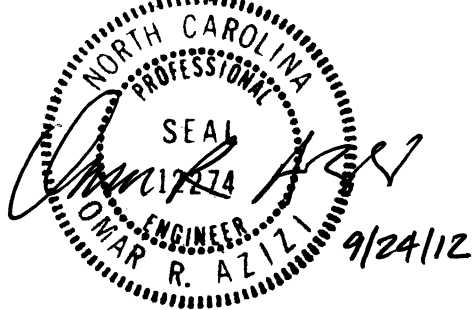


Project Special Provisions

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except special provisions #23, #24

**PROJECT SPECIAL PROVISIONS****STRUCTURE****PROJECT F-5500****CRAVEN COUNTY****SCOPE OF WORK:****(SPECIAL)**

This project consists of proposed Pivot Bent, Bulkhead, Lift Bent, Concrete Counterweights, Steel Pipe Piles, Dolphins, Ultra High Molecular Weight Polyethylene, Ramp A and Epoxy Skid Resistant Overlay. The existing bulkhead and anchor rods shall be removed as necessary to facilitate the construction of the proposed Ramp A at the Cherry Branch Ferry Landing. A new electrical system, hydraulic, and lubrication system shall be installed along with new hardware on the proposed lift bent.

Payment at the contract unit prices for the various pay items will be full compensation for all materials, equipment, tools, labor, and incidentals necessary to complete the above work.

**PILES****(1-17-12)**

Revise the *Standard Specifications* as follows:

Replace Section 450 with the following:

**SECTION 450****PILES****450-1 DESCRIPTION**

Furnish and drive bearing piles as shown on the plans and as directed by the Engineer to the required bearing and penetration. Furnish, weld, and attach steel pile points, pipe pile plates, pile tips and splicers; provide collars, hardware, concrete, reinforcing steel, and all other materials; furnish all equipment, preauger through embankments, install piles vertically or on a batter; galvanize, cut off, splice, and build up piles; place concrete and reinforcing steel; construct pile trestles; furnish and place temporary bracing; remove any obstructions; wrap, bolt, or fasten timber fender piles; and abandon, remove, replace, and restrike or redrive piles as necessary.

**450-2 MATERIALS**

Refer to Division 10.

<b>Item</b>	<b>Section</b>
Portland Cement Concrete	1000
Reinforcing Steel	1070
Timber, Steel and Prestressed Concrete Piles	1084-1
Steel Pipe Pile Plates	1072

**450-3 PREPARATION FOR DRIVING**

If applicable, completely excavate for the cap and/or footing before installing piles. If applicable and unless noted otherwise on the plans, construct the embankment to the bottom of cap or footing elevation for a horizontal distance of 50 ft (15 m) from any pile except where fill slopes are within 50 ft (15 m) of a pile. If preaugering through an embankment is necessary before driving prestressed concrete piles, submit the preaugering and pile installation methods with the proposed pile driving methods and equipment for approval.

**450-4 DETERMINATION OF PILE LENGTH**

The estimated total pile lengths per structure shown on the plans are for bid purposes only. Determine pile lengths and furnish piling of sufficient length to obtain the required bearing and penetration and the required embedment into the cap or footing as shown on the plans. As an option and at no cost to the Department, make investigations as necessary to determine the required pile lengths.

**450-5 DRIVING EQUIPMENT**

Submit the proposed pile driving methods and equipment including the pile driving hammer, hammer cushion, pile helmet and cushion, if any. Do not submit more than two pile driving hammers per pile type per submittal. Submit this information for approval at least 20 working days before driving piles. All equipment is subject to satisfactory field performance.

Drive bearing piles with approved driving equipment using steam, air, or diesel hammers. Use pile driving hammers with an energy that will not overstress the piles during driving and provide the required driving resistance at blows per foot ranging from 36 to 96, unless otherwise approved. Use a variable energy hammer to drive prestressed concrete piles.

Operate steam, air, or diesel hammers at the length of stroke and number of blows per minute required by the Engineer. Operate air and steam hammers within 10% of the manufacturer's rated speed in blows per minute or the rate approved by the Engineer.

Provide plant and equipment for air or steam hammers with sufficient capacity to maintain, under working conditions, the volume and pressure specified by the manufacturer. Equip the plant and equipment with accurate pressure gauges that are easily accessible. Use striking parts of air and steam hammers that weigh at least 1/3 the weight of the pile helmet and pile, with a minimum weight of 2,750 lb (1,250 kg).

Equip open-end (single acting) diesel hammers with a graduated scale (jump stick) extending above the ram cylinder, graduated rings or grooves on the ram, or an electric sound activated remote measuring instrument to allow the Engineer to visually determine hammer stroke at all times during pile driving operations.

Equip closed-end (double acting) diesel hammers with a calibrated bounce chamber pressure gauge, in good working order, mounted near ground level and easily read by the Engineer. Also, provide a current calibrated chart or graph equating bounce chamber pressure and gauge hose length to equivalent energy for the closed-end diesel hammer used. Submit this chart or graph with the proposed pile driving methods and equipment required above.

Protect and hold pile heads in position with an approved pile helmet. Make sure that the pile helmet closely fits the top of the pile and extends down the sides of the pile a sufficient distance to hold the pile in position. Protect the heads of concrete and timber piles from direct impact with an approved pile cushion. Provide collars or bands to protect timber piles against splitting or brooming where required.

#### **450-6 ACCURACY OF DRIVING**

Drive piles so that the axial alignment is within 1/4" (6 mm) per foot from the vertical or batter shown on the plans. Horizontally, keep the pile within 3" (75 mm) of the plan location longitudinally and transversely. Maintain pile embedment in the cap or footing to within 3" (75 mm) more or 2" (50 mm) less than that shown on the plans. No additional payment is made for increased cap or footing dimensions necessary due to piles driven out of position.

#### **450-7 CONSTRUCTION METHODS**

##### **(A) General**

Unless approved otherwise or directed by the Engineer, do not drive piles within 50 ft (15 m) of cast-in-place concrete until the concrete attains an age of at least 3 curing days. When approved by the Engineer, the Contractor may use vibratory hammers to install the initial portions of steel piles. The Engineer will approve the depth of pile installation with the vibratory hammer. Do not use vibratory hammers to install prestressed concrete piles.

The Engineer will inspect the capblock before beginning each pile driving project and periodically throughout the duration of the project, depending on driving conditions as determined by the Engineer. Expose the hammer cushion for inspection as directed by the Engineer. Replace or repair any hammer cushion that is less than 25% of the original thickness.

Do not exceed the allowable pile driving stresses during the entire driving time. Allowable pile driving stresses are defined in the *AASHTO Standard Specifications for Highway Bridges*. Drive piles to the required tip elevation or penetration into natural ground, whichever is lower, in a continuous operation unless stopped due to exceeding the maximum blow count or the allowable pile driving stresses, insufficient pile length, or other reasons approved by the Engineer. Once the required embedment is achieved, the Engineer may require the Contractor to stop driving and wait before restriking to allow for soil setup.

Use a pile cushion made of pine plywood with a 4" (100 mm) minimum thickness for driving prestressed concrete piles. When using a pile cushion, provide a new cushion for each pile unless otherwise approved. Replace the pile cushion if, during the driving of any pile, the cushion is either compressed more than one-half the original thickness or begins to burn.

Redrive any pile raised or moved laterally by the driving of adjacent piles.

**(B) Timber Piles**

Store and handle timber piles by methods that do not damage the pile. Take care to avoid breaking the surface of treated piles. Do not use cant-hooks, dogs, or pike-poles. Treat cuts or breaks in the surface of treated piles in an approved manner.

Cut off the tops of all piles at the elevation shown on the plans. Except where a cast-in-place concrete cap or footing is constructed, cut off piles to a plane that provides true bearing on every pile without the use of shims. Withdraw any pile damaged during driving operations, driven out of its proper location or below the cut-off grade and replace with a new pile, or otherwise correct as directed by the Engineer.

Thoroughly brush-coat the sawn surface of all timber piles not encased in concrete with 3 applications of approved preservative treatment and then cover with a coat of hot roofing pitch or other approved hot bituminous material. Place a sheet of galvanized iron or aluminum upon each pile head, bend it down over the sides of the pile, neatly trim and firmly secure to the pile with large headed galvanized roofing nails. Use sheets of iron that are 24 gauge and 24" (600 mm) by 24" (600 mm) in size. If using aluminum, use the same size as specified for galvanized iron sheets with a minimum thickness of 0.032" (0.81 mm).

**(C) Prestressed Concrete Piles**

Handle, transport, and store prestressed concrete piles by methods that do not damage the pile and support the piles at the pick-up points shown on the plans or along their full length. Replace piles damaged in handling or driving unless they are repaired to an acceptable condition.

When driving or cutting off piles below the elevation shown on the plans, build up the pile section to the plan elevation as shown on the plans unless otherwise directed by the Engineer.

Cut off piles not driven to grade perpendicular to the axis of the pile by means that do not result in spalling or other damage to the pile. Use steel pile tips with prestressed concrete piles when shown on the plans. Use pile splicers for splicing steel pile tips. Contact the Materials and Tests Unit for a list of approved pile splicers. Submit pile splicer specifications with the manufacturer's attachment detail to the Engineer for approval before installation.

**(D) Steel Piles**

Handle and store steel piles by methods that do not damage the pile. Store the piles above ground upon platforms, blocks, or other supports and keep the piles free from dirt, grease, and other foreign matter, and protect insofar as is practicable from corrosion. Do not damage coatings on steel piles. Protect coatings when driving piles through templates in an approved manner.

When shown on the plans, galvanize steel piles in accordance with Section 1076. Prepare the pile surface and provide materials in accordance with the applicable portions of this section.

Use pile points for steel piles when shown on the plans or as directed by the Engineer. Contact the Materials and Tests Unit for a list of approved pile points. Weld pile points to piles in accordance with the manufacturers' details as approved by the Engineer. The minimum weld length is twice the width of the flange.

Furnish plates for pipe piles when shown on the plans or as directed by the Engineer. Weld plates to the bottom of pipe piles as shown on the plans. Use pipe pile plates with a thickness as shown on the plans and that meets the requirements of ASTM A709, Grade 50.

Cut off piles at the required elevations along a plane normal to the axis of the pile. Use approved methods for cutting off piles.

Use welded butt splices for steel piles as shown on the plans. Do not use more than 3 pieces (2 splices) of steel pile in making up one full-length pile.

**(E) Redriving Piles**

Once the required pile embedment has been achieved, the Contractor may choose to or the Engineer may require restriking or redriving piles. If the Contractor chooses to stop driving and then restrike or redrive piles, no payment will be made for restrikes or redrives. If the Engineer requires the Contractor to stop driving and then restrike or redrive piles, the payment will be made in accordance with Article 450-9. When the Engineer requires restrikes or redrives, the Engineer will determine the time to wait after stopping driving and the number of restrikes or redrives. However, the maximum number of restrikes or redrives per pile during any 48 hour period will not exceed three. The minimum time separation between redrives required by the Engineer is 4 hours.

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

#### **450-8 PENETRATION AND WAVE EQUATION**

When no tip elevation is shown on the plans, drive piles to the required bearing capacity and a penetration of at least 10 ft (3 m) into natural ground unless otherwise directed by the Engineer. When a tip elevation is shown on the plans, drive piles to the required bearing capacity and the specified tip elevation. When noted on the plans, drive piles to additional capacity to account for downdrag or negative skin friction and scour.

Natural ground within an area of new embankment is defined as the bottom of the embankment or bottom of footing on piles, whichever is lower.

The Engineer will use the wave equation analysis to evaluate the suitability of the proposed pile driving methods and equipment to evaluate pile driving stresses and estimate the driving resistance in order to achieve the required bearing capacity. The required driving resistance in blows per foot or any equivalent set is based upon the bearing capacity shown on the plans with a minimum safety factor of 2 plus any additional capacity to account for downdrag or negative skin friction and scour, when applicable. The Engineer will provide the required driving resistance based upon the wave equation analysis and pile driving analyzer results, if applicable, using the approved pile driving methods and equipment.

Stop driving piles when practical refusal is reached, unless otherwise directed by the Engineer. Practical refusal is defined as 180 blows per foot (0.3 m) or any equivalent set.

#### **450-9 MEASUREMENT AND PAYMENT**

*Piles (Treated Timber Piles, \_\_\_\_\_ Prestressed Concrete Piles, \_\_\_\_\_ Steel Piles or \_\_\_\_\_ Galvanized Steel Piles)* will be measured and paid as the actual number of linear feet (meters) of piles incorporated into the completed and accepted structure. This quantity is measured as the length of pile before driving minus any pile cut-offs. No payment will be made for pile cut-offs or cutting off piles. However, once the required bearing and penetration has been achieved, the Contractor may drive the remaining portion of a pile to grade in lieu of cutting off the pile provided the remaining portion does not exceed 5 ft (1.5 m) and the pile can be driven without damaging the pile or reaching the maximum blow count or practical refusal. When this occurs, the additional length of pile driven will be measured as described above.

For prestressed concrete piles that are built up, the quantity of piles to be paid for will also include the actual number of linear feet (meters) added to the original pile length by the build-up. Steel pile tips are not included in the quantity of prestressed concrete piles. No payment will be made for steel pile tips or pile splicers and any associated hardware or welding. The cost for these items will be considered incidental to the cost of the prestressed concrete pile.

*Pile points* will be measured and paid for per each for the actual number of pile points incorporated into the completed and accepted structure.

*Pipe pile plates* will be measured and paid for per each for the actual number of plates incorporated into the completed and accepted structure.

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

No payment will be made for any defective or rejected piles or any piles driven for falsework, bracing, or temporary work bridges.

The prices and payments will be full compensation for all items required to provide bearing piles including but not limited to those items contained in Article 450-1.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
___ Prestressed Concrete Piles	Linear Foot
___ Steel Piles	Linear Foot
___ Galvanized Steel Piles	Linear Foot
Steel Pile Points	Each
Pipe Pile Plates	Each
Pile Redrives	Each

**THERMAL SPRAYED COATINGS (METALLIZATION)**

**(9-30-11)**

**1.0 DESCRIPTION**

Apply a thermal sprayed coating (TSC) and sealer to metal surfaces as specified herein when called for on the plans or by other Special Provisions, or when otherwise approved by the Engineer in accordance with the SSPC-CS 23.00/AWS C2.23/NACE No. 12 Specification. Only Arc Sprayed application methods are used to apply TSC coatings, the Engineer must approve other methods of application.



## 2.0 QUALIFICATIONS

Only use NCDOT approved TSC Contractors meeting the following requirements:

1. The capability of blast cleaning steel surfaces to SSPC SP-5 and SP-10 Finishes.
2. Employ Spray Operator(s) qualified in accordance with AWS C.16/C2.16M2002 and Quality Control Inspector(s) who have documented training in the applicable test procedures of ASTM D-3276 and SSPC-CS 23.00.

A summary of the contractor's related work experience and the documents verifying each Spray Operator's and Quality Control Inspector's qualifications are submitted to the Engineer before any work is performed.

## 3.0 MATERIALS

Provide wire in accordance with the metallizing equipment manufacturer's recommendations. Use the wire alloy specified on the plans which meets the requirements in Annex C of the SSPC-CS 23.00 Specification. Have the contractor provide a certified analysis (NCDOT Type 2 Certification) for each lot of wire material.

Apply an approved sealer to all metallized surfaces in accordance with Section 9 of SSPC-CS 23. The sealer must either meet SSPC Paint 27 or is an alternate approved by the Engineer.

## 4.0 SURFACE PREPARATION AND TSC APPLICATION

Grind flame cut edges to remove the carbonized surface prior to blasting. Bevel all flame cut edges in accordance with Article 442-10(D) regardless of included angle. Blast clean surfaces to be metallized with grit or mineral abrasive in accordance with Steel Structures Painting Council SSPC SP-5/10(as specified) to impart an angular surface profile of 2.5 - 4.0 mils. Surface preparation hold times are in accordance with Section 7.32 of SSPC-CS 23. If flash rusting occurs prior to metallizing, blast clean the metal surface again. Apply the thermal sprayed coating only when the surface temperature of the steel is at least 5°F above the dew point.

At the beginning of each work period or shift, conduct bend tests in accordance with Section 6.5 of SSPC-CS 23.00. Any disbonding or delamination of the coating that exposes the substrate requires corrective action, additional testing, and the Engineer's approval before resuming the metallizing process.

Apply TSC with the alloy to the thickness specified on the plans or as provided in the table below. All spot results (the average of 3 to 5 readings) must meet the minimum requirement. No additional tolerance (as allowed by SSPC PA-2) is permitted. (For Steel

Beams: For pieces with less than 200 ft<sup>2</sup> measure 2 spots/surface per piece and for pieces greater than 200 ft<sup>2</sup> add 1 additional spots/surface for each 500 ft<sup>2</sup>).

<b>Application</b>	<b>Thickness</b>	<b>Alloy</b>	<b>Seal Coat</b>
Pot Bearings	8 mil	85/15 Zinc (W-Zn-Al-2)	0.5 mil
Armored Joint Angles	8 mil	85/15 Zinc (W-Zn-Al-2)	0.5 mil
Modular Joints	8 mil	99.99% Zn (W-Zn-1)	0.5 mil
Expansion Joint Seals	8 mil	99.99% Zn (W-Zn-1)	0.5 mil
Optional Disc Bearings	8 mil	85/15 Zinc (W-Zn-Al-2)	0.5 mil

When noted on the plans or as specified in the above chart, apply the sealer to all metallized surfaces in accordance with the manufacturer's recommendations and these provisions. Apply the seal coat only when the air temperature is above 40°F and the surface temperature of the steel is at least 5°F above the dew point. If the sealer is not applied within eight hours after the final application of TSC, the applicator verifies acceptable TSC surfaces and obtains approval from the Engineer before applying the sealer.

## 5.0 INSPECTION FREQUENCY

The TSC Contractor must conduct the following tests at the specified frequency and the results documented in a format approved by the Engineer.

<b>Test/Standard</b>	<b>Location</b>	<b>Frequency</b>	<b>Specification</b>
Ambient Conditions	Site	Each Process	5°F above the dew point
Abrasive Properties	Site	Each Day	Size, angularity, cleanliness
Surface Cleanliness SSPC Vis 1	All Surfaces	Visual All Surfaces	SSPC-SP-10 Atmospheric Service SSPC-SP - 5 Immersion Service
Surface Profile ASTM D-4417 Method C	Random Surfaces	3 per 500 ft <sup>2</sup>	2.5 - 4.0 mils
Bend Test SSPC-CS 23.00	Site	5 per shift	Pass Visual
Thickness SSPC PA-2R SSPC-CS 23.00	Each Surface	Use the method in PA-2 Appendix 3 for Girders and Appendix 4 for frames and miscellaneous steel. See Note 1.	Zn - 8 mils minimum Al - 8 mils minimum Zn Al - 8 mils minimum  Areas with more than twice the minimum thickness are inspected for compliance to the adhesion and cut testing requirements of this specification.
Adhesion ASTM 4541	Random Surfaces Splice Areas	1 set of 3 per 500 ft <sup>2</sup>	Zn > 500 psi Al > 1000 psi Zn Al > 750 psi
Cut Test - SSPC-CS 23.00	Random Surfaces	3 sets of 3 per 500 ft <sup>2</sup>	No peeling or delamination
Job Reference Std. SSPC-CS 23.00	Site	1 per job	Meets all the above requirements

## 6.0 REPAIRS

All Repairs are to be performed in accordance with the procedures below, depending on whether the repair surface is hidden or exposed. As an exception to the following, field welded splices on joint angles and field welding bearing plates to girders may be repaired in accordance with the procedures for hidden surfaces.

**For hidden surfaces (including but not limited to interior girders, interior faces of exterior girders, and below-grade sections of piles):**

1. Welding of metallized surfaces may be performed only if specifically permitted by the Engineer. Remove metallizing at the location of field welds by blast cleaning (SSPC SP-6 finish), or hand (SSPC SP-2 finish) or power tool cleaning (SSPC SP-3 finish) just prior to welding. Clean sufficiently to prevent contamination of the weld. All repairs to welded connections are metallized in accordance with SSPC CS 23.00.
2. Minor areas less than or equal to  $0.1 \text{ ft}^2$  exposing the substrate are metallized in accordance with SSPC CS 23.00 or painted in accordance with ASTM A780, "Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings."
3. Large areas greater than  $0.1 \text{ ft}^2$  exposing the substrate are metallized in accordance with SSPC CS 23.00.
4. Damaged (burnished) areas not exposing the substrate with less than the specified coating thickness are metallized in accordance with SSPC CS 23.00 or painted in accordance with ASTM A780, "Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings."
5. Damaged (burnished) areas not exposing the substrate with more than the specified coating thickness are not repaired.
6. Defective coating is repaired by either method 2 or 3 depending on the area of the defect.

**For Exposed Surfaces (including but not limited to exterior faces of exterior girders and above-grade sections of piles):**

1. Welding of metallized surfaces may be performed only if specifically permitted by the Engineer. Remove metallization at the location of field welds by blast cleaning (SSPC SP-6 finish), or hand (SSPC SP-2 finish) or power tool cleaning (SSPC SP-3 finish) just prior to welding. Clean sufficiently to prevent contamination of the weld. All repairs to welded connections are metallized in accordance with SSPC CS 23.00.
2. All areas exposing the substrate are metallized in accordance with SSPC CS 23.00
3. Defective coating is repaired by either method 2 or 3 depending on the area of the defect.

## 7.0 TWELVE MONTH OBSERVATION PERIOD

The contractor maintains responsibility for the coating system for a twelve (12) month observation period beginning upon the satisfactory completion of all the work required in the plans or as directed by the engineer. The contractor must guarantee the coating system under the payment and performance bond (refer to Article 109-10). To successfully complete the observation period, the coating system must meet the following requirements after twelve(12) months service:

- No visible rust, contamination or application defect is observed in any coated area.
- Painted surfaces have a uniform color and gloss.
- Surfaces have an adhesion of no less than 500 psi when tested in accordance with ASTM D-4541.

## 8.0 BASIS OF PAYMENT

The contract price bid for the bridge component to which the coating is applied will be full compensation for the thermal sprayed coating.

## 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

(4-5-12)

### 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.

On the drawings, show all information necessary to allow the design of any component to be checked independently as determined by the Engineer.

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.

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.

As an option for the Contractor, overhang falsework hangers may be uniformly spaced, at a maximum of 36 inches, provided the following conditions are met:

Member Type (PCG)	Member Depth, (inches)	Max. Overhang Width, (inches)	Max. Slab Edge Thickness, (inches)	Max. Screenshot Wheel Weight, (lbs.)	Bracket Min. Vertical Leg Extension, (inches)
II	36	39	14	2000	26
III	45	42	14	2000	35
IV	54	45	14	2000	44
MBT	63	51	12	2000	50
MBT	72	55	12	1700	48

Overhang width is measured from the centerline of the girder to the edge of the deck slab.

For Type II, III & IV prestressed concrete girders (PCG), 45-degree cast-in-place half hangers and rods must have a minimum safe working load of 6,000 lbs.

For MBT prestressed concrete girders, 45-degree angle holes for falsework hanger rods shall be cast through the girder top flange and located, measuring along the top of the member, 1'-2 1/2" from the edge of the top flange. Hanger hardware and rods must have a minimum safe working load of 6,000 lbs.

The overhang bracket provided for the diagonal leg shall have a minimum safe working load of 3,750 lbs. The vertical leg of the bracket shall extend to the point that the heel bears on the girder bottom flange, no closer than 4 inches from the bottom of the member. However, for 72-inch members, the heel of the bracket shall bear on the web, near the bottom flange transition.

Provide adequate overhang falsework and determine the appropriate adjustments for deck geometry, equipment, casting procedures and casting conditions.

If the optional overhang falsework spacing is used, indicate this on the falsework submittal and advise the girder producer of the proposed details. Failure to notify the Engineer of hanger type and hanger spacing on prestressed concrete girder casting drawings may delay the approval of those drawings.

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 on concrete girders with thin top flanges. 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.

When staged construction of the bridge deck is required, detail falsework and forms for screed and fluid concrete loads to be independent of any previous deck pour components when the mid-span girder deflection due to deck weight is greater than  $\frac{3}{4}$ ".

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.

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. 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 above ground	Pressure, lb/ft <sup>2</sup> for Indicated Wind Velocity, mph				
	70	80	90	100	110
0 to 30	15	20	25	30	35
30 to 50	20	25	30	35	40
50 to 100	25	30	35	40	45
over 100	30	35	40	45	50

#### 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)	COUNTY	25 YR (mph)	COUNTY	25 YR (mph)
Alamance	70	Franklin	70	Pamlico	100
Alexander	70	Gaston	70	Pasquotank	100
Alleghany	70	Gates	90	Pender	100
Anson	70	Graham	80	Perquimans	100
Ashe	70	Granville	70	Person	70
Avery	70	Greene	80	Pitt	90
Beaufort	100	Guilford	70	Polk	80
Bertie	90	Halifax	80	Randolph	70
Bladen	90	Harnett	70	Richmond	70
Brunswick	100	Haywood	80	Robeson	80
Buncombe	80	Henderson	80	Rockingham	70
Burke	70	Hertford	90	Rowan	70
Cabarrus	70	Hoke	70	Rutherford	70
Caldwell	70	Hyde	110	Sampson	90
Camden	100	Iredell	70	Scotland	70
Carteret	110	Jackson	80	Stanley	70
Caswell	70	Johnston	80	Stokes	70
Catawba	70	Jones	100	Surry	70
Cherokee	80	Lee	70	Swain	80
Chatham	70	Lenoir	90	Transylvania	80
Chowan	90	Lincoln	70	Tyrell	100
Clay	80	Macon	80	Union	70
Cleveland	70	Madison	80	Vance	70
Columbus	90	Martin	90	Wake	70
Craven	100	McDowell	70	Warren	70
Cumberland	80	Mecklenburg	70	Washington	100
Currituck	100	Mitchell	70	Watauga	70
Dare	110	Montgomery	70	Wayne	80
Davidson	70	Moore	70	Wilkes	70
Davie	70	Nash	80	Wilson	80
Duplin	90	New Hanover	100	Yadkin	70
Durham	70	Northampton	80	Yancey	70
Edgecombe	80	Onslow	100		
Forsyth	70	Orange	70		

## 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.

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.

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.

## 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. 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**

(2-10-12)

**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](mailto:plambert@ncdot.gov) (Paul Lambert)

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

[jgaither@ncdot.gov](mailto:jgaither@ncdot.gov) (James Gaither)

[jlbolden@ncdot.gov](mailto:jlbolden@ncdot.gov) (James Bolden)

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) 707 – 6407  
 (919) 250 – 4082 facsimile  
[plambert@ncdot.gov](mailto:plambert@ncdot.gov)

Secondary Structures Contacts: James Gaither (919) 707 – 6409  
 James Bolden (919) 707 – 6408

Eastern Regional Geotechnical Contact (Divisions 1-7):

K. J. Kim (919) 662 – 4710  
 (919) 662 – 3095 facsimile  
[kkim@ncdot.gov](mailto: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.

**STRUCTURE SUBMITTALS**

<b>Submittal</b>	<b>Copies Required by Structure Design Unit</b>	<b>Copies Required by Geotechnical Engineering Unit</b>	<b>Contract Reference Requiring Submittal <sup>1</sup></b>
Arch Culvert Falsework	5	0	Plan Note, SN Sheet & “Falsework and Formwork”
Box Culvert Falsework <sup>7</sup>	5	0	Plan Note, SN Sheet & “Falsework and Formwork”
Cofferdams	6	2	Article 410-4
Foam Joint Seals <sup>6</sup>	9	0	“Foam 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 <sup>2</sup> (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 <sup>4,5</sup>	7	0	Article 1072-8
Miscellaneous Metalwork <sup>4,5</sup>	7	0	Article 1072-8
Optional Disc Bearings <sup>4</sup>	8	0	“Optional Disc Bearings”

Overhead and Digital Message Signs (DMS) (metalwork and foundations)	13	0	Applicable Provisions
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20
Pot Bearings <sup>4</sup>	8	0	“Pot Bearings”
Precast Concrete Box Culverts	2, then 1 reproducible	0	“Optional Precast Reinforced Concrete Box Culvert at Station ____”
Prestressed Concrete Cored Slab (detensioning sequences) <sup>3</sup>	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 (precast items)	10	0	Article 1077-2 & “Sound Barrier Wall”
Sound Barrier Wall Steel Fabrication Plans <sup>5</sup>	7	0	Article 1072-8 & “Sound Barrier Wall”
Structural Steel <sup>4</sup>	2, then 7	0	Article 1072-8
Temporary Detour Structures	10	2	Article 400-3 & “Construction, Maintenance and Removal of Temporary Structure at Station ____”
TFE Expansion Bearings <sup>4</sup>	8	0	Article 1072-8



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 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 1072-8 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**

<b>Submittal</b>	<b>Copies Required by Geotechnical Engineering Unit</b>	<b>Copies Required by Structure Design Unit</b>	<b>Contract Reference Requiring Submittal <sup>1</sup></b>
Drilled Pier Construction Plans <sup>2</sup>	1	0	Subarticle 411-3(A)
Crosshole Sonic Logging (CSL) Reports <sup>2</sup>	1	0	Subarticle 411-5(A)(2)
Pile Driving Equipment Data Forms <sup>2,3</sup>	1	0	Subarticle 450-3(D)(2)
Pile Driving Analyzer (PDA) Reports <sup>2</sup>	1	0	Subarticle 450-3(F)(3)
Retaining Walls <sup>4</sup>	8 drawings, 2 calculations	2 drawings	Applicable Provisions
Temporary Shoring <sup>4</sup>	5 drawings, 2 calculations	2 drawings	“Temporary Shoring” & “Temporary Soil Nail Walls”

**FOOTNOTES**

- 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. Subarticles refer to the *Standard Specifications*.
- Submit one hard copy of submittal to the Resident or Bridge Maintenance Engineer. Submit a second copy of submittal electronically (PDF via email) or by facsimile, US mail or other delivery service to the appropriate Geotechnical Engineering Unit regional office. Electronic submission is preferred.
- The Pile Driving Equipment Data Form is available from:  
[www.ncdot.org/doh/preconstruct/highway/geotech/formdet/](http://www.ncdot.org/doh/preconstruct/highway/geotech/formdet/)  
See second page of form for submittal instructions.
- Electronic copy of submittal is required. See referenced provision.

**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**

(9-30-11)

**1.0 DESCRIPTION**

This special provision addresses grout for use in pile blockouts, grout pockets, shear keys, dowel holes and recesses for structures. This provision does not apply to grout placed in post-tensioning ducts for bridge beams, girders, or decks. Mix and place grout in accordance with the manufacturer's recommendations, the applicable sections of the Standard Specifications and this provision.

**2.0 MATERIAL REQUIREMENTS**

Use a Department approved pre-packaged, non-shrink, non-metallic grout. Contact the Materials and Tests Unit for a list of approved pre-packaged grouts and consult the manufacturer to determine if the pre-packaged grout selected is suitable for the required application.

When using an approved pre-packaged grout, a grout mix design submittal is not required.

The grout shall be free of soluble chlorides and contain less than one percent soluble sulfate. Supply water in compliance with Article 1024-4 of the Standard Specifications.

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

Admixtures, if approved by the Department, shall be used in accordance with the manufacturer's recommendations. The manufacture date shall be clearly stamped on each container. Admixtures with an expired shelf life shall not be used.

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

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

Test the expansion and shrinkage of the grout in accordance with ASTM C1090. The grout shall expand no more than 0.2% and shall exhibit no shrinkage. Furnish a Type 4 material certification showing results of tests conducted to determine the properties listed in the Standard Specifications and to assure the material is non-shrink.

Unless required elsewhere in the contract the compressive strength at 3 days shall be at least 5000 psi. Compressive strength in the laboratory shall be determined in accordance with ASTM C109 except the test mix shall contain only water and the dry manufactured material. Compressive strength in the field will be determined by molding and testing 4" x 8" cylinders in accordance with AASHTO T22. Construction loading and traffic loading shall not be allowed until the 3 day compressive strength is achieved.

When tested in accordance with ASTM C666, Procedure A, the durability factor of the grout shall not be less than 80.

**3.0 SAMPLING AND PLACEMENT**

Place and maintain components in final position until grout placement is complete and accepted. Concrete surfaces to receive grout shall be free of defective concrete, laitance, oil, grease and other foreign matter. Saturate concrete surfaces with clean water and remove excess water prior to placing grout.

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Do not place grout if the grout temperature is less than 50°F or more than 90°F or if the air temperature measured at the location of the grouting operation in the shade away from artificial heat is below 45°F.

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.

The Engineer will determine the locations to sample grout and the number and type of samples collected for field and laboratory testing. 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.

**4.0 BASIS OF PAYMENT**

No separate payment will be made for "Grout for Structures". The cost of the material, equipment, labor, placement, and any incidentals necessary to complete the work shall be considered incidental to the structure item requiring grout.

**COORDINATION WITH THE FERRY DIVISION:**

**(SPECIAL)**

During construction, the Contractor shall coordinate with the Ferry Division for utilities. Ferry service shall be maintained at all times at existing Ramp. It is the responsibility of the Contractor to coordinate with the Ferry Division to maintain traffic and keep necessary circuits operational so as not to impede ferry service.

**CONSTRUCTION PROCEDURES:**

**(SPECIAL)**

**General**

The construction shall be as shown on the plans and these special provisions, applicable sections of the Standard Specifications, and as directed by the Engineer. The existing Ramp at the Cherry Branch Site shall be kept in service and operational at all times during construction.

The ferry shall be positioned, held in place and used as a template to ensure proper location of dolphins. During this operation, the location of dolphins may be adjusted as directed by the Engineer for proper fit to ferry.

**REMOVAL OF EXISTING BULKHEAD:****(SPECIAL)**

The existing coping, sheet piles and anchor rods shall be removed in the area of proposed Ramp A as shown on plans and as necessary to facilitate the construction of the proposed bulkhead to a line four feet below the top of the existing bulkhead. The waste material shall be disposed of in accordance with the Standard Specifications. All work, material, and disposal of the existing structures shall be paid for at the Lump Sum Bid Price for "Removal of Existing Bulkhead".

**SELECT MATERIAL:****(SPECIAL)**

Select material shall meet the requirements of Section 1016 of the Standard Specifications for the classification specified on the plans.

The quantity of Select Material, Class VI to be paid for will be the actual number of tons of this material, weighed in trucks on certified platform scales or other certified weighing devices which have been used for backfill material.

The quantity of Select Material, Class III to be paid for will be the actual number of cubic yard of this material, as measured by the engineer.

The quantity of select material, measured as provided above, will be paid for at the contract unit price for "Select Material, Class VI" and "Select Material, Class III" Such price and payment will be full compensation for all work necessary to provide the select material including hauling, furnishing, and placing the backfill material.

**PERMANENT ANCHOR TIEBACK SYSTEM:****(SPECIAL)****1.0 DESCRIPTION OF WORK:**

This work shall consist of furnishing materials for and construction of the proposed anchor tieback system in accordance with these specifications and in reasonably close conformity with the lines, grades, dimensions, and design shown on the plans or established by the Engineer.

Progress and sequence of the work shall be approved by the Engineer. In general, once work is begun, the completion of work must be expedited.

All materials to be as specified or better, and as approved by the Engineer. Requests for substitutions shall be submitted to the Engineer thirty (30) days before intended installation.

**2.0 MATERIALS:****A. Anchor Rods:**

Anchor Rods shall be fabricated from steel bars conforming to ASTM Designation A722. Anchor Rods shall be installed according to the plans. Care shall be taken not to damage the existing anchor rods. Extreme care shall be

taken not to damage the proposed anchor rods or their corrosion protection during installation and backfilling.

- B. Couplers and nuts for anchor rods shall be capable of developing 100% of the guaranteed minimum ultimate tensile strength of the rod.
- C. Cast-in-place concrete, reinforcing steel, prestressed concrete piles used as soldier piles and all other materials not having specific project requirements shall conform to the applicable sections of the Standard Specifications.

### 3.0 CORROSION PROTECTION:

#### General:

Anchor rods shall be doubly protected against corrosion. Corrosion protection begins with the storage, fabrication, and handling of the anchor rods prior to installation. Proper care is required to avoid prolonged exposure to the elements, and to avoid mechanical or physical damage which would reduce or impair the future ability of the components to resist any adverse conditions encountered during their service life.

The primary corrosion protection shall be an electrostatically applied epoxy coating.

The secondary corrosion protection, as detailed on the plans, consists of wrapping the anchor rods with TAPECOAT CT asphalt tape or an approved equal. Other acceptable methods include grouting in a plastic tube and greasing in a plastic tube. Other methods may be submitted. Any method of secondary corrosion protection used must completely enclose the anchor rod including the nuts, washers, plates, and couplings; and be free of voids, tears, scars, delamination, or any other flaws. Detailed plans shall be submitted to the Engineer for approval thirty (30) days prior to installation.

#### Cement Grout:

Cement grout shall be made using Portland Cement conforming to ASTM Specification C-150, Type I, II, or III, and potable water. The cement shall be fresh, free from lumps or any indication of hydration. Admixtures that will impart low water content, flow ability, and minimum bleeding may be used in the cement grout with the consent of the Engineer. The admixtures shall contain no chemicals that may have a harmful effect on the anchor rod or cement. If admixtures are to be used, the Contractor shall submit to the Engineer the manufacturer's literature indicating the type of admixture and the manufacturer's recommendations for mixing the admixtures with grout prior to using the admixture.

The grouting equipment shall include a mixer capable of producing a grout free of lumps, aggregate, and undispersed cement. A positive displacement grout pump shall be used. The pump shall be equipped with a pressure gauge to monitor grout pressures at the nozzle. The pressure gauge shall be capable of measuring pressure of at least 150 psi or twice the actual grout pressures used by the Contractor. The grouting equipment shall be sized to enable the tieback to be grouted in one continuous operation. Mixing and storage times shall not cause excessive temperature build-up in the grout. The mixer shall be capable of continuously agitating the grout.

After grouting, the tendon shall remain undisturbed until the grout has cured for at least 72 hours. The following data shall be recorded during the grouting operations:

Type of mixer  
 Water/cement ratio  
 Type of additives  
 Grout pressure  
 Type cement  
 Test sample strengths (prior to stressing)  
 Volume of grout placed in bond and free lengths

Corrosion Inhibiting Grease:

Grease shall be compounded to provide corrosion inhibiting and lubricating properties. When used in the unbounded length of the tieback anchor it shall completely fill the void area between the bond breaker and prestressing steel. When a strand tieback tendon is used, the grease shall completely coat all the wires of each strand. The allowable content of deleterious substances in the grease shall not exceed the following:

Chlorides	10 ppm max.	by ASTM D-152
Nitrates	10 ppm max.	by ASTM D-992
Sulfides	10 ppm max.	by APHA 427D (15 <sup>TH</sup> ED)

The grease shall remain ductile and free from cracks and shall not become fluid over the anticipated range of temperatures encountered during fabrication, transport, storage, and while in service. The inhibitor shall be impervious to moisture and air and shall be a self-healing film and displace water. The corrosion inhibitor shall have a reserve alkalinity for long-term acid neutralization.

Heat Shrinkable Tube:

Heat shrinkable tubing shall have an outer heat shrinkable polyethylene plastic internally cracked with a thixotropic sealant. Recovered wall thickness shall be at least 0.04 inches. Coating thickness shall be at least 0.02 inches.

4.0 Basis of Payment:

The entire cost of the above work including all materials, equipment, tools, labor, and incidentals necessary to complete the work shall be included in the various pay items as follows:

1. Cast-in-place concrete shall be included in the contract unit price for "Class AA Concrete".
2. Reinforcing steel shall be included in the contract unit price for "Reinforcing Steel".
3. Prestressed Concrete Piles shall be included in the contract unit price for "12" Prestressed Concrete Piles and 24" Prestressed Concrete Piles".



4. Anchor rods, coupler, nuts, washer, bolts, channels, plates, pipe spacers, and anchor rod corrosion protection shall be included in the contract unit price for "Tieback System Anchor Rods."

**REMOVAL OF EXISTING PILES:**

**(SPECIAL)**

The existing plastic composite marine piles and the existing timber dolphins adjacent to existing wall that will interfere with the installation of proposed Ferry Ramp A shall be removed as shown on plans and stock piled as directed by the Engineer. The Ferry Division will salvage some of the waste material; wire rope, staples, clamps, plastic composite marine piles, timber piles, that are in good condition and any other material shall be disposed of in accordance with the Standard Specifications. The removal and disposal of the existing piles shall be paid for at the lump sum price bid for "Removal of Existing Piles" - Lump Sum.

**ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE COMPOSITE:** (SPECIAL)

Material:

There shall be three distinct layers of material.

Layer #1, or the face layer, shall be composed of Ultra High Molecular Weight Polyethylene (UHMW-PE), VIRGIN GRADE. The UHMW-PE shall be UV stabilized with a minimum of 0.6% Carbon Black. The UHMW-PE shall have a coefficient of friction not to exceed 0.2 per ASTM-D-1894.

Layer #2, or the middle layer, shall be composed of a special elastomeric compound, with a  $65 \pm 5$  Durometer on the Shore "A" scale. The compression set of the elastomer shall not exceed 15%, per ASTM-D-395.

Layer #3, or the backing layer, shall be equal to Layer #1.

All three layers shall be fully molded and vulcanized as one integral piece in the manufacturing process.

Fully molded material shall have passed the "Moving Rigid Barrier Collision Test" SAE-S792 as modified by Mil-B-24781 with no damage other than superficial surface damage. Normal Impact energy to panel test shall be 98,455 in-lbs. The maximum deflection of the material shall not exceed 2".

For curved pile applications, material shall come ready from manufacturer to wrap onto piling with minimum effort. Material shall be Pre-Drilled for attachment as shown in the plans.

One source of this material is Duramax Marine LLC, 17900 Great Lakes Parkway, Hiram, Ohio 44234, Phone (440)834-5400, Fax (440-834-4950) or (800)497-9283.

Attachment Requirements:

Fully molded batterboard shall be mounted and attached to supporting steel pile as shown on plans.

The outer face layer and middle elastomeric layer shall be counterbored sufficiently to accept a washer and nut at each fastener/attachment location. The backing layer shall be drilled thru for the bolt diameter to be used. The backing layer shall be the only layer fastened with a bolt in order to isolate fasteners from impact.

Basis of Payment:

The ultra-high molecular weight polyethylene composite shall be paid for at the contract unit price per square foot for “Ultra High Molecular Weight Polyethylene Composite”. No separate measurement or payment will be made for hardware, tools, equipment, or labor necessary for furnishing and installing the ultra-high molecular weight polyethylene composite. This work and material shall be included in the contract unit bid price for “Ultra High Molecular Weight Polyethylene Composite”.

Payment will be made under:

Ultra High Molecular Weight Polyethylene Composite.....Square Feet

**SKID RESISTANT COATINGS:**

**(SPECIAL)**

SCOPE OF WORK:

Description

The work covered by this special provision consists of furnishing all materials, labor, equipment and incidentals necessary to prepare the top of the checkered floor plate to receive epoxy overlay, and to place epoxy and sand in the shop and field repair. This work shall be done in accordance with applicable parts of the Standard Specifications, these special provisions, as indicated on the plans and as directed by the Engineer. The epoxy shall be Type 2 in accordance with Section 1081-1 of the Standard Specifications.

Preparation of Surfaces:

The metallized surface of the checkered plate shall be brushed blasted to remove any loose materials and to give a roughened surface in accordance with Subarticle 442-12 of the Standard Specifications.

Painting of Steel

The structural steel is A36 steel. Perform the work using the paint system specified in these special provisions and Section 442 of NCDOT’s Standard Specifications. This paint system is an epoxy mastic primer or approved equal with a dark color 24 grit aluminum oxide broadcasted

until surface rejection and covered with epoxy mastic or approved equal over properly prepared galvanized surfaces in accordance with Section 442-12 of the Standard Specifications.

COAT	MATERIAL	MILS (DFT/WFT)
Primer	Mastic Aluminum*	3.0-6.0 mils DFT
Body Coat	Mastic Aluminum*	7.0-9.0 mils WFT
Broadcast	Dark 24 Grit Aluminum Oxide**	Broadcast to Rejection
Seal Coat	Mastic Aluminum*	10-15 mils DFT

\* Or approved Equal

\*\* Grit material must meet the requirements of NCDOT *Standard Specifications* Section 1080-15 prior to application.

Type 2 epoxy shall be applied in two coats by either long nap roller or squeegee with the surface of plate in a horizontal position. The first coat of epoxy shall be applied within two hours after blast cleaning and the surface shall be clean, dry, free of oil and any other deleterious materials. Immediately after application of the epoxy, grit shall be applied to the surface from a vertical direction. The application of grit shall be continued until there are no visible moist spots.

The first coat shall be allowed to cure as recommended by the epoxy manufacturer, excess grit swept off, and the second coat of epoxy and grit shall be applied in the same manner as the first coating. Excess grit is to be swept off after the second coat has cured.

### Materials

Only paint suppliers that have a NCDOT qualified inorganic zinc primer may furnish paints for this project. All paints applied to a structure must be from the same supplier. Before any paints are applied the Contractor provides the Engineer a manufacturer's certification that each batch of paint meets the requirements of the applicable Section 1080 of the Standard Specifications.

### Field Repair of Coating:

Areas which are damaged during shipping, handling, erection or any other cause shall be repaired with the same type of materials and manner as shop application at no additional cost to the Department.

### Twelve Months Observation Period:

The contractor maintains responsibility for the coating system for a twelve (12) months observation period beginning upon the satisfactory completion of all the work in the plans or as directed by the engineer. The contractor must guarantee the coating system under the payment and performance bond (refer to Article 109-10). To successfully complete the observation period, the coating system must meet the following requirements after twelve (12) months service:

- No visible rust, contamination or application defect is observed in any coated area.
- Painted surfaces have a uniform color and gloss.
- Surfaces have an adhesion of no less than 500psi when tested in accordance with ASTM D-4541.

Compensation:

There will be no direct payment for the work covered in this special provision. Payment at the contract lump sum price for "Approximately \_\_\_\_\_ Pounds Structural Steel" will be full compensation for work covered by this special provision.

**STEEL SHEET PILES:**

**(SPECIAL)**

General:

The steel sheet piles shall be as shown on the plans and in accordance with Section 452 of the Standard Specifications and these special provisions. The steel sheet piles shall have a minimum flange and web thickness of 0.375 inch and a minimum section modulus of 30.2 cubic inches per linear foot of wall PZ 27 equivalent or better. The properties of the steel sheet piles shall be submitted to the Engineer for approval.

The steel sheet piles shall be painted in accordance with the special provision entitled "Painting Steel Piles".

Basis of Payment:

Complete all work in accordance with the contract plans and Section 452 of the Standard Specifications except measurement and payment for the steel sheet piles will be as described below.

Steel sheet piles will be measured and paid as the actual number of square feet of steel sheet piles completed and accepted. In determining this quantity, the steel sheet pile length used in the computation is the steel sheet pile length shown on the plans. The steel sheet pile lengths are measured as the difference between the top elevation as shown on the plans and the bottom of the steel sheet piles.

This payment will be full compensation for all work including but not limited to, furnishing all steel sheet piles, hardware, and equipment, driving piles, cutting off, splicing, and building up piles, any removal, replacement, and correcting of piles. Payment for painting of the steel sheet piles shall be included in the lump sum price bid for "Painting Steel Piles.

Payment will be made under:

Steel Sheet Piles.....Square Feet

**DOLPHINS:****(SPECIAL)****1.0 Description:**

The Contractor shall furnish steel pipe piles, treated timber piles, untreated white oak timber fenders, ultra high molecular weight polyethylene, and all necessary hardware to construct the dolphins as shown on the plans and in accordance with the special provisions. The dolphins along the ferry ramp A shall consist of 6 steel pipe piles, 36 timber piles, oak timber fender, and ultra high molecular weight polyethylene and polyethylene composite. The dolphin along the mooring basin shall consist of 1 steel pipe pile and 18 timber piles.

**2.0 Steel Pipe Piles:****a. General:**

Provide 24" I.D. x ½" thick x 125 lb./ft. steel pipe piles in accordance with ASTM A-252, the Standard Specifications and this special provision.

Steel pipe piles shall be painted in accordance with the special provision entitled "Painting Steel Piles".

Provide sand fill for all steel pipe piles as directed by the Engineer. The sand shall be clean, dry, and free of chlorides. The source and type of sand used shall be subject to the approval of the Engineer.

**b. Construction:**

After being driven and prior to placing fill therein, the steel pipe pile shall be examined for collapse or reduced diameter at any point. Any pile that is improperly driven, broken, or shows partial collapse to such an extent as to materially decrease strength will be rejected. Rejected pipes shall be removed and replaced. The sand shall be placed in the pipe to the elevation as shown on the plans. The concrete shall be placed in accordance with Section 420 of the Standard Specifications.

**3.0 Treated Timber Piles:****a. General:**

Provide treated timber piles meeting the requirements of AWWA U1 with a minimum butt diameter of 14 inches and treated with chromate copper arsenate (CCA) to a minimum retention of 2.5 lbs. per cubic foot. All hardware shall be galvanized in accordance with the Standard Specifications.

**b. Construction:**

Dolphin piles shall be drawn together at the top and wrapped with six turns of ¾" wire rope at one point. The wire rope shall be secured with 3/8" square staples and two cable clamps at the end. Wire rope used for wrapping dolphins shall conform to ASTM A603 class B.

#### 4.0 Untreated White Oak Timber:

##### a. Material:

Timber shall be rough untreated, white oak, common dimension, sound square edge, and full sawn  $\pm 1/4"$ .

##### b. Construction:

Timber shall be open stacked at least 12 inches above the ground surface, and stacked to shed water and prevent warping. The ground under and in the vicinity of stacks shall be cleared of weeds and rubbish. The timber shall be neatly stacked with ends exposed and handled in a manner that will avoid injury or breakage.

The oak timber shall be installed on dolphins as shown on the plans and as directed by the Engineer.

#### 5.0 Ultra High Molecular Weight Polyethylene:

##### a. Material:

Material shall be composed of Ultra High Molecular Weight Polyethylene (UHMW-PE), Virgin grade. The UHMW-PE shall be UV stabilized with a minimum of 0.6% Carbon Black. The UHMW-PE shall have a coefficient of friction not to exceed 0.2 per ASTM-D-1894.

One source of this material is Duramax Marine L LC, 17900 Great Lakes Parkway, Hiram, Ohio 44234, Phone (440)834-5400, Fax (440-834-4950) or (800)497-9283.

##### b. Construction:

The ultra high molecular weight polyethylene shall be installed on dolphins as shown on the plans and as directed by the Engineer.

#### 6.0 Basis of Payment:

The cost of the above work shall be included in the various pay items as follows:

##### a. Steel Pipe Piles:

The entire cost of the above work including all materials, sand, equipment, tools, labor, and incidentals necessary to complete the work shall be paid for as "24 Steel Pipe Piles" – Linear Feet.

Measurement of the quantity of steel pipe piles to be paid for will be the actual number of linear feet of piles which have been in place, completed and accepted. Measurement will be made by measuring the pile before it is driven. No measurement will be made for piles that have been rejected. The quantity of piles, measured as provided above, will be

paid for at the contract unit price per linear foot for Steel Pipe Piles complete, in place, painted and accepted.

The quantity of the class "AA" concrete will be paid for under contract unit price per cubic yards for class "AA" concrete.

Payment will be made under:

24" Steel Pipe Piles.....Linear Feet

b. Treated Timber Piles:

The treated timber piles shall be measured and paid for in accordance with the Standard Specifications, which price shall be full compensated for all material, hardware, wire rope, tools, equipment, and labor to complete the work.

Payment will be made under:

Treated Timber Piles.....Linear Feet

c. Untreated White Oak Timber:

The quantity of untreated white oak to be paid for will be the number of thousand board feet measure of timber which has actually been installed and accepted. Measurement will be based on timber sizes and lengths as shown on the plans. Payment for untreated white oak timber will be made at the contract unit price per thousand board feet for untreated white oak timber which price shall be full compensation for all work, material, labor, tools, and incidental necessary for furnishing and installing timber.

Payment will be made under:

Untreated Structural Timber.....Thousand Board Feet

d. Ultra High Molecular Weight Polyethylene:

The ultra high molecular weight polyethylene shall be paid for at the contract unit price per square foot which price shall be full compensated for all material, hardware, tools, equipment, and labor necessary for furnishing and installing the ultra high molecular weight polyethylene.

Payment will be made under:

Ultra High Molecular Weight Polyethylene.....Square Feet

**PAINTING STEEL PILES:****(SPECIAL)****Scope of Work**

All surfaces of steel sheet piles, H-piles, the entire outside surface area of the steel pipe piles, including the top, and Lift Bent structural steel as shown on the plans shall be coated according to these special provisions.

**Description**

Paint System 2, as specified in these special provisions and Section 442 of NCDOT's Standard Specifications, is to be used for this work. System 2 is an inorganic zinc primer, and two coats of Coal Tar Epoxy paint over blast cleaned surfaces in accordance with SSPC-SP-10 (Near White Blast). The surface preparation, materials, and painting of the piles shall be in accordance with the applicable parts of the standard specifications and in accordance with this special provision. All work must be done in an enclosed shop meeting the requirements of Section 442-10(B) of the Standard Specifications.

**Surface Preparation**

Surfaces to be painted shall be prepared by near white blast cleaning in accordance with table 442-2 of the Standard Specifications. All weld splatter, slag or other surface defects resulting in a raised surface above the final paint layer shall be removed prior to application of primer coat.

Blasting is performed with abrasives meeting the requirements of Section 1080-13. The profile must be between 1.0 and 3.0 mils when measured on a smooth steel surface. A minimum of two tests per ten piles blasted shall be conducted and documented.

**Materials**

Only paint suppliers that have a NCDOT qualified inorganic zinc primer may furnish paints for this project. All paints applied to a structure must be from the same supplier. Before any paints are applied the Contractor provides the Engineer a manufacturer's certification that each batch of paint meets the requirements of the applicable Section 1080 of the *Standard Specifications*.

The inspector randomly collects a one pint sample of each paint product used on the project. Additional samples may be collected as needed to verify compliance to the specifications.

Do not expose paint materials to rain, excessive condensation, long periods of direct sunlight, or temperatures above 110F or below 40F. In addition, the Contractor shall place a device which records the high, low and current temperatures inside the storage location. Follow the manufacturer's storage requirements if more restrictive than the above requirements.

**Painting**

Damaged or rejected areas of paint shall be thoroughly cleaned of all foreign or loose material and promptly painted at the approval of the Engineer. Submit paint repair procedures for review and approval before commencing work. When the repair area exceeds one square foot, clean,



prime and topcoat damaged areas in accordance with Sub-article 442-7(A); otherwise, clean prime, and topcoat damaged areas in accordance with Sub-article 442-7(B)

### Inspection

NCDOT reserves the right for ongoing QA (Quality Assurance) inspection to include but not limited to surface contamination testing, adhesion pull testing and DFT readings as necessary to assure quality.

Two random adhesion tests (1 test=3 dollies) per ten piles primed and are conducted in accordance with ASTM D-4541 (Adhesion Pull Test) after the prime coat has been properly cured in accordance with ASTM D-4752 (MEK Rub Test) with no less than a 4 resistance rating, and will be touched up by the Contractor. The required minimum average adhesion is 400 psi.

The contractor maintains a daily quality control record in accordance with Section 442-12 and such records must be available at the job site for review by the inspector and be submitted to the Engineer as directed. In addition to the information required on M&T-610, the Contractor shall submit all DFT readings as required by these Special Provisions on a form equivalent to M&T-611.

The dry film thickness is measured at each spot as indicated on the attached diagram at no less than specified for each paint system as listed below:

Dry film thickness is measured at the required number of locations as specified below; in the case the length is not in increments of three foot the Contractor shall add an additional location.

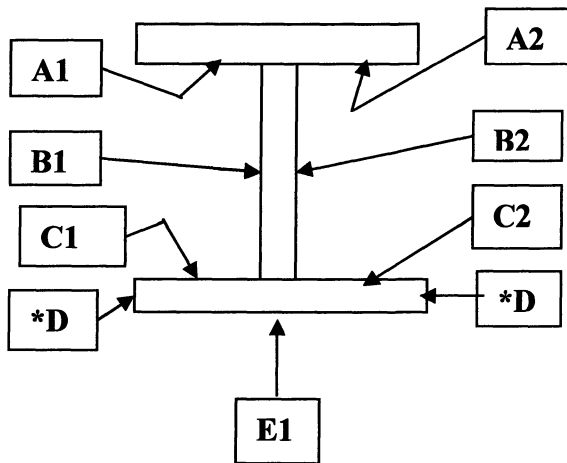
1. HP frequency: The following spot measurements apply
  - a. For every three feet in pile length use Diagram #1 for spot measurement areas.
2. Sheet Pile Frequency- The following spot measurements apply:
  - a. PZ Sheet Pile- For every three feet in sheet pile use Diagram #2 for spot measurement areas.
3. Pipe Pile Frequency- The following spot measurements apply:
  - a. 24" diameter- For every three feet in pipe pile length use Diagram #3 for spot measurement areas.

DFT measurements for the prime coat shall not be taken for record until the zinc primer has cured in accordance with ASTM D-4752 (MEK Rub Test) with no less than a four resistance rating.

DFT measurements on the intermediate layer shall be substituted for WFT (Wet Film Thickness). The frequency of WFT readings shall be three readings per length of pile

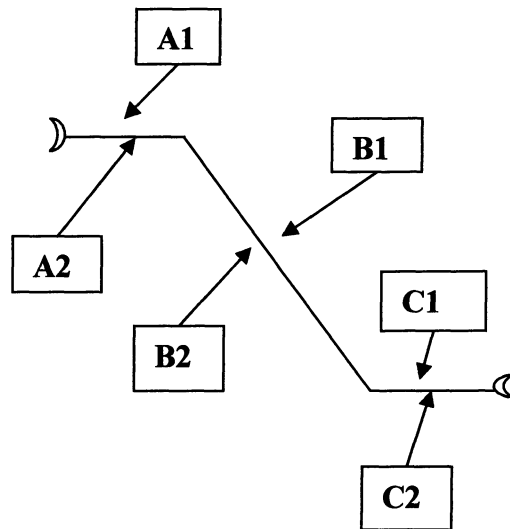
Each spot is an average of three to five individual gage readings as defined in SSPC PA-2. No spot average shall be less than 80% of minimum DFT for each layer applied. Spot readings that are non-conforming shall be re-accessed by performing additional spot measurements not to exceed one foot intervals on both sides of the low areas until acceptable spot averages are obtained. These non-conforming areas shall be corrected by the contractor prior to applying successive coats.

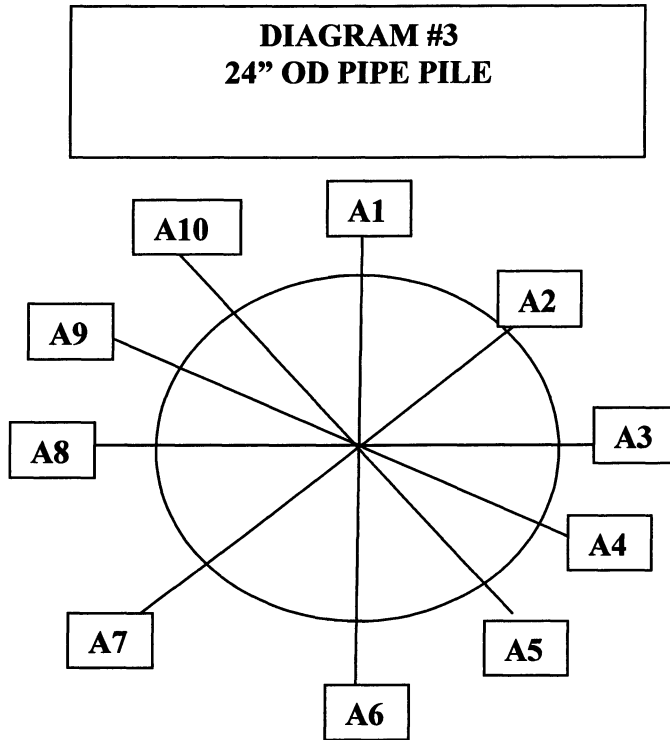
**Diagram #1  
7 Spot Areas  
21 Individual DFT Readings**



**\*D areas are only included when flange thickness is one inch (1") or greater.**

**Diagram #2  
PZ Sheet Pile**





Compensation

The work covered by this provision will be paid for at the contract lump sum price for “Painting Steel Piles”. The above prices and payments will be full compensation for all work covered by this provision including but not limited to furnishing all materials, labor, tools, equipment, and all incidentals necessary to complete the work.

Payment will be made under:

Painting Steel Piles, Station \_\_\_\_\_ Lump Sum

**1 ¼” DIAMETER STEEL PIPE RAIL:**

**(SPECIAL)**

Description:

The work covered by this section consists of furnishing and placing the steel pipe rail in accordance with the requirements of this special provision, and as shown on the plans or as directed by the Engineer.

Material:

All materials shall meet the requirements of the applicable parts of Sections 1074-4 and 1074-5 of the Standard Specifications with the exception that the steel pipe rail and hardware shall be

galvanized as required in Section 1076 of the Standard Specifications. The steel pipe shall be extra strong pipe.

Construction:

The steel pipe rail shall be constructed as detailed on the plans and directed by the Engineer. The rail shall be given the same finish paint system as required with the steel ramp.

Basis of Payment:

The quantity of steel pipe rail to be paid for will be the actual number of linear feet of rail measured along the top of the installed pipe rail, which has been completed and accepted.

The quantities of steel rail, measured as above, will be paid for at the contract unit price per linear foot for "1 ¼" Diameter Steel Pipe Rail", which prices and payments will be full compensated for all work covered by this special provision including but not limited to furnishing posts, rail bars, pipe fittings, hardware, paint, and all other materials, metallizing, painting, fabricating, and erecting rails.

Payment will be made under:

1 ¼" Diameter Steel Pipe Rail.....Linear Feet

**CONCRETE COUNTERWEIGHTS**

**(SPECIAL)**

Description:

The work covered in this special provision covers furnishing and installing two concrete counterweights at the lift bent to assist the mechanical hoists in raising and lowering the ramp.

Materials:

Provide Class "AA" concrete counterweights, epoxy coated reinforcing steel, eye bolts, steel plates, and bolts in accordance with the Standard Specifications and plans.

Furnishing:

Each concrete counterweight shall be of same weight, consisting of two halves with dimensions of counterweight as indicated on plans. The depth of the counterweight shown as 7'-7" on the plans may vary depending on the unit weight of cured concrete mix used. The weight of the counterweight shall be between 1500 lbs. and 1700 lbs. less than ½ the ramp reaction at the lift bent. Reactions of ramp at lift bent and dimensions and height of counterweights as indicated on the plans are approximate. The Contractor shall furnish the Engineer checked calculations and sketches of ramp reaction at lift bent and weight and volume of concrete to be used and steel plates in each counterweight. Calculations shall be based on scale weights of ramp materials and weight per cubic foot of cured concrete mix to be used in the counterweight. Dimensions of counterweight should be such that operation of ramp will not be interfered with by the movement

of the counterweight. The Contractor shall use a dynamometer to determine reactions in calculating counterweight weights.

The concrete portion of the counterweight shall represent 88% of the total required weight as calculated above. The remainder of the weight necessary to ensure the desired balance with the hydraulic system and proper operation of the ramp shall be determined in the field. Temporary removable weights may be used to determine the number of steel plates needed for proper operation of the ramp. The final quantity of steel plates to be added to the concrete shall be as directed by the Engineer.

Installation:

Counterweights shall be assembled as shown on the plans and with ramp in a horizontal position, counterweight wire rope shall be attached to provide free movement of at least 4'-0" above and below the horizontal position, thimbles shall be used where wire rope is connected to eyebolts or U-bolts. Ends of wire rope shall be secured with a minimum of 4 wire rope clamps.

Compensation:

There will be no direct payment for the work covered in this special provision except for class "AA" concrete. Payment at the contract lump sum price for "Ramp Lift and Lubrication System...Lump Sum" will be full compensation for work covered by this special provision except for class "AA" concrete.

The quantity of the class "AA" concrete will be paid for under contract unit price per cubic yards for class "AA" concrete.

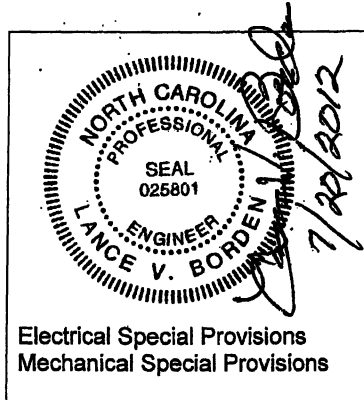
Project F-5500

Craven County

CHERRY BRANCH FERRY

FERRY RAMP AND LIFT BENT

Professional Registration and Specifications Responsibilities:



**CHERRY BRANCH FERRY RAMP – MECHANICAL SPECIFICATIONS****RAMP LIFT AND LUBRICATION SYSTEM****Description**

The work covered in this special provision consists of furnishing all materials, labor, equipment, and incidentals necessary for installing a complete and operable ramp lift system in accordance with the applicable parts of the Standard Specifications, details on the plans, and these special provisions. The ramp lift system consists of two (2) hydraulic cylinders, hydraulic pump with reservoir and controls (electrical and hydraulic), enclosure and support, chain, chain shackles, 2-concrete counter weights with hardware, wire rope, wire rope clamps, thimbles, wire rope blocks, lubricating system for wire rope blocks, and 2 electrically operated chain hoists. See plans and special provisions for details. For remote electrical controls, see special provisions and plans for "Electrical System".

The ramp hydraulic power unit will be mounted on shore adjacent to the ramp pivot bent as shown on the plans. Three hydraulic lines will be conveyed to the ramp support structure via the messenger cable. Installation of the flow integrator will be at the power unit requiring two return lines to the power unit from the cylinders. The flow integrator and the flow control valve will be piped with ½" stainless steel tubing at the power unit. ½" stainless steel tubing will be used between the power unit and the ½" hose that will be installed in the messenger system. The hose will transition to ¾" stainless steel tubing at the attachment point on the ramp support structure. All tubing installed on the ramp support structure will be ¾" stainless steel.

**GENERAL**

All ramp support and lift systems for the ramp are to be furnished new and complete as covered on the plans and in these special provisions.

Place the ramp in a horizontal position with chains attached to hydraulic cylinders, extend the hydraulic cylinders as recommended by the Ferry Division, and attach chain to the ramp lift beam with shackles. Each chain should have a minimum of 4 feet excess length from the point of attachment to ramp lift beam.

Concrete counterweights shall be installed in accordance with the special provision for concrete counterweights.

The electrically operated chain hoists are to be installed at elevations so they are operable from the ramp and provide a movement of the ramp of at least 5 feet above and below horizontal.

**RAMP HOISTING SYSTEM**

All material specified under this section of the contract shall require the contractor to submit to the Resident Engineer for approval eight (8) copies of catalog cuts, certified prints, descriptive bulletins, literature and/or drawings for each item, shop drawings, and assembled drawings with

specific dimensions, data, flow rates, and manufacturers part numbers to allow determination of plans and special provision compliance. Thirty days shall be allowed for the engineer's review of each submittal. Materials which have not been approved shall not be delivered to the project. The Department of Transportation will not be responsible for any costs (fabrication, etc.) prior to approval of submittals. Eight copies of each catalog cut, certified print, bulletin literature and drawings shall be submitted, and each shall show the material description, brand name, stock number, size, rating, manufacturing specifications, and the use for which it is intended.

#### HYDRAULIC HOIST AND LUBRICATION SYSTEM

The hoist system for the ramp shall be furnished complete and operational. The system shall consist of a hydraulic power unit (HPU) composed of the components listed below, two hydraulic cylinders with related mounting hardware, and all interconnecting tubing and hose.

The system shall provide for full extension and retraction of the cylinders in 45 seconds under rated load. The system is to be as previously furnished to the Ferry Division by Livingston and Haven or an approved equal.

The lubricating system for the cable blocks shall be accomplished by the installation of hose and tubing from each block terminating at a location as shown on the plans.

#### HYDRAULIC POWER UNIT (HPU)

HPU and components necessary to raise and lower ferry ramp shall be as follows:

##### Hydraulic Fluid

Hydraulic fluid shall be ENVIRON 32

##### Reservoir

Capacity	30 gallons
Material	Steel
Paint	Marine Enamel

Note: The following is a list of components that are to be contained in or be mounted upon the reservoir to make up the power unit. All components are to be painted with marine enamel.

##### Pump Mounting Bracket

Material	Steel
Size	Must accommodate 5 HP TEFC "C" face motor and SAE "A" pump mounting pad

##### Coupling

Material	Steel
Size	Bore/motor 1 1/8" w 1/4" keyway Bore/pump SAE J744 16-4 9T Spline



Pump

Positive Displacement 1.0 in<sup>3</sup>/rev. gear type  
 Working Pressure 3,000psi  
 Mat. Surge Press. 4,000psi  
 Mounting SAE 2 bolt  
 Port Size SAE12  
 Shaft SAE J744 16-4 9T Spline  
 Gears Sintered Metal  
 Seals Buna N  
 Bearings Pressure lubricated Teflon impregnated sleeve Body and End Covers Die Cast Aluminum

Electric Motor

Totally Enclosed Fan Cooled  
 5 HP, 1750 RPM, Single Phase service factor 1.1 Rated for operations on 208v 60 hz system

Directional Control Valve

4 way 3 position direct operated solenoid valve with manual overrides  
 Mounting Subplate  
 Size 1/4" ANSI DO3 standard  
 Terminal box Electrical Connection Central  
 Solenoid wet pin type 120 volt coil, 60 hz  
 Spool all ports connected to tank in center and cross over positions  
 Max Press. @ P, A, and B ports 4,600psi Max Tank Press. 1,450psi

Flow Integrator

Type Proportional nonadjustable with free reverse flow  
 Pressure 3,000psi  
 Rated Flow 8 to 16 GPM  
 Port Size 1/2  
 Ratio 50:50  
 Manufacturer Brand #B-300-1/2

Filter

Type Full flow inline return with bypass and spin-on throw away element  
 Rated Flow 35 GPM  
 Rated Pressure 500 psi  
 Filtration 10 micron  
 By Pass Press. 25 psi  
 Port Size 1" NPT

**Breather Cap**

Air Displacement	500 GPM
Strainer	Nylon
Cap	Nickel Chrome plated
Air Filtration	15 micron

**Relief Valve**

Type	Pressure Direct Operated Cartridge 3,000 psi
Operator	Handknob
Response	2 milliseconds
Seals	Buna N

**Manifold**

Type	Inline bar
Pattern	N.F.P.A. DO3 (DO1)
Material	6061-T6 Aluminum
Thread Size	Pressure and tank ports SAE 7/8-14, A & B ports SAE 3/ -16, Gauge Port 1/4 NPT

**Check Valve**

Type Pattern	Pilot operated Sandwich plate design A.N.S.I. DO3
No. of Service	Ports 2
Cartridge Type	Poppet/seat
Cracking Press	30 psi
Seals	Buna N
Max Press	5,000 psi
Flow Rating	15 GPM

**Fluid Level Indicator**

Size	127 mm Center Line Distance between screws
Pressure	Capable of 29 psi
Seals	Perbunan
Thermometer	Fahrenheit
Body Material	Galvanized Steel

**Flow Control Valve**

Type	Full flow one direction, metered flow opposite direction with Knurled knob option
Max Pressure	5,000 psi
Size	½" NPT
(Flow Control Valve cont...)	
Material	416 Stainless
Maximum Flow	15 GPM

Pressure gage

Design	Liquid filled with over pressure valve
Case Material	Stainless steel
Case Diameter	2-1/2"
Max Temp	60°C
Connection	¼" NPT
Accuracy	2.5%

THE FOLLOWING IS A LIST OF OTHER REQUIRED COMPONENTS WHICH ARE NOT AN INTEGRAL PART OF THE HPU:

Hydraulic Cylinders: The hydraulic cylinders shall be all stainless steel, NPTF ports, lip sealed piston, fixed NFPA MP1 cap clevis, cushioned both ends, large male unified rod end thread, Model Number 3.250CBBSHLU18AC72.000 by Parker, or approved equal.

Bore	3 1/4"
Stroke	72"
Mounting Style	MP 1
Rod Size	1 3/8" diameter
Stop Type	1"
Piston Seals	Lip Type
Rod Material	316 Stainless steel
Rod End Style	8 - Large Male
Pressure	3,000 psi

Eye Bracket and Pin

Thread Size	7/8" -14
Pin Size	1"
Load Rating	12,200 lbs
Material	Stainless Steel

Rod End Clevis Bracket and Pin

Thread Size	1-1/4" - 12
Pin Size	1.375"
Load Rating	18,850 lbs
Material	Stainless Steel

**Tubing**

Nominal Size (Wall Thickness)	½" OD (0.49") ¾" OD (0.72")
Material	Stainless steel seamless tubing ASTM A-269, Mil Specs 8808
Rockwell Hardness Rating	80 HRB or less for use w/ 37 degree JIC adaptors 3,000 psi

**Adaptors**

Nominal Size	½" and ¾"
Type Connection	37 degree JIC
Material	Stainless steel
Rating	3,000 psi

Note: Terminations are to be made with manufacturer procedures and equipment

**Flexible Hose**

Flexible high pressure hose shall be used to connect hard mounted stainless steel tubing to the hydraulic hoist cylinders and power unit.

Nominal Size	½" and ¾"
Material	Stainless steel braid with outer non-metallic sunlight resistant Outer jacket
Fittings	Stainless Steel
Rating	3,000 psi

**Straps and Hardware**

Stainless steel tubing is to be strapped to the steel support structure at intervals not to exceed 4 feet. Straps are to be stainless steel. All mounting hardware including plates, angle, and fasteners is to be stainless steel.

**WIRE ROPE LUBRICATING SYSTEM**

Each wire rope block is to have individual copper tubing run from a flexible hose connection to the block to a central location shown on the plans accessible from the ramp, with each tubing terminated with a fitting compatible with the grease fittings on the adjacent ramp.

**Lubrication Tubing**

Construction	Copper Tubing meeting ACR specifications
Size	¼" OD wall thickness 0.030"
Rating	1,250 psi working pressure, 5,000 psi ultimate burst

Flexible Hose

From the wire rope block center pin to tubing hard mounted on the structure, a flexible hose shall be installed.

Construction	Double stainless steel braid with outer sunlight resistant Non-metallic outer jacket
Rating	3,000 psi

RAMP SUPPORT AND COUNTERWEIGHT SYSTEM COMPONENTSWire Rope

The wire rope used in the support and movement of the ramp and counterweights is to meet the following requirements:

Size	¾"
Stranding	6X19
Core	IWRC
Lay	Right Hand Lay
Material	Galvanized Improved Plow Steel
Breaking Strength (min)	23 tons

Thimbles

For all terminations requiring the use of thimbles, the follow requirements are to be met:

Construction	Galvanized Steel
Type	USS Heavy Wire Rope
Size	¾"
Width of Opening (min)	2 ¾"
Length of Opening (min)	3 ¾"
Depth	1 1/16"
Overall Length	6 ½"
Overall Width (min)	3 ¾"

Wire Rope Clip

Wire rope clips are to be ¾" for use with ¾" wire rope. Clip is to have a 5/8" diameter U-bolt minimum. The base is to be of steel and be drop forged. The clip is to be hot dipped galvanized. A minimum of four clips is to be used for each termination. The first clip is to be installed tight against the thimble with each additional clip located a minimum of four inches apart. The clips are to be installed with the base against the live end and U-bolt against the dead end. After the wire rope has been placed in tension, the nuts shall be tightened again to compensate for any decrease in rope diameter.

**Chain**

Chain used with the hydraulic hoists shall be 3/4" trade size grade 100 (Spectrum 10) by Crosby or approved equal, hot dipped galvanized with a minimum working load of 35,300 pounds.

Chain dimensions shall conform to NACM specifications for 3/4" chain. Dimensions of the chain link shall allow the passing of a 0.89" diameter pin through any link in the chain.

**Bolt Type Shackle**

A 3/4" dropped forged steel anchor shackle with bolt, nut and cotter pin is to be furnished at locations shown on the plans. The shackle is to have a minimum working load of 9,500 pounds. Entire assembly is to be hot dipped galvanized.

**Wire Rope Blocks**

Wire rope blocks are to be furnished in the location and quantities shown on the plans. The Wire rope block is to be 14" for use with 3/4" wire rope with a working load minimum of 8 tons. The block shall be furnished with a shackle with the shackle opening axis mounted parallel to the sheave bearing pin.

The sheave is to be mounted on a bronze bearing with provisions for pressure lubrication of the bearing through the center pin.

The wire rope block is to be hot dipped galvanized.

The block is to be Single Sheave Block and Shackle with bronze bushings for 3/4" diameter wire rope.

The contractor must ensure that block and shackle dimensions are compatible with support structure shown on plans.

**Hydraulic Power Unit Enclosure**

The enclosure and drip pan details are shown on the plans.

The dimensions shown are guide lines and it is the responsibility of the contractor to ensure compatibility of these dimensions with the hydraulic power unit approved to be furnished.

All hardware on the enclosure is to be stainless steel. The enclosure is to be constructed from a minimum of 16 ga. 304 stainless steel. The angle base and mounting plates are to be of 304 alloy in the sizes shown. The contractor shall furnish the enclosure fabricator a foot print of the power unit to allow the location and drilling of the mounting plates.

Spares To Be Furnished

The following items are to be furnished as spares for this project:

- 2 Spare hydraulic cylinders filled with hydraulic fluid and plugged.
- 1 Spare hydraulic pump motor.

These items are to be packaged and furnished to the Cherry Brach Ferry Operations.

TESTING

Shop Testing

The ramp drive assembly consisting of the hydraulic power unit (HPU) and hydraulic cylinders shall be factory operated and certified before delivery. The ramp drive assemblies shall be factory operated through not less than 15 cycles or operated not less than 0.1 hours, whichever is greater and shall function without overheating or other evident deficiency.

These tests and calibrations shall be made in the presence of the Engineer. After calibrations are made, the equipment shall be match marked and tagged showing set points.

The HPU manifold, piping, and hoses shall be pressure tested at 3,000 psi for 15 minutes with no evidence of leakage. The Contractor shall provide the Engineer written notice 2 weeks prior to testing. Along with the written notice, the Contractor shall provide the following:

- 1. The manufacturer's certified performance test data on the pump and hydraulic cylinders.
- 2. Certification that the in-shop leak tests have been completed.
- 3. A description of the testing procedures along with a schematic of the hydraulic systems model showing placement of equipment, assemblies, measuring devices, and valves.
- 4. A checklist of the calibrations to be made.

Break-In Period

The hydraulic system will not operate correctly unless it is entirely free of air. After full assembly and leak testing, the hydraulic system shall be broken-in by many repeated operations, and continuously bled until completely free of air. Oil shall be added to the reservoir as needed and the filters observed and changed as they become filled with contaminates. Clean filters shall be left in place when break-in is complete.

All containers used in handling the oil shall be clean and all necessary precautions shall be taken to prevent the entry of foreign material during the filling process. Oil shall be filtered with 200 mesh filter as it is added to the system. Oil used for flushing and testing shall be the same as for operation.

Field Testing

All connections shall be tested in the field for leaks. The test shall be to pressurize the system at 3,000 psi for 15 minutes with no leaks. If any joint is broken after testing the connection shall be retested.

Upon acceptance of the installation by the Engineer the Contractor shall perform final acceptance testing. A minimum of 10 deficiency-free full raise and lower cycles shall be completed and approved by the Engineer. Any deficiency found shall be remedied by the Contractor to the satisfaction of the Engineer and the testing shall restart.

Basis of Payment

Payment for the ramp lift system shall be at the lump sum contract price "Ramp Lift and Lubrication System". This price and payment shall be full compensation for furnishing all materials, equipment, labor, tools, and incidentals required to install the ramp lift and lubrication system complete and operational as detailed on the plans in a workmanlike manner and satisfactory to the Engineer.

**CHERRY BRANCH FERRY RAMP – ELECTRICAL SPECIFICATIONS****ELECTRICAL SYSTEM INSTALLATION:**

The electrical installation for this project shall consist of modifications to the existing ferry ramp electrical system to provide for the new ferry ramp. These modifications, as shown on the plans and described elsewhere herein, include providing additional new circuits in the existing ramp electrical panel and associated new conduit and wire, providing new electrical feeders to the new ramp lift hydraulic system, new chain hoists, new traffic gate, and new ramp lighting, a receptacle and manual transfer switch for ferry power back to the hydraulic system, and relocation of one of the existing shore power receptacles with necessary additional wiring and conduit to the new ferry ramp location.

These plans and specifications show the intent and general requirements of the work. Additional detailing and measurements shall be provided by the Contractor to provide the necessary submittals and complete the installation.

Contractor is hereby informed that additional miscellaneous materials and hardware may be required beyond what is explicitly detailed on the plans. Such materials shall be furnished and installed as necessary to complete the new ramp electrical system as shown on the plans and described in these specifications, at the price bid for the work.

**ELECTRICAL COORDINATION FOR FERRY OPERATIONS:**

All electrical outages or disruptions during construction must be coordinated with Cherry Branch Ferry Operations through the Resident Engineer with a minimum of 10-working-days-notice.



All existing shore power and ramp hoist circuits must remain in use for Ferry operations and shall be kept in service during construction. Any temporary wiring used shall meet Article 305 of the National Electrical Code.

#### ELECTRICAL INSTALLATION - GENERAL

The electrical installation shall be installed by an Electrical Contractor duly licensed in the State of North Carolina for a project of this size.

The installation shall meet the latest addition of NFPA 70 (National Electrical Code) and any additions or addendum as approved by the North Carolina Building Code Council.

Eight copies of all catalog cuts for all material and equipment to be used in the electrical installation shall be submitted to the Resident Engineer for approval. Thirty days shall be allowed for the approval process and no material is to be ordered or installed until approval is granted.

All material is to be furnished new and stored in protective conditions. Any deterioration due to improper storage will be grounds for requiring replacement.

#### EXISTING RAMP CIRCUIT BREAKER PANELBOARD:

All new circuits for the new ferry ramp shall originate from the existing 120/208 volt, single phase panelboard mounted outdoors near the existing ferry ramp. New circuit breakers shall be mounted in spare slots.

New circuits shall be as follows:

- New Ramp Light – 120 volts, 20 amps (1 pole circuit breaker), 2c-AWG#10 w/ground
- New Hydraulic Power Unit – 120/208 volts single phase, 60 amps (2 pole circuit breaker), 3c-AWG#6 w/ground
- New Chain Hoists – 2 each at 120 volts single phase, 40 amps (1 pole circuit breakers), two circuits each 2c-AWG#8 w/ground
- New Traffic Gate – 120/208 single phase, 20 amps (2 pole circuit breaker), 3c-AWG#10 w/ground

All new circuit breakers shall be of same manufacturer as the existing panelboard and of a type explicitly manufactured for the existing panelboard.

Contractor shall verify the actual load current ratings of the actual equipment approved for installation against the above circuit ratings and increase circuit breaker and conductor capacities where necessary to accommodate equipment of higher electrical load requirements.

All conduit entrances are to be made only in the bottom of the enclosure.

TROUGHS AND WIREWAYS:

Troughs and wireways are not required, but if used for Contractor's convenience, shall be stainless steel NEMA 3R or NEMA 4 rating and shall bear a UL label. Troughs shall have screw covers and shall be reinforced as necessary for rigidity. Submittal to the Resident Engineer shall detail the complete trough dimensions.

GROUNDING:

Grounding of the new electrical circuits and equipment shall meet the requirements of Article 250 of the NEC.

Metallic grounding bushings are to be used on all metallic conduits (if used) and fittings, and shall be bonded to the equipment grounding conductor(s). Equipment grounding conductors shall be pulled in all conduit runs, both metallic and non-metallic. These conductors are to be sized in accordance with Article 250 of the NEC or as shown on the plans, and are to be color coded green and are to be THWN.

All equipment and devices are to be bonded to the equipment grounds including all panelboards, all shore power receptacles, all messenger cable, junction boxes, motor starters, cabinets, and troughs. All conduit and feeder schedules listing conduit size and circuit conductors do not include the equipment grounding conductors, but these are to be furnished in these runs as detailed above.

RIGID NON-METALLIC CONDUIT AND FITTINGS:

All conduit used in this project shall be non-metallic schedule 80 PVC except as noted on the plans. The PVC conduit shall be furnished in the sizes indicated. The PVC shall meet commercial standard CS-207-60 with a tensile strength of 5,500 psi at 78 degrees F, flexural strength of 11,000 psi, and compressive strength of 8,600 psi. All PVC conduit and fittings are to be UL listed and labeled. Catalog cuts are required on all PVC conduit and fittings.

All PVC fittings used are to be of same manufacturer as the conduit. Cement is to be as recommended by the manufacturer and applied per manufacturer's instructions with particular attention to minimum temperatures.

Field bending shall be accomplished by use of a heat bender designed for that purpose. No heating of conduit with open flames will be permitted.

All cutting of PVC conduit shall be accomplished with the use of a miter box to ensure square ends. These ends shall be reamed to ensure no restriction of the inside diameter.

All conduit runs connecting the electrical components of the hoist system are to use liquidtight flexible non-metallic conduit (CARFLEX). This conduit will be trade size 3/4" or larger as specified and shall be UL listed and labeled; and all fittings, adaptors, and connectors are to be UL listed for use with this conduit. All conduit and its installation shall meet the requirements of article 351 Part B of the NEC.

**FLEXIBLE NON-METALLIC CONDUIT AND FITTINGS:**

All flexible non-metallic conduit for this project shall be Type A jacketed and nylon reinforced core of PVC as manufactured by Electric-flex Type LNM-P in the appropriate sizes as shown on the plans. The conduit is to be Orange in color, and "UL" listed and labeled. Fittings for the above are to be T & B Type A 6300 series in the appropriate sizes made of fiberglass reinforced thermoplastic.

**JUNCTION AND PULL BOXES:**

No direct burial pull boxes are required but may be utilized for the Contractor's convenience. If used, direct buried pull boxes shall be constructed of polymer concrete and reinforced by a heavy-weave fiberglass. The boxes shall be furnished in two sections. The top section shall be 17" x 30" x 8" without a bottom. The top section is to be stacked on a 17" x 30" x 8" box extension with solid base. All conduit entrances are to be made in the box extension unless permission is obtained from the Resident Engineer. All conduit entrances are to be cut with a conduit trade size carbide tipped holesaw for each conduit size. No other method of cutting will be permitted. A steel cover is to be provided and the cover and box are to be installed in accordance with the manufacturer's instructions to achieve a H-20 (20,800 lb. load over 10" x 20" area) load rating. Two ¾" holes are to be drilled in the bottom of each box extension to allow water to drain into the sand bedding below the box.

No splices of conductors in the pull boxes will be permitted without the approval of the Resident Engineer with the exception of the equipment grounding conductors that are to be bonded together at each pull box.

Splices in junction boxes shall be made on corrosion resistant terminal strips.  
All exposed junction boxes shall be stainless steel NEMA 4X.

**WIRE AND CABLE:**

All wire for this project shall be copper with type THWN or XHHW insulation rated 600 volts. All wire shall be UL listed and labeled, and catalog cuts are to be submitted for approval for all sizes and types.

All wire used in the hoist electrical system shall be 19 strand copper with THWN insulation. Control wiring shall be #14 AWG stranded and the motor conductors shall be #8 AWG. All terminations shall use a NEC approved method for terminating stranded conductors.

**SHORE POWER RECEPTACLES:**

One existing 200 amp shore power receptacle presently located near the existing ferry ramp shall be relocated to the new ferry ramp and reused for powering the ferry vessels from shore power at the new ramp. Provide necessary conduit, wiring, miscellaneous fittings, boxes and hardware.

**FERRY POWER RECEPTACLE:**

Provide a receptacle identical to existing receptacle for providing ferry vessel power to operate the new ramp HPU through a transfer switch in the event of commercial power failure. The new receptacle shall be located near the new ferry ramp as determined by Ferry Division personnel on site.

**MESSENGER SYSTEM:**

A messenger system is to be installed from the bulkhead cap to the ferry ramp lift structure as shown on the plans at the two ramp locations. The messenger is to be terminated at a ¾" hot dipped galvanized eye bolt at each end. The eye bolt at the bulkhead end is to be set in a stainless steel anchor. The eye bolt at the "H" pile is to be through bolted. The messenger cable is to be terminated at the eye bolts using a reliable 3/8" strand vise.

The messenger cable is to be copperweld 3/8 inch. Due to the large minimum quantity required to purchase this cable, the necessary lengths will be furnished to the contractor by NCDOT for installation. A 30-working-days-notice should be given to the Resident Engineer prior to needing the cable on the job site.

A 1 ½ inch non-metallic flexible conduit will be supported from the messenger with copperweld cable rings on 2 foot centers. These rings will also be furnished to the contractor by NCDOT for installation.

**MAGNETIC COMBINATION MOTOR STARTERS:**

A combination magnetic starter is to be furnished for the new hydraulic pump for the ramp lift system. The starter enclosure is to be constructed of stainless steel with an electropolished finish with a NEMA rating of 4. The starter is to be rated 5 horse power at 208-230 VAC Single phase. The starter is to contain a fusible disconnecting device rated 60 amps with two fuses. The coil voltage for the magnetic starter is to be rated 120 VAC. Thermal overloads sized for the full load amperage taken from the nameplate of the pump motor are to be installed. All Conduit entrances are to be made in the bottom of the enclosure using approved corrosion resistant watertight hubs.

A combination reversing magnetic starter shall be furnished for the single phase motor in the traffic gate. The reversing gate motor starter shall be located in the gate housing and wired to the motor by the gate manufacturer. The reversing starter shall be sized for the gate motor horsepower.

**FERRY HYDRAULIC SYSTEM TRANSFER SWITCH:**

A manual transfer switch shall be provided for power the new ramp HPU from ferry vessel power during commercial power outages. The manual transfer switch shall be a two pole double throw safety switch, rated 100 amps at 240 volts, in a NEMA 4X enclosure. The new transfer switch shall be mounted on the same frame adjacent to the HPU motor starter.

PUSHBUTTON STATION HYDRAULIC RAMP CONTROL:

A four station pushbutton with a LED pilot light is to be furnished in a non-metallic enclosure rated NEMA 4x. It is to be furnished with a stainless steel hanger bracket with 3/4" threaded conduit hub in the top. A corrosion resistant liquid tight cord grip with mesh shall be installed in the threaded conduit hub.

Furnish push button units rated NEMA 4x. The top two push buttons shall consist of one normally open-momentary contact and one normally closed contact-momentary contact complete with a legend plate labeled "PUMP", "START", and "STOP". The next two push buttons shall consist of two interlocked normally open momentary contact units complete with a legend plate labeled "RAMP", "RAISE", and "LOWER". To enhance the NEMA 4x rating of the push buttons, weather proof boots are to be installed over the push button operations. They are to be of the following colors and are to be installed with the factory furnished tool:

START	Black Boot
STOP	Red Boot
UP	Black Boot
DOWN	Black Boot

The upper mounting blank is to contain a 120 VAC green NEMA 4x pilot light. Pushbutton enclosure to be Square "D" #9001 SKYP-4 with SKRU-1 and SKRU-10 push buttons with SKN-299 legend plates specially marked as indicated above and with a green LED pilot light with a green lens.

TRAFFIC GATE AND ARM:

A traffic gate (rail road style) will be installed at the new ramp complete with 20-foot (nominal) fiberglass and aluminum arm. Exact arm length shall be determined based on exact location established in the field (see below) as approved by the Engineer. The gate arm shall be provided with standard MUTCD red and white striping. A standard DOT Stop Sign shall be mounted on the gate arm positioned over the centerline of the ramp roadway. No warning lights shall be provided on the gate arm.

The concrete foundation shall be provided as detailed on the plans.

Gate housing shall be fabricated from welded steel plate, hot-dip galvanized after fabrication. Access doors shall be provided front and back, constructed equivalent to NEMA 3R or higher weather protection.

Gate housing details, mounting dimensions and mounting bolts sizes/locations shall be as provided by the gate manufacturer. Mounting bolts shall be stainless steel epoxy adhesive type, embedded at least eight inches into the concrete. Provide stainless steel nuts, flat washers and lock washers.

Gate motor shall be a single phase motor, operating on 208 volts AC single phase. Combination reversing magnetic starter shall be mounted in the gate housing. Gate control voltage shall be 120 volts AC. Terminal strips shall be provided in the gate housing for the remote control pendent wiring.

Approximate gate location is as shown on the plans. Exact location of the gate shall be confirmed/adjusted in the field by Ferry Division personnel. A three position push button station shall be mounted adjacent to the ramp for the operation of the gate arm as shown on the plans.

#### TRAFFIC GATE CONTROL PENDENT:

A three station pushbutton is to be furnished in a Type 316 stainless steel enclosure rated NEMA 4x. It is to be furnished and mounted with stainless steel hardware.

Furnish push button units rated NEMA 4x. The top pushbutton shall consist of a pushbutton labeled "GATE" and "OPEN". The middle pushbutton shall consist of a pushbutton labeled "EMERGENCY STOP". The bottom pushbutton shall consist of a pushbutton labeled "GATE" and "CLOSE". To enhance the NEMA 4x rating of the push buttons, weather proof boots are to be installed over the push button operations. They are to be of the following colors and are to be installed with the factory furnished tool:

GATE OPEN	Black Boot
EMERGENCY STOP	Red Boot
GATE CLOSE	Black Boot

All conduit and wiring shall be routed out of the bottom of the enclosure with liquid tight connections and fittings.

#### HARDWARE:

All hardware used in the electrical system for support, attachment, assembly, or mounting shall be corrosion resistant and consistent with the corrosion protection of the devices mounted. All hardware shall be either hot dipped galvanized or stainless steel. If hardware is not available with this protection, then standard hardware shall be sent to a galvanizer for hot dipping.

#### PAYMENT:

Payment for electrical system will be made at the lump price bid for "Electrical System". The above price and payment will be full compensation for all work, materials, equipment tools, and incidentals necessary for complete electrical system installed, operable, and accepted.