Pay Unit |
|-----------------------------------|-----------------|
| Narrow Drop Inlet Frame and Grate | Each |

CONVERT EXISTING JUNCTION BOX TO DROP INLET:

(1-1-02) (Rev. 7-18-06)

SP8 R50

At the proper phase of construction, convert the existing Junction Box at locations indicated in the plans or where directed, to Drop Inlet in accordance with the details in the plans and the applicable requirements of Sections 840 and 859 of the *2006 Standard Specifications*.

Convert Existing Junction Box to Drop Inlet will be measured and paid for as each, completed and accepted. Such price and payment is considered full compensation for all equipment, materials, labor, tools, and incidentals necessary to complete each conversion satisfactorily.

Payment will be made under:

Pay Item

Convert Existing Junction Box to Drop Inlet

Pay Unit

Each

GUARDRAIL ANCHOR UNITS, TYPE 350:

(4-20-04)

SP8 R65

Description

Furnish and install guardrail anchor units in accordance with the details in the plans, the applicable requirements of Section 862 of the *2006 Standard Specifications*, and at locations shown in the plans.

Materials

The Contractor may at his option, furnish any one of the guardrail anchor units.

Guardrail anchor unit (ET-2000) as manufactured by:

Trinity Industries, Inc.
2525 N. Stemmons Freeway
Dallas, Texas 75207
Telephone: 800-644-7976

The guardrail anchor unit (SKT 350) as manufactured by:

Road Systems, Inc.
3616 Old Howard County Airport
Big Spring, Texas 79720
Telephone: 915-263-2435

Prior to installation the Contractor shall submit to the Engineer:

(A) FHWA acceptance letter for each guardrail anchor unit certifying it meets the requirements of NCHRP Report 350, Test Level 3, in accordance with Section 106-2 of the *2006 Standard Specifications*.

(B) Certified working drawings and assembling instructions from the manufacturer for each guardrail anchor unit in accordance with Section 105-2 of the *2006 Standard Specifications*.

No modifications shall be made to the guardrail anchor unit without the express written permission from the manufacturer. Perform installation in accordance with the details in the plans, and details and assembling instructions furnished by the manufacturer.

Construction Methods

Guardrail end delineation is required on all approach and trailing end sections for both temporary and permanent installations. Guardrail end delineation consists of yellow reflective sheeting applied to the entire end section of the guardrail in accordance with Section 1088-3 of the *2006 Standard Specifications* and is incidental to the cost of the guardrail anchor unit.

Measurement and Payment

Measurement and payment will be made in accordance with Articles 862-6 of the *2006 Standard Specifications*.

Payment will be made under:

| | |
|----------------------------------|-----------------|
| Pay Item | Pay Unit |
| Guardrail Anchor Units, Type 350 | Each |

PREFORMED SCOUR HOLE WITH LEVEL SPREADER APRON:

(10-15-02) (Rev 10-20-09)

SP8 R105

Description

Construct and maintain preformed scour holes with spreader aprons at the locations shown on the plans and in accordance with the details in the plans. Work includes excavation, shaping and maintaining the hole and apron, furnishing and placing filter fabric, rip rap (class as specified in the plans) and permanent soil reinforcement matting.

Materials

| | |
|---------------|----------------|
| Item | Section |
| Plain Rip Rap | 1042 |
| Filter Fabric | 1056 |

The permanent soil reinforcement matting shall be permanent erosion control reinforcement mat and shall be constructed of synthetic or a combination of coconut and synthetic fibers evenly distributed throughout the mat between a bottom UV stabilized netting and a heavy duty UV

stabilized top net. The matting shall be stitched together with UV stabilized polypropylene thread to form a permanent three dimensional structure. The mat shall have the following minimum physical properties:

| <i>Property</i> | <i>Test Method</i> | <i>Value Unit</i> |
|--|------------------------|-------------------------|
| Light Penetration | ASTM D6567 | 9 % |
| Thickness | ASTM D6525 | 0.40 in |
| Mass Per Unit Area | ASTM D6566 | 0.55 lb/sy |
| Tensile Strength | ASTM D6818 | 385 lb/ft |
| Elongation (Maximum) | ASTM D6818 | 49 % |
| Resiliency | ASTM D1777 | >70 % |
| UV Stability * | ASTM 4355 | ≥80 % |
| Porosity (Permanent Net) | ECTC Guidelines | ≥85 % |
| Maximum Permissible Shear Stress (Vegetated) | Performance Bench Test | ≥8.0 lb/ft ² |
| Maximum Allowable Velocity (Vegetated) | Performance Bench Test | ≥16.0 ft/s |

*ASTM D1682 Tensile Strength and % strength retention of material after 1000 hours of exposure.

Submit a certification (Type 1, 2, or 3) from the manufacturer showing:

- (A) the chemical and physical properties of the mat used, and
- (B) conformance of the mat with this specification.

Construction Methods

All areas to be protected with the mat shall be brought to final grade and seeded in accordance with Section 1660 of the *Standard Specifications*. The surface of the soil shall be smooth, firm, stable and free of rocks, clods, roots or other obstructions that would prevent the mat from lying in direct contact with the soil surface. Areas where the mat is to be placed will not need to be mulched.

Measurement and Payment

Performed Scour Holes with Level Spreader Aprons will be measured and paid as the actual number that has been incorporated into the completed and accepted work. Such price and payment will be full compensation for all work covered by this provision.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Preformed Scour Hole with Level Spreader Aprons | Each |

GALVANIZED HIGH STRENGTH BOLTS, NUTS AND WASHERS:

(2-17-09)

SP10 R02

Revise the *Standard Specifications* as follows:

Page 10-126, Subarticle 1072-7(F)(3) Change the AASHTO reference to B 695 Class 55.

Page 10-247, Table 1092-2, Steel Sign Materials, Change High Strength Bolts, Nuts & Washers ASTM Specifications for Galvanizing to B695 Class 55.

Page 10-259, Subarticle 1094-1(A) Breakaway or Simple Steel Beam Sign Supports, replace the third paragraph with the following:

Fabricate high strength bolts, nuts, and washers required for breakaway supports from steel in accordance with ASTM A325 and galvanize in accordance with AASHTO B 695 Class 55.

Page 10-261, Article 1096-2 Steel Overhead Sign Structures, replace the last sentence with the following:

The galvanizing shall meet the requirement of AASHTO B 695 Class 55 for fasteners and of ASTM A123 for other structural steel.

GALVANIZING:

(8-17-10)

SP10 R03

Revise the *Standard Specifications* as follows:

Page 10-150, Subarticle 1076-1, Galvanizing, add a second paragraph as the follows:

Allow the Engineer to obtain samples of molten zinc directly from the galvanizing vat upon request.

AGGREGATE PRODUCTION:

(11-20-01)

SP10 R05

Provide aggregate from a producer who uses the current Aggregate Quality Control/Quality Assurance Program that is in effect at the time of shipment.

No price adjustment is allowed to contractors or producers who use the program. Participation in the program does not relieve the producer of the responsibility of complying with all requirements of the *2006 Standard Specifications*. Copies of this procedure are available upon request from the Materials and Test Unit.

CONCRETE BRICK AND BLOCK PRODUCTION:

(11-20-01)

SP10 R10

Provide concrete brick and block from a producer who uses the current Solid Concrete Masonry Brick/Unit Quality Control/Quality Assurance Program that is in effect on the date that material is received on the project.

No price adjustment is allowed to contractors or producers who use the program. Participation in the program does not relieve the producer of the responsibility of complying with all requirements of the *2006 Standard Specifications*. Copies of this procedure are available upon request from the Materials and Test Unit.

VOLUMETRIC CONCRETE BATCHING:

(5-18-10)

SP10 R13

Revise the *2006 Standard Specifications* as follows:

Page 10-19, after Article 1000-12, add the following as a new article:

1000-13 VOLUMETRIC MIXED CONCRETE

Upon written request by the contractor, the Department may approve the use of concrete proportioned by volume. The volumetric producer must submit and have approved a process control plan and product quality control plan by the Materials and Tests Unit. If concrete is proportioned by volume, the other requirements of these specifications with the following modifications will apply. Unless otherwise approved by the Department, use of concrete proportioned by volume shall be limited to Class B concrete and a maximum of 30 cubic yards per unit per day.

(A) Materials

Use materials that meet the requirements for the respective items in the *Standard Specifications* except that they will be measured by a calibrated volume-weight relationship.

Storage facilities for all material shall be designed to permit the Department to make necessary inspections prior to the batching operations. The facilities shall also permit identification of approved material at all times, and shall be designed to avoid mixing with or contaminating by unapproved material. Coarse and fine aggregate shall be furnished and handled so variations in the moisture content affecting the uniform consistency of the concrete will be avoided.

Moisture content of the coarse and fine aggregate will be made available onsite for the Engineer's review for each load. The frequency of moisture testing will be dependent on certain variables such as weather, season and source; however, moisture tests should be performed at least once at the beginning of the work day for each source material. Additional daily moisture tests for the coarse and fine aggregate shall be performed if requested by the Engineer.

Unused materials should be emptied from hopper daily. Concrete should not be mixed with materials that have been left in the hopper overnight.

(B) Equipment

Provide volumetric mixers with rating plates indicating that the performance of the mixer is in accordance with the Volumetric Mixer Manufacturer Bureau or equivalent. Mixers must comply with ASTM C685. Unless otherwise specified, all mixing operations must be in strict accordance with the manufacturer's recommended procedures. Such procedures shall be provided to the Department for review upon request.

The volumetric mixer shall be capable of carrying sufficient unmixed dry bulk cement, pozzolan (if required), fine aggregate, coarse aggregate, admixtures and water, in separate compartments and accurately proportioning the specified mix. Each batching or mixing unit (or both) shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator.

The concrete mixing device shall be an auger-type continuous mixer used in conjunction with volumetric proportioning. The mixer shall produce concrete, uniform in color and appearance, with homogeneous distribution of the material throughout the mixture. Mixing time necessary to produce uniform concrete shall be established by the contractor and shall comply with other requirements of these specifications. Only equipment found acceptable in every respect and capable of producing uniform results will be permitted.

Each volumetric mixer shall be equipped with an onboard ticketing system that will electronically produce a record of all material used and their respective weights and the total volume of concrete placed. Alternate methods of recordation may be used if approved by the Engineer. Tickets should also identify the following information, at minimum:

- Contractor Name
- Contractor Phone Number
- NCDOT Project No. and TIP No.
- Date
- Truck No.
- Ticket No.
- Time Start/End of Pour
- Mix ID & Description (Strength)
- Aggregate Moisture Before Mixing

(C) Proportioning Devices

Volume proportioning devices, such as counters, calibrated gate openings or flow meters, shall be easily accessible for controlling and determining the quantities of the ingredients discharged. All indicating devices that affect the accuracy of proportioning and mixing of concrete shall be in full view of and near enough to be read by the operator and Engineer while concrete is being produced. In operation, the entire measuring and dispensing mechanism shall produce the specified proportions of each ingredient.

The volumetric mixer shall provide positive control of the flow of water and admixtures into the mixing chamber. Water flow shall be indicated by a flow meter and be readily adjustable to provide for slump control and/or minor variations in aggregate moisture. The mixer shall be capable of continuously circulating or mechanically agitating the admixtures.

Liquid admixtures shall be dispensed through a controlled, calibrated flow meter. A positive means to observe the continuous flow of material shall be provided. If an admixture requires diluting, the admixture shall be diluted and thoroughly mixed prior to introducing the admixture into the dispenser. When admixtures are diluted, the ratio of dilution and the mixing shall be approved by and performed in the presence of the Department.

The volumetric mixer shall be capable of measurement of cement, pozzolan (if required), liquids and aggregate being introduced into the mix.

(D) Calibration

Volume-weight relationships will be based on calibration. The proportioning devices shall be calibrated by the contractor prior to the start of each NCDOT job, and subsequently at intervals recommended by the equipment manufacturer. Calibrations will be performed in the presence of the Department and subject to approval from the Department. Calibration of the cement and aggregate proportioning devices shall be accomplished by weighing (determining the mass of) each component. Calibration of the admixture and water proportioning devices shall be accomplished by weight (mass) or volume. Tolerances in proportioning the individual components will be as follows:

**TABLE 1000-4
VOLUMETRIC MIXED CONCRETE CALIBRATION
PROPORTION TOLERANCES**

| Item | Tolerance |
|---|------------------|
| Cement, Weight (Mass) percent | 0 to +4 |
| Fine Aggregate, Weight (Mass) percent | ± 2 |
| Coarse Aggregate, Weight (Mass) percent | ± 2 |
| Admixtures, Weight (Mass) or Volume percent | ± 3 |
| Water, Weight (Mass) or Volume percent | ± 1 |

Each volumetric mixer must be accompanied at all times by completed calibration worksheets and they shall be made available to the Department upon request.

(E) Verification of Yield

Verification of the proportioning devices may be required at any time by the Department. Verification shall be accomplished by proportioning the rock and sand based on the cement meter count for each concrete mobile mixer. Once the count (revolutions) for 94 pounds of cement has been determined then delivery of the correct amount of rock and sand can be verified.

(F) Uniformity

When concrete is produced, have present during all batching operations a Certified Concrete Batch Technician. During batching and placement, the sole duty of this employee is to supervise the production and control of the concrete, perform moisture tests, adjust mix proportions of aggregates for free moisture, complete and sign approved delivery tickets, and assure quality control of the batching.

Two samples of sufficient size to make the required tests will be taken after discharge of approximately 15 and 85 percent of the load. Each of the 2 samples of concrete will be separately tested for the properties listed in Table 1000-3. Tests will be conducted in accordance with the test procedures specified in Table 1000-3 or procedures established by the Materials and Tests Unit. The Engineer may recheck mixer performance at any time when in his opinion satisfactory mixing is not being accomplished.

PORTLAND CEMENT CONCRETE (Alkali-Silica Reaction):

(2-20-07)

SP10 R16

Revise the *2006 Standard Specifications* as follows:

Article 1024-1(A), replace the 2nd paragraph with the following:

Certain combinations of cement and aggregate exhibit an adverse alkali-silica reaction. The alkalinity of any cement, expressed as sodium-oxide equivalent, shall not exceed 1.0 percent. For mix designs that contain non-reactive aggregates and cement with an alkali content less than 0.6%, straight cement or a combination of cement and fly ash, cement and ground granulated blast furnace slag or cement and microsilica may be used. The pozzolan quantity shall not exceed the amount shown in Table 1024-1. For mixes that contain cement with an alkali content between 0.6% and 1.0%, and for mixes that contain a reactive aggregate documented by the Department, regardless of the alkali content of the cement, use a pozzolan in the amount shown in Table 1024-1.

Obtain the list of reactive aggregates documented by the Department at:<http://www.ncdot.org/doh/operations/materials/pdf/quarryasrprob.pdf>

| Table 1024-1 | |
|--|--|
| Pozzolans for Use in Portland Cement Concrete | |
| <i>Pozzolan</i> | <i>Rate</i> |
| Class F Fly Ash | 20% by weight of required cement content, with 1.2 lbs Class F fly ash per lb of cement replaced |
| Ground Granulated Blast Furnace Slag | 35%-50% by weight of required cement content with 1 lb slag per lb of cement replaced |
| Microsilica | 4%-8% by weight of required cement content, with 1 lb microsilica per lb of cement replaced |

WATER FOR CONCRETE:

(10-19-10)

SP10 R17

Revise the *Standard Specifications for Roads and Structures* as follows:

Page 10-63, Article 1024-4, replace article with the following:

1024-4 WATER

Ensure that water used to condition, wash, or as an integral part of materials is clear and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substance. It shall not be salty or brackish. Water used in the production of concrete or grout shall be from wells or public water systems which are suitable for drinking and must meet the criteria listed in Table 1024-1.

Test all water from wells and public water supplies from all out of state locations and in the following counties: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrell, and Washington unless the Engineer waives the testing requirements. Water from a municipal water supply in all other NC counties may be accepted by the Engineer without testing.

**TABLE 1024-1
ACCEPTANCE CRITERIA FOR WATER
USED IN THE PRODUCTION OF CONCRETE**

| Requirement | Limit | Test Method |
|--|---|---|
| Compressive Strength, minimum percent of control at 3 and 7 days | 90 percent | NCDOT Modified / AASHTO T106 |
| Time of set, deviation from control | From 1:00 hr. earlier to 1:30 hr. later | NCDOT Modified / AASHTO T131 |
| pH | 4.5 to 8.5 | NCDOT Modified / AASHTO T26 |
| Chloride Ion Content, Max. | 250 ppm | ASTM D512 |
| Total Solids Content (Residue), Max. | 1000 ppm | NCDOT Modified / Standard Methods for Examination of Water and Wastewater |
| Resistivity, Min. | 0.500 kohm-cm | NCDOT Modified / ASTM D1125 |
| Sulfate as SO ₄ , Max. | 1500 ppm | NCDOT Modified / ASTM D516 |
| Presence of Sugar | None | NCDOT Procedure |
| Dissolved Organic Matter | None | NCDOT Modified / AASHTO T26 |

Page 10-65, Article 1026-4, replace article with the following:

1026-4 WATER

All water used for curing concrete shall meet the requirements of Article 1024-4 and Table 1024-1. Water from wells, streams, ponds, or public water systems may be used.

CULVERT PIPE:

(1-19-10)

SP10 R32

Revise the *Standard Specifications for Roads and Structures* as follows:

Page 10-67, Article 1032-1, replace (A), (B), (C), (D), (E) and (F) with the following:

- (A) Coated corrugated metal culvert pipe and pipe arches.
- (B) Coated corrugated metal end sections, coupling band, and other accessories
- (C) Corrugated aluminum alloy structural plate pipe and pipe arches
- (D) Corrugated aluminum alloy end sections, coupling band, and other accessories
- (E) Welded steel pipe

Page 10-69, Subarticle 1032-3(A)(5) Coating Repair, replace with the following:

Repair shall be in accordance with Section 1076-6 of the *Standard Specifications*.

Subarticle 1032-3(A)(7) Aluminized Pipe, replace with the following:

Aluminized pipe shall meet all requirements herein, except that the pipe and coupling bands shall be fabricated from aluminum coated steel sheet meeting the requirements of AASHTO M274.

Page 10-71, Article 1032-4 Coated Culvert Pipe, replace (A), (1), (2), (3), (4), (B), (C), (D), (E), (F) and (G) with the following:**(A) Coatings for Steel Culvert Pipe or Pipe Arch**

The below coating requirements apply for steel culvert pipe, pipe arch, end sections, tees, elbows, and eccentric reducers.

- (1) Steel Culvert pipe shall have an aluminized coating, meeting the requirement of AASHTO M274
- (2) When shown on the plans or as approved by the Engineer, a polymeric coating meeting the requirements of AASHTO M246 for Type B coating may be substituted for aluminized coating.

(B) Acceptance

Acceptance of coated steel culvert pipe, and its accessories will be based on, but not limited to, visual inspections, classification requirements, check samples taken from material delivered to the project, and conformance to the annual Brand Registration.

Page 10-73, Article 1032-5, sixth paragraph, third sentence, remove the word "spelter"**Page 10-74, 1032-7 Vitrified Clay Culvert Pipe, delete section in its entirety.****Page 10-75, Article 1032-8 Welded Steel Pipe, change title to WELDED STEEL PIPE FOR DRAINAGE****Subarticle 1032-9(B) Plain Concrete Culvert Pipe, delete section in its entirety.****Page 10-77, Article 1032-10 Corrugated Polyethylene Culvert Pipe, change title to CORRUGATED POLYETHYLENE (HDPE) CULVERT PIPE****Add the following: Article 1032-11 Polyvinyl Chloride (PVC) Pipe**

Polyvinyl Chloride pipe shall conform to AASHTO M 304 or ASTM 949. When rubber gaskets are to be installed in the pipe joint, the gasket shall be the sole element relied on

to maintain a tight joint. Test pipe joints at the plant hydrostatically using test methods in ASTM D 3212. Soil tight joints shall be watertight to 13.8 kPa. Watertight joints shall be watertight to 34.5 kPa unless a higher pressure rating is specified in the plans.

GLASS BEADS:

(7-18-06)(Rev 10-19-10)

SP10 R35

Revise the *2006 Standard Specifications* as follows:

Page 10-223, 1087-4(A) Composition, add the following as the fourth paragraph:

Glass beads shall have no more than 75 parts per million of arsenic as determined by the United States Environmental Protection Agency Method 6010B in conjunction with the United States Environmental Protection Agency Method 3052 modified.

Page 10-223, 1087-4(C) Gradation & Roundness, delete the last paragraph and replace the second sentence of the first paragraph with the following:

All Drop-On and Intermixed Glass Beads shall be tested in accordance with ASTM D1155.

Page 10-226, 1087-8 Material Certification, add the following below the first sentence:

Glass Beads (for paint, thermoplastic and polyurea) – Type 3 Material Certification for no more than 75 parts per million of arsenic

ENGINEERING FABRICS:

(7-18-06) (Rev 10-19-10)

SP10 R40

Revise the *Standard Specifications* as follows:

Page 10-99, Delete Section 1056 ENGINEERING FABRICS and replace it with the following:

**SECTION 1056
ENGINEERING FABRICS**

1056-1 General

Use engineering fabrics that meet the requirements of Article 4.1 of AASHTO M288 and have been evaluated by National Transportation Product Evaluation Program (NTPEP). When required, sew fabrics together in accordance with Article X1.1.4 of AASHTO M288. Provide sewn seams with seam strengths meeting the required strengths for the engineering fabric type and class specified.

Load, transport, unload and store fabrics such that they are kept clean and free of damage. Label, ship and store fabrics in accordance with Section 7 of AASHTO M288. Fabrics with defects, flaws, deterioration or damage will be rejected. Do not unwrap fabrics until just before installation. With the exception of fabrics for temporary silt fences and mechanically stabilized earth (MSE) wall faces, do not leave fabrics exposed for more than 7 days before covering fabrics with material.

When required, use pins a minimum of 3/16" in diameter and 18" long with a point at one end and a head at the other end that will retain a steel washer with a minimum outside diameter of 1.5". When wire staples are required, provide staples in accordance with Subarticle 1060-8(D) of the *Standard Specifications*.

1056-2 Fabric Properties

Provide Type 1 Certified Mill Test Report, Type 2 Typical Certified Mill Test Report or Type 4 Certified Test Report in accordance with Article 106-3 of the *Standard Specifications*. Furnish certifications with minimum average roll values (MARV) as defined by ASTM D4439 for all fabric properties with the exception of elongation. For testing fabrics, a lot is defined as a single day's production.

Provide engineering fabric types and classes in accordance with the contract. Machine direction (MD) and cross-machine direction (CD) are as defined by ASTM D4439. Use woven or nonwoven fabrics with properties meeting the requirements of Table 1056-1.

**TABLE 1056-1
FABRIC PROPERTY REQUIREMENTS**

| Property | ASTM Test Method | Requirements (MARV ¹) | | | | |
|--|------------------|-----------------------------------|------------------------|-----------------------------|---------------------------|---|
| | | Type 1 | Type 2 | Type 3 ² | Type 4 | Type 5 ³ |
| <i>Typical Application</i> | | <i>Shoulder Drains</i> | <i>Under Riprap</i> | <i>Temporary Silt Fence</i> | <i>Soil Stabilization</i> | <i>Temporary MSE Walls</i> |
| Elongation (MD & CD) | D4632 | ≥ 50 % | ≥ 50 % | ≤ 25 % | < 50 % | < 50 % |
| Grab Strength (MD & CD) | D4632 | 90 lbs | 205 lbs | 100 lbs | 180 lbs | --- |
| Tear Strength (MD & CD) | D4533 | 40 lbs | 80 lbs | --- | 70 lbs | --- |
| Puncture Strength | D6241 | 220 lbs | 440 lbs | --- | 370 lbs | --- |
| Wide Width Tensile Strength @ Ultimate (MD & CD) | D4595 | --- | --- | --- | --- | 2400 lbs/ft (unless required otherwise in the contract) |
| Permittivity | D4491 | 0.20 sec ⁻¹ | 0.20 sec ⁻¹ | 0.05 sec ⁻¹ | 0.05 sec ⁻¹ | 0.20 sec ⁻¹ |
| Apparent Opening Size ⁴ | D4751 | #60 | #60 | #30 | #40 | #30 |
| Ultraviolet Stability (retained strength) ⁵ | D4355 | 50 % | 50 % | 70 % | 50 % | 50% |

¹MARV does not apply to elongation
²Minimum roll width of 36" required
³Minimum roll width of 13 ft required
⁴US Sieve No. per AASHTO M92
⁵After 500 hours of exposure

PRECAST DRAINAGE STRUCTURES - MACRO-SYNTHETIC FIBERS

(7-15-08)(Rev 11-18-08)

SP10 R42

Description

Substitute as an option, macro-synthetic fibers in lieu of 4" x 4" W1.4 x W1.4 welded wire fabric reinforcement for selected precast concrete products in accordance with the following requirements.

Materials

| Item | Section |
|--------------------------|----------------|
| Portland Cement Concrete | 1077-5 |

(A) Substitute macro-synthetic fibers only for steel reinforcement with an area of steel of 0.12 in²/ft or less in the following items:

- (1) **Precast Drainage Structure** units in accordance with the requirements of *Standard Drawing 840.45*.
- (2) **Precast Manhole 4.0' Riser Sections** in accordance with the requirements of *Standard Drawing 840.52*.

All other requirements, including reinforcement for these precast concrete items will remain the same.

(B) **Submittal** Submit to the Department for approval by the precast producer and fiber manufacturer, independently performed test results certifying the macro-synthetic fibers and the precast concrete products meet the requirements listed herein:

(C) **Macro-Synthetic Fibers**

- (1) Manufacture from virgin polyolefins (polypropylene and polyethylene) and comply with ASTM C 1116.4.1.3.

Fibers manufactured from materials other than polyolefins Submit test results certifying resistance to long-term deterioration when in contact with the moisture and alkalis present in cement paste and/or the substances present in air-entraining and chemical admixtures.

- (2) Fiber length - no less than 1-1/2 inch.
- (3) Macro-synthetic fibers - aspect ratio (length divided by the equivalent diameter of the fiber) between 45 and 150.
- (4) Macro-synthetic fibers - Minimum tensile strength of 40 ksi when tested in accordance with ASTM D 3822.
- (5) Macro-synthetic fibers - minimum modulus of elasticity of 400 ksi when tested in accordance with ASTM D 3822.

(D) **Fiber Reinforced Concrete**

- (1) Approved structural fibers may be used as a replacement of steel reinforcement in allowable structures of NCDOT Standards 840.45 and 840.52. The dosage rate,

in pounds of fibers per cubic yard, shall be as per recommended by the fiber manufacturer to provide a minimum average residual strength (in accordance with ASTM C 1399) of concrete of no less than that of the concrete with the steel reinforcement that is being replaced, but no less than 5 lbs. per cubic yard. Submit the recommendations of the manufacturer that correlate the toughness of steel-reinforced concrete with that of the recommended dosage rate for the fiber-reinforced concrete.

- (2) Fiber reinforced concrete - 4.5% air content, \pm 1.5% tolerance.
- (3) Fiber reinforced concrete - develop a minimum compressive strength 4000 psi in 28 days.
- (4) Workability of the concrete mix - determine in accordance with ASTM C995. The flow time - not be less than 7 seconds or greater than 25 seconds.
- (5) Assure the fibers are well dispersed and prevent fiber balling during production. After introduction of all other ingredients, add the plastic concrete and mix the plastic concrete for at least 4 minutes or for 50 revolutions at standard mixing speed.

Measurement and Payment

No separate payment will be made for substitution of macro-fiber synthetic reinforcement for the steel reinforcing. The price bid for the precast units will be full compensation for furnishing and incorporating the macro-fiber synthetic reinforcement.

QUALIFICATION OF WELDS AND PROCEDURES:

(7-21-09)

SP10 R43

Page 10-143, Subarticle 1072-20(D) Qualification of Welds and Procedures, replace the third sentence of the first paragraph with the following:

For all prequalified field welds, submit Welding Procedure Specifications (WPS) for each joint configuration for approval at least 30 days prior to performing any welding. In lieu of this, use the WPS provided and preapproved by the Department. These preapproved WPS are available from the Materials and Tests Unit or at:

http://www.ncdot.org/doh/operations/materials/structural/appr_proc.html. Use non-prequalified welds only if approved by the Engineer. Submit WPS for all non-prequalified welds to the Engineer for approval. At no cost to the Department, demonstrate their adequacy in accordance with the requirements of the Bridge Welding Code.

PAINT SAMPLING AND TESTING:

(8-15-06)

SP10 R45

Revise the *2006 Standard Specifications* as follows:

Page 10-190, Article 1080-4, Delete the first paragraph and replace with the following:

All paint will be sampled, either at the point of manufacture or at the point of destination. Inspection and sampling will be performed at the point of manufacture wherever possible. The Contractor shall not begin painting until the analysis of the paint has been performed, and the paint has been accepted.

PORTABLE CONCRETE BARRIER:

(2-20-07)

SP10 R50

The *2006 Standard Specifications* is revised as follows:

Page 10-245, Article 1090-1(A) General, add the following after the first sentence:

The requirement for approved galvanized connectors will be waived if the barrier remains the property of the Contractor.

CHANNELIZING DEVICES (Drums):

7-20-10

SP10 R60

Revise the *2006 Standard Specifications* as follows:

Page 10-236, Subarticle 1089-5(A) Drums (1) General, replace the paragraph with the following:

(1) General

Provide drums composed of a body, alternating orange and white 4 band pattern of Type III-High Intensity Microprismatic Sheeting and ballasts that have been evaluated by NTPEP.

The following guidelines will be used during the transition from drums with the standard 5 band engineer's grade sheeting to the new 4 band configuration.

(a) All **new** drums purchased **after July 20, 2010** shall have the new sheeting and 4 band configuration.

(b) Existing 5 band drums with engineer's grade sheeting (both new and used devices in existing inventories) will be allowed for use on all on-going construction projects until project completion and will also be allowed for use on other projects until a sunset date has been established.

(c) Intermixing of "old drums" and "new drums" on the same project is acceptable during the transition.

(d) 4 band drums with engineer's grade sheeting will not be allowed at anytime.

Page 10-236, Subarticle 1089-5(A) Drums (3) Retroreflective Stripes, replace the paragraph with the following:

(3) Retroreflective Bands

Provide a minimum of 4 retroreflective bands- 2 orange and 2 white alternating horizontal circumferential bands. The top band shall always be orange. Use a 6" to 8" wide band Type III-High Intensity Microprismatic Retroreflective Sheeting or better that meets the requirement of Section 1093 for each band. Do not exceed 2" for any non-reflective spaces between orange and white stripes. Do not splice the retroreflective sheeting to create the 6-inch band. Apply the retroreflective sheeting directly to the drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting. Do not place bands over any protruding corrugations areas. No damage to the reflective sheeting should result from stacking and unstacking the drums, or vehicle impact.

Page 10-237, Subarticle 1089-5(B) Skinny-Drums (1) General, replace the paragraph with the following:

(1) General

All existing skinny-drums that do not have Type III-High Intensity Microprismatic Sheeting as a minimum will have the same transition requirements as drums as stated above. All new skinny-drums purchased after July 20, 2010 shall have Type III-High Intensity Microprismatic Sheeting as the minimum. Type IV and higher grade sheeting is acceptable for use on both new and used devices.

Provide skinny-drums composed of a body, reflective bands, and ballasts that have been evaluated by NTPEP.

Page 10-237, Subarticle 1089-5(B) Skinny Drums (3) Retroreflective Stripes, replace the paragraph with the following:

(3) Retroreflective Bands

Provide a minimum of 4 retroreflective bands- 2 orange and 2 white alternating horizontal circumferential bands for each skinny-drum. The top band shall always be orange. Use a 6" to 8" wide band Type III-High Intensity Microprismatic Retroreflective Sheeting or better that meets the requirement of Section 1093 for each band. Do not exceed 2" for any non-reflective spaces between orange and white stripes. Do not splice the retroreflective sheeting to create the 6-inch band. Apply the retroreflective sheeting directly to the skinny-drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting. Do not place bands over any protruding corrugations areas. No damage to the reflective sheeting should result from stacking and unstacking the skinny-drums, or vehicle impact.

PAVEMENT MARKING LINES:

(11-21-06) (Rev. 08-17-10)

SP12 R01

Revise the *2006 Standard Specifications* as follows:

Page 12-2, 1205-3(D) Time Limitations for Replacement, add the following at the beginning of the chart:

| Facility Type | Marking Type | Replacement Deadline |
|--|--------------------------------|---|
| Full-control-of-access multi-lane roadway (4 or more total lanes) and ramps, including Interstates | All markings including symbols | By the end of each workday's operation if the lane is opened to traffic |

Page 12-5, 1205-3 (H) Observation Period, delete 1205-3 (H) and replace with the following:

Maintain responsibility for debonding and color of the pavement markings during a 12 month observation period beginning upon final acceptance of the project as defined under Article 105-17. Guarantee the markings under the payment and performance bond in accordance with Article 105-17.

During the 12 month observation period, provide pavement marking material that shows no signs of failure due to blistering, chipping, bleeding, discoloration, smearing or spreading under heat or poor adhesion to the pavement materials. Pavement markings that debond due to snowplowing will not be considered a failed marking. Replace, at no additional expense to the Department, any pavement markings that do not perform satisfactorily under traffic during the 12 month observation period.

Page 12-8, 1205-4 (C) Application, delete the last two sentences of the second paragraph and replace with the following:

Produce in place markings with minimum retroreflective values shown below, as obtained with a LTL 2000 Retroreflectometer or Department approved mobile retroreflectometer. Retroreflective measurements will be taken within 30 days after final placement of the pavement marking.

Page 12-9, 1205-4 (D) Observation Period, delete the entire section and replace with the following:

In addition to the requirements of Subarticle 1205-3(H), maintain responsibility for minimum retroreflective values for a 30-day period beginning upon the Engineer's acceptance of all markings on the project. Guarantee retroreflective values of the markings during the 30-day period under the payment and performance bond in accordance with Article 105-17.

Page 12-9, 1205-5 (B) Application, delete the second sentence of the fourth paragraph and replace with the following:

Produce in place markings with minimum retroreflective values shown below, as obtained with a LTL 2000 Retroreflectometer or Department approved mobile retroreflectometer. Retroreflective measurements will be taken within 30 days after final placement of the pavement marking.

Page 12-10, 1205-5 (C) Observation Period, delete this entire section and replace with the following:

Maintain responsibility for minimum retroreflective values for a 30-day period beginning upon satisfactory final placement of all markings on the project. Guarantee retroreflective values of the markings during the 30-day period under the payment and performance bond in accordance with Article 105-17.

Page 12-14, Article 1205-9, Maintenance, delete Article 1205-9 and replace with the following:

Replace pavement markings that prematurely deteriorate, fail to adhere to the pavement, lack reflectorization, or are otherwise unsatisfactory during the life of the project or during the 12 month observation period as determined by the Engineer at no cost to the Department.

Upon notification from the Engineer, winterize the project by placing an initial or additional application of paint pavement marking lines in accordance with Article 1205-8. Payment for *Paint Pavement Marking Lines* required to winterize the project will be made in accordance with Article 1205-10 except that no payment will be made on resurfacing projects where paving is completed more than 30 days prior to the written notification by the Department that winterization is required.

Page 12-14, Article 1205-10, Measurement and Payment, add the following after the first sentence of the first paragraph:

In addition, *Paint Pavement Marking Lines* will be paid per linear foot for each 15 mil application placed in accordance with Subarticle 1205-8(C).

EXCAVATION, TRENCHING, PIPE LAYING, & BACKFILLING FOR UTILITIES:

(2-17-09)

SP15 R01

Revise the *2006 Standard Specifications* as follows:

Page 15-5, Article 1505-4 Repair of Pavements, Sidewalks and Driveways, first paragraph, add at the end of the first sentence

in accordance with Section 848.

Page 15-6, Article 1505-6 Measurement and Payment,

Second paragraph,

Delete (5) *Repair of Sidewalks and Driveways* in its entirety.

Add as the eighth paragraph:

 " *Concrete Sidewalk* and " *Concrete Driveways* will be measured and paid for in accordance with Article 848-4.