14

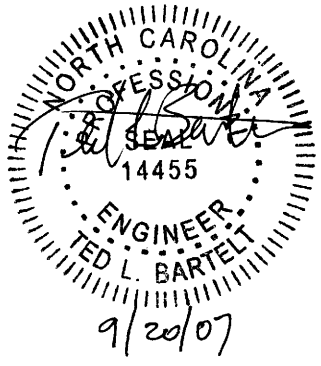
North Carolina Department of Transportation
TIP No. B-5014
Repair of Bonner Bridge (Bridge No. 11)
Dare County, NC

Project Special Provisions

Prepared by

ALPHA & OMEGA GROUP
CIVIL & STRUCTURAL ENGINEERS
4911 Green Road Suite 107 Raleigh, NC 27616
Phone 919 981 0310 info@aogroup.com www.aogroup.com

September 20, 2007



PROJECT SPECIAL PROVISIONS

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:

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.

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.

Crane Inspections: Inspection records for all cranes shall be current and readily accessible for review upon request.

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.

FALSEWORK AND FORMWORK (7-18-06)

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, including jacking and temporary support of existing structures. 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.

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.

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.

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.

C. 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.

D. 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.

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.

Method of Measurement

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

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.

MOORING PLAN AND COAST GUARD APPROVAL

If the Contractor elects to perform any of the contract work from a barge or to utilize water-going vessels then a mooring and action plan will be required for Coast Guard authorization. The Contractor will not be allowed to begin any work until a proposed mooring and work plan has been approved by the United States Coast Guard. The contractor shall submit his proposed mooring and work plan to the resident Engineer for forwarding to the Coast Guard for approval. These plans shall be submitted to the Engineer a minimum of two (2) months prior to the date the Contractor plans on beginning his operations. No work on the fender system or in the channel will be allowed until the Coast Guard has approved the proposed mooring and work plans.

SECURING OF VESSELS

Secure vessels in accordance with Section 107 of the Standard Specifications and the following provision:

When utilizing barges, tugboats or other vessels, take all necessary precautions to ensure that such vessels are securely anchored or moored when not in active operation. Take all necessary measures to ensure that the vessels are operated in a manner that avoids damage to or unnecessary contact with bridges and other highway structures and attachments. If severe

weather conditions are anticipated, or should be anticipated through reasonable monitoring of weather forecasts, take additional measures to protect bridges and other highway structures and attachments from extreme conditions. The Contractor is strictly liable for damages to any bridge or other highway structure or attachment caused by a vessel owned or controlled by the Contractor. The Contractor is also liable to third parties for property damages and loss of revenue caused by vessels under the Contractor's control.

Do not secure vessels to the existing bridge without prior written approval of the Engineer.

CONTAINMENT AND DISPOSAL OF DEBRIS

For the purposes of this Special Provision, the term "debris" applies to material removed from the existing structure as well as any excess material provided by the Contractor. Shotcrete overspray and rebound are specifically included.

All material removed becomes the Contractor's property. Comply with Standard Specifications Sections 408 and 802. Contain all debris and use an approved method to dispose of the material in an approved upland site.

No debris shall be placed at any time in any wetlands or surrounding waters. Demolition shall follow NCDOT Best Management Practices for Construction and Maintenance Activities dated August, 2003 and incorporate NCDOT policy entitled "Bridge Demolition and Removal in Waters of the United States" dated September 20, 1999.

Do not allow live or fresh concrete to come into contact with waters of the state or water that will enter waters of the state.

Do not allow debris to enter wetlands or waters of the United States, even temporarily.

EPOXY MORTAR REPAIRS

Materials: See Section 1081-1 of the Standard Specifications

Surface Preparation

Prior to the application of epoxy mortar, thoroughly clean surfaces to be repaired and remove all loose materials. Remove grease, wax, and oil contaminants by scrubbing with an industrial grade detergent or degreasing compound followed by a mechanical cleaning. Sawcut ½" deep around the perimeter of each repair area and remove weak or deteriorated concrete to sound concrete by bush hammering, gritblasting, scarifying, waterblasting, or other approved methods. Remove dirt, dust, laitance and curing compounds by gritblasting, sanding, or etching with 15% hydrochloric acid. Only acid etch if approved and follow it by scrubbing and flushing with copious amounts of clean water. Check the cleaning using moist pH paper. Water cleaning is complete when the paper reads 10 or higher. Follow all mechanical cleaning with vacuum cleaning.

All material removed becomes the Contractor's property. Contain all debris and use an approved method to dispose of the material.

Application

When surface preparation is completed, mix and apply epoxy mortar in accordance with manufacturer's recommendations. Mortar shall consist of low modulus liquid resin, sand, and pea gravel (maximum size of 3/8"). Use graded silica sand and aggregate that is washed, kiln-dried, and bagged. Provide manufacturer's approval of the mix design to be used. Apply epoxy bonding agent to all repair areas immediately prior to placing epoxy mortar. The finishing of those areas receiving the sand-epoxy mix with the epoxy bonding agent is permitted.

Apply epoxy mortar by forming and pouring.

Apply epoxy mortar to damp surfaces only when approved. In such instances, remove all free water by air-blasting.

After applying the epoxy mortar, remove excessive material and provide a smooth, flush surface. Remove excess epoxy material in accordance with the supplier's instructions.

Measurement and Payment

Payment for Epoxy Mortar Repairs will be at the contract unit price per cubic foot and will be full compensation for furnishing all material, labor, tools and equipment necessary for performing this work complete in place and accepted

EVAZOTE JOINT SEALS

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.

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.

Sawing the Joints

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.

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 existing 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.

E. 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.

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.

Basis of Payment

Payment for all evazote joint seals will be at the contract price bid per linear foot for "Evazote Joint Seals" which prices and payment will be full compensation for furnishing all material, labor, tools and equipment necessary for installing these units in place

ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS

Description:

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

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

Materials:

Use an adhesive conforming to Section 1081-1, (Type 3A) or Section 1081-6 of the Standard Specifications. Use an adhesive bonding system that has been tested for a tensile strength of 125% of the specified anchor bolt/dowel yield load. Provide certification that, for the particular bolt grade, diameter and embedment depth required, the anchor system will not fail by adhesive failure and that the anchor bolt/dowel will not move. The minimum concrete compressive strength is 3000 psi for certification and anchorage selection.

Package components of the adhesive so that one whole container of each component mixes to form one batch of adhesive. Use containers designed so that all of the contents may be removed easily and sealed tightly to prevent leakage. Furnish adhesive material requiring hand mixing in two separate containers designated as Component A and Component B. Provide a self contained cartridge or capsule consisting of two components which are automatically mixed as they are dispensed, as in the case of a cartridge, or drilled into, as in the case of a capsule.
Clearly label each container with the manufacturer's name, date of manufacture, batch number, batch expiration date, direction for use, and warnings and precautions concerning the contents as required by State or Federal Laws and Regulations.

Procedure:

Drilling of Holes into Concrete

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

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

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

Repair spalled or otherwise damaged concrete using approved methods.

Inspection of Holes

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

Mixing of Adhesive

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

Embedment of Anchor Bolt/Dowel

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

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

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

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

Field Testing

When specified on the plans, test the installed anchor bolts/dowels for adequate adhesive as specified below. Inform the Engineer when the tests will be performed at least 2 days prior to testing. Conduct the tests in the presence of the Engineer. Use a calibrated hydraulic centerhole jack system for testing. Place the jack on a plate washer that has a hole at least 1/8 inch larger than the hole drilled into the concrete. Position the plate washer on center to allow an unobstructed pull. Position the anchor bolts/dowels and the jack on the same axis. Have an approved testing agency calibrate the jack within 6 months prior to testing. Supply the Engineer with a certificate of calibration.

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

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

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

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

SHOTCRETE REPAIRS

Scope of Work:

This work consists of completely removing deteriorated and disintegrated concrete from the underside of deck, bent caps, columns, and struts in reasonably close conformity with the lines, depth and details shown on the plans, described herein and as established by the Engineer. This work also includes cleaning reinforcing steel, removing all loose materials, removing and disposing of debris, jacking and temporarily supporting girders, shooting test panels, and applying shotcrete.

The location and extent of repairs shown on the plans described herein are general in nature. The Engineer determines the exact extent of removal in the field based on an evaluation of the condition of the exposed surfaces.

Repair, to the Engineer's satisfaction, any portion of the structure that is damaged from construction operations. No extra payment will be made for these repairs.

Prior to beginning any repair work, provide a sufficiently sized temporary work platform at each repair location as required. Design steel members meeting the requirements of the American Institute of Steel Construction Manual. Design timber members in accordance with the "National Design Specification for Stress-Grade Lumber and Its Fastenings" of the National Forest Products Association. Submit the platform structure design for review and approval. Do not install the platform until the design is approved. Do not drill holes into the superstructure. When the platform is removed, remove all anchorages made in the structure and repair the structure at no additional cost to the Department.

Shotcrete:

F. Qualification of Shotcrete Contractor

Shotcrete Contractors are not acceptable as a Prime Contractor or Subcontractor unless all of following requirements are met:

1. The Shotcrete Contractor furnishes proof that his or her company has a minimum of 5 years experience in shotcrete repair work on jobs of similar size and character.

2. The Shotcrete Contractor furnishes five references who were responsible for supervision of similar projects and testifies to the successful completion of these projects. Include name, address, and telephone number.

3. Contractor furnishes proof that each of his nozzlemen is certified as an ACI Shotcrete Nozzleman (Dry-Mix Process)

4. Prior to starting work, the Contractor's nozzlemen are required to pass a test demonstrating their competence. This test is conducted at the job site and approximates actual working conditions as near as possible. For test requirements, see ACI 506.3R, Chapters 2.5 and 3. Only workmanship demonstration is tested.

G. General

When shotcreting, meet all requirements of ACI 506.2, published by the American Concrete Institute, Detroit, Michigan, except as modified by the requirements of this Special Provision.

H. Material

Use materials conforming to the requirements of the applicable sections of the Standard Specifications and the following provisions:

1. Use Type II Cement. Provide a minimum of 658 pounds per cubic yard of cementitious material.

2. Replace a minimum of 7 percent by weight of the cement with silica fume.

3. Do not use other admixtures without approval.

4. Produce shotcrete cores with a minimum compressive strength of 5000 psi at 28 days. The provisions of ACI 506.2, Section 1.6.3.3, Paragraph 2, do not apply.

5. Submit the shotcrete mix design, including the source of material, to the Engineer for acceptance prior to purchase.

6. Use pre-blended bagged material produced by an ISO 9001 certified manufacturer.

7. Use size 2S or 2MS fine aggregate unless otherwise approved.

8. Use galvanized welded wire fabric conforming to AASHTO M32 or synthetic fiber reinforcement.

9. For repairs to bridge deck and diaphragms provide a polymer modified shotcrete mix. Shotcrete in other locations may be polymer modified at the Contractor's option. Submit a Test Panel of polymer modified shotcrete to the Engineer for testing and approval prior to purchasing the polymer modified shotcrete. See "Testing" below for details of the Test Panel.

I. Finish

Slightly build up and trim the shotcrete surface to the final surface by cutting with the leading edge of a sharp trowel. Use a rubber float to float any imperfections. Limit work on the finished surface to correcting imperfections caused by trowel cutting.

J. Testing

Each day shotcreting takes place, have each nozzleman shoot one 18" x 18" x 3" Test Panel. Shoot the panel in the same position as the repair work that is being done. The panel demonstrates whether the shotcrete is being properly applied and furnishes cores for testing compressive strength. Drill three 3" diameter cores from each test panel and also drill cores from the shotcrete repairs as directed by the Engineer. Do not take cores from shotcrete repairs until the shotcrete has cured for 7 days. Drill a core that penetrates into the existing concrete at least 2 inches. These cores are inspected for delaminations and sand pockets and tested for bond strength and/or compressive strength. If a core taken from a repaired area indicates unsatisfactory application or performance of the shotcrete, take additional cores from the applicable repair areas for additional evaluation and testing as directed by the Engineer. No extra payment is provided for drilling extra cores. Patch all core holes in the repaired areas to the satisfaction of the Engineer. All material, sample, and core testing is done by the Materials and Tests Unit of North Carolina Department of Transportation.

K. Mixture

Provide pre-blended material in bags and apply using the "dry-mix" method.

L. Repair Method and Operations

Prior to starting the repair operation, delineate all surfaces and areas assumed to be deteriorated by visually examining and by sounding the concrete surface with a hammer or any other alternative approved method. The Engineer is the sole judge in determining the limits of deterioration. Do not repair deterioration in areas not shown on the plans unless specifically directed by the Engineer.

Sawcut ½" deep around the perimeter of each repair area and remove all deteriorated concrete to sound concrete with a 17 lb (maximum) pneumatic hammer with points that do not exceed the width of the shank or with hand picks or chisels as directed by the Engineer. Other removal methods will be allowed with the approval of the Engineer. Do not cut or remove the existing reinforcing steel. Do not remove more existing concrete than required to expose the surface of the sound concrete. Unless specifically directed by the Engineer, do not remove concrete deeper than 6 inches below the original surface, nor deeper than 1 inch behind the back of the first layer of reinforcing steel encountered. If the reinforcing steel is wholly or partially exposed, remove the deteriorated and/or sound concrete to a minimum clearance of 1 inch all around the first layer of reinforcing steel.

Provide additional reinforcing steel wherever any existing bar has been cut or has lost 25% or more of its original cross section. Supplement the damaged bar with a bar of the same size, spliced for a length of 30 bar diameters on each side of the damaged area. At the contractor's option, or if required by conditions, use an approved mechanical butt splice capable of developing 125% of the yield strength of the existing bar. Welding of reinforcing steel is not permitted.

Sandblast all exposed concrete surfaces and existing reinforcing steel in repair areas to remove all debris, loose concrete, loose mortar, rust, scale, etc. Use a wire brush to

clean all exposed reinforcing steel surfaces facing away from the sandblast nozzle to remove all dust and loose particles.

Restore all repaired members, including chamfered edges, as close as practicable to their original "As Built" dimensions and configuration. Provide a minimum of 2" shotcrete cover over reinforcing steel exposed during repair. Finish the shotcrete by cutting the surface to final grade with the leading edge of a trowel.

Provide welded wire fabric at each repair area larger than 1 ft^2 if the depth of the repair exceeds 2 inches from the "As Built" outside face. Provide a minimum 2" x 2" - 12 gage galvanized welded wire fabric. Rigidly secure the welded wire fabric to existing steel or to 3/16" minimum diameter adequately spaced galvanized hook fasteners to prevent sagging. Encase the welded wire fabric in shotcrete to a minimum depth of 1½ inches.

If preferred, use ASTM C1116 Type III polypropylene or nylon synthetic fiber reinforcement at a minimum rate of 6 pounds per cubic yard as an alternate to welded wire fabric. Steel fiber reinforcement is not permitted. Do not use both welded wire and synthetic fiber reinforcement at the same location.

Perform work using only experienced personnel. Always work under the direction of an experienced superintendent. The superintendent is required to show a certified experience record indicating at least 5 years experience on work of similar type. No nozzleman is deemed experienced unless they have worked on several other jobs similar to that specified herein and have passed the required pre-qualification test listed in this Special Provision. Provide only nozzlemen certified by ACI at the level of "Shotcrete Nozzleman (Dry-Mix Process)".

Before applying the shotcrete to the surface, thoroughly clean the surface of all dirt, grease, oil or foreign matter, and remove all loose or weakened material.

Wash the roughened existing concrete surface with fresh potable water and an air blast, or with a "stiff" hose stream of fresh water until all loosened materials and salt water spray are removed. Perform this operation 30 minutes to 1 hour prior to applying the shotcrete.

Maximum time allowed between removal of deteriorated concrete and shotcrete application is 5 days. If the time allowance is exceeded it will be necessary to prepare the surface again using the methods described above before shotcrete can be applied.

Apply shotcrete in layers. The properties of the applied shotcrete determine the proper thickness of each layer or lift.

If a work stoppage longer than 2 hours takes place on any shotcrete layer prior to the time it has been built up to required thickness, thoroughly wash the surface with a fresh water stream and air hose as outlined previously, prior to continuing with the remaining shotcrete course. Do not apply shotcrete to a dry surface.

Have the nozzleman hold the nozzle 3 – 4 feet from the surface being covered in a position that ensures the stream of flowing material strikes at approximately right angles to the surface being covered without excessive impact. Have the nozzleman control the water content so it never exceeds 3½ gallons per sack of cement. Direct the nozzlemen

to maintain the water at a practicable minimum, dependent on weather conditions, so that the mix properly adheres. Control water content so that it does not become high enough to cause the mix to sag or fall from overhead, vertical, or inclined surfaces, or to separate in horizontal layers.

Use shooting strips or guide wires that do not entrap rebound sand to bring the finished work to approximate shape. Use guide wires to provide a positive means of checking the total thickness of the shotcrete applied. Remove the guide wires prior to the final finish coat.

Blow or rake off sand that rebounds and does not fall clear of the work, or which collects in pockets in the work, to avoid leaving sand pockets in the shotcrete. Do not reuse rebound material in the work.

Apply shotcrete only when the air temperature is at least 40°F and rising, but less than 95°F. Do not apply shotcrete to frosted surfaces. Maintain shotcrete at a minimum temperature of 40°F for 3 days.

M. Testing Shotcrete Surfaces

Immediately after bringing shotcrete surfaces to final thickness, thoroughly check them for sags, bridging, and other deficiencies. Approximately 3 days after completing the final shotcrete placement, thoroughly test it again with a hammer. At this time, the shotcrete should have sufficient strength for all sound sections to ring sharply. Remove and replace any unsound portions of the work found during this 3 day age inspection period, or at any other time prior to the final inspection of the work. No additional compensation is provided for removal and replacement of concrete during or after the 3 day age inspection.

N. Curing

Begin curing in accordance with Section 3.7 of ACI 506.2 as soon as the finished shotcrete surface withstands the curing operation without damage.

Method of Measurement:

Shotcrete repair work will be measured in cubic feet of the shotcrete applied. Depth will be measured from a place at the original outside concrete face. The Contractor and Engineer will measure repair quantities after removal of unsound concrete and before application of shotcrete. Cores included in the item "Shotcrete Core Samples" are those taken from the finished work. Cores taken from the required test panels are not included in "Shotcrete Core Samples".

Basis of Payment:

Shotcrete repair work will be paid for at the contract unit price bid per cubic foot for "Vertical Shotcrete Repairs," "Horizontal Shotcrete Repairs," or "Overhead Shotcrete Repairs" which payment will be full compensation for removal, containment and disposal off-site of unsound concrete including the cost of materials, labor, tools, equipment and incidentals necessary to accomplish removal. Such payment will also include the cost of

sandblasting, surface cleaning and preparation, cleaning of reinforcing steel, cost of temporary work platform, jacking and supporting girders, testing of the soundness of the exposed concrete surface, furnishing and installation of welded wire fabric or fibers, shotcrete material, application of shotcrete, curing of shotcrete, preparation of test panels, drilling of cores from the test panels, except the drilling of cores from the repaired areas will be paid for as "Shotcrete Core Samples" at the unit price each.

If corroded reinforcing steel is encountered and requires replacement, payment will be made at the contract unit price per pound for "Additional Reinforcing Steel". However, if the contractor damages existing reinforcing steel, no payment will be made for supplemental reinforcing, nor will payment be made for the increased repair area necessary for the splicing of the reinforcing steel.

POURED CONCRETE REPAIRS

Scope of Work:

Repair existing substructure using poured concrete where shown on the plans. Remove deteriorated concrete and prepare existing concrete surface as indicated in the Shotcrete Repairs Special Provision above. At the Contractor's option, and after successfully demonstrating his application method to the Engineer, shotcrete repairs will be permitted in lieu of poured concrete repairs. If formwork is used with shotcrete, construct it and apply the shotcrete in a manner that will not trap rebound sand within the completed repair.

Materials:

Provide concrete meeting the requirements of Class AA Concrete with the following exceptions:

1. Concrete may be mixed on-site from a pre-blended cementitious bagged repair concrete mix. Provide bagged mix from an ISO 9001 certified manufacturer.
2. The maximum allowable slump as indicated in the Standard Specifications may be increased slightly to increase workability with the approval of the Engineer.
3. Use #78M coarse aggregate.

Procedure:

After preparing existing concrete surface as indicated in "Shotcrete Repairs" above, install mortartight formwork around area to be repaired. Construct sufficient access points and air vents in the formwork to allow placement of concrete to completely fill the formed area.

Flood the forms continuously with fresh water for a minimum of two hours immediately prior to placing repair concrete in order to saturate the existing concrete surface. Place concrete by pumping or pouring, and vibrate thoroughly to remove all air voids and ensure bond to old concrete.

Cure the repair in accordance with the Standard Specifications. Leave forms in place a minimum of seven days, or until the concrete has reached a compressive strength of 3000 psi.

Method of Measurement:

Poured concrete repair work will be measured in cubic feet. Depth will be measured from a place at the original outside concrete face. The Contractor and Engineer will measure repair quantities after removal of unsound concrete and before application of concrete.

Basis of Payment:

Poured concrete repair work will be paid for at the contract unit price bid per cubic foot for " Poured Concrete Repairs" which payment will be full compensation for removal, containment and disposal off-site of unsound concrete including the cost of materials, labor, tools, equipment and incidentals necessary to accomplish removal. Such payment will also include the cost of sandblasting, surface cleaning and preparation, cleaning of reinforcing steel, cost of temporary work platform, formwork and falsework, testing of the soundness of the exposed concrete surface, material, application, curing of concrete and sampling of concrete.

END OF PROJECT SPECIAL PROVISIONS