

Project Special Provisions
Structure

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A circular professional seal for a North Carolina Professional Engineer. The seal contains the text "NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 11915". Overlaid on the seal is a handwritten signature, "John C. Edge", and the date "Nov. 2, 2009".

PROJECT SPECIAL PROVISIONS
STRUCTURE

PROJECT B-4745

FORSYTH COUNTY

FALSEWORK AND FORMWORK

(8-4-09)

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 or metalize these devices. Electroplating will not be allowed. 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

(9-16-08)

1.0 GENERAL

Submit working drawings in accordance with Article 105-2 of the *Standard Specifications* and this provision. For 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 the project. Submittals are only necessary for those items as required by the contract. Make submittals that are not specifically noted in this 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@ncdot.gov

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@ncdot.gov

Western Regional Geotechnical Contact (Divisions 8-14):

John Pilipchuk
(704) 455 – 8902
(704) 455 – 8912 facsimile
jpilipchuk@ncdot.gov

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 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 Provisions
Pile Splicers	7	2	Subarticle 450-7(C) & “Piles”
Pile Points	7	2	Subarticle 450-7(D) & “Piles”
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 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 _____”
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 provision by that name. Articles and 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 & 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 provision.
7. Submittals are necessary only when the top slab thickness is 18” or greater.

GEOTECHNICAL SUBMITTALS

Submittal ¹	Copies Required by Geotechnical Engineering Unit	Copies Required by Structure Design Unit	Contract Reference Requiring Submittal ²
Crosshole Sonic Logging (CSL) Reports	1	0	“Crosshole Sonic Logging”
Drilled Pier Construction Sequence Plans	1	0	“Drilled Piers”
Pile Driving Analyzer (PDA) Reports	2	0	“Pile Driving Analyzer”
Pile Driving Equipment Data ³	1	0	Article 450-5 & “Piles”
Retaining Walls	8	2	Applicable Provisions
Contractor Designed Shoring	7	2	“Temporary Shoring”, “Anchored Temporary Shoring” & “Temporary Soil Nail Walls”

FOOTNOTES

1. With the exception of “Pile Driving Equipment Data”, electronic copies of geotechnical submittals are required. See referenced provision.
2. References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Articles refer to the *Standard Specifications*.
3. 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.

PILES

(3-6-09)

Remove Section 450 of the *Standard Specifications* and replace with the following.

1.0 DESCRIPTION

Furnish and install steel and prestressed concrete piles with the required resistance, penetration into natural ground and embedment in the cap or footing in accordance with the contract and accepted submittals. Drive and drill in piles and use pile tips and accessories as shown on plans. Preauger through embankments, galvanize, restrike, redrive, splice, cut

off and build up piles and perform pile driving analyzer (PDA) testing as necessary or required.

2.0 MATERIALS

Refer to Division 10 of the *Standard Specifications*:

Item	Section
Flowable Fill, Non-Excavatable	340
Portland Cement Concrete	1000
Reinforcing Steel	1070
Steel Plates	1072
Steel and Prestressed Concrete Piles	1084

For drilled-in piles, use Class A Concrete in accordance with Article 1000-4 of the *Standard Specifications* except as modified herein. Provide concrete with a slump of 6 to 8 inches (150 to 200 mm). Use an approved high-range water reducer to achieve this slump.

For galvanized steel piles, see Section 1076 of the *Standard Specifications*. Use approved steel pile points and pile splicers. Obtain a list of approved pile points and splicers from: <https://apps.dot.state.nc.us/vendor/approvedproducts/>

3.0 PILE LENGTHS

The estimated pile lengths shown on the plans are for bid purposes only. Provide piles of sufficient lengths for the required resistance, penetration into natural ground and embedment in the cap or footing. At the Contractor's option and no additional cost to the Department, make investigations as necessary to determine required pile lengths.

4.0 CONSTRUCTION METHODS

A. Handling and Storing Piles

Handle, transport and store piles so that piles are kept clean and undamaged. Do not use chains, cables or hooks that can damage or scar piles. Do not damage coatings on steel piles. When handling prestressed concrete piles, support piles at pick-up points as shown on the plans.

Protect steel piles as far as practicable from corrosion. Store piles above ground upon platform skids, or other supports, and keep free from dirt, grease, vegetation and other foreign material. Damaged, bent or cracked piles will be rejected.

B. Pile Installation

If applicable, completely excavate for caps and footings before installing piles. If applicable and unless noted otherwise on the plans, construct embankments to bottom of cap or footing elevations for a horizontal distance of 50 ft (15 m) from any pile except where fill slopes are within 50 ft (15 m) of a pile.

Install piles with the following tolerances.

1. Axial alignment within $\frac{1}{4}$ inch per foot (21 mm per meter) of vertical or batter shown on the plans
2. Horizontal alignment within 3" (75 mm) of plan location, longitudinally and transversely
3. Pile embedment in the cap or footing within 3" (75 mm) more and 2" (50 mm) less of the embedment shown on the plans

No additional payment will be made for increased cap or footing dimensions due to piles installed out of position.

If necessary, build up prestressed concrete piles or splice steel piles as shown on the plans. Do not use more than 3 sections (2 splices) of steel piling per pile. Cut off piles at required elevations along a plane normal to the axis of the pile as necessary. Do not damage or spall piles when cutting off prestressed concrete piles.

C. Pile Accessories

If required, use pile accessories including steel pile points, pipe pile plates and pile splicers as shown on the plans. Perform any welding in accordance with Article 1072-20 of the *Standard Specifications* and the accepted submittals. Weld steel plates with the specified dimensions to pipe piles as shown on the plans.

Attach steel pile points to steel piles in accordance with the manufacturer's instructions. The minimum weld length is twice the flange width for H piles.

Use steel pile tips with prestressed concrete piles as shown on the plans. Use pile splicers for splicing steel pile tips and attach pile splicers in accordance with the manufacturer's instructions.

D. Driven Piles

Drive piles in accordance with the accepted submittals and this provision. Unless otherwise approved, do not drive piles within 50 ft (15 m) of cast-in-place concrete until the concrete cures for at least 3 days.

When preaugering before driving piles or using a vibratory hammer to install the initial portions of steel piles, submit these pile installation methods with the proposed pile driving methods and equipment for review and acceptance. The Engineer will approve the preaugering depth, auger diameter and depth of pile installation with the vibratory hammer. Do not use vibratory hammers to install prestressed concrete piles.

Limit driving stresses in accordance with the *AASHTO LRFD Bridge Design Specifications*. If a tip elevation is noted on the plans, drive piles to the minimum required driving resistance and tip elevation. Otherwise, drive piles to the minimum

required driving resistance and a penetration into natural ground of at least 10 ft (3 m). Also, drive piles to the required tip elevation or penetration into natural ground, whichever is lower, in a continuous operation unless stopped due to exceeding the maximum blow count or driving stresses, insufficient pile length or other approved reasons. Natural ground within an area of a new embankment is defined as the bottom of the embankment or footings, whichever is lower.

Protect coatings in an approved manner when driving steel piles through templates. Redrive piles raised or moved laterally due to driving adjacent piles.

1. Driving Equipment

Submit the proposed pile driving methods and equipment (pile driving equipment data form) including the pile driving hammer, hammer cushion, pile helmet and cushion for review and acceptance. Do not submit more than two pile driving hammers per pile type per submittal. Submit this information for review and acceptance at least 30 calendar days before driving piles. All equipment is subject to satisfactory field performance.

Drive piles with accepted driving equipment using air, steam or diesel hammers. Use pile driving hammers that will not overstress piles and provide the required driving resistance at a blows per foot ranging from 30 to 180. Use a variable energy hammer to drive prestressed concrete piles.

Operate air and steam hammers within the manufacturer's specified ranges and 10% of the manufacturer's rated speed in blows per minute or a rate approved by the Engineer. Use a plant and equipment for air or steam hammers with sufficient capacity to maintain, under working conditions, the volume and pressure specified by the manufacturer. Equip the plant and equipment with accurate pressure gauges that are easily accessible. Provide striking parts of air and steam hammers that weigh at least one-third the weight of the pile helmet and pile, with a minimum weight of 2,750 lbs.

Equip open-end (single acting) diesel hammers with a graduated scale (jump stick) extending above the ram cylinder, graduated rings or grooves on the ram or an electric sound activated remote measuring instrument to determine the hammer stroke during driving. Equip closed-end (double acting) diesel hammers with a calibrated bounce chamber pressure gauge mounted near the ground and provide a current calibrated chart or graph equating bounce chamber pressure and gauge hose length to equivalent energy. Submit this chart or graph with the proposed pile driving methods and equipment for closed-end diesel hammers.

Hold pile heads in position with pile helmets that closely fit over the pile heads and extend down the sides of piles a sufficient distance. Protect pile heads of prestressed concrete piles from direct impact with accepted pile cushions. Use pile cushions made of pine plywood with a minimum thickness of 4" (100 mm). Unless otherwise approved, provide a new pile cushion for each prestressed concrete pile.

Replace pile cushions during driving when a cushion is compressed more than one-half its original thickness or begins to burn.

The Engineer may inspect the hammer cushion before beginning driving and periodically throughout the project. Expose the hammer cushion for inspection as directed by the Engineer. Replace or repair any hammer cushion that is less than 25% of its original thickness.

2. Required Driving Resistance

The Engineer will determine the acceptability of the proposed pile driving methods and equipment and provide the blows per foot and equivalent set for 10 blows for the required driving resistance. The minimum required driving resistance is equal to the factored resistance noted on the plans plus any additional resistance for downdrag and scour, if applicable, divided by a resistance factor. When performing PDA testing in accordance with the *AASHTO LRFD Bridge Design Specifications*, the resistance factor is 0.75. Otherwise, the resistance factor for the wave equation analysis is 0.60.

Unless otherwise approved, stop driving piles when refusal is reached. Refusal is defined as 240 blows per foot or any equivalent set.

3. Redriving Piles

Once the required pile penetration is achieved, the Contractor may choose to or the Engineer may require the Contractor to stop driving, wait and restrike or redrive piles to achieve the required driving resistance. If the Contractor chooses to restrike or redrive piles, no payment will be made for restrikes or redrives. If the Engineer requires the Contractor to restrike or redrive piles, payment will be made in accordance with this provision. When the Engineer requires restrikes or redrives, the Engineer will determine the number of restrikes or redrives and the time to wait after stopping driving and between restrikes and redrives. The time to wait will range from 4 to 24 hours.

Use the same pile driving methods, equipment and compressed pile cushion from the previous driving to restrike or redrive the pile unless the cushion is unacceptable due to deterioration. Do not use a cold diesel hammer for a restrike or redrive, unless it is impractical to do otherwise as determined by the Engineer. In general, warm up the hammer by applying at least 20 blows to a previously driven pile or timber mats on the ground.

4. Pile Driving Analyzer

If required, test piles with a pile driving analyzer (PDA) manufactured by Pile Dynamics, Inc., analyze data and provide PDA reports. Perform PDA testing in accordance with ASTM D4945. Either the Engineer will perform the PDA testing and analysis or use a PDA Consultant prequalified by the NCDOT Contractual

Services Unit for Pile Driving Analyzer Work (work code 3060) to perform the PDA testing and analysis and provide a PDA report.

The Engineer will determine the number of piles and which piles to be tested with a PDA. Do not drive piles with a PDA until the proposed pile driving methods and equipment has been preliminarily accepted. Notify the Engineer of the pile driving schedule a minimum of 7 calendar days in advance.

The Engineer will complete the review and acceptance of the proposed pile driving methods and equipment and provide the blows per foot and equivalent set for 10 blows for the required driving resistance within 10 calendar days after the Engineer receives the PDA report or the Engineer finishes PDA testing. A PDA report for or PDA testing on multiple piles may be required as determined by the Engineer before the 10 day time period begins.

a. Preparation

Provide piles for PDA testing that are 5 ft (1.5 m) longer than the estimated pile lengths shown on the plans. Supply an AC electrical power source of a voltage and frequency suitable for computer equipment.

Provide a shelter to protect the PDA equipment and operator from conditions of sun, water, wind and temperature. The shelter should have a minimum floor size of 6 ft by 6 ft (1.8 m by 1.8 m) and a minimum roof height of 8 ft (2.4 m). If necessary, heat or cool the shelter to maintain a temperature between 50 and 85 degrees F (10 and 30 degrees C). Place the shelter within 75 ft (23 m) of the pile such that the PDA cables reach the computer and the operator can clearly observe the pile. The Engineer may waive the shelter requirement if weather conditions allow.

Drill up to a total of 16 bolt holes in either 2 or 4 sides of the pile, as directed by the PDA Consultant or Engineer, at an approximate distance equal to 3 times the pile diameter below the pile head. If the PDA Consultant or Engineer chooses to drill the bolt holes, provide the necessary equipment, tools and assistance to do so. A hammer drill is required for concrete piles. Allow for 2 hours per pile to drill holes.

Lift, align and rotate the pile to be tested with a PDA as directed by the PDA Consultant or Engineer. Place the pile in the leads and template so that the PDA instruments and their accompanying wires will not be damaged. Attach PDA instruments as directed by the PDA Consultant or Engineer after the pile is placed in the leads and the template.

b. Testing

Use only the preliminarily accepted pile driving methods and equipment to drive piles with the PDA instruments attached. Drive piles in accordance with this provision and as directed by the PDA Operator or Engineer. The PDA

Operator or Engineer may require the Contractor to modify the pile installation procedure during driving. Dynamic measurements will be recorded and used to evaluate the hammer performance, driving resistance and stresses, energy transfer, pile integrity and various soil parameters such as quake and damping.

If required, reattach the PDA instruments and restrike or redrive the pile in accordance with this provision. Obtain the required stroke and at least 6" (150 mm) of penetration as directed by the PDA Operator or Engineer. Dynamic measurements will be recorded during restriking and redriving. The Engineer will determine when PDA testing has been satisfactorily completed.

The Contractor is responsible in terms of both actual expense and time delays for any damage to the PDA instruments and supporting equipment due to the Contractor's fault or negligence. Replace any damaged equipment at no additional cost to the Department.

c. Analysis

When using a PDA Consultant, analyze data with the CAse Pile Wave Analysis Program (CAPWAP), version 2006 or later. At a minimum, analysis is required for a hammer blow near the end of initial drive and for each restrike and redrive. Additional CAPWAP analysis may be required as determined by the PDA Consultant or Engineer.

d. Report

When using a PDA Consultant, submit three hard copies and an electronic copy (PDF on CD or DVD) of PDA reports sealed by a Professional Engineer registered in North Carolina within 7 calendar days of completing field testing. Include the following in the PDA Report:

i. Title Sheet

- NCDOT TIP number and WBS element number
- Project description
- County
- Bridge station number
- Pile location
- Personnel
- Report date

- ii. Introduction
- iii. Site and Subsurface Conditions (including water table elevation)
- iv. Pile Details
 - Pile type and length
 - Required driving resistance and resistance factor
 - Concrete compressive strength and/or steel pile yield strength
 - Pile splice type and locations
 - Pile batter
 - Installation methods including use of jetting, preaugering, spudding, vibratory hammer, template, barge, etc.
- v. Driving Details
 - Hammer make, model and type
 - Hammer and pile cushion type and thickness
 - Pile helmet weight
 - Hammer efficiency and operation data including fuel settings, bounce chamber pressure, blows per minute, equipment volume and pressure
 - Ground or mud line elevation and template reference elevation at the time of driving
 - Final pile tip elevation
 - Driving data (ram stroke, blows per foot (0.3 meter) and set for last 10 hammer blows)
 - Restrike and redrive information
- vi. PDA Field Work Details
- vii. CAPWAP Analysis Results
 - Table showing percent skin and tip, skin and toe damping, skin and toe quake and match quality
- viii. Summary/Conclusions
- ix. Attachments
 - Boring log(s)
 - Pile driving equipment data form (from Contractor)
 - Field pile driving inspection data (from Engineer)
 - Accelerometer and strain gauge locations

- Accelerometer and strain gauge serial numbers and calibration information
- PDA hardware model and CAPWAP software version information
- Electronic copy of all PDA data and executable CAPWAP input and output files

E. Drilled-in Piles

If required, perform pile excavation to specified elevations shown on the plans. Excavate holes with diameters that will result in at least 3" (75 mm) of clearance all around piles. Before filling holes, support and center piles in excavations and when noted on the plans, drive piles to the required driving resistance. Remove any fluid from excavations, and at the Contractor's option, fill holes with either concrete or flowable fill unless required otherwise in the contract.

1. Pile Excavation

Use equipment of adequate capacity and capable of drilling through soil, rock, boulders, debris, man-made objects and any other materials encountered. Blasting is not permitted to advance excavations. Blasting for core removal is only permitted when approved by the Engineer. 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 materials including fluids removed from excavations by pumps or drilling tools.

If unstable, caving or sloughing soils are anticipated or encountered, stabilize excavations with either slurry or steel casing. When using slurry, submit slurry details including product information, manufacturer's recommendations for use, slurry equipment details and written approval from the slurry supplier that the mixing water is acceptable before beginning drilling. When using steel casing, use either the sectional type or one continuous corrugated or non-corrugated piece. Steel casings should consist of clean watertight steel of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth and backfill. Use steel casings with an outside diameter equal to the hole size and a minimum wall thickness of ¼ inch (6 mm).

2. Filling Holes

Check the water inflow rate at the bottom of holes after all pumps have been removed. If the inflow rate is less than 6" (150 mm) per half hour, remove any fluid and free fall concrete or flowable fill into excavations. Ensure that concrete or flowable fill flows completely around piles. If the water inflow rate is greater than 6" (150 mm) per half hour, propose and obtain acceptance of a procedure for placing concrete or flowable fill before filling holes. Place concrete or flowable fill in a continuous manner and remove all casings.

5.0 MEASUREMENT AND PAYMENT

_____ *Prestressed Concrete Piles*, _____ *Steel Piles* and _____ *Galvanized Steel Piles* will be measured and paid for in linear feet (meters). Piles will be measured as the pile length before installation minus any pile cut-offs. No payment will be made for pile cut-offs or cutting off piles. No payment will be made for damaged, defective or rejected piles or any piles for falsework, bracing, templates or temporary work bridges. The contract unit price bid for _____ *Prestressed Concrete Piles*, _____ *Steel Piles* and _____ *Galvanized Steel Piles* will also be full compensation for driving piles and any preaugering.

For driven piles, once the required resistance and pile penetration is achieved, the Contractor may drive the remaining portion of piles to grade in lieu of cutting off piles provided the remaining portions do not exceed 5 ft (1.5 m) and the piles can be driven without being damaged or reaching the maximum blow count or refusal. When this occurs, the additional length of piles driven will be measured and paid for at the contract unit price bid for _____ *Prestressed Concrete Piles*, _____ *Steel Piles* and _____ *Galvanized Steel Piles*.

For prestressed concrete piles that are built up, the build-up will be measured and paid for at the contract unit price bid for _____ *Prestressed Concrete Piles*. Steel pile tips are not included in the measurement of prestressed concrete piles. No separate payment will be made for steel pile tips or pile splicers and any associated hardware or welding. Steel pile tips and pile splicers will be considered incidental to the contract unit price bid for _____ *Prestressed Concrete Piles*.

Steel Pile Points and *Pipe Pile Plates* will be measured and paid for in units of each.

Pile Redrives will be measured and paid for in units of each. *Pile Redrives* will be measured as the number of restrikes or redrives required by the Engineer. No payment will be made for restrikes or redrives when the Contractor chooses to restrike or redrive piles.

PDA Testing will be measured and paid for in units of each. No payment for *PDA Testing* will be made if the Engineer performs PDA testing. If the Engineer does not perform PDA testing, *PDA Testing* will be measured as one per pile. The contract unit price bid for *PDA Testing* will be full compensation for performing PDA testing the first time a pile is tested with a PDA, performing analysis on data collected during initial drive, restrikes and redrives and providing the PDA report. Subsequent PDA testing of the same piles will be considered incidental to the contract unit price bid for *Pile Redrives*.

PDA Assistance will be measured and paid for in units of each. *PDA Assistance* will be measured as one per pile. The contract unit price bid for *PDA Assistance* will be full compensation for the Contractor's assistance to perform the PDA testing during initial drive, restrikes and redrives.

Pile Excavation in Soil and *Pile Excavation Not in Soil* will be measured and paid for in linear feet (meters). Not in soil is defined as material with a rock auger penetration rate of less than 2" (50 mm) per 5 minutes of drilling at full crowd force. Once not in soil is

encountered, seams, voids and weathered rock less than 3 ft (1 m) thick with a rock auger penetration rate of greater than 2” (50 mm) per 5 minutes of drilling at full crowd force will be paid for at the contract unit price bid for *Pile Excavation Not in Soil*. Seams, voids and weathered rock greater than 3 ft (1 m) thick will be paid for at the contract unit price bid for *Pile Excavation in Soil* where not in soil is no longer encountered. The contract unit price bid for *Pile Excavation in Soil* and *Pile Excavation Not in Soil* will also be full compensation for filling holes with either concrete or flowable fill.

Payment will be made under:

Pay Item	Pay Unit
_____ Prestressed Concrete Piles	Linear Foot (Meter)
_____ Steel Piles	Linear Foot (Meter)
_____ Galvanized Steel Piles	Linear Foot (Meter)
Steel Pile Points	Each
Pipe Pile Plates	Each
Pile Redrives	Each
PDA Testing	Each
PDA Assistance	Each
Pile Excavation in Soil	Linear Foot (Meter)
Pile Excavation Not in Soil	Linear Foot (Meter)

PRESTRESSED CONCRETE MEMBERS

(4-02-07)

The 2006 Standard Specifications shall be revised as follows:

In Section 1078-1 “General” of the Standard Specifications, add the following after the second paragraph:

(A) Producer Qualification

Producers of precast, prestressed concrete members are required to establish proof of their competency and responsibility in accordance with the Precast/Prestressed Concrete Institute’s (PCI) Plant Certification Program in order to perform work for the project. Certification of the manufacturing plant under the PCI program and submission of proof of certification to the State Materials Engineer is required prior to beginning fabrication. Maintain certification at all times while work is being performed for the Department. Submit proof of certification following each PCI audit to the State Materials Engineer for continued qualification. These same requirements apply to producers subcontracting work from the producer directly employed by the Contractor.

Employ producers PCI certified in Product Group B, Bridge Products, and in one of the appropriate categories as listed below:

- B2 Prestressed Miscellaneous Bridge Products: Includes solid piles, sheet piles and bent caps.
- B3 Prestressed Straight-Strand Bridge Members: Includes all box beams, cored slabs, straight-strand girders and bulb-tees, bridge deck panels, hollow piles, prestressed culverts and straight strand segmental components.
- B4 Prestressed Deflected-Strand Bridge Members: Includes deflected strand girders and bulb-tees, haunched girders, deflected strand segmental superstructure components and other post-tensioned elements.

Categories for other elements will be as required by the project special provision or plans.

ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS

(6-11-07)

1.0 GENERAL

Installation and Testing of Adhesively anchored anchor bolts and dowels shall be in accordance with Section 420-13, 420-21 and 1081-1 of the Standard Specifications except as modified in this provision.

2.0 INSTALLATION

Installation of the adhesive anchors shall be in accordance with manufacturer's recommendations and shall occur when the concrete is above 40 degrees Fahrenheit and has reached its 28 day strength.

The anchors shall be installed before the adhesive's initial set ('gel time').

3.0 FIELD TESTING

Replace the third paragraph of Section 420-13 (C) with the following:

“In the presence of the Engineer, field test the anchor bolt or dowel in accordance with the test level shown on the plans and the following:

Level One Field testing: Test a minimum of 1 anchor but not less than 10% of all anchors to 50% of the yield load shown on the plans. If less than 60 anchors are to be installed, install and test the required number of anchors prior to installing the remaining anchors. If more than 60 anchors are to be installed, test the first 6 anchors prior to installing the remaining anchors, then test 10% of the number in excess of 60 anchors.

Level Two Field testing: Test a minimum of 2 anchors but not less than 10% of the all anchors to 80% of the yield load shown on the plans. If less than 60 anchors are to be installed, install and test the required number of anchors prior to installing the remaining anchors. If more than 60 anchors are to be installed, test the first 6 anchors prior to installing the remaining anchors, then test 10% of the number in excess of 60 anchors.

Testing should begin only after the Manufacturer's recommended cure time has been reached. For testing, apply and hold the test load for three minutes. If the jack experiences any drop in gage reading, the test must be restarted. For the anchor to be deemed satisfactory, the test load must be held for three minutes with no movement or drop in gage reading."

4.0 REMOVAL AND REPLACEMENT OF FAILED TEST SPECIMENS:

Remove all anchors and dowels that fail the field test without damage to the surrounding concrete. Redrill holes to remove adhesive bonding material residue and clean the hole in accordance with specifications. For reinstalling replacement anchors or dowels, follow the same procedures as new installations. Do not reuse failed anchors or dowels unless approved by the Engineer.

5.0 USAGE

The use of adhesive anchors for overhead installments is not permitted without written permission from the Engineer.

6.0 BASIS OF PAYMENT

No separate measurement or payment will be made for furnishing, installing, and testing anchor bolts/dowels. Payment at the contract unit prices for the various pay items will be full compensation for all materials, equipment, tools, labor, and incidentals necessary to complete the work.

CURING CONCRETE

(6-18-09)

The 2006 Standard Specifications shall be revised as follows:

Replace the first paragraph of Section **420-15(A) – Curing Concrete – General** with the following:

Unless otherwise specified in the contract, use any of the following methods except for membrane curing compounds on bridge deck and approach slab, or on concrete which is to receive epoxy protective coating in accordance with 420-18. Advise the Engineer in advance of the proposed method. Have all material, equipment, and labor necessary to promptly apply the curing on the site before placing any concrete. Cure all patches in accordance with this article. Improperly cured concrete is considered defective.

Replace the third paragraph of Section 420-15(C) – **Curing Concrete – Membrane Curing Compound Method** with the following:

Seal the surface with a single uniform coating of the specified type of curing compound applied at the rate of coverage recommended by the manufacturer or as directed, but not less than 1 gallon per 150 square feet of surface area.

PLACING LOAD ON STRUCTURE MEMBERS

(8-4-09)

The 2006 Standard Specifications shall be revised as follows:

Replace the fifth paragraph of Section 420-20 – **Placing Load on Structure Members** with the following:

Do not place vehicles or construction equipment on a bridge deck until the deck concrete develops the minimum specified 28 day compressive strength and attains an age of at least 14 curing days. The screed may be rolled across a previously cast bridge deck if the entire pour has not achieved initial set. If any portion of the deck concrete has achieved initial set, the screed can not be rolled across the bridge deck until the concrete develops a compressive strength of at least 1,500 psi. Construction equipment is allowed on bridge approach slabs after the slab concrete develops a compressive strength of at least 3,000 psi and attains an age of at least 7 curing days. A curing day is defined in Subarticle 420-15(A).

BRIDGE DECK GRINDING

(SPECIAL)

1.0 GENERAL

This Special Provision shall govern the longitudinal planing and all other related work associated with obtaining a smooth riding surface of uniform texture, true to the required grade and cross section on the bridge deck (cored slab units), bridge approach slabs and existing approach concrete pavement.

2.0 PLANING

Planing is required over the entire surface of bridge deck and approach slabs. Planing is required over the approach concrete pavement as directed by the Engineer. Surface planing of the bridge deck shall be a minimum of 0.0625" and a maximum of 2.0". A tapered pass or hand planing shall be used to provide a smooth transition to the surface near the barrier rail that does not receive planing. Surface planing of the approach slab and approach concrete pavement shall be a minimum of 0.0625" and a maximum of 0.5" or as directed by the Engineer.

Longitudinally plane the deck parallel to the roadway centerline. Plane the approach slabs and bridge deck surface by beginning at one end of an approach slab and continuing to the far end of the other approach slab without stopping. Complete each adjacent pass by starting at one end and planing the entire length without stopping. After the entire surface has been planed once,

plane centers of spans (highest points of camber) and other areas as necessary to provide a smooth riding surface within the additional guidelines given herein and on the plans.

Construct and operate the planing machine such that it will not cause strain or damage to the concrete surface, excessive ravels, aggregate fractures, spalls, or disturbance of transverse joints.

Continuously remove all slurry or other debris resulting from the planing operations from the surfaces by vacuum pick-up or other approved methods. Prevent the slurry from flowing onto the ground or body of water under the bridge. Dispose of all residues off the project.

When planing, use a Boart Longyear PC 5000, a Target 3804 or approved equal. Submit planing equipment specifications to the Engineer for approval before any planing is performed. Use a planing machine capable of removing a minimum of 3 feet of width with each pass. Multiple passes may be required to achieve the required depth of removal. Hand planing may be required adjacent to barrier rail and to remove vertical steps between passes.

The ground surface shall consist of between 50 and 60 grooves per foot of width. The grooves shall be between 0.09" and 0.15" in width and 0.0625" in depth. The area between the grooves shall be between 0.06" and 0.13" in width. The final concrete texture shall be uniform.

Limit planing such that the final reinforcement cover is not less than the plan cover minus 2". Any other corrective work may be required as directed by the Engineer.

3.0 BASIS OF PAYMENT

The price and payment below will be full compensation for all items required for "Bridge Deck Grinding". The payment shall include but not be limited to the cost of equipment, planing operation, and removal and disposal of slurry resulting from the planing operation.

Pay will be made under:

Bridge Deck Grinding.....Lump Sum

GROUT

(SPECIAL)

Use this grout in all locations grout is required or warranted by the plans or as directed by the Engineer including but not limited to cored slab shear keys, dowel holes, recesses for post-tensioning strands, pile blockouts, grout pipes to pile blockouts, holes in precast wing walls, and grout beds between precast pieces. Use Euclid Hi-Flow Grout or an approved equal.

For the approved equal, use a grout that is a commercially manufactured non-metallic, non-shrink material and is included in the Department's list of approved grouts and meets the requirements of the Standard Specifications when water or water and aggregate is added in accordance with the manufacturer's recommendations.

The grout shall be free of soluble chlorides and contain less than one percent soluble sulfate.

Initial set time shall not be less than 10 minutes when tested in accordance with ASTM C266.

Compressive strength shall be at least 5000 psi at 3 days.

Compressive strength in the laboratory will be determined in accordance with ASTM C109 except that the test mix shall contain only water and the dry manufactured material. Compressive strength will be determined in the field by molding and testing 4"x8" cylinders in accordance with AASHTO T22.

When tested in accordance with ASTM C666, Procedure A, the durability factor of the grout shall not be less than 800.

The quantity of water added to the mix shall be in accordance with the manufacturer's recommendations.

Aggregate may be added to the mix where recommended or permitted by the manufacturer. The quantity and gradation of the aggregate will be in accordance with the manufacturer's recommendations.

Furnish a Type 4 material certification showing results of tests conducted to determine the properties listed in the Standard Specifications and to assure that the material is non-shrink.

The Engineer reserves the right to reject material based on unsatisfactory performance.

EXISTING PEDESTRIAN BRIDGE

(SPECIAL)

The Department intends for the existing pedestrian bridge owned and maintained by the City of Winston-Salem to remain in place and open to pedestrian traffic in accordance with the Traffic Control Plans. If the Contractor determines the highway bridge cannot be replaced without damaging the pedestrian bridge, remove, safely store and reinstall the pedestrian bridge in the condition it was found. The removal and reinstallation of the pedestrian bridge shall be at no additional cost to the Department. If the pedestrian bridge is not removed, then the contractor shall take care to not damage the bridge. Any damage done to the bridge shall be repaired to the satisfaction of the Engineer and the City of Winston-Salem. Repairs to the bridge shall be at no additional cost to the Department or the City.

PROGRESS OF SUBMITTALS AND PRECASTING

(SPECIAL)

All submittals of working drawings, catalogue cuts, etc. shall be submitted as early in the project as possible so as to not delay any work. For potential submittals, see the Special Provision for "Submittal of Working Drawings," the Standard Specifications, and the Contract Plans.

Cast and receive NCDOT Materials and Test Unit approval of all prestressed cored slab units before the bridge is closed to traffic. If the precast end bent alternate is chosen, cast and receive NCDOT Materials and Test Unit approval of precast end bent elements before closing the bridge to traffic.

PRESTRESSED CONCRETE CORED SLABS

(SPECIAL)

Use 3'-0" X 2'-2" Prestressed Concrete Cored Slabs in accordance with Section 430 of the Standard Specifications.

Payment will be made under:

3'-0" x 2'-2" Prestressed Concrete Cored Slabs.....Linear Feet

CONTROL OF VIBRATION

(SPECIAL)

Attention is directed to Articles 107-12 and 107-15 of the Standard Specifications for Roads and Structures and to the Subsurface Plans. Control of vibration is required during construction of Bridge Number 322 on SR 1725 over 20th Street in Winston Salem and approaches. It is the responsibility of the Contractor to utilize construction methods and equipment to prevent damage to the adjacent structures. 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. Review and acceptance of any construction plan submittals does not relieve the Contractor of responsibility for damage or liability.

1. PRE-CONSTRUCTION STRUCTURE CONDITION ASSESSMENTS

Use a firm prequalified by the NCDOT Construction Unit for Vibration & Noise Monitoring work (work code 3120). The firm is to perform a Pre-Construction Structure Condition Assessment for the buildings at the listed addresses and submit three (3) copies to the Engineer at least 20 days before the preconstruction conference.

- Christopher L Carson, 2006 Lincoln Ave, Winston-Salem, NC 27105
- S E Snyder Group 2 LLC, 2019 Harrison Ave, Winston-Salem, NC 27105
- Albert R. and Veronica W. Conner, 604 W Twentieth St, Winston-Salem, NC 27105
- Joe E. and Wanda H. Walker, 1727 Harrison Ave, Winston-Salem, NC 27105

2. VIBRATION MONITORING

Submit a vibration monitoring plan developed by a firm prequalified by the NCDOT Construction Unit for Vibration and Noise Monitoring work (work code 3120) to the Engineer for approval at least 20 days before the preconstruction conference. Schedule the preconstruction conference before beginning any construction activities, and include Contractor personnel, vibration monitoring firm, Resident Engineer, and representatives from NCDOT Construction Unit and Geotechnical Engineering Unit.

The vibration monitoring 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 is required during pile driving or bridge foundation construction activities. Vibration monitoring is also required at each listed building during the first 5 days of any particular phase of work that could generate detectable vibrations at the subject buildings. Following the initial observatory period during a particular phase of work, vibration monitoring instruments are required to remain at each subject building where vibrations exceeded 0.2 inches per second peak particle velocity in any axis at the building at any time during the observatory period or, at a minimum, at the nearest structure to document ongoing vibrations. Construction vibration at any adjacent structure 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 exceed 0.5 inches per peak particle velocity in any axis, immediately notify the Engineer.

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.

3. POST-CONSTRUCTION REPORTING

At the completion of the project, the prequalified firm will perform post-construction condition assessments of listed buildings, and submit to the Engineer three (3) copies of the final report which should include all vibration monitoring records, post-construction condition assessments of listed buildings with both digital and hard copy pictures and video, and written documentation.

4. MEASUREMENT AND BASIS OF PAYMENT

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 preparation and submission of reports.

Pay Item: Vibration Monitoring Lump Sum

POSITIVE HOLD DOWN SYSTEM FOR VOIDS IN CORED SLABS (SPECIAL)

When cored slabs are cast, employ an internal positive hold-down system to prevent the voids from moving during concrete placement. Elements of the system shall not penetrate through or reduce concrete clearances detailed on the plans for the walls or top slab of the cored slabs. Elements of the system shall not protrude into or penetrate through the voids. At least three weeks prior to casting the cored slabs, submit to the Engineer for review and comments, detailed drawings of the proposed void material and hold-down system. In addition to structural details, indicate the location and spacing of the hold-downs. See the Special Provision "Submittal of Working Drawings."