

**Project Special Provisions
Structures**

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PROJECT SPECIAL PROVISIONS
STRUCTURES

PROJECT B-4820

YADKIN / SURRY COUNTIES

SECURING OF VESSELS

(10-12-01)

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.

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

(1-27-10)

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.

Submittals may also be made via email.

Send submittals to:

plambert@ncdot.gov (Paul Lambert)

Send an additional e-copy of the submittal to the following address:

jgaither@ncdot.gov (James Gaither)

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

The status of the review of structure-related submittals sent to the Structure Design Unit can be viewed from the Unit's web site, via the "Contractor Submittal" link.

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 “Temporary Shoring”, “Anchored Temporary Shoring” & “Temporary Soil Nail Walls”
Contractor Designed Shoring	7	2	

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.

**CONSTRUCTION, MAINTENANCE AND REMOVAL
OF TEMPORARY ACCESS AT STATION 14+14.81-L-****(SPECIAL)****1.0 GENERAL**

Construct, maintain, and remove the temporary access road and temporary barge access required to provide the working area necessary for removal of the existing bridge.

Temporary access may include other methods than those outlined in this Special Provision; however, all types of temporary access are required to meet the requirements of all permits, the Standard Specifications, and this Special Provision.

2.0 TEMPORARY ACCESS ROAD AND TEMPORARY BARGE ACCESS

Construction of a temporary access road and a barge access to provide access for the construction barge is permitted within the limits shown on the plans. Submit details of the barge access and access road to the Engineer prior to constructing the barge access and access road to ensure conformance with the plans and all permits. Completely remove the barge access and access road prior to final acceptance or as otherwise required by the permits.

3.0 BASIS OF PAYMENT

The lump sum price bid for “Construction, Maintenance and Removal of Temporary Access at Station 14+14.81-L-” will be full compensation for the above work, or other methods of access, including all material, pipes, barge access components, access road, equipment, tools, labor, disposal, and incidentals necessary to complete the work.

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.

GROUT FOR STRUCTURES

(7-12-07)

1.0 DESCRIPTION

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

2.0 MATERIALS

Refer to Division 10 of the *Standard Specifications*:

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

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

3.0 REQUIREMENTS

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

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

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

When using approved packaged grout, a grout mix design submittal is not required. Submit grout mix designs in terms of saturated surface dry weights on M&T Form 312U in accordance with the applicable section of the *Standard Specifications* or special provision for the structure. Use an approved testing laboratory to determine the grout mix proportions. Adjust proportions to compensate for surface moisture contained in the aggregates at the time of mixing. Changes in the saturated surface dry mix proportions will not be permitted unless a revised grout mix design submittal is accepted.

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

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

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

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

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

4.0 SAMPLING AND PLACEMENT

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

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

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

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

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

5.0 MISCELLANEOUS

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

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.

ARCHITECTURAL CONCRETE SURFACE TREATMENT

(SPECIAL)

1.0 GENERAL

The work covered by this special provision consists of constructing textured surfaces on formed reinforced concrete surfaces for the stairway walls, terrace walls, light pedestal and cast-in-place facing of the MSE retaining walls as indicated on the Plans and in this Special Provision. The Contractor shall furnish all materials, labor, equipment, and incidentals necessary for the construction of architectural concrete surface treatment using simulated stone masonry form liners (molds) and a compatible concrete coloring system.

The contractor is required to use the same source of form liner and coloration contractor for the stairway, terrace and the wired faced MSE retaining walls. For information purposes only, a manufacture of form liners and source of color application artist is HUNT VALLEY CONTRACTORS, INC., 3705 Crondall Lane, Owings Mills, MD 21117, Telephone 410-356-9677.

The architectural concrete surface treatment should match the appearance (stone size and shape, stone color, and stone texture, pattern, and relief) of natural stone and rock to match the existing retaining wall along East Market Street at its intersection with Main Street which resembles a New England drystack pattern with light brown to sandy brown coloration as directed by the Engineer. Grout pattern joints (mortar joints) and bed thickness should re-create the appearance and color of cast-in-place and/or precast concrete surfaces as indicated in the Plans, this Special Provision, or as directed by the Engineer.

2.0 SUBMITTALS

Shop Drawings - The Contractor shall submit for review and acceptance, plan and elevation views and details showing overall simulated stone pattern, joint locations, form tie locations, and end, edge or other special conditions. The drawings should include typical cross sections of applicable surfaces, joints, corners, stone relief, stone size, pitch/working line, mortar joint and bed depths. If necessary, the Contractor shall revise the shop drawings until the proposed form liner patterns and arrangement have been accepted by the Engineer. Shop drawings should be of sufficient scale to show the detail of all stone and joints patterns. The size of the sheets used for the shop drawings shall be 22" x 34" (560mm x 864mm).

The form liner shall be patterned such that long continuous horizontal or vertical lines do not occur on the finished exposed surface. The line pattern shall be random in nature and shall conceal construction joint lines. Special attention should be given to details for wrapping form liners around corners.

Shop drawings shall be reviewed and accepted prior to fabrication of form liners.

Sample Panels – After the shop drawings have been reviewed and accepted by the Engineer, the Contractor shall construct 24" x 24" (610mm x 610mm) transportable sample panel(s) at the project site. The materials used in construction of the sample panel(s) shall comply with section 420 of the Standard Specifications. The sample panel(s) shall be constructed using approved form liners. Sample panels will be required for each different form liner pattern that is to be used on the project. Any sample panel that is not accepted by the Engineer is to be removed from the project site and a new sample panel produced at no additional expense to the Department.

Architectural surface treatments and patterns of the finished work shall achieve the same final effect as demonstrated on the accepted sample panel(s). Upon acceptance by the Engineer, the sample panel(s) shall be used as the quality standard for the project. After the acceptance of the completed structure, the Contractor shall dispose of the sample panels as directed by the Engineer.

3.0 MATERIAL REQUIREMENTS

Form Liner – The form liner shall be a high quality, re-useable product manufactured of high strength urethane rubber or other approved material which attaches easily to the form work system, and shall not compress more than ¼" (6mm) when concrete is poured at a rate of 10 vertical feet (3 vertical meters) per hour. The form liners shall be removable without causing deterioration of the surface or underlying concrete.

Form Release Agent – Form release agent shall be a nonstaining petroleum distillate free from water, asphaltic, and other insoluble residue, or an equivalent product. Form release agents shall be compatible with the color system applied and any special surface finish.

Form Ties - Form ties shall be set back a minimum of 2" (51 mm) from the finished concrete surface. The ties shall be designed so that all material in the device to a depth of at least 2" (51mm) back of the concrete face (bottom of simulated mortar groove) can be disengaged and removed without spalling or damaging the concrete. The Contractor shall submit the type of form ties to the Engineer for approval.

Concrete color system/stain – Special surface color system shall be performed using approved coloring systems/stains suitable for the purpose intended and applied in a manner consistent with the design intent of the project. The approved sample panel shall be the basis for determining the appropriate color/stain application.

The coloring agent shall be a penetrating stain mix or other approved coloring system with a compatible finish designed for exterior application on old or new concrete with field evidence of resistance to moisture, acid or alkali, mildew, mold or fungus discoloration or degradation. The coloring agent shall be breathable, allowing moisture and vapor transmission. Final coloring system and the light brown to sandy brown colors are subject to acceptance by the Engineer.

Quality Standards - Manufacturer of simulated stone masonry form liners and custom coloring system shall have at least five years experience making stone masonry molds and color stains to create formed concrete surfaces to match natural stone shapes, surface textures and colors.

The Contractor shall schedule a pre-installation conference with manufacturer representative and the Engineer to assure understanding of simulated stone masonry form liner use, color application, requirements for construction of sample panel(s), and to coordinate the work. The Contractor shall be required to disclose their source of simulated stone masonry manufacturer and final coloration contractor at the Preconstruction Conference.

4.0 CONSTRUCTION

Form Liner Preparation – Prior to each concrete pour, the form liners shall be clean and free of build-up. Each liner shall be visually inspected for blemishes and tears. Repairs shall be made in accordance with the manufacturer's recommendations. Repairs shall be accepted by the Engineer before being used. Form liner panels that do not perform as intended or are no longer repairable shall be replaced.

Form Liner Attachment – Form liners shall be securely attached to forms in accordance with the manufacturer's recommendations, with less than a ¼" (6 mm) seam. Blend form liner butt joints into the stone pattern and finish off the final concrete surface. Create no visible vertical or horizontal seams or conspicuous form liner butt joint marks. At locations where the form liners are joined, carefully blend to match the balance of the stone pattern.

Form liners shall be installed to withstand anticipated concrete placement pressures without leakage and without causing physical or visual defects. Wall ties shall be coordinated with the form liner system.

The Contractor shall have a technical representative from the form liner manufacturer on site for technical supervision during the installation and removal of form liners. Unless directed by the Engineer, installation and removal of form liners shall not be permitted if the technical representative is not present.

Form Release – Form release agent shall be applied in accordance with the manufacturer's recommendations. The material shall be compatible with the form liner material and the concrete coloring system and in accordance with this Special Provision. Form release agent should be worked into all areas, especially pattern recesses.

Patching – All form tie holes and other defects in finished uncolored surface shall be filled or repaired within 48 hours of form removal. Use patching materials and procedures in accordance with the manufacturer's recommendations.

Surface Finish – All surfaces that are to receive coloring agent application shall be free of all laitency, dirt, dust, grease, efflorescence, paint or any other foreign material prior to the application of coloring agent. Cleaning of surfaces to be accomplished by pressure washing with water set at 3000 psi (20.7 MPa) to remove laitence. The fan nozzle shall be held perpendicular to the surface at a distance of 1 to 2 feet (300 to 600 mm). Sandblasting will not be permitted.

Final surface shall be free of blemishes, discolorations, surface voids, and other irregularities. All patterns should be continuous without visual disruption.

Reinforced concrete shall be finished in accordance with the Standard Specifications, except that curing of concrete should been done to accommodate the application of coloring and surface finish treatment.

Grout pattern joints – Grout pattern joints shall be constructed to simulate the appearance of mortared joints produced in laid up masonry work. Grout pattern joints shall be produced in accordance with the form liner / concrete color system manufacturer.

Color/Stain Application – Finished concrete and patches shall stand in place 30 days after form liners are removed prior to application of coloring/staining agent. Maintain the concrete temperature between 40°F (4°C) and 85°F (30°C) during color/stain application and for 48 hours after color/stain application. Consult the manufacturer's recommendations for preparation, application, curing, and storage of coloring agents/stains. The contractor shall provide a Color Application Artist who is trained in the special techniques to achieve realistic surface appearances, *if requested by the Engineer*. Treated surfaces located adjacent to exposed soil or pavement shall be temporarily covered to prevent dirt or soil splatter from rain.

Following the completion of all work, repairs of any damage made by other construction operations shall be made to the form lined and colored surfaces as directed by the Engineer.

Experience and Qualifications - The Contractor shall have a minimum of three consecutive years experience in architectural concrete surface treatment construction on similar types of projects. The Contractor shall furnish to the Engineer 5 references who were responsible for supervision of similar projects and will testify to the successful completion of these projects. Include name, address, telephone number, and specific type of application.

5.0 BASIS OF PAYMENT

Architectural concrete surface treatment as described on the plans and in this Special Provision will be paid for at the lump sum price bid for "Architectural Concrete Surface

Treatment". The above price and payment will be full compensation for all work covered by this Special Provision, the plans and applicable parts of the Standard Specifications and shall include, but not be limited to, furnishing all labor, materials, equipment, and other incidentals, including sample panels, necessary to complete this work.

Payment will be made under:

Architectural Concrete Surface Treatment.....Lump Sum

#57 STONE:

(SPECIAL)

Description

The Contractor shall place #57 stone in the in accordance with the details in the plans and the following provision.

Materials

Item	Section
# 57 Stone	1005

Construction Methods

The stone shall be placed and compacted as directed by the Engineer.

Measurement and Payment

#57 stone will be measured and paid for in cubic yards that are completed and accepted. The price and payment will be full compensation for furnishing, hauling, placing, and all incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
#57 Stone	Cubic Yard

METAL HANDRAIL

(SPECIAL)

Construct the metal handrail in accordance with the applicable details and notes shown on the plans and this special provision.

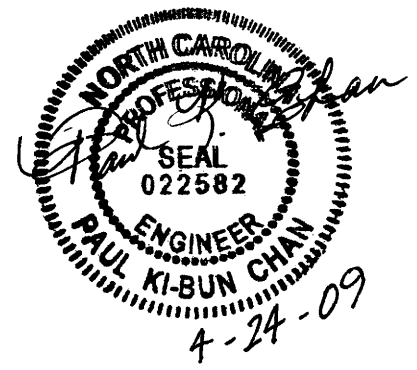
The quantity of metal handrail will be the actual number of linear feet of rail which has been completed and accepted for the stairway, terrace and top of abutment metal railing. All hardware used for the handrail and painting of the rail is included in the price of the metal handrail and will not be paid for separately.

Work includes but is not limited to furnishing working drawings including attachment details, furnishing and installing painted galvanized steel tubing, plates, bolts, screws, nuts, and any other materials necessary to complete the work as described in the plans and this special provision.

Payment will be made under:

Metal Handrail _____ Linear Foot

PROJECT SPECIAL PROVISIONS
STAIRWAY LIGHTING



1.00 DESCRIPTION

The work covered by this Section consists of installing, connecting, and placing into satisfactory operating condition stairway lighting at locations shown on the plans with lighting equipment furnished by Town of Elkin. Perform all work in accordance with these Special Provisions, the Plans, the National Electrical Code, and North Carolina Department of Transportation "Standard Specifications for Roads and Structures" (Standard Specifications).

Perform all work in conformance with Division 14 of the Standard Specifications except as modified or added to by these Special Provisions.

In addition to the requirements of Division 1400, other specific Sections of the Standard Specifications applicable to the work on this project are listed below.

Section 1404	Light Standards
Section 1405	Standard Foundation
Section 1406	Light Standard Luminaires
Section 1410	Feeder Circuits
Section 1411	Electrical Junction Boxes

2.00 WIRING METHODS

2.10 DESCRIPTION

Amend Section 1400-4(F) to include the following:

Pull conductors by hand, or use motorized cable-pulling equipment designed for pulling multiple cables into conduit. Use sheaves or rollers, as required to prevent damage to conductor insulation. Do not use an automobile to generate cable pulling forces. Use equipment similar to the Greenlee model UT2 cable pulling system, or Engineer approved equal.

3.00 INSPECTIONS

3.10 DESCRIPTION

Amend Section 1400-5 to include the following:

Provide the personnel and equipment necessary for removing and replacing fuseholders, to facilitate the insulation resistance test described in Section 4.00 of these Special Provisions.

4.00 PERFORMANCE TESTS

4.10 DESCRIPTION

Amend Section 1400-6 to include the following:

Provide a calibrated MegOhmMeter, with certification that calibration was done recently (within one year of use). Provide a meter manufactured by Fluke, Amprobe, Biddle, or Engineer approved equal. Present the meter for inspection, at the pre-lighting-work meeting described elsewhere in these Special Provisions.

Coordinate with the project inspector, to perform the insulation resistance test to prevent delays in preparing the final inspection punch list.

Removing water from the conduit of a faulty circuit is not considered a repair. Water in the conduit allows current to flow between skinned places in the conductors insulation. If a circuit fails the insulation resistance test, and removing water allows the circuit to pass, replace the conductors and re-test the new circuit.

5.00 CONSTRUCTION PHASING

5.10 DESCRIPTION

Amend Section 1400-11 to include the following:

Schedule a pre-lighting-work meeting before beginning work on the lighting system. Include staff members from the prime contractor, electrical sub-contractor, Resident Engineer's office, Duke Energy, and the Lighting/ Electrical squad in the Roadway Design Unit in Raleigh.

6.00 INSTALL POST TOP LIGHT

6.10 DESCRIPTION

The work covered by this section consists of installing fiberglass light standards with post top light fixtures by the stairway leading from Main Street to Market Street.

6.20 MATERIALS

Lighting equipment including fiberglass light standards, post top light fixtures, light standard anchor bolts with nuts and washers will be furnished by Town of Elkin.

6.30 CONSTRUCTION METHODS

A total of four light standards will be installed at the stairway as shown on the plans. Light standards #1 and #4 will be installed at grade at Market Street and Main Street as described in Section 7.00. Light standard #2 will be installed on a lighting pedestal at Stairway Landing No. 1. Light standard #3 will be installed on a lighting pedestal inside the terrace by Stairway Landing No. 2.

Secure the light standard base to the ground foundation or the lighting pedestal by means of anchor bolts. Position hot-dipped galvanized anchor bolts in poured concrete according to manufacturer's anchor bolt template. Use corrosion resistant nuts and bolts supplied by light standard manufacturer to secure light standard onto anchor bolts.

Install all light standards vertically plumb. Mount the post top light fixture securely onto the tenon of the light standard. Install wiring conductors inside the light standard, from the fixture to the feeder circuit at the pole base. Install a 5-Amp fuse and fuseholder for each current carrying conductor.

6.40 MEASUREMENT AND PAYMENT

“Install Post Top Light ____ “ will be measured and paid for as the actual number of post top lights of each appropriate size and style that have been installed and accepted. Such price and payment will be full compensation for all work of installing and wiring the light standard, the post top light fixture, fuseholders, and secure light standard onto standard foundation or lighting pedestal.

Payment will be made under:

Install Post Top Light Each

7.00 POST TOP LIGHT STANDARD FOUNDATION

7.10 DESCRIPTION

The work covered by this section is in conformance with Section 1405 of the Standard Specifications except as modified below.

7.20 MATERIALS

Same as Section 1405-2.

7.30 CONSTRUCTION METHODS

Same as Section 1405-3 except as modified below.

Construct the light standard foundation for post top light standard, (Type R1S), to be the same as standard foundation, (Type R1), as shown in Standard Drawing 1405.01 except as stated below.

Construct cylindrical concrete foundation of 24” in diameter and 48” in depth. Position anchor bolts according to manufacturer’s template, and place feeder circuit conduits before pouring concrete.

7.40 MESUREMENT AND PAYMENT

Measurement will be in accordance with Section 1405-4.

Payment will be made under:

Post Top Light Standard Foundation (Type R1S) Each

8.00 FEEDER CIRCUIT

8.10 DESCRIPTION

The work covered by this section is in conformance with Section 1410 of the Standard Specifications except as modified below.

8.20 MATERIALS

Same as Section 1410-2.

8.30 CONSTRUCTION METHODS

Same as Section 1410-3.

8.40 MESUREMENT AND PAYMENT

Measurement will be in accordance with Section 1410-4.

Payment will be made under:

2 #8 W/G Feeder Circuit in 1.5” Conduit Linear Foot

9.00 ELECTRICAL JUNCTION BOXES

9.10 DESCRIPTION

The work covered by this section consists of installing sidewalk junction boxes (Type SW), and in-ground junction box (Type PC18), to connect feeder circuit conductors in conduit to stairway post top lights.

9.20 MATERIALS

Same as Section 1411-2 except as modified below.

Provide in- ground junction box (Type PC18), as described in Section 1411-2.

Sidewalk junction boxes (Type SW) are NEMA 4, raintight, galvanized cast iron, with external recess flange for flush mounting. Provide boxes with steel checkered cover for pedestrian and light vehicle traffic. Use boxes similar to O Z Gedney, Type YR, and sized as shown in the plans.

Provide zinc rich paint conforming to Section 1080-9 of the Standard Specifications.

9.30 CONSTRUCTION METHODS

All conduit and Type SW junction boxes shall be securely fastened with ties prior to placing any concrete. To ensure against corrosion in the areas where hot dipped galvanizing has been damaged, cover all raw metal surfaces with a cold galvanized, zinc rich paint.

Stub the conduit out at an accessible location and seal with termination kits designed specifically for that purpose. Use termination kits of the same material as the conduit. Place backfill in accordance with Section 300-7 of the Standard Specifications. Conduit may enter Type SW junction boxes through field drilled holes protected with zinc rich paint before the conduit is inserted. Use threaded adapter and insulating bushing at all Type SW junction boxes to conduit connections.

Install a pull line in stubbed out conduit at JB1 and JB4 for future use. Leave sufficient slack for attachment of a rope that will be used to install conductors. Coordinate lighting feeder circuit work with work by others, and allow connection to electrical service, as directed by the Engineer.

All work must be inspected and approved by the Engineer before concealment.

9.40 MEASUREMENT AND PAYMENT

Measurement will be in accordance with Section 1411-4.

Payment will be made under:

Electrical Junction Boxes (Type SW)	Each
Electrical Junction Boxes (Type PC18)	Each

CONTROL OF VIBRATION

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

Control of vibration is required during demolition of the existing bridge and construction of the retaining walls. It is the responsibility of the Contractor to utilize construction methods and equipment to minimize disturbance and/or damage to the adjacent structures. See Building Surveys Special Provision for Pre-Construction and Post-Construction Structure Condition Inspections of adjacent structures.

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

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

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

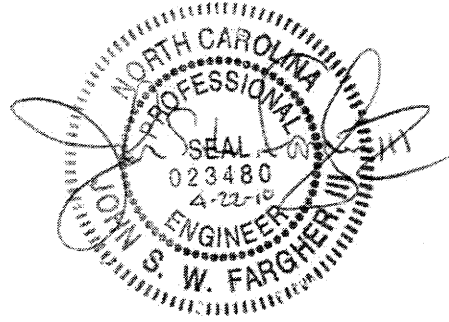
Continuous monitoring will be required during the initial stages of each particular phase of work that could generate detectable vibrations at adjacent buildings. Once safe levels have been confirmed, an instrument may be placed at the nearest structure to document ongoing safe vibrations. Construction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

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

Payment will be made by the Lump Sum bid price for "Vibration Monitoring." Such payment will be full compensation for all work described in this provision

including, but not limited to, control of vibration, inspection of the structures, vibration monitoring, and submission of reports.

Pay Item: Vibration Monitoring..... Lump Sum



BUILDING SURVEYS

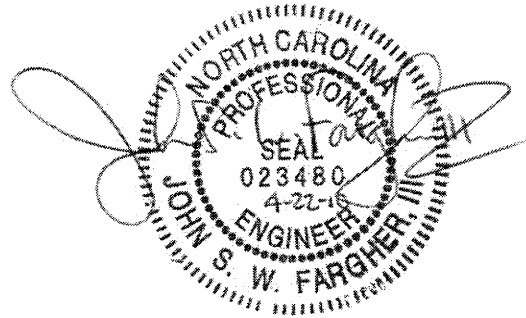
Attention is directed to Articles 107-12 and 107-15 of the Standard Specifications and to the Subsurface Plans. Use a geotechnical firm prequalified by the NCDOT Construction Unit for Structure Movement Monitoring (work code 3125). The building surveys can be used to fulfill the requirements for pre-construction and post-construction surveys.

The firm shall perform a Pre-Construction Structure Condition Inspections for the adjacent buildings and submit three (3) copies at least 5 business days before the preconstruction conference.

At the completion of the project, submit to the Engineer three (3) copies of the final report which should include all preconstruction and post construction condition assessments of the subject buildings with both photographic and written documentation.

Payment will be made by the Lump Sum bid price for "Building Surveys." Such payment will be full compensation for all work described in this provision including, but not limited to, inspection of the buildings and submission of reports.

Pay Item: Building Surveys Lump Sum



SOLDIER PILE RETAINING WALLS

(2-16-10)

1.0 GENERAL

A soldier pile retaining wall consists of steel H piles driven or placed in drilled holes and partially filled with concrete and either precast concrete panels set in the pile flanges or a cast-in-place reinforced concrete face connected to the front of the piles. Timber lagging is typically used for temporary support of excavations during construction. Design and construct soldier pile retaining walls based on actual elevations and dimensions in accordance with the contract and accepted submittals. For this provision, "soldier pile wall" refers to a soldier pile retaining wall. Also, "panels" refers to precast concrete panels and "concrete facing" refers to a cast-in-place reinforced concrete face.

2.0 SUBMITTALS

Two submittals are required which include the soldier pile wall design and construction submittals. Provide 11 hard copies of working drawings and 3 hard copies of design calculations for the soldier pile wall design submittal and 4 hard copies of the soldier pile wall construction submittal. Also, submit an electronic copy (PDF on CD or DVD) of each submittal. Provide the soldier pile wall construction submittal at least 30 calendar days before conducting the soldier pile wall preconstruction meeting. Do not begin soldier pile wall construction until both submittals are accepted.

A. Soldier Pile Wall Design Submittal

The Retaining Wall Plans show plan views, typical sections, details, notes and elevation or profile views (wall envelope) for each soldier pile wall. When noted on plans and before beginning soldier pile wall design, survey existing ground elevations shown on the plans and submit a revised wall envelope for review and acceptance. Use the accepted revised wall envelope for design.

Design soldier pile walls in accordance with the plans and the *AASHTO LRFD Bridge Design Specifications* for nongravity cantilevered walls unless otherwise required. Design walls for a maximum deflection of 1.5% of the exposed wall height or 3" (75 mm), whichever is less. Use a maximum H pile spacing of 10 ft (3 m). At the Contractor's option, use driven or drilled-in piles for soldier pile walls with concrete facing unless required otherwise on the plans. For soldier pile walls with panels, use drilled-in piles unless noted otherwise on the plans. Install drilled-in piles by excavating holes with diameters that result in at least 3" (75 mm) of clearance all around piles.

At the Contractor's option, use panels or concrete facing unless required otherwise on the plans. Design panels and concrete facing in accordance with the plans and Section 5 of the *AASHTO LRFD Bridge Design Specifications* unless otherwise required. Provide reinforcement of sufficient density to satisfy Section 5.7.3.4 of the AASHTO LRFD specifications. Use a minimum panel or concrete facing thickness of 6" (150 mm).

Provide temporary support of excavations for excavation heights greater than 4 ft (1.2 m) and timber lagging in accordance with the *AASHTO Guide Design Specifications for Bridge Temporary Works*. At the Contractor's option and when noted on plans, provide a temporary slope in lieu of temporary support of excavations. Do not extend temporary slopes beyond right-of-way or easement lines. With the exception of fill sections or when using temporary slopes, backfill voids behind panels, lagging and piles with no. 57 stone. Separation fabric is required between no. 57 stone and overlying fill or aggregate with the exception of when concrete pavement is placed directly on the stone.

Use 6 inch (150 mm) thick aggregate leveling pads beneath panels and concrete facing. Unless required otherwise on the plans, embed top of leveling pads a minimum of 1 ft (0.3 m) below where finished grade intersects the front face of soldier pile walls.

Provide geocomposite drain strips centered between each pair of adjacent piles. Attach drain strips to the excavation face, front face of timber lagging or back face of panels or concrete facing. Connect drain strips to leveling pads. Extend continuous drains along base of panels or concrete facing in front of piles and leveling pads. Provide drains meeting the requirements of an aggregate shoulder drain in accordance with Roadway Standard Drawing No. 816.02.

Unless shown otherwise on the plans, use cast-in-place reinforced concrete coping at top of walls for soldier pile walls with panels with dimensions shown on the plans. Extend coping or concrete facing a minimum of 6" (150 mm) above where finished grade intersects the back of soldier pile walls unless required otherwise on the plans. At the Contractor's option, connect coping to panels with dowels or extend coping down the back of panels a minimum of 6" (150 mm). When barriers are required above soldier pile walls, use concrete barrier rails with moment slabs in accordance with the plans.

Submit working drawings and design calculations for review and acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, wall profiles with pile locations, typical sections and details of piles, drainage, temporary support of excavations, leveling pads, panels or concrete facing and reinforcing. If necessary, include details on working drawings for concrete barrier rails with moment slabs and obstructions interfering with piles or extending through walls. Submit design calculations including deflection calculations for each wall section with different surcharge loads, geometry or material parameters. When using a software program for design, provide a hand calculation verifying the analysis of the tallest wall section. Also, submit design calculations for temporary support of excavations or slope stability calculations for temporary slopes, if applicable. Have soldier pile walls designed, detailed and sealed by a Professional Engineer registered in North Carolina.

B. Soldier Pile Wall Construction Plan Submittal

Provide project specific installation information including a detailed construction sequence. For driven piles, submit proposed pile driving methods and equipment in accordance with Article 450-5 of the *Standard Specifications*. For drilled-in piles, submit installation details including drilling equipment and method for stabilizing holes. Also, submit details of excavations and temporary support of excavations and any other information shown on the plans or requested by the Engineer.

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

3.0 MATERIALS

Load, transport, unload and store soldier pile wall materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Identify, store and handle drain strips and fabrics in accordance with ASTM D4873. Drain strips and fabrics with defects, flaws, deterioration or damage will be rejected. Do not leave drain strips and fabrics uncovered for more than 7 days.

Use timber lagging with a minimum allowable bending stress of 1000 psi (6.9 MPa) that meets the requirements of Article 1082-1 of the *Standard Specifications*.

A. Steel Piles

Use steel H piles meeting the requirements of Article 1084-1 of the *Standard Specifications*. For soldier pile walls with concrete facing, provide welded stud shear connectors in accordance with Article 1072-8 of the *Standard Specifications*. For soldier pile walls without concrete facing or veneers, galvanize steel piles in accordance with Section 1076 of the *Standard Specifications*.

For drilled-in piles, use excavatable flowable fill in accordance with Article 340-2 of the *Standard Specifications* and 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.

1. Painting Piles

When a note on plans requires painting piles, smooth, clean, prepare and shop paint portions of galvanized piles that will not be encased in concrete below ground in accordance with Sections 442 and 1080 of the *Standard Specifications* with the exception of the following. Provide shop certification in accordance with Article 442-10 of the *Standard Specifications* regardless of the quantity of painted steel.

Smooth high spots and rough edges, such as metal drip lines, of galvanized surfaces in accordance with ASTM D6386. Clean galvanized surfaces to be painted with a 2500 psi (17.2 MPa) pressure washer. Allow surfaces to dry completely before beginning surface preparation.

Prepare galvanized surfaces to be painted by sweep blasting in accordance with ASTM D6386. Use an abrasive material and technique that roughens the surface while leaving base zinc layers intact. After sweep blasting, blow down blasted surfaces with clean, dry, compressed air free of contamination.

Apply paint to clean, dry surfaces free of visible zinc oxides or zinc hydroxides within 8 hours of surface preparation. Use the paint system below for painting piles gray. For painting piles other colors, contact the NCDOT Materials & Tests Unit for an appropriate paint system.

Coat	Material*	Dry/Wet Film Thickness (mils)	
		Min	Max
Intermediate	1080-12 Brown	3.0 DFT	5.0 DFT
Stripe	1080-12 White	4.0 WFT	7.0 WFT
Topcoat	1080-12 Gray	2.0 DFT	4.0 DFT
Total		5.0 DFT	9.0 DFT

* See Article 1080-12 of the *Standard Specifications*

B. Wall Drainage Systems

Wall drainage systems consist of drain strips, drains and outlet components. Provide Type 3 Manufacturer's Certifications in accordance with Article 106-3 of the *Standard Specifications* for wall drainage materials and minimum average roll values (MARV) as defined by ASTM D4439 for core properties of drain strips. For testing drain strips, a lot is defined as a single day's production.

Use at least 12 inch (300 mm) wide prefabricated geocomposite drain strips consisting of a non-woven polypropylene geotextile bonded to one side of an HDPE or polystyrene drainage core, e.g., sheet drain. Provide drain strips with cores meeting the following requirements.

Core Property	Test Method	Requirement (MARV)
Thickness	ASTM D5199	¼ - ½ inch (6 - 13 mm)
Compressive Strength	ASTM D1621	40 psi (276 kPa) min
Flow Rate (with a gradient of 1.0)	ASTM D4716	5 gpm (1 l/s) min*

* per ft (m) of width tested

Use drain and outlet materials meeting the requirements of Section 816 of the *Standard Specifications*.

C. Precast Concrete Panels

Provide precast concrete panels meeting the requirements of Sections 1000 and 1077 of the *Standard Specifications* and reinforcing steel meeting the requirements of Section 1070 of the *Standard Specifications*. Produce panels within ¼ inch (6 mm) of the panel dimensions shown in the accepted submittals. Damaged panels with excessive discoloration, chips or cracks as determined by the Engineer will be rejected.

A minimum compressive strength of 4000 psi (27.6 MPa) at 28 days is required. For testing panels for compressive strength, 4 cylinders are required per 2000 ft² (186 m²) of panel face area or a single day's production, whichever is less.

Unless an exposed aggregate finish is required, provide a final finish in accordance with Article 1077-11 of the *Standard Specifications*.

1. Exposed Aggregate Finish

When a note on plans requires panels with an exposed aggregate finish, provide an exposed aggregate finish for front faces of panels with a depth of exposure ranging from 0 to ¼ inch (0 to 6 mm). Before beginning panel production, furnish three 12" by 12" (300 mm by 300 mm) sample panels to establish acceptable variations in color, texture and uniformity of the finish. After the sample panels are accepted and within 30 days of beginning panel production, produce a reinforced test panel of the largest size that will be used for the soldier pile walls with the accepted exposed aggregate finish and in accordance with the accepted submittals. Acceptance of the appearance of the panels during production will be based on the test panel and accepted sample panels.

Use aggregate and cement from the same source as was used for the test panel and accepted sample panels to produce the panels. Provide access to visually inspect the entire finish of each completed panel and compare it to the test panel appearance before stacking panels. Replace the test panel with a new test panel every 3 months during panel production.

D. No. 57 Stone

Use standard size no. 57 stone meeting the requirements of Class VI Select Material in accordance with Section 1016 of the *Standard Specifications*.

E. Leveling Pads

Use Class VI Select Material in accordance with Section 1016 of the *Standard Specifications* for aggregate leveling pads.

F. Concrete Facing, Coping and Concrete Barrier Rails with Moment Slabs

Provide concrete facing, coping and concrete barrier rails with moment slabs meeting the requirements of Section 1000 of the *Standard Specifications* and reinforcing steel

meeting the requirements of Section 1070 of the *Standard Specifications*. Use Class A Concrete for concrete facing, coping and moment slabs and Class AA Concrete for concrete barrier rails in accordance with Article 1000-4 of the *Standard Specifications*.

G. Separation Fabrics

Use separation fabrics meeting the requirements of Type 2 Engineering Fabric in accordance with Section 1056 of the *Standard Specifications*.

H. Joint Materials

Use joint materials in accordance with Section 1028 of the *Standard Specifications*.

4.0 SOLDIER PILE WALL PRECONSTRUCTION MEETING

Before starting soldier pile wall construction, conduct a preconstruction meeting to discuss the construction and inspection of the soldier pile walls. Schedule this meeting after all soldier pile wall submittals have been accepted. The Resident or Bridge Maintenance Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, Contractor and Soldier Pile Wall Contractor Superintendent will attend this preconstruction meeting.

5.0 CONSTRUCTION METHODS

Control drainage during construction in the vicinity of soldier pile walls. Direct run off away from soldier pile walls and areas above and behind walls. Contain and maintain no. 57 stone and backfill and protect material from erosion.

Perform necessary clearing and grubbing in accordance with Section 200 of the *Standard Specifications*. Notify the Engineer before blasting in the vicinity of soldier pile walls. Perform blasting in accordance with the contract. Install foundations located behind soldier pile walls and within a horizontal distance equal to the tallest wall section before beginning soldier pile wall construction.

Do not excavate behind soldier pile walls unless a temporary slope is shown in the accepted submittals. If overexcavation occurs and is not approved, repair walls at no additional cost to the Department with a method proposed by the Contractor and accepted by the Engineer. A revised soldier pile wall construction plan may be required.

If a temporary slope is shown in the accepted submittals, excavate the slope before installing piles. Otherwise, install piles before excavating. Cure concrete for drilled-in piles a minimum of 7 days before proceeding with soldier pile wall construction.

Perform any welding in accordance with the contract. At the Contractor's option, welding may be performed in the field in lieu of employing an American Institute of Steel Construction (AISC) certified fabricator in accordance with Subarticle 1072-1(A) of the *Standard Specifications*. For field welding, use welders certified as a bridge welder in accordance with the NCDOT Field Welder Certification Program.

Use equipment and methods reviewed and accepted in the construction plan or approved by the Engineer. Inform the Engineer of any deviations from the accepted plan.

A. Pile Installation

Install piles in accordance with the accepted submittals and this provision. Contact the Engineer if the design pile embedment is not achieved. Do not splice piles. If necessary, cut off piles at elevations shown in the accepted submittals.

Install piles within 1 inch (25 mm) horizontally and vertically of plan location and with no negative batter (piles leaning forward). For soldier pile walls with concrete facing, be aware that alignment variations between piles may result in a thicker concrete facing in some locations in order to provide the minimum required facing thickness elsewhere. No additional payment will be made for concrete facing thicker than the minimum required. Locate piles such that the minimum required concrete facing thickness, if applicable, and clearance between the wall face and roadways is maintained for varying pile alignments.

For driven piles, drive piles to the specified elevations in accordance with Section 450 of the *Standard Specifications* with the exception of Article 450-6 or at the Contractor's option and when approved by the Engineer, use vibratory hammers to install full depth of piles.

For drilled-in piles, excavate holes with the dimensions shown in the accepted submittals. If overexcavation occurs, fill to required elevations with no. 57 stone before setting piles. Before placing concrete, support and center piles in excavations and remove any fluid from drilled holes. After placing piles in holes, fill around piles with concrete to the elevations shown in the accepted submittals. Remove any fluid above the concrete and fill remaining portions of holes with flowable fill.

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. Concrete Placement

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 into excavations. Ensure that concrete flows completely around piles. If the water inflow rate is greater than 6" (150 mm) per half hour, propose and obtain acceptance of a concrete placement procedure before placing concrete. Place concrete in a continuous manner and remove all casings.

B. Excavation

If a temporary slope is shown in the accepted submittals, construct soldier pile walls by excavating the slope in accordance with the accepted submittals. Otherwise, construct soldier pile walls from the top down by removing material in front of walls and in between piles as needed.

Excavate in accordance with the accepted submittals and in staged horizontal lifts with heights not to exceed 5 ft (1.5 m). Use timber lagging or some other approved method for temporary support of excavations in accordance with the accepted submittals. Remove flowable fill as necessary to install timber lagging and ensure at least 3" (75 mm) of contact in the horizontal direction between the lagging and pile flanges.

Install temporary support within 24 hours of excavating each lift unless approved otherwise by the Engineer. The installation may be delayed if it can be demonstrated that the delay will not adversely affect the excavation face stability. If the excavation face will be exposed for more than 24 hours, use polyethylene sheets anchored at the top and bottom of the lift to protect the face from changes in moisture content.

If the excavation face becomes unstable at any time, suspend soldier pile wall construction and temporarily stabilize the face by immediately placing an earth berm against the unstable face. Soldier pile wall construction may not proceed until remedial measures are proposed by the Contractor and accepted by the Engineer. A revised soldier pile wall construction plan submittal may be required.

Do not excavate the next lift until the temporary support of excavations for the preceding lift is installed.

C. Wall Drainage Systems

Install wall drainage systems as shown in the accepted submittals. Place and secure geocomposite drain strips with the geotextile side facing away from the wall face. Ensure that drain strips continuously contact the surface to which they are attached and allow for full flow the entire height of the wall. Discontinuous drain strips are not allowed. If splices are needed, overlap drain strips a minimum of 12" (300 mm) such

that flow is not impeded. Connect drain strips to leveling pads by embedding strip ends at least 4" (100 mm) into the no. 57 stone.

Construct drains in accordance with Section 816 of the *Standard Specifications*. Provide drains with positive drainage toward outlets.

D. Leveling Pads, Panels and Concrete Facing

Construct leveling pads and drains at elevations and with dimensions shown in the accepted submittals. Construct drains in accordance with Section 816 of the *Standard Specifications*. Compact no. 57 stone for aggregate leveling pads with a vibratory compactor to the satisfaction of the Engineer.

Set panels against pile flanges as shown in the accepted submittals. Ensure at least 2" (50 mm) of contact in the horizontal direction between the panel faces and pile flanges. If contact can not be maintained, remove panels, fill gaps with joint filler and reset panels. Support panels securely until enough no. 57 stone or backfill is placed to hold panels in place.

Construct cast-in-place reinforced concrete facing in accordance with the accepted submittals and Section 420 of the *Standard Specifications*. Do not remove forms until concrete achieves a minimum compressive strength of 2400 psi (16.5 MPa). Unless required otherwise on the plans, provide a Class 2 Surface Finish for concrete facing in accordance with Article 420-17 of the *Standard Specifications*.

Construct concrete facing joints at a maximum spacing of 30 ft (9 m) unless required otherwise on the plans. Half-inch (13 mm) thick expansion joints in accordance with Article 420-10 of the *Standard Specifications* are required every third joint. Half-inch (13 mm) deep grooved contraction joints in accordance with Subarticle 825-10(B) of the *Standard Specifications* are required for the remaining joints. Stop reinforcement 2" (50 mm) from either side of expansion joints. Seal joints above and behind soldier pile walls between concrete facing and ditches with joint sealer.

If a brick veneer is required as shown on the plans, construct brick masonry in accordance with Section 830 of the *Standard Specifications*. Anchor brick veneers to panels and concrete facing with approved brick to concrete type anchors according to the manufacturer's specifications with a minimum vertical spacing of 16" (400 mm) and a minimum horizontal spacing of 32" (800 mm) with each row staggered 16" (400 mm) from the row of anchors above and below.

E. Backfill

For fill sections or if a temporary slope is shown in the accepted submittals, backfill behind piles and panels or concrete facing in accordance with Article 410-8 of the *Standard Specifications*. Otherwise, backfill voids behind panels, lagging and piles with no. 57 stone as shown in the accepted submittals. Ensure all voids between panels and lagging and between piles, lagging and the excavation face are filled with no. 57 stone. Compact stone to the satisfaction of the Engineer. When separation fabric is

required, overlap fabric a minimum of 18" (450 mm) with seams oriented parallel to the wall face.

F. Coping and Concrete Barrier Rails with Moment Slabs

Construct concrete coping as shown in the accepted submittals. Construct coping and moment slabs in accordance with Section 420 of the *Standard Specifications*. Do not remove forms until concrete achieves a minimum compressive strength of 2400 psi (16.5 MPa). Provide a Class 2 Surface Finish for coping in accordance with Article 420-17 of the *Standard Specifications*. Construct concrete barrier rails with moment slabs in accordance with the plans and concrete barrier rails in accordance with Subarticle 460-3(C) of the *Standard Specifications*.

Construct coping joints at a maximum spacing of 10 ft (3 m). Half-inch (13 mm) thick expansion joints in accordance with Article 420-10 of the *Standard Specifications* are required every third joint. Half-inch (13 mm) deep grooved contraction joints in accordance with Subarticle 825-10(B) of the *Standard Specifications* are required for the remaining joints. Stop coping reinforcement 2" (50 mm) from either side of expansion joints. Seal joints above and behind soldier pile walls between coping and ditches with joint sealer.

G. Coating Cleaning and Repair

After wall construction is complete, clean exposed galvanized or painted surfaces of piles with a 2500 psi (17.2 MPa) pressure washer. Repair galvanized surfaces that are exposed and damaged in accordance with Article 1076-6 of the *Standard Specifications*. Repair painted surfaces that are exposed and damaged by applying 4.0 to 7.0 mils wet of a topcoat to damaged areas with brushes or rollers. Use the same paint for damaged areas as used for the topcoat when painting piles initially. Feather or taper topcoats in damaged areas to be level with surrounding areas.

6.0 MEASUREMENT AND PAYMENT

Soldier Pile Retaining Walls will be measured and paid for in square feet (meters). Soldier pile walls will be measured as the exposed face area with the wall height equal to the difference between the top and bottom of wall elevation. The top of wall elevation is defined as the top of concrete facing or coping unless shown otherwise on the plans. The bottom of wall elevation is defined as where the finished grade intersects the front face of the soldier pile wall. No payment will be made for portions of soldier pile walls below bottom of wall elevations.

The contract unit price bid for *Soldier Pile Retaining Walls* will be full compensation for design, submittals, furnishing labor, tools, equipment and soldier pile wall materials, installing piles, excavating, backfilling and providing temporary support of excavations, wall drainage systems, reinforcement, leveling pads, panels and concrete facing, backfill, no. 57 stone, fabrics, coping and any incidentals necessary to design and construct soldier pile walls in accordance with this provision. If necessary, the contract unit price bid for

Soldier Pile Retaining Walls will also be full compensation for coating piles and providing brick veneers in accordance with the contract.

The contract unit price bid for *Soldier Pile Retaining Walls* does not include the cost for fences, hand rails, ditches, guardrail and barriers. With the exception of concrete barrier rails with moment slabs, see roadway pay items for these items.

Concrete Barrier Rail will be measured and paid for in accordance with Article 460-4 of the *Standard Specifications*. The contract unit price bid for *Concrete Barrier Rail* will be full compensation for providing concrete barrier rails with moment slabs in accordance with the contract and no separate payment for moments slabs will be made.

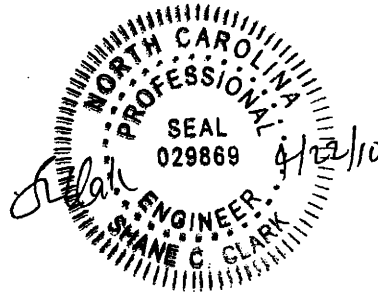
Payment will be made under:

Pay Item

Soldier Pile Retaining Walls

Pay Unit

Square Foot (Meter)



MECHANICALLY STABILIZED EARTH RETAINING WALLS WITH A CAST-IN-PLACE FACE (SPECIAL)

1.0 GENERAL

A. Description

A mechanically stabilized earth (MSE) retaining wall is defined as a soil retaining system with steel or geogrid tensile reinforcements in the reinforced zone and vertical or nearly vertical facing elements. For this provision, the facing elements are temporary and the tensile reinforcements are steel and connected to a cast-in-place reinforced concrete face. Design and construct MSE retaining walls based on actual elevations and dimensions in accordance with the contract and accepted submittals. Use an MSE Wall Installer prequalified by the NCDOT Contractual Services Unit for MSE retaining walls work (work code 3015). For this provision, "MSE wall" refers to a mechanically stabilized earth retaining wall with a cast-in-place face and "MSE Wall Vendor" refers to the vendor supplying the chosen MSE wall system. Also, "concrete facing" refers to a cast-in-place reinforced concrete face.

B. MSE Wall System

Use an MSE wall system supplied by one of the following MSE Wall Vendors. Value engineering proposals for MSE wall systems supplied by other vendors will not be considered.

Hilfiker Retaining Walls
1902 Hilfiker Lane
Eureka, CA 95503
(800) 762-8962
www.hilfiker.com

The Reinforced Earth Company
8614 Westwood Center Drive, Suite 1100
Vienna, VA 22182
(703) 749-4325
www.reinforcedearth.com

Tricon Precast, Ltd.
15055 Henry Road
Houston, TX 77060
(281) 931-9832
www.triconprecast.com

2.0 MSE WALL DESIGN SUBMITTAL

Submit 11 hard copies of working drawings and 3 hard copies of design calculations and an electronic copy (PDF on CD or DVD) of each for the MSE wall design submittal. Provide

the submittal at least 30 calendar days before conducting the MSE wall preconstruction meeting. Do not begin MSE wall construction until the design submittal is accepted.

The Retaining Wall Plans show plan views, typical sections, details, notes and elevation or profile views (wall envelope) for each MSE wall. When noted on plans and before beginning MSE wall design, survey existing ground elevations shown on the plans and submit a revised wall envelope for review and acceptance. Use the accepted revised wall envelope for design.

Design MSE walls in accordance the plans and the *AASHTO Standard Specifications for Highway Bridges* unless otherwise required. Either the simplified or Meyerhof coherent gravity approach is acceptable for determining maximum reinforcement loads. Design reinforcement and connection hardware for non-aggressive backfill with corrosion losses in accordance with the AASHTO specifications. Also, design MSE walls with a minimum reinforcement length of 6 ft (1.8 m) unless shown otherwise on the plans.

If existing or future obstructions such as foundations, guardrail posts, pavements, pipes, inlets or utilities will interfere with reinforcement, maintain a minimum clearance of 3" (75 mm) between the obstruction and reinforcement unless otherwise approved. Place reinforcement within 3" (75 mm) above the corresponding connection elevation.

Extend a continuous drain along the base of the concrete facing in front of the leveling pad. Provide drains meeting the requirements of an aggregate shoulder drain in accordance with Roadway Standard Drawing No. 816.02.

Use select material in the reinforced zone for MSE walls and extend the reinforced zone 6" (150 mm) beyond the end of reinforcement. Use welded wire facing for temporary facing elements and retention fabric to retain select material. Extend fabric at least 4 ft (1.2 m) back behind facing into select material. Separation fabric is required between select material and overlying fill or aggregate with the exception of when concrete pavement is placed directly on the select material. Separation fabric may also be required between stone and backfill or natural ground as determined by the Engineer.

Use 6 inch (150 mm) thick aggregate leveling pads beneath concrete facing. Unless required otherwise on the plans, embed top of leveling pads in accordance with the following.

EMBEDMENT DEPTH

Front Slope (H:V)	Minimum Facing Embedment Depth* (whichever is greater)	
6:1 or Flatter (except abutment walls)	H/20	1 ft (0.3 m)
6:1 or Flatter (abutment walls)	H/10	2 ft (0.6 m)
Steeper than 6:1 to 3:1	H/10	2 ft (0.6 m)

Steeper than 3:1 to 2:1	H/7	2 ft (0.6 m)
* H is from the top of leveling pad to the grade elevation		

Design concrete facing in accordance with the plans and the Load Factor Design method of Section 8 of the *AASHTO Standard Specifications for Highway Bridges* unless otherwise required. Provide reinforcement of sufficient density to satisfy Section 8.16.8.4 of the AASHTO specifications. Use a minimum concrete facing thickness of 8" (200 mm). Extend concrete facing a minimum of 6" (150 mm) above where finished grade intersects the back of MSE walls unless required otherwise on the plans. When barriers are required above MSE walls, use concrete barrier rails with moment slabs in accordance with the plans and design concrete facing for impact loads applied to top of walls as shown on the plans.

Submit working drawings and design calculations for review and acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, wall profiles with maximum applied bearing pressures, typical sections with reinforcement connection details, select material type, retention and separation fabric locations and details of leveling pads, welded wire and concrete facing, bin walls, etc. If necessary, include details on working drawings for concrete barrier rails with moment slabs, reinforcement connected to end bent caps and obstructions interfering with reinforcement or extending through walls. Submit design calculations for each wall section with different surcharge loads, geometry or material parameters. A minimum of one analysis is required for each wall section with different reinforcement lengths. When using a software program other than MSEW by ADAMA Engineering, Inc. for design, provide a hand calculation verifying the analysis of the section with the longest reinforcement length. Have MSE walls designed, detailed and sealed by a Professional Engineer registered in North Carolina.

3.0 MATERIALS

A. Certifications, Storage and Handling

Provide Type 3 Manufacturer's Certifications for all MSE wall materials in accordance with Article 106-3 of the *Standard Specifications*. Load, transport, unload and store MSE wall materials such that they are kept clean and free of damage. Identify, store and handle all fabrics in accordance with ASTM D4873. Fabrics with defects, flaws, deterioration or damage will be rejected. Do not leave fabrics uncovered for more than 7 days.

B. Temporary Facing Elements

Use welded wire reinforcement facing meeting the requirements of AASHTO M55 or M221. Use support struts and wires for welded wire facing meeting the requirements of AASHTO M32.

C. Geotextile Fabrics

Use retention fabrics meeting the requirements of Class 3 and the UV resistance, AOS and permittivity for separation geotextile in accordance with AASHTO M288. Use separation fabrics meeting the requirements of Type 2 Engineering Fabric in accordance with Section 1056 of the *Standard Specifications*.

D. Steel (Inextensible) Reinforcement

Use welded wire reinforcement mesh and mats meeting the requirements of AASHTO M55 or M221 and steel strips or straps meeting the requirements of ASTM A572 or A1011 with a grade as specified in the accepted submittals. Galvanize steel reinforcement in accordance with Section 1076 of the *Standard Specifications*.

E. Select Material

Provide select material meeting the requirements of standard size nos. 57, 67 or 78M in accordance with Sections 1005 and 1014 of the *Standard Specifications*. Use select material free of deleterious materials with a maximum organic content of 1% tested in accordance with AASHTO T267.

F. Miscellaneous Components

Miscellaneous components may include attachment devices, connectors (e.g., pins, bars, plates, etc.), fasteners (e.g., bolts, nuts, etc.) and any other wall components not included above. Galvanize steel components in accordance with Section 1076 of the *Standard Specifications*. Provide miscellaneous components in accordance with the MSE Wall Vendor's recommendations for the chosen MSE wall system.

G. Wall Drainage Systems

Wall drainage systems consist of drains and outlet components. Use shoulder drain materials meeting the requirements of Section 816 of the *Standard Specifications*.

H. Coping, Leveling Concrete and Pads

Provide concrete coping and leveling pads meeting the requirements of Section 1000 of the *Standard Specifications* and reinforcing steel meeting the requirements of Section 1070 of the *Standard Specifications*. Provide precast coping meeting the requirements of Section 1077 of the *Standard Specifications* and leveling concrete for precast coping meeting the requirements of Section 1000 of the *Standard Specifications*.

Use Class A Concrete for coping, leveling concrete and pads in accordance with Article 1000-4 of the *Standard Specifications*. For testing precast coping for compressive strength, 4 cylinders are required per 40 yd³ (31 m³) of concrete or a single day's production, whichever is less.

Use Class VI Select Material in accordance with Section 1016 of the *Standard Specifications* for aggregate leveling pads.

I. Concrete Facing and Concrete Barrier Rails with Moment Slabs

Provide concrete facing and concrete barrier rails with moment slabs meeting the requirements of Section 1000 of the *Standard Specifications*. Use deformed steel bar reinforcement and welded wire fabric meeting the requirements of reinforcing steel in accordance with Section 1070 of the *Standard Specifications*.

Use Class A Concrete for concrete facing and moment slabs and Class AA Concrete for concrete barrier rails in accordance with Article 1000-4 of the *Standard Specifications*.

J. Joint Materials

Use joint materials in accordance with Section 1028 of the *Standard Specifications*.

4.0 CORROSION MONITORING

Corrosion monitoring is required for MSE walls with steel reinforcement. The Engineer will determine the number of monitoring locations and where to install the instrumentation. Contact the NCDOT Materials & Tests (M&T) Unit before beginning wall construction. M&T will provide the corrosion monitoring instrumentation kits and assistance with installation, if necessary.

5.0 MSE WALL PRECONSTRUCTION MEETING

Before starting MSE wall construction, conduct a preconstruction meeting to discuss the construction and inspection of the MSE walls. Schedule this meeting after all MSE wall submittals have been accepted. The Resident or Bridge Maintenance Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, Contractor and MSE Wall Installer Superintendent will attend this preconstruction meeting.

6.0 MSE WALL VENDOR SITE ASSISTANCE

Provide a representative employed by the MSE Wall Vendor to assist and guide the MSE Wall Installer on-site for at least 8 hours when the first welded wire facing and reinforcement layer are placed unless otherwise approved. If problems are encountered during construction, the Engineer may require the vendor representative to return to the site for a time period determined by the Engineer at no additional cost to the Department.

7.0 CONSTRUCTION METHODS

Control drainage during construction in the vicinity of MSE walls. Direct run off away from MSE walls, select material and backfill. Contain and maintain select material and backfill and protect material from erosion.

Perform necessary clearing and grubbing in accordance with Section 200 of the *Standard Specifications*. Excavate as necessary for MSE walls in accordance with the accepted submittals. If applicable and at the Contractor's option, "temporary shoring for wall construction" may be used in lieu of temporary slopes to construct MSE walls. For this provision, temporary shoring for wall construction is defined as temporary shoring not shown on the plans or required by the Engineer including shoring for OSHA reasons or the Contractor's convenience.

Unless prohibited by a note on plans, install foundations located in the reinforced zone before placing select material or the first reinforcement layer. Notify the Engineer when foundation excavation is complete. Do not place welded wire facing, select material or reinforcement until obtaining approval of the excavation depth and foundation material.

Erect and support welded wire facing with no negative batter (wall face leaning forward) such that the final position is as shown in the accepted submittals. Stagger vertical joints of welded wire facing to create a running bond when possible unless shown otherwise on the plans or accepted submittals. Construct MSE walls with a vertical and horizontal tolerance of 3/4 inch (19 mm) when measured with a 10 ft (3 m) straight edge and a final overall vertical plumbness (batter) of less than 1/2 inch per 10 ft (13 mm per 3 m) of wall height.

Place retention fabric as shown in the accepted submittals and cover fabric with at least 3" (75 mm) of select material. Place reinforcement at the locations and elevations shown in the accepted submittals. Do not splice reinforcement. Contact the Engineer when unanticipated existing or future obstructions such as foundations, guardrail posts, pavements, pipes, inlets or utilities will interfere with reinforcement. To avoid obstructions, deflect, skew and modify reinforcement as shown in the accepted submittals.

Place select material in the reinforced zone in 8 to 10 inch (200 to 250 mm) thick lifts. Use only hand operated compaction equipment within 3 ft (1 m) of the wall face. At a distance greater than 3 ft (1 m), compact select material with at least 4 passes of an 8 – 10 ton (7.3 - 9.1 metric ton) vibratory roller. Smooth wheeled or rubber tired rollers are also acceptable for compacting select material. Do not use sheepsfoot, grid rollers or other types of compaction equipment with feet. Compact select material in a direction parallel to the wall face. Do not damage reinforcement when placing and compacting select material. End dumping directly on the reinforcement is not permitted. Do not operate heavy equipment on the reinforcement until it is covered with at least 10" (250 mm) of select material. Replace any damaged reinforcement to the satisfaction of the Engineer. Backfill for wall construction outside the reinforced zone in accordance with Article 410-8 of the *Standard Specifications*.

Install wall drainage systems as shown in the accepted submittals and in accordance with Section 816 of the *Standard Specifications*. Provide drains with positive drainage towards outlets.

Place and construct coping and leveling concrete as shown in the accepted submittals. Construct cast-in-place concrete coping, leveling concrete and moment slabs in accordance with Section 420 of the *Standard Specifications*. Do not remove forms until concrete

achieves a minimum compressive strength of 2400 psi (16.5 MPa). Provide a Class 2 Surface Finish for cast-in-place concrete coping in accordance with Article 420-17 of the *Standard Specifications*. Construct concrete barrier rails with moment slabs in accordance with the plans and concrete barrier rails in accordance with Subarticle 460-3(C) of the *Standard Specifications*.

Compact standard size no. 57 stone for aggregate leveling pads with a vibratory compactor to the satisfaction of the Engineer. Construct cast-in-place reinforced concrete facing in accordance with the accepted submittals and Section 420 of the *Standard Specifications*. Do not remove forms until concrete achieves a minimum compressive strength of 2400 psi (16.5 MPa). Unless required otherwise on the plans, provide a Class 2 Surface Finish for concrete facing in accordance with Article 420-17 of the *Standard Specifications*.

Construct concrete facing joints at a maximum spacing of 30 ft (9 m) unless required otherwise on the plans. Half-inch (13 mm) thick expansion joints in accordance with Article 420-10 of the *Standard Specifications* are required every third joint. Half-inch (13 mm) deep grooved contraction joints in accordance with Subarticle 825-10(B) of the *Standard Specifications* are required for the remaining joints. Stop reinforcement 2" (50 mm) from either side of expansion joints.

Construct concrete barrier rails with moment slabs in accordance with the plans. Construct moment slabs in accordance with Section 420 of the *Standard Specifications* and concrete barrier rails in accordance with Subarticle 460-3(C) of the *Standard Specifications*. When separation fabric is required, overlap fabric a minimum of 18" (450 mm) with seams oriented parallel to the wall face. Seal joints above and behind MSE walls between coping and ditches with joint sealer as shown on the plans.

Construct cast-in-place concrete coping joints at a maximum spacing of 10 ft (3 m) to coincide with vertical joints between panels or blocks. Half-inch (13 mm) thick expansion joints in accordance with Article 420-10 of the *Standard Specifications* are required every third joint. Half-inch (13 mm) deep grooved contraction joints in accordance with Subarticle 825-10(B) of the *Standard Specifications* are required for the remaining joints. Stop coping reinforcement 2" (50 mm) from either side of expansion joints.

8.0 MEASUREMENT AND PAYMENT

MSE Retaining Walls will be measured and paid for in square feet (meters). MSE walls will be measured as the exposed concrete facing area with the wall height equal to the difference between the top and bottom of wall elevation. The top of wall elevation is defined as the top of coping unless shown otherwise on the plans. The bottom of wall elevation is defined as where the finished grade intersects the front face of the MSE wall. No payment will be made for portions of MSE walls below bottom of wall elevations.

The contract unit price bid for *MSE Retaining Walls* will be full compensation for design, submittals, furnishing labor, tools, equipment and MSE wall materials, excavating, backfilling, hauling and removing excavated materials and providing site assistance,

welded wire facing, fabrics, coping, reinforcement, select material, miscellaneous components, wall drainage systems, leveling pads, concrete facing and any incidentals necessary to design and construct MSE walls in accordance with this provision. If necessary, the contract unit price bid for *MSE Retaining Walls* will also be full compensation for reinforcement connected to and select material behind end bent caps in the reinforced zone in accordance with the contract.

No separate payment will be made for temporary shoring for wall construction. Temporary shoring for wall construction will be considered incidental to the contract unit price bid for *MSE Retaining Walls*.

Payment will be made under:

Pay Item

MSE Retaining Walls

Pay Unit

Square Foot (Meter)

