

**STRUCTURE SPECIAL PROVISIONS****SCOPE OF WORK****Location and Description of Bridge**

Bridge No. 13 New Hanover County was built in 1969 and carries US 17/74/76 across the Cape Fear River and SR 1300 in Wilmington, NC. The bridge has an overall length of 3,033 feet and consists of 32 approach spans of variable length consisting of prestressed concrete girders and steel plate girders with a concrete deck; and a 408' moveable lift span section consisting of a steel truss with open steel grid deck.

**Description of Work**

This work shall consist of furnishing all labor, materials and equipment to clean and paint the structural steel of the Lift Span as well as the exterior surfaces of the lift towers, control house, machinery house, counter weight housings, and all previously painted areas including all access ladders, checkered plate flooring, and tower framework; rehabilitation of the Lift Span guide rollers and electrical repairs including replacement of the existing light standards and luminaires on the approach spans and replacement of existing luminaires on the Lift Span; installation of a new HVAC system for the control house including a new structural steel support platform, new indoor and outdoor HVAC units, transformer, electrical panel board, and all piping and wiring as shown in the contract documents and plans. Contractor shall provide all necessary access; boats, underdeck platforms, scaffolding, ladders, etc.; provide all traffic control (both vehicular and navigational); coordinate all navigation channel work with the US Coast Guard; provide all staging area, material storage, boat storage and boat access; provide environmental controls to limit loss of materials into water and air; jacking equipment, sawing equipment, and chipping equipment; and all else necessary to complete the work.

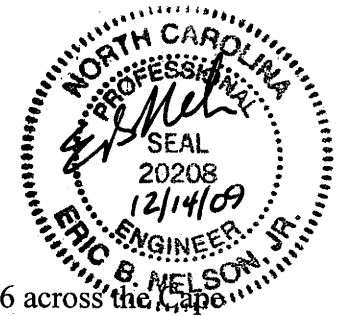
The contractor shall be responsible for fulfilling all requirements of the NCDOT Standard Specifications for Roads and Structures dated July 2006, except as otherwise specified herein.

**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.



**COORDINATION WITH THE U. S. COAST GUARD**

(SPECIAL)

At no time during work will the waterway be closed or narrowed to navigation without prior approval from the Coast Guard. The contractor is required to maintain close and regular contact with the Coast Guard, Sector North Carolina to keep them informed to activities in the waterway with Steve Lyons at (252)-247-4525 or email [Stephen.w.lyons2@uscg.mil](mailto:Stephen.w.lyons2@uscg.mil). Also must contact the 5<sup>th</sup> Coast Guard District with Bill Brazier at (757) 398-6422 or email at [Bill.H.Brazier@uscg.mil](mailto:Bill.H.Brazier@uscg.mil).

All waterway narrowing or closures shall be requested in writing and shall be received by the District Commander of the Coast Guard at least 30 days in advance of the closure so that the appropriate marine notifications can be made.

All work shall be conducted so that free navigation of the waterway is not unreasonably interfered with and the present navigable depths are not impaired. Timely notice of any and all events that affect navigation shall be given to the District Commander during the work on the moveable span. The channel shall be promptly cleared of all obstructions placed therein or caused by the contractor.

**WORK IN, OVER OR ADJACENT TO NAVIGABLE WATERS:**

(SPECIAL)

All work in, over, or adjacent to navigable waters shall have no adverse effect on navigation of the waterway including traffic flow, navigational depths, and horizontal and vertical clearances without approval from the U.S. Coast Guard, U.S. Army Corps of Engineers, or other authority having jurisdiction.

The Contractor shall prepare drawings necessary to obtain any permits which may be required for his operations including but not limited to excavation and dumping, constructing wharves, piers, ramps, and other structures connecting to bank or shore, and drawings for constructing falsework, cofferdams, sheeting, temporary bridges, and any other construction within the waterway. Submittals shall show locations of such work with respect to the navigational opening. The Contractor shall coordinate the submittal of drawings with the Engineer.

All construction shall progress and be maintained in a safe and timely manner. Temporary construction facilities shall be removed completely and promptly upon discontinuation of their useful purpose.

The Contractor shall immediately notify the appropriate authorities and take corrective measures as needed when any situation occurs that imposes a threat to the public. He shall also immediately correct any acts or occurrences that contradict or violate any requirements in the plans, special provisions, or permits when corrective measures can be performed in a safe manner. The Contractor shall notify the appropriate authorities when such corrective measures cannot be performed in a safe manner.

All costs incurred by the Contractor in complying with the above requirements shall be included in the prices bid for the various pay items and no additional payment will be made.

## **MAINTAINING BRIDGE OPERATIONS**

**SPECIAL**

### **1. SCOPE**

This section covers maintaining normal bridge operations and coordinating any disruptions thereto, including required coordination for disruptions to waterway traffic, as related to this project.

### **2. GENERAL REQUIREMENTS**

The Contractor shall maintain span balance throughout the course of the project.

Normal bridge operation shall be maintained at all times, and the Contractor's activities shall not cause the bridge to be inoperable, except for those limited periods of allowed waterway disruption as described elsewhere herein (see Waterway Disruptions and Coast Guard Coordination).

As used in this section, the phrase "normal bridge operation", and similar phrases, shall be understood to signify all of the following.

1. That all bridge operating systems, sub-systems, and components are operating as intended and in the same manner as they did prior to the beginning of the project.
2. That no special procedures or equipments are required in order to operate any bridge systems, sub-systems, or components.
3. That the lift span is capable of being raised to allow the passage of marine traffic, upon request and without intentional delay, at normal speed via the normal drive system.

Should the Contractor's activities result in any of the roadway traffic controls (signals, warning gates, and barrier gates) being inoperable, the Contractor shall provide appropriate temporary measures (temporary signals, flaggers, Truck Mounted Impact Attenuators, etc.) as may be dictated by the Department in order to safely close the roadway to traffic for operation of the lift span. Any such measures shall be provided at no additional cost to the Department.

The Contractor shall bear full responsibility for all fines, fees, and damages resulting from non-compliance with the requirements of this section, United States Coast Guard regulations and requirements, and/or any other applicable local, state, or federal laws and regulations. The Contractor shall immediately reimburse the Department for any fines, fees, and damages assessed against the Department due to the Contractor's activities.

### **3. SEQUENCE OF CONSTRUCTION**

The Contractor shall be responsible for developing a written sequence of construction, which shall take into account all required work. The Contractor's written sequence of construction shall provide sufficient detail to permit the Department to determine if the sequence complies with the requirements of the Contract Documents, and to ensure coordination between work items.

The Contractor shall submit the written sequence of construction to the Department, which shall take into account the actual waterway disruptions allowed by the Coast Guard. The actual sequence of construction must be approved by the Department prior to commencing on-site activities. However, such review and approval shall in no way relieve the Contractor of full responsibility for performing all work in accordance with the requirements of the Contract Documents. The Contractor shall bear full responsibility for the accuracy and practicality of the actual sequence of construction, and agrees to hold blameless the Department, and/or the Department's designated representative(s), for any mistakes, inconsistencies, etc. within the approved sequence. Any difficulties, damages, fines, etc. which may result from usage of the approved sequence of construction shall be the sole responsibility of the Contractor, and shall not be considered cause for delay or additional payment.

#### **4. WATERWAY DISRUPTIONS AND COAST GUARD COORDINATION**

The Contractor is hereby notified that, while the requirements of this section related to allowed waterway disruptions have been informally coordinated with the United States Coast Guard in advance, formal approval by the Coast Guard for waterway disruptions will be determined at the time of the Contractor's request(s). Where such requirements are given, explicitly or implicitly, they are provided solely to illustrate anticipated Coast Guard requirements and to assist in bidding. The actual waterway disruptions allowed will be fully at the discretion of the Coast Guard. The Department shall not be held responsible for any requirements, stipulations, limitations, etc. related to waterway disruptions as imposed by the Coast Guard which conflict with the requirements of the Contract Documents. Any such conflict shall not be considered cause for delay or additional payment.

The Contractor shall bear full responsibility for all required coordination with the Coast Guard. Advance coordination with the Coast Guard for any anticipated disruptions to waterway traffic shall begin within 30 days following award of Contract and prior to commencing on-site activities. Approval for scheduled waterway disruptions shall be initiated approximately 45 days in advance, and confirmed no less than 30 days but no more than 45 days, in advance of the first disruption.

Any waterway disruption longer than 24 hours shall include one pre-scheduled opening per 24 hour period to allow waterway traffic to pass. The specific time that each such opening commences, and the length of the opening(s), shall be as directed by the Coast Guard.

All waterway disruption periods must be separated by continuous periods of no disruption, the length of which shall be as directed by the Coast Guard.

Note: that actual waterway disruptions shall be as coordinated with, and approved by the Coast Guard as stated above and may vary depending upon waterway usage at the time of the proposed disruptions.

The Contractor shall work continuously (around the clock in multiple shifts) during any waterway disruption and re-open the waterway as soon as the work necessitating the disruption is completed.

## 5. MEASUREMENT AND PAYMENT

There will be no measurement or direct payment for compliance with this section. Associated costs shall be included in the prices bid for the various work items.

### **MAINTENANCE AND PROTECTION OF TRAFFIC BENEATH STRUCTURE**

#### **General**

Maintain traffic on SR-1300 as directed by the Engineer.

Submit plans and calculations for review and approval for protecting traffic as described herein, at the above station before beginning work at this location. Have the drawings and design calculations prepared, signed, and sealed by a North Carolina Registered Professional Engineer. The approval of the Engineer will not relieve the Contractor of the responsibility for the safety of the method or equipment.

#### **Protection of Traffic**

Protect traffic from any operation that affords the opportunity for construction materials, equipment, tools, etc. to be dropped into the path of traffic beneath the structure. Based on Contractor means and methods determine and clearly define all dead and live loads for this system, which, at a minimum, shall be installed between beams or girders over any travelway or shoulder area where traffic is maintained. Install the protective system before beginning any construction operations over traffic.

#### **Basis of Payment**

Payment at the contract unit prices for the various pay items will be full compensation for the above work.

### **CRANE SAFETY**

(8-15-05)

Comply with the manufacturer specifications and limitations applicable to the operation of any and all cranes and derricks. Prime contractors, sub-contractors, and fully operated rental companies shall comply with the current Occupational Safety and Health Administration regulations (OSHA).

Submit all items listed below to the Engineer prior to beginning crane operations involving critical lifts. A critical lift is defined as any lift that exceeds 75 percent of the manufacturer's crane chart capacity for the radius at which the load will be lifted or requires the use of more than one crane. Changes in personnel or equipment must be reported to the Engineer and all applicable items listed below must be updated and submitted prior to continuing with crane operations.

#### **Crane Safety Submittal List**

**Competent Person:** Provide the name and qualifications of the "Competent Person" responsible for crane safety and lifting operations. The named competent person will have the responsibility and authority to stop any work activity due to safety concerns.

**Riggers:** Provide the qualifications and experience of the persons responsible for rigging operations. Qualifications and experience should include, but not be limited to, weight

calculations, center of gravity determinations, selection and inspection of sling and rigging equipment, and safe rigging practices.

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

Certifications: **By July 1, 2006**, crane operators performing critical lifts shall be certified by NC CCO (National Commission for the Certification of Crane Operators), or satisfactorily complete the Carolinas AGC's Professional Crane Operator's Proficiency Program. Other approved nationally accredited programs will be considered upon request. All crane operators shall also have a current CDL medical card. Submit a list of anticipated critical lifts and corresponding crane operator(s). Include current certification for the type of crane operated (small hydraulic, large hydraulic, small lattice, large lattice) and medical evaluations for each operator.

## **SUBMITTAL OF WORKING DRAWINGS**

## **SPECIAL**

### **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 complete 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.**

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 or State Bridge Management Unit.

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.

### **Addresses and Contacts**

Mail submittals to:

Mr. Rick Nelson, PE  
Asst. State Bridge Management Engineer  
NC Dept. of Transportation  
State Bridge Management Unit  
4809 Beryl Drive  
Raleigh, NC 27606  
Fax: 919.733.2348  
Ph: 919.733.4362  
Email: enelson@ncdot.gov

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 State Bridge Management Unit and/or the Structure Design Unit.

The table below covers “Structure Submittals”. The Resident Engineer will receive review comments and drawing markups for these submittals from the State Bridge Management Unit.

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

**STRUCTURE SUBMITTALS**

Submittal	Copies Required by SBMU	Copies Required by Structure Design Unit	Contract Reference Requiring Submittal <sup>1</sup>
Falsework & Forms <sup>2</sup> (substructure)	5	0	Article 420-3 & “Falsework and Formwork”
Falsework & Forms (superstructure)	5	0	Article 420-3 & “Falsework and Formwork”
Placement of Equipment on Structures (cranes, blasting/painting equip., etc.)	5	0	Article 420-20
Painting Platforms and Containment	5	0	SP

**FALSEWORK AND FORMWORK**

(8-4-09)

**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.

**Materials**

Select materials suitable for temporary works; however, select materials that also ensure the safety and quality required by the design assumptions. The Engineer has authority to reject

material on the basis of its condition, inappropriate use, safety, or nonconformance with the plans. Clearly identify allowable loads or stresses for all materials or manufactured devices on the plans. Revise the plan and notify the Engineer if any change to materials or material strengths is required.

**Design Requirements**

Working Drawings:

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

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

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

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

Wind Loads:

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

**Table 2.2 - Wind Pressure Values**

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

Time of Removal:

The following requirements replace those of Article 3.4.8.2.

Do not remove forms until the concrete has attained strengths required in Article 420-16 of the Standard Specifications and these Special Provisions.

Do not remove forms until the concrete has sufficient strength to prevent damage to the surface.



Table 2.2A - Steady State Maximum Wind Speeds by Counties in North Carolina

COUNTY	25 YR (mph) (km/hr)	COUNTY	25 YR (mph) (km/hr)	COUNTY	25 YR (mph) (km/hr)
Alamance	70 (112.7)	Franklin	70 (112.7)	Pamlico	100 (160.9)
Alexander	70 (112.7)	Gaston	70 (112.7)	Pasquotank	100 (160.9)
Alleghany	70 (112.7)	Gates	90 (144.8)	Pender	100 (160.9)
Anson	70 (112.7)	Graham	80 (128.7)	Perquimans	100 (160.9)
Ashe	70 (112.7)	Granville	70 (112.7)	Person	70 (112.7)
Avery	70 (112.7)	Greene	80 (128.7)	Pitt	90 (144.8)
Beaufort	100 (160.9)	Guilford	70 (112.7)	Polk	80 (128.7)
Bertie	90 (144.8)	Halifax	80 (128.7)	Randolph	70 (112.7)
Bladen	90 (144.8)	Harnett	70 (112.7)	Richmond	70 (112.7)
Brunswick	100 (160.9)	Haywood	80 (128.7)	Robeson	80 (128.7)
Buncombe	80 (128.7)	Henderson	80 (128.7)	Rockingham	70 (112.7)
Burke	70 (112.7)	Hertford	90 (144.8)	Rowan	70 (112.7)
Cabarrus	70 (112.7)	Hoke	70 (112.7)	Rutherford	70 (112.7)
Caldwell	70 (112.7)	Hyde	110 (177.0)	Sampson	90 (144.8)
Camden	100 (160.9)	Iredell	70 (112.7)	Scotland	70 (112.7)
Carteret	110 (177.0)	Jackson	80 (128.7)	Stanley	70 (112.7)
Caswell	70 (112.7)	Johnston	80 (128.7)	Stokes	70 (112.7)
Catawba	70 (112.7)	Jones	100 (160.9)	Surry	70 (112.7)
Cherokee	80 (128.7)	Lee	70 (112.7)	Swain	80 (128.7)
Chatham	70 (112.7)	Lenoir	90 (144.8)	Transylvania	80 (128.7)
Chowan	90 (144.8)	Lincoln	70 (112.7)	Tyrell	100 (160.9)
Clay	80 (128.7)	Macon	80 (128.7)	Union	70 (112.7)
Cleveland	70 (112.7)	Madison	80 (128.7)	Vance	70 (112.7)
Columbus	90 (144.8)	Martin	90 (144.8)	Wake	70 (112.7)
Craven	100 (160.9)	McDowell	70 (112.7)	Warren	70 (112.7)
Cumberland	80 (128.7)	Mecklenburg	70 (112.7)	Washington	100 (160.9)
Currituck	100 (160.9)	Mitchell	70 (112.7)	Watauga	70 (112.7)
Dare	110 (177.0)	Montgomery	70(112.7)	Wayne	80 (128.7)
Davidson	70 (112.7)	Moore	70 (112.7)	Wilkes	70 (112.7)
Davie	70 (112.7)	Nash	80 (128.7)	Wilson	80 (128.7)
Duplin	90 (144.8)	New Hanover	100 (160.9)	Yadkin	70 (112.7)
Durham	70 (112.7)	Northampton	80 (128.7)	Yancey	70 (112.7)
Edgecombe	80 (128.7)	Onslow	100 (160.9)		
Forsyth	70 (112.7)	Orange	70 (112.7)		

Note on the working drawings any anchorages, connectors, inserts, steel sleeves or other such devices used as part of the falsework or formwork that remains in the permanent structure. If the plan notes indicate that the structure contains the necessary corrosion protection required for a Corrosive Site, epoxy coat, galvanize, metallize or otherwise protect these devices as directed by the Engineer. Any coating required by the Engineer will be considered incidental to the various pay items requiring temporary works.

### Review and Approval

The Engineer is responsible for the review and approval of temporary works' drawings. Submit the working drawings sufficiently in advance of proposed use to allow for their review, revision (if needed), and approval without delay to the work.

Do not start construction of any temporary work for which working drawings are required until the drawings have been approved. Such approval does not relieve the Contractor of the responsibility for the accuracy and adequacy of the working drawings.

The time period for review of the working drawings does not begin until complete drawings and design calculations, when required, are received by the Engineer.

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

If requested by the Engineer, submit with the working drawings manufacturer's catalog data listing the weight of all construction equipment that will be supported on the temporary work. Show anticipated total settlements and/or deflections of falsework and forms on the working drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders. Falsework hangers that support concentrated loads and are installed at the edge of thin top flange concrete girders (such as bulb tee girders) shall be spaced so as not to exceed 75% of the manufacturer's stated safe working load. Use of dual leg hangers (such as Meadow Burke HF-42 and HF-43) are not allowed. Design the falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

### **Construction Requirements**

All requirements of Section 420 of the Standard Specifications apply.

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

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

### **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.

**Foundations:**

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

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

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

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

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

**Removal**

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

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

**Method of Measurement**

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

**Basis of Payment**

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

**ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS**

(6-11-07)

**General**

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

**Installation**

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

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

**Field Testing**

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

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

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

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

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

**Removal and Replacement of Failed Test specimens:**

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

**Usage**

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

**Basis of Payment**

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

**LAW ENFORCEMENT**

**SPECIAL**

**Description**

Furnish law enforcement officers and marked law enforcement vehicles to direct traffic in accordance with the contract.

**Construction Methods**

Use uniformed law enforcement officers and marked law enforcement vehicles equipped with lights mounted on top of the vehicle and law enforcement vehicle emblems to direct or control traffic as required by the plans or by the Engineer.

**Measurement and Payment**

*Law Enforcement* will be measured and paid for in the actual number of hours that each law enforcement officer is provided during the life of the project as approved by the Engineer. There

will be no direct payment for marked law enforcement vehicles as they are considered incidental to the pay item.

Payment will be made under:

**Pay Item**  
Law Enforcement

**Pay Unit**  
Hour

**CLEANING AND PAINTING EXISTING STRUCTURE**

**SPECIAL**

**GENERAL**

This work shall consist of furnishing all labor, equipment, and materials to clean and paint the structural steel of the existing Lift Span, towers, and control house; and the exterior portions of the lift towers, counter weights, control house, and machinery house. Work includes: removing, containment and disposal of the existing paint system; preparation of the surfaces to be painted; applying the new paint system; and portable lighting and all else as required in the contract documents.

All structural steel of the Lift Span and towers shall be painted. All machinery and all other areas that have previously been painted shall be painted. The roadway stringers under the Tower Spans shall also be painted. All machinery, lift cables, electrical cables and other areas not to be painted shall be protected from blasting and painting. Equipment bearings, seals, and gear faces shall be sealed to keep out blasting medium and paint. The open steel grid floor of the span will not be painted.

The Lift Span consists of an open steel grid floor on floor beams and stringers supported by a steel truss. There are 13 - 72" plate girder floor beams at a "bay" spacing of 34' with each bay containing 14 - W24 I-Beam stringers at 4'-4" spacing, 2 - 120" plate girder lifting beams, and a steel truss consisting of 20"x28" and 20"x20" hollow chord box sections, gusset plates, and various other steel members. The truss "panel" length is 34' per panel. Structural steel for the towers consist of hollow chord box sections of various sizes, plate girders, I-Beams, and various steel shapes. The bridge has a clear roadway width of 54' and a vertical clearance of 65' in the seated position. The approximate steel area to be painted is:

- Lift Span: 190,098 sq. ft. (Total)
  - Exterior Chord Area: 21,246 sq. ft.
  - Interior Chord Area: 19,952 sq. ft.
- Towers (4): 129,796 sq. ft. (Total)
  - Exterior Chord Area: 35,553 sq. ft.
  - Interior Chord Area: 32,877 sq. ft.
- Counter Weights (2): 7,339 sq. ft.
- Control House: 7,836 sq. ft.
- Machinery Houses (2): 15,726 sq. ft.
- Total Area: 350,795 sq. ft.**

Paint on the bridge (regardless of color) contains red lead and other hazardous constituents. All cleaning and surface preparation activities must prevent dispersion of debris into the environment.

Surface area shown is approximate and may vary from the actual quantity to be painted. The Contractor is responsible for determining the actual area to be painted.

The bridge will be operated by NCDOT during the project.

**SPECIALTY ITEMS:**

**Work Schedule** – Prior to beginning work, the Contractor shall submit his work schedule to the Engineer. Schedule shall be kept up to date, with a copy of the revised schedule being provided to the Engineer in a timely manner.

**SSPC QP-2 Certification** - The existing paint systems include toxic substances such as red lead oxide, which are considered hazardous if improperly removed. Only contractors who are currently SSPC QP-2, Category A certified, and have successfully<sup>1</sup> completed lead paint removal on similar structures within 18 months prior to this bid, may bid on and perform this work. **The apparent low bidder or sub-contractor for the apparent low bidder shall complete and submit to the Assistant State Bridge Management Engineer a “Lead Abatement Affidavit” by 12:00 noon of the third day following the opening of bids. This form may be downloaded from:**

[http://www.ncdot.gov/doh/operations/dp\\_chief\\_eng/maintenance/bridge/](http://www.ncdot.gov/doh/operations/dp_chief_eng/maintenance/bridge/)

**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.
- Painted surfaces have an adhesion that meets an ASTM D-3359, 3A rating.

Final acceptance is made only after the paint system meets the above requirements.

**Containment Plan** - No work begins until the Contractor furnishes the Engineer with a containment plan for surface preparation and coating operations and the Engineer reviews and responds in writing about the acceptability of said plan. Such plan must meet or exceed the requirements of a Class 2A containment in accordance with SSPC Guide 6. Enclosure drawings and loads supported by the structure must be prepared, signed and sealed by a Registered North Carolina Professional Engineer. **The containment plan must take into consideration the span weight balance.**

In the containment plan describe how debris are contained and collected. Describe the type of tarpaulin and bracing materials and the maximum designed wind load. Describe the dust

<sup>1</sup> Successfully: Lead abatement work completed in accordance with contract specifications, free of citation from safety or environmental agencies. Lead abatement work shall include but not be limited to: abrasive blasting; waste handling, storage and disposal; worker safety during lead abatement activities (fall protection, PPE, etc.); and containment. This requirement is in addition to the contractor pre-qualification requirements covered by NCDOT Std. Specification, Section 102-2.

collection system and how a negative pressure of 0.03 inches of water column is maintained inside the enclosure while blasting operations are being conducted. Describe how the airflow inside the containment structure is designed to meet all applicable OSHA Standards. Describe how water run-off from rain will be routed by or through the enclosure. Describe how wash water will be contained and paint chips separated. Describe what physical containment will be provided during painting application to protect vehicles and areas not to be painted.

**Wash water Sampling and Disposal Plan** - No work begins until the Contractor furnishes the Engineer with a containment plan for collecting and disposing of wash water, surface preparation and coating operations and the Engineer reviews and approves in writing said plan. All wash water shall be collected and sampled prior to disposal. Representative sampling and testing methodology shall conform to 15A NCAC 02B.0103, "Analytical Procedures". Wash water shall be tested for pollutants listed in 15A NCAC 02B.0211 (3), 15A NCAC 02T.0505 (b)(1) and 15A NCAC 2T.0905 (h) (See NCDOT Guidelines for Managing Bridge Wash Water). Depending on the test results, wash water disposal methods shall be described in the disposal plan. Wash water shall be disposed of in accordance with all current state and federal regulations.

**Waste Handling of Paint and Abrasives** – Use a company from the below list of approved waste management companies. Immediately after award of the contract, the Contractor arranges for waste containers, transportation and disposal of all waste. No work begins until the Contractor furnishes the Engineer with a written waste disposal plan. Any alternative method for handling waste must be pre-approved by the Engineer.

Southern Logistics, Inc. – 312 Orvil Wright Blvd, Greensboro, NC 27409 (Ph. 336-662-0292)  
A&D Environmental – PO Box 484, High Point, NC 27261 (Ph. 336-434-7750)

All removed paint shall be considered a hazardous waste. The Contractor has the option of furnishing the Engineer certified test reports showing Toxicity Characteristic Leaching Procedure (TCLP) results of the paint chips stored on site, with disposal being in accordance with "Flowchart on Lead Waste Identification and Disposal"

([www.wastenotnc.org/hwhome/guidance/guidance.htm](http://www.wastenotnc.org/hwhome/guidance/guidance.htm)).

If the Contractor elects to have TCLP testing done, samples shall be taken from at least 10% of the barrels to be disposed of, with at least one sample being from each bridge.

Once the waste has been collected and the quantity determined, the Contractor prepares the appropriate shipping documents and manifests and presents them to the Engineer for waste shipment and disposal. The Engineer will verify the type and quantity of waste and obtain a Temporary Waste Disposal Identification Number (TWDIN) from the NC Hazardous Waste Section.

North Carolina Hazardous Waste Section  
Division of Waste Management  
Department of Environment & Natural Resources  
401 Oberlin Rd, Suite 150  
Raleigh, NC 27605  
Phone-919-508-8539  
Fax: 919-715-4061

Internet: [www.wastenotnc.org](http://www.wastenotnc.org)

At the time of shipping the Engineer will sign, date and add the TWDIN in the appropriate section on the manifest. The cost for waste disposal (including any lab fees) is included in the bid price for this contract. Note NC Hazardous Waste Management Rules (15A NCAC 13A) for more information.

**Equipment Mobilization** - The equipment used in any travel lanes and paved shoulder must be mobile equipment on wheels that has the ability to be moved on/off the roadway and **lift span** in less than 30 minutes. All work conducted in travel lanes must be from truck or trailer supported platforms and all equipment must be self propelled or attached to a tow vehicle at all times.

### **SUBLETTING OF CONTRACT:**

Only contractors certified to meet SSPC QP-2, Category A, and have successfully completed lead paint removal on similar structures within 18 months prior to this bid are qualified for this work. Work is only sublet by approval of the Engineer.

### **SPECIFICATIONS:**

The North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures dated July 1, 2006, together with these Special Provisions apply to this project. Surface preparation and painting are performed in accordance with Section 442 except where otherwise noted in these Special Provisions. The Paint materials must meet the applicable materials specifications under Section 1080. Materials approvals are in accordance with 4.0 Materials of this Special Provision.

### **1.0 PREPARATION OF SURFACES:**

- 1.1 Power wash all surfaces before any other surface preparation is conducted. All surfaces shall be power washed to remove dust, salts, and other contaminants, except for exterior surfaces consisting of siding such as the towers, control house and machinery galleries, etc. a low pressure wash shall be used. All wash water shall meet the requirements of NCDOT Managing Bridge Wash Water specification.
- 1.2 Surface preparation for surfaces behind and immediately adjacent to bridge operational items including electrical conduit, hydraulic hoses and other related areas shall be power washed with low pressure water, SP 1 followed by SP 10 with a minimum of 1.5 mil profile.
- 1.3 Blasting is done with recyclable steel grit meeting the requirements of Section 1080-15. The profile must be between 1.0 and 3.0 mils when measured on a smooth steel surface. Blasting abrasives used in cleaning operations shall meet the requirements of SSPC AB2 and SSPC AB3.
- 1.4 Before the contractor departs from the work site at the end of the work day, all debris generated during surface preparation are collected in approved containers.
- 1.5 The Contractor cleans a two square foot area at each structure to demonstrate the specified finish and the inspector preserves this area by covering it with tape, plastic or some other suitable means so that it can be retained as a site standard.



- 1.6 Any area of corroded steel (steel which has lost more than 50% of its original thickness) must not be painted until the Engineer observes its condition.
- 1.7 All parts of the bridges not to be painted, and the travelling public, shall be protected from overspray by a physical barrier.
- 1.8 Contractor is responsible for protecting all electrical, hydraulic and other areas not to be blast cleaned that are responsible for bridge operations, additionally responsible for replacing any broken hardware, fasteners, lines and or hoses due to contractor performing work.
- 1.9 Surface chloride levels for painting are 7 PPM or below.

## **2.0 PAINTING OF STEEL:**

Paint System 1 (**modified**), as specified in these special provisions and Section 442 of NCDOT's Standard Specifications, is to be used for this work. System 1 is an inorganic zinc primer (**For this project the IOZ primer shall be replaced with Organic Zinc Primer.**) and acrylic topcoats used over blast cleaned surfaces (SP10 – near white) except as noted below:

- A. Hollow Chord Members- The interior or inside all surfaces shall be blast cleaned to an (SP-10-Near White Blast). Apply 1 coat (3-5 mils DFT) of Organic Zinc Primer and 2 coats, (5-7 WFT) of an approved Epoxy Aluminum Mastic or such suitable coating approved by the Engineer to all interior surfaces of the hollowed chorded members.
- B. Surfaces with Siding (Towers, Control House, etc.)- These areas shall not be blast cleaned. All surfaces shall be power washed with low pressure water followed by an SP-2 (Power Tool) cleaning as necessary to remove loose and or detrimental coatings prior to the application of acceptable primer and finish coats. These areas shall be top coated with two coats of acrylic paint the same color of paint as lift span.

Any area where newly applied paint fails to meet the specifications must be repaired or replaced by the Contractor. The Engineer approves all repair processes before the repair is made. Repaired areas must meet the specifications. The Contractor applies an additional finish coat of paint to areas where the tape adhesion test is conducted.

Do not apply any coating below 40 F or when a temperature of the air or substrate is 40 F or below is predicted during the drying and curing period of the paint. Do not apply any coating above or below the manufacturers recommended application temperatures or during a period when an ambient temperature outside the recommended range is predicted during the drying and curing period of the paint. During adverse weather, use enclosures that control atmospheric conditions artificially inside within limits suitable for painting during the painting operation and until the paints is cured or until weather conditions permit its exposure in the open.

Should the contractor elect to apply Organic Zinc Primer at or below 50 F the recoat window shall be a minimum of 24 hours or as necessary for the solvent to fully evaporate from the coating.

No application of acrylic coats (intermediate, stripe or top) shall be applied when the air or substrate is below 50 F.

Contractor must insure that chloride, sulfate and nitrate contaminants shall be removed from all steel surfaces prior to painting using an acceptable sample method in accordance with SSPC Guide 15. Levels of contaminants shall be at or below the coating manufacturer's recommendation for each contaminant. In addition if contractor elects to remove containment and expose previously coated surfaces; all surfaces shall be power washed with low pressure water prior to the application of each successive remaining coat and demonstrate that chloride, sulfate and nitrate contaminants are below the paint manufacturers recommended limits.

Should the contractor elect to blast and paint to adjacent areas of newly applied layers of coating they shall provide sufficient protection to coatings layers as well as stop each layer twelve (12") inches from the end of each coating layer to provide sufficient coating application

All steel to steel contact areas in the truss such as gusset connections shall be sealed with an approved caulking as recommended by the paint manufacturer and approved by Engineer prior to start of work.

### **3.0 MATERIALS:**

All **Organic Zinc-Rich** coatings **submitted for use** shall be evaluated for performance through the National Transportation Product Evaluation program (NTPEP) for Structural Steel Coatings as part of a Coating System that appears on one of the North East Protective Coatings Committee's (NEPCOAT) Qualified Products Lists. Submission of products through AASHTO/NTPEP is a continuous process and manufacturers may submit systems at any time. Prior to the start of work, a 1 quart unmixed sample kit (including the zinc dust) of the Organic Zinc Primer shall be sent to the Materials and Tests Unit for verification testing.

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 NCDOT's Standard Specifications.

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

### **3.1 REQUIREMENTS FOR SUITABLE CAULKING**

**Submit for approval to the Engineer and Materials & Tests Unit, Chemical Testing Engineer**

#### **A. APPROVAL**

1. Manufacturer's letter certifying the Caulking Compound supplied to the project will meet or exceed Department expectations and will be adequate for the intended use
2. Contractor shall submit for approval necessary paperwork at a minimum of 7 working days prior to Pre-Construction Meeting:
  - Product data sheet
  - MSDS sheet

- Letter from paint manufacturer stating caulking material is suitable and compatible with the type and brand of paint being used on the project
1. Show typical markings on the packaging and any date markings.
  2. Provide application instructions and temperature limitations.
  3. State effective product life

#### **B. WORK SEQUENCE**

Contractor shall apply suitable caulking in accordance the manufacturer's product data sheet. In no case shall caulking be applied to moist, damp or frost bearing surfaces or if temperature will fall below freezing for more than 48 hours.

Suitable caulking shall be applied to all steel to steel contact surfaces after application of the primer coat.

#### **C. ACCEPTANCE BY DEPARTMENT**

The Engineer of Record & Chemical Testing Engineer will review the manufacturer's submittal for compliance with specification requirements.

#### **D. FIELD DOCUMENTATION REQUIREMENTS**

Accepted suitable caulking products will be accepted if they can be identified in the field by manufacturer name and (in applicable) brand name.

### **4.0 INSPECTION:**

Quality Assurance Inspection - The Contractor furnishes all necessary apparatus such as ladders, scaffolds and platforms as required for the inspector to have reasonable and safe access to all parts of the work. The contractor illuminates the surfaces to be inspected to a minimum of 50-foot candles of light.

Contractor must insure that chloride levels on the surfaces prior to each coat of paint are below 7 PPM using an acceptable sample method in accordance with SSPC Guide 15. The frequency of testing shall be 1 test per 5000 square feet and 3 tests per tower prior to any work being performed on the towers.

**NOTE- Contractor has the option to expose each layer of paint applied permitting proper curing to outside exposure. Random quality assurance testing of chloride levels will done to assure all layers of paint have acceptable chloride levels prior to the application of the next layer.**

If contractor elects to use an approved organic zinc rich primer and is approved in accordance with "4.0 Materials" of this specification, verification of the cure of organic zinc rich primer shall be tested by the following:

ASTM D 3363- 2H  
ASTM D 4541- 400 PSI

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.

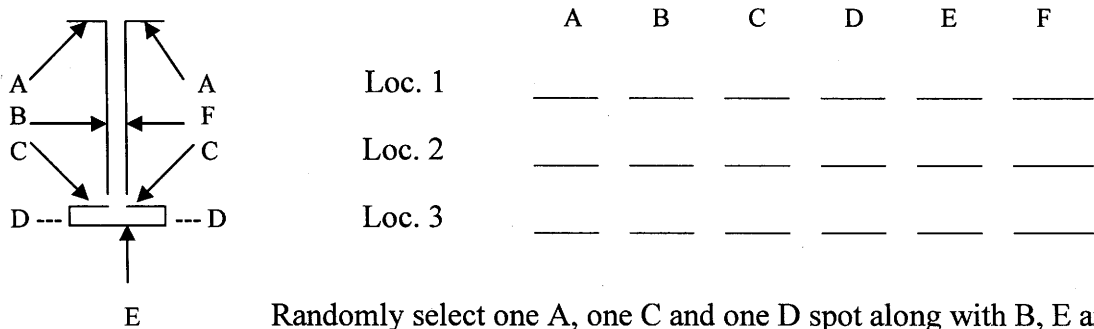
The contractor informs the Engineer of all scheduled and unannounced inspections from SSPC, OSHA, EPA and/or others that come on site.

Inspection Instruments - The Contractor furnishes at least the following calibrated instruments at site and conducts the quality control testing:

- Sling Psychrometer - ASTM E-337 – bulb type
- Surface Temperature Thermometer
- Wind Speed Indicator
- Tape Profile Tester – ASTM D-4417 Method C
- Surface Condition Standards – SSPC VIS-1 and VIS-3
- Wet Film Thickness Gage – ASTM D-4414
- Dry Film Thickness Gage – SSPC-PA2 Modified
- Solvent Rub Test Kit – ASTM D-4752
- Adhesion Tape Kit – ASTM D-3359
- Elcometer and dollies
- Surface Contamination Analysis Kit or (Chloride Level Test Kit)

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 on M&T611.

- A. The dry film thickness is measured at each spot as indicated on the attached diagram at no less than three random locations along each floor beam, stringer, and truss chord member in each floor beam bay or truss panel. Also dry film thickness is measured at no less than six random spots per span on diaphragms and lateral bracing. Each spot is an average of three to five readings in accordance with SSPC PA-2.



- B. Two random adhesion tests per span are conducted on interior surfaces after the primer coat has been properly cured, and will be touched up by the Contractor. One random Cut Tape adhesion test per floor beam bay or truss panel is conducted on interior surface after the finish coat is cured, and will be touched up by the Contractor.

**5.0 SAFETY AND ENVIRONMENTAL COMPLIANCE PLANS:**

Personnel access boundaries are delineated for each work site using signs, tape, cones or other approved means. Submit copies of safety and environmental compliance plans that comply with SSPC QP-2 Certification requirements.

**6.0 ENVIRONMENTAL MONITORING:**

Comply with Section 442-13(B) of NCDOT's Standard Specifications.

A "Competent Person<sup>2</sup>" is on site during all surface preparation activities and monitors the effectiveness of containment and dust collection systems. Any visible emissions outside the containment enclosure or pump monitoring results exceeding the level of 30 µg/m<sup>3</sup> TWA is justification to suspend the work. Before any work begins the Contractor provides a written summary of the responsible person's safety training.

**7.0 HEALTH AND SAFETY RESPONSIBILITY:**

Comply with Section 442-13(C) of NCDOT's Standard Specifications. Insure employee blood sampling test results are less than 50 micrograms per deciliter. Remove employees with a blood sampling test of 50 or more micrograms per deciliter from work activities involving any lead exposure.

An employee who has been removed with a blood level of 50 micrograms per deciliter or more shall have two consecutive blood sampling tests indicating that the employee's blood lead level is at or below 40 micrograms per deciliter before returning to work activities involving any lead exposure.

**8.0 STORAGE OF PAINT AND EQUIPMENT:**

The Prime Contractor provides a location for materials, equipment and waste storage. Tarpaulins are spread over all pavements and surfaces underneath equipment utilized for abrasive recycling and other lead handling equipment or containers.

**9.0 UTILITIES:**

The Contractor protects all utility lines or mains which may be supported on, under, or adjacent to bridge work sites from damage and paint over-spray.

**10.0 PAYMENT:**

The cost of inspection, surface preparation and repainting the existing structure is included in the lump sum price bid for *Cleaning and Painting of Existing Structure*. This price is full compensation for furnishing all inspection equipment, all paint, cleaning abrasives, cleaning solvents and all other materials; preparing and cleaning surfaces to be painted; applying paint in

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<sup>2</sup> **Competent Person** as defined in OSHA 29 CFR 1926.62 is one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who have authorization to take prompt corrective measures to eliminate them.

the field; protecting work, traffic and property; and furnishing blast cleaning equipment, paint spraying equipment, brushes, rollers and any other hand or power tools and any other equipment; containment, handling and disposal of debris and wash water, all personal protective equipment, and all personal hygiene requirements.

This price shall be full compensation for all inspection equipment, all materials and labor necessary to fully contain the blast debris; daily collection of the blast debris into the specified containers; and any measures necessary to ensure conformance to all safety and environmental regulations as directed by the Engineer.

## **MAINTAINING LIFT SPAN BALANCE**

**SPECIAL**

### **1. SCOPE**

The Contractor shall be responsible for all labor and material necessary to maintain the existing balance condition throughout construction. At the conclusion of all work on the lift span, the balance condition shall again be evaluated and confirmed by the Engineer, with any adjustments required to restore proper balance condition being performed by the Contractor.

### **2. MATERIALS**

Additional balance weights for installation in the counterweight pockets, if necessary, shall be furnished by the Contractor, and shall be 50 pounds each, all of the same weight. New balance weights shall be ASTM A36 Steel plate no larger than 12 inches high by 12 inches wide, with a hand hole or handle at the top for ease of handling. Steel balance weights shall be painted with an approved rust inhibitor.

NOTE: Approximately 32,000 lbs. of counterweight is available from NCDOT. Any additional counterweight required will be furnished by the Contractor and retained by the contractor upon completion of the work.

### **3. BALANCE CONDITION DETERMINATION**

The existing bridge balance condition, and the final balance condition (after all work completed) shall be determined by the strain gage method or by reading the drive motor torque on the existing flux vector drives during raising operation.

If the flux vector drive torque readings are utilized, they shall be taken at the slowest possible steady running speed, at 20 feet above seated. Several readings shall be taken and averaged. Readings shall be taken both immediately before work is performed and after all work is completed. Speed shall be identical for all readings. Readings shall be taken when the lift span is dry, and with little or no wind.

The Contractor's Engineer shall convert the motor torque readings to equivalent weight values as measured at each end of the lift span.

#### 4. REQUIRED BALANCE RANGE

45

During construction, the acceptable balance condition shall be within 1,000 pounds of the existing weight (downward reaction) at each end of the lift span. Balance conditions shall be strictly maintained within the above stated range during all construction activities.

The Contractor shall provide balance calculations for all additions and removals of components and materials to and from the lift span and counterweights. Such calculations shall be submitted to the Engineer for each operation that involved any alterations to the weight or balance of the lift span.

When weight adjustments are necessary to maintain the balance condition, weight shall be added to or removed from the counterweight pockets in accordance with the approved calculations. The bridge balance conditions shall be adjusted the same day that construction activities result in any alteration of the bridge balance, and prior to any required openings for waterway traffic. At no time shall any brakes or span locks be released or disengaged, respectively, until bridge balance has been properly adjusted.

Temporary equipment and tools shall be removed from the lift span prior to each bridge operation, and therefore need not be included in the balance.

At completion of the project, acceptable balance condition shall be the initial balance condition prior to any work being performed, plus or minus 500 pounds downward reaction at each end as measured at 20 feet above seated as described above.

#### 5. PERFORMANCE

The Contractor shall perform balance calculations as herein specified. The balance calculations shall be performed by a Professional Engineer licensed in the State of North Carolina and having moveable span experience. **The calculations shall account for the detailed weight of all materials removed and added as part of this project and their locations on the lift span including removal of existing red lead primer paint, application of the new paint system, caulk, fill plates, welds, bolts, washers, nuts and any other components removed, added or replaced as part of this project.**

Calculations shall be submitted on spreadsheets showing the material callout, weight, location on the lift span, and resulting impact on balance conditions at both ends. Weight removed and weight added shall be tabulated on separate sheets from the balance calculations. A summary balance table shall be developed. The summary tables shall show the staging of the balance and proposed imbalances. The calculations shall also account for the placement of any new balance blocks, and the removal or repositioning of any existing balance blocks. A brief narrative shall be included with the outline of the proposed construction staging, the duration of the unbalance and all the other aspects of the work. This information shall be coordinated with the Contractor's scheduling requirements and shall be submitted to the Engineer for approval prior to commencement of any work on the lift span. The weights shall be shown on the shop drawings for each component. The calculations and spreadsheet shall be updated daily by the Contractor throughout construction on the lift span and submitted to the Engineer daily.

6. MEASUREMENT AND PAYMENT

There will be no separate measurement and payment for maintaining of the span balance condition. This work is considered an integral part of the overall work, and the costs thereof shall be included in the price bid for *Cleaning and Painting Existing Structure*.

**UNDER STRUCTURE WORK PLATFORM**

SPECIAL

**Description**

Prior to any painting operations on the structure, the Contractor shall design and install an understructure work platform which will be used to provide access to the work to be done as well as serve as containment for the cleaning and painting of the bridge. The Contractor shall determine the capacity of the platform which will be required, but the capacity shall not be less than that required by State or Federal regulations. The platform shall remain in place until all work is completed on the moveable span. Platform shall be constructed of materials capable of withstanding damage from any of the work required on this project. The platform shall be fireproof. Drawings of the platform and loads supported by the platform shall be sealed by a North Carolina Registered Professional Engineer. Submit drawings to the Engineer for approval prior to beginning work on the platform. Platform shall be cleaned after each work day to prevent materials from falling or washing into the river.

The Contractor shall furnish and install additional counterweights as required to keep the moveable span balanced and shall maintain the balance of the bridge to allow for normal opening and closing. The Contractor shall furnish, install and maintain 6 warning signs at least 48"x48" indicating the reduced clearance resulting from the platform. The signs shall be installed on the Lift Span (2 locations) and at the corners of the pier protection (4 locations).

**Payment**

*Under Structure Work Platform* will be paid for at the lump sum contract price and will be full compensation for the design, installation, maintenance, and removal of the platform and warning signs.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Under Structure Work Platform	Lump Sum

**MANAGING BRIDGE WASH WATER**

**1.0 Description**

Collect and properly dispose of Bridge Wash Water from bridge decks.

**2.0 Construction Methods**

- (A) Prepare a written Bridge Wash Water management plan in accordance with the Guidelines for Managing Bridge Wash Water available at <http://www.ncdot.org/doh/preconstruct/ps/contracts/letting.html>. Submit plan and obtain approval from the Engineer prior to beginning of the bridge cleaning operation.



- (B) Prior to final payment, submit a paper copy of all completed records pertaining to disposal of Bridge Wash Water.

### 3.0 Measurement and Payment

Payment for collecting, sampling, testing, pH adjustment, monitoring, handling, discharging, hauling, disposing of the bridge wash water, documentation, record keeping, and obtaining permits if applicable, shall be included in the payment for other items.

## ELECTRICAL AND MECHANICAL REPAIR SPECIAL PROVISIONS

### GENERAL REQUIREMENTS FOR ELECTRICAL WORK

#### 1. SCOPE

- (A) This section covers all products, labor, services, incidentals, and related work necessary to furnish, install, test, and put into permanent service all electrical work as shown on the plans and described herein.
- (B) This section, along with the following sections, comprise the Special Provisions for electrical work. The provisions and requirements of all sections of these electrical Special Provisions shall apply fully and equally to all electrical work and to all contractors performing electrical work. The provisions and requirements of this section are hereby incorporated into the sections listed below by this reference, and shall have the same force and effect as if printed in full in each of the sections listed.
1. Miscellaneous Electrical Work
  2. Wiring Methods and Materials
  3. Grounding and Bonding
  4. Roadway Lighting Rehabilitation
  5. Control House HVAC System
- (C) The contractor is expected to deliver a complete, functional, reliable, and safe installation which fully satisfies the requirements, both explicit and implicit, and intents of the contract documents.
- (D) Any work shown and/or described in any portion of the contract documents shall be executed as if shown and/or described in all portions of the contract documents.
- (E) Any work which is not shown and/or described in the contract documents, but is nevertheless necessary in order to properly carry out the intent thereof, shall be executed in its entirety as if it were specifically shown and/or described therein.

#### 2. GENERAL PROVISIONS

- (A) Unless specifically noted otherwise in these contract documents, the Contractor shall bear full responsibility, at no additional payment, for all costs, damages, etc. related to compliance with this section and those sections which incorporate this section by reference.

- (B) Where terms such as "include" are used in identifying items belonging to a group, such identification shall be understood to be non-exhaustive and shall not in any way limit the applicable items to those explicitly identified.
- (C) Use of terms such as "furnish" or "provide" shall be understood to include acquisition, delivery to the project site, and installation of the identified item(s). Installation shall include physical installation, electrical and mechanical hook-ups, testing and adjustment, and generally making the identified item(s) fully operable in accordance with the requirements and intents of these contract documents.
- (D) Use of terms such as "required" or "necessary" shall be understood to include all of the following: as required by the contract documents; as stipulated by the Engineer; as required by applicable laws, regulations, and/or codes; as needed for correct, safe, and reliable operation.
- (E) Use of terms such as "approved" or "accepted" shall be understood to solely refer to approval by the Engineer as satisfying the requirements of the contract documents and acceptable for use and/or execution, except where a different meaning is made clear by the context of use.
- (F) Where terms such as "appropriate", or similar subjective terms, are used, the determination of appropriateness shall be solely at the discretion of the Engineer, the exercise of which shall not be considered cause for delay or additional payment.
- (G) The terms "products" and "materials" may be used interchangeably, and shall both generally be understood to include all raw materials, standard and custom manufactured products, equipment, devices and related appurtenances required to be furnished for the specified work.
- (H) Where these Special Provisions provide a list of acceptable alternatives for a product and/or method, it shall be understood as if the list were followed by the phrase "unless otherwise shown on the plans".
- (I) The term "contract documents" shall be understood to refer to the plans, Standard Specifications, Special Provisions, and all agreements, addenda, and additional documents which comprise the contract for this project.
- (J) The term "Prime Contractor" shall be understood to refer to the Contractor who is primarily liable for the acceptable completion of the overall project.
- (K) The term "Electrical Contractor" shall be understood to refer to the sub-contractor who, apart from the Prime Contractor, is primarily responsible for performing the electrical work. This is the Prime Contractor if no separate sub-contractor is used for the electrical work.

### **3. REFERENCED PUBLICATIONS**

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- (A) Unless otherwise noted, the version of referenced standards or publications is the version in effect at the bid opening time for this contract.
- (B) The following publications form a part of these Special Provisions by this reference, and shall have the same force and effect as if printed herewith in full.
  - 1. AASHTO LRFD Movable Highway Bridge Design Specifications
  - 2. NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting
  - 3. NETA Acceptance Testing Specifications
  - 4. NFPA 70 – National Electrical Code
  - 5. North Carolina Electrical Code
  - 6. North Carolina Department of Transportation Standard Specifications for Roads and Structures
  - 7. All applicable state and local codes.
- (C) Additionally, all work shall comply with all additional requirements of the Authorities Having Jurisdiction. It shall be the responsibility of the Contractor to contact the proper Authorities prior to beginning work in order to determine all requirements, as well as to maintain relevant communications with such Authorities throughout construction.

### **4. QUALIFICATIONS OF CONTRACTORS, VENDORS, AND MANUFACTURERS**

- (A) The contract documents assume that all contractors and/or sub-contractors undertaking electrical work related to this project are properly qualified, skilled, and experienced in the type of work involved. It is similarly assumed that all vendors and manufacturers selected by the Contractor to provide products for this project are properly qualified, skilled, and experienced in the fabrication and/or manufacturer of the products involved.

The Contractor shall make no excuse for failure to satisfy the requirements of the contract documents based on lack of qualifications, skills, or experience of any contractor, sub-contractor, vendor, and/or manufacturer.

#### **(B) Electrical Contractor**

- (1) The Electrical Contractor shall be properly licensed by the State of North Carolina, and be primarily and regularly engaged in the installation and service of industrial electrical power distribution and control systems.
- (2) The Electrical Contractor shall employ on site supervisory personnel who are licensed electricians experienced in the installation and maintenance of industrial electrical power distribution and control systems.
- (3) The Electrical Contractor shall have been in the business of installing and servicing industrial electrical power distribution and control systems for at least ten continuous years as of the bid date.

- (4) In lieu of sub-contracting the electrical work to a separate Electrical Contractor, Prime Contractor personnel satisfying all of the above requirements may perform electrical work.
- (5) The Electrical Contractor shall be identified prior to performing this work. Documentation demonstrating that the Electrical Contractor satisfies the requirements of these Special Provisions shall also be provided along with the bid documents. If no separate sub-contractor is to be used, the Prime Contractor shall be clearly identified as the Electrical Contractor and documentation demonstrating that the Prime Contractor satisfies the requirements of these Special Provisions shall be provided.

Failure to comply with this paragraph, and/or identification of an Electrical Contractor who does not satisfy the requirements of this sub-section, may be considered cause for declaring an offending bidder to be non-responsive.

(C) General Vendors and Manufacturers

- (1) Vendors and/or manufacturers for electrical systems, sub-systems, and/or products, other than the control system, shall be primarily and regularly engaged in providing the items for which they are responsible.
- (2) Vendors and/or manufacturers for electrical systems, sub-systems, and/or products shall have been the business of providing the items for which they are responsible for at least 5 continuous years as of the bid date.
- (3) Additional qualification requirements for vendors and/or manufacturers shall be as given elsewhere in these Special Provisions.
- (4) Vendors and/or manufacturers for electrical systems, sub-systems, and/or products, other than the control system, need not be identified along with the bid documents unless such identification is required elsewhere in the contract document.

However, the Engineer may at any time request documentation demonstrating that a particular vendor or manufacturer satisfies the applicable qualification requirements of the contract documents. Any such request must be fulfilled to the complete satisfaction of the Engineer, including satisfaction of all applicable requirements. Failure to fulfill such a request to the satisfaction of the Engineer may be considered cause for the Engineer to order a halt to any work, without consideration for additional payment or delay, which is related to and/or affected by the vendor or manufacturer in question.

**5. CONTROL OF WORK AND MATERIALS**

(A) Character of Work

- (1) It is the intent, under this contract to secure high class workmanship in all respects, and that the finished work be workmanlike and acceptable in every detail.
- (2) In addition to the specific requirements given by the contract documents, all work shall comply with the following.
  1. All work must properly perform its intended function in a reliable manner.
  2. All work must be of substantial character such that it is not likely, in the Engineer's judgment, to become subject to premature failure during the course of normal service, including normal wear and tear.
  3. All work must not pose any unusual and/or unreasonable danger to persons and/or property. All work must not be likely, in the Engineer's judgment, to expose persons and/or property to any unusual and/or unreasonable danger as a result of normal service, including normal wear and tear.
  4. All work must be aesthetically acceptable in every way, including neatness and cleanliness.

(B) Quality Control

- (1) The Contractor shall bear full responsibility for all coordination of features, ratings, etc. of products as may be required to provide complete, operational, reliable and safe system(s) and sub-system(s) in accordance with the requirements and intents of these contract documents.
- (2) The Contractor shall bear full responsibility for all coordination necessary to perform all work, including, but not be limited to, coordination with and/or between suppliers, vendors, sub-contractors, and trades.
- (3) All details shown on the plans are typical and apply to all similar locations, or as otherwise indicated. All dimensions and details shall be verified at the site before proceeding with any work, purchasing any items, or fabrication of any custom components. The Contractor shall bear all costs and/or damages which may result from the ordering or fabrication of any items or materials prior to such verifications.
- (4) The Engineer may request that the Contractor furnish product samples in order to assist the Engineer in determining the acceptability of a proposed product or procedure. Such samples shall be furnished by the Contractor at no additional cost, and will be returned at or before the end of the project.
- (5) The Engineer may request that the Contractor furnish standards, reference materials, and/or similar publications in order to assist the Engineer in determining the acceptability of a proposed product, procedure, or test result. Such publications shall be furnished by the Contractor at no additional cost, and will be returned at or before the end of the project.

- (6) All items shall be handled, applied or installed in strict accordance with manufacturer's recommendations and instructions and with these Special Provisions.

(C) Familiarity with Contract Requirements and Examination of Plans

- (1) It is the responsibility of the Contractor, prior to submission of a bid, to fully determine the nature and location of the work, the character, quality and quantity of the materials which will be required, the nature of equipment and facilities needed preliminary to and during the performance of the work, the general and local conditions, and of all other matters which can in any way affect the work for this project. Failure to comply with this requirements shall not relieve the Contractor from responsibility for completion of all specified work, and shall not be considered cause for delay or additional payment.
- (2) Do not acquire dimensions by scale measuring of the contract plans except where a scale is explicitly indicated. Do not acquire dimensions of existing features by scale measuring of the contract plans.
- (3) Any reference drawings included with the plans are provided as-is and may not reflect the actual current conditions at the job site. The Owner makes no claim as to the accuracy of any reference drawings. The Contractor shall bear full responsibility for field verification of all critical dimensions.
- (4) The Contractor shall bring to the attention of the Engineer for clarification any apparent typographical or drafting error in the plans and/or these Special Provisions. Typographical and/or drafting errors, discovered or undiscovered, shall not relieve the Contractor from responsibility for satisfactory completion of all specified work in accordance with the intent of these contract documents, and shall not be considered cause for additional payment.

(D) Harmony And Coordination Of Contract Documents

- (1) The contract documents, including any referenced publications, are intended to form a cohesive and consistent whole.
- (2) These Special Provisions shall in no way be interpreted as voiding any applicable provision or requirement contained in any other portion of the contract documents, including those intended to be generally applicable to all work regardless of type or trade, except that in the case of an irreconcilable conflict the Engineer shall determine which provision(s) and/or requirement(s) take precedence. Otherwise, the Contractor shall make every effort to comply with all applicable provisions and requirements.
- (3) The contractor shall immediately bring to the attention of the Engineer any conflict between or within the contract documents and/or referenced publications.
- (4) Resolution of any conflicts between or within the contract documents and/or referenced publications shall be at the discretion of the Engineer. The existence

and/or resolution of such conflicts shall not be considered cause for delay or additional payment.

- (5) Dimensions shown on plans, unless obviously incorrect, shall take precedence over measurement by scale. Larger scale and/or detail plans shall take precedence over smaller scale and/or general plans.

(E) Field Measurements

- (1) Before ordering any materials or fabricating any items, the Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
- (2) All field measurements which are critical to the fabrication of new items shall be verified before submission of shop drawings for such items. Field measurements noted on shop drawings shall be clearly differentiated from other dimensions.
- (3) The Owner and/or Engineer will not, as a part of shop drawings review, bear responsibility for verification of any field measurements made by the Contractor. Review of shop drawings by the Owner and/or Engineer does not in any way relieve the Contractor from responsibility for the accuracy of field measurements.
- (4) The Contractor shall bear full responsibility for any errors which may result from inaccuracy of field measurements.

(F) Brand Name Products and Substitutions

- (1) Identification by "brand name" shall be understood to indicate identification by manufacturer name and/or model name or number.
- (2) The identification of products, both on the plans and in these Special Provisions, by brand name or equal description is intended to be descriptive, but not restrictive, and is to indicate the characteristics, performance, and quality of products that are satisfactory. Except when noted otherwise, the Contractor may propose "equal" products for consideration by the Engineer. Such "equal" products may be used only if the Engineer determines that the proposed product satisfies the requirements identified in the contract documents, is acceptable for the intended use, and is substantially equal in characteristics, performance, and quality to the specified product.
- (3) The Engineer may disqualify any proposed "equal" product which in his past experience and/or judgment is of poor quality and/or not likely to perform reliably in the application under consideration.
- (4) Where a product is identified by brand name, that brand name product was used as the design basis. Where the Contractor proposes to use an approved "equal" product, even if such a substitution is approved by the Engineer, the Contractor shall assume all responsibility for its proper installation and fit into the system and shall bear sole responsibility for any resultant extra work, including products, labor, and related costs.

- (5) The Contractor shall bear full responsibility for supplying to the Engineer all information required for the Engineer to determine the acceptability of a proposed "equal" product or procedure. The Engineer may request additional information, beyond what is explicitly required by these contract documents, to assist in determination of acceptability.
- (6) Determination of the acceptability of a proposed "equal" product shall be solely at the discretion of the Engineer. Rejection of a proposed "equal" product shall not be considered cause for delay or additional payment.
- (7) Because of the continuously changing nature of commercially manufactured products, neither the Owner nor the Engineer warrant that any identified brand names are available, accurate, and/or satisfy all requirements of the contract documents. The Contractor shall bear full and final responsibility for selection of products which satisfy all identified requirements. In case of any discrepancy, or other conflict, between the salient requirements identified in the contract documents and products identified by brand name, the salient requirements shall govern. Any such conflict, or other discrepancy, shall not be considered cause for delay or additional payment.

(G) Inspection Of Materials And Workmanship

- (1) All products and work, including fabrication, erection, and/or installation procedures, are subject to inspection and testing by the Engineer at all times. If any products and/or installations are found to be defective it shall be the Contractor's responsibility to coordinate repair or replacement at no additional cost.
- (2) Under no circumstances shall any inspection and/or test by the Engineer or his duly authorized representative, or any approval granted as a result thereof, relieve the Contractor from responsibility for full compliance with the requirements of these contract documents.
- (3) Where inspections or tests are to be made at the point of manufacture or fabrication, the Contractor shall in all cases give ample notice to the Engineer to permit such inspection and tests to be performed before shipment is made.
- (4) The Contractor shall make all work and products physically accessible to the Engineer for inspection and testing at all times. Walkways, platforms, ladders, and specialized equipment required for convenient and safe access to areas of work shall be provided by the Contractor. The Contractor shall provide all tools and labor to remove and replace covers, disassemble and reassemble equipment or structural features, etc. as may be directed by the Engineer to facilitate inspection and testing by the Engineer.
- (5) The Contractor shall keep the Engineer informed regarding the progress of work and provide the Engineer with reasonable advance notice of milestones during construction when inspection and/or testing by the Engineer may be required. The



Contractor shall also coordinate construction activities to allow access to all work by the Engineer, as well as provide the time required by the Engineer to perform all inspection and testing. If, in the Engineers judgment, the requirements of this paragraph are not being complied with, the Engineer may order the Contractor to halt work to allow for inspection and testing to take place. Any such disruption to work shall not be considered cause for delay or additional payment.

- (6) The Contractor shall furnish all facilities for the inspection of products and workmanship at the point of manufacture or fabrication, and inspectors shall be allowed free access to the necessary parts of the premises.
- (7) The Contractor shall be charged with any additional cost of inspection when material and workmanship are not ready at the time inspection is requested by the Contractor.
- (8) The Contractor shall furnish, promptly and without additional charge, all samples and specimens that are herein specified or that may be required by the Engineer to be taken or prepared in the field, and shall furnish labor and assistance, testing machines, tools and equipment necessary to prepare the samples and specimens as directed by the Engineer. Samples and specimens which the Engineer shall designate to be sent to the testing laboratories shall be shipped by the Contractor, as directed by the Engineer, at the Contractor's expense.
- (9) For any materials not covered by a designed specification of some specified organization, appropriate methods of testing and inspection to be outlined or designated by the Engineer shall be followed.
- (10) All samples for analyses and tests shall be taken in such manner as to be truly representative of the entire lot under test and shall not be worked in any way to alter the quality before testing. Where expressly permitted by the Engineer in the case of materials taken from stock or for use in minor parts, certified analyses and tests of the manufacturer furnished in triplicate may be accepted in lieu of tests prescribed herein. In case the records of physical and chemical tests of stock material are not available, a reasonable number of tests shall be furnished to the Engineer free of charge as required by the Engineer to satisfy himself as to its quality.
- (11) Inspection and tests of fabricated parts and manufactured articles shall be made by such methods and at such times as to insure compliance with the specification in all respects.
- (12) Any material may be rejected if, in the opinion of the Engineer, service records indicate that it is unsound or otherwise unsatisfactory.
- (13) The Contractor shall furnish the Engineer with as many copies of purchase orders to subcontractors, suppliers or manufacturers as the Engineer may direct.

- (14) All machining and preparation of test samples, required by the A.S.T.M. or other specification and cited as standard for this contract, shall be done by the Contractor at his own expense, except as otherwise specified herein.
  - (15) Should the preparation of the material be at far or inaccessible points or should it be divided into unreasonably small quantities, or widely distributed to an unreasonable extent, or should the percentage of rejected material be unreasonably large, the additional cost of extra inspection resulting therefore shall be borne by the Contractor, the Engineer being sole judge of what is to be deemed extra inspection.
  - (16) The Engineer shall have full power to reject any and all material or work which fails to meet the terms of the contract documents and such material or work shall be promptly repaired, or removed and replaced with new, as may be directed by the Engineer. All material or work which develops defects during the life of the contract either before or after installation shall be removed and replaced notwithstanding that it may have passed the prescribed inspection and tests.
  - (17) The Contractor shall immediately correct any imperfect work which may be discovered before final acceptance of the project at no additional cost. The fact that any such work may have been inspected shall not relieve the Contractor of any of his obligations to perform proper and satisfactory work, as herein specified, and all work which, during its progress, may become damaged from any cause or fails for any reason to satisfy the requirements of the contract documents, shall be removed and replaced by good and satisfactory work by the Contractor without any additional cost to the Owner and such work shall be subject to the approval of the Engineer.
  - (18) The Contractor shall furnish, at no additional cost, all labor and assistance necessary for the Engineer or his duly authorized representative to make such inspection and tests of workmanship as specified herein or as directed by the Engineer.
  - (19) These requirements shall apply equally to all work and products at the project site, in a shop, and in off-site storage.
- (H) Acceptance of Work
- (1) Acceptance of all work is at the sole discretion of the Owner and the Engineer.
  - (2) The Contractor shall perform all tests and operational demonstrations, and fully cooperate with all inspections, required by the Owner and Engineer for the purpose of determining that all work satisfies the requirements of the contract documents. Such tests, demonstrations, and inspections shall be at no additional cost.
  - (3) While individual systems and/or sub-systems may be granted preliminary acceptance during the course of construction, final overall acceptance of all work will not be granted until such time as the Owner and Engineer are satisfied that all

work fully satisfies the requirements of the contract documents. Any preliminary acceptance granted prior to final acceptance shall in no way restrict the Owner's right to require further adjustment prior to final acceptance, nor shall it relieve the Contractor of responsibility for full compliance with the requirements of the contract documents.

The Contractor is hereby notified that the Engineer is in no way obligated to grant preliminary acceptance to any portion of the electrical work. Denial of any request to grant preliminary acceptance shall not be considered cause for additional payment or delay.

- (4) Acceptance of any work, either partial or full, shall not relieve the Contractor for full and final responsibility for compliance with the contract documents, and shall in no way be interpreted as limiting the Contractor's liability for defects in the work due to failure to comply with the contract documents, including any defects discovered after acceptance of the work.

## 6. SUBMITTALS

- (A) The contract documents are intended only to depict the general intent of this contract; they are not of sufficient detail to be used in lieu of required submittals. All required additional detail development shall be provided at no additional cost.
- (B) The Contractor's Electrical Engineer shall coordinate and supervise the preparation of all electrical submittals, and fully review and check all submittal items, including those originally prepared by all sub-contractors and vendors, prior to submission for compliance with the requirements of the contract documents, compatibility with all new and existing work, and coordination with other submittal items.
- (C) Submittals shall comply with the special provision *Submittal of Working Drawings*.
- (D) Product Submittals
  - (1) Brochures, catalog cut and specification sheets, and other product literature for all standard or semi-standard products.
  - (2) Certified drawings for standard or semi-standard products when requested by the Engineer, or as otherwise required by the contract documents. Submit certified drawings shall be provided for all motors not provided as an integral component of a piece of standard or semi-standard equipment by the manufacturer of that equipment. Certified drawings shall clearly depict all critical dimensions, as well as all electrical and mechanical ratings. Where motors are provided with special modifications (encoders, extended shafts, etc.), these modifications shall be reflected on the certified drawings. Manufacturer's standard catalog drawings are not acceptable in place of certified drawings.
  - (3) Material test certificates for raw materials when requested by the Engineer, or as otherwise required by the contract documents.

- (4) Product submittals shall be provided for all products proposed for installation, even if the proposed products are identical to those specified by the contract documents.
  - (5) Each set of product submittal information shall cover only one distinct product.
- (E) Working Drawings
- (1) Shop and assembly drawings for fabricated items and assemblies.
  - (2) Layout, erection, and installation drawings and details.
    - (a) Layout and installation drawings shall be developed to show proposed locations, dimensions, and clearances to floors, walls, ceilings, structural members, mechanical components, and other nearby objects and equipment. Drawings need not necessarily be to scale, but items must be shown in their proper relative positions and be dimensioned. Drawings shall explicitly show National Electrical Code required "working" and "dedicated equipment" spaces about electrical equipment. Drawings shall clearly show the Contractor's proposed method of attachment, mounting details, specific hardware, any and all holes to be drilled or cut in structural steel or masonry, etc. Mounting detail drawings may be in the form of hand drawn details on 8 1/2 x 11 inch or 11 x 17 inch sheets where appropriate, but must be clearly titled and include a drawing number.
    - (b) Layout and installation drawings shall be submitted for approval prior to performing the work in question.
    - (c) If layout and installation drawings are not submitted for approval prior to performing related work, or the submitted drawings are in any way incomplete or deficient (omitted items, inaccurate scale or dimensions, etc.), the Engineer may require the Contractor to relocate any affected electrical equipment which is installed in violation of National Electrical Code "working" or "dedicated equipment" spaces or which the Engineer determines is installed in an inappropriate location. Such relocation, and/or any related remedial work, shall not be considered cause for delay or additional payment.
  - (3) Conduit, raceway, and cable tray layout drawings and details.
    - (a) Conduit and raceway layout diagrams shall show each raceway utilized, with all wire numbers installed therein, in tabular or spreadsheet format. Spare conductors shall also be assigned wire numbers. Different symbols shall be used to clearly distinguish between underground, concrete encased, in-wall, and exposed conduits, as well as cable trays, flexible cables, wireways, junction boxes, terminal cabinets, equipment, and enclosures.
    - (b) Drawings shall be fully coordinated with the all wiring diagrams, tabulations, and shop drawings.

- (4) Wiring diagrams and tabulation.
- (a) Multi-line wiring diagrams shall be submitted for approval prior to installation of raceways and wiring. Diagrams shall show all circuit phase, neutral, and grounding conductors. All conductors shall be identified on the diagrams by wire numbers that match the same respective conductors or connections shown on other diagrams and shop drawings. Wiring diagrams shall clearly indicate the size and type of all conductors.
  - (b) Wiring diagrams are not intended to be to scale, but shall show all equipment, terminal cabinets, splices, etc. Items shall be shown in their approximate geographic orientation to each other to the extent practical.
  - (c) Wiring diagrams shall show locations of all conductor splices and connections, including equipment hook-ups, and indicate the proposed splice or connection method.
  - (d) Conductor tabulations shall be provided and clearly indicate all wire numbers passing through or terminating in each raceway, box, cabinet, and equipment enclosures. All raceways, boxes, cabinets, and equipment enclosures shall be included on the tabulations. Tabulations shall include device served and function of each conductor. Spare conductors shall also be assigned wire numbers and listed.
- (5) Nameplates for electrical equipment, including proposed text. The text of nameplates which are part of a product depicted on a shop drawing shall be clearly shown on that shop drawing.

(F) Submit testing procedures and results as required.

(G) Submit all additional information as may be described elsewhere in the contract documents, or as otherwise required by the Engineer in order to determine the acceptability of proposed products and/or work.

## **7. PRODUCT WARRANTIES**

(A) All product warranty certificates, and similar warranty information, shall be stored at a single location on the project site and be turned over to the Owner prior to final acceptance of the project.

(B) Warranty information shall be clearly marked to identify the components covered and allow cross referencing back to the as-built contract and shop drawings.

(C) Where registration is necessary as a condition of warranty coverage, warranties shall be registered to the Owner.

## 8. PRODUCTS AND EXECUTION

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- (A) All electrical work shall be performed by electricians and helpers who are trained and experienced in the installation and maintenance of industrial electrical power and control systems. Specialty technicians shall be trained and experienced in the type of work they are performing. All electrical work shall be supervised by properly qualified supervisory personnel (see requirements for Contractor qualifications and the Contractor's Electrical Engineer given elsewhere in these Special Provisions).
- (B) All mechanical, structural, or other such work related to electrical work shall be performed by persons who are properly trained, qualified, and experienced in the type of work being performed.
- (C) All electrical work shall conform to the requirements of the contract documents, the National Electrical Code, and any applicable federal, state, and local laws and/or regulations.

In no way shall these contract documents be interpreted as requiring a violation of the National Electrical Code (NEC), or any other applicable federal, state, or local laws and/or regulations. In any case of dispute between the contract documents and the NEC, preference shall be given to the more stringent requirements. The Engineer shall immediately be informed of any such dispute.

- (D) All work shall be neat and workmanlike per NECA 1.
- (E) The Contractor shall bear full responsibility for the completion of all work in a professional and safe manner.
- (F) The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Engineer of any discrepancy before performing any work.
- (G) Unless specifically indicated otherwise, products, tools, and equipment used for electrical work shall be standard items of manufacturers regularly engaged in the manufacture of such items.
- (H) In addition to the items explicitly shown on the plans and described in these Special Provisions, the Contractor shall be responsible for providing all miscellaneous products, tools, equipment, and labor necessary for providing a complete, operational, reliable and safe system(s) and sub-system(s) in accordance with the requirements and intents of these contract documents.
- (I) Unless specifically noted otherwise, all electrical equipment locations, conduit and raceway routings, etc. shown on the plans are schematic in nature and may not reflect actual dimensions and/or locations. The Contractor shall verify all relevant dimensions prior to performing any work, and shall bear full responsibility for compliance with National Electrical Code (NEC) required clearances (i.e. "Working Space", "Dedicated Equipment Space", etc.). The Engineer shall immediately be informed of any conflict between equipment locations shown on the plans and NEC required clearances. In the

case of any such conflict, the equipment in question shall be relocated, or similar remedial action taken, as may be directed by the Engineer and at no additional cost.

- (J) All details shown on the plans are typical and apply to all similar locations, or as otherwise indicated. All dimensions and details shall be verified at the site before proceeding with any work, purchasing any items, or fabrication of any custom components. The Contractor shall bear all costs and/or damages which may result from the ordering or fabrication of any items or materials prior to such verifications.
- (K) Manually operable devices shall not be mounted less than 2 feet or more than 6 feet above the finished floor as measured to the center of the handle, button, or similar operator. Mounting heights for various other devices shall be as indicated, or as given in Chapter 11 of NECA 1 where no height is indicated.
- (L) The manufacturer(s) of all products covered shall have been primarily and regularly engaged in the manufacture of such products for a continuous period of at least ten years as of the bid date. When requested by the Engineer, documentation demonstrating compliance with this requirement shall be submitted.
- (M) To the extent practical, and unless otherwise indicated, all like products shall be by the same manufacturer.
- (N) Install all products in accordance with their manufacturers' recommendations and the requirements of the NEC and these contract documents.
- (O) Physically install all products in a secure manner as indicated and as required to provide a reliable installation.
- (P) Inspect and test all installed products for correct installation, performance, and workmanship.
- (Q) Torque all terminals and other current carrying connections per the manufacturer's recommendations using calibrated tools.
- (R) Nameplates and warning labels shall be provided for all equipment, cabinets, boxes, etc. in accordance with the requirements given elsewhere in these Special Provisions.
- (S) All conductors shall be labeled in accordance with the requirements given elsewhere in these Special Provisions.

## **9. MISCELLANEOUS PRODUCTS**

- (A) In addition to the products explicitly indicated, it shall be the responsibility of the Contractor to provide all additional items required to provide a complete bridge electrical power and control system. Such items include, but are not limited to: miscellaneous conductors and jumpers, conductor lugs and terminals, raceways and fittings, boxes and enclosures, fasteners, and miscellaneous mounting hardware.

## **10. COORDINATION OF INTERFACES**

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- (A) The Contractor shall be responsible for ensuring proper interfacing between electrical systems, and/or sub-systems, and the bridge operating machinery, the bridge structure, and miscellaneous equipment.

## **11. DELIVERY, STORAGE, AND HANDLING**

- (A) All products shall be delivered to the site in accordance with the approved sequence of construction. All products shall be properly protected until installation, including during shipment and storage.
- (B) Prior to shipment from the manufacturer's and/or fabricator's plant or plants, the Contractor shall prepare all products for shipment. All large, bulky and/or heavy items shall be securely mounted on skids or pallets of ample size and strength to facilitate loading and unloading. All small parts shall be boxed in sturdy wood or heavy corrugated paperboard boxes. A packing list enclosed in a moisture-proof envelope and indicating the contents of each such box shall be securely attached to the outside of the container. The skid/pallet mounting and boxing shall be done in a manner that will prevent damage to the equipment during loading, shipment, unloading, storage and any associated and/or subsequent handling. Weatherproof covers shall be provided during shipment to protect any and all items shipped in open railway cars, trucks, or barges. Any eyebolts, special slings, strongbacks, skidding attachments or other devices used in loading the equipment at the manufacturer's and/or fabricator's plant or plants shall be furnished for unloading and handling at the destination.
- (C) Products shall be stored so as to permit easy access for inspection and identification, and be protected from the ground by the use of pallets, platforms or other means. Products shall not be stored in a manner that would cause distortion or damage.
- (D) All large units shall have lifting eye bolts or lifting holes properly sized for safe working loads and located to provide a balanced lift.

## **12. EXISTING FACILITIES**

- (A) The Contractor shall verify the locations of all existing facilities, both above ground and below ground, and exercise extreme care during construction to not damage existing facilities. Any damage to existing facilities resulting from the Contractor's activities shall be repaired by the Contractor, to the satisfaction of the owner of the facility, at no additional cost.
- (B) The Contractor shall trace, locate, identify, and tag all existing equipment and conductors which are to remain or be moved and put back into service. Any damage to equipment and/or conductors which are to remain or be moved and put back into service resulting from the Contractor's activities shall be repaired by the Contractor, to the satisfaction of the Engineer, at no additional cost.



### **13. PROTECTION OF WORK 63**

- (A) The Contractor shall at all times protect and preserve all materials, supplies, and equipment of every description (including property which may be furnished or already owned by the Owner) and all work performed.
- (B) All reasonable requests of the Engineer to enclose or specially protect such property shall be complied with.
- (C) If, as determined by the Engineer, material, equipment, supplies, and work performed are not adequately protected by the Contractor, such property may be protected by the Owner and the cost thereof may be charged to, or deducted from any payments due to, the Contractor.

### **14. TEMPORARY PROVISIONS**

- (A) The Contractor shall bear full responsibility for providing all temporary provisions as may be required to accomplish all work and permit continued operation and use of existing equipment and facilities during prosecution of such work.
- (B) The Contractor shall maintain, throughout the course of the project, temporary navigation lighting as may be required by the United States Coast Guard. The Contractor shall be responsible for coordinating temporary navigation lighting requirements with the Coast Guard.
- (C) Unless specifically noted otherwise, all temporary provisions required by these contract documents shall be provided at no additional cost.

### **15. CLEANING AND MAINTENANCE**

- (A) The Contractor shall keep the project premises, and adjoining premises, clean from excess material, debris, and rubbish caused by Contractor's operations at all times.
- (B) The Contractor shall clean the project premises prior to final acceptance. Cleaning shall include, but not be limited to, the following.
  1. Removal of excess materials, debris, and rubbish.
  2. Removal of grease, oil, paint, and similar materials from the surfaces of installed materials and equipment.
  3. Touch-up painting as may be required to repair damage to the finishes of installed materials and equipment.
  4. The Contractor shall maintain all work during construction and until the work is finally accepted. All costs of such maintenance shall be included in the unit prices bid for the various items; no additional payment will be made for materials, labor, or incidental costs related to any such maintenance.

## 16. TESTING AND ADJUSTMENTS

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- (A) The Contractor shall be responsible for performing all testing, inspections, and any resulting corrective work as may be necessary in order to ensure that all work is functioning properly, and as otherwise required elsewhere in these Special Provisions.
- (B) All testing, inspections, and demonstrations, and any resulting remedial work, will be deemed solely the responsibility of the Contractor and will not be considered cause for delay or additional payment.
- (C) Procedures and equipment used for the testing required by these Special Provisions shall be in accordance with manufacturer's recommendations, NETA Acceptance Testing Standards, any other applicable industry standards, and be appropriate for the specific test being performed. Voltmeters, ammeters, etc. shall be true RMS type. Where recording instruments are required, they shall be three phase, strip chart or computer based type. All tools and instruments shall be specifically designed for measuring the quantity in question and be maintained in properly calibrated condition.
- (D) Prior to energizing any circuit or connection of any piece of equipment to any circuit, the following tests shall be performed.
  - 1. Measure the supply voltage and phase rotation and verify that both are correct for the equipment installed.
  - 2. Verify that all conductors and current carrying parts of equipment are continuous, free of shorts, opens, or unintentional grounds, and that all conductors are properly terminated.
- (E) In addition to the required quantitative tests, the Contractor shall also be responsible for performing all qualitative inspections which may be required to ensure that all electrical work is properly executed. Such inspections shall include, but not be limited to, the following.
  - 1. Visual inspection of all electrical connections.
  - 2. Visual inspection of all raceway, conductor, device, and equipment installations.
  - 3. Verifying proper operation of all operating mechanisms and mechanical interlocks.
  - 4. Verifying proper tightening of mechanical lugs and terminals.
  - 5. Inspection of all hardware connections.
- (F) All portions of the electrical work, both individually and as a whole, shall be subjected to operational, as installed, testing. Such testing shall be as required to establish that the item(s) under test meet all specified requirements and are operating in a reliable manner. The Contractor shall also be prepared to conduct any additional miscellaneous operational demonstrations as may be requested by the Engineer to establish that a given product, system, or subsystem meets all specified requirements and is operating in a reliable manner.
- (G) For all test results which fall outside the stated acceptable values or conditions or the Engineer finds unacceptable, the Contractor shall investigate the cause of the failure, take

appropriate corrective actions, and repeat the test(s). This procedure shall be repeated until such time as all test results are deemed acceptable by the Engineer.

## 17. MEASUREMENT AND PAYMENT

- (A) Compliance with the requirements of this section shall be considered incidental to the *Roadway Lighting Rehabilitation* and *Control House HVAC System* items, and will not be separately measured or paid for.

## MISCELLANEOUS ELECTRICAL WORK

### 1. SCOPE

- (A) This section covers all products, labor, services, incidentals, and related work necessary to furnish, install, test, and put into permanent service all miscellaneous electrical work as shown on the plans and described herein.
- (B) This section is a component of the electrical Special Provisions. The provisions and requirements of Section 5 – General Requirements for Electrical Work are hereby incorporated into this section by this reference, and shall have the same force and effect as if printed here in full.
- (C) Specific items covered by this section include the following.
1. General Materials, Brackets, and Supports
  2. Fasteners
  3. Metal Framing Strut
  4. Equipment Cabinets and Enclosures
  5. Equipment Nameplates, Signs, and Labels
  6. Cutting, patching, and welding
  7. Painting
  8. Removals and salvage

### 2. SUBMITTALS

- (A) All submittals as required by *General Requirements for Electrical Work*.
- (B) Nameplates, signs, and labels text, graphics, layouts, and other descriptive characteristics.

### 3. GENERAL MATERIALS, BRACKETS, AND SUPPORTS

- (A) Unless specifically indicated otherwise, plates, shapes (angles, channels, etc.), fabricated brackets, and similar items shall be hot-dip galvanized ASTM A36, or approved equivalent, steel.
- (B) Where plates, shapes, fabricated brackets, and similar items are identified as aluminum, they shall be 6061-T6, or approved equivalent, unless otherwise noted.

- (C) Unless specifically indicated otherwise, all stainless steel shall be "Marine Grade", such as Type 316. If the Contractor can demonstrate to the satisfaction of the Engineer that Marine Grade stainless steel is not available for the item in question, a lesser grade, such as Type 304, will be considered.
- (D) Fabricated items which are constructed by welding shall be thermally stress relieved after welding and before any additional machining or finishing.
- (E) Fabricated steel items which are to be galvanized shall be hot-dip galvanized after fabrication. Hot-dip galvanizing shall be in accordance with the American Galvanizers Association Suggested Specification for Hot-Dip Galvanizing.
- (F) Welding shall be in accordance with American Welding Society standards appropriate for the material(s) and final product in question.
- (G) Isolate aluminum items from concrete and dissimilar with neoprene shims. Do not install aluminum products in contact with the ground.
- (H) Isolate galvanized items from unpainted and/or "weathering" steel with neoprene shims.

#### **4. FASTENERS**

- (A) Unless indicated otherwise for a specific application, all fasteners shall comply with the requirements listed below.
- (B) All bolts, threaded rod, machine screws, nuts, washers, and similar hardware shall be Type 316 stainless steel.
- (C) Concrete anchors shall be either epoxy adhesive type or wedge stud type. Concrete anchors shall be Type 316 stainless steel.
- (D) Screws (wood, sheet metal, self tapping, masonry etc.) shall not be used except where specifically indicated, or with the special permission of the Engineer.
- (E) Beam clamps in dry or damp locations shall be galvanized. Beam clamps in wet locations shall be PVC coated galvanized or stainless steel. All beam clamps shall be provided with locknuts (or utilize thread locking adhesive) and stainless steel retainer straps (minimum 12 Gauge).
- (F) All bolted connections shall utilize lock washers. Bolted connections which, due to their inherit geometry, do not permit the use of lock washers may utilize an approved thread locking adhesive or other approved method of vibration proofing.

#### **5. METAL FRAMING STRUT**

- (A) Metal framing strut (Unistrut) and fittings shall be manufactured in accordance with the requirements of the Metal Framing Manufacturers Association.
- (B) Metal framing strut and fittings shall be Type 316 stainless steel.

- (C) Unless specifically indicated otherwise, metal framing strut shall not be used where it is subject to vibration without the explicit written permission of the Engineer on a case by case basis. Where the use of metal framing strut is permitted, the Engineer may require the use of special hardware and/or installation configurations to increase vibration resistance.
- (D) Metal framing strut and fittings shall be as manufactured by Cooper B-Line, Allied Power-Strut, Unistrut Corporation, Thomas and Betts, or approved equal.

**6. EQUIPMENT CABINETS AND ENCLOSURES**

- (A) Unless specifically indicated otherwise, cabinets and enclosures for electrical equipment shall comply with the following.
  - 1. Dry and Damp Locations: NEMA 12 steel with corrosion resistant finish inside and out and corrosion resistant hinges and/or hardware.
  - 2. Wet Locations: NEMA 4 or 4X Type 316 stainless steel, or welded or cast aluminum, with stainless steel or similarly corrosion resistant hinges and/or hardware.
  - 3. Cabinets and enclosures containing devices or terminal blocks shall include aluminum or steel internal mounting panels with corrosion resistant finishes.
  - 4. Cabinets and enclosures shall comply with the requirements of NEMA 250 and UL 50.
  - 5. Cabinets and enclosures installed in wet or damp locations shall be provided with drains. See the requirements for conduit system drains given elsewhere in these Special Provisions.
- (B) Install cabinets and enclosures plumb and level. Anchor cabinets securely as indicated and as required to provide a dependable installation.
- (C) Unless specifically indicated otherwise, conduit and cable entrances in damp and wet locations shall be made only in the bottom of cabinets and/or enclosures.
- (D) Isolate aluminum cabinets and enclosures from concrete and dissimilar metals with neoprene shims. Do not install aluminum cabinets and enclosures in contact with the ground. Isolate cabinets and enclosures which are not stainless steel from unpainted and/or "weathering" steel with neoprene shims.
- (E) Provide all accessories and miscellaneous hardware required for a complete installation.

**7. EQUIPMENT NAMEPLATES, SIGNS, AND LABELS**

- (A) Provide nameplates for all electrical equipment.
  - (1) Nameplates shall be engraved plastic laminate. Text shall be minimum 3/16 inch high. General purpose nameplates shall have white text on black background. Nameplates with warning or cautionary text shall have white text on red background.

- (2) Nameplates shall be securely and dependably attached to equipment with stainless steel machine screws. Screw holes shall be sealed with silicone, or other approved and effective method, to prevent water ingress.
  - (3) Nameplate text shall be coordinated with the as-built plans and shop drawings to clearly identify each piece of equipment. Nameplate text shall include the following.
    1. Both device designations (e.g. "S-1"), where applicable, and plain English identification of the equipment and its purpose (e.g. "Main Drive Motor Disconnect Switch").
    2. Where the equipment is fed from and/or the nearest upstream disconnecting means (e.g. "Fed from MCC Bucket 2A").
    3. The equipment voltage, phase, either full load current or overcurrent protective device rating, as appropriate, and other pertinent characteristics (e.g. "480 Volts, 3 Phase, 15 Amperes Full Load" or "208Y/120 Volts, 3 Phase, 4 Wire, 100 Amperes Main Breaker" or "480 Volts, 3 Phase, 50 Ampere Thermal-Magnetic Breaker").
- (B) Provide electrical hazard warning labels in accordance with NEC 110.16.

## **8. CUTTING, PATCHING, AND WELDING**

- (A) Provide all openings through walls, floors and ceilings, etc. required for the installation of work.
- (B) Following installation and testing, restore floors, walls and ceilings with materials equal to the original construction and finish to match existing surfaces.
- (C) Cutting, patching, and welding shall be performed only by tradesmen familiar with the construction involved.
- (D) Welding shall be performed only by welders certified according to American Welding Society or American Society of Mechanical Engineers standards appropriate for the work being performed.
- (E) Do not cut or drill structural elements (steel or concrete) without explicit written permission from the Engineer.
- (F) Do not weld to structural elements without explicit written permission from the Engineer.
- (G) Field cuts to, or drilled holes in, galvanized materials shall be treated with an approved, zinc rich, cold galvanizing compound prior to installation. Field cuts to, or drilled holes in, painted structural members shall be treated with a rust inhibiting primer. Any over spray which will not be covered by the item to be installed shall be painted to match the surrounding structure.

## 9. PAINTING

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- (A) Electrical equipment cabinets and enclosures, surface mounted raceways, and surface mounted boxes in finished areas shall be painted to match the surrounding area.
- (B) Electrical equipment cabinets and enclosures, raceways, and boxes with factory applied finishes shall be "touch-up" painted as required to repair any damage to the factory finish. "Touch-up" painting shall utilize, at minimum, one coat of primer and two coats of finish paint. Primer and paint shall be as supplied or recommended by the manufacturer of the item being painted.

## 10. REMOVALS

- (A) Remove all equipment and/or conductors designated for removal as shown on the plans or otherwise noted in the contract documents.
- (B) Perform all removals in such a manner as to avoid damage to existing equipment and/or conductors which are to remain.
- (C) The Contractor shall give the Owner the option of salvaging all electrical equipment which is to be removed.
- (D) The Contractor shall deliver all equipment which is to be salvaged to the location designated by the Engineer. All equipment which is to be salvaged shall be handled with care at all times to avoid damage.
- (E) All equipment which is to be removed and is not to be salvaged shall become the property of, and be removed from the project site by, the Contractor.
- (F) The Contractor shall bear full responsibility for proper disposal of removed equipment and/or materials in accordance with all applicable regulations.
- (G) Except where specifically noted otherwise, only existing concrete embedded raceways and boxes may be abandoned in place. Existing underground raceways, in-ground boxes, and other equipment shall not be abandoned in place, except where specifically noted otherwise.

Existing concrete embedded raceways which are to be abandoned in place shall have all conductors removed, be ground flush with the concrete, and filled with non-shrink grout.

Existing concrete embedded boxes which are to be abandoned in place shall have all conductors removed and be covered with a new blank galvanized steel cover.

The locations and characteristics of all raceways, boxes, and equipment which are abandoned in place shall be clearly documented on the as-built drawings.

## 14. MEASUREMENT AND PAYMENT

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- (A) There will be no separate measurement and payment for *Miscellaneous Electrical Work*. Work covered by this section is incidental to the various items of electrical work, and will not be separately measured or paid for. All costs associated with this section shall be included in the prices bid for the various other items of electrical work.

## WIRING METHODS AND MATERIALS

### 1. SCOPE

- (A) This section covers all products, labor, services, incidentals, and related work necessary to furnish, install, test, and put into permanent service all general wiring as shown on the plans and described herein.
- (B) This section is a component of the electrical Special Provisions. The provisions and requirements of Section 5 – General Requirements for Electrical Work are hereby incorporated into this section by this reference, and shall have the same force and effect as if printed here in full.

### 2. SUBMITTALS

- (A) All submittals as required by the section *General Requirements for Electrical Work*.

### 3. GENERAL REQUIREMENTS

- (A) All conductors shall be labeled in accordance with the requirements given elsewhere in these Special Provisions.
- (B) All wire and cables shall be fully insulated with stranded copper conductors. Solid and/or aluminum conductors shall not be used.
- (C) Conductors with green colored insulation shall be used only for grounding conductors. The re-identification of conductors with green colored insulation, such as with colored tape, is not permitted.
- (D) All branch and feeder circuits requiring a neutral shall be supplied with a dedicated neutral conductor. Neutrals shall not be shared by two or more phase conductors, except where all conductors are serving a single piece of equipment, or for multiwire branch circuits serving lighting loads where indicated.
- (E) Coordinate all wire and cable requirements with manufacturers of equipment served.
- (F) Wiring, where practical, shall be bundled and run neatly, plumb or level, parallel to edges of cabinets, or at right angles.
- (G) Care shall be exercised in the handling and installation of wire and cable to avoid damage to conductors, insulation, jackets, armor, etc. Wire or cable which is found to be damaged shall be replaced at no additional cost.



- (H) Unless specifically indicated otherwise, conduit and cable entrances in damp and wet locations shall be made only in the bottom of cabinets and/or enclosures.
- (I) To the extent practical, maintain at least one foot separation between power wiring and communication and/or instrumentation cables.
- (J) Conduits, cable trays, cable armor, boxes and other raceways shall be installed such that they are electrically continuous from end to end. Bonding jumpers and related hardware shall be provided at expansion fittings and elsewhere as necessary to ensure electrical continuity.
- (K) Except where specifically noted otherwise, insulated throat bonding bushings or bonding nuts shall be provided wherever conduits or metal armored cables enter metal boxes or enclosures. Bonding bushings and bonding nuts shall be connected to the equipment grounding conductor installed in the conduit or cable. Boxes, cabinets, and enclosures shall be bonded directly, not just through the conduit(s) and or connector(s), to each equipment grounding conductor. This connection may be made by a jumper tapped to the main equipment grounding conductor(s).
- (L) Provide riser supports for vertical conduits as required by the NEC. Riser supports shall consist of stainless steel mesh cable grips mounted inside a pull box or similar enclosure. Secure cable grip mesh to at top and bottom with stainless steel hose clamps. In-conduit type supports shall not be used.
- (M) Provide conduit expansion fittings as indicated, at all structural expansion joints, as required to comply with the NEC, and as required to provide a complete and reliable installation.
- (N) Install metal conduit and tubing in accordance with the Steel Tube Institute of North America's Guidelines for Installing Steel Conduit / Tubing.
- (O) Make bends in rigid conduit with tools which are specifically designed for bending the type and size of conduit in question. Exercise care when bending conduit to maintain proper internal diameter and wall thickness.
- (P) All conduits, cables, conductors, and terminal blocks shall be labeled. See the specific requirements given elsewhere in this section.
- (Q) Prior to energizing any circuit for the first time:
  1. Verify that all conductors are continuous and free of shorts, opens, and/or unintentional grounds.
  2. Physically inspect accessible portions of the wire and/or cable for signs of damage.
  3. Verify that all circuit conductors are properly terminated and that all connections are tight. Use calibrated torque wrenches, screw drivers, and/or similar tools to verify proper mechanical connection torque levels in accordance with NETA Acceptance Testing Specifications and/or the manufacturer's recommendations.

**4. WIRING METHODS**

- (A) Only the wiring methods specifically indicated on the plans are permitted.

**5. CONDUCTORS FOR GENERAL WIRING**

- (A) UL Listed Type XHHW-2, except that UL Listed Type MTW, THWN, or similar moisture and heat resistant insulation shall be permitted for use inside factory assembled control panels. Rated 600 volts.
- (B) Shall satisfy the requirements of ICEA S-95-658 / NEMA WC-70, and the National Electrical Code.
- (C) Conductor sizes as indicated, as required for the equipment served, and as required elsewhere in this section.
- (D) Suitable for use in wet locations, oil resistant. Where installed in cable tray, or otherwise exposed to sunlight, shall be rated as sunlight resistant.
- (E) Soft annealed copper conductors per ASTM B3, stranded per ASTM B8 Class B.
- (F) Size of conductors permanently marked on insulation.
- (G) Shall be as manufactured by Encore Wire, Southwire, Okonite, or approved equal.

**6. SPECIALTY CABLE**

- (A) Specialty cables shall be provided as required for the equipment and/or systems served. Conductor sizes, counts, and similar characteristics shall be as recommended by the manufacturer of the equipment and/or system served.
- (B) Insulation shall be rated at least 300 volts. Where installed in the same raceway, cable tray, or enclosure with power and/or lighting circuits, or where otherwise required by the NEC, insulation shall be rated at least 600 volts.
- (C) Outer jacket shall be sunlight and oil resistant.
- (D) Where required by the Engineer due to the installation method and/or environment, cable shall be rated for direct burial.

**7. LOW VOLTAGE SPLICES, TERMINALS, AND TERMINAL BLOCKS**

- (A) Provide all splices, taps, connectors, terminals, terminal blocks, and related appurtenances as required to provide a complete installation.
- (B) Conductors shall not be spliced, except under one of the following conditions.
  - 1. When making final connection to luminaires, receptacles, or similar devices.

2. When making field connection(s) to equipment which is factory supplied with hook-up leads.
  3. Where specifically indicated otherwise.
  4. With the permission of, and as prescribed by, the Engineer when absolutely required by conditions of installation.
- (C) Splices and/or taps made in conductors 10 AWG and smaller for making final connection to luminaires, receptacles, or similar devices may be made with insulated, set-screw type connectors (Ideal Models 10, 11, or 22, or approved equal). Set-screw connectors shall be provided with a flame retardant insulating shell and wrapped with vinyl electrical tape after installation.
- (E) All other splices and/or taps shall be made on heavy duty, insulated, screw type terminal blocks mounted in terminal cabinets. Terminal blocks shall have no more than two conductors per terminal.
- (F) Splices and/or taps made at equipment or in locations which do not permit the use of terminal blocks may be made with crimp or mechanical type connectors with the Engineers permission. Splices made with crimp or mechanical type connectors shall be insulated with rubber and vinyl tape, or an insulating cover specifically designed for use with the connector, after installation. The Engineer may requires the use of special splices or splice kits to address specific application considerations.
- (G) Terminal Blocks and Power Distribution Blocks
- (1) Terminal blocks and power distribution blocks shall be heavy duty, UL Listed or Recognized, rated 600 volts and 90 Celsius, suitable for use with copper conductors, NEMA style, barrier type, tin plated copper or aluminum, Valox or phenolic insulated, either terminal screws or mechanical box lugs.
  - (2) Terminal blocks in control system cabinets may be as described elsewhere in these Special Provisions.
  - (3) Mount terminal blocks with stainless steel bolts or machine screws.
  - (4) Provide engraved labels for all terminals.
  - (5) Terminal blocks and power distribution blocks shall be as manufactured by Marathon Special Products, ILSCO, or approved equal.
- (H) Crimp Type Lugs, Terminals, and Connectors
- (1) Crimp type lugs, terminals, and connectors shall be UL listed for 600 volts and 90 Celsius, for use with copper conductors, and manufactured from electro-tin plated copper or aluminum.
  - (2) Lugs and connectors for conductors 8 AWG and larger shall be one-piece, seamless design.

- (3) Terminals shall be ring or flanged-fork type.
- (4) Terminals and connectors for conductors 10 AWG and smaller shall be provided with integral nylon insulating sleeves and brass sleeve insulation grips.
- (5) Crimp type lugs, terminals, and connectors shall be as manufactured by 3M, ILSCO, or approved equal.

(I) Mechanical Type Lugs and Connectors

- (1) Mechanical type lugs and connectors shall be set-screw type, UL listed for 600 volts and 90 Celsius, for use with copper conductors, and manufactured from electro-tin plated copper or aluminum.
- (2) Torque all mechanical lugs and connectors per the manufacturer's recommendations using calibrated tools.
- (3) Mechanical type lugs and connectors shall be as manufactured by ILSCO, or approved equal.

(J) Insulating Tape and Taping

- (1) Rubber tape shall be highly conformable, linerless Ethylene Propylene Rubber, high voltage (suitable for use up to 69 kV), self bonding insulating tape. Minimum 30 mils thick. Shall be rated 90 Celsius continuous and 130 Celsius short term. Scotch (3M) 130C, or approved equal.
- (2) Vinyl tape shall be UL Listed, premium grade, all weather, flame retardant, self bonding vinyl electrical tape. Shall be UV (per UL 510), abrasion, corrosion, alkaline, and acid resistant. Minimum 7 mils thick. Shall be rated 105 Celsius continuous. Scotch (3M) Super 33+ or Super 88, or approved equal.
- (3) For splices without integral insulating sleeves, tightly apply a minimum of one half-lapped layer of rubber tape, tacky side up, over entire splice and extending onto the conductor insulation at least one tape width on both sides of splice. Apply a minimum of two half-lapped layers of vinyl tape completely over rubber tape and extending onto conductor insulation past ends of rubber tape.
- (4) For splices which are provided with integral insulating sleeves, apply a minimum of two half-lapped layers of vinyl tape completely over splice and extending onto conductor insulation past ends of splice.

- (K) Provide special splices and splice kits, with all required accessories and appurtenances, as shown on the plans, as required elsewhere in these Special Provisions, or as required by the Engineer to address specific application considerations for splices allowed by special permission.

**8. CONDUCTOR IDENTIFICATION**

- (A) All conductors and terminal blocks shall be permanently labeled at every terminal or connection, splice, and tap. Each conductor shall be assigned an identifying number (including spares), and shall be assigned only one number throughout the entire electrical or control system. Identification numbers shall be coordinated for consistency and accuracy with numbers shown on the contract plans, and on the Contractor's approved wiring diagrams and shop drawings, field wiring diagrams, and any other diagrams containing the same respective conductor.
- (B) Conductor labels shall be machine printed, water and smudge resistant. Hand written labels are not acceptable. Labels shall be snap-on, slide-on, or heatshrink type. Adhesive type labels are not acceptable.
- (C) Terminal blocks labels shall be engraved plastic.

**9. RIGID METAL CONDUIT (RMC) – STEEL**

- (A) UL Listed, threaded rigid metal conduit. Manufactured from high-strength steel and hot-dip galvanized inside and out per ANSI C80.1.
- (B) Size shall be as indicated and as required. Minimum size shall be 3/4 inch.
- (C) Threads shall be 3/4-inch taper NPT. Factory cut threads shall be galvanized after cutting.
- (D) Field cuts to conduit shall be made square and reamed to remove burrs. Field cut threads shall have same length, dimensions, and taper as factory-cut threads. Clean field cut threads with an appropriate degreasing solvent after cutting and coat with zinc-rich cold galvanizing compound. Any area on the interior of the conduit which has been disturbed by reaming shall be similarly treated.
- (E) Shall be as manufactured by Allied Tube and Conduit, or approved equal.

**10. RIGID METAL CONDUIT (RMC) – PLASTIC COATED STEEL**

- (A) UL Listed, threaded rigid metal conduit. Manufactured from high-strength steel and hot-dip galvanized inside and out per ANSI C80.1.
- (B) Size shall be as indicated and as required. Minimum size shall be 3/4 inch.
- (C) Exterior coating shall be UV resistant PVC, minimum 40 mils thick. The adhesion of the PVC coating to the conduit shall be greater than the strength of the coating itself. Overall conduit shall be UL listed with the PVC coating as the primary corrosion protection and the underlying galvanized coating as supplemental protection. Conduit shall be ETL verified to the Intertek ETL Semko High Temperature H2O PVC coating adhesion test procedure for 200 hours.
- (D) Shall comply with the requirements of NEMA RN1.

- (E) Independent certified test results shall be available to confirm coating adhesion under the following conditions.
1. Conduit immersed in boiling water with a minimum mean time to adhesion failure of 200 hours per ASTM D870.
  2. Conduit and conduit exposure to 65 Celsius and 95% relative humidity with a minimum mean time to failure of 30 days per ASTM D1151.
  3. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test per ASTM D3359.
  4. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone per ASTM D1308.
  5. The exterior coating bond shall be confirmed using the methods described in Section 3.8 of NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1 of NEMA RN1.
- (F) Interior coating shall be urethane, minimum 2 mils in thickness.
- (G) Threads shall be 3/4-inch taper NPT. Factory cut threads shall be galvanized after cutting.
- (H) Field cuts to conduit shall be made square and reamed to remove burrs. Field cut threads shall have same length, dimensions, and taper as factory-cut threads. Clean field cut threads with an appropriate degreasing solvent after cutting and coat with a touch-up compound as recommended by the conduit manufacturer. Any area on the interior of the conduit which has been disturbed by reaming shall be similarly treated.
- (I) Plastic coated rigid metal conduit shall be installed using tools and methods which will not cause damage to the PVC coating. Any areas on the exterior of the conduit which have been damaged during installation shall be coated with an exterior patching compound as recommended by the conduit manufacturer.
- (J) All installers of PVC coated conduit shall be certified by the conduit manufacturer. Written documentation of such certification shall be provided to the Engineer.
- (K) Shall be Robroy Industries Plasti-Bond REDH2OT, or approved equal.

#### **11. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- (A) UL Listed, continuous, flexible galvanized steel conduit made liquidtight by covering with an oil, chemical, sunlight, weather resistant, and liquidtight polyvinyl chloride cover.
- (B) Size shall be as indicated and as required. Minimum size shall be 3/4 inch, except that 1/2 inch may be used for connections to luminaires, and at other locations where specifically identified.
- (C) Suitable for use in exposed and concealed locations from -46 to +105 Celsius.
- (D) Shall be ANAMET Electrical Anaconda Sealtite Type HTUA, or approved equal.

**12. CONDUIT COUPLINGS, UNIONS, AND FITTINGS**

- (A) Conduit couplings, unions, and fittings shall be UL Listed and specifically designed for use with the type of conduit in question.
- (B) Non-threaded couplings and/or unions (i.e. "split couplings") shall not be used in wet locations. Set-screw type coupling and/or unions shall not be used.
- (C) In damp and wet locations, conduit entrances to boxes and/or enclosures which do not have integral threaded hubs shall be made with watertight hubs (i.e. "Myers Hubs"). Hubs shall be UL Listed, watertight, grounding (with lug), threaded type. Hubs shall be provided with sealing gaskets to preserve the NEMA enclosure rating of the boxes and/or enclosures they are used with.
- (D) In dry locations only, conduit entrances to boxes and/or enclosures which do not have integral threaded hubs may be made with sealing type steel locknuts and grounding bushings with lugs (rigid and flexible conduits).
- (E) In dry locations only, conduit entrances to sheet steel outlet, device, and junction boxes installed in concealed areas (such as inside walls and above ceilings) may be made with standard steel locknuts and insulating bushings.
- (F) Conduit couplings, unions, and fittings for use with plastic coated rigid metal conduit shall be galvanized steel, or galvanized iron alloy, with overall plastic coating. Plastic coating shall satisfy the requirements for coating for plastic coated rigid metal conduit given elsewhere in this section.
- (G) Conduit couplings, unions, and fittings for rigid nonmetallic conduit shall be PVC and satisfy the requirements for rigid nonmetallic conduit given elsewhere in this section.
- (H) Fittings for liquidtight flexible metal conduit shall be watertight, threaded type, with integral insulating bushings.
- (I) In dry and damp locations, fittings for flexible conduit shall be galvanized steel. In wet locations, fittings for flexible conduit shall be galvanized steel with overall plastic coating. Plastic coating shall satisfy the requirements for coating for plastic coated rigid metal conduit given elsewhere in this section.
- (J) Fittings shall be provided with sealing gaskets to preserve the NEMA enclosure rating of the boxes and/or enclosures they are used with.
- (K) Shall be as manufactured by O-Z/Gedney, Cooper Crouse-Hinds, Robroy Industries, or approved equal.

**13. CONDUIT BODIES**

- (A) UL Listed, with threaded hubs and integral bushings. Conduit bodies shall be as follows, unless explicitly indicated otherwise.

- (1) Where plastic coated rigid steel conduit is required or otherwise used.
  1. Plastic coated cast iron alloy with plastic coated iron alloy or stainless steel cover.
- (2) Other locations.
  1. Any permitted in (1) above.
  2. Galvanized cast iron alloy with iron alloy cover or stainless steel.

- (B) Plastic coating shall satisfy the requirements for coating for plastic coated rigid metal conduit given elsewhere in this section.
- (C) All covers shall be screw-in type; clip-in or other wedge type covers shall not be used. Cover screws shall be stainless steel.
- (E) Shall be as manufactured by O-Z/Gedney, Cooper Crouse-Hinds, Robroy Industries, or approved equal.

#### **14. CONDUIT AND CABLE SUPPORTS**

- (A) Support rigid conduits near each elbow and within 18 inches of each box, enclosure, conduit body, or similar termination, and at regular intervals not to exceed 6 feet.
- (B) Support flexible conduits near each elbow and within 12 inches of each box, enclosure, conduit body, or similar termination, and at regular intervals not to exceed 3 feet, except where flexibility is required.
- (C) Support cables, other than flexible cables, not installed in raceways within 12 inches of each box, enclosure, or conduit body, and at regular intervals not to exceed 3 feet.
- (D) Support flexible cables within 12 inches of each box, enclosure, or conduit body.
- (E) Support cables installed in cable trays as required elsewhere in this section.
- (F) Provide additional supports as indicated and as required to provide a complete, reliable installation.
- (G) Support types and attachment methods shall be as indicated. Where not explicitly shown on the plans, support types and attachment methods shall be as follows or as otherwise directed by the Engineer.
- (1) Inside the Control House
    1. Any method permitted in (2) below.
    2. Galvanized malleable iron mechanical type clamps (i.e. "Right Angle", "Parallel", and "Edge" type).
    3. Galvanized or stainless steel one hole straps or hangers.



## (2) All Other Locations

1. Galvanized malleable iron one-hole clamps with clamp backs
  2. Stainless steel U-bolts with fabricated brackets
  3. Stainless steel U-bolts with trapeze hangers.
- (H) Clamps and U-bolts installed in wet locations, or otherwise used with plastic coated rigid metal conduit, shall be plastic coated. Plastic coating shall satisfy the requirements for coating for plastic coated rigid metal conduit given elsewhere in this section.
- (I) Fabricated brackets for conduit supports shall be hot-dip galvanized steel or stainless steel.
- (J) Trapeze hangers shall be constructed from hot-dip galvanized steel or stainless steel angle or channel and stainless steel threaded rod.
- (K) Spring steel, clip type supports shall not be used.
- (L) Shall be as manufactured by O-Z/Gedney, Cooper Crouse-Hinds, Robroy Industries, or approved equal.

**15. OUTLET AND DEVICE BOXES**

- (A) Outlet and device boxes and covers shall be UL Listed and appropriate for the intended use. Boxes shall be as follows, unless explicitly indicated otherwise.
- (1) Where plastic coated rigid steel conduit is required or otherwise used.
    1. Plastic coated cast iron alloy
  - (2) Other Locations.
    1. Any permitted in (1) above.
    2. Galvanized cast iron alloy.
- (B) Cast iron alloy boxes shall be galvanized with threaded hubs, integral bushings, and internal ground screws.
- (C) Plastic coating shall satisfy the requirements for coating for plastic coated rigid metal conduit given elsewhere in this section.
- (D) Sheet steel boxes shall be galvanized and provided with pre-punches knockouts.
- (E) Outlet and device boxes shall include external mounting ears where required to permit secure mounting of the box without compromising its integrity.

- (F) Provide appropriate covers. Material of blank cover shall match material of box. Covers for cast iron boxes shall be gasketed and use stainless steel fasteners. Cover plates for use with wiring devices shall be as required elsewhere in these Special Provisions.
- (G) Outlet and device boxes shall be as manufactured by O-Z/Gedney, Cooper Crouse-Hinds, Robroy Industries, or approved equal. Box covers and device cover plates shall be as manufactured by O-Z/Gedney, Cooper Crouse-Hinds, Robroy Industries, Hubbell, or approved equal.

## 16. PULL BOXES, JUNCTION BOXES, AND TERMINAL CABINETS

- (A) Junction boxes, pull boxes, and terminal cabinets shall be UL Listed, appropriate for the intended use, and conform to the requirements of NEMA 250 and UL 50.
- (B) Unless specifically indicated otherwise, junction boxes, pull boxes, and terminal cabinets shall be as follows.
  - (1) All Locations
    - 1. NEMA 4X Type 316 stainless steel with stainless steel, or similarly corrosion resistant, hinges and/or hardware.
    - 2. NEMA 4 hot-dip galvanized cast iron with stainless steel, or similarly corrosion resistant, hinges and/or hardware.
    - 3. NEMA 4 cast aluminum with stainless steel, or similarly corrosion resistant, hinges and/or hardware.
  - (2) Damp or Dry Locations
    - 1. NEMA 12 steel with corrosion resistant finish inside and out and corrosion resistant hinges and/or hardware.
- (C) Boxes and cabinets installed in wet or damp locations shall be provided with drains. See the requirements for conduit system drains given elsewhere in this section.
- (D) Boxes and cabinets shall be sized as indicated, as required by the NEC, and as appropriate for the conductors or equipment served.
- (E) Terminal cabinets shall include aluminum or steel internal mounting panels with corrosion resistant finishes, heavy duty terminal blocks for wire terminations, and uninsulated ground bars. Terminal blocks shall comply with the requirements given elsewhere in these Special Provisions.
- (F) Boxes and cabinets which contain terminal blocks for more than one type of circuit (power, control, instrumentation and communication, etc.) shall include suitable dividers in accordance with NEC requirements.
- (G) Terminal cabinets, and pull and junction boxes with large and/or heavy doors, shall have hinged doors. Boxes and cabinets with hinged doors shall include bonding jumpers between the door(s) and the box or cabinet body.

- (H) Where appropriate, outlet and device boxes satisfying the requirements given elsewhere in this section may be used as junction and/or pull boxes.
- (I) Install boxes and cabinets plumb and level. Anchor cabinets securely as indicated and as required to provide a dependable installation.
- (J) Isolate aluminum boxes and cabinets from concrete and dissimilar metals with neoprene shims. Do not install aluminum boxes and cabinets in contact with the ground. Isolate boxes and cabinets which are not stainless steel from unpainted and/or "weathering" steel with neoprene shims.
- (K) Junction boxes, pull boxes, and terminal cabinets shall be as manufactured by O-Z/Gedney, Cooper Crouse-Hinds, Hammond Manufacturing, Hoffman, or approved equal.

**17. CONDUIT AND CABLE PENETRATIONS**

- (A) Provide penetrations for conduits and cables as shown on the plans, and as otherwise required for proper installation of conduits and cables.
- (B) Where specific penetration methods and/or details are not shown on the plans, penetrations shall comply with the following.
  - 1. Between dry and damp or wet areas: environmentally sealed penetrations.
  - 2. Between other areas: standard sleeved penetrations.
- (C) Environmentally Sealed Penetrations
  - (1) Penetration sealing system providing air, dust, and water tight seal using rubber seal(s) in stainless steel (Type 316) compression frame(s).
  - (2) As manufactured by Roxtec (G frame with RM modules, R frame with RM modules, or RS seal), or approved equal.
- (D) Standard Sleeved Penetrations
  - (1) Pipe sleeve, secured in place with epoxy adhesive. Sleeves for penetrations in concrete or masonry shall be UV resistant Schedule 40 PVC. Sleeves for penetrations in all other types of construction shall be hot-dip galvanized Schedule 40 steel pipe. Inside diameter of sleeves shall be not less than 1/2 inch larger than the outside diameter of the conduit or cable to be installed in the sleeve.
  - (2) After installation of conduit or cable, the penetration shall be sealed with expanding foam insulation.

- (E) Following installation, restore floors, walls and ceilings with materials equal to the original construction and finish to match surrounding surfaces. Materials used shall be subject to the approval of the Engineer for appropriateness.
- (F) Penetrations in concrete shall be repaired with either non-shrink grout or silicone caulk. The Engineer will advise the Contractor regarding the method to be used at each penetration location.

## **18. CONDUIT SYSTEM DRAINS**

### **(A) Boxes and Enclosures**

- (1) A combination drain/breather shall be installed in all boxes and enclosures installed in wet locations, and as otherwise indicated.
- (2) Drain/breathers shall be capable of passing 25 cc of water per minute and 0.1 cubic feet of air per minute at atmospheric pressure. Stainless steel body with 1/2 inch male external thread. Crouse-Hinds ECD18 "Combination", or approved equal.
- (3) Drain/breathers shall be installed in the bottom wall of the box or enclosure.

### **(B) Conduits**

- (1) All conduit runs installed in wet or damp locations shall be arranged to drain. Conduit runs between dry locations and wet or damp locations shall be arranged to drain away from the dry location and toward the wet or damp location.
- (2) Conduit drain fittings shall be installed at the low point(s) of all conduit runs in wet and damp locations.
- (3) Conduits shall preferably be arranged to drain away from boxes and enclosures in wet and damp locations. Where this is not practical, a drain fitting as described below shall be installed immediately adjacent to the box or enclosure.
- (4) Conduit drain fitting shall consist of a conduit body and screened drain. The screened drain shall be installed down to permit proper drainage and help prevent water ingress through the drain. Drain body shall be copper-free aluminum, and screen shall be stainless steel. Crouse-Hinds CD Series, or approved equal. Apply an anti-oxidant and anti-seizing compound (Ideal Noalox, or equal) to the threads of the drain before installing in the conduit body.

## **19. MEASUREMENT AND PAYMENT**

- (A) There will be no separate measurement and payment for this work. Work covered by this section is incidental to the various other items of electrical work, and will not be separately measured or paid for. All costs associated with this section shall be included in the prices bid for the various items of electrical work, as appropriate.

**GROUNDING AND BONDING****1. SCOPE**

- (A) This section covers all products, labor, services, incidentals, and related work necessary to furnish, install, test, and put into permanent service all electrical grounding and bonding as shown on the plans and described herein.
- (B) This section is a component of the electrical Special Provisions. The provisions and requirements of Section 5 – General Requirements for Electrical Work are hereby incorporated into this section by this reference, and shall have the same force and effect as if printed here in full.

**2. SUBMITTALS**

- (A) All submittals as required by *General Requirements for Electrical Work*.

**3. GENERAL REQUIREMENTS**

- (A) All grounding and bonding shall be in accordance with NEC Article 250.
- (B) All raceways and multi-conductor cable shall include at least one equipment grounding (bonding) conductor. Raceways and metallic cable armor/sheaths shall not be used as the sole grounding or bonding conductor for any circuit.

**4. TRANSFORMER GROUNDING AND BONDING**

- (A) Equipment grounding conductors shall be provided for all feeder circuits to transformers and bonded to the transformer enclosure and/or ground bus.
- (B) Transformer secondaries shall be solidly grounded. Secondary bonding jumpers shall generally be located at the transformer, but may be made at the first overcurrent protective device with the permission of the Engineer when connection at the transformer is impractical.
- (C) Grounding electrodes shall generally be the nearest substantial structural steel member. Alternate grounding electrodes may be used with the permission of the Engineer where connection to a suitable structural member is impractical.
- (D) The grounding electrode conductors shall be bare or insulated soft annealed copper per ASTM B3, stranded per ASTM B8 Class B. Conductors shall be sized as indicated and as required by the NEC. The equipment grounding conductors shall be continuous and unspliced from end to end. Grounding electrode conductors shall be protected from physical damage by installation in rigid nonmetallic conduit. Conduit shall extend from the main bonding jumper location to the grounding electrode.
- (E) When secondary bonding jumpers are installed at the transformer, a line side equipment bonding jumper shall be provided and routed with the circuit conductors from the transformer ground bar to the ground bar at the first overcurrent device.

**5. EQUIPMENT GROUNDING AND BONDING**

- (A) All conduits and cables, except for conduits and cables containing only service conductors (line side of main bonding jumper) shall contain at least one equipment grounding conductor. Equipment grounding conductor(s) shall be insulated soft annealed copper per ASTM B3, stranded per ASTM B8 Class B. Equipment grounding conductor(s) shall be sized as indicated, as required by the NEC, and as recommended by the manufacturer(s) of the equipment served.
- (B) Where equipment grounding conductors are required to be increased in size to comply with the NEC, it shall be permissible to splice the large conductor to a smaller conductor to facilitate final connection to the equipment served. The smaller conductor shall not be smaller than required by NEC 250.122. The splice shall be made in a convenient location in the immediate vicinity of the equipment served (motor local disconnect switch, junction box or terminal cabinet, equipment enclosure, etc.). The Engineer may require the addition of an additional box for making such a splice where a suitable box or enclosure is not located sufficiently close to the equipment served.
- (C) Conduits, cable trays, cable armor, boxes and other raceways shall be installed such that they are electrically continuous from end to end. Bonding bushing, fittings, lugs, jumpers, and related hardware shall be provided as indicated and as necessary to provide a complete electrically continuous installation.
- (D) Except where specifically indicated otherwise, insulated throat bonding bushings or bonding nuts shall be provided wherever conduits or metal armored cables enter metal boxes or enclosures. Bonding bushings and bonding nuts shall be connected to the equipment grounding conductor installed in the conduit or cable. Boxes, cabinets, and enclosures shall be bonded directly, not just through the conduit(s) and or connector(s), to each equipment grounding conductor. This connection may be made by a jumper tapped to the main equipment grounding conductor(s).
- (E) All electrical equipment shall be solidly connected to the equipment grounding conductor serving that equipment.
- (F) The ground buses of all panelboards, switchboards, switchgear, motor control centers, and similar equipment shall be bonded to the nearest substantial structural steel member. Bonding jumpers shall conform to the requirements for equipment grounding conductors given elsewhere in this section, and shall be sized equal to the equipment grounding conductors serving the equipment. Installation of the bonding jumper shall conform to the requirements for grounding electrode conductors given in the NEC.
- (G) Terminal cabinets shall be provided with un-insulated ground bars for terminating and bonding together all equipment grounding conductors.
- (H) Where bolted connections are used for connection equipment grounding conductors to equipment, the area around the connection shall be cleaned down to bare metal prior to making the connection. Touch-up paint the area after the connection is made.

- (I) Equipment grounding conductors shall not be spliced except as follows.
1. To tie multiple conductors together in junction boxes, pull boxes, terminal cabinets, or similar equipment enclosures.
  2. When connecting a large conductor to a smaller conductor for making final connection to equipment as permitted elsewhere in this section.
  3. When making taps for connection to boxes or enclosures as permitted elsewhere in these Special Provisions.
  4. When making taps for connection to luminaires, light switches, receptacles, and similar devices.
  5. Where specifically indicated otherwise.
  6. With the permission of, and as prescribed by, the Engineer when absolutely required by conditions of installation.

Splices and taps for equipment grounding conductors shall be made with heavy duty crimp or mechanical type connectors, or by exothermic weld.

- (J) Equipment grounding conductor connections to equipment shall be made with appropriate crimp or mechanical type lugs. Ground bars shall include set-screws for conductor connections, or utilize bolted connections to crimp or mechanical type lugs.

## **6. MEASUREMENT AND PAYMENT**

- (A) There will be no separate measurement and payment for this work. Work covered by this section is incidental to the various items of electrical work, and will not be separately measured or paid for. All costs associated with this section shall be included in the prices bid for the various items of electrical work, as appropriate.

## **ROADWAY LIGHTING REHABILITATION**

### **1. SCOPE**

- (A) This section covers all products, labor, services, incidentals, and related work necessary to furnish, install, test, and put into permanent service all work related to rehabilitation of the existing roadway lighting system as shown on the plans and described herein.
- (B) This section is a component of the electrical Special Provisions. The provisions and requirements of Section 5 – General Requirements for Electrical Work are hereby incorporated into this section by this reference, and shall have the same force and effect as if printed here in full.
- (C) Specific items covered by this section include the following.
1. Roadway Lighting Luminaires
  2. Roadway Lighting Poles
  3. Related Hardware

**2. SUBMITTALS****(A) Product Submittals**

(1) For each type of luminaire, submit the following items all together.

1. Catalog cut sheets for the luminaire and all accessories.
2. Dimensioned drawing(s), including weight.
3. Complete photometrics, in IES format, on CDROM.

(2) For each pole, submit the following items all together.

1. Catalog cut sheets for the pole and all accessories.
2. Dimensioned drawing(s), including weight.

**(B) Submit calculations as required elsewhere in this section.**

**3. SUPPORTING CALCULATIONS FOR PROPOSED SUBSTITUTIONS**

**(A) The specific manufacturer(s) and model(s) of luminaires identified in this section and on the plans have been selected to meet specific lighting criteria. If the Contractor wishes to propose any alternate luminaire(s) for consideration, he shall submit complete lighting calculations demonstrating that the proposed alternate products provide performance which is equal to, or better than, the specified products. Such calculations shall be included along with the luminaire product submittals.**

**(B) The lighting calculations for proposed alternate luminaire(s) must be determined by the Engineer to be completely acceptable in every way, and be prepared using computer software according to ANSI/IESNA RP-8-00 methodologies. The results of these calculations shall satisfy ANSI/IESNA RP-8-00 criteria for Class A Freeways using the Illuminance Method. Pavement classification shall be R1 for the approaches and R3 for the lift span.**

**4. LUMINIARES**

**(A) The luminaire types (e.g. "Type A", etc.) identified in this section correspond with the types identified on the plans.**

**(B) Type A**

- (1) Arm-less type roadway luminaire. UL Listed for wet locations.
- (2) 200 watt high pressure sodium. IES Type IV ("Wide") light distribution.
- (3) Knuckle fitter mounting for a 2 inch O.D. by 4 inch vertical tenon.
- (4) Die cast low copper aluminum alloy housing. Electrostatically applied and baked powder coat paint finish.



- (5) Porcelain enclosed socket with nickel plated grip screw shell. Socket shall be field adjustable for changing light distribution.
- (6) Fixture shall pass a vibration fatigue test simulating a minimum 1 g peak acceleration.
- (7) Prismatic borosilicate glass refractor with smooth outer surface.
- (8) Hinged door providing access to lamp, with stainless steel latches.
- (9) All exposed hardware stainless steel.
- (10) High power factor ballast. Capable of starting to -40 Fahrenheit.
- (11) Protected starter.
- (12) 480 volts, 1 phase.
- (13) Holophane Vector, or approved equal.

(C) Type B

- (1) Ceiling mount, tunnel type, roadway luminaire. UL Listed for wet locations.
- (2) 70 watt high pressure sodium. Symmetrical light distribution.
- (3) Supplied with matching mounting plate.
- (4) Die cast low copper aluminum alloy housing. Epoxy powder paint finish.
- (5) Porcelain enclosed socket with nickel plated grip screw shell.
- (6) Tempered glass lens. Aluminum reflector with ALGLAS finish.
- (7) Hinged door providing access to lamp, with stainless steel latches.
- (8) All exposed hardware stainless steel.
- (9) High power factor ballast. Capable of starting to -40 Fahrenheit.
- (10) Protected starter.
- (11) 480 volts, 1 phase.
- (12) GE Tunnel Guard, or approved equal.

## 5. POLES

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- (A) Round, tapered pole with dimensions as indicated on the plans. Rated for 150 pounds luminaire weight and minimum 5.8 square feet of luminaire effective projected area at 110 MPH wind.
- (B) Shaft spun tapered from all new seamless 6063 alloy aluminum, heat treated to T6 temper. Polished to a satin finish with fine grain aluminum oxide cloths.
- (C) Anchor base cast from A356 alloy aluminum and circumferentially welded to the shaft. Completed assembly heat treated to T6 temper after all welding is complete.
- (D) 5/16"-18 tapped provision for ground connector.
- (E) Flush covered hand hole. Minimum dimensions shall be 4 inches by 6 inches.
- (F) 2 inch O.D. by 4 inch vertical tenon on top of shaft for luminaire mounting.
- (G) Natural finish.
- (H) With matching transformer base cast from A356 alloy aluminum and heat treated to T6 temper.
- (I) Bolts for connecting the pole anchor base to the transformer base supplied by the pole manufacturer.
- (J) As manufactured by Valmont, or approved equal.

## 6. FUSED SPLICES

- (A) Water-tight in-line fuse holder. UL Listed.
- (B) 600 volts, 30 amperes.
- (C) Class CC fuses, ratings as indicated.
- (D) Ferraz Shawmut FEC, or approved equal.

## 7. MEASUREMENT AND PAYMENT

- (A) *Roadway Lighting Rehabilitation* will be paid at the lump sum contract price, complete and fully functional in place. This price shall include all products, labor, tools, equipment, testing, and incidentals necessary to complete the work in accordance with these contract documents.

## CONTROL HOUSE HVAC SYSTEM

### 1. SCOPE

- (A) This section covers all products, labor, services, incidentals, and related work necessary to furnish, install, test, and put into permanent service all work related to installation of a new HVAC system in the existing bridge control house as shown on the plans and described herein.
- (B) This section is a component of the electrical Special Provisions. The provisions and requirements of Section 5 – General Requirements for Electrical Work are hereby incorporated into this section by this reference, and shall have the same force and effect as if printed here in full.

**2. SUBMITTALS**

- (A) Provide product submittals (catalog cut sheets, specification sheets, product drawings, etc.) for all materials and equipment provided under this section.

**3. HVAC SYSTEM**

- (A) The new HVAC system shall comply with all applicable state and local codes.
- (B) The new HVAC system shall be divided into two independently controllable zones: the operator's room and the electrical room. Each zone shall utilize duct-free split unit heat pumps.
  - (1) Operator's Room: One 36,000 BTUH unit.
  - (2) Electrical Room: Two 36,000 BTUH units (72,000 BTUH total), with common thermostat control.

**4. DUCT-FREE HEAT PUMP**

- (A) Commercial grade, duct-free, split unit heat pump system consisting of an indoor fan and coil unit matched to an outdoor compressor.
- (B) Minimum system SEER shall be 13 at ARI conditions. Minimum system HSPF shall be 7.7.
- (C) Indoor Fan Coil
  - (1) Direct-expansion, high-wall type.
  - (2) Equipped for wired control via an external wall-mounted thermostat.
  - (3) High impact plastic cabinet.
  - (4) Three speed, tangential direct-drive blower with top intake and bottom discharge. User adjustable automatic motor driven vertical and horizontal air sweep. Open drip-proof motors with permanently lubricated ball bearings and inherent overload protection.

- (5) Copper tube coils with aluminum fins and galvanized steel tube sheets. Fins bonded to tubes by mechanical expansion.
- (6) Integral drip pan with drain tubing and condensate pump(s) as required.
- (7) Microprocessor based control system with the following features.
  - 1. Automatic restart after power loss, at the same operating conditions as before.
  - 2. 24-hour timer automatic start/stop function.
  - 3. Return air temperature sensing.
  - 4. indoor coil freeze protection.
  - 5. Dehumidification mode.
  - 6. Fan only mode.
  - 7. Self diagnostics.
  - 8. Selectable fan speed.
  - 9. Automatic heating to cooling changeover, with deadband to prevent cycling between modes.
- (8) 208 volts, 1 phase.

(D) Outdoor Condenser

- (1) Factory assembled, single piece, air-cooled outdoor condenser.
- (2) Galvanized steel cabinet with baked enamel finish inside and outside. Removable panels to provide access to internal components.
- (3) Direct-drive propeller type fan with horizontal air discharge. Totally enclosed fan motor with Class B insulation, permanently lubricated ball bearings, and inherit thermal overload protection. Inherently corrosion resistant fan shaft and blades. Fan blades shall be statically and dynamically balanced.
- (4) Fan openings covered with PVC coated metallic grilles.
- (5) Fully hermetic scroll compressor, equipped with oil system, operating oil charge, and motor. Class F motor, suitable for operation in a refrigerant atmosphere. Equipped with internal motor overcurrent and over-temperature protection. Installed on rubber vibration isolators.
- (6) Copper tube coils with aluminum fins. Fins bonded to tubes by mechanical expansion.
- (7) Additional components shall include: brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage connection ports on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, and reversing valve.

- (8) Controls and safeties shall include: time delay control sequence, automatic motor protection, diagnostics through the matched indoor fan coil unit, compressor motor current and temperature overload protection, fan failure protection, low pressure protection, fusible plug to vent refrigerant safely in case of fire.
- (9) With crankcase heater and wind baffle.
- (10) 208 volts, 3 phase.
- (E) Carrier 40QNQ036 with 38QRF036, or approved equal.

**5. PIPING**

- (A) All piping shall be Type L or K copper tubing with wrought copper sweat type fittings. All joints shall be made up by soldering.
- (B) All refrigerant lines shall be insulated with minimum 3/4 inch thick rigid, weather and UV resistant, foam pipe insulation.
- (C) Condensation and drip pan lines for indoor units shall be insulated with minimum 3/4 inch thick rigid, weather and UV resistant, foam insulation, and routed to outside of the house.
- (D) All penetrations for HVAC system piping shall be made in the walls and/or floors of the control house; roof penetrations are not permitted. Utilize existing abandoned penetrations where possible.
- (E) Provide appropriate valves and filters in all refrigerant lines as required.

**6. HVAC SYSTEM ELECTRICAL EQUIPMENT**

- (A) Outdoor Condensing Unit Disconnect Switch
  - (1) Disconnect switches shall be UL Listed heavy duty safety switches and comply with the requirements of NEMA KS 1. Ratings shall be as indicated and as required by the circuits and/or equipment served.
  - (2) Switches shall be horsepower rated.
  - (3) Switches shall utilize quick-make, quick-break contacts. Contacts shall be visible with the door open.
  - (4) Enclosure shall be NEMA 4X stainless steel (Type 316) enclosure with external handle. Enclosure shall include provisions for locking the door closed and for locking the external handle in the OFF position.
  - (5) Disconnect switches shall be Cutler-Hammer DH, or approved equal.
- (B) Indoor Fan Coil Unit Disconnect Switch (Manual Motor Switch)

- (1) Manual motor switches shall be UL Listed "light switch" type. Ratings shall be as indicated and as required by the circuits and/or equipment served.
- (2) Switches shall be horsepower rated.
- (3) Enclosure shall be NEMA 1 aluminum with provisions for locking the switch toggle in the OFF position.
- (4) Manual motor switches shall be Cutler-Hammer B230, or approved equal.

(C) Panelboard

- (1) Panelboards shall be UL Listed and comply with the requirements of NEMA PB 1. Ratings shall be as indicated and as required by the circuits served.
- (2) Panelboards shall be fully rated to withstand short circuit currents (at rated voltage) of at least 14,000 amperes.
- (3) Interiors shall be completely factory assembled and designed such that switching and protective devices may be replaced without disturbing adjacent devices and without removing the main bus connections.
- (4) Main bus shall be copper, sized in accordance with UL and NEMA standards. Switching and protective device taps to the main bus shall be arranged for ABC phase sequencing such that adjacent poles are not connected to the same phase.
- (5) A full size (100% rated), insulated, copper neutral bus shall be provided for all panelboards designated as single phase and three phase four wire. The neutral bus shall have suitable lugs to provide a connection for each branch circuit requiring a neutral.
- (6) An un-insulated, copper ground bus shall provided for all panelboards.
- (7) Panelboards shall include an engraved nameplate with the manufacturer's name, model number, serial number, system electrical data, bus ampacity, and the bus short circuit rating.
- (8) Enclosures shall be constructed from steel with corrosion resistant finish and sized in accordance with UL, NEMA, and NEC requirements. Covers shall be removable to permit access to the panelboard interior, and shall include a hinged, lockable door covering all switching and protective device handles. Opening the door shall permit access to all device handles, but shall not uncover any energized parts. Enclosures for recessed panelboards installed in dry, finished areas shall use the manufacturer's standard box and flush trims with corrosion resistant finish. Enclosures for all other panelboards shall be NEMA 12, or as otherwise indicated, with corrosion resistant finish. All hardware shall be corrosion resistant.

- (9) Overcurrent protective devices shall be UL Listed molded case and/or miniature circuit breakers having inverse-time and instantaneous tripping characteristics. Breakers shall connect to the panelboard bus by bolting.
  - (10) Number of device spaces shall be as indicated. Blank covers shall be provided for all unused spaces.
  - (11) Provide a typewritten circuit directory, placed in a clear plastic cover inside the panelboard door, for each panelboard.
  - (12) Provide integral surge suppression where indicated. Surge suppression shall satisfy the requirements for such products given elsewhere in these specifications.
  - (13) Panelboards shall be installed in accordance with the requirements of NEMA PB 1.1.
  - (14) Rearrange branch circuits as directed by the Engineer to achieve balanced loading.
  - (15) Panelboards shall be Cutler-Hammer PRL2a, or approved equal.
- (D) Transformer
- (1) Low voltage power distribution transformers shall be UL Listed dry type designed for continuous operation at rated KVA.
  - (2) Ratings shall be as indicated. BIL shall be 10 kilovolts.
  - (3) Unless specifically indicated otherwise, three phase transformer primaries shall be delta connected, secondaries shall be solidly grounded wye-connected. Transformer secondary neutral grounding shall conform to the requirements for grounding and bonding given elsewhere in these special provisions.
  - (4) Unless specifically indicated otherwise, transformers shall be ventilated type. Ventilated type transformers shall be NEMA TP-1 Energy Efficient, with copper or aluminum windings. The coil assembly shall be impregnated with non-hygroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The core and coil assembly shall be mounted on vibration absorbing pads. Insulation system shall be 220 Celsius, with maximum 150 Celsius operating temperature rise under full load. Enclosures shall be NEMA 2 steel with corrosion resistant finish. All openings shall be screened.
  - (5) Transformers shall include a minimum of two 2.5% above normal full capacity taps and four 2.5% below normal full capacity taps.
  - (6) Transformers shall operate at or below NEMA ST 20 sound levels.
  - (7) Nameplates shall be engraved and comply with the requirements of NEMA ST 20.

- (8) Final conduit connection to transformers shall be by flexible conduit.
  - (9) Grounding and bonding shall comply with the requirements given elsewhere in these special provisions.
  - (10) Adjust transformer taps as directed by the Engineer.
  - (11) Transformers shall be as manufactured by Cutler-Hammer, or approved equal.
- (E) Receptacle
- (1) Receptacles shall be UL listed, heavy-duty type, suitable for use in industrial environments.
  - (2) General purpose receptacles shall be duplex grounding type rated 120 volts AC, 20 amperes (NEMA 5-20R). Receptacles installed in damp and wet locations shall be GFCI type
  - (3) Receptacle configurations shall be as defined by NEMA for the rated voltage and current.
  - (4) Receptacles shall be as manufactured by Hubbell, or approved equal.
  - (5) Covers for receptacles in wet locations shall be cast aluminum, self-closing, rated "Rain-Tight While In Use" type.

**7. PAYMENT**

- (A) *Control House HVAC System* will be paid at the lump sum contract price, complete and fully functional in place. This price shall include all products, labor, tools, equipment, testing, and incidentals necessary to complete the work in accordance with these contract documents.

**GUIDE ROLLER REHABILITATION**

**1. DESCRIPTION**

- (A) This section covers the rehabilitation of the guide roller assemblies on the existing span of the Cape Fear Memorial Bridge in Wilmington, North Carolina, and includes all mechanical details.

**2. SCOPE OF WORK**

- (A) The guide roller assemblies shall consist of new shafts and bronze bushings for the longitudinal, transverse, upper and lower locations. The existing shafts and bushings shall be removed and replaced, while reusing the existing guide rollers. The existing longitudinal guide rollers shall be turned to the next clean diameter.



**3. FITS AND FINISHES**

- (A) The fits and finishes shall be as specified in the AASHTO LRFD Movable Highway Bridge Design Specification.

**4. BRONZE BUSHINGS**

- (A) All bronze bushings shall be ASTM B 22, Alloy C91100, unless otherwise specified. New bushings shall be provided as shown in the Contract Drawings.

**5. JOURNALS**

- (A) All journal bearing areas on shafts and pins shall be accurately turned, ground, and polished with no trace of tool marks or scratches on the journal surface or adjoining shoulder fillets. The journal bearing area shall have a 8-microinch finish or better. Journal diameters shall be finished to the limits of an ANSI B 4.1 Class RC6 running fit, unless otherwise noted. Before erection, the journals shall be coated with graphite, thoroughly worked into the surface by hand.

**6. GUIDE ROLLER SHAFTS**

- (A) Rounds and shafts shall be true, straight and free from flaws, piping, laps, seams, or cracks. All shafts shall have finished ends with a 60-degree lathe center with a clearance hole at the exact center of the shaft. Stepped shafts shall have fillets finished smoothly to adjacent surfaces without tool marks or scratches.
- (B) All forged shafts shall be reduced to size from a single bloom or ingot until perfect homogeneity is secured. The blooms or ingots, from which shafts or pins are to be made, shall have a cross-sectional area at least three times that required after finishing. No forging shall be done at less than red-heat. Forged rounds for shafts and pins shall be true, straight, and free from any defect.
- (C) All shafts shall be accurately finished, round, smooth, and straight; and when turned to different diameters, they shall have rounded fillets at the shoulders. Shafts exhibiting defects will not be accepted. Shafts that are bored with an inspection hole shall have the ends prepared for the attachment of a centering device equivalent to the lathe center. All such devices shall be furnished as part of the work.

**7. HIGH STRENGTH BOLTS, NUTS AND WASHERS**

- (A) Heavy hexagonal head structural bolts, heavy hexagonal nuts, and hardened washers complying with respectively ASTM A325, Type 1, A563, Grade C, and F436 shall be used for bolting components to their supports and the supports to structural steel or concrete floor. For anchor bolts that go through the concrete floor, but do not attach to structural steel, large ½" thick backing plates under the concrete floor shall be used.

**8. HIGH STRENGTH TURNED BOLTS**

- (A) Turned bolts shall be made from a material and have a strength equal to ASTM A325, Type 1. Heavy hexagonal nuts, and hardened washers complying with A563, Grade C, and F436 respectively shall be used with the turned bolts. Locking shall preferably be by use of double nuts.
- (B) The body of the turned bolts shall be finished to 63 microinches or better. Threads for the turned bolts and nuts shall conform to the Unified Thread Standards, coarse thread series with a Class 2A tolerance for bolts and Class 2B tolerance for nuts, in accordance with ANSI B1.1, unless otherwise specified. Turned bolts are designated by their nominal thread size. The turned bolt body shall be 1/16th of an inch larger in diameter than the nominal size specified, and shall have an LC6 fit with reamed holes. Bolt head and nut bearing surfaces shall be flat and square with the axis of the bolt holes and shall be spot faced if necessary. Unless otherwise noted, bolt holes in machinery parts required for connecting to supporting steelwork may be sub-drilled (in the shop) smaller than the turned bolt diameter and shall be reamed together with supporting structural steel either during assembly or at erection, after the parts are correctly assembled and aligned. Positive type locking shall be provided. Double nuts are preferred. Where double nuts are used, heavy hex and jam nuts shall be used. Alternate locking methods shall be submitted to the Engineer for approval.

**9. BRONZE FLAT HEAD CAP SCREWS**

- (A) Bronze flat head cap screws shall be used to secure all bronze bushings.

**10. SHIMS**

- (A) Where shown on the drawings, all machinery shims required for leveling and alignment of equipment shall be stainless steel, ASTM A167, Type 302/304, neatly trimmed to the dimensions of the assembled parts and drilled for all bolts that pass through the shims. In general, total shim pack thickness shall be no less than twice the nominal thickness shown on the drawings, and of sufficient varying thicknesses shall be furnished to secure 0.03125-inch variations of the shim allowance including one shim equal to the full allowance. Shims shall be placed to provide full contact between machinery and machinery supports. Shims shall be shown in detail on the shop drawings.

**11. COMPONENTS TO BE REUSED**

- (A) Components that are reused such as the sleeve, rollers, keeper plates, etc, shall be match marked before removal for both their location and orientation. They shall be completely cleaned to bare white metal and painted as specified herein.

**12. INSTALLATION**

- (A) The guide roller shafts and bushings shall be removed and replaced individually as shown on the plans. All dimensions relating to existing equipment must be verified by the contractor on site. The Contractor shall supply all apparatus, tools, devices, materials and labor to manufacture, paint, ship, install, erect, align, adjust, lubricate, and test the

auxiliary span drive machinery for the lift bridge in an approved manner. Any apparatus, tools, devices, materials and labor, not specifically stated or included, which may be necessary for the work, shall be furnished by the Contractor. Painting specifications and color shall be as required by the NCDOT.

**13. PAYMENT**

- (A) *Guide Roller Rehabilitation* will be paid at the lump sum contract price which price includes the completed rehabilitation of all span guide roller assemblies as detailed on the plans and described herein.