Project Special Provisions
Structures & Culverts

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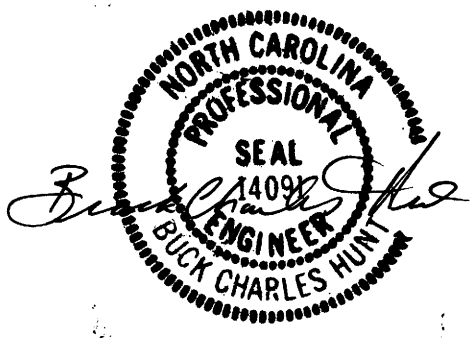

10-13-04

PROJECT SPECIAL PROVISIONS
STRUCTURES AND CULVERTS

PROJECT R-2911D **ROWAN COUNTY**

FALSEWORK AND FORMS OVER OR ADJACENT TO TRAFFIC (10-12-01)

This Special Provision applies in addition to Article 420-3 of the Standard Specifications.

This Special Provision covers falsework or forms including metal stay-in-place forms and precast concrete deck panels erected over vehicular, pedestrian or railroad traffic, or vessel traffic on navigable waterways. It also covers falsework and forms for those parts of a substructure unit constructed within 20 ft. (6 m) of the edge of a travelway or railroad track and more than 25 ft. (7.6 m) above the ground line at the time of substructure construction.

1.0 SUBMITTALS

Submit detailed drawings as required by the Standard Specifications or other Special Provisions and one set of design calculations for falsework and forms for review and acceptance before beginning construction of the falsework or forms. Have the drawings and design calculations prepared, signed and sealed by a North Carolina Registered Professional Engineer. These submittal requirements apply to all falsework and form systems covered by this Special Provision.

2.0 DESIGN

Design falsework and forms for the combined effects of dead load and live load and with appropriate safety factors in accordance with these Special Provisions and the respective design codes of the materials used. Include the weight of concrete, reinforcing steel, forms and falsework in the dead load. Live load includes the actual weight of any equipment the falsework supports, applied as concentrated loads at the points of contact, and a uniform load of not less than 20 lbs/ft^2 (1.0 kPa) applied over the supported area. In addition, apply a line load of 75 lbs/ft (1.1 kN/m) along the outside edge of deck overhangs.

3.0 INSPECTION

Before the form or falsework system is loaded, inspect the erected falsework and forms and submit a written statement certifying that the erected falsework system complies with the accepted detailed drawings prepared by the Registered Professional Engineer. Submit a separate certification for each span, unit, or bridge component. Any condition that does not comply with the accepted drawings, or any other condition deemed unsatisfactory by the Engineer, is cause for rejection until corrections are made.

4.0 BASIS OF PAYMENT

Payment at the contract unit prices for the various pay items will be full compensation for the above work required for falsework or forms.

DRILLED PIERS (10-03-02)

1.0 GENERAL

A. Description

The work in this special provision governs the construction of Drilled Piers, also known as "Drilled Shafts" and "Caissons". Drilled piers are a reinforced concrete section, cast-in-place against in situ, undisturbed material. Drilled piers are a straight shaft type and vertical. Construct drilled piers in accordance with the details and dimensions shown on the plans and the requirements of this special provision.

B. Work Experience

The Contractor/Subcontractor and the Contractor's/Subcontractor's superintendent performing the work described in this special provision is required to have installed drilled piers of both diameter and length similar to those shown on the plans and have a minimum of five years experience with underwater concrete placement prior to the bid date for this project. This work is performed under the supervision of the Contractor's/Subcontractor's superintendent, who is knowledgeable and experienced in the construction of drilled piers using casing and/or slurry. Use equipment that has the capacity to undertake the work and is sufficient to complete the work within the specified contract time. Furnish evidence of experience and expertise that the Contractor/Subcontractor meets the following requirements.

To verify the ability to construct drilled piers for this project, submit a list containing a description of at least two projects completed in the last five years on which those responsible for the drilled pier construction have installed drilled piers of similar size as shown in the plans and with similar excavation techniques anticipated for this project. Include on the list of projects the names and phone numbers of the project owner's representatives who can verify the Contractor/Subcontractor's participation on the project.

C. Construction Sequence Plan

Develop and submit a drilled pier construction sequence plan for all the drilled piers for review and acceptance 30 days prior to beginning construction of the drilled piers. Provide detailed project specific information in the drilled pier construction sequence plan including:

1. Work experience in accordance with Section 1.0, Item B.

2. List and size of proposed equipment including: cranes, kelly bars, drill rigs, vibratory hammers, augers, core barrels, cleanout buckets, airlifts and/or submersible pumps, tremies and/or concrete pumps, casing (diameters, thicknesses and lengths), desanding equipment (for slurry construction), etc.

3. Details of the sequence of drilled pier construction, including the order of drilled pier construction.

4. Details of pier excavation methods.

5. Details of proposed methods to clean the pier excavation bottom.

6. Details of reinforcement placement including support and method to center in the excavation.

7. Details of concrete placement including proposed operational procedures for the concrete tremie or pump; including initial placement, how the tremie or pump is raised during concrete placement and what type of discharge control is proposed to prevent concrete contamination when the tremie or pump is initially placed in the excavation.

8. Details of casing installation and temporary casing removal including order of telescoped casing removal.

9. Required submittals for concrete mix designs.

10. Details of the slurry to be used (if applicable), including: product information, manufacturers mixing instructions, slurry equipment information and how the Contractor proposes to use the slurry. Also, submit a written approval from the bentonite supplier that the water to be used is acceptable.

11. Details on the handling of drilling spoils and slurry overflow including environmental control procedures used to prevent the loss of concrete, slurry and spoils.

12. Details of how the level of slurry is maintained above the highest piezometric pressure head (if applicable).

13. Other information shown in the plans or requested by the Engineer.

The Engineer reviews the drilled pier construction sequence plan for conformance with the plans, specifications and special provisions. Within 15 days of receiving the plan, the Engineer notifies the Contractor of any additional information required and/or changes that are necessary to satisfy the plans, specifications and special provisions. Submit changes for re-evaluation of any unsatisfactory part of the construction sequence plan that is rejected. The Engineer responds to the Contractor within 7 days after receiving the proposed changes.

If any changes in procedure are made during the construction of the drilled piers, inform the Engineer in writing and await approval of the proposed modifications prior to the construction of the remaining drilled piers.

D. Preconstruction Conference

After the drilled pier construction sequence plan is accepted but prior to beginning any drilled pier work, schedule a drilled pier preconstruction conference with the drilling superintendent, the Concrete Supplier, the Resident Engineer including the inspector, the Area Bridge Construction Engineer and the Soils and Foundation Design Engineer to discuss construction and inspection of the drilled piers.

E. Definition of Rock

For the purposes of this special provision, "Rock" is defined as a continuous intact natural material in which the penetration rate with a rock auger is less than 2 inches (50 mm) per 5 minutes of drilling at full crowd force. This definition excludes discontinuous loose natural materials such as boulders and man-made materials such as concrete, steel, timber, etc.

F. Rock Socket

When required by a plan note, provide a minimum penetration into rock as directed by the Engineer.

2.0 EXCAVATION

Perform the excavations required for the drilled piers to the dimensions and elevations shown on the plans or otherwise required by the Engineer, including any miscellaneous grading or excavation to install the drilled pier.

Excavate the drilled pier with a drill rig of adequate capacity. Use a rig that is capable of drilling through soil and non-soil including rock, boulders, timbers, man-made objects and any other materials encountered. Blasting is not permitted to advance the excavation. Blasting for core removal is only permitted when approved by the Engineer. Use a drill rig capable of drilling a minimum of 25% deeper than the deepest drilled pier shown in the plans. Use drilling tools equipped with vents designed to stabilize the hydrostatic pressure above and below the tool during extraction from the excavation. For drilled piers constructed with slurry, monitor the rate at which the drilling tools are inserted and extracted so as to minimize sidewall suction action in the excavation. Drilling below the tip elevations shown on the plans is required if necessary to achieve adequate bearing.

Maintain a drilling log during the drilled pier excavation and provide it to the Engineer. Include in the log information such as top and bottom elevation of each stratum encountered, drilling tools used and drilling time in each stratum and material descriptions of each soil and rock layer.

Drilling spoils consist of all material excavated including water removed from the excavation either by pumping or with augers. Dispose of spoils, with the exception of those containing slurry, as directed by the Engineer and in accordance with Section 802 of the Standard Specifications.

Construct drilled piers at the locations shown on the plans and within the tolerances specified herein. If tolerances are exceeded, provide additional construction as approved by the Engineer to bring the piers within the tolerances specified. Construct the drilled piers such that the axis at the top of the piers is no more than 3 inches (75 mm) in any direction from the position indicated in the plans. Build drilled piers within 1% of the plumb deviation for the total length of the piers. Measure the plumbness of the drilled piers by an accurate procedure, such as an inclinometer on the kelly bar or other approved techniques. Unless a plan note requires the construction joint to be moved below the ground line, construct the finished top of pier elevation between 1 inch (25 mm) above and 3 inches (75 mm) below the top of pier elevation shown on the plans.

When drilling from a barge, use a fixed template that maintains shaft position and alignment during all excavation and concrete placement operations. Floating templates (attached to a barge) are not allowed unless approved by the Engineer.

Stabilize all drilled pier excavations with steel casing and/or bentonite slurry except, as approved by the Engineer, the portions of the excavations in rock as defined by Section 1.0, Item E. Stabilize excavations at all times from the beginning of drilling through concrete placement. Provide casing or slurry in rock if unstable material is anticipated or encountered during drilling. When slurry is used, a partially excavated pier is subject to the time requirements in Section 2.0, Item C, Number 1. When slurry is not used, do not leave a partially excavated pier open overnight unless the excavation is cased to rock.

If the tip of the drilled pier excavation is in rock as defined by Section 1.0, Item E, dewater the excavation to the satisfaction of the Engineer. The minimum diameter of the drilled pier excavation in rock is 2 inches (50 mm) less than the design drilled pier diameter shown on the plans.

If electing to remove a casing and substitute a larger diameter or longer casing through unstable or caving material, either backfill the excavation or stabilize it with a bentonite slurry prior to removing the casing to be replaced. Use other methods, as approved by the Engineer, to control the stability of the excavation during casing replacement.

A. Permanent Steel Casing

Use permanent steel casings as directed by the Engineer and/or a note on the plans. Use permanent casings that are clean smooth non-corrugated watertight steel of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth or backfill. Provide permanent casing steel conforming to ASTM A252, Grade 2. The minimum wall thickness of the permanent steel casing depends on the casing diameter and the following requirements.

CASING WALL THICKNESS

Casing Diameter	Minimum Wall Thickness
Less than 42 inches (1066 mm)	3/8 inch (9 mm)
42 inches (1066 mm) to 78 inches (1982 mm)	1/2 inch (12 mm)
Greater than 78 inches (1982 mm)	5/8 inch (16 mm)

Provide permanent casings with an outside diameter not less than specified size of the drilled pier. If approved by the Engineer, a permanent casing larger in diameter than the drilled pier design diameter is permitted. No payment will be made for additional construction materials or other costs associated with a request for a larger casing diameter. Extend the permanent casings from the top of pier elevation or top of permanent casing elevation if shown on the plans to a depth not greater than the permanent casing tip elevation shown on the plans. If electing to extend the permanent steel casing below the permanent casing tip elevation, get prior approval from the Engineer and provide additional drilled pier length if required. No payment will be made for the additional drilled pier length and casing unless the previously approved extension is necessary for dewatering purposes. Place all permanent casings in contact with undisturbed material. Install permanent casing in one continuous unit. If splices are necessary for the casing, use an approved method of splicing. Splices are considered incidental and no additional compensation will be allowed if approved.

Remove any portion of the permanent steel casing that extends above the top of the drilled pier after the drilled pier concrete has achieved a compressive strength of 4500 psi (31.0 MPa). The cost of casing removal will be considered incidental to the cost of the permanent steel casing.

B. Temporary Steel Casing

Provide temporary casing to stabilize drilled pier excavations, protect personnel and prevent caving or sloughing, that is clean smooth non-corrugated watertight steel of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth or backfill.

Use temporary steel casings with an outside diameter not less than the specified size of the piers, except for casing to protect inspection personnel. Temporary steel casings are subjected to the same minimum wall thickness requirement as permanent steel casings as shown in Section 2.0, Item A.

Temporary steel casings that become bound or fouled during pier construction and cannot be practically removed constitute a defect in the drilled pier. Improve such defective shafts to the satisfaction of the Engineer by removing the shaft concrete and extending the shaft deeper, providing a replacement shaft, or other acceptable means. Complete all corrective measures including redesign as a result of defective shafts to the satisfaction of the Engineer without additional compensation or an extension of the completion date of the project.

C. Slurry

When slurry use is not noted on the plans, slurry construction is an option.

Use slurry composed of bentonite having a mineral grain size that remains in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system to minimize or eliminate bottom sedimentation. Provide material used to make the suspension with a percentage and specific gravity sufficient to maintain the stability of the excavation and allow for proper concrete placement.

When slurry is used and permanent steel casing is not required, use temporary casing a minimum of 10 feet (3 m) long at the top of the excavation. Maintain the top of the temporary casing a minimum of 1 foot (300 mm) above the ground surface surrounding the casing. This temporary casing is also subject to the minimum wall thickness as required for permanent steel casing as shown in Section 2.0, Item A.

Maintain the slurry in the pier excavation at a level not less than 5 feet (1.5 m) or the drilled pier diameter (whichever is greater) above the highest piezometric pressure head along the depth of the pier. It is anticipated that the highest piezometric pressure head is the static water elevation or the groundwater elevation. However, the Contractor is responsible for determining the highest piezometric pressure head. The use of steel casing to maintain the required slurry level is permitted; however, in accordance with the basis of payment for permanent steel casing, no payment will be made for casing that is cut off. If the slurry level in the excavation suddenly changes or cannot be practically maintained, or the slurry construction method does not produce the desired result, stop the pier construction until an alternate construction procedure is approved by the Engineer.

Thoroughly premix the bentonite slurry with clean, fresh water. Have a sample of the water used on the project tested by an independent laboratory, at no additional cost to the Department, to verify that it is suitable for use with the bentonite slurry. Submit written approval from the bentonite supplier that the water to be used is acceptable. Allow 24 hours for hydration of the slurry, prior to introduction into the pier excavation. Slurry tanks of adequate capacity are required for slurry circulation, storage and treatment. Excavated slurry pits are not allowed in lieu of slurry tanks without prior approval from the Engineer. Take all steps necessary to prevent the slurry from "setting up" in the drilled pier. Such methods include, but are not limited to: agitation, circulation and/or adjusting the properties of the slurry. Provide desanding equipment as necessary to achieve a slurry sand content of 2% or less by volume prior to placement of the reinforcement steel.

1. Time

Adjust the excavation operations so that the maximum time the slurry is in contact with the sidewalls of the uncased portions of the drilled pier excavation (from time of drilling to completing concrete placement) does not exceed 24 hours. Also, agitate the slurry in the drilled pier excavations a minimum of every 4 hours. Do not allow an excavated slurry shaft below the steel casing to go unagitated overnight. Do not work on more than two drilled piers per drill rig below the steel casing at any time.

If the 24 hour time limit is exceeded, overream the drilled pier excavation beneath the steel casing a minimum of 1 inch (25 mm) and a maximum of 3 inches (75 mm), or as required by the Engineer, prior to performing other operations in the excavation. Overream with a grooving tool, overreaming bucket or other approved equipment at a minimum spacing of 12 inches (300 mm). The Contractor bears all costs associated with both overreaming and additional shaft concrete placement at no additional cost to the Department.

If concrete placement is not completed within three days of beginning drilling, enlarge the design drilled pier diameter by a minimum of 6 inches (150 mm), or as required by the Engineer, the entire length of the pier at no additional cost to the Department. Enlarging the drilled pier includes replacing the steel casing with steel casing the same size to which the drilled pier is enlarged at no additional cost to the Department.

2. Sampling

Take all slurry samples using an approved sampling tool. Test slurry samples to determine density, viscosity and pH to establish an acceptable working pattern during slurry use. Test a minimum of four samples during each 8 hours of slurry use for each drilled pier. Take the first sample for the first 8 hours from the slurry tank prior to introduction into the pier excavation. Take the remaining samples from the bottom of the drilled pier excavation. When the test results are acceptable and consistent, a decrease in the testing frequency to one sample per 4 hours of slurry use is permitted.

Prior to placing the reinforcing steel in any drilled pier excavation, extract slurry samples from the bottom of each pier excavation and at intervals not exceeding 10 feet (3 m) up the pier, until two consecutive samples produce acceptable values for density, viscosity, pH and sand content.

3. Testing

Have a qualified Engineer or technician, approved by the Engineer, conduct control tests to determine density, viscosity and pH. Use suitable apparatus for the control tests. The following table shows the acceptable range of values for those physical properties:

BENTONITE SLURRY Sodium Montmorillonite (Commercial Bentonite) Acceptable Range of Values			
Property (units)	**At Time of Slurry Introduction**	**In Hole at Time of Drilling**	**Test Method**
Density, pcf (kg/m^3)	64.3 – 69.1* (1030-1107*)	64.3 – 75.0* (1030-1201*)	Density Balance
Viscosity, sec./quart (sec./0.95 liters)	28 – 45	28 – 45	Marsh Cone
pH	8 – 11	8 – 11	pH paper pH meter
* Increase the density by 2 pcf (32 kg/m^3) in saltwater.			

Notes:

1. Perform tests when the slurry temperature is above 40°F (4.4°C).
2. The maximum sand content is 2% by volume at any point in the borehole prior to placement of the reinforcement steel as determined by the American Petroleum Institute sand content base.
3. When field conditions warrant, an adjustment to the limits and test methods in the above table is permitted only after a successful test hole demonstration. Obtain the Engineer's written approval before use.

When any slurry samples are found to be unacceptable, take whatever action is necessary to bring the bentonite slurry within specification requirements. Do not place reinforcement steel until resampling and testing produce acceptable results.

Generate reports of all tests required above, have them signed by an authorized representative, and submit them to the Engineer upon completion of each drilled pier. Representatives of the Department reserve the right to perform comparison tests as determined necessary during bentonite slurry operations.

4. Slurry Disposal

Comply with all applicable local, state and federal regulations, as well as with the environmental permits of the project when disposing of excavated materials contaminated with slurry. Keep all excavated materials, spoils from the desanding unit and slurry out of the water and contain them at all times. The cost of the containment, removal and disposal of excavated materials contaminated with slurry, as well as the slurry itself, is incidental to the cost of constructing the drilled piers.

3.0 CLEANING

Excavate the bottom of the drilled pier to a level plane or stepped with a maximum step height of 12 inches (300 mm). Regardless of construction methods used, clean the bottom of the excavation of loose material using a technique approved by the Engineer. When the drilled pier excavation can not be dewatered and is not hand cleaned, clean the bottom of the excavation with a cleanout bucket and an airlift or submersible pump.

4.0 INSPECTION METHODS AND REQUIREMENTS

After the drilled pier excavation is complete and immediately prior to placement of the reinforcing steel and concrete, demonstrate the proper condition of the drilled pier excavation to the Engineer for verification. Provide bosun chairs, gas meters, safety equipment, lights, mirrors, weighted tape measures, steel probes, personnel and all assistance required for the Engineer to inspect the drilled pier excavations.

A. Bearing Capacity

One or more of the following tests are used to verify the conditions and continuity of the bearing material prior to placement of the reinforcing steel. If the required tip bearing capacity is not satisfied, then increase the drilled pier length as determined by the Engineer. Payment for the additional length of the drilled pier to achieve adequate bearing will be made per the drilled pier pay items.

1. Visual Inspection

The tip bearing of the drilled pier excavation is inspected either by entering the excavation or visually from the top of the excavation as directed by the Engineer.

2. Test Hole

If the tip of the drilled pier excavation is in rock as defined by Section 1.0, Item E, drill one or more 1½ inch (38 mm) diameter test holes in each drilled pier to a depth at least 6 feet (1.83 m) below the tip elevation.

3. Standard Penetration Test (SPT)

When noted on the plans that a SPT is required, drive a split barrel sampler a minimum of 18 inches (450 mm) below the drilled pier tip elevation or to refusal in accordance with ASTM D1586. Complete the SPT using NW rods through casing or another stabilizing method as approved by the Engineer. Extend the SPT rods from the top of the drilled pier excavation to the drilled pier tip elevation. Firmly support the SPT casing at the top of the drilled pier excavation and rest it on the bottom of the excavation. Conduct the SPT a minimum of 12 inches (300 mm) away from the sidewalls of the excavation and be sure not to scrape the sidewalls of the excavation while inserting or withdrawing the SPT equipment. Have the SPT device on-site prior to reaching the drilled pier tip elevation. Report the number of blows needed to drive the split barrel sampler and a description of the recovered soil sample to the Engineer. The Engineer determines the number of blows required for bearing.

B. Bottom Cleanliness

One or more of the following inspection procedures are used to check the cleanliness of the pier excavation bottom prior to placement of the reinforcement steel and concrete.

The pier excavation bottom is considered clean if a minimum of 50% of the bottom area has less than ½ inch (13 mm) of sediment and no portion of the bottom area has more than 1½ inches (38 mm) of sediment as determined by the Engineer.

1. Visual Inspection

The cleanliness of the drilled pier excavation bottom is observed either by entering the excavation or from the top of the excavation as directed by the Engineer.

2. Steel Probe

If the excavation is not dewatered or if the Engineer requires it, lower a steel probe to the bottom of the drilled pier excavation to ensure that cleaning has been satisfactorily completed. Supply a steel probe that is 2 feet (0.6 m) long with a flat tip on the sounding end, weighs approximately 9 pounds (#10 rebar) (4 kg, #32 rebar) and is suspended from the opposite end with a non-stretch cable.

3. Shaft Inspection Device (SID)

When noted on the plans, the SID is used to take sediment measurements and observe the bottom conditions of the drilled pier excavation at a minimum of five locations selected by the Engineer. The SID is a remotely operated camera capable of observing bottom conditions and measuring sediment underwater and slurry. Each SID inspection (including all 5 locations) takes approximately 1 hour after the equipment has been set up. The Engineer provides the SID and the personnel to operate the device. Notify the Engineer a minimum of 2 days prior to beginning the

drilled pier excavation so the Engineer can arrange for the transportation of the SID to the site and the personnel to perform the inspections. SID inspections are required until the cleanliness of the drilled pier excavation bottom is acceptable in accordance with Section 4.0, Item B of this special provision. Do not conduct operations that interfere with the SID inspections as directed by the Engineer. Remove all cleaning and drilling equipment from the drilled pier excavation during any SID inspection. Provide a working area large enough for the SID equipment, within the reach of the cabling supplied, and within clear sight distance of the drilled pier excavation, as directed by the Engineer. Assist the Engineer in the transportation and handling of the SID and all the associated equipment and in supporting the electric hoist and/or hoisting tripod for the SID, as directed by the Engineer. Provide a safe and secure storage area for the SID and all the associated equipment while it is located unattended on the project site. If any of the SID equipment is damaged, lost or stolen due to the Contractor's negligence, then replace the equipment at no additional cost to the Department. Provide replacement equipment that exactly matches the damaged, lost or stolen equipment as directed by the Engineer. All costs involved with the initial SID inspection of each drilled pier excavation will be made per the SID pay item. No additional payment will be made for subsequent or repeated SID inspections of the same drilled pier excavation. Claims against the Department for either lost time or actual expense of any SID inspections that do not find the cleanliness of the drilled pier excavation bottom in compliance with this special provision are not permitted.

5.0 REINFORCING STEEL

Completely assemble a cage of reinforcing steel, consisting of longitudinal and spiral bars and place it in the drilled pier excavation as a unit immediately after the proper condition of the excavation is demonstrated to the Engineer. When concrete placement does not follow immediately after cage placement, remove the steel from the pier excavation unless the Engineer directs otherwise. If the cage is removed, recheck pier excavation cleanliness in accordance with this special provision prior to reinstallation of the cage.

If the drilled pier excavation is cased down to rock, immediate placement of the reinforcing steel and the concrete is not required. If electing to delay placement of the reinforcing steel and concrete due to the presence of rock, recheck the excavation for proper cleanliness immediately prior to placement of the reinforcing steel.

A. Construction, Placement, Support and Alignment

If it is determined in the field that the drilled pier must be longer, adequate reinforcement is required in the extended length as directed by the Engineer. Lift the cage so racking and cage distortion does not occur. Keep the cage plumb during concrete operations and casing extraction. Check the position of the cage before and after placing the concrete. Position the splice length of the drilled pier cage so that the column or footing has the minimum concrete cover shown on the plans.

Securely cross-tie the vertical and spiral reinforcement at each intersection with double wire. Support or hold down the cage so that the vertical displacement during concrete placement and casing extraction does not exceed 6 inches (150 mm).

B. Bolsters, Blocks and Spacers

Do not set the cage on the bottom of the drilled pier excavation. Place plastic bolsters under each vertical reinforcing bar. If required by the Engineer, provide concrete blocks instead of plastic bolsters to limit rebar cage settlement. Place blocks under each vertical rebar that have a 4 inch (100 mm) minimum diameter and that have a depression to receive the vertical reinforcing bar. Ensure that the blocks are tall enough to raise the rebar cage off the bottom of the drilled pier excavation a minimum of 3 inches (75 mm).

In order to ensure a minimum of 4 inches (100 mm) of concrete cover and achieve concentric spacing of the cage within the pier, tie plastic spacer wheels, subject to the Engineer's approval, at five points around the cage perimeter. Use spacer wheels that provide a minimum of 4 inches (100 mm) "blocking" from the outside face of the spiral bars to the outermost surface of the drilled pier except in rock as defined by Section 1.0, Item E. Use spacer wheels in the rock zone that provide a minimum of 2 inches (50 mm) "blocking". Tie spacer wheels that snap together with wire and allow them to rotate. Use spacer wheels that span at least two adjacent vertical bars. Start placing spacer wheels at the bottom of the cage and continue up along its length at maximum 10 foot (3 m) intervals. At the Engineer's direction, supply additional peripheral spacer wheels and closer intervals if necessary.

6.0 CONCRETE

Begin concrete placement immediately after inserting reinforcing steel into the drilled pier excavation. Prior to placing concrete, assure the Engineer that sufficient quantities of concrete are available and that sufficient transportation is committed to the project to deliver the concrete within the time frame set forth within this special provision.

A. Concrete Mix

Provide the mix design for Drilled Pier Concrete for approval and, except as modified herein, meeting the requirements of Section 1000 of the Standard Specifications.

Designate the concrete as Drilled Pier Concrete with a minimum compressive strength of 4500 psi (31.0 MPa) at 28 days. Make certain the cementitious material content complies with one of the following options:

- Provide a minimum cement content of 640 lbs/yd^3 (380 kg/m^3) and a maximum cement content of 800 lbs/yd^3 (475 kg/m^3); however, if the alkali content of the cement exceeds 0.4%, reduce the cement content by 20% and replace it with fly ash at the rate of 1.2 lb (1.2 kg) of fly ash per lb (kg) of cement removed.

- If Type IP blended cement is used, use a minimum of 665 lbs/yd^3 (395 kg/m^3) Type IP blended cement and a maximum of 833 lbs/yd^3 (494 kg/m^3) Type IP blended cement in the mix.

Limit the water-cementitious material ratio to a maximum of 0.45. Do not air-entrain Drilled Pier Concrete.

Produce a workable mix so that vibrating or prodding is not required to consolidate the concrete. When placing the concrete, make certain the slump is between 5 and 7 inches (125 and 175 mm) for dry placement of concrete or 7 and 9 inches (175 and 225 mm) for wet placement of concrete.

Use Type I or Type II cement or Type IP blended cement and either No. 67 or No. 78M coarse aggregate in the mix. Use an approved water-reducer, water-reducing retarder, high-range water-reducer, or high-range water-reducing retarder to facilitate placement of the concrete if necessary. Do not use a stabilizing admixture as a retarder in Drilled Pier Concrete without approval of the Engineer. Use admixtures that satisfy AASHTO M194 and add them at the concrete plant when the mixing water is introduced into the concrete. Redosing of admixtures is not permitted.

Place the concrete within 2 hours after introducing the mixing water. Ensure that the concrete temperature at the time of placement is 90°F (32°C) or less.

1. Slump Loss Test

   If any drilled pier concrete pour is greater than 40 yd^3 (31 m^3) per pier, provide a slump loss test before beginning the drilled pier operation. The slump loss test verifies that the drilled pier concrete maintains a slump of at least 4 inches (100 mm) a minimum of 4 hours after batching. Perform the test with a Division of Highways representative present. Have the concrete producer notify the Department at least 72 hours prior to the test.

   Conduct the slump loss test as follows:

   a. Batch the actual mix design at 9 inches (225 mm) initial slump and at the highest concrete temperature expected on the job, but no less than 60°F (15.5°C).

   b. Batch at least 4 yd^3 (3 m^3) in a mixer truck. Begin timing the test when the mixing water is introduced into the mix.

   c. After initial mixing, measure and record the slump, ambient temperature, concrete temperature and percent air. Ensure all concrete properties are within specifications.

   d. Mix the concrete intermittently at agitation speed for 30 seconds every 15 minutes.

e. Measure and record the slump, ambient and concrete temperatures, and percent air after every second 15 minute interval until the slump is 3½ inches (90 mm).

Make certain the concrete maintains a minimum slump of 4 inches (100 mm) 4 hours after batching.

Once a mix design is accepted and the slump loss test is on file with the Materials and Tests Unit, resubmit the design for subsequent projects without the slump loss test.

B. Concrete Placement

Place concrete such that the drilled pier is a monolithic structure. Vibration is only permitted, if needed, in the top 10 feet (3 m) of the drilled pier or as directed by the Engineer. Remove any contaminated concrete from the top of the drilled pier and the wasted concrete from the area surrounding the drilled pier. Contain all concrete that spills over the permanent casing of the drilled pier.

Do not remove temporary casing until the level of concrete within the casing is in excess of 10 feet (3 m) above the bottom of the casing being removed. Maintain the concrete level at least 10 feet (3 m) above the bottom of innermost casing throughout the entire casing extraction operation, except when concrete is at or above the top of drilled pier elevation. Sustain a sufficient head of concrete above the bottom of casing to overcome outside soil and water pressure. As the casing is withdrawn, exercise care in maintaining an adequate level of concrete within the casing so that fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the drilled pier concrete. Exerting downward pressure, hammering and/or vibrating the temporary casing is permitted to facilitate extraction.

After all the pumps have been removed from the excavation, the water inflow rate determines the concrete placement procedure. If the inflow rate is less than 6 inches (150 mm) per half hour, the concrete placement is considered dry. If the water inflow rate is greater than 6 inches (150 mm) per half hour, the concrete placement is considered wet.

Keep a record of the volume of concrete placed in each drilled pier excavation and make it available to the Engineer. For drilled piers constructed with slurry or as directed by the Engineer, record a graphical plot of the depth versus theoretical concrete volume and actual measured concrete volume for each drilled pier and provide it to the Engineer when finished placing concrete.

1. Dry Placement

Prior to placing concrete, make certain the drilled pier excavation is dry so the flow of concrete completely around the reinforcing steel can be certified by visual inspection. If the concrete free fall does not exceed 60 feet (18.3 m), placing the concrete by a central drop method where the concrete is chuted directly down the center of the excavation is permitted.

For drilled piers exceeding 60 feet (18.3 m) in length, use a tremie or a pump to place concrete as described in Section 6.0, Item B, Number 3. Support the tremie or pump so that the concrete free fall is less than 60 feet (18.3 m) at all times.

2. Wet Placement

Maintain a static water or slurry level in the excavation prior to placing concrete underwater. When temporary casing is used as the method to stabilize the excavation, place concrete only with a pump (no tremie).

Once the concrete in the excavation reaches the same elevation as the static water level, placing concrete with the dry method is permitted. Before changing to the dry method of concrete placement, remove the water above the concrete and clean the concrete surface of all scum and sediment to expose clean, uncontaminated concrete.

3. Tremie and Pump

Place concrete with a tremie or a pump in accordance with the applicable parts of Sections 420-6 and 420-8 of the Standard Specifications that concern tremie and/or concrete pumping operations. Use a tremie consisting of a sectional tube a minimum of 10 inches (254 mm) in diameter unless otherwise approved or directed by the Engineer. Use a tremie tube or pump pipe made of steel with watertight joints. Passing concrete through a hopper at the tube end or through side openings as the tremie is retrieved during concrete placement is permitted. Use a discharge control to prevent concrete contamination when the tremie tube or pump pipe is initially placed in the excavation. Extend the tremie tube or pump pipe into the concrete a minimum of 5 feet (1.5 m) at all times except when the concrete is initially introduced into the pier excavation. If the tremie tube or pump pipe pulls out of the concrete for any reason after the initial concrete is placed, restart concrete placement with a steel capped tremie tube or pump pipe.

4. Placement Time

Place concrete within the time frames specified in Table 1000-2 of the Standard Specifications for Class AA concrete and this special provision. Never place concrete so fast as to trap air, slurry, water, fluids, soil or any other deleterious materials in the vicinity of the reinforcing steel and the annular zone between the rebar cage and the excavation walls. Should a delay occur because of concrete delivery or other factors, reduce the placement rate to maintain some movement of the concrete. No more than 45 minutes is allowed between placements.

7.0 SCHEDULING AND RESTRICTIONS

After the first drilled pier is successfully completed, do not make any significant changes in construction methods, equipment or materials, unless approved by the Engineer.

If caving or sloughing occurs, compensation is not provided for additional concrete to fill the resulting voids.

Within the first 16 hours after a drilled pier has achieved its initial concrete set (as determined by the Engineer), do not drill adjacent piers, do not install adjacent piles, and do not allow any equipment wheel loads or "excessive" vibrations to occur at any point within a 20 foot (6 m) radius of the drilled pier.

In the event that the procedures described herein are performed unsatisfactorily, the Engineer reserves the right to shut down the construction operations and/or reject the drilled piers. If the integrity of a drilled pier is in question, use core drilling, sonic or other approved methods at no additional cost to the Department and under the direction of the Engineer. Dewater and backfill core drill holes with an approved high strength grout with a minimum compressive strength of 4500 psi (31.0 MPa) as directed by the Engineer. Remedial measures are directed by and require approval from the Engineer. No compensation will be paid for losses or damage due to remedial work or any investigation of drilled piers found defective or not in accordance with this special provision or the construction plans.

8.0 NON-DESTRUCTIVE TESTING (NDT)

The Engineer furnishes the non-destructive testing (NDT) equipment. NDT requires the attachment of an accelerometer to the top of the drilled pier. Measurements are made while tapping the top of the drilled pier with a hammer. The Engineer furnishes the materials, labor and equipment necessary for the installation of the accelerometer.

If the NDT instruments and supporting equipment are damaged due to the fault or negligence of the Contractor, replace the damaged equipment at no additional cost to the Department.

After installation, notify the Engineer that the drilled piers are ready to be tested. A drilled pier is tested only after the concrete has been in place for 5 days and the concrete has achieved a minimum compressive strength of 3000 psi (20.7 MPa). Grind four flat dry areas on top of the drilled pier down to exposed aggregate with a grinder or some other acceptable device. The Engineer selects the location of the four ground surfaces. Several velocity records as a function of time are averaged at each test location. The NDT field data is recorded with digital data acquisition equipment. Field testing is estimated to take 1 hour per drilled pier. Evaluation and interpretation of the field data requires 3 working days after testing. Further construction above the drilled piers that were tested is not allowed until the analysis of the NDT field data is complete.

The Engineer determines the number of drilled piers to be tested with NDT. It is anticipated that all drilled piers require testing. The cost of this work is included in the contract unit price bid for the drilled pier pay items. No separate payment will be made. Claims are not permitted for any delay incurred, including but not limited to the installation of the instrumentation or the collection and analysis of the NDT data.

9.0 COMPENSATION

A. Method of Measurement

1. Drilled Piers in Soil

The quantity of "Drilled Piers in Soil" to be paid for will be the linear feet (meters) of the drilled piers exclusive of the linear feet (meters) of "Drilled Piers Not in Soil" computed from elevations and dimensions as shown on the plans or from revised dimensions authorized by the Engineer. Drilled piers through air or water will be paid for as "Drilled Piers in Soil".

2. Drilled Piers Not in Soil

The quantity of "Drilled Piers Not in Soil" to be paid for will be the linear feet (meters) of drilled piers excavated in non-soil as determined by the Engineer. Non-soil is defined as material that can not be cut with a rock auger and requires excavation by coring, air tools, hand removal or other acceptable methods. Top of non-soil elevation is that elevation where the rock auger penetration rate is less than 2 inches (50 mm) per 5 minutes of drilling at full crowd force and coring, air tools, etc. are used to advance the excavation. For pay purposes, after non-soil is encountered, earth seams, rock fragments and voids in the excavation less than 3 feet (0.9 m) in total length will be considered "Drilled Piers Not in Soil". If the non-soil is discontinuous, payment will revert to "Drilled Piers in Soil" at the elevation where non-soil is no longer encountered.

3. Permanent Steel Casing

The quantity of "Permanent Steel Casing" to be paid for will be the linear feet (meters) of permanent steel casing as directed and authorized to be used. The length to be paid for will be measured along the permanent casing from the top of the casing elevation or top of the pier elevation, whichever is lower, to the casing tip elevation. Casing will be paid for only when permanent casing is authorized or when the Engineer directs the Contractor to leave a casing in place that then becomes a permanent part of the pier. No payment will be made for temporary steel casings that become bound or fouled during pier construction and cannot be practically removed.

4. Shaft Inspection Device (SID)

   The quantity of "SID Inspection" to be paid for will be per drilled pier as noted on the plans and/or directed by the Engineer. SID inspections are performed until the bottom cleanliness of the drilled pier excavation is acceptable by this special provision; however, payment will only be made for the initial SID inspection of each drilled pier excavation.

5. Standard Penetration Test (SPT)

   The quantity of "SPT Testing" to be paid for will be the actual number of SPT tests performed as noted on the plans and/or directed by the Engineer.

B. Basis of Payment

1. Drilled Piers in Soil

   Payment will be made at the contract unit price per linear foot (meter) for "____ Dia. Drilled Piers in Soil". Such payment will include, but is not limited to, furnishing all labor, tools, equipment, materials including concrete complete and in place and all incidentals necessary to excavate the drilled piers and complete the work as described in this special provision. No additional payment will be made for slurry use. No additional payment will be made for any miscellaneous grading or excavation to install the drilled pier. "Reinforcing Steel" and "Spiral Column Reinforcing Steel" will be paid for separately and will not be part of this pay item.

2. Drilled Piers Not in Soil

   Payment will be made at the contract unit price per linear foot (meter) for "____ Dia. Drilled Piers Not in Soil". Such payment will include, but is not limited to, furnishing all labor, tools, equipment, materials including concrete complete and in place and all incidentals necessary to excavate the drilled piers and complete the work as described in this special provision. No additional payment will be made for slurry use. No additional payment will be made for any miscellaneous grading or excavation to install the drilled pier. "Reinforcing Steel" and "Spiral Column Reinforcing Steel" will be paid for separately and will not be part of this pay item.

3. Permanent Steel Casing

   Payment will be made at the contract unit price per linear foot (meter) for "Permanent Steel Casing for ____ Dia. Drilled Pier". Such payment will include, but is not limited to, furnishing all material, labor, tools, equipment and all incidentals necessary to install the casing in the pier excavation.

4. Shaft Inspection Device (SID)

   Payment for SID will be at the contract unit price per each for "SID Inspection". Such payment will include, but is not limited to, furnishing all materials, labor, tools, equipment and all incidentals necessary to complete the SID inspection as described in this special provision.

5. Standard Penetration Test (SPT)

   Payment for SPT will be at the contract unit price per each for "SPT Testing". Such payment will include, but is not limited to, furnishing all materials, labor, tools, equipment and all incidentals necessary to complete the SPT at each test location.

CROSSHOLE SONIC LOGGING (7-09-02)

1.0 GENERAL

Use the non-destructive testing method called Crosshole Sonic Logging (CSL) to verify the integrity of the drilled pier and the quality of the concrete. The Engineer will determine the number of CSL tests and which drilled piers will be CSL tested on this project. Drilled piers are referred to as piers in this special provision.

The CSL test measures the time for an ultrasonic pulse to travel from a signal source in one access tube to a receiver in another access tube. In uniform, good quality concrete, the travel time between equidistant tubes should yield relatively consistent arrival times and corresponds to a reasonable pulse velocity, signal amplitude and energy from the bottom to the top of the pier. Longer travel times, decrease in pulse velocity, and lower amplitude/energy signals indicate the presence of irregularities such as poor quality concrete, voids, honeycombing, cracking and soil intrusions. The signal may be completely lost by the receiver and CSL recording system for severe defects such as voids and soil intrusions.

The CSL Consultant must have a minimum 3 years experience of CSL testing and have a Registered North Carolina Professional Engineer supervising the testing and interpretation of results. **Submit** the proposed CSL Consultant to the Engineer for approval 30 days before beginning drilled pier construction. The following evidence of qualification needs to be included, unless previously approved by the Department and no changes have occurred since previous submittal:

- Written evidence of successful completion of CSL tests, brief descriptions and reference's phone numbers for three recent CSL projects.
- Personnel qualifications
- Equipment description
- Example report

Make all necessary arrangements with the CSL Consultant to have the CSL tests satisfactorily performed on the selected drilled piers and in accordance with this special provision. The CSL Consultant must supply to the Contractor technical instruction and guidance in preconstruction activities, and on-site technical assistance and guidance during set up and performance of the CSL tests. Provide suitable access to the site and to the top of piers to be tested. Follow instructions from the CSL Consultant unless the Engineer directs otherwise.

Place CSL tubes in all drilled piers. Perform CSL testing only on drilled piers selected by the Engineer a minimum 7 days after concrete placement and after concrete achieves a minimum compressive strength of 3000 psi (20.7 MPa), but within 30 days after concrete placement. After CSL test results have been reviewed and the Engineer has accepted the drilled pier or approves grouting of the tubes, dewater the tubes and core holes, if any, and backfill with the approved grout. When the Engineer elects not to CSL test a pier, dewater the tubes and backfill them with an approved 4500 psi (31.0 MPa) compressive strength grout.

2.0 PREPARATION FOR CSL

Install four tubes in each drilled pier with a diameter of 5 feet (1524 mm) or less, and install six tubes in each pier with a diameter of greater than 5 feet (1524 mm). Provide 2 inch (50 mm) inside diameter Schedule 40 steel pipe conforming to ASTM A53, Grade A or B, Type E, F, or S. The tubes must have a round, regular internal diameter free of defects or obstructions, including any at tube joints, in order to permit the free, unobstructed passage of source and receiver probes. The tubes must provide a good bond with the concrete, and be watertight.

Fit the tubes with a watertight threaded cap on the bottom and a removable threaded cap on the top. Securely attach the tubes to the interior of the reinforcement cage. Install the tubes in each drilled pier in a regular, symmetric pattern such that each tube is equally spaced from the others around the perimeter of the cage. Tube placement must be such that large vertical reinforcing bars do not block the direct line between adjacent tubes. The tubes are typically wire-tied to the reinforcing cage every 3 feet (1 m) or otherwise secured such that the tubes remain in position during placement of the rebar cage and the concrete. The tubes must be as near to vertical and as parallel as possible, **as non-vertical tubes can adversely affect data analysis**. Extend the tubes from 6 inches (150 mm) above the pier tip to at least 3 feet (1 m) above the top of the pier. If the pier top elevation is below ground elevation, extend tubes at least 2 feet (610 mm) above ground surface. If the drilled pier tip elevation is excavated more than 1 foot (305 mm) below the tip elevation in the original plans, extend the tubes using proper threaded mechanical couplings to within 6 inches (150 mm) of the revised pier tip elevation.

Before placement of the reinforcement cage into the drilled pier, record the tube lengths and tube positions along the length of the cage. After placement of concrete, measure the stickup of the tubes above the top of the drilled piers and verify tube spacing.

Verify that unobstructed passage of the probes is achievable before the CSL Consultant arrives on site. If testing equipment will not pass through the entire length of the CSL tube, core a 2 inch (50 mm) diameter hole through the concrete the full length of the drilled pier at no cost to the Department. Locate the core hole approximately 9 inches (230 mm) inside the pier reinforcement from obstructed tube or as determined by the Engineer. Fill core hole with clean, potable water and cover to keep out debris.

Immediately after placement of the reinforcement cage and within 2 hours after concrete placement, fill the CSL tubes with clean, potable water, and cap them to keep out debris. The Engineer will reject CSL tubes that are not filled with water or capped. When removing the caps, exercise care not to apply excess torque, force or stress, which could break the bond between the tubes and the concrete.

Submit to the Engineer the CSL tube size, the manufacturer's certificate of compliance, cap details, couplings, any joints details, and the proposed method of attaching the tubes, 30 days before beginning drilled pier construction.

3.0 CSL EQUIPMENT

The minimum requirements of the CSL equipment are as follows:

- A microprocessor based CSL system for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses and printing of report quality CSL logs
- Ultrasonic source and receiver probes which can travel through 2 inch (50 mm) I.D. steel pipe
- An ultrasonic voltage pulser to excite the source with a synchronized triggering system to start the recording system
- A depth measurement device to electronically measure and record the source and receiver depths associated with each CSL signal
- Appropriate filter/amplification and cable systems for CSL testing
- An acquisition system that stores each log in digital format, with drilled pier identification, date, time and test details, including the source and receiver gain. Arrival time data must be displayed graphically during data acquisition.
- 3D tomographic imaging software, or source for completing the work

4.0 CSL TEST PROCEDURE

Provide the Engineer and CSL Consultant with the following:

- Tube lengths and positions
- Record of the drilled pier construction information including the pier bottom and top elevations
- Construction dates before CSL testing

Conduct CSL tests between each perimeter pair and major principal diameter and log, unless otherwise directed by the Engineer.

Perform the CSL testing with the source and receiver probes in the same horizontal plane unless test results indicate defects or poor concrete zones, in which case the defect zones must be further evaluated with angle tests (source and receiver vertically offset at greater than 1.5 feet (460 mm) in the tubes). Report any defects indicated by decreased signal velocity and lower amplitude/energy signals to the Engineer at the time of testing, and conduct angle tests in the zones of the defects as defined by the Concrete Condition Rating Criteria (CCRC) in Section 5.0 of this special provision. Make CSL measurements at depth intervals of 2 ½ inches (65 mm) or less from the bottom of the tubes to the top of each pier. Pull the probes simultaneously, starting from the bottom of the tubes, using a depth-measuring device to electronically measure and record the depths associated with each CSL signal. Remove any slack from the cables before pulling to provide for accurate depth measurements of the CSL records. In the event defects are detected, conduct additional logs, as needed, at no additional cost to the Department. The Department will not accept any claims for either lost time or the actual expense of further investigation of defects.

If steel tube debonding occurs, then core drill a 2 inch (50 mm) diameter hole to the depth of debonding for each debonded tube in order to perform the CSL logs at no additional cost to the Department.

5.0 CSL RESULTS AND REPORTING

Submit the test results in the form of a report including four original copies of CSL results to the Engineer within 5 working days of completion of CSL testing. The CSL report should include but not limited to the following:

- Project identification
- Dates of testing
- Table and a plan view of each pier tested with accurate identification of tube coordinates and tubes referenced to the site
- Tube collar elevation
- Names of personnel that performed the tests/interpretation and their affiliation
- Equipment used
- Interpretation, analysis, and results.

Include CSL logs for each tube pair tested with analysis of the initial pulse arrival time, velocity, relative pulse energy/amplitude, and stacked waveform plotted versus depth. List all zones defined by the Concrete Condition Rating Criteria (CCRC) in a tabular format including the percent velocity reduction and the velocity values used from the nearby zone of good quality concrete. Discuss each zone defined by the CCRC in the CSL report as appropriate. Base the results on the percent reduction in velocity value from a nearby zone of good quality concrete with good signal amplitude and energy as correlated to the following:

Concrete Condition Rating Criteria (CCRC)			
CCRC	**Rating Symbol**	**Velocity Reduction**	**Indicative Results**
Good	G	≤ 10 %	Good quality concrete
Questionable Defect	Q	>10 % & < 20 %	Minor concrete contamination or intrusion. Questionable quality concrete.
Poor	P/D	≥ 20 %	Defects exist, possible water/slurry contamination, soil intrusion, and/or poor quality concrete.
No Signal	NS	No Signal received	Soil intrusion or other severe defect absorbed the signal (assumes good bond of the tube-concrete interface).
Water	W	V = 4750 fps (1450 mps) to 5000 fps (1525 mps)	Water intrusion, or water filled gravel intrusion with few or no fines present.

The following are a few examples of types and causes of defects:

- Necking or arching of the concrete on withdrawal of the temporary casing.
- Necking or contamination of the concrete due to collapse of the side walls.
- Soft toe due to incomplete cleaning or collapse of the side walls.
- Horizontal lenses of silt\mud\bentonite due to the tremie pipe rising above the concrete
- Voids due to the use of low-slump concrete.
- Honeycombing due to washout of fines.
- Trapping of contaminants due to pumping concrete to fast.

Provide the original pulse signal data files and ASCI format of the picks with a header (identifying the pier tested, tube coordinates and each data column) in an electronic file to the Engineer. The Engineer will require 7 working days to evaluate the CSL test results and determine whether or not the drilled pier is acceptable. Evaluation of CSL test results, with ratings other than good (G) per the Concrete Condition Rating Criteria (CCRC) may require further investigation and additional time for review and analysis of the data. Do not grout the CSL tubes or perform any further work on the CSL tested drilled pier until the Engineer determines whether the drilled pier is acceptable. Perform tomography in order to further investigate and delineate the boundaries of any defective/unconsolidated zones with 20% or more reduction in velocity value as correlated to the CCRC. Process CSL data to construct easy to understand 2D/3D (2D cross-sections between tubes and 3D volumetric images for the entire pier) *color-coded* tomographic images indicating velocity variations along the pier. Location and geometry of defective/unconsolidated zones must be identified in 3D color images with detailed discussion in the CSL report. Any further tests deemed necessary by the Engineer in order to determine the acceptability of the drilled pier will be determined after reviewing the CSL report. Additional test or analysis options include 3D tomographic imaging, single-hole sonic testing, gamma-gamma nuclear density logging, sonic echo or impact response tests, and concrete coring, in addition to load testing of the piers.

The Engineer will determine the depth, location, and the number of core holes when concrete coring is required. Drill a minimum of two PQ size core holes to intercept the suspected defect zones. Use a coring method that provides maximum core recovery and minimizes abrasion and erosion. Provide concrete cores properly marked in a wooden crate and labeling the drilled pier depth at each interval of core recovery to the NCDOT Materials and Test Unit for evaluation and testing. Submit to the Engineer a drilling report that includes the NCDOT project number, name of the Drilling Contractor, date drilled, percent core recovery and signed by the Contractor. Allow 7 working days after submitting the core records for the Department's review.

6.0 CORRECTION OF UNACCEPTABLE DRILLED PIER

When the Engineer determines a drilled pier is unacceptable, the Engineer will direct the Contractor to submit remedial measures to the Department for approval. No compensation will be made for remedial work or losses or damage due to remedial work of drilled piers found defective or not in accordance with the drilled pier special provision or the construction plans. Modifications to the drilled pier design or any load transfer mechanisms required by the remedial action must be designed and calculations sealed by a Registered North Carolina Professional Engineer. Include drawings sealed by a Registered North Carolina Professional Engineer for all foundation elements affected. Do not begin remedial action work until the Department has reviewed and accepted the remedial action plan. Allow 10 working days after submitting the remedial work plan for the Department's review and acceptance. Furnish all materials and work necessary to correct defective drilled piers.

7.0 MEASUREMENT AND BASIS OF PAYMENT

The complete and accepted CSL testing will be paid for at the unit bid price for "Crosshole Sonic Logging" per each, which will constitute full compensation for all costs incurred for procurements, conducting the CSL testing, including any other test required to determine acceptability, reporting of results and incidentals necessary to complete the work.

The complete and accepted crosshole sonic logging tubes will be paid for at the unit bid price for "CSL Tubes" per foot (meter) of tube. The unit bid price will constitute full compensation for furnishing, installing, extending tubes, dewatering and grouting of all CSL tubes and 2 inch (50 mm) diameter core holes, if applicable, and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

STEEL PILE POINTS (10-12-01)

Provide steel pile points in accordance with the plans, applicable parts of the Standard Specifications, and this provision.

The following is a list of approved pile points:

Brand Name	Manufacturer	Pile Size
PAR 12T Super-Bite Point	Piling Accessories, Inc.	HP 12x53 (HP 310x79)
HPH-12-RB-1	International Construction Equipment, Inc.	HP 12x53 (HP 310x79)
PAR 14T Super-Bite Point	Piling Accessories, Inc.	HP 14x73 (HP 360x108)

For pile points not on the approved list, as a condition of approval, submit seven copies of the proposed pile point and attachment details for acceptance prior to use as stated in Subarticle 450-8(D) of the Standard Specifications.

When approved pile points are used, the submission procedure as stated in Subarticle 450-8(D) of the Standard Specifications is waived.

Provide the Engineer with the manufacturer's welding and attachment details. Weld pile points to the pile in accordance with the manufacturer's details as approved. The minimum weld length is twice the width of the flange.

MECHANICAL BUTT SPLICING FOR REINFORCING STEEL (10-12-01)

1.0 GENERAL

When mechanically butt splicing reinforcing steel, use a standard metal filled sleeve, cement mortar filled sleeve, threaded steel couplings, forged steel sleeve, cold-forged sleeve or an exothermic process whereby molten filler metal, contained by a high strength steel sleeve of larger inside diameter than the bars, is introduced into the annular space between the bars and the sleeve and also between the ends of the bars. Provide a splice that is capable of transferring at least 125% of the yield strength of the bars from one bar to the other by the mechanical strengths of the splice components.

The following is a list of approved connectors:

Brand Name	Approved Size
Bar-Lock Couplers	#4 - #11 (#13 - #36)
Barsplice Products	
Bar-Grip System	#4 - #18 (#13 - #57)
Grip-Twist System	#4 - #18 (#13 - #57)
Threaded Dowel Bar Coupler	#4 - #8 (#13 - #25)
Erico	
Lenton Interlok Grout-Filled Coupler	#6 - #11 (#19 - #36)
Lenton Position Coupler	#4 - #18 (#13 - #57)
Lenton Standard Coupler	#4 - #18 (#13 - #57)
Quick-Wedge Coupler	#4 - #6 (#13 - #19)
Richmond DB-SAE Dowel Bar Splicer	#4 - #11 (#13 - #36)
Williams Form Engineering Flange Coupler	#4 - #14 (#13 - #43)
Zap Screwlok	#4 - #11 (#13 - #36)

For splices not on the approved list, as a condition of approval, assemble three test splices in the presence of the Engineer for each of the bar materials identical to that which is proposed for use in the structure and forward the test splices to N. C. Department of Transportation Materials and Tests Unit in Raleigh, N.C.

When an exothermic connector is used, do not let the splice depend upon fusion of the filler metal with the bars. Select a temperature for heating the bars that is below the melting point of the bars and is sufficiently low so as not to significantly affect the original hardness nor decrease the structural properties of the bars. Visual inspection of the finished splices is sufficient; the splice is acceptable if sound filler metal is present at both ends of the splice sleeve and at the sleeve entry port.

Splice the bars in accordance with the manufacturer's recommendations using the manufacturer's required accessories as approved by the Engineer. Use mechanical butt splices only where specified on the plans. Any additional splices require approval.

If bars are epoxy coated, strip the epoxy coating within the limits of the sleeve prior to splicing. After making the splice, paint any unprotected areas of the reinforcing bar and the coupling sleeve with epoxy paint as described in the Standard Specifications.

2.0 BASIS OF PAYMENT

No separate measurement or payment will be made for this work. The following pay items will be full compensation for the above work as follows:

- The unit contract price bid for "Reinforced Concrete Deck Slab" will be full compensation for mechanical butt splices in concrete decks.
- The unit contract price bid for "Reinforcing Steel" or "Epoxy Coated Reinforcing Steel" will be full compensation for mechanical butt splices in bridge substructures and cast-in-place culverts.

MINIMIZING RAILROAD FLAGGING SERVICE (10-12-01)

Notify the Engineer whenever construction activity on, or immediately adjacent to, the railroad right-of-way is expected to be delayed for more than 2 weeks due to:

- Construction activity being confined to an area where the activity, including the possible falling or overturning of proposed construction equipment and/or material, is not reasonably expected to interfere with Railroad operations or cause damage to facilities of the Railroad or its tenants, and where Railroad operations would not affect personnel and/or equipment.
- The Contractor removing his work force from the site to pursue his work at other locations.
- Scheduling of needed construction equipment and/or material
- Coordination with other required construction activity
- Seasonal considerations

In the notification, describe the reason for the delay and provide a schedule of when the delay in the area is expected to begin and when work in the area is expected to resume.

Contact the Railroad's authorized representative to determine if the flagman can be released and reassigned to accommodate the proposed work delay schedule. If the Railroad agrees, the Engineer follows the advance notification procedures for releasing and rescheduling a flagman as stated elsewhere in this Special Provision or as provided by the Railroad.

Prior to the release of the flagman, ensure that drainage facilities and erosion control measures adjacent to the tracks are properly maintained and that the site is left in a condition satisfactory to the Railroad. In addition, remove any material or equipment stored on the Railway right of way that is needed during the absence of the flagman.

If failing to notify the Engineer of a construction activity delay as stated above and a flagman remains assigned to the site for more than 2 weeks after the delay begins, the flagman time exceeding the 2 weeks, until work resumes on a routine schedule, is considered the Contractor's responsibility.

For that portion of the flagman time considered as the Contractor's responsibility, the Department will continue to pay the flagging charges but an amount of $250 per day will be withheld from partial or final payment due the Contractor.

ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS (10-12-01)

1.0 DESCRIPTION

The work covered by this Special Provision consists of furnishing all necessary labor, equipment, and materials and performing all operations necessary for installing anchor bolts/dowels in concrete using an adhesive bonding system in accordance with the details shown on the plans and with the requirements of this specification unless otherwise directed.

Submit a description of the proposed adhesive bonding system to the Engineer for review, comments and acceptance. Include in the description the bolt type and its deformations, equipment, manufacturer's recommended hole diameter, embedment depth, material specifications, and any other material, equipment or procedure not covered by the plans or these specifications. List the properties of the adhesive, including density, minimum and maximum temperature application, setting time, shelf life, pot life, shear strength and compressive strength. If bars/dowels containing a corrosion protective coating are required, provide an adhesive that does not contain any chemical elements that are detrimental to the coating and include a statement to this effect in the submittal.

2.0 MATERIALS

Use an adhesive bonding system that has been tested for a tensile strength of 125% of the specified anchor bolt/dowel yield load. Provide certification that, for the particular bolt grade, diameter and embedment depth required, the anchor system will not fail by adhesive failure and that the anchor bolt/dowel will not move. The minimum concrete compressive strength is 3000 psi (20.7 MPa) for certification and anchorage selection.

Package components of the adhesive so that one whole container of each component mixes to form one batch of adhesive. Use containers designed so that all of the contents may be removed easily and sealed tightly to prevent leakage. Furnish adhesive material requiring hand mixing in two separate containers designated as Component A and Component B. Provide a self contained cartridge or capsule consisting of two components which are automatically mixed as they are dispensed, as in the case of a cartridge, or drilled into, as in the case of a capsule.

Clearly label each container with the manufacturer's name, date of manufacture, batch number, batch expiration date, direction for use, and warnings and precautions concerning the contents as required by State or Federal Laws and Regulations.

3.0 PROCEDURE

A. Drilling of Holes into Concrete

When directed, use a jig or fixture to ensure the holes are positioned and aligned correctly during the drilling process. Upon approval, adjusting hole locations to avoid reinforcing steel is permitted.

Drill the holes with a pneumatic drill unless another drilling method is approved. Follow the manufacturer's recommendations regarding the diameter of the drilled hole.

Immediately after completion of drilling, blow all dust and debris out of the holes with oil-free compressed air using a wand extending to the bottom of the hole. Remove all dust from the sides of the holes by brushing the holes with a stiff-bristled brush of a sufficient size and then blow the hole free of dust. Repeat this procedure until the hole is completely clean. Check each hole with a depth gauge to ensure proper embedment depth.

Repair spalled or otherwise damaged concrete using approved methods.

B. Inspection of Holes

Inspect each hole immediately prior to placing the adhesive and the anchor bolts/dowels. Ensure all holes are dry and free of dust, dirt, oil, and grease. Rework any hole that does not meet the requirements of this Special Provision.

C. Mixing of Adhesive

Mix the adhesive in strict conformance with the manufacturer's instructions.

D. Embedment of Anchor Bolt/Dowel

Clean each anchor bolt/dowel so that it is free of all rust, grease, oil, and other contaminants.

Unless otherwise shown on the plans, the minimum anchor bolt/dowel embedment depth is such that the adhesive develops at least 125% of the anchor bolt/dowel yield load as determined by the manufacturer.

Insert the anchor bolt/dowel the specified depth into the hole and slightly agitate it to ensure wetting and complete encapsulation. After insertion of the anchor bolt/dowel, strike off any excessive adhesive flush with the concrete face. Should the adhesive fail to fill the hole, add additional adhesive to the hole to allow a flush strike-off.

Do not disturb the anchor bolts/dowels while adhesive is hardening.

4.0 FIELD TESTING

When specified on the plans, test the installed anchor bolts/dowels for adequate adhesive as specified below. Inform the Engineer when the tests will be performed at least 2 days prior to testing. Conduct the tests in the presence of the Engineer.

Use a calibrated hydraulic centerhole jack system for testing. Place the jack on a plate washer that has a hole at least 1/8 inch (3 mm) larger than the hole drilled into the concrete. Position the plate washer on center to allow an unobstructed pull. Position the anchor bolts/dowels and the jack on the same axis. Have an approved testing agency calibrate the jack within 6 months prior to testing. Supply the Engineer with a certificate of calibration.

In the presence of the Engineer, field test 10% of the first 50 anchor bolts/dowels prior to installing any additional anchors. For testing, apply and hold briefly 90% of the anchor bolt/dowel yield load shown on the plans. No visible signs of movement of the anchor bolts/dowels is permitted under this load. Upon receiving satisfactory results from these tests, install the remaining anchors. Test a minimum of 2% of the remaining anchors as previously described.

Record data for each anchor bolt/dowel tested on the report form entitled "Installation Test Report of Adhesively Anchored Anchor Bolts or Dowels". Obtain this form from the North Carolina Department of Transportation Materials and Tests Engineer. Submit a copy of the completed report forms to the Engineer.

Final acceptance of the adhesively anchored system is based on the conformance of the pull test to the requirements of this specification. Failure to meet the criteria of this specification is grounds for rejection.

5.0 BASIS OF PAYMENT

No separate measurement or payment will be made for furnishing, installing, and testing anchor bolts/dowels.

Payment at the contract unit prices for the various pay items will be full compensation for all materials, equipment, tools, labor, and incidentals necessary to complete the above work.

EVAZOTE JOINT SEALS (8-13-04)

1.0 SEALS

Use preformed seals compatible with concrete and resistant to abrasion, oxidation, oils, gasoline, salt and other materials that are spilled on or applied to the surface. Use a low-density closed cell, cross-linked ethylene vinyl acetate polyethylene copolymer nitrogen blown material for the seal.

Use seals manufactured with grooves 1/8" (3 mm) ± wide by 1/8" (3 mm) ± deep and spaced between 1/4 (6 mm) and 1/2 inch (13 mm) apart along the bond surface running the length of the joint. Use seals sized so that the depth of the seal meets the manufacturer's recommendation, but is not less than 70% of the uncompressed width. Provide a seal designed so that, when compressed, the center portion of the top does not extend upward above the original height of the seal by more than 1/4 inch (6 mm). Splice the seal using the heat welding method by placing the joint material ends against a teflon heating iron of 350°F (177°C) for 7 - 10 seconds, then pressing the ends together tightly. Do not test the welding until the material has completely cooled. Use material that resists weathering and ultraviolet rays. Provide a seal that has a working range of 30% tension and 60% compression and is watertight along its entire length including the ends.

Provide seals that meet the requirements given below.

TEST	TEST METHOD	REQUIREMENT
Elongation at break	ASTM D3575	210 ± 15%
Tensile strength, psi (kPa)	ASTM D3575	110 ± 15 (755 ± 100)
Compression Recovery (% of original width)	AASHTO T42 50% compr. for 22 hr. @ 73°F (23°C) 1/2 hr. recovery	87 ± 3
Weather/Deterioration	AASHTO T42 Accelerated Weathering	No deterioration for 10 years min.
Compression/Deflection	@ 50% deflection of original width @ 50% deflection of original width	10 psi (69 kPa) min. 60 psi (414 kPa) max.
Tear Strength, psi (kPa)	ASTM D624	16 ± 3 (110 ± 20)
Density	ASTM D545	2.8 to 3.4
Water Absorption (% vol/vol)	ASTM D3575 Total immersion for 3 months	3

Have the top of the evazote seal clearly shop marked. Inspect the evazote seals upon receipt to ensure that the marks are clearly visible upon installation.

2.0 ADHESIVES

Use a two component, 100% solid, modified epoxy adhesive with the seal that meets the requirements of ASTM C881, Type 1, Grade 3, Class B & C and has the following physical properties:

Tensile strength	3500 psi (24.1 MPa) min.
Compressive strength	7000 psi (48.3 MPa) min.
Shore D Hardness	75 psi (0.5 MPa) min.
Water Absorption	0.25% by weight

Use an adhesive that is workable to 40°F (4°C). When installing in temperatures below 40°F (4°C) or for application on moist, difficult to dry concrete surfaces, use an adhesive specified by the manufacturer of the joint material.

3.0 SAWING THE JOINTS

When the plans call for sawing the joints, the joints shall be initially formed to a width as shown on the plans including the blockout for the elastomeric concrete. Complete placement of the elastomeric concrete after the reinforced concrete deck slab has cured for seven full days and reached a minimum strength of 3000 psi (20.7 Mpa).

Cure the elastomeric concrete for a minimum of 2 days prior to sawing the elastomeric concrete to the final width and depth as specified in the plans.

When sawing the joint to receive the evazote seal, always use a rigid guide to control the saw in the desired direction. To control the saw and to produce a straight line as indicated on the plans, anchor and positively connect a template or a track to the bridge deck. Do not saw the joint by visual means such as a chalk line. Fill the holes used for holding the template or track to the deck with an approved, flowable non-shrink, non-metallic grout.

Saw cut to the desired width and depth in one or two passes of the saw by placing and spacing two metal blades on the saw shaft to the desired width for compression seals.

The desired depth is the depth of the seal plus 1/4 inch (6 mm) above the top of the seal plus approximately 1 inch (25 mm) below the bottom of the seal. An irregular bottom of sawed joint is permitted as indicated on the plans. Grind exposed corners on saw cut edges to a 1/4" (6 mm) chamfer.

Remove any staining or deposited material resulting from sawing with a wet blade to the satisfaction of the Engineer.

Use extreme care to saw the joint straight to the desired width and to prevent any chipping or damage to sawed edges of the joint.

4.0 PREPARATIONS FOR SAWED JOINTS

When the plans call for sawing the joint, the Engineer thoroughly inspects the sawed joint opening for spalls, popouts, cracks, etc. Make all necessary repairs prior to blast cleaning and installing the seal.

Immediately before sealing, clean the joints by sandblasting with clean dry sand. Sandblast to provide a firm, clean joint surface free of curing compound, loose material and any foreign matter. Sandblast without causing pitting or uneven surfaces. The aggregate in the elastomeric concrete may be exposed after sandblasting.

After blasting, either brush the surface with clean brushes made of hair, bristle or fiber, blow the surface with compressed air, or vacuum the surface until all traces of blast products and abrasives are removed from the surface, pockets, and corners.

If nozzle blasting, use compressed air that does not contain detrimental amounts of water or oil.

Examine the blast cleaned surface and remove any traces of oil, grease or smudge deposited in the cleaning operations.

Bond the seal to the blast cleaned surface on the same day the surface is blast cleaned.

5.0 PREPARATIONS FOR ARMORED JOINTS

When the plans call for armored joints, form the joint and blockout openings in accordance with the plans. If preferred, wrap the temporary form with polyethylene sheets to allow for easier removal. Do not use form release agents.

A. Submittals

Submitting detailed working drawings is not required; however, submitting catalog cuts of the proposed material is required. In addition, direct the joint supplier to provide an angle segment placing plan.

B. Surface Preparation

Prepare the surface within the 48 hours prior to placing the elastomeric concrete. Do not place the elastomeric concrete until the surface preparation is completed and approved.

1. Angle Assembly

Clean and free metallized steel of all foreign contaminants and blast the non-metallized steel surfaces to SSPC SP-10. Blast-cleaning anchor studs is not required.

2. Concrete

Prior to placing the elastomeric concrete, thoroughly clean and dry all concrete surfaces. Sandblast the concrete surface in the blockout and clear the surface of all loose debris.

C. Elastomeric Concrete Placement

Make sure that a manufacturer's representative is present when placing elastomeric concrete. Do not place elastomeric concrete if the ambient air temperature is below 45°F (7°C).

Prepare and apply a primer, as per manufacturer's recommendations, to all vertical concrete faces, all steel components to be in contact with elastomeric concrete, and to areas specified by the manufacturer. Align the angles with the joint opening.

Prepare, batch, and place the elastomeric concrete in accordance with the manufacturer's instructions. Place the elastomeric concrete in the areas specified on the plans while the primer is still tacky and within 2 hours after applying the primer. Pay careful attention to properly consolidate the concrete around the steel and anchors. Trowel the elastomeric concrete to a smooth finish.

D. Joint Preparation

Prior to installing the seal, the Engineer thoroughly inspects the armored joint opening for proper alignment and full consolidation of elastomeric concrete under the angle assemblies. Make all necessary repairs prior to cleaning the joint opening and installing the seal.

Clean the armored joint opening with a pressure washer rated at 3000 psi (20.7 MPa) minimum at least 24 hours after placing the elastomeric concrete. Dry the cleaned surface prior to installing the seal.

Examine the cleaned surface and remove traces of oil, grease or smudge deposited during the cleaning operations.

Bond the seal to the cleaned surface on the same day the surface is cleaned.

6.0 SEAL INSTALLATION

Install the joint seal according to the manufacturer's procedures and recommendations and as recommended below. Do not install the joint seal if the ambient air temperature is below 45°F (7°C). Have a manufacturer's representative present during the installation of the first seal of the project.

Begin installation at the low end of the joint after applying the mixed epoxy to the sides of both the joint material and both sides of the joint, making certain to completely fill the grooves with epoxy. With gloved hands, compress the material and with the help of a blunt

probe, push it down into the joint until it is recessed approximately 1/4 inch (6 mm) below the surface. Do not push the seal at an angle that would stretch the material. Once work on a joint begins, do not stop until it is completed. Clean the excess epoxy off the surface of the joint material *quickly* and *thoroughly*. Do not use solvents to remove excess epoxy. Remove excess epoxy in accordance with the joint manufacturer's recommendations.

Install the seal so that it is watertight. Testing of the joint seal is not required, but it is observed until final inspection.

7.0 BASIS OF PAYMENT

Payment for all evazote joint seals will be at the lump sum contract price bid for "Evazote Joint Seals" which prices and payment will be full compensation for furnishing all material, including elastomeric concrete when required, labor, tools and equipment necessary for installing these units in place and accepted.

EPOXY PROTECTIVE COATING (10-12-01)

1.0 DESCRIPTION

This work consists of preparing the concrete surface and furnishing and applying an epoxy protective coating to the surfaces described in this Special Provision. When epoxy protective coating is required, cure the top surfaces of the bent or end bent caps in accordance with the Standard Specifications, but do not use the Membrane Curing Compound method.

2.0 MATERIALS

Use an epoxy coating that meets the most recently published NCDOT Specification on the date of advertisement. Use the epoxy coating that meets NCDOT-Type 4A Flexible, epoxy coating, moisture insensitive.

Provide a certification for the proposed epoxy showing that it meets NCDOT-Type 4A.

The following companies have epoxies that meet Type 4A Specifications:

- E-Bond Epoxy, Inc.
  Fort Lauderdale, Florida 33307
- Permagile Industries
  Plainview, NY 11803
- Poly-Carb
  Cleveland, OH 44139
- Tamms, Inc.
  Mentor, OH 44060

- Adhesive Engineering
  Cleveland, OH 44122-5554
- Kaufman Products
  Baltimore, MD 21226-1131
- Prime Resins
  Lithonia, GA 30058
- Sika Corporation
  Lyndhurst, N. J. 07071

A copy of the specifications for Epoxy Resin Systems is available from the Materials and Tests Unit.

3.0 SURFACES

With the exception of cored slab bridges, apply the epoxy protective coating to the top surface area, including chamfer area, of bent caps under expansion joints and of end bent caps, excluding areas under elastomeric bearings. For cored slab bridges, do not apply the epoxy protective coating to the bent or end bent caps. Also, apply epoxy protective coating to the ends of prestressed concrete members as noted on the plans.

Use extreme care to keep the area under the elastomeric bearings free of the epoxy protective coating. Do not apply the epoxy protective coating in the notch at the ends of the prestressed concrete girders.

Thoroughly clean all dust, dirt, grease, oil, laitance, and other objectionable material from the concrete surfaces to be coated. Air-blast all surfaces immediately prior to applying the protective coating.

Only use cleaning agents pre-approved by the Engineer.

4.0 APPLICATION

Apply epoxy protective coating only when the air temperature is at least 40°F (4°C) and rising, but less than 95°F (35°C) and the surface temperature of the area to be coated is at least 40°F (4°C). Remove any excess or free standing water from the surfaces before applying the coating. Apply one coat of epoxy protective coating at a rate such that it covers between 100 and 200 ft^2/gal (2.5 and 5 m^2/liter).

Note: Under certain combinations of circumstances, the cured epoxy protective coating may develop "oily" condition on the surface due to amine blush. This condition is not detrimental to the applied system.

Apply the coating so that the entire designated surface of the concrete is covered and all pores filled. To provide a uniform appearance, use the exact same material on all visible surfaces.

5.0 BASIS OF PAYMENT

No separate measurement or payment will be made for preparing, furnishing and applying the epoxy protective coating to the concrete surfaces.

Payment at the contract unit prices for the various pay items will be full compensation for the above work including all materials, equipment, tools, labor, and incidentals necessary to complete the work.

ELASTOMERIC CONCRETE (10-12-01)

1.0 DESCRIPTION

Elastomeric concrete is a mixture of a two-part polymer consisting of polyurethane and/or epoxy, and kiln-dried aggregate. Have the manufacturer supply it as a unit. Use the concrete in the blocked out areas on both sides of the bridge deck joints as indicated on the plans.

2.0 MATERIALS

Provide materials that comply with the following minimum requirements at 14 days.

CONCRETE PROPERTIES	TEST METHOD	MINIMUM REQUIREMENT
Bond Strength to Concrete, psi (MPa)	ASTM D638 (D638M)	450 (3.1)
Brittleness by Impact, ft-lb (kg-m)	Ball Drop	7 (0.97)
Compressive Strength, psi (MPa)	ASTM D695 (D695M)	2800 (19.3)

BINDER PROPERTIES (without aggregate)	TEST METHOD	MINIMUM REQUIREMENT
Tensile Strength, psi (MPa)	ASTM D638 (D638M)	800 (5.5)
Ultimate Elongation	ASTM D638 (D638M)	150%
Tear Resistance, lb/in (kN/m)	ASTM D624	90 (15.7)

In addition to the requirements above, use elastomeric concrete that also resists water, chemical, UV, and ozone exposure and withstands extreme temperature (freeze-thaw) changes.

Furnish a manufacturer's certification verifying that the materials satisfy the above requirements. Provide samples of elastomeric concrete to the Engineer, if requested, to independently verify conformance with the above requirements.

Require a manufacturer's representative to be present on site during the installation of the elastomeric concrete.

3.0 BASIS OF PAYMENT

No separate payment will be made for elastomeric concrete. The lump sum contract price bid for "Evazote Joint Seals" will be full compensation for furnishing and placing the Elastomeric Concrete.

FALSEWORK AND FORMWORK (10-12-01)

1.0 DESCRIPTION

Use this Special Provision as a guide to develop temporary works submittals required by the Standard Specifications or other provisions; no additional submittals are required herein. Such temporary works include, but are not limited to, falsework and formwork.

Falsework is any temporary construction used to support the permanent structure until it becomes self-supporting. Formwork is the temporary structure or mold used to retain plastic or fluid concrete in its designated shape until it hardens. Access scaffolding is a temporary structure that functions as a work platform that supports construction personnel, materials, and tools, but is not intended to support the structure. Scaffolding systems that are used to temporarily support permanent structures (as opposed to functioning as work platforms) are considered to be falsework under the definitions given. Shoring is a component of falsework such as horizontal, vertical, or inclined support members. Where the term "temporary works" is used, it includes all of the temporary facilities used in bridge construction that do not become part of the permanent structure.

Design and construct safe and adequate temporary works that will support all loads imposed and provide the necessary rigidity to achieve the lines and grades shown on the plans in the final structure.

2.0 MATERIALS

Select materials suitable for temporary works; however, select materials that also ensure the safety and quality required by the design assumptions. The Engineer has authority to reject material on the basis of its condition, inappropriate use, safety, or nonconformance with the plans. Clearly identify allowable loads or stresses for all materials or manufactured devices on the plans. Revise the plan and notify the Engineer if any change to materials or material strengths is required.

3.0 DESIGN REQUIREMENTS

A. Working Drawings

Provide working drawings for items as specified in the contract, or as required by the Engineer, with design calculations and supporting data in sufficient detail to permit a structural and safety review of the proposed design of the temporary work.

When concrete placement is involved, include data such as the drawings of proposed sequence, rate of placement, direction of placement, and location of all construction joints. Submit the number of copies as called for by the contract.

When required, have the drawings and calculations prepared under the guidance of, and sealed by, a North Carolina Registered Professional Engineer who is knowledgeable in temporary works design.

Design falsework and formwork requiring submittals in accordance with the 1995 AASHTO *Guide Design Specifications for Bridge Temporary Works* except as noted herein.

1. Wind Loads

   Table 2.2 of Article 2.2.5.1 is modified to include wind velocities up to 110 mph (177 km/hr). In addition, Table 2.2A is included to provide the maximum wind speeds by county in North Carolina.

Table 2.2 - Wind Pressure Values

Height Zone feet (m) above ground	Pressure, lb/ft^2 (kPa) for Indicated Wind Velocity, mph (km/hr)				
	70 (112.7)	80 (128.7)	90 (144.8)	100 (160.9)	110 (177.0)
0 to 30 (0 to 9.1)	15 (0.72)	20 (0.96)	25 (1.20)	30 (1.44)	35 (1.68)
30 to 50 (9.1 to 15.2)	20 (0.96)	25 (1.20)	30 (1.44)	35 (1.68)	40 (1.92)
50 to 100 (15.2 to 30.5)	25 (1.20)	30 (1.44)	35 (1.68)	40 (1.92)	45 (2.15)
over 100 (30.5)	30 (1.44)	35 (1.68)	40 (1.92)	45 (2.15)	50 (2.39)

2. Time of Removal

   The following requirements replace those of Article 3.4.8.2.

   Do not remove forms until the concrete has attained strengths required in Article 420-17 of the Standard Specifications and these Special Provisions.

   Do not remove forms until the concrete has sufficient strength to prevent damage to the surface.

Table 2.2A - Steady State Maximum Wind Speeds by Counties in North Carolina

COUNTY	25 YR (mph) (km/hr)	COUNTY	25 YR (mph) (km/hr)	COUNTY	25 YR (mph) (km/hr)
Alamance	70 (112.7)	Franklin	70 (112.7)	Pamlico	100 (160.9)
Alexander	70 (112.7)	Gaston	70 (112.7)	Pasquotank	100 (160.9)
Alleghany	70 (112.7)	Gates	90 (144.8)	Pender	100 (160.9)
Anson	70 (112.7)	Graham	80 (128.7)	Perquimans	100 (160.9)
Ashe	70 (112.7)	Granville	70 (112.7)	Person	70 (112.7)
Avery	70 (112.7)	Greene	80 (128.7)	Pitt	90 (144.8)
Beaufort	100 (160.9)	Guilford	70 (112.7)	Polk	80 (128.7)
Bertie	90 (144.8)	Halifax	80 (128.7)	Randolph	70 (112.7)
Bladen	90 (144.8)	Harnett	70 (112.7)	Richmond	70 (112.7)
Brunswick	100 (160.9)	Haywood	80 (128.7)	Robeson	80 (128.7)
Buncombe	80 (128.7)	Henderson	80 (128.7)	Rockingham	70 (112.7)
Burke	70 (112.7)	Hertford	90 (144.8)	Rowan	70 (112.7)
Cabarrus	70 (112.7)	Hoke	70 (112.7)	Rutherford	70 (112.7)
Caldwell	70 (112.7)	Hyde	110 (177.0)	Sampson	90 (144.8)
Camden	100 (160.9)	Iredell	70 (112.7)	Scotland	70 (112.7)
Carteret	110 (177.0)	Jackson	80 (128.7)	Stanley	70 (112.7)
Caswell	70 (112.7)	Johnston	80 (128.7)	Stokes	70 (112.7)
Catawba	70 (112.7)	Jones	100 (160.9)	Surry	70 (112.7)
Cherokee	80 (128.7)	Lee	70 (112.7)	Swain	80 (128.7)
Chatham	70 (112.7)	Lenoir	90 (144.8)	Translyvania	80 (128.7)
Chowan	90 (144.8)	Lincoln	70 (112.7)	Tyrell	100 (160.9)
Clay	80 (128.7)	Macon	80 (128.7)	Union	70 (112.7)
Cleveland	70 (112.7)	Madison	80 (128.7)	Vance	70 (112.7)
Columbus	90 (144.8)	Martin	90 (144.8)	Wake	70 (112.7)
Craven	100 (160.9)	McDowell	70 (112.7)	Warren	70 (112.7)
Cumberland	80 (128.7)	Mecklenburg	70 (112.7)	Washington	100 (160.9)
Currituck	100 (160.9)	Mitchell	70 (112.7)	Watauga	70 (112.7)
Dare	110 (177.0)	Montgomery	70(112.7)	Wayne	80 (128.7)
Davidson	70 (112.7)	Moore	70 (112.7)	Wilkes	70 (112.7)
Davie	70 (112.7)	Nash	80 (128.7)	Wilson	80 (128.7)
Duplin	90 (144.8)	New Hanover	100 (160.9)	Yadkin	70 (112.7)
Durham	70 (112.7)	Northampton	80 (128.7)	Yancey	70 (112.7)
Edgecombe	80 (128.7)	Onslow	100 (160.9)		
Forsyth	70 (112.7)	Orange	70 (112.7)		

Note on the working drawings any anchorages, connectors, inserts, steel sleeves or other such devices used as part of the falsework or formwork that remains in the permanent structure. If the plan notes indicate that the structure contains the necessary corrosion protection required for a Corrosive Site, epoxy coat, galvanize, metallize or otherwise protect these devices as directed by the Engineer. Any coating required by the Engineer will be considered incidental to the various pay items requiring temporary works.

B. Review and Approval

The Engineer is responsible for the review and approval of temporary works' drawings.

Submit the working drawings sufficiently in advance of proposed use to allow for their review, revision (if needed), and approval without delay to the work.

Do not start construction of any temporary work for which working drawings are required until the drawings have been approved. Such approval does not relieve the Contractor of the responsibility for the accuracy and adequacy of the working drawings.

The time period for review of the working drawings does not begin until complete drawings and design calculations, when required, are received by the Engineer.

On the drawings, show all information necessary to allow the design of any component to be checked independently as determined by the Engineer.

If requested by the Engineer, submit with the working drawings manufacturer's catalog data listing the weight of all construction equipment that will be supported on the temporary work. Show anticipated total settlements and/or deflections of falsework and forms on the working drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders. Design the falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

4.0 CONSTRUCTION REQUIREMENTS

All requirements of Section 420 of the Standard Specifications apply.

Construct temporary works in conformance with the approved working drawings. Ensure that the quality of materials and workmanship employed is consistent with that assumed in the design of the temporary works. Do not weld falsework members to any portion of the permanent structure unless approved. Show any welding to the permanent structure on the approved construction drawings.

Provide tell-tales attached to the forms and extending to the ground, or other means, for accurate measurement of falsework settlement. Make sure that the anticipated compressive settlement and/or deflection of falsework does not exceed 1 inch (25 mm). For cast-in-place concrete structures, make sure that the calculated deflection of falsework flexural members does not exceed 1/240 of their span regardless of whether or not the deflection is compensated by camber strips.

A. Maintenance and Inspection

Inspect and maintain the temporary work in an acceptable condition throughout the period of its use. Certify that the manufactured devices have been maintained in a condition to allow them to safely carry their rated loads. Clearly mark each piece so that its capacity can be readily determined at the job site.

Perform an in-depth inspection of an applicable portion(s) of the temporary works, in the presence of the Engineer, not more than 24 hours prior to the beginning of each concrete placement. Inspect other temporary works at least once a month to ensure that they are functioning properly. Have a North Carolina Registered Professional Engineer inspect the cofferdams, shoring, sheathing, support of excavation structures, and support systems for load tests prior to loading.

B. Foundations

Determine the safe bearing capacity of the foundation material on which the supports for temporary works rest. If required by the Engineer, conduct load tests to verify proposed bearing capacity values that are marginal or in other high-risk situations.

The use of the foundation support values shown on the contract plans of the permanent structure is permitted if the foundations are on the same level and on the same soil as those of the permanent structure.

Allow for adequate site drainage or soil protection to prevent soil saturation and washout of the soil supporting the temporary works supports.

If piles are used, the estimation of capacities and later confirmation during construction using standard procedures based on the driving characteristics of the pile is permitted. If preferred, use load tests to confirm the estimated capacities; or, if required by the Engineer conduct load tests to verify bearing capacity values that are marginal or in other high risk situations.

The Engineer reviews and approves the proposed pile and soil bearing capacities.

5.0 REMOVAL

Unless otherwise permitted, remove and keep all temporary works upon completion of the work. Do not disturb or otherwise damage the finished work.

Remove temporary works in conformance with the contract documents. Remove them in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own weight.

6.0 METHOD OF MEASUREMENT

Unless otherwise specified, temporary works will not be directly measured.

7.0 BASIS OF PAYMENT

Payment at the contract unit prices for the various pay items requiring temporary works will be full compensation for the above falsework and formwork.

SUBMITTAL OF WORKING DRAWINGS (8-13-04)

1.0 GENERAL

Submit working drawings in accordance with Article 105-2 of the Standard Specifications and the requirements of this Special Provision. The list of submittals contained herein does not represent a list of required submittals for this project. Submittals are only necessary for those items as required by the Standard Specifications, other Special Provisions, or contract plans. Make submittals that are not specifically noted in this Special Provision directly to the Resident Engineer.

If submittals contain variations from plan details or specifications, significantly affect project cost, or significantly affect field construction or operations, discuss them with, and submit them through, the Resident Engineer. State the reason for the proposed variation in the submittals. To minimize overall review time, make sure all working drawing submittals are complete when first submitted. Provide a contact name and phone number with each submittal. Direct any questions regarding working drawing submittal requirements to the Resident Engineer, Structure Design Unit contacts or the Geotechnical Engineering Unit contacts noted below.

2.0 WORKING DRAWINGS SUBMITTAL CONTACTS

All submittals noted herein are reviewed by the Structure Design Unit and/or the Geotechnical Engineering Unit.

For submittals to the Structure Design Unit, use the following addresses:

Via US mail:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department
of Transportation
Structure Design Unit
1581 Mail Service Center
Raleigh, NC 27699-1581

Attention: Mr. P. D. Lambert, P. E.

Via other delivery service:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department
of Transportation
Structure Design Unit
1000 Birch Ridge Drive
Raleigh, NC 27610

Attention: Mr. P. D. Lambert, P. E.

For submittals to the Geotechnical Engineering Unit, use the following addresses:

For projects in Divisions 1-7, use the following Eastern Regional Office address:

Via US mail:

Mr. K. J. Kim, Ph. D., P. E.
Eastern Regional Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Eastern Regional Office
1570 Mail Service Center
Raleigh, NC 27699-1570

Via other delivery service:

Mr. K. J. Kim, Ph. D., P. E.
Eastern Regional Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Eastern Regional Office
3301 Jones Sausage Road, Suite 100
Garner, NC 27529

For projects in Divisions 8-14, use the following Western Regional Office address:

Via US mail:

Mr. John Pilipchuk, L. G., P. E.
Western Regional Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

Via other delivery service:

Mr. John Pilipchuk, L. G., P. E.
Western Region Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

Direct any questions concerning submittal review status, review comments, or drawing markups to the following contacts:

Primary Structures Contact:
Paul Lambert
(919) 250 – 4041
(919) 250 – 4082 facsimile
plambert@dot.state.nc.us

Secondary Structures Contacts:
James Gaither (919) 250 – 4042
Man-Pan Hui (919) 250 – 4044

Eastern Regional Geotechnical Contact (Divisions 1-7):
K. J. Kim
(919) 662 – 4710
(919) 662 – 3095 facsimile
kkim@dot.state.nc.us

Western Regional Geotechnical Contact (Divisions 8-14):
John Pilipchuk
(704) 455 – 8902
(704) 455 – 8912 facsimile
jpilipchuk@dot.state.nc.us

3.0 SUBMITTAL COPIES

The quantities provided in this Special Provision act as a guide in the submittal process.

Unless otherwise required by the contract, submit two sets of supporting calculations to the Structure Design Unit.

Furnish one complete copy of the submittal, including all attachments, to the Resident Engineer. If requested, provide additional copies of any submittal. At the same time, submit the following number of copies directly to the Structure Design Unit and/or the Geotechnical Engineering Unit:

Working Drawing Submittal	Copies Required by Structure Design Unit	Copies Required by Geotechnical Engineering Unit	Contract Reference Requiring Submittal [1]
Arch Culvert Falsework	5	0	Plan Note & SN Sheet
Box Culvert Falsework [2]	5	0	Plan Note & SN Sheet
Cofferdams [4]	6	1	Articles 410-5 and 420-8
Expansion Joint Seals (hold down plate type with base angle)	9	0	"Expansion Joint Seals"
Expansion Joint Seals (modular)	2, then 9	0	"Modular Expansion Joint Seals"
Expansion Joint Seals (strip seals)	9	0	"Strip Seals"
Falsework & Forms (superstructure)	8	0	Article 420-3
Falsework & Forms [2] (substructure)	8	0	Article 420-3
Mechanically Stabilized Earth Retaining Walls [4]	7	1	"MSE Retaining Walls"
Metal Bridge Railing	8	0	Plan Note
Metal Stay-in-Place Forms	8	0	Article 420-3
Metalwork for Elastomeric Bearings [5,6]	7	0	Article 1072-10
Miscellaneous Metalwork [5,6]	7	0	Article 1072-10
Overhead Sign Assemblies	13	0	Article 903-3(C)
Pile Points	7	1	Article 450-8(D) & "Steel Pile Points"
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20

Precast Concrete Box Culverts	2, then 1 reproducible	0	"(Optional) Precast Reinforced Concrete Box Culvert at Station ___"
Precast Retaining Wall Panels	10	0	Article 1077-2
Pot bearings [5]	8	0	"Pot Bearings"
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3
Proprietary retaining walls [4]	9	1	Applicable Project Special Provision
Prestressed Concrete Girder (strand elongation and detensioning sequences)	6	0	Articles 1078-8 and 1078-11
Prestressed Concrete Cored Slab (detensioning sequences) [3]	6	0	Article 1078-11
Revised Bridge Deck Plans (adaptation to metal stay-in-place forms)	2, then 1 reproducible	0	Article 420-3
Revised Bridge Deck Plans (adaptation to modular expansion joint seals)	2, then 1 reproducible	0	"Modular Expansion Joint Seals"
Soil Nail Retaining Walls [4]	4	1	Applicable Project Special Provision
Sound Barrier Wall Steel Fabrication Plans [6]	7	0	Article 1072-10 & "Sound Barrier Wall"
Sound Barrier Wall Casting Plans	10	0	Article 1077-2 & "Sound Barrier Wall"
Structural Steel [5]	2, then 7	0	Article 1072-10
TFE Expansion Bearings [5]	8	0	Article 1072-10
Temporary Detour Structures [4]	10	1	Article 400-3 & "Construction, Maintenance and Removal of Temporary Structure at Station ____"
Temporary Shoring [4]	6	1	Article 410-4 & "Temporary Shoring for Maintenance of Traffic"

Temporary Fabric or Wire Walls [8]	0	2	Applicable Project Special Provision
Permanent Anchored Tieback Retaining Walls [4]	4	1	Applicable Project Special Provision
Evazote Joint Seals [7]	9	0	Applicable Project Special Provision
Optional Disc Bearings [5]	8	0	"Optional Disc Bearings"
Removal of Existing Structure over Railroad	5	0	Railroad Special Provisions
Drilled Pier Construction Sequence Plans [8]	0	2	"Drilled Piers"
Pile Hammers [8]	0	2	Article 450-6

FOOTNOTES

1. References are provided to help locate the part of the contract where the working drawing submittals are required. References in quotes refer to the Project Special Provision by that name. Articles refer to the Standard Specifications.
2. Submittals for these items are necessary only when plan notes require them.
3. Submittals for these items may not be required. A list of pre-approved sequences is available from the producer or the Materials and Tests Unit.
4. These submittals are reviewed by the Structure Design Unit and the Geotechnical Engineering Unit. If NCDOT Shoring Standards are used, working drawings need not be submitted, but the Shoring Selection Form should be forwarded to the Geotechnical Engineering Unit.
5. The fabricator may submit these items directly to the Structure Design Unit.
6. The two sets of preliminary submittals required by Article 1072-10 of the Standard Specifications are not required for these items.
7. Submittals for Fabrication Drawings are not required. Submission of Catalogue Cuts of Proposed Material is required. See Section 5.A of the Project Special Provision.
8. Submittals for these items are reviewed by the Geotechnical Engineering Unit only and correspondence regarding these items should be directed to and will come from the Geotechnical Engineering Unit.

ELASTOMERIC BEARINGS (10-03-02)

Use elastomeric bearings in accordance with Article 1079-2 of the Standard Specifications except as follows:

TABLE 1079-2
NATURAL RUBBER ELASTOMER REQUIREMENTS

Grade (durometer)	50	60
PHYSICAL PROPERTIES Hardness ASTM D2240	50 +5 -5	60 +5 -5

UNCLASSIFIED STRUCTURE EXCAVATION AT STATION 304+22.00 -L- (12-12-02)

The 2002 Standard Specifications shall be revised as follows:

Unclassified structure excavation shall be in accordance with Section 412 of the Standard Specifications with the following exception:

Payment will be made under:

Unclassified Structure Excavation at Station _____.....Lump Sum

PERMANENT ANCHOR TIEBACK RETAINING WALL:

1.0 General:

The work under this section consists of design, plan preparation, furnishing materials, and construction of proposed Permanent Tieback Retaining Wall No. 1 from Station 11+80.81 -Y8- to Station 14+90.56 -Y8- (39.0' Rt), and proposed Permanent Tieback Retaining Wall No. 2 from Station 13+65.91 -Y8- to Station 16+79.77 -Y8- (39.0' Lt) in accordance with the plans, these specifications and in reasonably close conformity with the lines, grades, and dimensions shown on the approved drawings.

A permanent anchor tieback anchor retaining wall consists of soldier piles and timber lagging supported by post-tensioned ground anchors with permanent cast-in-place facing.

Design and construct the permanent anchor tieback retaining wall by using one of the following contractors, or an approved equal that must be approved by NCDOT prior to beginning design.

F&W CONSTRUCTION COMPANY
376 Powder Springs Street, Suite 221
Marietta, GA 30064
(770) 424-9002

FOUNDATION SERVICES, DIV OF HAYWARD BAKER
208 Little Santee Rd.
Colfax, NC 27235
(336) 668-0884

Schnabel Foundation Company
1654 Lower Roswell Road
Marietta, GA 30068
(770) 971-6455

SUBSURFACE CONSTRUCTION COMPANY
1107 Fuller Street
Raleigh, NC 27603
(919) 857-4609

Terra Tech, Inc.
101 Loudoun Street SW
Leesburg, VA 20175
(703) 771-4600

Submit 5 copies of plans and calculations to the Engineer for review and approval and allow 40 calendar days from the date they are received until they are returned by the Engineer.

A pre-construction meeting must be held prior to the start of the work and must be attended by representatives from the Contractor, Wall Subcontractor, Resident Engineer, Materials and Test Unit, and Geotechnical Engineering Unit to discuss construction details and inspection of the wall construction. Review of all submittals must be completed prior to scheduling the pre-construction meeting.

2.0 Design Criteria:

Wall design must be in accordance with the criteria set forth in the AASHTO Specifications for Highway Bridges and the FHWA Manual "Ground Anchors and Anchored Systems Manual", Publication No FHWA-IF-99-015.

Use the soil parameters shown on the plans to design the tieback wall.

Design all wall components for a 100-year design life.

Include calculations and details of the cast-in-place facing in the design package. Design a facing of a minimum 10 inch (250 mm) in thickness to be constructed on a minimum 6 inch (150 mm) thick by 12 inch (300 mm) wide unreinforced concrete leveling pad. Construct the concrete facing of the tieback retaining wall in accordance with Section 825 of the Standard Specifications with an ordinary surface finish.

Embed the wall a minimum of 24 inches (600 mm) below the proposed finished grade in front of the wall.

Provide plans containing sufficient information to lay out and construct the wall including but not limited to the following:

- Elevation views showing all proposed and existing ground lines and stations, soldier piles, leveling pad elevations, construction joint locations.

- Plan views showing all horizontal layout information.

- Section views showing in detail all wall components, the proximity of other structures, proposed and existing ground lines, etc.

- Specific details of wall components.

- Construction sequence.

3.0 Materials:

All materials are to be as specified or better, and as approved by the Engineer. Submit requests for substitutions to the Engineer thirty days before intended installation.

A. Fabricate tieback tendons from single or multiple elements of the following:

a. Steel bars conforming to ASTM Designation A722, "Uncoated High-Strength Steel Bars for Prestressed Concrete."

b. Seven-wire strand conforming to ASTM Designation A416/416M, "Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete."

c. Compact seven-wire strands conforming to ASTM Designation A779, "Uncoated Seven-Wire Compacted, Stress-Relieved Steel Strand for Prestressed Concrete."

Submit to the Engineer mill test reports for each heat or lot of prestressing material used to fabricate tendons.

B. Submit cement anchor grout mix design to the State Materials Engineer for approval. Supply Portland Cement conforming to ASTM Specification C-150, Type I, II, or III, and potable water. Supply cement that is fresh, free from lumps or any indication of hydration. Use admixtures that will impart low water content, flowability and minimum bleeding in the cement grout only with the consent of the Engineer. Do not use admixtures that contain chemicals that may have a harmful effect on the prestressing steel or cement. If admixtures are to be used, submit to the Engineer prior to using the admixture, the manufacturer's literature indicating the type of admixture and the manufacturer's recommendations for mixing the admixtures with grout. Expansive additives which cause air bubbles in the grout will not be allowed. Use grouting equipment that includes a mixer capable of producing a grout free of lumps and undispersed cement. Use a positive displacement grout pump. Equip the pump with a pressure gauge to monitor grout pressures at the nozzle, using a gauge capable of measuring pressures of at least 150 psi (1035 kPa), or twice the actual grout pressures used.

Size the grouting equipment to enable the tieback to be grouted in one continuous operation. Use mixing and storage times that do not cause excessive temperature build-up in the grout. Use a mixer capable of continuously agitating the grout.

C. Use anchorage and hardware suitable for the type of anchor tendon used and capable of developing 95% of the guaranteed specified minimum ultimate tensile strength of the tendon when tested in the unbonded state without failure of the tendon. Supply anchorage devices capable of holding the prestressing steel at a load producing a stress of not less than 95% of the guaranteed specified minimum ultimate tensile strength of the prestressing steel without exceeding anticipated set and without failure of either the anchorage or the prestressing steel. Anchorages shall be capable of lift-off, detensioning or retensioning a tendon at any time prior to grouting.

Fabricate the bearing plate from steel plate conforming to AASHTO M270 Grade 250 Specifications. Size the bearing plate so that the bending stress in the plate does not exceed 0.75 times the yield strength of the steel at the tieback design load or 1.00 times the yield strength of the steel at the maximum tieback test load.

Provide polyvinyl chloride (PVC) trumpets made from Type I, Schedule 40, Grade PVC 1120 pipe conforming to the requirements of ASTM D-1785. The plastic material shall be resistant to aging by ultra-violet light.

Provide steel trumpets made from pipe or tube conforming to the requirements of ASTM A-53 for pipe and ASTM A-500 for tubing.

Provide trumpets with an inside diameter equal to or larger than the hole in the bearing plate furnished by the tendon supplier, and long enough to accommodate movements of the structure during testing and stressing. For strand tendons, consult the tendon supplier to determine the minimum length trumpet required to make a transition from the diameter

of the tendon in the unbonded length to the diameter of the tendon at the anchorhead. Provided a watertight seal between the trumpet and the unbonded length corrosion protection.

If grout is used to fill the trumpet, then the seal is temporary and it acts as a grout form. If corrosion inhibitor is used to fill the trumpet, then the seal is permanent and it shall be fabricated from Buna-N-synthetic rubber or equal.

Furnish anchor nuts and plates for bars having complementary spherical shapes at the contact areas.

Furnish anchorheads of either steel meeting the requirements of AASHTO M270 Grade 250, or cast ductile iron meeting the requirements of ASTM A-536 Grade 80-55-06.

D. Use corrosion inhibitor (grease) conforming to the following test requirements:

Chlorides	10 ppm max.	by ASTM B-512
Nitrates	10 ppm max.	by ASTM D-992
Sulfides	10 ppm max.	by APHA 427D(15th ED)

The corrosion inhibitor (grease) must remain ductile and free from cracks and must not become fluid over the anticipated range of temperatures encountered during fabrication, transport, storage and while in service. The inhibitor must be impervious to moisture and air, be a self-healing film and displace water. The corrosion inhibitor must have a reserve alkalinity for long-term acid neutralization.

E. Epoxy Coating: Epoxy coating must be an electrostatically applied coating meeting M-284 (ASTM A-775). Any required field patching must meet ASTM A-775 or ASTM D-3196.

F. Corrugated Tubes: The following corrugated tubes will be acceptable:

a. High density corrugated polyethylene (PE) tubing conforming to the requirements of AASHTO M252-851.

b. High density corrugated polypropylene (PP) tubing manufactured from plastic classified as Type II-26500-D by ASTM D-2146. The minimum wall thickness of the tubing shall be 0.04 inches (1.0 mm).

c. Corrugated polyvinyl chloride (PVC) tubes with a minimum wall thickness of 0.04 inches (1.0 mm).

G. Heat Shrinkable Tube: Heat shrinkable tubing must have an outer heat shrinkable polyethylene plastic internally coated with a thixotropic sealant.

Recovered wall thickness must be at least 0.04 inches (1.0 mm). Coating thickness must be at least 0.02 inches (0.50 mm).

H. Bondbreaker: Use any of the following bondbreakers:

a. Bar Tieback Tendon: Low density polyethylene tubing, polypropylene tubing or polyvinyl chloride tubing with a minimum wall thickness of 0.06 inches (1.50 mm).
b. Strand Tieback Tendon: A polyethylene tube or a hot melt extruded polypropylene tube with a minimum wall thickness of 0.06 inches (1.50 mm).

I. Electrical Insulation: The electrical insulation must be a multipolymer plastic sheet manufactured expressly for bearing purposes. Fabricate the electrical insulation from a material that is: an electrical insulator; resistant to attack from cement; the corrosion inhibitor, or the environment; nondetrimental to the prestressing steel; prevents oxygen and moisture from coming in contact with the anchorage or bearing plate; and is capable of withstanding atmospheric exposure and ultra-violet light degradation if the anchorhead is to remain exposed to the atmosphere.

J. Steel members used as soldier piles must conform to the applicable sections of the Standard Specifications. Steel piles must contain 0.2% minimum copper, and must be ASTM Grade A36 or better. Stiffeners at the anchor location must be 0.75 inch (19 mm) thick steel plates and must be ASTM Grade A36 or better and 0.2% copper, or must be painted (including welds) with two coats of zinc-rich paint.

K. Cast-in-place concrete and reinforcing steel must conform to the applicable sections of the Standard Specifications.

L. Concrete for coping must be Class A and conform to the applicable requirements in sections 420 and 1000 of the Standard Specifications. Reinforcing Steel in coping must conform to the applicable requirements in sections 425 and 1070 of the Standard Specifications.

M. Filter fabric on the backside of the wall, used in conjunction with a granular material or with a molded, polymeric core must conform to Section 1056-1 of the Standard Specifications.

N. Drain pipes installed along the lower portions of the wall near the leveling pad or footing must conform to Section 815 of the Standard Specifications. These drain pipes must be incorporated into the roadway drainage structures at the nearest available point.

O. Timber lagging must conform to the requirements of Section 1082-1 of the Standard Specifications and Table 16 entitled Recommended Thickness of Wood Lagging in Appendix C of the AASTHO "Construction Handbook for Bridge Temporary Works".

P. #57 Stone must conform to the requirements of Section 1005 of the Standard Specifications.

4.0 Corrosion Protection:

A. General:

Prestressed rock and soil anchors and the anchor head assembly must be doubly protected against corrosion. The cement grout in the bond zone constitutes one protection system; cement grout in the unbonded zone does not constitute a protection system. Corrosion protection begins with the storage, fabrication, and handling of the tendon components prior to insertion in the borehole.
Proper care is required to avoid prolonged exposure to the elements, and to avoid mechanical or physical damage which would reduce or impair the future ability of the components to resist any adverse conditions encountered during their service life.

B. Tendon Fabrication:

Fabricate tendons in accordance with approved details and free of dirt, detrimental rust, or other deleterious substances. Install the plastic sheath at the fabrication shop as a single piece without splices. Field installation of the plastic sheath shall not be allowed. Prior to installation, handle and store tendons in such a manner as to avoid corrosion and physical damage. Field repair damaged coatings with ultra-high molecular weight polyethylene tape or heat shrinkable tubing. Damage such as abrasions, cuts, nicks, welds, weld splatters, or heavy corrosion and pitting, will be cause for rejection of the tendon. Replace rejected tendons at no cost to the Department in terms of either material replacements and/or resulting time delays.

Strand Tendon:

Apply a polyethylene tube or a hot-melt extruded polypropylene tube over a corrosion inhibiting grease coated strand for the entire unbonded length of each individual strand of the tieback tendon. Coat the individual wires of each tendon with grease to completely fill the space between the tube and the strand, making provisions to prevent the grease from escaping at the ends of the tubes. Place the bond length and lower two feet of the unbonded length in a corrugated tube. Centralize the tendon within the corrugated tube with a minimum of 0.02 inches (0.50 mm) of grout cover. Use spacers along the bond length to separate the strands so the tendon will bond to the encapsulation grout. Mix with the encapsulation grout, if desired, admixtures which control bleed, improve flowability, reduce water content and are expansive can be. Three options for grouting inside the encapsulation are available:

1. Grout the tendons inside the encapsulation after the tendon has been placed in the drill hole, or

2. Grout the tendons inside the encapsulation prior to inserting the tendon in the drill hole and then place in the drill hole provided the grout has not achieved initial set or a maximum of 45 minutes, or

3. Grout the tendons and allow to set inside the encapsulation for a period of 24 hours prior to inserting the tendon in the drill hole. In this case, support the entire length of tendon at sufficient intervals during installation such that excessive bending does not occur.

Bar Tendon:

Epoxy coat the bar tendon with a minimum thickness of 0.008 inches (0.20 mm). Install a tight fitting bondbreaker around the encapsulated bar over the unbonded length.

5.0 Construction:

Excavation and Backfill:

Coordinate scheduling with the Wall Subcontractor such that earthwork and wall construction can be accomplished at a minimum of delay to each.

Excavation must be in reasonably close conformity to the limits and construction stages shown on the plans or specified in the contract and limited to that necessary to install the lagging.

Use #57 stone as backfill behind the lagging to the limits as shown on the plans or as directed by the engineer.

Fill small voids behind the lagging with hand tamped on site soils.

Temporary Earth Support:

Construct temporary earth support between soldier piles such as to be safe and provide adequate resistance to earth loads. Use sound materials, free of defects, and placed in a workmanlike manner.

Soldier Piles:

Set all soldier piles in pre-augered or drilled holes. Keep holes open, if required, by casing or other means approved by the Engineer. Place concrete such that free fall greater 5 feet (1.5 meters) does not occur. Use a lean sand grout mixture to fill the remainder of the hole to the ground surface. Remove this mixture as required to install the timber lagging. Set piles and concrete holes as soon as practical after drilling. At no time shall more than 5 holes be left open before setting piles and concreting.

Shaft excavation must conform to the applicable provisions of Section 410 of the Standard Specifications. Haul off and waste material resulting from shaft excavation. Do not place shaft excavation on the slope. Provide Class A concrete meeting the requirements of Section 1000 of the Standard Specifications or as approved by the Engineer. Design the Class "A" concrete with a 6-inch to 8-inch slump.

Cast shaft concrete against undisturbed ground unless otherwise permitted by the Engineer, and construct in accordance with Section 825 of the Standard Specifications. If over-excavation occurs vertically, backfill with #57 Stone Backfill before setting the pile. Remove all loose and soft material and dewater the excavation immediately before and during the concrete casting operation. Make the top of the concrete shafts generally level.

Anchor Installation:

The holes for the anchors must be drilled. Core drilling, rotary drilling, auger drilling or percussion drilling may be used. If water is used in the drilling operation, dispose of the water in such a manner that erosion of the wall site is minimized. *Any damage to the site by water erosion shall be repaired by the Contractor at no cost to the Department.* If the hole will not stand open, install casing as required to maintain a clean and open hole. Provide a hole diameter not less than 3 inches (75 mm) if no pressure grouting is used. Pressure grouting is defined as grouting with a pressure greater than 60 psi (415 kPa). Use a drill bit with a diameter not less than 0.12 inches (3 mm) smaller than the specified hole diameter. The hole shall be within 3 inches (75 mm) of plan location and drilled to the inclination specified on the approved design plans within a three degree tolerance. Do not extend holes outside the right-of-way limits. Thoroughly clean holes in rock of all dust, rock chips, grease or other deleterious material prior to inserting the tendon.

Install the tendon in the casing or hole drilled for the anchor, taking care to insure that the tendon's corrosion protection is not damaged during handling or installation. If the sheathing has been damaged, repair it with ultra high molecular weight PE tape. Wind the tape spirally around the tendon so as to completely seal the damaged area. Use a pitch of the spiral to ensure a double thickness at all points. Install the tendon in the bond length in such a way as to insure that it has a minimum of 0.5 inch (13 mm) grout cover. Degrease the bond length of strands or wires prior to installation by using Acetone, MEK, or MIBK leaving no residue on the tendon. Other substances may be used subject to approval by the Engineer. Include all costs of cleaning tendons in the price bid for Contract items.

Drill holes 1 foot (0.3 meter) minimum longer than tendons. Insert the tendon after the hole is drilled to the final depth. Do not subject anchor tendons to sharp bends. Provide centralizers at maximum 10 foot (3.0 meters) center-to-center spacing throughout the bond length to insure that the tendons do not contact the wall of the drill hole, with the lowest centralizer no more than 5 feet (1.5 meters) from the bottom of the bond length. Do not use centralizers made of wood or any other material detrimental to the tendon steel or sheathing. If multi-element tendons are used without a fixed anchorage at the lower end, provide adequate spacing of the tendon elements to achieve proper grout coverage. Do not use anchors for grounding electric equipment.

Perform the grouting operation after the tendon is inserted. Inject grout at the lowest point of the anchor. Place grout over the entire anchor length. Do not allow the top of the grout column to contact the wall or the trumpet. After grouting, the tendon shall remain undisturbed until the grout has cured for at least 72 hours. Record the following data during the grouting operation:

a. Type of mixer
b. Water/cement ratio
c. Type of additives
d. Grout pressure
e. Type cement
f. Test sample strengths (prior to stressing)
g. Volume of grout placed in bond and free lengths

After lockoff of the post-tension force, fill the trumpet with non-bleed, expansive grout, or grease. Coat the exposed surface of the anchorage with mastic, and cover with a metal cap or Portland Cement concrete.

Anchor Testing and Stressing:

Each anchor must be tested. The maximum test load must not exceed 80% of the guaranteed ultimate tensile strength of the tendon. Performance test the first two anchors installed of each specified design load capacity and 5% of the remaining anchors at locations to be chosen by the Engineer. Proof test all remaining anchors. Install no additional anchors until the first two anchors have been successfully performance tested.

Performance Tests:

Do performance tests by incrementally loading and unloading the anchor in accordance with the following schedule. Record the movement of the tendon to the nearest 0.001 inch (0.025 mm) with respect to an independent fixed reference point. The jack and pressure gauge shall have been calibrated as a unit. Use a pressure gauge graduated in 100 psi (700 kPa) increments or less. Use a master gauge to verify the accuracy of the production gauge at the beginning of each shift.

CycleLoad	Cycle	Load	
1	0	5	0.50P
	0.25P		0.75P
	AL		1.00P
2	0.25P		1.20P
	0.50P		1.33P
	0.25P		1.20P
	AL		1.33P*

3	0.50P	Adjust to lockoff load.
	0.75P	Actual lock-off loads may be
	0.50P	somewhat higher to account
	AL	for seating losses.
		* Hold 50 minutes for creep test.
4	0.50P	
	0.75P	
	1.00P	AL (Alignment Load)
	0.75P	P (Design Load)
	0.50P	
	AL	

To prevent misalignment of testing equipment, maintain a minimum Alignment Load (AL) of 0.05P.

Hold each load increment until movement ceases, or a minimum of 1 minute. Submit loading and unloading rates (tons per minute) for approval. Apply each load in less than 30 seconds after the jack pump is started.

Perform a Creep Test by holding the 1.33P load for 50 minutes. While maintaining a constant load, record anchor movement (total movement) at 0, 1/2, 1, 3, 5, 10, 20, 30, 40 and 50 minutes. Begin the observation time when load is applied to the pump.
The Engineer will review all performance tests to determine if the anchor is acceptable. An anchor shall be acceptable if:

a. The total elastic movement obtained exceeds 80% of the theoretical elastic elongation of the free length.
b. The creep movement does not exceed 0.08 inches (2 mm) during the 5 minutes to 50 minutes time increments regardless of tendon length and load.

Proof Tests:

Perform proof tests by incrementally loading and unloading the anchor in accordance with the following schedule. Record the movement of the tendon to the nearest 0.001 inch (0.025 mm) with respect to an independent fixed reference point. Monitor the jack load with a pressure gauge or load cell.

0
0.25P
0.50P
0.75P
1.00P
1.20P
1.33P (Hold for creep test)
Adjust to lockoff load.

Actual lockoff load may be somewhat higher to account for seating losses.

Perform a Creep Test by holding the 1.33P load for 5 minutes. Holding the load constant, record anchor movement (total movement) at 0 second, 30 second, 1 minute, 3 minute, and 5 minute intervals. Begin observation times the moment the jack begins to apply the 1.33P load. If the movement between the 30 second and the 5 minute reading is 0.08 inches (2 mm) or more, maintain the load for an additional 45 minutes and record the movement at 10, 20, 30, 40, and 50 minutes. Record all movements in relation to a fixed reference point. The acceptance criteria shall be as in A and B above.

Lift-Off Tests:

Make a lift-off reading of all anchors after transferring the load to the end anchorage and prior to removing the jack. The load determined shall be within 5% of lockoff load. If the lift-off load is not within this tolerance, reset the end anchorage and make another lift-off reading. Perform lift-off tests within 7 days of when the load was locked-off in the anchor.

After five lift-off tests are performed, the Engineer will *specify* lift-off tests be performed on a random basis such that the total number of tests will be on no more than 10% of the remaining anchors.

Cutting of Tendon Protrusions:

After an anchor has been accepted by the Engineer, the portion of the anchored tendon protruding over the anchor may be cut, if not otherwise required for use in retesting. Cutting must be done according to the tendon manufacturer's recommendations as approved by the Engineer. Care must be taken not to damage the tendon anchor.

Redesign:

If anchors fail during performance tests or proof tests, modify the design or construction procedures, subject to review by the Engineer. These modifications may include reducing the anchor design load by increasing the number of anchors, increasing the grout pressure, requiring post-grouting or increasing the bond length. Any modification of design or construction procedure will be at no cost to the Department. Install the redesigned anchors in the wall and test as previously defined at no cost to the Department.

Those anchors that fail the performance or proof tests may be incorporated in the wall. Propose a reduced Design Load and retest as noted above. Acceptance of such anchors will be at the discretion of the Department.

6.0 Records

Provide the Engineer with the following records:

1. As-built drawings showing the location of the tiebacks, total tieback length, anchor length, and unbonded length one month after completion of the tieback installation.

2. Steel and grout certifications and mill reports prior to incorporating these materials in the work.

3. Grouting records indicating the cement type, quantity injected, and the grout pressures once a week.

4. Tieback test results once a week.

7.0 Method of Measurement

Permanent Anchor Tieback Retaining Wall - No separate measurement of the wall for payment purposes will be made for this work.

#57 Stone Backfill - The quantity of #57 Stone to be paid for will be the actual number of cubic yards (cubic meters) of this material which has been placed as backfill behind the wall within the limits as shown on the plans and as directed by the Engineer.

8.0 Basis of Payment

Permanent Anchor Tieback Retaining Wall

Payment will include all costs for concrete, reinforcing steel, excavation, lagging, piles, anchors, labor, design and all other materials and equipment including but not limited to grouting, drilling holes, post-tensioning, performing and evaluating all tests, submitting records of tests, all tools and all other miscellaneous items necessary to complete the work, including concrete coping and drainage above and below wall.

Payment will be made under:

"Permanent Anchored Wall No. 1,
Sta 11+80.81 -Y8- to Sta 14+90.56 -Y8- (39.0' RT.)", ...Lump Sum

"Permanent Anchored Wall No. 2,
Sta 13+77.91 -Y8- to Sta 16+79.77 -Y8- (39.0' LT.)", ... Lump Sum

#57 Stone Backfill

The quantity of #57 Stone, measured as provided above will be paid for at the contract unit price per cubic yard (cubic meter) for "#57 Stone Backfill for Permanent Anchored Wall". Such price and payment will be considered full compensation for furnishing, hauling, excavating into existing ground, and compacting the backfill material necessary to complete the work satisfactorily.

Payment will be made under:

"#57 Stone Backfill for Permanent Anchored Wall".....Cubic Yard (Cubic Meter)

GALVANIZED REINFORCING STRAPS

1.0 DESCRIPTION

Design, prepare plans, and install galvanized reinforcing straps at all end bents for dual bridges at Sta. 231+17.87 -L- in accordance with this specification and the details shown in the plans. Work includes all excavation, galvanized reinforcing straps, attachment devices, retaining wall backfill, and all other materials, labor, tools, equipment and incidentals necessary to complete the work.

Furnish galvanized reinforcing straps and attachment devices from any one of following retaining wall system suppliers in accordance with this Special Provision. Declare the choice of retaining wall system supplier at the Preconstruction Conference for the project. The wall system supplier chosen at the Preconstruction Conference becomes the required galvanized reinforcing strap supplier for the contract.

The Reinforced Earth Wall as manufactured by:
The Reinforced Earth Company
8614 Westwood Center Drive, Suite 1100
Vienna, VA 22182
Telephone (703) 821-1175

The Retained Earth Wall as manufactured by:
Foster Geotechnical
1372 Old Bridge Road, Suite 101
Woodbridge, VA 22192
Telephone (703) 499-9818

The Hilfiker RSE Wall as manufactured by:
T and B Structural Systems
637 W. Hurst Boulevard, Suite 2A
Hurst, TX 76053
Telephone (817) 280-9858

Design the galvanized reinforcing straps to meet the criteria of the current AASHTO Standard Specifications for Highway Bridges and the requirements specified in the plans. Design **multiple layers** of galvanized reinforcing straps to resist the resultant lateral load as shown on the plans.

Use the following soil parameters for design of the galvanized reinforcing straps:

$\gamma = 110$ lb/ft^3
$\phi = 34$ degrees
$C = 0$ psf

Submit eight sets of complete working drawings/shop plans, erection plans and design calculations, sealed by a North Carolina Registered Professional Engineer, for review and approval prior to beginning wall work. Allow 40 days for review and approval from the date they are received by the Engineer until they are returned to the Contractor.

Provide the option chosen to meet the requirements of the plans, this Special Provision and the Standard Specifications.

2.0 GENERAL

The Resident Engineer schedules a Preconstruction Conference with representatives from the Contractor, the retaining wall system Supplier, and the Geotechnical Engineering Unit to discuss construction details and inspection of the galvanized reinforcing straps.

Provide all necessary material from the Supplier chosen.

Obtain from the Supplier technical instruction and guidance in preconstruction activities, including the Preconstruction Conference, and on-site technical assistance during construction. Follow any instructions from the Supplier closely unless otherwise directed by the Engineer.

3.0 MATERIALS

A. Reinforcing Steel, Reinforcing Mesh, Mats, or Straps, Tie Strips and Fasteners

Use reinforcing Steel conforming to the applicable requirements in Sections 425 and 1070 of the Standard Specifications.

Shop-fabricate tie strips of hot rolled steel conforming to the minimum requirements of ASTM A570-85, Grade 50 (Grade 345) or equivalent. Shop fabricate the reinforcing mesh or mats of cold drawn steel wire conforming to the minimum requirements of AASHTO M32 (M32M) and weld into the finished mesh fabric in accordance with AASHTO M55 (M55M). Hot roll reinforcing strips from bars to the required shape and dimensions with their physical and mechanical properties conforming to AASHTO M223 (M223M), Grade 65 (Grade 450). Cut to lengths and tolerances shown on the plans and punch holes for bolts in the locations shown on plan details. The minimum bending radius of tie strips is 1 inch (25 mm). Inspect all reinforcing and tie strips

carefully to ensure they are true to size and free from defects that may impair their strength or durability. Galvanize in accordance with the minimum requirements of AASHTO M111.

Use 1/2" (12.70 mm) diameter bolts, nuts and washers conforming to AASHTO M164 (M164M). Provide Bolt and thread lengths in accordance with Supplier's recommendations. Hot-dip galvanize bolts and nuts in accordance with the requirements of AASHTO M232 (M232M).

B. Miscellaneous Attachment Devices

Provide miscellaneous components, polyvinylchloride pipe, stirrups, etc., in accordance with the Supplier's recommendations.

Fabricate clevis connector and connector bar from cold drawn steel wire conforming to the requirements of AASHTO M32 (M32M) and welded in accordance with AASHTO M55 (M55M). Galvanize loops in accordance with AASHTO M111.

Cold form mat anchors or buttonheads, where applicable, symmetrically about the axis of the wire to develop the minimum guaranteed ultimate tensile strength of the wire. Do not use a cold forming process that causes indentations in the wire. Provide mat anchors and buttonheads that do not contain wide open splits or splits not parallel with the axis of the wire.

Galvanize mat anchors and buttonheads after fabrication in accordance with the requirements of AASHTO M111. Repair damage to the galvanized coating prior to or during installation in the acceptable manner providing a coating comparable to that provided by AASHTO M111.

C. #57 Washed Crushed Stone Backfill

Use backfill material conforming to the applicable requirements of Section 1005 of the Standard Specifications and meeting the following criteria:

- Free of organic or otherwise deleterious substances.
- Contains a maximum organic content of 0.1%.
- Soundness (AASHTO T104): Have a maximum weighted average loss of 15% when subjected to five cycles of the soundness test.
- Resistance to Abrasion (AASHTO T96): Have a maximum percentage of wear of 55%.
- Electrochemical:

Resistivity > 5000 ohm-cm	ASTM D1125
4.5 < pH < 9.5	ASTM D1293

Before placing any backfill, furnish a Type IV certification in accordance with Article 106-3 of the Standard Specifications. Include a copy of all test results conducted in accordance with the above requirements in the certification. The Engineer determines how often NCDOT samples backfill material to assure compliance with gradation and electrochemical requirements.

1. Sample Preparation

Obtain approximately 2,000 grams of representative material and transfer it into a 1 gallon (3.8 liters) wide mouth plastic jug. Then add an equal weight of deionized or distilled water to the sample, and let this mixture set for approximately 30 minutes. At the end of this period, place a lid on the container and vigorously agitate the mixture for 3 minutes. Repeat this agitation at the 2 hour and 4 hour intervals. Allow the sample to set for approximately 20 hours after the 4 hour agitation so the solids will settle out. At this time remove a sufficient amount of the solution and filter through a coarse paper (Fisher Q8) to obtain the supernate to be analyzed in accordance with the above procedures.

4.0 CONSTRUCTION METHODS

A. Site Preparation

Perform surface excavation operations and random fill construction in the vicinity of the structure in accordance with the applicable portions of this Special Provision, and in reasonably close conformity to the lines, grades, dimensions, and cross-sections shown on the plans.

B. Excavation

Excavate all material necessary for the installation of the reinforcing straps in accordance with the plans and this provision. Excavation includes the construction and subsequent removal of all necessary bracing, shoring, sheeting and cribbing and all pumping, bailing, and draining. Perform random backfilling in accordance with the details in the plans and dispose of or stockpile surplus or unsuitable excavated material as directed by the Engineer.

Perform all necessary clearing and grubbing at the site in accordance with Section 200 of the Standard Specifications.

Notify the Engineer a sufficient time before beginning the excavation so that measurements may be taken of the undisturbed ground.

Shore or brace the excavation in accordance with local and state safety standards. Perform excavation and related work in such sequence that no portion of the retaining wall will be endangered by subsequent operations.

When the excavation is adjacent to a traveled way, obtain approval before beginning the excavation. Submit drawings and design calculations in accordance with the provisions of Subarticle 410-5(D) of the Standard Specifications.

C. Reinforcing Placement

Placing Backfill and Reinforcing Straps

Place the backfill material in layers for the full width shown on the plans. Place layers not more than 7½ inches (190 mm) in depth loose thickness and compact. Compact #57 stone backfill with at least four passes of an 8 – 10 ton (7.3 - 9.1 metric ton) vibratory roller in the vibratory mode, or as directed by the Engineer. At each tie strip level, reinforcing mesh level, or reinforcing mat level of the wall, level and compact the backfill material before placing and attaching tie strip, mat or mesh. Place the reinforcing strips, mat or mesh normal to the face of the wall or as shown on the plans. Compact backfill layers in a direction parallel to the wall and without disturbance or distortion of the reinforcing strips, mats, or mesh. Use only a hand-operated mechanical compactor within 3 feet (1 m) of the face of the wall as a precaution against pushing the wall outward. Exercise extreme care to prevent bending tie strips, mats, or mesh during compaction. Compact as required with a minimum of three passes of the compactor.

At the end of each day's operation, slope the areas adjacent to the stone backfill such that in the event of rain, surface runoff will be diverted away from the backfill area. Contamination of the stone backfill by soil fines from runoff is grounds for rejection of the backfill.

5.0 METHOD OF MEASURMENT:

A. Galvanized Reinforcing Straps

The quantity of galvanized reinforcing straps to be paid for will be the actual number of linear feet (linear meters) of the material used in the work as specified.

B. #57 Stone Backfill

The quantity of #57 Stone Backfill to be paid for will be the actual number of cubic yards (cubic meters) of this material which has been placed as backfill within the limits of the galvanized reinforcing straps or as directed by the Engineer.

6.0 BASIS OF PAYMENT:

A. Galvanized Reinforcing Straps

The quantity of straps, measured as provided above, will be paid for at the contract unit price per linear foot (linear meter), for "Galvanized Reinforcing Straps". Such price and payment will be full compensation for all work covered by this provision, including but not limited to furnishing, hauling, placing, and attachment devices.

Attachment devices are considered incidental to the cost of the galvanized reinforcing straps.

Payment will be made under:

"Galvanized Reinforcing Straps".....Linear Foot (Linear Meter)

B. #57 Stone Backfill

The quantity of #57 Stone, measured as provided above will be paid for at the contract unit price per cubic yard (cubic meter) for "#57 Stone Backfill for Galvanized Reinforcing Straps". Such price and payment will be considered full compensation for furnishing, hauling, excavating into existing ground, and compacting the backfill material necessary to complete the work satisfactorily.

Payment will be made under:

"#57 Stone Backfill for Galvanized Reinforcing Straps" .....Cubic Yard (Cubic Meter)

TIP: R-2911D Rowan County

SPECIAL PROVISIONS FOR PROTECTION OF RAILWAY INTEREST

1. FLAGGING SERVICES:

A. When Required

Under the terms of the agreement between the N. C. Department of Transportation, herein called Department and the Norfolk Southern Railway Company herein called the Railroad, the Railroad has sole authority to determine the need for flagging required to protect its operations. In general, the requirements of such services will be whenever the Contractor's men or equipment are, or are likely to be, working on the Railroad's right-of-way, or across, over, adjacent to or under a track, or when such work has disturbed or is likely to disturb a railroad structure or the railroad roadbed or surface and alignment of any track to such extent that the movement of trains must be controlled by flagging. Normally, the Railroad will assign one flagman to a project; but in some cases, more than one may be necessary, such as yard limits where three (3) flagmen may be required. However, if the Contractor works within distances that violate instructions given by the Railroad's authorized representative or performs work that has not been scheduled with the Railroad's authorized representative, a flagman or flagmen may be required full time until the project has been completed. Should such violations or unscheduled, unauthorized work by the contractor result in full time flagging being required by Railroad, the additional cost of such flagging above normal flagging cost shall be deducted from the final payment to the Contractor as provided in Article 109-9 of the Standard Specifications. Neither Railroad nor Department will be liable for damages resulting from unscheduled or unauthorized work.

B. Scheduling and Notification

(1) The Contractor's work requiring railroad flagging should be scheduled to limit the presence of a flagman at the site to a maximum of 50 hours per week. The Contractor shall receive Railroad approval of work schedules requiring a flagman presence in excess of 40 hours per week.

(2) Not later than the time that approval is initially requested to begin work on Railroad right-of-way, Contractor shall furnish to the Railroad and the Department a schedule for all work required to complete the portion of the project within Railroad right-of-way and arrange for a job site meeting between the Contractor, the Department, and the Railroad's authorized representative. Flagman or flagmen may not be provided until the job site meeting has been conducted and the Contractor's work scheduled.

(3) The Contractor will be required to give the Railroad representative at least 10 working days of advance written notice of intent to begin work within Railroad

right-of-way in accordance with this special provision. Once begun, when such work is then suspended at any time, or for any reason, the Contractor will be required to give the Railroad representative at least 3 working days of advance notice before resuming work on Railroad right-of-way. Such notices shall include sufficient details of the proposed work to enable the Railroad representative to determine if flagging will be required. If such notice is in writing, the Contractor shall furnish the Highway Engineer a copy; if notice is given verbally it shall be confirmed in writing with copy to the Highway Engineer. If flagging is required, no work shall be undertaken until the flagman, or flagmen, is present at the job site. It may take up to 30 days to obtain flagging initially from the Railroad. When flagging begins, the flagman is usually assigned by the Railroad to work at the project site on a continual basis until no longer needed and cannot be called for on a spot basis. If flagging becomes unnecessary and is suspended, it may take up to 30 days to again obtain from the Railroad. Due to labor agreements, it is necessary to give 5 working days notice before flagging service may be discontinued and responsibility for payment stopped.

(4) If, after the flagman is assigned to the project site, emergencies arise which require the flagman's presence elsewhere, then the Contractor shall delay work on Railroad right-of-way until such time as the flagman is again available. Any additional costs resulting from such delay shall be borne by the Contractor and not the Department or Railroad.

C. Payment

(1) The Department will be responsible for paying the Railroad directly for any and all costs of flagging which may be required to accomplish the construction. The Contractor shall reimburse the Railroad for any costs of the flagging which is required for work for the benefit of the Contractor.

(2) The cost of flagging service is based on an 8-hour work day and 40-hour work week. This cost includes the base pay for each flagman, overhead, and includes an estimated per diem charge for travel expenses, meals and lodging. The charge by the Railroad will be the actual cost based on the rate of pay for the Railroad's employees who are available for flagging service at the time the service is required. Work by a flagman in excess of 8 hours per day or 40 hours per week but not more than 12 hours a day will result in overtime pay at 1½ times the appropriate rate. Work by a flagman in excess of 12 hours per day will result in overtime pay at 2 times the appropriate rate. If work is performed on a holiday, the flagging rate is 2½ times the normal rate. Railroad work involved in preparing and handling bills will also be charged. Charges by the Railroad shall be in accordance with applicable provisions of Federal-Aid Policy Guide 23 CFR 140I and 23 CFR 646B issued by the Federal Highway Administration on December 9, 1991, including all current amendments.

ID. Verification

(1) The Contractor and Department will review and sign the Railroad flagman's time sheet, (Form 11123) attesting that the flagman was present during the time recorded. Flagmen may be removed by Railroad if form is not signed. If flagman is removed, the Contractor will not be allowed to re-enter the Railroad right-of-way until the issue is resolved. Complaints concerning flagman or flagmen must be resolved in a timely manner. If need for flagman or flagmen is questioned, please write or telephone Railroad's Engineer-Grade Separation Structures. All verbal complaints must be confirmed in writing by the Contractor within 5 working days with copy to the Highway Engineer. All written correspondence should be addressed to:

Chief Engineer-Bridges & Structures
Norfolk Southern Railway Company
99 Spring Street, S.W.
Atlanta, GA 30303
Attention: Engineer-Grade Separation Structures

(2) The Railroad flagman assigned to the project will be responsible for notifying the Highway Engineer upon arrival at the job site on the first day (or as soon thereafter as possible) that flagging services begin and on the last day that he performs such services for each separate period that services are provided. The Highway Engineer will document such notification in the project records. When requested, the Highway Engineer will also sign the flagman's diary showing daily time spent and activity at the project site.

2. AUTHORITY OF RAILROAD ENGINEER AND STATE ENGINEER:

The authorized representative of the Railroad company, hereinafter referred to as Railroad Engineer, shall have final authority in all matters affecting the safe maintenance of Railroad traffic of his Company including the adequacy of the foundations and structures supporting the Railroad tracks.

The authorized representative of the Department, hereinafter referred to as the Engineer, shall have authority over all other matters as prescribed herein, in the Project Specifications, and Special Provisions, and on the plans.

3. NOTICE OF STARTING WORK:

A. The Contractor shall not commence any work on Railroad rights of way until he has complied with the following conditions:

(1) Given the Railroad written notice, with copy to the Engineer who has been designated to be in charge of the work, at least ten days in advance of the date he proposes to begin work on Railroad rights of way to:

Chief Engineer-Bridges & Structures
Norfolk Southern Railway Company
99 Spring Street, SW
Atlanta, Georgia 30303

(2) Obtain written authorization from the Railroad to begin work on Railroad rights of way, such authorization to include an outline of specific conditions with which he must comply.

(3) Obtain written approval from the Railroad for Railroad Protective Insurance coverage as required by paragraph 13 herein.

B. The Railroad's written authorization to proceed with the work will include the names, addresses, and telephone numbers of the Railroad's representatives who are to be notified as hereinafter required. Where more than one representative is designated, the area of responsibility of each representative will be specified.

4. INTERFERENCE WITH RAILROAD OPERATIONS:

A. The Contractor shall so arrange and conduct his work that there will be no interference with Railroad operations, including train, signal, telephone and telegraphic services, or damage to the property of the Railroad Company or to poles, wires, and other facilities of tenants on the rights of way of the Railroad Company. Whenever work is liable to affect the operations or safety of trains, the method of doing such work shall first be submitted to the Railroad Engineer for approval, but such approval shall not relieve the Contractor from liability. Any work to be performed by the Contractor which requires flagging service or inspection service (watchman) shall be deferred by the Contractor until the flagging protection required by the Railroad is available at the job site.

B. Whenever work within Railroad rights-of-way is of such a nature that impediment to Railroad operations such as use of runaround tracks or necessity for reduced speed is unavoidable, the contractor shall schedule and conduct his operations so that such impediment is reduced to the absolute minimum.

C. Should conditions arising from, or in connection with the work, require that immediate and unusual provisions be made to protect operations and property of the Railroad, the Contractor shall make such provisions. If in the judgment of the Railroad Engineer, or in his absence, the Engineer, such provision is insufficient, either may require or provide such provisions as he deems necessary. In any event, such unusual provisions shall be at the Contractor's expense and without cost to the Railroad or the Department.

5. TRACK CLEARANCES:

A. The minimum track clearances to be maintained by the Contractor during construction are as follows:

(1) Horizontal clearance measured from centerline of track to falsework; 13'-0" on tangent track
14'-0" on curved track

(2) Vertical clearance from top of rail to falsework - 22'-0"

However, before undertaking any work within Railroad right of way, or before placing any obstruction over any track, the Contractor shall:

(1) Notify the Railroad's representative at least 72 hours in advance of the work.

(2) Receive assurance from the Railroad's representative that arrangements have been made for flagging service as may be necessary.

(3) Receive permission from the Railroad's representative to proceed with the work.

(4) Ascertain that the Engineer has received copies of notice to the Railroad and of the Railroad's response thereto.

6. CONSTRUCTION PROCEDURES:

A. General:

Construction work on Railroad property shall be:

(1) Subject to the inspection and approval of the Railroad.

(2) In accord with the Railroad's written outline of specific conditions.

(3) In accord with these Special Provisions.

(4) Bridge Demolition and Girder Erection Plans and other submittals as required, shall be prepared by a North Carolina registered Professional Engineer.

(5) Cranes and all attachments shall have a capacity of 150% load lifted.

B. Excavation:

The subgrade of an operated track shall be maintained with edge of berm at least 10'0" from centerline of track and not more than 24 inches below top of rail. The Contractor will not be required to make existing section meet this specification if substandard, in which case existing section will be maintained.

C. Excavation for Structures:

The Contractor will be required to take special precaution and care in connection with excavating and shoring pits, and in driving piles, for footings adjacent to tracks to provide adequate lateral support for the tracks and the loads which they carry, without disturbance of track alignment and surface, and to avoid obstructing track clearances with working equipment, tools or other material. The procedure for doing such work, including need of and plans for shoring, shall first be approved by the Railroad Engineer, but such approval shall not relieve the Contractor from liability. Before submission of plans to the Railroad Engineer for approval, such plans shall first be reviewed and certified satisfactory by the Department.

D. Blasting:

(1) The Contractor shall obtain advance approval of the Railroad Engineer and the Engineer for use of explosive on or adjacent to Railroad property. If permission for use of explosives is granted, the Contractor will be required to comply with the following:

(a) Blasting shall be done with light charges under the direct supervision of a responsible officer or employee of the Contractor.

(b) Electric detonating fuses shall not be used because of the Possibility of premature explosions resulting from operation of two-way train radios.

(c) No blasting shall be done without the presence of an authorized representative of the Railroad. At least 72 hours advance notice to the person designated in the Railroad's notice of authorization to proceed (see paragraph 3B above) will be required to arrange for the presence of an authorized Railroad representative and such flagging as the Railroad may require.

(d) Have at the job site adequate equipment, labor and materials and allow sufficient time to clean up debris resulting from the blasting without delay to trains, as well as correcting at his expense any track misalignment or other damage to Railroad property resulting from the blasting as directed by the Railroad's authorized representative. If his actions result in delay of trains, the Contractor shall bear the entire cost thereof.

(2) The Railroad representative will:

(a) Determine the approximate location of trains and advise the Contractor the approximate amount of time available for the blasting operation and clean-up.

(b) Have the authority to order discontinuance of blasting if, in his opinion, blasting is too hazardous or is not in accord with these special provisions.

E. Maintenance of Railroad Facilities:

(1) The Contractor will be required to maintain all ditches and drainage structures free of silt or other obstructions which may result from his operations; to promptly repair eroded areas within Railroad rights of way and to repair any other damage to the property of the Railroad or its tenants.

(2) All such maintenance and repair of damages due to the Contractor's operations shall be done at the Contractor's expense.

F. Storage of Materials and Equipment:

Materials and equipment shall not be stored where they will interfere with Railroad operations, nor on the rights of way of the Railroad company without first having obtained permission from the Railroad engineer, and such permission will be with the understanding that the Railroad Company will not be liable for damage to such material and equipment from any cause and that the Railroad Engineer may move or require the Contractor to move, at the contractor's expense, such material and equipment.

All grading or construction machinery that is left parked near the track unattended by a watchman shall be effectively immobilized so that it cannot be moved by unauthorized persons. The Contractor shall protect, defend, indemnify and save Railroad, and any associated, controlled or affiliated corporation, harmless from and against all loss, costs, expenses, claim or liability for loss of or damage to property or the loss of life or personal injury, arising out of or incident to the Contractor's failure to immobilize grading or construction machinery.

G. Cleanup:

Upon completion of the work, the Contractor shall remove from within the limits of the Railroad rights of way, all machinery, equipment, surplus materials, falsework, rubbish or temporary buildings of the Contractor, and leave said rights of way in a neat condition satisfactory to the Chief Engineer of the Railroad or his authorized representative.

7. DAMAGES:

A. The Contractor shall assume all liability for any and all damages to his work, employees, servants, equipment and materials caused by Railroad traffic.

B. Any cost incurred by the Railroad for repairing damages to its Property or to property of its tenants, caused by or resulting from the operations of the contractor, shall be paid directly to the Railroad by the contractor.

8. HAUL ACROSS RAILROADS:

A. Where the plans show or imply that materials of any nature must be hauled across a Railroad, unless the plans clearly show that the State has included arrangements for such haul in its agreement with the Railroad, the Contractor will be required to make all necessary arrangements with the Railroad regarding means of transporting such materials across the Railroad. The Contractor will be required to bear all costs incidental, including flagging, to such crossings whether services are performed by his own forces or by Railroad personnel.

B. No crossing may be established for use of the Contractor for transporting materials or equipment across the tracks of the Railroad Company unless specific authority for its installation, maintenance, necessary watching and flagging thereof and removal, all at the expense of the contractor, is first obtained from the Railroad Engineer.

9. WORK FOR THE BENEFIT OF THE CONTRACTOR:

A. All temporary or permanent changes in wire lines or other facilities which are considered necessary to the project are shown on the plans; included in the force account agreement between the Department and the Railroad or will be covered by appropriate revisions to same which will be initiated and approved by the State and/or the Railroad.

B. Should the Contractor desire any changes in addition to the above, then he shall make separate arrangements with the Railroad for same to be accomplished at the Contractor's expense.

10. COOPERATION AND DELAYS:

A. It shall be the Contractor's responsibility to arrange a schedule with the Railroad for accomplishing stage construction involving work by the Railroad or tenants of the Railroad. In arranging his schedule he shall ascertain, from the Railroad, the lead time required for assembling crews and materials and shall make due allowance therefor. The Contractor shall cooperate with others in the construction of the project to the end that all work may be accomplished to the best advantage.

B. No charge or claims of the Contractor against either the Department or the Railroad Company will be allowed for hindrance or delay on account of railroad traffic, any work

done by the Railroad company or other delay incident to or necessary for safe maintenance of railroad traffic or for any delays due to compliance with these special provisions.

C. The Contractor's attention is called to the fact that neither the Department nor the Railroad Company assumes any responsibility for any work performed by others in connection with the construction of the project, and the Contractor shall have no claim whatsoever against the Department, or the Railroad Company for any inconvenience, delay, or additional cost incurred by him on account of such operations by others.

11. TRAINMAN'S WALKWAYS

A. Along the outer side of each exterior track of multiple operated track, and on each side of single operated track, an unobstructed continuous space suitable for trainman's use in walking along trains, extending to a line not less than 10' from centerline of track, shall be maintained. Any temporary impediments to walkways and track drainage encroachments or obstructions allowed during work hours while Railroad's protective service is provided shall be removed before the close of each work day. If there is any excavation near the walkway, a handrail, with 10'-0 minimum clearance from centerline of track, shall be placed.

12. COMPLETION AND ACCEPTANCE:

A. Upon completion of the work, the Contractor shall remove from within the limits of the railroad right of way all machinery, equipment, surplus materials, rubbish or temporary buildings of the Contractor, and leave said rights of way in a neat and orderly condition. After the final inspection has been made and work found to be completed in a satisfactory manner acceptable to the Department and the Railroad Company, the Department will be notified of the Railroad Company's acceptance in writing by the Railroad Company's Chief Engineer or his authorized representative within ten (10) days or as soon thereafter as practicable.

13. SAFETY:

A. GUIDELINES FOR PERSONNEL ON RAILROAD RIGHT-OF-WAY:

1. All persons shall wear hard hats. Appropriate eye and hearing protection must be used. Working in shorts is prohibited. Shirts must cover shoulders, back and abdomen. Working in tennis or jogging shoes, sandals, boots with high heels, cowboy and other slip-on type boots is prohibited. Hard-sole, lace-up footwear, zippered boots or boots cinched up with straps which fit snugly about the ankle are adequate. Safety boots are strongly recommended.

2. No one is allowed within 25' of the centerline of track without specific authorization from the flagman.

3. All persons working near track while train is passing are to lookout for dragging bands, chains and protruding or shifted cargo.

4. No one is allowed to cross tracks without specific authorization from the flagman.

5. All welders and cutting torches working within 25' of track must stop when train is passing.

6. No steel tape or chain will be allowed to cross or touch rails without permission.

B. GUIDELINES EQUIPMENT ON RAILROAD RIGHT-OF-WAY:

1. No crane or boom equipment will be allowed to set up to work or park within boom distance plus 15 ft. of centerline of track without specific permission from railroad official and flagman.

2. No crane or boom equipment will be allowed to foul track or lift a load over the track without flag protection and track time.

3. All employees will stay with their machines when crane or boom equipment is pointed toward track.

4. All cranes and boom equipment under load will stop work while train is passing (including pile driving).

5. Swinging loads must be secured to prevent movement while train is passing.

6. No loads will be suspended above a moving train.

7. No equipment will be allowed within 25' of centerline of track without specific authorization of the flagman.

8. Trucks, tractors or any equipment will not touch ballast line without specific permission from railroad official and flagman.

9. No equipment or load movement within 25' or above a standing train or railroad equipment without specific authorization of the flagman.

10. All operating equipment within 25' of track must halt operations when a train is passing. All other operating equipment may be halted by the flagman if the flagman views the operation to be dangerous to the passing train.

11. All equipment, loads and cables are prohibited from touching rails.

12. While clearing and grubbing, no vegetation will be removed from railroad embankment with heavy equipment without specific permission from the Railroad engineer and flagman.

13. No equipment or materials will be parked or stored on Railroad's property unless specific authorization is granted from the Railroad engineer.

14. All unattended equipment that is left parked on Railroad property shall be effectively immobilized so that it cannot be moved by unauthorized persons.

15. All cranes and boom equipment will be turned away from track after each work day or whenever unattended by an operator.

14. INSURANCE

A. In addition to any other forms of insurance or bonds required elsewhere in the contract documents, the Contractor will be required to provide coverage conforming to the requirements of the Federal-Aid Policy Guide outlined under 23 CFR 646A for all work to be performed on Railroad right(s) of way under the terms of the contract by carrying insurance of the following kinds:

1. CONTRACTOR'S COMMERCIAL GENERAL LIABILITY INSURANCE:

a. The Contractor shall furnish an original and one copy of the certificates of insurance and one certified copy of the policy to the Department as evidence that, with respect to the operations he performs on railroad right of way, he carries regular Contractor's Commercial General Liability Insurance including "XCU" coverage providing for limits of liability as follows:

COVERAGE	MINIMUM COMBINED LIMITS OF LIABILITY
Bodily Injury Liability	
	$ 2,000,000 Per Occurrence
Property Damage Liability	
	$ 2,000,000 Aggregate

b. If any part of the work is sublet, similar insurance and evidence thereof in the same amounts as required of the Prime Contractor, shall be provided by the subcontractor to cover his operations on railroad right of way. As an alternative, the Prime Contractor may provide insurance for the subcontractor by means of separate and individual policies.

c. Certificates of Insurance holders are to be the addressees given below. Certificates shall make reference to the project, milepost and county.

Division of Highways Dept. of Transportation c/o State Railroad Agent 1546 Mail Service Center Raleigh, N.C. 27601	Norfolk Southern Railway Company c/o Director of Risk Management Three Commercial Place Norfolk, VA 23510-2191

2. RAILROAD PROTECTIVE LIABILITY INSURANCE:

a. The Contractor shall furnish to the Department an original and one duplicate of the Railroad Protective Liability Insurance Policy with limits of liability as follows:

COVERAGE	MINIMUM COMBINED LIMITS OF LIABILITY
Bodily Injury Liability Property Damage Liability Physical Damage to Property	$2,000,000 Per Occurrence $6,000,000 Aggregate Per Annual Policy Period

b. The Railroad Protective Liability Policy is to be written on the ISO/RIMA Form No. CG 00 35 06 90 including Endorsements CG 28 31 11 85 and IL 00 21 or their equivalents.

c. The named insured, description of the work and designation of the job site to be shown on the Policy are as follows:

Named Insured: Norfolk Southern Railway Company
Three Commercial Place
Norfolk, VA 23510-2191

Description and Designation: Construction of new dual overhead bridges on US 70 and removal of existing Bridge Number 71 over the tracks of Norfolk Southern Railway Company in Barber, Rowan County, North Carolina near Railroad Milepost S-9.97 identified as State TIP R-2911D and Federal Project STP-70(77).

B. The Railroad Protective Liability Policy shall contain a clause requiring that sixty (60) days written notice be given the Department and the Railroad Company prior to cancellation or change.

All other policies and certificates shall contain a clause requiring that thirty (30) days written notice be given the Department and the Railroad Company prior to cancellation or change. The notices shall make reference to the project, milepost and county.

NOTICE TO:	COPY NOTICE TO:
Norfolk Southern Railway Company c/o Director of Risk Management Three Commercial Place Norfolk, VA 23510-2191	Division of Highways Dept. of Transportation c/o State Railroad Agent 1546 Mail Service Center Raleigh, NC 27601

C. All insurance herein before specified shall be carried until the final inspection and acceptance of the project, or that portion of the project within railroad right of way, by the Department or, in the case of subcontractors, until the Contractor furnishes a letter to the Engineer stating that the subcontractor has completed his subcontracted work within railroad right of way to the satisfaction of the Contractor and that the Contractor will accomplish any additional work necessary on railroad right of way with his own forces. It is understood that the amounts specified are minimum amounts and that the Contractor may carry insurance in larger amounts if he so desires. As to "aggregate limits", if the insurer establishes loss reserves equal to or in excess of the aggregate limit specified in any of the required insurance policies, Contractor shall immediately notify the Department of Transportation and shall cease all operations until the aggregate limit is reinstated. If the insurer establishes loss reserves equal to or in excess of one/half of the aggregate limit, Contractor shall arrange to restore the aggregate limit to at least the minimum amount stated in these requirements. Any insurance policies and certificates taken out and furnished due to these requirements shall be approved by the Department and the Railroad Company as to form and amount prior to beginning work on railroad right of way.

D. Evidence of insurance as required above shall be furnished for review to the Department at the address shown below after which it will be forwarded by the Department to the Railroad.

Send to Department:

Division of Highways
Dept. of Transportation
c/o State Railroad Agent
1546 Mail Service Center
Raleigh, NC 27601

15. FAILURE TO COMPLY:

A. In the event the Contractor violates or fails to comply with any of the requirements of these Special Provisions:

(1) The Railroad Engineer may require that the Contractor vacate Railroad property.

(2) The Engineer may withhold all monies due the Contractor on monthly statements.

Any such orders shall remain in effect until the Contractor has remedied the situation to the satisfaction of the Railroad Engineer and the Engineer.

16. PAYMENT FOR COST OF COMPLIANCE:

A. No separate payment will be made for any extra cost incurred on account of compliance with these special provisions. All such cost shall be included in prices bid for other items of the work as specified in the payment items.

R-2911D

Railroad Site Data:

The following information was received from the Railroad on **September 15, 2004,** and is provided as a convenience to the Contractor in bidding this project. This information is subject to change and the Contractor may, at his discretion, contact the Railroad directly to verify its current accuracy. Since this information is shown as a convenience to the Contractor, but is subject to change, the Contractor shall have no claims whatsoever against either the Railroad or the Department of Transportation for any delays or additional costs incurred based on changes in this information which occur after the above date of receipt.

Type and number of tracks within 50 ft. of project.

1 - Mainline

Number of trains on affected track per day.

12 per day

Type of trains.

Freight

Maximum authorized operating speed of trains.

45 mph

Type and number of RR employees assigned to job.

1 - Flagman