

# **NORFOLK SOUTHERN RAILWAY BRIDGE over SR1007**

## **CITY of HICKORY CATAWBA COUNTY, NC**

### **U-2306A**

SR1007 (Lenoir Rhyne Blvd Ext /Highland Ave)  
between Tate Blvd and 7<sup>th</sup> AVE NE

STA. P.O.T. 18+83.139 -L- =  
STA. P.O.T. 14+57.318-Y13-

NCDOT PROJECT NUMBER: 8.2791701 (U-2306A)  
NORFOLK SOUTHERN RAILWAY MILEPOST: S-56.67  
NORFOLK SOUTHERN RAILWAY FILE: 117-13525 (PND)

Project Number: 8.2791701 (U-2306A)

Catawba County

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ENGINEERING CERTIFICATION for the PROJECT SPECIAL PROVISIONS,  
METRIC

# NORFOLK SOUTHERN RAILWAY BRIDGE over SR1007

SR1007 (Lenoir Rhyne Blvd Ext /Highland Ave) between Tate Blvd and 7<sup>th</sup> AVE NE  
City of Hickory, Catawba County, NC

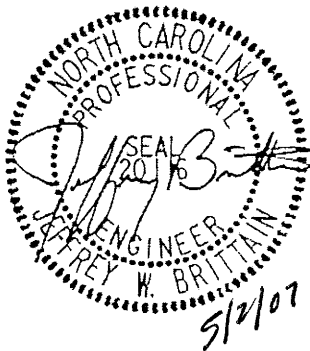
STA. P.O.T. 18+83.139 -L- =  
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I hereby certify that the documents contained herein, for the structure and trackwork at the station and milepost listed above, were prepared by me or under my direct supervision.

Signed, Sealed and Dated, this, the second day of May, 2007.



**Jeffrey W. Brittain, P.E.**

PROJECT ENGINEER

**TGS Engineers**

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**Project Number: 8.2791701(U-2306A)**

**Catawba County**

Norfolk Southern Railway Bridge over SR1007 (Lenoir Rhyne Blvd Extension /Highland Avenue) between Tate Blvd and 7<sup>th</sup> Avenue NE at Sta. 18+83.139-L- and at Norfolk Southern Railway MP S-56.67.

The "Standard Specifications for Roads and Structures, January 2002" of the North Carolina Department of Transportation, hereinafter referred to as the Standard Specifications, shall apply to the articles of the Project Special Provisions.

**PORTLAND CEMENT**

**(Special)**

Portland cement shall meet the requirements of the Standard Specifications for the type specified for the work. In addition to the other requirements, in order to prevent alkali reaction in concrete, all cement used on the railroad structure shall have a low alkali content. The total percentage of the sodium oxide (Na<sub>2</sub>O) present, plus 0.658 times the total percentage of potassium oxide (K<sub>2</sub>O) present, shall not exceed 0.60 percent. The Contractor shall furnish the Engineer with two (2) copies of certified mill test reports from the manufacturer of all cement, stating that the above requirements have been complied with.

No substitution of fly ash, blast furnace slag or other material will be permitted in meeting these minimum cement requirements.

**FINE AND COURSE AGGREGATE**

**(Special)**

The fine and coarse aggregates used in all concrete on the railway structure shall be non-reactive in accordance with the "Method of Test for Potential Reactivity of Aggregates (Chemical Method)", ASTM Designation C289-81. The Contractor shall furnish the Engineer with two (2) copies of the above test reports certifying that the fine and coarse aggregates are non-reactive and will not cause an alkali reaction.

**MECHANICAL BUTT SPLICING FOR REINFORCING STEEL**

**(Special)**

**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.

**WATERSTOPS**

**(Special)**

Waterstops shall be made of an approved flexible polyvinyl-chloride plastic, conforming to the U.S. Corps of Engineers Specification CRD-C-572-74, or rubber conforming to U.S. Corps of Engineers Specification CRD-C-513-75. Waterstops shall be made in the shape and of the material specified on the plans. The material shall form a continuous waterstop across the slab and up the curb of bridge decks, in abutment wings, or other locations as shown on the plans. Waterstops shall be fabricated in continuous units without splice, using material of the longest length available. Where bonded joints are necessary, like materials shall be bonded together by experienced men in accordance with the manufacturer's instructions. The entire cost of the waterstop, complete in place, shall be included in the unit contract price bid for "Reinforced Concrete Deck Slab."

**ELASTOMERIC FLASHING**

**(Special)**

The elastomeric flashing at the expansion joint between deck slabs shall be a continuous sheet of synthetic rubber 1.6mm thick by 254mm wide, or equal based on polychloroprene having properties specified by the following test data:

Tensile Strength	ASTM D-412-80	13.8 MPa minimum
Elongation	ASTM D-412-80	300% minimum
Hardness	ASTM D-2240-81	60 " 10
Water Absorption	ASTM D-471-79	10% maximum

The adhesive for use with the flashing shall be as recommended by the manufacturer of the synthetic rubber furnished and shall be applied according to manufacturer's instructions.

The entire cost of the elastomeric flashing, complete in place, shall be included in the unit contract price bid for "Reinforced Concrete Deck Slab."

**RUBBER JOINT COMPOUNDS**

**(Special)**

Expansion joints shall be sealed with a two component elastomeric polymer type cold-applied synthetic joint sealer, manufactured with thiokol polysulfide liquid polymers. The material shall be grey polysulfide rubber base caulking compound conforming to Specification ANSI A-116.1. Pouring type compound shall be used for horizontal joints and non-sag type for other joints. The mixing and application of the joint sealing compound shall be performed with the equipment recommended and in strict accordance with the manufacturer's instructions. The entire cost of the rubber joint compounds shall be included in the unit contract price bid for "Reinforced Concrete Deck Slab."

**WATERPROOFING**

**(Special)**

Waterproofing for protection of concrete surfaces on substructure to be backfilled against shall consist of a two (2)

part system having a membrane layer and a protection course layer meeting the requirements of the American Railway Engineering and Maintenance of Way Association's (AREMA) Manual of Railway Engineering Chapter 29, Waterproofing.

The Waterproofing shall be installed per manufacture's instructions. The entire cost of the two (2) part system shall be included in the unit contract price bid per sq. meter for "Two Part Membrane Waterproofing System".

Waterproofing for protection of the concrete deck shall consist of a two (2) part system having a membrane layer and an asphalt plank, or other Railroad approved, protection course meeting the requirements of the AREMA Manual Chapter 29, Waterproofing.

The Waterproofing shall be installed per manufacture's instructions. The entire cost of the membrane waterproofing shall be included in the unit contract price bid per sq. meter for "Membrane Layer Waterproofing For Deck".

The entire cost of the Asphalt Plank shall be included in the unit contract price bid per sq. meter for "25mm Asphalt Planking Protective Course For Deck".

**STRUCTURE DRAINAGE SYSTEM**

**(Special)**

- A. **Materials:** Ductile iron pipe collector system shall be as detailed and specified on the plans. French drain material behind abutments shall be No. 467M crushed stone or gravel conforming to Table 1005-1, Aggregate Gradation.
- B. **Installation:** Deck drains shall be located as shown on the plans. The ductile iron pipe collector system shall be installed as detailed and specified on the plans.

Perforated pipe drains behind the abutments shall be laid with perforations turned down and bedded on a layer of compacted impervious clay. The perforations shall be kept open and free from the clay bedding course, asphalt coating, or other materials. The french drain material shall be placed concurrently with the backfill and shall be kept separate with a thin timber slide or burlap bag. Perforated pipe behind abutments and outfall pipes shall be laid on a grade of at least one percent (1%) and shall be as shown on the plans. Grades of pipe drains shall be set by the Engineer. Copies of shop drawing details of the drainage system shall be submitted by the Contractor to the Department of Transportation for approval. The drainage system must be approved before fabrication.

- C. **Basis of Payment:** Payment for the "Structure Drainage System, Sta. \_\_\_\_\_" will be made at the contract lump sum price bid, which price and payment shall be full compensation for furnishing all materials and labor to install the drainage system complete, including corrugated metal and ductile iron pipe, deck drains, fittings, excavation, french drain material, other backfill and outfall pipes.

**CONDUIT IN PARAPETS**

**(Special)**

Conduit in the parapets shall be 102mm (4") diameter PVC conduit conforming to applicable Underwriters Laboratory specifications and shall be located as shown on the Plans. Provisions shall be made for expansion between the deck slab and abutment backwalls and between deck slabs at expansion joints. Couplings shall be provided behind backwalls for connection to the 102mm (4") diameter rigid pipe. If non-PVC fittings, couplings, or other incidental items are required, they must be fully compatible with PVC conduit. Details and material data shall be submitted by the Contractor to the Engineer for approval by the Railroad Company of all materials required for this work. The entire cost of furnishing and installing all conduit, expansion fittings, couplings and incidental items required for this work shall be included in the bid price of cubic meters for "Class AA Concrete."

**BACKFILLING AROUND STRUCTURES**

**(Special)**

Backfill material behind abutments (except No. 467M crushed stone or gravel for french drains over perforated drain pipes) shall be Type A Aggregate Base Course (ABC) in accordance with the Standard Specifications. Placing and compacting shall be as provided for in Section 410-9 of the Standard Specifications.

Backfill around structures, except as specified above, shall be suitable material available from the excavations. In the event material excavated is not approved for use as backfill by the Engineer, the Contractor will be required to furnish and haul to the structure site necessary suitable backfill material. Placing and compacting shall be as provided in Section 410-9 of the Standard Specifications.

Disposal of surplus excavated material shall be as specified in Section 410-1 of the Standard Specifications.

Payment for furnishing ABC backfill material and any suitable material to replace excavated material and for placing and compacting all backfill material shall be included in the contract unit price for other pay items.

### **SELF-LUBRICATING EXPANSION BEARING ASSEMBLIES**

**(Special)**

#### **Description:**

The self-lubricating expansion bearing assemblies shall each consist of an oilless self-lubricating copper alloy plate, a sole plate, a sliding plate with keeper bars, a masonry plate, any necessary fill plates, bearing pad, anchor bolt assembly which includes anchor bolts, nuts, washers, pipe, and any other necessary material as detailed on the plans. These bearing assemblies are located at the expansion ends of applicable spans as shown on the plans.

#### **Requirements:**

The self-lubricating copper alloy bearing plates shall be an approved article of standard production by an established manufacturer of such equipment installed in accordance with the manufacturer of such equipment installed in accordance with the manufacturer's recommendations and shall conform to the following requirements:

- (A) The copper alloy shall conform to AASHTO M107 Alloy 911 or AASHTO M108 Alloy 510.
- (B) The lubricant shall be of the solid type and shall consist of graphite, metallic substances having lubricating properties and a lubricating binder. Materials which do not have lubricating qualities or which promote chemical or electrolytic reactions, will not be acceptable. The lubricant shall be integrally molded and compressed into the lubrication recesses to form a dense, non-plastic lubricant.
- (C) The recesses shall be arranged in a geometric pattern such that successive rows shall overlap in the direction of motion and the distance between extremities of recesses shall be closer in the direction of motion than that perpendicular to motion. The entire bearing area of all surfaces which have provisions for motion shall be lubricated by means of these lubricant filled recesses. The total area of these recesses shall comprise not less than 25 % nor more than 35 % of the total bearing area of the plate.
- (D) The bearing plates shall be furnished to the sizes specified on the drawings. Bearing surfaces shall be machine finished and the surface roughness shall not exceed 125 micro inches (3.18 microns) when measured in accordance with ASA Standard B46.1-1955. Also, the bearing surfaces of the opposing steel plates shall also be finished as above. Align the tool marks shall be in the direction of motion. Finish the bearing surfaces so that all machine surfaces shall be flat within 0.0005 inch per inch (0.0127 mm per 25mm) of length and width.
- (E) For mating curved surfaces of steel and copper alloy, the maximum positive tolerance for the concave surface is 0.010 inch (0.25 mm) and the maximum negative tolerance for the convex surface is 0.010 inch (0.25mm).
- (F) The coefficient of friction between the copper alloy self-lubricating plates and the steel plates in contact with them shall not exceed 0.10 when subjected to the designed unit loading and also at twice the designed unit loading.

Payment for the bearing assemblies shall be at the contract lump sum price bid for "Self-lubricating Expansion Bearing Assemblies". This price shall be full compensation for all materials, tools, equipment, labor and incidentals necessary to furnish and install the self-lubricating bearing assemblies.

Payment for the Fixed Bearing Assemblies as shown on plans shall be included in the Lump Sum price bid for structural steel.



**METAL HANDRAIL****(Special)**

The Metal Handrail shall be constructed as shown on the plans. The quantity of Handrail to be paid for will be the actual number of linear meters of handrail, measured along the top bar of the rail, on the abutment wing walls and on the bridge superstructure, which has been completed and accepted. The quantities of Handrail, measured as provided herein, will be paid for at the contract unit price per linear meter for "Metal Handrail".

The above prices and payments will be full compensation for all work covered by this provision including but not limited to furnishing posts, rail bars, base plates, anchor cords, hardware and all other materials; fabrication and erection of the handrail; and incidentals necessary to complete the work as shown on the plans.

**CRANE SAFETY****(8-15-05)**

Comply with the manufacturer specifications and limitations applicable to the operation of any and all cranes and derricks. Prime contractors, sub-contractors, and fully operated rental companies shall comply with the current Occupational Safety and Health Administration regulations (OSHA).

Submit all items listed below to the Engineer prior to beginning crane operations involving critical lifts. A critical lift is defined as any lift that exceeds 75 percent of the manufacturer's crane chart capacity for the radius at which the load will be lifted or requires the use of more than one crane. Changes in personnel or equipment must be reported to the Engineer and all applicable items listed below must be updated and submitted prior to continuing with crane operations.

**CRANE SAFETY SUBMITTAL LIST**

- A. **Competent Person:** Provide the name and qualifications of the "Competent Person" responsible for crane safety and lifting operations. The named competent person will have the responsibility and authority to stop any work activity due to safety concerns.
- B. **Riggers:** Provide the qualifications and experience of the persons responsible for rigging operations. Qualifications and experience should include, but not be limited to, weight calculations, center of gravity determinations, selection and inspection of sling and rigging equipment, and safe rigging practices.
- C. **Crane Inspections:** Inspection records for all cranes shall be current and readily accessible for review upon request.
- D. **Certifications:** By July 1, 2006, crane operators performing critical lifts shall be certified by NC CCO (National Commission for the Certification of Crane Operators), or satisfactorily complete the Carolinas AGC's Professional Crane Operator's Proficiency Program. Other approved nationally accredited programs will be considered upon request. All crane operators shall also have a current CDL medical card. Submit a list of anticipated critical lifts and corresponding crane operator(s). Include current certification for the type of crane operated (small hydraulic, large hydraulic, small lattice, large lattice) and medical evaluations for each operator.

**DRILLED PIERS**

6-7-05

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 material or permanent steel casing. Drilled piers are a straight shaft type and vertical. Construct drilled piers in accordance with the details and dimensions shown on the plans and this special provision.

B. Work Experience

The Contractor/Subcontractor and the Contractor's/Subcontractor's superintendent performing the work described in this special provision must 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 drilled pier excavation and both dry and wet concrete placement. This work should be 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. The Contractor/Subcontractor should use equipment that is sufficient to complete the work in accordance with this special provision.

To verify the Contractor's/Subcontractor's ability to meet these requirements, 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 shown on the plans and with similar construction methods anticipated for this project. Include the names and phone numbers of the project owner's representatives who can verify the Contractor/Subcontractor's participation and performance on the listed projects.

C. Construction Sequence Plan

Submit two copies of 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 this plan including:

1. Work experience in accordance with Section 1.0, Item B.
2. List and size of 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 order of drilled pier construction.
4. Details of pier excavation methods.
5. Details of 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 how the tremie or pump will be controlled during concrete placement and what type of discharge control will be used 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 slurry supplier that the water to be used is acceptable.
11. Details on the handling of drilling spoils and slurry overflow including environmental control procedures to be used to prevent the loss of concrete, slurry and spoils.
12. Details of how the slurry level will be maintained above the highest piezometric head (if applicable).
13. Other information shown on the plans or requested by the Engineer.

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

If any changes in the 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 Meeting

Conduct a drilled pier preconstruction meeting with the Drilling Superintendent, the Resident or Bridge Maintenance Engineer and/or his or her representatives, the Bridge Construction Engineer and the Geotechnical Operations Engineer to discuss construction and inspection of the drilled piers. This meeting should occur after the Drilled Pier Contractor/Subcontractor has mobilized to the site and the construction sequence plan has been approved.

#### 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. This definition of rock is not for pay purposes; see Section 8.0 for method of measurement of "Drilled Piers Not in Soil".

#### F. Rock Socket

When required by a note on plans, 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 pier.

Excavate 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 on 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 may be required to achieve adequate bearing.

A drilling log including information such as top and bottom elevation of each stratum encountered, drilling tools used, drilling time in each stratum and material descriptions of each soil and rock layer must be signed by the Contractor upon completion of each pier.

Dispose of drilling spoils in accordance with Section 802 of the Standard Specifications and as directed by the Engineer. Drilling spoils consist of all excavated material including water removed from the excavation either by pumping or drilling tools. Construct drilled piers at the locations shown on the plans and within the tolerances specified herein. If tolerances are exceeded, the Engineer may require corrective measures to meet 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 shown in the plans. Build drilled piers within 2% of the plumb deviation for the total length of the piers. Verify the plumbness of the drilled pier excavations 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 pier 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 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. When using multiple casings in a telescoped arrangement, overlap subsequent casings a minimum of 2 feet (600 mm). 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 drilled pier excavation open overnight unless it is cased to rock.

If a note on plans does not prohibit dewatering and 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 a drilled pier excavation in rock or an excavation constructed with slurry may be 2 inches (50 mm) less than the design drilled pier diameter shown on the plans.

In order to remove a casing and substitute a larger diameter or longer casing through unstable or caving material, either backfill the excavation, stabilize the excavation with slurry before removing the casing to be replaced or insert the larger casing around the casing to be replaced before removal.

**A. Permanent Steel Casing**

Use permanent steel casings as directed by the Engineer and/or as required by a note on 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 steel casings conforming to ASTM A252, Grade 2 and the following minimum wall thickness requirements.

**CASING WALL THICKNESS**

Casing Diameter	Minimum Wall Thickness
Less than or equal to 48 inches (1220 mm)	3/8 inch (9 mm)
Greater than 48 inches (1220 mm) and less than or equal 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 the 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. However, no payment will be made for any costs associated with larger permanent casings. Extend the permanent casings from the top of pier elevation or top of permanent casing elevation, if shown on the plans, to a depth no deeper than the permanent casing tip elevation shown on the plans or the revised permanent casing tip elevation approved by the Engineer. Do not extend permanent casings below the permanent casing tip elevation shown on the plans without prior

approval from the Engineer. Additional drilled pier length and reinforcement may be required if permanent casings are extended below the permanent casing tip elevation shown on the plans. No payment will be made for the resulting additional drilled pier length, reinforcement and permanent casing unless the Engineer approves the revised permanent casing tip elevation. Install permanent casings 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 made.

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 steel 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 a minimum wall thickness of 3/8 inch (9 mm) and an outside diameter not less than the specified size of the drilled pier.

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

**C. Slurry**

When slurry use is not noted on the plans, slurry construction is an option. If slurry use is required or an option, polymer slurry use may either be required or prohibited as noted on the plans. If slurry use is required or an option and polymer slurry use is not noted on the plans, polymer slurry use is an option.

If polymer slurry is required or an option, use one of the following polymers listed in the table below:

PRODUCT	MANUFACTURER
SlurryPro EXL	KB Technologies Ltd. 3648 FM 1960 West, Suite 107 Houston, TX 77068 (800) 525-5237
Super Mud	PDS Company 105 West Sharp Street El Dorado, AR 71730 (800) 243-7455
Shore Pac GCV	CETCO Drilling Products Group 1500 West Shure Drive Arlington Heights, IL 60004 (800) 527-9948

Use polymer slurry and associated additives in accordance with the manufacturer's guidelines and recommendations unless otherwise approved by the Engineer. The Contractor should be aware that polymer slurry might not be appropriate for a given site. Polymer slurry should not be used for excavations in soft or loose soils as determined by the Engineer. When using polymer slurry, a representative of the manufacturer must be on-site to assist and guide the Contractor during the construction of the first three drilled piers unless otherwise approved by the Engineer. This representative must also be available for on-site assistance to the Contractor if problems are encountered during the construction of the remaining drilled piers as requested by the Engineer. The cost of all on-site assistance and representation will be considered incidental to the cost of the drilled piers.

If mineral slurry is required or an option, use mineral 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 bottom sedimentation. Provide bentonite slurry 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.

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 head along the depth of the pier. It is anticipated that the highest piezometric head is the static water or groundwater elevation (elevation head). However, the Contractor is responsible for determining the highest piezometric head. The use of steel casing to maintain the required slurry level is permitted; however, no payment will be made for casing that is used for this purpose. 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 slurry with water in tanks before introducing the slurry into the excavation. Submit written approval from the slurry supplier that the mixing water is acceptable. Allow bentonite slurry to hydrate 24 hours in tanks before use. 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 excavation. Such methods include, but are not limited to agitation, circulation and/or adjusting the properties of the slurry. Perform desanding operations as necessary to achieve the acceptable sand contents prior to placement of the reinforcing 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 concrete placement) does not exceed 36 hours. Do not work on more than two drilled piers per drill rig below the steel casing at any time.

Agitate bentonite slurry in the drilled pier excavations a minimum of every 4 hours. If the bentonite slurry is not agitated a minimum of every 4 hours or the 36 hour time limit is exceeded, the Engineer may require the Contractor to overream the drilled pier excavation beneath the steel casing a minimum of 1 inch (25 mm) and a maximum of 3 inches (75 mm) before performing any 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). All costs associated with both overreaming and the resulting additional concrete placement will be considered incidental to the cost of the drilled piers.

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

Collect all slurry samples using an approved sampling tool. Test slurry samples to determine density, viscosity, pH and sand content 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. Collect 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 qualified personnel, approved by the Engineer, conduct slurry tests to determine density, viscosity, pH and sand content. The following tables show the acceptable range of values for the slurry properties:

<b>BENTONITE SLURRY</b> Sodium Montmorillonite (Commercial Bentonite) Acceptable Range of Values			
Property (units)	At Time of Slurry Introduction	In Excavation Immediately Before Concrete Placement	Test Method
Density, pcf (kg/m <sup>3</sup> )	64.3 – 69.1 (1030-1107)	64.3 – 75.0 (1030-1201)	Mud Weight (Density) API 13B-1 Section 1
Viscosity, sec./quart (sec./0.95 liters)	28 – 45	28 – 45	Marsh Funnel and Cup API 13B-1 Section 2.2
PH	8 – 11	8 – 11	pH paper
Sand Content (percent)	Less than or equal to 4	Less than or equal to 2	Sand API 13B-1 Section 5
Notes: 1. Perform tests when the slurry temperature is above 40°F (4.4°C). 2. When approved by the Engineer for use in saltwater, increase the density by 2 pcf (32 kg/m <sup>3</sup> ).			

SLURRYPRO EXL KB Technologies Ltd. Acceptable Range of Values			
Property (units)	At Time of Slurry Introduction	In Excavation Immediately Before Concrete Placement	Test Method
Density, pcf (kg/m <sup>3</sup> )	Less than or equal to 67 (1073)	Less than or equal to 64 (1025)	Mud Weight (Density) API 13B-1 Section 1
Viscosity, sec./quart (sec./0.95 liters)	53 – 127	Less than or equal to 74	Marsh Funnel and Cup API 13B-1 Section 2.2
PH	8 – 11	8 – 11	pH paper
Sand Content (percent)	Less than or equal to 1	Less than or equal to 1	Sand API 13B-1 Section 5
Notes: 1. Perform tests when the slurry temperature is above 40°F (4.4°C). 2. When approved by the Engineer for use in saltwater, increase the density by 2 pcf (32 kg/m <sup>3</sup> ).			

SUPER MUD PDS Company Acceptable Range of Values			
Property (units)	At Time of Slurry Introduction	In Excavation Immediately Before Concrete Placement	Test Method
Density, pcf (kg/m <sup>3</sup> )	Less than or equal to 64 (1025)	Less than or equal to 64 (1025)	Mud Weight (Density) API 13B-1 Section 1
Viscosity, sec./quart (sec./0.95 liters)	34 – 64	Less than or equal to 64	Marsh Funnel and Cup API 13B-1 Section 2.2
PH	8 – 10	8 – 10	pH paper
Sand Content (percent)	Less than or equal to 1	Less than or equal to 1	Sand API 13B-1 Section 5
Notes: 1. Perform tests when the slurry temperature is above 40°F (4.4°C). 2. When approved by the Engineer for use in saltwater, increase the density by 2 pcf (32 kg/m <sup>3</sup> ).			



SHORE PAC GCV CETCO Drilling Products Group Acceptable Range of Values			
Property (units)	At Time of Slurry Introduction	In Excavation Immediately Before Concrete Placement	Test Method
Density, pcf (kg/m <sup>3</sup> )	Less than or equal to 64 (1025)	Less than or equal to 64 (1025)	Mud Weight (Density) API 13B-1 Section 1
Viscosity, sec./quart (sec./0.95 liters)	35 – 78	Less than or equal to 60	Marsh Funnel and Cup API 13B-1 Section 2.2
PH	8 – 11	8 – 11	pH paper
Sand Content (percent)	Less than or equal to 1	Less than or equal to 1	Sand API 13B-1 Section 5
Notes:			
<ol style="list-style-type: none"> <li>1. Perform tests when the slurry temperature is above 40°F (4.4°C).</li> <li>2. When approved by the Engineer for use in saltwater, increase the density by 2 pcf (32 kg/m<sup>3</sup>).</li> </ol>			

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

Sign and submit reports of all slurry tests required above to the Engineer upon completion of each drilled pier. The Department reserves the right to perform comparison slurry tests at any time.

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 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 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 may be used to verify the conditions and continuity of the bearing material prior to placement of the reinforcing steel. If the required end bearing capacity is not satisfied, increase the drilled pier length as directed 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 end bearing of the drilled pier excavation may be inspected either by entering the excavation or visually from the top of the excavation.

**2. Test Hole**

If the tip of the drilled pier excavation is in rock as defined by Section 1.0, Item E, drill a 1½ inch (38 mm) diameter test hole 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 may be used to inspect 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 may be observed either by entering the excavation or from the top of the excavation.

**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)

The Department may use the SID 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. If required, provide a safe and secure location to park the trailer for the SID while it is unattended on the project site. If any of the SID equipment is damaged 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 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. No claims 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 will be paid.

## 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 may be 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 and Spacers

Set the rebar cage directly on the bottom of the drilled pier excavation with plastic bolsters under each vertical reinforcing bar. Ensure that spacers are tall enough to raise the rebar cage off the bottom of the drilled pier excavation a minimum of 3 inches (75 mm). If approved by the Engineer, the rebar cage may be hung in the excavation provided the mechanisms supporting the cage are left in place until the Drilled Pier Concrete strength has achieved 3000 psi (20.7 MPa).

In order to ensure the minimum required concrete cover and achieve concentric spacing of the cage within the pier, attach plastic spacer wheels 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 and when using slurry construction. Use spacer wheels for slurry construction or in rock 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.

## 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 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. Use a mix that complies with one of the following:

- Type I or II cement with a minimum cement content of 640 lbs/yd<sup>3</sup> (380 kg/m<sup>3</sup>) and a maximum cement content of 800 lbs/yd<sup>3</sup> (475 kg/m<sup>3</sup>).
- Type IP blended cement with a minimum cement content of 665 lbs/yd<sup>3</sup> (395 kg/m<sup>3</sup>) and a maximum cement content of 833 lbs/yd<sup>3</sup> (494 kg/m<sup>3</sup>).

Limit the water cement ratio based on total cementitious materials to a maximum of 0.45. Air-entrainment is not required. Air content should be less than 7.5%.

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

Use 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. Ensure that the concrete temperature at the time of placement is 90°F (32°C) or less.

### 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 at the time of concrete placement. Contain and remove all wasted concrete that spills over the casing.

Do not twist, move or otherwise disturb temporary casings until the concrete depth in the casing is in excess of 10 feet (3 m) above the bottom of the casing being disturbed. If the head is greater than 30 feet (9 m), the Engineer may require a concrete depth greater than 10 feet (3 m). The head is defined

as the difference between the highest piezometric head along the depth of the pier and the static water elevation inside the excavation. If the Engineer requires a concrete depth greater than 10 feet (3 m), the Contractor may choose to either place concrete with this required concrete depth or place concrete with the wet method and a minimum concrete depth of 10 feet (3 m).

Maintain the required concrete depth above the bottom of the innermost casing during casing removal, except when the concrete level is at or above the top of drilled pier elevation. Sustain a sufficient concrete depth above the bottom of casing to overcome outside soil and water pressure. As the casing is withdrawn, exercise care in maintaining an adequate concrete depth 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 removal.

Use the water inflow rate to determine the concrete placement procedure after any pumps have been removed from the excavation. 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

Before concrete placement, make certain the drilled pier excavation is dry so the flow of concrete around the reinforcing steel can be verified by visual inspection.

For drilled piers exceeding 60 feet (18.3 m) in length, use a tremie or a pump to place concrete unless otherwise approved by the Engineer. Support the tremie or pump pipe 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 with a sectional tremie or pump (no continuous 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 and/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 a minimum of 10 inches (254 mm) in diameter unless otherwise approved by the Engineer. Use a tremie tube or pump pipe made of steel with watertight joints. 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. Do not 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.

## 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 will not be provided for additional concrete to fill the resulting voids.

For 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 within 20 feet (6 m) 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. If the integrity of the drilled pier is in question, the Engineer reserves the right to reject the drilled piers and require remediation. Remedial measures are proposed by the Contractor and require approval of 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 plans.

## 8.0 MEASUREMENT AND PAYMENT

### 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 or required 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 permanent casing tip elevation. The Department will also pay for up to an additional 3 feet (1 m) of permanent casing cut off if the casing can not be installed to the permanent casing tip elevation shown on the plans. Permanent casing will be paid for only when permanent casing is authorized or when the Engineer directs the Contractor to leave a casing in place such that it 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 the unit bid price for "Drilled Piers in Soil".

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 the unit bid price for "Drilled Piers Not in Soil".

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**

**6-7-05**

**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. 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 correspond 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 is required, unless the Department previously approved the consultant 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 an approved 4500 psi (31.0 MPa) compressive strength grout. If the Engineer elects not to CSL test a pier, obtain approval from the Engineer to dewater the tubes and backfill them with an approved grout.

## 2.0 PREPARATION FOR CSL

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

Install four tubes in each drilled pier with a diameter of 5 feet (1524 mm) or less and 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 shown on the 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 concrete placement, measure the stickup of the tubes above the top of the drilled piers and verify tube spacing.

After placement of the reinforcement cage and before concrete placement, fill the CSL tubes with clean water and cap them to keep out debris. CSL tubes that are not filled with water and capped will be rejected. When removing the caps, use care not to apply excess torque, force or stress, which could break the bond between the tubes and the concrete.

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 water and cover to keep out debris.

### 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 CSL test results in both electronic and hard copy form including two original copies of CSL report 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:

<b>Concrete Condition Rating Criteria (CCRC)</b>			
<b>CCRC</b>	<b>Rating Symbol</b>	<b>Velocity Reduction</b>	<b>Indicative Results</b>
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\slurry 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 ASCII 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 5 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, sonic echo or impact response tests and concrete coring.

The Engineer determines the depth, location, diameter (PQ or NQ size) and number of core holes when concrete coring is required. If the Engineer is concerned about concrete strength or requires the use of a borehole camera for inspection, large diameter cores (PQ size) are required. Drill a minimum of two 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 labeled with 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 coring records, signed by the Contractor, that include NCDOT project number, name of the Drilling Contractor, date cored and percent core recovery. Allow 5 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, 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 Piers Special Provision or the plans. Modifications to the drilled pier design or any load transfer mechanisms required by the remedial action must be designed by a Registered North Carolina Professional Engineer. Include supporting calculations and 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 5 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 PAYMENT**

The complete and accepted CSL will be paid for at the unit bid price for "Crosshole Sonic Logging" per drilled pier. The Department will only pay for the initial CSL test on a drilled pier; no additional payment will be made for subsequent CSL tests performed on the same drilled pier. Include in this unit bid price all costs incurred for procurements, conducting the CSL testing, reporting of results and incidentals necessary to complete the work including any other test required to determine the acceptability of the drilled pier.

Include the cost of the crosshole sonic logging tubes in the unit bid price for drilled piers. No separate payment will be made for the CSL tubes. The unit bid price for the drilled piers will include full compensation for

furnishing, installing, extending tubes, dewatering and grouting of all CSL tubes and core holes, if applicable, and all materials, labor, tools, equipment and incidentals necessary to complete the work.

## **FABRICATION OF STRUCTURAL STEEL**

**(Special)**

- A. These specifications cover the furnishing, fabricating, preparing, assembling, welding, testing, painting and delivering of all structural steel and bridge bearings as shown on the plans.
- B. The following specifications are referred to in this document. The term current shall indicate the edition listed below:
1. American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual)
  2. American Society for Testing and Materials, Annual Book of Standards - dated 1990 (A.S.T.M.)
  3. American Institute of Steel Construction, Manual of Steel Construction - Ninth Edition (A.I.S.C.)
  4. American Welding Society - Bridge Welding Code, D1.5, dated 1995 (A.W.S.)
- C. Fabricator shall be certified for "Major Steel Bridges" Category Cbr (Old III), under the AISC Quality Certification Program.
- D. Except as otherwise specified hereinafter, the current American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), Chapter 15 - Steel Structures, apply to all work.
- E. Materials
1. Structural steel shall meet the current requirements of the Specifications of the American Society for Testing and Materials, for Structural Steel, Designation A-709, Grade 50, S84-F2 (Fracture Critical - Charpy Test Zone 2), S91 (Fine Austenitic Grain Size), S93 (Limitation on Weld Repairs), except as noted on the plans or in these specifications.
  2. High strength bolts shall meet the current requirements of the Specifications of the American Society for Testing and Materials for High Strength Bolts for Structural Steel Joints, Designation A-325, unless otherwise indicated.
  3. Welding electrodes for arc welding shall meet the current requirements of the Specifications for mild steel arc-welding electrodes Series E70, AWS 5.1, Low Hydrogen Classification for SMAW and AWS 5.17 for SAW.
- F. Shop Drawings
1. The Fabricator's attention is called to the requirements for shop drawings, Chapter 15, Article 1.1.3 Shop Drawings, AREMA Specifications.
  2. The Fabricator shall furnish eight (8) complete sets of detailed shop drawings to the Department for approval prior to starting fabrication. Unchecked drawings shall not be submitted for approval.
  3. The rejection of or the procedure for the correction of shop drawings will not be considered as cause for delay.
  4. Approval by the Engineer of shop drawings shall not relieve the Fabricator from furnishing material of proper dimensions, quantities and quality, nor will such approval relieve the Fabricator from responsibility for errors of any sort in the shop drawings.
  5. Copies of approved shop drawings shall be furnished to the Department for distribution.
- G. Welding Inspection by Company:
1. The Company may arrange for additional inspection by an independent inspection firm under a separate contract. This will be in addition to the Fabricator's Quality Assurance Program.
  2. The Fabricator shall notify the Company and the Company's inspector of the scheduled date for beginning

fabrication and shall not begin fabrication until the Company's inspector is present.

3. The Contractor shall retain and pay for an Independent Testing Agency to perform the following weld inspection:
  - a. Inspection shall verify that welds meet the quality requirements of American Welding Society (A.W.S.) Structural Welding Code, D1.1, dated 1985.
  - b. Welds shall be inspected visually and by use of nondestructive testing.
  - c. All nondestructive testing shall be performed by the Independent Testing Agency.
  - d. The Independent Testing Agency shall furnish copies of all nondestructive weld testing reports.
  - e. Nondestructive Testing:
    - All welds shall be visually inspected.
    - 100 percent of all flange to web fillet welds shall be magnetic particle tested and ultrasonically tested.
    - 100 percent of all transverse stiffener welds (bearing and intermediate) shall be magnetic particle tested.
    - 25 percent of other fillet welds shall be magnetic particle tested.
  - f. The Contractor shall submit the name and address of the Independent Testing Agency and evidence of AWS certification of welding inspectors to the Company for approval prior to the weld inspection. The Contractor shall submit test reports.

H. Welding Inspection by the Department

The Fabricator shall notify the Department and the Department's inspector of the schedule date for beginning fabrication and shall not begin fabrication until the Department's inspector is present.

Welding Inspection shall be in accordance with the above-mentioned AREA specifications. In addition to the weld inspection required by the AREMA specifications, the following weld inspection shall be made:

The top and bottom flange-to-web welds shall be tested on both sides by the ultrasonic and magnetic particle method as follows:

- (a) Along top flange within 4.572 meter length end of girder: 300mm of every 900mm of weld length.
- (b) Along the top flange for remainder length of girder: 300mm of every 2.438 meters of weld.
- (c) The bottom flange-to-web welds: full length of each girder.

Groove welds in top and bottom flanges shall be 100% radiographic tested and 100% ultrasonic tested. Twenty-five percent (25%) of all other groove welds shall be tested by radiographic or ultrasonic testing.

Ten percent (10%) of all fillet welds shall be tested by ultrasonic or magnetic particle testing. Any single weld having unacceptable deficiencies shall be 100% tested. If more than 10% of the tested groove or fillet welds have unacceptable deficiencies, then all groove or fillet welds, whichever is deficient, shall be 100% tested.

Magnetic particle, radiographic, and ultrasonic procedure, technique, and standard of acceptance shall be in accordance with Section 6 of the current AWS Structural Welding Code.

The Contractor shall require the Fabricator to make provision for convenient access to the joints to be inspected and cooperate with the Inspector in doing the required work. The inspection equipment and supplies will be furnished by the Inspector and payment for the work will be handled between the Department of Transportation and the Inspector except in the event corrections are necessary as the result of such inspection, the cost of any additional inspection of the joints must be borne by the Contractor, and he will be required to pay the Inspector directly for this portion of the work. Except for the cost of the first inspection as specified above, the entire cost of the first inspection as specified above, the entire cost of any nature resulting from the required magnetic particle, radiographic or ultrasonic inspection shall be

included in the lump sum contract price for structural steel.

I. Paint

All steel preparation and shop painting shall be in accordance with the Special Provision for PAINTING OF STRUCTURAL STEEL.

J. Measurement and Payment

Payment will be made at the contract lump sum price for the bid item "STRUCTURAL STEEL " and shall constitute full payment for all costs of plant, superintendence, labor, material, and equipment necessary to furnish, fabricate, shop paint, shop assemble and deliver, all the structural steel required for the project in accordance with the Plans and Specifications, including furnishing the fixed bearing assemblies and anchor bolts.

**FOUNDATION EXCAVATION**

**(Special)**

The Standard Specifications shall be revised as follows: Foundation Excavation for Abutments shall be in accordance with Section 410 of the Standard Specifications with the following exception.

Payment will be made under:

Foundation Excavation for Abutment \_\_\_\_\_ at Station \_\_\_\_\_.....Lump Sum

**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:

- A. 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.
- B. The Contractor removing his work force from the site to pursue his work at other locations.
- C. Scheduling of needed construction equipment and/or material
- D. Coordination with other required construction activity
- E. 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.

**RAILROAD SITE DATA****(SPECIAL)**

The following information was received from the Railroad on April 2, 2007, 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: 10

Type of trains (passenger or freight): Freight

Maximum authorized operating speed of trains: 45 mph

Type and number of RR employees assigned to job: 1 - Flagman

**METRIC STRUCTURAL STEEL**

**10-12-01**

The structural steel for this project is specified in SI (Metric) units with plate thickness designated in millimeters in accordance with AASHTO M160M.

The substitution of structural steel in US Customary nominal thickness is permitted for primary and secondary members defined as follows:

- A. Primary members - members such as webs and flanges of plate girders, transverse and bearing stiffeners, girder field splice plates, and connector plates for curved girders.
- B. Secondary members - members such as connector plates for straight girders, bearing plates and miscellaneous hardware.

Such substitution is limited to the values shown in the following table:

Material Specified Metric (mm)	Primary Members US Customary (in)	Secondary Members US Customary (in)
8	3/8	*
9	3/8	*
10	7/16	3/8
11	7/16	*
12	1/2	*
14	9/16	*
16	11/16	5/8
18	3/4	11/16
20	13/16	3/4
22	7/8	*
25	1	*
28	1-1/8	*
30	1-3/16	*
32	1-5/16	1-1/4
35	1-7/16	1-3/8
38	1-1/2	*
40	1-5/8	*
45	1-13/16	*
50	2	*
55	2-1/4	*
60	2-3/8	*
70	2-13/16	2-3/4

\* These values are the same as those for Primary members.

There will be no additional payment for any extra weight incurred as a result of any substitution.

**PROTECTION OF PAINTED STEEL**

**(SPECIAL)**

The painted structural steel shall be protected during concreting operations. Any concrete that gets on the painted steel is to be removed as soon as possible by a method approved by the Engineer to restore the surface to the specified condition.



**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 <sup>2</sup> (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)	Transylvania	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.

The minimum pile penetration shall be as described in section 450-9 of the Standard Specifications with the exception of the minimum pile embedment, which will be a minimum of 15 feet.

**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**

**6-7-05**

**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.

In order to facilitate in-plant inspection by NCDOT and approval of working drawings, the Contractor shall provide the name, address, and telephone number of the facility where fabrication will actually be done, if different than shown on the title block of the submitted working drawings. This includes, but is not limited to, precast concrete items, prestressed concrete items, and fabricated steel or aluminum items.

**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  
 100  
 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  
 Garner, NC 27529

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

Via US mail:

Via other delivery service:

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

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:

<b>Working Drawing Submittal</b>	<b>Copies Required by Structure Design Unit</b>	<b>Copies Required by Geotechnical Engineering Unit</b>	<b>Contract Reference Requiring Submittal <sup>1</sup></b>
Arch Culvert Falsework	5	0	Plan Note & SN Sheet
Box Culvert Falsework <sup>2</sup>	5	0	Plan Note & SN Sheet

Cofferdams <sup>4</sup>	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 <sup>2</sup> (substructure)	8	0	Article 420-3
Mechanically Stabilized Earth Retaining Walls <sup>4</sup>	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 <sub>5,6</sub>	7	0	Article 1072-10
Miscellaneous Metalwork <sup>5,6</sup>	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 <sup>5</sup>	8	0	"Pot Bearings"
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3
Proprietary retaining walls <sup>4</sup>	9	0	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) <sup>3</sup>	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)	2, then 1 reproducible	0	"Modular Expansion Joint Seals"



joint seals)			
Soil Nail Retaining Walls <sup>4</sup>	4	1	Applicable Project Special Provision
Sound Barrier Wall Steel Fabrication Plans <sup>6</sup>	7	0	Article 1072-10 & "Sound Barrier Wall"
Sound Barrier Wall Casting Plans	10	0	Article 1077-2 & "Sound Barrier Wall"
Structural Steel <sup>5</sup>	2, then 7	0	Article 1072-10
TFE Expansion Bearings <sup>5</sup>	8	0	Article 1072-10
Temporary Detour Structures <sup>4</sup>	10	1	Article 400-3 & "Construction, Maintenance and Removal of Temporary Structure at Station ____"
Temporary Shoring <sup>4</sup>	6	1	Article 410-4 & "Temporary Shoring for Maintenance of Traffic"
Temporary Fabric or Wire Walls <sup>8</sup>	0	2	Applicable Project Special Provision
Permanent Anchored Tieback Retaining Walls <sup>4</sup>	4	1	Applicable Project Special Provision
Evazote Joint Seals <sup>7</sup>	9	0	Applicable Project Special Provision
Optional Disc Bearings <sup>5</sup>	8	0	"Optional Disc Bearings"
Removal of Existing Structure over Railroad	5	0	Railroad Special Provisions
Drilled Pier Construction Sequence Plans <sup>8</sup>	0	1	"Drilled Piers"
Pile Hammers <sup>8</sup>	0	1	Article 450-6
Crosshole Sonic Logging (CSL) Reports <sup>8</sup>	0	1	"Crosshole Sonic Logging"
Pile Driving Analyzer (PDA) Reports <sup>8</sup>	0	1	"Pile Driving Analyzer"

**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.

# Project Special Provisions

## Norfolk Southern Specification - Painting Of Structural Steel (Special)

Dated : February 8, 2002

### I. General

#### A. Plans and Specifications

1. This work consists of furnishing all labor, material, plant and equipment, and performing all operations in connection with Shop Painting (prime coat, wash coat, and Finish coat applied in the fabricators plant or unless otherwise specified by the Railway). All painting shall be in accordance with AREMA Specifications, Chapter 15 - Section 3.4, and recommendations of the Society of Protective Coatings Specifications with the following specific requirements.
2. The paint thickness will be measured according to "SSPC-PA2" Method for Measurement of Dry Paint Thickness with Magnetic Gages.

#### B. Surface Preparation

1. The surface preparation shall be in accordance with Steel Structures Painting Council Specifications SP 10 (NEAR WHITE BLAST) latest revision and Visual Standard NACE No. 2. Average surface profile to be 2 mils.
2. Application - The paint shall be applied in accordance with SSPC Specifications for Paint Application - PA1.
3. The Prime Coat shall be applied in the shop promptly after blast cleaning, but in no case shall the prime coat be applied more than 8 hours after blast cleaning or after visible or detrimental rusting occurs.
4. Steel shall be cleaned by washing, or other mechanical means to remove all residue (loose zinc dust and foreign matter) prior to applying Wash and Finish Coat.
5. Surfaces damaged during shipment and handling shall be repaired using the same paint system as applied in the shop except that the Prime coat shall be repaired using an **Organic Zinc Primer** when the Primer Coat is repaired in the field.

#### C. Welded Areas And Faying (Contact) Surfaces

1. No paint shall be applied to areas to be welded in the field. No Vinyl paint (wash or Finish coat) shall be applied to any Faying surfaces.

### II. Painting Requirements

#### A. Paint System

1. The fabricator will be given the option of using one of the following paint systems (**Prime Coat, Intermediate and Finish Coats shall be applied in the fabricator's plant unless otherwise specified by the Railway**). If the Intermediate Coat and Top Coat are applied in the field, the steel shall be solvent wiped to removed all grease and oil and a "**High Pressure Power Washing" with clean water (3500 p.s.i. minimum)** shall be used to clean all mud and dirt off prior to applying the touch-up Primer or Intermediate and Finish Coats. **The fabricator shall supply sufficient quantities of touch-up Organic Zinc-Rich Primer, Intermediate Coat, Finish Coat and Thinner.** The Chief Engineer Bridges and Structures is to be notified of the

fabricator's choice. Priming of the contact surfaces with **Inorganic Zinc-Rich primer** is required.

2. If approved, or further specified by the Railway, the Wash Coat and Finish Coat shall be applied in the shop.
3. DFT denotes **Dry Film Thickness** in all system information listings hereinafter.
4. Provide a STRIPE COAT in accordance with NCDOT Standards Section 442-7, system 3.

#### B. System #1 (Elite)

Prime Coat: Elite 1312 Inorganic Zinc Rich Primer applied at 4.0 - 5.0 mils DFT.  
Intermediate Coat - Elite 156 Exterior Acrylic Latex (White) applied at 3.0 - 4.0 mils DFT.

Finish Coat - Elite 156 Exterior Acrylic Latex (gray) applied at 3.0 - 4.0 mils DFT.

Touch Up Primer - Elite 305 Organic Zinc-Rich Primer applied at 4.0 - 5.0 mils DFT.

Suggested Supplier: Elite Coatings Company, Inc.  
P. O. Box 130  
Gordon, GA 31031  
Telephone: 912/628-2111

#### C. System #2 (Devoe)

Prime Coat: Catha-Coat 301 Inorganic Zinc-Rich Primer applied at 4.0 - 5.0 mils DFT.  
Intermediate Coat: DEVRAN 646 Water Based Epoxy primer (White) applied at 3.0 - 4.0 mils DFT.

Prime Coat: DEVFLEX 604-S-9903 Water Based Gloss Enamel (Gray) applied at 3.0 - 4.0 mils DFT.

Touch Up Primer - Cata-Coat 303H Organic Zinc-Rich Epoxy applied at 4.0 - 5.0 mils DFT.

Suggested Supplier: Devoe Coatings Company  
320 Westbrook Drive  
Butler, PA 16001  
Telephone: 724/283-1471  
Attn. : Gary M. Mato

#### D. System #3 (Sherwin-Williams)

Prime Coat: ZINC CLAD II HS - (B69VZ1 B69VZ3 B69D11) Inorganic Zinc-Rich Primer applied at 4.0 - 5.0 mils DFT.

Intermediate Coat - B66 Series DTM ACRYLIC GLOSS (White) applied at 3.0 - 4.0 mils DFT.

Finish Coat - B66 Series DTM ACRYLIC GLOSS (Gray) applied at 3.0 - 4.0 mils

DFT.

Touch Up Primer - ZINC-CLAD IV - (B69 A8/B69 V8) applied at 4.0 - 5.0 mils DFT.

Suggested Supplier: The Sherwin-Williams Company  
765 North Avenue NE  
Atlanta, GA 30306  
Telephone: 404/873-6723

#### F. System #4 (Ameron)

Prime Coat: Amercoat 21-5 Inorganic Zinc-Rich primer applied at 4.0 - 5.0 mils DFT.  
Intermediate Coat - Amercoat 148 Waterborne Acrylic primer applied at 3.0 - 4.0 mils DFT.

Finish Coat - Amercoat 220 Waterborne Acrylic (Gray) applied at 3.0 - 4.0 mils DFT.

Touch Up Primer - Amercoat 68HS Zinc-Rich Primer applied at 4.0 - 5.0 mils D. F. T.

Suggested Supplier: Ameron Protective Coatings Division  
11605 Vimy Ridge Road  
Little Rock, AK 72209  
Telephone: 800/283-6627

#### H. Post-Painting Requirements

1. Steel shall be cleaned by washing, or other mechanical means to remove all residue (loose zinc dust and foreign matter) prior to applying Wash and Top Coat. An "**M. E. K. Rub Test**" shall be used to assure proper cure of the inorganic zinc primer prior to applying the next coat.
2. ***The Intermediate Coat may have to be thinned to prevent gassing.***

### III. Painting Materials Requirements

#### A. Packaging and Shipping

1. All paint shall be received at the point of use in original containers and carefully stored. All paint to be used shall be freshly mixed and shall be ordered only a sufficient length of time in advance of its use to insure an adequate supply being on hand at all times so as not to delay the work.
2. Paint shipped to the job shall arrive in sealed containers clearly marked with the type of paint and specifications controlling its manufacture.
3. There shall be no modification of the paint except upon, and in accordance with, express written stipulation by an authorized representative of the paint manufacturer and with specific approval of the Engineer.

#### B. Storage

Paint in storage at the shop or in the field shall have the position of the containers reversed at least once a week to prevent settlement and separation of the pigment from the vehicle. There shall be suitable devices maintained at the point of storage and used for agitation and thorough mixing of the paint prior to its use on this work.

#### C. Sample Panel

If directed by the Engineer, a sample panel shall be made up. The panel shall be used as a basis of comparison of the work on this contract. The panel shall be of size designated by the Engineer and shall be prepared and painted in all respects in the same manner as the work will be done.

### IV. Workmanship

#### A. Weather Conditions

Paint shall not be applied when the temperature of the air is less than 40 degrees F., when the surface of the metal is not dry, the relative humidity is above 85%, or when, in the opinion of the Engineer, conditions are otherwise unsatisfactory for such work. Paint shall not be applied upon damp, or frosted surfaces. Material painted under cover in damp or cold weather shall remain under cover until dry or until weather conditions permit its exposure in the open. Painting shall not be done when the metal is hot enough to cause the paint to blister and produce a porous paint film.

#### B. Application

1. Paint shall be applied in accordance with SSPC Specifications for Paint Application - PA1 and in accordance with manufacturer's recommendation.
2. All blast cleaned steel surfaces shall be primed before completion of the work day.
3. Steel shall be cleaned by washing, brushing or other mechanical means of all residue (loose foreign matter) prior to applying the finish coat.

#### C. Removal Of Unsatisfactory Paint

If the Prime Coat "mud- cracks", the Finish Coat wrinkles or shows evidence of having been applied under unfavorable conditions or if the workmanship is poor, the Engineer may order it removed and the metal thoroughly cleaned and repainted. Any "Blushing" of the Finish Coat shall be corrected by solvent wiping and/or re-coating before final acceptance by the Company.

#### D. Thinning

No thinner shall be used if the paint can be applied in a neat workmanlike manner without thinning. If the paint is too thick to spray, only the manufacturer's specified thinner (in hot weather vinyl paint shall be thinned with M.I.B.K. to reduce the chances of "Blushing" occurring) may be added to the paint up to 25% by volume or as otherwise specified by the manufacturer. Thinning shall not relieve the contractor from applying the specified coating D.F.T.

#### E. Paint Touch-Up

After erection, all damaged areas shall be cleaned of mud and dirt by **High Pressure Power Washing with clean water (3500 p.s.i. minimum)**; grease, and oil by **solvent wiping**; and rusted areas shall be cleaned by **sand blasting** or **power tool cleaning** with non-woven abrasives prior to touch-up or Finish coating. The paint used for touch-up shall be the same system used in the shop. The Contractor and/or Fabricator shall be responsible for cleaning all damaged surfaces and applying all field touch-up coatings in accordance with all manufacturer's recommendations. The Zinc Primer shall be touched up with only **Organic Zinc Primer** when applied in the field.

#### F. Warranty

The Fabricator and or Contractor will be required to guarantee his work against defective workmanship or the use of defective materials for a period of one (1) year

from the completion of the contract.

G. Handling Shop Primed Steel

**Only Nylon web slings or padded lifting points** shall be used to move shop primed steel to prevent damage to the coating.

V. Environmental Protection Requirements

A. Air Quality Requirements

Abrasive blasting operations shall be conducted in full compliance with all current **National primary and secondary ambient air quality standards 40 CFR 50.** (for Particulate matter - 40 CFR 50.6; Lead - 40 CFR 50.12; and nuisance dust). Abrasive blasting operations shall also be compliant with any and all local and state air quality requirements.

VI. Environmental Protection Statement

"All collection, containment, disposal and transportation for disposal must be compliant with all applicable State, Federal and Local air pollution, water pollution, solid waste and hazardous waste regulations, ordinances or statutes."

VII. Measurement and Payment

All work covered by this provision, except for shop painting, will be paid for at the contract lump sum price for this item.

Payment will be made under:

"Structural Steel (Approximately \_\_\_\_\_ kilograms)"  
Lump Sum (full compensation for the work of shop painting)

Painting Structural Steel Lump Sum  
(full compensation for all other work of painting)

## Project Special Provisions

Norfolk Southern Specification

# PROTECTION OF RAILWAY INTEREST

### 1. AUTHORITY OF RAILROAD ENGINEER AND DEPARTMENT 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 Railroad 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 and in the Project Specifications.

### 2. NOTICE OF STARTING WORK:

A. The contractor shall not commence any work on railroad rights-of-way until the contractor has complied with the following conditions:

a. 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 the contractor proposes to begin work on Railroad rights-of-way. Notice to be given to:

Office of Chief Engineer  
Bridges & Structures  
Norfolk Southern Corporation  
99 Spring Street, SW  
Atlanta, Georgia 30303

b. Obtained written authorization from the Railroad to begin work on Railroad rights-of-way, such authorization to include an outline of specific conditions with which the contractor must comply.

c. Obtained written approval from the Railroad of Railroad Protective Insurance Liability coverage as required by paragraph 14 herein.

d. Furnished a schedule for all work within the Railroad rights-of-way as required by paragraph 7,B.1.

B. The Railroad's written authorization to proceed with the work shall 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 shall be specified.

### 3. INTERFERENCE WITH RAILROAD OPERATIONS:

A. The Contractor shall so arrange and conduct the 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 that requires flagging service or inspection service shall be deferred by the Contractor until the flagging service or inspection service 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 construction 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 the Railroad Engineer's absence, the Engineer, determine such provisions are insufficient, either may require or provide such provisions as deemed necessary. In any event, such unusual provisions shall be at the Contractor's expense and without cost to the Railroad or the Department.

4. TRACK CLEARANCES:

- A. The minimum track clearances to be maintained by the Contractor are shown on the Project Plans. 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.

## 5. CONSTRUCTION PROCEDURES:

### A. General:

Construction work and operations by the Contractor on Railroad property shall be:

1. Subject to the inspection and approval of the Railroad.
2. In accord with all of the Railroad's written specific conditions.
3. In accord with the Railroad's general rules, regulations and requirements including those relating to safety, fall protection and personal protective equipment.
4. In accord with these Special Provisions.

### B. Excavation:

The subgrade of an operated track shall be maintained with edge of beam at least 14'-0" from centerline of track and not more than 24-inches below top of rail. 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 or sheeting 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. All plans and calculations for shoring shall be prepared and signed by a Registered Professional Engineer. The Registered Professional Engineer will be responsible for the accuracy for all controlling dimensions as well as the selection of soil design values that accurately reflect the actual field conditions. The procedure for doing such work, including the need of and plans and calculations for shoring, shall first be approved by the Engineer and the Railroad Engineer, but such approval shall not relieve the Contractor from liability

### D. Demolition, Erection, Hoisting

1. Railroad tracks and other railroad property must be protected from damage during the procedure.
2. The Contractor is required to submit a plan showing the location of cranes, horizontally and vertically, operating radii, with delivery or disposal locations shown. The location of all tracks and other railroad facilities as well as all obstructions such as wire lines, poles, adjacent structures, etc. must also be shown.
3. Crane rating sheets showing cranes to be adequate for 150% of the actual weight of the pick. A complete set of crane charts, including crane, counterweight, and boom nomenclature is to be submitted.
4. Plans and computations showing the weight of the pick must be submitted. Calculations shall be made from plans of the existing and/or proposed structure showing complete and sufficient details with supporting data for the demolition or erection of the structure. If plans do not exist, lifting weights must be calculated from field measurements. The field measurements are to be made under the supervision of the Registered Professional Engineer submitting the procedure and calculations.
5. A data sheet must be submitted listing the types, size, and arrangements of all rigging and connection equipment.

6. A complete procedure is to be submitted, including the order of lifts, time required for each lift, and any repositioning or re-hitching of the crane or cranes.
7. All erection or demolition plans, procedures, data sheets, etc. submitted must be prepared, signed and sealed by a Registered Professional Engineer.
8. The Railroad's representative must be present at the site during the entire demolition and erection procedure period.
9. All procedures, plans and calculations shall first be approved by the Engineer and the Railroad Engineer, but such approval does not relieve the Contractor from liability.

E. Blasting:

1. The Contractor shall obtain advance approval of the Railroad Engineer and the Engineer for use of explosives on or adjacent to Railroad property. The request for permission to use explosives shall include a detailed blasting plan. 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 and a licensed blaster.
  - (b) Electric detonating fuses shall not be used because of the possibility of premature explosions resulting from operation of two-way 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 2B) 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 Railway'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) Advise the Contractor of the amount of track 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

F. Maintenance of Railroad Facilities:

1. The Contractor will be required to maintain all ditches and drainage structures free of silt or other obstructions that may result from construction operations and provide and maintain any erosion control measures as required. The Contractor will promptly repair eroded areas within Railroad rights-of-way and 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.

G. 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 losses, costs, expenses, claim or liability for loss 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.

H. 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.

6. 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.

7. FLAGGING SERVICES:

Any work to be performed by the Contractor requiring flagging service shall be deferred by the Contractor until the flagging protection required by the Railroad is available at the job site. It will take approximately \_\_\_\_\_ days from the date the railroad receives notification of award from the N. C. Department of Transportation to provide flag protection for this project.

A. When Required:

Under the terms of the agreement between the Department and 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 personnel 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.

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's 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, through the Engineer, 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, through the Engineer, 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 Engineer a copy; if notice is given verbally, it shall be confirmed in writing with copy to the 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 Railroad 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, an emergency arises that requires 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.
2. The estimated cost of flagging is \$425 per day based on a 10hour work day. This cost includes the base pay for the flagman, overhead, and includes an estimated \$50 per diem charge for travel expenses, meals and lodging. The charge to the Department 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.
3. 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 1 and 1/2 times the appropriate rate. Work by a flagman in excess of 12 hours per day will result in overtime at 2 times the appropriate rate. If work is performed on a holiday, the flagging rate is 2 and 1/2 times the normal rate.
4. Railroad work involved in preparing and handling bills will also be charged to the Department. Charges to the Department by the Railroad shall be in accordance with applicable provisions of Subchapter B, Part 140, Subpart I and Subchapter G, Part 646, Subpart B of the Federal-Aid Policy Guide issued by the Federal Highway Administration on December 9, 1991, including all current amendments. Flagging costs are subject to change. The above estimates of flagging costs are provided for information only and are not binding in any way.

D. Verification:

1. The Railroad flagman assigned to the project will notify or make an attempt to notify the 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 Engineer will document such notification in the project records. The Engineer will also sign the flagman's diary showing daily time spent and activity at the project site, when requested.

8. HAUL ACROSS RAILROAD:

- A. Where the plans show or imply that materials of any nature must be hauled across the Railroad, unless the plans clearly show that the Department 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 to such crossings whether services are performed by the contractor's own forces or by Railroad personnel.

- B. No crossing, including those arranged for by the Department, may be established for use of the Contractor for transporting materials or equipment across the track or tracks of the Railroad unless specific authority for its installation, maintenance, necessary watching and flagging thereof and removal has been obtained, and until a private crossing agreement has been executed between the Contractor and Railroad.

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 Department and/or the Railroad.
- B. Should the Contractor desire any changes in addition to the above, then the Contractor 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 the schedule the contractor shall ascertain, from the Railroad, the lead tie required for assembling crews and materials and shall make due allowance therefore.
- B. No charge or claim of the Contractor against either the Department or the Railroad Company will be allowed for hindrance or delay on account of railway traffic; any work done by the Railway Company or other delay incident to or necessary for safe maintenance of railway traffic or for any delays due to compliance with these special provisions.

11. **TRAINMAN'S WALKWAYS:**

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 feet from centerline of track, shall be maintained. Any temporary impediments to walkways and track drainage encroachments or obstructions allowed during work hours while Railway'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. **GUIDELINES FOR PERSONNEL ON RAILROAD RIGHT-OF-WAY:**

- A. 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.
- B. No one is allowed within 25' of the centerline of track without specific authorization from the flagman.
- C. All persons working near track while train is passing are to lookout for dragging bands, chains and protruding or shifted cargo.
- D. No one is allowed to cross tracks without specific authorization from the flagman.

- E. All welders and cutting torches working within 25' of track must stop when train is passing.
- F. No steel tape or chain will be allowed to cross or touch rails without permission.

### 13. GUIDELINES EQUIPMENT ON RAILROAD RIGHT-OF-WAY:

- A. No crane or boom equipment will be allowed to set up to work or park within boom distance plus 15' of centerline of track without specific permission from railroad official and flagman.
- B. No crane or boom equipment will be allowed to foul track or lift a load over the track without flag protection and track time.
- C. All employees will stay with their machines when crane or boom equipment is pointed toward track.
- D. All cranes and boom equipment under load will stop work while train is passing (including pile driving).
- E. Swinging loads must be secured to prevent movement while train is passing.
- F. No loads will be suspended above a moving train.
- G. No equipment will be allowed within 25' of centerline of track without specific authorization of the flagman.
- H. Trucks, tractors or any equipment will not touch ballast line without specific permission from railroad official and flagman.
- I. No equipment or load movement within 25' or above a standing train or railroad equipment without specific authorization of the flagman.
- J. 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.
- K. All equipment, loads and cables are prohibited from touching rails.
- L. While clearing and grubbing, no vegetation will be removed from railroad embankment with heavy equipment without specific permission from the Railroad Engineer and flagman.
- M. No equipment or materials will be parked or stored on Railroad's property unless specific authorization is granted from the Railroad Engineer.
- N. All unattended equipment that is left parked on Railroad property shall be effectively immobilized so that it cannot be moved by unauthorized persons.
- O. 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 under the terms of the contract and specifications, the Prime Contractor will be required to carry insurance of the following kinds and amounts:
  - 1. Commercial General Liability Insurance having a combined single limit of not less than \$2,000,000 per occurrence for all loss, damage, cost and expense, including attorneys' fees, arising out of bodily injury liability and property damage liability during the policy period. Said policy shall include

“explosion, collapse, and underground hazard” (“XCU”) coverage, shall be endorsed to name Railroad specified in item A.2 below as an additional insured, and shall include a severability of interests provision.

2. Railroad Protective Liability Insurance having a combined single limit of not less than \$2,000,000 each occurrence and \$6,000,000 in the aggregate applying separately to each annual period. If the project involves track over which passenger trains operate, the insurance limits required are not less than a combined single limit of \$5,000,000 each occurrence and \$10,000,000 in the aggregate applying separately to each annual period. Said policy shall provide coverage for all loss, damage or expense arising from bodily injury and property damage liability, and physical damage to property attributed to acts or omissions at the job site. The standards for the Railroad Protective Liability Insurance are as follows: The insurer must be rated A- or better by A.M. Best Company, Inc. The policy must be written using one of the following combinations of Insurance Services Office (“ISO”) Railroad Protective Liability Insurance Form Numbers: CG 00 35 01 96 and CG 28 31 10 93; or CG 00 35 07 98 and CG 28 31 07 98.

The named insured shall read:

[Name of railroad that owns the track]; and  
 Norfolk Southern Railway Company  
 Three Commercial Place  
 Norfolk, Virginia 23510-2191  
 Attn: D. W. Fries, Director Risk Management

The description of operations must appear on the Declarations, must match the project description in this agreement, and must include the appropriate Department project and contract identification numbers.

The job location must appear on the Declarations and must include the city, state and appropriate highway name/number. The name and address of the prime contractor must appear on the Declarations.

The name and address of the Department must be identified on the Declarations as the “Involved Governmental Authority or Other Contracting Party.”

Other endorsements/forms that will be accepted are: Broad Form Nuclear Exclusion – Form IL 00 21 30-day Advance Notice of Non-renewal or cancellation Required State Cancellation Endorsement Quick Reference or Index Form CL/IL 240

Endorsements/forms that are NOT acceptable are: Any Pollution Exclusion Endorsement except CG 28 31 Any Punitive or Exemplary Damages Exclusion Known injury or Damage Exclusion form CG 00 59 Any Common Policy Conditions form Any other endorsement/form not specifically authorized in item no. 2.h above.

- B. If any part of the work is sublet, similar insurance, and evidence thereof as specified in A.1 above, shall be provided by or on behalf of the subcontractor to cover its operations on Railroad’s right of way.
- C. Prior to entry on Railroad right-of-way, the original Railroad Protective Liability Insurance Policy shall be submitted by the Prime Contractor to the Department at the address below for its review and transmittal to the Railroad. In addition, certificates of insurance evidencing the Prime Contractor’s and any subcontractors’ Commercial General Liability Insurance shall be issued to the Railroad and the Department at the addresses below, and forwarded to the Department for its review and transmittal to the Railroad. The certificates of insurance shall state that the insurance coverage will not be suspended, voided, canceled, or reduced in coverage or limits without (30) days advance written notice to Railroad and the Department. No work will be permitted by Railroad on its right-of-way until it has reviewed and approved the evidence of insurance required herein.



**DEPARTMENT:**  
**Division of Highways**  
**Dept. of Transportation**  
**c/o State Railroad Agent**  
**1555 Mail Service Center**  
**Raleigh, NC 27699-1555**

**RAILROAD:**  
**Mr. D. W. Fries, ARM**  
**Risk Manager**  
**Norfolk Southern Corporation**  
**Three Commercial Place**  
**Norfolk, VA 23510-2191**

15. **FAILURE TO COMPLY:**

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

- A. The Railroad Engineer may require that the Contractor vacate Railroad property.
- B. 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:**

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

Office of Chief Engineer  
Bridges & Structures  
Norfolk Southern Corporation  
Atlanta, GA 30303

Date: March 23, 2004  
Railroad File:  
Railroad Milepost:

# Project Special Provisions

Norfolk Southern Specification

## CROSSTIES

R&T 11/89

### SCOPE

This specification cancels and supersedes all previous specifications of Norfolk and Western Railway Company and Southern Railway Company covering the purchase of crossties.

### SECTION 1 - Kinds of Acceptable Woods

Mixed oak and mixed hardwood, with the following exceptions: poplar, cottonwood, willow and basswood. Ash will be allowed, but not to exceed 1% of a shipment. Mixed oak must make up a minimum of 50% of the total ties shipped from a location.

### SECTION 2 - Physical Requirements and Manufacture

All ties shall be cut from live, sound timber free from any defects that may impair their strength and durability as crossties. Limiting definitions which express causes for rejection are in Section 4. Mixed hardwood ties and mixed oak shall be separated and these ties then segregated according to size classification. Hickories will be included with the mixed hardwoods for both bouldonizing and air-drying. Ties shall be shipped to the treating plant within 30 days after cutting. Green ties containing nails, anti-checking irons, or any other metal will be rejected.

### SECTION 3 - Classification and Design

<u>Size Classification</u>	<u>Grade</u>	<u>Dimension Size &amp; Length</u>
6" Standard	2	6" x 8" x 8'-6"
	3	6" x 8" x 8'-6"
7" Standard	4	7" x 8" x 8'-6"
	5	7" x 9" x 8'-6"

Thickness and width specified are minimum cross section dimensions for green ties. Dry or treated ties may be ¼" thinner or narrower than the specified sizes. Ties exceeding these dimensions by more than 1" will be rejected. Not more than 20% of the 7" standard ties can be 7" x 8", and not more than 5% of the 6" standard ties can be grade 2. A maximum of 1" wane, on grades 3-5, will be allowed in the rail-bearing areas, which are those sections between 20" and 40" from the tie center. For grade 2 ties, 1½" wane will be allowed. Outside the rail-bearing areas, wane will be limited to half the face width on the top and none on the bottom. The grade of each tie shall be determined at the point of most wane, on the top or bottom, within the rail-bearing areas. (The top is defined as the horizontal face farthest from the heartwood or pith center.) Green ties shall be of adequate length to produce a square-ended tie, not in excess of 9 feet. Finished ties shall be double end-trimmed to 8'-6" +/- 1".

**SECTION 4 - Definitions of Defects**

**Wane:** Wane is defined as bark or the lack of wood (see Section 3 for allowance).

**Bark Seam:** Bark seam will not be acceptable within the rail-bearing area. Bark seam will not be acceptable outside the rail-bearing areas if more than 2" deep or more than 10" long. Bark seams showing on the end only will be acceptable.

**Decay:** Ties having decay will be rejected.

**Splits and Checks:** A split is a separation of the wood extending from one surface to an opposite or adjacent surface B not counting the end as a surface. In unseasoned ties, a split greater than 1/8" wide or 4" long will be nail-plated in both ends. Seasoned or treated ties with two-way or three-way splits from 3" to 10" long or 3/8" to 1" wide shall be properly nail-plated on both ends before acceptance. Ties with splits exceeding 1" width or with 4-way splits will be rejected as grade ties. Nail-plated shall be of 18 gauge galvanized steel 6" x 7" for use on 7" ties and 5" x 6" for use on 6" ties. Nail plates shall bear the required NS identification marks where practical. No 100% hand-driven nail plates allowed. The split shall be compressed prior to seating of the nail plate. Treated ties, with or without nail plates, shall be rejected at the plant before shipment for splits wider than 3/8" or longer than 9".

A check is a separation of wood due to seasoning which appears on one surface only B not counting the end as a surface. Season checks greater than 1" deep and 3/8" wide and 36" long, or checks 1/2" wide, will be rejected. Any treated tie showing a check on the end 3/8" wide shall be plated.

**Shakes:** Ties with shakes (ring separations) having a length on the cross-section greater than 3" or extending nearer than 1" to any surface will be rejected. Ties with shakes in both ends will be rejected.

**Holes:** Ties having holes on any surface within the rail-bearing areas that are greater than 1/2" in diameter or greater than 3" deep will be rejected. Outside the rail-bearing areas, a hole greater than 2" in diameter or greater than 3" deep will be rejected. Ties having numerous small holes in either section, which equal a large hole in damaging effect will also be rejected.

**Knots:** Within the rail-bearing areas, a 3" diameter knot will be rejected. Such a knot will be allowed if located outside the rail-bearing areas. Within the rail-bearing areas, numerous knots equaling a large knot in damaging effect will be rejected.

**Cross or Spiral Grain:** Except in wood having characteristic interlocking grain, ties having cross, slant, or spiral grain greater than 1" in 15" of length will be rejected.

**Manufacturing Defects:** All ties must be straight, square-sawn, cut square at the ends, have top and bottom parallel, and have bark entirely removed. Any ties which do not meet the following characteristics of good manufacture will be rejected:

- A. A tie will be considered straight when a straight line from a point on one end to a corresponding point on the other end is no more than 1 1/2" from the surface at all points.
- B. A tie is not well-sawn when its surfaces are cut into with scoremarks more than 1/2" deep, or when its surfaces are not even.
- C. The top and bottom of a tie will be considered parallel if any difference at the sides or ends does not exceed 1/2".
- D. For proper seating of nail plates, tie ends must be flat, and will be considered square with a sloped end of up to 1/2", which equals a 1 in 20 cant.

**SECTION 5 - Seasoning and Conditioning.**

**Air Seasoning:** Prior to air seasoning, ties shall be incised, separated by size classification and species, and stacked promptly upon receipt at the treating plant. Hickory shall be air-stacked with the mixed hardwoods.

Each completed run of green crossties will be dated on the front of the run, conforming to the fiscal or status month in which it was completed. No longer than 30 days will be allowed for the construction, completion and dating of any given run of ties. Each completed and properly dated run of crossties will be scheduled for treatment in accordance with the minimum and maximum time frame for air seasoning. Due to the numerous environmental variables involved with air seasoning, i.e., plant location, weather, etc., drying periods shall be determined on an individual plant basis. The month stacked shall not count as a drying month, i.e., January-November equals a 10-month period.

Each plant shall monitor moisture content of both oak and mixed hardwood ties scheduled for treatment to establish adequate drying cycles. Moisture contents shall be taken according to A.W.P.A. procedures when the ties are loaded on trams for treatment. A 3" boring shall be taken in the middle of one crosstie per tram. Moisture contents shall not exceed the following limits:

Mixed oak (use red oak only)	50% moisture content
Mixed hardwood	40% moisture content

Manner of stacking for air seasoning will be done in accordance with the method that normally produces best results for the particular locality involved. However, regardless of stacking method employed, all stacks must be supported on treated sills. The first layer of ties shall be off the ground 12" or more. Space between stacks or runs shall be not less than 3'. Horizontal and vertical alignment of ties within a stack or run must be equal to provide for good air circulation within and between stacks or runs of ties. When stickers are used for air-drying, they must be treated and at least 1½" thick.

All air seasoning yards shall be so located and constructed as to provide for free, unobstructed flow of prevailing air currents, and complete drainage of water away from stacks of seasoning ties. Seasoning yards will be kept free and clear of grass, weeds, decayed wood, and other such objects that inhibit good seasoning.

**Artificial Seasoning (Boultonizing):** Ties scheduled for boultonizing shall be separated by size and species, incised, then sent to the tramming station and handled as outlined in Section 6 before the drying process begins. Hickory ties shall be boultonized with the mixed hardwoods. Each layer of ties on the tram shall be separated with two drying strips 3/8" thick ties will not be acceptable for artificial seasoning if more than 60 days old.

Moisture contents will be taken according to A.W.P.A. procedures on every charge prior to drying to determine moisture removal. Figure water removal based on a target moisture content of 50% for oak charges and 40% for mixed hardwoods. A preheating period will be started after filling the cylinder and heating the oil to a minimum of 190 degrees F. This period must be shown on charge reports as "Heated in oil at 190-210 degrees F". After this heating period, the Boulton cycle as described below will begin with temperatures of 170-210 degrees F and vacuums sufficient to boil the water at the desired rate. The Boulton cycle will continue until the required amount of water is removed. A hot vacuum will be applied for a minimum of one hour after the cylinder is emptied of oil. Water removed during this hot vacuum will be included in the total for the cycle.

The Boulton cycle may be stopped before the calculated amount of water is removed if the following conditions have all been met during the previous 2 hours:

The temperature of the oil bath was 205 degrees F or more.

A vacuum of 20" or more mercury existed in the cylinder.

Not more than 0.30 lbs. water/cubic ft. of wood in the cylinder was recovered.

Moisture content after treatment shall be taken on one charge per week and shall not exceed the following limits in a 3" core:

Mixed oak (use red oak only)	50% moisture content
Mixed hardwood	40% moisture content

### **SECTION 6 - Processing and Handling**

Just prior to being loaded on tram for preservative treatment and/or boultonizing, all ties shall be double end-trimmed square to 8'-6" in length, inspected, graded and end-branded with NS, plant location and year treated. Letters shall be a minimum of 1" high, ½" wide, and ¼" deep. Letter designation for plants are as follows:

A - KOPPERS, Glenvar	L - K/M, Indianapolis
C - KOPPERS, Carbondale	N - K/M, Madison
E - K/M, Columbus	S - AW, Savannah
I - KOPPERS, Montgomery	X - SEAMAN, Montevallo

Inspection and grading shall consist of the permanent marking of the top of the tie plus the examination of all four surfaces and both ends of the tie with acceptance being in accordance with the requirements of this specification.

### **SECTION 7 - Treatment and Preservatives**

The methods, requirements, and specifications to insure proper handling, conditioning, and treatment of crossties shall be governed by American Wood-Preservers= Association Standards C1, C6, M1, M2, M3, and M4, with the following exceptions:

Treatment shall be by the empty cell method with a creosote/coal tar solution in accordance with A.W.P.A. Standard P-2. The preservative solution shall be tested monthly according to A.W.P.A. Standard A-1 with a copy forwarded to the Quality Assurance Engineer, Norfolk Southern, Research & Tests Laboratory, Box 78, Roanoke, VA 24042-0078.

Net retention shall be not less than 8 lbs. per cubic foot in oaks and 10 lbs. per cubic foot in mixed hardwoods by gauge or refusal.

**Air-Dry Treatment:** All air-dried charges of crossties shall be held in 190-210 degree F oil for a minimum of 6 hours. This time will be a combination of pressure and preheating in oil to achieve sterilization and deeper distribution of creosote in air-dried material. These preheats will be 3 hours minimum for both oak and mixed hardwoods. Pressure periods will be sufficient to meet desired retentions. Each tram of air-dried crossties will have two 3/8" stickers per layer.

**Boulton Treatment:** Pressure period will be sufficient to meet desired retentions.

A treatment report covering the treatment of each charge or "lot" of materials treated to the accounts of Norfolk Southern must be submitted to the Quality Assurance Engineer. In addition to all other pertinent information, as required by A.W.P.A. standards, the supplier shall certify on the face of the treating record that the materials, preservative, treating process, and penetration results have been properly tested and appraised, and that they are in full compliance with all of the minimum requirements of this specification.

### **SECTION 8 - Inspection After Treatment**

Except as hereinafter provided, all after-treatment inspection tests shall be made in accordance with the requirements stipulated in A.W.P.A. Standard C-6. Each treated charge or "lot" of crossties will be tested for penetration of preservative after removal from the treating cylinder or retort.

The test shall consist of at least twenty (20) borer cores taken at random throughout the entire charge of material, and shall be representative of the charge as a whole. All borings made for the penetration test shall be made midway between the ends and midway between top and bottom to a minimum depth of 3 ½". All holes made for the penetration test shall be plugged with tight-fitting treated plugs.

Minimum penetration requirements are as follows:

White Oak	-	95% of the sapwood
Red Oak	-	65% of the annual rings in a 3 ½" test core.

If the average oak penetration of the 20 test cores meets the penetration requirements, the charge shall be accepted. Charges of recalcitrant wood with less penetration may be accepted, if the wood is conditioned properly, and treatment continued to refusal.

Gum	-	2½" or 90% of the sapwood
Mixed Hardwood	-	90% of the sapwood

If 80% of the test cores meet the penetration requirements, the charge shall be accepted.

Assay extractions by zones (0-1", 1"-2", 2"-3") on a 3" core, as per A.W.P.A. A-6 shall be done weekly, or more often as required by the Norfolk Southern inspector. Only red oaks shall be assayed to determine if adequate retention levels are being obtained. Assay results should be at least 70% of gauge retentions.

No charge shall be pulled from the cylinder for refusal with less than the specified amount of treating solution injected until the charge has been "bumped" twice after the injection rate of creosote has slowed to no more than 0.2 lbs./cubic ft. of wood per hour. The bumping procedure shall consist of:

1. Pressure drop to initial air pressure;
2. Hold initial air pressure for 15 minutes;
3. Pressure back up to 200 psi for 30 minutes; and
4. Repeat (1), (2), (3), if needed, a second time.

A temperature of 190-210 degrees F must be maintained throughout the pressure and bumping cycles.

### **SECTION 9 - Retreatment**

Material not conforming to the minimum requirements for retention and/or penetration may be retreated and re-offered for acceptance in accordance with A.W.P.A. Standards C-1 and C-6 and the following conditions:

- 2 Crosstie charges to be retreated will be heated in 190-210 degree F oil for 3 hours before starting press without initial air. A pressure period of 1 hour at 200 psi will be required to improve penetration.
- 3 Material shall not be retreated more than twice.
3. When a charge of material is retreated, the total retention as a result of all treatments shall be sufficient to satisfy the specification requirements for both net retention and penetration.

### **SECTION 10 -Care and Handling After Treatment**

All treated ties not shipped from trams to car shall be stacked in tram bundles, provided the bands are sufficient to hold the ties together. Different size classifications must be kept separated, and all bundles or stacks marked accordingly regardless of the stacking or storage method used. All ties should be stacked so as not to impair straightness during storage. Treated stringers should be placed underneath all stacks of treated ties. Drainage conditions should be such as to provide rapid drainage of water from beneath stacks of treated ties. Storage areas should also be kept free of grass and weeds. Care should be exercised in handling of ties for storage or shipment, so that damage of any nature is prevented.

# Project Special Provisions

Norfolk Southern Specification

## PREPARED STONE BALLAST

*(Granite, Limestone and Traprock)*

*(Specification developed by the Research and Tests Laboratory, Roanoke, Virginia)*

Rev. 2/14/97

### 1. **SCOPE**

These specifications cover the requirement for grading and other significant physical properties of prepared stone ballast.

### 2. **GENERAL REQUIREMENTS**

Prepared ballast shall be crushed stone composed of hard and durable particles, free from objectionable amounts of deleterious substances and conforming to the requirements of this specification.

### 3. **QUALITY REQUIREMENTS**

(a) Clay lumps and Friable material -

The percentage of clay lumps and friable particles when determined in accordance to ASTM Method of Test C-142 shall not exceed 0.5%.

(b) Material finer than No. 200 sieve -

Material finer than the No. 200 sieve when determined in accordance to ASTM Method of Test C-117 shall not exceed 0.5%.

(c) Sodium Sulfate Soundness -

Sodium sulfate soundness test when made in accordance to ASTM Method of Test Designation C-88 shall not, after 5 cycles, result in a weighted average loss in excess of 2.5%.

(d) Absorption -

Absorption when determined in accordance to ASTM Method of Test Designation C-127 shall not exceed 1.0%.

(e) Resistance to Degradation -

The resistance to degradation when determined in the Los Angeles Abrasion Test, ASTM Method of Test Designation C-535 (Type 2 Grading) shall not result in a percentage wear greater than 27.5% for granite, and 27.5% for traprock, and 25.0% for limestone.

(f) Flat and Elongated Particles -

The percentage of flat and/or elongated particles when determined in accordance with the ASTM D4791-89, using a 3: ratio, shall not exceed 5.0%.

## (g) Rock Cementing Value

The rock cementing value pertains to limestone only and shall not exceed 200 psi (lbs. per square inch). The testing shall conform to the following procedure:

- (1) Take 350 grams of stone dust passing 100 mesh sieve. Dust is obtained by running approximately one (1) quart of pea size stone chips (retained on No. 4 sieve - pass 3/8" sieve) in standard LA Abrasion machine for 10,000 revolutions, or 5 to 6 hours at 30 to 33 rpm with three (3) balls.
- (2) Place dust on glass surface, make a crater, add approximately 70 cc water, cover and allow to absorb for one (1) minute. Wearing rubber gloves, mix, roll, and knead for five (5) minutes to obtain a stiff dough. Adjust amount of water to obtain this. Place in air tight can for two (2) hours.
- (3) Mold 10 standard 1" diameter x 1" high cylinders. In a balance, weigh about 30 to 31 grams of stiff dough or enough to obtain cylinders 1" plus or minus 1/32" high. Place in mold and compress with 1475 lbs. (1877.5 psi), holding load constant for one (1) minute.
- (4) Air dry cylinders for 20 hours at room temperature, then for four (4) hours in hot air bath at 212 degrees F. Place immediately in a desiccator for 20 minutes.

Then test in a compression testing machine with a pivoted or ball socket head for uniform load distribution. Load is applied at 600 lbs. per minute.

Report average crushing strength in psi as the cementing value of stone.

$$\text{Calculation: PSI} = \frac{\text{Load}}{0.7854}$$

4. **GRADING REQUIREMENTS**

Gradation test shall be determined in accordance to ASTM Method of Test Designation C-136, utilizing square opening sieves conforming to ASTM Specification E-11. The percentage passing each sieve shall fall within the following limits for #3 (modified) and #5 ballast.

Sieve Designation	Sieve Opening	#3 Ballast (Modified) % Passing Sieve	#5 Ballast % Passing Sieve
2 ½"	2.5"	100	-
2"	2"	95-100	-
1 ½"	1.5"	30-65	100
1"	1.0"	0-15	90-100
¾"	0.75"	-	40-75
½"	0.5"	0-5	15-35
3/8"	0.375"	-	0-15
No. 4	0.187"	-	0-5
No. 200	0.0029"	0.5 Max.	0.5 Max.



## 5. **HANDLING**

Processed ballast shall be handled in a manner so as to assure a clean material.

Blending, stockpiling and other production and handling operations shall be managed by the producer to minimize segregation of the finished product. Stockpiling operations shall minimize as practical the breakage or excessive fall in stockpiling operations and the movement of wheeled or tracked machines over stockpiled materials shall be limited.

Processed ballast shall be treated as necessary to remove fine particulate in accordance with the specification, or as directed by Norfolk Southern prior to stockpiling in operations using stockpiles, or immediately prior to loading operations. The treatment must include washing. Loaded ballast trains that have been sitting at the quarry for a period of 24 hours or longer must have the ballast re-wetted just prior to leaving the quarry.

## 6. **LOADING**

The manufacturer shall arrange the required supply of rail cars, unless the purchase arrangement provides otherwise. The manufacturer shall assure the fitness of the cars for loading of the prepared materials, arranging to clean cars of deleterious materials, plug leaks and other like operations as necessary.

## 7. **ACCEPTANCE TESTING PERFORMED BY THE SUPPLIER**

- (a) Sampling Procedure - One sample from every thousand tons of ballast shall be taken from the freight car loading belt taking a full cross-belt sample. This sampling frequency applies to both odd lot and unit train shipments. Norfolk Southern reserves the right to specify increased sampling if necessary to accurately determine the quality of the product.
- (b) Analysis - A sieve analysis shall be performed on each sample while the freight cars are being loaded.
- (c) Report of Findings - A gradation report shall be prepared on each sample providing the following information:
  - (1) Quarry Identification;
  - (2) Date and Time;
  - (3) Sample Analysis; Results by % weight passing 2 ½", 2", 1 ½", 1", ¾", ½", 3/8" or No. 4 sieve (when applicable); and
  - (4) Gradation Specification.
- (d) Submission of Test Results - Gradation reports shall be mailed for each train load of ballast directly from the quarry within 24 hours of train loading marked of the attention of the Chief Chemist, Norfolk Southern Corporation, 110 Franklin Road, SE, Roanoke, Virginia 24042-0077, and Mr. J.R. Zimmerman, Norfolk Southern Corporation, 99 Spring Street, Atlanta, Georgia 30303.
- (e) Corrective Action in the Event of Sample Failure - In the event any individual sample fails to meet any gradation requirement, immediate corrective action shall be taken to restore the process to acceptable quality. The supplier shall advise Norfolk Southern in writing of the corrective action being taken. In the event of repeated failures, Norfolk Southern retains the right to negotiate price reduction or cancel the contract.

**8. INSPECTION**

Norfolk Southern, or its representatives, reserve the right to visit the supplier's facility during usual business hours, unscheduled, for the following purposes:

- A. Observe sampling and testing procedures to assure compliance with requirements of these specifications.
- B. Obtain representative 100-lb. samples of the prepared material being produced and shipped.
- C. Review plant inspection, methods, quality control procedure, equipment, and examine test results of current and previous tests.

The supplier shall provide the inspector with such assistance, materials, and laboratory testing equipment as necessary to perform production site gradation and percent passing No. 200 Mesh Sieve analysis. Performance of these tests at the time of an unscheduled inspection visit is the right, but not the duty, of the inspector.

**9. ACCEPTANCE TESTING PERFORMED BY NORFOLK SOUTHERN**

Norfolk Southern reserves the right to perform all tests defined by the specification at a frequency to be defined by Norfolk Southern, but in such a manner and frequency so as not to interfere with production levels at the quarry. In the event that a sample fails a test, Norfolk Southern shall notify the supplier promptly of the unacceptability of the process, and the supplier shall notify Norfolk Southern, in writing, of the corrective action being taken.

# Project Special Provisions

Norfolk Southern Specification

## RAIL ANCHORS

*(Specification developed by Norfolk Southern Research and Tests Laboratory)*  
10/01/93

### 1. **SCOPE**

These requirements cover one-piece spring type rail anchors suitable for application by hand or by machine.

Anchors must be of a design that is compatible with existing anchor application and anchor spreader machines. If a new anchor design is accepted, the manufacturer must bear the expense to modify equipment.

### 2. **DRAWINGS**

- a. A drawing showing the design, the **AISI** grade of steel, Brinell hardness range, and the dimensions and tolerances for each size of anchor to be supplied shall be submitted by the manufacturer to Norfolk Southern. Each drawing shall bear a reference number and date.
- b. The manufacturer's drawing showing the dimensions of GO and NO-GO or other gages for finished anchors for each rail section shall be submitted to Norfolk Southern for approval. Critical areas to be gaged, will be established by agreement between the manufacturer and Norfolk Southern. Each drawing shall bear a reference number and date.
- c. Subsequent amendments to any manufacturer's drawing, changes in material and/or design, shall be submitted in writing to Norfolk Southern prior to effecting the changes in manufacture.

### 3. **GAGES**

The gages referred to in Section 2(b) shall be used by the manufacturer for his in-plant inspection of finished anchors, and a set of similar gages shall be supplied to the Norfolk Southern inspector. The gages used by the manufacturer for his in-plant inspection must be periodically checked for accuracy against the drawing mentioned in Section 2(b) using measuring instruments whose accuracy is traceable to a national standard.

Worn or damaged gages must not be used.

### 4. **STEEL**

The steel used in the manufacture of rail anchors shall be made by one of the following processes: Open-hearth, basic-oxygen, or electric furnace.

## 5. CHEMICAL COMPOSITION

The manufacturer shall furnish a copy of the mill analysis of each heat of steel used in the manufacture of rail anchors to be supplied to Norfolk Southern. The chemistry shall be within a range as specified by the manufacturer to satisfy the hardness and mechanical requirements. Examples of such grades are AISI C-1070 Regular or Modified and C-1059 Modified.

Chemical compositions of these grades are as follows:

	<b><i>C-1070 Regular</i></b>	<b><i>C-1070 Modified</i></b>	<b><i>C-1059 Modified</i></b>
Carbon	0.65 to 0.75 %	0.65 to 0.75 %	0.55 to 0.66 %
Manganese	0.60 to 0.90	0.80 to 1.10	0.60 to 0.90
Phosphorus	0.040 Maximum	0.040 Maximum	0.040 Maximum
Sulphur	0.050 Maximum	0.050 Maximum	0.050 Maximum
Silicon	-	-	0.15 to 0.25

All mill chemical reports and internal chemical checks shall be kept on file and made available to Norfolk Southern.

## 6. VERIFICATION OF TESTING MACHINES AND HEAT TREATING EQUIPMENT

- a. Mechanical and hardness tests shall be carried out on machines which are maintained in satisfactory and accurate condition, and which have been calibrated at annual intervals.
- b. Furnace temperatures for heat treatment and oil temperatures for quenching shall be monitored by pyrometers having associated recording equipment which will produce time-temperature charts. The pyrometers and recording equipment shall be calibrated at least once annually.
- c. Calibrations must be performed by and/or traceable to a recognized national or industry authority, and records of these calibrations shall be available for examination by Norfolk Southern.

## 7. MECHANICAL REQUIREMENTS OF ANCHORS

- a. For successive applications of the anchor to the rail, the anchor shall resist movement relative to the rail base when a longitudinal load is applied to the rail and is reacted by the anchor at a location that is flush with the base of the rail.  
The anchor must be fully removed prior to reapplication.

	<b><i>Longitudinal Load Applied (lbs.)</i></b>	<b><i>Longitudinal Load Applied (lbs.)</i></b>	<b><i>Maximum Permitted Movement</i></b>
<i>Application</i>	<i>136/132# RE to 100# RE</i>	<i>Below 100# RE</i>	<i>(After Release of Loads)</i>
1 <sup>st</sup>	10,000 Minimum	7,000 Minimum	1/16"
2 <sup>nd</sup>	9,000 Minimum	5,000 Minimum	1/16"
3 <sup>rd</sup>	7,500 Minimum	5,000 Minimum	1/16"

This test shall be performed at sufficient intervals to ensure holding ability of the anchor, but in no case should this test be performed less than the rate of one anchor per press for every hour of normal operation.

- b. The rail anchor shall not create sharp or deep gouges in the rail base when pushed for a minimum distance of 1 inch along the base by a load longitudinally applied flush with the bottom of the rail base. The force to cause movement of an individual anchor shall not exceed 20,000 lbs. The average force to cause movement for all anchors tested during a production run shall not exceed 15,000 lbs. This push test shall be performed at sufficient intervals to ensure conformance with this requirement, but in no case should this test be performed at a rate of less than one anchor per press for every 8 hours of normal operation.
- c. The rail anchor shall not create sharp or deep gouges in the rail base when pushed for a minimum distance of 1 inch along the base by a load longitudinally applied flush with the top of the rail base and evenly on both sides. This push test shall be performed at sufficient intervals to ensure conformance with this requirement, but in no case should this test be performed at a rate of less than one anchor per press for every 8 hours of normal operation.
- d. All anchors shall be capable of withstanding a minimum of 80,000 cycles of dynamic testing on the Norfolk Southern fatigue test fixture. The fixture is used to dynamically apply a pulsating load varying between 500 and 7,000 lbs. longitudinally to the anchor at a point 5/8 inches below the bottom of the rail base. Cycles are run at a frequency of 1.0 Hertz using a haversine waveform. The anchor must not break, gouge rail, or move on the rail during the 80,000 cycles. Each anchor design will be qualified on the NS fatigue test fixture prior to approval of the anchors for purchase. Any design changes to the anchor will require retesting prior to changes in production.
- e. Snap-on tests consisting of manually snapping an anchor onto the rail shall be performed at the rate of one anchor per press for every half hour of normal operation. Each anchor, when applied to the rail, should be checked for grip, holding ability, and contact points. In no case shall the rail base have nicks or sharp edges as a result of anchor application or removal.
- f. Should any anchor fail any of these requirements, the associated production lot shall be rejected. Retests in the presence of a Norfolk Southern inspector will be permitted to determine if a part of that production lot can be accepted. Sample lot for retests shall be determined by Norfolk Southern.

## 8. HARDNESS

- a. The hardness of all rail anchors shall be within the range of 363 to 401 BHN, or as agreed upon between the manufacturer and Norfolk Southern.
- b. The hardness determination shall be made at any convenient location on the rail anchor providing it is at least one-inch from the ends. Before making the test for hardness, the surface where the test is to be made shall be ground to a minimum depth of 1/32" to provide a true hardness indication. Anchors to be tested for hardness shall be allowed to cool to room temperature prior to preparing the surface by grinding.
- c. The manufacturer shall carry out hardness determinations at sufficient intervals to assure compliance of the production run with the hardness requirements, but in no case shall the number of tests be less than one for each half hour of production.
- d. Continuous Heat Treatment

In the event a test anchor fails to meet the hardness requirements, every third anchor will be tested until proper hardness is obtained. All anchors from the preceding acceptable test anchor to the proper hardness anchor shall be rejected.

e. Batch Heat Treatment:

In the event that a test anchor fails to meet the hardness requirements, an additional two anchors from the same half-hour of production shall be tested. If either of the two anchors fail, the half-hour of production shall be rejected.

9. RE-TREATMENT

Rail anchors, which fail to meet the conditions prescribed in Section 8, may be re-treated by the manufacturer. Re-treated rail anchors shall be tested for compliance with the requirements prescribed in Sections 8 and 10.

10. DIMENSIONS/WEIGHT

The manufacturer shall carry out dimensional checks at sufficient intervals to assure compliance with the dimensions shown on the manufacturer's submitted drawing, but in no case shall the number of dimensional checks be less than one for every 15 minutes of normal production.

If any of the tested anchors fail to conform, the manufacturer shall individually gage each anchor and those found not to conform shall be rejected. The minimum weight per anchor shall be 2.25 lbs. for 136/132RE rail anchors. The same bar stock size for 136/132RE rail anchors must be used in the manufacture of anchors for all other rail sections.

11. REPORTING TEST RESULTS

All test results as required by Sections 5, 7, 8, 9, and 10 of this Specification shall be recorded and saved for a minimum of 7 years. These reports shall be furnished upon request to either of the following:

Norfolk Southern Corporation  
Research and Tests Laboratory  
P. O. Box 233  
Alexandria, VA 22313

Norfolk Southern Corporation  
Engineer - Track & Material  
99 Spring Street  
Atlanta, GA 30303

In addition, records will be made available to NS auditors at time of plant audit. A copy of all pertinent shipping notices should accompany these test results.

12. WORKMANSHIP

The finished rail anchors shall not be marred or deformed and shall be free of laps, cracks, detrimental seams and other detrimental defects, including burned steel.

13. IDENTIFICATION

Each rail anchor shall be hot stamped to show the following:

- a. Rail section and weight;
- b. Month of manufacture;
- c. Week of the month;
- d. Year of manufacture; and
- e. Anchor press.

14. **SHIPMENT**

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a. **Bagging:**

All anchors shall be bagged fifty (50) acceptable anchors per bag for shipment or storage. All anchors within each bag shall be for the same rail size and shall be of the same type of anchor. All correctly filled anchor bags shall be securely bound in such a manner as to ensure that the bound end will not open during handling and shipping.

Spillage shall not occur when filled bags are dropped from a height of 10 feet or when bags are hooked for loading on machines. Anchor bags must be of a material that will not deteriorate when exposed to the environment for a period of 5 months.

b. **Tagging:**

Each bag shall have securely affixed to its outside, an inspector's tag which shows the date of manufacture, type of anchor, and the rail section covering the anchors contained in that bag.

c. **Shipping Tag:**

Each load shall have securely affixed to not less than 10 percent of its bags, tags which show consignee name and address, customer order number, manufacturer's order number, date of shipment, and quantity of anchors in that shipment.

15. **INSPECTION**

Rail anchors ordered to these Purchase Requirements are subject to inspection by Norfolk Southern. The Research and Tests Laboratory (P. O. Box 233, Alexandria, Virginia 22313 - 703/684-4395) is to be notified by Friday noon for inspection the following week.

The Research and Tests Laboratory may also be notified by Voice Mail, by leaving a message for the Senior Quality Assurance Engineer on Voice Mail number 703/684-6272. The inspector representing Norfolk Southern shall have, during working hours, free entry to all parts of the manufacturer's plant used in the manufacture of rail anchors ordered to these purchase requirements.

16. **QUALITY ASSURANCE PROVISIONS**

It is the manufacturer's responsibility to satisfy the Norfolk Southern's inspector that the commodity conforms to this specification. This may be accomplished by performing the tests prescribed in this specification, and by demonstrating to Norfolk Southern inspector that the manufacturing processes and techniques are so controlled that conformity to this specification is assured. The manufacturer shall maintain complete records of his examinations and tests which shall be available to the Norfolk Southern.

The manufacturer must have in place a working quality assurance program modeled after AAR M-1003 or ISO 9000. Quality assurance audits to verify compliance to these requirements will be conducted periodically by Norfolk Southern representatives.

Norfolk Southern reserves the right to perform any of the tests set forth in the specification where such tests are deemed necessary to assure the commodity conforms to the prescribed requirements.

17. **RETURN OF SHIPMENT**

Rail anchors, which do not comply with these purchase requirements, or rail anchors which, notwithstanding test, inspection or acceptance at any time or location, are found to contain deficiencies, will be subject to rejection and returned to the manufacturer. The manufacturer shall be entitled to a joint inspection of the defective rail anchors on the Norfolk Southern premises. The manufacturer shall assume the expenses of associated handling and transportation.

18. **JURISDICTION**

With regard to all matters pertaining to inspection of rail anchors covered by these purchase requirements, the decision of Norfolk Southern shall be final.



Project Special Provisions  
Norfolk Southern Specification

# STRUCTURAL STEEL

**I. STRUCTURAL STEEL**

**A. Scope**

These specifications shall cover the furnishing, fabrication, preparation, assembly, welding, painting, and erection of all structural steel shown on the plans.

**B. General Specifications**

Except as otherwise specified hereinafter, the current AREMA Specification, Chapter 15, Steel Structures, apply to all work.

**C. Structural Steel**

**1. Fracture Critical Members**

- a. All fracture critical members are identified on the plans.
- b. All fracture critical members will be fabricated in accordance with the Fracture Control Plan stated in the AREMA Specifications, Chapter 15, Section 1.14.
- c. Fabricator shall be certified under the AISC Quality Certification Program as follows:  
  
Welded Plate Girders, Category III  
Rolled Beam Bridges, Category I.
- d. Structural Steel shall meet the current requirements of the A.S.T.M. Specifications for Structural Steel, Designation A-709, Grade 50, (345) S84-F2, S91, S93.  
  
S84-F2            (Fracture Critical - Charpy Test Zone 2)  
S91                (Fine Austenitic Grain Size)  
S93                (Limitation on Weld Repairs)

Except as noted in the AREMA Fracture Control Plans.

**2. Non-Fracture Critical Members**

- a. All primary members or components requiring improved notch toughness are identified on the plans.
- b. Fabricator shall be certified under the AISC Quality Certification Program as follows:  
  
Welded Plate Girders            Category III  
Rolled Beam Bridges            Category I

- c. Structural steel shapes and plates used as primary members or components shall meet the current requirements of the A.S.T.M. Specifications for Structural Steel, Designation A-709, Grade 50, (345) S83-T2, S91.

S83-T2 (Non-Fracture Critical - Charpy Test Zone 2)  
S91 (Fine Austenitic Grain Size)

3. Other Structural Steel

- a. It is preferred that the Fabricator be certified under the AISC Quality Certification Program, Category I.
- b. All structural steel shall meet the current requirements of the Specification for A.S.T.M. Designation A-36, unless specified otherwise in these specifications or on the plans.

D. Other Materials

1. High strength bolts shall meet the current requirements of the A.S.T.M. Specifications for High Strength Bolts for Structural Steel Joints, Designation A 325-97.
2. Anchor bolts shall be threaded rods with heavy hex nut meeting the current requirements of ASTM specification for fasteners, Designation A-307-97.
3. Welding electrodes for arc welding shall meet the current requirements of the Specifications for mild steel arc-welding electrodes Series E70, AWS 5.1, Low Hydrogen Classification for SMAW and AWS 5.17 for SAW.
4. Preformed fabric bearing pads shall be Shock Pad Style No. 15175 as manufactured by Alert Manufacturing and Supply Company, Chicago, Illinois, or FABREEKA Pads as manufactured by Fabreeka Products Company, 1190 Adams Street, Boston, Massachusetts, or SORBTEX Pads as manufactured by Voss Engineering, Inc., Chicago, Illinois, or approved equal.

E. Welding Processes

Only submerged arc welding (SAW) or shielded metal arc welding (SMAW) may be used. No other process will be allowed.

F. Bolted Connections

Permanent bolted connections using High Strength Bolts shall be installed and tightened using the Turn-of-the-Nut Method.

G. Paint

All steel preparation and painting shall be in accordance with Norfolk Southern Corporation Paint Specifications.

H. Shop Drawings

1. The Contractor's attention is called to the requirements for shop drawings, Chapter 15, Article 1.1.2 Shop Drawings, AREMA Specifications.
2. The Contractor shall furnish three (3) complete sets of detailed shop drawings to the Company for approval prior to starting fabrication. Unchecked drawings shall not be submitted for approval. After approval of shop drawings, the Contractor shall supply the Company with one set of reproducible of the approved drawings.

3. The rejection of or the procedure for the correction of shop drawings will not be considered as cause for delay.
4. Approval by the Engineer of the shop drawings shall not relieve the Contractor from furnishing material of proper dimensions, quantity, and quality, nor will such approval relieve the Contractor from the responsibility for errors of any sort in the shop drawings.
5. Original drawings or photographic reproductions on mylar, or equivalent film, shall be furnished at the completion of the Contract in accordance with Chapter 15, Article 1.1.3, AREMA specifications. Reproductions made by the diazo process are not acceptable.

The plans shall be sent to:

Chief Engineer - Bridges & Structures  
 Norfolk Southern Corporation  
 99 Spring Street, SW  
 Atlanta, GA 30303

#### I. SHOP INSPECTION & TESTING

1. The Company may arrange for inspection by an independent inspection firm under a separate contract. This inspection will be in addition to the Fabricator's Quality Control Program.
2. The Fabricator shall notify the Company and its inspector of the scheduled date for beginning fabrication and shall not begin fabrication until the Company's Inspector is present.
3. The Fabricator shall furnish copies of certified mill inspection reports to the Company for all structural steel requiring improved notch toughness.
4. The Fabricator shall meet the requirements of the AREMA Fracture Control Plan described in Chapter 15, Section 1.14 for all members and components designated as fracture critical.
5. Welding inspection shall verify that all welds and welding procedures meet the requirements of the American Welding Society (A.W.S.) Bridge Welding Code, D1.5, dated 2002.
6. All welds shall be inspected visually and by use of nondestructive testing. All nondestructive testing shall be performed by the Fabricator and witnessed by the Company's Inspector.
7. Witnessing of weld inspection shall be done in a timely manner without disruption of normal shop operations. Copies of all weld inspections and nondestructive testing reports shall be furnished to the Company.
8. The Fabricator shall perform the following weld inspection and testing:
  - a. All transverse tension groove welds in FCM members, when allowed by the Engineer, shall be RT and UT tested 100%. In non-FCM components of FCM's all transverse groove welds shall be RT or UT tested 100%.
  - b. All flange to web welds shall be tested on both sides as follows:
    1. Top flange to web welds will be UT tested 100% over 10% of the length from each end and the remaining length of weld will be UT tested 10%.
    2. Bottom flange to web welds will be UT tested 100% .

- c. All flange to web fillet welds, when allowed by the Engineer, are to be magnetic particle tested 100%.
- d. Ten percent (10%) of all welds not mentioned above shall be magnetic particle tested.

Project Special Provisions, Metric  
**RAILROAD ROADBED**

**(SPECIAL)**

The "Standard Specifications for Roads and Structures, January 2002" of the North Carolina Department of Transportation, hereinafter referred to as the Standard Specifications, shall apply to the articles of the Project Special Provisions.

**I. Clearing and Grubbing**

This work shall be performed in accordance with Section 200, "CLEARING AND GRUBBING", of the Standard Specifications, except that grubbing will be performed on all cleared excavation and embankment areas and will include all stumps, roots, and other embedded debris.

**II. Excavation**

This work shall be performed in accordance with Section 225, "ROADWAY EXCAVATION" of the Standard Specifications. The applicable typical roadbed template will be maintained throughout the railway portion of the project. Waste material will be disposed of in accordance with Section 802 of the Standard Specification or at locations designated by the Engineer.

**III. Embankment**

This work shall be performed in accordance with Section 235, "EMBANKMENTS", of the Standard Specifications.

**IV. Seeding and Mulching - Erosion Control**

This work shall be performed in accordance with Section 1660 of the Standard Specifications. In addition to Section 1660, the Contractor shall perform the following work:

After by-passed trackage has been removed, the Contractor shall remove sufficient by-passed embankment to provide adequate drainage away from the permanent roadbed. In the event ditching is required to move the water, this shall be provided at slopes not less than 0.5%. All areas shall be left to drain and provide an acceptable appearance as directed by the Engineer prior to performing the seeding and mulching operation. Should the Department elect to salvage the stone ballast and sub-ballast from the by-passed locations, the smoothing and shaping will not be performed until completion of the salvage operation. There will be no direct measurement of or payment for performing this operation. The cost for this work will be included in contract unit price for other items of work.

**V. Sub-ballast**

Material:

Sub-ballast shall be composed of crusher-run granite, meeting the following gradations:

Sieve Size (mm)	50	25	9.5	4.75	2.00	0.425	0.075
% Passing (Optimum)	100	95	67	50	38	21	7
Permissible Range % Passing	100	90-100	50-85	35-65	25-50	15-30	5-15

Construction Methods:

After the sub-grade has been finished to proper grade and cross-section, the sub-ballast shall be distributed in quantities to meet the requirements of Article 520-5 of the Standard Specifications and the roadbed section as shown on the Drawings. The sub-ballast shall be uniformly compacted to the density specified in Article 520-8 of the Standard Specifications. Following the distribution and compaction, the sub-ballast shall be smoothed to the proper surface, sprinkled and rolled.

The quantity for "Aggregate Base Course (Sub-Ballast)" to be paid for will be the actual number of metric tons of sub-ballast which has been used to construct the track roadbed sections, measured as provided for in Article 520-11 of the Standard Specifications.

The quantity of sub-ballast, determined as provided above, will be paid for at the Contract Unit Price per Metric Ton for "Aggregate Base Course (Sub-ballast)". Such price and payment will be full compensation for all furnishing, weighing, hauling, and placing of sub-ballast and for any other work necessary for the construction of the track roadbed section.

**VI. Maintenance of Track Roadbed**

The Contractor shall be responsible for the maintenance of the track roadbed during the construction period. Ditches and temporary pipes shall be provided and maintained as may be necessary to satisfactorily drain the sub-grade. Where previously approved sub-grade is damaged by natural causes, by hauling equipment or other traffic the Contractor shall restore the sub-grade to the required lines, grades and typical sections and to the required density at no additional cost to the Department.

**VII. Measurement and Payment**

The measurement and payment will be made in accordance with the articles of the Standard Specifications. All work, materials, and labor and other items necessary to complete the railroad roadbed shall be included in various pay items. No additional payment shall be made.

## Project Special Provisions, Metric

Norfolk Southern Specification

# RAILROAD TRACKWORK

# (SPECIAL)

### Description

The work covered by these special provisions consists of furnishing all material, labor, tools, equipment, and incidentals (except as noted) necessary for all trackwork, other than trackwork to be performed by the Railway Company, to be done by the Contractor in conjunction with construction of detour and permanent main tracks to final line and profile grades, removal of existing main, and the raising and lining of segments of existing lead track. The Contractor will also be required to do all clearing, grubbing, grading, aggregate base course for sub-ballast, stone ballast, erosion control and crosstie replacement that is necessary for the construction of the above mentioned tracks, all in accordance with the applicable provisions of the Standard Specifications, the Plans and these Project Special Provisions. Work to be performed by the Railway Company will be as indicated on the Construction Plans.

Trackwork shall include but not be limited to sub-ballast, stone ballast, crossties, rails, track hardware, rail anchors, gage rods, constructing, removing, lining, raising, adjusting vertically, surfacing and tamping track.

The item of "Railroad Track to be Constructed" consists of the construction of a track structure consisting of, but not limited to; rails, ballast, ties, rail anchors, gage rods, track hardware, and other track material at locations indicated on the plans.

The item of "Railroad Track to be Removed and Reconstructed" consists of the removal of existing main track from the construction area bypassed by the detour alignment between stations designed on the plans, and relaying of these same tracks over the completed railway bridge structure using new grades crossties and new continuous welded rail. New rail to be furnished by the railway at project cost. Included in this item will be cost of raising the reconstructed track to final profile grade.

The item of "Railroad Track to be Lined" consists of the lining over of segments of track to permanent alignment and connecting to other track segments to form a complete track. Included in this item will be the cost of raising the lined track a maximum of 300mm to meet final profile grade.

**NOTE:** Track that is moved horizontally, intact, less than 1.524m is said to be lined. Track that is moved horizontally, intact 1.524m or more is said to be lined and relocated. However, in these special provisions, no distinction will be made and track that is to be moved horizontally, intact, whatever the distance, will be referred to as lined.

The item of "Railroad Track to be Raised" consists of raising segments of existing track to the new proposed grade at locations noted on the plans.

The Contractor's attention is directed to the fact that work on any operative track will be accomplished by the Railway Company within a time limit set by the Railway Company.

It shall be the Contractor's responsibility to arrange a schedule with the Railway Company and to provide notification prior to the need for accomplishing final cutting in of existing track to new track to form a complete track. In arranging this schedule the Contractor shall ascertain from the Railway Company the lead time required for assembling crews and materials and make due allowance therefore.

The Contractor is directed to the fact that work on any operative track will be accomplished by the Railway Company, and that any work to be done in connection with the signals, track circuits or other signal items or communication facilities will be performed by the Railway Company.

The Railway Company will make the necessary cuts and connection welds involved in cutting in for the final track alignment. The Contractor shall give the Railway Company written notice at least ten (10) days prior to the date the Contractor proposes to perform work that will require the track to be cut or connection welds made.

Prior to starting any trackwork, the Contractor shall submit a schedule for approximate location of all required rail cuts and connection welds to the Railway's Division Engineer. This work will include all cutting of rails, welds, and lining of tracks that are required and will be paid for under a Force Account Agreement between the Department and the Railway Company.

The Contractor shall furnish all replacement crossties needed to replace any crossties in the existing track rendered unusable due to cutting in final track alignment. These ties shall be stockpiled near the point of insertion. All other lost or damaged materials, including crossties, will be replaced at the Contractor's expense with material of acceptable quality conforming to applicable specifications.

Before starting any operation that will jeopardize the "wholeness" of any operative track, the Railway Company and the Contractor shall have on hand a supply of track materials adequate to complete all scheduled work and to replace any damaged track material. This track material shall be as specified elsewhere in these Special Provisions.

The Contractor shall conduct his work in such a manner as not to interfere with the safe movement of trains.

#### Location

The proposed work will be located as shown on the Plans, as staked out on the ground and as noted in the "Sequence of Construction for Trackwork and Railway Bridge".

#### Labor, Tools and Equipment

Labor will be considered to include all superintendents, supervisors, foremen, skilled labor and unskilled labor that is necessary to properly execute and complete the work. Tools and equipment will be considered to include all special mechanical equipment, machinery or other devices which are peculiar to the operation of constructing, removing, lining, raising, surfacing and tamping track.

#### Track Materials

All materials which are furnished by the Contractor shall meet the requirements contained herein. Track hardware shall conform to the requirements of Volume 1, Chapters 4 and 5 of the current American Railway Engineering and Maintenance-of-Way Association (AREMA) "Manual for Railway Engineering".

Rails for new track shall be new domestic 132 lb. RE (CWR) and shall be furnished by Norfolk Southern Railway Company. New rail shall conform to the AREMA Specifications for Open Hearth Steel Rails, latest edition.

Tie plates shall conform to AREMA "Specifications for Steel Tie Plates", current edition. They shall be 457mm X 203mm X 29mm thick, doubled shoulder, with eight spike holes as detailed on Railway's Standard Plan L-383-G. Tie plates may be either new or approved relay.

Track bolts shall be new bolts conforming to AREMA "Specifications for Heat-Treated Carbon-Steel Track Bolts, and Carbon-Steel Nuts", current edition. They shall be 29mm diameter, 146mm long under the head, and have 64mm of thread.

Washers for track bolts shall be new washers conforming to AREMA "Specifications for Spring Washers", current edition.

Rail spikes shall be new spikes 16mm X 150mm, conforming to AREMA "Specifications for Soft-Steel Track Spikes", current edition.

Rail anchors shall be new or approved relay and of the type approved by the Railway Company and conforming to "Norfolk Southern Specification for Rail Anchors", included hereinafter.

Compromise joints are to be new or relay and of proper design to accommodate the rails to be joined.



Insulated and non-insulated gage rods to be new or approved relay.

Crossties in the existing tracks that may be lined or are to be removed and re-laid should first be inspected jointly by the Contractor, Railway Company and the Department before any work proceeds to determine and identify which existing crossties are usable and which are unusable. Existing crossties which are unusable or unserviceable shall be replaced by the Railway Company at no cost to the Contractor or the Department. Thereafter, crossties in existing track which may be rendered unusable by disturbance of the track shall be replaced with new creosote ties furnished by the Contractor. New crossties shall be creosote Grade 5. The designation of ties rendered unusable shall be mutually agreed upon by representatives of the North Carolina Department of Transportation and Norfolk Southern Railway Company.

Stone ballast shall be granite and shall conform to the Railway Specifications, entitled, "Prepared Stone Ballast" (revised 2/14/97).

The Contractor shall notify the Railway Company and obtain approval before installation of any materials substituted (change in grade, type, manufacture, quality) for the above-described track materials.

#### Inspection of Materials

Track materials furnished by the Contractor will be inspected and approved by the Railway's Division Engineer or his authorized representative before being incorporated into the work. All materials are to be in accordance with the applicable provisions of the Standard Specifications and will be inspected by the North Carolina Department of Transportation Division of Highways or its authorized inspection agency.

#### Unloading and Handling of Materials

All track material shall be handled in such a manner as to insure against damage. Welded rail ribbons shall be handled so that no damage will be incurred from nicking or undue distortion. Hammers or mauls shall not be used to drive rails into position laterally or longitudinally. Crossties are to be handled in such a manner as not to damage them by puncturing with picks or splintering and denting with mauls. Use tie tongs or lining bars for handling or moving crossties.

#### Advance Notice

Prior to performing any operation which requires work between trains on operating tracks, the Contractor shall notify the Railway Engineer sufficiently in advance so that arrangements can be made for this work to be done by railway forces in the presence and under the supervision of the Railway's Division Engineer or his authorized representative. The operations can not be performed until all necessary advance work and arrangements have been completed by the Contractor to the satisfaction of the Railway's Division Engineer who will set the date and time for the operation to be performed. No liability shall accrue to the Railway company or the Department to any delay to the Contractor, which could result from train operations or from other causes.

#### Roadbed

After the sub-grade has been finished to proper grade and cross-section, the sub-ballast shall be distributed in quantities to meet the requirements of the roadbed section as shown on the plans. The sub-ballast shall be uniformly compacted to the density specified in Article 520-8 of the Standard Specifications for Roads and Structures. Following the distribution and compaction, the sub-ballast shall be smoothed to the proper surface, sprinkled and rolled. The Contractor will be responsible for maintaining proper line and grade of the roadbed and any ruts or depressions caused by his equipment will be filled and compacted prior to track laying. Track materials shall not be distributed on the roadbed nor track laying started until the Contractor has been advised by the Railway Engineer that the roadbed is finished and acceptable for the track.

#### Laying Tracks

Installation of the welded rail shall be done with off track equipment so as to not interfere with the operation of main line traffic.

Prior to laying CWR, the Railway Company shall determine and record the maximum and minimum rail temperatures in the area, as laying procedures are dependent on the total range of temperatures to be experienced by the rail.

Although it is a recommended practice to lay CWR when the rail temperature is within plus or minus 10 degrees F of the regional main temperature, it should be the Railway Company's responsibility to establish the desired laying temperature. When it is not possible to lay the rail at the desired laying temperature, the Contractor shall record the temperature of each rail laid and make the necessary adjustments at a later date. All adjustments shall be as instructed by the Railway's Division Engineer.

The Contractor shall be required to keep accurate record of rail temperatures taken three times daily (morning, noon and afternoon). Rail temperature report charts shall be furnished to the Contractor by the Railway Company.

Welded rail shall be handled in such a manner as to prevent bending and damaging the rail. Any rail damaged by the Contractor, due to mishandling, shall be replaced at the Contractor's expense.

Strands of welded rail shall be connected with joint bars. Welded rail shall be laid without expansion gaps at the joints. The Contractor will not be required to field weld the joints.

Flame cutting of rails or burning of bolt holes with a torch will not be permitted. Rails shall be cut with rail saw only. Bolt holes shall be drilled with rail drill only. Any Railway Company owned rail, which is flame cut by the Contractor, shall be replaced by the Contractor at his expense.

All cutting of rails shall be the responsibility of the Railway Company. The Railway Company will make the rail cuts in operating trackage and will make all the field welds for connecting welded rail strands in the field. Field cuts shall be made at locations approved by the Railway Company.

Crossties shall be spaced 508mm, center to center and laid at right angles to the rail with heartwood face down and ends lined evenly.

All track shall be fully tie-plated. The tie plates shall be applied in a workmanlike manner, with 1:40 cant down toward center of track at the time the rail is laid and shall be so placed that the outside shoulder is in contact with the base of rail for the entire length of the shoulder. Center line of tie plate shall be directly over and parallel with center line of crosstie.

Track shall be gaged to 1.435 meters and spiked at a minimum of every third tie after the rail is laid and jointed. The intermediate ties shall then be spiked.

Joint bars shall be cleaned of any foreign material, except metal preservative, and properly installed with the full number of and correct size of bolts, nuts and spring washers. Bolts placed with nuts alternately on inside and outside of rail shall be drawn tight before spiking. Before placing joint bars, the inner sides of the bars as well as rail ends within the joint bar area shall be free of any foreign material except metal preservative. Before acceptance of the work, all bolts shall be checked by the Contractor and tightened if necessary.

All rail field welds will be performed by the Railway Company.

Rails shall be fully spiked, using four spikes to crosstie on tangent track (2 spikes per tie plate) for tangent track and in accordance with the Railway's MW&S Standard Procedure 375 for tangent and curved track. Spikes shall be driven in pre-bored holes of new ties. When driving spikes in relay ties, tie plugs shall be placed in all old spike holes before driving. Relay spikes, in good condition, may be used for anchor spikes. All spikes shall be started and driven perpendicular to the tie and square with the rail and so driven that the head of the spike shall have a full hold on the base of the rail. Spikes shall not be overdriven. No spikes shall be driven at the ends of the joint bars.

Unless otherwise directed by the Railway Engineer, gage rods will be installed at 3.048 meter centers in track having a curvature of 3 degrees to 6 degrees and 2.134 meter centers in track having a curvature greater than 6 degrees. Gage rods to be either insulated or non-insulated, depending on point of use. Gage rods will be installed in turnouts as directed by the Railway Engineer.

Rail Anchors shall be installed as follows:

Welded Rail:

- (a) Main track, passing tracks, and heavy lead tracks:
  - Box anchor every other tie on tangent track and curves less than 3 degrees;
  - Box anchor all ties in curves 3 degrees and over;
  - Box anchor every tie 71.324 meters on each side of a joint.
- (b) All other tracks: Box anchor every other tie at all locations.
- (c) Box anchoring shall include four anchors per tie. All anchors are to secure on the base of rail and snug against the crosstie.
- (d) Every fourth tie should be box anchored for jointed rail.

Super-elevation of curves to be in accordance with the Plans or as directed by the Railway Engineer.

Ballast shall be uniformly distributed as it is unloaded by the Contractor after spiking of the track has been completed. The depth of preliminary ballast for surfacing to be one-half of the total depth shown on typical roadbed sections between top of sub-ballast and bottom of tie. Care to be taken to avoid disturbing or destroying any center line or grade stakes or any center line or grade stakes or the surface of the sub-grade.

A preliminary surfacing will follow each unloading of stone ballast. When using jacks, they are to be placed close enough together to prevent undue bending of the rail or stain on the joints. Both rails to be raised at one time and as nearly uniformly as possible. The track should not be raised more than 150mm in one lift, and the ballast is to be well tamped under the ties before the next lift is made. All ties that are pulled loose or skewed are to be placed in proper position and be fully spiked before tamping. Ballast shall be well tamped from a point 380mm inside of each rail, on both sides and under the tie, to the end of the ties.

Upon completion of the final surfacing and lining of the track, the Contractor shall trim the ballast to conform to the Typical Roadbed Sections shown on plans and dispose of any surplus ballast as directed by the Railway's Division Engineer.

The track shall be installed as follows:

- A. The alignment for the track shall not deviate from uniformity more than 3mm mid-ordinate in any 18.898 meter line of tangent track or more than 3mm mid-offset in any 18.898 meter chord of curved track.
- B. Track surface may not deviate from uniformity more than the following:
  - a. The deviation from uniform profile on either rail at the mid-ordinate of any 18.898 meter chord may not be more than 3mm .
  - b. Deviation from zero cross level at any point on tangent may not be more than 3mm.

Lining Track, Raising Track, Removing Track, Relaying Track and Relocating Track

Track to be lined or relocated in segments will be double spiked if necessary before starting either of these operations. The Contractor and Railway shall exercise extreme caution during these operations to insure against bending or other damage to rail, crossties and other track material. All ties that are pulled loose or become skewed during these operations will be replaced in proper position and fully spiked before tamping. Ballast distribution, surfacing and tamping to be performed as described in "LAYING TRACKS".

Existing track to be raised shall be raised to interim and final profiles by placing and tamping sufficient ballast under the ties. All ties that are pulled loose or become skewed during these operations will be replaced in proper position and fully spiked before tamping. Surfacing and tamping shall be performed as described in "LAYING TRACKS".

The Contractor shall furnish all replacement crossties need to replace any crossties in the existing track rendered unusable due to cutting in final track alignment, under the pay item "Crosstie Replacements". These ties shall be stockpiled near the point of insertion. All other lost or damaged materials, including crossties, will be replaced at the Contractor's expense with material of acceptable quality conforming to applicable Specifications.

### Maintenance of Detour Track Roadbed

Once the detour tracks are in place and accepted for train operations by the Railway Company, the Contractor shall be responsible for the maintenance of the detour track roadbed below the stone ballast during the period that the detour tracks are in operation. All maintenance work is to be done to operation. All maintenance work is to be done to the satisfaction of the Railway Engineer or his authorized representative. As soon as practicable, the Railway Engineer will notify the Contractor of any items that require maintenance so that the Contractor can do the necessary work. The Railway Company will be responsible for the maintenance of the ballast while the detour tracks are in operation and will be paid for under a force account agreement between the Department and Railway Company.

### Ownership of Materials

All salvaged material originally furnished by the Contractor shall remain the property of the Contractor, and he shall give consideration to this when making his bid. While the detour tracks are in operation, if the Railway Company finds it necessary to replace any defective material, the material furnished and placed by the Railway Company shall remain the property of the Railway Company, and the Contractor shall turn over said material to the Railway Company at the completion of the project. All salvaged track materials owned by the Contractor shall be disposed of by the Contractor, and the construction area shall be left in a neat and orderly condition. All other salvaged track material is and shall remain the property of the Railway Company.

### Detour Embankment Removal

All embankment required to construct temporary detours is to be removed as shown on the plans or to satisfaction of the Railway Company. Said material is to be removed from the railway right of way and used to form highway embankments or wasted should it not be required for further highway embankments. Areas where embankment has been removed are to be topsoiled and seeded.

### Method of Measurement

The quantity of "Railroad Main Track to be Lined", which is to be paid for, will be the actual number of meters of track which is acceptably lined, measured between the rails along the center line of the completed track.

The quantity of "Stone Ballast" (A.R.E.M.A Number 3 Modified) to be paid for will be the actual number of metric tons of stone which has been used to construct the completed ballast section, measured as provided for in Article 520-12 of the Standard Specifications.

The quantity of "Crosstie Replacements" to be paid for will be the actual number of crossties furnished and installed as replacement crossties rendered unusable by disturbance of track.

The quantity of "Field Rail Cuts and Welds" to be paid for will be the actual number of field rail cuts and welds performed.

*Exception: If the Contractor performs field rail cuts and welds in order to replace rail which he has damaged during construction, such work shall be at his own expense.*

The quantity of "Continuous Welded Rail Strands (CWR)" to be paid for will be the actual number of strands furnished and installed.

The quantity of "Railroad Main Track to be Raised", which is to be paid for, will be the actual number of meters of track which is acceptably raised, measured between the rails along the center line of the completed track.

The quantity of "Railroad Detour Main Track to be Constructed and Removed" which is to be paid for will be the actual number of meters of track which is acceptably constructed and acceptably removed, measured between the rails along the center line of the track prior to removal.

The quantity of "Railroad Bypass Main Track to be Removed and Relayed (Including New Cross Ties)" which is to be paid for will be the actual number of meters which has been acceptably removed and relayed, measured between the rails along the center line of track prior to removal.

The quantity of "Railroad Detour Main Track to be Raised", which is to be paid for, will be the actual number of meters of track which is acceptably raised, measured between the rails along the center line of the completed track.

The quantity of "Jointed CWR Connections", which is to be paid for, will be the actual number of jointed CWR connections which have been acceptably incorporated into the work.

The quantity of "Aggregate Base Course (Sub-ballast)" to be paid for will be the actual number of metric tons of Aggregate Base Course (Sub-Ballast) which has been used to construct the track roadbed sections, measured as provided for in Article 520-12 of the Standard Specifications.

No separate measurement will be made for rail anchors, gage rods or other miscellaneous track material as they will be considered as part of the track structure.

#### Basis of Payment

The quantity of "Railroad Main Track to be Lined", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per meter for "Railroad Main Track to be Lined". Such price and payment will be considered full compensation for all work necessary to line the existing track, including all necessary track hardware, such as rail anchors, gage rods, and crossties.

The quantity of "Stone Ballast", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per metric ton for "Stone Ballast (A.R.E.M.A Number 3 Modified)". Such price and payment will be full compensation for all furnishing, weighing, hauling, and placing of stone and for any other work necessary for the construction of the completed ballast section on all permanent tracks.

The quantity of "Crosstie Replacements", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per each for "Crosstie Replacements". Such price and payment will be full compensation for all furnishing, hauling, stockpiling, and other work necessary for the furnishing of crosstie replacements.

The quantity of "Field Rail Cuts and Welds", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per each for "Field Rail Cuts and Welds". Such price and payment will be full compensation for all work necessary to perform field rail cuts and welds.

The quantity of "Continuous Welded Rail Strands (CWR)", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per each for "Continuous Welded Rail Strands (CWR)". Such price and payment will be full compensation for all work necessary to furnish and install CWR.

The quantity of "Railroad Main Track to be Raised", as determined in "Method of Measurement" above, will be paid for at the contract unit price per meter for "Railroad Track to be Raised". Such price and payment will be considered full compensation for all work necessary to raise the existing track, including all necessary track hardware, such as rail anchors, gage rods, and crossties.

The quantity of "Railroad Detour Main Track to be Constructed and Removed", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per meter for "Railroad Detour Main Track to be Constructed and Removed". Such price and payment will be full compensation for all work necessary for the construction of the detour main track and the subsequent removal of same track after it is no longer needed.

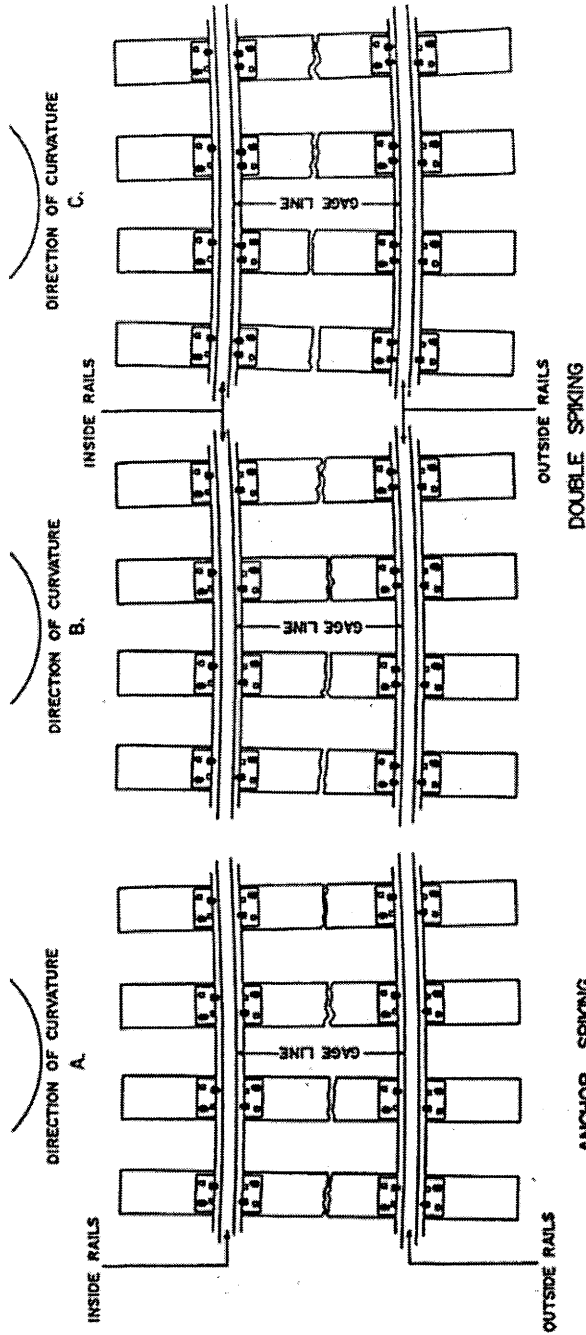
The quantity of "Railroad Bypass Main Track to be Removed and Relayed (Including New Crossties)", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per meter for "Railroad Bypass Main Track to be Removed and Relayed (Including New Crossties)". Such price and payment will be full compensation for all work necessary for the removal and relaying of existing track.

The quantity of "Railroad Detour Main Track to be Raised", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per meter for "Railroad Detour Main Track to be Raised". Such price and payment will be full compensation for all work necessary for the raising of existing track.

The quantity of "Jointed CWR Connections", as determined in "Method of Measurement" above, will be paid for at the contract unit price per each for "Jointed CWR Connections". Such price and payment will be considered full compensation for all work necessary to acceptably incorporate the jointed CWR connections into the work.

The quantity of "Aggregate Base Course (Sub-Ballast)", determined as provided in "Method of Measurement" above, will be paid for at the contract unit price per metric ton for "Aggregate Base Course (Sub-Ballast)". Such price and payment will be full compensation for all furnishing, weighing, hauling, and placing of Aggregate Base Course (Sub-Ballast) and for any other work necessary for the construction of this portion of the track roadbed section for permanent tracks.

No separate payment will be made for rail anchors, gage rods or other miscellaneous track material. The cost of these items shall be included in the contract unit price bid for other items of work.



CURVES  $8^\circ$  AND OVER WITH 1% OR MORE GRADE;  
 CURVES  $10^\circ$  AND OVER

$6^\circ$  to  $7^\circ 59'$

$3^\circ$  to  $5^\circ 59'$

NOTE:  
 W = SPIKES

PATTERNS OF ANCHOR SPIKING  
 AND  
 DOUBLE SPIKING OF CURVES

PLAN 5-8

In Section 1084-3 "Steel Bearing Piles" of the Standard Specifications, revise the first sentence as follows: Steel bearing piles must meet the requirements of ASTM A572 or ASTM A588 and have a grade of 50 [345].

**REMOVE & REPLACE 1800mm CHAINLINK & 3-STRAND BARB WIRE FENCE****(Special)**

- A. Description: Remove existing 1800mm chainlink & 3-strand barb wire fence and replace it. Use new materials if necessary to restore the fence to a like new condition.
- B. Method of Measurement: The quantity of fence removed and replaced to be paid for will be the actual number of linear meters of fence that has been replaced. Measurement will be made along the fence after it has been replaced from center of end post to center of end post.
- C. Basis of Payment: Payment will be made at the linear meter price bid for "Remove & Replace 1800mm Chainlink & 3-Strand Barb Wire Fence". Such price and payment will be full compensation for all costs necessary to complete the work.

**TEMPORARY RAILROAD SHORING****(Special)****General**

Provide temporary railroad shoring at Abutment #1 as indicated in the plans and in accordance with the Standard Specifications and this Special Provision.

Submit design computations and plans for the temporary shoring for review, comments and acceptance. Provide sealed computations and plans from a North Carolina Registered Professional Engineer. After acceptance by the appropriate State agency, the design will be submitted by the State agency to the Railroad for review, comments and acceptance. A minimum of 30 days should be allowed for the Railroad's review. The Contractor shall not begin excavation at the excavation site or sites in question until notified by the Engineer of acceptance by both the State and Railroad of the design and plans.

This proposed shoring is located in zone 1 as identified on Norfolk Southern Corporation Standard Overhead Bridge Detail, Shoring Requirements, sheet 4, dated February 1998 which indicates that interlocking sheeting or soldier pile temporary shoring will be required.

**Design Requirements**

PHI = 34 degrees  
Gamma = 120 pcf  
RR Surcharge = 0.179 ksf  
Active Pressure = 0.085 ksf

**Basis of Payment**

Payment for the temporary railroad shoring will be made at the lump sum price bid for "Temporary Railroad Shoring for Abutment 1 at Sta \_\_\_\_\_". This price shall be full compensation for all design, materials, equipment, tools, labor, and incidentals necessary to complete the work.