

PROJECT SPECIAL PROVISIONS

ROADWAY

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.

SEALING ABANDONED WELLS:

There are two wells on the project that shall be sealed by the Contractor unless otherwise directed by the Engineer. They are located at parcels 13 and 16. The wells shall be sealed in accordance with Section 205 of the *Standard Specifications* except that no separate payment will be made. All work involved with sealing these two wells will be considered incidental to the lump sum payment for *Clearing & Grubbing*.

BUILDING AND UNDERGROUND STORAGE TANK REMOVAL:

(1-1-02) (Rev. 5-17-11)

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.

The Department has performed asbestos assessments and abatement 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 abatement performed by others or the cost of asbestos removal and disposal will be paid in accordance with Article 104-7 of the *2006 Standard Specifications*. When directed to perform removal and disposal of asbestos, do so 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. 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

Known Underground Storage Tanks (UST's) will be removed by the Department prior to the opening of bids. When UST's 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*.

When directed to remove UST'S, prior to their removal, 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.

Disposal 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 076 – Right of Survey Station 471+50, Line –L-
One-Story Framed Dwelling (1,688 sf), Deck (210 sf), Porch (159 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 079 – Left of Survey Station 466+00, Line –L-
One-Story Framed Dwelling (1,038 sf), Porch (146.3 sf) partially outside right of way and/or construction limits.

Building Removal

Parcel 080 – Right of Survey Station 466+05, Line –L-
Two-Story Framed Dwelling (1,234 sf), Deck/Balcony (32 sf), Covered Sidewalk (30 sf)

Building Removal

Parcel 080 – Right of Survey Station 466+75, Line –L-
One-Story Framed Dwelling (2,267 sf), Porch (45 sf), Balcony (70 sf)

Building Removal

Parcel 081 – Left of Survey Station 466+50, Line –L-
One-Story Framed Dwelling (750 sf), Covered Porch (81.3 sf) partially outside right of way and/or construction limits.

Building Removal

Parcel 114 – Right of Survey Station 487+75, Line –L-
One-Story Framed Dwelling (1,604 sf), Basement (745 sf), Covered Porch (56 sf) partially outside right of way and/or construction limits.

Building Removal

Parcel 115 - Right of Survey Station 488+50, Line –L-
One-Story Framed Dwelling (1,346 sf) Wood Deck/Porch (209 sf) Wood Deck/Porch (361 sf), attached Garage (344 sf) partially outside right of way and/or construction limits.

Building Removal

Parcel 123 – Right of Survey Station 493+75, Line –L-
Underground Storage Tanks

Building Removal

Parcel 133 – Right of Survey Station 501+25, Line –L-
One-Story Framed Business (2,576 sf), Porch (224 sf), Kennel (800 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 138 – Right of Survey Station 505+10, Line –L-
One and One-half Story (1,233 sf), Front Deck (352 sf), Back Deck (1, 120 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 138 – Right of Survey Station 505+60, Line –L-
One-Story Framed Shed (255 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 149 – Right of Survey Station 509+50, Line –L-
Three Story Framed Dwelling, (3,690 sf), Porch (114 sf), Deck (985 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 152 – Left of Survey Station 511+70 to 512+50, Line –L-
One-Story Framed Business (1,183 sf), Wood Deck Walkway (118 sf), Deck/Patio (168 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 160 – Right of Survey Station 522+25, Line –L-
One-Story Framed Business (629 sf), Deck (166 sf), Side Deck (16 sf), Side Deck (40 sf)

Building Removal

Parcel 160 – Right of Survey Station 522+00, Line –L-
Shed (96 sf)

Building Removal

Parcel 161-B – Right of Survey Station 527+20 to 527+80, Line –L-
One and One-half Story Framed Business (2,616 sf), Wood Deck with Steps (878 sf), Concrete Slab Porch (197 sf), partially outside of right of way/and or construction limits.

Building Removal

Parcel 171 – Right of Survey Station 532+60 to 534+80, Line –L-
30' x 60' Fuel Canopy, Two Gasoline/Diesel Dispensers, Underground Fuel and Oil Storage Tanks

Building Removal

Parcel 172 – Right of Survey Station 535+00 to 535+80 Line –L-
Two-Story Framed Business, (3,560 sf), Wood Deck (315 sf), Covered Porch (52 sf), partially outside right of way and/or construction limits.

Building Removal

Parcel 174 – Left of Survey Station 536+00 to 536+70, Line –L-
One-Story Framed Business, (1,870 sf)

Building Removal

Parcel 181 – Right of Survey Station 542+00 to 543+25, Line –L-
Underground Tanks

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. (This paragraph pertains to Item No. 76, 79, 081, 114, 115, 133, 138, 149, 152, 161-B, 172)

EMBANKMENTS:

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

SP2 R18

Revise the *Standard Specifications* as follows:

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

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

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

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

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

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

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

AGGREGATE SUBGRADE:

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

SP2 R35

Description

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

Materials

Refer to Division 10 of the *Standard Specifications*.

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

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

Construction Methods

When shallow undercut is required to construct aggregate subgrades, undercut 6 to 24 inches as shown on the plans or as directed by the Engineer. Perform undercut excavation in accordance with Section 225 of the *Standard Specifications*. Install fabric for soil stabilization in accordance with Article 270-3 of the *Standard Specifications*. Place Class IV Subgrade Stabilization (standard size no. ABC) by end dumping ABC on the fabric. Do not operate heavy equipment

on the fabric until it is covered with Class IV Subgrade Stabilization. Compact ABC to 92% of AASHTO T180 as modified by the Department or to the highest density that can be reasonably obtained.

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

Measurement and Payment

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

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

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

Payment will be made under:

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

CONTAMINATED SOIL

The Contractor's attention is directed to the fact that soil containing petroleum hydrocarbon compounds and volatile organic compounds exist within the project area. Soil samples collected from Parcel #123, Sandra J Glover Property and Parcel #171 WF Intermediate Real Estate LLC Property, indicated petroleum contaminated soil is present in the right of way.

The following is a known area of contamination and its approximate station location:

Parcel #123 -L- Stations 493+00 to 494+25, 15 to 50 Feet Right
 Parcel #171 -L- Stations 532+75 to 534+25, 25 to 125 Feet Right

Information relating to this contaminated area, 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 petroleum odors and unusual soil staining. Contaminated soil not required to be excavated is to remain in place and undisturbed. Undisturbed soil shall remain in place, whether contaminated or not. The Contractor shall stockpile all excavated contaminated soil within the property boundaries of Parcel #123 or Parcel 171, as applicable. 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 is to 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.

Measurement and Payment:

The quantity of contaminated soil excavated and stockpiled shall be the actual number of tons of material, which has been acceptably excavated, transported, and weighed with certified scales. Include in the unit bid price for *Excavating and Stockpiling Contaminated Soil* all costs associated with this activity including excavation, stockpile construction material, and personal protective equipment.

Payment shall be made under:

Pay Item	Pay Unit
Excavation and Stockpiling Contaminated Soil	Ton

FALSE SUMPS:

(7-1-95)

SP2 R40

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

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

SHOULDER AND FILL SLOPE MATERIAL:

(5-21-02)

SP2 R45 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*.

RESCALING SLOPES**(SPECIAL)****Description**

Work under this item is for the complete removal of loose rock material by appropriate manual scaling at the direction of the Engineer. This work will typically take place in areas where cut slopes have been blasted. Blasted slopes are required to be cleared of loose blasted debris as incidental to completing the slope, this will involve removing cut slope hazards determined to be natural that have not been over-blasted. Work also includes removal and disposal of the scaled rock and soil materials.

Construction Methods

Use a work unit consisting of the following:

A two person man-lift, crane, ropes or other suitable equipment, capable of accessing existing rock faces up to those heights present on the project.

A work crew, consisting of at least a minimum of two scalers (2 man-hours per hour worked) completely conversant with scaling at heights, is required.

Tools and material needed for the efficient performance of the work.

Manual scaling is defined as all authorized work by the manual scaling crew including scaling, grubbing, sounding, trimming with hand-tools and hand-held machine tools, air bags, as well as minor blasting with a small quantity of explosives.

Undertake manual scaling from the top of the rock face down to ensure that at no time the scaling crew is working beneath loosened or undercut sections of the rock face.

At the start of each workday, the scaling crew is required to inspect the rock face to identify rock that requires immediate removal so as not to endanger the workers.

Prior to ending the day's operation, the scaling crew is required to inspect the rock face for approval by the Engineer.

Measurement and Payment

Rescaling Slopes will be measured and paid for at the contract unit price per man hour. This work includes but is not limited to furnishing the labor, tools, equipment and materials, removal of the scaled material and performing the actual scaling work.

Payment will be made under:

Pay Item	Pay Unit
Rescaling Slopes	Man-hour

ROCKFALL CONTROL FENCE**(SPECIAL)****1.0 DESCRIPTION**

Design, prepare plans, furnish, and install energy absorbing Rockfall Control Fence system at approximate locations listed in these Special Provisions and at exact locations as directed by the Engineer. Work includes all barrier components, structural nets, steel posts, concrete foundations, anchors, and all other materials, labor, tools, equipment, and incidentals required to complete the installation.

STATION	TO	STATION	SIDE
555+00		559+50	RT

2.0 GENERAL

Provide a rockfall control fence system with a minimum height of 10 feet and of sufficient structural capacity to absorb impact design loads of 92 foot-tons (250 kJ) of kinetic energy without the passage of particles larger than 2 inches in diameter through the barrier and with little or no maintenance required. Provide a system that is a free standing structure in which all supports and anchors lie within the plane of the barrier, not extending back towards the slopes to preserve access to the catchment area between rock barrier and rock slopes (i.e. no tie-back or upslope anchorage/ropes are allowed).

Provide the manufacturer test report and certificate for that specific system design being provided on the contract demonstrating satisfactory performance in a similar application and capacity. Select a manufacturer engaged in designing and manufacturing rockfall protection systems, having a minimum of five (5) years of documented experience with manufacturing of such systems used in a similar application and capacity. Supply written evidence from manufacturer demonstrating certification of a quality assurance program, as well as proof and validity of seller's liability insurance.

Submit four sets of complete working drawings/shop plans, erection plans and design calculations, sealed by a Registered Professional Engineer, for review and approval prior to beginning rockfall control fence system work. Allow 5 calendar days for review and approval from the date they are received by the Engineer until they are returned to the Contractor.

The installation contractor shall provide all necessary materials from the chosen barrier supplier and will obtain from the Supplier technical instruction and guidance in preconstruction activities, including the Preconstruction Conference and on-site technical assistance during construction. The installation contractor shall follow any instructions from the material Supplier closely, unless otherwise directed by the Engineer.

3.0 MATERIALS

A. Structural Nets

Construct nets from interlocking steel rings, cable nets, etc., that meet the design strength requirements, each ring with a maximum aperture opening of 11.75 inches.

Use wire with high tensile strength carbon steel wire with a nominal 0.118-inch diameter and the minimum breaking strength of the wire must be 256,000 psi.

Galvanize wire with a zinc/aluminum super coating and the minimum weight of the coating must be 0.41 oz/ft² (125 g/m²).

B. Wire Mesh

Cover nets with chain link mesh material, which must be attached to the wire rope netting and fastened with galvanized hog rings and/or galvanized tie wire on 2-foot centers horizontally and vertically. The chain link fabric must meet the requirements of Section 1050 of the NCDOT Standard Specifications. Chain link material shall have 2 inch x 2 inch openings, be fabricated from 9-gauge minimum wire in accordance with AASHTO M181-90, and be zinc coated in accordance with A392-84, Class 1 Standards.

C. Net Support Columns

Direct-buried posts shall be fabricated from HEB-200 / W8x40 wide flange structural members for the 10.0' high system with a post length equal to 150% of the net height. Weld cable guides welded to the columns (top and bottom) shall be fabricated from extra strong pipe meeting ASTM A53, Grade B, or A106. All steel shapes must comply with ASTM A36-84 and bolts, nuts and washers to ASTM A325-86.

The posts shall meet the requirements for ASTM A36 for preformed steel shapes and shall be hot dipped galvanized along with all welded attachments for corrosion protection.

D. Net Support Ropes

The system shall have double top and double bottom support ropes which shall be manufactured from 3/4-inch diameter, galvanized, 6x19 construction or equivalent, IWRC wire rope having a minimum breaking strength of 52,920 lbs.

The top and bottom net support ropes must each incorporate a factory-swaged eye at one end and a brake rope sling shall be installed at the end of each support rope run using an appropriately designed and tested brake ring. Verify braking

element design through testing to ensure satisfactory performance and a minimum of required maintenance.

E. Lateral Support Ropes

Lateral support ropes must incorporate a factory swaged eye on one end and be manufactured from ¾" diameter rope. The lateral support ropes must be of 6x19 construction (or equivalent), IWRC and have a minimum breaking strength of 52,920 lbs.

F. Rock and Soil Anchors

Wire Rope Anchors must incorporate a factory swaged eye on one end and be manufactured from ¾" diameter rope. The wire rope anchors must be of 6x19 construction (or equivalent), IWRC and have a minimum breaking strength of 52,920 lbs.

Anchors must have minimum pullout strength of 25 tons and be verified by the Contractor in the field. Pullout testing is required on a minimum of 20% of the production anchors. If more than 25% of the tested anchors fail, all anchors must be tested. Replace failed anchors at no additional cost to the Department. Perform testing against a temporary yoke or load frame. No part of the yoke or load frame may bear within 3 feet of the anchor.

G. Vertical End Ropes

The ropes shall be made from ¾-inch diameter, galvanized, 6x19 construction or equivalent, IWRC wire rope and shall incorporate a factory swaged eye on each end.

H. Shackles

Use shackles to fasten the ring nets to each other and to the net support ropes. Use 1/2" shackles or better along the top and bottom of each net. Use 7/16" shackles or better to affix two net panels together.

I. Miscellaneous Materials

Supply all miscellaneous hardware such as wire rope clips, thimbles, bolts, etc. with the system.

J. Wire Rope Specifications

All ropes (i.e. support ropes, lateral anchor ropes, vertical end ropes, etc.) and wire rope anchors shall meet the Federal Specification RR-W-410D or ASTM A1023/1023M or equivalent.

K. Corrosion Protection

All ropes (i.e. support ropes, lateral anchor ropes, vertical end ropes, etc.) and wire rope anchors shall meet Federal Specification RR-W-410D or ASTM A1023/A1023M for galvanizing. Hog rings or tie wire shall be supplied with zinc coating meeting the requirements of ASTM A641-92.

All miscellaneous material associated with the rockfall system such as wire rope clips, bolts, nuts, thimbles shall be hot dipped galvanized.

Where the system is exposed to corrosive elements such as salt spray or where the owner determines it necessary, coat all ropes and nets with a wire rope protectant by the Manufacturer.

4.0 CONSTRUCTION METHODS

Drill a sixteen (16) inch diameter hole for each post that is at approximately five (5) feet deep and a four (4) inch diameter hole for the wire rope anchors in accordance with the typical cross sections shown on the approved working drawings. The distance from centerline to centerline of the columns must be kept as close as possible to that shown on the approved working drawings. The spacing cannot exceed ± 3 inches of the distance as indicated on the approved working drawings.

Prior to placing foundation concrete all loose soil or rocks must be removed from the holes. The minimum concrete strength is to be 4500 psi. The concrete must meet the requirements of Section 825 of the NCDOT Standard Specifications. Prior to attaching any cables or netting to the column, cure the foundation concrete a minimum of 7 days or as directed by the Engineer.

Rockfall System Installation

Step 1: Locate and install the posts and anchors in accordance with the approved working drawings. The columns must not vary from the indicated pitch or from vertical by more than 2 inches from the top to bottom of the column and must not deviate more than ± 3 inches from centerline to centerline of the columns.

Step 2: After the columns are properly set, install the lateral ropes, retaining ropes and support ropes through the cable guide assemblies on the columns as indicated on the working drawings. Using the supplied wire rope clips, tension the lateral ropes, retaining ropes and support ropes and fasten the ropes as shown on the approved working drawings. The distance from the column to the braking elements must not exceed 5 feet. Tension the lateral ropes before tensioning the support ropes. Tension all ropes as necessary to eliminate slack, and tension the support ropes until there is no sag in the ropes.

Step 3: Position the top row of rings on each net to the top support rope connecting each ring to the support rope with 1/2" shackles or better. Attach the bottom of the nets to the bottom support rope in a similar manner. Use 1/2" shackles or better to attach the nets to the side vertical support rope (at end posts). Using 7/16" shackles or better, attach the sides of each net to the adjacent net (ring to ring). The first of these side shackles should be used to hold the top corners of each two adjacent nets together. Finally, remove any temporary fasteners that have been used.

- Notes: a. Do not attach the nets to the cable guide assemblies or to the columns.
- b. Bottom support rope braking elements should be oriented vertically and tied to the ring nets using tie wire or plastic ties. Do not use shackles or wire rope clips! This is done for maintenance and/or aesthetic reasons.

Step 4: Position and attach the chain link mesh to the ring nets as indicated on the working drawings. As an option, position the chain link against the ring nets and seam it to the support ropes when the nets are seamed. Using hog rings or tie wire fasteners or other approved fastener, attach the chain link to the nets on two-foot center, horizontally and vertically.

Step 5: Make sure that the system is properly tightened and the installation appearance looks aesthetically pleasing to the surrounding area to the satisfaction of the Engineer.

5.0 METHOD OF MEASUREMENT

The quantity of Rockfall Control Fence to be paid for will be the actual number of linear feet of fence, measured in place from center of end support column to center of end support column at each fence location, which has been completed and accepted.

6.0 BASIS OF PAYMENT

The quantity of Rockfall Control Fence measured as provided for above, will be paid for at the contract unit price per linear foot for "Rockfall Control Fence."

The above price and payment will be full compensation for all work covered by this provision including but not limited to furnishing and installing all wire rope netting, wire support rope, clips and other hardware, support columns, drilling, concrete, wire rope anchors, cable guide assemblies, spare parts, and any other materials necessary to install a complete system ready to use.

Payment will be made under:

Rockfall Control Fence.....Linear Foot

ROCK BLASTING and CONTROL OF VIBRATION: (SPECIAL)

Description

This project special provision governs fracturing rock for excavation and constructing stable rock cut slopes using controlled, production and trench blasting. Controlled blasting is used to form a shear plane in rock at a certain slope by limiting the effects of blasting with presplitting, cushion or trim blasting. The purpose of controlled blasting is to construct stable rock cut slopes without damaging the rock face. Production blasting is used to fracture rock in manageable sizes for excavation. Trench blasting is used to create trenches in rock for utilities and pipes and construct open ditches. This provision also addresses secondary blasting and blasting adjacent to highway structures in lieu of Article 410-11 of the *Standard Specifications*.

Control blasting to avoid damaging public and private property. Contain flyrock in the construction limits or perform blasting such that no flyrock occurs if required in the "Project Requirements" section of this provision. When blasting in the vicinity of an open travelway, have equipment standing by to remove material that interferes with traffic flow.

Perform rock blasting, develop blast plans, provide explosive materials, drill, load and stem holes, record drilling, conduct blast surveys, monitor blasts and submit drilling records, surveys and reports in accordance with the contract and accepted submittals.

Project Requirements

Statement of Concern: This Statement of Concern is expressly written to alert the Contractor (or prospective bidders) to the fact that ordinary practices customarily considered as standard for the blasting industry will not be acceptable on this project. Extra caution and skill will be required to accomplish this work in a satisfactory manner. Blasting must be safely done near residential and commercial structures; utilities; and historical structures. Because of these concerns, NCDOT will exercise their prerogative to examine carefully the qualifications of any persons whose knowledge and skills may bear on the outcome of the work. In addition, NCDOT will reject any persons who are deemed unqualified for any tasks that may be required to accomplish the blasting and monitoring work.

(A) Pre-Construction Condition Surveys

The condition of all buildings, improvements and surface utilities located within 500 feet of all locations where blasting may occur shall be surveyed at least 30 days before any holes are drilled for blasting operations. Condition survey reports and the experience of persons performing the surveys shall conform to standards provided in Submittals Section (D) of these special provisions. Similar surveys, done to the same standards, shall be done at all buildings, improvements and surface utilities located within 100 feet of all locations where heavy equipment is used to construct new roadways, retaining walls, and other structures associated with the work. These reports shall be submitted 30 days before any work occurs within 100 feet of identified survey targets. No heavy construction work shall occur until NCDOT has accepted surveys done in accordance with standards provided in Submittals Section (D) of these special provisions.

(B) Vibration and Air-Overpressure Limitations

All blasting work shall be designed and executed to assure the following vibration and air-overpressure limits are not exceeded.

Vibration Limits at all frequencies of motion:

Location	Warning Level	Not-to-Exceed Level
Historic Structures ¹	0.15 in/s	0.25 in/s
Residential Structures	0.35 in/s	0.5 in/s
Commercial Buildings	0.35 in/s	0.5 in/s
Public Buildings	0.35 in/s	0.5 in/s
Heavy Commercial Structures	0.75 in/s	1.0 in/s
Buried Utilities and Surface Poles	3.0 in/s	4.0 in/s

¹Green Park Inn near station 457+00 -L-, A.G. Jonas Cottage (Laughter Home) near station 465+00 -L-, Bollinger-Hartley House near station 542+00 -L-

Air-Overpressure Limits:

Location	Warning Level	Not-to-Exceed Level
All Surface Structures	128 dBL	130 dBL

At the Performing Arts Center, there is a large air conditioning unit in the vicinity of station 543+00 right of -L-. Verify the unit is turned off before blasting within 200 feet.

(C) Flyrock

Design and perform rock blasting such that no flyrock occurs. If flyrock occurs, the Engineer may suspend blasting operations in accordance with Article 108-7 of the Standard Specifications and require test blasts and a revised General Blast Plan. For the purposes of this work, flyrock is defined as the movement of blasted rock or debris that lands on private property, impacts any structures, or travels outside a reasonable area required to accommodate the swelling of blasted rock and overburden. Any rock that travels more than 5 feet from the limits of blasts covered with mats is also considered flyrock.

(D) Blasting Support Personnel

Retain an independent specialist to serve as the Pre-construction Condition Survey Specialist to provide pre-construction condition surveys at all defined properties in the Project Requirements.

Retain an independent specialist to serve as Vibration Monitoring Consultant and perform vibration and air-overpressure monitoring for all heavy construction work and blasting.

Retain an independent Blasting Consultant to assist in the preparation of General Blast Plans, review and modify blast plans as needed, and for participation in site meetings and public meetings. For planning and bidding purposes, the Contractor shall assume that the Blasting Consultant will make a minimum of six two-day visits to the site. The Contractor's Blasting Consultant shall also be available to attend a kick-off meeting and other meetings as requested by the Engineer.

The Contractor shall also retain a Blasting Specialist assigned full-time to this project to assist blasters with all required blast planning, logging, and reporting documentation. The Blasting Specialist shall be located at the Contractor's on-site project office.

(E) Test Blasts

Two test blasts with rock volume not exceeding 100 cubic yards are required before individual blast plans can be submitted for larger-scale production blasting.

Definitions

Air-Overpressure or Air Blast (Noise) – The pulsating pressure changes above and below ambient air pressure generated by an explosion. Air-overpressure “linear scale” measurements include low frequency noise with a 2 hertz (Hz) response and are expressed in units of decibels-L (dBL).

Blast Pattern – A plan of blast hole locations or an expression of the burden and spacing distance and their relationship to each other.

Burden – The amount of rock broken by an explosive charge measured as the distance between the blast hole and the nearest free face.

Charge per Delay (W) – The sum of all charge weights firing within any 8 milliseconds (ms) time period. For example, if two 10 lb (4.5 kg) charges fire at 100 ms and one 15 lb (6.8 kg) charge fires at 105 ms, the charge per delay would be 35 lbs (15.8 kg).

Cushion or Trim Blasting – A controlled blasting technique in which a line of blast holes along a rock face is detonated during the last delay period of the blast. The main burden is moved from the face by production blast holes leaving only a small burden to be removed by the line of blast holes at the face. Charges in these holes are lighter than charges in the production blast holes.

Deck Loading (Decking) – A method of loading blast holes in which two or more explosive charges, called decks or deck charges, are loaded in the same hole separated by stemming or an air cushion.

Delay Blasting – The practice of initiating individual explosive decks, blast holes or rows of holes at predetermined time intervals using delays or delay detonators as compared to firing all blast holes simultaneously.

Flyrock – Rocks propelled through the air by the force of an explosion. For the purposes of this work, flyrock is defined as the movement of blasted rock or debris that lands on private property, impacts any structures, or travels outside a reasonable area required to accommodate the swelling of blasted rock and overburden. Any rock that travels more than 5 feet from the limits of blasts covered with mats is also considered flyrock.

Free Face – A rock surface exposed to air or water that provides room for expansion upon fragmentation.

Magazine – Any building, structure or container, approved for storage of explosive materials other than an explosive manufacturing building.

Misfire – An event where all or some charges in a blast fail (do not detonate) when initiated or a term for any portion of explosive materials that fail to detonate as planned.

Peak Particle Velocity (PPV) – The maximum ground vibration velocity measured in the vertical, longitudinal or transverse direction. PPV measurement units are expressed in inches or millimeters per second (in/sec or mm/sec).

Presplitting – A controlled blasting technique that results in continuous or semi-continuous fracture between blast holes.

Scaled Distance (Ds) – A calculated value in units of $\text{ft/lb}^{0.5}$ ($\text{m/kg}^{0.5}$) describing relative vibration energy based on distance to a structure (D) and charge per delay (W). Ds is equal to D divided by the square root of W, $D_s = D / W^{0.5}$ or $W = (D / D_s)^2$.

Spacing – The distance between blast holes in a row. In production blasting, the distance is measured parallel to the free face and perpendicular to the burden.

Stemming – Crushed stone placed in the unloaded collar area of blast holes for the purpose of confining explosive charges and limiting rock movement and air-overpressure.

Subdrilling – The portion of a blast hole that is drilled below or beyond the desired excavation depth or limit. Subdrilling is generally required to prevent the occurrence of high or tight areas of unfractured rock between blast holes.

Regulations

Comply with all the latest applicable Federal, State and local codes, laws, rules and regulations as well as professional society standards for the storage, transportation and use of explosives. These include but are not limited to the following:

- The Occupational Safety and Health (OSH) Act of 1970 and the Construction Safety Act (CSA) of 1969, as amended
- Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296; Interim Final Rule
- Title 29, U. S. Code, Section 651 et seq., including safety and health regulations for construction
- Title 27, Code of Federal Regulations (27 CFR), Part 555, U. S. Department of Justice, Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF)
- Organized Crime Control Act of 1970, Title XI, Public Law 91-452, as amended
- Title 49, Code of Federal Regulations (49 CFR), Parts 105-177 (DOT RSPA) & Parts 301-399 (DOT FHA)
- Title 29, Code of Federal Regulations (29 CFR), Parts 1910 & 1926, N. C. Department of Labor, Division of Occupational Safety and Health
- The Mining Act of 1971, North Carolina General Statute, Chapter 74, Article 7, as amended
- Fire Code of North Carolina, Section 105.6.15 Explosives
- Administrative Rules, 13 NCAC 06.0521 – 13 NCAC 06.0526, N. C. Department of Labor
- “A Guide to the Safe Storage of Explosive Materials” and “North Carolina Occupational Safety and Health Standards in Construction for Blasting & Use of Explosives”, N. C. Department of Labor

Keep a copy of all regulations listed above at the project site.

Non-regulatory Industry Support Organizations:

- Blast Monitoring Equipment Operation Standards (1999), Vibration Subcommittee of the International Society of Explosive Engineers (ISEE)

- Institute of Makers of Explosives (IME) Safety Library Publications (SLPs)

In case of conflict, the more stringent regulation applies.

Submittals

In lieu of a blasting plan in accordance with Article 107-11 of the *Standard Specifications*, the following submittals are required for rock blasting.

- Blasting Contractor Personnel and Experience including Blasting Consultant and Blasting Specialist and Blaster(s)-in-Charge
- General Blast Plan including Vibration Monitoring Consultant
- Pre-construction Condition Surveys
- Drill Logs, Individual Blast Plans and Post-blast Reports as defined in the Blasting Documentation System required for all blasting.
- Blast Damage Report, when necessary

For the Individual Blast Plans, drill logs and post-blast reports, submit two hard copies of each to the Resident Engineer. After completing all blasting for a cut, structure or an excavation, submit electronic copies in PDF format.

Allow 30 calendar days upon receipt by the Department for the review and acceptance of the Blasting Contractor and Support Personnel and Experience and General Blast Plan. Provide these submittals in both electronic and hard copy form in accordance with the following:

Submit one hard copy to the Resident Engineer. At the same time, submit a second hard copy and an electronic copy (PDF on CD or DVD) directly to the Geotechnical Engineering Unit at the following addresses:

Western Regional Geotechnical Manager
North Carolina Department of
Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

The Engineer may suspend blasting operations in accordance with Article 108-7 of the *Standard Specifications* if submittals are illegible, incomplete or not provided.

(A) Blasting Contractor and Support Personnel Experience

Obtain acceptance of the Blasting Contractor personnel and experience before submitting a General Blast Plan.

(1) Blasting Contractor

Use a Blasting Contractor prequalified by the NCDOT Contractual Services Unit for rock blasting work (work code 070). Submit documentation that the Blasting Contractor has successfully completed at least 5 blasting projects within the last 3 years with subsurface conditions and blasting of a scope and complexity similar to that anticipated for this project. Documentation should include the General Contractor and Owner's name, descriptions of each past project, and current contact information of a representative of the project owner or construction manager. Contact information shall include at least one valid phone number.

(2) Blaster-in-Charge

The Blaster-in-Charge has total authority over the handling, use and security of explosives and is responsible for coordinating, planning and supervising explosives use. The Blaster-in-Charge is also responsible for inspecting blast areas and completing check-list activities identified in the blast planning form included in the Blasting Documentation System. Either the Blaster-in-Charge or an alternate Blaster-in-Charge is required to be on-site during blasting. All acting Blasters-in-Charge must be preapproved by NCDOT.

Provide verification of employment with the Blasting Contractor for the Blaster-in-Charge and any alternate Blasters-in-Charge assigned to this project. Submit documentation that each Blaster-in-Charge has a minimum of 5 years experience in blasting with past projects of scope and complexity similar to that anticipated for this project. Documentation should include resumes, references, certifications, project lists, experience descriptions and details, etc. References shall include valid phone numbers for representative of the project owner or construction manager from at least three past projects involving similar close-in blasting. The submittal shall also include a signed statement from the proposed blaster certifying that during the prior five years they: 1) not been involved in flyrock incidents, 2) have not had a blasting license restricted or revoked in any State, and 3) they have not been fined or sanctioned in any way by a regulating authority. If there is a change in the Blaster-in-Charge, discontinue explosives use until qualifications of a new Blaster-in-Charge are submitted and accepted.

(3) Blasting Consultant

A Blasting Consultant is required. Employees of the Contractor, any affiliated companies or product suppliers are not allowed to be independent consultants. Use a Blasting Consultant prequalified by the NCDOT Contractual Services Unit for the rock blasting evaluation & design discipline.

(4) Blasting Specialist

The Contractor shall retain a Blasting Specialist with at least 5 years of direct blasting experience who can assist the blasters with all blasting documentation and submittals including drill logs, blast plans, blast reports, and vibration monitoring records. The blasting specialist must have proven computer skill to use Microsoft WORD®, EXCEL®, vibration reporting software, and other software as needed to prepare all documents and to submit them in PDF format for review by others as required. The Blasting Specialist shall also direct the video taping of blast and submittals in .mpg or better format.

(5) Pre-construction Condition Survey Specialist

The Contractor shall retain a third-party specialist with at least 5 years of experience in surveying structures at a minimum of five projects with similar complexity to the proposed work.

(6) Vibration Monitoring Specialist

The Contractor shall retain a third-party specialist with at least 5 years of experience in vibration monitoring on a minimum of 5 projects with similar complexity to the proposed work. The specialist shall have proven experience in performing PPV curve regression analysis.

(B) Blast Plans

Individual blast plans are required to be signed by the Blaster-in-Charge. The Blasting Consultant must author the General Blast Plan or provide a signed review letter indicating their approval of it. Review and acceptance of blast plans does not relieve the Contractor of responsibility for the blast results or liability in accordance with Articles 107-11 and 107-12 of the *Standard Specifications*.

(1) General Blast Plan

Submit a General Blast Plan before beginning drilling, when revised drilling or blasting methods are proposed or as directed by the Engineer. At a minimum, include the following in the plan:

- Work procedures and safety precautions for the storage, transportation, handling and detonation of explosives
- Explosive products and devices for dry and wet blast holes including explosives, primers and detonators with material safety data sheets
- Drilling equipment and methods for maintaining blast hole alignment
- Typical plan, profile and sectional views for both production and controlled blasting showing hole diameter, depth, inclination and spacing, maximum blast limits, burden, subdrill depth and method of determining maximum charge per delay
- Initiation and delay methods and delay times
- Sample blast monitoring report format and equipment including calibration information
- Blast Monitoring Consultant, if applicable
- Test blast locations when required
- Methods of placing dirt or mat cover where required

Do not deliver explosives to the project site until the General Blast Plan is reviewed and accepted.

(2) Individual Blast Plan

After the General Blast Plan is accepted, submit individual blast plans at least 24 hours in advance of each blast. In addition to information shown on the Blast Planning Forms, the following is required for each individual blast plan:

- Check list activities shall be dated and initialed by the blaster-in-charge and an accepted Contractor management person to assure they have been done.
- A plan sketch of the blast area showing hole locations, free faces and any observed joints, bedding planes, weathered zones, voids or other significant rock structure that may influence the blast. Also include hole-numbers corresponding to numbers used in drill logs and note burden and spacing dimensions.
- Typical diagrams showing charge configurations including the location and amount of each type of explosives, primers, detonators, top-stemming, column heights, inert stemming decks and subdrill.
- Calculations showing maximum charge per delay determinations based on scaled distance calculations to various structures, using appropriate PPV limits
- A delay and initiation diagram showing surface delay connections, in-hole delay times, and actual firing times of all charges.
- Predicted maximum vibration level at the most restrictive point of concern
- Description of methods that will be used to cover blasts
- Description of plans to notify residents of buildings located within 200 feet of blasts.
- Description of methods and trained personnel that will be deployed to block roadways during blasting

Drill Logs and Post Blast Reports shall be submitted within 24 hours after the time of blasting. Drill logs shall include all information shown on the forms and hole numbers shall consistent with numbers used in blast plan diagrams. Post Blast Reports shall contain all blast design information required in the blast plans and shall show as-built changes and a summary of vibration monitoring results.

(C) Blasting Documentation System for Individual Blasts

Blast planning forms, drill log forms, and post blast report forms included in the Blasting Documentation System, shall be used to document individual blasts. The Contractor may customize these forms to add more information for their own purposes. If the Contractor chooses to use their own forms, all of the information contained on forms in the Blasting Documentation System shall be included on the Contractor's forms. The Blasting Documentation System is available at the following web address:

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

(D) Pre-construction Condition Surveys

Conduct pre-construction condition surveys in accordance with the "Project Requirements" section of this provision and the accepted General Blast Plan. Text of reports shall be typed (or printed) and two copies shall be submitted.

At a minimum, reports shall include the following:

- Summary naming the person who performed the survey and comments about each structure and existing condition
- Sketches of interior and exterior walls and foundations with existing cracks and a written description of the cracks including the length, width, type and angle
- Reports shall include hard copy color photographs from a 5-megapixel or greater digital camera or 35-mm Kodak or Fuji Film, sized at least 4 x 6 inches, printed on Kodak or Fuji Film Paper in glossy format; or printed two-to-a-page on glossy photo-quality paper by a digital printer. Photos must be taken of all cracks and other damaged, weathered or otherwise deteriorated structural conditions. If necessary, macro lenses and flash illumination shall be used to ensure defects are shown clearly in the photographs. Photos shall contain an accurate date stamp. Submit two copies of CD or DVD format disks of digital pictures attached to the two submitted copies of written reports.
- A walk-through video-tape with audio commentary shall be done for each surveyed structure or improvement within the specified survey boundaries. Audio comments shall include name(s) of survey staff, property type, name of owner, date and time of survey, and comments about the condition of the observed structure. Video-audio tapes shall be made with digital quality camcorders and two copies shall be submitted in DVD format Disks attached to two submitted copies of written reports.

(E) Blast Videotaping

The Contractor shall set up a video camera to record all blasts in High Definition format. The camera shall be run remotely without an operator if located within 200 feet of the blast. A copy of the video file shall be submitted with final blast reports.

Blast Monitoring

At a minimum, monitor vibration and air-overpressure (noise) at a minimum of three locations. One instrument shall be located at the nearest occupied building. Two other instruments shall be located at other structures or utilities of concern. All instruments and their use shall fully conform to standards published by the Vibration Section of the International Society of Explosive Engineers (ISEE). All monitoring equipment shall be calibrated within one year of the date the data is collected. Interpret the recorded data and submit a blast monitoring report signed by the Vibration Monitoring Consultant with the post-blast report signed by the Blaster-In-Charge within 3 days after each blast or before the next blast, whichever is sooner.

Damage Notification

If damage occurs from blasting or if damage is alleged, notify the Engineer immediately. Submit a blast damage report signed by the Blaster-in-Charge (and Blast Monitoring Consultant, if applicable) with the post-blast report that includes the following:

- Property owner's (and injured person's, if any) names, addresses and telephone numbers

- Details and description of damage or alleged damage (and injury, if any) with photos or video
- Any associated tort claims, complaint letters and other applicable information

Blast Design Requirements

(A) Vibration and Air-overpressure Control

Design blasts for the vibration and air-overpressure (noise) warning levels and not-to-exceed limits in the “Project Requirements” section of this provision. If warning levels are exceeded, the Engineer may require additional monitoring and the Contractor should be aware that future blasts could exceed the not-to-exceed limits. If not-to-exceed limits are exceeded, the Engineer may suspend blasting operations in accordance with Article 108-7 of the *Standard Specifications* and require test blasts and a revised General Blast Plan.

Design and perform rock blasting to assure no excessive movement of rock or adjacent material occurs. If excessive movement of blasted rock or adjacent material occurs, the Engineer will suspend blasting operations in accordance with Article 108-7 of the *Standard Specifications* and require test blasts and a revised General Blast Plan.

(1) Peak Particle Velocity and Scaled Distance

Use the following formulas to predict peak particle velocity (PPV) and scaled distance (Ds).

$$PPV = K(Ds)^m \quad \text{and} \quad Ds = D / (W_{max})^{0.5}$$

where:

- PPV = Peak Particle Velocity (in/sec)
- K and m = Site specific constants defining initial energy and decay
- Ds = Scaled Distance (ft/lb^{0.5})
- D = Distance to subject structure (ft)
- W_{max} = Maximum charge per delay (lbs)

For the Highway 321 Widening Project in Blowing Rock, NC, a K-value of 70 and an m-value of -1.2 shall be used until regression curves, based on at least 30 data points covering scaled distances from 20 to over 100, are developed from actual site data. The K-value based on site data must be based on the 95% upper limit curve.

(B) Test and Production Blasts

Design production blasts in accordance with the following unless otherwise approved:

- Diameter of production blast holes may not exceed 3” (76 mm).
- Only fixed-cartridge explosives shall be used for this work and the diameter of explosives shall not exceed 2.0 inches (51 mm). No ANFO or flowable (pumped) bulk explosives shall be used.

- No dynamite or nitroglycerin-based explosives should be used.
- Subdrilling of blastholes beyond the desired lines of cut slopes shall not exceed 6 inches (15 cm).
- Only shock-tube or electronic initiation systems shall be used for this work. The use of electric detonators and cap-and-fuse is prohibited. Use delay blasting to detonate production blast holes towards a free face.
- Maximum burden of rock between all portions of charges and nearest rock surface shall be at least 25-charge-diameters. For example, for 2-inch-diameter charges, minimum confining burden is 50 inches (25 x 2) or 4.2 feet.
- All charges shall be stemmed with at least 25 charge-diameters of clean washed crushed stone sized from 3/8 to 1/2 inch.
- All blasts located within 500 feet of structures or power lines should be covered with blasting mats or 3 feet of dirt.
- Blast benches should be wetted with sprayed water to suppress dust on days when maximum forecasted wind speed is greater than 20 mph.
- The minimum scaled distance used to limit charge-per-delay shall be 80 for occupied residential and commercial structures; and 140 for historic structures.

(C) Controlled Blasts

(1) Presplitting

Presplitting is required for final cut slopes $\frac{3}{4}$:1 (H:V) or steeper. Design presplitting such that irregularities in the presplit rock face between holes does not exceed 1 ft (0.3 m) and in accordance with the following unless otherwise approved:

- Use presplit blast holes with a diameter of 2 to 3 inches (50 to 75 mm)
- Space presplit blast holes 10 times the hole diameter
- Minimize subdrilling between lifts to only the width of the horizontal offset between lifts
- Do not subdrill below final grade
- Extend presplit blast holes a minimum of 30 ft (9.1 m) beyond the limits of the production blasting or to the end of the cut section
- Bench height or lift thickness may not exceed 25 ft (7.6 m)
- Do not use ANFO or any other bulk loaded products
- Use cartridge explosives or other types of explosives specifically designed for presplitting
- The maximum charge diameter may not exceed one half the diameter of the presplit blast holes except for the charge in the bottom 2 ft (0.6 m) of the holes
- Presplitting may be performed with production blasting provided all presplit blast holes are fired at least 75 ms before the production blast holes and no more than 200 ms before adjacent blasthole

(2) Cushion Blasts

Cushion blasts refer to either trim or cushion blasting. Design cushion blasts in accordance with the following unless otherwise approved:

- Diameter of cushion blast holes may not exceed 3" (76 mm)
- Minimize subdrilling to only that required for excavation of the final cut slopes
- Do not subdrill below final grade
- Bench height or lift thickness may not exceed 25 ft (7.6 m)
- Use a maximum of half the charge density and burden of the production blast holes for the cushion blast holes
- Do not use bulk ANFO or any other bulk loaded products
- Fire cushion blast holes after production blast holes with a minimum 50 ms delay

(D) Trench Blasts

Design trench blasts in accordance with the following unless otherwise approved:

- Diameter of trench blast holes may not exceed 3" (75 mm)
- Do not use bulk ANFO or any other bulk loaded products
- Use cartridge explosives or other types of explosives specifically designed for trench blasting
- Use a charge diameter $\frac{1}{2}$ to $\frac{3}{4}$ inch (13 to 19 mm) less than the diameter of the trench blast holes

Test Blasts

A test blast is defined as drilling, blasting and excavation of a test section before beginning or restarting full scale blasting. When test blasts are required in the "Project Requirements" section of this provision or as directed by the Engineer, perform the required number of test blasts for both production and controlled blasting (presplitting, cushion or trim blasting) or trench blasting before beginning full scale blasting. Submit proposed test blast locations with the General Blast Plan. Also, if the Engineer suspends blasting operations after full scale blasting has begun, one or more test blasts may be required before resuming blasting. When this occurs, inform the Engineer of the test blast locations before submitting any Individual Blast Plans.

Perform test blasts in accordance with the submittal, blast design and construction requirements except submit an Individual Blast Plan for test blasts 72 hours before beginning drilling. Full scale blasting may not begin or resume until the test blasts are acceptable to the Engineer. The Engineer will not consider whether a test blast is acceptable until the rock face is exposed and the post-blast report is submitted. Examples of results that may be unacceptable include excessive vibration, air-overpressure or flyrock, overbreakage, damage to the final cut slope face and overhangs.

Blasting Methods and Activities

Before beginning drilling, conduct a pre-blast kick-off meeting to discuss the blasting and monitoring. Schedule this meeting after the General Blast Plan has been submitted and accepted.

The Resident Engineer, Roadway Construction Engineer, Geotechnical Operations Engineer, Contractor and Blaster-in-Charge, Blasting Consultant, Blasting Specialist and Vibration Monitoring Consultant will attend this pre-blast meeting.

Drill and blast in accordance with Individual Blast Plans, the general blast plan, and this provision as directed by the Engineer. Use explosives in accordance with all applicable government regulations, professional society standards and manufacturer guidelines and recommendations.

Remove all overburden material along the top of the excavation for a minimum of 30 ft (9.1 m) beyond the blast holes or the end of the cut unless otherwise approved. Inspect all rock surfaces to identify free faces and weaknesses for the purpose of appropriately locating blast holes so charges are adequately confined.

Drill blast holes within 3" (75 mm) of planned location and control drilling to maintain the final cut slope angles and to assure sub-drilling does not exceed specified amounts in shallow rock slopes. Accurately determine the angle at which the drill steel enters the rock. Alignment is crucial for presplit holes (if used). Drilling will not be permitted if the alignment of presplit holes can not be verified during drilling to the satisfaction of the Engineer. Deviations in presplit holes from the required alignment by more than 6" (150 mm) either parallel or normal to the cut slope are not allowed.

Cover or plug all blast holes after drilling to prevent unwanted backfill and identify and mark each hole with hole number and depth. Blast holes are required to be free of obstructions the entire depth. Load holes without dislodging material or caving in the blasthole wall.

Notify all occupants of residences, businesses and structures in the surrounding area and the Engineer at least 24 hours before blasting. Check for misfires immediately after each blast before signaling all clear. Remove any loose, hanging or potentially dangerous conditions by hand or machine scaling methods. Resume drilling only after scaling is complete.

When the height of a cut requires multiple lifts or benches, offset the controlled blast holes for each subsequent lift the minimum distance necessary to allow for drill equipment clearances. Adjust the alignment of controlled blast holes to account for this offset as well as any drift that occurred in the preceding lift.

The Engineer may suspend blasting operations in accordance with Article 108-7 of the *Standard Specifications* when vibration, air-overpressure or flyrock limits are exceeded, unsatisfactory rock cut slopes are produced or other reasons.

Remove all loose material from final rock faces by scaling. The Contractor is responsible for the final rock face. If blasting damages the final rock face, stabilize the slope at no additional cost to the Department with a method proposed by the Contractor and accepted by the Department.

Secondary Blasting

Secondary blasting is used to reduce the size of naturally occurring boulders or those resulting from initial blasting. Secondary blasting methods include block holing or boulder busting. Block holing or boulder busting is the breaking of boulders by loading and firing small explosive charges in small diameter blast holes. Submit a combined general and site specific blast plan for secondary blasting.

Mud capping, which is defined as placing an unconfined explosive charge in contact with a rock surface without the use of a blast hole and covering it with mud, is not allowed.

All blast covering requirements and monitoring requirements specified for test and production blasts shall be applied for secondary blasting.

Blasting Adjacent to Highway Structures

Do not blast adjacent to highway structures until the concrete strength reaches 2400 psi (16.5 MPa). When blasting adjacent to highway structures, limit PPV to 4 in/sec (100 mm/sec) measured at a location on the structure nearest the blast. Perform blasting adjacent to highway structures in accordance with the submittal, blast design and construction requirements in this provision.

When blasting for foundation excavation, submit a combined general and site specific blast plan.

Measurement and Payment

Pre-splitting of Rock will be measured and paid for in square yards (meters). Presplitting will be measured along the presplit rock face from the toe of the slope to the crest of the presplit line. No payment will be made for unsatisfactory presplitting as determined by the Engineer.

No direct payment for rock blasting or scaling will be made. The contract unit price for *Unclassified Excavation* in accordance with Article 225-7 of the *Standard Specifications* or the lump sum price for *Grading* in accordance with Article 226-3 of the *Standard Specifications* will be full compensation for all necessary rock blasting and scaling in accordance with the contract.

No direct payment for rock blasting will be made for any pipe, utility or foundation excavation. Rock blasting for these items will be considered incidental to the compensation for the required excavation at the various locations. Where no direct payment for excavation is made, the cost for all rock blasting will be considered incidental to the required work and no separate payment for blasting will be made.

No additional payment will be made or extension of contract time allowed when the Engineer suspends blasting operations and requires test blasts, additional monitoring or submittals in accordance with this provision.

Payment will be made under:

Pay Item	Pay Unit
Pre-splitting of Rock	Square Yard (Meter)

TOE BENCHING EXCAVATION

(SPECIAL)

1.0 DESCRIPTION

Excavate material necessary for the formation of benches and shear keys in the existing ground beneath proposed Rock Buttress Toe embankments in order to increase the bond between the existing ground and the proposed embankment.

2.0 CONSTRUCTION METHODS

When steepened rock embankment toes are to be placed and compacted on hillsides, or when new embankments are to be compacted against existing embankment, or when embankment is built in part widths, or at other locations designated by the Engineer, excavate benches in the existing ground in accordance with the detail shown on the plans and as directed by the Engineer.

3.0 METHOD OF MEASUREMENT

The quantity of excavation to be paid for will be the actual number of cubic yards of materials, measured in their original position and computed by the average end area method, which have been acceptably excavated in accordance with the plans and specifications or as directed by the Engineer. Original cross-sections for the determination of excavation quantities will be taken before any grading begins. Final cross-sections will be the sections required by the plans or directed by the Engineer.

The upper bound of the benching excavation is the point at which the 5' by 5' typical benches as shown on the plans intersect the existing ground line.

No measurement will be made of any materials excavated outside of authorized excavation limits, or of any materials excavated before stakes have been set.

4.0 BASIS OF PAYMENT

The quantity of excavation, measured as provided for above, will be paid for at the contract unit price per cubic yard for "Toe Benching Excavation". The above prices and payments will be full compensation for all work covered by this section, including but not

limited to excavation, blasting, and hauling; disposal of materials; removal and disposal of stumps and the formation and compaction of embankments.

Payment will be made under:

Toe Benching Excavation.....Cubic Yard

TENSIONED ROCK BOLT

(SPECIAL)

1.0 DESCRIPTION

This work consists of furnishing, drilling, installing, and testing, grouted rock bolts and accessories at the locations and in the patterns shown on the plans or as directed by the Engineer.

MATERIALS

Provide Type 3 Manufacturer’s Certifications in accordance with Article 106-3 of the *Standard Specifications* for all rock bolt materials. Store steel materials on blocking a minimum of 12” (300 mm) 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 steel materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Galvanize all accessories including plates, washers, wedges, clips, clamps, wires, rings and all incidentals necessary for installation, to the requirements of ASTM A-153-80.

Rock Bolt Bars.

Rock bolt bars shall be straight shaft, deformed, solid, continuous thread bar, new, and undamaged. Rock bolt bars shall be ASTM A722 Grade 150 steel and shall have a minimum diameter of 1.25 inches.

Anchorage Assembly, Couplers, Covers and Centralizers.

The anchorage, couplers and bearing plate shall be capable of developing a minimum of 100 percent of the guaranteed minimum ultimate tensile strength of the steel rock bolt bar.

Surface Bearing Plates.

Surface bearing plates shall be fabricated from Grade 50 steel and shall have a minimum size of 7 X 7 X 1.25 in (177.8 X 177.8 X 38.1 mm).

Beveled Washers, Flat Washers and Wedges.

Beveled washers, hardened flat washers, and wedges for the anchorage shall be designed to preclude premature failure of the pre-stressing steel due to notch or pinching effects.

Heavy 2H Spherical Hex Nuts.

Heavy 2H spherical hex nuts shall be constructed for threaded engagement with the outer end of the rock bolt bar. The nut should be heavy duty type with round head, conforming to ASTM A-325.

Centralizer.

Fabricate centralizers from schedule 40 polyvinyl chloride (PVC) plastic pipe or tube, steel or other material not detrimental to steel bars (no wood). Size centralizers to position the bar within 1/2 inch (12.5 mm) of the drill hole center and allow a tremie to be inserted to the bottom of the hole. Use centralizers that do not interfere with grout placement or flow around bars.

Coupler Protection.

The coupler and any exposed bar section next to it shall be covered with a corrosion proof compound or wax impregnated cloth tape. The coupler area shall be covered by a smooth plastic tube complying with the requirements set forth in section addressing sheathing, overlapping the adjacent sheathed bar by at least 1 in (25 mm). The two joints shall be sealed each by a coated heat shrink sleeve of at least 6 in (150 mm) length, or approved equal. The corrosion proof compound shall completely fill the space inside the cover tube.

Cement Grout.

For grout, See the Grout for Rock Bolts Project Special Provision.

Sheathing.

Sheathing used over the rock bolt bar in the unbonded (free stressing) zone shall be made of material with the following properties: resistant to chemical attack from aggressive environments, grout or corrosion inhibiting compounds; resistant to aging by ultra-violet light; non-detrimental to the rock bolt bar and capable of withstanding abrasion, impact and bending during handling and installation. The minimum wall thickness for the sheathing shall be 0.060 in (1.5 mm) for polyethylene or polypropylene, 0.040 in (1.0 mm) for PVC tubing and 0.20 in (5.0 mm) for steel tubing or pipe. The sheathing shall permit the unobstructed elongation of the unbonded length during stressing.

3.0 CONSTRUCTION METHOD**Contractor Qualifications**

The work defined in this section is specialty construction requiring a Contractor who is highly knowledgeable and experienced in the installation of rock bolts. The Contractor performing the work in this section shall submit proof of five projects within five years

on which the Contractor has successfully installed rock bolts of similar types and capacities required for this project. A brief description of each project with the owner's name and current phone number shall be included.

Design Load, Tolerance and Construction Criteria.

Design Load

The design load for the **TENSIONED ROCK BOLTS** is **75 kips**.

The minimum hole diameter and minimum rock socket will be as shown on plans or as directed by the Engineer. A minimum of 1.0 in (25.4 mm) of grout cover is required around the rock bolt bar within the bonded zone.

The unbonded length shall be as directed by the Engineer or as shown on the plans.

Centralizers will be located as shown on the plan sheet or as directed by the Engineer.

Drilling

Rotary percussion equipment shall be used to drill the holes. The minimum drill hole diameter is shown on the plan sheets. The drill hole must extend 12 in (300 mm) below the design depth of the rock bolt bar. Care shall be taken to insure an accurate and straight hole. Drilled holes shall be cleaned of all drill cuttings, sludge and debris before the rock bolt bar is inserted into the hole.

Installation

As a minimum, the bottom of the rock bolt bar shall be positioned 12 in (300 mm) above the bottom of the drilled hole.

The threaded outer end of the rock bolt bar shall extend the minimum length beyond the anchorage that will be capable of accepting the proof test and lift off equipment. The anchorage nut shall be tightened using an approved post tensioning hydraulic jack, which permits tightening of the nut during tensioning.

All equipment used for placing shall be such that it will not damage the rock bolt or its accessories.

For tensioned bolts, chipping out the rock may be required to provide a level surface for the bearing plate. Facing bits may also be used for this purpose.

No couplers will be allowed in the bonded zone.

Grouting

Use grout meeting or exceeding the criteria defined in the Grout for Rock Bolts Project Special Provision. Produce cylinders or grout cubes at such frequencies as determined by

the Engineer and conduct testing in accordance with Section 1054-6 of the Standard Specifications.

Remove oil, rust inhibitors, residual drilling fluids and similar foreign materials from holding tanks/hoppers, stirring devices, pumps, lines, grout tubes and all other equipment in contact with grout before use. All surplus water and diluted grout shall be flushed or blown from all lines before commencing injections. The grout line shall be attached to the grout injection tube with suitable fittings such that leakage is entirely prevented.

Grouting of the annular space around the rock bolt shall be accomplished by pressure grouting with a grout pump, capable of providing a minimum of 90 psi (620 kPa) capacity at the grouting location. Mixers and pumps shall have adequate capacity and hoses shall be sized to allow continuous grouting of an individual bolt within one hour or less.

The grout shall be injected at a pressure, which is sufficient to overcome hydrostatic head. Dewatering or pre-grouting may be required for proper grouting of the rock bolt in groundwater or poor rock conditions. Fill drill holes progressively from the bottom to top and withdraw grout tube at a slow even rate as the hole is filled to prevent voids in the grout. Extend grout tube into grout a minimum of 5 ft (1.5 m) at all times except when grout is initially placed in a drill hole.

Provide grout free of segregation, intrusions, contamination, structural damage or inadequate consolidation (honeycombing). Cold joints in grout are not allowed in bonded zone.

Proof Tests, Acceptance Criteria and Lock Off Procedures.

Each production rock bolt shall be proof tested in accordance with the requirements of this specification. Testing of the rock bolts shall not be performed until the rock bolt grout has attained at least 100 percent of the minimum required compressive strength. Rock bolts which do not meet the proof test criteria contained herein shall be rejected and a replacement rock bolt shall be installed.

The testing equipment shall be capable of stressing the rock bolt to the maximum specified test load within the rated capacity. The pump shall be capable of applying each load increment in less than 60 seconds. The equipment shall permit the rock bolt to be stressed in increments so that the load can be raised or lowered in accordance with the test specifications. Stressing equipment shall have been calibrated within an accuracy of $\pm 2\%$ within 60 days prior to use. The calibration certificate and graph shall be available on site at all times. The calibration shall be traceable to the National Institute of Standards and Technology (NIST). The production gauge shall have graduations not larger than 100 psi (690 kPa). One certified dial gauge, traceable to the National Institute of Standards and Technology (NIST), shall be used which permit the measurement of total movement at every load increment to be read to the nearest 0.001 in (0.025 mm). The dial gauge shall have sufficient travel to record the total rock bolt movement at the maximum test load without the need to reset at an interim point.

Testing Equipment Setup

Prior to setting the dial gauge, the alignment load shall be accurately placed on the rock bolt. The alignment load shall be 10% percent of the design load (75 kips). The dial gauge shall bear on the pulling head of the jack and the stems shall be in alignment with the rock bolt direction. The dial gauge shall be supported on an independent fixed frame, such as a tripod, which will not move as a result of stressing or other construction activities during the test.

Testing Schedule.

Proof tests shall be performed by incrementally loading the rock bolt to 133 percent of the design test load (DTL). The rock bolt movement at each load shall be measured and recorded by the Installer and/or the Inspector. At load increments other than the maximum test load, the load shall be held long enough to obtain a stable reading. Incremental loading for proof tests shall be in accordance with the following schedule:

AL
 0.25 DTL
 0.50 DTL
 0.75 DTL
 1.00 DTL
 1.20 DTL
 1.33 DTL
 AL

Lock-off

All load increments shall be maintained within 5 percent of the intended load. Depending on performance, either 10 minute or 60 minute creep tests shall be performed at the maximum test load (1.33 DTL). The creep period shall start as soon as the maximum test load is applied and rock bolt movement shall be measured and recorded at 1, 2, 3, 4, 5, 6, and 10 minutes. Where the rock bolt movement between 1 and 10 minutes exceeds 0.040 in (1.00 mm), the maximum test load shall be maintained an additional 50 minutes and movements shall be recorded at 20, 30, 40, 50, and 60 minutes. Total creep movement must not exceed 0.080 in (2.0 mm) between the 6 and 60 minute readings.

Proof Test Acceptance Criteria.

Proof tests shall be considered acceptable when all of the following criteria is met.

A total creep movement of less than 0.04 in (1.00 mm) is observed between the 1 and 10 minute readings or a total creep movement of less than 0.08 in (2.00 mm) is observed between the 6 and 60 minute readings.

The creep rate is constant or decreasing throughout the creep test load hold period.

The total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the rock bolt unbonded length.

A pullout failure does not occur at the maximum test load. Pullout failure is defined as the load at which attempts to increase the test load simply result in continued pullout movement of the rock bolt. The pullout failure load shall be recorded as part of the test data.

Lock Off Procedures.

After completion and acceptance of the proof test, the rock bolt shall be locked off at the design load or at a load as directed by the Engineer.

Corrosion Protection.

All accessible rock bolt bars, plates, washers, wedges and nuts, shall be protected against corrosion in accordance with ASTM A780, Standard Practice for Repair of Damaged Hot-Dipped Galvanized Coatings, Annex A2. This includes a minimum of 12 inches (300 mm) behind the rock face. Thoroughly clean areas to produce a clean, bare and dry bright metal surface with a roughened profile. For bolts use a thorough wire brushing and SP1 cleaning as a minimum. Apply an approved organic zinc-rich repair painting containing 92 percent (min.) zinc by weight in the dry film, according to the manufacturer's recommendations, in two to four coats. Paints shall be approved and may be a liquid and brushed on or an aerosol and sprayed, whichever is appropriate to achieve and aesthetic finish as long as cure is achieved.

Submittals.

The Contactor shall submit the rock bolt bonded length based on drill hole diameter for approval by the Engineer. The bonded length shall be sufficient to provide a capacity of 1.33 times the specified design load. Provide Type 3 Manufacturer's Certifications in accordance with Article 106-3 of the *Standard Specifications* for rock bolt materials.

Construction Records

Provide 2 original hard copies to the Inspector of rock bolt installation records including the following within 24 hours of completing each bolt:

- 1) Project description, county, NCDOT contract, TIP and WBS element number
- 2) Rock bolt locations, diameters, lengths and inclinations, bar types, sizes and grades, corrosion protection and temporary casing information.

- 3) Date and time rock bolts are placed, grout mixed and/or arrives on-site and grout placement begins and ends
- 4) Ground and surface water conditions and elevations, if applicable
- 5) Weather conditions including air temperature at time of grout placement
- 6) All other pertinent details related to rock bolt placement

4.0 METHOD OF MEASUREMENT

Rock bolts shall be measured by the linear foot (linear meter) to the nearest foot (0.3-meter) for the length of rock bolt bar installed. Only the embedded length of the installed rock bolt is measured for payment.

5.0 BASIS OF PAYMENT

The accepted quantity of rock bolts shall be paid for at the contract price per linear foot (linear meter) complete in place and passing the required proof test.

The unit price shall include all items for the anchor assembly, couplers, bearing plate, washers, wedges, hex nut, grout, drilling of the hole, installation, preparation of a bearing surface by chipping out the rock or using a facing bit, corrosion protection, and any other accessories or equipment required to install and test the rock bolts.

Drill holes which are found to be unsuitable for use due to undesirable conditions will be paid for at 25 percent of the contract price per linear foot (linear meter) of the rock bolts.

The quantities in the contract are approximate only. There will be no adjustment in the contract price for differences between the estimated and the actual quantities.

Such price and payment will be full compensation for furnishing all labor, materials, equipment, and supervision necessary for the actual installation of the rock bolts and the performance of pull out tests as specified by the Engineer.

Payment will be made under:

Tensioned Rock Bolt.....Linear Feet

GROUT FOR ROCK BOLTS

(SPECIAL)

1.0 Description

This special provision addresses grout for use in tensioned and untensioned rock bolts, dowels, or pins. If necessary, use set controlling admixtures. Proportion, mix and place grout in accordance with the plans, the applicable section of the *Standard Specifications* or special provision for the application and this provision.

2.0 Materials

Refer to Division 10 of the Standard Specifications:

Item	Article
Portland Cement	1024-1
Water	1024-4
Admixtures	1024-3

At the Contractor's option, use an approved packaged grout in lieu of the materials above with the exception of the water. Contact the Materials and Tests (M&T) Unit for a list of approved packaged grouts. Consult the manufacturer to determine if the packaged grout selected is suitable for the application and meets the compressive strength and shrinkage requirements.

3.0 Requirements

Unless required elsewhere in the Contract, provide non-metallic, non-shrink grout with minimum compressive strengths as follows:

Property	Requirement
Compressive Strength @ 3 days	3000 psi (20.6 MPa)
Compressive Strength @ 28 days	5000 psi (34.4 MPa)

When using approved packaged grout, a grout mix design submittal is not required. Submit grout mix designs in terms of saturated surface dry weights on M&T Form 312U in accordance with the applicable section of the Standard Specifications or special provision for the structure. Use an approved testing laboratory to determine the grout mix proportions. Adjust proportions to compensate for surface moisture contained in the aggregates at the time of mixing. Changes in the saturated surface dry mix proportions will not be permitted unless a revised grout mix design submittal is accepted.

For each grout mix design, provide laboratory test results for compressive strength, density, flow and if applicable, aggregate gradation and shrinkage. Submit compressive strength for at least 3 cube and 2 cylinder specimens at the age of 3, 7, 14 and 28 days for a total of at least 20 specimens tested. Perform laboratory tests in accordance with the following:

Property	Test Method
Compressive Strength	AASHTO T106 and T22
Density	AASHTO T133
Flow for Neat Cement Grout (no fine aggregate)	Marsh Funnel and Cup API RP 13B-1, Section 2.2
Shrinkage for Non-shrink Grout	ASTM C1090

When grout mix designs are submitted, the Engineer will review the mix designs and notify the Contractor as to their acceptability. Do not use grout mix designs until written acceptance has been received. Acceptance of grout mix designs or use of approved packaged grouts does not relieve the Contractor of responsibility to furnish a product that meets the Contract requirements.

Upon written request from the Contractor, a grout mix design accepted and used satisfactorily on a Department project may be accepted for use on other projects.

4.0 Sampling and Placement

The Engineer will determine the locations to sample grout and the number and type of samples collected for field and laboratory testing. Use API RP 13B-1 for field testing grout flow and density of neat cement grout. The compressive strength of the grout will be considered the average compressive strength test results of 3 cube or 2 cylinder specimens at 28 days.

Do not place grout if the grout temperature is less than 50°F (10°C) or more than 90°F (32°C) or if the air temperature measured at the location of the grouting operation in the shade away from artificial heat is below 40°F (4°C). It is the responsibility of the Contractor to protect the grouted components from freezing prior to reaching the minimum design strength.

Provide grout at a rate that permits proper handling, placing and finishing in accordance with the manufacturer's recommendations unless directed otherwise by the Engineer. Use grout free of any lumps and undispersed cement. Agitate grout continuously before placement.

Control grout delivery so the interval between placing batches in the same component does not exceed 20 minutes. Place grout before the time between adding the mixing water and placing the grout exceeds that in the table below.

ELAPSED TIME FOR PLACING GROUT (with continuous agitation)

Air or Grout Temperature Whichever is Higher	Maximum Elapsed Time	
	No Set Retarding Admixture Used	Set Retarding Admixture Used
90°F (32°C) or above	30 min.	1 hr. 15 min.
80°F (27°C) through 89°F (31°C)	45 min.	1 hr. 30 min.
79°F (26°C) or below	60 min.	1 hr. 45 min.

5.0 Miscellaneous

Comply with Articles 1000-9 through 1000-12 of the Standard Specifications to the extent applicable for grout in lieu of concrete.

ROCK ANCHOR AND MESH SLOPE STABILIZATION**(SPECIAL)****1.0 DESCRIPTION**

Install untensioned rock anchors for wire mesh and wire mesh in accordance with details shown on the plans, at locations determined by and as directed by the Engineer. The wire mesh is anchored to the slope with rock anchors along the top of the slope and is draped and anchored down the face so as to restrain and limit rockfall. The wire mesh is attached to the anchors using the manufactures approved methods or as directed by the Engineer.

2.0 MATERIALS

Furnish and install wire mesh as detailed in the plans and as directed by the Engineer. The mesh shall be woven construction and shall be diamond shaped. The mesh shall be made with 0.118 inch diameter wire and the ends of each wire formed into a loop and twisted. The loops of the wire mesh shall be fastened together to prevent unraveling of the mesh. The wire shall be galvanized high strength alloy steel wire with a minimum tensile strength of 256,000 pounds per square inch (or 1,770 kN per square meter). The mesh shall have a minimal longitudinal tensile strength of 10,200 pounds per foot (150 kN per meter) for the 0.118 inch (3-millimeter mesh).

The wire shall be hot dipped galvanized with Zinc/Aluminum and the minimum weight of the coating shall be 0.49 ounces per square foot. The coating shall be 95% Zinc and 5% Aluminum.

The mesh shall be 3 dimensional. The size of the mesh shall be approximately 3 inches by 5 inches and the depth shall be (0.6 inches) (+ 1 mm). The mesh shall have approximately 12 meshes per meter in the transverse direction and 7 meshes per meter in the longitudinal direction.

Use manufacturer's recommended mesh anchoring plates for attaching the slope to the slope. Use manufacturer's recommended method for attaching overlaps and performing field splices in the mesh material.

Secure the wire mesh rigidly with rock anchors as shown on the plans with a maximum of 10-foot center to center. Install each rock anchor such that a manufacturer approved anchor plate is placed on each anchor and is placed through the wire mesh to position the wire mesh between the rock and the steel plate. All rock anchors and must be a minimum of one inch in diameter deformed or continuously threaded Grade 150 ksi steel and meet the requirements of ASTM A615-80. Equip each anchor and bolt with plastic centering sleeves as shown on the plans to achieve concentric spacing of the entire anchor or bolt.

Galvanize bolts and all accessories including clips, clamps, wires, rings and all incidentals necessary for installation, to the requirements of ASTM A-153-80.

For grout, see the Grout for Rock Bolts Project Special Provision.

Each rock anchor must be a minimum of 12 feet long.

10% of the rock anchors will be pull-tested to 80 kips. The contractor shall use the requirements and specifications for jack calibration and certification as described in the Tensioned Rock Bolt Special Provision. The creep shall be measured as no more than 0.04” in 10 minutes. All testing will be considered incidental to this provision.

3.0 CONSTRUCTION METHOD

Drill and grout rock anchors as indicated on the plans or as directed by the Engineer. Attach the top of the wire mesh to the top row of anchors and secure with anchor plate. Cut and wrap the wire mesh such that the mesh is draped straight down the slope as the detail shown on the plans and that a minimum overlap of 12 inches is maintained between rolls. The wire mesh overlap is connected with locking clips on as prescribed by the manufacturer.

4.0 METHOD OF MEASUREMENT

The quantity of wire mesh to be paid for will be the number of square yards, measured along the surface over which mesh has been accepted and completed in place.

The quantity of rock anchors and bolts to be paid for will be the actual number of linear feet installed in the completed work. The anchor or bolt is measured from the lower end of the threaded bar to the surface of the rock.

5.0 BASIS OF PAYMENT

The quantity of wire mesh, measured as provided for above, will be paid for at the contract unit price per square yard for “Wire Mesh”. Such price and payment will be full compensation for all work covered by this provision, including but not limited to furnishing all wire mesh, ties, locking clips, clamps, rings, wire, cable; placing and securing the wire mesh, and for all incidentals necessary to complete the work satisfactorily.

The quantity of rock anchors, measured as provided for above, will be paid for at the contract unit price per linear foot for “Untensioned Rock Anchor for Wire Mesh”. Such price and payment will be full compensation for furnishing all labor, materials, equipment, and supervision necessary for the actual installation of the rock anchors and rock bolts and the performance of pull out tests as specified by the Engineer.

Payment will be made under:

Wire Mesh.....	Square Yard
Untensioned Rock Anchor for Wire Mesh.....	Linear Feet

WEEP HOLES

(SPECIAL)

1.0 GENERAL

Install weep holes as specified in these special provisions and as directed by the Engineer.

2.0 CONSTRUCTION

Install weep holes as shown on the plans. The locations of weep holes shown on the plans are approximate only and the exact location and sequence of placing weep holes is as directed by the Engineer.

Drill weep holes a minimum of 40 feet with equipment capable of drilling 2 to 3 inch diameter holes to designated lines and grades through rock formations to depths as shown on the plans.

3.0 METHOD OF MEASUREMENT

The quantity of weep holes to be paid for will be the actual linear feet of hole drilled. Measurement of horizontal drilling will be made by counting the number of drilling rod joints extended into the ground at each drill hole and multiplying by the length of the joint. Where the last joint extends partially into the ground, measurement will be made to the nearest foot. The length of the drilling bit used shall be measured to the nearest foot and be added to the length of drill rod to obtain the total quantity of drilling for each hole.

4.0 BASIS OF PAYMENT

The quantity of weep hole, measured as provided above, will be paid for at the contract unit price per linear foot for Weep Holes.

The above prices and payments will be considered full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in drilling the weep holes complete in place and accepted.

Payment will be made under:

Weep Holes.....Linear Feet

EMBANKMENTS WITH ROCK BUTTRESS TOE:

(SPECIAL)

Description

Construct embankments with rock buttress toe for fill slopes steeper than 2.0:1.0 in accordance with the contract at locations shown on the plans.

Materials

Refer to Division 10 of the *Standard Specifications*:

Item	Section
Select Material	1016
Filter Fabric for Rock Embankments	1056
Rip Rap, Class A	1042

Use Class VII Select Material for rock embankments. Class VII Select Material must be mechanically sorted to Specification. Use Rip Rap, Class A on top of rock embankments.

Construction Methods

Construct 2.0:1.0 embankments above in accordance with the slopes, dimensions and elevations shown on the plans and Section 235 of the *Standard Specifications*. Place and grade rock so smaller pieces are uniformly distributed throughout rock embankments. Provide a uniform surface free of obstructions, debris and groups of large rocks that could cause voids within embankments. When placing rock embankments in lifts, place core material to the top of the lift elevation before placing the next lift of rock embankment.

Place and compact a 1 ft. thick layer of Rip Rap, Class A on top of rock embankments. Install filter fabric on top of Rip Rap stone in accordance with Article 270-3 of the *Standard Specifications* before placing embankment fill material.

Measurement and Payment

Select Material, Class VII and *Rip Rap, Class A* will be measured and paid for in tons. Select material will be measured by weighing material in trucks in accordance with Article 106-7 of the *Standard Specifications*. The contract unit prices for *Select Material, Class VII* and *Rip Rap, Class A* will be full compensation for providing, hauling, handling, placing, compacting and maintaining select material.

Filter Fabric for Rock Embankments has to meet or exceed the parameters defined for Type II, Engineering Fabric as defined in Table 1056-1 of the *Standard Specifications*. Filter Fabric for Rock Embankments will be measured and paid for in square yards. Filter fabric will be measured along the top surface of the Rip Rap and no additional payment will be made for overlapping fabric. The contract unit price for *Filter Fabric for Rock Embankments* will be full compensation for supplying, transporting and installing filter fabric and wire staples.

Payment will be made under:

Pay Item	Pay Unit
Select Material, Class VII	Ton
Rip Rap, Class A	Ton
Filter Fabric for Rock Embankments	Square Yard

SELECT GRANULAR MATERIAL: (10-19-10)

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 III	1016

265-3 Construction Methods

Use select granular material over fabric for soil stabilization and 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, Class III* 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, Class III* will be made.

Select Granular Material, Class III 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, Class III* 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, Class III	Cubic Yard

WELDED STEEL PIPE:

10-20-09

SP3 R25

Revise the 2006 *Standard Specifications* as follows:

Page 3-11 and page 3-12, Article 330-4 Measurement and Payment, replace the phrase ___" *Welded Steel Pipe in Soil* with ___" *Welded Steel Pipe, ___"Thick, Grade ___ in Soil* in each place shown. Replace the phrase ___" *Welded Steel Pipe Not in Soil* with the phrase ___" *Welded Steel Pipe, ___" Thick Grade ___ Not in Soil* in each place shown.

Payment will be made under:

Pay Item	Pay Unit
___" Welded Steel Pipe, ___" Thick Grade ___ in Soil	Linear Foot
___" Welded Steel Pipe, ___" Thick Grade ___ Not in Soil	Linear Foot

FLOWABLE FILL:

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

SP3 R30

Description

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

Materials

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

Construction Methods

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

Measurement and Payment

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

Payment will be made under:

Pay Item Flowable Fill	Pay Unit Cubic Yard
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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
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:

$$\text{Pay Adjustment (per linear foot)} = [(APE - AAE) \pm 1 \text{ foot}] (0.15 \times \text{CUP})$$

Where: CUP = Contract Unit Price of Pipe Culvert

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

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

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

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

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

300-6 LAYING PIPE

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

(A) Rigid Pipe

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

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

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

For all pipes 42 inches in diameter and larger, wrap filter fabric around all pipe joints. 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 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

” HDPE PIPE LINER:

SPI 3-3

Description

Furnish, haul and install all pipe, fittings, couplings and other material; construct joint connections; and clean out the existing pipe for the HDPE Pipe Liner inside the existing corrugated steel pipe as shown in the plans.

Materials

Refer to Division 10:

Item	Section
High Density Polyethylene Pipe	Article 1044-7

Construction Methods

Install the pipe in accordance with Section 310 of the *Standard Specifications*.

Measurement and Payment

Pipe liner will be measured and paid for as the actual number of linear feet of pipe liner that has been incorporated into the completed and accepted work.

Measurement of pipe liner will be made by counting the number of joints used and multiplying the length of the joint to obtain the number of linear feet of pipe liner installed and accepted. Measurements of partial joints are made along the longest length of the partial joint to the nearest 0.1 of a foot.

Payment will be made under:

Pay Item	Pay Unit
___-inch High Density Polyethylene Pipe Liner	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 10-18-11)

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 D2041

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

- (i) Option 1

Insert the following immediately after the first paragraph:

- (ii) Option 2

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

Second paragraph, delete and replace with the following:

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

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

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

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

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

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

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

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

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

CONTROL LIMITS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Mix Type	Design ESALs Millions (a)	Binder PG Grade (b)	Compaction Levels No. Gyration @		Max. Rut Depth (mm)	Volumetric Properties (c)			
			N _{ini}	N _{des}		VMA % Min.	VTM %	VFA Min. - Max.	%G _{mm} @ N _{ini}
S-4.75A(e)	< 0.3	64 -22	6	50	-----	20.0	7.0 - 15.0	-----	-----
SF-9.5A	< 0.3	64 -22	6	50	11.5	16.0	3.0 - 5.0	70 - 80	≤ 91.5
S-9.5B	0.3 - 3	64 -22	7	65	9.5	15.5	3.0 - 5.0	65 - 80	≤ 90.5
S-9.5C	3 - 30	70 -22	7	75	6.5	15.5	3.0 - 5.0	65 - 78	≤ 90.5
S-9.5D	> 30	76 -22	8	100	4.5	15.5	3.0 - 5.0	65 - 78	≤ 90.0
S-12.5C	3 - 30	70 -22	7	75	6.5	14.5	3.0 - 5.0	65 - 78	≤ 90.5
S-12.5D	> 30	76 -22	8	100	4.5	14.5	3.0 - 5.0	65 - 78	≤ 90.0
I-19.0B	< 3	64 -22	7	65	-----	13.5	3.0 - 5.0	65 - 78	≤ 90.5
I-19.0C	3 - 30	64 -22	7	75	-----	13.5	3.0 - 5.0	65 - 78	≤ 90.0
I-19.0D	> 30	70 -22	8	100	-----	13.5	3.0 - 5.0	65 - 78	≤ 90.0
B-25.0B	< 3	64 -22	7	65	-----	12.5	3.0 - 5.0	65 - 78	≤ 90.5
B-25.0C	> 3	64 -22	7	75	-----	12.5	3.0 - 5.0	65 - 78	≤ 90.0

	Design Parameter	Design Criteria
All Mix Types	1. Dust to Binder Ratio ($P_{0.075}/P_{be}$)	0.6 – 1.4
	2. Retained Tensile Strength (TSR) (AASHTO T283 Modified)	85% Min. (d)

- Notes:
- (a) Based on 20 year design traffic.
 - (b) Volumetric Properties based on specimens compacted to N_{des} as modified by the Department.
 - (c) 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.
 - (d) Mix Design Criteria for Type S 4.75A may be modified subject to the approval of the Engineer.

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

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

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

- Note: (1) Category 1 RAP has been processed to a maximum size of 2 inches.
 (2) Category 2 RAP has been processed to a maximum size of one 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 one inch, fractionating the RAP into 2 or more sized stockpiles

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

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

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

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

Page 6-44, 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 6-45, 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 and US routes that have four or more lanes and median divided. Where required

above, utilize the MTV when placing all full width travel lanes and collector lanes. Use MTV for all ramps, loops, -Y- line travel lanes, full width acceleration and deceleration lanes, and full width turn lanes that are greater than 1,000 feet in length.

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:

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

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:

First Paragraph, delete and replace with the following:

Asphalt Binder for Plant Mix and Polymer Modified Asphalt Binder for Plant Mix will be measured and paid for as the theoretical number of tons required by the applicable job mix formula based on the actual number of tons of plant mix completed and accepted on the job.

Second paragraph, delete entire paragraph.

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.

Delete pay items and add the following pay items:

Pay Item	Pay Unit
Asphalt Binder for Plant Mix	Ton
Polymer Modified Asphalt Binder for Plant Mix	Ton

Page 6-55, Article 650-2 Materials, insert the following at the end of the list of items.

Reclaimed asphalt shingles 1012-1(F)

Page 6-57, Subarticle 650-3(B), Mix Design Criteria, insert the following as the fourth paragraph.

Reclaimed asphalt shingle (RAS) material may constitute up to 6% by weight of total mixture. The maximum percentage of binder contributed from reclaimed asphalt material will be 20% of the total binder in the completed mix.

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 and US routes that have four or more lanes and median divided. Where required above, utilize the MTV when placing all full width travel lanes and collector lanes. Use MTV for all ramps, loops, -Y- line travel lanes, full width acceleration and deceleration lanes, and full width turn lanes that are greater than 1,000 feet in length.

Page 6-61, Article 650-7 MEASUREMENT AND PAYMENT delete the second paragraph and replace with the following:

Furnishing asphalt binder for the mix will be paid for as provided in Article 620-4 for *Asphalt Binder for Plant Mix* or *Polymer Modified Asphalt Binder for Plant Mix*. Adjustments in contract unit price due to asphalt binder price fluctuations will be made in accordance with Article 620-4.

Page 6-64, Article 652-6 MEASUREMENT AND PAYMENT delete the second paragraph and replace with the following:

Asphalt Binder for Plant Mix will be paid for in accordance with Article 620-4.

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 POLYMER MODIFIED 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. The grade of asphalt binder to be paid for the production of Ultra-thin will be *Polymer Modified Asphalt Binder For Plant Mix*.

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)		
3/4 inch	19.0	100		
1/2 inch	12.5	85 - 100	100	
3/8 inch	9.5	60 - 80	85 - 100	100
#4	4.75	28 - 38	28 - 44	40 - 55
#8	2.36	19 - 32	17 - 34	22 - 32
#16	1.18	15 - 23	13 - 23	15 - 25
#30	0.600	10 - 18	8 - 18	10 - 18
#50	0.300	8 - 13	6 - 13	8 - 13
#100	0.150	6 - 10	4 - 10	6 - 10
#200	0.075	4.0 - 7.0	3.0 - 7.0	4.0 - 7.0

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 6-83, Article 661-4, MEASUREMENT AND PAYMENT delete third paragraph and replace with the following:

Polymer Modified Asphalt Binder For Plant Mix will be paid for in accordance with Article 620-4. Asphalt binder price adjustments when applicable will be based on Grade PG 64-22, regardless of the grade used.

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), delete and replace with the following:

(F) Reclaimed Asphalt Shingles (RAS)

For use in asphalt mix, Reclaimed Asphalt Shingles (RAS) can be either manufacturer- waste shingles or post-consumer shingles that have been processed into a product that meets the requirements of this section.

Manufacturer-waste RAS (MRAS) are processed shingle materials discarded from the manufacturing of new asphalt shingles. It may include asphalt shingles or shingle tabs that have been rejected by the shingle manufacturer.

Post-consumer RAS (PRAS) are processed shingle materials recovered from mixed roofing material scrap removed from existing structures. Tear-off shingle scrap must be sorted and other roofing debris, including nails, plastic, metal, wood, coal tar epoxy, rubber materials, or other undesirable components, shall be removed. This sorting of the scrap must be done prior to grinding of the PRAS for use in asphalt production.

Sample and test PRAS for asbestos and provide results demonstrating that the bulk samples contain less than one percent of asbestos containing material in accordance with Federal, State of North Carolina, and Local regulations. Use NC-accredited Asbestos Inspectors or Roofing Supervisors to sample the PRAS to meet the above criteria. Maintain records on-site indicating shingle source(s), asbestos operation plan approved by Division of Public Health's Health Hazards Control Unit, and all asbestos analytical reports. All documentation will be subject to review by the Department.

Process RAS by ambient grinding or granulating methods such that 100% of the particles will pass the 9.50 mm (3/8") sieve when tested in accordance with AASHTO T27. Perform sieve analysis on processed asphalt shingles prior to ignition or solvent extraction testing.

RAS shall contain no more than 0.5% by total cumulative weight of deleterious materials. These materials include, but are not limited to, excessive dirt, debris, concrete, metals, glass, paper, rubber, wood, plastic, soil, brick, tars, or other contaminating substances.

Blend RAS with fine aggregate or RAP, meeting the requirements of this Section, if needed to keep the processed material workable.

MRAS and PRAS shall not be blended together for the production of hot mix asphalt.

(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 meet the gradation requirements 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. Store RAS materials in such a manner as to prevent contamination.

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 BINDER AND GRADATION TOLERANCES (Apply Tolerances to Mix Design Data)	
P_b %	±2.5
<i>Sieve Size, mm</i>	<i>Tolerance</i>
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 subarticle 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		
	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

GEOTEXTILE FOR PAVEMENT STABILIZATION:**(10-19-10)****Description**

Furnish and install geotextile for pavement stabilization in accordance with the contract. Geotextile for pavement stabilization may be required to prevent longitudinal pavement cracks and provide separation between the subgrade and pavement structure at locations shown on 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 base course.

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.

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	0.10 sec ⁻¹
Apparent Opening Size ¹	D4751	#30
Ultraviolet Stability (retained strength) ²	D4355	70 %
Melting Point	D276	300 °F

¹US Sieve No. per AASHTO M92

²After 500 hours of exposure

Construction Methods

Construct embankments to subgrade elevation in accordance with the contract. The Engineer will determine if a geotextile for pavement stabilization is required at locations shown on the plans based on testing subgrade soils for quality. For subgrades that are not stabilized, allow 24 calendar days for the Engineer to determine if a geotextile for pavement stabilization is

required. When using geotextiles on stabilized subgrades, stabilize subgrade soils to 12" beyond the bottom of the base course as shown on the plans.

Place the geotextile for pavement stabilization on the subgrade immediately below the pavement structure as shown on the plans. Place geotextiles in slight tension free of kinks, folds, wrinkles or creases. Install geotextiles with the machine direction (MD) perpendicular to the roadway centerline. The MD is the direction of the length or long dimension of the roll. Do not splice or overlap geotextiles in the MD such that splices or overlaps are parallel to the roadway centerline. Extend geotextiles 12" beyond the bottom of the base course as shown on the plans.

Cover the entire subgrade at each location by placing geotextile rolls adjacent to each other in the cross-machine direction (CD), i.e., perpendicular to the MD. The CD is the direction of the width or short dimension of the roll. Overlapping adjacent geotextiles in the CD is permitted but not required. Overlap geotextiles in the direction that base courses will be placed to prevent lifting the edge of the top geotextile.

Do not damage the geotextile for pavement stabilization when constructing base courses. Place and compact base courses in accordance with the *Standard Specifications*. Do not operate heavy equipment on the geotextiles more than necessary to construct the pavement structure. Replace any damaged geotextiles to the satisfaction of the Engineer.

Measurement and Payment

Geotextile for Pavement Stabilization will be measured and paid for in square yards. Geotextiles will be measured along the top surface of the subgrade and no additional payment will be made for overlapping geotextiles. The contract unit price bid for *Geotextile for Pavement Stabilization* will be full compensation for supplying, transporting and installing geotextiles.

Payment will be made under:

Pay Item	Pay Unit
Geotextile for Pavement Stabilization	Square Yard

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) (Rev. 7-19-11)

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	4.4%
Asphalt Concrete Intermediate Course	Type I 19.0	4.8%
Asphalt Concrete Surface Course	Type S 4.75A	6.8%
Asphalt Concrete Surface Course	Type SF 9.5A	6.7%
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 **\$577.86** per ton.

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

MEDIAN CROSSOVER:

5-18-04

SPI (revised)

Description

The Contractor shall construct a median crossover at the location indicated on the plans, in accordance with the detail in the plans and as directed by the Engineer.

Materials

The sand shall meet the requirements of Section 1012(C)(2) of the *Standard Specifications*.

The #57 stone shall meet the requirements of Section 1005 of the *Standard Specifications*.

The paving blocks shall match as closely as possible the dimensions and pattern shown in the detail in the plans.

Fill the cores of the paving blocks with topsoil with a P.I. greater than 6 and less than 25 and with a pH ranging from 5.5 to 6.8.

Measurement and Payment

The quantity of median crossover to be paid for will be the actual number of square yards of median crossover which have been incorporated into the completed and accepted work.

The quantity of median crossover, measured as provided above, will be paid for at the contract unit price per square yard for *Median Crossover*. Such price and payment will be full compensation for all material, labor and incidentals to complete the work. No separate measurement and payment will be made for filling the paving block cores with topsoil and seeding as such work shall be incidental to the work of *Median Crossover*.

MASONRY DRAINAGE STRUCTURES:

(10-16-07)

SP8 R01

Revise the *2006 Standard Specifications* as follows:

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

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

BORROW EXCAVATION AND SHPO DOCUMENTATION FOR BORROW/WASTE

SITES:

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

SP8 R02

Revise the *2006 Standard Specifications* as follows:

Division 2 Earthwork

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

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

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

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

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

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

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

CONCRETE TRANSITIONAL SECTIONS FOR CATCH BASINS AND DROP INLETS:

(1-20-09)

SP8 R03

Revise the *Standard Specifications* as follows:

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

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

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

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

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

Payment will be made under:

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

Revise the *Roadway Standard Drawings* as follows:

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

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

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

SUBSURFACE DRAINAGE:

(7-20-10)

SP8 R05

Revise the *Standard Specifications* as follows:

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

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

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.

FRAME WITH GRATE (Driveway Drop Inlet):

(3-21-00) (Rev.7-18-06)

SPI 8-35

Description

Provide grates for driveway drop inlets that are fabricated steel or cast iron. Provide grates that are of a design and weight that is recommended by the manufacturer as being adequate for HS-20 loadings. Furnish a manufacturer's certification stating that the grates and frame furnished on the project have been designed and manufactured to be adequate for an HS-20 loading. Provide grates with a minimum clear waterway opening of 50 in² per 1'-0" length of grate.

If the frame and grate is made from fabricated steel, the requirements of Article 1074-9 of the *2006 Standard Specifications* will be applicable. If the grate and frame is made from iron castings, the requirements of Article 1074-7 of the *2006 Standard Specifications* will be applicable.

Measurement and Payment

Frame with Grate, Driveway Drop Inlet will be measured and paid for as the actual number of linear feet that have been incorporated into the completed and accepted work. Such price and payment will be full compensation for furnishing the grates and frame, and all labor and incidentals necessary to complete the work.

Payment will be made under:

Pay Item

Frame with Grate, Driveway Drop Inlet

Pay Unit

Linear Foot

WEATHERING STEEL BEAM GUARDRAIL (Painted Lap):

12-18-09

SPI 8-33

Description

Install steel beam guardrail (weathering steel) at locations shown on the plans in accordance with Section 862 of the *Standard Specifications*.

Materials

Guardrail posts shall be galvanized steel painted in accordance with the provisions shown elsewhere in this contract. At the Contractor's option and at no additional expense to the Department, treated timber posts will be allowed in lieu of painted steel posts.

Material used in the steel beam guardrail shall meet the corrosion requirements of Unpainted Structural Steel ASTM A242 and the rail and terminal sections shall meet the requirements of AASHTO M180.

Submit Type 1 Certified Mill Test Report in accordance with Section 106-3 of the *Standard Specifications*. The Engineer reserves the right to sample the materials.

Construction Methods

Install guardrail with a uniform color appearance on the outside surfaces on the roadway face of the guardrail. A brush-off blast cleaning or brushing in the field may be required after erection, if weathering of the sections has not been consistent.

Use reflectorized washers on curve areas where nighttime visibility is required.

At locations where the guardrail is lapped, the ends of both sections to be lapped shall be coated in accordance with Section 442 of the *Standard Specifications* for Paint System 4. The coated back on the end of one rail shall be placed over the end with a coated front on the adjacent rail. Only the side of the rail that is in contact with the adjacent rail shall be coated and each rail shall be coated for the entire length of the lap.

Measurement and Payment

Weathering Steel Beam Guardrail with Painted Laps will be measured and paid for in linear feet of guardrail that has been satisfactorily completed and accepted exclusive of that length of guardrail that is within the pay limits of guardrail anchors. Measurement will be made from center to center of the outermost post in the length of guardrail being measured.

Weathering Steel Beam Guardrail with Painted Laps, Shop Curved will be measured and paid for in linear feet of guardrail that has been satisfactorily completed and accepted exclusive of that length of guardrail that is within the pay limits of guardrail anchors. Measurement will be made from center to center of the outermost post in the length of guardrail being measured.

Such price and payment will be full compensation for all work covered by this provision including but not limited to furnishing and erecting painted posts (or optional treated timber posts), offset blocks, rail, miscellaneous hardware, painting of laps and all other materials and all incidentals necessary to complete the work satisfactorily.

Payment will be made under:

Pay Item	Pay Unit
Weathering Steel Beam Guardrail with Painted Laps	Linear Foot
Weathering Steel Beam Guardrail with Painted Laps, Shop Curved	Linear Foot

GUARDRAIL WITH EXTRA LENGTH POSTS:

Description

The Contractor shall install weathering steel beam guardrail with extra length guardrail posts at the locations indicated in the plans and as directed by the Engineer.

Materials

Refer to Division 10 in the *Standard Specifications*:

Item	Section
Guardrail Steel Post (8')	1046-3
Guardrail Steel Post (9')	1046-3

Paint extra length guardrail posts in accordance with the Project Special Provision entitled **PAINTED GALVANIZED GUARDRAIL ANCHOR UNITS AND POSTS** elsewhere in the Contract documents.

Weathering steel beam guardrail with painted laps shall be in accordance with the Project Special Provision entitled **WEATHERING STEEL BEAM GUARDRAIL (Painted Lap)** elsewhere in the Contract documents.

Construction Methods

Extra length guardrail posts shall be installed in accordance with Section 862 of the *Standard Specifications* and the *Roadway Standard Drawings*.

Measurement and Payment

Weathering Steel Beam Guardrail with Painted Laps (__ ' Post) and *Weathering Steel Beam Guardrail with Painted Laps, Shop Curved* (__ ' Post) will be measured and paid for in linear feet of guardrail that has been satisfactorily completed and accepted exclusive of that length of guardrail that is within the pay limits of guardrail anchors. Measurement will be made from center to center of the outermost post in the length of guardrail being measured.

Payment will be made under:

Pay Item	Pay Unit
Weathering Steel Beam Guardrail with Painted Laps (___' Post)	Linear Foot
Weathering Steel Beam Guardrail with Painted Laps, Shop Curved (___' Post)	Linear Foot

PAINTED GALVANIZED GUARDRAIL ANCHOR UNITS AND POSTS:

Description

Install painted galvanized guardrail anchor units at locations shown on the plans.

Materials

Material	Section
Galvanizing	1076
Reflective sheeting	1088-3

Guardrail materials shall meet the requirements of Section 1046 of the 2006 *Standard Specifications* except that guardrail materials shall not be water quenched or treated with chromate conversion coatings.

For painted Guardrail Anchor Units, Type 350, the Contractor may at his option, furnish any one of the following 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 the following 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 *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 *Standard Specifications*.

No modifications shall be made to the guardrail anchor unit without the express written permission from the manufacturer.

Painting shall be performed in accordance with the requirements of Section 1080 and Section 442 of the *2006 Standard Specifications* using System 4 as modified herein.

**System 4 (Modified)
Acrylic Primer and Top Coats**

Coat	Material	Mils Dry/Wet Film	Mils Dry/Wet Film
		Thickness Minimum	Thickness Maximum
Primer	1080-12 White	3.0 DFT	5.0 DFT
Stripe	1080-12 Brown	4.0 WFT	7.0 WFT
Topcoat	1080-12 Brown	2.0 DFT	4.0 DFT
Total		5.0 DFT	9.0 DFT

Construction Methods

- (A) *Preparation of anchor units, guardrail posts and hardware for painting:* Perform surface smoothing by removing or cleaning all zinc high spots, such as metal drip line, by hand or power tools in accordance with SSPC SP 2 or 3. Level zinc material flush with the surrounding plane without removing the base coating.

Abrasive sweep blasting shall be performed in accordance with Section 5.4.1 of ASTM D 6386. This section also provides a description of the abrasive blast material to be used. The material and technique used will provide a stripping action to remove corrosion products and to provide a rough surface profile while leaving base zinc layers intact.

All surfaces of the anchor units, posts and hardware shall be blown down with clean compressed air to provide a clean, dry surface for additional coating to be applied.

All surfaces shall be free of visible zinc oxides or zinc hydroxides.

- (B) (1) *Certification:* Only SSPC QP-3 certified contractor shall shop paint guardrail material.
- (2) *Shop Paint:* Galvanized guardrail anchor units, guardrail posts and hardware shall be shop painted within 8 hours after surface preparation with the following exceptions:
- (a) Paint bolt heads after installation.
 - (b) Do not paint impact head of end terminals.

(C) *Repair of Damaged Coating:*

Repair damage occurring to the galvanized portion of the coating during shipment or installation in accordance with Articles 1076-6 and 1080-9 of the *Standard Specifications*. Repair damage occurring to the painted portion of the coating during shipment or installation by applying 4.0-7.0 wet mils of topcoat with a brush or roller and feather or taper this to be level with the surrounding areas.

(D) *Anchor Unit Installation:* Install guardrail anchor units in accordance with Section 862, details in the plans, and details and assembling instructions furnished by the manufacturer. Guardrail end delineation shall be applied to the entire end section of all approach and trailing end sections.

(E) 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

Painted Galvanized Guardrail Anchor Units, Type ___ will be measured and paid for in accordance with the applicable requirements of Article 862-6 of the *Standard Specifications*.

Painted Additional Guardrail Posts will be measured and paid for in accordance with the applicable requirements of Article 862-6 of the *Standard Specifications*.

Such price and payment includes, but is not limited to furnishing and installing anchor units, furnishing and erecting extra length posts, offset blocks, miscellaneous hardware, and all other materials, excavation; furnishing and installing additional guardrail posts and additional offset blocks; backfilling; fabrication; welding; painting, galvanizing; furnishing and installing guardrail delineators and end delineation.

Payment will be made under:

Pay Item	Pay Unit
Painted Galvanized Guardrail Anchor Units, Type ___	Each
Painted Additional Guardrail Posts	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

RETAINING WALL ALUMINUM PICKET FENCE:

Description

Construct retaining wall aluminum picket fence that complies with the Plans and this provision.

Materials

See detail in the Plans for material requirements

Construction Methods

Construct the retaining wall aluminum picket fence in accordance with the detail in the Plans.

Measurement and Payment

Retaining Wall Aluminum Picket Fence will be measured and paid for per linear foot of fence that has been satisfactorily completed and accepted. Such price and payment shall be full compensation for all labor, materials and incidentals to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Retaining Wall Aluminum Picket Fence	Linear Foot

72" WOODEN FENCE:

Description

Construct 72" wooden fence that complies with the Plans and this provision.

Materials

See detail in the Plans for material requirements

Construction Methods

Construct the 72" wooden fence in accordance with the detail in the Plans and the applicable requirements Article 866-3 of the *Standard Specifications*.

Measurement and Payment

72" Wooden Fence will be measured and paid for per linear foot of fence that has been satisfactorily completed and accepted. Such price and payment shall be full compensation for all labor, materials and incidentals to complete the work.

Payment will be made under:

Pay Item	Pay Unit
72" Wooden Fence	Linear Foot

VINYL COATED CHAIN LINK FENCE, ___" FABRIC:
 (1-1-02) (Rev.7-18-06)

SPI 8-

Description

Construct vinyl coated chain link fence that complies with the plans and this provision.

Materials

Provide materials that meet the requirements of Article 1050-6 of the *Standard Specifications*.

Construction Methods

Construct the vinyl coated chain link fence in accordance with Article 866 of the *Standard Specifications*.

Measurement and Payment

Vinyl Coated Chain Link Fence, ___" Fabric will be measured and paid for in accordance with Article 866-4 of the *Standard Specifications*.

Payment will be made under:

Pay Item	Pay Unit
Vinyl Coated Chain Link Fence, ___" Fabric	Linear Foot

TREE PRESERVATION

Tree Preservation

The preservation of existing trees, shrubs and other vegetation where possible is an important aspect of this project and will require the utmost care during the construction process. The contractor will assist the department by educating its employees, subcontractors and any utility companies conducting work in the vicinity of the tree preservation, of the efforts and the preservation measures required herein. Tree Preservation Areas will be identified and located by the Engineer in the field and designated with Tree Protection Fence (See Special Provision).

General Requirements and Restrictions: All construction unless approved by the Engineer will occur outside the Tree Protection Fence (See Special Provision). *Do not trespass* with vehicles or machinery in the areas indicated for tree preservation. Do not park, refuel, repair or maintain vehicles or equipment in the tree preservation areas. Do not stockpile materials or store equipment in the tree preservation areas.

Do not release petroleum products, fuels, paints, or lubricants anywhere within this project in the vicinity of the tree preservation areas or in areas that drain into this vicinity. Do not apply or release herbicides, fertilizers or chemicals of any kind that may be toxic to plant life and do not 'clean out' concrete trucks in the vicinity of the tree preservation areas, or into areas that drain into this vicinity. Do not burn trash, debris or vegetation in the vicinity of tree preservation areas.

Demolition, ground disturbing activities or construction that occurs within the drip line of the tree(s) or within a radius three times the drip line of the tree(s) will be done with utmost care. All grading will be accomplished in such a manner to avoid standing water or saturated soils around root systems of trees that are to remain. Install erosion control devices in a timely manner to prevent sedimentation from accumulating around the root zone in the tree preservation areas and the surrounding vicinity. In areas to be 'cut' by grading or where utility trenches or footings occur, prevent shredding, tearing or exposing roots by excavating a trench not less than 6" wide and to the maximum depth of the cut up to 24" deep. Hand saw any roots 2" or greater in diameter that are encountered to make a clean smooth cut. If necessary, dig out enough soil to reach an undamaged portion of the root to make the smooth cut. To prevent drying out of roots, immediately cover any exposed root surfaces with 6" of approved mulch or soil until 'finish' construction operations dictate removal. Water as directed by the Engineer.

Branches that protrude into the construction area that interfere with construction operations will be tied back if possible or if not, pruned. Follow proper pruning techniques as established in American National Standards Institute ANSI Z133.1 and perform pruning by a professional arborist. Submit description of proposed work along with arborist credentials to the Engineer for approval prior to conducting work.

Violation of any of these tree preservation measures will result in suspension of all work until the violation is resolved or repaired to the satisfaction of the Engineer. Such suspension of work will not be considered justification for additional compensation in accordance with Section 104 of the Standard Specifications or extension of the contract time.

All measures described herein are incidental to the project construction and there will be no direct compensation.

TREE PROTECTION FENCE

General: "Tree Protection Fence" consists of furnishing, installing, maintaining, and removing wood or steel post, yellow poly-barricade fence fabric and signs at locations directed by the Engineer in the field and in accordance with the special provisions included herein. **Tree protection fence will be installed after the slope-stake line is staked and prior to all other work.**

Materials: Use *wood posts* that are nominal 4" x 4" (102 mm x 102 mm), length as required, structural light framing, grade No. 2, Southern Pine or *steel posts* that are a minimum of 1 3/8" (35 mm) wide measured parallel to the fence, with a weight of 1.25 lb./ft. (1.9 kg/m) of length. Post must have a means for retaining wire in desired position without displacement. Use of steel posts will be required in any area where the tree protection fence is in close proximity to the tree's trunk or any major roots.

Use neon lime/yellow polyethylene or polypropylene prefabricated safety/barricade type fence fabric that is a minimum of 48 inches (1220 mm) high and approved by the Engineer.

Treat wood posts if used, with a preservative in accordance with Section 1082-3 of the Standard Specifications.

Use a durable, weatherproof lightweight material to fabricate 'Tree Protection Area' signs. Signs will be a minimum of five square feet (0.46 square meter) and lettering will be a minimum of two inches (51 mm) tall and text will be clearly legible. Each sign will contain the following wording in both English and Spanish on the same sign:

**TREE PROTECTION AREA
DO NOT ENTER**

Use a red background with white lettering. **Submit sample sign to the Engineer for approval prior to installation.**

Installation: Erect fence to conform to the general contour of the ground. Do not remove existing plant material or perform any grading unless indicated on the plans or directed by the Engineer. Avoid soil compaction within tree protection area; do not use heavy equipment and stay outside the perimeter of the tree protection area where possible.

Install posts and maintain in a vertical position. Post may be hand set or set with a post driver. If hand set tamp backfill material thoroughly. Power driven wood posts may be sharpened to a dull point. Remove and replace posts damaged by power driving prior to final acceptance. At the direction of the Engineer use steel post instead of wood post when installing fence in close proximity to a tree's trunk or any major roots.

Stretch neon lime/yellow safety/barricade fence fabric taut and attach to post with appropriate means according to post type used. In sections where signs will be located, reinforce top of fabric by weaving a 12 gauge (2.68 mm) galvanized wire in the fabric and firmly attach to a post at each end of the section. Attach signs to fence fabric at all four corners. Locate signs every one hundred feet, at all corners, changes in direction and as directed by the Engineer.

Maintenance: Maintain tree protection fence with required signs in good condition, fully upright with no loose attachments or missing links for the duration of the project. Signs must be visible and legible throughout the duration of the contract. *The Engineer must approve in*

writing, prior to entering the tree protection area, access for the contractor and subcontractor for anything other than routine vegetation maintenance and liter pick-up. Approval must be made for each access occurrence.

Removal: As a last item of work after construction and all related work is complete, and at the direction of the Engineer, remove the tree protection fence, backfill post holes and remove, and properly dispose of fence materials off the construction site. While performing this work do not use heavy equipment and stay on the outside perimeter of the tree protection area where possible to avoid soil compaction within root zone.

Method of Measurement: Tree protection fence to be paid for will be the actual number of linear feet (meter) installed in place and accepted.

Basis of Payment: The quantity of tree protection fence will be paid for at the contract unit price per linear foot (meter). Such payment will be full compensation for the work as described above, including but not limited to furnishing, installing, maintaining and removing the tree protection fence and signs.

Payment will be made under

Tree Protection Fence.....LF

DETECTABLE WARNINGS FOR PROPOSED CURB RAMPS:

(6-15-10) (Rev 8-16-11)

SP8 R126

Description

Construct detectable warnings consisting of integrated raised truncated domes on proposed concrete curb 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 curb 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 Curb 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 curb 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 curb 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 C1028 (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 curb 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 curb ramps in accordance with the manufacturer's recommendations.

Measurement and Payment

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

CONCRETE SIDEWALKS, DRIVEWAYS AND CURB RAMPS:

(8-16-11)

SP8 R128

Revise the 2006 Standard Specifications as follows:

Page 8-35, Section 848 CONCRETE SIDEWALKS, DRIVEWAYS AND CURB RAMPS, replace “wheelchair” with “curb” throughout the section.

Page 8-35, Article 848-2 Materials, replace the last paragraph with the following:

Detectable warnings may be precast concrete blocks or other approved material. Construct detectable warning truncated domes in accordance with details and plans.

Page 8-36, Article 848-3 Construction Requirements, replace the last sentence of the last paragraph with the following:

The surface of the domes shall contrast visibly with adjoining surfaces, either light-on-dark or dark-on-light sequence, covering the entire ramp.

Page 8-36, Article 848-4 Measurement and Payment, replace the pay item “Concrete Wheelchair Ramps” with “Concrete Curb Ramps.” The pay item list will include the following:

Payment will be made under:

Pay Item	Pay Unit
Concrete Curb Ramps	Each

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.

SHIPPING SIGNS:

5-15-07

SP9 R03

Revise the *2006 Standard Specifications* as follows:

Page 9-2, Section 901-3(A), General, add the following as the 7th paragraph:

Ship all multi-panel signs to the project intact, completely assembled and ready to be hung. Fabricate signs taller than 12 ft as 2 separate signs with a horizontal splice, ready to be spliced and hung. No assembly other than a horizontal splice will be permitted.

GALVANIZED HIGH STRENGTH BOLTS, NUTS AND WASHERS:

(2-17-09) (Rev 5-17-11)

SP10 R02

Revise the *Standard Specifications* as follows:

Page 10-126, Subarticle 1072-7(F)(3) Change the AASHTO reference to ASTM B695 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 ASTM B695 Class 55.

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

The galvanizing shall meet ASTM B695 Class 55 for fasteners and ASTM A123 for other structural steel.

GALVANIZING:

(8-17-10)

SP10 R03

Revise the *Standard Specifications* as follows:

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

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

AGGREGATE PRODUCTION:

(11-20-01)

SP10 R05

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

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

CONCRETE BRICK AND BLOCK PRODUCTION:

(11-20-01)

SP10 R10

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

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

VOLUMETRIC CONCRETE BATCHING:

(5-18-10)

SP10 R13

Revise the 2006 *Standard Specifications* as follows:

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

1000-13 VOLUMETRIC MIXED CONCRETE

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

(A) Materials

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

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

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

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

(B) Equipment

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

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

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

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

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

(C) Proportioning Devices

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

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

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

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

(D) Calibration

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

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

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

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

(E) Verification of Yield

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

(F) Uniformity

When concrete is produced, have present during all batching operations a Certified Concrete Batch Technician. During batching and placement, the sole duty of this

employee is to supervise the production and control of the concrete, perform moisture tests, adjust mix proportions of aggregates for free moisture, complete and sign approved delivery tickets, and assure quality control of the batching.

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

PORTLAND CEMENT CONCRETE (Alkali-Silica Reaction):

(2-20-07)

SP10 R16

Revise the *2006 Standard Specifications* as follows:

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

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

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

Table 1024-1

Pozzolans for Use in Portland Cement Concrete

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

WATER FOR CONCRETE:

(10-19-10)

SP10 R17

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

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

1024-4 WATER

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

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

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

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

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

1026-4 WATER

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

CULVERT PIPE:

(1-19-10)

SP10 R32

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

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

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

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

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

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

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

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

- (A) Coatings for Steel Culvert Pipe or Pipe Arch

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

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

(B) Acceptance

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

Page 10-73, Article 1032-5, sixth paragraph, third sentence, remove the word "spelter"

Page 10-74, 1032-7 Vitrified Clay Culvert Pipe, delete section in its entirety.

Page 10-75, Article 1032-8 Welded Steel Pipe, change title to WELDED STEEL PIPE FOR DRAINAGE

Subarticle 1032-9(B) Plain Concrete Culvert Pipe, delete section in its entirety.

Page 10-77, Article 1032-10 Corrugated Polyethylene Culvert Pipe, change title to CORRUGATED POLYETHYLENE (HDPE) CULVERT PIPE

Add the following: Article 1032-11 Polyvinyl Chloride (PVC) Pipe

Polyvinyl Chloride pipe shall conform to AASHTO M 304 or ASTM 949. When rubber gaskets are to be installed in the pipe joint, the gasket shall be the sole element relied on to maintain a tight joint. Test pipe joints at the plant hydrostatically using test methods in ASTM D 3212. Soil tight joints shall be watertight to 13.8 kPa. Watertight joints shall be watertight to 34.5 kPa unless a higher pressure rating is specified in the plans.

GLASS BEADS:

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

SP10 R35

Revise the *2006 Standard Specifications* as follows:

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

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

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

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

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

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

ENGINEERING FABRICS:

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

SP10 R40

Revise the *Standard Specifications* as follows:

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

**SECTION 1056
ENGINEERING FABRICS**

1056-1 General

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

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

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

1056-2 Fabric Properties

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

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

**TABLE 1056-1
FABRIC PROPERTY REQUIREMENTS**

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

¹MARV does not apply to elongation

²Minimum roll width of 36" required

³Minimum roll width of 13 ft required

⁴US Sieve No. per AASHTO M92

⁵After 500 hours of exposure

PRECAST DRAINAGE STRUCTURES - MACRO-SYNTHETIC FIBERS

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

SP10 R42

Description

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

Materials

Item	Section
Portland Cement Concrete	1077-5

- (A) Substitute macro-synthetic fibers only for steel reinforcement with an area of steel of 0.12 in²/ft or less in the following items:
- (1) **Precast Drainage Structure** units in accordance with the requirements of *Standard Drawing 840.45*.
 - (2) **Precast Manhole 4.0' Riser Sections** in accordance with the requirements of *Standard Drawing 840.52*.

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

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

(C) **Macro-Synthetic Fibers**

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

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

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

(D) **Fiber Reinforced Concrete**

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

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

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

Measurement and Payment

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

QUALIFICATION OF WELDS AND PROCEDURES:

(7-21-09)

SP10 R43

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

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

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

PAINT SAMPLING AND TESTING:

(8-15-06)

SP10 R45

Revise the *2006 Standard Specifications* as follows:

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

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

PORTABLE CONCRETE BARRIER:

(2-20-07)

SP10 R50

The *2006 Standard Specifications* is revised as follows:

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

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

CHANNELIZING DEVICES (Drums):

7-20-10

SP10 R60

Revise the *2006 Standard Specifications* as follows:

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

(1) General

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

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

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

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

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

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

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

(3) Retroreflective Bands

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

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

(1) General

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

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

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

(3) Retroreflective Bands

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

TEMPORARY SHORING:

(2-20-07) (Rev. 9-25-07)

SP11 R02

Description

Design and construct temporary shoring in accordance with the contract. Temporary shoring includes standard shoring, temporary mechanically stabilized earth (MSE) walls and non-anchored temporary shoring. Trench boxes are not considered temporary shoring. "Standard shoring" refers to *standard temporary shoring* and *standard temporary MSE walls*. Notes on plans may restrict the use of one or both types of standard shoring. Notes on plans may also require or prohibit temporary MSE walls.

Unless noted otherwise on the plans, temporary shoring is required as shown on the plans and to maintain traffic. 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.

This provision is not applicable to anchored temporary shoring or the installation of pipes, drop inlets and utilities unless noted otherwise on the plans. Provide all shoring submittals before beginning work.

Materials**(A) Certifications, Storage and Handling**

Provide Type 7 Contractor's Certifications in accordance with Article 106-3 of the *Standard Specifications* for all shoring materials used with the exception of reinforcing fabrics and geogrids. Furnish Type 2 Typical Certified Mill Test Reports in accordance with Article 106-3 of the *Standard Specifications* for all seam strengths and reinforcing fabric and geogrid properties. Provide minimum average roll values (MARV) in accordance with ASTM D4759 for test reports. For testing reinforcing fabric and geogrids, a lot is defined as a single day's production.

Load, transport, unload and store shoring materials such that they are kept clean and free of damage. Identify, store and handle all geogrids and geotextile fabrics in accordance with ASTM D4873. Geogrids and fabrics with defects, flaws, deterioration or damage will be rejected. Do not leave fabrics or geogrids uncovered for more than 7 days.

(B) Shoring Backfill

Use shoring backfill for the construction of all temporary shoring including backfilling behind non-anchored temporary shoring and in the reinforced zone for temporary MSE walls. Unless backfilling around culverts, use shoring backfill that meets the requirements of Class II Type I, Class III, Class V or Class VI select material in accordance with Section 1016 of the *Standard Specifications* or AASHTO M145 for soil

classification A-2-4 with a maximum plasticity index (PI) of 6. For backfilling around culverts, use shoring backfill as defined herein except for A-2-4 soil.

(C) Non-anchored Temporary Shoring

Use steel shapes, plates and piles that meet the requirements of ASTM A36 and steel sheet piles that meet the requirements of Article 1084-2 of the *Standard Specifications*. Use timber lagging with a minimum allowable bending stress of 1000 psi that meets the requirements of Article 1082-1 of the *Standard Specifications*. For standard temporary shoring, use pile sections and lengths and lagging sizes as shown on the plans.

(D) Temporary MSE Walls

Use welded wire reinforcement forms, facings, mesh and mats that meet the requirements of AASHTO M55 or M221. Use connector bars and wires for welded wire wall components and support struts that meet the requirements of AASHTO M32. For standard temporary MSE walls, use wire gauges, strut sizes and welded wire components as shown on the plans.

(1) Geotextile Fabrics

Use geotextile fabrics that meet the requirements of Article 1056-1 of the *Standard Specifications*.

(a) Reinforcing Fabric

The reinforcement direction (RD) is defined as the direction perpendicular to the wall face and the cross-reinforcement direction (CRD) is defined as the direction parallel to the wall face.

Use woven polyester or polypropylene fabric that meets the following properties:

Property	Test Method	Requirement (MARV)
Wide Width Tensile Strength @ Ultimate (RD)	ASTM D4595	Varies – 200 lb/in min
Wide Width Tensile Strength @ Ultimate (CRD)	ASTM D4595	100 lb/in min
Trapezoidal Tear Strength	ASTM D4533	100 lb min
CBR Puncture Strength	ASTM D6241	600 lb min
UV Resistance after 500 hrs	ASTM D4355	70 %
Apparent Opening Size (AOS), US Sieve	ASTM D4751	20 min – 70 max
Permittivity	ASTM D4491	0.20 sec ⁻¹

For standard temporary MSE walls (temporary fabric wall) use reinforcing fabric wide width tensile strengths and lengths in the RD as shown on the plans.

(b) Retention Fabric

Retain shoring backfill at the face of temporary MSE walls with retention fabric. Use fabric that meets the requirements of Class 3 and the UV resistance, AOS and permittivity for separation geotextile in accordance with AASHTO M288.

(2) SierraScape Temporary Wall

Use uniaxial (UX) geogrids composed of high-density polyethylene (HDPE) manufactured by Tensar Earth Technologies. Test geogrids in accordance with ASTM D6637. Use connection rods manufactured by Tensar Earth Technologies to transfer the load between the facings and geogrids.

For standard temporary MSE walls (SierraScape temporary wall) use geogrid types and lengths as shown on the plans.

(3) Terratrel Temporary Wall

Use ribbed reinforcing steel strips manufactured by The Reinforced Earth Company that meet the requirements of ASTM A572, Grade 65. Use connector rods that meet the requirements of AASHTO M31, Grade 60 and hair pin connectors that meet the requirements of ASTM A1011, Grade 50. Use bolts, nuts and washers that meet the requirements of AASHTO M164.

For standard temporary MSE walls (Terratrel temporary wall) use ribbed steel strip size and lengths, rod lengths and diameters, hairpin connectors, bolts, nuts and washers as shown on the plans.

Embedment

“Embedment” is defined as the depth of shoring below the bottom of the excavation or the grade in front of the shoring. For cantilever shoring, embedment is the depth of the piling below the grade in front of the shoring. For temporary MSE walls, embedment is the difference between the grade elevation in front of the wall and the elevation of the bottom of the reinforced zone.

Portable Concrete Barriers

Provide portable concrete barriers in accordance with the 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*. Use Oregon Tall F-Shape Concrete Barriers in accordance with detail drawing and special provision obtained from:

<http://www.ncdot.org/doh/preconstruct/wztc/DesRes/English/DesResEng.html>

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. At the Contractor's option or if the minimum required clear distance is not available, set an unanchored PCB against the traffic side of the shoring and design shoring for traffic impact or use the "surcharge case with traffic impact" for the standard temporary shoring. An anchored PCB or Oregon barrier is required for barriers above and behind temporary MSE walls.

Contractor Designed Shoring

"Contractor designed shoring" is defined as non-anchored temporary shoring or temporary MSE walls designed by the Contractor. Unless prohibited or required, Contractor designed shoring is optional. Contractor designed shoring is required when notes on plans prohibit the use of standard shoring. Non-anchored Contractor designed shoring is prohibited when notes on plans require the use of temporary MSE walls and Contractor designed temporary MSE walls are prohibited when notes on plans prohibit the use of temporary MSE walls.

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.

Design non-anchored temporary shoring in accordance with the *AASHTO Guide Design Specifications for Bridge Temporary Works* and temporary MSE walls in accordance with the *AASHTO Allowable Stress Design Standard Specifications for Highway Bridges*. Use the following soil parameters for shoring backfill in the reinforced zone.

Total Unit Weight = 120 pcf
Friction Angle = 30 degrees
Cohesion = 0 psf

Design temporary shoring in accordance with the in-situ assumed soil parameters shown on the 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 non-anchored temporary shoring, the top of shoring elevation is defined as the elevation where the grade intersects the back face of the shoring. For traffic impact, apply 2 kips/ft to the shoring 1.5 ft above the top of shoring elevation. When designing for traffic impact, extend shoring at least 32" above the top of shoring elevation. Otherwise, extend shoring at least 6" above the top of shoring elevation.

Standard Shoring

Unless notes on plans prohibit the use of one or both types of standard shoring, standard shoring is optional. Submit a "Standard Temporary MSE Wall Selection Form" for each standard temporary MSE wall location and a "Standard Temporary Shoring Selection Form" for up to three standard temporary shoring locations. Submit selection forms at least 14 days before beginning shoring construction. Obtain standard shoring selection forms from:

<http://www.ncdot.org/doh/preconstruct/highway/geotech/formdet/standards.html>

(A) Standard Temporary Shoring

Determine the shoring height, traffic impact, groundwater condition and slope or surcharge case for each standard temporary shoring location. Determine the minimum required extension, embedment and sheet pile section modulus or H pile section from the plans for each location.

(B) Standard Temporary MSE Walls

Choose a standard temporary MSE wall from the multiple temporary MSE wall options shown in the plans. Do not use more than one option per wall location.

Step bottom of reinforced zone in increments equal to vertical reinforcement spacing for the wall option chosen. Determine the wall height and slope or surcharge case for each section of standard temporary MSE wall. With the exception of either the first or last section of wall, use horizontal section lengths in increments equal to the following for the wall option chosen.

Standard Temporary MSE Wall Option	Increment
Temporary Fabric Wall	9 ft min (varies)
Hilfiker Temporary Wall	10 ft min (varies)
SierraScape Temporary Wall	18 ft – 7 1/4 in
Retained Earth Temporary Wall	24 ft
Terratrel Temporary Wall	19 ft – 8 in

Determine the appropriate facings and/or forms and reinforcement length, spacing, strength, type, density and/or size from the plans for each wall section.

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 MSE walls, shoring and shoring backfill.

(A) Non-anchored Temporary Shoring

Install and interlock sheet piling or install piles as shown on the plans or accepted submittals with a tolerance of 1/2 inch per foot from vertical. Contact the Engineer if the design embedment is not achieved. If piles are placed in drilled holes, perform pile excavation to the required elevations and backfill excavations with concrete and lean sand grout.

Remove grout as necessary to install timber lagging. Install timber lagging with a minimum bearing distance of 3" on each pile flange. Backfill voids behind lagging with shoring backfill.

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

(1) Pile Excavation

Excavate a hole with a diameter that will result in at least 3" of clearance around the entire pile. Use equipment of adequate capacity and capable of drilling through soil and non-soil including rock, boulders, debris, man-made objects and any other materials encountered. Blasting is not permitted to advance excavations. Blasting for core removal is permitted only when approved by the Engineer. Dispose of drilling spoils in accordance with Section 802 of the *Standard Specifications*. Drilling spoils consist of all excavated material including water removed from excavations by either pumping or drilling tools.

If unstable, caving or sloughing soils are encountered, stabilize excavations with clean watertight steel casing. Steel casings may be either sectional type or one continuous corrugated or non-corrugated piece. Provide casings of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth or backfill. Use steel casings with an outside diameter equal to the hole size and a minimum wall thickness of 1/4 inch.

Before placing concrete, check the water inflow rate in the excavation after any pumps have been removed. If the inflow rate is less than 6" per half hour, remove any water and free fall the concrete into the excavation. Ensure that concrete flows completely around the pile. If the water inflow rate is greater than 6" per half hour, propose and obtain approval of the concrete placement procedure before placing concrete.

Center the pile in the excavation and fill the excavation with Class A concrete in accordance with Section 1000 of the *Standard Specifications* except as modified herein. Provide concrete with a slump of 6 to 8 inches. Use an approved high-range water reducer to achieve this slump. Place concrete in a continuous manner to the bottom of shoring or the elevations shown on the accepted submittals. Fill the remainder of the excavation with a lean sand grout and remove all casings.

(B) Temporary MSE Walls

The Engineer may require a wall preconstruction meeting to discuss the construction and inspection of the temporary MSE walls. If required, conduct the meeting with the Site Superintendent, the Resident or Bridge Maintenance Engineer, the Bridge Construction Engineer and the Geotechnical Operations Engineer before beginning wall construction.

Perform all necessary clearing and grubbing in accordance with Section 200 of the *Standard Specifications*. Excavate as necessary as shown on the plans or accepted submittals. Notify the Engineer when foundation excavation is complete. Do not place shoring backfill or first reinforcement layer until obtaining approval of the excavation depth and foundation material.

If applicable, install foundations located within the reinforced zone in accordance with the plans or accepted submittals.

Erect and maintain facings and forms as shown on the plans or accepted submittals. Stagger vertical joints of facings and forms to create a running bond when possible unless shown otherwise on the plans or accepted submittals.

Place facings and forms as near to vertical as possible with no negative batter. Construct temporary MSE walls with a vertical and horizontal tolerance of 3" when measured with a 10 ft straight edge and an overall vertical plumbness (batter) and horizontal alignment of less than 6".

Place reinforcement at locations and elevations shown on the plans or accepted submittals and in slight tension free of kinks, folds, wrinkles or creases. Repair or replace any damaged reinforcement. Contact the Engineer when existing or future structures such as foundations, pavements, pipes, inlets or utilities will interfere with reinforcement. To avoid structures, deflect, skew and modify reinforcement.

Do not splice reinforcement in the reinforcement direction (RD), i.e., parallel to the wall face. Seams are allowed in the cross-reinforcement direction (CRD). Bond or sew adjacent reinforcing fabric together or overlap fabric a minimum of 18" with seams oriented perpendicular to the wall face.

Place shoring backfill in 8 to 10 inch thick lifts and compact in accordance with Subarticle 235-4(C) of the *Standard Specifications*. Use only hand operated compaction equipment within 3 ft of the wall face. Do not damage reinforcement when placing and

compacting shoring backfill. End dumping directly on the reinforcement is not permitted. Do not operate heavy equipment on reinforcement until it is covered with at least 10" of shoring backfill. Do not use sheepsfoot, grid rollers or other types of compaction equipment with feet.

Cover reinforcing and retention fabric with at least 3" of shoring backfill. Place top reinforcement layer between 4 and 24 inches below top of wall as shown on the plans or accepted submittals.

Bench temporary MSE walls into the sides of excavations where applicable. If the top of wall is within 5 ft of finished grade, remove top form or facing and incorporate the top reinforcement layer into the fill when placing fill in front of the wall. Temporary MSE walls remain in place permanently unless required otherwise.

Measurement and Payment

Temporary Shoring will be measured and paid for at the contract unit price per square foot of exposed face area at locations shown on the plans or required by the Engineer. For temporary MSE walls, the wall height will be measured as the difference between the top and bottom of wall and does not include the embedded portions of the wall or any pavement thickness above the wall. For all other temporary shoring, the shoring height will be measured as the difference between the top and bottom of shoring elevation. The bottom of shoring elevation is defined as where the grade intersects the front face of the shoring. The top of shoring elevation is defined as where the grade intersects the back face of the shoring. No payment will be made for any extension of shoring above the top of shoring or any embedment below the bottom of shoring. Such price and payment will be full compensation for furnishing all labor, tools, equipment, materials and all incidentals necessary to design and install the temporary shoring and complete the work as described in this provision.

No payment will be made for temporary shoring not shown on the plans or required by the Engineer including shoring for OSHA reasons or the Contractor's convenience. No value engineering proposals will be accepted based solely on revising or eliminating the shoring locations shown on the plans or the estimated quantities shown in the bid item sheets as a result of actual field measurements or site conditions.

No additional payment will be made for anchoring PCBs or providing Oregon barriers in lieu of unanchored PCBs. Additional costs for anchoring PCBs or providing Oregon barriers will be considered incidental to *Temporary Shoring*.

Payment will be made under:

Pay Item

Temporary Shoring

Pay Unit

Square 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.

WORK ZONE TRAFFIC CONTROL:

(8-16-11)

SP11 R20

Revise the 2006 Standard Specifications as follows:**Page 11-3, Article 1101-12 Traffic Control Supervision**, in addition to the stated requirements, add the following:

Provide the service of at least one qualified Work Zone Supervisor. The Work Zone Supervisor shall have the overall responsibility for the proper implementation of the traffic management plan, as well as ensuring all employees working inside the NCDOT Right of Way have received the proper training appropriate to the job decisions each individual is required to make.

The work zone supervisor is not required to be on site at all times but must be available to address concerns of the Engineer. The name and contact information of the work zone supervisor shall be provided to the Engineer prior to or at the preconstruction conference.

Qualification of Work Zone Supervisors shall be done by an NCDOT approved training agency or other approved training provider. For a complete listing of these, see the Work Zone Traffic Control's webpage, <http://www.ncdot.gov/doh/preconstruct/wztc/>.

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 Drawings* No. 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.

PERMANENT SEEDING AND MULCHING:

(7-1-95)

SP16 R01

The Department desires that permanent seeding and mulching be established on this project as soon as practical after slopes or portions of slopes have been graded. As an incentive to obtain an early stand of vegetation on this project, the Contractor's attention is called to the following:

For all permanent seeding and mulching that is satisfactorily completed in accordance with the requirements of Section 1660, Seeding and Mulching, and within the following percentages of elapsed contract times, an additional payment will be made to the Contractor as an incentive additive. The incentive additive will be determined by multiplying the number of acres of seeding and mulching satisfactorily completed times the contract unit bid price per acre for Seeding and Mulching times the appropriate percentage additive.

Percentage of Elapsed Contract Time	Percentage Additive
0% - 30%	30%
30.01% - 50%	15%

Percentage of elapsed contract time is defined as the number of calendar days from the date of availability of the contract to the date the permanent seeding and mulching is acceptably completed divided by the total original contract time.