

Project Special Provisions
Structure

Table of Contents

	Page #
Evazote Joint Seals (8-13-04)	1
Elastomeric Concrete (10-12-01)	6
Falsework and Formwork (7-18-06)	7
Submittal of Working Drawings (7-12-07)	12
Crane Safety (8-15-05)	19
Shipping Steel Structural Members (7-18-06)	19
Grout for Structures (7-12-07)	21
High Strength Bolts (11-17-06)	23
Continuous Flight Auger Piles (SPECIAL)	24
Control of Vibration (SPECIAL)	31
Construction, Maintenance, and Removal of Temporary Structure at Station 24+02.00 -L- (SPECIAL)	32



Jesse McArthur Bailey
10/8/07

PROJECT SPECIAL PROVISIONS
STRUCTURE

PROJECT B-4128

GUILFORD COUNTY

EVAZOTE JOINT SEALS

(8-13-04)

1.0 SEALS

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

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

Provide seals that meet the requirements given below.

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

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

2.0 ADHESIVES

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

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

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

3.0 SAWING THE JOINTS

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

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

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

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

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

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

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

4.0 PREPARATIONS FOR SAWED JOINTS

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

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

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

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

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

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

5.0 PREPARATIONS FOR ARMORED JOINTS

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

A. Submittals

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

B. Surface Preparation

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

1. Angle Assembly

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

2. Concrete

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

C. Elastomeric Concrete Placement

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

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

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

D. Joint Preparation

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

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

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

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

6.0 SEAL INSTALLATION

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

Begin installation at the low end of the joint after applying the mixed epoxy to the sides of both the joint material and both sides of the joint, making certain to completely fill the grooves with epoxy. With gloved hands, compress the material and with the help of a blunt probe, push it down into the joint until it is recessed approximately 1/4 inch (6 mm) below the surface. Do not push the seal at an angle that would stretch the material. Once work on a joint begins, do not stop until it is completed. Clean the excess epoxy off the surface of the joint material *quickly* and *thoroughly*. Do not use solvents to remove excess epoxy. Remove excess epoxy in accordance with the joint manufacturer's recommendations.

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

7.0 BASIS OF PAYMENT

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

ELASTOMERIC CONCRETE

(10-12-01)

1.0 DESCRIPTION

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

2.0 MATERIALS

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

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

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

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

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

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

3.0 BASIS OF PAYMENT

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

FALSEWORK AND FORMWORK

(7-18-06)

1.0 DESCRIPTION

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

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

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

2.0 MATERIALS

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

3.0 DESIGN REQUIREMENTS

A. Working Drawings

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

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

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

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

1. Wind Loads

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

Table 2.2 - Wind Pressure Values

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

2. Time of Removal

The following requirements replace those of Article 3.4.8.2.

Do not remove forms until the concrete has attained strengths required in Article 420-16 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. Falsework hangers that support concentrated loads and are installed at the edge of thin top flange concrete girders (such as bulb tee girders) shall be spaced so as not to exceed 75% of the manufacturer's stated safe working load. Use of dual leg hangers (such as Meadow Burke HF-42 and HF-43) are not allowed. Design the falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

4.0 CONSTRUCTION REQUIREMENTS

All requirements of Section 420 of the Standard Specifications apply.

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

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

A. Maintenance and Inspection

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

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

B. Foundations

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

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

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

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

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

5.0 REMOVAL

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

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

6.0 METHOD OF MEASUREMENT

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

7.0 BASIS OF PAYMENT

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

SUBMITTAL OF WORKING DRAWINGS

(7-12-07)

1.0 GENERAL

Submit working drawings in accordance with Article 105-2 of the Standard Specifications and the requirements of this special provision. For the purposes of this provision, "submittals" refers to only those listed in this 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. Either the Structure Design Unit or the Geotechnical Engineering Unit or both units will jointly review submittals.

If a submittal contains variations from plan details or specifications or significantly affects project cost, field construction or operations, discuss the submittal with and submit all copies to the Resident Engineer. State the reason for the proposed variation in the submittal. To minimize review time, make sure all submittals are complete when initially submitted. Provide a contact name and information with each submittal. Direct any questions regarding 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, 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 ADDRESSES AND CONTACTS

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

Via US mail:

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

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

Via other delivery service:

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

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

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

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

Via US mail:

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

Via other delivery service:

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

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

Via US mail:

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

Via other delivery service:

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

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

Primary Structures Contact:	Paul Lambert (919) 250 – 4041 (919) 250 – 4082 facsimile plambert@dot.state.nc.us
Secondary Structures Contacts:	James Gaither (919) 250 – 4042 David Stark (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

Furnish one complete copy of each submittal, including all attachments, to the Resident Engineer. At the same time, submit the number of hard copies shown below of the same complete submittal directly to the Structure Design Unit and/or the Geotechnical Engineering Unit.

The first table below covers “Structure Submittals”. The Resident Engineer will receive review comments and drawing markups for these submittals from the Structure Design Unit. The second table in this section covers “Geotechnical Submittals”. The Resident Engineer will receive review comments and drawing markups for these submittals from the Geotechnical Engineering Unit.

Unless otherwise required, submit one set of supporting calculations to either the Structure Design Unit or the Geotechnical Engineering Unit unless both units require submittal copies in which case submit a set of supporting calculations to each unit. Provide additional copies of any submittal as directed by the Engineer.

STRUCTURE SUBMITTALS

Submittal	Copies Required by Structure Design Unit	Copies Required by Geotechnical Engineering Unit	Contract Reference Requiring Submittal ¹
Arch Culvert Falsework	5	0	Plan Note, SN Sheet & "Falsework and Formwork"
Box Culvert Falsework ⁷	5	0	Plan Note, SN Sheet & "Falsework and Formwork"
Cofferdams	6	2	Article 410-4
Evazote Joint Seals ⁶	9	0	"Evazote Joint Seals"
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 ² (substructure)	8	0	Article 420-3 & "Falsework and Formwork"
Falsework & Forms (superstructure)	8	0	Article 420-3 & "Falsework and Formwork"
Girder Erection over Railroad	5	0	Railroad Special Provisions
Maintenance and Protection of Traffic Beneath Proposed Structure	8	0	"Maintenance and Protection of Traffic Beneath Proposed Structure at Station ____"
Metal Bridge Railing	8	0	Plan Note
Metal Stay-in-Place Forms	8	0	Article 420-3
Metalwork for Elastomeric Bearings ^{4,5}	7	0	Article 1072-10

Miscellaneous Metalwork ^{4,5}	7	0	Article 1072-10
Optional Disc Bearings ⁴	8	0	“Optional Disc Bearings”
Overhead Signs	13	0	Article 903-3(C) & Applicable Project Special Provisions
Pile Splicer	7	2	Subarticle 450-7(C)
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20
Pot Bearings ⁴	8	0	“Pot Bearings”
Precast Concrete Box Culverts	2, then 1 reproducible	0	“Optional Precast Reinforced Concrete Box Culvert at Station ____”
Precast Retaining Wall Panels	10	1	Article 1077-2
Prestressed Concrete Cored Slab (detensioning sequences) ³	6	0	Article 1078-11
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3
Prestressed Concrete Girder (strand elongation and detensioning sequences)	6	0	Articles 1078-8 and 1078- 11
Removal of Existing Structure over Railroad	5	0	Railroad Special Provisions
Revised Bridge Deck Plans (adaptation to prestressed deck panels)	2, then 1 reproducible	0	Article 420-3
Revised Bridge Deck Plans (adaptation to modular expansion joint seals)	2, then 1 reproducible	0	“Modular Expansion Joint Seals”
Sound Barrier Wall Casting Plans	10	0	Article 1077-2 & “Sound Barrier Wall”
Sound Barrier Wall Steel Fabrication Plans ⁵	7	0	Article 1072-10 & “Sound Barrier Wall”
Structural Steel ⁴	2, then 7	0	Article 1072-10

Temporary Detour Structures	10	2	Article 400-3 & “Construction, Maintenance and Removal of Temporary Structure at Station ____”
Temporary Shoring ⁸	7	2	“Temporary Shoring”
TFE Expansion Bearings ⁴	8	0	Article 1072-10

FOOTNOTES

1. References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the Project Special Provision by that name. Articles or subarticles refer to the Standard Specifications.
2. Submittals for these items are necessary only when required by a note on plans.
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. The fabricator may submit these items directly to the Structure Design Unit.
5. The two sets of preliminary submittals required by Article 1072-10 of the Standard Specifications are not required for these items.
6. Submittals for Fabrication Drawings are not required. Submittals for Catalogue Cuts of Proposed Material are required. See Section 5.A of the referenced Project Special Provision.
7. Submittals are necessary only when the top slab thickness is 18 inches or greater.
8. Electronic copies of submittals are required. See referenced Project Special Provision.

GEOTECHNICAL SUBMITTALS

Submittal	Copies Required by Geotechnical Engineering Unit	Copies Required by Structure Design Unit	Contract Reference Requiring Submittal ¹
Crosshole Sonic Logging (CSL) Reports ²	1	0	“Crosshole Sonic Logging”
Drilled Pier Construction Sequence Plans ²	1	0	“Drilled Piers”
Mechanically Stabilized Earth (MSE) Retaining Walls	8	2	“MSE Retaining Walls”
Pile Driving Analyzer (PDA) Reports ²	2	0	“Pile Driving Analyzer”
Pile Driving Equipment Data ³	1	0	Article 450-5
Proprietary Retaining Walls	8	2	Applicable Project Special Provision
Anchored Retaining Walls	8	2	Applicable Project Special Provision
Soil Nail Retaining Walls	8	2	Applicable Project Special Provision
Temporary Mechanically Stabilized (MSE) Earth Wall ²	9	0	“Temporary Shoring”

FOOTNOTES

- 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.
- Electronic copies of submittals are required. See referenced Project Special Provision.
- Download Pile Driving Equipment Data Form from following link:
<http://www.ncdot.org/doh/preconstruct/highway/geotech/formdet/>
Submit one hard copy of the completed form to the Resident Engineer. Submit a second copy of the completed form electronically, by facsimile or via US Mail or other delivery service to the Geotechnical Engineering Unit. Electronic submission is preferred. See second page of form for submittal instructions.

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.

SHIPPING STEEL STRUCTURAL MEMBERS

(7-18-06)

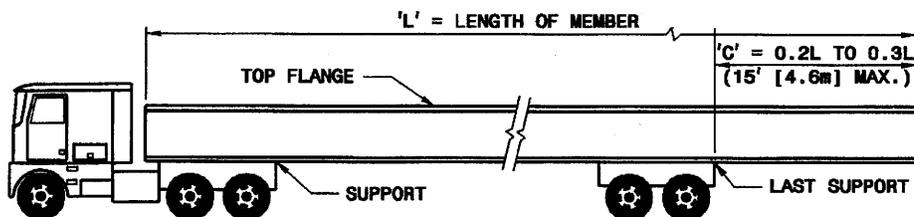
Section 1072-23 Marking and Shipping

Add the following paragraphs after the third paragraph of the Section.

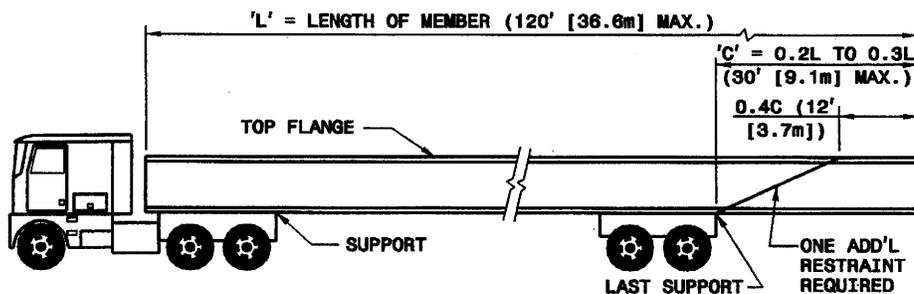
Load and ship steel beams and girders in accordance with the Figure below for all types of transportation.

Below is the sketches provided to Materials and Tests Unit on May 8, 1991. When the contractor wishes to place members on trucks not in accordance with these limits, to ship by rail, to attach shipping restraints to the members, to ship horizontally curved steel members, or to invert members, he shall submit a shipping plan prior to shipping. See also Article 1072-11.

LIMITS FOR PLACEMENT OF BEAMS AND GIRDERS DURING SHIPMENT



WHEN 'C' = 15' (4.6m) OR LESS



WHEN 'C' = OVER 15' (4.6m) THRU 30' (9.1m)

L	MIN. 'C'	MAX 'C'
75 (22.9m)	15 (4.6m)	22½ (6.9m)
80 (24.4m)	16 (4.9m)	24 (7.3m)
85 (25.9m)	17 (5.2m)	25½ (7.8m)
90 (27.4m)	18 (5.5m)	27 (8.2m)
95 (29.0m)	19 (5.8m)	28½ (8.7m)
100 (30.5m)	20 (6.1m)	30 (9.1m)
105 (32.0m)	21 (6.4m)	30 (9.1m)
110 (33.5m)	22 (6.7m)	30 (9.1m)
115 (35.1m)	23 (7.0m)	30 (9.1m)
120 (36.6m)	24 (7.3m)	30 (9.1m)

NOTES: ALL DIMENSIONS ARE IN FEET (METERS).
 TRUCK LOADING SHOWN FOR SIMPLICITY
 DIMENSIONS APPLY TO ALL TYPES OF SHIPMENTS.

GROUT FOR STRUCTURES

(7-12-07)

1.0 DESCRIPTION

This special provision addresses grout for use in structures, including continuous flight auger (CFA) piles, micropiles, soil nail and anchored retaining walls and backfilling crosshole sonic logging (CSL) tubes or grout pockets, shear keys, dowel holes and recesses for cored slabs and box beams. This provision does not apply to grout placed in post-tensioning ducts for bridge beams, girders, or decks. Provide grout composed of portland cement, water and at the Contractor's option, fine aggregate and/or pozzolan. If necessary, use set controlling admixtures. Proportion, mix and place grout in accordance with the plans, the applicable section of the *Standard Specifications* or special provision for the application and this provision.

2.0 MATERIALS

Refer to Division 10 of the *Standard Specifications*:

Item	Article
Portland Cement	1024-1
Water	1024-4
Fine Aggregate	1014-1
Fly Ash	1024-5
Ground Granulated Blast Furnace Slag	1024-6
Admixtures	1024-3

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

3.0 REQUIREMENTS

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

Property	Requirement
Compressive Strength @ 3 days	2500 psi (17.2 MPa)
Compressive Strength @ 28 days	4500 psi (31.0 MPa)

For applications other than micropiles, soil nails and ground anchors, use non-shrink grout with shrinkage of less than 0.15%.

When using approved packaged grout, a grout mix design submittal is not required. Submit grout mix designs in terms of saturated surface dry weights on M&T Form 312U in accordance with the applicable section of the *Standard Specifications* or special provision

for the structure. Use an approved testing laboratory to determine the grout mix proportions. Adjust proportions to compensate for surface moisture contained in the aggregates at the time of mixing. Changes in the saturated surface dry mix proportions will not be permitted unless a revised grout mix design submittal is accepted.

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

Property	Test Method
Compressive Strength	AASHTO T106 and T22
Density	AASHTO T133
Flow for Sand Cement Grout	ASTM C939 (as modified below)
Flow for Neat Cement Grout (no fine aggregate)	Marsh Funnel and Cup API RP 13B-1, Section 2.2
Aggregate Gradation for Sand Cement Grout	AASHTO T27
Shrinkage for Non-shrink Grout	ASTM C1090

When testing grout for flow in accordance with ASTM C939, modify the flow cone outlet diameter from 1/2 to 3/4 inch (13 to 19 mm).

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

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

4.0 SAMPLING AND PLACEMENT

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

Do not place grout if the grout temperature is less than 50°F (10°C) or more than 90°F (32°C) or if the air temperature measured at the location of the grouting operation in the shade away from artificial heat is below 40°F (4°C).

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

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

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

5.0 MISCELLANEOUS

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

HIGH STRENGTH BOLTS

(11-17-06)

In Section 440-8(A) of the *Standard Specifications*, revise the third paragraph and insert a new paragraph four, respectively, as follows:

“Make sure that plain bolts and washers have a thin coat of lubricant at the time of installation.”

“Use nuts that are pre-waxed by the producer/supplier prior to shipping to the project.”

CONTINUOUS FLIGHT AUGER PILES**(SPECIAL)****1.0 GENERAL****A. Description**

This special provision governs the construction of continuous flight auger (CFA) piles. CFA piles are constructed by drilling a borehole with a continuous flight hollow stem auger and filling the borehole by pumping grout through the auger as it is withdrawn. After completing grout placement, reinforcement is inserted into the column of fluid grout. Construct CFA piles with the required capacity in accordance with the Contract. For this provision, "pile" refers to a CFA pile.

B. Prequalification Requirements

The CFA Pile Subcontractor is responsible for the installation and monitoring of the CFA piles. Use a CFA Pile Subcontractor prequalified by the Contractual Services Unit of the Department for CFA pile work (work code 3110).

C. Preconstruction Meeting

Before starting CFA pile construction, conduct a preconstruction meeting to discuss the installation and monitoring of the CFA piles. Schedule this meeting after all CFA pile submittals have been accepted and the CFA Pile Subcontractor has mobilized to the site. The Resident Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, General Contractor and the CFA Pile Subcontractor Superintendent, Drill Rig Operators, Project Manager will attend this preconstruction meeting.

2.0 SUBMITTALS

Two submittals are required. These submittals include the CFA Pile Subcontractor personnel and experience, and CFA pile installation plan. Provide 4 hard copies and an electronic copy (pdf or jpg format on CD or DVD) of each submittal. Allow 10 working days for the review of the personnel and experience submittal. After the personnel and experience submittal is accepted, submit the installation plan at least 30 working days before starting pile construction. Do not begin CFA pile construction until the installation plan is accepted.

A. CFA Subcontractor Personnel and Experience Submittal

Submit documentation that the CFA Pile Subcontractor has successfully completed at least 5 CFA pile projects and 250 CFA piles within the last 3 years with diameters and lengths similar to those anticipated for this project. Documentation should include the General Contractor and Owner's name and current contact information with descriptions of each past project. Also, submit documentation of experience with

automated monitoring and recording equipment and CFA pile construction in subsurface conditions similar to those for this project.

Provide a list of the Superintendent, Drill Rig Operators and Project Manager that will be assigned to this project. Submit documentation for these personnel verifying employment with the CFA Pile Subcontractor and a minimum of 5 years experience in CFA pile construction with past projects of scope and complexity similar to that anticipated for this project. Documentation should include resumes, references, certifications, project lists, experience descriptions and details, etc. Perform work with the personnel submitted and accepted. If personnel changes are required during construction, suspend CFA pile construction until replacement personnel are submitted and accepted.

B. CFA Pile Installation Plan Submittal

Submit detailed project specific information including the following.

1. List and sizes of proposed equipment, including CFA drilling rigs, augers and other drilling tools, and grout equipment.
2. Step-by-step description of CFA pile installation and sequence of pile construction.
3. Methods for placing reinforcement including procedures for supporting and positioning the reinforcement.
4. Acceptable ranges for drilling parameters i.e., auger rotation speed and penetration rate, torque and crowd pressure and required grouting parameters i.e., maximum and minimum (systolic and diastolic) grouting pressures and minimum grout volume factor. The grout volume factor is equal to the grout volume placed divided by the theoretical grout volume for each depth increment. A grout volume factor of at least 1.15 is required.
5. Equipment and procedures for monitoring and recording auger rotation speed and depth, torque, crowd pressure and grout pressures and volume with calibration certificates within one year of submittal date.
6. Examples of records to be provided in accordance with Section 6.0.
7. Procedures for containment and disposal of drilling spoils in accordance with Section 802 of the Standard Specifications.
8. Grout mix design including laboratory test results in accordance with the Grout for Structures Special Provision.
9. Plan and methods for protecting adjacent structures and utilities incorporating the requirements in the Control of Vibrations special provision.
10. Other information shown on the plans or requested by the Engineer.

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

3.0 MATERIALS

Use steel piles meeting the requirements of Section 1084 of the Standard Specifications.

Use grout in accordance with the Contract.

4.0 CFA DEMONSTRATION PILES

Construct CFA demonstration piles in accordance with the accepted submittals and this provision including any monitoring requirements. The minimum dimensions, elevations, and locations of demonstration piles are shown on the plans. No reinforcement is required for the demonstration piles. Install a demonstration pile to a depth of the longest pile on the project. The purpose of demonstration piles is to demonstrate the CFA Pile Subcontractor's ability to successfully install CFA piles. The demonstration pile results will be used to evaluate the grout mix design and possibly revise required grouting parameters and acceptable ranges for drilling parameters established with the CFA pile installation plan. The Engineer will determine if CFA demonstration piles are satisfactory or not. If the Engineer determines a demonstration pile is unsatisfactory, a replacement pile is required at no additional cost to the Department. Do not begin construction of any CFA production piles until all demonstration piles are accepted. The Engineer will provide notification of acceptance or rejection for the demonstration pile within 24 hours of submittal of all construction records.

5.0 CONSTRUCTION METHODS

Use equipment and methods reviewed and accepted in the CFA pile installation plan or approved by the Engineer. Inform the Engineer of any deviations from the accepted plan. Install CFA piles in the same way as the demonstration pile.

A. Drilling

Use a CFA piling rig capable of drilling through whatever materials are encountered to the dimensions and elevations shown on the plans or otherwise required by the Engineer.

Use single helix hollow stem augers with uniform diameters and continuous flights from the top of the auger to the bottom tip of the cutting face. Provide augers with flights and teeth that cut the bottom of the borehole flat. Augers with outside diameters at least 97% of the pile design diameter are required. Augers capable of installing piles to a depth 20% greater than plan depth are also required unless the pile tip is in rock.

Unless piles are installed with a hydraulic fixed mast installation platform and the stem to which the auger is fixed has an outside diameter 10 in (250 mm) or greater, at least

one guide connected to the leads of the CFA piling rig is required. If the auger is over 40 ft (12 m) long, use two guides with the second guide placed approximately half the length of the auger above the first. Prevent the leads from rotating during drilling and grouting.

Seal the grout injection port to prevent entry during drilling. Keep the hollow stem of augers clean when drilling. Clearly mark augers or leads every foot (0.3 m) along their length with markings visible to the unaided eye from the ground. Check for correct pile location and plumbness or proper inclination before beginning drilling.

Do not begin drilling until enough grout to complete the pile is on the project site. Do not drill within 4 pile diameters, center to center, of any pile until the grout in all adjacent piles reaches initial set as determined by the Engineer.

Advance the auger into the ground at a continuous rate. Do not raise the auger until beginning grout placement. Control the auger rotation speed to prevent excess spoil from being transported to the ground surface and surrounding soil being drawn laterally into the borehole.

If muck, organics, soft soil or other unsuitable materials are encountered within 5 ft (1.5 m) of the ground surface, contact the Engineer as these materials can cause problems with pile head construction. If auger refusal is encountered before reaching plan depth, stop the auger rotation and inform the Engineer. Unless it is determined otherwise, refusal is defined as less than 1 ft (0.3 m) of auger penetration per minute.

B. Grouting

Remove all oil, rust inhibitors, residual drilling slurries and similar foreign materials from holding tanks/hoppers, stirring devices, pumps and lines and all other equipment in contact with the grout before use.

Place a screen between the ready mix truck and the grout pump to remove large particles or cement balls using a mesh that has openings no larger than 3/4 in (19 mm).

Use a positive displacement piston type pump with a known volume per stroke that can develop peak pressures at the pump of at least 350 psi (2.4 MPa). Size the pump to maintain a smooth continuous delivery of grout while limiting pressure variations (particularly pressure drops) due to pump strokes. At the beginning of construction, provide the grout volume delivered by each pump stroke and verify this value is within 3% of the actual volume. Recalibrate the grout volume per pump stroke during construction as necessary or directed by the Engineer.

Place grout in accordance with the Contract and accepted submittals. Pump grout without difficulty to fill any soft or porous zones and with sufficient pressure to ensure a continuous monolithic pile with at least the plan cross section from the maximum borehole depth to the top of the grout column. Provide grout free of any segregation, soil inclusions, contamination, structural damage or inadequate consolidation (honeycombing).

Begin placing grout within 5 minutes after the auger has reached plan depth. At the beginning of grout placement, lift the auger 6 to 12 in (150 to 300 mm) and remove the sealing device by applying grout pressure or with a steel bar. Do not lift the auger beyond this range in order to minimize soil movement. After grout flow is initiated, reinsert the auger to the original depth.

Pump grout continuously while extracting the auger at a smooth steady rate. Maintain a positive grout pressure at the auger injection point at all times. If rotation occurs while removing the auger, rotate the auger in the same direction as during drilling. If grout placement is suspended for any reason, inform the Engineer and redrill the CFA pile.

C. Monitoring and Recording

Record the following versus depth of the auger injection point in increments of 2 ft (0.6 m) or less for drilling and grouting.

- Auger rotation speed
- Torque
- Crowd pressure
- Maximum and minimum (systolic and diastolic) grout pressures
- Grout volume and factor

Monitor the depth of the auger injection point with an electronic position indicator placed on the crane line or boom holding the auger. Monitor the auger rotation speed with an electronic position indicator placed on the auger head system. Monitor the torque and crowd pressure using load cells placed on the auger head system or pressure sensors placed in the appropriate hydraulic line on the power pack. Monitor the grout pressures with a pressure transducer located as close to the auger injection point as possible and no further from the injection point than in the grout pressure line at the base of the leads. Monitor the grout volume with an electromagnetic flowmeter placed in the grout pressure line.

If the monitoring and recording equipment malfunctions, suspend CFA pile construction and repair the equipment. CFA pile installation may be allowed without monitoring for only the pile currently under construction during malfunction of the equipment. If this occurs, keep a record of pump strokes versus depth of the auger injection point while the equipment is not operating or functioning properly. Do not resume construction of CFA piles until repair or replacement of the monitoring and recording equipment is completed.

D. Pile Top Finishing and Protection

After placing grout, remove all excess grout and spoil from and place a temporary form within the top of the grout column. Use a form 3 to 5 ft (1 to 1.5 m) long with a diameter equal to or larger than the pile diameter. Place the form with equal lengths above and below the ground surface. Recheck the top of the grout and remove any

foreign material. After the grout has reached initial set as determined by the Engineer, remove the form without disturbing the ground surface around the pile.

After placing reinforcement, square the top of the pile with the pile axis while grout is still fluid or by cutting off hardened grout. Construct the top of pile to the elevation shown on the plans.

E. Reinforcement

Provide reinforcement for CFA piles consisting of a steel pile as shown on the plans.

Provide a method to center the steel pile in the borehole and maintain the required minimum grout cover.

Place reinforcement as a unit while the grout is still fluid. Lower or gently push reinforcement into the grout. Do not vibrate or drive the reinforcement.

6.0 RECORDS

Provide 3 original hard copies of CFA pile construction records including the following within 24 hours after completing each pile.

1. Project or bridge description, county, NCDOT TIP number and WBS element number
2. Bent station and number, pile location and identifier and allowable load and required pile capacity
3. The following in graphical or numerical format versus depth of the auger injection point in increments of 2 ft (0.6 m) or less for drilling and grouting
 - Auger rotation speed
 - Torque
 - Crowd pressure
 - Maximum and minimum (systolic and diastolic) grout pressures
 - Grout volume and factor
4. Pile diameter, length and tip elevation, top of pile and ground surface elevations
5. Auger diameter and theoretical volume of the borehole
6. Steel pile reinforcement, size, length, top elevation and grade of pile
7. Date and time drilling begins and ends, grout is mixed and arrives on-site, pumping grout begins and ends and reinforcement is placed
8. Weather conditions including air temperature at time of grout placement
9. All other pertinent details related to CFA pile construction

After completing all CFA piles for a structure or a stage of a structure, submit electronic copies (pdf or jpg format on CD or DVD) of all corresponding construction records.

7.0 CFA PILE ACCEPTANCE

CFA pile acceptance is based on the following criteria.

1. Auger rotation speed, torque and crowd pressure are within acceptable ranges for any 2 ft (0.6 m) depth increment.
2. Grout volume factor is greater than the minimum required for any 4 ft (1.2 m) depth increment. Maximum and minimum (systolic and diastolic) grout pressures exceed required pressures for any 2 ft (0.6 m) depth increment.
3. CFA pile is within 3 in (75 mm) of plan location and inclination is within 2% of plumb or the required batter. Top of pile is within 1 in (25 mm) below and 3 in (75 mm) above the top of pile elevation shown on the plans.
4. Reinforcement is properly placed. Steel pile reinforcement, location, inclination and elevation are within the tolerances shown above for the CFA pile.
5. Grout is in accordance with the Contract and does not have any evidence of excessive settlement, intrusions, contamination, structural damage or inadequate consolidation (honeycombing).

If the Engineer determines a CFA pile is unacceptable or unsatisfactory, additional testing, remedial measures or replacement piles are required at no additional cost to the Department. Obtain approval for remediation proposals before performing work. No compensation will be made for losses or damages for remedial work or investigation of unacceptable or unsatisfactory piles.

8.0 MEASUREMENT AND PAYMENT

Complete and accepted CFA piles will be paid for at the unit bid price for "18 inch dia. Continuous Flight Auger Piles" per linear foot computed from elevations and dimensions shown on the plans or revised dimensions authorized by the Engineer. Include in this unit bid price all costs for submittals, automated monitoring and recording, labor, tools, equipment and grout complete and in place and all incidentals necessary to drill and construct CFA piles in accordance with this provision. No additional payment will be made for drilling through non-soil materials. No additional payment will be made for any costs associated with unacceptable CFA piles. Reinforcement will be paid for separately and will not be part of the unit bid price for "18 inch dia. Continuous Flight Auger Piles".

Complete and accepted CFA demonstration piles will be paid for at the unit bid price for "18 inch dia. CFA Demonstration Piles" per each. The number of "18 inch dia. CFA Demonstration Piles" per acceptable demonstration pile will be equal to one. Include in this unit bid price all costs for submittals, automated monitoring and recording, labor, tools, equipment and grout complete and in place and all incidentals necessary to drill and construct CFA demonstration piles in accordance with this provision. No additional

payment will be made for drilling through non-soil materials. No additional payment will be made for any costs associated with unacceptable CFA demonstration piles.

CONTROL OF VIBRATION

(SPECIAL)

Review and acceptance of any construction plan submittals does not relieve the Contractor of responsibility for damage or liability. Attention is directed to Articles 107-12 and 107-15 of the Standard Specifications for Roads and Structures.

Control of vibration is required during construction of Bridge No. 73 over Bull Run Creek and approaches. It is the responsibility of the Contractor to utilize construction methods and equipment to minimize disturbance and/or damage to the adjacent structures.

Contact the Geotechnical Engineering Unit Contract Administration Office for an approved consultant from the list of movement, noise, and vibration monitoring work. Submit a vibration monitoring plan to the Engineer for approval at least 20 days before beginning any construction work. Schedule a preconstruction conference before beginning any work, and include Contractor personnel, vibration monitoring firm, Resident Engineer, and representatives from NCDOT Construction Unit and Geotechnical Engineering Unit.

Utilize construction methods and equipment to avoid construction induced damage to the adjacent structures/properties. Use of vibratory compaction equipment is only allowed for placement and/or compaction of earth material, stone or asphalt pavement to the limit that does not cause damage to the adjacent structures.

This work includes furnishing and operating vibration monitoring devices (engineering seismographs) for the project at adjacent buildings of vibration concern. Vibration monitoring devices shall have been calibrated within twelve months from the date the calibration data are submitted to the Engineer. Devices shall be capable of recording vibrations in three perpendicular axes: vertical, transverse, and longitudinal, and also be capable of recording the full vibration waveform with a precision level of 0.01 inch per second. Geophones shall exhibit linear response in the frequency range of 4-100 Hertz. The monitoring devices shall also be capable of recording sound.

Continuous monitoring will be required during the initial stages of each particular phase of work that could generate detectable vibrations at adjacent buildings. Other than during bridge foundation construction activities, once safe levels have been confirmed, an instrument may be placed at the nearest structure to document ongoing safe vibrations. Construction vibration at all adjacent structures shall not exceed 0.5 inches per second peak particle velocity in any axis at any time. Inspect the conditions of adjacent structures during the construction to assess any damage to the structures. If the vibrations recorded show any potential to damage adjacent structures, suspend work immediately and take action to prevent damage to the structure.

Throughout the duration of the vibration monitoring on the project, the Department reserves the right to request that the Contractor provide information associated with this work for review without delay. At the completion of the project, submit to the Engineer three (3) copies of the final report which should include all vibration monitoring records, pre-construction, construction and post construction condition assessments of adjacent structures with both photographic/video and written documentation.

Payment will be made by the Lump Sum bid price for "Vibration Monitoring." Such payment will be full compensation for all work described in this provision including, but not limited to, control of vibration, inspection of the structures, vibration monitoring, and submission of reports.

CONSTRUCTION, MAINTENANCE AND REMOVAL (SPECIAL)
OF TEMPORARY STRUCTURE AT STATION 24+02.00 -L-

Construct, maintain and afterwards remove a temporary structure in accordance with the applicable parts of the Standard Specifications and this Special Provision, (structure only; the approaches are not a part of this pay item). Provide a temporary structure with a minimum overall length of 85 feet with 1 ½:1 end slopes. Center the length of the structure about Station 24+46.50-Det.-. Detour with the alignment, grade, and skew as indicated on the Roadway plans. If the skew is not 90°, then lengthening of the structure to accommodate a 90° skew is permitted. Provide a temporary structure with a minimum clear roadway width of 26 feet and an underclearance elevation no less than elevation 768.5.

A pile driving hammer is not allowed for installing and achieving bearing capacity of the foundation type chosen to support the temporary structure.

The contractor may at his option, construct temporary vertical walls to shorten the temporary structure to a minimum total length of 70 feet.

Design the temporary structure for HS25 (MS22.5) live load in accordance with the current edition of the AASHTO Standard Specifications for Highway Bridges. The design of the temporary structure need not satisfy the seismic design criteria of AASHTO Division I-A "Seismic Design", Section 3. Due to the expected issuance of overweight permits by the NCDOT for certain loads above legal limits, design the temporary structure for the following five vehicle configurations:

Truck #1			Truck #2			Truck #3		
Axle	P (k)	Distance (ft)	Axle	P (k)	Distance (ft)	Axle	P (k)	Distance (ft)
1	12.00	0.00	1	12.00	0.00	1	4.50	0.00
2	20.00	8.08	2	20.00	8.08	2	25.00	8.08
3	20.00	4.00	3	20.00	4.00	3	25.00	4.00
4	20.00	4.00	4	20.00	4.00	4	20.00	18.00
5	16.67	20.00	5	18.00	18.00	5	20.00	4.00
6	16.67	4.00	6	18.00	4.00			
7	16.66	4.00						

Truck #1			Truck #2			Truck #3		
Axle	P (kN)	Distance (m)	Axle	P (kN)	Distance (m)	Axle	P (kN)	Distance (m)
1	53.38	0.00	1	53.38	0.00	1	20.02	0.00
2	88.96	2.46	2	88.96	2.46	2	111.21	2.46
3	88.96	1.22	3	88.96	1.22	3	111.21	1.22
4	88.96	1.22	4	88.96	1.22	4	88.96	5.49
5	74.15	6.10	5	80.07	5.49	5	88.96	1.22
6	74.15	1.22	6	80.07	1.22			
7	74.11	1.22						

Truck #4			Truck #5		
Axle	P (k)	Distance (ft)	Axle	P (k)	Distance (ft)
1	12.00	0.00	1	12.00	0.00
2	20.00	15.00	2	26.00	15.00
3	20.00	4.00	3	26.00	4.00
4	20.00	4.00	4	17.00	20.00
5	20.00	20.00	5	17.00	4.00
6	20.00	4.00	6	17.00	4.00
7	20.00	4.00	7	17.00	4.00

Truck #4			Truck #5		
Axle	P (kN)	Distance (m)	Axle	P (kN)	Distance (m)
1	53.38	0.00	1	53.38	0.00
2	88.96	4.57	2	115.65	4.57
3	88.96	1.22	3	115.65	1.22
4	88.96	1.22	4	75.62	6.10
5	88.96	6.10	5	75.62	1.22
6	88.96	1.22	6	75.62	1.22
7	88.96	1.22	7	75.62	1.22

Limit maximum stresses to the Operating Rating permitted values as defined in AASHTO Manual for Condition Evaluation of Bridges.

As a minimum, design the bridge rails for the AASHTO LRFD Test Level 2 (TL-2) crash test criteria, except when the plans state that a Test Level 3 (TL-3) bridge rail is required. The design criteria are defined in the current edition of the AASHTO LRFD Bridge Design Specifications. In addition, design structural elements to which the bridge rail is attached, or elements which may receive loads transmitted through the rail, to distribute and/or withstand these loads.

Attach the bridge rails in a way that permits the bridge approach railing system to transition from the guardrail system and attach to the rigid railing system on the temporary bridge.

Using timber floors or timber mat floors is not permitted due to anticipated high truck traffic. If timber piles are used, use piles that are new and conform to ASTM D25. Rough-peeled or clean-peeled untreated timber piles are permitted.

Submit design calculations to the Engineer that, as a minimum, include stress calculations for the following structural components: railings, rail post, rail post connections, flooring, main girders or floor beam system, bent cap, pile bearing, pile as a structural member and longitudinal and lateral stability of pile bents if necessary. For stream crossings, determine the pile stability assuming a scour depth equal to 250% of the pile diameter or width below the existing bed elevation. The Engineer may require a more detailed analysis of scour depth for pile bents containing more than a single row of piles.

Include material specifications for all new and used materials in the detail drawings of the structure. In addition, show the location and a detailed sketch of the used materials indicating condition of the material, the location and geometry of existing but unused holes, attachments left over from previous use and any other irregularities in the material.

Indicate the condition of any used materials in the design calculations. Provide access to any used materials for inspection prior to assembly.

Used high strength bolts, nuts and washers are permitted only in already bolted-up connections of used diaphragm and girder systems that are proposed for reuse. The use of used bolts is limited to secondary member connections such as diaphragms and is subject to approval.

The lump sum price bid for “Construction, Maintenance and Removal of Temporary Structure at Station 24+02.00 -L- ” will be full compensation for the above work including all materials, equipment, tools, labor and incidentals necessary to complete the work.