

PROJECT SPECIAL PROVISIONS

BMU-15110R

Carteret County

SCOPE OF WORK

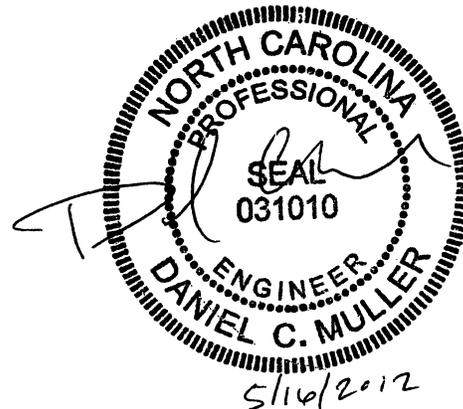
SPECIAL

1.0 DESCRIPTION OF WORK

The Rehabilitation of Bridge No. 110 consists of structural repairs to the bascule span and upgrades to the mechanical and electrical drive systems as shown in the plans. The structural repairs on the bascule span consist of the replacement of the floor beams, stringers, lateral bracing and their related attachments. The floor beam connections will be modified to improve horizontal clearance. The bascule main girders will also have additional cover plates installed to supply increased live load capacity. The A frame structure will be repaired by reinforcing the anchor bolts as well as strengthening the tie struts. Span balancing will be required prior to, during and after construction of the proposed modifications. Cleaning and painting the existing structural members will be performed as noted in the plans and specifications. The existing gasoline engine power drive will be replaced with an electrical motor and new push button controls. The new system will provide controls on the bridge and also on the western approach. Electrical power supply will be installed on the parallel US 70 highway bridge and trenched across to the bascule pier. Miscellaneous mechanical repairs will also be performed on bearings, shafts and other components. New automated toe and heel lock mechanisms will also be supplied.

The Contractor shall provide all necessary access; boats, scaffolding, ladders, etc.; provide all traffic control (both vehicular and navigational); coordinate all navigation channel work with the U.S. 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/drilling/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 2012, except as otherwise specified herein.



SUBMITTAL OF WORKING DRAWINGS**SPECIAL****1.0 GENERAL**

Submit working drawings in accordance with Article 105-2 of the *Standard Specifications* and this provision. For this provision, “submittals” refers to only those listed in this provision. The list of submittals contained herein does not represent a list of required submittals for the project. Submittals are only necessary for those items as required by the contract. Make submittals that are not specifically noted in this provision directly to the Resident Engineer. Either the Structure Design Unit or the Geotechnical Engineering Unit or both units will jointly review submittals.

If a submittal contains variations from plan details or specifications or significantly affects project cost, field construction or operations, discuss the submittal with and submit all copies to the Resident Engineer. State the reason for the proposed variation in the submittal. To minimize review time, make sure all submittals are complete when initially submitted. Provide a contact name and information with each submittal. Direct any questions regarding submittal requirements to the Resident Engineer, Structure Design Unit contacts or the Geotechnical Engineering Unit contacts noted below.

In order to facilitate in-plant inspection by NCDOT and approval of working drawings, provide the name, address and telephone number of the facility where fabrication will actually be done if different than shown on the title block of the submitted working drawings.

This includes, but is not limited to, precast concrete items, prestressed concrete items and fabricated steel or aluminum items.

2.0 ADDRESSES AND CONTACTS

For submittals to the Structure Design Unit, use the following addresses:

Via US mail:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department of
Transportation
Structure Design Unit
1581 Mail Service Center
Raleigh, NC 27699-1581
Attention: Mr. P. D. Lambert, P. E.

Via other delivery service:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department of
Transportation
Structure Design Unit
1000 Birch Ridge Drive
Raleigh, NC 27610
Attention: Mr. P. D. Lambert, P. E.

Submittals may also be made via email.

Send submittals to: plambert@ncdot.gov (Paul Lambert)

Send an additional e-copy of the submittal to the following address: jgaither@ncdot.gov
(James Gaither)

For submittals to the Geotechnical Engineering Unit, use the following addresses:

For projects in Divisions 1-7, use the following Eastern Regional Office address:

Via US mail:

Mr. K. J. Kim, Ph. D., P. E.
 Eastern Regional Geotechnical
 Manager
 North Carolina Department of
 Transportation
 Geotechnical Engineering Unit
 Eastern Regional Office
 1570 Mail Service Center
 Raleigh, NC 27699-1570

Via other delivery service:

Mr. K. J. Kim, Ph. D., P. E.
 Eastern Regional Geotechnical
 Manager
 North Carolina Department of
 Transportation
 Geotechnical Engineering Unit
 Eastern Regional Office
 3301 Jones Sausage Road, Suite 100
 Garner, NC 27529

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

Direct any questions concerning submittal review status, review comments or drawing markups to the following contacts:

Primary Structures Contact:

Paul Lambert
 (919) 707-6407
 (919) 250-4082 facsimile
plambert@ncdot.gov

Secondary Structures Contacts:

James Gaither
 (919) 707- 6409
jgaither@ncdot.gov

Eastern Regional Geotechnical Contact (Divisions 1-7):

K. J. Kim
 (919) 662-4710
 (919) 662-3095 facsimile
kkim@ncdot.gov

3.0 SUBMITTAL COPIES

Furnish one complete copy of each submittal, including all attachments, to the Resident Engineer. At the same time, submit the number of hard copies shown below of the same complete submittal directly to the Structure Design Unit and/or the Geotechnical Engineering Unit.

The first table below covers “Structure Submittals”. The Resident Engineer will receive review comments and drawing markups for these submittals from the Structure Design Unit. The second table in this section covers “Geotechnical Submittals”. The Resident Engineer will receive review comments and drawing markups for these submittals from the Geotechnical Engineering Unit.

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

STRUCTURE SUBMITTALS

Submittal	Copies Required by Structure Design Unit	Copies Required by Geotechnical Engineering Unit	Contract Reference Requiring Submittal ¹
Arch Culvert Falsework	5	0	Plan Note, SN Sheet & “Falsework and Formwork”
Box Culvert Falsework ⁷	5	0	Plan Note, SN Sheet & “Falsework and Formwork”
Cofferdams	6	2	Article 410-4
Foam Joint Seals ⁶	9	0	“Foam Joint Seals”
Expansion Joint Seals (hold down plate type with base angle)	9	0	“Expansion Joint Seals”
Expansion Joint Seals (modular)	2, then 9	0	“Modular Expansion Joint Seals”
Expansion Joint Seals (strip seals)	9	0	“Strip Seals”
Falsework & Forms ² (substructure)	8	0	Article 420-3 & “Falsework and Formwork”
Falsework & Forms (superstructure)	8	0	Article 420-3 & “Falsework and Formwork”
Girder Erection over Railroad	5	0	Railroad Provisions
Maintenance and Protection of Traffic Beneath Proposed Structure	8	0	“Maintenance and Protection of Traffic Beneath Proposed Structure at Station ____”

Metal Bridge Railing	8	0	Plan Note
Metal Stay-in-Place Forms	8	0	Article 420-3
Metalwork for Elastomeric Bearings ^{4,5}	7	0	Article 1072-8
Miscellaneous Metalwork ^{4,5}	7	0	Article 1072-8
Optional Disc Bearings ⁴	8	0	“Optional Disc Bearings”
Overhead and Digital Message Signs (DMS) (metalwork and foundations)	13	0	Applicable Provisions
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20
Pot Bearings ⁴	8	0	“Pot Bearings”
Precast Concrete Box Culverts	2, then 1 reproducible	0	“Optional Precast Reinforced Concrete Box Culvert at Station ____”
Prestressed Concrete Cored Slab (detensioning sequences) ³	6	0	Article 1078-11
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3
Prestressed Concrete Girder (strand elongation and detensioning sequences)	6	0	Articles 1078-8 and 1078-11
Removal of Existing Structure over Railroad	5	0	Railroad Provisions
Revised Bridge Deck Plans (adaptation to prestressed deck panels)	2, then 1 reproducible	0	Article 420-3
Revised Bridge Deck Plans (adaptation to modular expansion joint seals)	2, then 1 reproducible	0	“Modular Expansion Joint Seals”
<i>Sound Barrier Wall (precast items)</i>	10	0	Article 1077-2 & “Sound Barrier Wall”
Sound Barrier Wall Steel Fabrication Plans ⁵	7	0	Article 1072-8 & “Sound Barrier Wall”
Structural Steel ⁴	2, then 7	0	Article 1072-8

Temporary Detour Structures	10	2	Article 400-3 & “Construction, Maintenance and Removal of Temporary Structure at Station _____”
TFE Expansion Bearings ⁴	8	0	Article 1072-8

FOOTNOTES

- References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Articles refer to the *Standard Specifications*.
- Submittals for these items are necessary only when required by a note on plans.
- Submittals for these items may not be required. A list of pre-approved sequences is available from the producer or the Materials & Tests Unit.
- The fabricator may submit these items directly to the Structure Design Unit.
- The two sets of preliminary submittals required by Article 1072-8 of the *Standard Specifications* are not required for these items.
- Submittals for Fabrication Drawings are not required. Submittals for Catalogue Cuts of Proposed Material are required. See Section 5.A of the referenced provision.
- Submittals are necessary only when the top slab thickness is 18” or greater.

GEOTECHNICAL SUBMITTALS

Submittal	Copies Required by Geotechnical Engineering Unit	Copies Required by Structure Design Unit	Contract Reference Requiring Submittal¹
Drilled Pier Construction Plans ²	1	0	Subarticle 411-3(A)
Crosshole Sonic Logging (CSL) Reports ²	1	0	Subarticle 411-5(A)(2)
Pile Driving Equipment Data Forms ^{2,3}	1	0	Subarticle 450-3(D)(2)
Pile Driving Analyzer (PDA) Reports ²	1	0	Subarticle 450-3(F)(3)

Retaining Walls ⁴	8 drawings, 2 calculations	2 drawings	Applicable Provisions
Temporary Shoring ⁴	5 drawings, 2 calculations	2 drawings	“Temporary Shoring” & “Temporary Soil Nail Walls”

FOOTNOTES

1. References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Subarticles refer to the *Standard Specifications*.
2. Submit one hard copy of submittal to the Resident or Bridge Maintenance Engineer. Submit a second copy of submittal electronically (PDF via email) or by facsimile, US mail or other delivery service to the appropriate Geotechnical Engineering Unit regional office. Electronic submission is preferred.
3. The Pile Driving Equipment Data Form is available from:
www.ncdot.org/doh/preconstruct/highway/geotech/formdet/
See second page of form for submittal instructions.
4. Electronic copy of submittal is required. See referenced provision.

4.0 ADVANCE APPROVAL FOR ORDERING OF RAW MATERIALS

- A. In order to expedite delivery of long lead time raw materials prior to acceptance of the related shop drawings, the Contractor may request, in writing, approval from the Engineer to order raw materials of the correct type for later fabrication from approved shop drawings.
- B. Such approval by the Engineer shall be valid only if provided in writing (verbal authorization is not binding) and shall not relieve the Contractor from responsibility for compliance with all requirements of these Contract Documents.
- C. The Engineer is under no obligation to grant such advance approval, and refusal to grant such approval shall not be considered cause for delay or additional payment.

5.0 PRELIMINARY SUBMITTALS

In order to expedite the submittal review process, the Contractor may request, in writing, approval from the Engineer to submit preliminary submittals for examination. Approval for submission of preliminary submittals shall be exclusively at the discretion of the Engineer, and refusal of such approval shall not be considered cause for delay or additional payment.

Preliminary submittals shall be brief submittals describing the concept and materials sufficiently for the Engineer to determine if the contract requirements appear likely to be satisfied. Many detailed characteristics (dimensions, ratings, etc.) may be omitted. However, any missing information shall be clearly indicated on the submittal. Preliminary submittals shall be clearly identified with "PRELIMINARY SUBMITTAL FOR EXAMINATION

ONLY - NOT FOR REVIEW, APPROVAL, OR CONSTRUCTION" marked on all sheets of the submittal item (this marking is permitted to be placed only on the cover sheet required elsewhere in this Section for catalog cut sheets and similar standard product literature).

Preliminary submittals shall be submitted separately from other submittals.

Preliminary submittals will be examined only, as opposed to reviewed and approved. This examination will be for anticipated compliance with the requirements of the Contract Documents and for conformance with the overall design concept, insofar as such anticipation is possible with the limited information provided in the submittal; examination will not be conducted with the same rigor or thoroughness as a review for approval. This examination is intended only to establish that the Contractor is apparently proceeding properly in the selection of the respective submittal item. This examination, and any comments and/or corrections provided to the Contractor as a result of this examination, shall not be considered binding upon the Engineer and shall in no way restrict the comments provided, and/or actions taken, by the Engineer during any subsequent review for approval of the same item. Also, procurement of any component through this process does not relieve the contractor from full responsibility to coordinate with subsequent submissions as well as adjust for any field verified dimensions and details.

See the provisions for "Submittals for Examination Only" given later in this Section.

6.0 GENERAL REQUIREMENTS FOR SUBMITTALS

Submittal items shall be grouped and submitted according to logical groupings of equipment with related function in order to facilitate review. Specific requirements for submittal groupings may also be given elsewhere in these specifications. Where a group of items are required by these Specifications to be submitted together, any submission which is missing required information may be rejected, without further review, to be resubmitted along with the missing information.

All submittals shall be in English. United States (English) standard units of measure shall be used except where necessary to match units of measure used in the Contract Documents.

All drawings shall be furnished with a clear white background, be numbered, include a revision block, include a minimum 3 inch by 3 inch block or space for the Engineer's approval stamp, and clearly indicate the current version/revision number and date of the drawing. Each drawing shall clearly indicate the originating party.

All drawings shall include scales (except wiring diagrams do not require scales). Where reduced or enlarged copies of drawings are submitted, they shall be clearly marked as such.

Drawings shall not be larger than 34 inches by 22 inches, nor smaller than 11 inches by 8.5 inches. The preferred sizes shall be 34 inches by 22 inches and 17 inches by 11 inches. Other non-drawing submittal sheets shall be either 11 inches by 8.5 inches or 17 inches by 11 inches.

All catalog cuts, brochures or other literature submitted shall be manufacturer's latest issue in current use.

All information on all submittals shall be neat and clearly legible. Those submittals which are not neat and clearly legible may be rejected without review.

All items submitted shall include a notation identifying the component or use for which it is proposed. Submittals without such component identification will not be reviewed by the Engineer, but will be returned for resubmission with proper marking as required.

Once a submittal item has been approved; any proposed deviation from the information depicted thereon shall be submitted as revisions for the Engineer's approval prior to implementation of the proposed deviation. All drawings affected by such deviations shall be revised by the Contractor and resubmitted for re-approval.

All submittals shall clearly show dimensions and pertinent ratings, with markings/notation explicitly identifying the intended use of each component on this project. Where a submittal includes a table, listing, or group of similar items with different catalog numbers and/or options, the specific product(s) and options being proposed shall be clearly marked.

All submittals shall clearly and explicitly depict all information required to permit the Engineer to determine if the item(s) proposed satisfy the requirements of the Contract Documents.

The Engineer is not responsible for locating or securing any information that is not readily available on the submitted documents.

Where a specific manufacturer and/or model is specified for a component, and the Contractor proposes a different manufacturer and/or model as an equal replacement, the Engineer may require back-up calculations in order to positively establish that the proposed item is equal to the specified item and is acceptable for use.

If the Contractor proposes to modify a product so as to make it conform to the requirements of the Contract Documents, the Contractor shall include in the required submittals a clear description of such proposed modifications and clearly mark any descriptive material to show the proposed modifications.

Any proposed variance from the Contract Documents shall be clearly identified.

Catalog cut sheets, shop drawings showing overall views of a component (as opposed to drawings showing only detail views), and similar submittals shall clearly identify the weight(s) of the component(s) depicted. Where a number of individual electrical and/or mechanical components are to be combined into a single unit, the weight of the combined unit may be identified in lieu of the weights of the individual components. Additional information regarding component weights shall be provided when requested by the Engineer.

All submittals shall indicate the manufacturer's anticipated delivery time for the item after receipt of approval by the Engineer. Shipping time to the project site shall also be indicated for items with transit times greater than one week when such transit times are critical to the project schedule.

Submittals which do not comply with the requirements of this Section will be returned without consideration. Time lost because of the submission of incorrect or incomplete submittals by the Contractor will not be cause delay claims, additional compensation, or for extension of the specified contract period.

A. Standard Product Literature

The following shall apply to all catalog cut sheets, brochures, and similar standard product literature.

1. For individually submitted catalog cut sheets, each sheet, or set of several sheets all pertaining to the same item, shall be provided with a cover sheet. Cover sheet shall clearly list the submittal item title, the manufacturer's name, the complete model name and/or number, the number of sheets in the cut sheet set, and similar relevant information. The cover sheet shall also include a minimum 3 inch by 3 inch block for the Engineer's approval stamp, and clearly indicate the current revision date of the submittal. The cover sheet shall be stapled to the front of the catalog cut sheet(s) it pertains to. Note that this cover sheet is separate from the submittal cover letter described elsewhere in this section.
2. Where a number of items are to be shop assembled into a complete assembly or sub-system, the catalog cut sheets for all of the items in the assembly or Sub-system may be submitted bound together with a single cover sheet listing the information required above for each item. However, in such a case, the items bound together will be treated as a single submittal item and approved or rejected as a unit.

B. Calculations

All required calculations shall be signed and sealed by a Professional Engineer holding a valid license, in the appropriate discipline, to practice in the State of North Carolina. Calculations shall be complete and show all information, including assumptions and references, required to permit re-creation by an independent Engineer.

C. Quality Control

All submittal items required by these Contract Documents shall be regarded as part of the work items to which they relate, and shall be of the highest quality and acceptable in all respects. Prior to transmittal, all submittals shall be thoroughly checked by Contractor to ensure conformity with the requirements of these Contract Documents. In addition, the Contractor shall be certain that any equipment he proposes to furnish and/or install will fit and functionally operate within the designated available space. Clearances shall be functional, as specified, and shall take into account all applicable Codes, regulations, and

similar requirements, and shall permit suitable access for routine operation and maintenance. Quality control of submittal items shall be solely the responsibility of the Contractor. The Contractor shall ensure that all submittals satisfy the requirements presented in these Contract Documents, and bear full responsibility for all costs and damages associated with, and/or resulting from, failure to provide submittals which conform to such requirements. Submittals which do not conform to the requirements relating to format, neatness, accuracy, completeness etc. presented in these Contract Documents will be returned without consideration.

The Contractor shall coordinate and review all submittals of all trades and sub-Contractors for accuracy, compliance with the requirements of the Contract Documents, compatibility with all new and existing work of all trades, and coordination with other submittal items. A statement to this effect shall be affixed to all submittal items or placed on the submittal cover letter, along with a list of the submittals that have been reviewed for compatibility and coordination.

Reviews of submittal items by the Engineer are intended to establish that the materials and work depicted are acceptable, not to serve as quality control for the submittals themselves. The Contractor shall conduct a complete and careful review of all submittal items prior to their submission. Such a review shall include, but not necessarily be limited to the items listed below, shall consider all portions of all submittal items, and shall be conducted by personnel who are familiar with the project and properly qualified to understand the information depicted in the submittal.

- Accuracy of content.
- Consistency with submittal items for related and/or adjacent materials and/or work.
- Compatibility with related and/or adjacent materials and/or work.
- Formatting and presentation according to the requirements of these Contract Documents.
- Typographical accuracy.
- Drafting accuracy.
- Completeness of required information.
- Accuracy of cross references, both within a submittal item and between multiple submittal items.
- Compatibility of interfaces between components.
- Clear identification of all variances from the requirements of these Contract Documents.
- Overall conformity with the requirements for submittals given in these Contract Documents.

The Contractor shall be fully responsible for the accuracy of all submittals, including submittals which have been approved by the Engineer, and shall bear full responsibility for all costs and damages associated with, and/or resulting from, any errors within submittals.

7.0 SCHEDULING

Sufficient time shall be allowed for initial review, correction and resubmission, and final review of all submittals. In no case shall the time allowed for review and return of any submittal be less than 45 calendar days from the date of its receipt by the Engineer. The Contractor shall clearly identify the requested return date for each item at the time of its submittal however, no less than 60 days shall be allowed in the contractor's schedule of work.

Submittal and checking time is included in total time for completion of all work.

At the beginning of the project, a schedule shall be submitted of the items of materials and equipment for which submittals are required. For each required submittal, the date shall be given for intended submission of the submittal to Engineer for review, and the date required for its return to avoid delay in any activity beyond the scheduled start date.

8.0 SUBMITTALS FOR EXAMINATION ONLY

These Contract Documents may also require certain items to be submitted for examination only, as opposed to review and approval. Such items will be examined only to the extent and/or for the purposes stated by these Contract Documents; they will not be reviewed in the same manner as items submitted for approval. After examination, the Engineer will return one "mark-up" copy marked either "EXAMINED" or "EXAMINED AS NOTED", as appropriate. Comments resulting from the Engineers examination may or may not be included with the returned "mark-up" copy.

Under no circumstances shall the Engineer's examination be considered to waive any of the provisions or requirements of these Contract Documents, nor release the Contractor from responsibility for the corrections of submittals and/or for errors in details which may interfere with erection and installation. Nor shall such examination relieve the Contractor from furnishing materials and products of proper dimensions, quantity, quality, and from the responsibility for their correct installation and for the proper operational performance intended.

9.0 RECORD COPIES KEPT ON SITE

The Contractor shall maintain, on site, at least one record copy of all final approved submittals. Record copies of approved submittals shall be stored in such a manner as to prevent damage due to dirt, water, sunlight, insects, rodents, etc., and shall be continuously available for the Engineer's inspection. These on site copies of approved submittals are in addition to, and not in place of or part of, the onsite as-built documentation required elsewhere in Section 2.

10.0 SUBMITTAL TRACKING

For the purposes of tracking items throughout the entire submission process, each submittal item (shop drawing, catalog cut, installation detail, calculation set, etc.) shall be assigned a

unique tracking number by the Contractor. Where a single catalog cut is comprised of several physical sheets, one tracking number shall be assigned for all sheets. Calculation sets, bound sets of multiple catalog cut sheets and similar items containing multiple physical sheets which are all related shall be assigned one tracking number for each item. All other submittals, including shop drawing sets comprised of multiple physical sheets, shall have an individual tracking number assigned to each sheet. Once an item has been assigned a tracking number, it shall remain the same for all subsequent revisions and resubmissions of the item.

The Contractor shall clearly mark all submittal items with the following information: project name, tracking number, title, contract plan equipment schedule item number (where applicable), and submission number. This information shall be typewritten, or legibly handwritten, on the front of each sheet of a submittal item. Additionally, submittal items which are comprised of multiple physical sheets which are all related to a common tracking number shall be marked with the page number and the total number of pages. Submittal items which are not prepared as required by these Specifications will be returned unchecked.

Each submittal shall also be assigned a unique, descriptive title. Titles shall not be repeated, either within a single submission or between multiple submissions. Titles shall be descriptive of the function of the item(s) depicted and shall not, to the extent practicable, utilize a manufacturer's part or model name or number, or a trade name (for example, use "Liquidtight Flexible Metal Conduit", not "Sealtite"). Once an item has been assigned a title, it shall remain the same for all subsequent revisions and resubmissions of the item.

11.0 SUBMITTAL COVER LETTER

All submissions shall include a cover letter, signed by an authorized representative of the Contractor, identifying the submission and its contents. The cover letter shall be assigned a unique and sequential transmittal number (note that this transmittal number is different from the tracking number assigned to each individual submittal item).

The cover letter shall list the following information for each submittal item:

- Item tracking number.
- Submission number. For items which are being re-submitted, the previous transmittal number shall be indicated.
- Title and description. Where a single item is comprised of multiple physical pages, the total number of pages shall be noted. Any item designated as a long lead-time, or similar critical path, item shall be clearly identified as such.
- Number of copies.
- Name of party (Contractor, sub-Contractor, vendor, manufacturer, system integrator, etc.) responsible for originating the item.
- A list of the submittals that have been reviewed for compatibility and coordination.
- Purpose of submission (for approval, information only, etc.).
- The requested return date.

Where copies of a submission are sent to multiple parties, a properly addressed cover letter shall accompany each copy. In such a case each cover letter shall bear the same transmittal number, and shall clearly identify the other parties receiving copies of the submission.

1.0 REQUEST FOR INFORMATION AND CORRESPONDENCE TRACKING

Each Request for Information (RFI), or similar correspondence, shall be clearly marked with a tracking number similar to those required for submittal items. Each RFI shall cover only one distinct item and/or question.

2.0 RESTRICTIONS ON USE, REPRODUCTION, AND/OR DISTRIBUTION

The term "documentation", as used in this section, includes submittal items, as-built documentation, operation and maintenance manuals, and all other similar items required by these Contract Documents, or provided for this project by, or through, the Contractor.

No restrictions shall be placed on the reasonable use, reproduction, and/or distribution of any documentation by the Department, the Department's designated representative(s), the Engineer, and/or the Engineer's designated representative(s) for the purposes of this project. All documentation shall be considered to be incidental to the materials, products, and/or work they are concerned with, and therefore shall become the unrestricted property, in perpetuity, of the Department upon completion and final acceptance of the project.

The Contractor shall bear full responsibility for assuring compliance with these requirements, including obtaining permission for use of any copyrighted material, and for any compensation required by, and/or damages sought by, parties preparing or providing documentation which may result from compliance with these requirements.

3.0 MEASUREMENT AND PAYMENT

There will be no measurement or direct payment for submittals and working drawings. Associated costs shall be included in the prices bid for the various other items requiring submittals. Delivery and/or approval of required submittals shall not be considered to be a basis for partial payment against any item.

COAST GUARD COORDINATION

SPECIAL

At no time during work will the waterway be closed or narrowed to navigation, nor will bridge operation deviate from the established USCG requirements without prior approval from the U.S. Coast Guard (USCG). The Contractor is required to maintain close and regular contact with the USCG, Sector North Carolina to keep them informed of activities in the waterway with Terrance Knowles of the 5th Coast Guard District at (757) 398-6587 or email Terrance.A.Knowles@uscg.mil. The contractor must also contact Joseph Edge at (252) 247-4525 or email joseph.m.edge@uscg.mil

The Contractor is made aware that NCDOT has requested approval to close the bridge to marine traffic per the following schedule:

October 1, 2012 to October 1, 2013:

The bridge may be placed in the closed position between the hours of 8:30 P.M. and 5:00 A.M. for bridge repairs except that a 12:00 AM opening will be allowed provided notification is given six (hours) in advance.

The Contractor shall bear full responsibility for all required coordination with the USCG. Advance coordination with the USCG shall begin within 14 days following award of Contract and prior to commencing on-site activities. Other than those waterway disruption listed above, 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.

Refer to CFR 33 Parts 1 thru 124 for regulations regarding bridge operation and the required notifications for deviations.

The Contractor shall note that the length of required notification may be altered by the USCG at any time, and the Contractor shall have no claim whatsoever against the Department due to changes in the requirements by the USCG.

The Contractor is to be made aware that marine traffic logs are not available. However, high marine traffic during daytime hours is to be expected and closures during these hours will be limited. Marine traffic reduces significantly during nighttime hours. Temporary lighting shall meet the requirements specified under "WORK IN THE NAVIGABLE WATERWAY".

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 THE NAVIGABLE WATERWAY

SPECIAL

1.0 DESCRIPTION

The Contractor's attention is directed to the navigable channel which the Radio Island Bridge crosses. It shall be the sole responsibility of the Contractor to conduct operations to comply with all the regulations and requirements of the U.S. Coast Guard (USCG), the U.S. Army Corps of Engineers, the North Carolina Department of Environmental and Natural

Resources, and local agencies, in connection with but not limited to, the maintenance of navigation and water pollution control.

The Contractor shall submit multiple copies of the plan and schedule of operations to the Engineer for approval no more than 14 calendar days following notification of award. Two copies of the Contractor's approved plan and schedule shall then be submitted by the Contractor to the USCG for their approval at least 90 calendar days prior to commencement of any work that would restrict the navigable waterway and 60 days prior to commencing any work.

The plan and schedule or sequence of operations shall include:

- sketch of the waterway
- location of any restrictions that shall be placed in the waterway
- location and height above mean high water of any scaffolding or netting
- placement, type and dimensions of barges, temporary enclosures, etc., if used
- projected dates and durations of each operation
- hours of the night time hours and the operations will take place
- Amount of time to remove the equipment if so directed by the Engineer or the USCG

The Contractor shall be responsible for all fees, costs and/or effort associated with:

- issuance of any "Notice to Mariners"
- temporary relocation of any existing navigational aids, if needed
- services performed by the USCG, as required, such as special surveys in connection with displaced material in the waterway or making dumping inspections

The Contractor shall coordinate his activities with local mariners and accommodate their needs to the fullest extent practical. The Contractor shall be responsible for all USCG fines associated with the bridge being in an inoperable condition during the work without having provided prior notice and obtained required approval. In addition, the Contractor may be held liable for user costs associated with such a condition.

Approvals issued by the USCG may be revoked and/or fines imposed for failure to ensure these provisions and other applicable stipulations and regulations issued by the USCG and other regulatory agencies having jurisdiction are adhered to or if the way in which the work is performed is determined to be a hazard to or an impairment of navigation. The Contractor shall be responsible for the costs associated for all such fines and schedule delays associated with the manner in which the work is performed and the means and methods employed.

2.0 MAINTENANCE AND PROTECTION OF NAVIGATION

The nature of the proposed construction may require some activities that impose restrictions upon current navigational clearances. At no time during construction shall restrictions be placed upon navigation without first coordinating these restrictions with local mariners and without receiving approval from the Engineer and the USCG. If the Contractor wishes to

perform work that would in any way restrict the navigational channel outside of those dates and times outlined in "Coast Guard Coordination", the Contractor shall request approval from Chief Warrant Officer Joseph Edge of US Coast Guard, Sector North Carolina no less than 135 days prior to the commencement of the proposed work at (252) 247-4525 or email joseph.m.edge@uscg.mil. No guarantee of approval of a request to restrict the waterway is implied by this contract, and it is the sole responsibility of the Contractor to coordinate with the USCG any navigable waterway restrictions.

Any dredged material taken from the waterway beds shall be removed in accordance with the conditions as stated and/or required by the USCG, the U.S. Army Corps of Engineers, and NCDOT.

If permanent bridge navigational lighting cannot be maintained as operational during any phase of this project, temporary battery/power lights must be installed at the same locations. These temporary lights must be visible for a distance of 2,000 yards on 90% of the days of the year. Generally, a lamp of 20 footcandles will meet these requirements. Plans for temporary lighting, if needed, shall be developed by the Contractor and submitted to the USCG for approval.

VHF-FM marine radios set to the bridge communications channels 16/13 or the designated channel for the bridge must be maintained at the project site by the supervisor in charge. Additional marine radios monitoring the above channels must also be maintained at the main control of any floating equipment or barges on station.

3.0 NOTICE TO MARINERS

The Contractor shall notify the USCG and NCDOT per the above requirements in advance of work completion so that appropriate notice can be given to mariners. The Contractor shall keep all interested parties apprised of conditions existing at the site which relate to navigation so that marine traffic may be notified accordingly on a timely basis.

4.0 MISPLACED MATERIALS

Preventative measures must be taken to prevent any hot work, debris or construction material from entering the waterway. This includes sandblasting material, paint, waste water from machinery cleaning or purging operations, and any concrete work by-products. Welding and burning must cease upon the approach of a vessel and shall not start again until the vessel has passed the bridge.

Should the Contractor, during the progress of the work, lose, dump, throw overboard, sink or misplace any material, plant, machinery or appliance which may be dangerous or obstruct navigation, the Contractor shall promptly recover and remove the same. The Contractor shall give immediate notice of such obstruction to the USCG, to the Engineer, and to all users of the channel. The Notice shall give a description and location of any such object and the action taken or being taken to protect navigation. Until removal can be effected, the object(s) shall be properly marked in order to protect navigation. Should the Contractor neglect to

report, remove, or refuse to promptly remove any such obstruction, the Engineer shall have the same removed and charge the cost against monies due to the Contractor or recover under his Bond.

Spillage of oil or hazardous substances is specifically prohibited by Section 311 of the Clean Water Pollution Act, as amended. Approved spill containment equipment and absorbent material must be located at the project site in the event of a spill into the waterway or the shoreline. The USCG must be notified immediately in the event a spill occurs. The Contractor shall bear the full responsibility for any costs associated with fines, cleanup activities, disposal and user costs associated with a spillage as a result of their work or activities.

5.0 OBSTRUCTION OF THE CHANNEL AND WATERWAY

Should the Contractor's equipment obstruct the channel or waterway so as to endanger the passage of vessels, as defined in the most recent River and Harbors Act, it shall be promptly moved to the extent necessary to afford a practicable passage. Upon completion of the work, the Contractor shall promptly remove the equipment, including ranges, buoys, piles, anchors and other markers placed by the Contractor.

All barges placed in the waterway must be lighted in accordance with CFR 33 Parts 1 – 124. The Contractor is required to comply with all provisions of the USCG Navigation Rules, International-Inland, regarding the use of work barges or floating equipment in the waterway.

Placement of barges in the navigable channel shall be done so as to provide a minimum horizontal clearance reduction. No barges will be allowed in the channel unless approved by the USCG. Barges held in place by anchor lines must be marked by anchor buoys which should be lighted.

6.0 BRIDGE OPERATIONS

The Contractor shall be responsible for operating the bridge at all times not only for the Contractor's own operation and needs but also as needed and required for rail traffic in place of the Department's bridge operator at such time as the Contractor begins construction on the bascule span. The Contractor shall also lower and lock the span in the lowered position as directed by the Port and during storms with a sustained wind greater than 45 MPH. Contractor shall conform and follow USCG procedures while operating the span.

The contractor shall also be responsible for the maintenance and operation of the existing equipment and shall maintain in good working order all components of the bridge operating equipment rather being retained or not. Maintenance shall begin with the Contractor's first official bridge operation and continue until final acceptance of the project.

The Contractor shall provide certified bridge operators. A certified bridge operator shall be present at the bridge during construction activities anytime the bridge is not in the fully opened position and the tail locks are driven and not just when the bridge operation is

required. All bridge openings shall be under the direct supervision of a certified bridge operator. To receive certification operators shall receive 80 hours of training provided by NCDOT. The Contractor shall coordinate with NCDOT on the number of personnel attending the training and when/where the training shall occur. A minimum of two qualified operators shall be trained and available to operate the bridge.

7.0 MEASUREMENT AND PAYMENT

There will be no measurement or direct payment for Work in Navigable Waterways. Associated costs shall be included in the prices bid for the various other items of work.

Approvals, fees, costs required to perform work or resulting from work within the navigable waterway shall not be considered to be a basis for payment against any item. 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.

MOREHEAD PORT COORDINATION

SPECIAL

1.0 ACCESS

The Contractor shall be responsible for insuring that all construction personnel, including sub-Contractors and suppliers, have the appropriate access identification documents. All of Contractor's employees accessing the site and all sub-Contractors working at the site shall coordinate access requirements with the Port Authority and shall obtain Transportation Worker Identification Credentials <https://twicprogram.tsa.dhs.gov/TWICWebApp/if> awarded the contract. The Contractor shall adhere to all Port Authority requirements. At no time will work be performed on Port Property without prior approval from the Port Personnel. The Contractor is required to maintain close and regular contact with the Port Authority representative, Mark Blake at (910) 251-5674 or email Mark.Blake@ncports.com to keep him informed of and obtain approval from for upcoming activities on or adjacent to Port Property.

CONSTRUCTION

The Contractor shall be responsible for maintenance of the construction area such that it is maintained in a condition acceptable to the Port Representative. The Contractor shall implement such corrective actions as required by the Port Representative to maintain the site in a condition which will protect Port personnel, allow Port operations to be maintained and ensure Port equipment and facilities are protected from damage. All construction activities on Port Property shall be approved by the Port Representative in writing. Any damage resulting from the Contractor's personnel, operations, sub-Contractors or suppliers will be repaired at the Contractor's expense.

3.0 RAILROAD OPERATIONS

The Contractor's work plan shall be scheduled in such a way that the bridge is operable per the requirements found in Intermediate Contract Time Number 2.

Train Data: Type: Freight # Trains/Month: 1 Speed: 10 mph

The Contractor shall coordinate daily with the Port Representative to ensure the proposed schedule accommodates anticipated railroad operations and to ensure the port is aware of any upcoming windows in which it would be difficult to lower the bridge on a 10 day notification.

Prior to any construction activities, the Port Representative shall provide approval for the scheduled train operational windows. The Contractor shall submit the proposed schedule along with documentation from the Port verifying their approval to the Engineer for review. The Contractor shall coordinate operation of the bridge for rail traffic with the Port.

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.

**SPECIAL PROVISIONS FOR PROTECTION OF RAILWAY INTEREST
CAROLINA COASTAL RAILWAY 09/06**

14 **INSURANCE:** State Project: County:

A. In regards to the above project the prime contractor is required to carry:

1. **CONTRACTOR'S COMMERCIAL GENERAL LIABILITY INSURANCE:**

As specified in the NCDOT Standard Specifications Manual (Section 107-15) the contractor shall furnish proof that he carries Commercial General Liability Insurance. Said policy shall be endorsed with form CG 24 17 which removes any exclusion regarding construction to be performed on railroad right of way. Said policy **shall be endorsed to name Carolina Coastal Railway as an additional insured.**

An additional copy of this policy is to be provided to the Department at the below address:

Rail Division-Engineering & Safety Branch
1556 Mail Service Center
Raleigh NC 27699-1556
Attn: Meredith McLamb

For questions or clarification on the above mentioned insurance, please contact Meredith McLamb of the Rail Division at (919) 715-0955.

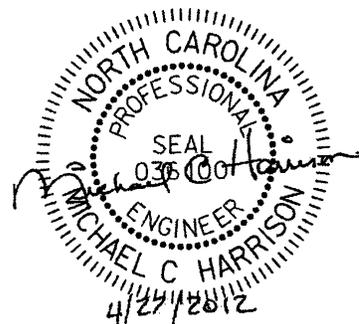


Structures Special Provisions

**Project BMU-15110R
Carteret County
STV Project No. 2514545-0740
Contract No. C203050**

**Prepared for:
North Carolina Department of Transportation
Structures Management Unit
1000 Birch Ridge Road, Door A-4
Raleigh, NC 27610**

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Structures Special Provisions

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PROJECT SPECIAL PROVISIONS**SEQUENCE OF CONSTRUCTION****SPECIAL****1.0 SCOPE**

This section is intended to present the requirements associated with construction sequencing, roadway disruptions, waterway disruptions, etc., and to demonstrate a recommended sequence of construction. While certain work items are not explicitly considered by this section, all work shown on the plans and described elsewhere in these special provisions is required.

2.0 GENERAL PROVISIONS

The Contractor shall be responsible for developing the actual sequence of construction, which shall take into account all required work. The Contractor's actual 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 is hereby notified that, while the requirements of this project related to waterway disruptions and the recommended sequence of construction given in this section, have been informally coordinated with the U.S. Coast Guard (USCG), they have not been formally approved by the USCG. Where such requirements are given, explicitly or implicitly, they are provided solely to illustrate anticipated USCG requirements and to assist in bidding. The actual waterway disruptions allowed shall be fully at the discretion of the USCG. The Department shall not be held responsible for any requirements, stipulations, limitations, etc. related to waterway disruptions as imposed by the USCG 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 USCG, and shall secure approval from the USCG for any disruptions to waterway traffic prior to commencing on-site activities.

The Contractor shall submit the actual sequence of construction to the Department, which shall take into account the actual waterway disruptions allowed by the USCG. 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.

The Contractor's actual sequence of construction shall comply with the requirements of the Contract Documents, all applicable state, federal, and local laws and regulations, and the following:

- A. The Contractor shall operate the bridge from the time work on the bascule bridge begins, based on the approved construction schedule until the system is restored and the bridge is properly balanced and accepted by the Engineer.
- B. The Contractor shall provide certified bridge operators. A certified bridge operator shall be present at the bridge during all construction activities, not just when the bridge operation is required. To receive certification operators shall receive 80hrs of training provided by NCDOT. The Contractor shall coordinate with NCDOT on the number of personnel attending the training and when/where the training shall occur.
- C. INTENTIONALLY LEFT BLANK

- D. INTENTIONALLY LEFT BLANK

- E. The Contractor must keep a licensed electrician on site 24 hours per day any time significant (as determined by NCDOT) temporary wiring is being utilized. The Contractor must keep a licensed electrician on call 24 hours per day any time the Contractor is responsible for operation of the bridge utilizing the new electrical system and the bridge is being operated until final acceptance by the Engineer available to respond in person to the site within 30 minutes.
- F. When the Contractor is responsible for operating the bridge, a NCDOT representative may remain on-site to observe that all procedures and safety regulations are adhered to with respect to bridge operations.
- G. The new electrical system, control system, drive, motor starters, and related items must be fully shop tested and electrically tested at the bridge prior to removal of the existing gasoline engine drive or disturbing any existing bridge operating equipment. The new components shall be fully installed, adjusted and field tested prior to operating the bridge for rail traffic or navigation. The Contractor shall coordinate with NCDOT, PORT, and Railroad when the new motor will be installed and to inform them how long the bridge will be out-of-service. The Contractor may perform this work during a rail outage

window described in these provisions anytime after the floor system and bascule girder reinforcements have been completed.

- H. The bridge must remain available to rail traffic as described in other sections of these provisions. Any required test operations must be conducted at night or as otherwise directed by NCDOT, without prior USCG approval for a navigation outage.
- I. Waterway disruptions by the Contractor are anticipated to be permissible during nighttime hours. Such disruptions are anticipated to occur between 8:30 pm and 5 am. (Note that this requirement has not been formally approved by the USCG. Actual waterway disruptions allowed shall be coordinated with the USCG as stated elsewhere herein.)
- J. All waterway disruption periods must allow continuous periods of navigation without operation of the bridge, the length of which shall be as directed by the Coast Guard. (Note that this requirement has not been formally approved by the Coast Guard. Actual waterway disruptions allowed shall be coordinated with the Coast Guard as stated elsewhere herein.)
- K. 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.
- L. The Contractor shall maintain span balance, as required elsewhere in these Special Provisions, throughout the course of the project.
- M. The Contractor shall bear full responsibility for all fines, fees, and damages resulting from noncompliance with the requirements of this section, USCG regulations and requirements, and/or any other applicable local, state, or federal laws and regulations.

3.0 SEQUENCE OF CONSTRUCTION

Recommended sequence of construction is provided to illustrate how to comply with the requirements of this section and to assist in bidding. The Contractor shall bear full responsibility for determining the actual sequence of construction in accordance with the requirements specifically stated or not stated and required to complete the work necessary with the understanding that he or she must at a minimum execute the work shown on the Plans and adjust the General Recommended Sequence as required without claim to additional payment. The Contractor's actual sequence of construction shall comply with the explicit and implicit requirements of the Plans, as well as the general intent of the General Recommended Sequence, in accordance with the Contractor's proposed schedule, and in accordance with NCDOT requirements.

Available vessel traffic records indicate that the months of December, January, February and March historically have fewer vessels navigating through this channel. Previous work performed on this suggests that navigation closures during daylight hours will be very limited

and the Contractor should anticipate work during nighttime hours and when the span is in the raised position. The current letting schedule provides the opportunity to coordinate potential daytime outages with the USCG at the Contractor's discretion.

GENERAL RECOMMENDED SEQUENCE

- Span Balance and Span Balance Monitoring (Maintain Throughout Construction)
- Initial Surface Preparation of Structural Steel
- Installation of Electrical Utilities
- Tower Frame Repairs
- Installation of New Floor System
- Installation of Bridge Span Lock Assembly
- Trunnion Bearing Repairs
- Replace the Deck System
- Installation of New Bascule Girder Cover Plates
- Replacement of Rest Pier and Bascule Pier Live Load Shoe
- Build Remote Control Station and Install Electrical Control System / Rehabilitate Control Building
- Installation of Bridge Tail Locks
- Installation of Machinery Brakes and New Motor
- Final Surface Preparation and Painting of Structural Steel
- Test-Operation Bridge / Final Bridge Balance

Once the new electrical and control system is in place, bridge testing will be required. Operation of the bridge will be the contractor's responsibility until The North Carolina State Port Authority and their representatives have received operation training. Operation from the bridge control building and remote control station is anticipated to occur during nighttime hours until the system is demonstrated to be reliable to the Engineer. Final testing and operational adjustments can then be performed during daylight hours subject to the approval of the Engineer. The Contractor shall have personnel at the bridge to operate the bridge locally (for periods of testing and passage of rail traffic) from the control building in the event of an issue with the remote station until NCDOT and their representatives have received operation training.

4.0 MEASUREMENT AND PAYMENT

There will be no separate payment for costs associated with the sequence of construction provisions.

REMOTE CONTROL STATION HOUSE

SPECIAL

The plan details include minimum requirements, location and geometry for the Remote Control Station. The Contractor shall submit structural plans and details for the Remote Control Station sealed by a Professional Engineer licensed in the state of North Carolina. The plans shall include subsurface utility exploration information to verify the proposed details do not conflict with any existing facilities. The Contractor shall also include catalog manufacturer information for all components to be included in the Remote Control Station. The Contractor shall make minor location adjustments to avoid conflicts if present. If unavoidable conflicts are determined to be present the Contractor shall submit the location of these conflicts along with structural plans of the house to the Engineer as well as a proposed alternate location. All costs incurred by the Contractor in complying with the above requirements shall be included in the price bid for Remote Control Station House.

Payment will be made under:

Pay Item	Pay Unit
Remote Control Station House	Lump Sum

SECURING OF VESSELS

(10-12-01)

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

When utilizing barges, tugboats or other vessels, take all necessary precautions to ensure that such vessels are securely anchored or moored when not in active operation. Take all necessary measures to ensure that the vessels are operated in a manner that avoids damage to or unnecessary contact with bridges and other highway structures and attachments. If severe weather conditions are anticipated, or should be anticipated through reasonable monitoring of weather forecasts, take additional measures to protect bridges and other highway structures and attachments from extreme conditions. The Contractor is strictly liable for damages to any bridge or other highway structure or attachment caused by a vessel owned or controlled by the Contractor. The Contractor is also liable to third parties for property damages and loss of revenue caused by vessels under the Contractor's control.

FALSEWORK AND FORMWORK

(9-30-11)

1.0 DESCRIPTION

Use this Special Provision as a guide to develop temporary works submittals required by the Standard Specifications or other provisions; no additional submittals are required herein. Such temporary works include, but are not limited to, falsework and formwork.

Falsework is any temporary construction used to support the permanent structure until it becomes self-supporting. Formwork is the temporary structure or mold used to retain plastic or fluid concrete in its designated shape until it hardens. Access scaffolding is a temporary structure that functions as a work platform that supports construction personnel, materials,

and tools, but is not intended to support the structure. Scaffolding systems that are used to temporarily support permanent structures (as opposed to functioning as work platforms) are considered to be falsework under the definitions given. Shoring is a component of falsework such as horizontal, vertical, or inclined support members. Where the term “temporary works” is used, it includes all of the temporary facilities used in bridge construction that do not become part of the permanent structure.

Design and construct safe and adequate temporary works that will support all loads imposed and provide the necessary rigidity to achieve the lines and grades shown on the plans in the final structure.

2.0 MATERIALS

Select materials suitable for temporary works; however, select materials that also ensure the safety and quality required by the design assumptions. The Engineer has authority to reject material on the basis of its condition, inappropriate use, safety, or nonconformance with the plans. Clearly identify allowable loads or stresses for all materials or manufactured devices on the plans. Revise the plan and notify the Engineer if any change to materials or material strengths is required.

3.0 DESIGN REQUIREMENTS

A. Working Drawings

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

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

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

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

If requested by the Engineer, submit with the working drawings manufacturer’s catalog data listing the weight of all construction equipment that will be supported on the temporary work. Show anticipated total settlements and/or deflections of falsework and forms on the working drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders. Falsework hangers that support concentrated loads and are installed at the edge of thin top flange concrete girders (such as bulb tee girders) shall be spaced so as not to exceed 75% of the manufacturer’s stated safe working load. Use of dual leg hangers (such as Meadow Burke HF-42 and HF-43) are not allowed on concrete girders with thin top flanges. Design the falsework and forms supporting deck slabs and

overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

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

Note on the working drawings any anchorages, connectors, inserts, steel sleeves or other such devices used as part of the falsework or formwork that remains in the permanent structure. If the plan notes indicate that the structure contains the necessary corrosion protection required for a Corrosive Site, epoxy coat, galvanize or metalize these devices. Electroplating will not be allowed. Any coating required by the Engineer will be considered incidental to the various pay items requiring temporary works.

Design falsework and formwork requiring submittals in accordance with the 1995 AASHTO *Guide Design Specifications for Bridge Temporary Works* and AREMA 15.4.13 except as noted herein.

1. Wind Loads

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

Table 2.2 - Wind Pressure Values

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

2. Time of Removal

The following requirements replace those of Article 3.4.8.2.

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

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

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

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

B. Review and Approval

The Engineer is responsible for the review and approval of temporary works' drawings.

Submit the working drawings sufficiently in advance of proposed use to allow for their review, revision (if needed), and approval without delay to the work.

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

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

4.0 CONSTRUCTION REQUIREMENTS

All requirements of Section 420 of the Standard Specifications apply.

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

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

A. Maintenance and Inspection

Inspect and maintain the temporary work in an acceptable condition throughout the period of its use. Certify that the manufactured devices have been maintained in a condition to allow them to safely carry their rated loads. Clearly mark each piece so that its capacity can be readily determined at the job site.

Perform an in-depth inspection of an applicable portion(s) of the temporary works, in the presence of the Engineer, not more than 24 hours prior to the beginning of each concrete placement. Inspect other temporary works at least once a month to ensure that they are functioning properly. Have a North Carolina Registered Professional Engineer inspect the cofferdams, shoring, sheathing, support of excavation structures, and support systems for load tests prior to loading.

B. Foundations

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

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

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

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

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

5.0 REMOVAL

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

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

6.0 METHOD OF MEASUREMENT

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

7.0 BASIS OF PAYMENT

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

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, requires the use of more than one crane, cranes or picks within the utility's R/W, lifts that impact navigational clearances and any lifts that require closure of the navigation channel. 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:** Crane operators performing critical lifts shall be certified by NC CCO (National Commission for the Certification of Crane Operators), or satisfactorily complete the Carolinas AGC’s Professional Crane Operator’s Proficiency Program. Other approved nationally accredited programs will be considered upon request. All crane operators shall also have a current CDL medical card. Submit a list of anticipated critical lifts and corresponding crane operator(s). Include current certification for the type of crane operated (small hydraulic, large hydraulic, small lattice, large lattice) and medical evaluations for each operator.

GROUT FOR STRUCTURES

(9-30-11)

1.0 DESCRIPTION

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

2.0 MATERIAL REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

3.0 SAMPLING AND PLACEMENT

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

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

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

Control grout delivery so the interval between placing batches in the same component does not exceed 20 minutes.

The Engineer will determine the locations to sample grout and the number and type of samples collected for field and laboratory testing. The compressive strength of the grout will be considered the average compressive strength test results of 3 cube or 2 cylinder specimens at 28 days.

4.0 BASIS OF PAYMENT

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

AS-BUILT DOCUMENTATION

SPECIAL

1.0 SCOPE

This section covers all as-built documentation for all work related to this project.

2.0 GENERAL REQUIREMENTS FOR AS-BUILT DOCUMENTATION

Satisfactory completion of all of the requirements of this section shall be regarded as equal in importance to all other work performed as part of this project, and shall be prosecuted, executed, coordinated, and in all respects dealt with as such. All as-built documentation shall be turned over to the Engineer prior to the completion of the project and prior to submittal of final payment for the project. The overall project will not be granted final acceptance, until all required as-built documentation has been furnished and accepted.

All as-built documentation which is required by these contract documents to be submitted to the Engineer, for any reason, shall be subject to the same requirements for all other submittals given elsewhere in these specifications.

3.0 FIELD COPIES

The Contractor shall maintain, on site, full size sets of contract plans, shop drawings, erection and installation drawings, layout drawings, and similar drawings and tabulations, marked up with changes and revisions in red to reflect the as-built or as-installed condition. Note that this on site as-built documentation is in addition to, and not in place of or part of, the onsite copies of approved submittal items required elsewhere by these specifications. Documentation shall be updated weekly, such that no changes or deviations are more than one week old without being correctly recorded.

The Contractor shall also maintain a written log of all as-built changes. Log shall be typewritten or maintained on a computer, and clearly indicate the affected item (plan sheet, shop drawing, etc.), the revision date, the person making the revision, and a brief description of the revision. This log shall be updated weekly, and submitted to the Engineer, for information only, each week after being updated.

All as-built documentation shall be stored in such a manner as to prevent damage due to dirt, water, sunlight, insects, rodents, etc., and shall be continuously available for the Engineer's inspection.

Final copies of all as-built documentation shall be neat, clean, and easily readable. Drawings shall preferably be updated via CAD, but may be updated by hand where the Engineer agrees

that updating via CAD is not practical. As-built versions of contract plans, catalog cut sheets, shop drawings, installation and layout drawings, and similar items shall be provided irregardless of whether or not the original versions contain as-built changes. All as-built documentation items shall be clearly identified as such.

In cases where plans are effectively replaced by the Contractor's shop and/or installation drawings, such as for control logic drawings, such contract plans may, with the explicit permission of the Engineer, not be required to be updated with specific as-built changes. In such cases, the as-built versions of the affected plans shall be updated with a clear statement indicating that they do not reflect the as-built condition and referring to the appropriate as-built shop and/or installation drawings. Any case in which the Engineer does not allow plans to be updated in this manner shall not be considered cause for delay or additional payment.

Final copies of all as-built documentation shall be clearly marked with the phrase "AS BUILT" in minimum 1/4 inch high bold or block text, along with the revision date in smaller text. This marking shall appear on every individual sheet of drawings, and on the first page of multi-page catalog cut sheets and similar items.

As-built versions of all contract plans, shop drawings, erection drawings, materials tabulations, and similar items shall be provided on both paper and reproduction quality Mylar. Number of copies shall be as follows:

- Mylar: two copies
- Paper: six copies
- Electronic: full size in portable document format (PDF)

Paper shall be matte white 20 pound Engineering quality bond (minimum 3.5 mils thickness). Mylar shall be Engineering quality matte (minimum 4 mils thickness).

Drawings shall be plotted at their original full size so that all scales are accurate.

4.0 REVIEW AND APPROVAL OF FINAL RECORD COPIES

The Contractor shall submit to the Engineer preliminary copies of all as-built documentation for review and approval prior to delivery of the final record copies. These preliminary copies may be printed on plain paper (vellum copies are not required), but shall otherwise be equal in every respect to the final record copies.

The preliminary copies will be reviewed by the Engineer for completeness, general accuracy, and compliance with the requirements for as-built documentation given in these contract documents. Upon approval of the preliminary copies, the Contractor shall deliver the final record copies.

5.0 MEASUREMENT AND PAYMENT

There will be no measurement or direct payment for as-built documentation. Associated costs shall be included in the prices bid for the various other items of work.

Delivery and/or approval of required as-built documentation shall not be considered to be a basis for partial payment against any item. However, the overall project will not be granted final acceptance until all required as-built documentation has been furnished and accepted.

COMMON PROVISIONS

SPECIAL

1.0 GENERAL

Work consists of furnishing, installing, adjusting, testing, painting, and placing in operating condition in accordance with the Plans and Special Provisions, the following items of work:

- Structural repairs to the bascule span
- Floorbeam replacement to improve clearances
- Cover plated main bascule girders
- Span balancing
- Painting
- New automated toe and heel lock assemblies
- Upgrades to the drive system
- Replaced diesel engine with an electrical motor
- Electric motor controls at bridge site
- Electric motor controls on the western approach
- Electrical power supply installed on the parallel US 70 highway bridge

All special machining, tools and installation shall be included as part of the work. This work also includes coordination of special manufacturer requirements, special shimming and alignment.

2.0 APPLICABLE STANDARDS

Work as described shall comply with, but not be limited to only complying with, all applicable requirements of the current and most up-to-date versions and/or revisions of the codes and standards referenced in these provisions.

The work shall meet the requirements of all other codes and standards as specified elsewhere in these Specifications. Where codes and standards are mentioned for any pay item, it is intended to call particular attention to them; it is not intended that any other codes and standards shall be assumed to be omitted if not mentioned.

3.0 RULES, REGULATIONS AND ORDINANCES

Work shall comply with all applicable Federal, State and local rules, regulations, and ordinances.

In the event of a conflict between these Specifications and the above-mentioned codes, standards, rules, regulations, and ordinances, the most stringent requirement shall apply.

4.0 QUALIFICATIONS, PERSONNEL AND FACILITIES

For the fabrication, erection, installation, alignment, adjustment, cleaning, lubrication, testing and all other work required by the bridge machinery and electrical items, the Contractor shall use adequate numbers of skilled, trained and experienced electricians, mechanics, millwrights and service personnel who are thoroughly familiar with the requirements and methods specified for the proper execution of the work.

Electricians, mechanics, millwrights and service personnel shall be equipped with all necessary instruments to assure the related components are provided and installed within the specified tolerances and function as described.

Millwrights or a professional mechanical Engineer shall be present through and responsible for all phases of machinery erection, installation and alignment. Millwrights shall perform final alignment and installation of machinery components.

A licensed electrician shall be present through and responsible for all phases of electrical installation.

5.0 DELIVERY & STORAGE/ PROTECTION FOR SHIPMENT

Machined surfaces shall be cleaned of dirt, chips, grit, and all other injurious materials prior to shipping and shall be given a coat of corrosion-inhibiting preservative.

Finished metal surfaces and unpainted metal surfaces that would be damaged by corrosion shall be coated as soon as practicable after finishing with a corrosion-inhibiting preservative. This coating shall be removed prior to operation and from all surfaces prior to painting after erection.

Any interface between stainless steel or aluminum and structural steel shall receive a coat of zinc-chromate primer prior to assembly.

New and rehabilitated components shall be completely protected from weather, dirt, and all other injurious conditions during manufacture, shipment, and storage.

6.0 QUALITY ASSURANCE AND FACILITIES

Products used in the work described shall be produced by manufacturers regularly engaged in the manufacture of the specified products.

Provide adequate plant and all necessary tools and instruments required for the proper performance of the personnel engaged in the execution of the specified work.

7.0 VERIFICATION OF DIMENSIONS

Dimensions shown are based on best available information and are intended for guidance and provided for the convenience of the Contractor. Dimensions shall be field verified prior to fabrication of new components. All variations from the nominal dimensions shown shall be

noted on the shop drawings. The Contractor shall have no claim whatsoever against the Department of Transportation for any delays or additional costs incurred based on the differences between the existing bridge shown on the plans, described herein and the actual conditions at the project site.

8.0 SUBSTITUTIONS

Substitutions for specified equipment or materials are permitted only according to the conditions given in the following paragraph.

Where a particular product is specified by a manufacturer's name and catalog or part number in these Common Provisions, the related Special Provisions or on the Plans, it is so specified to establish quality, configuration, and arrangement of parts. An equivalent product made by another manufacturer may be substituted for the specified product subject to the approval of the Engineer; however, all necessary changes required by the substitution in related machinery, structural, architectural and electrical parts, shall be made by the Contractor at no additional cost.

9.0 MANUFACTURERS RECOMMENDATIONS

Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, furnish printed copies of these recommendations to the Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material. Provide all special machining and installation required by the manufacturer.

10.0 LABOR

A. Personnel

For the fabrication, installation, cleaning, aligning, testing and all other work required as described, use adequate numbers of skilled, trained, and experienced electricians, mechanics and millwrights who are thoroughly familiar with the requirements and methods specified for the proper execution of the specified work. Provide personnel, including supervisory personnel, who have a minimum of three movable bridge jobs as previous experience in the installation of bridge machinery.

11.0 CONSTRUCTION METHODS

A. Welding

Requirements for welding may be given in the individual items. In all cases welding shall conform to the requirements of, NCDOT Standard Specifications, AREMA and AWS D1.5.

Welding joint types, sizes and details shall be shown on shop, assembly and/or working drawings. Distortion during fabrication shall be kept to a minimum by the use of welding fixtures and proper welding procedures.

B. Alignment and Bolting

Where double nuts are used to secure a fastener assembly, the first nut shall be fastened one-quarter turn past snug tight to the assembly. The second nut shall be torqued against first nut in accordance with the requirements described below.

High strength fasteners shall be torqued to the same requirements as for ASTM A325 high-strength fasteners per AREMA. High-strength fasteners greater than 1-1/2" in diameter, which are not covered under the ASTM A325 specification, shall be torqued to a value equal to 0.2 multiplied by the bolt nominal diameter, multiplied by the proof load – length measurement method.

Torques for other classes of bolts shall be proportioned to their strength and shall be indicated on the erection drawings.

C. Inspection and Testing

Provide no less than ten (10) working days notice to the Engineer of the beginning of work at machine shops so that inspection may be arranged. No materials shall be fabricated or machined before the Engineer has been notified where the orders have been placed.

Furnish all facilities for the inspection of material and workmanship in machine shops. The Inspector designated by the Engineer shall be allowed free access to necessary parts of the premises. Work done while the Inspector has been refused access or presented in a manner that prevents adequate inspection will automatically be rejected. The Inspector shall have the authority to reject materials or workmanship that does not fulfill the requirements of these Provisions.

Furnish the Engineer a copy of all orders covering work performed by sub-Contractors or suppliers.

Unless otherwise specified, furnish without additional charge test specimens as required, and all labor, testing machines, tools, and equipment necessary to prepare the specimens and to make the physical tests and chemical analyses required by material specifications. Furnish a copy of all test reports and chemical analyses.

D. Shop Assembly

The NCDOT reserves the right for the Engineer or designated representative to make visual inspection of shop assembled components, and to witness shop tests.

Provide no less than ten (10) working days notice to NCDOT and the Engineer prior to the start of such test to provide every opportunity for them to be witnessed.

E. Contractor's Inspection

After erection is completed, make a thorough inspection prior to Field Testing, accompanied by the Engineer, to insure that all gears are clean and free of obstruction debris and other foreign materials; that all components are properly aligned and adjusted as closely as practicable without actual operation; and that all bolts are properly tightened.

The Contractor's inspection shall also verify that field painting has been performed as specified herein. Perform touch-up painting to correct all painting defects found during this inspection.

The Contractor's inspection shall also verify that all machinery components have been lubricated.

On the basis of the results of this inspection, the Engineer will determine whether the bridge is ready for testing.

Provide no less than ten (10) working days notice to NCDOT and the Engineer prior to the start of the Contractor's Inspection.

F. Field Testing

When new and rehabilitated equipment is ready for testing, arrange a mutually convenient test schedule with the Engineer. Provide and keep available a complete crew of mechanics and electricians during the field testing period in order to make all adjustments and corrections which may be required to meet the passing criteria.

Prepare a field testing procedure(s) and submit for approval by the Engineer. The testing procedure(s) shall be coordinated between the individual pay items. Do not exceed the electrical design rating of any component during testing.

G. Training

After successfully achieving all field testing acceptance criteria, the Contractor shall instruct the NCDOT's and/or NC Port's bridge operators and maintenance personnel on the changes. Instruction for bridge operators shall cover operational, control sequence and procedural changes required to operate the drawbridge such that the field testing acceptance criteria can be met as part of normal, day-to-day bridge operations. Training shall cover troubleshooting operational problems and corrective procedures. Training for maintenance personnel shall cover basic maintenance and troubleshooting of the new brake and refurbished electrical components and modified control wiring. Training shall be given in multiple sessions over a one week period to accommodate the schedules of the operators and maintenance personnel. Each operator and maintenance employee shall receive a minimum of 4 hours of instruction, including supervised bridge test operations.

H. Operations & Maintenance Information

The Contractor shall supply the NCDOT with written, step-by-step operating and troubleshooting instructions and manufacturer's literature for the modified control system, the brake, the motor reducer and any new equipment installed as part of the work. The Contractor shall supply the Engineer with an accurate as-built wiring diagram of the modified control and power circuits, including point-to-point wiring information. These diagrams shall include accurate information on all portions of the bridge wiring, including those portions not modified or replaced under this contract.

12.0 MEASUREMENT AND PAYMENT

The work required by this section, and any work caused thereby or related thereto, is considered incidental to the work covered by the guarantee and will not be separately measured or paid for. All associated costs shall be included in the prices bid for those items for which measurement and payment are allowed.

PAINTING EXISTING STRUCTURES

REV 9/2011

Description of Work - This work shall consist of furnishing all labor, equipment, and materials to clean and paint the structural steel of the existing bridges. Work includes: removing, containment and disposal of the existing paint system; an initial SSPC-6 surface preparation prior to steel repairs; final SSPC-10 preparation of the surface to be painted and applying the new paint system; traffic control, marking & delineation; portable lighting; erosion and sediment control; seeding and mulching all grassed areas disturbed; and all incidental items necessary to complete the project as specified and shown on the plans. The contractor shall be responsible for fulfilling all requirements of the NCDOT Standard Specifications for Roads and Structures dated January 2012, except as otherwise specified herein.

Work Schedule – Prior to the pre-construction meeting, 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 (as determined by the Engineer).

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 successfully¹ completed lead paint removal on all similar structures within 18 months prior to this bid, may bid on and perform this work. **The apparent low bidder shall submit a list of projects for which QP2 work was performed within the last 18 months including owner contact information 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/projects/ncbridges/#stats>**

¹ Successfully: All 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.

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.

Submittals - All submittals must be submitted to the Engineer for review and approval prior to the pre-construction meeting:

- Containment Drawings sealed by NC Professional Engineer
- Bridge Wash Water Sampling & Disposal Plan
- Sub- Contractor identification
- Lighting Plan for night work in accordance with NCDOT *Standard Specifications* Section 1413.
- Traffic Control Plan
 - a) NCDOT certified supervisors, flaggers and traffic control devices
- Health & safety Plan²
 - a) ²Plan must address the minimum required topics as specified by the SSPC QP-1 and QP-2 program to also include hazard communication, respiratory health, emergency procedures, and local hospital and treatment facilities to include directions and phone numbers, disciplinary criteria for workers who violate the plan and accident investigation.
 - b) Contractor shall provide the Engineer a letter of certification that all employees performing work on the project have blood lead levels that are below the OSHA action level.
 - c) Competent Person qualifications and summary of work experience.
- Environmental Compliance Plan
- Quality Control Plan (Project Specific)
 - a) Quality control qualifications and summary of work experience
- Bridge and Public Protection Plan (Overspray, Utilities, etc. - Project/Task Specific)
- Abrasive Blast Media
 - a) Product Data Sheet
 - b) Blast Media Test Reports in accordance with NCDOT *Standard Specification* Section 1080-15.

² SSPC QP-1 required minimum: Hazardous Materials, Personal Protective Equipment, General Health and Safety, Occupational Health and Environmental Controls, Personal Protective Equipment, Fire Protection and Prevention, Signs Signals, and Barricades, Materials Handling, Storage, Use, and Disposal, Hand and Power Tools, Welding and Cutting, Electrical, Scaffolds, Fall Protection, Cranes, Derricks, Hoists, Elevators, and Conveyors, Ladders, Toxic and Hazardous Substances, Airless Injection and HPWJ.

- Coating Material
 - a) NCDOT HICAMS Test Reports (testing performed by NCDOT Materials & tests Unit).
 - b) Product Data Sheets
 - c) Material Safety Data Sheets
 - d) Product Specific Repair Procedures
 - e) Acceptance letters from paint manufacturer's for work practices that conflict with Project Special Provisions and or paint manufactures product data sheets.

Pre-Construction Meeting – Submittals shall be reviewed and be approved by the engineer prior to scheduling the Pre-Construction Meeting. The Contractor shall allow for a review process of no less than two (2) weeks.

When requesting a pre-construction meeting the Contractor must contact the Engineer at least 7 working days in advance of the desired pre-construction date. The contractor's project supervisor, competent person, quality control personnel and certified traffic control supervisor shall be in attendance for the Pre-Construction meeting in order for the Contractor and DOT team to establish roles responsibilities for various personnel during project duration and to establish realistic timeframes for problem escalation.

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. Allow a minimum of two weeks for review of the plan. Such plan must meet or exceed the requirements of 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.

In the containment plan describe how debris is contained and collected. Describe the type of tarpaulin and bracing materials and the maximum designed wind load. Describe the dust 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 the public 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 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 link below for 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 – The Contractor will comply with the Resource Conservation and Recovery Act (RCRA – 40 CFR 261 - 265) and the Occupational Safety and Health Act (OSHA - 29 CFR 1910 - 1926) regulations for employee training, and for the handling, storage, labeling, recordkeeping, reporting, inspections and disposal of all hazardous waste generated during paint removal.

A summary of Generator Requirements is available at the above NCDOT web link which cites the specific regulations for each Generator category. Quantities of waste by weight and dates of waste generation must be recorded. Waste stored at the project site must be properly labeled.

The North Carolina Department of Environment and Natural Resources (NCDENR) have adopted RCRA as the North Carolina Hazardous Waste Management Rules and are responsible for enforcement. The “Hazardous Waste Compliance Manual for Generators of Hazardous Waste” is published by the Compliance Branch of the Division of Waste Management of NCDENR, and can be found at

<http://portal.ncdenr.org/web/wm/hw/rules>

The Contractor is required to maintain compliance with all federal, state and local regulations. Failure to comply with the regulations could result in fines and loss of qualified status with NCDOT.

Use a company from the below list of approved waste management companies or an approved equal. Immediately after award of the contract, the Contractor arranges for waste containers, sampling and testing, 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 Orville Wright Dr., Greensboro, NC 27409 (Ph. 336-662-0292)

A&D Environmental – PO Box 484, High Point, NC 27261 (Ph. 336-434-7750)

Poseidon Environmental Services, Inc. – 837 Boardman-Canfield Rd #209, Youngstown, OH (Ph. 330-726-1560)

Clean Harbors Reidsville, LLC – 208 Watlington Industrial Drive, Reidsville, NC 27320 (Ph. 336-342-6106)

Waste and Wash Water Sampling

All removed paint and spent abrasive media shall be tested for lead following the SW-846 TCLP Method 1311 Extraction, as required in 40 CFR 261, Appendix 11, to determine whether it must be disposed of as hazardous waste. The Contractor shall furnish the Engineer certified test reports showing TCLP results and Iron analysis of the paint chips stored on site, with disposal being in accordance with “Flowchart on Lead Waste Identification and Disposal”.

http://portal.ncdenr.org/c/document_library/get_file?p_l_id=38491&folderId=328599&name=DLFE-9855.pdf

The Competent Person shall obtain composite samples from each barrel of the wash water and waste generated by collecting two or more portions taken at regularly spaced intervals during accumulation. Composite the portions into one sample for testing purposes. Do not obtain portions of the composite sample from the very first or last part of the accumulation process. The sample(s) should be acquired after 10 percent or before 90 percent of the barrel has accumulated. Due to the difficulty of acquiring samples the intent is to provide samples that are representative of widely separated portions, but not the beginning and end of wash water or waste accumulation.

Perform sampling by passing a receptacle completely through the discharge stream, or by completely diverting the discharge into a sample container. If discharge of the wash water or waste is too rapid to divert the complete discharge stream, discharge into a container or transportation unit sufficiently large to accommodate and then accomplish the sampling in the same manner as given above.

Until test results are received, all waste shall be stored and labeled as “NCDOT Bridge Paint Removal Waste-Pending Analysis” and include the date generated and contact information for the Division HazMat Manager or Project Engineer. Waste containers shall be stored in an enclosed, sealed and secured storage container **protected from traffic from all directions.** **A protection plan for these containers must be approved by the Engineer. If adequate protection cannot be obtained by use of existing guardrail, the contractor will be required to provide adequate protection.** Once test results are received and characterized, waste shall be labeled as either “Hazardous Waste-Pending Disposal” or “Paint Waste-Pending Disposal”.

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. The Engineer will verify the type and quantity of waste and obtain a Provisional EPA ID number from the

NC Hazardous Waste Section
 North Carolina Department of Environment & Natural Resources
 1646 Mail Service Center
 Raleigh, NC 27699
 Phone (919) 508-8400 Fax (919) 715-4061

At the time of shipping the Engineer will sign, date and add the ID number in the appropriate section on the manifest. The maximum on-site storage time for collected waste shall be 90 days. All waste whether hazardous or non-hazardous will require numbered shipping manifests. The cost for waste disposal (including lab and Provisional EPA ID number) is included in the bid price for this contract. Note NC Hazardous Waste Management Rules (15A NCAC 13A) for more information. Provisional EPA ID numbers may be obtained at this link:

<http://portal.ncdenr.org/web/wm/provisional-hw-notification-page>

Testing labs shall be certified in accordance with North Carolina State Laboratory Public Health Environmental Sciences. List of certified laboratories may be obtained at this link:

(<http://slphreporting.ncpublichealth.com/EnvironmentalSciences/Certification/CertifiedLaboratory.asp>)

All test results shall be documented on the lab analysis as follows:

- For leachable lead
 - Soils/Solid/Liquid- EPA 1311/200.7/6010

All sampling shall be done in presence of the Engineer's representative.

Equipment Mobilization - The equipment used in any travel lanes and paved shoulder must be mobile equipment on wheels that has the ability to move on/off the roadway 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.

QUALITY CONTROL INSPECTOR – The Contractor provides a quality control inspector in accordance with the SSPC QP guidelines to ensure that all processes, preparation, blasting and coating application are in accordance with the requirements of the contract. The inspector shall have written authority to perform QC duties to include continuous improvement of all QC internal procedures. The presence of the engineer or inspector at the work site shall in no way lessen the contractor's responsibility for conformity with the contract

QUALITY ASSURANCE INSPECTOR- The quality assurance inspector which may be a Department employee or a designated representative of the Department shall observe, document, assess and report that the Contractor is complying with all of the requirements of the contract. Inspectors employed by the Department are authorized to inspect all work performed and materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. The inspector is not authorized to alter or waive the requirements of the contract. Each stage in preparing the structure to be coated which includes but not limited to washing, blasting, coating testing and inspection shall be inspected and approved by the Engineer or his authorized representative.

SUBLETTING OF CONTRACT:

Only contractors certified to meet SSPC QP-2, Category A, and have successfully completed lead paint removal on all 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 January 2012; 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 3.0 Materials of this Special Provision.

1.0 PREPARATION OF SURFACES:

- 1.1 Power washing – Before any other surface preparation are conducted, all surfaces shall be power washed to remove dust, salts, dirt and other contaminants. All wash

water shall be contained, collected and tested in accordance with the requirements of NCDOT Managing Bridge Wash Water specification. Under no circumstances will surface preparation or painting activities be started over cleaned surfaces until all surfaces are free of standing water and dry to the touch, and then only after approval by the Engineer. Power washing is only required prior to initial SSPC-6 surface preparation.

- 1.2** Blasting is done with recyclable steel grit meeting the requirements of Section 1080-15. The profile after final surface preparation prior to application of paint must be between 1.0 and 3.0 mils when measured on a smooth steel surface. A minimum of two tests per beam/girder and two tests per span of diaphragms/cross bracing shall be conducted and documented.
- 1.3** Tarpaulins are spread over all pavements and surfaces underneath equipment utilized for abrasive recycling and other lead handling equipment or containers. This requirement shall be enforced during activity and inactivity of equipment. Should the contractor elect to perform work from a barge all equipment, paint and other material shall be properly secured and provide sufficient containment on barge that prevent accidently spills from contaminating the waterway.
- 1.4** Before the contractor departs from the work site at the end of the work day, all debris generated during surface preparation and all dust collector hoses, tarps, or other appurtenances containing blasting residue are collected in approved containers.
- 1.5** The Contractor cleans a three inch by three inch 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 the DFT gage adjustment standard. An acceptable alternative is for the Contractor to provide a steel plate with similar properties and geometry as the substrate to be measured.
- 1.6** The contractor and or quality assurance representative shall notify the Engineer of any area of corroded steel which has lost more than 50% of its original thickness.
- 1.7** All parts of the bridges not to be painted, and the travelling public, shall be protected from overspray. The Contractor shall submit a plan to protect all parts of bridge that are not required to be painted, in addition to a plan to protect the traveling public and surrounding environment while applying all coats of paint to a structure. Prior to performing blasting operations the Contractor shall notify the Engineer or their representative to verify that the machinery used to operate the bridge is sufficiently sealed.
- 1.8** Prior to application of primer the Contractor must insure that chloride levels on the surfaces are $7 \mu\text{g}/\text{cm}^2$ or lower using an acceptable sample method in accordance with SSPC Guide 15. The frequency of testing shall be two (2) tests per bascule member after all surface preparation has been completed and immediately prior to applying the primer coat. An additional two (2) tests per bascule member shall be selected prior to applying the intermediate and or top coat layers. Test areas selected shall represent the greatest amount of corrosion in the span as determined by the Engineers' representative.

- 1.9 All weld splatter, slag or other surface defects resulting in a raised surface above the final paint layer shall be removed prior to application of primer coat.

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 modified is an organic zinc primer, organic zinc stripe coat, two coats acrylic paint and one stripe coat of acrylic paint over blast cleaned surfaces in accordance with SSPC-SP-10 (Near White Blast). Cleaning and painting behind the faying surfaces shall be done in accordance with SSPC-SP-11 (Power Tool Cleaning to Bare metal) and coated with an organic zinc primer.

Perform all mixing operations over an impervious surface with provisions to prevent runoff to grade of any spilled material. The contractor is responsible for reporting quantities of thinner purchased as well the amounts used. No container with thinner shall be left uncovered, when not in use.

Apply two inch (2") stripe coat by **BRUSH OR ROLLER ONLY** to all exposed edges of steel including fasteners before applying the finish coat. Locate the edge or corner in the approximate center of the paint stripe.

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.

3.0 MATERIALS:

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

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

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

4.0 INSPECTION:

Surface Preparation for System 1 modified shall be in accordance with SSPC SP-10. Any area(s) not meeting the requirements of SSPC SP 10 shall be remediated prior to application of coating. Surface inspection is considered ready for inspection when all blast abrasive, residue and dust is removed from surfaces to be coated.

Quality Assurance Inspection - The Contractor furnishes all necessary OSHA approved 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. All access points shall be illuminated to a minimum of 20-foot candles of light.

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 and the Division Safety Engineer of all scheduled and unannounced inspections from SSPC, OSHA, EPA and/or others that come on site and furnishes the Engineer a copy of all inspection reports except for reports performed by a third party and or consultant on behalf of the contractor.

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
- Film Hardness by Pencil Test- ASTM D-3363
- Adhesion Test Kit – ASTM D-3359 Method A (Tape Test)
- Adhesion Pull test – ASTM D-4541
- 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 by these Special Provisions on a form equivalent to M&T-611.

Paint System 1 Modified

Coat	Material	Mils Dry / Wet Film Thickness	
		Minimum	Maximum
Primer	OZ (See Section 1080-9)	3.0 DFT	5.0 DFT
Stripe	OZ(See Section 1080-9)	5.0 <u>WFT</u>	8.0 <u>WFT</u>
Intermediate	Brown (See Section 1080-11)	2.0 DFT	4.0 DFT
Stripe	White (See Section 1080-11)	4.0 <u>WFT</u>	7.0 <u>WFT</u>
Topcoat	Gray (See Section 1080-11)	3.0 DFT	5.0 DFT
TOTAL		8.0 DFT	14.0 DFT

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

Dry film thickness is measured at each spot on the attached diagram and at the required number of locations as specified below:

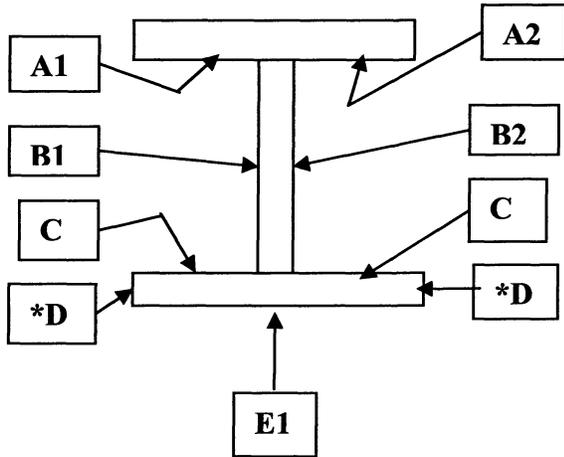
1. For each bascule member eight (8) locations shall be accessed.
2. Counterweight and tower assemblies shall be accessed in no less than twenty (20) spot areas accessed.
3. Each of the eleven (11) bays of miscellaneous stringers, floor beams shall have ten (10) spot areas accessed.

DFT measurements for the prime coat shall not be taken for record until the zinc primer has cured in accordance with ASTM D-3363 (Film Hardness by Pencil Test) in which the scratch hardness shall not be less than a 2A.

Stiffeners and other attachments shall be measured at no less than five random spots per bascule member. Also dry film thickness is measured at no less than six random spots per span on diaphragms/"K" frames.

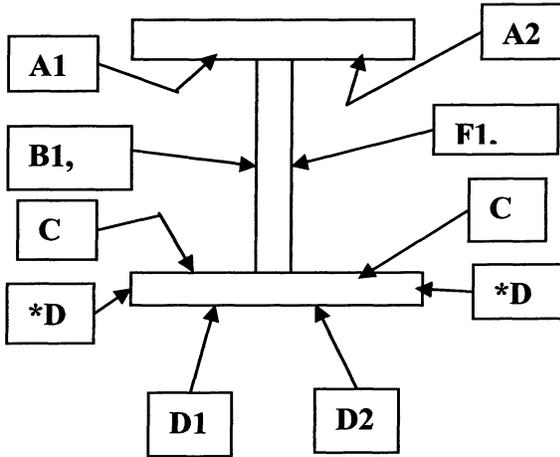
Each spot is an average of three to five individual gage readings as defined in SSPC PA-2. No spot average shall be less than 80% of minimum DFT for each layer applied; this does not apply to stripe coat application. Spot readings that are non-conforming shall be re-accessed by performing additional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

Less than 36" in height and/or bottom flanges less than 16" in width.
7 Spot Areas
21 Individual DFT Readings



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

36" in height or greater and/or bottom flanges greater than 16" in width.
10 Spot Areas
30 Individual DFT Readings



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

- A. Two random adhesion tests (1 test=3 dollies) per span are conducted on interior surfaces in accordance with ASTM D-4541 (Adhesion Pull Test) after the prime coat has been properly cured in accordance with ASTM D-3363 (Film Hardness by Pencil Hardness) with a scratch resistance no less than 2A, and will be touched up by the Contractor. The required minimum average adhesion is 400 psi.
- B. Cure of the intermediate and stripe coats shall be accessed by utilizing the thumb test in accordance with ASTM D-1640 (Curing Formation Test) prior to the application of any successive layers of paint.
- C. One random Cut Tape adhesion test per span is conducted in accordance with ASTM D-3359 (X-Cut Tape Test) on interior surface after the finish coat is cured. Repair areas shall be properly tapered and 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 Person³” is on site during all surface preparation activities and monitors the effectiveness of containment, dust collection systems and waste sampling. Before any work begins the Contractor provides a written summary of the responsible person’s safety training.

Area sampling will be performed for the first two (2) days at each bridge location. The area sample will be located within five feet of the containment and where the highest probability of leakage will occur (access door, etc.). Results from the area sampling will be given to the Engineer within seventy-two (72) hours of sampling (excluding weekends) If the results of the samples exceed 20 ug/m³ corrective measures must be taken and monitoring will be continued until two consecutive samples come back less than 20 ug/m³.

Any visible emissions outside the containment enclosure or pump monitoring results exceeding the level of 30 µg/m³ TWA is justification to suspend the work.

Where schools, housing and/or buildings are within five hundred (500) feet of the containment, the Contractor shall perform initial TSP-Lead monitoring for the first ten (10) days of the project; during abrasive blasting, vacuuming and containment removal. Additional monitoring will be required during abrasive blasting two days per month thereafter. Results of the TSP monitoring at any location shall not exceed 1.5 ug/m³.

This project may involve lead and other toxic metals such as arsenic, cadmium and hexavalent chromium. It is the contractor’s responsibility to test for toxic metals and if found, comply with the OSHA regulations, which may include medical testing.

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 spaced one week apart 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.

Prior to blasting operations the Contractor shall have an operational OSHA approved hand wash station at each bridge location and a decontamination trailer at each bridge or between bridges unless the work is on the roadway, or the contractor can show reason why it is not feasible to do so in which the Contractor will provide an alternative site as approved by the Engineer. The

³ **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.

contractor shall assure that all employees whose airborne exposure to lead is above the PEL shall shower at the end of their work shift.

All OSHA recordable accidents that occur during the project duration are to be reported to the Engineer within twenty four (24) hours of occurrence. In addition, for accidents that involve civilians and or property damage that occur within the work zone the Division Safety Engineer shall be notified immediately.

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. All land and or lease agreements that involve private property shall disclose to the property owner that lead and other heavy metals may be present on the Contractor's equipment. Prior to storing the Contractor's equipment on private property the Engineer shall receive a notarized written consent signed by the land owner submitted at least forty-eight (48) prior to using property. All storage of paint, solvents and other materials applied to structures shall be stored in accordance with Section 442 of the Specifications or manufacturers' requirements. The more restrictive requirements will apply.

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 MACHINERY RELUBRICATION

The Contractor shall schedule painting operations under this item such that the bridge shall not be operated during the execution of the work.

Immediately after the completion of Painting and prior to the start of any other work items, the Contractor shall thoroughly clean all machinery components to bare metal and relubricate them with new grease of a type approved by the Engineer. The central gear reducer shall be drained, flushed with mineral spirits, and re-filled with new lubricant approved by the Engineer. The flushing of the central gear reducer shall be done in conjunction with its servicing, as required by Bridge Mechanical Work.

11.0 PAYMENT:

The cost of inspection, initial SSPC-6 surface preparation, final SSPC-10 surface preparation and repainting the existing structure is included in the lump sum price bid for *Cleaning and Repainting of Bridge #110*. 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 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.

Pollution Control will be paid for at the contract lump sum price which price will be full compensation for all collection, handling, storage, air monitoring, and disposal of debris and wash water, all personal protective equipment, and all personal hygiene requirements, and all equipment, material and labor necessary to fully contain the blast debris; daily collection of the blast debris into specified containers; and any measures necessary to ensure conformance to all safety and environments regulations as directed by the Engineer.

Payment will be made under:

Pay Item	Pay Unit
Cleaning and Repainting of Bridge #110	Lump Sum
Pollution Control	Lump Sum

DESCRIPTION OF BRIDGE:

Bridge #150110R (Bridge #110) in Carteret County: The bridge was originally built in 1960 and carries the Carolina Coastal Railroad across the Newport River between Morehead City and Beaufort, NC. The approach spans were replaced in 1999 with primarily 33’ spans of double 36” prestressed concrete T-Beams on precast pier caps with two composite piles per pier consisting of 24” dia. pipe piles encased in 36” dia. precast cylinder piles. The Single Leaf Bascule Span has a total length of approximately 130’. The areas to be cleaned and painted consist of 1-112’ Thru Plate Girder Single Leaf Bascule Span normally stored in the Open to Navigation Position, 1-Flanking span miscellaneous components, Tower A Frame assemblies, Counterweight and supporting structure, exposed machinery elements (To be paid for as part of the Mechanical Pay Item). The thru plate girder spacing width is 17’ and the vertical clearance is approximately 5’ to normal water surface. The existing paint system has red lead primer. Painting is restricted between November 15th and April 15th each year unless otherwise granted by the Engineer in writing. The approximate steel area to be painted is **10,000 square feet**. The contractor shall provide his own estimate of area for painting of the bridge. No measurement or payment will be made for any differences in the approximate area and the actual area painted.

MANAGING BRIDGE WASH WATER

SPECIAL

1.0 DESCRIPTION

Collect and properly dispose of Bridge Wash Water from bridge, machinery, counterweight, towers and the deck.

2.0 CONSTRUCTION METHODS

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.

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.

BALANCE TEST AND MAINTENANCE OF BALANCE

SPECIAL

1.0 GENERAL

The Contractor shall meet all the requirements associated with span balance during all phases of construction, shall monitor balance throughout the length of the project, and shall perform all required weight adjustments to maintain the balance requirements provided herein.

The Contractor shall submit the balance plan to the Engineer to approve, including temporary anchorage of the bascule girder, the weight changes to maintain the balance and locations and method to add the weights. The balance plan shall include the affects of painting the structure and counterweight.

The balance calculations shall follow the format used on the plans. The span X and Y coordinates shall be assigned 0:0 at the centerline of the main trunnion. All balance weights on and off the span will be based on this criteria. The span shall be kept in reasonable balance so that at any time the span can be operated under the control of the Contractor through either the existing diesel engine or the new electrical system or some other temporary operating system that the Contractor may propose. Complete calculations shall be submitted verifying this capability prior to any field work being started.

An assessment of the internal pockets will be required and this information submitted to as part of the balance procedure the Engineer. The Contractor shall be prepared to add or to remove some weight from the counterweight as required in this special provision to maintain operational balance. Addition and subtraction of weight on the counterweight or the span as required to keep the span in proper operational balance, as well as that balance required on the Balance Table, shall not be considered Extra Work and no additional payments will be made.

2.0 SPAN BALANCE TEST

The project assumes that the span is essentially in proper balance. Prior to any field work, the Contractor (Via a Third Party) is responsible for determining the preliminary balance conditions of the bascule span by testing the force the bascule girder applies to the bearing at

the toe via calibrated jacks. The Contractor will submit his proposed jacking location, jacking details, manifold layout and all other information to assure that proper measurements are being taken. This method shall also used to test the balance with the span in the seated position after the floor system and track replacement. The final force on the rest pier bearing under the dead load only shall be 1,000 lbs +/- 500 pounds each girder.

If during the initial jack tests it is determined the span is well out of balance (Adjustments required to the counterweight in excess or +/- 20,000 pounds) then the Contractor shall alert the Engineer and appropriate steps will be made to address this condition. This effort will be considered 'Extra Work' and based on time and materials as per NCDOT Standard Contract Provisions.

The Contractor shall develop a test procedure to determine balance with the span in the open position thru machinery operation and submit to the Engineer for Approval by measuring the span power draw through the full opening cycle. Power readings from the new electric motors shall be taken while raising and lowering the span. Power readings from the existing engine shall be measured utilizing torque wrench or similar method taken at various positions while raising and lowering the span. The power readings or torque measurements taken during the span raising operation and the lowering operation shall be within 10%. Readings beyond 10% shall cause a balance effort to bring the toe reaction to within 1000 pounds +/- 500 pounds at each girder. Regardless of whether they are needed or not, the contract shall order 50 balance blocks, made of cast iron or steel plate or billet, not to weigh more than 100 pounds each with a size not to exceed that of the existing blocks.

3.0 BASIS OF PAYMENT

Balance Test and Maintenance of Balance will be paid at the contract lump sum price. No measurement for payment will be made for this pay item, and no adjustment in the contract lump sum price will be made for number of balance adjustments required necessary to complete the work. This cost shall include, but is not limited to, costs associated with balancing the span, furnish balance blocks, furnish balance material, take measurements and perform all calculations to balance the span, equipment, labor and any incidentals necessary to complete the work shall be considered incidental to the project.

Pay Item	Pay Unit
Balance Test and Maintenance of Balance	Lump Sum

BRIDGE STRUCTURAL WORK

SPECIAL

1.0 GENERAL

The Fabricator shall furnish all equipment, tools, labor and materials in connection with the fabrication and shipping of all bridge superstructure steel, including bearings, in accordance with plans and as herein specified. The structural steel shall be fabricated in accordance with details shown on the plans. The material and workmanship shall conform to the current American Railway Engineering Association's Specifications for Steel Railway Bridges, except as modified by the following stipulations:

A. Shop Drawings

The steel fabricator shall prepare shop detail drawings and shall obtain the approval of them before proceeding with the fabrication. An approved title shall be in the lower right hand corner. These drawings or transparent reproductions on Mylar shall become the property of, and shall be delivered to NCDOT.

During the preparation of shop drawings, the Fabricator shall check all general dimensions of the steel work and shall report any discrepancies to the Engineer for revision and correction before the fabrication is begun. No allowance shall be made to the Fabricator for material fabricated to incorrect dimensions not so reported. Shop drawings shall indicate the type and grade of steel used in each of the fabricated members. Members subject to the Fracture Control Plan and Charpy V-Notch toughness tests shall be designated as such on the shop drawings.

B. Inspection

The fabrication shall be subject to the approval of the Engineer, or shall be subject to the approval of such inspection agency as the NCDOT may designate.

C. Shipping Statements

The steel fabricator shall furnish to the NCDOT Structures Design a copy of the detailed shipping statements showing the weight of each piece of structural steel shipped. Shipping weights shall be scale weights in accordance with current A.R.E.M.A. specifications.

D. Test Reports

The steel fabricator shall furnish to the NCDOT Structures Design one copy of the Rolling Mill Report covering the physical and chemical tests made on the main material used in the fabrication.

E. Shop Painting

After shop fabrication is completed the structural steel shall be shop primed as noted on the plans and special provisions. Paint shall not be applied on damp or frosted surfaces. The paint shall be mixed thoroughly and the pigment kept in suspension until the paint is applied.

F. Welding

Shop welding and inspection shall be as noted on the plans. The fabricator shall submit to the Engineer shop detail drawings, welding procedure specifications, and erection procedures for review, as to conformity to contract requirements. Shop drawings and weld procedures require approval by the Engineer before any fabrication is begun.

All welding shall be fully detailed. One copy of the proposed welding procedures giving complete details for each type and thickness of joint to be used on the project, whether prequalified or subject to qualification tests, shall be submitted to the Engineer for review prior to submitting shop drawings. The shop drawings submitted for final approval shall indicate the welding procedure to be used for each joint. Welding symbols shall be those shown in the latest edition of American Welding Society (AWS) Publication A2.4, "Symbols for Welding and Non-destructive Testing." Special conditions including location of joints subject to non-destructive testing and type of non-destructive testing shall be fully explained by added notes or details.

G. Materials

1. Structural Steel A709 Grade 50

Except as noted on the plans or specified herein, all structural steel shall conform to the requirements of ASTM A 709 Grade 50 with a minimum Impact testing value (CVN) 30 Ft-pounds at 10° F and shall be the proprietary product of the mill. Other grades of A709 or steel meeting the requirements of A709 but not the proprietary product of the mill may be accepted, if approved by the Engineer. Approval will be based on submitted data of mechanical and impact tests, chemical composition and properties, and proof of weldability acceptable to the Engineer.

- a. Imperfections in surfaces of rolled sections or plates shall be repaired in accordance with ASTM A-6 except that repair by welding will be permitted only when approved by the Engineer after the material is delivered to the fabricating shop. All grinding, chipping, and arc-air gouging necessary to condition plate surfaces shall be performed at the mill in accordance with ASTM 6, Section 9.2.

2. Identification of Steel

Rolled steel shall be marked in accordance with the requirements of ASTM A 6 except that each piece of steel shall be stamped or stenciled at the mill to clearly show the heat number. Loss of identification on pieces will be cause for rejection of the piece.

3. Quality of Rolled Steel

All structural steel, whether carbon steel or low-alloy steel, as it comes from the rolls shall be free from seams, flaws, cracks, laps, blisters, ragged or defective edges and other defects, and shall have a smooth, uniform, workmanlike finish. All material shall be straightened in the mill before shipping and at the time of fabrication shall be free from loose mill scale, rust pits or other defects affecting its strength and durability

4. High Strength Steel Bolts

High strength bolts, nuts, and washers shall conform to the requirements of ASTM A 325. Shop drawings shall indicate number, length, grip and location of all shop and field high strength fasteners.

5. Steel Weldments

All surfaces of steel parts in contact with one another for bearing weldments shall be surface finished to 250 micro inches prior to welding unless noted otherwise on the plans. Weldment construction shall be stress-relieved in accordance with AWS D1.5. All weldment surfaces shall be finished according to the ANSI standard surface roughness limits shown on the plans after stress-relieving.

6. Tests and Inspection

As promptly as practicable after rolling or casting of metal and before shipping, mills shall make the chemical analyses and physical tests required and shall furnish certified copies of the tests to the Engineer in the number requested. Certified copies must be furnished to the Engineer prior to use of material in the work.

Shop inspection of metal fabrication will be performed by the Company as the work progresses without expense to the Fabricator. The Fabricator shall give two weeks written notice to the Engineer of the beginning of work in the shops so inspection may be provided. No work in the shop shall be done until the Engineer has been so notified.

The Engineer and Inspector shall have full access to all parts of the shop where material is being fabricated for the contract, and shall be provided every reasonable facility for determining the character of the material and workmanship. The Fabricator shall lay out and arrange the individual members or units to be inspected so that erection marks on each may be readily distinguished and so that each member or unit is accessible for such measurements as the Inspector may deem necessary. If the material has not been inspected at the mill before being delivered to the fabricating shop, the Fabricator shall assist the Inspector by turning the steel to permit examination on both sides. Final inspection shall take place after the fabrication is complete, before shipping.

Should the Inspector be denied reasonable access for inspection or should material be presented to the Inspector in such a way as to not permit adequate inspection, the material will be automatically rejected.

It is understood that whether or not shop inspection is made, workmanship and materials which do not conform to the specifications and to recognized good practice will be rejected at any time prior to final acceptance of the work. Non-destructive testing of welds is considered a part of quality control and shall be at the Fabricator's expense. No additional payment will be made for non-destructive testing.

7. General Fabrication

The steel shop fabrication shall be governed by the applicable provisions of the latest NCDOT Standard Specifications and AREMA Manual for Railway Engineering, Chapter 15, "STEEL STRUCTURES", Part 3, "Fabrication", except as specified herein.

A prefabrication meeting shall be held to establish shop fabrication schedules, material supplies, inspection procedures, repair procedures, record keeping procedures, and all other related subjects. All interested parties shall be invited to attend.

8. Cutting Structural Steel

a. General

Plates making up structural members shall be cut so that the direction of rolling is parallel to the longitudinal axis of the member. Cut edges shall be ground to eliminate micro cracks.

All main stress carrying members composed of plates shall have rolled edges or may be oxygen cut.

A mechanical guide shall be used in all oxygen cutting. Cuts shall be made in accordance with AWS Structural Welding Code, Article 3.2 requirements, except as modified in these specifications.

b. Repair of Plate Cut Edges

The corrective procedures described in of AWS D1.5 shall apply to discontinuities in rolled plate surfaces.

c. Shearing

Shearing edges, where permitted, shall be left in a neat and finished condition. A sheared edge is defined as the termination of any part cut by shearing, whether on sides, ends or otherwise.

Edges of all main material, if sheared, shall be planed to a depth of $\frac{1}{4}$ inch. Main material includes all components, gusset and lateral plates, bearing stiffeners and floorbeam end connectors.

Planing may be omitted at the sheared ends of plates and shapes which become ends of main stress carrying members and are not otherwise specified to be milled.

Other methods of smoothing sheared edges by grinding or otherwise, which the

Engineer may approve as being equivalent to the planing specified, will be given consideration.

d. Bolt Holes

All holes for 7/8 inch diameter high strength bolts shall be 15/16 inch diameter unless otherwise indicated on the plans. All other holes for high strength bolts shall be 1/16 inch larger in diameter than the specified bolt unless otherwise indicated on the plans.

Open holes for field connections of the through plate girder shall be subdrilled ¼ inch diameter undersize and reamed to final diameter with parts fully shop assembled, or drilled full size with the parts assembled as indicated on the plans.

9. Installation Procedure for High Strength Bolts

a. General

High strength bolts shall be installed in accordance with the procedures for the installation of high strength bolts using the turn-of-nut method detailed in AREMA Manual for Railway Engineering Chapter 15, Section 15.3.2.3 and in accordance with the following requirements. This specification covers the installation of bolts conforming to ASTM A 325 and ASTM A449.

Bolts shall be of such length that they will extend entirely through their nuts and approximately ¼ inch beyond them and the full threads shall extend no more than 3/8 inch into the grip. All high strength bolts shall have a hardened washer under the turned element.

Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material except as shown on the plans.

When assembled, all joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of scale, except tight mill scale; and shall also be free of dirt, loose scale, burrs, other foreign material and other defects that would prevent solid seating of the parts.

Contact surfaces within the joints shall be free of oil, paint, lacquer, rust inhibitor or galvanizing.

b. Bolt Tension

When tested with the inspecting wrench, each fastener shall provide, when all fasteners in the joint are tight, at least the minimum bolt tension shown in Table 2-1 of AREMA Manual for Railway Engineering Chapter 15, Section 15.3.2.3(a) for the size of fastener used.

10. Welding

a. General

Welding of the steel shall conform to the current edition of Structural Welding Code, D1.5 (herein referred to as "the Code") of the American Welding Society, except for the following modifications and additions:

- i. No temporary or permanent welds, if not shown on the plans or permitted in the Special Provisions, shall be made without specific written authorization by the Engineer. No electroslag or electrogas welding shall be used.
- ii. One copy of the proposed welding procedures giving complete details for each type and thickness of joint to be used on the project, whether prequalified or subject to qualification tests, shall be submitted to the Engineer prior to submitting shop drawings. The shop drawings submitted for final approval shall indicate the welding procedure to be used for each joint.
- iii. All costs involved in qualifying welding processes, joint welding procedures, tackers, welders and welding operators, including all costs of materials, furnishing test specimens, performing the specified physical tests and preparing the required tests reports shall be borne by the Fabricator.
- iv. The qualifying agency shall be subject to approval by the Engineer. The Fabricator shall notify the Engineer, in writing, at least one week prior to qualification tests.
- v. All primary shop welds shall be made by approved automatic feed and travel welding processes. Non-compliance with the requirement will be cause for rejection of the welded material unless prior approval is granted by the Engineer for welding the specified joints by the use of other processes.
- vi. The automatic welding process requirement for primary shop welds shall be shown on the shop drawing for each joint. Primary shop welds are defined as girder flange to web welds.
- vii. Surfaces and edges to be welded shall be smooth, uniform, and free from fins, tears, cracks, or other defects which would adversely affect the quality or strength of the weld.
- viii. Surfaces to be welded and surfaces within 2 inches to a weld shall also be free from loose or thick scale, slag, rust, moisture, grease, or other foreign material that will prevent proper welding or produce objectionable fumes. All mill scale shall be removed from the surface on which flange-to-web welds are to be made.
- ix. Shop welded web and flange splices, not shown on the approved shop

drawings, are permitted only with the written approval of the Engineer. All required nondestructive testing of such welds shall be completed and approved before the spliced piece is welded to another component part of the girder.

- x. No payment will be made for shop welded web and flange splices not shown on approved shop drawings.

b. Weld Inspection

- i. Facilities: The Fabricator shall, at his own cost, provide an approved inspection service for non-destructive testing of all welds as specified. Other costs such as providing scaffolding, supports, hoisting equipment, labor, other necessary means to make the work readily available for this inspection, as well as the usual visual inspection, and any cost due to delays in fabrication because of the required inspection will be considered as completely covered by the lump sum price quoted for fabricated structural metalwork.
- ii. Any non-destructive inspection facilities or services furnished by the Fabricator which are found to be unsatisfactory by the Engineer shall be improved or replaced by the Fabricator so as to provide a satisfactory level of performance, after which re-inspection of designated welded materials by adequate nondestructive inspection facilities and services shall be performed by the Fabricator when required by the Engineer.
- iii. Personnel: Personnel performing non-destructive testing shall be qualified in accordance with the American Society for Non-destructive Testing Recommended Practice No. SNT-TC-IA. Only individuals qualified for NDT Level II or NDT Level III, or individuals qualified for NDT Level 1 working under the supervision of an individual qualified for NDT Level II or III, may perform non-destructive testing.
- iv. Acceptance: The Engineer's approval of the welds and of the repair of defects must be obtained before members will be accepted for shipment from the shop.

The Fabricator's independent inspector shall ascertain that equipment, procedures and techniques conform to the requirements of the Code and these specifications. The inspector shall be responsible for making non-destructive tests, shall examine and interpret test results, approve satisfactory welds, disapprove or reject unsatisfactory welds, approve satisfactory methods proposed by the Fabricator for repairing unacceptable welds, and inspect the preparation and re-welding of unacceptable welds, and inspect the preparation and re-welding of unacceptable welds. The inspector shall record the locations of tested areas and the findings of all non-destructive tests, together with descriptions of any repairs made and shall periodically furnish such records to the Engineer as the work progresses.

The responsibility for insuring adequate workmanship and techniques shall not, however, be upon the inspector alone. The Fabricator shall provide competent supervision of all welding to insure acceptable quality. The Engineer reserves the right to make his own determination at any time of the adequacy of any weld, and to reject welds which, in his opinion, are deficient.

All welds shall be visually inspected by the Fabricator to check for cracks, undercutting, excessive weld metal, improper weld contours, etc.

- v. Ultrasonic Testing: Ultrasonic testing in accordance with Part C of Section 6 of the Code. A minimum of 25% of each weld will be tested. The inspection service shall report the location and length of defects, if any, and furnish a certification that inspection tests were performed in accordance with these specifications.
- vi. Magnetic Particle Testing: Magnetic particle testing in accordance with the requirements of Article 6.7.6 of the Code shall be made on 50% of all fillet welds. Welds requiring repair shall be re-tested after repairs are made.

The inspection service shall report the amount of inspection performed in lineal feet, location and length of defects, if any, and furnish a certification that these were performed in accordance with these specifications.

- vii. If rejectable discontinuities are found, the provisions of the Code for additional testing shall apply.

c. Welding on Steel Spans

The welding details and selection of consumables of new plates to existing material on the A-frame shall be developed by a Certified Welding Engineer. The details shown on the plans are considered minimum standards of care for the details. The final details shall show the specific weld type and the specific consumable. If the Welding Engineer feels testing of the existing material is required then it shall be performed as part of the work and no additional cost for the testing will be considered. No other field welding will be allowed on the bascule span superstructure unless authorized in writing by the Engineer or specifically defined on the plans.

d. Bearing Surfaces

The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the American National Standards Institute (ANSI) surface roughness requirements as defined in ANSI Standard B 46.1-47, "Surface Roughness, Waviness, and Lay", Part I, and as shown on the plans, or in the following listing:

- Masonry bearing plates (surface in contact with neoprene) 500
- Heavy plates in contact to be welded or bolted 250
- Rocking surfaces of rocker plates 250

All plates in bearing assemblies shall be flat and level.

e. Cleaning

In order to provide a sound uniform surface for the formation of the protective oxide, all unpainted steel shall be prepared in accordance with the following procedures. The surface preparation shall be completed by the Fabricator prior to shipping the structural steel.

All structural steel shall be prepared by blast cleaning according to Surface Preparation Specifications SSPC-SP6, Current Edition, and "Commercial Blast Cleaning". Particular care shall be taken to remove welding flux, slag and spatter.

In general, structural steel fabricated from corrosion resistant steel (Stainless Steel) and galvanized members shall not be painted.

f. Galvanizing

Hot-dip galvanizing shall be applied to all parts indicated on the plans or elsewhere specified in these Special Provisions for galvanizing. All rolled steel shapes, plates, and bars to be galvanized by the hot-dip process shall be thoroughly cleaned and pickled in hot acid bath before application of zinc. Hot-dip galvanizing of metal shall conform to ASTM Standard A 123. The weight of the zinc coating per square foot of actual surface shall average of less than 2.0 oz. and no individual specimen shall show less than 1.8 oz.

11. Loading and Shipping

All materials shall be carefully loaded so as to avoid injury in transit. Members weighing more than three tons shall have the weight marked thereon. All small parts such as rivets, bolts, pins, washers, and small connection plates shall be packed in containers, of adequate strength. The contents of each unit shall be plainly marked on the top of each container.

The welded members, floorbeams and stringers shall be shipped in an upright position and be adequately blocked and braced to prevent damage during shipping. The Fabricator shall submit girder loading diagrams to the Engineer for approval well in advance of the anticipated shipping date. These diagrams shall include proposed blocking, bracing and tie-down details.

3.0 A-FRAME TOWER

The Contractor shall install the channel side single tower anchor bolts first. After all single anchor bolts are installed the Contractor can start the multi-anchor bolt assembly and strengthen the tie beam. It is possible to strengthen the tie beam at an earlier time if the work does not impede or interfere with other operations. This will be left to the Contractors discretion. The Contractor shall repair and install the new multi-anchor bolt one tie beam at a time and only one Channel leg of the tie beam shall be repaired at any one time. Follow the installation procedure on the plans. No more than 5 bolts or rivets shall be completely

removed at any one time. Drift pins shall be installed that allow the connection to remain in position as well as adequate transfer of existing load. The rivets shall all be removed and replaced with temporary HS Bolts prior to the installation of the new anchor bolt chair. The chair and gusset connection can be separate plates and field welded. After one tie beam and related anchor bolts are fully installed, start working on the next one, which is symmetric with one about the center of bridge.

3.0 COUNTERWEIGHT

The counterweight will be blast cleaned and painted. The Contractor shall also inspect the counterweight and report any total section loss greater than 75% within a three (3) square foot area to the Engineer. The Contractor shall also survey the counterweight pocket and submit to the Engineer a report of the remaining available space in the pocket. Repairs to the counterweight, if any, will be determined based on the findings in the field and as determined and approved by the Engineer. The Contractor shall assume that these repairs, if any, will have minimal affect on the balance.

4.0 BASIS OF PAYMENT

Bridge Structural Work will be paid for at the contract lump sum price bid which will be full compensation for furnishing all labor, materials, tools, equipment and incidentals required to complete the work in accordance with the contract documents for all structural steel work including, but not limited to, cover plates, kneebraces, floor beams, stringers, cross bracing, repairs to the tower frame, bascule girder shoes, limit switch and toe lock receivers and those items contained in Article 440-1 of the Standard Specifications. This item includes rivet replacement required for all the above mentioned work. No measurement for payment will be made for this pay item, and no adjustment in the contract lump sum price will be made for any variation from the structural steel shown on the plans except for revisions in the plans which affect the quantity of structural steel necessary to complete the work.

Pay Item
Bridge Structural Work

Pay Unit
Lump Sum

ANCHOR BOLTS

SPECIAL

1.0 GENERAL

The Fabricator shall furnish all equipment, tools, labor and materials in connection with the fabrication and shipping of anchor bolts, in accordance with plans and as herein specified. Fabrication shall be in accordance with details shown on the plans. The material and workmanship shall conform to the current American Railway Engineering Association's Specifications for Steel Railway Bridges, except as modified by the following stipulations:

The embedment depth of adhesively anchored anchor bolts shall be as shown on the plans or shall be increased to meet the manufacturers recommendations. Installation and testing of adhesively anchored anchor bolts shall conform to the provisions of the Standard Specifications.

Shop drawings, Inspections, Shipping statements, Test Reports, Tests and Inspection, and General Fabrication of anchor bolts shall be in accordance with the applicable sections of the Bridge Structural Steel Special Provision.

2.0 LIVE LOAD SHOES

The existing anchor bolts shall be removed in their entirety and new holes drilled for acceptance of the new anchor bolts. The contractor may elect to use whatever equipment they determine best for removal of anchor bolts but the use of utility grade diamond core drill bits, thickness-1/4", to remove the existing deteriorated anchor bolts is suggested. The bolts shall be ASTM A193 grade B8M stainless fully threaded bolts. Nuts and fastener material shall be ASTM A194, and matching the bolt material.

3.0 TOWER BEARING

Use Hilti capsule adhesive anchor system or equivalent to install the tower bearing anchor bolts. The contact information: www.us.hilti.com, phone: 800-879-8000.

The bolts shall be ASTM A193 Grade B8M stainless steel fully threaded bolts Nuts and fastener material shall be ASTM A194, and matching the bolt material.

4.0 OTHERS

Use Hilti capsule adhesive anchor system or equivalent to install the other anchor bolts, for example, proximity switch anchor bolts and toe lock receiver support anchor bolts.

The bolts shall be ASTM A193 Grade B8M stainless steel threaded bolts. Nuts and fastener material shall be ASTM A194, and matching the bolt material.

5.0 MEASUREMENT AND PAYMENT

Anchor bolts will be paid for at the contract lump sum price bid. Such price and payment shall be full compensation for furnishing and installing anchor bolts as designated on the plans, and for all equipment, tools, labor, services, materials and incidentals necessary to remove existing anchor bolts, furnish new anchor bolts, place, install, and test anchor bolts.

Pay Item
Anchor Bolts

Pay Unit
Lump Sum

BRIDGE DECK WORK**SPECIAL****1.0 GENERAL**

Bridge Deck Work shall consist of replacement of existing ties, tie plates and rail, penalization of rail, removal and replacement of track sections for the purpose of repairing bridge components and all materials, labor and incidentals required to complete the work.

The Contractor shall furnish all equipment, tools, labor and materials in connection with the fabrication and shipping of all bridge deck work, including all accessories, hardware and bolts, grating, in accordance with plans and as herein specified. The material and workmanship shall conform to the current American Railway Engineering Association's Manual for Railway Engineering, Chapters 7 and 15, except as modified by the following stipulations:

2.0 MATERIALS**A. Timber**

Except as noted on the plans or specified herein, all timber shall conform to the requirements of AREMA Chapter 7, Section 1.7 for Southern Yellow Pine.

1. Ties at the rest pier, two (2) shall be replaced with Oak ties. Reuse existing hardware to secure ties to the rest pier.
2. Toe of the bascule span, the two (2) ties adjacent to the steel tie shall be furnished with Oak ties.
3. Heel of the bascule span, the two (2) ties adjacent to the steel tie on both sides of the steel tie shall be Oak ties.

B. Tie Plates, Track Spikes, Rail Anchors

Except as noted on the plans or specified herein, Tie Plates shall conform to the requirements of AREMA Chapter 5, Section 1.

Except as noted on the plans or specified herein, Track Spikes shall conform to the requirements of AREMA Chapter 5, Section 2.

Except as noted on the plans or specified herein, Rail Anchors shall conform to the requirements of AREMA Chapter 5, Section 7.

Except as noted on the plans or specified herein, Rail shall conform to the requirements of AREMA Chapter 4, 115RE to match the existing rail on the bridge. The Contractor shall furnish and install compromise joints as required for installation on the bridge and the connections to the approach spans.

C. Track Accessories

Unload, handle and place track material, ties, tie plates, spikes and all necessary accessories in a manor to prevent damage and such as not to interfere with Railroad operations. Ties shall be placed on blocks 6 inches above firm ground. The Contractor shall promptly unload and handle all furnished materials delivered by rail. The Contractor shall coordinate with the Port on the storage of materials and the staging for the deck replacement so as not to interfere with necessary railroad operations. The Contractor shall be responsible for the safe storage, protection and handling of all Railroad furnished material upon delivery.

Installation of all track and tie material, placement at the proper gage, removal of the existing material, panelizing of the existing deck, removal and re-installation, miscellaneous parts, nuts, washers, etc., if specified and/or required to complete this task to allow railroad operation will be incidental to this item. Joining of rail will be performed per AREMA Chapter 4, Part 3.

The Contractor shall furnish and place structural steel ties as part of this work item. Separate payment for the steel tie fabrication and installation will not be accepted and is incidental to the Bridge Deck Work item. Any temporary blocking or final blocking under ties to adjust any elevation differential during the placement of deck shall be incidental.

It is not intended for the new rails to be cut or track to be removed for nor after the floor system replacement has been completed. Cutting of the rails shall only be performed with the approval of the Engineer.

When the new deck is complete, the Contractor will verify final grade profile and alignment on the bridge and approaches, as acceptable to the Engineer. The Contractor shall remove and dispose of remaining and used deck elements. The Contractor shall remove the existing toe and heel rail joints as required to perform the work and reinstall the joint rail sections as necessary incidental to this work and as directed by the Engineer. The contractor shall furnish and install new walkway grating, placed between the running rails on the bascule span and the tower span attached to the new deck as recommended by the grating manufacturer. Contractor shall furnish "As-Built" drawings of the final deck with elevations.

3.0 MEASUREMENT AND PAYMENT

Bridge Deck Work will be paid for at the contract lump sum price. Such price and payment shall be full compensation for furnishing the and installing the system specified, and for all equipment, tools, labor, services, materials and incidentals necessary to furnish, place, install, removal, reinstallation, panelization, coordinate, test, make operational, required to install and complete the deck installation necessary to operate rail traffic during construction and the final condition. Final acceptance is by the Carolina Railroad Operator and demonstrating

that the bascule span operates satisfactorily and track alignment is acceptable for 10 MPH rail operation.

Payment will be made under:

Pay Item

Bridge Deck Work

Pay Unit

Lump Sum

BRIDGE MECHANICAL WORK**SPECIAL****1.0 SCOPE**

This section covers providing all products, labor, services, incidentals and related work to furnish, install, align, adjust, test and place in permanent service all mechanical work items shown on the Plans and/or described herein. In addition, this section covers providing all products, labor, services, incidentals and related work to service, repair, clean, re-lubricate, spot-paint and service existing mechanical components as shown on the Plans and/or as described herein. The work includes coordination of special machinery manufacturer requirements, special shimming and alignment, and installation and alignment of electrical components, including motors and limit switches.

In general, the mechanical work items are intended to work in conjunction with electrical work items shown on the plans and described elsewhere in the Special Provisions to safely and reliably operate the Radio Island Bridge bascule span from either on site or from a remote location. Mechanical work items shall be coordinated and staged with related electrical and structural work items.

The installation, alignment of adjustment of new mechanical components, as well as electrical components and switches integrated with the bridge machinery, shall be performed by qualified millwrights experienced in this class of work and who have performed similar work on at least three movable bridges in the past eight years.

2.0 REFERENCES, STANDARDS & CODES

The design of bridge machinery shall conform to the requirements of the American Railway and Maintenance of Way Association Manual for Railway Engineering, 2011 Edition, except as otherwise noted on the Contract Drawings or otherwise specified herein.

The work shall comply with all applicable requirements codes and standards issued by the following organizations:

American Association of State Highway and Transportation Officials	(AASHTO)
American Gear Manufacturers Association	(AGMA)
American Iron and Steel Institute	(AISI)
American National Standards Institute	(ANSI)
American Society of Mechanical Engineers	(ASME)
American Society of Testing and Materials	(ASTM)
American Welding Society	(AWS)
Anti-Friction Bearing manufacturers Association	(AFBMA)
National Fluid Power Association	(NFPA)
National Lubricating Grease Institute	(NLGI)
Occupational Safety and Health Administration	(OSHA)
Society of Automotive Engineers	(SAE)
Steel Structures Painting Council	(SSPC)
National Electric Code	(NEC)
National Electrical Manufacturers Association	(NEMA)
Underwriters Laboratory, Inc	(UL)
North Carolina Department of Transportation Standard Specifications	(NCDOT)

Additional organizations may also issue codes or standards applicable to the work. The work shall comply with all such standards.

The work shall meet the requirements of all other codes and standards specified elsewhere in the Standard Specifications and Special Provisions. Where codes and standards are mentioned for any pay item, it is to call particular attention to their requirements; it shall not be assumed that the requirements of any other codes or standards are to be omitted or are not applicable if not mentioned.

The issue date of references included in these project special provisions and Contract Plans need not be more current than the date of issue of the Contract.

3.0 RULES, REGULATIONS & ORDINANCES

Work shall comply with all applicable Federal, State and Local rules regulations and ordinances.

In the event of a conflict between these Provisions and the above-mentioned codes, standards, rules, regulations and ordinances, the most stringent requirement shall apply.

4.0 QUALITY ASSURANCE

Components provided as part of the work shall be produced by manufacturers regularly engaged in the manufacture of the same.

For the fabrication, erection, installation, alignment, adjustment, cleaning, lubrication, testing and all other work required by the Contract Documents, the Contractor shall use adequate numbers of skilled, trained, and experienced mechanics, millwrights and service personnel who are thoroughly familiar with the requirements and methods specified for the proper execution of the work.

Qualified millwrights shall perform installation, alignment and adjustment of machinery components. Personnel involved in the machinery erection, installation, and alignment shall have had experience in the installation of movable bridge machinery in a minimum of three previous movable bridge projects or approve similar experience in the last eight years.

Provide adequate facilities and all necessary equipment, tools, and instruments required for the proper performance of the personnel engaged in the specified work.

Materials and fabrication procedures are subject to inspection and testing in the mill, shop and field by the Engineer. Such inspections and tests, if performed, will not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with specified requirements.

All details shown on the Contract Drawings are typical and apply to similar conditions unless otherwise indicated. Dimensions and details in the Contract Plans are for Bid-Purposes only

and shall be verified via field measurements and erection-design layouts by the Contractor before proceeding with any work, obtaining final approval of any Shop Drawings by the Engineer, and to avoid causing subsequent delay in work.

The Engineer shall be notified immediately for clarification whenever any portion of the work appears unclear.

As used herein, “certified test reports” refer to reports of tests conducted on previously manufactured materials or equipment which are purported to be identical to that proposed for this application.

As used herein, “shop tests,” “mill tests” or “factory tests” refer to tests required to be performed on the actual materials or equipment proposed for this application. Results of the tests shall be submitted in accordance with the provisions of this Contract.

5.0 SUBMITTALS

In addition to the requirements of the Working Drawings and Submittals Provision, the Contractor shall submit for review and approval by the Engineer:

- Proposed schedule of submissions
- Qualifications of proposed millwrights
- Mill test reports or certified test reports for all metals used
- Initial bearing clearance measurements to an accuracy of ± 0.002 -inches
- A complete maintenance record, including of all new or rehabilitated machinery items which require lubrication. The list shall be maintained throughout construction and shall contain the type of lubricant used and the date it was installed by the Contractor. The list shall be submitted to the Engineer prior to start up and testing of the respective machinery.
- Proposed schedule of shop and field tests
- Proposed detailed procedures for shop and field tests
- Mechanical maintenance and troubleshooting section of the Operations and Maintenance Manuals

In addition to the requirements of the Working Drawings and Submittals Provision, the following requirements apply.

- A. No work shall be performed nor materials ordered without approval by the Engineer of Submittals describing such work or materials.
- B. Prior to any other submittals, the Contractor shall submit a single, detailed, coordinated schedule of submissions, including submission information from each of their suppliers. The schedule shall include a complete list of all anticipated submissions, including, but not limited to shop drawings, assembly drawings, erection drawings, catalog cuts, installation procedures, welding procedures, paint materials and procedures, along with estimated times when submissions will take place. As part of the work in preparing this list, the Contractor shall coordinate the activities of their suppliers and identify

information and submissions generated by one or more suppliers that may be needed by other suppliers to complete their submissions.

- C. Prior to the submittal of any shop, assembly or erection drawing, the Contractor shall submit to the Engineer for review copies of all field measurements taken as part of the requirements under subsection "Verification of Dimensions." Subsequent submittals will not be considered complete and will not be reviewed until copies of field measurements have been received and reviewed by the Engineer. Identify all field verified dimensions on the shop, assembly and erection drawings.
- D. Prior to the submittal of any shop drawing, the Contractor shall submit to NCDOT for review and approval all weld procedures to be used during fabrication of machinery and welding qualifications from the machinery supplier. Shop drawings with components requiring welding will not be considered complete and will not be reviewed until weld procedures have been submitted. Work shall not proceed until all weld procedures and welding qualifications have been approved.

Submit unstamped shop drawings for review and approval by the Engineer in accordance with Section 1, and with the following requirements:

1. Manufacturer's data and/or shop drawings shall be submitted for all manufactured and purchased items of machinery.
2. The Contractor shall coordinate the work of all designers, suppliers and manufacturers. This coordination shall include insuring that all suppliers have dimensional and all other applicable information on components and supports supplied by others and that this information is incorporated in the drawings. The coordination effort must be sufficient and thorough enough to allow for all machinery components to be properly installed, assembled and aligned with any adjacent components or supports.
3. Submitted shop drawings shall be those actually intended to be used in producing the detailed parts and components. All information required to produce the finished part, to verify contract compliance, and to properly install and align the detailed part with adjacent components, including but not limited to dimensions, tolerances, surface finishes, special machining, painting, testing, material standards, and any other process or procedure required under this Contract to produce the finished part shall be presented on the shop drawings. Reproduced Contract Drawings shall not be considered to provide sufficient detail for use as shop drawings.
4. Submittals for each manufactured item shall include all information required to verify contract compliance, all information required to acquire equivalent replacement parts in the future, and all information required to properly install and align the item with adjacent components. Typical information provided shall include, but not be limited to, the manufacturer's descriptive literature, external dimensions, recommended lubrication, location of fittings and ports, seal types, mounting bolt requirements, paint, ratios, operating speeds, ratings, gross weight and any other critical parameters

of the products actually supplied for this Project. Submittals for each manufactured item shall be signed by an officer of the manufacturing company.

5. Complete shop bills of material shall be made for all machinery parts. If bills are not shown on the shop drawings, prints of the bills shall be furnished for review and approval by the Engineer in the same manner and to the same requirements as that specified for shop drawings.
 6. Complete Assembly and Erection Drawings shall be submitted for review and approval by the Engineer. These drawings shall give part numbers, match marks, and essential dimensions for locating each part or assembled unit with respect to the bridge structure, foundation, and adjacent components.
- E. The Contractor shall submit copies of all orders covering work performed by sub-Contractors and suppliers to the Engineer.
 - F. The Contractor shall submit all material certifications to NCDOT for review and approval as required by the Standard Specifications.
 - G. Prior to blast cleaning or painting operations in the field, the Contractor shall submit a detailed procedure for the protection of new and existing machinery components to the Engineer for review and approval. No blast cleaning or painting in the field shall be permitted until an approved procedure has been received.
 - H. The Contractor shall submit as a single package for review and approval by the Engineer a list of all new and existing machinery items that require lubrication and their recommended re-lubrication frequency; charts showing machinery layouts and the location of the items requiring lubrication, their re-lubrication frequency, their points of lubrication, and the method used to apply or change the lubricant; a list of types of lubricant to be used; Material Safety Data Sheets (MSDS) and technical information for each of the lubricants; and a schedule showing the dates each item was lubricated by the Contractor. This information shall be submitted prior to any testing of the machinery and prior to submission of the Operating and Maintenance Manuals. The machinery shall not be operated until approval of this submittal has been received.
 - I. The Contractor shall submit the proposed machinery paint system information to the Engineer for review and approval. Paint system information shall consist of the paint manufacturer's descriptive literature, paint procedures to be used, surface preparation to be used, and MSDS and technical information for the components of the paint system. Information submitted that does not present enough information to verify contract compliance, adequately describe the surface preparation required and painting methods used, and describe any safety concerns will not be approved by the Engineer. No painting or surface preparation work shall be permitted until approval of the painting system information has been obtained.
 - J. The Contractor shall submit proposed coating information to the Engineer for review and approval. Coating information shall consist of the manufacturer's descriptive literature

and MSDS and technical information for the anti-seize, corrosion-inhibiting, and thread-locking coatings to be used on the Project. Information submitted that does not present enough information to verify contract compliance, verify compatibility with other materials and describe any safety concerns will not be approved by the Engineer.

- K. Submit copies of manufacturer's recommendations and proposed erection and alignment procedures to the Engineer for review prior to related installation work in accordance with subsection "Manufacturer's Recommendations". Erection and alignment procedures shall provide detailed, step-by-step procedures and must present a clear methodology by which the requirements of the Contract Documents will be achieved. Installation of the related items shall not be permitted to proceed until these recommendations have been received. Failure to furnish these recommendations will result in rejection of the related work
- L. The Contractor shall submit for review and approval by the Engineer proposed shop testing procedures as required herein. Shop testing procedures shall provide a step-by-step description of the test, identify what is to be measured and how frequently, list the equipment to be used during the tests, state the ratings of the equipment, state the speed and torque and/or other settings to be used during the tests, state the test duration, and state the acceptance criteria. The procedures shall be sufficiently detailed to verify compliance with the requirements of the machinery special provisions and to enable an inspector to fully understand how the test is to be performed, what information is to be generated by the test, and what the acceptance criteria is. No shop testing shall be performed until the associated shop test procedure has been approved by the Engineer.
- M. The Contractor shall submit for review and approval by the Engineer the results of all shop tests. Tested components or materials shall not be shipped to the job site until the test results have been approved by the Engineer.
- N. The Contractor shall submit for review and approval by the Engineer the results of all field measurements used to verify alignment of the new machinery components to the tolerances specified herein. Measurements shall have levels of accuracy and precision adequate to measure differences of 0.002 inches. No field testing shall be performed until the associated field measurements have been approved by the Engineer.
- O. The Contractor shall submit for review and approval by the Engineer proposed field testing procedures as required herein. Field testing procedures shall provide a step-by-step description of the test, identify what is to be measured and how frequently, state the test durations, identify safety precautions, and state the acceptance criteria. The procedures shall be sufficiently detailed to verify compliance with the requirements of the machinery special provisions and to enable an inspector to fully understand how the test is to be performed, what information is to be generated by the test, and what the acceptance criteria is. Field testing shall not take place until the field testing procedures have been approved by the Engineer.
- P. The Contractor shall submit for review and approval by the Engineer the results of all field tests. Final acceptance of the work shall not be granted until the test results have been approved by the Engineer.

- Q. If any departures from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable to the Engineer and NCDOT for review and approval. Contractor submittals showing departures from the Contract Drawings or Special Provisions shall be automatically rejected unless approval of the departure by the Engineer and NCDOT has been received.

6.0 DELIVERY, STORAGE & HANDLING

New components shall be completely protected from weather, debris, chips, shavings and other injurious conditions during manufacture, shipment, storage, installation, and at all other times throughout the Project. Damaged components shall be repaired or replaced, at the option of NCDOT, by the Contractor at its own expense.

Components damaged as a result of the Contractor's activities or failure to take reasonable precautions shall be repaired or replaced, at the option of NCDOT, by the Contractor at its own expense.

All machined surfaces and any unpainted surfaces that could be subject to corrosion shall be cleaned of dirt, chips, grit and all other injurious materials and given a coat of an Engineer-approved corrosion-inhibiting preservative prior to shipment. This coating shall be removed in the field prior to erection, operation and/or field painting. Components not properly protected in this way may be rejected by the Inspector and removed from the job site.

Shaft and pin journals that are shipped disassembled from their bearings shall be protected during shipment in such a way as to completely protect them from corrosion and to completely protect the journal surface finish from being marred in any way at all times during storage, shipment and prior to erection. Application of an Engineer-approved corrosion-inhibiting preservative on the journal surface shall not be permitted. It is recommended that the journal surfaces be packed in oil-soaked rags and secured in place by burlap and covered with heavy metal thimbles or timber lagging securely attached. Components not properly protected in this way may be rejected by the Inspector, removed from the job site, and replaced by the Contractor at its own expense.

Components and assemblies shall be packaged and shipped in such a way that they are securely fastened, firmly supported, protected from vibration and all other injurious conditions that can be expected to occur during their shipment. Components not properly protected in this way may be rejected by the Inspector, removed from the job site, and replaced by the Contractor at his own expense.

7.0 PACKAGING AND DELIVERY OF SPARE PARTS

Protect spare parts for shipment and prolonged storage by coating, wrapping, and crating. Spare parts not suitably prepared and crated may be rejected by the Inspector, removed from the job site, and replaced by the Contractor at its own expense.

All spare parts shall be durably tagged or marked with clear identification showing the designation used on the approved shop drawing. Clearly mark crates for spare parts on the outside to show their contents and displaying the part designations used on the approved shop drawings. Spare parts will not be accepted unless such identification is clearly present.

The Contractor shall deliver all spare parts to a location or locations designated by NCDOT. Final acceptance shall not be granted until all spare parts have been delivered.

8.0 VERIFICATION OF DIMENSIONS

Existing dimensions shown on the Plans are based on the best available information and are intended for guidance only. All existing dimensions and elevations required for the proper manufacture and alignment of machinery and electrical components shall be field verified by the Contractor prior to submission of any shop, assembly or erection drawings and submitted to the Engineer in accordance with the requirements of Section 1.

Measurements made to verify existing dimensions shall be of sufficient accuracy and precision to meet the alignment and fit-up tolerances required elsewhere in the Contract documents. In no case shall the measurement methodology used be capable of achieving an accuracy of less than ± 0.015 -inch.

Measure the maximum clearance between the operating machinery gear shafts and their supporting bearing bushings to an accuracy of ± 0.002 -inches.

9.0 SUBSTITUTIONS

Substitutions for specified equipment or materials are permitted only according to the Standard Specifications and the conditions given in the following paragraphs.

Where a particular product is specified by a manufacturer's name and catalog or part number in these Contract Documents, it is to establish a level of quality and a configuration and arrangement of components. An equivalent product made by another manufacturer may be substituted for the specified product subject to the approval of the Engineer. The proposed substituted product must be shown by the Contractor to comply with the requirements of the Contract Documents and must be shown to be of equivalent quality to the specified product to the satisfaction of the Engineer. All changes required by the substitution to related machinery, structural, and electrical components shall be made by the Contractor at no additional cost to NCDOT.

Where a particular material is specified in these Contract Documents, it is because the design requires a material of certain mechanical and/or chemical properties. An equivalent material may be substituted for the specified material subject to the approval of the Engineer. The proposed material must be shown by the Contractor to comply with the requirements of the Contract Documents and must be shown to possess those mechanical and/or chemical properties required by the application. The Engineer shall evaluate each proposed material substitution request on a case-by-case basis.

Requests for substitutions shall be submitted in writing to the Engineer for review and approval. The Contractor shall obtain approval of a substitution prior to submission of effected shop drawings or manufactured item data in accordance with Section 1. Submittals received showing un-approved changes will be automatically rejected by the Engineer.

10.0 MANUFACTURER'S RECOMMENDATIONS

Installation procedures or any part thereof shall be in accordance with the recommendations of the manufacturer of the component being installed. Submit copies of these recommendations to the Engineer for review prior to the related installation. Installation of the related items shall not be permitted to proceed until these recommendations have been received. Failure to furnish these recommendations may be cause for rejection of the related work.

Any special machining, aligning and installation techniques suggested by the manufacturer's recommendations shall be performed by the Contractor and the cost of such effort shall be included in the lump sum bid price.

11.0 STANDARD PRODUCTS

Materials and equipment provided under this Project shall be essentially the standard catalogued products of manufacturers regularly engaged in production of such materials or equipment and shall be the manufacturer's latest standard design that complies with the requirements of the Contract Documents. Materials and equipment shall essentially duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer. Each major component of equipment shall have the manufacturer's name, address, model and serial number, weight, and ratings on a nameplate securely attached in a conspicuous place. The manufacturer shall select a location for the nameplate such that the nameplate will be readily visible when the unit is in its final installed position. The nameplate of a distributing agent will not be acceptable.

12.0 CASTINGS

A. General

Before any work is started on castings, make arrangements with the manufacturer, the Engineer, and the Inspector for inspections and tests. Notify the Engineer and the Inspector not less than five working days prior to the start of work.

Take all necessary precautions to fabricate the castings true to pattern in form and dimensions, free of pouring faults, cracks, cold shuts, blow holes and other defects.

Clean all castings of loose scale and sand, remove all fins, seams, gates, risers and other irregularities. All unfinished edges of castings shall be neatly cast with rounded corners and all inside angles shall have ample fillets.

Remove all surface defects by rough machining prior to final heat treatment.

B. Required Testing

Additional testing and/or stricter acceptance criteria than that listed in the following paragraphs may be required for critical areas of the castings or castings of critical components. Any such additional testing or stricter acceptance criteria shall be identified on the Plans. In the absence of such identifications, the following shall apply:

1. Visually examine all castings in accordance with ASTM A802. Castings shall meet Level II visual inspection acceptance criteria. Castings that do not meet these criteria may be rejected.
2. Castings that have solid sections 2 inches thick or greater in the as-cast condition and all castings for fracture critical members shall be ultrasonically tested in accordance with ASTM A609 Method A. Castings undergoing this test shall be required to meet Quality Level 2. Castings that do not meet these criteria may be rejected.
3. All casting surfaces shall be magnetic particle tested in accordance with ASTM E125 and shall meet the following acceptable levels of discontinuities:

Type I	Cracks/Hot Tears	1/4-inch maximum
Type II	Shrinkage	Degree 3
Type III	Inclusions	Degree 3
Type IV	Chaplets	Degree 2
Type V	Porosity	Degree 1

Castings that do not meet these criteria may be rejected.

4. Submit the results of all tests to the Engineer and NCDOT for review and approval. No material shall be accepted until they meet the above acceptance criteria.

5. The Contractor may propose repair procedures in order to allow the castings to pass the above acceptance tests. The proposed repair procedures shall be submitted to NCDOT and the Engineer for review and approval as required by the "Submittals" section. All proposed repair procedures shall include details of the areas to be repaired and a means to qualify the repair method. The Contractor must demonstrate to the satisfaction of the Engineer and NCDOT that the proposed repair method will result in a sound and continuous casting, provide equivalent mechanical and chemical properties to the base metal, and is generally sufficient for the anticipated loads and service life. Test welds and additional testing may be required as a condition for approval. Approved repairs shall be performed prior to final heat treatment, so that no weld repairs will be needed after final machining.
6. Castings will be rejected if the above acceptance testing criteria cannot be met and if the Contractor is either unable to repair the casting satisfactorily or if the Contractor is unable to propose an acceptable repair procedure. The Contractor shall replace all rejected castings with castings that meet all the requirements of the Contract Documents at no additional cost to NCDOT.

13.0 FORGINGS

A. General

All carbon and alloy steel forgings shall meet the requirements of the materials standards listed on the Plans.

All forgings shall be reduced in size from a single bloom or ingot until homogeneity has been achieved. The blooms or ingots shall have a cross-sectional area at least three times that of the final forged component. No forging shall be done at less than red heat.

B. Required Testing

Additional testing and/or stricter acceptance criteria than that listed in the following paragraphs may be required for critical areas of the forgings or forgings of critical components. Any such additional testing or stricter acceptance criteria shall be identified on the Plans or in the Special Provisions. In the absence of such identifications, the following shall apply:

1. All finish-machined forging surfaces shall be magnetic particle examined in accordance with ASTM A275. The maximum permissible indication on any surface shall be 1/4-inch. Castings that do not meet this criterion may be rejected.
2. Submit the results of all tests to the Engineer and NCDOT for review and approval. No material shall be accepted until they meet the above acceptance criteria.
3. The Contractor may propose repair procedures in order to allow the forgings to pass the above acceptance tests. The proposed repair procedures shall be submitted to the Engineer for review and approval as required by the "Submittals" section. All

proposed repair procedures shall include details of the areas to be repaired and a means to qualify the repair method. The Contractor must demonstrate to the satisfaction of the Engineer and NCDOT that the proposed repair method will provide equivalent mechanical and chemical properties to the base metal, be sufficient for the anticipated loads and service life, and comply with the Special Provisions. Test welds and additional testing may be called for as a condition for approval. Approved repairs shall be performed prior to final heat treatment, so that no weld repairs will be needed after final machining.

4. Forgings will be rejected if the above acceptance testing criteria cannot be met and if the Contractor is either unable to repair the forging satisfactorily or if the Contractor is unable to propose an acceptable repair procedure. The Contractor shall replace all rejected forgings with forgings that meet all the requirements of the Contract Documents at no additional cost to NCDOT.

14.0 SHAFTING AND PINS

All shafts and pins shall be accurately finished, round, smooth, straight, and when turned to different diameters, shall have rounded fillets at the shoulders. Each shaft or pin having a uniform diameter of 8 inches or more and each shaft or pin having several diameters, the smallest of which is 8 inches or more, shall be bored lengthwise through the center to a diameter approximately one-fifth the smallest body diameter.

All shafts and pins shall conform to the tolerances in ASTM A29 unless otherwise indicated on the Plans or elsewhere in the Special Provisions.

Turned, ground and polished shafting straightness tolerances shall be 0.002 inches per foot for shafts up to and including 1-1/2 inches in diameter and 0.003 inches per foot for shafts over 1-1/2 inches in diameter. Turned, ground and polished commercial shafting of the grade specified shall be used where shown on the Plans.

Cold finished shall be steel of the type and grade shown on the Plans and shall be tested for its mechanical properties. A test certificate shall be submitted to the Engineer and NCDOT for review and approval in accordance with the "Submittals" section. Each cold finished shaft shall be free from camber and shall run without vibration, noise, or chatter at all speeds up to and including at all operating speeds.

Floating shafts shall be as shown on the Plans and shall conform to the straightness and other tolerances on the indicated ASTM standard. Welding shall conform to the "Welding" subsection.

Steps on shafts shall have fillets blended smoothly into adjacent surfaces without tool marks or scratches. Unless otherwise indicated on the Plans or specified elsewhere in the Special Provisions, the shoulder fillet surface shall have a maximum surface roughness of 32 micro-inches.

Each end of all shafts, when finished to the required length, shall have a 60-degree lathe center, with a clearance hole, at the exact center of the shaft. Shafts that have been bored lengthwise through the center shall have each end prepared for the attachment of a centering device equivalent to the lathe center.

In general, in order to achieve the required fits between hubs and bushings and the shafts and pins to which they are mounted, the Contractor shall detail the shaft to be stepped and/or turned down at the ends. In general, this shall be done even where the shaft or pin is shown to be straight on the Plans. Other methods to achieve the required fits and tolerances may be proposed by the Contractor on the shop drawings.

15.0 SHAFT AND PIN JOURNALS

All journal bearing areas on shafts and pins shall be accurately machined and polished, with no trace of tool marks or scratches on the journal surface or adjoining shoulder fillets. Burnishing of the shaft and pin journal areas and adjoining shoulder fillets will be acceptable in lieu of polishing provided that burnishing is done with a Stellite roller or Engineer-approved equal. The surfaces shall be given a mirror finish to a surface roughness of 8 microinches. Journal diameters shall be finished to provide the running fit indicated on the Plans.

16.0 FASTENERS

All bolts for connecting structural components ("structural bolts") shall be 7/8-inch diameter bolts conforming to ASTM A325, unless otherwise shown on the Plans. All structural bolts shall meet the requirements of the Standard Specifications.

All bolts for connecting machinery parts to each other or connecting machinery or electrical components to supporting members shall be as shown on the Plans or specified otherwise and shall conform to one of the following types:

- Hex cap screws
- Turned bolts, turned cap screws, and turned studs
- High-strength turned bolts, turned cap screws, and turned studs
- High-strength bolts
- Hex socket flat countersunk head cap screws
- Hex socket head cap screws

Hex cap screws shall meet all the requirements given in ASTM A449 or A307. Hex cap screws shall be uncoated and have rolled threads. Holes for hex cap screws shall be not more than 0.010-inch larger than the actual body diameter of the individual screws for screws up to and including 1-inch diameter and not more than 0.012-inch larger than the actual body diameter of the individual screws for screws over 1-inch diameter. Use 0.011-inch diameter and 0.013-inch diameter carbon steel wire to verify proper clearances. If the wire can be inserted between the body of the screw and the hole, then the clearance will be considered too great.

Turned bolts and turned cap screws shall meet all the requirements given in ASTM A307 Grade A, except for body diameter dimensions. Turned studs shall meet all the requirements given in ASTM A307 Grade C or ASTM A193 Type 316, except for body diameter dimensions. Turned fasteners shall be uncoated and have rolled threads, unless otherwise noted. All body diameters of turned fasteners shall be 1/16-inch larger than the nominal thread diameter. The nominal thread diameter shall dictate the head and nut dimensions. The bodies of turned bolts, cap screws and studs shall have a fit with their finished bolt holes as indicated on the Plans and in accordance with tolerances given by ANSI B4.1.

High-strength turned bolts, turned cap screws, and turned studs shall meet all the requirements given in ASTM A449 Type 1, except for body diameter dimensions. High-strength turned fasteners shall be uncoated and have rolled threads, unless otherwise noted. All body diameters of turned fasteners shall be 1/16-inch larger than the nominal thread diameter. The nominal thread diameter shall dictate the head and nut dimensions. The bodies of turned bolts, cap screws and studs shall have a fit with their finished bolt holes as indicated on the Plans and in accordance with tolerances given by ANSI B4.1.

High-strength bolts shall meet the requirements for structural bolts as stated above. Use of bolts of this type with mechanical and electrical components shall only be permitted where indicated on the Plans.

Hex socket flat countersunk head cap screws shall meet all the requirements of ASTM F835. Unless otherwise indicated, these fasteners shall be cadmium plated in accordance with ASTM B766 Type II or Type III, have rolled threads with sufficient allowance for the plating process, and be furnished with a self-locking nylon pellet embedded in the threaded section.

Hex socket head cap screws shall meet all the requirements of ASTM A574. Unless otherwise indicated, these fasteners shall be cadmium plated in accordance with ASTM B766 Type II or Type III, have rolled threads with sufficient allowance for the plating process, and be furnished with a self-locking nylon pellet embedded in the threaded section.

All set screws shall be hex socket set screws and shall meet all the requirements of ASTM F912. Set screws shall have a cup point. Set screws shall neither be used to transmit torsion nor as the fastening or stop for any equipment that contributes to the stability or operation of the bridge.

Nuts shall meet the requirements of ASTM A563. Nut grades shall be matched with fastener types as recommended by ASTM A563 Table X1.1. Nuts shall be provided with a zinc coating. Where an additional lubricant is required is required by ASTM A563, supplementary requirement S2 shall also be applied. Unless otherwise indicated on the Contract Drawings, nuts shall conform to heavy hex dimensions. Nuts shall also meet the requirements given in the Standard Specifications.

Nuts used with ASTM A193 Type 316 stainless steel studs shall meet the requirements of ASTM A194 Grade 8M/8MA with supplementary requirement S1.

Plain hardened washers meeting all the requirements of ASTM F436 shall be provided under the heads of all fasteners and under all nuts adjacent to connected components, unless indicated otherwise on the Plans.

Washers used with stainless steel fasteners shall be machined from 3/16" thick, ASTM A240 AISI 316 plate. Washer diameter shall be as required by ASTM F436 for the given fastener size.

Lock washers shall be used where indicated on the Plans. Unless otherwise indicated, lock washers shall be heavy or extra heavy duty helical spring lock washers conforming to ASME B18.21.1. Lock washers shall be either carbon steel conforming to SAE J403 1055-1065 or alloy steel conforming to SAE J404 4037. The lock washer material shall preferably be softer than the nut material.

All cotter pins shall conform to the requirements of ASME B18.8.1, shall be the extended prong square cut type, and shall be made of half-round stainless steel wire conforming to ASTM A276 Type 316.

Anchor bolts connecting machinery parts to masonry shall conform to ASTM A307 Grade C material and shall be hot-dipped galvanized per ASTM A153, unless otherwise indicated. When anchor bolts connect a mechanical component directly to concrete, there must be a filler material in the annular area between the anchor bolt and the bolt hole in the machinery component. The filler material may be a non-shrink grout, babbitt metal, or zinc.

All elements connected by bolts, screws and studs shall be drilled and reamed assembled to assure accurate alignment of the hole and proper hole clearance along the entire length of the fastener.

Wherever possible, fasteners connecting machinery or electrical components to structural elements or to other machinery or electrical components shall be installed such that the head is adjacent to the thinnest element.

Bolt holes through unfinished surfaces shall be spotfaced for the head and nut, square with the axis of the bolt. The spotface surface shall have a 125 micro-inch surface finish.

Holes in shims and fill plates for machinery and electrical components shall be drilled and reamed at final assembly to the same tolerances as those for the machinery and electrical components.

All fasteners shall be of United States manufacture and shall be clearly marked with the fastener grade and manufacturer's mark.

17.0 KEYS AND KEYSEATS

Keys and keyways shall conform to the requirements of ANSI/ASME B17.1 "Keys and Keyseats", except as indicated below and unless otherwise indicated in the Plans. All keys shall be effectively held in place, preferably by setting them into closed-ended keyways

milled into the shaft. The ends of all such keyways and keys shall be rounded to a half circle equal to the width of the key. Keyways shall have their inside corners filleted as per ANSI/ASME B17.1. Keyways shall not extend into any bearing. The fit between keys and keyways shall be Class 2 fit as given by ANSI B17.1.

Unless otherwise specified elsewhere in the Contract Documents, keys shall be machined from alloy steel forgings meeting the requirements of ASTM A668 Class K.

18.0 BEARINGS AND BUSHINGS

A. Sleeve Bearings

All grease-lubricated bronze bushings 8 inches in diameter or less shall have grease grooves cut in a spiral pattern for the full length of the bearing, unless otherwise shown on the Plans or required in the Special Provisions. All grease grooves shall be machine cut, preferably by a CNC machine, and smooth. The corners of all grooves shall be rounded to a radius of not more than half the width of the groove. Unless otherwise shown on the Plans, grease grooves shall be 5/16 inches wide at the bushing surface and have their inside and outside corners filleted to a 1/8 inch radius. All grease groove surfaces shall have the same surface finish as the bushing surface. Grooves for shafts greater than 8 inches in diameter shall be as shown on the plans.

All split sleeve bearings shall have one half fitted into the other half as shown on the Plans. The surface at the interface between the cap and base halves shall be accurately machined. All caps shall be securely bolted to the bases with turned bolts or studs or high-strength turned bolts and studs, as defined in the "Fasteners" subsection, and double nuts, as required in the "Alignment and Bolting" subsection. All caps and bases shall be with double-flanged bronze bushings securely held against changing position under load by hex socket flat countersunk head cap screws, defined in the "Fasteners" subsection, unless otherwise shown on the Plans or via another method proposed by the Contractor and approved by the Engineer. The faces of all hex socket flat countersunk head cap screws shall be recessed from the bushing flange face by at least 1/16 inch.

All bushings shall fit the inside bore and end faces of the base and cap with an ANSI Class LC1 clearance and location fit, unless otherwise shown on the Plans.

Bushings for split sleeve bearings shall be finish-bored with the caps and rolled bronze or brass liners in place. At least half the indicated thickness of the liners shall be of laminated construction. The edges of the liners toward the shaft journal shall be cut to fit shaft shoulder fillets and shall be cut square and 1/32 inch recessed from the outside edges of with the bushing. Except for a short distance from each end, the liners shall be cut back to form a grease groove along the shaft. All bolt holes shall be drilled through the liners to the same tolerance and fit as bolt holes through the cap or base, whichever is more stringent.

Laminated brass liners shall be surface-bonded, laminated brass or bronze shim stock conforming to the requirements of AMS-DTL-22499/2. The laminations shall be peelable by knife for reductions of 0.003 inches in thickness of the laminated stack.

All bearing caps shall be provided with tapped holes for at least one lifting eyebolt. The lifting eyebolts shall be furnished with each bearing.

B. Anti-friction Bearings

Pillow block bearings shall be adapter mounted, self-aligning expansion and non-expansion types as indicated on the Plans. Housings shall be cast steel in accordance with the bearing and pillow block manufacturer's standards. Mounting holes shall be drilled from the solid at assembly with the supporting steel. Final bolt hole tolerances shall conform to those required by the "Fasteners" subsection for hex cap screws. Alternately, the Contractor may detail the support for the bearings to include chocks, in which case the pillow block castings may feature slotted holes. Seals shall retain lubricant and prevent water and debris from entering the interior of the pillow block housing or contaminating the lubricant. Cap bolts on pillow blocks shall be high-strength steel in accordance with the bearing and pillow block manufacturer's standards.

19.0 HUBS AND BORES

The hubs of all gears, wheels, and couplings shall be finished on both faces and polished where the hub face performs the function of a collar to prevent shaft movement. The hubs shall be bored concentric with the rims of gears and wheels or with the outside of couplings. All hubs shall have an ANSI Class FN2 shrink fit on shafts, unless otherwise specified. Assembly shall be accomplished by heating the hub, cooling the shaft and moving the parts to the correct position without force. The use of liquid nitrogen for cooling is prohibited.

20.0 SHIMS

Shims for leveling and alignment of all new mechanical and electrical equipment shall be provided and shall be neatly trimmed to the dimensions of the assembled parts. Shims shall conform to the requirements of ASTM A240 Type 316. Two types of shims shall be used to align and level machinery and electrical components: a tapered shim plate or an adjustable shim stack.

In general, a tapered shim plate shall be used where new machinery or electrical components must be mounted and aligned in the field. The amount of taper shall be determined by field measurements and shall be that required to accurately align the machinery or electrical components to adjacent and/or mating components to the alignment tolerances given elsewhere in the Plans. Tapered shim plates shall be accurately machined such that firm contact is made across the entire contact surface with the mechanical or electrical component and with the structural support. The tapered shim plate shall have a minimum thickness of 1/4-inch, shall have a multidirectional lay top and bottom, and shall have all surfaces

machine-finished to 125 micro-inches. The starting thickness of the tapered shim plates prior to final machining shall be 1-inch, unless otherwise indicated.

After the proper taper has been machined and proper alignment of the components has been verified, bolt holes shall be drilled and reamed in the field to the same fit as the other connected components.

In general, an adjustable shim stack shall be used where new machinery or electrical components are to be shop aligned and shipped to the job site as an assembly. The thickness of the adjustable shim stack provided shall be double the nominal thickness indicated on the Plans. Where no nominal thickness is indicated on the Plans, the Contractor shall determine the nominal thickness required, which shall be the distance between the bottom of the machinery or electrical component mounting surface to the top mounting surface of the support. Where the nominal thickness required is determined by the Contractor, the thickness of the adjustable shim stack provided shall be double that thickness. The adjustable shim stack shall be comprised of plies of varying thickness. The thinnest ply shall be a maximum of 1/64-inch. Thinner plies may be required where finer adjustment is needed. Thinner plies shall be provided as needed at no additional cost. The maximum thickness of any ply shall be 1/2-inch.

After the adjustable shim stack thickness has been adjusted and the proper alignment of the components has been verified, bolt holes shall be drilled and reamed to the same fit as the other connected components.

Shims shall be shown fully dimensioned and detailed on the shop drawings. The final taper need not be shown, as that can only be determined after final alignment.

Shims with open side or U-shaped holes for bolts will not be permitted. No shims shall have less than two holes for bolts.

The use of stainless steel peelable laminated shims with solder or resin bonding may be permitted for use as an adjustable shim stack.

Plastic or other non-metallic shims will not be permitted.

21.0 LUBRICATION MATERIALS

A. Lubricants

Coordinate all lubricants to be used for the bridge machinery with NCDOT maintenance forces and the requirements and recommendations of component manufacturers. Submit lubricant information to the Engineer for review and approval as required by the "Submittals" subsection.

Lubricant materials shall comply with all applicable environmental rules, regulations and ordinances as required herein.

B. Lubrication Piping & Fittings

Lubrication piping shall be as shown on the Plans. Threads shall be NPT (National Pipe Threads) and shall meet the requirements of ASME B1.20.1. Fittings shall be forged stainless steel threaded pipe fittings as shown on the Plans. Fittings shall meet ASME B16.11 and ASTM A105. Bearing housings and manifolds shall be equipped with 1/4-inch NPT internal and 1/2-inch NPT external adapter fittings. No single pipe shall have more than 180 degrees of bends.

C. Lubrication Flexible Hose

Flexible hose between rigid piping and bearing housings shall be as shown on the Plans. Hose shall be equipped with 1/4-inch NPT, AISI 316 stainless steel fittings at each end, one swivel end, male fitting for the bearing end, and one female fitting for the pipe end.

D. Lubrication Piping Supports

Supports for rigid piping shall be as shown on the Plans. The Contractor shall be responsible for determining the actual pipe routing. The Contractor shall submit details of his or her proposed pipe routing to the Engineer for review and approval prior to ordering materials. Proposed pipe routing shall be coordinated with that proposed for conduit runs and conduit supports.

22.0 PAINT MATERIALS

A. General

Electrical components such as brake assemblies (except for brake wheel contact surfaces), driving motors and other components identified in the electrical Special Provisions shall be painted using paint materials meeting the following requirements for machinery paint.

B. Cleaning

All machinery and electrical component surfaces to be painted, as well as debris laden areas of the counterweight struts, shall be cleaned as per SSPC-SP1 "Solvent Cleaning". Refer to the "Painting Machinery" subsection, Part 3. All waste materials generated by this process shall be disposed of assuming they meet the conditions required to be classified as hazardous materials.

C. Primer

Primer for painting machinery shall be a zinc-chromate primer suitable for use in severe industrial and marine environments, shall be fully compatible with the machinery enamel, and shall comply with all applicable requirements of the Standard Specifications. The enamel shall not contain lead and shall comply with all applicable environmental rules, regulations and ordinances.

D. Machinery Enamel

Enamel for painting machinery shall be a high-gloss oil-resistant paint for external use, resistant to weathering and abrasion, and shall comply with all applicable requirements of the Standard Specifications. The enamel shall not contain lead and shall comply with all applicable environmental rules, regulations and ordinances.

23.0 COATINGS

Unless otherwise indicated in the Plans, coat the threads of all hex cap screws; turned bolts, turned cap screws, and turned studs; high-strength turned bolts, turned cap screws, and turned studs; and anchor bolts with anti-seize compound before assembly with nuts to prevent corrosion or galling and to facilitate future removal.

Coat threads of hex cap screws; turned bolts, turned cap screws, and turned studs; and high-strength turned bolts, turned cap screws, and turned studs; hex socket flat countersunk head cap screws; and hex socket head cap screws mating inserted into tapped holes with thread-locking compound. The thread-locking compound shall be resistant to corrosion and loosening under vibration.

Coat all machined surfaces and unpainted metal surfaces that may be subject to corrosion with corrosion-inhibiting preservative for temporary protection during shipment and storage. The coating will protect coated surfaces from corrosion when subjected to prolonged exposure to an outdoor, marine environment and shall be removable by a means that will not mar machined surfaces in any way.

Coatings shall comply with all applicable environmental rules, regulations and ordinances.

Submit all information on coating required by the "Submittals" section.

24.0 OPERATING MACHINERY REPLACEMENT/REHABILITATION

A. Replacement of Existing Engine

The existing gasoline engine shall be replaced with a new electric motor, enclosed motor reducer, thrustor brake, brake shaft and spherical roller bearings as shown on Sheet No. M-02 and M-03.

The components shall be shop mounted and aligned on a common bedplate. Field alignment shall be accomplished using leveling nuts at four locations near the corners of the bedplate. The bedplate shall be suitably stiffened for shipment and field installation such that the alignment of the components is not altered in any way during shipment, storage and installation. The bedplate shall be shipped, stored and installed with the motor reducer coupling disconnected. Alignment of the components mounted on the bedplate shall be re-checked during field alignment and adjustment.

The new motor reducer output shaft shall be shop aligned with the new brake shaft such that they are either parallel to within 1/16 of a degree of one another, or parallel to within the coupling manufacturer's recommended installation angular offset, whichever is stricter. These two shafts shall also simultaneously be shop aligned such that they have a parallel offset of no more than 0.008-inches from each other, or a parallel offset within the coupling manufacturer's recommended installation parallel offset, whichever is stricter.

The work shall include removing and properly disposing of the existing engine, reversing clutch, manual drive equipment, and supporting members encased in the existing concrete floor of the machinery house. Removal of concrete from the existing floor as shown on Sheets M-02 and M-03 shall be considered as incidental and paid for under other items.

Anchors for the new bedplate shall be 1-inch diameter anchors, meeting the requirements of ASTM F1554, hot dip galvanized. Anchors shall be installed using a template to a minimum embedment in existing concrete of 12-inches.

The new brake shaft shall be field aligned such that it is either parallel to within 0.05-degrees of the existing main reducer input shaft, or parallel to within the coupling manufacturer's recommended installation angular offset, whichever is more strict. The new brake shaft shall simultaneously be field aligned such that it either has a parallel offset of no more than 0.10-inches from the existing main reducer input shaft, or an offset, whichever is stricter.

The shoes of the new brake shall be aligned in axial, parallel and angular offset to the new brakewheel to within the brake manufacturer's recommended tolerances for initial installation settings.

The "maximum operating" alignment of couplings or brake shall not be considered an appropriate target for initial field alignment purposes, as this tolerance is intended to account for future wear of components and their slight movement during operation.

B. Main Gear Reducer Servicing

The existing main gear reducer shall be drained of its oil and its interior inspected using a flexible borescope cable of taking and recording digital images. The Contractor's inspection shall record images of the internal gear teeth, gear wheel castings, shafts, keyways, housing interior and bearings. The inspection shall be done in the presence of the Engineer. Electronic files containing images recorded during the inspection shall be submitted to the Engineer and NCDOT. The purpose of the inspection shall be to determine if any internal components require replacement. Replacement of internal components, other than lubricating oil and bearing seals, shall be Extra Work.

The main gear reducer shall be completely flushed with mineral spirits iteratively as needed until as much old grease, sludge and debris as practical have been removed from

the interior of the reducer housing and its integral sleeve bearings. This flushing shall be performed immediately after all structural painting is completed and prior to the first operation of the bridge after the completion of structural bridge painting.

Any internal bearing seals shall be removed and replaced.

If the bearings are intended to be grease lubricated, they shall be re-lubricated with NLGI Extreme Pressure Grade 2 grease compatible with that currently used by NCDOT forces maintaining the bridge and compatible with the gear oil to be used. The grease shall have molybdenum disulfide (3% minimum) additives, EP additives, and rust and oxidation inhibitors.

Replace the oil bath to a level as directed by the Engineer. New oil shall be a long term, extreme pressure, AGMA No. 5 lubricating gear oil with additives for demulsibility; rust, corrosion and oxidation protection; and anti-foaming.

Replace existing breather with a new, hygroscopic breather with a color-changing desiccant.

C. South Secondary Open Gearset Bearing Anchor Replacement

Locate existing anchors to an accuracy of $\pm 1/16$ -inches to a fixed base point. Submit field measurements to the Engineer for review and approval.

Remove existing anchors by drilling.

Adjust position of the existing bearing assembly such that:

1. The existing secondary open gearset pinion is axially centered with the larger, driven gear to within $1/16$ -inch.
2. The cross mesh between the driving pinion and driven gear of the secondary open gearset is within 0.020-inches per 6 inches of face width.
3. The gear root – pinion tip clearance matches the average of that of the north secondary open gearset to within ± 0.015 -inches.
4. At least 50% of the center of the gear and pinion tooth faces shall be in contact on both the opening and closing faces.
5. The angular offset of the secondary pinion shaft to the output shaft of the main gear reducer is no more than 1.0-degree.
6. The parallel offset of the secondary pinion shaft to the output shaft of the main gear reducer is no more than 0.120-inches.

These measurements shall be taken by a qualified millwright or mechanical engineer licensed in the State of North Carolina and submitted to the Engineer for review and approval. Gear tooth face contact shall be measured using bluing or other Engineer-approved method. The Contractor shall submit a detailed procedure for measuring the face contact, as well as the other required measurements, to the Engineer for review and approval.

Provide shims meeting the requirements of subsection 20 as needed to achieve these tolerances.

Once alignment has been verified and approved by the Engineer, install new galvanized anchors conforming to the requirements provided on Sheet M-01. The nominal diameter of the new anchors shall match the existing. Fill the annular space between the anchor and the existing anchor holes with non-shrink grout.

D. Existing Coupling Servicing

The existing main reducer output shaft couplings shall be partially disassembled flushed with mineral spirits, have their seals replaced, have their flange bolts replaced, and re-lubricated.

The couplings shall be completely flushed with mineral spirits iteratively as needed until as much old grease, sludge and debris as practical have been removed from their interior. Preferably, this flushing shall be performed after all structural painting is completed.

Remove the existing flange bolts and replace with new bolts as recommended by the original coupling manufacturer, Emerson Power Transmission (Kop-flex type couplings). The Contractor shall submit correspondence to the Engineer for review and approval. The correspondence shall indicate the type and size of bolt and nut and the recommended tightening procedure to be used in the field.

Remove the existing seals and replace with new seals as recommended by the original coupling manufacturer, Emerson Power Transmission (Kop-flex type couplings). The Contractor shall submit correspondence to the Engineer for review and approval.

Re-lubricate the couplings with long term coupling grease of a type and grade recommended by the manufacturer for the service in a marine environment with ambient temperatures ranging from -20°F to 160°F.

E. Replace Gear Covers

Replace existing gear covers with new covers as shown on Sheet M-09.

The dimensions and details shown on M-09 are based on existing as-built drawings. The Contractor shall field verify the details and dimensions to ensure proper fit-up with existing structural steel members and adequate clearances with all moving parts. If modifications to the gear cover details or dimensions shown on Sheet M-09 are deemed

necessary or desirable by the Contractor, the Contractor shall submit the proposed changes to the Engineer in accordance with Section 1 and subsection 5.

F. Floating Shaft Replacement

Replace the existing floating shaft as shown on Sheet M-02 and M-03.

Remove and discard the existing brakes mounted on the north and south sides of the existing main reducer. Remove the existing brakewheel coupling and coupling shaft key from the north input shaft to the existing main reducer.

Prepare the existing main reducer input shaft for installation of the new floating shaft coupling half using solvent, emery cloth, or other Engineer-approved means. Fill the existing keyway with an Engineer-approved liquid epoxy shim compound and hand finish to match the rest of the prepared shaft. The preparation shall meet the requirements and recommendations of the taper-lock bushing manufacturer's to the fullest extent practical.

Field install the new flexible coupling half on the prepared, existing main reducer input shaft.

Prior to installation of the new operating machinery bedplate, place the new floating shaft through the existing machinery house and through the existing holes through the A-frame lower tension members. Field install rigid coupling halves on both ends of the new floating shaft.

After new operating machinery bedplate is installed, attach the ends of the new floating shaft to the flexible coupling halves previously installed to the main reducer input shaft and the end of the new brake shaft. Any length difference shall be removed using the 1-inch shim pack shown on Sheets M-02 and M-03. This shim pack shall meet the requirements of subsection 20.

G. Electrical Instrumentation

Provide mounting brackets and install, align, adjust and paint brackets for new proximity switches as shown on Sheet M-05.

Providing, installing, wiring and adjusting proximity switches shall be paid for under other items.

H. Replacement of Corroded Fasteners

As directed by the Engineer, replace existing corroded fasteners with new ASTM A449 high strength turned fastener assemblies.

For bidding purposes, assume 75% of all sleeve bearing cap bolt/stud assemblies and half of all main pinion shaft bearing mounting bolt assemblies require replacement.

No more than one fastener assembly shall be removed and replaced at any one time from any bearing assembly.

I. Bearing Liner Adjustment

Based on the submitted bearing liner clearance measurements, remove bearing liner ply's as directed by the Engineer so as to achieve between an ANSI RC6 and RC9 clearance between the existing gear shaft journal surfaces and the existing bearing bushings. Reconnect turned bearing cap studs and bolts as per the "Alignment and Bolting" subsection.

After adjustment, repeat clearance measurements to an accuracy of ± 0.002 -inches and submit the results to the Engineer for review and approval.

25.0 TAIL LOCK MACHINERY PARTIAL REPLACEMENT

Retain the existing tail lock bars, guides and sockets and remove the levers and associated pins and brackets used currently to manually actuate the lock bars. Provide, install, align, adjust, paint and test new electro-mechanical linear actuator based system of operation as shown on Sheet M-04.

Install two actuators as shown on the Plans and provide two actuators as spares.

The new linear actuator shall be as shown on the Plans, with the following special features and options:

- Marine duty epoxy paint
- Washdown duty motor
- Heavy duty seals
- End of travel protection
- Thrust overload protection

26.0 NEW TOE LOCK MACHINERY

Provide, install, align, adjust, paint and test new toe lock machinery, guides, sockets and related supports as shown on Sheets M-06.

Install one actuator as shown on the Plans and provide two actuators as spares.

The new linear actuator shall be as shown on the Plans, with the following special features and options:

- Marine duty epoxy paint
- Washdown duty motor
- Heavy duty seals
- End of travel protection
- Thrust overload protection

The Contractor shall provide a hinged, lockable cover for the toe lock machinery fabricated from 14 gauge ASTM A240 Type 316 stainless steel.

The toe lock bar shall be aligned with the receiving socket on the rest pier such that, with the bascule span in its fully seated position:

- The angular offset between the lock bar and the receiving socket bore shall be no more than ½-degree
- The parallel offset between the lock bar and the socket bore shall be no more than 1/16-inch

Final alignment of the toe lock machinery shall not take place until all work related to the bridge bearings, live load shoes, structural repairs, deck replacement, and balance have been completed and accepted.

27.0 MAIN TRUNNION BEARING REHABILITATION

Replace main trunnion bearing cap stud assemblies and provide new cap stud springs as shown on Sheet M-07.

At field assembly coat the threads of the special square nuts with Engineer-approved anaerobic thread locking compound and peen over the threads sticking out from the square nuts.

Clean out grease passages and grooves and relubricate as per by subsection 28.

Modify existing bearing end covers as needed to accept new lubrication hardware as shown as required under subsection 29.

The Contractor may substitute an alternate material to partially fill the central bore through the main trunnion shafts subject to the approval of the Engineer. Any substitute material must have stable mechanical properties between -20°F and 160°F, be able to flex sufficiently to conform to live load and wind induced deflections of the trunnion shafts, shall not shift axially within the bore once installed, and be chemically compatible with the lubricating grease.

28.0 TRUNNION/LINK PIN BEARING CLEANING

The Contractor shall clean out all grease passages and grease grooves of the existing main trunnion bearings, counterweight trunnion bearings and counterweight link arm bearings during an outage.

The Contractor shall develop and submit a proposed procedure to dispose of all water, old grease and debris generated as part of the external bearing cleaning and internal bearing purging operations. This procedure shall be submitted to the Engineer for review and approval. The approval criteria shall be compliance with all applicable laws, rules and ordinances.

Existing lubrication hose serving the bearings shall be removed and discarded.

The Contractor shall pump steam or hot water through the existing grease passages to remove all old grease and debris buildup within the passages. The passages shall be cleaned to bare metal. The Contractor shall verify the cleaned condition of the grease passages to the Engineer using a borescope appropriately sized for this purpose. The Contractor is alerted to the fact this may be an iterative process.

The internal grease purging operation shall incorporate a means to collect all water and waste grease and debris for subsequent disposal.

Following acceptance by the Engineer, fittings and hoses shall be replaced as required by subsection 28.

After the condition of the cleaned grease passages and grooves has been approved by the Engineer, the Contractor shall re-pack all bearings with new lubricant. New lubricant shall be NLGI Extreme Pressure Grade 2 grease compatible with that currently used by NCDOT forces maintaining the bridge and compatible with the gear oil to be used. The grease shall have molybdenum disulfide (3% minimum) additives, EP additives, and rust and oxidation inhibitors. Lubrication of individual bearings and grease ports shall be complete when new lubricant just begins to exit the bearings.

29.0 NEW LUBRICATION PIPING AND FITTINGS

Existing lubrication piping, supports and manifolds shall be removed and discarded. New lubrication piping, hoses, supports and fittings shall be as shown on Sheet M-08 and as required by subsection 21. In addition, all existing bearings and couplings shall have their lubrication fittings replaced with fittings meeting the same requirements as those indicated on Sheet M-08 and in subsection 21. Existing and new gear couplings shall be provided with one grease fitting and one plug on each of their flex half hubs.

30.0 BUMPER ADJUSTMENT AND GIRDER RUBBING PLATE REPLACEMENT

The Contractor shall field bore the open lock tongue to a minimum diameter of 7 inches parallel to the Tail Lock bar. The maximum the tongue can be bored to will provide a minimum edge distance of $1 \frac{3}{4}$ inch (approximately $7 \frac{1}{2}$ inch diameter bore). The diameter of the open lock tongue shall provide consistent and reliable tail lock operation. The tail lock shall consistently and reliably drive into open lock tongue for a temperature range of 20°F to 100°F.

The existing bumpers located within the existing cutouts in the bascule pier for the tail of the bascule girder when the bascule span is in the raised position shall be adjusted and/or shimmed as needed such that when the bascule span is in its fully raised position:

- A. Each girder of the bascule bridge is in firm, solid contact with its respective bumper;
- B. Each tail lock drives consistently and reliably in all weather conditions and in temperatures ranging from 20°F to 100°F;
- C. The Fully Open switch provides consistent, reliable, and constant indication of the bascule bridge being in its fully raised position

Adjustment of the bumpers shall be coordinated closely with tail lock and control system instrumentation work items to meet these conditions simultaneously.

The curved rubbing plates fixed to the inside faces of the A-frame tower rear legs shall be replaced in-kind with new plates conforming to ASTM A36 or ASTM A709 Grade 36 or Grade 50. The existing rubbing plates shall be used as templates for cutting, shaping and drilling of the new plates. New plates shall be match marked to their locations on the A-frame towers. Existing welds shall be ground flush to the gusset plates. Faying surfaces shall be cleaned and primed. The new rubbing plates attached using a ¼-inch continuous fillet field welds conforming to the "Welding" subsection, except that the welds need not be ultrasonically tested. At all locations where the new plates have drilled holes to fit around rivets, the hole edges shall either be welded to the rivet heads or the holes filled flush to the top edge of the plate with an Engineer-approved marine grade epoxy resin.

31.0 WELDING

Welding required for machinery shall be done in accordance with the requirements and recommendations for welding structural steel given by AWS D1.5, except as otherwise indicated on the Plans. Stress relieving shall be required only where specified elsewhere in the Special Provisions or on the Plans. Completely test all welds used to fabricate machinery by ultrasonic inspection using the methods given by ASTM E164, according to AWS D1.5 for compression members, unless noted otherwise.

Perform all machining after welding and any stress relieving.

Submit all weld procedures and welding qualifications prior to the start of work as per Section 1.

Distortion during fabrication shall be kept to a minimum through the use of welding fixtures and proper welding procedures.

32.0 LUBRICATION

Phenolic nameplates with number or other designations matching those shown on the submitted lubrication information (refer to the "Submittals" subsection and in the Operation and Maintenance Manual requirements) shall be provided and mounted at each lubrication point on both manifolds. Characters on the nameplates shall be readily visible. Attach phenolic nameplates in a permanent manner that will not degrade over time; use of stainless steel fasteners is preferred. Alternate means of identifying manifold lubrication points may be proposed by the Contractor for review and approval by the Engineer.

The Contractor shall provide sufficient amounts of each lubricant for 24 months worth of regular maintenance. These amounts shall be in addition to the lubricant amounts required for initial lubrication and any lubrication required during the work. The lubricant shall be stored in clearly marked, corrosion resistant containers and shall be placed in locations to be indicated by NCDOT maintenance forces. Storage shall be in such a way as to prevent contamination of the lubricants.

Immediately after fabrication, plug all threaded holes for fittings until components are installed and regular lubrication is ready to be started. When regular lubrication is ready to be started, remove plugs and install all specified grease piping, hose, and fittings.

The Contractor shall lubricate all machinery components and motor bearings with their approved lubricants in accordance with the approved procedures based on manufacturers' recommendations and as indicated in the Operation and Maintenance Manuals.

33.0 ALIGNMENT AND BOLTING

Provide double nuts where indicated on the Plans.

Where double nuts are used to secure a fastener assembly, the first nut shall be torqued to between 150 ft-lbs and 200 ft-lbs. The second nut shall be fastened ¼ turn past snug tight to the first nut.

Impact wrenches shall not be used to tighten any fastener assemblies used in connection with machinery or electrical components. The method of torquing fasteners as well as required torque levels and a method of qualification of the connections shall be submitted as part of any submitted erection and alignment procedures.

High-strength fasteners shall be torqued to the same requirements as for ASTM A325 high-strength fasteners. High-strength fasteners greater than 1-1/2 inches in diameter shall be torqued to a value equal to 0.2 multiplied by the nominal bolt diameter and the proof load (length of measurement method).

Torques for other classes of bolt shall be proportioned to their strength and shall be indicated on the erection drawings.

34.0 PAINTING MACHINERY

1. General

Cleaning and painting of unfinished surfaces of machinery and electrical components shall comply with all the applicable requirements of the Standard Specifications.

Colors for painting machinery shall be as per ANSI/OSHA.

2. Shop Painting

Prior to painting, clean all unfinished surfaces of machinery with a final surface preparation by blast cleaning, meeting the requirements of SSPC-SP6 "Commercial Blast Cleaning," with the following exceptions:

- Sleeve bearing with bushings in place
- Pillow blocks or housings with anti-friction bearings in place

- Shaft journal surfaces
- Any machined surfaces with a specified level of surface finish that would be damaged by the blast cleaning process
- Motors
- Brakes
- Pumps
- Any equipment excepted by the Engineer or the Inspector

Excepted components shall be cleaned with solvent and hand tools to meet the requirements of SSPC-SP2 “Hand Tool Cleaning” and meeting the visual depiction given in SSPC Vis. 1.

All excepted components shall be completely protected from any blast cleaning. Excepted components damaged by adjacent blast cleaning shall be replaced or repaired, at the option of NCDOT, at no additional cost.

After the specified surface preparation, give all unfinished surfaces two shop coats of Engineer-approved primer by hand brushing. Application of the primer shall adhere to all applicable rules, regulations and ordinances, and shall be in done in accordance with the manufacturer’s recommendations and requirements.

3. Field Painting

After erection is complete, thoroughly clean all new machinery surfaces remaining exposed and surface areas of existing components identified by the Inspector or Engineer, including paint defects and voids, and except rubbing surfaces, with an Engineer-approved high-flash solvent to meet the requirements of SSPC-SP1 “Solvent Cleaning,” and apply two coats of Engineer-approved primer by hand brushing. Application of the primer shall adhere to all applicable rules, regulations and ordinances, and shall be in done in accordance with the manufacturer’s recommendations and requirements.

After the primer coats have been applied, give all machinery surfaces, except those listed in the following paragraph, two coats of Engineer-approved machinery enamel by hand brushing. Application of the machinery enamel shall adhere to all applicable rules, regulations and ordinances, and shall be in done in accordance with the manufacturer’s recommendations and requirements.

Machinery surfaces that are not to be painted shall include surfaces which shall be in normal rubbing contact, nameplates, legend plates, escutcheons, and lubrication fittings. The Contractor shall take all necessary precautions to ensure lubrication fittings remain clog-free. Excepted machinery surfaces damaged, obscured or clogged by painting operations shall be replaced or repaired, at the option of NCDOT, at no additional cost.

After completion of the Field Testing and the results have been approved by the Engineer, all accumulated oil, grease, dirt, debris, and any other contaminants shall be cleaned from exposed machinery surfaces, except rubbing surfaces, with an Engineer-approved high-flash solvent to meet the requirements of SSPC-SP1 “Solvent Cleaning”.

The cleaned exposed surfaces, except those surface indicated in the previous paragraph, shall then be given a third and final coat of Engineer-approved machinery enamel by hand brushing. Application of the machinery enamel shall adhere to all applicable rules, regulations and ordinances, and shall be in done in accordance with the manufacturer's recommendations and requirements.

35.0 PAINTING MACHINERY SUPPORTS

Paint structural steel support components in accordance with the Cleaning and Re-Painting of Bridge No. 110 provision.

36.0 INSPECTION AND TESTING

Provide no less than ten working days notice to NCDOT and the Engineer of the beginning of work at foundries, forges, and machine shops so that inspection may be arranged. No work shall be done prior to the work start date indicated.

Furnish all facilities for the inspection of material and workmanship in foundries, forges and machine shops. NCDOT and/or its representatives shall be allowed free access to necessary areas of the premises. Work done while NCDOT or its representatives have been refused access or presented in a manner that prevents adequate inspection will be rejected. No work shall be performed without the knowledge of NCDOT or the Engineer. Work performed without the knowledge of NCDOT or the Engineer will be rejected. NCDOT shall have the authority to reject materials and workmanship that do not fulfill the requirements of the Contract Documents or approved submittals. Rejected work will be re-done and rejected items will be replaced by the Contractor at no additional cost with work and/or material in full compliance with the Contract Documents.

Inspection at foundries, forges, and machine shops is intended as a means of facilitating the work and shall not relieve the Contractor of responsibility to provide effective quality assurance and quality control services.

The Contractor shall furnish all test specimens, testing machines, tools, equipment, and labor required to conduct the physical and chemical tests required by the Contract Documents and the standards referenced therein. Submit copies of all test reports and chemical analyses for review and approval as required by Section 1 of the Special Provisions.

36.0 SHOP ASSEMBLY

NCDOT and/or its representatives will make visual inspection of shop assembled components and will witness shop tests. The Contractor shall correct any malfunctions and retest until all assemblies pass all shop tests before they are released from the manufacturer's shop and shipped to the job site. Correction of malfunctions and retesting shall be done by the Contractor at no additional cost. Delays caused by correction of malfunctions and retesting shall not be the basis for any claim for additional compensation or additional time to meet contract milestones by the Contractor.

The Contractor shall thoroughly review the requirements and acceptance criteria for shop tests and shop assembly work prior to the submission of test procedures. Any objections to the requirements must be submitted for review prior to submission of test procedures. Objections raised after the test has been performed will not be the basis for any claim for additional compensation by the Contractor.

The Contractor shall perform all shop tests and connect all assemblies, including:

- The operating machinery bedplate assembly
- The toe lock machinery assembly

The results of all shop tests and measurements associated with all shop assembly work shall be submitted to the Engineer for review and approval as required by the "Submittals" subsection.

37.0 REQUIRED SHOP ASSEMBLY MEASUREMENTS

A. Operating Machinery Bedplate Assembly

The Contractor shall measure the motor reducer output shaft coupling axial clearance and angular and parallel offset alignments and the spherical roller bearing angular and parallel offset alignments.

B. Toe Lock Machinery Assembly

The Contractor shall measure the angular and parallel offsets of the lock bar guide bushings and the linear actuator.

38.0 REQUIRED SHOP TESTS

A. Operating Machinery Bedplate Assembly

The Contractor shall spin test at no load the assembly using the intended motor and motor reducer for 30 minutes in each direction. The assembly shall operate free of binding and interferences and shall not exhibit any unusual noises, vibrations or temperature changes. The temperature shall not exceed the recommended operating limit of any lubricant used for this assembly.

B. Toe Lock Machinery Assembly

The Contractor shall cycle the assembly at no load the assembly using the intended motor and motor reducer 30 times in each direction in immediate succession. The assembly shall operate free of binding and interferences and shall not exhibit any unusual noises, vibrations or temperature changes. The temperature shall not exceed the recommended operating limit of any lubricant used for this assembly.

C. Tail Lock Machinery

The Contractor shall cycle at no load the linear actuator using the intended motor and motor reducer 30 times in each in immediate succession. The assembly shall operate free of binding and interferences and shall not exhibit any unusual noises, vibrations or temperature changes. The temperature shall not exceed the recommended operating limit of any lubricant used within the actuator.

39.0 FIELD TESTING

After the machinery installation has been approved to proceed with Field Testing, the Contractor shall arrange a test schedule with the Engineer, NCDOT and its representatives and shall submit a field testing procedure to the Engineer and NCDOT in accordance with the "Submittals" subsection.

During testing, all machinery components shall be inspected to verify they are in proper working order and operating in conformance with the requirements of the Contract Documents. The Contractor shall not exceed the design rating of any component during field testing or at any other time during the Project.

If any tests indicate that components are not operating properly or in full conformance with the Contract Documents, the Contractor shall make all corrections or adjustments necessary to bring the components into full conformance and achieve proper operation. Such corrections and adjustments shall be made at no additional cost. The Contractor shall keep a full crew of qualified millwrights, mechanics and electricians on the job site at all times during Field Testing to make any such corrections and adjustments as may be required.

Components damaged during testing or at any other time during the Project, due to improper operational control, insufficient safety precautions, or negligence on the part of the Contractor, or any deficiency not identified during the Contractor's Inspection, shall be repaired or replaced, at the option of NCDOT, with components in full conformance with the Contract Documents at no additional cost.

Field tests shall be repeated until the machinery is in full compliance with the Contract Documents. Delays caused by retesting shall not be the basis for any claim for additional compensation by the Contractor.

Field Testing will be considered successfully completed when all machinery components are verified to operate as required.

40.0 REQUIRED FIELD TESTS

A. Operating Machinery Bedplate Assembly

The Contractor shall test operate the bascule bridge through a minimum of 10 consecutive opening and closing cycles. During this time, each machinery component shall be checked visually and aurally for any unexpected noises, vibrations or

interferences. Field Testing of this assembly shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

B. Toe Lock Machinery Assembly

The Toe Lock Machinery Assembly shall be operated through 10 consecutive opening and closing cycles, in conjunction with the testing for the Operating Machinery Bedplate Assembly. During this time, each component shall be checked visually and aurally for any unexpected noises, vibrations or interferences. Field Testing of the assembly shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

C. Tail Lock Machinery

The Tail Lock Machinery shall be operated through 10 consecutive opening and closing cycles, in conjunction with the testing for the Operating Machinery Bedplate Assembly. During this time, each component shall be checked visually and aurally for any unexpected noises, vibrations or interferences. Field Testing of the assemblies shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

D. Gear Covers

In conjunction with testing for the Operating Machinery Bedplate Assembly, the Gear Covers shall be observed through 5 consecutive opening and closing cycles. During this time, the covers shall be checked visually and aurally for any unexpected noises, vibrations or interferences. Field Testing of the gear covers shall be successfully passed when the 5 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

E. Bearing Anchor Replacement

In conjunction with testing for the Operating Machinery Bedplate Assembly, the south secondary open gearset outboard bearing shall be observed through 10 consecutive opening and closing cycles. During this time, the bearing and the main reducer south output shaft coupling shall be checked visually and aurally for any unexpected

movements, shifting, noises, vibrations or interferences. In addition for 5 of the 10 consecutive test operations, the Gear Covers shall be removed and the secondary open gearset shall be checked visually and aurally for any unexpected noises, vibrations or interferences. Field Testing of the Bearing Anchor Replacement shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

F. Miscellaneous Bearing Bolt/Stud Replacement

In conjunction with testing for the Operating Machinery Bedplate Assembly, the replaced bearing cap and anchor bolts and studs shall be observed through 10 consecutive opening and closing cycles. During this time, the bolt and stud assemblies shall be checked visually and aurally for any unexpected movements, shifting, noises, vibrations or interferences. Field Testing of the Bearing Bolt/Stud Replacement shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

G. Existing Couplings

In conjunction with testing for the Operating Machinery Bedplate Assembly, the rehabilitated main reducer output shaft couplings shall be observed through 10 consecutive opening and closing cycles. During this time, the couplings shall be checked visually and aurally for any unexpected movements, shifting, noises, leaks, vibrations or interferences. Field Testing of the Existing Coupling Rehabilitation shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

H. Main Reducer

In conjunction with testing for the Operating Machinery Bedplate Assembly, the rehabilitated main reducer shall be observed through 10 consecutive opening and closing cycles. During this time, the reducer shall be checked visually and aurally for any unexpected movements, shifting, noises, leaks, vibrations or interferences. Field Testing of the Existing Main Reducer Rehabilitation shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

I. Floating Shaft

In conjunction with testing for the Operating Machinery Bedplate Assembly, the new floating shaft assembly shall be observed through 10 consecutive opening and closing cycles. During this time, the shaft and couplings shall be checked visually and aurally for any unexpected movements, shifting, noises, leaks, vibrations or interferences. Field Testing of the Floating Shaft shall be successfully passed when the 10 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

J. Main Trunnion Bearings

In conjunction with testing for the Operating Machinery Bedplate Assembly, the main trunnion bearings shall be observed through at least 5 consecutive opening and closing cycles. During this time, the bearing assemblies shall be checked visually and aurally for any unexpected movements, shifting, noises, leaks, vibrations or interferences. In addition, the bearing assemblies shall be observed as an engine or other rail vehicle of the revised structural rating of the bridge passes over the bridge at 15 mph 6 consecutive times. The Contractor shall assume the cost for providing and operating the engine or other rail vehicle as part of his lump sum bid for "Bridge Mechanical Work". During this time, the bearing assemblies shall again be checked visually and aurally for any unexpected movements, shifting, noises, leaks, vibrations or interferences. Field Testing of the Main Trunnion Bearings shall be successfully passed when the 5 consecutive opening and closing cycles are completed and the 6 passages of an engine or rail vehicle across the bridge with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

K. Counterweight Trunnion and Counterweight Link Arm Bearings

In conjunction with testing for the Operating Machinery Bedplate Assembly, the counterweight trunnion and counterweight link arm bearings shall be observed through at least 5 consecutive opening and closing cycles. During this time, the bearing assemblies shall be checked visually and aurally for any unexpected movements, shifting, noises, leaks, vibrations or interferences. Field Testing of the Main Trunnion Bearings shall be successfully passed when the 5 consecutive opening and closing cycles are completed with no deficiencies observed. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

L. Lubrication Piping

The entire length of the new lubrication piping system shall be inspected during initial re-lubrication prior to the start of Field testing for the other work items. The system shall be checked visually for any leaks and for signs of grease exiting each of the main trunnion, counterweight trunnion and counterweight link arm bearings and for any other unanticipated deficiencies. Field Testing of the Lubrication Piping shall be successfully passed when the system is pressurized with no deficiencies observed and when the bearings shown to be properly lubricated. If any deficiencies are noted during testing, the Contractor shall make whatever adjustments, corrections or repairs as may be necessary, subject to the approval of the Engineer and NCDOT, and re-start the testing from the first test operation.

41.0 GUARANTEES AND WARRANTIES

A. Manufacturers' Warrantees

Manufacturers' warrantees or guarantees on equipment, materials or products supplied as part of the work shall be consistent with those provided as part of customary trade practice, shall be obtained by the Contractor, and, upon successful completion of all Field Testing, shall assign all such warrantees and guarantees to NCDOT.

B. Contractor's Warranty

The Contractor shall warrant all work covered by this bridge mechanical work pay item. This warranty shall extend for a period of one year following the date of final acceptance of the project.

42.0 MEASUREMENT AND PAYMENT

Work required by this section shall be measured as a single item, bridge mechanical work, complete, installed and tested. Payment shall be on the basis of a single lump sum item. The price is full compensation for furnishing and installing all mechanical equipment, coordination with the other work areas, coordination and testing with electrical, and all other materials, labor or tasks required to perform the mechanical work.

Pay Item
Bridge Mechanical Work

Pay Unit
Lump Sum

BRIDGE ELECTRICAL WORK

SPECIAL

1.0 GENERAL

The electrical work specified herein shall be coordinated, as required, with the work of all other disciplines, sections of the specifications, and the plans, so that all installations are properly staged and shall operate as designed.

Any apparatus, device, circuit, appliance, material, or labor not herein specifically mentioned or included, but that may be found necessary to complete or perfect the installation and equipment in a manner acceptable to the Engineer, shall be furnished by the Contractor as if specifically included in these specifications, and without additional cost.

All labor, material, equipment, and services shall be provided by the Contractor to perform operations required for the complete installation.

The prospective Contractor shall bid on all equipment, materials and construction and installation methods as described in this specification. Should the prospective Contractor wish to propose an alternate construction or installation method, he/she may do so in addition to responding to the scheme as shown in this document and the associated Plans.

All equipment shall be new and have not been installed in any other location. Any equipment damaged during installation shall be replaced at no additional cost to the owner.

The control system shall be coordinated, furnished and tested through a single system vendor/subcontractor. The control system vendor/subcontractor shall be responsible for the coordinating control work with other work, be responsible for the control system functionality and reliability, and provide supervision during installation and field testing. See the *6.0 Control System* section for other requirements for the control system vendor/subcontractor.

2.0 STANDARDS AND CODES

Portions or all of certain recognized industry or association standards referred to herein as being a requirement of these specifications shall be considered as binding as though reproduced in full herein unless supplemented and/or modified by more stringent requirements in this specification. Unless otherwise stated, the reference standard shall be the standard which is current as of the date of issuance of these specifications. Reference may be made to standards either by full name or, for the sake of brevity, by letter designation as follows:

American National Standards Institute, Inc.	ANSI
American Railway Engineering and Maintenance-of-Way Association	AREMA
American Society of Mechanical Engineers	ASME
American Wire Gauge	AWG
American Society for Testing and Materials	ASTM
Environmental Protection Agency of the United States Government	EPA
Federal Highway Administration	FHWA
Illuminating Engineering Society	IES
Insulated Cable Engineer's Association	ICEA
International Municipal Signal Association	IMSA
International Power Cable Council Engineers Association	IPCEA
Joint Industrial	JIC
National Electric Code	NEC
National Electric Manufacturers Association	NEMA
National Electrical Safety Code	NESC
National Fire Protection Association	NFPA
Occupational Safety and Health Administration	OSHA
Underwriters' Laboratories, Inc.	UL

The electrical installation shall comply with all applicable laws and ordinances in effect at the construction site, with applicable regulations of the NEC, and with regulations of the utility companies furnishing power and telephone services to the site.

The Contractor shall obtain approval from the Coast Guard for any construction that has the potential of impeding navigation.

3.0 COORDINATION

The contractor shall arrange with the local power company to obtain, at his own expense, electric power for all stages of this contract, including the testing period, until the bridge has been accepted. During final acceptance, the utility service shall be changed over to the Port for billing.

The contractor shall coordinate with the local power company when doing any work in the utilities Right-of-Way, especially when stringing the aerial cable on the highway bridge and when installing the submarine cable between the highway and railroad bridge.

The local Utility is Progress Energy. Local contacts for Progress Energy are Herschel Wells (910-256-7228) and Jackie Lee (910-346-1412).

Under the contract the Contractor shall be required to do all electrical work, and in addition to this shall be required to protect all adjoining properties, all Utilities and existing highway facilities within the Right-of-Way and to repair or replace any such properties, Utilities and facilities damaged or destroyed by it or its employees through the construction operations, both within and adjacent to the Right-of-Way.

The Contractor's attention is directed to the fact that during the life of this contract the owners and operators of Utilities may make changes in their facilities. These changes may be made by the Utility employees or by contract within the limits of or adjacent to this contract and may be both temporary and permanent.

4.0 DRAWINGS AND SPECIFICATIONS

A. General

Omissions from the drawings and specifications, or the mis-description of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omissions and details or work, but they shall be performed as if fully and correctly set forth and described in the drawings and specifications. In any case of discrepancy in figures, catalog numbers, or descriptions in the drawings or in the specifications, the matter shall be properly submitted to the Engineer who shall promptly make determination in writing. Any adjustment in the Plans by the Contractor without written approval shall be at the Contractor's own risk and expense.

B. Equipment Locations

The layout drawings show, in general, the arrangements and locations of all equipment. This shall be considered as illustrative and subject to the approval of the Engineer; the Contractor shall slightly modify it as necessary, for complete and proper construction and operation. The locations of the conduits, boxes, and equipment shown on the Plans are diagrammatic only, and may be subject to slight shifting as required or as the Engineer may direct in order to conform to local conditions.

5.0 MATERIALS AND EQUIPMENT

A. General

The Electrical Equipment and its installation shall be in accordance with regulations of the NEC. All materials and equipment furnished under these Special Provisions shall be new and, to the extent possible, standard products of the various manufacturers. Where more than one of any specific item is required, all shall be of the same type and manufacturer. Items of equipment or material, which are not specifically defined herein, shall conform to the general standard of quality established herein.

B. Shop Drawings

Shop drawings shall include manufacturer's test data, shall be certified by the manufacturer, and shall identify the application(s) for which they are proposed.

C. 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. 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 (brakes, 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. 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. Approval shall be obtained for all submittals prior to the purchase, delivery to the site, or commitment to this project of the respective equipment or materials.

D. Working Drawings

1. Shop and assembly drawings for fabricated items and assemblies shall be provided prior to installation.
2. Layout, erection, and installation drawings and details.

Layout and installation drawings shall be submitted for approval prior to installation of the following: electrical cabinets and equipment enclosures, conduits, luminaires, switches, junction boxes, any components for which mounting provisions have not been detailed on the Plans, or any components for which the Contractor is proposing alternative mounting provisions from those shown on the Plans. Layout and installation drawings shall show proposed locations, dimensions, and clearances to floors, walls, ceilings, structural members, mechanical components, and other nearby objects and equipment. 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 methods, specific hardware, any and all holes to be drilled or cut in structural steel or masonry, etc.

Layout and installation drawings shall be submitted for approval prior to performing the work in question.

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.

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, encased, in-wall, and exposed conduits, as well as flexible cables, wireways, junction boxes, terminal cabinets, equipment, and enclosures.

Drawings shall be fully coordinated with the all wiring diagrams, tabulations, and shop drawings.

4. Wiring diagrams and tabulation.

The elementary point-to-point wiring diagrams shall be submitted for approval prior to installation of raceways and wiring. 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. Each conductor shall be assigned only one wire number which shall be continuous from the origin point to the termination point of the conductor, and consistent on the diagrams on which the conductor appears, regardless of which vendor or manufacture produced the diagrams. Wiring diagrams shall clearly indicate the size and type of all conductors.

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.

Wiring diagrams shall show locations of all conductor splices and connections, including the equipment hook-ups.

Conductor tabulations shall be provided on Microsoft Excel compatible spreadsheets 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. Spreadsheets shall be set up so as to be sortable by wire number, raceway, cabinet, or equipment served.

Nameplates list for electrical equipment, including proposed text shall be provided. The text of nameplates which are part of a product depicted on a shop drawing shall be clearly shown on that shop drawing.

Submittals for electrical work shall include shop and working drawings, layout drawings, wiring diagrams, catalog cut and specification sheets, installation details, test procedures and results, and other items as necessary for the fabrication and installation of electrical work, and as may be required by these Contract Documents.

Equipment identification shall be the same as shown on the drawings. Standard drawings and catalog sheets showing more than one model or size shall be marked to indicate the model or size proposed. Provide manufacturer's technical information on products to be used, including product descriptive bulletin. Include data sheets that include manufacturer's name and product model number. Clearly identify all optional accessories. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components. Include manufacturer's delivery, storage, handling and installation instructions.

Three-line and point-to-point wiring diagrams shall be submitted for approval. Each conductor shall have a distinct wire number. The number shall be identified on the

wiring diagrams. Each conductor shall have only one number. The wiring diagrams shall indicate all terminations and equipment hookup connections.

See additional sections within this special provision for additional requirements.

a. References

Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar in design. Whenever any article, materials, or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term "or approved equal", if not inserted, shall be implied, except as otherwise noted.

b. Substitutions

Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar in design.

Equipment for which an acceptable manufacturer is not specifically named, or named equipment for which substitution is proposed, shall be manufactured by a company which has had a minimum of ten years of experience in the manufacture of similar equipment and which, in the Engineer's opinion, has demonstrated its proficiency in the manufacture of such equipment. All equipment will be subject to the Engineer's approval.

c. Nameplates

Nameplates shall be provided for all major pieces of equipment named on the drawings and for all devices on and in the control console and electrical cabinets.

Nameplates shall be mounted under, over and adjacent to each device for proper identification as indicated on the Plans.

Each terminal block, device, fuse block and terminal shall be permanently labeled to coincide with the identification indicated on the schematic wiring diagrams. Fuse nameplates shall show the type, ampere, and voltage rating of the fuses. The control relay nameplates shall cross reference the actual control relays to the schematic diagrams.

Nameplates shall be made of a hot-polished, laminated phenolic compound not less than 3/16 inch thick. The compound shall have a white surface 1/32 inch thick, and intermediate black layer 1/32 inch thick and a white back 1/8 inch thick. All corners shall be rounded, and the edges of the plates shall be chamfered. All engraving shall be upper case, standard gothic characters, cut through the

surface into the intermediate layer to show black letters on a white background. All plates shall be securely fastened with stainless steel screws or rivets.

E. Execution

Install and wire all equipment, including pre-purchased equipment, and perform all tests necessary to assure conformance to the Plans and Special Provisions and ensure that equipment is ready and safe for energization. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70. Install equipment plumbed, square and true with construction features and securely fastened. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.

Install equipment in accordance with the requirements of:

1. NFPA 70 (NEC)
2. ANSI C2
3. The manufacturer's instructions

Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments in equipment locations in accordance with the following without obtaining the Engineer's approval:

1. 1 foot at grade, floor and roof level in any direction in the horizontal plane
2. 1 foot for equipment other than lighting at ceiling level in any direction in the horizontal plane
3. 1 foot for lighting fixtures at ceiling level in any direction in the horizontal plane
4. 1 foot on walls in a horizontal direction within the vertical plane
5. Changes in equipment location exceeding those defined above require the Engineer's approval
 - a. Testing

The contractor shall be responsible for performing all testing, inspections and any resulting correction to ensure that all components are functioning properly. Prior to energizing any circuit or connection of any piece of equipment to any circuit measure the supply voltage and phase rotation and verify that both are correct and

verify that all conductors and current carrying parts are continuous, free of shorts, unintentional ground and that all conductors are properly terminated.

All portions of the electrical work, both individually and as a whole, shall be subjected to an operational, as-installed testing. The testing shall be required to establish that all functions of the bridge and equipment are installed correctly and functioning as intended. All portions of the controls shall be tested to ensure proper connection and operation. The bridge must operate reliably to pass any testing procedure.

6.0 CONTROL SYSTEM

Material and installation requirements for a relay based control system. The control system shall consist of all switches, relays, timers, auxiliaries, pilot devices, wiring, and any other devices required to provide a complete control system.

Furnish and coordinate the control system through a single control system vendor/subcontractor. The control system vendor/subcontractor shall be responsible for the functional operations the systems, the performance of the control system engineering, providing the supervision of the installation, providing the final connections, preparation of drawings and operation and maintenance manuals, startup, training, demonstration of substantial completion and all other aspects of the control system.

The single control system vendor/subcontractor will also ensure proper coordination of the control system with other work to ensure that necessary wiring, conduits, contacts, relays, and incidentals are provided in order to transmit, receive, the necessary control signals to control panels and other devices.

A. Shop Drawings

Submit product technical data that includes, acknowledgement that products submitted meet requirements of standards referenced, equipment catalog cut sheets, wiring diagrams, panel fabrication details, and nameplate layout drawings. Provide an internal component layout drawing to scale.

A fully complete electrical schematic control diagrams indicating all of the control logic shall be submitted for approval. The schematics shall provide point-to-point wiring that shows all interconnections between all systems and components. Terminal blocks on all equipment and the equipment itself shall be identified. The diagrams shall include wire numbers that correspond to the actual wire numbers installed in the field. The wiring of remote and local devices shall be identified. All of the control devices and contacts shall have a unique identification as identified in the drawings or as required. The nomenclature in the drawings shall be utilized throughout all of the submittals.

B. As-Built Drawings

Update the control panel drawings and ship at least one copy with the control panel to the jobsite.

C. Preliminary (Shop) Testing

The relay cabinet, main control station, remote control station, motor starters, and the Variable Frequency Drive (VFD) shall be used to perform the preliminary testing.

All of the control logic, such as relays, timers, switches, pushbuttons, indicating lights, and all other control system components shall be assembled in a shop in their proper cabinets ready to be shipped before performing the test. Any adjustments or corrections as a result of the preliminary testing shall also be tested.

The drive, motor starters, the main control station, and the remote control station shall also be included in this test. The various motors do not generally need to be included during the testing. Toggle or selector switches can be utilized for the various limit switches. Any and all operations of the control system shall be tested. All errors shall be corrected and the test rerun.

The test shall be conducted in the presence of a Department representative. The Department shall be given at least two weeks notice prior to any test date.

D. Start-Up Services

The control system vendor shall provide a factory trained field engineer/technician to inspect the control system and ensure that it has been installed properly. The field engineer/technician shall remain on-site during field testing of the control system/bridge should any adjustments or modifications be required.

The field engineer/technician shall coordinate with the drive manufacturer to ensure the drive manufacturer is on-site during the initial testing of the drive. A marked-up hard copy of any changes done in the field that were required during testing shall remain on-site at all times.

E. Materials and Equipment

1. Selector Switches

Selector switches shall be NEMA 4, heavy-duty type. The rotary cam units shall conform to NEMA ICS 2-216.22 and be UL listed. The mounting hole shall be 30.5 mm. The switches shall have the number of positions and contact blocks required to perform the functions shown on the drawings. The switches shall be maintained momentary contact type as indicated on the drawings. The switches shall be black knob type operators. The legend plate shall be as indicated on the drawings. The contact blocks shall be standard type rated for 10A continuous current. The switches shall be keyed as indicated on the drawings.

2. Pushbuttons

Pushbuttons shall be NEMA 4, heavy-duty type. The buttons shall conform to NEMA ICS 2-216.22 and be UL listed. The mounting hole shall be 30.5 mm. The pushbuttons shall have the number of positions contact blocks required to perform the functions shown on the drawings. The pushbutton shall be momentary contact type as indicated on the drawings. Pushbuttons shall be standard flush type operators with

full shroud. The legend plate shall be as indicated on the drawings. The contact blocks shall be standard type rated for 10A continuous current.

3. Indicating Lights

Lights shall be NEMA 4, heavy-duty type. The mounting hole shall be 30.5 mm. The lights shall allow the replacement of the bulb without removal from control panel. 120V full voltage LED type lights. The lens shall be glass and the color shall be as indicated on the drawings. The legend plate shall be as indicated on the drawings.

4. Timers

Timers shall be Tyco Electronics CNT Series timers or approved equal. The same timer shall be able to perform all time functions indicated in the drawings. A minimum of two (2) form C contacts per timer. Contacts shall be rated 120V, 10A minimum.

5. Relays

All relays shall be machine tool type relays. All relays shall be 10 ampere, 600 volt rated, Square D Type X class 8501 or equal approved equal. The minimum number of normally open and normally closed relays shall be four (4) each.

6. Current Monitor

Monitors single phase AC current for with a top-mounted current transformer (CT) for an over-current condition. The current monitor shall have an adjustable start-up and trip delay. The start-up delay shall have a minimum range of 0.5 to 6 seconds. The trip delay shall have a minimum range of 0.2 to 2.5 seconds. Automatic or manual reset. The current monitor shall be installed in the manual reset mode. Indicating lights for "POWER" and "TRIPPED". The operating voltage shall be 120 Vac. The over current range shall be 2-20A for one (1) pass through the CT. The monitor shall a minimum of 1 SPDT contact rated for 10A trip point repeatability of $\pm 2\%$ of trip point.

The current monitor shall be a Time Mark Model 2734.

7. Terminal Blocks

Terminal block screw type both sides. Install machine-printed terminal markers on both sides of block. Rated voltage shall be 600 V and rated current shall be 30A, minimum. All conductors #10 AWG or smaller shall be terminated to terminal blocks with ring type connectors. A minimum of 20% spare terminal blocks shall be provided.

8. Horn

The signal horn shall be U.L. listed, of the solid state type, rated 114 dB at 10 feet, and shall operate at 120 volts AC. The horn shall be constructed of aluminum with finish suitable for outdoor use. All internal amplification circuitry, tone module and

gain control shall be enclosed in a finished, die-cast aluminum enclosure. The internal gain control shall allow the output adjustment from 90 dB to a maximum 114 dB at 10 feet. The horn shall be capable of producing multiple coded tone generated by the tone and voice command module of the unit. Tone coding shall be of audio frequency of continuous air horn tone. All hardware, and fabricated mounting brackets shall be stainless steel.

9. Proximity Switches

Each limit switch shall be a NEMA 4X rated proximity sensor type, with the exception of the limit switches for the brakes. The switch shall be of nickel plated brass and have one normally open limit switch with a molded weather-sealed pigtail. The sensor shall have a threaded case and a 30mm diameter. The nominal sensing distance shall be 10mm. The proximity switch shall be rated for 120V AC. It shall have a minimum temperature range of -20 degC to 70 degC. The switch shall be a Square D XS type or equal as approved by the Engineer.

10. Control Panels – Free Standing Panels – Relay Cabinet

The control panel shall be NEMA 4X stainless steel and lockable. The cabinet shall be of the freestanding type. The construction shall be of neat, substantial construction, incorporating any details shown on the drawings and all components necessary to have a functional operating system. The cabinet shall be fabricated from not less than no. 12 gauge minimum steel properly formed, and suitably reinforced by steel members joined by electrical welding to ensure true surfaces and adequate support for the instruments mounted thereon. Maximum deflection of any component under a live load of 200 pounds shall be 1/8 inch deflection in any direction. All mating members shall be neatly fitted up with close joints. Provide rubber mats in front of all control panels.

All welds on all exposed surfaces or corners shall be ground smooth and all projecting edges rounded off. All edges and corners shall be ground off smooth. Finished surfaces shall be free from waves, bellies or other imperfections. Exterior surfaces shall be ground smooth, filled, primed, sanded and carefully cleaned of all dirt, moisture, rust, scale, lubricants and other substances. Lubricants shall be removed by suitable solvents. Protect all labels and tags during cleaning.

Unless specified otherwise, doors shall be hinged and shall have turned-back edges and additional bracing where required to assure rigidity. Hinges shall be of the piano or concealed type. Door latches shall be of the three-point type to assure tight closing and shall be furnished with gaskets. All metal hardware shall be of substantial construction, and shall have a satin finish. All equipment mounting screws and bolts shall be stainless steel.

The stainless steel exteriors shall remain unpainted and shall be treated to provide a number 4 satin finish. Special care shall be taken throughout the construction to

ensure that the stainless steel exterior surfaces are completely protected from damage or defacement at all times.

11. Control Panels – Wall Mounted Panels – Remote Control Station

The control panel shall be NEMA 4X stainless steel and lockable. All welds on all exposed surfaces or corners shall be ground smooth and all projecting edges rounded off. All edges and corners shall be ground off smooth. Finished surfaces shall be free from waves, bellies or other imperfections. Exterior surfaces shall be ground smooth, filled, primed, sanded and carefully cleaned of all dirt, moisture, rust, scale, lubricants and other substances. Lubricants shall be removed by suitable solvents. Protect all labels and tags during cleaning.

Unless specified otherwise, doors shall be hinged and shall have turned-back edges and additional bracing where required to assure rigidity. Hinges shall be of the piano or concealed type. Door latches shall be of the three-point type to assure tight closing and shall be furnished with gaskets. All metal hardware shall be of substantial construction, and shall have a satin finish. All equipment mounting screws and bolts shall be stainless steel.

The stainless steel exteriors shall remain unpainted and shall be treated to provide a number 4 satin finish. Special care shall be taken throughout the construction to ensure that the stainless steel exterior surfaces are completely protected from damage or defacement at all times.

12. Panel Wiring

Factory wire panels to identified terminal blocks equipped with screw type lugs. Install all wiring without splicing in factory in plastic wire duct and do not exceed manufacturer's recommended fill limits. Ducts shall have removable covers. Splicing and tapping of wires allowed only at terminal blocks. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve. Equip each panel with a main thermal magnetic circuit breaker. Limit load to maximum of 80 percent of circuit breaker rating. Assure each panel mounted device is bonded or otherwise grounded to panel or panel grounding system by means of locknuts or pressure mounting methods. Equip panels with grounding terminals. All sub-panels and hinged doors shall be bonded to ground. Arrange wiring with sufficient clearance for all leads. Arrange wire neatly, cut to proper length, and remove surplus wire. Conductors shall be type MTW or SIS stranded copper suitable for operation at 600V while inside the panels. Conductor size shall be as required for load and 14AWG minimum. All conductors leaving the control panel shall be THHN and #12 AWG minimum. Identify all wires with plastic sleeve type (heat-shrinkable) wire markers at each end.

13. Panel Lighting

In the relay control cabinet include continuous fluorescent lighting strip with switches and separate circuit breakers.

14. Control System Surge Protective Device

Mount internally to control panels for point-of-use loads. SPD shall be MOV based or multi-stage hybrid solid state high performance suppression system and be designed for series connection. The enclosure shall be metallic or plastic, flange or DIN rail mounting. Provide a unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors. The operating voltage shall be 120VAC, the operating current shall be 15A minimum, and the operating current shall be 45 to 65 Hz. All modes shall be protected, L-N, L-G and N-G. The maximum continuous operating voltage shall be less than 130 percent of system peak voltage. External protection as recommended by manufacturer.

15. Receptacle

In the relay control cabinet a minimum of one receptacle shall be included with a separate circuit breaker.

F. Execution

Install the control system so that it functions reliably and safely during all required operations as indicated on the Plans. Install individual components in accordance with manufacturer's instructions and as indicated on the Plans.

1. Control System Surge Protective Device

Provide on all incoming 120 V power to all control panels and the line side of 120 V power terminals to equipment mounted externally of the control building. Connect in series with the panel's or equipment's branch circuit. Provide fuse protection as recommended by manufacturer. Flange mount or DIN rail mount in control panel. Connect all SPDs in the panel to the same grounding point.

G. Spare Parts

A minimum of 5 spare relays, timers, and proximity switches shall be provided. A minimum of one spare selector switch of each type shall be provided. A minimum of one spare current monitor shall be provided. A minimum of 20% spare of each color indicating light lamps shall be provided (minimum of 2 each).

7.0 GROUNDING

Material and installation requirements for grounding systems.

A. Materials and Equipment

Bare conductors utilized for grounding shall be soft drawn stranded meeting ASTM B8. Insulated conductors utilized for grounding shall be color coded green.

Ground rods shall be a minimum of 3/4 IN x 10 FT. Ground rods shall be copperclad with a heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core. There shall be a corrosion resistant bond between the copper and steel and the rods shall be hard drawn for a scar-resistant surface.

Compression clamps shall meet UL 467, be of a high copper ally content and non-reversible.

A 4/0 AWG bare conductor shall be mechanically connected to the bridge support frame. The other end of the conductor shall be CAD Welded to the nearest fender system steel pile.

B. Execution

Install products in accordance with manufacturer's instructions. Grounding conductors and bonding jumpers shall be sized in accordance with NFPA 70 Article 250, except where larger sizes are indicated on the Plans. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves. Do not splice grounding conductors except at ground rods. Install ground rods and grounding conductors in undisturbed, firm soil.

Low Voltage Transformer transformers XO terminal shall be grounded to the closest grounding electrode, or building steel using mechanical type terminal bolted to the steel, compression type connection or exothermic weld.

ALL raceways, including power, lighting and control (except instrumentation) shall contain an equipment ground conductor. All metallic conduits shall be installed so that it is electrically continuous.

All conduits shall contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Plans. Provide grounding-type insulating bushings for all equipment not supplied with a conduit hub. Provide double locknuts at all panels. Bond all conduits, at entrance and exit of equipment, to the equipment ground bus or lug. Provide bonding jumpers if conduits are installed in concentric knockouts. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

Ground all equipment supplied from electrical gear through the gear's equipment ground bus. Provide an equipment grounding conductor connected to the ground bus and equipment ground lug. Grounding conductor insulation shall be identical to phase conductor insulation. Where green-colored insulated wire is not available, green electrical tape shall be applied to all equipment grounding conductors where exposed, to include, but not be limited to, in manholes and handholes, pull and junction boxes, wireways, and inside equipment enclosures. Tape shall be applied continuously where exposed.

8.0 WIRE AND CABLE

Material and installation requirements for building wire, multi-conductor power/control cable, aerial cable supported by a messenger, submarine cable, coaxial cable, wire connectors, and insulating tape.

A. Materials and Equipment

1. Conductors shall be copper with 600 V rated insulation surface marked with manufacturers name or trademark, conductor size, insulation type and UL label. Number of conductors shall be as required, including a bare ground conductor.

B. Building Wire

Conductors shall be stranded except for, size #12 AWG used only in lighting and receptacle circuits, may be stranded or solid.

Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.

Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW and XHHW-2 insulation.

C. Multi-Conductor Power Cable

Individual conductor color coding shall be by the ICEA Method 4. When exposed to sunlight, UL Listed and marked as sunlight resistant. Cable shall conform to NFPA 70 Type TC.

Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.

Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.

D. Multi-Conductor Control Cable

Number of conductors as required, provided with or without bare ground conductor of the same AWG size. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c #14 w/g and 7/c #14 are equal). Individual conductor color coding shall be by NEMA/ICEA Method 1, Table E-2. When exposed to sunlight, UL listed and marked as sunlight resistant. Cable shall conform to NFPA 70 Type TC.

Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.

Conform to NEMA/ICEA WC 57/S-73-532 and UL 44 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.

E. Aerial Cable Supported by a Messenger

Number of conductors as required. Individual color coding shall be by ICEA Method 3, Table E-1. Conductor insulation shall be ethylene propylene rubber (EPR) and rated for 600V. Cable components shall be cabled together with non-hygroscopic fillers as required. The cable core shall be wrapped with a moisture-resistant binder tape. Two layers of aramid fibers shall be applied helically in reverse directions under the cable jacket for reinforcement. The outer jacket shall be heavy duty UV-resistant.

The cable messenger shall be Type 302 or 304 stainless steel with a minimum diameter of 9/16 IN. The cable and messenger shall be binder together with a Type 302 stainless steel tape helically wound around the cable and messenger.

Fiber optics shall also be included as required on the drawings. The number of required fibers as required. The fiber shall Multi-mode, 50/125 μ m, 1Gb. Provide connectors, terminations, and splices as required.

Conform to NEMA/ICEA WC 57/S-73-532

Acceptable manufactures are Draka, or approved equal.

F. Submarine Cable

The minimum quantity and configuration of the submarine cables shall be:

- 25- #10AWG
- 3- #2AWG
- 1- #8AWG Ground
- 6 – Multi-mode Fibers

Prior to manufacturing, the Contractor shall submit to the Engineer, for review, drawings showing the actual cross-section and makeup of each required cable together with a detailed description of each component.

Individual color coding shall be by ICEA Method 3, Table E-1. Conductors shall be stranded uncoated copper. Conductor insulation shall be crosslinked polyethylene (XLPE). Cable components shall be cabled together with jute or polypropylene as required. The cable core shall be wrapped with a moisture-resistant binder tape. The inner jacket shall be weather and UV-resistant high density polyethylene (HDPE). The inner jacket shall have a minimum thickness of 0.08 inches. The armor wire shall be galvanized steel wire coated with HDPE. The wires shall be a minimum of #8 AWG with a minimum HDPE coating of 0.03 inches. The outer jacket shall be weather and UV-resistant HDPE with a minimum thickness of 0.08 inches.

Fiber optics shall also be included as required on the drawings. The number of required fibers as required. The fiber shall Multi-mode, 50/125 μ m, 1Gb. Provide connectors, terminations, and splices as required.

Conform to NEMA/ICEA WC 70/S-95-658 and WC 57/S-73-532

Acceptable manufactures are Draka, or approved equal.

The submarine cable support shown shall be O-Z/Gedney type FS or equal by Crouse-Hinds or Appleton. The sealing bushing at the terminal cabinet shall be O-Z/Gedney type CSBI or equal by Crouse-Hinds or Appleton.

G. Wire Connectors and Insulation Tape

Twist/screw, compression, and mechanical screw type shall be 600 V rated.

Terminal block type shall be a high density, screw-post barrier-type with white center marker strip rated at 600V. 20 ampere rating for control circuits and as required for power circuits.

Insulating tape shall be premium grade pressure sensitive vinyl. Tape shall be heat, cold, moisture and sunlight resistant. For outdoor locations tape shall be all-weather.

H. Execution

General:

Type XHHW and XHHW-2 shall be utilized for No. 6 AWG and larger.

Type THHN/THWN and THHN/THWN-2 shall be utilized for No. 8 AWG and smaller.

Feeder and branch power conductors and control conductors shall not be smaller than No. 10 AWG unless otherwise indicated on the drawings. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except where specifically indicated on the Drawings or where field conditions dictate and written permission is obtained from the Engineer.

Splices and taps for the following circuit types shall be made in the indicated enclosure type using the indicated method.

1. Feeder, branch power and control circuits:
 - a. Device outlet boxes:
 - b. Twist/screw on type connectors.
2. Junction and pull boxes and termination cabinets:
 - a. Terminal block or terminal strip type connectors.

3. Motor terminal boxes:

- a. Twist/screw on type connectors.

After wire and cable have been installed and connected, conduit ends shall be sealed with a non-hardening sealing compound (Duxseal or equal), forced into conduits to a minimum depth equal to the conduit diameter. This shall apply for all conduits entering any structures or electrical enclosures from underground.

Tag wires with wire markers in control panels, electrical gear, terminal boxes.

Before the aerial cables and the submarine cable are installed they shall be fully tested to ensure that they are in adequate condition when they arrive in the field. The cables shall be retested after installation to ensure the cables have not been damaged during the installation. Minimum insulation testing requirements are 100 MegOhms to ground and to each conductor in the cable. If any conductor/fiber fails a test the entire cable shall be replaced at no additional cost to the Department.

Each conductor, of power, control and signal wiring, shall be color coded with colored insulation. Color coding of conductors shall be as follows:

	<u>120/208 volts</u>	<u>277/480 volts</u>
Phase A	Black	Brown
Phase B	Red	Yellow
Phase C	Blue	Orange
Neutral	White	Gray

Submarine Cable:

The cable shall cross between the highway bridge and the railroad bridge in a trench. The submarine cable installation shall be performed by jet cutting the trench. The bottom of the trench shall be a minimum of 4.5 feet below the river bottom (as determined by the Army Corps of Engineers) between the highway bridge and the railroad bridge. Note the submarine cable crosses a high voltage transmission Right of Way. The contractor shall provide adequate equipment for installation of the cable and protection to the high voltage transmission lines conforming to any permits, costs and requirements of Progress Energy. and USACE. Sediment control and the use of turbidity curtains during the installation of the submarine cable are considered incidental to the cost of the Bridge Electrical Work Pay Item. The contractor shall furnish an independent diver and the necessary diving equipment for use of the Engineer or his/her representative in making inspections of the cable installation. The contractor shall operate the equipment when being used by the Engineer or his/her representative. All cable bends shall be of large easy curvature well within that recommended by its manufacturer so as not to damage or over stress the cable or its insulation. The ends of the cable shall not be exposed to the water. Should the end ends of the cable be exposed to the water, the Contractor shall

remove a minimum of 20 feet from the end of the cable, perform Megger insulation tests and dispose of the waste prior to making any connection to the cable supports.

The wire armor shall be removed from the submarine cable at the support clamps, and cables shall enter the cabinets through cabinet sealing glands. An electrical bond shall be made between the terminal cabinet and the submarine cable armor for each location such that the measured resistance between cabinet and armor is not more than 10 ohms.

9.0 RACEWAYS AND BOXES

Material and installation requirements for conduits, conduit bodies and fittings, conduit supports, wireways, outlet boxes, and pull and junction boxes.

A. Materials and Equipment

1. General

All conduit shall be PVC coated rigid galvanized steel. All raceways and boxes shall be NEMA 4X stainless steel.

2. PVC-Coated Rigid Steel Conduit (PVC-RGS)

Nominal 40 mil polyvinyl chloride exterior coating bonded to hot-dipped galvanized rigid steel conduit conforming to ANSI C80.1. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the coating.

The interior shall have a nominal 2 mil (min) urethane coating. A urethane coating shall be on the threads. The conduit shall be epoxy prime coated prior to application of PVC and urethane coatings.

The female ends shall have a plastic sleeve extending a minimum of 1 pipe diameter or 2 IN, whichever is less beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.

Standards: ANSI C80.1, UL 6, NEMA RN 1.

3. PVC-Coated Flexible Galvanized Steel (Liquid-Tight) Conduit (FLEX-LT)

Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked. Extruded PVC outer jacket positively locked to the steel core. Conduit shall be liquid and vapor tight and meet UL 360.

4. Wireway

Suitable for lay-in conductors. Wireway shall be designed for continuous grounding. Covers shall be fully gasketed and held in place with captive clamp type latches, hinged or removable in accessible areas and non-removable when passing through

partitions. The flanges shall be fully gasketed and bolted. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.

Standards: UL 870, NEMA 250.

5. Conduit Bodies and Fitting and Accessories

Conduit bodies and fittings and accessories are defined as locknuts, bushings, hubs, couplings, unions, conduit bodies (elbows and tees), conduit bodies (round) sealing fittings, expansion couplings, and expansion/deflection couplings. All conduit bodies and fittings and accessories shall be rigid galvanized steel with a nominal 40 mil polyvinyl chloride exterior coating. The bond between the PVC coating and surface shall be greater than the tensile strength of the coating. The interior shall have a nominal 2 mil (min) urethane coating. A urethane coating shall be on the threads. Epoxy prime coated prior to application of PVC and urethane coatings.

6. Outlet Boxes

Cast outlet box type. Outlet boxes shall be zinc plated cast iron (RGS) with threaded hubs and grounding screw. Boxes shall have a 40 mil PVC exterior coating and 2 mil urethane interior coating.

Standards: UL 514A

7. Pull and Junction Boxes

The body and cover shall 14 GA Type 304 or 316 stainless steel. The Seams shall be continuously welded and ground smooth. No knockouts. External mounting flanges. Hinged door and with stainless steel screws and clamps. The door shall have an oil-resistant gasket.

B. Execution

1. Raceway Installation General

Install in accordance with the requirements of NFPA 70.

Raceway sizes are indicated on the Drawings, if not indicated on the Drawings, then size in accordance with NFPA 70. Unless specifically indicated otherwise, the minimum raceway size shall be 3/4 IN for conduits and 2-1/2 IN x 2-1/2 IN for wireways. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

When field bending and cutting conduits utilize tools and equipment recommended by the manufacturer of the conduit, and that are designed for the purpose and the conduit material to make all field bends and cuts. Do not reduce the internal diameter of the conduit when making conduit bends. Prepare tools and equipment to prevent damage to the PVC coating.

Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

The protective coating integrity of conduits, fittings, and accessories shall be maintained. Repair PVC-RGS utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape. The total nominal thickness is 40 mil. Repair surfaces which will be inaccessible after installation prior to installation.

Remove moisture and debris from conduit before wire is pulled into place. Pull a mandrel with a diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions. Swab conduit by pulling a clean, tight-fitting rag through the conduit. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

2. Raceway Routing

Raceways shall be routed in the field unless otherwise indicated. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes. Run in straight lines parallel to or at right angles to building lines. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

Conduits shall be installed to eliminate moisture pockets. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings. Provide all required openings in walls, floors, and ceilings for conduit penetration.

Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

3. Raceway Applications

PVC-RGS shall be utilized for all required conduits. FLEX-LT conduits shall be installed as the final conduit connection to light fixtures, dry type transformers, motors, electrically, and other electrical equipment that is liable to vibrate. The maximum length shall not exceed, 6 FT to light fixtures, 3 FT to motors., and 2 FT to all other equipment.

10.0 WIRING DEVICES

Material and installation requirements for light switches, receptacles, and device wallplates and coverplates.

A. Materials and Equipment

1. Light Switches

Switches shall be toggle type, quiet action, Standard Specification grade. Switches shall have self grounding with grounding terminal. Back and side wired. Solid silver cadmium oxide contacts. Rugged urea housing and one-piece switch arm. Rated 20 A, 120/277 VAC. Types as indicated on the Drawings: single pole, double pole, 3-way. Wallplate shall be type 302 stainless steel, single or multiple gang as required.

Standards: UL 20, UL 514A, NEMA WD 6.

2. Receptacles

Receptacle shall be straight blade, Standard Specification grade with brass triple wipe line contacts. The receptacle shall have a one piece grounding system with double wipe brass grounding contacts and self grounding strap. Back and side wired. Rated 20 A, 125 V AC. High impact nylon body.

Receptacles shall be self grounding with grounding terminal unless otherwise indicated. Ground fault circuit interrupter (GFCI) when indicated on the drawings shall be a feed-through type with test and reset buttons. Duplex type receptacles with a NEMA 5-20R configuration, unless otherwise indicated on the Drawings. Wallplates shall be type 302 stainless steel.

Standards: UL 498, UL 514A, UL 943, NEMA WD 1, NEMA WD 6.

B. Execution

Install products in accordance with manufacturer's instructions. Mount devices where indicated on the Drawings. Light switches (to center) shall be 48 IN above finished floor. Receptacles (to center) shall be 18 IN above finished floor, unless otherwise indicated on the drawings.

11.0 VARIABLE FREQUENCY DRIVES (FLUX VECTOR) (FURNISH AS PART OF CONTROL SYSTEM SECTION FOLLOWING THE REQUIREMENTS IN THAT SECTION)

Variable frequency drives (VFDs) for operation of squirrel cage induction motors rated 460 V AC or less, 3 PH, 60 Hz. The drives shall be provided with Flux Vector type control and shall be supplied by the control system vendor.

A. General

Drive manufacturer shall clearly identify conditions that will limit the operation of, or cause damage to, the drive. Speed regulating and static contactor-less reversing control for opening and closing the bridge shall be of the flux vector type with dynamic braking. The control system development is based on using a flux vector drive in an open-loop

control configuration. The Contractor shall provide all necessary system development details and control system interfacing, prepared in advance and submitted for approval, as one complete package.

1. Qualifications

Provide drives that have the standard factory configuration of the variable speed drive listed and labeled by Underwriters Laboratories, Inc. (UL), Canadian Standards Association (CSA), ETL Testing Laboratories (ETL), or that shall be capable of field inspection and subsequent field labeling by a UL-recognized field inspector. Where drives and controlling equipment are mounted in a custom enclosure, UL listed components shall be furnished. The manufacturer shall be ISO 9001 or 9002 certified.

Drive supplier shall maintain an authorized service organization within 300 miles of the project site. The location shall be identified.

2. Coordination

Drive manufacturer shall verify with the motor manufacturer that the VFD and the motor are compatible and that the drive will operate over its required operating range and will do so without exceeding the motor or drive safety factors. Drive shall be supplied complete with all required control components. VFD manufacturer shall review the application and provide, at no additional cost to the Owner, the hardware and software necessary to allow the drive to control the motor over its required operating range.

Verify plan dimensions with equipment space requirements as indicated on the Drawings. Equipment which exceeds the allotted maximum dimensions may not be acceptable. Equipment which reduces clear space below the minimums established by the NEC will not be acceptable. Contractor shall coordinate submittal with submittals from the motor manufacturer and the equipment manufacturer to provide concurrent submittals.

3. Shop Drawings

Product technical data for: rated VFD input kVA and current, rated output kVA and current, and overload current. Provide the panel interior, and front and side exterior views, with details showing maximum overall dimensions of the VFD and accessories such as input/output contactors and braking resistors.

4. As-Built Drawings

The control system vendor shall provide a minimum of four (4) hard copies of the as-built drive parameter listings for the drive. An electronic PDF file shall also be provided as a backup to the hard copies.

If parameter backup software is available from the drive manufacturer provide as-built electronic back up files of each drive's parameters and the appropriate licensed copy of the software, manuals, and necessary programming cable. Provide a configured memory card backup of drive parameters when available from the manufacturer.

Electronic backups shall be provided on compact disk, or other media approved by the Department.

All passwords shall be provided to the Department.

B. Materials and Equipment

As manufactured by Allen-Bradley or approved equal.

Heavy duty rated.

Drive shall provide a quality output waveform for stepless motor control from 1 to 100 percent base speed. The drives shall be suitable for Constant Torque (CT) or Variable Torque (VT) applications. VFD manufacturer shall coordinate with the manufacturer of the driven equipment to identify CT and VT applications.

Speed range shall be a minimum of 100:1.

The drive shall be equipped with a line side reactor that has a minimum nominal impedance of 3 percent.

Current overload shall be 150 percent for 1 minute and 180 percent for 10 seconds.

The drive shall be equipped with a line side thermal-magnetic circuit breaker disconnect that is pad lockable in the off position.

Each VFD system shall be shop assembled with interchangeable plug-in printed circuit boards and power conversion components wherever possible. Shop assembly shall be performed by the drive manufacturer or authorized agent. Reactors and contactors shall be mounted within or in an ancillary enclosure adjacent to the drive enclosure, or with the Engineer's permission may be mounted in a separate enclosure. Cooling fans shall be provided to run when drive is running. Enclosures shall be stainless steel and be rated NEMA 12 at a minimum.

Provide braking resistors. Resistors shall be rated 100% full load torque at a minimum. The resistors shall have a duty cycle of five minutes on and then five minutes off. Resistors shall be edge wound stainless steel, mounted in a stainless steel enclosure. Protect the resistors with a properly size overload relay. Provide the resistors with an overload-temperature relay that shall be interconnected with the drive to stop the drive from running.

1. Operator Interface

Door mounted sealed keypad, membrane type with LED or LCD display. All messages shall be in English and engineering units. All drive operating parameters shall be programmable, menu driven, with password security. A second password shall be required when making any changes to the drive parameters. Fault and diagnostic data shall be displayed on the drive. The operating parameters, fault and diagnostic data maintained in non-volatile memory with historic log of fault and diagnostic data. Manual speed adjustment can be done at the display. Speed indication shall be shown in RPM.

Inputs and outputs shall be 120V. See the drawings for number and type Contacts shall be rated 2 A inductive at 120 Vac. All contacts shall be wired to terminal boards.

C. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings. Verify the installed motor nameplate electrical requirements do not exceed the drive capacity. Provide services of manufacturer's representative to perform start-up services. The manufacturer representative shall remain on site until it is satisfactorily demonstrated to the Department that the drives are operating reliably and no further adjustment is needed. All travel shall be included in the pay item.

Drive shall be mounted a minimum of 36 inches above the floor.

11.0 SAFETY SWITCHES

Material and installation requirements for safety switches.

A. Materials and Equipment

NEMA 4X stainless steel enclosure. Fusible or non-fusible shall be as indicated on the drawings. Fuse ratings shall be as indicated on the drawings. Service entrance rated when indicated on the Drawings. The switches shall be NEMA Type HD heavy-duty construction with a quick-make/quick-break operating mechanism. Switch blades will be fully visible in the off position with the enclosure door open. Double-break rotary action shaft and switchblade shall be manufactured as one common component. Operating handle shall be easily recognizable and padlockable in the off position. The door shall be interlocked to prevent the door from opening when the switch is in the on position with a defeater mechanism.

The switches shall be horsepower rated when connected to a motor. Voltage and amperage shall be as indicated on the drawings.

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings.

12.0 MANUAL TRANSFER SWITCH

Material and installation requirements for manual transfer switches.

A. Materials and Equipment

The transfer switch shall be 3 pole, 60A (min). All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved. Main contacts shall be rated for 600 Volts AC minimum. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure, in ambient temperatures of -40 to +50 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet.

Transfer switch equipment shall withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault current. The transfer switch and its upstream protection shall be coordinated. The contractor shall coordinate with the utility. Submit calculations to the Engineer for review and approval.

Transfer switches shall be double-throw, mechanically interlocked, and mechanically held in both positions. Transfer switches shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms suitable for safe manual operation under load.

Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishment. Arc chutes shall have insulating covers to prevent interphase flashover.

All poles shall be switched simultaneously using a common crossbar. Equipment using add-on accessory overlapping contacts are not acceptable. Transfer switches which are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs, sized to carry 100% of the current designated on the switch rating. Enclosures shall be UL listed. The enclosure shall provide NEC wire bend space. The cabinet door shall be key locking. Controls on cabinet door shall be key-operated.

Transfer switch shall be mounted in a NEMA 4X enclosure. The cabinet shall provide required wire bend space at point of entry.

Each contact pole of the main transfer device shall be double-throw design, with solid silver cadmium contacts, capable of handling both non-inductive and inductive loads and allow for inrush currents of 20 times the continuous rating. Contact pressure shall be maintained by a coil spring, not a part of the current carrying path. The ampere rating of the transfer switch shall be sufficient to handle the capacity of the plant and loads being transferred.

1. Generator Receptacle

A generator receptacle shall be mounted to each manual transfer switch. The receptacle shall be rated 60A (min), 15hp (min), 600V, 4W, 3-phase, pin-and-sleeve

type and a NEMA 3R type enclosure with a 1 1/2 inch hub. Provide the owner with a matching plug (2). The plug shall be NEMA 3R and have the same ratings as the receptacle. The NEMA 3R rating shall remain when the receptacle/plug is in use.

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings.

13.0 PANELBOARDS

Material and installation requirements for panelboards.

A. Materials and Equipment

Current, voltage, number of phases, number of wires, short circuit current rating as indicated on the Drawings.

Interiors shall be factory assembled and designed so that protective devices can be replaced without other units and without removing the main bus connectors. The bus bars shall be copper sized to limit temperature rise to a maximum of 65 DegC above an ambient of 40 DegC. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.

Panelboards shall be in a NEMA 4 stainless steel enclosure. Doors lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike. Provide a clear plastic cover for directory card mounted on the inside of each door.

Main overcurrent protective device shall be a molded case circuit breaker. Branch overcurrent protective devices shall be a mounted molded case circuit breaker.

Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings. The top of the panelboard shall be 72 IN.

Provide a typed directory in each panelboard. All equipment shall be identified as indicated on the drawings.

14.0 MOTOR STARTERS

Material and installation requirements for separately mounted motor starters and manual motor starters.

A. Shop Drawings

Provide fabrication and layout drawings.

B. Materials and Equipment

Standards: NEMA 250, ICS 2, UL 508.

1. Separately Mounted Combination Starters

Full voltage non-reversing (FVNR) magnetic starters shall be equipped with a NEMA full size contactor. Starter shall be equipped with double-break silver alloy contacts. The overload relays shall be ambient insensitive, adjustable solid state type with phase loss protection, phase imbalance protection and manual reset. Auxiliary contacts shall be wired to terminal blocks. Provide a minimum of one spare normally open and normally closed contact.

Full Voltage Reversing (FVR) Magnetic Starters shall be manufactured from two FVNR starters with one overload relay assembled together. The starter shall be mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously. See FVNR paragraph for additional requirements.

Enclosure shall be NEMA 4X stainless steel.

The enclosure door shall be hinged. When the door is closed the handle mechanism provides clear indication of the disconnect status. Overcurrent and short circuit protective devices shall be either a motor circuit protector or molded case circuit breaker. Circuit breaker and MCP operators shall include a separate TRIPPED position. A mechanical interlock shall be included to prevent the opening of the door when the disconnect is in the on position with a defeater mechanism for use by authorized personnel. The door handle shall be padlockable in the OFF position. An external mounted overload relay pushbutton shall be included. Fault current withstand shall be equal or greater than that of the electrical equipment from which it is fed.

2. Manual Motor Starter

Starter shall be a quick-make, quick-break toggle mechanism that is padlockable in the off position. The starter shall be horsepower rated, for on and off control and thermal overload protection. Voltage and current ratings and number of poles as required. Enclosure shall be NEMA 4X stainless steel.

C. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings. The bottom of the motor starter enclosures shall be a minimum of 36 IN above the floor.

Overload heaters shall be sized for the actual motor full load current.

15.0 MINI-POWER ZONE

Material and installation requirements for mini-power zone. A mini-power zone consists of a small dry-type transformer and panelboard.

A. Materials and Equipment

See the drawings for the number of phases and circuits on panel board and the kVA and voltage ratings. A mini-power zone shall consist of a main primary circuit breaker, an encapsulated dry-type transformer, a panelboard with a main circuit breaker.

Enclosure shall be stainless steel with a minimum rating of NEMA 3R. Door shall be hinged and padlockable.

The transformer shall be a non-ventilated, air cooled, two-winding type. The core and coil assembly shall be encapsulated and provide a moisture proof seal. The core shall be high grade, non-aging silicon steel with high magnetic permeability. Coils shall be continuous wound with electrical grade aluminum and grounded to the enclosure. Insulation shall be 115 DegC rise. The sound levels shall be a maximum of 40 dB.

The panelboard bus shall be aluminum. The wiring between the primary breaker and the transformer, the transformer and the secondary breaker and distribution shall be factory installed.

Standards: ANSI C57.96, ANSI C89.2, NEMA PB 1, NEMA ST 20, UL 67 and UL 1561.

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings. The bottom of the mini-power zone enclosure shall be a minimum of 36 IN above the floor.

16.0 OVERCURRENT PROTECTIVE DEVICES

Material and installation requirements for overcurrent protective devices, circuit breakers and fuses.

A. Materials and Equipment

Overcurrent protective devices shall be ambient temperature compensated.

1. Circuit Breakers

Circuit breakers shall be molded case thermal magnetic type. The breakers shall be of a unit construction, bolt on type. Quick-make, quick-break, that is independent of

toggle handle operation. The handle shall have three positions: on, off and tripped. On and off shall be molded-in the breaker cover.

One-, two- or three-pole and current rating shall be as indicated on the Drawings. The magnetic trip units shall be non-interchangeable and non-adjustable. All poles shall open and close simultaneously.

A motor circuit protector shall have adjustable instantaneous short circuit protection and be sized for the motor it is connect.

Standards: NEMA AB 1, UL 489.

2. Fuse

The fuse shall be a UL Class RK-1 fuse. The fuse shall be a single-element and fast acting. Voltage, current and interrupt ratings as indicating on the drawings.

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings. Series rated systems shall not be allowed.

17.0 SURGE PROTECTION DEVICES (SPD)

Material and installation requirements for surge protection devices.

A. Materials and Equipment

SPD shall be integrally mounted in a panelboard designed for parallel connection. The nominal unit operating voltage and configuration as indicated on the Drawings. The SPD shall be of a hybrid solid state high performance suppression system. Use mechanical or compression lugs for each phase, neutral and ground. The maximum continuous operating voltage shall be less than 130 percent of system peak voltage. The operating frequency shall be 45 to 65 Hz. Maximum surge current shall be 160,000A per phase, 80,000A per mode minimum. The device monitor shall be long-life, solid state, externally visible indicators that monitor the on-line status of each mode or power loss in any of the phases. An IEEE B combination wave shall not cause the fuse to open and render the SPD inoperable.

Modes of Protection: All modes.

Three phase (delta): L-L, L-G.

Three phase (wye): L-N, L-L, L-G and N-G.

Single phase (2 pole): L-L, L-N, L-G and N-G.

Single phase: L-N, L-G and N-G.

Maximum Clamping Voltages:

IEEE C62.41				
System Voltage	Test Mode	B Comb. Wave	B3 Ring Wave	UL 1449
L-L < 250 V L-N < 150 V	L-L	1000 V	700 V	800 V
	L-N	600 V	400 V	500 V
	L-G	800 V	550 V	600 V
L-L > 250 V L-N > 150 V	N-G	800 V	550 V	600 V
	L-L	2000 V	1400 V	1800 V
	L-N	1150 V	800 V	1000 V
	L-G	1550 V	1000 V	1200 V
	N-G	1550 V	1000 V	1200 V

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings. SPD shall be connected in parallel to the equipment. Install in dedicated panelboard enclosure at the factory. The lead lengths shall be as short as possible with a maximum length of 12 IN.

The SPD shall be connected to the panelboard being protected through a circuit breaker mounted in the panelboard.

18.0 INTERIOR AND EXTERIOR LIGHTING

Material and installation requirements for interior and exterior building lighting fixtures, lamps and ballasts.

A. Materials and Equipment

All lighting fixtures and electrical components shall be UL labeled and be complete with lamps and ballasts.

1. Fluorescent Fixtures

The lenses shall be as indicated in Fixture Schedule. The fixture finish shall be the manufacturer's standard polyester, acrylic enamel or epoxy powder coating applied after fabrication. Manufacturer's standard color or special color specified in Fixture Schedule. The fixtures shall be prewired and provided with lamps that are properly mated to the ballast operating characteristics.

2. High Intensity Discharge Fixtures

The fixture finish shall be the manufacturer's standard polyester, acrylic enamel or epoxy powder coating applied after fabrication. Manufacturer's standard color or

special color specified in Fixture Schedule. The fixtures shall be prewired and provided with lamps that are properly mated to the ballast operating characteristics. A safety chain shall be provided.

3. Fluorescent Lamps

T8 (265 mA) rapid-start medium bipin type lamps. The lamps shall have a correlated color temperature of 3500 degrees Kelvin and a minimum color rendering index (CRI) of 70.

The minimum initial lumen ratings shall be 2800 lumens for 48 IN, 32 watt F32T8 lamp.

4. High Intensity Discharge (HID) Lamps

Metal halide lamps – The lamps shall have a correlated color temperature of 4000 degrees Kelvin and a minimum CRI of 65.

5. Fluorescent High Frequency Electronic Ballasts

The lamps shall at a frequency of 20 KHz or higher without visible flicker. The power factor shall be greater than 90 percent. The ballast shall be instant start with lamps wired in parallel. The noise rating shall be Class A at a minimum. The ballast shall operate in ambient temperatures up to 40 DegC (105 DegF) without damage.

6. High Intensity Discharge Ballasts

Metal halide – Input voltage variation shall be +10 percent. The starting current shall not greater than operating current.

B. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings.

Pendant mounted, open, industrial fluorescent fixtures shall not be installed in continuous rows and shall be supported by conduit or by approved chains with a plug connection to a ceiling mounted twistlock receptacle. The fixtures shall be hardwired to a ceiling mounted junction box.

Light fixtures shall be mounted to the heights as indicated in the drawings.

All inoperable or non-working lights shall be replaced with new lamps prior to final acceptance.

20.0 DRIVE MOTOR

Material and installation requirements for the drive motor.

A. Shop Drawings

Provide nameplate data as required by the NEC, such as manufacturer's name, rated voltage, full load current, rated frequency, number of phases, rated full load speed, insulation system class and rated ambient temperature or rated temperature rise, rated HP, code letter or locked rotor current, NEMA design letter. Provide the motor service factor, motor enclosure type, and NEMA frame size.

B. Materials and Equipment

The drive motor shall be a two-speed, two-winding constant torque motor. The motor shall be rated 460VAC, 3-phase, 5/10 HP, 900/1800RPM, 60 hz and a minimum 60 minute duty cycle. The motor shall be fully compatible with the VFD with constant torque and a minimum speed range of 100:1 on the high speed windings. The motor shall also be designed for full voltage starting on the low speed windings. Furnish with stainless steel nameplates.

Motor shall be provided with dual C-face mounting flanges and the enclosure shall be TEFC. Coordinate C-face mounting flange dimensions and details with the motor reducer supplier, solenoid brake and mechanical/machinery contractor. Contractor shall coordinate the brake hub, clearances and dimensions of the motor and the brake with the suppliers to assure fit and function.

The motor shall have a solenoid brake mounted to the back. The brake shall be spring held, electrically released. The brake shall be rated for 460V and shall be controlled from a motor starter. The brake shall not be connected to the motor terminals. A proximity type limit switch shall be mounted in the brake. The limit switch shall be normally open and close when the brake is released. Furnish brake with conduit box and terminal strip for wire connections. Furnish brake with stainless steel hardware.

Furnish brake through shaft with a special connection and end cover lockable with a padlock. Furnish and install a pad lockable cover over the shaft extension, a pad lock and connection to the brake assembly, a special shaft end to match a 15 inch diameter hand wheel, furnish a 15 inch hand wheel painted yellow able to connect to the shaft without using tools and a "lock out – tag out" procedure to manually operate the machinery with the hand wheel after manually disconnecting and locking the power to the bridge and all electrical controls. Procedure shall be furnished to the Engineer for approval prior to ordering the motor and brake assemblies.

C. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings.

D. Spare Parts

One spare motor with a complete brake assembly shall be furnished and stored as directed by the NCDOT.

21.0 MACHINERY BRAKE

Material and installation requirements for the machinery brake.

A. Materials and Equipment

Each brake shall be a spring-set, thruster-released, shoe-type, open brake and shall be provided with corrosion resistant fittings. Each brake shall be rated at no more than 550 foot-pounds on a 60-second basis and shall be factory set to exert an actual retarding torque as required by the Engineer.

Brakewheels shall be furnished with the brakes by the machinery manufacturer. The bores shall be left undersized and the brakewheels shipped to the machinery manufacturer, who shall finish-bore and keyseat the brakewheels and install them on the primary differential enclosed gear reducer extended input shafts. The brakewheels shall have a hub diameter at least 1.8 times the shaft diameter. The brakewheel hub/shaft connection shall be an ANSI Class FN2 shrink fit. The keyway shall extend the length of the brakewheel hub.

Brakes shall be equipped with hand release lever, which shall not change the torque setting or removable levers or wrenches to operate. The hand release mechanism shall be located on the side of the brake opposite the speed reducer – right hand and left hand units are required. Each hand release shall be provided with a lever-type limit switch with two double throw contacts for interlocking purposes. Interlocking shall be in accordance with the Plans. It shall not be possible to set the hand release of the brakes without tripping his switch.

Two additional lever-type limit switches shall be mounted on each brake, each with double throw contacts. One shall indicate that the brake is fully set and the other that the brake is fully released. The brake released limit switch (which shall have two normally open contacts) shall trip when the brake is electrically or hand released. The brake set limit switch (which shall have one normally open and one normally closed contact) shall trip when the brake is fully set.

Each switch shall be furnished with a pre-wired, factory-sealed epoxy coated SOW cable and shall have a NEMA 6P rating. Switches shall be Cutler-Hammer Series E50, Square-D Series 9007, NEMA 6P, or Allen Bradley Type 802, or equal approved by the Engineer.

Brake shall be provided with adjustable set time delay. The set time delay of the thruster shall be set in such a manner that the brake will not be applied suddenly and simultaneously should electric power fail while the lift span is in motion. The delay time shall be adjusted such that a smooth stopping is achieved.

The oil used in the thruster operating chambers of the brakes shall be of a grade recommended by the brake manufacturer and approved by the Engineer. The oil shall have a free operating temperature range of between -40°F and 150°F.

The thrusters shall be actuated by 480-volt, three-phase, 60 Hertz, totally enclosed, squirrel cage motors controlled by magnetic contactors with manual reset thermal overload relays. The rated stalled thrust of each thruster shall be not less than 135% of the thrust required to release the brake with the torque adjusted to the continuous rated value.

Each brake shall be equipped with a NEMA 3R enclosure, which encloses the entire brake assembly, including the brake thruster unit and brakewheel, and which does not prevent hand release operation.

A. Execution

Install in accordance with manufacturer's instructions and as indicated on the Drawings.

22.0 PAYMENT

The cost of the electrical work for the bridge and for the repair and construction of the Control Building as detailed on the plans shall be included in the lump sum price bid Bridge Electrical Work shown below. The price is full compensation for furnishing and installing all electrical equipment, coordination with the utility, and all other materials or tasks required for the electrical work.

Payment will be made under:

Pay Item	Pay Unit
Bridge Electrical Work	Lump Sum

CCTV

SPECIAL

The work under shall consist of furnishing, installing, and placing in permanent operating condition all closed circuit television equipment as described in this specification and all junction boxes, terminal cabinets, and wiring termination associated with this equipment.

1.0 MATERIALS AND EQUIPMENT

Provide and install camera, monitor, controller, mounting hardware, and all other necessary hardware to install a complete CCTV System as shown in the plans and described herein. Conduits and wiring shall be installed as part of the work described under, "Electrical" and paid for as part of "CCTV" work. All termination of the CCTV System wiring, shall be done as part of the "CCTV" work.

Contractor shall provide all equipment necessary for a fully functional system. Camera and monitor shall meet the requirements described below:

Camera shall be a low light, (minimum 1/3 inch sensor, 0.5 LUX light sensitivity) CCD color camera with an auto iris zoom lens with spot filter, and mounting hardware. Units shall be mounted in a pressurized weatherproof enclosure with heater, mounted atop a weatherproof assembly. Camera shall be pendant mounted. Camera shall be a Pelco IS50/IS51 Series Camclosure 2 Camera System or approved equal. A 120/24V power supply shall be included.

Monitors shall be 17-inch color LCD 1024 x 768 (minimum pixels) desk top unit model that is capable of standard VESA mounting for attachment to a wall of an enclosure. Control system shall consist of a “plug and play” appropriate controller and a means of routing the camera image to any monitor. All equipment shall be provided in quantities necessary to complete the system and all units shall operate at 120 volts AC. Monitor shall be a Pelco 17 inch 400 Series Flat Panel, TFT LCD Monitor or approved equal.

Any requirements for CCTV, beyond the configuration described here or shown in the Plans, will not be paid as additional work. Any such work shall be proposed, drawn on Plan sheets and submitted by the Contractor for review by the Engineer. No proposed changes in the designed work shall be performed without approval from the Engineer.

Cameras shall be located so that the Bridge Operator may easily verify that no vessels are in the waterway to the South of the US70 Highway Bridge with the view of the camera. Camera lenses shall be selected to provide ample view with some overlap so that no opportunity exists for a vessel to hide from the operator anywhere between the fenders. Cameras shall be aimed and equipped to provide the required views (shown on the Plans).

Camera, monitor, and power supply shall all be from the same manufacturer.

Coaxial cable shall be rated for outdoor use. Nominal impedance is 75 OHMS. Voltage rating shall be 600V. The cable shall be lashed with a multi-conductor cable (2#12AWG, #12G) to a 5/16 IN stainless steel messenger for routing on the highway bridge. The lashing shall be stainless steel. The multi-conductor cable shall provide power for the camera (via the power supply). See the electrical provisions for other messenger/aerial cable requirements.

2.0 METHODS OF CONSTRUCTION

The construction requirements for Closed Circuit Television electrical work shall be as indicated under Common Provisions and the Materials and Equipment portion of this section.

3.0 MEASUREMENT AND PAYMENT

CCTV will be paid for at the contract lump sum price. Such price and payment shall be full compensation for furnishing the and installing the system specified, and for all equipment, tools, labor, services, materials and incidentals necessary to furnish, place, install, coordinate, test, make operational, training and maintenance required to install and complete the CCTV installation necessary to complete the work of viewing the channel from the Remote Control Station.

Payment will be made under:

Pay Item	Pay Unit
CCTV	Lump Sum

**MISCELLANEOUS RIVET REPLACEMENT
SPECIAL****1.0 GENERAL**

The Contractor will replace damaged or missing structural rivets, that are not otherwise called out to be replaced as part of another structural repair, on the bascule span, A-tower and stationary span in accordance with the criteria of this provision and the contract drawings. Structural rivets replaced in the course of other structural repairs, as shown on the contract plans, will be considered incidental to the work being performed and hence will not be measured and paid for under Miscellaneous Rivet Replacement.

The bascule span superstructure will be cleaned and painted as part of this contracted described in these provisions. The contractor shall provide the Engineer with a report of the remaining rivets after cleaning operations and after the structural repairs and reinforcements have been completed, that exhibit a section loss of greater than 40 Percent of head or are found to be loose.

The Contractor shall furnish all equipment, tools, labor and materials in connection with the removal of the rivet and replacement with a galvanized ASTM A-325 bolt of the proper grip, including all accessories, hardware, nuts and washers, in accordance with plans and as herein specified. The material and workmanship shall conform to the current American Railway Engineering Association's Specifications for Steel Railway Bridges, except as modified by the following stipulations:

A. Materials**1. Bolts**

ASTM A-325 galvanized bolts manufactured in the USA. ASTM A-449 galvanized bolts may also be used.

2. Washers

Furnish and install galvanized hardened steel washer under the head and the nut conforming to ASTM F436.

3. High Strength Nuts

Furnish and install galvanized heavy hex nuts conforming to ASTM A563. Tighten per AREMA Turn of the Nut method.

2.0 MEASUREMENT AND PAYMENT

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Rivet removal and installation of a galvanized high strength bolt will be paid for at the contract price per each. Such price and payment shall be full compensation for removal of a rivet, furnishing the new high strength bolt, nuts, washers and proper tensioning of the bolt. All equipment, tools, labor, services, materials and incidentals necessary to furnish, place, install, coordinate, test and complete the rivet replacement shall be included in the cost per each rivet replaced item.

Payment will be made under:

Pay Item

Miscellaneous Rivet Replacement

Pay Unit

Each