# PROJECT SPECIAL PROVISIONS

## ROADWAY

## CONTROL OF VIBRATION

The Engineer will use an independent consultant prequalified by the NCDOT Contractual Services Unit for vibration and noise monitoring work (work code 3120) to monitor construction induced noise and vibration during the project.

Noise and vibration monitoring by the Engineer of construction induced vibration does not relieve the Contractor of responsibility for damage or liability. Attention is directed to Articles 107-12 and 107-15 of the Standard Specifications.

Control of vibration and noise is required during construction of the project. It is the responsibility of the Contractor to utilize construction methods and equipment to avoid damage to the adjacent buildings and structures. Hand-held low pressure tampers may be required for compaction of earth material, stone or asphalt pavement to avoid vibration induced damage.

The Engineer's Consultant will furnish and operate vibration and noise monitoring devices (engineering seismographs with geophones) for the duration of the project at the locations shown below and any additional locations deemed necessary by the Engineer.

| Station: | Offset: |
|---|---|
| 19+70 -L- | 50' Right |
| 22+00 -L- | 30' Left |
| 25+90 -L- | 35' Right |
| 28+15 -L- | 40' Right |
| 29+80 -L- | 40' Right |
| 30+34 -L- | 36' Left |
| 31+80 -L- | 38' Right |
| 13+95 -Y7- | 20' Left |
| 15+92 -Y7- | 20' Left |
| 13+12 –Y8- | 34' Right |

These devices will have been calibrated within the twelve months prior to the start of construction and at 12 month intervals thereafter until completion of the project. These devices will be capable of recording vibrations in the three perpendicular axes: vertical, transverse, and longitudinal, and also be capable of recording the full vibration waveform. Peak particle velocity (PPV) is defined for this provision as the vector sum of particle velocities in each of the three individual perpendicular axes. The monitoring devices will also be capable of recording sound from all construction and traffic activities. Provide access and assistance to the Engineer's

Consultant for placement of devices in locations mentioned above and any additional locations as directed by the Engineer before beginning any construction operations.

Continuous monitoring will be performed throughout the duration of the project's construction. Construction induced vibrations shall not exceed a peak particle velocity of 0.50 inches per second at buildings or structures off NCDOT Right of Way at any time. If construction vibrations recorded show a peak particle velocity exceeding 0.50 inches per second or any potential to damage adjacent buildings or structures, cease all work immediately and furnish the Engineer with an alternative method of construction. The Engineer will review the proposed alternative method of construction and respond to the Contractor within three (3) working days from the time the submittal is received. If construction vibration recorded exceeding a peak particle velocity of 0.5 inches per second has damaged any structures or buildings, the Contractor shall repair the damage or compensate the property owner for the damage at no additional cost to the North Carolina Department of Transportation.

No measurement or payment will be made for control of vibration. Any work or change in construction technique needed to conform to the requirements of this provision will be considered incidental to the overall project's cost. No contract time extension or additional compensation is granted to the contractor for delays due to noncompliance with this specification.

**CLEARING AND GRUBBING – METHOD II:**
(9-17-02) (Rev 3-18-08) SP2 R01

Perform clearing on this project to the limits established by Method "II" shown on Standard No. 200.02 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.

**DEMOLITION OF BUILDINGS AND APPURTENANCES:**
(1-1-02) (Rev. 9-19-06) SP2 R10

Demolish the buildings and appurtenances listed below in accordance with Section 210 of the *2006 Standard Specifications* and the following provisions:

Prior to demolishing any building, comply with the notification requirements of *Title 40 Code of Federal Regulations*, Part 61, Subpart M, which are applicable to asbestos. Give notification to the North Carolina Department of Health and Human Services, Division of Public Health, Health Hazards Control Unit and/or the appropriate county agency when enforcement of the Federal Regulation is performed by the county (Buncombe, Forsyth, Mecklenburg only). Submit a copy of the notification to the Engineer prior to the building demolition.

The Department has performed asbestos assessments for building items identified below. Copies of this report may be obtained through the Division Right-of-Way Agent. When asbestos is discovered after the opening of bids for the project, the cost of asbestos removal and disposal will be paid for in accordance with Article 104-7 of the *2006 Standard Specifications*. Perform removal and disposal of asbestos in accordance with the requirements of *Title 40 Code of Federal Regulations, NCGS 130A-444-452 and 10A NCAC 41C 0600.*

Comply with all Federal, State and local regulations when performing building demolition and/or asbestos removal and disposal. Any fines resulting from violations of any regulation are the sole responsibility of the Contractor and the Contractor agrees to indemnify and hold harmless the Department against any assessment of such fines.

Prior to removal of any Underground Storage Tank (UST), comply with the notification requirements of the *Title 40 Code of Federal Regulations*, Part 280.71(a). Give notification to the appropriate regional office of the North Carolina Department of Environment, and Natural Resources, Division of Waste Management, UST Section. Submit a copy of the notification to the Engineer prior to the removal of the underground storage tank.

Permanently close UST systems by removal and dispose of in compliance with the regulations set forth in *Title 40, Code of Federal Regulations*, Part 280.71 and *North Carolina Administrative Code Title 15A*, Chapter 2, Subchapter 2N and any applicable local regulations. Assess Underground Storage Tank sites at closure for the presence of contamination as required in *North Carolina Administrative Code Title 15A*, Chapter 2, Subchapter 2N, Section .0803 and as directed by the appropriate Regional Office of the Division of Waste Management. Remove and dispose of UST systems and contents in a safe manner in conformance with requirements of *American Petroleum Institute Bulletin 1604*, Removal and Disposal of Used Underground Petroleum Storage Tanks, Chapters 3 through 6. (Note: As an exception to these requirements, the filling of the tank with water as a means of expelling vapors from the tank as described in section 4.2.6.1 of *American Petroleum Institute Bulletin 1604*, will not be allowed). Where underground storage tanks are indicated below, there will be no direct payment for the closure or assessment, as payment at the contract lump sum price for *Clearing and Grubbing* will be full compensation for all costs of such closure or assessment. When the contract does not indicate the presence of storage tanks and storage tanks are discovered after the opening of bids for the project, the cost of closure, assessment and/or removal will be paid for in accordance with Article 104-7 of the *2006 Standard Specifications*.

Disposition of any contaminated material associated with underground storage tanks will be made as provided in Article 107-26 of the *2006 Standard Specifications*.

| Improvement Removal |
|---|
| Parcel 022 - Right of Survey Station 18+23, Survey Line –L1- |
| 340 LF Rip Rap Bulkhead |

## BUILDING AND UNDERGROUND STORAGE TANK REMOVAL:

(1-1-02) (Rev.6-21-05) SP2 R15 C

### Building Removal

Remove the buildings and appurtenances listed below in accordance with Section 215 of the *2006 Standard Specifications* and the following:

Prior to removal of any building, comply with the notification requirements of *Title 40 Code of Federal Regulations*, Part 61, Subpart M, which are applicable to asbestos. Give notification to the North Carolina Department of Health and Human Services, Division of Public Health Epidemiology Branch and/or the appropriate county agency when the county performs enforcement of the Federal Regulation. Submit a copy of the notification to the Engineer prior to the building removal.

Perform removal and disposal of asbestos in accordance with the requirements of *Title 40 Code of Federal Regulations*; comply with all Federal, State and local regulations when performing building removal and/or asbestos removal and disposal. Any fines resulting from violations of any regulation are the sole responsibility of the Contractor and the Contractor agrees to indemnify and hold harmless the Department against any assessment of such fines.

The Department has performed asbestos assessments for building items identified below. Copies of this report may be obtained through the Division Right-of-Way Agent. When asbestos is discovered after the opening of bids for the project, the Engineer may have the work performed by others or the cost of asbestos removal and disposal will be paid for in accordance with Article 104-7 of the *2006 Standard Specifications*. When a building has had or will have asbestos removed and the Contractor elects to remove the building such that it becomes a public area, the Contractor is responsible for any additional costs incurred including final air monitoring.

### Underground Storage Tank Removal

Prior to removal of any Underground Storage Tank (UST), comply with the notification requirements of the *Title 40 Code of Federal Regulations*, Part 280.71(a). Give notification to the appropriate regional office of the North Carolina Department of Environment and Natural Resources, Division of Waste Management, UST Section. Submit a copy of the notification to the Engineer prior to the removal of the underground storage tank.

Permanently close UST systems by removal and disposal in compliance with the regulations set forth in *Title 40, Code of Federal Regulations*, Part 280.71 and *North Carolina Administrative Code (NCAC)* Title 15A, Chapter 2, Subchapter 2N and any applicable local regulations. Assess Underground Storage Tank sites at closure for the presence of contamination as required in *NCAC* Title 15A, Chapter 2, Subchapter 2N, Section .0803 and as directed by the appropriate Regional Office of the Division of Waste Management. Remove and dispose of UST systems and contents in a safe manner in conformance with requirements of *American Petroleum Institute Bulletin 1604*, Removal and Disposal of Used Underground Petroleum Storage Tanks, Chapters 3 through 6. (Note: As an exception to these requirements, the filling of the tank with

water as a means of expelling vapors from the tank as described in Section 4.2.6.1 of *American Petroleum Institute Bulletin 1604*, will not be allowed. Comply with all Federal, State and local regulations when performing UST removal and contaminated material disposal. Any fines resulting from violations of any regulation are the sole responsibility of the Contractor and the Contractor agrees to indemnify and hold harmless the Department against any assessment of such fines.

Where underground storage tanks are indicated below, there will be no direct payment for the assessment or closure. When the contract does not indicate the presence of storage tanks and storage tanks are discovered after the opening of bids for the project, the Engineer may have the work performed by others or the cost of assessment, closure, and/or removal will be paid for in accordance with Article 104-7 of the *2006 Standard Specifications.*

Disposition of any contaminated material associated with underground storage tanks will be made as provided in Article 107-26 of the *2006 Standard Specifications*.

| Building Removal |
|---|
| Parcel 018 – Left of Survey Station 33+15, Survey Line -L- |
| 1 SBLK Bus |

| Building Removal |
|---|
| Parcel 035 – Right of Survey Station 10+50, Survey Line -Y8- |
| 1 SBLK Bus |

When the description of the work for an item indicates a building partially inside and partially outside the right of way and/or construction area, but does not require the building to be cut off, the entire building shall be removed.

**CONTAMINATED SOIL AND GROUNDWATER (January 25, 2011)**

The Contractor's attention is directed to the fact that soil and groundwater containing petroleum hydrocarbon and septic compounds exist within the project area.

The approximate limits of petroleum hydrocarbon soil contamination are shown on the construction plan sheets. Groundwater is assumed to be contaminated throughout the project as noted below. Information relating to these contaminated areas, sample locations, and laboratory results are available at the following web address:

**www.ncdot.org/doh/preconstruct/ps/contracts/letting.html**

Impact to contamination is possible during any earthwork activities on the project. The Contractor shall only excavate those soils which the Engineer designates necessary to complete a particular task. The Engineer shall determine if soil is contaminated based on previous investigations, petroleum odors, and unusual soil staining. Contaminated soil not required to be excavated is to remain in place and undisturbed.

**Stockpiling**

The Contractor shall stockpile all excavated contaminated soil within the property boundaries of which it was removed. If the volume of contaminated material exceeds available space on site, the Contractor shall obtain a permit from the NCDENR UST Section for off-site temporary storage. The stockpile shall be constructed in accordance with the "Diagram for Temporary Containment of Petroleum Contaminated Soil" detail located in the plans. The Engineer shall notify the Geotechnical Engineering Unit if petroleum contaminated soil is encountered and the Geotechnical Engineering Unit shall arrange for the sampling and disposal of the contaminated soil.

**Soil Disposal**

Upon approval by the Engineer, the Contractor may choose, as an alternative to or in conjunction with stockpiling, to load contaminated soil directly into trucks for disposal at a facility licensed to accept contaminated soil. Shipping manifests, weigh tickets, and letters of acceptance from the disposal facility shall be delivered to the Engineer on a monthly basis.

**Coordination**

Soil sample results from parcel 18 indicate that petroleum contaminated soil and two abandoned in place buried fuel tanks will be encountered during the proposed expansion of the Drainage Basin. In addition to the requirements listed above, the Contractor shall coordinate with the Department's environmental consultant to allow the consultant to document the soil removal, document the removal of the two (2) suspected underground fuel storage tanks (USTs), and collect soil samples from the final grade. The Consultant will prepare a report to meet NCDENR's reporting requirements for UST and petroleum contaminated soil removal.

**Dewatering**

Groundwater sampling across the project indicates widespread petroleum and septic contamination. As a result, all groundwater pumped from excavations is to be metered and sent to the city's waste water treatment plant by way of the sanitary sewer in accordance with the pending Municipal Agreement between the City of Elizabeth City and the Department. During a rain event, the Contractor shall store the groundwater in vessels provided by the Department until such time as the City is able to accept the water. In the event that the Municipal Agreement is not available for the contract, the contractor shall containerize the groundwater in vessels provided by the Department. The Department will be responsible for the sampling and disposal of the water.

**Measurement and Payment:**

*Contaminated Soil Stockpiling* will be paid for as the actual number of cubic yards of contaminated soil which has been acceptably excavated and stockpiled. Include in the unit bid price for *Contaminated Soil Stockpiling* all costs associated with this activity including stockpile construction material and personal protective equipment.

*Contaminated Soil, Hauling, and Disposal* shall be the actual number of tons of contaminated soil which has been acceptably transported and weighed with certified scales. The quantity of contaminated soil, measured as provided above, shall be paid for at the contract unit price per ton for "Contaminated Soil Hauling and Disposal".

*Underground Storage Tank Removal and Disposal* shall be paid for at a unit rate for each tank removed and disposed.

*Dewatering* will be incidental to the project.

Payment shall be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Contaminated Soil Stockpiling | Cubic Yard |
| Contaminated Soil Hauling, and Disposal | Ton |
| Underground Storage Tank Removal and Disposal | Each |

**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.

**REMOVAL OF EXISTING PAVEMENT:**

Revise the *2006 Standard Specifications* as follows:
**Page 2-26, Article 250-3 MEASUREMENT AND PAYMENT**, replace the first paragraph with the following:
*Removal of Existing Asphalt Pavement* will be measured and paid in cubic yards of existing asphalt pavement actually removed and disposed of properly.
Also,
**Page 2-27**, replace the first line under **Pay Item** with the following:

| | |
|---|---|
| Removal of Existing Asphalt Pavement | Cubic Yard |

**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 |

**FOAMED CONCRETE:** **(U-4438)**

**Description**

This work consists of furnishing and placing foamed concrete of the appropriate type at the locations indicated on the plans and where directed by the Engineer. The Contractor shall furnish all labor, materials and equipment required for completing the work. The Foamed Concrete Subcontractor shall furnish and place the foamed concrete. Excavation, placement of high strength fabric for foamed concrete, welded wire fabric for foamed concrete, utility lines and stormwater pipes, and formwork for foamed concrete may be provided and placed by the general contractor. The work shall be done in accordance with this provision and in conformity with the lines, grades, thickness and typical sections shown on the plans or established by the Engineer in writing.

The Contractor shall schedule a pre-construction meeting with the representatives of the Contractor, the Foamed Concrete Subcontractor, the Resident Engineer, and the Geotechnical Engineering Unit. The pre-construction meeting shall be conducted at least ten (10) working days prior to the start of any foamed concrete work to clarify the construction requirements, to provide appropriate scheduling of the construction activities and to identify contractual relationships and responsibilities. All costs associated with attending the pre-construction meeting shall be considered incidental to the work

The Foamed Concrete Subcontractor shall provide proven records of the following credentials to be approved for this project:

1. He shall be able to supply the required material for the project, and
2. He shall have done at least three (3) foamed concrete construction projects of similar size and nature to this project.

**Submittals**

Two (2) submittals are required. These submittals include (1) Foamed Concrete Subcontractor experience and (2) detailed construction schedule and foamed concrete mix design.

Submit documentation that the Foamed Concrete Subcontractor has successfully completed at least three (3) foamed concrete construction projects of similar size and nature to this project. Documentation should include the General Contractor and Owner's name and current contact information with descriptions of each past project.

Allow ten (10) working days for the review of the Foamed Concrete Subcontractor experience submittal. After the personnel and experience submittal is accepted, submit the detailed construction schedule and the foamed concrete mix design at least five (5) working days before pre-construction meeting.

Do not begin foamed concrete construction until after the Foamed Concrete Subcontractor experience submittal has been accepted and the pre-construction meeting has been held.

**Materials**

A. Materials shall meet the requirements of the following:

| Materials | Standard Specification Section |
|---|---|
| Portland cement (Type I, II, or III) | Section 1000 |
| Fine Aggregate | Section 1014-1 |
| Fly Ash | Section 1024-5 |
| Boiler Slag | Section 1024-6 |
| Water | Section 1024-4 |
| Admixtures | Section 1024-3 |
| Foaming agent | (See Below) |

The foaming agent shall conform to the requirements of ASTM C-869 unless specified otherwise by this specification.

B. The foamed concrete shall conform to the following:

Cast Wet Density
68 $lb/ft^3$ +/- 3 $lb/ft^3$

Minimum Compressive Strength
300 psi at 7 days and
500 psi at 28 days

The foamed concrete shall be mixed in accordance with the recommendations of the supplier of the foaming agent. The Foamed Concrete Subcontractor shall be responsible for designing the mix so that the foamed concrete meets the corresponding criteria listed above.

C. Demonstrate mix density at the end of the hose prior to beginning placement for each pour. Adjust the mix density, as required, prior to beginning each pour. Re-verify the density at the point of placement at the beginning of the pour and thereafter at 30 minute intervals during the entire concrete placement. The Foamed Concrete Subcontractor shall adjust his operations as necessary to maintain the wet cast density within the specified range.

The Engineer will take samples of the foamed concrete to make specimens for the compressive strength tests at the point of placement. The Foamed Concrete Subcontractor shall assist the Engineer as needed to take the samples. The Engineer will sample as follows:

1. Six representative samples (3 in x 6 in cylinders) will be taken at the point of placement for each day's pour or each 100 cubic yards of material placed, whichever is more frequent. Samples will be marked for clear identification, and all pertinent field information will be recorded on the corresponding field report, including the station and elevation of the placement. Slump and air content will not be measured.
2. Samples will be obtained by overfilling the cylinders by pouring the concrete down the inside of the cylinders, allowing air to escape during filling. DO NOT ROD THE SAMPLES. The sides and bottom of the cylinder molds will be tapped to close any accidentally entrained air voids. Strike off the top of the cylinder (not more than three times) and cover.
3. Samples will be stored in accordance with ASTM C-495. Excessive handling may damage these test cylinders.
4. After 24 hours the samples will be transported to the appropriate NCDOT location for storage and testing. Three cylinders each will be compressive strength tested at both 7 days and 28 days. Compressive strength testing will be done in accordance with ASTM C-495 except cylinders will not be oven dried.

**Construction Methods**

Mixing and placing operations shall be under the supervision of the Engineer. A representative of the supplier of the foaming agent shall be on site during the initial placement and at such times as requested by the Engineer to advise the Foamed Concrete Subcontractor on his operations. The foamed concrete shall be placed in lifts not less than nine (9) inches and not to exceed twenty (20) inches unless otherwise approved by the Engineer or noted on the plans. Subsequent lifts shall be placed only after a minimum 12 hour waiting period has been observed. Lift thickness requirements do not apply to foamed concrete being placed under the existing concrete slab on timber piles.

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Revised 3-31-11

Scarify the entire surface area of each lift before placing the next lift. Each lift shall be scarified to a minimum depth of ½ inch using a hand rake or other suitable means. Scarifying shall be done after sufficient curing time such that foot traffic will not excessively damage the lift surface (no greater than ¼-inch indention). Do not scarify the final top surface of the foamed concrete. Scarifying requirements do not apply to foamed concrete being placed under the existing concrete slab on timber piles.

The final top surface of the foamed concrete shall match the grade and cross-slope of the pavement subgrade to within 0.1 feet without abrupt steps. Abrupt steps or areas above pavement subgrade elevations shall be ground or milled off.

The foamed concrete shall be placed on supporting surfaces which have been cleaned of loose debris, dust, or other foreign material to the satisfaction of the Engineer. Dewater excavations prior to foamed concrete placement. Surfaces against which the foamed concrete is to be placed shall be free of ice, snow, or standing water and shall be at a temperature of 35°F or higher. Placement of concrete in cold weather must conform to Standard Specifications Section 420-7.

**Acceptance Criteria**

Foamed Concrete will be accepted based on the result of density tests at the time of placement and 7 day and 28 day compressive strength test results. All foamed concrete incorporated into the final work must meet the density requirements at the time of placement. The average compressive strength of three cylinders tested will be used to determine acceptance for the 7 day and 28 day compressive strength requirements. Additionally, no individual compressive strength test from each set of three cylinders may be more than 20 percent below the required compressive strength.

Failure to meet the cast wet density or the strength criteria may require removal and replacement of that entire lift, and all overlying lifts, at the Contractor's expense as determined by the Engineer.

**Measurement and Payment**

The quantity of *Foamed Concrete* to be measured for payment will be the actual quantity of *Foamed Concrete* in cubic yards incorporated into the completed project. Measurement will be made in place based on the actual dimensions of foamed concrete completed and accepted. The quantity of foamed concrete measured as provided above will be paid for at the contract unit price per cubic yard for *Foamed Concrete*. No payment will be made for foamed concrete which does not meet the acceptance criteria. The unit bid price for this item shall include the cost of furnishing all equipment, labor, and materials necessary to complete the required work. All costs for form work, cold weather insulating, density testing, dewatering excavations prior to foamed concrete placement, and incidentals, shall be included in the bid price for foamed concrete.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Foamed Concrete | Cubic Yard |

## HIGH STRENGTH GEOTEXTILE FOR FOAMED CONCRETE:

### Description

Furnish and install high strength geotextile for foamed concrete in accordance with this provision and the plans.

### Materials

Load, transport, unload and store geotextiles such that they are kept clean and free of damage. Label, ship and store geotextiles in accordance with Section 7 of AASHTO M288. Geotextiles with defects, flaws, deterioration or damage will be rejected. Do not unwrap geotextiles until just before installation and do not leave geotextiles exposed for more than 7 days before covering geotextiles with foamed concrete.

Use geotextiles with a minimum roll width of 13 ft that meet the requirements of Article 1056-1 of the *Standard Specifications*. Provide Type 1 Certified Mill Test Report in accordance with Article 106-3 of the *Standard Specifications* with minimum average roll values (MARV) as defined by ASTM D4439 for geotextile properties. For testing geotextiles, a lot is defined as a single day's production. The Engineer reserves the right to inspect or test the geotextiles at any time. If requested by the Engineer, provide a sample of the geotextile for testing.

Machine direction (MD) and cross-machine direction (CD) are as defined by ASTM D4439. Use woven polyester or polypropylene geotextiles with properties meeting the following requirements.

| Property | ASTM Test Method | Requirement (MARV) |
|---|---|---|
| Wide Width Tensile Strength @ 5% Strain (MD & CD) | D4595 | 1900 lbs/ft |
| Wide Width Tensile Strength @ Ultimate (MD & CD) | D4595 | 4800 lbs/ft |
| Permittivity | D4491 | Min 0.10 $sec^{-1}$ |
| Apparent Opening Size[1] | D4751 | #30 to #50 |
| Ultraviolet Stability (retained strength)[2] | D4355 | 70 % |

[1]US Sieve No. per AASHTO M92
[2]After 500 hours of exposure

### Construction Methods

Place the high strength geotextile for foamed concrete on the bottom of excavations as shown on the plans prior to placing foamed concrete. Place geotextiles in slight tension free of kinks, folds, wrinkles or creases. Install geotextiles with the machine direction (MD) parallel to the roadway centerline. The MD is the direction of the length or long dimension of the roll. Overlap machine and cross-machine (CD) directions as shown on the plans.

Do not damage the high strength geotextile for foamed concrete when placing pipe, box, or welded wire fabric supports. Replace any damaged geotextiles to the satisfaction of the Engineer.

**Measurement and Payment**

*High Strength Geotextile for Foamed Concrete* will be measured and paid for in square yards. *High Strength Geotextile for Foamed Concrete* will be measured as the exposed surface of the geotextile in square yards and no additional payment will be made for overlapping geotextiles. The contract unit price bid for *High Strength Geotextile for Foamed Concrete* will be full compensation for supplying, transporting and installing *High Strength Geotextile for Foamed Concrete* and all incidentals necessary to complete the work as described in this provision and the plans.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| High Strength Geotextile for Foamed Concrete | Square Yard |

**WELDED WIRE FABRIC FOR FOAMED CONCRETE:**

**Description**

Furnish and install Welded Wire Fabric for Foamed Concrete in accordance with this provision and the plans.

**Materials**

Load, transport, unload and store Welded Wire Fabric for Foamed Concrete in accordance with Article 1070 of the *Standard Specifications.*

Provide Welded Wire Fabric for Foamed Concrete in flat sheets and meeting the requirements of AASHTO M221. Provide Type 1 Certified Mill Test Report in accordance with Article 106-3 of the *Standard Specifications.* Epoxy coat Welded Wire Fabric for Foamed Concrete in accordance with AASHTO M284 and Article 1070-8 of the *Standard Specifications*; except use reinforcing steel in accordance with AASHTO M221 in lieu of AASHTO M31.

Provide bent Welded Wire Fabric for Foamed Concrete where shown on the plans. Bend Welded Wire Fabric for Foamed Concrete prior to epoxy coating or in accordance with Subarticle 1070-8(J) of the *Standard Specifications*. Use a bend radius no smaller than two (2) inches or six (6) bar diameters, whichever is larger.

**Construction Methods**

Place the Welded Wire Fabric for Foamed Concrete as shown on the plans prior to placing foamed concrete. Overlap all adjacent sheets by a minimum of eighteen (18) inches. Support Welded Wire Fabric for Foamed Concrete prior to and during placement of foamed concrete.

**Measurement and Payment**

*Welded Wire Fabric for Foamed Concrete* will be measured and paid for in square yards. *Welded Wire Fabric for Foamed Concrete* will be measured as the surface area of the welded wire fabric in square yards and no additional payment will be made for overlapping welded wire fabric as required by this provision. The contract unit price bid for *Welded Wire Fabric for Foamed Concrete* will be full compensation for supplying, bending, epoxy coating, transporting, installing, and supporting *Welded Wire Fabric for Foamed Concrete* and all incidentals necessary to complete the work as described in this provision and the plans.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Welded Wire Fabric for Foamed Concrete | Square Yard |

**SHOULDER AND FILL SLOPE MATERIAL:**
(5-21-02) SP2 R45 C

**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.

**Compensation**

When the Contractor elects to obtain material from an area located beneath a proposed fill sections which does not require excavation for any reason other than to generate acceptable shoulder and fill slope material, the work of performing the excavation will be considered incidental to the item of *Borrow Excavation* or *Shoulder Borrow*. If there is no pay item for *Borrow* or *Shoulder Excavation* in the contract, this work will be considered incidental to *Unclassified Excavation*. Stockpile the excavated material in a manner to facilitate measurement

by the Engineer. Fill the void created by the excavation of the shoulder and fill slope material with suitable material. Payment for material used from the stockpile will be made at the contract unit price for *Borrow Excavation* or *Shoulder Borrow*. If there is no pay item for *Borrow Excavation* or *Shoulder Borrow*, then the material will be paid for at the contract unit price for *Unclassified Excavation*. The material used to fill the void created by the excavation of the shoulder and fill slope material will be made at the contract unit price for *Unclassified Excavation*, *Borrow Excavation*, or *Shoulder Borrow*, depending on the source of the material.

Material generated from undercut excavation, unclassified excavation or clearing and grubbing operations that is placed directly on shoulders or slope areas, will not be measured separately for payment, as payment for the work requiring the excavation will be considered adequate compensation for depositing and grading the material on the shoulders or slopes.

When undercut excavation is performed at the direction of the Engineer and the material excavated is found to be suitable for use as shoulder and fill slope material, and there is no area on the project currently prepared to receive the material generated by the undercut operation, the Contractor may construct a stockpile for use as borrow at a later date. Payment for the material used from the stockpile will be made at the contract unit price for *Borrow Excavation* or *Shoulder Borrow*.

When shoulder material is obtained from borrow sources or from stockpiled material, payment for the work of shoulder construction will be made at the contract unit price per cubic yard for *Borrow Excavation* or *Shoulder Borrow* in accordance with the applicable provisions of Section 230 or Section 560 of the *2006 Standard Specifications*.

**SELECT GRANULAR MATERIAL:**
(3-16-10) SP2 R80

Revise the *Standard Specifications* as follows:

**Page 2-29, Delete Section 265 SELECT GRANULAR MATERIAL** and replace it with the following:

**SECTION 265**
**SELECT GRANULAR MATERIAL**

**265-1 Description**

Furnish and place select granular material in accordance with the contract or as directed by the Engineer.

**265-2 Materials**

Refer to Division 10 of the *Standard Specifications.*

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

**265-3 Construction Methods**

Use Class II or III Select Material over fabric for soil stabilization and only Class III Select Material for backfill in water.

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

**265-4 Measurement and Payment**

Select granular material will be paid for as *Select Granular Material* unless the material is obtained from the same source as the borrow material and the contract includes a pay item for *Borrow Excavation*. When this occurs, select granular material will be paid for as *Borrow Excavation* in accordance with Article 230-5 of the *Standard Specifications* and no payment for *Select Granular Material* will be made.

*Select Granular Material* will be measured and paid for in cubic yards. When *Undercut Excavation* is in accordance with Section 226 (Comprehensive Grading) of the *Standard Specifications* and the Engineer requires undercut to be backfilled with select granular material, the second sentence of the sixth paragraph of Article 226-3 will not apply, as payment for the backfill will be made as specified in this provision.

Select granular material 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 select granular material is weighed in trucks, a unit weight of 135 pcf will be used to convert the weight of select granular 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 prices for *Select Granular Material* and *Borrow Excavation* as described above will be full compensation for furnishing, hauling, handling, placing, compacting and maintaining select granular material.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Select Granular Material | Cubic Yard |

**ROCK PLATING:**
(7-21-09) (Rev 10-19-10) SP2 R85

**Description**

Construct rock plating in accordance with the contract. Rock plating is required to stabilize slopes at locations shown on the plans.

**Materials**

Refer to Division 10 of the *Standard Specifications*:

| Item | Section |
|---|---|
| Select Material | 1016 |
| Plain Riprap | 1042 |
| Subsurface Drainage Materials | 1044 |
| Filter Fabric for Rock Plating, Type 2 | 1056 |

Use Class IV Select Material (standard size no. ABC) over riprap and Class V Select Material (standard size no. 78M) for subdrain coarse aggregate. Use Class 1, 2 or B Riprap unless required otherwise on the plans. Provide polyvinyl chloride (PVC) plastic subdrain pipes, fittings and outlet pipes for subsurface drainage materials.

**Construction Methods**

Construct embankments in accordance with the contract. Compact fill slopes to the satisfaction of the Engineer using tracked equipment or other approved methods. Undercut as necessary to install rock plating on cut slope faces or embed rock plating below the ground line.

Unroll fabrics down slopes, i.e., perpendicular to the roadway centerline. Bury filter fabrics at or near top of slopes and embed fabrics at toe of slopes as shown on the plans. Filter fabrics should be continuous down slopes. However, if fabric roll length is too short, overlap ends of fabric rolls at least 5 ft with the upper fabric over the lower as shown on the plans. Filter fabrics may be discontinuous down slopes in the direction perpendicular to the roadway centerline only once per roll width.

Overlap adjacent filter fabrics along slopes at least 18" as shown on the plans. Use wire staples as needed to hold fabrics in place until covered. Do not displace or damage filter fabrics while placing riprap. When shown on the plans, install 6" diameter perforated subdrain pipes at toe of slopes in accordance with Article 815-3 of the *Standard Specifications*. Place subdrain coarse aggregate beneath, around and over pipes such that pipes are covered by at least 6" of aggregate. Provide subdrain pipes with positive drainage towards outlets.

When shown on the plans, place filter fabrics and 18" of ABC over riprap at top of slopes. Compact ABC to 92% of AASHTO T180 as modified by the Department or to the highest density that can be reasonably obtained.

**Measurement and Payment**

*Rock Plating* will be measured and paid in square yards. Rock plating will be measured along the slope faces of rock plated slopes as the exposed riprap and if applicable, ABC. No payment will be made for portions of rock plating embedded below the ground line. The contract unit price for *Rock Plating* will be full compensation for providing, transporting and placing filter fabric, wire staples, riprap and ABC. The contract unit price for *Rock Plating* will also be full compensation for undercut excavation to install rock plating on cut slope faces or embed rock plating below the ground line.

Subsurface drainage will be measured and paid in accordance with Section 815 of the *Standard Specifications*.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Rock Plating | Square 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 | Pay Unit |
|---|---|
| Flowable Fill | Cubic Yard |

## CONTRACTOR DESIGNED CAA STRUCTURAL PLATE PIPE ARCH WITH HEADWALLS:

### Description

This work consists of the design, manufacture and installation of Corrugated Aluminum Alloy Structural Plate Pipe Arches with Headwalls of the size and thickness called for in the contract documents in the locations designated in the plans. The Contractor shall provide detailed shop drawings to the Engineer for approval.

### Materials

Refer to Article 320-2 of the *Standard Specifications*. Aluminum Headwalls shall meet the requirements of the manufacturer's specifications.

### Construction

Refer to Article 320-3 of the *Standard Specifications*.

### Measurement and Payment

*9'-7" x 6'-6" CAA Structural Plate Pipe Arch, 0.125" Thick, Contractor Design* will be measured and paid for in linear feet. Such price and payment will be full compensation for all work and will include, but not be limited to, furnishing all labor, materials, equipment and other incidentals necessary to complete this work. No separate payment will be made for Aluminum Headwalls as the cost of such will be considered incidental to the price paid for *9'-7" x 6'-6" CAA Structural Plate Pipe Arch, 0.125" Thick, Contractor Design.*

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| 9'-7" x 6'-6" CAA Structural Plate Pipe Arch, 0.125" Thick, Contractor Design | Linear Feet |

## 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 HDPE pipe is called for in the plans use watertight joints and connections in accordance with AASHTO M 294.

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)(Rev 1-18-11) SP3 R40 B

Revise the *Standard Specifications* as follows:

Replace Section 300 and Section 310 with the following:

## SECTION 300
## 1.0 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 Fabrics | 1056 |

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

Provide filter fabric meeting the requirements of Article 1056-2 for any type of engineering fabric.

Provide foundation conditioning fabric meeting the requirements of Article 1056-2 for Type 2 Engineering Fabric.

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. Encapsulate the foundation conditioning material with foundation conditioning 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 $\frac{\text{(Actual Inlet elev. + Actual Outlet elev.)}}{2}$

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

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. Extend fabric at least 12 inches beyond each side of the joint. Secure 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
## 2.0 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 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 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 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 |

## DETENTION BASIN WALL:

### Description

Design Detention Basin Wall as shown on the plans and as required by this provision. Construct Detention Basin Wall from permanent application sheet piling with deadman anchors and/or micropile supported bracing at locations as shown on the accepted design submittals. Design and detail soil tight connects where Detention Basin Wall ties into other sheetings and retaining wall shown on the plans. Detention Basin Wall must be anchored with deadman or braced with micropiles. Provide and install sheet piles; connection details, furnish collars, hardware, and all other materials and equipment; cut off sheet piles as necessary; furnish and place temporary bracing and reinforcing steel; remove any obstructions; and remove, replace, and correct sheet piles as necessary.

### Submittals

Two submittals are required for the Engineer's review and approval. These submittals include (1) detention basin wall design and (2) detention basin wall construction plan. Provide 11 hard copies of working drawings and 3 hard copies of design calculations for the detention basin wall design submittal and 4 hard copies of the remaining submittals. Also, submit an electronic copy (PDF on CD or DVD) of each submittal. Allow 30 calendar days for the review of the Detention Basin Wall design and construction plan submittals. Do not begin wall construction until the construction plan is accepted by the Engineer. If micropiles are proposed for the Detention Basin Wall, submit all micropile submittals, including Micropile Subcontractor personnel and experience, as required by the *Micropiles* special provision included with the contract.

A. Detention Basin Wall Design Submittal

Use a Design Engineer registered as a Professional Engineer in the State of North Carolina to design and detail the Detention Basin Wall. The Design Engineer must seal all plan sheets and design calculation packages.

The Detention Basin Wall Plans shall show a plan view, typical sections, details, notes and an elevation or profile view (wall envelope) for the detention basin wall. At a minimum, incorporate Foamed Concrete, Welded Wire Fabric for Foamed Concrete, and High Strength Geotextile for Foamed Concrete as shown on the Detention Basin Wall contract plan sheet into the Detention Basin Wall working drawings and design submittal.

Design Detention Basin Wall in accordance with the plans and the *AASHTO LRFD Bridge Design Specifications* unless otherwise required in this provision. Micropile supported bracing or deadman anchors are required for Detention Basin Wall. Design Detention Basin Wall for a 75-year design service life. If a construction surcharge will be present within a horizontal distance equal to the height of the wall, design the wall for the required construction surcharge. Design Detention Basin Wall for a maximum horizontal deflection of one (1) inch.

Design and detail soil tight connects where detention basin wall sheeting ties into other sheetings and retaining wall shown on the plans. Contractor detailed soil tight connections at tie-ins with other sheetings and retaining walls as shown on the plans.

Do not extend deadman anchors or micropile supported bracing system beyond right-of-way or permanent easement lines. If existing or future obstructions such as foundations, guardrail, fence or handrail posts, pavements, pipes, inlets or utilities will interfere with deadman or micropiles, maintain a minimum clearance of 6" (150 mm) from the obstruction.

If micropiles are incorporated into the Detention Basin Wall design, design and construct micropiles in accordance with the *Micropiles* special provision included with the contract and the *AASHTO LRFD Bridge Design Specifications.* If micropiles are used, permanent steel casing is required to a tip elevation no higher than Elevation -52.0 ft.

If deadman anchors are proposed, design deadman in accordance with the *AASHTO LRFD Bridge Design Specifications.*

Submit working drawings and design calculations including unit grout/ground bond strengths for micropiles for review and acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, wall profiles with micropile or deadman locations, typical sections and details of micropiles or deadman anchors, reinforced webs, or temporary support of excavations. If necessary, include details on working drawings for obstructions extending through walls or interfering with piles or deadman anchors. Submit design calculations including deflection calculations for each wall section with different surcharge loads, geometry or material parameters. A minimum of one analysis is required for each wall section. When using a software program for design, provide a hand calculation verifying the analysis of the highest wall section.

Detention Basin Wall Construction Plan Submittal

Submit detailed project specific information including the following.

1. Sheet pile installation methods and equipment.
2. Sequence and step-by-step description of detention basin wall construction.
3. Deadman anchor installation methods and equipment.
4. Micropile construction plan as described in the *Micropiles* special provision.
5. Other information shown on the plans or requested by the Engineer.

If alternate installation and testing procedures are proposed or necessary, a revised construction plan submittal may be required. If the work deviates from the accepted submittal without prior approval, the Engineer may suspend wall construction until a revised plan is submitted and accepted.

**Materials**

Provide Type 3 Contractor's Certifications in accordance with Article 106-3 of the *Standard Specifications* for Detention Basin Wall materials. Store steel materials on blocking a minimum of 12" above the ground and protect it at all times from damage; and when placing in the work make sure it is free from dirt, dust, loose mill scale, loose rust, paint, oil or other foreign materials. Load, transport, unload and store wall materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Use steel sheet piles meeting the permanent applications requirements of Section 1084 of the *Standard Specification.* For miscellaneous steel shapes, wales, and plates not addressed herein, use steel materials meeting the requirements of ASTM A36 and shall be galvanized in accordance with Section 1076 of the *Standard Specifications*. Paint all welds with zinc rich paint in accordance with Section 1080-7 of the *Standard Specifications*.

A. Deadman Anchors

Deadman anchors may consist of cast-in-place or precast concrete blocks or steel sheet piles. Reinforced concrete shall meet the requirements in applicable sections of the *Standard Specifications*. Sheet piles shall meet the permanent applications requirements of Section 1084 of the *Standard Specifications*.

Tie rods shall be epoxy coated and encapsulated within a grout or grease filled corrugated plastic sleeve. Use epoxy coated encapsulated deformed steel bars meeting the requirements of AASHTO M275 or M31, Grade 60 or 75. Splice bars in accordance with Article 1070-10 of the Standard Specifications. Epoxy coat bars in accordance with the requirements of Article 1070-8 of the Standard Specifications. Encapsulate epoxy coated bars in unperforated corrugated high-density polyethylene (HDPE) sheathing a minimum of 0.04" thick meeting the requirements of AASHTO M252. Provide at least 0.4" of grout or grease cover between the bar and sheathing. Do not crack, fracture or otherwise damage grout inside sheathing of shop grouted encapsulated soil nails. Damaged or deformed materials will be rejected. Grout or grease shall be in accordance with the encapsulated bar manufacturers recommendations.

Anchorages consist of steel bearing plates with washers and hex nuts for bars. Provide bearing plates meeting the requirements of Article 6.3.3 of the AASHTO LRFD Specifications and washers and hex nuts in accordance with the tie rod manufacturer's recommendations. Corrosion protect bar anchorages within grout or grease filled anchorages in accordance with the encapsulated bar manufacturers recommendations.

B. Micropiles

Micropile materials shall be in accordance with the *Micropile*s special provision included with the contract. Any exposed portions of Micropile casings must be galvanized in accordance with Section 1076 of the Standard Specifications.

**Preconstruction Meeting**

Before starting detention basin wall construction, conduct a preconstruction meeting to discuss the construction, inspection and testing of the wall. Schedule this meeting after all detention basin wall submittals have been accepted. The Contractor and Detention Basin Wall Contractor Superintendent and Project Manager shall attend the preconstruction meeting. The Resident Engineer, Bridge Construction Engineer, and Geotechnical Operations Engineer will attend the preconstruction meeting.

**Construction Methods**

Construct the Detention Basin Wall without exceeding the vibration limits established in the Control of Vibration special provision at the nearest structure off NCDOT Right-of-Way.

Perform any welding in accordance with the contract. At the Contractor's option, welding may be performed in the field in lieu of employing an American Institute of Steel Construction (AISC) certified fabricator in accordance with Subarticle 1072-1(A) of the *Standard Specifications*. For field welding, use welders certified as a bridge welder in accordance with the NCDOT Field Welder Certification Program.

Use equipment and methods as accepted in the construction plan unless otherwise approved by the Engineer. Inform the Engineer of any deviations from the accepted submittals.

A. Sheet Pile Installation

Install piles in accordance with the accepted submittals and this provision. Contact the Engineer if the design pile embedment is not achieved. Do not splice piles. If necessary, cut off piles at elevations shown in the accepted submittals.

Install sheet piles to a tolerance of not more than 1/8" per foot from the vertical. Horizontally, keep the sheet piles within 3" of the plan location longitudinally and transversely.

Unless otherwise approved or directed by the Engineer, do not install sheet piles within 50 feet of cast-in-place concrete until the concrete attains an age of at least 3 curing days.

B. Deadman Anchors

Install deadman anchors in accordance with the accepted submittals.

C. Micropiles

Fabricate, install and test micropiles in accordance with the accepted submittals and the *Micropiles* Special Provision. Proof test a minimum of 5% of micropiles incorporated into the Detention Basin Wall design.

**Construction Records**

Construction records are required for micropiles. Provide micropile construction records in accordance with the *Micropiles* Special Provision

**Measurement and Payment**

*Detention Basin Wall* will be measured and paid for at the contract unit price per linear foot of wall as measured along the top of sheeting at locations shown on the accepted wall design plans or required by the Engineer. Quantity to be measured for payment is the linear length in a straight line along the sheeting alignment and does not include dimensions within individual sheeting corrugations. Such price and payment will be full compensation for furnishing all design, submittals, labor, tools, equipment, materials including but not limited to deadman anchors or micropile bracing, steel sheet piling, tie rods, and all incidentals necessary to install the *Detention Basin Wall* and complete the work as described in this provision. No additional compensation will be made if hydraulic pressing or pushing is required to install *Detention Basin Wall* as shown on accepted submittals without exceeding the established vibration limits at the nearest structure off NCDOT Right-of-Way.

Foamed Concrete, High Strength Geotextile for Foamed Concrete, and Welded Wire Fabric for Foamed Concrete as shown on the *Detention Basin Wall* design plans or incorporated into the *Detention Basin Wall* design will be measured and paid for in accordance with the *Foamed Concrete*, *High Strength Geotextile for Foamed Concrete*, and *Welded Wire Fabric for Foamed Concrete* special provisions.

Payment will be made under:

| **Pay Items** | **Pay Unit** |
|---|---|
| *Detention Basin Wall* | Linear Foot |
| *Foamed Concrete* | Cubic Yard |
| *High Strength Geotextile for Foamed Concrete* | Square Yard |
| *Welded Wire Fabric for Foamed Concrete* | Square Yard |

**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 |

## ANCHORED SHEET PILING BULKHEAD WALL:

### Description

Design Anchored Sheet Piling Bulkhead Wall as shown on the plans and as required by this provision. Construct Anchored Sheet Piling Bulkhead Wall from permanent application sheet piling with deadman anchors at locations as shown on the accepted design submittals. Design and detail soil tight connects where Anchored Sheet Piling Bulkhead Wall ties into other sheetings and retaining walls shown on the plans. Anchored Sheet Piling Bulkhead Wall must be anchored with deadman. Provide and install sheet piles, tie rods, connection details, furnish collars, hardware, and all other materials and equipment; cut off sheet piles as necessary; furnish and place reinforcing steel; remove any obstructions; and remove, replace, and correct sheet piles as necessary.

### Submittals

Two submittals are required for the Engineer's review and approval. These submittals include (1) anchored sheet piling bulkhead wall design and (2) anchored sheet piling bulkhead wall construction plan. Provide 11 hard copies of working drawings and 3 hard copies of design calculations for the anchored sheet piling bulkhead wall design submittal and 4 hard copies of the remaining submittals. Also, submit an electronic copy (PDF on CD or DVD) of each submittal. Allow 30 calendar days for the review of the Anchored Sheet Piling Bulkhead Wall design and construction plan submittals. Do not begin wall construction until the construction plan is accepted by the Engineer.

A. Anchored Sheet Piling Bulkhead Wall Design Submittal

Use a Design Engineer registered as a Professional Engineer in the State of North Carolina to design and detail the Anchored Sheet Piling Bulkhead Wall. The Design Engineer must seal all plan sheets and design calculation packages.

The Anchored Sheet Piling Bulkhead Wall Plans shall show a plan view, typical sections, details, notes and an elevation or profile view (wall envelope) for the sheet pile bulkhead wall. Survey the existing ground surface at the proposed wall alignment and submit a revised wall envelope with the design submittal.

Design Anchored Sheet Piling Bulkhead Wall in accordance with the plans and the *AASHTO LRFD Bridge Design Specifications* unless otherwise required in this provision. Deadman anchors are required for the Anchored Sheet Piling Bulkhead Wall. Design Anchored Sheet Pile Bulkhead Wall for a 75-year design service life. If a construction surcharge will be present within a horizontal distance equal to the height of the wall, design the wall for the required construction surcharge. Design Anchored Sheet Pile Bulkhead Wall for a maximum horizontal deflection of one (1) inch.

Design and detail soil tight connects where Anchored Sheet Pile Bulkhead Wall ties into other sheetings and retaining wall shown on the plans.

If existing or future obstructions such as foundations, guardrail, fence or handrail posts, pavements, pipes, inlets or utilities will interfere with deadman, maintain a minimum clearance of 6" from the obstruction.

Design deadman in accordance with the *AASHTO LRFD Bridge Design Specifications.*

Submit working drawings and design calculations for review and acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views and wall profiles with deadman locations, typical sections and details of deadman anchors, reinforced webs, or temporary support of excavations. If necessary, include details on working drawings for obstructions extending through walls or interfering with piles or deadman anchors. Submit design calculations including deflection calculations for each wall section with different surcharge loads, geometry or material parameters. A minimum of one analysis is required for each wall section. When using a software program for design, provide a hand calculation verifying the analysis of the highest wall section.

B. Anchored Sheet Piling Bulkhead Wall Construction Plan Submittal

Submit detailed project specific information including the following.

1. Sheet pile installation methods and equipment.

2. Sequence and step-by-step description of sheet pile bulkhead wall construction.

3. Deadman anchor installation methods and equipment.

4. Other information shown on the plans or requested by the Engineer.

If alternate installation procedures are proposed or necessary, a revised construction plan submittal may be required. If the work deviates from the accepted submittal without prior approval, the Engineer may suspend wall construction until a revised plan is submitted and accepted.

**Materials**

Provide Type 3 Contractor's Certifications in accordance with Article 106-3 of the *Standard Specifications* for Anchored Sheet Piling Bulkhead Wall materials. Store steel materials on blocking a minimum of 12" above the ground and protect it at all times from damage; and when placing in the work make sure it is free from dirt, dust, loose mill scale, loose rust, paint, oil or other foreign materials. Load, transport, unload and store wall materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Use steel sheet piles meeting the permanent applications requirements of Section 1084 of the *Standard Specification* with a minimum section modulus of 30.2 $in^3/ft$. For miscellaneous steel shapes, wales, and plates not addressed herein, use steel materials meeting the requirements of ASTM A36 and shall be galvanized in accordance with Section 1076 of the *Standard Specifications*. Paint all welds with zinc rich paint in accordance with Section 1080-7 of the *Standard Specifications*.

A. Deadman Anchors

Deadman anchors may consist of cast-in-place or precast concrete blocks or steel sheet piles. Reinforced concrete shall meet the requirements in applicable sections of the *Standard Specifications*. Sheet piles shall meet the permanent applications requirements of Section 1084 of the *Standard Specifications*.

Tie rods shall be epoxy coated and encapsulated within a grout or grease filled corrugated plastic sleeve. Use epoxy coated encapsulated deformed steel bars meeting the requirements of AASHTO M275 or M31, Grade 60 or 75. Splice bars in accordance with Article 1070-10 of the Standard Specifications. Epoxy coat bars in accordance with the requirements of Article 1070-8 of the Standard Specifications. Encapsulate epoxy coated bars in unperforated corrugated high-density polyethylene (HDPE) sheathing a minimum of 0.04" thick meeting the requirements of AASHTO M252. Provide at least 0.4" of grout or grease cover between the bar and sheathing. Do not crack, fracture or otherwise damage grout inside sheathing of shop grouted encapsulated soil nails. Damaged or deformed materials will be rejected. Grout or grease shall be in accordance with the encapsulated bar manufacturers recommendations.

Anchorages consist of steel bearing plates with washers and hex nuts for bars. Provide bearing plates meeting the requirements of Article 6.3.3 of the AASHTO LRFD Bridge Construction Specifications and washers and hex nuts in accordance with the tie rod manufacturer's recommendations. Corrosion protect bar anchorages within grout or grease filled anchorages in accordance with the encapsulated bar manufacturers recommendations.

**Preconstruction Meeting**

Before starting anchored sheet piling bulkhead wall construction, conduct a preconstruction meeting to discuss the construction and inspection of the wall. Schedule this meeting after all anchored sheet piling bulkhead wall submittals have been accepted. The Contractor and Anchored Sheet Piling Bulkhead Wall Contractor Superintendent and Project Manager shall

attend the preconstruction meeting. The Resident Engineer, Bridge Construction Engineer, and Geotechnical Operations Engineer will attend the preconstruction meeting.

**Construction Methods**

Construct the Anchored Sheet Piling Bulkhead Wall without exceeding the vibration limits established in the Control of Vibration special provision at the nearest structure off NCDOT Right-of-Way.

Perform any welding in accordance with the contract. At the Contractor's option, welding may be performed in the field in lieu of employing an American Institute of Steel Construction (AISC) certified fabricator in accordance with Subarticle 1072-1(A) of the *Standard Specifications*. For field welding, use welders certified as a bridge welder in accordance with the NCDOT Field Welder Certification Program.

Use equipment and methods as accepted in the construction plan unless otherwise approved by the Engineer. Inform the Engineer of any deviations from the accepted submittals.

A. Sheet Pile Installation

Install piles in accordance with the accepted submittals and this provision. Contact the Engineer if the design pile embedment is not achieved. Do not splice piles. If necessary, cut off piles at elevations shown in the accepted submittals.

Install sheet piles to a tolerance of not more than 1/8" per foot from the vertical. Horizontally, keep the sheet piles within 3" of the plan location longitudinally and transversely.

Unless otherwise approved or directed by the Engineer, do not install sheet piles within 50 feet of cast-in-place concrete until the concrete attains an age of at least 3 curing days.

B. Deadman Anchors

Install deadman anchors in accordance with the accepted submittals.

**Measurement and Payment**

*Anchored Sheet Piling Bulkhead Wall* will be measured and paid for at the contract unit price per linear foot of wall as measured along the top of sheeting at locations shown on the accepted wall design plans or required by the Engineer. Quantity to be measured for payment is the linear length in a straight line along the sheeting alignment and does not include dimensions within individual sheeting corrugations. Such price and payment will be full compensation for furnishing all design, submittals, labor, tools, equipment, materials including but not limited to deadman anchors, steel sheet piling, tie rods, and all incidentals necessary to install the *Anchored Sheet Piling Bulkhead Wall* and complete the work as described in this provision. Removal of the existing bulkhead wall and excavation of soil in front of the new anchored sheet piling bulkhead is incidental to the *Anchored Sheet Piling Bulkhead* pay item. No additional

compensation will be made if hydraulic pressing or pushing is required to install *Anchored Sheet Piling Bulkhead Wall* as shown on accepted submittals without exceeding the established vibration limits at the nearest structure off NCDOT Right-of-Way.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| *Anchored Sheet Piling Bulkhead Wall* | Linear Foot |

**CURTAIN WALL SHEETING:** **SPECIAL**

**Description**

Construct Curtain Wall Sheeting from permanent application sheet piling at locations as shown on the plans and as directed by the Engineer. Design and detail soil tight connects where Curtain Wall Sheeting ties into other sheetings and retaining wall shown on the plans. Provide and install sheet piles; connection details, furnish collars, hardware, and all other materials and equipment; cut off sheet piles as necessary; furnish and place temporary bracing and reinforcing steel; remove any obstructions; and remove, replace, and correct sheet piles as necessary.

**Submittals**

Design and detail soil tight connects where Curtain Wall Sheeting ties into other sheetings and retaining wall shown on the plans. Contractor detailed soil tight connections at tie-ins with other sheetings and retaining walls as shown on the plans must run full height of Curtain Wall Sheeting. Submit connection details a minimum of 20 working days prior to beginning construction of Curtain Wall Sheeting or any of the connecting sheeting and retaining walls.

**Materials**

Use steel sheet piles meeting the permanent applications requirements of Section 1084 of the *Standard Specification.*

**Construction Methods**

Submit the proposed sheet pile installation methods and equipment to the Engineer. Submit this information for approval at least 20 working days before installing sheet piles. Do not use impact or vibratory hammers to install curtain wall sheeting. Install sheeting to the required embedment as noted on the Curtain Wall. Hydraulic pressing or pushing is required to install Curtain Wall Sheeting to the required embedment.

Install sheet piles to a tolerance of not more than 1/8" per foot from the vertical. Horizontally, keep the sheet piles within 3" of the plan location longitudinally and transversely.

Unless otherwise approved or directed by the Engineer, do not install sheet piles within 50 feet of cast-in-place concrete until the concrete attains an age of at least 3 curing days.

Handle and store steel sheet piles by methods that do not damage the pile. Store the sheet piles above ground upon platforms, blocking, or other supports. Keep the sheet piles free from dirt, grease, and other foreign matter, and protect them insofar, as is practicable from corrosion. Cut off sheet piles with approved methods at the required elevations.

Install sheet piles such that the tips of the sheet piles penetrate to the required embedment as noted on the plans.

**Measurement and Payment**

*Curtain Wall Sheeting* will be measured and paid for at the contract unit price per linear foot of sheeting as measured along the top of sheeting at locations shown on the Curtain Wall Sheeting plans or required by the Engineer. Quantity to be measured for payment is the linear length in a straight line along the sheeting alignment and does not include dimensions within individual sheeting corrugations. Such price and payment will be full compensation for furnishing all labor, tools, equipment, materials, design and details of soil tight connections to other sheetings, construction of soil tight connections, and all incidentals necessary to install the *Curtain Wall Sheeting* and complete the work as described in this provision. No additional compensation will be made for hydraulic pressing or pushing required to install *Curtain Wall Sheeting* to the required embedment noted on the plans.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Curtain Wall Sheeting | Linear Foot |

**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 3-15-11) 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. Gyrations @ | | 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). Payment for Binder Grade for recycled mixes shall be based solely on the grade for the specified mix type as shown in the above table.
(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:**

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

| | Percentage of RAP in Mix | | |
|---|---|---|---|
| | **Category 1** | **Category 2** | **Category 3** |
| Mix Type | % RAP ≤20% | 20.1% ≤ %RAP ≤ 30.0% | %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
(4) Payment for binder grade shall be based solely on Table 610-2.

**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:,**

$$PF = 100 - 10(D)^{1.465}$$

Where: PF = Pay Factor (computed to 0.1%)
D = the deficiency of the lot average density, not to exceed 2.0%

**Page 6-51, Article 610-15 MEASUREMENT AND PAYMENT, fourth paragraph, delete and replace with the following:**

Furnishing asphalt binder will be paid for as provided in Article 620-4.

**Page 6-53, Article 620-4 MEASUREMENT AND PAYMENT, modify as follows:**

**Second paragraph, delete the first sentence and replace with the following:**
Where recycled plant mix is being produced, the grade of asphalt binder shall be paid for based on the grade for the specified mix type as shown in Table 610-2.

**Sixth paragraph, delete the last sentence.**

**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.

**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:**

**TABLE 661-4 – MIXTURE DESIGN CRITERIA**
**Gradation Design Criteria (% Passing by Weight)**

| Standard Sieves | | 1/2 in. Type A | 3/8 in. Type B | 1/4 in. Type C |
|---|---|---|---|---|
| ASTM | mm | (% Passing by Weight) | | |
| ¾ inch | 19.0 | 100 | | |
| ½ 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 |

| | Mix Design Criteria | | |
|---|---|---|---|
| | 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 2-15-11) SP6 R02A

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 WMA so the Engineer can arrange a pre-pave meeting. Discuss special testing requirements necessary for WMA at the pre-pave meeting. Include at the pre-pave meeting the Contractor's QC manager, Paving Superintendent, and manufacturer's representative for the WMA technology, the Department's Roadway Construction Engineer, Resident Engineer, State Pavement Construction Engineer, and Quality Assurance Supervisor.

Require a manufacturer's representative for the WMA technology 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.

The requirement for the manufacturer's representative to be present at the pre-pave meeting and on-site at the plant may be waived by the Engineer based on previous work experience with the specific WMA technology used.

If the use of WMA is suspended during production, and the Contractor begins using Hot Mix Asphalt (HMA), then the Contractor shall be required to use HMA for the remainder of the specific route or map unless otherwise approved by the Engineer.

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. Use WMA at the Contractor's option when shown in the contract.

**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, perform field verification testing including Tensile Strength Ratio (TSR) testing in accordance with AASHTO T 283 as modified by the Department.

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

Verification is 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 satisfactory for WMA when all volumetric properties except $\%G_{mm}@N_{ini}$ are within the applicable mix design criteria, the TSR meets the 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 WMA, 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:
(i.) Prior to initial production for each JMF and
(ii.) Every 15,000 tons.

After three (3) consecutive passing TSR tests for a specific JMF, a request may be submitted to the State Asphalt Design Engineer to revert to the *Hot-Mix Asphalt QMS Manual* procedures for TSR testing on that JMF. This request shall be submitted in writing and shall include all test result data (Material and Tests Unit Form 612s) performed on the specific JMF.

**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 when shown in the contract.

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

Use only WMA technologies on the allowable routes listed on the Department's approved list maintained by the Materials and Tests Unit. The Department's approved list can be found at the following website: **http://www.ncdot.org/doh/operations/materials/pdf/wma.pdf.**

**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 technology used, the recommended dosage rate, and the requested plant mix temperature on the JMF submittal. Verify the JMF based on plant produced mixture from the field verification test.

**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 to 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.*

## ASPHALT PLANT MIXTURES:

(7-1-95) SP6 R20

Place asphalt concrete base course material in trench sections with asphalt pavement spreaders made for the purpose or with other equipment approved by the Engineer.

## 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 **$ 486.00** per ton.

This base price index represents an average of F.O.B. selling prices of asphalt binder at supplier's terminals on **February 1, 2011**.

## EPOXY COATED REINFORCING STEEL (ROADWAY):

### Construction

Epoxy Coated Reinforcing Steel (Roadway) shall be in accordance with the detail in the plans and Section 425 of the *Standard Specifications*.

### Materials

Refer to Article 425-2 of the *Standard Specifications*.

### Measurement and Payment

Epoxy Coated Reinforcing Steel (Roadway) will be measured and paid for in accordance with Article 425-6 of the *Standard Specifications*.

## POROUS CONCRETE PAVERS:

### Description

The Contractor shall construct emergency vehicle access using porous concrete pavers at the location indicated on the plans, in accordance with the detail in the plans and as directed by the Engineer.

### Materials

Sand shall be clean and free of extraneous material and shall meet the approval of the Engineer.

ABC shall meet the requirements of Section 1005 of the *Standard Specifications*.

The porous concrete pavers shall match as closely as possible the design, dimensions and pattern shown in the detail in the plans.

**Method of Measurement**

*Porous Concrete Pavers* shall be measured and paid for per square yard which has been incorporated into the completed and accepted work. Such price and payment shall be full compensation for all materials, labor and incidentals necessary to satisfactorily complete the work covered by this provision.

**MILLING CONCRETE PAVEMENT ▒▒" DEPTH:**
(1-2-02) (Rev 6-12-08) SPI 7-15

**Description**

Mill concrete pavement in accordance with the *Standard Specifications* and this provision.

**Construction Methods**

Furnish equipment and perform work in accordance with the requirements of Section 607 of the *Standard Specifications*.

**Measurement and Payment**

*Milled Concrete Pavement ▒ " Depth* will be measured and paid for as the actual number of square yards of pavement surface that has been milled and accepted. The length will be the actual length milled, measured along the pavement surface. The width will be the width required by the plans or directed, measured along the pavement surface.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Milling Concrete Pavement, ▒" Depth | Square Yard |

**NONWOVEN GEOTEXTILE INTERLAYER FOR SEPARATING CEMENTITIOUS PAVEMENT LAYERS:**
(DRAFT 10-14-10)

**Description**

Furnish and install a nonwoven geotextile interlayer at locations shown on the plans.

**Materials**

The geotextile interlayer shall be constructed of a non-woven needle-punched geotextile, with no thermal treatment (calendaring or IR). The material shall be resistant to chemicals, mildew, and rot and shall not have any tears or holes that will adversely affect the in-situ performance and physical properties of the installed material.

Furnish with each shipment a Type 3 Certification in accordance with Article 106-3 certifying that the paving mat is a non-woven needle-punched geotextile with no thermal treatment (calendaring or IR) meeting the requirements shown:

**Physical Properties of Non-Woven Geotextile Interlayer for Separating Cementitious Pavement Layers**

| Property | Test Method | Units | Value |
|---|---|---|---|
| Mass per unit area | ASTM D 5261 | $oz/yd^2$ | 13.3 – 16.2 |
| Minimum thickness under load<br>(a) at 2 kPa (0.29 psi)<br>(b) at 20 kPa (2.9 psi)<br>(c) at 200 kPa (29 psi) | ASTM D 5199 | in | (a) 0.12<br>(b) 0.10<br>(c) 0.04 |
| Minimum wide-width tensile strength | ASTM D 4595 | lb/ft | 685 |
| Maximum wide-width elongation | ASTM D 4595 | % | 130 |
| Minimum water permeability in normal direction under load (pressure) at 20 kPa (2.9 psi) | Mod. ASTM D 5493 or ASTM D 4491 | ft/s | $3.3x10^{-4}$ |
| Minimum in-plane water permeability (transmissivity) under load (pressure)<br>(a) at 20kPa (2.9 psi)<br>(b) at 200kPa (29 psi) | Mod. ASTM D 6574 or ASTM D 4716 | ft/s | (a) $1.6x10^{-3}$<br>(b) $6.6x10^{-4}$ |
| Minimum weather resistance retained strength | ASTM D 4355 at 500 hrs. exposure | % | 60 |
| Alkali resistance, minimum polypropylene/polyethylene | Manufacturer certification of polymer | % | 96 |

Note: Requirements must be met for 95 percent of samples.

**General Requirements**

A trained and experienced installer, certified by the Geotextile Manufacturer, shall be present on-site during the installation of the geotextile and until the crew has a comfort level working with this material.

Ensure that any potential for keying of the two cementitious layers is minimized through proper repair techniques. Clean the underlying surface to remove loose debris before applying the interlayer. Roll the geotextile out on the underlying layer. The geotextile shall be tight and without excess wrinkles and folds. No more than 650 ft of geotextile shall be installed in advance of the paving operation at a given time. The interlayer shall be placed no more than 3 days before concrete placement.

Keep driving on the interlayer to a minimum. Tight radius turns and excessive acceleration and braking shall be avoided.

The geotextile shall be secured to the underlying layer with pins or nails punched through 2 to 2.75 inch galvanized washers or disks every 6 feet or less. Additional fasteners shall be used as needed to ensure that the geotextile does not shift or fold before or during concrete placement. Edges of the geotextile shall overlap by 8 +/- 2 inches. No more than three layers of geotextile shall overlap at any location. Transverse seams of adjacent rolls shall be staggered to prevent four layers from coinciding at any location. The free edge of the geotextile shall extend beyond the edge of the new concrete into a location that facilitates drainage.

**Measurement and Payment**

*Nonwoven Geotextile Interlayer for Separating Cementitious Pavement Layers* will be measured and paid at the contract unit price per square yard. In measuring this quantity, the length will be the actual length installed, measured along the surface. The width will be the width measured along the underlying layer that has been acceptably placed. No separate measurement will be made for overlapping fabric.

The contract prices for this section shall include but not be limited to furnishing all labor, materials, tools, equipment and other incidentals necessary to perform the required work.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Nonwoven Geotextile Interlayer for Separating Cementitious Pavement Layers | Square Yard |

**TYING PROPOSED CONCRETE PAVEMENT TO EXISTING CONCRETE PAVEMENT:**

(7-1-95) SP7 R05

Tie proposed concrete pavement on this project to existing concrete pavement in accordance with the detail shown in the plans and the following provision:

(A) Drill holes in the existing concrete pavement 1/8" greater than the diameter of the dowel bar. After drilling, blow the hole out with air and allow to dry.

(B) Next, place the cement grout or epoxy resin in the back of the dowel hole. The placement of grout can be achieved by using a flexible tube with a long nose that places the material in the back of the dowel hole; the placement of epoxy-type materials can be achieved by using a cartridge with a long nozzle that dispenses the material to the rear of the dowel hole.

(C) Insert the dowel into the hole with a slight twisting motion so that the material in the back of the hole is forced up and around the dowel bar to ensure a uniform coating of the anchoring material over the dowel bar.

(D) Place a thin nylon or plastic grout retention disk of at least 1/16" thickness manufactured to slip tightly over the dowel and against the slab face to prevent the anchoring material from flowing out of the hole, and to create an effective face at the entrance of the dowel hole.

No direct payment will be made for this work as such work will be included in the contract unit price for the concrete pavement being constructed.

**VARIABLE DEPTH CONCRETE OVERLAY:** **SPECIAL**

**1.0 General**

This Special Provision governs materials, forming, and all other related work in the construction of a reinforced concrete wearing surface in accordance with applicable parts of the Standard Specifications, the details shown on the plans, and as outlined in these Special Provisions.

**2.0 Materials**

Unless otherwise noted on the plans, use class AA concrete and a coarse aggregate gradation of 78M. The Class AA concrete shall contain fly ash or ground granulated blast furnace slag at the substitution rate specified in Article 1024-1 and in accordance with Articles 1024-5 and 1024-6 of the Standard Specifications. Place the wearing surface according to the grades, thicknesses and cross sections shown on the plans.

**3.0 Preparation of Surface**

Prepare all surfaces to be overlayed using the equipment specified herein and prior to placing the epoxy coated reinforcing steel. Additionally, clean the surface within 48 hours prior to placing the overlay unless otherwise approved.

Thoroughly soak the cleaned surface for at least 12 hours prior to placing the concrete wearing surface. While soaking the surface, cover it with a layer of white opaque polyethylene film that is at least 4 mils (0.100 mm) thick. Immediately prior to placing the concrete wearing surface, remove standing water from the surface.

**4.0 Equipment**

Prior to beginning any work, obtain approval for all equipment to be used for deck preparation, placing, finishing, and curing the concrete wearing surface.

For surface preparation, use sandblasting or pressure washing equipment capable of removing all foreign matter. If using high pressure water blast, a minimum nozzle pressure of 3000 psi is required.

**5.0 Placing and finishing**

Follow the placing, finishing, and curing requirements of Article 420-14 (A) and (B). Construction Joints other than those shown on the plans are not permitted.

**6.0 Limitations of Operations**

The requirements of Article 420-20 will apply to placing vehicles and construction equipment on the finished concrete wearing surface.

Use insulation that meets the requirements of Article 420-7(C), and if required, place it on the concrete wearing surface as soon as the initial set permits.

**7.0 Method of Measurement**

The quantity of concrete wearing surface to be paid for is the actual number of square yards of concrete wearing surface as provided on the plans.

**8.0 Basis of Payment**

The quantity for which payment is made will be that quantity shown in square yards on the plans. Where the plans have been revised, the quantity to be paid for will be the quantity shown on the revised plans.

The unit bid per square yard will be full compensation for all work covered by this Special Provision and applicable parts of the Standard Specifications, but not limited to furnishing and placing concrete and any other material; erecting and removing all forms, curing concrete, protecting concrete in wind, rain, low humidity, high temperatures or other unfavorable weather.

Payment will be made under:

Variable Depth Concrete Overlay.....Square Yard

**CONCRETE PAVEMENTS AND SHOULDERS:**
(10-16-07) (Rev 7-20-10) SP7 R20

Revise the *2006 Standard Specifications* as follows:

**Page 10-2, Subarticle 1000-3(A) Composition and Design**, delete the Subarticle and substitute the following:

Submit concrete paving mix design in terms of saturated surface dry weights on M&T Form 312U for approval a minimum of 30 days prior to proposed use. Use a mix that contains a minimum of 526 pounds of cement per cubic yard, a maximum water cement ratio of 0.559, an air content in the range of 4.5 to 5.5 percent, a maximum slump of 1.5" and a minimum flexural strength of 650 psi and a minimum compressive strength of 4,500 psi at 28 days.

The cement content of the mix design may be reduced by a maximum of 20% and replaced with fly ash at a minimum rate of 1.2 pounds of fly ash to each pound of cement replaced. Use a maximum water-cementitious material ratio not to exceed 0.538.

The cement content of the mix design may be reduced by a maximum of 50% and replaced with blast furnace slag pound for pound.

Include in the mix design the source of aggregates, cement, fly ash, slag, and admixtures; the gradation and specific gravity of the aggregates; the fineness modulus (F.M.) of the fine aggregate; and the dry rodded unit weight and size of the coarse aggregate. Submit test results showing that the mix design conforms to the criteria, including the 1, 3, 7, 14 and 28-day strengths of the average of two beams and the average of two cylinders for each age made and tested in accordance with AASHTO R39, T22 and T97. Design the mix to produce an average strength sufficient to indicate that a minimum strength of 650 psi in flexure and 4,500 psi in compression will be achieved in the field within 28 days.

If any change is made to the mix design, submit a new mix design.

If any major change is made to the mix design, also submit new test results showing the mix design conforms to the criteria. A major change to the mix design is defined as:

1) A source change in Coarse aggregate, Fine aggregate, Cement or Pozzolan (applies only to a change from one type of pozzolan to another; e.g., Class F fly ash to Class C fly ash).
2) A quantitative change in Coarse aggregate (applies to an increase or decrease greater than 5 %), Fine aggregate (applies to an increase or decrease greater than 5 %), Water (applies to an increase only), Cement (applies to a decrease only), Pozzolan (applies to a decrease only).

Where concrete with a higher slump for hand methods of placing and finishing is necessary, submit an adjusted mix design for approval to provide a maximum slump of 3" and to maintain the water-cementitious material ratio established by the original mix design.

**Page 10-6, Table 1000-1,** under column titled "Minimum compressive Strength at 28 days, psi", in row titled "Pavement", delete "560 flexural" and substitute "4,500".

## SECTION 700
## GENERAL REQUIREMENT FOR PORTLAND CEMENT CONCRETE PAVING

**Page 7-1, Article 700-3 CONCRETE HAULING EQUIPMENT**, delete the fourth paragraph and substitute the following:

For concrete hauled in a transit mix (ready mix) truck, use Table 1000-2 to determine the maximum elapsed time. For concrete hauled in other equipment, minimize the elapsed time to be 60 minutes or less, unless otherwise approved. The elapsed time is defined as the period from first contact between mixing water and cement until the entire operation of placing and finishing up to micro-surfacing, including corrective measures if necessary, has been completed.

**Page 7-2, Article 700-4 PREPARATION OF SUBGRADE AND BASE**, fourth paragraph, delete the 3rd and 4th sentence and substitute the following:

Set pins at a distance no farther than 50 feet apart. When located on a vertical curve, set pins no farther than 25 feet apart.

**Page 7-3, Subarticle 700-5(A)(4),** delete the 2nd and 3rd paragraph and substitute the following:

Where additional pavement, aggregate or soil must be placed adjacent to new pavement by machine methods, do not place it until the concrete has attained a compressive strength of at least 3000 psi.

Construction equipment or hauling equipment will not be allowed over the pavement until the concrete has attained a compressive strength of 3,000 psi.

**Page 7-5, Article 700-7 FINISHING**, insert the following as the second sentence:

The use of excessive water for finishing will not be allowed.

**Page 7-5, Subarticle 700-8(C) Hot Weather**, 1st sentence:

Substitute 90°F for 80°F.

**Page 7-7, Subarticle 700-11(A) General**, delete the fourth paragraph and substitute the following:

Immediately after sawing the joint to the dimensions shown on the plans, completely remove the resulting slurry from the joint. Immediately reapply curing membrane following the sawing operation to damaged areas in the vicinity of the joint.

**Page 7-8, insert the following as Subarticle 700-11(G):**

### (G) Verification of Dowel Bar Alignment

Use either properly secured dowel baskets or a dowel bar inserter, provided the ability to correctly locate and align the dowels at the joints is demonstrated as described below.

Provide a calibrated magnetic imaging device that will document dowel bar location and alignment. Calibrate the magnetic imaging device to the type and size dowel bar used in the work. Utilize this device as a process control and make necessary adjustment to ensure the dowels are placed in the correct location.

Scan at least 25% percent of the joints in the initial placement or 1.0 mile of pavement, whichever is greater, at random intervals throughout the pavement each time the paving train is mobilized. Mark scanned joints on the pavement.

Scan all joints in this initial placement if the dowel bars exhibit longitudinal translation (side shift), horizontal translation, vertical translation (depth), horizontal skew, or vertical tilt, above the allowable tolerances defined below. In addition, continue scanning no less than 25% of the joints until it is established that the dowel bar inserter or secured dowel basket assemblies are consistently placing the dowel bars at the correct location (meeting the tolerances defined below). Once the engineer determines that consistency is established, the contractor may reduce the percentage of scanned joints to no less than 10%. Any time inconsistency in the placement of the dowel bars becomes evident, additional scanning may be required up to 100% of the joints.

If consistency of the proper dowel bar alignment cannot be established within a reasonable time frame, the Engineer will have the option of suspending the paving operation.

Provide a report of the scanned joints within 48 hours of completing the day's production. The report should include the station and lane of the joint scanned, as well as the horizontal location, depth, longitudinal translation (side shift), horizontal skew, and vertical tilt, of each dowel bar in the joint. If a dowel bar inserter is used, the joint score described below should also be provided in the report.

Longitudinal translation (side shift) is defined as the position of the center of the dowel bar in relation to the sawed joint. The maximum allowable longitudinal translation (side shift) is 2 inches.

Horizontal translation is defined as difference in the actual dowel bar location from its theoretical position as detailed in the standard details. The maximum allowable horizontal translation is 2 inches.

Vertical translation (depth) is the difference in the actual dowel bar location from the theoretical midpoint of the slab. The maximum allowable vertical translation is 1/2 inch higher than the theoretical midpoint, and 1 inch lower than the theoretical midpoint.

Dowel bar misalignment, either vertical tilt or horizontal skew is defined as the difference in position of the dowel bar ends with respect to each other. Vertical tilt is measured in the vertical axis whereas horizontal skew is measured in the horizontal axis.

If a dowel bar inserter is used, determine a joint score for each joint scanned. The joint score is a measure of the combined effects from the dowel's horizontal skew or vertical tilt. The joint score is determined by summing the product of the weight

(shown in the table below) and the number of bars in each misalignment category and adding 1. The vertical tilt and horizontal skew should be evaluated and the greater misalignment shall be utilized in determining the joint score. If two lanes are poured simultaneously, the joint score is calculated for the 24 foot section.

| **Misalignment Category, mm** | **Weight** |
|---|---|
| $0 \leq d \leq 15$ | 0 |
| $15 < d \leq 20$ | 2 |
| $20 < d \leq 25$ | 4 |
| $25 < d \leq 38$ | 5 |
| $38 \leq d$ | 10 |

where d is the individual dowel bar misalignment.

A joint that has a joint score of 10 or greater will be considered locked.

When a locked joint as defined above is discovered, scan the two joints immediately adjacent to the locked joint. If either of the adjacent joints are deemed to be locked, provide a written proposal to address the dowel misalignment for each locked joint. No corrective action should be performed without written approval.

Any and all corrective action necessitated by improper joint alignment shall be at no cost to the Department.

**Page 7-9, Article 700-13 USE OF NEW PAVEMENT OR SHOULDER,** delete the Article and substitute the following:

Traffic or other heavy equipment will not be allowed on the concrete pavement or shoulder until the estimated compressive strength of the concrete using the maturity method has exceeded 3,000 psi unless otherwise permitted.

Estimate the compressive strength of concrete pavement in accordance with the most current version of ASTM C 1074 *Standard Practice for Estimating Concrete Strength by the Maturity Method* unless otherwise specified herein.

Furnish thermocouples or thermistors and digital data logging maturity meters that automatically compute and display the maturity index in terms of a temperature-time factor. The maturity meters must be capable of storing a minimum of 28 days worth of data and exporting data into an Excel spreadsheet. Submit the proposed equipment to the Engineer for approval.

When establishing a strength-maturity relationship, perform compressive tests at ages 1, 3, 7, 14 and 28 days in accordance with AASHTO Test Method T22.

Use the temperature-time factor maturity function to compute the maturity index from the measured temperature history of the concrete. Set the datum temperature at –10°C to calculate the temperature-time factor in Equation 1 of ASTM C 1074.

Establish and submit a strength-maturity relationship in conjunction with each concrete pavement mix design. Determine the temperature-time factor corresponding to the strength-maturity relationship at 3,000 psi, TTF. Any changes to plant operations, material sources, or mix proportions will affect the strength-maturity relationship. If any changes occur during production, develop a new strength-maturity relationship unless otherwise directed.

Verify the strength-maturity relationship during the first day's production. Utilize the temperature-time factor developed at mix design TTF to verify the production strength-maturity relationship. Verify the strength-maturity relationship at a minimum of every 10 calendar days or when production is suspended for more than 10 days. If the verification sample's compressive strength when tested at TTF is less than 3,000 psi, immediately suspend early opening of traffic on pavement that has not obtained TTF until a new strength-maturity relationship is developed.

No permanent traffic will be allowed on the pavement until construction of the joints, including all sawing, sealing, and curing that is required, has been completed.

Take particular care to protect the exposed pavement edges and ends.

**Page 7-11, Subarticle 700-15(E) Flexural Strength,** delete the Subarticle and replace with the following:

**(E)Compressive Strength**

Determine the compressive strength of concrete using one set of two 6"' x 12" cylinders at 28 calendar days. Test samples will be made by the Engineer from the concrete as it comes from the mixer. The samples will be made and cured in accordance with AASHTO T 23. Test specimens will be tested by the Engineer in accordance with AASHTO T 22. Furnish curing facilities for the test samples in accordance with Section 725.

**Page 7-11, Subarticle 700-15(F) Thickness,** delete the first and second paragraphs and replace with the following:

The thickness of the pavement will be determined by measurement of cores in accordance with AASHTO T 148.

Take 4-inch diameter cores in the presence of the Engineer. Take the cores when the concrete has attained a compressive strength of at least 3,000 psi and at least 72 hours have elapsed since placement of the pavement. If the concrete has not attained a compressive strength of at least 3,000 psi, the gross vehicle weight rating of vehicles supporting the coring operation may not exceed 7,000 pounds. Take cores no later than 30 days after the pavement has been placed. The core locations for each lot will be selected at random by the Engineer.

Patch all core holes within 72 hours of taking the core, using a Department approved nonshrink grout compatible with the pavement or shoulder concrete.

## SECTION 710
## CONCRETE PAVEMENT

**Page 7-12. Article 710-1 DESCRIPTION,** 1st sentence:

Insert *and cylinders* after the words *test beams*.

Insert *verifying dowel bar alignment*; after the words *sealing joints;*.

**Page 7-12. Article 710-3 COMPOSITION OF CONCRETE,** after the first paragraph, insert the following:

Prior to placement, concrete produced by the plant must demonstrate that it is represented by the mix design submitted. The Engineer will make compressive and flexural samples from plant produced mix for testing at 1, 3, 7, 14 and 28 days of age. The strength results must be within 10% of the strengths reported by the Contractor during the mix design process. If the plant produced mix meets this criteria at 14 days of age, the Engineer will notify the Contractor that placement of concrete may commence.

If any major change as defined in section 1000-3 is made to the mix design, the process shall be initiated again.

**Page 7-12. Article 710-4 ACCEPTANCE OF CONCRETE,** delete the first sentence and replace with the following:

Test the concrete pavement for acceptance with respect to compressive strength and thickness on a lot by lot basis in accordance with the requirements of Article 700-15 and the following requirements:

For all concrete pavement, including mainline, shoulders, ramps, tapers, intersections, entrances, crossovers, and irregular areas not otherwise defined, produce a lot consisting of 1,333.3 square yards or fraction thereof placed within 28 calendar days. From each lot, make a minimum of one set of two 6" x 12" cylinders from a randomly selected batch of concrete. The average compression strength of the two cylinders is considered one test. If Division of Highways personnel make and test additional sets of cylinders for a lot, these sets will be averaged with the original set to determine the strength. In the case of low strength, the Engineer will perform an investigation.

**Page 7-13, Article 710-6 FINISHING,** insert the following at the end of the 6th paragraph.

Provide a textured surface with an average texture depth of 0.8 mm as tested in accordance with ASTM E 965 *Test Method for Measuring Pavement Macrotexture Depth Using a Sand Volumetric Technique* with no single test having a texture depth of 0.5 mm or less. Perform

four randomly located tests in accordance with ASTM E 965 within the initial pavement lot of each mobilization and provide test results to the Engineer. A lot is defined in Article 710-4. If the average of the four tests does not meet the above criteria, make appropriate changes to the surface texture operations and test the next lot as detailed above. Once the surface texture process is established to meet minimum texture requirements, maintain consistency within the operation to provide the above minimum texture depth. Perform additional sand patch tests in accordance with ASTM E 965 when directed.

Should the surface texture become damaged or reduced by rain or any other action, reestablish or restore surface texture by an approved method.

**Page 7-15, Article 710-9 THICKNESS TOLERANCES**, delete the 4th and 5th paragraph and substitute with the following:

When the measurement of the core from a lot is deficient by 0.2" or less from the plan thickness, full payment will be made. When such measurement is deficient by more than 0.2" from the plan thickness, take 2 additional cores at random within the lot and calculate the average thickness of the lot from the 3 cores.

In determining the average thickness of the pavement lot, the Engineer will use all 3 core measurements. Individual core measurements which are greater than the plan thickness plus 0.2" will be considered as the plan thickness plus 0.2". Individual cores which are less than the plan thickness minus 1.0" will be considered as the plan thickness minus 1.0 inch. If the average measurement of the 3 cores is within 0.2" from the plan thickness, full payment will be made. If the average measurement of the 3 cores is deficient by more than 0.2" from the plan thickness, an adjusted unit price in accordance with Subarticle 710-10(B) will be paid for the lot represented.

Areas found deficient in thickness by more than 1.0" will be removed and replaced with concrete of the thickness shown on the plans. Any full lane or full shoulder width repairs to the concrete pavement must be performed in accordance with the *North Carolina Department of Transportation Partial and Full Depth Repair Manual* and not be less than 1/2 of the panel length (7.5 feet).

When the measurement of any core (original core or additional cores taken to calculate the average) is less than the plan thickness by more than 1.0", the extent of the removal area due to thickness deficiency will be determined by taking additional exploratory cores at approximately 10 foot intervals parallel to the center line in each direction from the deficient core until an exploratory core is found in each direction which is within 1.0" of the plan thickness. The pavement between these exploratory cores will be removed full lane width wide and replaced with concrete of the thickness shown on the plans. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price.

Patch all core holes within 72 hours of taking the core, using a Department approved nonshrink grout compatible with the pavement concrete.

**Page 7-16, Subarticle 710-10(A) General**, delete the second paragraph and substitute the following:

Separate measurement will be made of pavement that is deficient in thickness by more than 0.2" and of pavement that is deficient in compressive strength.

**Page 7-17, Subarticle 710-10(C) Concrete Pavement Varying In Flexural Strength**, delete the title, first paragraph and the equation for the pay factor calculation and substitute the following:

**(C) Concrete Pavement Varying in Compressive Strength**

The pay factor for pavement achieving a compressive strength in 28 days of 4,500 psi or greater is 100%. The pay factor for pavement achieving a compressive strength in 28 days between 3000 psi and 4,500 psi is determined by the following formula:

Pay Factor (%) = 0.0333(PSI) - 50

(pay factor rounded to nearest tenth of one percent)

**Page 7-17, Subarticle 710-10(C) Concrete Pavement Varying In Flexural Strength**, delete the first sentence of the third paragraph and substitute the following:

Any pavement that fails to attain 3,000 psi in compression is subject to removal.

**Page 7-19, Article 720-4 ACCEPTANCE OF CONCRETE**, delete the first sentence and substitute the following:

Concrete shoulders will be tested for acceptance with respect to compressive strength and thickness on a lot by lot basis.

**Page 7-19, Article 720-9 THICKNESS TOLERANCES**, replace the first paragraph with the following:

The thickness of the shoulder will be determined by measurement of cores in accordance with AASHTO T 148.

**Page 7-20, Subarticle 720-10(C) Concrete Shoulder Varying in Flexural Strength,** delete the title and the first sentence of the second paragraph and substitute the following, respectively:

**(C) Concrete Pavement Varying in Compressive Strength**

The quantities of concrete shoulder that fail to meet 4,500 psi, measured as provided in Article 710-10, will be paid for at an adjusted unit price per square yard completed in place and accepted.

## SECTION 725
## FIELD LABORATORY FOR PORTLAND CEMENT CONCRETE PAVEMENT

**Page 7-21, Article 725-2, GENERAL REQUIREMENTS**, replace with the following:

Furnish and maintain for the exclusive use of the Engineer a field office and laboratory in which to house and use all testing equipment needed. Only Department representatives will have access to these facilities. Provide a field office that is dust and water tight, floored, and has an adequate foundation so as to prevent excessive floor movement. Provide a field office that contains 6 or more 110 volt electrical double outlets properly grounded and spaced; a telephone; at least 2 windows, satisfactory locks on all doors and windows; adequate lighting, heating, and air conditioning; sink; running water to sink; and satisfactory exhaust fan. Provide a field office that meets the following approximate minimum requirements: 200 square feet of floor space; 10 feet interior width; 6 feet 6 inches interior height; 20 square feet of counter space, 2.5 to 3 feet high and 2 feet deep with cabinets or drawers below the counter top; and 6 square feet of desk space not enclosed with cabinets. Locate the office in a position that will permit full view of the plant from the interior of the office. At or near the office, furnish toilet facilities, with waste disposal, available for use of the Department personnel. Maintain these toilets in a neat and clean condition.

Provide a laboratory trailer adjacent to the field office that is at least 400 square feet in area, approximately 20 feet wide, 20 feet long, and 7 feet in height. Provide a laboratory trailer that contains 6 or more 110 volt electrical double outlets properly grounded and spaced; satisfactory locks on all doors and windows; adequate lighting, heating, and air conditioning; sink; running water to sink; and satisfactory exhaust fans. Provide two workbenches that are approximately 10 feet long, 2 feet wide, and 2.5 feet high. One workbench shall be installed inside the trailer and the other across the end of the trailer. Provide a shelter or roof over the outside workbench to provide protection from weather. Provide, in the laboratory, an adequate number of water storage tanks to hold all acceptance beams and cylinders and any additional beams and cylinders made for the purpose of determining early strengths. Construct the water storage tanks of non-corroding materials and have requirements for automatic control of the water temperature. Maintain the water in the tank at a temperature of 73°F ±3°F. Equip each tank with a recording thermometer with its bulb located in the water. Provide sufficient tank volume to maintain all beams and cylinders, stored with the long axis vertical, in a fully submerged condition for the duration of the required curing period. Furnish a wooden mixing board at least 3/4 inch thick and approximately 4 feet wide and 4 feet long that is covered on one side with sheet metal of at least 22 gage, at the shelter. Provide facilities to maintain the test beams and cylinders at temperature between 60°F and 80°F during initial curing.

**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.

**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:

## SECTION 815
## SUBSURFACE DRAINAGE

### 815-1 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.

### 815-2 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.

### 815-3 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.

**815-4 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 |
| __" Perforated Subdrain Pipe | Linear Foot |
| __" Outlet Pipe | Linear Foot |
| Subdrain Pipe Outlets | Each |

**MODIFIED CONCRETE FLUME WITH CONCRETE OUTLET:**
(3-19-96)(Rev 6-17-08) SP8 R10

At locations shown in the plans, construct concrete flumes, concrete curb, and apron in accordance with the details in the plans. Use materials meeting the requirements of Section 825 of the *Standard Specifications* except that the concrete must be Class "B" or of higher compressive strength.

Each concrete flume, concrete curb, and apron completed and accepted will be paid for at the contract unit price per each for *Modified Concrete Flume*. Such price and payment will be full compensation for all materials, labor, equipment, tools, removing and disposing of the temporary slope drains, and any other incidentals necessary to complete the work satisfactorily.

The concrete curb and ditch outside the pay limits of the apron will be measured and paid for in accordance with Section 846 and 850 of the *Standard Specifications*.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Modified Concrete Flume | Each |

## OBSERVATION TUBES:

Construct observation tubes in accordance with the detail in the plans and as directed by the Engineer.

Observation tubes will be measured and paid for at the contract unit price per each for *Observation Tubes.* Such price and payment shall be full compensation for all labor, incidentals and materials necessary to satisfactorily construct the observation tubes, including but not limited to viewing tubes, manhole covers and special frames.

## ENDWALLS:

(5-20-08) SP8 R25

Revise the *Standard Specifications* as follows:

**Page 8-28, Article 838-4 Replace the 1st and 2nd paragraph with the following:**

*Endwalls* will be measured and paid for in cubic yards of concrete or brick that have been completed and accepted. This quantity will be computed from the dimensions shown on the plans or from revised authorized dimensions. Where precast concrete units have been approved and are used in lieu of cast-in-place units the quantity to be paid for will be computed the same as if cast-in-place units were used, as no reduction in pay quantity will be made due to the use of precast in lieu of cast in place endwalls.

*Reinforced Endwalls* will be measured and paid for in cubic yards of concrete or brick that have been completed and accepted. This quantity will be computed from the dimensions shown on the plans or from revised authorized dimensions. Where precast concrete units have been approved and are used in lieu of cast-in-place units the quantity to be paid for will be computed the same as if cast-in-place units were used, as no reduction in pay quantity will be made due to the use of precast in lieu of reinforced cast in place endwalls.

## CONVERT EXISTING JUNCTION BOX TO CATCH BASIN:

(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 catch basin 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 Catch Basin* 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** | **Pay Unit** |
|---|---|
| Convert Existing Junction Box to Catch Basin | 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 |

**IMPACT ATTENUATOR UNITS, TYPE 350:**
(4-20-04) (Rev 7-18-06) SP8 R75

**Description**

Furnish and install impact attenuator units and any components necessary to connect the impact attenuator units in accordance with the manufacturer's requirement, the details in the plans and at locations shown in the plans.

**Materials**

**NON-GATING** IMPACT ATTENUATOR UNITS:

The impact attenuator unit (QUADGUARD) as manufactured by:

Energy Absorption Systems, Inc.
One East Wacker Drive
Chicago, Illinois 60601-2076
Telephone: 312-467-6750

The impact attenuator unit (TRACC) as manufactured by:

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

**GATING** IMPACT ATTENUATOR UNITS:

The impact attenuator unit (BRAKEMASTER) as manufactured by:

Energy Absorption Systems, Inc.
One East Wacker Drive
Chicago, Illinois 60601-2076
Telephone: 312-467-6750

The impact attenuator unit (CAT) as manufactured by:

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

Prior to installation the Contractor shall submit to the Engineer:

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

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

No modifications shall be made to the impact attenuator 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**

If the median width is 40 feet or less, the Contractor shall supply one of the NON-GATING Impact Attenuator Units listed in the Materials Section herein.

If the median width is greater than 40 feet, the Contractor may use any of the GATING or NON-GATING Impact Attenuator Units listed in the Materials Section herein.

**Measurement and Payment**

*Impact Attenuator Unit, Type 350* will be measured and paid for at the contract unit price per each. Such prices and payment will be full compensation for all work covered by this provision including but not limited to furnishing, installing and all incidentals necessary to complete the work.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Impact Attenuator Unit, Type 350 | Each |

**FENCE:**
(3-6-06) SP8 R86

Revise the *2006 Standard Specifications* as follows:

**Page 8-54, Subarticle 866-3(A)**, second sentence,

Add *existing fencing* after stumps

**DETECTABLE WARNINGS FOR PROPOSED WHEELCHAIR RAMPS;**
(6-15-10) SP8 R126

**Description**

Construct detectable warnings consisting of integrated raised truncated domes on proposed concrete wheelchair ramps in accordance with the *2006 Standard Specifications,* plan details, the requirements of the *28 CFR Part 36 ADA Standards for Accessible Design* and this provision.

**Materials**

Detectable warning for proposed wheelchair ramps shall consist of integrated raised truncated domes. The description, size and spacing shall conform to Section 848 of the *Standard Specifications.*

Use material for detectable warning systems as shown herein. Material and coating specifications must be stated in the Manufacturers Type 3 Certification and all Detectable Warning systems must be on the NCDOT Approved Product List for Wheelchair Ramps.

Install detectable warnings created from one of the following materials: precast concrete blocks or bricks, clay paving brick, gray or ductile iron castings, mild steel, stainless steel, and engineered plastics, rubber or composite tile. Only one material type for detectable warning will be permitted per project, unless otherwise approved by the Engineer.

**(A)** **Detectable Warnings shall** consist of a base with integrated raised truncated domes, and **when constructed of precast concrete** they shall conform to the material requirements of Article 848-2 of the *Standard Specifications.*

**(B)** **Detectable Warnings shall** consist of a base with integrated raised truncated domes, and **may be comprised of other materials including but not limited to clay paving brick, gray iron or ductile iron castings, mild steel, stainless steel, and engineered plastics, rubber or composite tile**, which are cast into the concrete of the wheelchair ramps. The material shall have an integral color throughout the thickness of the material. The detectable warning shall include fasteners or anchors for attachment in the concrete and shall be furnished as a system from the manufacturer.

Prior to installation, the Contractor shall submit to the Engineer assembling instructions from the manufacturer for each type of system used in accordance with Article 105-2 of the *Standard Specifications*. The system shall be furnished as a kit containing all consumable materials and consumable tools, required for the application. They shall be capable of being affixed to or anchored in the concrete ramp, including green concrete (concrete that has set but not appreciably hardened). The system shall be solvent free and contain no volatile organic compounds (VOC). The static coefficient of friction shall be 0.8 or greater when measured on top of the truncated domes and when measured between the domes in accordance with ASTM C 1028 (dry and wet). The system shall be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to degradation by motor fuels, lubricants and antifreeze.

**(C)** When steel or gray iron or ductile iron casting products are provided, only products that meet the requirements of Article 106-1(B) of the *Standard Specifications* may be used. Submit to the Engineer a Type 6 Certification, catalog cuts and installation procedures at least 30 days prior to installation for all.

**Construction Methods**

**(A)** Prior to placing detectable warnings in proposed concrete ramps, adjust the existing subgrade to the proper grade and in accordance with Article 848-3 of the *Standard Specifications*.

**(B)** Install all detectable warning in proposed concrete ramps in accordance with the manufacturer's recommendations.

**Measurement and Payment**

Detectable Warnings installed for construction of proposed wheelchair ramps will not be paid for separately. Such payment will be included in the price bid for *Concrete Wheelchair Ramps*.

**STREET SIGNS AND MARKERS AND ROUTE MARKERS:**
(7-1-95) SP9 R01

Move any existing street signs, markers, and route markers out of the construction limits of the project and install the street signs and markers and route markers so that they will be visible to the traveling public if there is sufficient right of way for these signs and markers outside of the construction limits.

Near the completion of the project and when so directed by the Engineer, move the signs and markers and install them in their proper location in regard to the finished pavement of the project.

Stockpile any signs or markers that cannot be relocated due to lack of right of way, or any signs and markers that will no longer be applicable after the construction of the project, at locations directed by the Engineer for removal by others.

The Contractor shall be responsible to the owners for any damage to any street signs and markers or route markers during the above described operations.

No direct payment will be made for relocating, reinstalling, and/or stockpiling the street signs and markers and route markers as such work shall be considered incidental to other work being paid for by the various items in the contract.

**STEEL U-CHANNEL POSTS AND STEEL SQUARE TUBE SUPPORTS:**
(7-18-06) (Rev 1-18-11) SP9 R02

Revise the *2006 Standard Specifications* as follows:

**Page 9-15 Subarticle 903-3(D) delete the last sentence in the first paragraph and add the following:**

Use posts of sufficient length to permit the appropriate sign mounting height. Spliced posts are not permitted on new construction.

**Page 9-16 Subarticle 903-3(G) delete the last sentence in the first paragraph and add the following:**

Use posts of sufficient length to permit the appropriate sign mounting height. Spliced posts are not permitted on new construction.

**Page 9-16 Subarticle 903-3(G), delete the fourth paragraph and add the following:**

Do not weld or cut supports in the field except for the saw cutting of steel square tube material for the frames and cross-braces that may be required for Types D, E, and F signs with two or more supports.

**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**

| *Pozzolan* | *Rate* |
|---|---|
| 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]** |
| *Typical Application* | | *Shoulder Drains* | *Under Riprap* | *Temporary Silt Fence* | *Soil Stabilization* | *Temporary MSE Walls* |
| 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% |

[1]MARV does not apply to elongation
[2]Minimum roll width of 36" required
[3]Minimum roll width of 13 ft required
[4]US Sieve No. per AASHTO M92
[5]After 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 $in^2$/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 alkalies 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, ± 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.

**TEMPORARY SHORING:** **SPECIAL**

**Description**

Design and/or construct temporary shoring in accordance with the contract and the traffic control plans. Temporary shoring includes temporary sheeting and contractor designed temporary shoring. Trench boxes are not considered temporary shoring. Contractor designed temporary shoring must be anchored or braced.

Temporary shoring is required to maintain traffic as shown on the traffic control plans. Temporary shoring to maintain traffic is defined as shoring necessary to provide lateral support to the side of an excavation or embankment parallel to an open travelway when a theoretical 2:1 (H:V) slope from the bottom of the excavation or embankment intersects the existing ground line closer than 5 ft from the edge of pavement of the open travelway.

Provide all shoring submittals before beginning work.

**Materials**

Provide Type 7 Contractor's Certifications in accordance with Article 106-3 of the *Standard Specifications* for shoring materials. Store steel materials on blocking a minimum of 12" above the ground and protect it at all times from damage; and when placing in the work make sure it is free from dirt, dust, loose mill scale, loose rust, paint, oil or other foreign materials. Load, transport, unload and store shoring materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Use steel piles meeting the requirements of Section 1084 of the *Standard Specifications*. For miscellaneous steel shapes and plates not addressed below, use steel materials meeting the requirements of ASTM A36.

**(A) Ground Anchors**

A ground anchor consists of a grouted steel bar or strands with miscellaneous elements. Use high-strength steel bars meeting the requirements of AASHTO M275 or seven-wire strands meeting the requirements of ASTM A886 or Article 1070-5 of the *Standard Specifications*. Splice bars in accordance with Article 1070-10 of the *Standard Specifications*. Do not splice strands.

Provide bondbreakers, spacers and centralizers meeting the requirements of Section 6.3.5 of the *AASHTO LRFD Bridge Construction Specifications*. Use grout in accordance with the *Grout for Structures* special provision.

**(B) Helical Anchors**

A helical anchor consists of a lead section with a central steel shaft and at least one helix steel plate followed by extensions with only central shafts (no helixes). Use helical anchors with an ICC Evaluation Service, Inc. (ICC-ES) report. Helical anchors without

an ICC-ES report may be approved at the discretion of the Engineer. Provide couplers, thread bar adapters and bolts for connecting helical anchors together and to piling in accordance with the anchor manufacturer's recommendations.

**(C) Anchorages**

Anchorages consist of steel bearing plates with washers and hex nuts for bars or steel wedge plates and wedges for strands. Provide bearing plates meeting the requirements of Section 6.3.3 of the *AASHTO LRFD Bridge Construction Specifications* and washers, hex nuts, wedge plates and wedges in accordance with the anchor manufacturer's recommendations.

**Portable Concrete Barriers**

Provide portable concrete barriers in accordance with the traffic control plans and if shoring is located within the clear zone as defined in the *AASHTO Roadside Design Guide*. Use NCDOT portable concrete barriers (PCBs) in accordance with Roadway Standard Drawing No. 1170.01 and Section 1170 of the *Standard Specifications.*

The clear distance is defined as the horizontal distance from the back face of the barrier to the edge of pavement and the minimum required clear distance is shown on the traffic control plans.

**Contractor Designed Temporary Shoring**

"Contractor Designed Temporary Shoring" is defined as temporary shoring designed by the Contractor. Contractor designed temporary shoring is required at locations as noted on the traffic control plans. Anchors or bracing are required for contractor designed temporary shoring.

Before beginning design, survey the shoring location to determine existing elevations and actual design heights. Submit design calculations and drawings including typical sections for review and acceptance showing details of the proposed design and construction sequence in accordance with Article 105-2 of the *Standard Specifications*. Have shoring designed, detailed and sealed by a Professional Engineer registered in the State of North Carolina. Submit 3 hard copies of design calculations and 10 hard copies of drawings and an electronic copy (pdf or jpeg format on CD or DVD) of both the calculations and drawings.

If anchors are used, design shoring in accordance with the traffic control plans and the *FHWA Geotechnical Engineering Circular No. 4 "Ground Anchors and Anchored Systems"* (Publication No. FHWA-IF-99-015). If bracing is used, design temporary shoring in accordance with the traffic control plans and the *AASHTO Guide Design Specifications for Bridge Temporary Works.*

Design temporary shoring in accordance with the in-situ assumed soil parameters shown on the traffic control plans. Design shoring for a 3-year design service life and a traffic surcharge equal to 240 psf. This surcharge is not applicable for construction traffic. If a construction surcharge will be present within a horizontal distance equal to the height of the shoring, design the shoring

for the required construction surcharge. If the edge of pavement or a structure to be protected is within a horizontal distance equal to the height of the shoring, design shoring for a maximum deflection of 3". Otherwise, design shoring for a maximum deflection of 6".

For contractor designed temporary shoring, the top of shoring elevation is defined as the elevation where the existing ground surface intersects the back face of the shoring. Extend contractor designed temporary shoring at least 6" above the existing ground surface.

**Construction Methods**

When using an anchored PCB, anchor the barrier in accordance with Roadway Standard Drawing 1170.01 and Section 1170 of the *Standard Specifications*. Control drainage during construction in the vicinity of temporary shoring. Collect and direct run off away from temporary shoring.

**(A) Temporary Sheeting**

Install and interlock sheet piling as shown on the traffic control plans with a tolerance of 1/2 inch per foot from vertical. Install temporary sheeting to the required embedment below the existing ground surface as noted on the traffic control plans without exceeding the vibration limits established in the *Control of Vibration Special Provision* at the nearest structure. Hydraulic pressing or pushing may be required to install piles to the required embedment.

Extend temporary sheeting to at least 6" above the existing ground surface.

Perform welding in accordance with Article 1072-20 of the *Standard Specifications*.

**(B) Contractor Designed Temporary Shoring**

Before starting contractor designed temporary shoring construction, conduct a preconstruction meeting to discuss the construction, inspection and testing of the shoring. Schedule this meeting after all shoring submittals have been accepted. The Resident Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, Contractor and Shoring Contractor Superintendent and Project Manager will attend this preconstruction meeting.

Install piling with a tolerance of 1/2 inch per foot from vertical and in accordance with the accepted submittals and this provision. Install contractor designed temporary shoring as shown on accepted submittals without exceeding the vibration limits established in the *Control of Vibration Special Provision* at the nearest structure. Hydraulic pressing or pushing may be required to install piles

Construct contractor designed temporary shoring from the top down by excavating material in front of shoring in accordance with the accepted submittals.

Perform any welding in accordance with Article 1072-20 of the *Standard Specifications* and the accepted submittals.

Anchors or braces must not extend off the Right of Way.

**(1) Anchor Fabrication and Installation**

Fabricate and install ground anchors in accordance with the accepted submittals. Corrosion protection for unbonded lengths of ground anchors and anchorage covers are not required

Install helical anchors in accordance with the accepted submittals and the anchor manufacturer's instructions. Measure the torque during installation and do not exceed the torsion strength rating of the helical anchors. Satisfy the minimum installation torque and length requirements before terminating anchor installation. When replacing helical anchors, embed the last helix of the replacement anchor at least 3 helix plate diameters past where the first helix of the previous anchor was located.

**(2) Anchor Testing**

Proof test and lock-off all anchors in accordance with the accepted submittals and Section 6.5.5 of the *AASHTO LRFD Bridge Construction Specifications* with the exception of the acceptance criteria in Section 6.5.5.5. For the AASHTO LRFD specifications, "ground anchor" refers to a ground or helical anchor and "tendon" refers to a bar or strand for a ground anchor and a central shaft for a helical anchor.

**(3) Anchor Acceptance**

Anchor acceptance is based on the following criteria.

(a) For ground and helical anchors, total movement is less than 0.04" (1 mm) between the 1 and 10 minute readings or less than 0.08" (2 mm) between the 6 and 60 minute readings.

(b) For ground anchors, total movement at maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

**(4) Anchor Test Results**

Submit 2 original hard copies of anchor test records including movement versus load plots for each load increment within 24 hours of completing each row of anchors. The Engineer will review the test records to determine if the anchors are acceptable.

If the Engineer determines an anchor is unacceptable, revise the anchored shoring design /or installation methods. Submit a revised anchored shoring design for review and acceptance and provide an acceptable anchor with the revised design and/or installation methods at no additional cost to the Department. If required, replace the anchor and/or provide additional anchors with the revised design and/or installation methods at no additional cost to the Department.

After completing anchor testing for each anchored shoring, submit electronic copies (PDF on CD or DVD) of all corresponding test records.

**Measurement and Payment**

*Temporary Sheeting* will be measured and paid for at the contract unit price per linear foot of sheeting as measured along the ground surface at locations shown on the traffic control plans or required by the Engineer. Quantity to be measured for payment is the linear length in a straight line along the sheeting alignment and does not include dimensions within individual sheeting corrugations. Such price and payment will be full compensation for furnishing all labor, tools, equipment, materials and all incidentals necessary to install the temporary sheeting and complete the work as described in this provision. No additional compensation will be made if hydraulic pressing or pushing is required to install *Temporary Sheeting* to the required embedment noted on the traffic plans without exceeding the established vibration limits at the nearest structure.

*Contractor Designed Temporary Shoring* will be measured and paid for at the contract unit price per linear foot of temporary shoring as measured along the ground surface at locations shown on the traffic control plans or required by the Engineer. Quantity to be measured for payment is the linear length in a straight line along the sheeting alignment and does not include dimensions within individual sheeting corrugations. Such price and payment will be full compensation for furnishing design, submittals, all labor, tools, equipment, materials, installing anchors or bracing, testing anchors if used, and all incidentals necessary to design and install the *Contractor Designed Temporary Shoring* and complete the work as described in this provision. No additional compensation will be made if hydraulic pressing or pushing is required to install *Contractor Designed Temporary Shoring* as shown on accepted submittals without exceeding the established vibration limits at the nearest structure.

No payment will be made for temporary shoring required for the Contractor's convenience or for OSHA reasons. No value engineering proposals will be accepted based solely on revising or eliminating the shoring locations shown on the traffic control plans or the estimated quantities shown in the bid item sheets as a result of actual field measurements or site conditions.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Temporary Sheeting | Linear Foot |
| Contractor Designed Temporary Shoring | Linear Foot |

**CHANGEABLE MESSAGE SIGNS:**
(11-21-06) SP11 R11

**Revise the *2006 Standard Specifications* as follows:**

**Page 11-9, Article 1120-3**, Replace the 3rd sentence with the following:

Sign operator will adjust flash rate so that no more than two messages will be displayed and be legible to a driver when approaching the sign at the posted speed.

**FLAGGERS:**
(2-15-11) SP11 R20

**Revise the *2006 Standard Specifications* as follows:**

**Page 11-13, Article 1150-3 Construction Methods,** replace the article with the following:

Provide the service of properly equipped and qualified flaggers (see *Roadway Standard Drawing* 1150.01) at locations and times for such period as necessary for the control and protection of vehicular and pedestrian traffic. Anyone who controls traffic is required to be qualified. Qualification consists of each flagger receiving proper training in the set-up and techniques of safely and competently performing a flagging operation. Qualification of flaggers is to be done at an NCDOT approved training agency. For a complete listing of these, see the Work Zone Traffic Control's webpage, http://www.ncdot.gov/doh/preconstruct/wztc/.

Prior to beginning work on the project, a Qualification Statement that all flaggers used on the project have been properly trained through an NCDOT approved training resource shall be provided to the Engineer.

Flagging operations are not allowed for the convenience of the Contractor's operations. However, if safety issues exist (i.e. sight or stopping sight distance), the Engineer may approve the use of flagging operations. Use flagging methods that comply with the guidelines in the MUTCD.

**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.