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Letting April 27, 2018

Notice to Bidders, Specifications and Proposal



**Illinois Department
of Transportation**

Springfield, Illinois 62764

**Contract No. 60P55
WILL County
Section 2011-045-I
Various Routes
Project NHPP-STP-FAP6(281)
District 1 Construction Funds**

Prepared by

Checked by

F

(Printed by authority of the State of Illinois)



NOTICE TO BIDDERS

- 1. TIME AND PLACE OF OPENING BIDS.** Electronic bids are to be submitted to the electronic bidding system (iCX-Integrated Contractors Exchange). All bids must be submitted to the iCX system prior to 10:00 a.m. April 27, 2018 at which time the bids will be publicly opened from the iCX SecureVault.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60P55
WILL County
Section 2011-045-I
Project NHPP-STP-FAP6(281)
Various Routes
District 1 Construction Funds**

Local centralized control and operation of the six movable bridges from Ruby Street to Brandon Road in the City of Joliet

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.

(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to readvertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Randall S. Blankenhorn,
Secretary

INDEX
 FOR
 SUPPLEMENTAL SPECIFICATIONS
 AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2018

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used RECURRING SPECIAL PROVISIONS.

ERRATA Standard Specifications for Road and Bridge Construction (Adopted 4-1-16) (Revised 1-1-18)

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STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted April 1, 2016, the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," and the "Manual of Test Procedures for Materials" in effect on the date of invitation for bids, and the Supplemental Specifications and Recurring Special Provisions indicated on the Check Sheet included herein which apply to and govern the construction of Various Routes, Project NHPP-STP-FAP6(281), Section 2011-045-I, Will County, Contract No. 60P55 and in case of conflict with any part or parts of said Specifications, the said Special Provisions shall take precedence and shall govern.

Various Routes
Project NHPP-STP-FAP6(281)
Section 2011-045-I
Will County
Contract No. 60P55

LOCATION OF PROJECT

The project is located in Will County, in the City of Joliet. The project includes work on the IDOT Bridge Office Building located at 105 Bridge Street and work on the following movable bridges over the Des Plaines River:

- Ruby Street Bridge
- Jackson Street Bridge
- Cass Street Bridge
- Jefferson Street Bridge
- McDonough Street Bridge
- Brandon Road Bridge

Minor work will also be performed on the I-80 Bridge over the Des Plaines River.

DESCRIPTION OF PROJECT

The project provides centralized control capability of the six Joliet movable bridges from three new operator stations in the IDOT Bridge Office building. The project scope includes improvements to the IDOT Bridge Office building, individual bridge control and monitoring system upgrades, design of dedicated fiber optic communications networks, and installation of wireless backup network equipment.

For the IDOT Bridge Office building, the project provides interior renovations to create space for three bridge operator stations including mechanical HVAC work, restroom renovations, installing new lighting, replacing the existing electrical system, and installing operator desks and centralized monitoring equipment. Supporting work on the building exterior and electrical service will include installation of entrance door access control, and the installation of a new building electric utility service, backup diesel generator, and automatic transfer switch.

New automated control systems, CCTV camera systems, and related systems are provided for each movable bridge. These systems will be designed for primary centralized control from the IDOT Bridge Office building while retaining the ability to locally operate each bridge from the bridge's operator house. Centralized control capability will be tested and implemented for the Jackson Street Bridge with a dedicated fiber optic network connection to the IDOT Bridge Office building. The centralized control capability of the other five bridges will be tested upon the installation of the fiber optic communications cable system by a separate contract. The project will also provide a wireless backup network to support centralized control. Wireless equipment will be installed on the I-80 bridge in addition to the wireless network equipment installed on the six movable bridges and the IDOT Bridge Office building.

The project includes providing other equipment and systems as described herein and all incidental and collateral work necessary to complete the project as shown on the Plans and described herein.

COORDINATION WITH ADJACENT AND/OR OVERLAPPING CONTRACTS

This contract abuts and/or overlaps with other concurrent and future contracts as listed below. Each contract includes work items requiring close coordination between the various Contractors regarding the sequence and timing for execution of work items in accordance with Article 105.08 of the Standard Specifications and as herein noted. This contract also includes critical work items that affect the future staging of traffic and the completion dates of other contracts. These critical items along with their completion dates are listed after each contract. The list below identifies known contracts, but other contracts may become active prior to construction and the Contractor shall be also be responsible for coordination with these contracts. Such contracts will be identified at the time of the pre-construction meeting.

(a) Contract #62A22

Critical items affecting the above contract:

- (1) Brandon Road Bridge conduit and wiring replacement.

(b) Contract #62C04

Critical items affecting the above contract:

- (1) Structural repairs on the Jefferson Street Bridge.

(c) Contract #62B79

Critical items affecting the above contract:

- (1) Structural repairs on the Ruby Street Bridge.

(d) Contract #62G14 (Fiber Optic Network Installation to support Centralized Control 60P55)

Critical items affecting the above contract:

- (1) Coordination of fiber optic network design.
- (2) Installation schedule for fiber optic cable segments.
- (3) Testing and labeling of fiber optic cables.
- (4) Coordination of traffic control and road closures.

Add the following paragraph to the beginning of Article 105.08.

“The Contractor shall identify all such work items (including the critical items listed in the Contract) at the beginning of the contract and coordinate the sequence and timing for their execution and completion with the other Contractors through the Engineer. All of these work items shall be identified as separate line items in the Contractor’s proposed Construction Progress Schedule. Items requiring coordination between contracts are not limited to those critical items listed herein. The Contractor shall exercise diligent effort to coordinate all contract work for the benefit of the project effort as a whole. Additional compensation or the extension of contract time will not be allowed for the progress of the work items affected by the lack of such coordination by the Contractor.”

COORDINATION OF MARINE NAVIGATION

Description. This work consists of conforming all operations in the waterway to the requirements or directions of the U.S. Coast Guard.

U.S. Coast Guard Coordination. The Contractor shall bear full responsibility for all required coordination with the U.S. Coast Guard. All communications with the U.S. Coast Guard shall be coordinated through the IDOT Resident Engineer. The Contractor shall submit a work plan for approval to the Coast Guard (copy also to be provided to the Engineer) prior to starting any work. This shall include a description of the Contractor’s method of doing the repairs, the days and hours of the week that work will be done, the location of work barges in relation to the navigation channel, and any other means and methods that may affect navigation. This also shall include dates and times of any desired scheduled river closures. The Contractor shall not start work until he is in receipt of a Conditions Approval from the Coast Guard.

The actual river closures allowed shall be fully at the discretion of the Coast Guard. The Department shall not be held responsible for any requirements, stipulations, limitations, etc. related to waterway disruptions as imposed by the Coast Guard, which conflict with the requirements of the Contract Documents. Any such conflict shall not be considered cause for delay or additional payment.

The Contractor shall bear full responsibility for all fines, fees, and damages resulting from non-compliance with the requirements of this section, Coast Guard regulations and requirements, and/or any other applicable local, state, or federal laws and regulations.

Signing. During construction activity on the six movable bridges, four channel warning signs shall be securely erected, one on each channel bank upstream and downstream of the centerline of the affected bridge for the duration of construction activity.

The signs shall be a minimum of 4 feet by 8 feet exterior grade, 3/4-inch thick plywood and shall be painted with two coats of exterior grade white enamel paint. The lettering shall be painted with black exterior grade paint. The letters shall be a minimum of 8 inches high, using uppercase block lettering indicating “Bridge Construction 500 Feet Ahead”.

At the completion of new construction for each bridge, the Contractor shall provide and install permanent signs to display IDOT bridge tender marine radio channel and telephone number contact information to marine vessels. Signs shall be installed on the upstream and down stream sides of each movable bridge. Construction and materials for signs shall follow Federal Highway Administration MUTCD guidelines for General Service Signs having reflective blue foreground with white letters/numbers, symbols, and borders. Sign content and design shall follow current 33 CFR 117.24 regulations and shall be as required by the local Coast Guard District Commander. Final locations for signs shall be approved by the Coast Guard.

Observer. Whenever construction is in operation over and/or adjacent to the channel, one observer shall be positioned to watch for oncoming marine vessels from either direction. An audible signal shall be sounded for all work to cease when a marine vessel is 500 feet from the bridge. An all clear signal shall be sounded when the vessel has passed the construction area and work may resume. The observer shall have a radio that can be used to communicate with the marine vessel.

The Contractor shall notify the bridge operator whenever workers are in a position to be affected by marine traffic. The bridge operator will notify the Contractor's observer that vessels are approaching and from which direction.

All work, including flame-cutting, welding, and similar spark-producing operations, shall be suspended whenever a marine vessel, regardless of size, is approaching the bridge and is within 500 feet of the bridge and shall remain suspended until the entire marine vessel has completely passed away from the bridge area.

Obstructions. Should the Contractor, during progress of work, lose, throw overboard, sink or misplace any material, machinery, plant, or appliance, he shall immediately recover and remove the same. The Contractor shall give immediate notice, with the description and location of any item not recovered immediately, to the Coast Guard; and when required by the Coast Guard, shall mark or buoy such item until it is recovered and removed.

Lighting. The Contractor shall provide and maintain whatever navigation lights and other navigation signals or facilities as may be required by the Coast Guard on all temporary construction or vessels and on all existing permanent construction. Temporary lights, signals or facilities, when required by the Coast Guard, shall be provided and maintained by the Contractor until final acceptance of the work under this contract.

Notice of Unscheduled River Closure. The Contractor shall be responsible to arrange with the Coast Guard for times and dates when work on the bridge shall require restrictions to the navigation of the waterway. A two week (14 day) advance notice will be required for any unscheduled river closure for a period of 8 hours or one day. The Contractor shall work continuously (around the clock in multiple shifts) during any unscheduled waterway disruption and re-open the waterway as soon as the work necessitating the disruption is completed.

River Level. Due to unpredictable weather conditions, work may have to be stopped until the river level returns to normal pool elevations. This decision will be made by the Coast Guard.

Trial Phase. Upon completion of the Contractor's work and centralized control testing for the first bridge, there shall be a trial centralized control operation period to demonstrate the safety and reliability of the system to the Coast Guard. The trial period is currently estimated to be 60 consecutive days of centralized control operations requiring no intervention from the bridge operators with local (at bridge) controls, except for the incidence of failures unrelated to centralized control operations.

U.S. Coast Guard Contact Person. The contact person from the Coast Guard for this rehabilitation project is:

Mr. Eric Washburn
U.S. Coast Guard
Coast Guard 8th District
1222 Spruce Street
St. Louis, Missouri 63103-2832
Phone: (314) 269-2378

Basis of Payment. All costs incurred by the Contractor in complying with the above requirements shall be considered as completely covered by the prices bid for the various items of work included in the Contract.

COORDINATION WITH OTHER AGENCIES

Description. This work consists of all necessary coordination with other agencies outside of IDOT's District 1 Bureau of Design and Bureau of Construction. Coordination with the USCG shall be as described in Coordination of Marine Navigation. All coordination with outside agencies shall be done through the IDOT Resident Engineer. This shall include coordination with other Bureaus within IDOT. Coordination with other agencies shall include, but is not limited to, the following agencies:

City of Joliet. The Contractor shall coordinate with the City of Joliet for all construction activities closing or otherwise limiting vehicular traffic flow / pedestrian sidewalk access on any of the six movable bridges and for all construction activities within City right-of-ways. The Contractor is alerted to the fact that local and regional events could potentially place restrictions on when individual bridges are allowed to be closed to vehicular traffic. Annual events that could potentially impact roadway closures include:

- (a) Race Fan Rally – Parade/Rally, coincides with early July NASCAR race at Chicagoland Speedway, Chicago Street between Cass and Jefferson Streets.
- (b) New Orleans North – June outdoor festival event, downtown Joliet.
- (c) IHSA Baseball Tournament – June.

Immediately following Contract Execution, the Contractor shall coordinate with the City of Joliet to identify any potential event dates to incorporate into the Contractor's construction schedule.

United States Army Corps of Engineers (USACOE). Coordinate with the USACOE for construction activities involving the river wall and construction at the Brandon Road Bridge adjacent to or within the secured Brandon Locks area. The Contractor shall provide advance notice of construction activities a minimum of 72 hours prior to beginning work. The Contractor shall submit hard copy and electronic as-built drawings to the USACOE detailing all modifications and shall provide all supporting documentation.

The USACOE contact person is:

Mr. Henry DeHaan
Chief, Operations Technical Services
(309)-794-5853
Henry.C.Dehaan@usace.Army.mil

The Contractor is alerted to a potential USACOE wall repair project for river walls south of McDonough Street.

Illinois EPA. The Contractor is alerted to a potential hydroelectric project down river from the Brandon Road Bridge. Coordinate construction activities with the Illinois EPA and/or all other associated agencies.

Will County. Coordinate planned closures of Brandon Road with the Will County Division of Transportation as indicated on the Plans.

Basis of Payment. All costs incurred by the Contractor in complying with the above requirements shall be considered as completely covered by the prices bid for the various items of work included in the Contract.

MAINTENANCE OF ROADWAYS

Effective: September 30, 1985

Revised: November 1, 1996

Beginning on the date that work begins on this project, the Contractor shall assume responsibility for normal maintenance of all existing roadways within the limits of the improvement. This normal maintenance shall include all repair work deemed necessary by the Engineer, but shall not include snow removal operations. Traffic control and protection for maintenance of roadways will be provided by the Contractor as required by the Engineer.

If items of work have not been provided in the contract, or otherwise specified for payment, such items, including the accompanying traffic control and protection required by the Engineer, will be paid for in accordance with Article 109.04 of the Standard Specifications.

RESTRICTION ON WORKING DAYS AFTER A COMPLETION DATE

Effective: January 21, 2003

Revised: January 1, 2007

All temporary lane closures during the period governed by working days after a completion date will not be permitted during the hours of 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m. Monday through Friday.

All lane closure signs shall not be erected any earlier than one-half (1/2) hour before the starting hours listed above. Also, these signs should be taken down within one-half (1/2) hour after the closure is removed.

Failure to Open Traffic Lanes to Traffic: Should the Contractor fail to completely open and keep open all the traffic lanes to traffic in accordance with the limitations specified above, the Contractor shall be liable and shall pay to the Department the amount of \$250 per lane blocked, not as a penalty but as liquidated and ascertained damages, for each and every 15 minute interval or a portion thereof that a lane is blocked outside the allowable time limitations. The Department may deduct such damages from any monies due the Contractor. These damages shall apply during the period governed by working days after a completion date and any extensions of that contract time.

FAILURE TO COMPLETE THE WORK ON TIME

Effective: September 30, 1985

Revised: January 1, 2007

Should the Contractor fail to complete the work on or before the completion date as specified in the Special Provision for "Completion Date Plus Working Days", or within such extended time as may have been allowed by the Department, the Contractor shall be liable to the Department in the amount of \$8,000, not as a penalty but as liquidated damages, for each calendar day or a portion thereof of overrun in the contract time or such extended time as may have been allowed.

In fixing the damages as set out herein, the desire is to establish a certain mode of calculation for the work since the Department's actual loss, in the event of delay, cannot be predetermined, would be difficult of ascertainment, and a matter of argument and unprofitable litigation. This said mode is an equitable rule for measurement of the Department's actual loss and fairly takes into account the loss of use of the roadway if the project is delayed in completion. The Department shall not be required to provide any actual loss in order to recover these liquidated damages provided herein, as said damages are very difficult to ascertain. Furthermore, no provision of this clause shall be construed as a penalty, as such is not the intention of the parties.

A calendar day is every day shown on the calendar and starts at 12:00 midnight and ends at the following 12:00 midnight, twenty-four hours later.

COMPLETION DATE PLUS WORKING DAYS

Effective: September 30, 1985

Revised: January 1, 2007

Revise Article 108.05 (b) of the Standard Specifications as follows:

"When a completion date plus working days is specified, the Contractor shall complete all contract items and safely open all roadways to traffic by 11:59 PM on August 31, 2020 except as specified herein.

The Contractor will be allowed to complete all clean-up work and punch list items within 10 working days after the completion date for opening the roadway to traffic. Under extenuating circumstances the Engineer may direct that certain items of work, not affecting the safe opening of the roadway to traffic, may be completed within the working days allowed for clean up work and punch list items. Temporary lane closures for this work may be allowed at the discretion of the Engineer.

Article 108.09 or the Special Provision for "Failure to Complete the Work on Time", if included in this contract, shall apply to both the completion date and the number of working days.

TRAFFIC CONTROL PLAN

Effective: September 30, 1985

Revised: January 1, 2007

Traffic Control shall be according to the applicable sections of the Standard Specifications, the Supplemental Specifications, the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways", any special details and Highway Standards contained in the plans, and the Special Provisions contained herein.

Special attention is called to Article 107.09 of the Standard Specifications and the following Highway Standards, Details, Quality Standard for Work Zone Traffic Control Devices, Recurring Special Provisions and Special Provisions contained herein, relating to traffic control.

The Contractor shall contact the District One Bureau of Traffic at least 72 hours in advance of beginning work.

STRUCTURE CLOSURES:

- SN 099-9901 Ruby Street Bridge over Des Plaines River
- SN 099-0239 Jackson Street Bridge over Des Plaines River
- SN 099-0101 Cass Street Bridge over Des Plaines River
- SN 099-0166 Jefferson Street Bridge over Des Plaines River
- SN 099-9904 McDonough Street Bridge over Des Plaines River
- SN 099-9903 Brandon Road Bridge over Des Plaines River

The Contractor shall be allowed to close each of the bridges for a maximum of 60 days. Only one bridge shall be closed at a time, except that the Brandon Road Bridge closure may coincide with closure of the bridges at Ruby Street, Jackson Street, and Cass Street.

STANDARDS:

701601

This Standard is used for lane closure during the Ruby Street Bridge detour.

701701

This Standard is used for lane closure during the Cass Street Bridge detour.

701901

This Standard includes the traffic control device details. All heights shown shall be measured from the pavement surface.

DETAILS:

Ruby Street Detour Plans

Jackson Street Detour Plan

Cass Street Detour Plan

Jefferson Street Detour Plans

McDonough Street Detour Plan

Brandon Road Detour Plan

TC-21 (Detour Signing for Closing State Highways)

SPECIAL PROVISIONS:

Traffic Control and Protection (Special)

Overall Construction Sequence

Maintenance of Roadways

Temporary Traffic Signal Timing

Temporary Information Signing

Portable Changeable Message Signs (BDE)

Lights on Barricades (BDE)

Equipment Parking and Storage (BDE)

ENGINEER'S FIELD OFFICE TYPE A (SPECIAL)

Effective: December 1, 2011

Revised: May 1, 2013

Revise the first paragraph of Article 670.02 to read:

670.02 Engineer's Field Office Type A (Special). Type A (Special) field offices shall have a ceiling height of not less than 7 feet and a floor space of not less than 3000 square feet with a minimum of two separate offices. The office shall also have a separate storage room capable of being locked for the storage of the nuclear measuring devices. The office shall be provided with sufficient heat, natural and artificial light, and air conditioning. Doors and windows shall be equipped with locks approved by the Engineer.

Revise the first sentence of the second paragraph of Article 670.02 to read:

An electronic security system that will respond to any breach of exterior doors and windows with an on-site alarm shall be provided.

Revise the last sentence of the third paragraph of Article 670.02 to read:

Adequate all-weather parking space shall be available to accommodate a minimum of twelve vehicles.

Revise the fifth paragraph of Article 670.02 to read:

Sanitary facilities shall include hot and cold potable running water, lavatory and toilet as an integral part of the office where available. Solid waste disposal consisting of seven waste baskets and an outside trash container of sufficient size to accommodate a weekly provided pick-up service. A weekly cleaning service for the office shall be provided.

Revise subparagraph (a) of Article 670.02 to read:

(a) Twelve desks with minimum working surface 42 inch x 30 inch each and twelve non-folding chairs with upholstered seats and backs.

Revise the first sentence of subparagraph (c) of Article 670.02 to read:

(c) Two four-post drafting tables with minimum top size of 37-½ inch x 48 inch.

Revise subparagraph (d) of Article 670.02 to read:

(d) Eight free standing four-drawer legal size file cabinets with lock and an underwriters' laboratories insulated file device 350 degrees one hour rating.

Revise subparagraph (e) of Article 670.02 to read:

- (e) Twenty folding chairs and two conference tables with minimum top size of 44 inch x 96 inch.

Revise subparagraph (h) of Article 670.02 to read:

- (h) Three electric desk type tape printing calculator and two pocket scientific notation calculators with a 1000 hour battery life or with a portable recharger.

Revise subparagraph (i)(2) of Article 670.02 to read:

- (i)(2) Telephones lines. Five separate telephone lines including one line for the fax machine, and two lines for the exclusive use of the Engineer. All telephone lines shall include long distance service and all labor and materials necessary to install the phone lines at the locations directed by the Engineer. The TELCOM company shall configure ROLL/HUNT features as specified by the engineer.

Revise subparagraph (j) of Article 670.02 to read:

- (j) Two plain paper network multi-function printer/copier/scanner machines capable of reproducing prints up to 11 inch x 17 inch within automatic feed tray capable of sorting 30 sheets of paper. Letter size and 11 inch x 17 inch paper shall be provided. The contractor shall provide the multi-function machines with IT support for setup and maintenance.

Revise subparagraph (k) of Article 670.02 to read:

- (k) One plain paper fax machine including maintenance and supplies.

Revise subparagraph (l) of Article 670.02 to read:

- (l) Six four-line telephones, with touch tone, where available, and two digital answering machines, for exclusive use by the Engineer.

Revise subparagraph (m) of Article 670.02 to read:

- (m) One electric water cooler dispenser including water service.

Add the following subparagraphs to Article 670.02:

- (s) One 4 foot x 6 foot chalkboard or dry erase board.
- (t) One 4 foot x 6 foot framed cork board.

Add the following to Article 670.07 Basis of Payment.

The building or buildings, fully equipped, will be paid for at the contract unit price per calendar month or fraction thereof for ENGINEER'S FIELD OFFICE, TYPE A (SPECIAL).

UNDERGROUND RACEWAYS

Effective: March 1, 2015

Revise Article 810.04 of the Standard Specifications to read:

“Installation. All underground conduits shall have a minimum depth of 30-inches (700 mm) below the finished grade.”

Add the following to Article 810.04 of the Standard Specifications:

“All metal conduit installed underground shall be Rigid Steel Conduit unless otherwise indicated on the plans.”

Add the following to Article 810.04 of the Standard Specifications:

“All raceways which extend outside of a structure or duct bank but are not terminated in a cabinet, junction box, pull box, handhole, post, pole, or pedestal shall extend a minimum of 300 mm (12”) or the length shown on the plans beyond the structure or duct bank. The end of this extension shall be capped and sealed with a cap designed for the conduit to be capped.

The ends of rigid metal conduit to be capped shall be threaded, the threads protected with full galvanizing, and capped with a threaded galvanized steel cap.

The ends of rigid nonmetallic conduit and coilable nonmetallic conduit shall be capped with a rigid PVC cap of not less than 3 mm (0.125”) thick. The cap shall be sealed to the conduit using a room-temperature-vulcanizing (RTV) sealant compatible with the material of both the cap and the conduit. A washer or similar metal ring shall be glued to the inside center of the cap with epoxy, and the pull cord shall be tied to this ring.”

TEMPORARY INFORMATION SIGNING

Effective: November 13, 1996

Revised: January 2, 2007

Description.

This work shall consist of furnishing, installing, maintaining, relocating for various states of construction and eventually removing temporary informational signs. Included in this item may be ground mount signs, skid mount signs, truss mount signs, bridge mount signs, and overlay sign panels which cover portions of existing signs.

Materials.

Materials shall be according to the following Articles of Section 1000 - Materials:

	<u>Item</u>	<u>Article/Section</u>
a.)	Sign Base (Notes 1 & 2)	1090
b.)	Sign Face (Note 3)	1091
c.)	Sign Legends	1092
d.)	Sign Supports	1093
e.)	Overlay Panels (Note 4)	1090.02

Note 1. The Contractor may use 5/8 inch (16 mm) instead of 3/4 inch (19 mm) thick plywood.

Note 2. Type A sheeting can be used on the plywood base.

Note 3. All sign faces shall be Type A except all orange signs shall meet the requirements of Article 1106.01.

Note 4. The overlay panels shall be 0.08 inch (2 mm) thick.

GENERAL CONSTRUCTION REQUIREMENTS

Installation.

The sign sizes and legend sizes shall be verified by the Contractor prior to fabrication.

Signs which are placed along the roadway and/or within the construction zone shall be installed according to the requirements of Article 701.14 and Article 720.04. The signs shall be 7 ft (2.1 m) above the near edge of the pavement and shall be a minimum of 2 ft (600 mm) beyond the edge of the paved shoulder. A minimum of two (2) posts shall be used.

The attachment of temporary signs to existing sign structures or sign panels shall be approved by the Engineer. Any damage to the existing signs due to the Contractor's operations shall be repaired or signs replaced, as determined by the Engineer, at the Contractor's expense.

Signs which are placed on overhead bridge structures shall be fastened to the handrail with stainless steel bands. These signs shall rest on the concrete parapet where possible. The Contractor shall furnish mounting details for approval by the Engineer.

Method of Measurement.

This work shall be measured for payment in square feet (square meters) edge to edge (horizontally and vertically).

All hardware, posts or skids, supports, bases for ground mounted signs, connections, which are required for mounting these signs will be included as part of this pay item.

Basis Of Payment.

This work shall be paid for at the contract unit price per square foot (square meter) for TEMPORARY INFORMATION SIGNING.

TEMPORARY TRAFFIC SIGNAL TIMING

Effective: May 22, 2002
890.02TS

Revised: July 1, 2015

Description.

This work shall consist of developing and maintaining appropriate traffic signal timings for the specified intersection for the duration of the temporary signalized condition, as well as impact to existing traffic signal timings caused by detours or other temporary conditions.

All timings and adjustments necessary for this work shall be performed by an approved Consultant who has previous experience in optimizing Closed Loop Traffic signal Systems for District One of the Illinois Department of Transportation. The Contractor shall contact the Traffic Signal Engineer at (847) 705-4424 for a listing of approved Consultants.

The following tasks are associated with TEMPORARY TRAFFIC SIGNAL TIMING.

- (a) Consultant shall attend temporary traffic signal inspection (turn-on) and/or detour meeting and conduct on-site implementation of the traffic signal timings.
- (b) Consultant shall be responsible for making fine-tuning adjustments to the timings in the field to alleviate observed adverse operating conditions and to enhance operations.
- (c) Consultant shall provide monthly observation of traffic signal operations in the field.
- (d) Consultant shall provide on-site consultation and adjust timings as necessary for construction stage changes, temporary traffic signal phase changes, and any other conditions affecting timing and phasing, including lane closures, detours, and other construction activities.
- (e) Consultant shall make timing adjustments and prepare comment responses as directed by the Area Traffic Signal Operations Engineer.
- (f) Return original timing plan once construction is complete.

Basis of Payment.

The work shall be paid for at the contract unit price each for TEMPORARY TRAFFIC SIGNAL TIMING, which price shall be payment in full for performing all work described herein per intersection. When the temporary traffic signal installation is turned on and/or detour implemented, 50 percent of the bid price will be paid. The remaining 50 percent of the bid price will be paid following the removal of the temporary traffic signal installation and/or detour.

FURNITURE REMOVAL, PROTECTION, RETURN

Description. Work shall consist of the removal of furniture and/or protection of furniture and relocation of furniture as required to complete the remodeling work in the Bridge Office Building.

Materials. Materials shall be those determined by the contractor as necessary for protecting during construction the furniture scheduled to remain within areas affected by the Work of this project. Materials may be new or used, but shall be serviceable to meet the Construction Requirements.

CONSTRUCTION REQUIREMENTS

Moving Furniture. In general, Contractor shall manage furniture in the Bridge Office during construction by:

- a) Moving it to the first floor for final disposition by the Department;
- b) Temporarily relocating it to the first floor and relocating it to the second floor when appropriate during Construction;
- (1) OR
- c) Temporarily relocating it on the second floor and repositioning it on the second floor at a time appropriate during construction.

Protection of Furniture. Condition of furniture at beginning of construction shall be maintained by Contractor during construction. Furniture will need to be protected by Contractor against damage by methods deemed appropriate by Contractor.

Schedule of Furniture. Refer to itemized inventory of furniture and photographs for summary of furniture to be handled by Contractor:

Location	Description of Furniture	Photograph #	Move to 1 st Floor for final disposition by IDOT	Temporarily Relocated To 1 st Floor and Returned to 2 nd Floor, Room #	Remains on 2 nd Floor During Construction – Return to Room # After Construction
Office 205	3 Yellow Desks	5, 7, 8			203
	Drafting Table	6			212
Office 209	None				
Office 212	Drafting Table	13			212
	2 Yellow Desks	14, 16			212
	Yellow File Cabinet	15	X		
	4 Gray File Cabinets	17	X		
Plan Room 204	4 Modular Plan Cabinets	1			206
	Small Yellow Desk/Table	2	X		
	Large Brown Desk	3	X		
	2 Drafting Tables	4			203
Plan Room / Storage 206	Xerox Machine	9			206
	10 Gray File Cabinets	10, 11			206
	1 Yellow Desk	12			203
Corridor 201	None				
Closet 207	None				

Closet 208	None				
Closet 210	None				
Closet 213	None				
Vault 211	None				



Plan Room 204 – 4 Mod. Plan Cabinets – Photo. 1



Plan Room 204 – Small Yellow Desk/Table – Photo. 2



Plan Room 204 – Large Brown Desk – Photo. 3



Plan Room 204 – 2 Drafting Tables – Photo. 4





Office 205 – Drafting Table – Photo. 6



Office 205 – 3 Yellow Desks – Photo. 7



Office 205 – 3 Yellow Desks – Photo. 8



Plan Room/Storage 206 – Xerox Machine – Photo. 9



Plan Room/Storage 206 – 10 File Cabinet Gray – Photo. 10



Plan Room/Storage 206 – 10 File Cab. Gray – Photo 11



Plan Room/Storage 206 – 1 Yellow Desk – Photo. 12



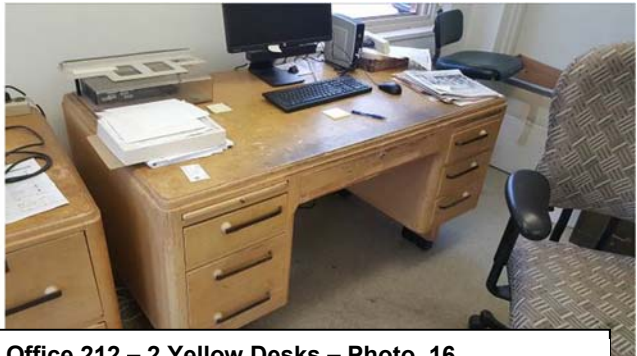
Office 212 – Drafting Table – Photo. 13



Office 212 – 2 Yellow Desks – Photo. 14



Office 212 – Yellow File Cabinet – Photo. 15



Office 212 – 2 Yellow Desks – Photo. 16



Office 212 – 4 Gray File Cabinets – Photo. 17

Method of Measurement. This work will be measured for payment as a single lump sum item.

Basis of Payment. This work will be paid for at the contract lump sum price for FURNITURE REMOVAL, PROTECTION, RETURN including all work associated with the furniture relocation/protection.

DEMOLITION - INTERIOR

Description. This work shall consist of demolition and removal of selected portions of general construction at the Bridge Office building as indicated by the drawings and as specified herein. Demolition of Plumbing, Mechanical and HVAC, and Electrical systems is not included under this Special Provision. Relocation, covering and protection of furniture, furnishings, and other equipment that has not been removed by the Department shall be included under the Special Provision "FURNITURE, REMOVAL, PROTECTION, RETURN."

Definitions.

Remove – Detach specified items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

Existing to Remain – Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed.

Materials Ownership. Unless otherwise indicated, demolition waste becomes property of Contractor.

Pre-demolition Conference. Conduct conference at project site with Engineer to inspect and discuss condition of construction to be selectively demolished and review all items designated to be removed.

Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

Review areas where existing construction is to remain and requires protection.

Informational Submittals.

Proposed Protection Measures. Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

Submit a Schedule of Selective Demolition Activities that includes a detailed sequence of selective demolition and removal work with starting and ending dates for each activity to ensure the Department's operations and employees and utility services on-site are uninterrupted.

Specifically identify any shutoff and capping to ensure continuation of all utility services to building.

Coordinate all demolition activities with Engineer while continuing occupancy of portions of the existing building and the Department's partial occupancy of completed work.

Field Conditions. The Department will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so the Department's operations will not be disrupted.

Review first

Conditions existing at time of inspection for bidding purpose will be maintained by the Department as far as practical.

Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

Retain one of

Hazardous Materials. It is not expected that hazardous materials will be encountered in the Work.

Hazardous materials will be removed by the Department before start of the Work. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer. Hazardous materials will be removed by the Department under a separate contract.

Storage or sale of removed items or materials on-site is not permitted.

Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

Maintain fire-protection facilities in service during selective demolition operations.

Performance Requirements.

Regulatory Requirements. Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

Standards. Comply with ANSI/ASSE A10.6 and NFPA 241.

Examination. Verify that utilities have been disconnected and capped before starting selective demolition operations.

Retain first

Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

Usually retain S

Existing Services/Systems to Remain. Maintain services/systems indicated to remain and protect them against damage:

Preparation.

Site Access and Temporary Controls. Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

Temporary Facilities. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain:

Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

Temporary Shoring. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

Strengthen or add new supports when required during progress of selective demolition.

Selective Demolition – General.

General. Demolish and remove existing construction only to the extent required by new construction and as indicated on Plans. Use methods required to complete the Work within limitations of governing regulations and as follows:

Proceed with selective demolition systematically, from higher to lower level.

Neatly cut openings and holes plumb, square, and true to dimensions required.

Use cutting methods least likely to damage construction to remain or adjoining construction.

Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.

Temporarily cover openings to remain.

Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

Do not use cutting torches until work area is cleared of flammable materials.

At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations.

Maintain portable fire-suppression devices during flame-cutting operations.

Maintain adequate ventilation when using cutting torches.

Provide temporary dustproof partitions isolating construction areas from the Department's occupied work areas to prevent dust infiltration into occupied area.

Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

Disposal of Demolished Materials. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Department's property, remove demolished materials from Project site.

Do not allow demolished materials to accumulate on-site.

Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

Burning of any demolished materials is strictly prohibited.

All demolished materials shall be removed from project site and legally dispose of.

Cleaning. Professionally clean entire area of selective demolition of dust, dirt, and debris caused by selective demolition operations.

Return adjacent areas to existing conditions before selective demolition operations began.

Demolition and construction areas shall be cleaned to the satisfaction of the Engineer.

Method of Measurement. Demolition - Interior will be measured for payment as a single lump sum. Demolition of Plumbing, Mechanical and Electrical systems is not considered under this pay item, but shall be included with "PLUMBING WORK BRIDGE OFFICE," "MECHANICAL HVAC WORK BRIDGE OFFICE" and "ELECTRICAL WORK BRIDGE OFFICE."

Basis of Payment. This work will be paid for at the contract lump sum price for DEMOLITION - INTERIOR, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

WALL ASSEMBLY

Description. This special provision covers the following components of construction for the interior partition Wall Assembly work at the Bridge Office: Non-Structural Metal Framing, Sound Attenuation Batt Insulation, and Gypsum Board as shown on the Plans and as specified herein.

NON-STRUCTURAL METAL FRAMING

Submittals.

- (a) Product Data: For each type of product.

Framing Systems.

- (a) Framing Members, General: Comply with ASTM C 754 for conditions indicated:
- (b) Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
- (c) Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- (d) Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
 - (1) Steel Studs and Runners: Minimum Base-Metal Thickness: 20 ga.
 - (2) Depth: As indicated on Plans.

(e) Slip-Type Head Joints: Provide deflection track where indicated.

- (1) Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

Installation – General.

Installation Standard. ASTM C 754.

Gypsum Board Assemblies. Also comply with requirements in ASTM C 840 that apply to framing installation.

Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

Install bracing at terminations in assemblies.

Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

Installing Framed Assemblies. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types:

- (a) Single-Layer Application: 16 in. o.c. unless otherwise indicated.
- (b) Tile Backing Panels: 16 in. o.c. unless otherwise indicated.

Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

Install studs so flanges within framing system point in same direction.

Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

Slip-Type Head Joints. Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

Door Openings. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

Install two (2) studs at each jamb unless otherwise indicated.

Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 in. clearance from jamb stud to allow for installation of control joint in finished assembly.

Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 in. o.c.

At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 in. from corner and cut insulation to fit.

Installation Tolerance. Install each framing member so fastening surfaces vary not more than 1/8 in. from the plane formed by faces of adjacent framing.

GYPSUM BOARD

Submittals.

- (a) Product Data: For each type of product indicated.

Interior Gypsum Board.

General. Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

- (a) Walls and Ceilings: A moisture- and mold-resistant type. With moisture- and mold-resistant core and surfaces:
 - (1) Core: 5/8 in., Type X.
 - (2) Long Edges: Tapered.

Trim Accessories.

Interior Trim. ASTM C 1047:

- (a) Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
- (b) Shapes:
 - (1) Cornerbead.
 - (2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - (3) Expansion (control) joint.

Exterior Trim. ASTM C 1047:

- (a) Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
- (b) Shapes:
 - (1) Cornerbead.
 - (2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - (3) Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

Joint Treatment Materials.

General. Comply with ASTM C 475/C 475M.

Joint Tape for Interior Gypsum Wallboard. Paper.

Joint Compound for Interior Gypsum Wallboard. For each coat use formulation that is compatible with other compounds applied on previous or for successive coats:

Prefilling. At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

Embedding and First Coat. For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound:

Use setting-type compound for installing paper-faced metal trim accessories.

Fill Coat. For second coat, use setting-type, sandable topping compound.

Finish Coat. For third coat, use setting-type, sandable topping compound.

Water-Resistant Gypsum Backing Board. Use setting-type taping compound and setting-type, sandable topping compound.

Auxiliary Materials.

General. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

Steel Drill Screws. ASTM C 1002, unless otherwise indicated:

Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 in. thick.

Sound Attenuation Batt Insulation. ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:

Fire-Resistance-Rated Assemblies. Comply with mineral-fiber requirements of assembly.

Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Execution. Comply with ASTM C 840.

Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

Applying Interior Gypsum Board. Install interior gypsum board in the following locations:

- (a) Type X: Vertical surfaces, unless otherwise indicated.

Installing Trim Accessories.

General. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

Interior Trim. Install in the following locations:

- (a) Cornerbead: Use at outside corners.

Exterior Trim. Install in the following locations:

- (a) Cornerbead: Use at outside corners.

Finishing Gypsum Board.

General. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for painting with egg-shell enamel paint. Promptly remove residual joint compound from adjacent surfaces.

Prefill open joints, rounded or beveled edges, and damaged surface areas.

Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

Gypsum Board Finish Levels. Finish panels to Level 4.

Protection. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

Remove and replace panels that are wet, moisture damaged, and mold damaged:

Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

Method of Measurement. Wall Assembly will be measured for payment as a lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for WALL ASSEMBLY, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

EXTERIOR DOOR AND WINDOW ASSEMBLY

Description. This special provision covers the replacement exterior door and window assembly and hardware to be furnished and installed at the second floor of the Bridge Office, as shown on the Plans and as specified herein. Removal of the existing door and window assembly is included under Demolition – Interior.

Performance Requirements. Basis of Design shall meet requirements of Kawneer-451T.

Submittals.

- (a) Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- (b) Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work:
 - (1) Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - (2) For exterior doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
 - (3) Submit only computer drawing (CAD) shop drawing not less than 11 in. by 17 in. paper size.
- (c) Samples for Initial Selection: For units with factory-applied color finishes.
- (d) Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- (e) Other Action Submittals:
 - (1) Exterior Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- (f) Qualification Data: For qualified Installer.
- (g) Welding certificates.
- (h) Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- (i) Warranties: Sample of special warranties.

Quality Assurance.

Installer Qualifications. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

Engineering Responsibility. Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

Source Limitations for Aluminum-Framed Systems. Obtain from single source from single manufacturer.

Project Conditions.

Field Measurements. Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

Warranty.

Special Warranty. Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period:

Failures include, but are not limited to, the following:

- (a) Structural failures including, but not limited to, excessive deflection.
- (b) Noise or vibration caused by thermal movements.
- (c) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- (d) Adhesive or cohesive sealant failures.
- (e) Water leakage through fixed glazing and framing areas.
- (f) Failure of operating components.

Special Warranty Period. Five (5) years from date of Substantial Completion.

Special Finish Warranty. Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering:

Special Finish Warranty Period. Ten (10) years from date of Substantial Completion.

Materials.

Aluminum. Alloy and temper recommended by manufacturer for type of use and finish indicated.

Framing Systems.

Framing Members. Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads:

Construction. Thermally broken.

Glazing System. Retained mechanically with gaskets on four (4) sides.

Glazing Plane. Center.

Brackets and Reinforcements. Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

Fasteners and Accessories. Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:

Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

Reinforce members as required to receive fastener threads.

Concrete and Masonry Inserts. Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

Concealed Flashing. Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

Framing System Gaskets and Sealants. Manufacturer's standard, recommended by manufacturer for joint type:

Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Glazing Systems.

Glazing. 1 in. insulated, Low E glass, tinted.

Glazing Gaskets. Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

Spacers and Setting Blocks. Manufacturer's standard elastomeric type.

Bond-Breaker Tape. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

Glazing Sealants. For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

Color. Black (to be confirmed with Engineer).

Aluminum Exterior Doors (Medium Stile Doors).

Exterior Doors. Manufacturer's standard glazed exterior doors for manual-swing operation.

Door Construction. 2 in., with minimum 0.125 in.- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods:

Door Design. Medium Stile (8-1/2 in. bottom rail, 3-1/2 in. top rail, 4-1/4 in. verticals).

Glazing Stops and Gaskets. Square, snap-on, extruded-aluminum stops and preformed gaskets:

Provide nonremovable glazing stops on outside of door.

Hardware Basis of Design.

- (a) Hinge: Concealed Leaf Continuous Hinge - 780-112HD - CLR
- (b) Exit Device: Von Duprin Rim Exit - 35A-NL-386 Trim-US26D
- (c) Keyed Cylinder: Schlage Conventional – match Department's keying
- (d) Closer: LCN – 4040-61-3018 XP DEL S-Cush Series – Parallel Arm Closer
- (e) Thermal Threshold: Hager 5" Saddle – 421S – MIL
- (f) Bottom Sweep: Hager 875 S x MIL
- (g) Weatherstripping: Hager 891 S x MIL
- (h) Drip Cap: Hager 810 S x MIL

Accessory Materials.

Joint Sealants. For installation at perimeter of aluminum-framed systems.

Fabrication. Extrude aluminum shapes before finishing.

Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Framing Members, General. Fabricate components that, when assembled, have the following characteristics:

Profiles that are sharp, straight, and free of defects or deformations.

Accurately fitted joints with ends coped or mitered.

Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

Physical and thermal isolation of glazing from framing members.

Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

Mechanically Glazed Framing Members. Fabricate for flush glazing without projecting stops.

Storefront Framing. Fabricate components for assembly using head, sill, and jamb-receptor system with screw spline at intermediate horizontal members.

Exterior Door Frames. Reinforce as required to support loads imposed by door operation and for installing door hardware:

At exterior doors, provide compression weather stripping at fixed stops.

At exterior doors, provide weather sweeps applied to door bottoms.

After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

Aluminum Finishes. Anodized, color as selected by Department. Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

Examination. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

Installation. Comply with manufacturer's written instructions.

Do not install damaged components.

Fit joints to produce hairline joints free of burrs and distortion.

Rigidly secure nonmovement joints.

Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

Seal joints watertight unless otherwise indicated.

Metal Protection. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

Install components plumb and true in alignment with established lines and grades, and without warp or rack.

Exterior Doors. Install to produce weathertight enclosure and tight fit at weather stripping.

Field-Installed Exterior Door Hardware. Install door hardware according to door hardware manufacturer's written instructions using concealed fasteners to greatest extent possible.

Install perimeter joint sealants (urethane to match mortar color) to produce weathertight installation.

Erection Tolerances. Install aluminum-framed systems to comply with the following maximum erection tolerances:

Location and Plane. Limit variation from true location and plane to 1/8 in. in 12 ft; 1/4 in. over total length.

Alignment. Where surfaces abut in line, limit offset from true alignment to 1/16 in.

Where surfaces meet at corners, limit offset from true alignment to 1/32 in.

Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in.

Adjusting. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer:

For entrance doors accessible to people with disabilities, adjust closers to provide a three (3) second closer sweep period for doors to move from a 70-degree open position to 3 in. from the latch, measured to the leading door edge.

Method of Measurement. Exterior Door and Window Assembly will be measured for payment as a single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price EXTERIOR DOOR AND WINDOW ASSEMBLY, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

DOORS, FRAMES, AND HARDWARE

Description. Extent of interior doors, frames and hardware is as shown on the Plans and as specified herein. Work shall include new flush wood doors, hollow metal frames and hardware for noted interior doors only. Refer to the Special Provision for “Exterior Door and Window Assembly” for requirements, measurement and payment for that separate component of work.

Definitions.

Minimum Thickness – Minimum thickness of base metal without coatings.

Standard Hollow Metal Work – Hollow metal work fabricated according to ANSI/SDI A250.8.

Submittals.

- (a) Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- (b) Shop Drawings: Include the following:
 - (1) Elevations of door design.
 - (2) Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - (3) Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - (4) Locations of reinforcement and preparations for hardware.
 - (5) Details of each different wall opening condition.
 - (6) Details of anchorages, joints, field splices, and connections.
 - (7) Details of accessories.
 - (8) Details of moldings, removable stops, and glazing.
 - (9) Details of conduit and preparations for power, signal, and control systems.
- (c) Other Action Submittals:
 - (1) Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Plans. Coordinate with door hardware schedule.
 - (2) Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.
 - (3) Hardware: Prepared by or under the supervision of hardware supplier detailing fabrication and assembly of door hardware as well as procedures and diagrams for installation.

Quality Assurance.

Source Limitations. Obtain hollow metal work from single source from single manufacturer.

Fire-Rated Door Assemblies. Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

Delivery, Storage, and Handling. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic:

Provide additional protection to prevent damage to finish of factory-finished units.

Deliver welded frames with two (2) removable spreader bars across bottom of frames, tack welded to jambs and mullions.

Store hollow metal work under cover at Project site. Place in stacks of five (5) units maximum in a vertical position with heads up, spaced by blocking, on minimum 4 in.- high wood blocking. Do not store in a manner that traps excess humidity:

Provide minimum 1/4 in. space between each stacked door to permit air circulation.

Project Conditions.

Field Measurements. Verify actual dimensions of openings by field measurements before fabrication.

Coordination. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

Materials.

Metallic-Coated Steel Sheet. ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

Frame Anchors. ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized:

Flush Wood Doors.

Submittals.

- (a) Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data:
 - (1) Indicate dimensions and locations of mortises and holes for hardware.
 - (2) Indicate fire-protection ratings for fire-rated doors.
- (b) Samples for Initial Selection: For factory-finished doors.
- (c) Samples for Verification:
 - (1) Factory finishes applied to actual door face materials, approximately 8 by 10 in., for each material and finish.
- (d) Warranty: Sample of special warranty.

Quality Assurance.

- (a) Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- (b) Source Limitations: Obtain flush wood doors from single manufacturer.
- (c) Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - (1) Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- (d) Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

Products.

- (a) Fire-Protection-Rated Doors: Provide specified or mineral core as needed to provide fire-protection rating indicated.
 - (1) Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

(b) Mineral-Core Doors:

- (1) Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
- (2) Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

(c) Interior Solid-Core Doors:

- (1) Grade: Premium, with Grade A faces.
- (2) Species: Select white birch.
- (3) Cut: Plain sliced (flat sliced).
- (4) Match between Veneer Leaves: Book match.
- (5) Construction: Five (5) or seven (7) plies.

Finishing.

- (a) General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
- (b) Prime paint all four edges of doors at factory. Apply two coats of finish paint to doors on site.
- (c) Painted Finish:
 - (1) Grade: Premium.
 - (2) Color: As selected by Engineer from manufacturer's full range.
 - (3) Sheen: Satin.

Hardware.

- (a) Basis of Design:
 - (1) Hinges: Hager BB1279.
 - (2) Latches: Schlage L-9000 Series Mortise Lock with 06 Levers.
 - (3) Functions: Passage F01 except F22 (lockable) for Restroom.

Standard Hollow Metal Frames.

General. Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

Interior Frames. Fabricated from cold-rolled steel sheet:

Fabricate frames with mitered or coped corners.

Frames for Level 1 Steel Doors: 0.042 in.- thick steel sheet.

Hardware Reinforcement. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

Anchors.

Floor Anchors. Formed from same material as frames, not less than 0.042 in. thick, and as follows:

Fabrication. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

Tolerances. Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861. Hollow Metal Frames. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames:

Welded Frames. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

Floor Anchors. Weld anchors to bottom of jambs and mullions with at least four (4) spot welds per anchor.

Jamb Anchors. Provide number and spacing of anchors required to meet specified fire protection rating.

Door Silencers. Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction:

Single-Door Frames. Drill stop in strike jamb to receive three (3) door silencers.

Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

Hardware Preparation. Factory prepare hollow metal work to receive specified hardware.

Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

Frame Steel Finishes.

Prime Finish. Apply manufacturer's standard primer immediately after cleaning and pretreating:

Shop Primer. Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

Examination. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Preparation. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

Squareness. Plus or minus 1/16 in., measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

Alignment. Plus or minus 1/16 in., measured at jambs on a horizontal line parallel to plane of wall.

Twist. Plus or minus 1/16 in., measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

Plumbness. Plus or minus 1/16 in., measured at jambs on a perpendicular line from head to floor.

Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

Installation.

General. Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Plans and manufacturer's written instructions.

Hollow Metal Frames. Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11:

Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged:

At fire-protection-rated openings, install frames according to NFPA 80.

Remove temporary braces necessary for installation only after frames have been properly set and secured.

Check plumbness, squareness, and twist of frames as walls are constructed.

Floor Anchors. Provide floor anchors for each jamb and mullion that extends to floor, and secure with concrete screws.

Installation Tolerances. Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

- (a) Squareness: Plus or minus 1/16 in., measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
- (b) Alignment: Plus or minus 1/16 in., measured at jambs on a horizontal line parallel to plane of wall.
- (c) Twist: Plus or minus 1/16 in., measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
- (d) Plumbness: Plus or minus 1/16 in., measured at jambs at floor.

Adjusting and Cleaning.

Final Adjustments. Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

Prime-Coat Touchup. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

Metallic-Coated Surfaces. Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

Method of Measurement. Doors, Frames, and hardware will be measured for payment as a single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for DOORS, FRAMES, AND HARDWARE, which price shall be payment in full for labor, equipment and material to furnish and install the work as specified herein.

FINISHES

Description. This special provision covers the following items of Finishes in the Bridge Office: Patching 1 x 1 surface-applied Ceiling Tile and Plaster, Resilient Wall Base, Resilient Tile Flooring and Interior Paint (walls, ceilings, interior door frames, trim, stair risers and rail, ducts, pipes and radiators) as shown on the Plans and as specified herein.

SURFACE-APPLIED ACOUSTICAL CEILING TILE

Match existing finish and textures. Adhere to existing construction. Cut in to blend jointing pattern. Paint to match adjacent finishes.

RESILIENT WALL BASE (RWB)

Description. Extent of resilient wall base is as shown on the drawing and as specified herein. Work shall include furnishing and installation of wall base at newly constructed walls and replacement of existing resilient wall base.

Action Submittals.

Product Data. For each type of product. Include preparation requirements and application instructions.

Samples for Verification. For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 in. long, of each resilient product color, texture, and pattern required.

Maintenance Material Submittals. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish not less than 10 lin. ft for every 500 lin. ft or fraction thereof, of each type, color, pattern and size of resilient product installed.

Quality Assurance.

Fire Test Response Characteristics. As determined by testing identical products according to ASTM e 648 or NFPA 253 by a qualified testing agency. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

Delivery, Storage and Handling. Store resilient products and installation material in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50°F or more than 90°F.

Project Conditions. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70°F or more than 95°F, in spaces to receive resilient products during the following time periods: 48 hours before installation, during installation or 48 hours after installation.

Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55°F or more than 95°F.

Install resilient products after other finishing operations, including painting, have been completed.

Product.

Resilient Base Standard. ASTM F 1861. Material Requirements: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic). Manufacturing Method: Group I (solid, homogeneous). Style: Cove (base with toe). Minimum Thickness: 0.125 in. Height: Match existing wall base. Lengths: Coils in manufacturer's standard length. Inside and Outside Corners: Preformed. Finish: Matte. Color and Patterns: To match existing wall base.

Installation Materials.

Adhesives. Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated. Adhesives shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Examination. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

Proceed with installation only after unsatisfactory conditions have been corrected.

Preparation. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products. Fill cracks, holes, and depression in substrates with leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Do not install resilient products until they are same temperature as the space where they are to be installed.

Resilient Base Installation. Comply with manufacturer's written instructions for installing resilient base.

Apply resilient base to walls, case work and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

Do not stretch resilient base during installation.

Pre-formed Corners: Install preformed corners before installing straight pieces.

Cleaning and Protection. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

Perform the following operations immediately after completing resilient product installation: Remove adhesive and other blemishes from exposed surfaces.

Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

RESILIENT TILE FLOORING (VCT)

Description. Extent of Resilient Tile Flooring (VCT) work is as shown on the Plans and as specified herein. The restroom will receive new Resilient Tile Flooring (VCT) along with any areas that need to be patched due to the removal of existing walls.

Submittals. Submit Product Data for each type of product indicated.

- (a) Samples for Verification: Full-size units of each color and pattern of floor tile required.
- (b) Submit sample of special warranty.

Informational Submittals.

- (a) Qualification Data: For qualified Installer.

Closeout Submittals.

- (a) Maintenance Data: For each type of floor tile to include in maintenance manuals.

Quality Assurance.

Installer Qualifications. A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.

Fire-Test-Response Characteristics. AS determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

Delivery, Storage, and Handling. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50°F or more than 90°F. Store floor tile on flat surfaces.

Maintain ambient temperatures within range recommended by manufacturer, but not less than 70°F or more than 95°F, in spaces to receive floor tile during the following time periods: 48 hours before installation, during installation and 48 hour after installation.

Until Substantial Completion, maintain ambient temperatures within range recommend by manufacturer, but not less than 55°F or more than 95°F.

Close spaces to traffic during floor tile installation.

Close spaces to traffic for 48 hours after floor tile installation.

Install floor tile after other finishing operations, including painting, have been completed.

Extra Materials. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish 1 box for every 50 boxes or fraction thereof, of each type, color and pattern of floor tile installed.

Vinyl Composition Floor Tile (VCT).

Tile Standard. ASTM F 1066, Class 2, through-pattern tile.

Wear Surface to be smooth.

Thickness to be 0.125 in.

Size to be 12 by 12 in.

Color and pattern to match existing VCT floor tile.

Installation Materials.

Adhesives. Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

VCT Tile Adhesives. Not more than 50 g/L.

Floor Polish. Provide protective liquid floor polish products as recommended by manufacturer.

Examination. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale and foreign deposits that might interfere with adhesion of floor tile.

Proceed with installation only after unsatisfactory conditions have been corrected.

Preparation. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

Concrete Substrates. Prepare according to ASTM F 710.

Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

Alkalinity and Adhesion Testing: Perform test recommended by manufacturer. Proceed with installation only after substrates pass testing.

Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

Do not install floor tiles until they are same temperature as space where they are to be installed.

Move resilient products and installation materials into spaces where they will be installed at least forty-eight (48) hours in advance of installation.

Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

Floor Tile Installation. Comply with manufacturer's written instructions for installing floor tile.

Layout floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half (1/2) tile at perimeter.

Lay tiles square with room axis.

Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped or deformed tiles.

Lay tiles with grain running in same direction as existing tile.

Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets and door frames.

Extend floor tiles into toe spaces, door reveals, closets and similar openings. Extend floor tiles to center of door openings.

Maintain reference markers, holes and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.

Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

Cleaning and Protection. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

Perform the following operation immediately after completing floor tile installation:

- (a) Remove adhesive and other blemishes from exposed surfaces.
- (b) Sweep and vacuum surfaces thoroughly.
- (c) Damp-mop surfaces to remove marks and soil.

Protect floor tile products from mars, marks, indentations and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

Floor Polish. Remove soil, visible adhesive and surface blemishes from floor tile surfaces before applying liquid floor polish.

Apply two (2) coats. Cover floor tile until Substantial Completion.

INTERIOR PAINT

Description. Furnish and install interior coatings as indicated herein. These coating systems are not intended for use in containment situations.

Referenced Specifications Codes and Standards. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section. All references and standards listed shall be the latest revisions. Joint and individual documents are referenced.

SSPC – THE SOCIETY FOR PROTECTIVE COATINGS
40 24TH STREET, 6TH FLOOR
PITTSBURGH, PA 15222-4643
(412) 281-2331

ASTM – AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 BARR HARBOR DRIVE
WEST CONSHOHOCKEN, PA 19428-2959
(610) 832-9585

Definitions.

Gloss Level 1 – Not more than five (5) units at 60 degrees and ten (10) units at 85 degrees, according to ASTM D 523.

Gloss Level 2 – Not more than ten (10) units at 60 degrees and ten (10) to thirty-five (35) units at 85 degrees, according to ASTM D 523.

Gloss Level 3 – Not more than ten (10) to twenty-five (25) units at 60 degrees and ten (10) to thirty-five (35) units at 85 degrees, according to ASTM D 523.

Gloss Level 4 – Not more than twenty (20) to thirty-five (35) units at 60 degrees and not less than thirty-five (35) units at 85 degrees, according to ASTM D 523.

Gloss Level 5 – Thirty-five (35) to seventy (70) units at 60 degrees, according to ASTM D 523.

Gloss Level 6 – Seventy (70) to eighty-five (85) units at 60 degrees, according to ASTM D 523.

Gloss Level 7 – More than eighty-five (85) units at 60 degrees, according to ASTM D 523.

Action Submittals.

- (a) Product Data: For each type of product. Include preparation requirements and application instructions.
- (b) Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - (1) Submit samples on rigid backing, 8 in. sq.
 - (2) Label each coat of each sample.
 - (3) Label each sample for location and application area.
- (c) Product List: For each product indicated, include the following:
 - (1) Cross-reference to paint system and locations of application areas. Use same designations indicated on Plans and in schedules and VOC content.

Maintenance Material Submittals. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- (a) Paint: 5 percent, but not less than 1 gal. of each material and color(s) applied.

Warranty. The Contractor and coating manufacturer shall jointly and severally warrant in writing to the Department and guarantee the work under this section against defective workmanship and materials for all newly and previously coated surfaces for a period of two (2) years commencing on the date of final acceptance of the work.

Delivery, Storage and Handling. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45°F.

Maintain containers in clean condition, free of foreign materials and residue.

Remove rags and waste from storage areas daily.

Field Conditions. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95°F.

Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5°F above the dew point; or to damp or wet surfaces.

Paint, General.

Material Compatibility. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

For each coat in a paint system, provide products recommended in writing by manufacturer of topcoat for use in paint system and on substrate indicated.

VOC Content. Products shall comply with VOC limits of authorities having, jurisdiction.

Non-flat paints and coatings: 150 g/L.

Primers, sealers, and undercoats: 200 g/L.

Anticorrosive and antirust paints applied to ferrous metals: 250 g/L.

Colors: As selected by Engineer from manufacturer's full range.

Examination. Do not begin application of coatings until substrates have been properly prepared. Notify Engineer of unsatisfactory conditions before proceeding.

Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coating will be considered as an acceptance of surface conditions.

On previously coated surfaces, primer may be omitted except for spot priming as needed.

Surface Preparation. The surface shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

Remove mildew before painting by washing with a solution of one (1) part liquid household bleach and three (3) parts warm water. Apply the solution and scrub the mildew area. Allow the solution to remain on the surface for ten (10) minutes. Rinse thoroughly with clean water and allow the surface to dry 48 hours before painting. Do not add detergents or ammonia to the bleach/water solution.

Steel Substrates – Hand rails and stair risers, treads, and stringers: For existing steel previously painted substrates to be painted, remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

Application. Apply paints according to manufacturer's written instructions.

Use applicators and techniques suited for paint and substrate indicated.

Paint surfaces behind moveable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

If undercoats or other conditions show through topcoat, apply additional coats until cured film has uniform paint finish, color, and appearance.

Apply paints to produce surface films without cloudiness, spotting, laps, brush marks, roller tracking, runs, sags, or other surface imperfections. Cut in sharp lines and color breaks.

Interior Painting Schedule.

(a) Gypsum Drywall, plaster walls and ceilings – walls and ceilings Medium Duty:

- (1) 1st Coat: Vinyl acrylic wall primer. Minimum DFT: 1.5 mils.
- (2) 2nd Coat: Waterbased enamel.
- (3) 3rd Coat: Sheen to match adjacent surfaces. Waterbase catalyzed eg-shel. DFT 2.0 - 4.0 mils per coat.

(b) Wood (casework and doors) – Painted:

- (1) 1st Coat: Vinyl acrylic wall primer. Minimum DFT: 1.6 mils.
- (2) 2nd Coat: Zero VOC acrylic semi-gloss.
- (3) 3rd Coat: Zero VOC acrylic semi-gloss. Minimum DFT: 2.5 – 4.0 mils per coat.

(c) Ferrous Metal – Medium Duty (door frames, ducts, pipes and radiators):

- (1) 1st Coat: Heavy metal free, rust inhibitive, universal, alkyd metal primer. DFT: 2.0 – 5.0.
- (2) 2nd Coat: Zero VOC acrylic semi-gloss.
- (3) 3rd Coat: Zero VOC acrylic semi-gloss. Minimum DFT: 2.5 – 4.0 mils per coat.

Cleaning. Remove all unused material, partially used materials, waste materials, and other supplies except for maintenance materials as required by specifications.

Method of Measurement. Finishes, which include: Patching 1 x 1 Surface-applied Ceiling Tile and Plaster, Resilient Wall Base, Resilient Tile Flooring (VCT) and Interior Paint will be measured for payment as a single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for FINISHES, which price shall be payment in full for labor, equipment and material to complete the work specified herein.

CASEWORK

Description. Extent of casework is as shown on the Plans and as specified herein. Work shall include furnishing and installing plastic laminate upper and base cabinets and plastic laminate counter top in KITCHENETTE and new clear pine casing and trim at all windows in CONTROL ROOM 203 of the Bridge office.

Submittals.

- (a) Product Data: For each type of product indicated.
- (b) Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components: Show details one-half (1/2) size. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
 - (1) Apply WI-certified compliance label to first page of Shop Drawings.
- (c) Samples for Initial Selection: Plastic laminates.

Quality Assurance.

Fabricator Qualifications. Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in service performance. Shop is a certified participant in AWI's Quality Certification Program.

Installer Qualifications. Certified participant in AWI's Quality Certification Program.

Quality Standard. Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements:

Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

Delivery, Storage and Handling. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

Project Conditions.

Environmental Limitations. Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

Field Measurements. Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work:

Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

Established Dimensions. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

Coordination. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

Materials.

- (a) General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- (b) Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1:
 - (1) Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
- (c) High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

Cabinet Hardware and Accessories.

- (a) General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- (b) Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.
- (c) Wire Pulls: Back mounted, solid metal, 4 in.- long, 2-1/2 in.- deep, and 5/16 in. in diameter.

- (d) Shelf Rests: BHMA A156.9, B04013; metal, 2-pin type with shelf hold-down clip.
- (e) Drawer Slides: BHMA A156.9, B05091: Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated steel with polymer rollers.
- (f) Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated: Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

Plastic Laminate Cabinets.

- (a) Grade: Custom.
- (b) AWI Type of Cabinet Construction: Flush overlay.
- (c) Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements: Horizontal surfaces other than tops, vertical surfaces and edges to be Grade HGS.
- (d) Material for Semiexposed Surfaces: Surfaces other than drawer bodies, thermoset decorative panels: edges for plastics laminate shelves shall have PVC edge banding 0.12 in. thick, matching laminate in color, pattern and finish. For semiexposed backs of panels with exposed plastic laminate surfaces shall provide surface of high pressure decorative laminate – Grade VGS.
- (e) Drawer Side and Backs: Thermoset decorative panels.
- (f) Drawer Bottoms: Thermoset decorative panels.
- (g) Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- (h) Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements: As selected by Engineer from laminate manufacturer's full range.
- (i) Provide dust panels of 1/4 in. plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

Plastic Laminate Countertops.

- (a) Grade: Custom
- (b) High Pressure Decorative Laminate Grade: HGS.
- (c) Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements: As selected by Engineer from laminate manufacturer's full range.
- (d) Grain Direction: Parallel to cabinet fronts.
- (e) Edge Treatment: Same as laminate cladding on horizontal surfaces.
- (f) Core Material: Particleboard.
- (g) Core Material at Sinks: Particleboard made with exterior glue.
- (h) Backer Sheet: Provide plastic laminate backer sheet, Grade BKL, on underside of countertop substrate.
- (i) Paper Backing: Provide paper backing on underside of countertop substrate.

Execution. Before installation, condition casework to average prevailing humidity conditions in installation areas.

Before installing shop-fabricated work, examine work for completion and complete work as required, including removal of packing and backpriming.

Installation.

Grade. Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 in. in 96 in. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

Cabinets. Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated:

- (a) Install cabinets with no more than 1/8 in. in 96 in. sag, bow, or other variation from a straight line.
- (b) Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 in. o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

Countertops. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop:

Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

Install countertops with no more than 1/8 in. in 96 in. sag, bow, or other variation from a straight line.

Secure backsplashes to tops with concealed metal brackets at 16 in. o.c. and to walls with adhesive.

Caulk space between backsplash and wall with clear silicone sealant.

Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

Adjusting and Cleaning. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

Clean, lubricate, and adjust hardware.

Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

Method of Measurement. Casework will be measured for payment as a single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for CASEWORK, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

TOILET ACCESSORIES

Description. Extent of toilet accessories is as shown on the Plans and as specified herein.

Submittals.

- (a) Submit Product Data for each type of product indicated include construction details and dimensions, anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation, material and finish descriptions and manufacturer's warranty.
- (b) Submit a Product Schedule indicating types, quantities, sizes and installation locations by room of each accessory required. Identify locations using room designations indicated and identify product using designations indicated.
- (c) Submit Maintenance Data for toilet and bath accessories.
- (d) Submit sample of special warranty.

Quality Assurance.

Source Limitations. Obtain products from single source from single manufacturer.

Coordination. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning and servicing of accessories.

Warranty.

Mirror Warranty. Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship with fifteen (15) years from date of Substantial Completion.

Materials.

- (a) Stainless Steel: ASTM A 666, Type 304, 0.031-in. minimum nominal thickness unless otherwise indicated.
- (b) Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- (c) Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-in. minimum nominal thickness.
- (d) Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

- (e) Fasteners: Screws, bolts and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- (f) Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- (g) Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- (h) ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

Public-Use Washroom Accessories.

- (a) Toilet Tissue Dispenser TA-1: Double-roll toilet tissue dispenser shall be type-304 stainless steel with satin finish. Unit shall accommodate two standard-core toilet paper rolls up to 5-1/2 in. diameter. Flanges shall be equipped with concealed, 16-gauge stainless steel mounting brackets that are secured to concealed stainless steel wall pates with stainless steel setscrews. Spindles shall be equipped with a heavy-duty internal spring.
- (b) Combination Towel Dispenser/Waste Receptacle TA-2: Semi-recessed convertible paper towel dispenser and waste receptacle shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Flange shall be drawn and beveled, one-piece, seamless construction. Door shall be secured to cabinet with a full-length stainless steel piano-hinge and equipped with a semi-concealed tumbler lock keyed like other washroom accessories. Paper towel dispenser shall dispense 600 C-fold or 800 multifold paper towels. Removable waste receptacle shall be secured to cabinet with a tumbler lock, have front and side edges of bottom and all top edges hemmed for safe handling, and shall have a minimum capacity of 12 gal.
- (c) Liquid-Soap Dispenser TA-3: Soap dispenser shall have grey, high-impact-resistant ABS wall bracket, lid, push button and spout. Bracket shall be equipped with a locking device to secure lid, container, and a removable plastic key to disengage locking device. Corrosion-resistant valve shall have soap head-holding mushroom valve, stainless steel spring. U-packing seal, and duckbill; and shall dispense commercially marketed all-purpose hand soaps. Valve shall be operable with one hand and with less than 5 lbs of force to comply with barrier-free accessibility guidelines (including ADAAG in USA). Container shall be black, translucent ABS with a capacity of 40-fl oz, be retained to the wall bracket by a sliding latch and a container stop spring tab and shall be removable for maintenance or replacement.

- (d) Grab Bar TA-4: 42 in. straight grab bar shall be type-304 stainless steel with satin-finish. Grab bar shall have 18-gauge wall thickness and 1-1/4 in. outside diameter. Clearance between the grab bar and the wall shall be 1-1/2 in. Concealed mounting flanges shall be 1/8 in. thick stainless steel plate, 2 in. x 3-1/8 in., and equipped with two screw holes for attachment to wall. Flange covers shall be 22-gauge stainless steel, 3-1/4 in. diameter, and shall snap over mounting flanges to conceal mounting screws and / or WingIt fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar shall comply with barrier-free accessibility guidelines (including ADAAG in the USA) for structural strength.
- (e) Grab Bar TA-5: 36 in. straight grab bar shall be type-304 stainless steel with satin-finish. Grab bar shall have 18-gauge wall thickness and 1-1/4 in. outside diameter. Clearance between the grab bar and the wall shall be 1-1/2 in. Concealed mounting flanges shall be 1/8 in. thick stainless steel plate, 2 in. x 3-1/8 in., and equipped with two screw holes for attachment to wall. Flange covers shall be 22-gauge stainless steel, 3-1/4 in. diameter, and shall snap over mounting flanges to conceal mounting screws and / or WingIt fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar shall comply with barrier-free accessibility guidelines (including ADAAG in the USA) for structural strength.
- (f) Mirror TA-6: Mirror shall have a one-piece type-430 stainless steel channel frame, 1/2 in. x 1/2 in. x 3/8 in., with 90 degree mitered corner; all exposed surfaces shall have bright polished finish. Select float glass mirror shall be guaranteed for fifteen (15) years against silver spoilage. Corners shall be protected by friction-absorbing filler strips and the back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 3/16 in. thick polyethylene padding. Galvanized steel back shall have integral horizontal hanging brackets located at top and bottom for mounting on concealed rectangular wall hanger to prevent the mirror from pulling away from the wall. Locking devices secure mirror to concealed wall hanger. Mirror shall be removable from the wall.
- (g) Underlavatory Guard TA-7: Underlavatory guard shall be an insulated pipe covering for supply and drain piping assemblies to prevent direct contact with piping; Insulated pipe covering shall allow service access without removing coverings. Material shall be white antimicrobial, molded plastic.

Fabrication.

General. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

Keys. Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of three (3) keys to Engineer.

Installation. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommend by unit manufacture. Install units level, plumb and firmly anchored in locations and at heights indicated. Grab bars shall withstand a downward load of at least 250 lbs, when tested according to ASTM F446.

Adjusting and Cleaning. Adjust accessories for unencumbered, smooth operation; replace damaged or defective items; remove temporary labels and protective coatings; clean and polish exposed surfaces according to manufacturer's written recommendations.

Method of Measurement. Toilet Accessories will be measured for payment as a single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for TOILET ACCESSORIES, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

FIRE EXTINGUISHERS

Description. Extent of portable fire extinguishers and cabinets work is as shown on the Plans and as specified herein shall include providing and installing the fire extinguisher and cabinet within a 3-5/8 in. metal frame and sheetrock walls located in north wall of Corridor 201 and south wall of Control Room 203 of the Bridge Office.

Submittals. Submit product data for fire extinguishers and cabinets as indicated herein with material descriptions, dimensions of individual components, profiles, and finishes for fire extinguisher and cabinet including but not limited to fire extinguisher rating classification, description and mounting bracket. Submit special warranty upon closeout.

Special Warranty. Submit manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period, failures include, but are not limited to failure of hydrostatic test according to NFPA 10 and faulty operation of valves or release levers for a period of six (6) years from date of Substantial Completion.

Quality Assurance.

- (a) NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- (b) Fire Extinguisher: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

Coordination. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

Coordinate size and location of fire extinguisher cabinet with wall depth; refer to partition typed on Plans.

Portable Hand-Carried Fire Extinguisher – (FE-1).

(a) Fire Extinguisher Type:

- (1) Multipurpose Dry-Chemical Type in Steel Container FE-1.
- (2) UL-rated 4-A: 60-B: C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

(b) Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

(c) Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

Fire Extinguisher Cabinet – (FEC-1).

(a) Cabinet Type: Suitable for fire extinguisher:

- (1) Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, Sheet - ASTM B 209, extruded Shapes - ASTM B 221.
- (2) Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm- thick, Class 1 (clear).

(b) Cabinet Construction: Nonrated.

(c) Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

- (d) Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation:
- (1) Square-Edge Trim: 1-1/4 in. to 1-1/2 in. backbend depth.
 - (2) Cabinet Trim Material: Aluminum sheet.
 - (3) Door Material: Aluminum sheet.
 - (4) Door Style: Vertical duo panel with frame.
 - (5) Door Glazing: Tempered float glass (clear).
 - (6) Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type.
 - (7) Door Hinge: Manufacturers standard permitting door to open 180 degrees.

Accessories.

- (a) Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- (b) Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
- (c) Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location:
 - (1) Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER:" applied to cabinet door in red lettering oriented vertically.
- (d) Finishes: Manufacturer's standard baked-enamel or power coat paint for the exterior of cabinet, door, and trim.

Cabinet Fabrication.

- (a) Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated with weld joints and grind smooth, factory-drilled mounting holes.
- (b) Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected:
 - (1) Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 in.- thick.
 - (2) Fabricate door frames of one-piece construction with edges flanged, miter and weld perimeter door frames.
- (c) Cabinet Trim: Fabricate cabinet trim in one (1) piece with corners mitered, welded, and ground smooth.

General Finish Requirements. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

Finish fire protection cabinets after assembly.

Appearance of Finished Work. Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Aluminum Finishes.

Baked-Enamel or Powder-Coat Finish. AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

Examination. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

Installation.

General. Install fire extinguisher cabinets in locations and at mounting heights at 54 in. above finished floor to top of cabinet.

Fasten cabinets to metal framing substrate square and plumb.

Unless otherwise indicated, provide semi-recessed fire protection cabinets.

Adjusting and Cleaning. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

Method of Measurement. Fire Extinguishers will be measured for payment as single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for FIRE EXTINGUISHERS, which price shall be payment in full for labor, equipment and material to complete the work specified herein.

WINDOW BLINDS

Description. This Special Provision covers manually operated, roll-up fabric interior window shades which include mounting and operating hardware for Room 203 in the second floor of the Bridge Office as shown on the Plans and as specified herein.

Submittals.

- (a) Product Data: Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- (b) Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- (c) Samples: For each exposed product and for each color and texture specified, 10 in. long.
- (d) Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- (e) Quality Assurance: Obtain roller shades through one (1) source from a single manufacturer.
- (f) NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

Delivery, Storage and Handling. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation. Inspect roller window shades for freight damage, concealed or otherwise, upon delivery to project site. Report damage to freight carrier immediately for replacement of roller shades.

Store roller window shades in resealed manufacturer's original containers until installation.

Warranty. Manufacturer's Hardware and Shade Warranty: Manufacture agrees to repair or replace roller window shades that fail in materials or workmanship within specified warranty period. Failures include but are not limited to mounting hardware, headbox, clutch, fascia and shade fabric. Warranty period shall be twenty-five (25) years from date of Substantial Completion.

Field Conditions.

Environmental Limitations. Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

Field Measurements. Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicated measurements on Shop Drawings. Allow clearances for operation hardware of operable glazed units through entire operating range. Notify Engineer of installation conditions that vary from Plans. Coordinate fabrication schedule with construction progress to avoid delaying the work.

Manually Operated Dual Roller Window Shades.

- (a) Dual Roller Window Shades: Manually operated, vertical roll-up, dual roller, fabric window shade. Assembly to include operator, controls, mounting hardware and other components necessary for complete installation.
- (b) Chain-and-Clutch Operating Mechanisms: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far. Operation Location: Right side.
- (c) Clutch Mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon.
- (d) Bead Chain Loop: Nickel-plated metal or Stainless steel. Loop length: Full length of roller shades. Limit Stops: Provide upper and lower ball stops. Chain-Retainer Type: Clip, jamb mounted.
- (e) Idler assembly: Provide roller idler assembly of molded nylon with adjustable length idler pin to facilitate easy installation, and removal of shades for service.

Dual Rollers.

- (a) Roller Tubes: Extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
- (b) Method of Installation: Surface mounted inside jambs to wall with screws. (wall construction is plaster over brick masonry with surface-applied 1x pine casing around windows)
- (c) Double-Roller Method Configuration: Side by Side
- (d) Inside Roller - Drive-End Location: Right side of inside face of shade. Direction of Shadeband Roll: Regular, from back of roller.
- (e) Outside Roller – Drive-End Location: Right side of inside face of shade. Direction of Shadeband Roll: Regular, from back of roller.

- (f) Shadeband –to Roller Attachment: Manufacturer’s standard method.
- (g) Mounting Hardware: Brackets and endcaps, corrosion resistant and compatible with roller assembly, operation mechanism, installation accessories, and mounting location and conditions indicated. Endcap covers to match fascia color.

Shadebands.

Inside Shadebands.

- (a) Shadeband Material:
 - (1) Light-Filtering Fabric: Duplex twill fabric, light outer panel color combined with dark interior color for thermal comfort and view-through. Flame retardant per NFPA 701 (TM#1, small scale), NFPA 701 (TM#2, large scale). Bacteria and fungi resistant per ASTM E2180, GREENGUARD Indoor Air Quality Certified®.
- (b) Openness Factor: 3-percent in accordance with ASHRAE 74.
- (c) Thickness: 0.028 in. Weight: 14 oz/sq yd.
- (d) Shadeband Bottom (Hem) Bar: Steel or extruded aluminum. Type: Enclosed in sealed pocket of shadeband material.
- (e) Color and Finish: As selected by Engineer from manufacturer’s full range.
- (f) Shadeband Color: As selected by Engineer from manufacturer’s full range.

Outside Shadebands.

- (a) Shadeband Material:
 - (1) Light-blocking fabric. PVC-free coated polyester. Flame retardant per NFPA 701 (TM#1, small scale), NFPA 701 (TM#2, large scale). Bacteria and fungi resistant per ASTM E2180, GREENGUARD Indoor Air Quality Certified®.
- (b) Openness Factor: Zero percent in accordance with ASHRAE 74.
- (c) Thickness: 0.013 in. Weight: 11.80 oz/sq yd.
- (d) Shadeband Bottom (Hem) Bar: Extruded aluminum. Type: Enclosed in sealed pocket of shadeband material.
- (e) Color and Finish: As selected by Engineer from manufacturer’s full range.
- (f) Shadeband Color: As selected by Engineer from manufacturer’s full range.

Fascia. L-shaped aluminum extrusion to conceal shade roller and hardware.

- (a) Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two (2) or more shade bands.
- (b) Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 in.
- (c) Fascia Color: As selected by Engineer from manufacturer's full range.

Endcaps. Stamped steel with universal design suitable for mounting to ceiling, wall or jambs. Provide size compatible with roller size.

Color and Finish. As selected by Engineer from manufacturer's full range. Endcap covers to match fascia color.

Execution. Verify field dimensions of windows prior to fabrication of roller window shades.

Examine substrates, area, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

Roller-Shade Installation. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

Opaque Shadebands. Located so shadeband is not closer than 2-in. to interior face of glass. Allow clearances for window operation hardware.

Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

Testing and Demonstration. Operate shades through complete cycle of lowering, stopping and raising to ensure proper operation. Correct deficiencies.

Demonstrate operation of roller window shades to Engineer.

Cleaning and Protection. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

Replace damaged roller shades that cannot be repaired, in a manner approved by Engineer, before time of Substantial Completion.

Method of Measurement. Window Blinds will be measured for payment as a single lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for WINDOW BLINDS, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

PLUMBING WORK BRIDGE OFFICE

Description. This work shall include the removal of the existing toilets, lavatories, urinal and associated domestic water and sanitary waste/vent piping as illustrated on the plumbing demolition plan. This work also includes furnishing and installing plumbing fixtures and piping for remodeling of the two existing restrooms into a single ADA accessible restroom for which the new plumbing consists of a toilet, lavatory and associated domestic water and sanitary waste/vent piping. This work also includes furnishing and installing a new sink and associated domestic water and sanitary waste/vent piping in the Break Room area. This work also includes furnishing and installing fire caulk in all new piping penetrations through the floor slab of the second floor.

MATERIAL REQUIREMENTS

Ball Valves for Plumbing Piping. Provide 2-piece brass or bronze full port ball valves with brass or bronze trim and threaded or soldered ends. Ball valves shall be NSF 61 and MSS SP-110 compliant, have a CWP rating of 600 psig, PTFE seats, brass or bronze valve stem, chrome plated brass ball and quarter turn handlever actuator. Bronze valve construction shall contain less than 15 percent zinc. Provide products from one (1) of the following manufacturers – Apollo Valves, Nibco Inc., Milwaukee Valve Company or American Valve, Inc. Provide data on each product for shop drawing submittal review.

Hangers and Supports for Plumbing Piping and Equipment. Provide carbon steel clevis hangers, trapeze support assemblies and clamps to support domestic water, sanitary waste and vent piping and piping accessories. Hangers and supports shall be installed as required to properly support the piping from the building structure and in accordance with the piping manufacturer's recommendations. Install hangers and supports complete with the necessary attachments, inserts, bolts, threaded rods, nuts, washers and other accessories. Nonmetallic coatings on attachments shall be used for electrolytic protection where attachments are in direct contact with copper piping. Provide data on each product for shop drawing submittal review.

Identification for Plumbing Piping. Provide pipe labels for identification purposes. Labels shall be printed plastic with contact-type, permanent-adhesive backing. Include identification of piping service and an arrow indicating flow direction with letter size of at least 1-1/2 in. Clean piping surfaces that could impair bond of identification labels. Locate labels where accessible and visible. Provide products from one (1) of the following manufacturers – Kolbi Pipe Marker Co., Seton Identification Products, Brady Corporation or Brimar Industries, Inc. Provide data on each product for shop drawing submittal review.

Plumbing Piping Insulation. Provide Type I, 850°F mineral or glass fiber preformed pipe insulation utilizing a thermosetting resin for bonding of fibers. Pipe insulation shall have a factory applied all service jacket and 1 in. wall thickness. Provide products from one (1) of the following manufacturers – Johns Manville, Knauf Insulation, Owens Corning or Manson Insulation Inc. All insulation materials and associated components that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials and associated components shall also have a flame-spread index of 25 or less and smoke developed index of 50 or less when tested according to UL 723. Provide data on each product for shop drawing submittal review.

Insulation materials shall be installed on domestic cold and hot water piping and kept dry during the application and finishing process. Seams and joints shall be bonded with adhesive recommended by insulation material manufacturer with additional securement by bands or outward-clinching insulation staples. Adhesives, vapor barrier mastic for cold water piping, breather mastic for hot water piping and sealants shall be applied at manufacturer's recommended coverage rate and wet and dry film thicknesses.

A white, high impact resistant 20 mils-thick PVC jacket shall be field installed on all new exposed domestic water piping. Factory or field fabricated fitting covers matching jacket material shall also be installed. Provide products from one (1) of the following manufacturers – Johns Manville, P.I.C. Plastics Inc., or Proto Corporation. White vapor-retarding tape matching field-applied PVC jacket with acrylic adhesive and a width of 2 in. shall be used. All jacketing and associated components shall also have a flame-spread index of 25 or less and smoke developed index of 50 or less when tested according to UL 723. Provide data on each product for shop drawing submittal review.

PVC jacketing material seams and joints shall be bonded with manufacturer's recommended adhesive and applied at manufacturer's recommended coverage rate and wet and dry film thicknesses.

Provide manufactured protective plastic shielding guards for covering exposed lavatory domestic water and waste piping connections. Provide products from one (1) of the following manufacturers – Truebro, Zurn Industries, McGuire Manufacturing or Insul-Tect Products Co. Provide data on each product for shop drawing submittal review.

Domestic Water Piping. Provide NSF-61 compliant ASTM B 88, Type L, drawn temper water tube and wrought-copper, solder-joint fittings. Joint connections shall utilize ASTM B 32 lead-free alloy solder filler metals and ASTM B 813 water flushable flux. Dielectric nipples and unions with solder or threaded end connections and a pressure rating of 125 psig at 180°F shall be installed at connections of dissimilar metal piping and tubing. Provide dielectric unions and nipples from one (1) of the following manufacturers – Wilkins, Watts, McDonald, A.Y. Mfg. Co. or Hart Industries International, Inc. Provide data on each product for shop drawing submittal review.

Piping shall be installed per the current Illinois Plumbing Code, level and plumb without sags or bends and with fittings used for changes in direction and branch connections. Piping shall be joined in accordance with ASTM B 828 or CDA's "Copper Tube Handbook." Piping shall be pressure tested to 50 psig above operating pressure, without exceeding pressure rating of piping system materials for a duration of four (4) hours. Observed leaks shall be repaired and retested. After pressure tests have been performed, piping system shall be cleaned and disinfected using a 50 ppm water/chlorine solution for a duration of twenty-four (24) hours or 200 ppm for a duration of three (3) hours. After cleaning and disinfection has been performed, piping system shall be flushed with clean potable water until no chlorine is present.

Sanitary Waste and Vent Piping. Provide ASTM A 888 or CISPI 301 hubless, cast-iron soil pipe and fittings. ASTM C 1277 and CISPI 310 non-pressure hubless-piping couplings with elastomeric or rubber sleeve, full length corrosion-resistant outer shield and corrosion-resistant metal tension band shall be utilized for pipe joint construction. Cast-iron soil pipe and fittings shall be provided from one (1) of the following: Charlotte Pipe and Foundry Company, AB&I Foundry or Tyler Pipe. Hubless-piping couplings shall be provided from one (1) of the following: Charlotte Pipe and Foundry Company, AB&I Foundry, Tyler Pipe or ANACO-Husky. Provide data on each product for shop drawing submittal review.

Elastomeric or rubber sleeve non-pressure transition fittings with full length corrosion-resistant outer shield and corrosion-resistant metal tension band constructed in accordance with ASTM C 1460 shall be used for joining piping with small differences in outside diameters or of different materials. Transition fittings shall be provided from one (1) of the following manufacturers – ANACO-Husky or Mission Rubber Company. Provide data on each product for shop drawing submittal review.

Piping shall be installed per the current Illinois Plumbing Code and according to CISPI's "Cast-Iron Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings." Piping system shall be pressure tested prior to concealment by filling system with water to point of overflow, but not less than 10-ft head of water for a duration of fifteen minutes. Observed leaks shall be repaired and retested.

Sanitary Waste Piping Specialties. Provide a cast iron floor drain with a 6 in. by 6 in. nickel bronze heel proof strainer as per schedule on Plans. Provide products from one (1) of the following manufacturers – Zurn Industries, Josam Company, Jay R. Smith Mfg. Co. or Watts Drainage Products. Provide data on each product for shop drawing submittal review.

Commercial Water Closets. Provide a 2-piece floor mounted bottom outlet, ADA compliant vitreous china water closet as per schedule on Plans. Provide products from one (1) of the following manufacturers – Zurn Industries, Kohler Co., American Standard America or Crane Plumbing, LLC. Provide data on each product for shop drawing submittal review.

Provide an open front toilet seat without cover as per schedule on Plans. Provide products from one (1) of the following manufacturers – Bemis Manufacturing Company, Church Seats, Zurn Industries, Kohler Co. or American Standard America. Provide data on each product for shop drawing submittal review.

Commercial Lavatories. Provide a white vitreous china, ADA compliant wall hung lavatory as per schedule on Plans. Provide products from one (1) of the following manufacturers – Zurn Industries, Kohler Co., American Standard America or Crane Plumbing, LLC. Provide data on each product for shop drawing submittal review.

Provide a deck mounted, ADA compliant, chrome plated brass construction, 0.5 gpm, two-handle, lavatory faucet as per schedule on Plans. Provide products from one (1) of the following manufacturers – Chicago Faucets, Kohler Co, Zurn Industries or Delta Faucet Company. Provide data on each product for shop drawing submittal review.

Commercial Sinks. Provide a single bowl, ADA compliant, 18 gauge, Type 304, stainless steel self-rimming sink as per schedule on Plans. Provide products from one (1) of the following manufacturers – Elkay Manufacturing Co., Kohler Co. or American Standard America. Provide data on each product for shop drawing submittal review.

Provide a deck mounted, ADA compliant, chrome plated brass construction, 2.2 gpm, two-handle, swing gooseneck spout faucet as per schedule on Plans. Provide products from one (1) of the following manufacturers – Chicago Faucets, Kohler Co, Zurn Industries or Delta Faucet Company. Provide data on each product for shop drawing submittal review.

Method of Measurement. All items described in this special provision shall be included as part of the plumbing system and shall be measured for payment as a single lump sum item.

Basis of Payment. This work will be paid for at the contract lump sum price for Plumbing Work Bridge Office, which price shall be payment in full for all labor, equipment and material to complete the work as specified herein.

MECHANICAL HVAC WORK BRIDGE OFFICE

Description. This work shall include the removal and relocation of steam radiators along with the removal of exhaust duct, supply duct and wall mounted thermostats as illustrated on the mechanical demolition plan. This work also includes the furnishing and installation of supply and return duct in Control Room 203 that is to be connected to the rooftop unit (RTU-1) that was installed under a previous project. This work also includes the furnishing and installation of new exhaust duct along with the reinstallation of a steam radiator to accommodate the new restroom layout. Modifications to the existing DX split system that serves the second floor of the building which includes the furnishing and installation of a control damper and new supply ductwork will also be included. This work also includes furnishing and installing fire caulk in all new piping penetrations through the floor slab of the second floor. This work also includes having an HVAC equipment start-up technician (factory trained and authorized by the manufacturer of RTU-1, Aaon) perform the start-up of RTU-1.

MATERIAL REQUIREMENTS

Hangers and Supports for HVAC Piping and Equipment. Provide carbon steel clevis hangers, trapeze support assemblies and clamps to support steam and steam condensate piping and piping accessories. Hangers and supports shall be installed as required to properly support the piping from the building structure and in accordance with the piping manufacturer's recommendations. Install hangers and supports complete with the necessary attachments, inserts, bolts, threaded rods, nuts, washers and other accessories. Provide data on each product for shop drawing submittal review.

Testing, Adjusting And Balancing for HVAC. Balance RTU-1 (supply and return) and EF-1 (exhaust) air systems as per cfm's indicated on Plans. TAB entity shall be certified by AABC, NEBB or TABB. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing".

Duct Insulation. Supply ducts shall be externally insulated with 1.5 in. thick/6.0 pcf density mineral-fiber board insulation manufactured of mineral or glass fibers bonded with a thermosetting resin. Mineral-fiber board shall have a factory applied white colored all-service jacket and be in compliance with ASTM C 612, Type IA or IB. Provide products from one (1) of the following manufacturers – Johns Manville, Knauf Insulation, Owens Corning or Manson Insulation Inc. All insulation materials and associated components that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials and associated components shall also have a flame-spread index of 25 or less and smoke developed index of 50 or less when tested according to UL 723. Provide data on each product for shop drawing submittal review.

Mineral fiber adhesive shall be compatible with insulation materials, be in compliance with MIL-A-3316C, Class 2, Grade A and have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

ASJ jacket adhesive for bonding insulation jacket lap seams and joints shall be in compliance with MIL-A-3316C, Class 2, Grade A and have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Water based vapor-barrier mastic shall be compatible with insulation materials, comply with MIL-PRF-19565C, Type II and have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Vapor-barrier mastic shall have a water-vapor permeance of 0.013 perm at 43-mil dry film thickness and be in compliance with ASTM E 96/E 96M, Procedure B. Service temperature range shall be minus 20 to plus 180°F, have a solids content of 58 percent by volume and 70 percent weight in accordance with ASTM D 1644 and have a white finish color.

ASJ flashing sealants shall be compatible with insulation materials, be a flexible, water resistant elastomeric sealant with a service temperature range of minus 40 to plus 250°F and have a white finish color. Sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

ASJ tape shall be a white-vapor retarder tape matching factory-applied jacket with acrylic adhesive complying with ASTM C 1136. ASJ tape shall have a width of 3 in., thickness of 11.5 mils, adhesion of 90 ounces force/in. in width, an elongation of 2 percent and a tensile strength of 40 lbf/in. in width.

Insulation pins and washers shall also be provided. Insulation pins shall be cupped-head capacitor discharge-weld pins constructed of copper or zinc coated steel with a 0.106-in. diameter shank and an integral 1.5-in. diameter galvanized steel washer.

Length of shank shall suit depth of insulation indicated. Insulation-retaining washers shall be self-locking washers formed of 0.016-in. thick galvanized steel with beveled edge sized as required to hold insulation securely in place but not less than 1.5-in. in diameter.

Insulation materials shall be installed on supply ducts and kept dry during the application and finishing process. Insulation materials, accessories and finishes shall be installed with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings. Insulation shall be installed with longitudinal seams at top and bottom of horizontal runs with tight longitudinal seams and end joints. Seams and joints shall be bonded with adhesive recommended by insulation material manufacturer and sealed with vapor-barrier mastic. Adhesives (100 percent coverage of duct surfaces), sealants and mastics shall be applied at manufacturer's recommended coverage rate and wet and dry film thicknesses. Cupped-head capacitor discharge-weld pins shall also be installed on sides and bottom of horizontal ducts and sides of vertical ducts in addition to the application of adhesive. On duct sides with dimensions 18 in. and smaller, place pins along longitudinal centerline of duct and spaced 3 in. maximum from insulation end joints and 16 in. on center. On duct sides with dimensions 18 in. and larger, space pins 16 in. on center each way and spaced 3 in. maximum from insulation end joints. Exposed insulation pins and washers shall be covered with tape matching the insulation facing. Insulation on duct elbows and transitions shall be installed with a full insulation section for each surface.

HVAC Piping Insulation. Provide Type I, 850 deg. F mineral or glass fiber preformed pipe insulation utilizing a thermosetting resin for bonding of fibers. Pipe insulation shall have a factory applied all-service-jacket (ASJ) and shall have a wall thickness equivalent to the insulation materials installed on the existing piping. Provide products from one (1) of the following manufacturers – Johns Manville, Knauf Insulation, Owens Corning or Manson Insulation Inc. All insulation materials and associated components that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials and associated components shall also have a flame-spread index of 25 or less and smoke developed index of 50 or less when tested according to UL 723. Provide data on each product for shop drawing submittal review.

Insulation materials shall be installed on steam piping (new steam condensate piping is not required to be insulated as the existing steam condensate piping system is uninsulated) and kept dry during the application and finishing process. Insulation materials shall only be installed on new steam piping installed on the first floor. Insulation materials are not required to be installed on the section of new steam piping located on the second floor that is connected to the relocated radiator installed in the second floor restroom (this insulation methodology resembles the insulation methodology of the existing system). Insulation seams and joints shall be bonded with adhesive recommended by insulation material manufacturer with additional securement by bands or outward-clinching insulation staples. Adhesives, mastics and sealants shall be applied at manufacturer's recommended coverage rate and wet and dry film thicknesses.

A white, high impact resistant 20 mils-thick PVC jacket (rated for high temperature applications) shall be field installed overtop all new exposed insulated steam piping. Factory or field fabricated fitting covers matching jacket material shall also be installed. Provide products from one (1) of the following manufacturers – Johns Manville, P.I.C. Plastics Inc., or Proto Corporation. White vapor-retarding tape matching field-applied PVC jacket with acrylic adhesive and a width of 2 in. shall be used. All jacketing and associated components shall also have a flame-spread index of 25 or less and smoke developed index of 50 or less when tested according to UL 723. Provide data on each product for shop drawing submittal review.

PVC jacketing material seams and joints shall be bonded with manufacturer's recommended adhesive and applied at manufacturer's recommended coverage rate and wet and dry film thicknesses.

Steam And Condensate Heating Piping. Provide ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B steel pipe for steam and steam condensate piping. Malleable-iron threaded fittings (ASME B16.3) and malleable-iron unions (ASME B16.39) shall be used in combination with the steel pipe. Schedule 40 materials shall be used for steam piping whereas schedule 80 materials shall be used for steam condensate piping.

Steam and steam condensate piping shall be installed at right angles or parallel to building lines, free of sags and bends and with fittings used for changes in direction and branch connections. Steam piping shall be installed at a minimum uniform grade of 0.2 percent downward in the direction of steam flow and steam condensate return piping shall be installed at a minimum uniform grade of 0.4 percent downward in direction of condensate flow. Unions shall be installed adjacent to valves and at final connections to equipment and escutcheons shall be installed at floor penetrations. Piping shall be threaded with tapered pipe threads according to ASME B1.20.1. Prior to assembly, threaded pipe ends shall be reamed to remove burrs and debris from inside the pipe shall be removed. After assembly, piping system shall be subject to a test pressure that is not less than 1.5 times the working pressure but, should not exceed maximum pressure of any piping system component. The test shall be performed for a duration of ten (10) minutes and any observed leaks shall be repaired and retested.

Steam And Condensate Piping Specialties. Provide a balanced pressure thermostatic type steam trap and thermostatic radiator control valve at the relocated steam radiator. Refer to keyed notes on new work drawings for requirements pertaining to these piping specialties.

Metal Ducts. Provide rectangular ducts and fittings, sheet metal materials, sealants/gaskets and hangers/supports. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Galvanized sheet steel shall comply with ASTM A 653/A 653M with a galvanized coating designation of G90. Seal all duct joints and duct wall penetrations. Metal hanger straps shall be used for supporting ductwork. Ductwork shall be kept clean during construction.

Return ducts (and new supply ducts installed in the existing DX split system where indicated on the new work plans) shall be internally lined with 1 in. thick, 3.0 pcf Armaflex AP Coilflex conformable elastomeric duct liner or an equivalent duct liner produced by an alternative manufacturer. The duct liner shall be in compliance with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B. Insulation materials and associated components shall also have a flame-spread index of 25 or less and a smoke developed index of 50 or less when tested according to UL 723.

Duct liner adhesive shall be provided as recommended by the insulation manufacturer, be in compliance with NFPA 90A or NFPA 90B and have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Duct liner pins and washers shall also be provided. Liner pins shall be cupped-head capacitor discharge-weld pins constructed of copper or zinc coated steel with a 0.106-in. diameter shank and an integral 1.5-in. diameter galvanized steel washer.

Length of shank shall suit depth of liner indicated. Insulation-retaining washers shall be self-locking washers formed of 0.016-in. thick galvanized steel with beveled edge sized as required to hold insulation securely in place but not less than 1.5-in. in diameter.

Duct liner installation shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

Provide data on each product for shop drawing submittal review.

Air Duct Accessories. Provide galvanized steel manual volume dampers with standard leakage rating, minimum .094 in. thick hat-shaped flangeless frame with mitered and welded corners, single or multiple parallel or opposed blade design and full length blade axel with oil-impregnated bronze or molded synthetic bearings at both ends of operating shaft. Provide products from one (1) of the following manufacturers – Ruskin Company, McGill AirFlow LLC, Nailor Industries Inc. or Aire Technologies. Provide data on each product for shop drawing submittal review.

Provide manufactured turning vanes with curved blades of galvanized sheet steel supported with bars perpendicular to blade set, set into vane runners and suitable for duct mounting. Turning vane construction shall comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows." Provide products from one (1) of the following manufacturers – Ductmate Industries, Ward Industries, Duro Dyne Inc. or Aero-Dyne Sound Control Co. Provide data on each product for shop drawing submittal review.

Provide metal-edged flexible connectors factory fabricated with a fabric strip 3.5 in. wide attached to two (2) strips of 2.75 in. wide, 0.028 in. thick galvanized sheet steel. Flexible connector fabric shall be constructed of flame-retardant or non-combustible glass fabric double coated with neoprene and in compliance with UL 181, Class 1. Flexible connector fabric shall also have a minimum weight of 26 oz/sq. yard, a tensile strength of 480 lbf/in. in the warp and 360 lbf/in. in the filling and have a service temperature range of minus 40 to plus 200°F. Provide products from one (1) of the following manufacturers – Ductmate Industries, Duro Dyne Inc., Ward Industries or Ventfabrics Inc. Provide data on each product for shop drawing submittal review.

Diffusers, Registers and Grilles. Provide air devices as per schedule on Plans. Provide products from one (1) of the following manufacturers – Titus, Price Industries, Nailor Industries Inc. or Tuttle and Bailey. Provide data on each product for shop drawing submittal review. Product data shall include performance criteria of the air device and associated accessories.

Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, etc. Maintain factory finish during/after installation.

Method of Measurement. All items described in this special provision shall be included as part of the mechanical system and shall be measured for payment as a single lump sum item.

Basis of Payment. This work will be paid for at the contract lump sum price for Mechanical HVAC Work Bridge Office, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

ELECTRICAL WORK BRIDGE OFFICE

Description. The work to be included under this item shall be the furnishing, installing, and testing of all materials and electrical equipment necessary in order to provide a complete and operational electrical system for the Joliet Bridge Office in Joliet, Illinois.

The Contractor shall furnish and install all materials necessary for a complete and operational installation of the electrical equipment. The complete installation and wiring shall be done in a neat, workmanlike manner. All electrical work shall comply with the requirements of NFPA 70 – National Electrical Code (NEC), most current issue in force, and all other applicable local codes, laws, ordinances, and requirements in force. Electrical equipment shall be installed in conformance with the respective manufacturer's directions and recommendations for the respective application. Any installations which void the UL listing, FM Approval, ETL listing (or other third party listing), and/or the manufacturer's warranty of a device will NOT be permitted.

The electrical work and equipment specified is based on equipment of the type and size as noted on the Plans and specified herein. Should the proposed loads exceed the ratings of the electrical equipment specified, the General Contractor shall be solely responsible for furnishing any and all modifications necessary in order to provide a fully functional system to the satisfaction of the Engineer at no change to the contract cost. The Contractor shall also be required to submit for review, sufficient information determined by the Engineer to be necessary to review such alternates or modifications.

All work, power outages, and/or shut down of existing systems shall be coordinated with the respective department's representative. Once shut down, the circuits shall be labeled as such to prevent accidental energizing of the respective circuits. All personnel shall follow U.S. Department of Labor Occupational Safety & Health Administration (OSHA) 29 CFR Part 1910 Occupational Safety & Health Standards for electrical safety and lockout/tagout procedures, including, but not limited to, 29 CFR Section 1910.147 the control of hazardous energy (lockout/tagout).

Contractor shall keep a copy of the latest National Electrical Code in force on site at all times during construction for use as a reference.

Contractor and respective electrical contractor shall keep a set of construction plans and specifications with all addenda and copies of any applicable change orders on site at all times.

Submittals. Contractor shall provide shop drawings for all electrical equipment. Shop drawings shall clearly indicate proposed items, capacities, characteristics and details in conformance with the Plans and Specifications. The respective manufacturer shall certify capacities, dimensions, special features, etc. Shop Drawings for all items shall be prepared immediately upon award of Contract. The Contractor shall submit PDF electronic copies. No materials shown thereon shall be ordered until Shop Drawings are reviewed and approved by the Engineer. When a submittal is marked "Revise and Resubmit," "Rejected," and/or "Submit Specified Item" do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations, resubmit, and repeat if necessary to obtain a different action mark such as "No Exceptions Taken" or "Furnish as Corrected". Contractor is responsible for compliance with the specified characteristics. Contractor's responsibility for error and omissions in submittals is not relieved by the Engineer's review of submittals. Accompany each submittal with a transmittal letter that includes the date, project title and number, Contractor's name and address, the number of shop drawings, product data, and/or samples submitted, notification of any deviations from the Contract, and any other pertinent data. Shop drawing submittals shall include the following:

- (a) Date and revision dates.
- (b) Project title and number(s).
- (c) Identification of product or material.
- (d) Certified outline and installation drawings.
- (e) Performance data and operating characteristics.

- (f) Arrangement drawings showing piping, controls and accessory equipment.
- (g) Drawings on non-standard components and accessories.
- (h) Catalog data marked to indicate materials being furnished.
- (i) Operation and Maintenance/Instruction Manuals.
- (j) Specified standards, such as ASTM numbers, ANSI numbers, UL listing/standard, NEMA ratings, etc.
- (k) Identification of previously approved deviation(s) from Contract documents.
- (l) Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract documents.
- (m) Space for Prime Contractor's approval stamp.
- (n) Fire Alarm Shop Drawing Submittals Will Include:
 - (1) Shop Drawings shall be prepared by persons with the following qualifications:
 - a) Trained and certified by manufacturer in fire-alarm system design.
 - b) NICET-certified fire-alarm technician, Level III minimum.
 - (2) Product Data: For each type of product indicated.
 - (3) Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work:
 - a) Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - b) Include voltage drop calculations for notification appliance circuits.
 - c) Include battery-size calculations.
 - d) Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 - e) Retain subparagraph below for projects where routing of cable or conduit is critical and only outlet locations are shown on Plans. Delete reference to device addresses if shown on Plans.
 - f) Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

- (4) Field quality-control reports.
 - (5) Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals:
 - a) Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b) Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c) Record copy of site-specific software.
 - d) Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - i) Frequency of testing of installed components.
 - ii) Frequency of inspection of installed components.
 - iii) Requirements and recommendations related to results of maintenance.
 - iv) Manufacturer's user training manuals.
 - (6) Manufacturer's required maintenance related to system warranty requirements.
 - (7) Abbreviated operating instructions for mounting at fire-alarm control unit.
 - (8) Copy of NFPA 25.
 - (9) Software and Firmware Operational Documentation:
 - a) Software operating and upgrade manuals.
 - b) Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c) Device address list.
 - d) Printout of software application and graphic screens.
- (o) Premise Distribution System Shop Drawing Submittals Will Include:
- (1) Submit to the engineer/designer shop drawings, product data (including cut sheets and catalog information), required by the contract documents. Submit shop drawings, product data, with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors. The engineer/designer will indicate approval of shop drawings and product data submitted to the engineer by marking them approved. Submitted shop drawings shall be initialed or signed by the contractor, showing the date and the contractor's legitimate firm name:
 - a) By submitting shop drawings and product data the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within shop drawings and product data conform to the requirements of the work and of the contract documents. The engineer/designer remains responsible for the design concept expressed in the contract documents as defined herein.

- b) The engineer's/designer's approval of shop drawings and product data submitted by the contractor shall not relieve the contractor of responsibility for deviations from requirements of the contract documents, unless the contractor has specifically informed the engineer/designer in writing of such deviation at time of submittal, and the engineer/designer has given written approval of the specific deviation. The contractor shall continue to be responsible for deviations from requirements of the contract documents not specifically noted by the contractor in writing, and specifically approved by the engineer in writing.
- c) The engineer's/designer's approval of shop drawings and product data shall not relieve the contractor of responsibility for errors or omissions in such shop drawings, product data, and samples.
- d) The engineer's/designer's review and approval, or other appropriate action upon shop drawings and product data, is for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents. The engineer's/designer's review of such submittals is not conducted for the purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the contractor as required by the contract documents. The review shall not constitute approval of safety precautions or of construction means, methods, techniques, sequences, or procedures. The engineer's/designer's approval of a specific item shall not indicate approval of an assembly of which the item is a component:
 - i) Perform no portion of the work requiring submittal and review of shop drawings, product data, or samples, until the engineer/designer has approved the respective submittal. Such work shall be in accordance with approved submittals.
 - ii) Submit shop drawings and product data as a complete set within thirty (30) days of award of contract:
 - a. For initial submission and for resubmission required for approval, submit one (1) electronic copy of each item. The engineer/designer will review and return an electronic file. Make reproductions as required for your use and distribution to subcontractors.
 - b. Illegible submittals will not be checked by the engineer.
 - iii) General: Submit the following:
 - a. Bill of materials, noting long lead time items.
 - b. Optical loss budget calculations for each optical fiber run.
 - c. Project schedule including all major work components that materially affect any other work on the project.

- iv) Shop drawings: Submit the following:
 - a. Backbone (riser) diagrams.
 - b. System block diagram, indicating interconnection between system components and subsystems.
 - c. Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor.

- v) Product Data -- Provide catalog cut sheets and information for the following:
 - a. Wire, cable, and optical fiber.
 - b. Outlets, jacks, faceplates, and connectors.
 - c. Terminal blocks and patch panels.
 - d. Enclosures, racks, and equipment housings.
 - e. Over-voltage protectors.
 - f. Splice housings.

- vi) Project record drawings:
 - a. Submit project record drawings at conclusion of the project and include:
 - i. Approved shop drawings.
 - ii. Plan drawings indicating locations and identification of work area outlets, nodes, telecommunications rooms (TRs), and backbone (riser) cable runs.
 - iii. Telecommunications rooms (TRs), Telecommunications Enclosures (TEs) and equipment room (ER and/or MC) termination detail sheets.
 - iv. Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
 - v. Labeling and administration documentation.
 - vi. Warranty documents for equipment.
 - vii. Copper certification test result printouts and diskettes.
 - viii. Optical fiber power meter/light source test results.

- vii) Operation and maintenance manuals.

Replace Electrical Services. This Item shall consist of removing, relocating, replacing and/or adjusting existing electric utility service to the Control Building and the respective service conductors, conduits and ducts from the respective utility transformer to the respective service metering and/or disconnect equipment. This item shall include all labor, equipment, wiring, raceways, grounding, materials, tools, utility coordination, labeling, testing and all incidentals required to remove, relocate, replace and/or adjust the respective electric service installation to the satisfaction of the serving electric utility, Owner and Engineer.

Included under this Item shall be the following:

- (a) Coordinating with the serving electric utility (Commonwealth Edison Company, 1910 S. Briggs Street, Joliet, Illinois 60433, Attn. Mr. Jamie Fishbeck, Phone: 815-724-5970) the removal and replacement of the existing service to the Joliet Bridge Control Building.
- (b) Furnishing and installing meter base, service panelboard, support hardware, grounding, and all associated equipment as detailed on the Plans and specified herein.
- (c) Remove existing 120/240 high leg delta overhead service and replace it with a 208Y/120 VAC 3 ϕ service. Remove and replace all existing panels in the building and reconnect all existing branch circuits to the new panels.

Demolition.

- (a) All existing abandoned items above ceiling including hangers, supports, conduit, piping, wiring, etc., to be removed back to source and capped.
- (b) Remove all existing electrical materials and associated items as shown or noted on the Plans and as required by the Work.
- (c) Remove all abandoned wiring, conduit, fittings, etc., in the project area. Cap all stubs, and seal penetrations through walls and floors.
- (d) All Conditions shall be carefully field determined and verified prior to removal.
- (e) All existing items requiring power to remain, shall be re-connected to their existing circuits if interrupted by an adjacent item to be demolished.
- (f) Salvageable items such as lighting fixtures, devices, circuit breakers, etc., to be removed shall be turned over to the Owner. Items not salvaged shall be removed from the property and disposed of legally.
- (g) Existing conduit to be re-used as much as possible. Add new conduit as needed. All wiring to be replaced complete.
- (h) Contractor to field verify all circuit numbers and update plans to reflect correct numbers during as-built drawing phase.

EQUIPMENT AND MATERIALS

Distribution Panels. Service panel shall be a 400 Amp, 208Y/120 VAC, 3-phase, 4 wire with solid neutral with 400 Amp, main switch (no overcurrent protection), copper bus braced for 22,000 Amperes symmetrical (minimum) at 208 VAC, 36 in. of breaker mounting space, suitable for 250 Amp frame max branch breakers, in a NEMA 1 enclosure UL listed suitable for service entrance, sized in accordance with UL 67, Square D, I-line, Type HCM Series, or approved equal. All bussing shall be copper. Neutral buss shall be copper. Include separate copper equipment ground bars adequately sized for all ground wires and grounding electrode conductors to and from the panel. All branch and feeder breakers shall have an interrupting rating of 22,000 Amps minimum at 208 VAC and shall be constructed in accordance with NEMA AB1 and UL 489. Circuit breakers shall be equipped with individually insulated braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position (or equip each breaker with a circuit card holder and neatly printed card identifying the circuit). Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. See Plans for details on size and quantity of branch and feeder breakers. Panel shall be UL-listed and bear the UL label. Provide legend plates as detailed on the Plans. Also identify the main service breaker per the requirements of NEC 230.70 (B). Coordinate selection of two pole breakers with the manufacturer to confirm proper bus connections.

Transient Voltage Surge Suppressor for Service Panelboard. AC power surge arrester/transient voltage surge suppressor shall be UL-listed per UL 1449, Third Edition. AC power surge arrester/transient voltage surge suppressor for the main distribution panel shall be suitable for a 208Y/120 VAC, 3-phase, 4-wire, plus ground system with a surge current rating of 240,000-Amps, 8 x 20 microsecond wave per mode (L-L, L-N, L-G, N-G), and status indication lights in a NEMA 12-rated enclosure, Lightning Protection Corporation Model LPC 2030, or approved equal.

Branch Circuit Panels. Circuit breaker panelboard shall be rated 208Y/120 VAC, 3-phase, 4-wire and shall have copper bus structure braced for 22,000 RMS Amperes fault current minimum at 208Y/120 VAC. All copper parts shall be plated to prevent corrosion. Panelboards shall bear the UL label. All panelboards shall be dead-front safety-type, equipped with thermal magnetic-molded case breakers and solid neutral bus. Bus bar connections to the branch circuit breakers shall be the "Distributed Phase" or "Phase Sequence" type. Bussing shall be such that adjacent single-pole breakers will be on different phases or polarities, and that two pole breakers can be installed at any location. Panelboard numbering shall be such that starting at the top, odd numbers shall be used in sequence down the left hand side, and even numbers shall be used in sequence down the right hand side. Cabinets shall be fabricated of code-gauge, galvanized steel with gutters per the NEC. Fronts shall have doors with matching one-piece trim, be code-gauge, and be finished with rust-inhibiting primer and baked enamel. Fronts shall have adjustable indicating trim clamps completely concealed when door is closed. Provide a circuit directory frame and card with a clear plastic covering on the inside of the doors. Fronts shall have flush locks, and be furnished with two keys per lock. Provide circuit breakers, quick-make, quick-break, thermal-magnetic, trip indicating, and common trip on all multi-pole breakers. Handles shall have "ON", "OFF" and "TRIPPED" positions. Circuit breakers shall be UL-listed in accordance with UL Standard 489. Breakers shall have bolt-on connections to the bus. Amperage trip ratings, voltage ratings, interrupting current ratings, and number of poles shall be as shown on the panelboard schedules. Contractor shall confirm and adjust circuit breaker sizes, as required for the respective equipment or device being fed, in accordance with the respective equipment manufacturer's recommendation and the NEC. Panelboards shall be furnished with copper-ground bus and separate insulated copper neutral bus."

Fractional Horsepower Manual Motor Starters. Fractional horsepower manual motor starters shall be toggle-operated type with thermal overload protection in each phase conductor sized for the respective motor. Fractional horsepower manual motor starters shall be installed in NEMA 1 surface enclosures where located indoors in a dry, non-corrosive, non-hazardous location. Fractional horsepower manual motor starters shall be installed in NEMA 4/4X enclosures where located outdoors or in wet locations. Starters shall include handle guard/lock off feature to permit pad locking the device in the off position. Acceptable Fractional horsepower manual motor starter products are General Electric - CR101, Square D - Class 2510, Cutler-Hammer – MS, or approved equal.

Safety Switches. Furnish and install a safety switches as detailed on the Plans and specified herein. Safety switches shall be heavy duty, UL-listed, with amperage, voltage, number of poles, and type (fusible or not fusible), and accessories as detailed on the Plans. Safety switches shall be pad lockable in the off position. Include ground lugs or grounding kits with all safety switches. Safety switches located indoors in dry, non-corrosive, non-hazardous areas shall be in NEMA 1 or NEMA 12 enclosures. Safety switches located outdoors or in damp areas shall be in NEMA 3R and 12 or NEMA 4X enclosures without knockouts. Safety switches located in hazardous areas shall be suitable for the respective location. Safety switches shall be manufactured by Square D, or approved equivalent.

Conduit and Fittings.

Electrical Metallic Tubing (EMT). Electrical Metallic Tubing shall be galvanized steel tubing conforming to ANSI C80.3 and U.L. 797. Electrical Metallic Tubing shall be as manufactured by Allied Tube and Conduit Corporation, or equal. All EMT and mounting hardware shall be constructed of corrosion resistant materials and be listed for use in wet locations. EMT fittings, couplings and connectors shall be steel compression type. Set screw fittings will not be allowed. Steel used to manufacture conduits shall be 100 percent domestic steel. Contractor shall provide certification that the respective steel conduits used on this project are manufactured from 100 percent domestic steel.

Galvanized Rigid Steel Conduit. Rigid Steel Conduit and fittings shall be hot-dipped, galvanized, UL-listed, and produced in accordance with UL Standard 6 – Rigid Metal Conduit and ANSI C80.1 – Rigid Steel Conduit, Zinc Coated. Couplings, connectors, and fittings for rigid steel conduit shall be threaded, galvanized steel or galvanized, malleable iron, specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.4 – Fittings Rigid Metal Conduit and EMT and UL 514B – Conduit, Tubing, and Cable Fittings. Set screw type fittings are not acceptable.

Schedule 40 PVC and Schedule 80 PVC Conduit. Conduit shall be Schedule 40 PVC or Schedule 80, 90 C, UL-rated or approved equal. Material shall comply with NEMA Specification TC-2 (Conduit), TC-3 (Fittings-UL-514), and UL-651 (Standard for rigid nonmetallic conduit). The conduit and fittings shall carry a UL label (on each 10 ft length of conduit and stamped or molded on every fitting). Conduit and fittings shall be identified for type and manufacturer and shall be traceable to location of plant and date manufactured. The markings shall be legible and permanent. The conduit shall be made from polyvinyl chloride C-300 compound which includes inert modifiers to improve weatherability, heat distortion. Clean rework material, generated by the manufacturer's own conduit production, may be used by the same manufacturer, provided the end products meet the requirements of this Specification. The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes, or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could mar conductors or cables. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity and shall be Carlon Plus 40, Plus 80 conduit, or approved equal.

Surface Non-metallic Raceway. One, Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Resident Engineer from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics. Products by Hubble Panduit, Legrand/Wiremold or approved equal.

Conductors.

XHHW Wire. Cable shall be UL-listed as Type XHHW-2 per UL Standard 44 for Rubber-Insulated wires and cables. Cable shall also conform to ICEA S-95-658/NEMA WC70 and Federal Specification J-C-30B. Conductors shall be Class B stranded annealed uncoated copper per UL Standard 44. Insulation shall be rated for 600-Volt. Insulation shall be cross-linked polyethylene complying with the physical and electrical requirements of UL Standard 44 for Type XHHW-2. Service conductors shall be Service Wire Company, Type XHHW-2, or approved equal.

THWN Wire. Cable shall be 1/C sized as indicated on the Plans. Cable shall comply with Underwriters' Laboratories Standard UL-83 and shall be UL-listed as VW-1. Conductor shall be soft annealed uncoated copper and shall comply with ASTM B3 and B8. Insulation shall be rated for 600-Volt. Insulation shall be polyvinyl-chloride conforming to Underwriters' Laboratories requirements for Type THW. The outer covering shall be nylon conforming to Underwriters' Laboratories for type THHN or THWN-2. Cable shall be UL-listed and marked THWN. Power and control wiring shall be Southwire Type THWN-2, or approved equal.

Supporting Devices. Strut supports for interior or exterior applications shall be strut support, Unistrut P-1000 or approved equal. Provide necessary hardware, such as floor flanges, etc., as required to install equipment as specified and as shown on the Plans.

Provide materials, sizes and types of anchors, fasteners, and supports necessary to carry the loads of equipment and conduits. Consider weights of conduit when selecting products.

Fasteners and anchors shall be corrosion resistant, stainless steel. Where suitable, nonmetallic clamps and fasteners may be used.

Cable hangers shall be heavy duty nylon saddle rack with 3 in. throat opening Underground devices, Northbrook, IL, Cat. No. 3SR1 or 3SR2. Cable hangers shall be adequately sized to accommodate the respective cables. Secure cables to cable hangers with corrosion resistant cable ties.

Cable tray shall be ladder type, fabricated from aluminum. The cable tray system shall be designed with 20% spare capacity, and shall be sized to meet NEC requirements. Cable tray system shall be electrically continuous throughout. Bonding jumper shall be provided at all flexible splices and discontinuities. All cables run in cable tray shall be listed for such use.

Lighting. Lighting Fixtures and lamps shall be as designated in "Lighting Fixture Schedule" on the Plans. Provide fixtures complete with all required accessories. Provide conduit and wiring as detailed on the Plans. Fixture wiring shall comply with fixture manufacturer's recommendations and the NEC requirements. Mounting Hardware: Provide mounting hardware to supplement building structure for support of fixtures. Supports shall be capable of supporting 300 percent fixture and lamp weight. Emergency lighting system consists of selected fixtures as indicated on Plans. Emergency lighting fluorescent fixtures shall be self-contained, modular, battery-inverter unit factory-mounted within fixture body. Comply with UL 924, and include the following features:

- (a) Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
- (b) Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
- (c) Charger: Fully automatic, solid-state, constant-current type.
- (d) Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.

Outlets.

General Purpose Receptacles. General purpose receptacles for all wall-type convenience outlets in non-hazardous areas shall be of the 20-Amp, 125-volt, 3-wire grounding type, NEMA 5-20R, heavy-duty specification-grade **ivory** in color, Arrow Hart Part Number 5362, Bryant Part Number 5362, Hubbell Part Number 5362, Pass & Seymour Part Number 5362, or approved equal. Cover plates for flush-mounted, general purpose receptacles shall be of the stainless steel type as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal.

GFCI Receptacles. Receptacles with ground-fault circuit interrupters shall be provided and installed where noted on the Plans. Ground-fault circuit interrupter receptacles shall be rated 120 VAC, 60 HZ, 20 Amps, specification-grade with NEMA 5-20R receptacle configuration and a trip threshold of 5 ± 1 milliamps. Ground fault circuit interrupter receptacles shall be UL Class "A" ground-fault interrupter receptacle units complying with and tested in accordance with UL Standard No. 943. Ground fault circuit interrupter receptacles shall be Arrow Hart Part Number GF5342, Bryant Part Number GFR53FT, Hubbell Part Number GF5362, Pass & Seymour Part Number 2091-S, or approved equal.

Device Boxes. Device boxes for flush-mounted, non-hazardous receptacles and switches shall be sheet steel construction. Cover plates shall be stainless steel, as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal. Surface-mount device boxes in unfinished spaces shall be of cast aluminum or malleable iron FS design with cover plates of surface-mount FS design, as manufactured by Appleton, Crouse Hinds, or equal. Weatherproof covers shall be industrial grade, rain-tight NEMA 3R (while outlet is in use, as well as when not in use), UL-listed, FS box-mountable, weatherproof covers, TayMac Corporation Catalog No. 20550, or approved equal. Provide non-metallic boxes in finished spaces to match surface non-metallic raceway by Hubbell, Panduit, Wiremold/Legrand or approved equals.

Switches.

Toggle Switches. Single-pole toggle switches shall be 20-Amp, 120/277-volt, specification-grade, as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal. Single-pole, 20-Amp, 120/277-Volt toggle switches shall be Arrow Hart Part Number 1991, Bryant Part Number 4901, Hubbell Part Number 1220, Pass & Seymour Part Number 20AC1, or approved equal.

Indoor Occupancy Sensors.

- (a) General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 - (1) Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - (2) Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - (3) Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 - (4) Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - (5) Mounting:
 - a) Sensor: Suitable for mounting in any position on a standard outlet box.
 - b) Relay: Externally mounted through a 1/2-in. knockout in a standard electrical enclosure.
 - c) Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- (1) Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- (2) Bypass Switch: Override the "on" function in case of sensor failure.

(b) Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

- (1) Sensitivity Adjustment: Separate for each sensing technology.
- (2) Detector Sensitivity: Detect occurrences of 6-in.- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 in. in either a horizontal or a vertical manner at an approximate speed of 12 in./s.
- (3) Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft when mounted on a 96-in.- high ceiling.

(c) Switchbox-Mounted Occupancy Sensors

- (1) General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - a) Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - b) Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 - c) Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- (2) Wall-Switch Sensor:
 - a) Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
 - b) Sensing Technology: Dual technology - PIR and ultrasonic.
 - c) Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
 - d) Voltage: Dual voltage, 120 and 277 V; passive-infrared dual-technology type.
 - e) Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - f) Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
 - g) Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
- (3) Products by Hubbell, Sensor Switch, Watt Stopper or approved equal.

- (d) Device Boxes. Device boxes for flush-mounted, non-hazardous receptacles and switches shall be sheet steel construction. Surface mount device boxes in unfinished spaces for receptacles and toggle switches shall be die cast construction weatherproof boxes as manufactured by Appleton, Crouse Hinds, Hubbell/RACO/Bell or approved equal. Cover plates shall be stainless steel as manufactured by Arrow Hart, Bryant, Hubbell, Pass & Seymour, or approved equal.

Digital, Addressable Fire-Alarm System.

(a) System Description

- (1) Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

(b) Summary

(1) Section Includes:

- a) Fire-alarm control unit.
- b) Manual fire-alarm boxes.
- c) System smoke detectors.
- d) Heat detectors.
- e) Notification appliances.
- f) Remote annunciator.
- g) Addressable interface device.
- h) Digital alarm communicator transmitter.

(c) Quality Assurance

- (1) Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- (2) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- (3) NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

(d) Products by:

- (1) NOTIFIER; a Honeywell company.
- (2) Siemens Building Technologies, Inc.; Fire Safety Division.
- (3) SimplexGrinnell LP; a Tyco International company.
- (4) Honeywell.
- (5) Or approved equal.

(e) Software Service Agreement

- (1) Comply with UL 864.
- (2) Technical Support: Beginning with Substantial Completion, provide software support for two (2) years.
- (3) Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software:
 - a) Provide ten (10) days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

(f) Systems Operational Description

- (1) Fire-alarm signal initiation shall be by one (1) or more of the following devices:
 - a) Manual stations.
 - b) Heat detectors.
 - c) Retain one or both of first two subparagraphs below. Coordinate with Plans if retaining both.
 - d) Smoke detectors.
 - e) Duct smoke detectors.
- (2) Fire-alarm signal shall initiate the following actions:
 - a) Continuously operate alarm notification appliances.
 - b) Identify alarm at fire-alarm control unit and remote annunciators.
 - c) Transmit an alarm signal to the remote alarm receiving station.
 - d) Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - e) Record events in the system memory.
- (3) System trouble signal initiation shall be by one (1) or more of the following devices and actions:
 - a) Open circuits, shorts, and grounds in designated circuits.
 - b) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - c) Loss of primary power at fire-alarm control unit.
 - d) Ground or a single break in fire-alarm control unit internal circuits.
 - e) Abnormal ac voltage at fire-alarm control unit.
 - f) Break in standby battery circuitry.
 - g) Failure of battery charging.
 - h) Abnormal position of any switch at fire-alarm control unit or annunciator.
- (4) System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

(g) Fire-Alarm Control Unit

- (1) General Requirements for Fire-Alarm Control Unit:
 - a) Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL:
 - i) System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - ii) Include a real-time clock for time annotation of events on the event recorder and printer.
- (2) Addressable initiation devices that communicate device identity and status:
 - a) Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b) Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
- (3) Addressable control circuits for operation of mechanical equipment.

(h) Manual Fire-Alarm Boxes

- (1) General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box:
 - a) Double-action mechanism requiring two (2) actions to initiate an alarm, breaking-glass or plastic-rod and pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - b) Station Reset: Key- or wrench-operated switch.

(i) System Smoke Detectors

- (1) General Requirements for System Smoke Detectors:
 - a) Comply with UL 268; operating at 24-Volt dc, nominal.
 - b) In first subparagraph below, retain first option for additions to existing four-wire systems or if detector auxiliary contacts are used for critical control functions such as air-handler shutdowns. Otherwise, retain type based on class of initiating device circuit.
 - c) Detectors shall be two-wire type.

- d) Retain one or both of first two subparagraphs below. If retaining both, indicate detector types on Plans.
 - e) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - f) Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - g) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - h) Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 - i) Retain subparagraph below for analog-addressable system where remotely adjustable detectors are to be used.
 - j) Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit:
 - i) Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20°F per minute.
 - ii) Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155°F.
 - iii) Number of settable levels in fire-alarm control unit varies among manufacturers and between detector types. Indicate specific number of levels on Plans or in "Remarks" column of a detector schedule.
 - iv) Provide multiple levels of detection sensitivity for each sensor.
- (2) Photoelectric Smoke Detectors:
- a) Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b) An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - i) Primary status.
 - ii) Device type.
 - iii) Present average value.
 - iv) Present sensitivity selected.
 - v) Sensor range (normal, dirty, etc.).

(3) Ionization Smoke Detector:

- a) Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- b) An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - i) Primary status.
 - ii) Device type.
 - iii) Present average value.
 - iv) Present sensitivity selected.
 - v) Sensor range (normal, dirty, etc.).

(4) Duct Smoke Detectors: Photoelectric type complying with UL 268A:

- a) Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- b) An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - i) Primary status.
 - ii) Device type.
 - iii) Present average value.
 - iv) Present sensitivity selected.
 - v) Sensor range (normal, dirty, etc.).
- c) Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
- d) Number of settable levels in fire-alarm control unit varies among manufacturers and between detector types. Indicate specific number of levels on Plans or in "Remarks" column of a detector schedule.
- e) Each sensor shall have multiple levels of detection sensitivity.
- f) Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- g) Retain subparagraph below if required for direct shutdown of the fan associated with detector.
- h) Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

(j) Heat Detectors

- (1) General Requirements for Heat Detectors: Comply with UL 521.
- (2) Heat Detector, Combination Type: Actuated by either a fixed temperature of 135°F or a rate of rise that exceeds 15°F per minute unless otherwise indicated:
 - a) Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - b) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- (3) Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190°F:
 - a) Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - b) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

(k) Notification Appliances

- (1) General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections:
 - a) Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- (2) Horns: Electric-vibrating-polarized type, 24-Volt dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 ft from the horn, using the coded signal prescribed in UL 464 test protocol.
- (3) Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-in.- high letters on the lens:
 - a) Rated Light Output:
 - i) 15/30/75/110 cd, selectable in the field.
 - b) Mounting: Wall mounted unless otherwise indicated.
 - c) For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - d) Flashing shall be in a temporal pattern, synchronized with other units.
 - e) Strobe Leads: Factory connected to screw terminals.
 - f) Mounting Faceplate: Factory finished, white.

(l) Addressable Interface Device

- (1) Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- (2) Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

(m) Remote Annunciator

- (1) Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing:
 - a) Mounting: Flush cabinet, NEMA 250, Type 1.
- (2) Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

(n) Digital Alarm Communicator Transmitter

- (1) Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- (2) Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two (2) telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than forty-five (45) seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- (3) Local functions and display at the digital alarm communicator transmitter shall include the following:
 - a) Verification that both telephone lines are available.
 - b) Programming device.
 - c) LED display.
 - d) Manual test report function and manual transmission clear indication.
 - e) Communications failure with the central station or fire-alarm control unit.

- (4) Digital data transmission shall include the following:
 - a) Address of the alarm-initiating device.
 - b) Address of the supervisory signal.
 - c) Address of the trouble-initiating device.
 - d) Loss of ac supply or loss of power.
 - e) Low battery.
 - f) Abnormal test signal.
 - g) Communication bus failure.
- (5) Secondary Power: Integral rechargeable battery and automatic charger.
- (6) Self-Test: Conducted automatically every twenty-four (24) hours with report transmitted to central station.
- (o) Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu:
 - (1) Annunciator and Display: Liquid-crystal type, two (2) line(s) of forty (40) characters, minimum.
 - (2) Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- (p) Circuits:
 - (1) Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
- (q) Smoke-Alarm Verification:
 - (1) Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - (2) Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - (3) Record events by the system printer.
 - (4) Sound general alarm if the alarm is verified.
 - (5) Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- (r) Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

- (s) Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station by digital communicator and telephone lines.

Premise Distribution System:

- (a) Section Includes: Equipment, materials, labor, and services to provide Category 6 Telecommunications distribution system, including, but not limited to:

- (1) Raceway and boxes.
- (2) Telephone and data cabling terminations.
- (3) Optical fiber and terminations.
- (4) Telecommunications outlets.
- (5) Terminal blocks/cross-connect systems.
- (6) Equipment racks and cabinets.
- (7) System testing.
- (8) Documentation and submissions.
- (9) Grounding.

- (b) Work not included:

- (1) The following work will be done by others:
 - a) Off-site services.
 - b) Providing electrical wiring and outlets.
 - c) Providing data concentrators, hubs, switches, servers, computers, and other active devices such as PBX's.

- (c) Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA-70 (National Electrical Code®), IEEE C2 (NESC), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

ANSI/NECA/BICSI-568 -- Standard for Installing Commercial Building Telecommunications Cabling

ANSI/TIA/EIA Standards:

- (1) ANSI/TIA/EIA-568-B.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
- (2) ANSI/TIA/EIA-568-B.2 -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.
- (3) ANSI/TIA/EIA-568-B.3 -- Optical Fiber Cabling Components Standard.
- (4) ANSI/TIA/EIA-569-B -- Commercial Building Standard for Telecommunications Pathways and Spaces.
- (5) ANSI/TIA/EIA-606(A) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

- (6) ANSI-J-STD-607(A) -- Commercial Building Grounding and Bonding Requirements for Telecommunications.
- (7) TIA-526-7 –OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
- (8) TIA-526-14A –OFSTP-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
- (9) ANSI/TIA/EIA-758(A) -- Customer-Owned Outside Plant Telecommunications Cabling Standard.
- (10) TIA TSB-140 Additional Guidelines for Field Testing Length, Loss.
- (11) And Polarity of Optical Fiber Cabling Systems:
 - a) Install cabling in accordance with the most recent edition of BICSI® publications:
 - i) BICSI -- Telecommunications Distribution Methods Manual.
 - ii) BICSI – Installation Transport Systems Information Manual.
 - iii) BICSI – Network Design Reference Design Manual.
 - iv) BICSI –Outside Plant Design Reference Manual.
 - b) Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Engineer, in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.
- (d) The telecommunications cabling system generally consists of one (1) voice and one (1) telecommunications outlet in each workstation, wall telephones in common and mechanical areas, pathways, and patch panels located on each floor.
 - (1) The typical work area consists of a single-gang plate with two (2) standards compliant work area outlets.
 - (2) One (1) work area outlet consists of two (2) 4-pair data Category 6 cables, installed from work area outlet to the Communications Rack. Terminate data cables on wall /rack mounted modular patch panels located in the appropriate Communications Rack.
 - (3) Vertical/horizontal copper backbone cabling consists of multiple pair unshielded twisted-pair installed from the main cross-connect (MC) to the horizontal cross-connect (HC) and/or from the MC to the intermediate cross-connect (IC) to the HC.

(e) Provide Product By:

(1) UTP Cable:

- a) Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
- i) Hubbell Premise Wiring
 - ii) Leviton Voice and Data Division
 - iii) Panduit Corp.
 - iv) Siemon Co. (The)
 - v) Belden CDT Inc.: Electronics Division.
 - vi) Berk-Tek; a Nexans company.
 - vii) Nordex/CDT; a subsidiary of Cable Design Technologies.
 - viii) Superior Essex Inc.
 - ix) SYSTIMAX Solutions; a CommScope, Inc. brand.
 - x) 3M. Corp.
 - xi) Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 - xii) Or approved equal.

(2) UTP Cable Hardware:

- a) Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
- i) Hubbell Premise Wiring
 - ii) Leviton Voice and Data Division
 - iii) Panduit Corp. Siemon Co. (The)
 - iv) Siemon Co. (The).
 - v) Belden CDT Inc.: Electronics Division.
 - vi) Berk-Tek; a Nexans company.
 - vii) Nordex/CDT; a subsidiary of Cable Design Technologies.
 - viii) Superior Essex Inc.
 - ix) SYSTIMAX Solutions; a CommScope, Inc. brand.
 - x) 3M. Corp.
 - xi) Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 - xii) Or approved equal.

(f) Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets:

- (1) Comply with NFPA 70 and Underwriters Laboratories, Inc. (UL) 2043 for fire-resistant and low-smoke-producing characteristics.
- (2) Support brackets with cable tie slots for fastening cable ties to brackets.
- (3) Lacing bars, spools, J-hooks, and D-rings.
- (4) Straps and other devices.

(g) Conduit and Boxes: Comply with requirements in this Special Provision:

(1) Outlet boxes shall be no smaller than 4 in. wide, 4 in. high, and 2-1/2 in. deep, including plaster rings to match outlets.

(h) Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of equipment and its installation.

(i) Provide products that are suitable for intended use, including, but not limited to environmental, regulatory, and electrical.

(j) Indoor Voice/Data Telecommunications Service Backbone Cable:

(1) Solid copper, 24 AWG, 100 Ω balanced twisted-pair (UTP) backbone cable, in sizes as indicated on the Plans, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA-568-B.2

a) Note: Listed Type CMP, (as *required in the NEC*):

(k) Voice and Data Station Cable (Copper)

(1) Solid copper, 22 AWG to 24 AWG, 100 Ω balanced twisted-pair (UTP) Category 6 cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ISO/IEC 11801: 2007 up to 500 MHz.

a) Note: Listed Type CMP.

(l) Patch Cords:

(1) Provide color Category 6 patch cords, using the methods stated in Part 3 568B wiring, and RJ-45 connectors. Refer to construction documents for station and patch-cable requirements. Provide number of patch cords to meet needs of project plus 10 percent spare.

(2) Patch cords for fiber optic system shall be cable assemblies of flexible optical fiber cable with type LC connectors as used elsewhere in the system. Include a minimum of twenty-five (25) patch cords.

(3) Patch Cord Jackets shall be ivory for voice/data. Patch cords shall be factory assembled.

(4) Patch Cords: Four (4) pair category 3 and 6 cables in 3 ft, 5 ft, 7 ft, 10 ft, 15 ft, and 20 ft lengths as required to meet needs of project.

(m) Voice/Data – Work Area Outlets (Copper Only)

- (1) Single-gang mounting plate with four (4) openings containing the following devices:
 - a) Voice Outlet – 8-pin modular, Category 6, unkeyed, grey, pinned to T568B standards.
 - b) Data Outlet – 8-pin modular, Category 6, unkeyed, blue, pinned to T568 standards.

(n) Wall Voice Outlets

- (1) Single-gang stainless steel faceplate with 6-conductor jack and wall telephone mounting lugs.

(o) Termination Blocks

- (1) Product(s) as approved by the engineer/designer: Wiring blocks are to be in following configurations:
 - a) List dimensional configurations.
 - b) ER – List pairs connectorized for PBX portion of ER and pairs field terminated for backbone and CO portion of ER:
 - i) Provide wiring troughs between ER frame sections.

(p) Patch Panels

- (1) 19 in. rack mountable, 48-port 8-pin modular to insulation displacement connector (IDC) meeting Category 6 performance standards.

(q) Power Strips

- (1) Comply with UL 1363:
 - a) Rack mounting.
 - b) Six (6) 20-A, 120-Volt ac, NEMA WD 6, Configuration 5-20R receptacles.
 - c) LED indicator lights for power and protection status.
 - d) LED indicator lights for reverse polarity and open outlet ground.
 - e) Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - f) Cord connected with 15 ft line cord.
 - g) Rocker-type on-off switch, illuminated when in on position.
 - h) Peak Single-Impulse Surge Current Rating: 33 kA per phase.
 - i) Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three (3) modes shall be not more than 330-Volts.

Ground Bus. Ground bus for the vault interior shall be 1/4 in. thick by 2 in. wide Copper bus bar, as manufactured by Harger Lightning Protection Inc., Gus Berthold Electric Company, or approved equivalent. Ground bus shall include standoffs, insulators, splices, bonding jumpers, mounting hardware, etc., as required for the respective application. Splices for 1/4 in. thick by 2 in. wide bus bar shall be with manufacturers splice plates and stainless nuts, bolts, and washers. Exothermic weld connections are also acceptable splices for the ground bus. Splice plates shall be bolt through type Copper with minimum dimensions 1/4 in. thick by 2 in. wide by 6 in. length with 4 bolts. Include an engraved phenolic or plastic legend plate 1/2-in. high white letters on a green background labeled "COMMUNICATIONS GROUND BUS". All cable connections to the ground bus shall be with two-hole tongue, long barrel compression lugs bolted to the bus bar, as detailed on the Plans.

Ground Rods. Ground rods for the Building ground field shall be 3/4-in. diameter, 10 ft long, UL-listed, Copper-clad Ground rods shall have 10 mils minimum Copper coating. Ground rods shall be manufactured in the United States of America. Steel used to manufacture ground rods shall be 100 percent domestic steel.

Junction and Pull Boxes. Junction and pull boxes shall be sized, as required for conductors and splices and per NEC most current issue in force Article 314. Boxes shall be UL-listed. Special boxes made to suit conditions shall be used to accommodate the respective application, or where required by the NEC, even though they might not be indicated on the Plans. Surface-mounted exterior junction and pull boxes located in non-hazardous, non-classified areas shall be NEMA 4X stainless steel or aluminum, Crouse-Hinds, Killark, Hoffman, Hennessy, or equal.

CONSTRUCTION REQUIREMENTS

Installation of Fire Alarm System.

- (a) Comply with NFPA 72 for installation of fire-alarm equipment.
- (b) Equipment Mounting: Install fire-alarm control unit on wall with tops of cabinets not more than 72 in. above the finished floor:
 - (1) Mount control panel to wall according to manufacturer's requirements.
- (c) Install wall-mounted equipment, with tops of cabinets not more than 72 in. above the finished floor.

- (d) Smoke or Heat-Detector Spacing:
- (1) Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - (2) Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - (3) Smooth ceiling spacing shall not exceed 30 ft.
 - (4) Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 - (5) HVAC: Locate detectors not closer than 3 ft from air-supply diffuser or return-air opening.
 - (6) Lighting Fixtures: Locate detectors not closer than 12 in. from any part of a lighting fixture.
- (e) Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- (f) Heat Detectors in Elevator Shafts: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- (g) Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- (h) Audible Alarm-Indicating Devices: Install not less than 6 in. below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- (i) Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 in. below the ceiling.
- (j) Device Location-Indicating Lights: Locate in public space near the device they monitor.
- (k) Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 in. above the finished floor.
- (l) Annunciator: Install with top of panel not more than 72 in. above the finished floor.
- (m) For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system:
- (1) Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

- (n) Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 ft from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
- (o) Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in this Special Provision.
- (p) Install framed instructions in a location visible from fire-alarm control unit.
- (q) Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- (r) Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- (s) Tests and Inspections:
 - (1) Visual Inspection: Conduct visual inspection prior to testing:
 - a) Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b) Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - (2) System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - (3) Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - (4) Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - (5) Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - (6) Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - (7) Provide ampere draw on each signal (horn and strobe) circuit.
 - (8) Test, measure, and record audible sound levels (dB) for each horn.

- (t) Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- (u) Fire-alarm system will be considered defective if it does not pass tests and inspections.
- (v) Prepare test and inspection reports.
- (w) Annual Test and Inspection: One (1) year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.
- (x) Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide two (2) two (2) hour sessions.

Installation of Premise Distribution System.

- (a) The contractor shall be a factory- authorized cabling system installer, as recognized by the manufacturer of the equipment being provided.
- (b) The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.
- (c) Equipment and materials of the type for which there are independent standard testing requirements, listings, and labels, shall be listed and labeled by the independent testing laboratory.
- (d) Where equipment and materials have industry certification, labels, or standards (i.e., NEMA - National Electrical Manufacturers Association), this equipment shall be labeled as certified or complying with standards.
- (e) Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout.
- (f) Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than twenty-five (25) years from date of acceptance by the owner. The owner shall deem acceptance as beneficial use.
- (g) Transfer manufacturer's warranties to the owner in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve you of these obligations.

- (h) Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local telecommunications equipment and service supplier.
- (i) Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- (j) All network electronics, including Ethernet switch, will be Department furnished and installed.
- (k) Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the Department for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.
- (l) Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Department acceptance, and demolition completion.
- (m) Use of the site shall be at the Department's direction in matters in which the department deems it necessary to place restriction.
- (n) Access to building wherein the work is performed shall be as directed by the Department.
- (o) Schedule necessary shutdowns of plant services with the Department, and obtain written permission from the Department. Refer to article - *CONTINUITY OF SERVICES* herein.
- (p) Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the Department.
- (q) Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Department's representative. Arrange the work to minimize shutdown time.
- (r) Department's personnel will perform shutdown of operating systems. The contractor shall give three (3) days' advance notice for systems shutdown.
- (s) Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

- (t) Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the Department's representative. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.
- (u) Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, state, and local authorities having jurisdiction, and *National Electrical Code*® (NEC) current edition in force and with manufacturer's printed instructions.
- (v) Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables:
 - (1) Where manufacturer does not provide bending radii information, minimum-bending radius shall be fifteen (15) times cable diameter. Arrange and mount equipment and materials in a manner acceptable to the engineer and the Department.
- (w) Penetrations through floor and fire-rated walls shall utilize intermediate metallic conduit (IMC) or galvanized rigid conduit (GRC) sleeves and shall be firestopped after installation and testing, utilizing a firestopping assembly approved for that application.
- (x) Install station cabling to the nearest telecommunications room (TR), unless otherwise noted.
- (y) Installation shall conform to the following basic guidelines:
 - (1) Use of approved wire, cable, and wiring devices.
 - (2) Neat and uncluttered wire termination.
- (z) Route cables through cable tray and conduit, as noted on the Plans. J-hooks are not acceptable.
- (aa) Install adequate support structures for 10 ft of service slack at each TR.
- (bb) Support riser cables every three (3) floors and at top of run with cable grips.
- (cc) Limit number of 4-pair data riser cables per grip to fifty (50).
- (dd) Install cables in one (1) continuous piece. Splices shall not be allowed except as indicated on the Plans.
- (ee) Provide overvoltage protection on both ends of cabling exposed to lightning or accidental contact with power conductors.

- (ff) Hook and latch fasteners will be used in lieu of cable ties.
- (gg) Service loops shall be made with a loose Figure "8" shape rather than circular.
- (hh) Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- (ii) Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- (jj) Comply with BICSI TDMM, "Firestopping Systems" Article.
- (kk) Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- (ll) Comply with ANSI-J-STD-607-A.
- (mm) Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2 in. clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- (nn) Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
- (oo) Identification
 - (1) Identify system components, wiring, and cabling complying with TIA/EIA-606-A. For fire-resistant plywood, do not paint over manufacturer's label.
- (pp) Labels shall be preprinted or computer-printed type.
- (qq) Labeling
 - (1) Labeling shall conform to the ANSI/TIA/EIA-606(A) standards. In addition, provide the following:
 - (2) Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
 - a) Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
 - i) Inside receptacle box at the work area.
 - ii) Behind the communication closet patch panel or punch block.
 - (3) Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.

- (4) Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.
- (5) Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.
- (6) Label cables, outlets, patch panels, and punch blocks, as detailed on the construction documents.
- (7) Mark up floor plans showing outlet locations, type, and cable marking of cables. Turn these drawings over to the Department two (2) weeks prior to move in to allow the Department's personnel to connect and test Department-provided equipment in a timely fashion:
 - a) Three (3) sets of as-built drawing shall be delivered to the Engineer within four (4) weeks of acceptance of project by the Department. A set of as-built drawings shall be provided to the Department in electronic form and utilizing CAD software that is acceptable to the Department. The electronic media shall be delivered to the Department within six (6) weeks of acceptance of project by Department.

(rr) Testing

- (1) Testing shall conform to Category 6 and ANSI/TIA/EIA-568-B.1 standards. Testing shall be accomplished using manufacturer approved testers.
- (2) Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded, and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets:
 - a) Perform testing of copper cables with tester meeting ANSI/TIA/EIA-568-B.1 requirements.
 - b) If copper backbone cable contains more than one (1) percent bad pairs, remove and replace entire cable.
 - c) If horizontal cable contains bad conductors or shield, remove and replace cable.
- (3) Where any portion of system does not meet the specifications, correct deviation and repeat applicable testing at no additional cost to the Department.

(ss) Field Quality Control

- (1) Employ job superintendent or project manager during the course of the installation to provide coordination of work of this specification and of other trades, and provide technical information when requested by other trades. This person shall maintain current RCDD® (Registered Communications Distribution Designer) registration or industry equivalent certified installer and shall be responsible for quality control during installation, equipment set-up, and testing.
- (2) Installation personnel shall meet manufacturer's training and education requirements for implementation of extended warranty program.

Locate Existing Utilities. The location, size, and type of material of existing underground and/or aboveground utilities indicated on the Plans are not represented as being accurate, sufficient, or complete. Neither the Department nor the Engineer assumes any responsibility whatever in respect to the accuracy, completeness, or sufficiency of the information. There is no guarantee, either expressed or implied, that the locations, size, and type of material of existing underground utilities indicated are representative of those to be encountered in the construction. It shall be the Contractor's responsibility to determine the actual location of all such facilities, including service connections to underground utilities. Prior to construction, the Contractor shall notify the utility companies of his operational plans, and shall obtain from the respective utility companies detailed information and assistance relative to the location of their facilities and the working schedule of the companies for removal or adjustment, where required. In the event an unexpected utility interference is encountered during construction, the Contractor shall immediately notify the utility company of jurisdiction. The Department's Representative and/or the Resident Engineer shall also be immediately notified. Any damage to such mains and services shall be restored to service at once and paid for by the Contractor at no additional cost to the Contract.

Contact JULIE (Joint Utility Location Information for Excavation) for utility information, phone: 1-800-892-0123.

Installation of Conduits.

- (a) All exterior above grade exposed conduit shall be galvanized rigid steel (GRSC).
- (b) All interior conduit serving branch circuits 1 in. and below will be EMT. All interior conduits exposed or larger than 1 in. will be rigid galvanized steel.
- (c) All work shall be laid out with sleeves for openings through slabs, building walls, etc., as required. If sleeves and inserts are not properly installed, the Contractor will be required to do all necessary cutting and patching to accommodate conduits.
- (d) Conduit size and fill requirements shall comply with Chapter 9 and Annex C of the NEC. It should be noted these are minimum requirements and larger conduit sizes or smaller fill requirements shall be used whenever specified or detailed on the Plans.
- (e) Ream conduits only after threads are cut. Cut joints square to butt solidly into couplings. Where necessary to join two pieces of conduit and it is impossible to use standard coupling, use 3-piece malleable iron conduit coupling. The use of running thread is prohibited. This applies to all rigid conduit installations, underground or otherwise.
- (f) Make all joints in steel underground conduit water-tight with approved joint compound. Temporarily plug conduit openings to exclude water, concrete or any foreign materials during construction. Clean conduit runs before pulling in conductors.

- (g) Hickey bends will not be acceptable for conduits 1-in. and larger. Use manufactured elbows or bends fabricated with bending machine. Field bending of all PVC conduit shall be accomplished with the use of equipment approved by the conduit manufacturer. Open flame bending equipment will not be acceptable.
- (h) A run of conduit between a junction box, pull box, and/or fitting shall not contain more than the equivalent of four (4) quarter bends, including bends immediately at the respective box or fitting.
- (i) Where conduits enter a box or fitting, provide a steel locknut and an insulated metallic bushing. Use this method to terminate conduit in panels, pull boxes, safety switches, etc. Conduit terminations in service equipment shall have grounding bushings with ground wire connections between the bushing and the ground bus.
- (j) Run exposed conduits parallel with respective walls or supporting structure and at right angles to the respective building, vault, etc., not diagonally. Make bends and turns with pull boxes or hot-dipped galvanized malleable iron fittings and covers.
- (k) Conduit terminations shall include bushings to protect cables and wires from damage from conduit.
- (l) Set screw type fittings are prohibited. Use compression fittings for EMT conduits.
- (m) Use only screws, bolts, washers, etc. fabricated from rust resisting metals for the supporting of boxes.
- (n) Schedule 40 PVC conduit and/or sleeves shall be used for grounding electrode conductors and service entrance conductors from both the transformer and the generator.
- (o) Metal conduit in direct contact with earth and not concrete encased shall be PVC coated galvanized steel. Concrete encased conduit shall be Schedule 40 PVC conduit.
- (p) Underground conduits shall be minimum 24-in. below finish grade to the top of conduit where located in areas not subject to vehicular traffic. Underground conduits shall be minimum 36-in. below grade where located in areas subject to vehicular traffic. Where shown on the Plans or where required to avoid obstructions and/or interferences with other underground utilities, deeper burial depths may be required.
- (q) Conduits shall be kept clean of concrete, dirt, or foreign substances during storage and construction. After conduit installation, a standard flexible mandrel shall be used for cleaning followed by a brush with stiff bristles. Mandrel shall be at least 12-in. long and have a diameter 1/4 in. less than the inside diameter of the conduit being cleaned. All obstructions in conduits shall be removed prior to pulling wires or final acceptance. Conduits unable to pass mandrel shall be replaced. All unused conduits shall be capped.

- (r) Trench widths shall be held to a minimum.
- (s) Examine all available site utility information in regard to existing utility lines and locate and protect existing lines. Repair all existing utility lines that are damaged by this construction.
- (t) All excavations shall be barricaded, lighted (where applicable) and protected during construction.
- (u) Contractor shall backfill all excavations.

Installation of Wire and Cable.

- (a) Wire and cable shall be installed using accepted industry methods to prevent damage to conductors and insulation. Installation shall comply with all applicable sections of the NEC regarding conduit fill.
- (b) No splices shall be permitted in conduit bodies. All splices shall be made in junction boxes provided for that purpose as detailed or required by need.
- (c) All conduits shall be swabbed until all moisture and grit is removed before any wires are pulled.
- (d) Manufacturers recommended pulling tension shall not be exceeded during conductor installation. Use approved pulling lubricant on long pulls or when pulling No. 4 or larger wire.
- (e) Neatly train and lace wiring inside boxes, equipment and panelboards.
- (f) Color code conductor insulation for #6 AWG and smaller. Color code conductors with tape or colored insulation for #4 AWG and larger. Where conductors are color coded with tape, they shall be identified (color coded) at all points of access. Insulated ground wires shall have green colored insulation for all conductor AWG and/or Kcmil to comply with NEC 250.119. Neutral conductors shall have white colored insulation for No. 6 AWG and smaller to meet the requirements of NEC 200.6. Color coding shall be as follows:

208Y/120 VAC, 3-PHASE, 4-WIRE

Phase A – Black
Phase B – Red
Phase C – Blue
Neutral – White
Ground - Green

(g) Splicing 600 volt wire shall be as follows:

- (1) Wire #8 and smaller:
 - a) Ideal "wing nut" type insulated connectors.
 - b) Scotchlok R, B, and Y type insulated connectors.
 - c) Thomas and Betts, PT-1, PT-2, and PT-3 insulated connectors.
- (2) Wire #6 and larger:
 - a) For straightway connections, use compression connector with rubber shrink type insulating cover.
 - b) For tee cable taps, use compression connector with rubber shrink type insulating cover.
 - c) For taps in cutout cabinets, gutters, and other close locations, use O.Z., Burndy, or PLM fittings, type "PT" cable tape with type "PTC" insulating cover.
- (3) Use plastic tape on all uninsulated wire splices manufactured by Scotch, Okonite, Brady Co. or Plymouth.
- (4) Splice only in accessible junction or outlet boxes.

(h) Connections and Terminations shall be as follows:

- (1) Identify each conductor in pump/motor control panels, panelboards, junction or pull boxes, or troughs with a permanent pressure sensitive label with suitable numbers or letters for easy recognition. Identify control wiring at each end and in junction boxes with numeric wire number corresponding to control wiring diagram.
 - (2) Thoroughly clean wire before installing lugs and connectors.
 - (3) Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
 - (4) Terminate spare conductors with electrical tape and roll up in box. Label spare conductors "SPARE."
- (i) Inspect wiring for physical damage and proper connection. All wire and cable shall be tested for continuity and short circuits prior to energizing circuits. Verify proper phasing where applicable.

Installation Of Supporting Devices. Install products in conformance with manufacturer's instructions and as detailed on the Plans. Provide anchors, fasteners and supports in accordance with NECA Standard of Installation, and as recommended by the equipment manufacturer for the respective application.

Do not fasten/secure supports to pipes, ducts, mechanical equipment, or conduit. Do not use spring steel clips or clamps. Install surface-mounted cabinets, enclosures and panelboards with a minimum of four (4) anchors. Use spring-lock washers under all nuts. All supports installed in the wet well and/or valve vault shall be corrosion resistant. Install supports with stainless steel hardware.

Concrete work associated with support structures shall conform to Section 1020 PORTLAND CEMENT CONCRETE of the Standard Specifications for Road and Bridge Construction and as detailed on the Plans.

Installation of Panelboards. Panelboards shall be thoroughly inspected for physical damage, proper alignment, anchorage, and grounding. The exterior finish shall be inspected for blemishes, nicks, and bare spots and touched up, as required, using matching touch-up paint. Inspections shall be made for proper installation and tightness of connections for circuit breakers. Install panelboards, as shown on the Plans and in accordance with NEMA PB1.1. Maximum distance from floor to highest breaker shall not exceed 6 ft-6 in. Install panelboards plumb. Install circuit breakers in panelboards in conformance with the respective manufacturer's directions. Connect only one wire/cable to each breaker terminal. Provide filler plates for unused spaces in panelboards. Provide typed circuit directory for each branch circuit panelboard to identify the respective device fed by each circuit breaker. Revise directory to reflect circuiting changes, as required. Provide legend plates for all panelboards to identify the panelboard designation, the power source, and the voltage system. Legend plates shall be weatherproof and abrasion-resistant, phenolic material. Lettering shall be black on white background. Panelboards shall be thoroughly tested after installation and connection to respective loads.

Surge Arrester Installation. Install Surge Protector Devices (SPD)/TVSS devices in conformance with the respective manufacturer's directions and recommendations. Contractor shall confirm all connections to the surge arrester (phases, neutral, and ground) are completed and secure. Connection leads to the surge arrester shall be sized per the respective manufacturer's recommendation and as detailed herein, and shall be maintained as short as possible, maximum 2 ft in length, and laced together for mutual coupling. The conduit or conduit nipple connecting the SPD/TVSS device enclosure to the panel enclosure shall be sealed with duct seal or other nonflammable medium to prevent soot from entering the enclosure in the event of a SPD/TVSS device failure. The surge arrestors may also be installed within the panel tubs by the panelboard manufacturer at the contractor's discretion.

Installation of Safety Switches. Safety switches shall be provided with appropriate mounting hardware and strut support. Strut support shall be hot-dipped, galvanized steel strut support, Unistrut P-1000 HG, or approved equal. Provide zinc rich paint applied to field cuts of strut support to minimize the potential for corrosion per the respective strut support manufacturer's recommendation. All hardware shall be corrosion-resistant. Mount safety switches securely in accordance with the manufacturer's recommendations/instructions and as required for the respective application. Inspect all safety switches for proper operation, tight and secure connections, and correctness. All safety switch enclosures shall be bonded to ground with a ground lug or bar and ground wire. Field cut holes in safety switch enclosures to accommodate conduit entrances. Where safety switch enclosures are provided with concentric knockouts, and the respective conduit does not use the largest knockout, install a grounding bushing with ground wire connections between the bushing and the ground bus. Where safety switches enclosures are used for service entrance applications provide a grounding bushing with ground wire connections between the bushing and the ground bus at each metal conduit entry. Do not use safety switch enclosures for a splice box or for a pull box. Do not route control wires or other circuit wiring through a safety switch enclosure. Where splices are required or other control circuit wires are installed in the respective conduit to a safety switch, provide a separate junction box to accommodate the splices and/or other circuit conductors. Provide weatherproof, abrasion-resistant, engraved legend plates for each safety switch noting the device served, the power source, and the voltage system.

Grounding Requirements. Grounding shall conform to the following as applicable: The Contractor shall furnish and install all grounding shown on the Plans and/or as may be necessary or required to make a complete grounding system as required by the latest National Electrical Code (NFPA 70) in force. The reliability of the grounding system is dependent on careful, proper installation and choice of materials. Improper preparation of surfaces to be joined to make an electrical path, loose joints, or corrosion can introduce impedance that will seriously impair the ability of the ground path to protect personnel and equipment and to absorb transients that can cause noise in communications circuits. The following functions are particularly important to ensure a reliable ground system:

- (a) All products associated with the grounding system shall be UL-listed and labeled.
- (b) All bolted or mechanical connections shall be coated with a corrosion preventative compound before joining, Sanchem "NO-OX-ID A Special" compound, Burndy Penetrox E, or approved equal.
- (c) Metallic surfaces to be joined shall be prepared by the removal of all non-conductive material, per National Electrical Code Article 250-12.

- (d) Metallic raceway fittings shall be made up tight to provide a permanent low impedance path for all circuits. Metal conduit terminations in enclosures shall be bonded to the enclosure with UL-listed fittings suitable for grounding. Provide grounding bushings with bonding jumpers (from bushing to the respective ground connection/enclosure frame) for all metal conduits entering service equipment (meter bases, CT cabinet, service disconnects, service panelboards, main service breaker enclosure, etc.). Provide grounding bushings with bonding jumpers for all metal conduits entering an enclosure through concentric or eccentric knockouts that are punched or otherwise formed so as to impair the electrical connection to ground. Standard locknuts or bushings shall not be the sole means for bonding where a conduit enters an enclosure through a concentric or eccentric knockout.
- (e) All connections, located above grade, between the different types of grounding conductors shall be made using UL-listed double compression crimp-type connectors or UL-listed bolted ground connectors. For ground connections to enclosures, cases and frames of electrical equipment not supplied with ground lugs the Contractor shall drill required holes for mounting a bolted ground connector. All bolted ground connectors shall be Burndy, Thomas and Betts, or equal. Tighten connections to comply with tightening torques in UL Standard 486A to assure permanent and effective grounding.
- (f) All metal equipment enclosures, conduits, cabinets, boxes, receptacles, motors, etc. shall be bonded to the respective grounding system.
- (g) Each feeder circuit and/or branch circuit shall include an equipment ground wire. The equipment ground wire shall not be smaller than allowed by NEC Table 250-122 "Minimum Size Conductors or Grounding Raceway and Equipment." When conductors are adjusted in size to compensate for voltage drop, equipment-grounding conductors shall be adjusted proportionately according to circular mil area. All equipment ground wires shall be copper either bare or insulated green in color. Where the equipment grounding conductors are insulated, they shall be identified by the color green and shall be the same insulation type as the phase conductors.
- (h) Provide all boxes for outlets, switches, circuit breakers, etc. with grounding screws. Provide all control panel, transfer switch, etc. enclosures with grounding bars with individual screws, lugs, clamps, etc. for each of the grounding conductors that enter the respective enclosures. Do not terminate more than one (1) ground wire in ground lug or terminal unless the respective lug or terminal is rated for multiple conductors.
- (i) Equipment ground wires shall be identified with green colored insulation for all conductor AWG or Kcmil. Green tape shall not meet this requirement.

- (j) All exterior metal conduit, where not electrically continuous because of non-metallic junction boxes, etc., shall be bonded to all other metal conduit in the respective duct run, and at each end, with a copper bonding jumper sized in conformance with NEC 250-102. Where metal conduits terminate in an enclosure (such as a motor control center, switchboard, etc.) where there is not electrical continuity with the conduit and the respective enclosure, provide a bonding jumper from the respective enclosure ground bus to the conduit sized per NEC 250-102.
- (k) Install grounding electrode conductors and/or individual ground conductors in Schedule 40 or Schedule 80 PVC conduit. Where grounding electrode conductors or individual ground conductors are run in PVC conduit, Do Not completely encircle conduit with ferrous and/or magnetic materials. Use non-metallic reinforced fiberglass strut support. Where metal conduit clamps are installed, use nylon bolts, nuts, washers and spacers to interrupt a complete metallic path from encircling the conduit.

Electrical Testing. The installation shall be tested in operation and as a completed unit prior to acceptance. Contractor shall furnish all equipment, meters, instruments, cable connections, tools, manpower, and labor to perform the respective tests. Test all new equipment and all existing equipment where modifications take place and confirm proper operation. Coordinate tests with the respective airport personnel and the Resident Engineer/Resident Project Representative. Tests shall include resistance, voltage, and current reading, as applicable for the respective equipment. When tests disclose any unsatisfactory workmanship or equipment furnished under this contract, correct defects and retest. Repeat tests until satisfactory results are obtained. When any wiring or equipment is damaged by tests, the wiring or equipment shall be repaired or replaced at no additional cost to the contract. Test repaired or replaced items to ensure satisfactory operation. Submit three copies of all test reports to the Engineer. All test reports shall be assembled and bound in a folder or binder. Each test report shall include the following information:

- (a) Project number,
- (b) Project title and location,
- (c) Device or system tested,
- (d) Test performed,
- (e) Date performed,
- (f) Test equipment used,
- (g) Respective Contractor's name, address, and telephone number,
- (h) Testing firm's name, address, and telephone number if other than the Contractor,
- (i) Names of individuals performing tests,
- (j) Names of individuals observing tests,

- (k) Statement verifying each test,
- (l) Nameplate data from respective equipment tested,
- (m) Test results, and
- (n) Retest results after correction of defective components or systems (where applicable).

Marking and Labeling. Legend plates shall be provided for all equipment. Legend plates shall be provided to identify the equipment controlled, the power source, and the function of each device. Each individual circuit breaker, control panel, safety switch, shall be furnished with a phenolic engraved legend plate that identifies the respective device, the power source, and the respective voltage, phase, and wire. Furnish additional phenolic engraved legend plates as detailed on the Plans and/or where required by code. Legend plates shall be weatherproof and abrasion resistant phenolic/plastic engraved material and fastened with contact type permanent adhesive, screws, or rivets. Installation shall not break, crack, or deform the legend plate. Lettering shall be 1/4 in. high or larger. Equipment that is powered from a utility power source shall have black lettering on a white background.

Furnish and install weatherproof warning label for control panels to warn persons of potential electric arc flash hazards, per the requirements of NEC 110.16 "Flash Protection." Labels shall also conform to ANSI Z535.4-2002 "American National Standard for Product Safety Signs and Labels." NEC 110.16 requires that switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential arc flash hazards. The markings shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. The warning labels are to indicate to a qualified worker who intends to open the equipment for analysis of work that a serious hazard exists and that the worker should follow appropriate work practices and wear appropriate personal protective equipment (PPE) for the specified hazard. Labels shall be as detailed on the Plans or shall include at least the following information: Warning – Potential Arc-Flash Hazards existing while working on this energized equipment. Appropriate PPE Required."

Measurement and Payment. The quantity of ELECTRICAL WORK BRIDGE OFFICE to be paid for under this item shall consist of all labor, equipment, materials, associated supports, hardware, concrete work, tools, operational instructions, utility service work, coordination, and testing required to complete the installation of the system and to place it into proper working order. The system shall be furnished by the manufacturer's representative and installed by the Electrical Contractor. The furnishing of the control panels and manufacturer representative's services shall not be included with this item and shall be paid for as incidental to the "grit removal system." The installation of the grit removal system and all associated electrical work and coordination shall be included with this item.

Basis of Payment. This work will be paid for at the contract lump sum price for ELECTRICAL WORK BRIDGE OFFICE, which price shall be payment in full for labor, equipment and material to complete the work as specified herein.

DIESEL ENGINE GENERATOR

Description. This work shall consist of providing, installing, and testing a diesel engine generator for the Joliet Bridge Office Building according to the contract plans and approved shop drawings. This work shall be according to the applicable articles of Sections 500, 600, 800, 1000 and the following:

General. The diesel engine generator shall meet the following requirements:

- (a) Fuel shall be No. 2 diesel, and engine emissions shall be certified compliant with EPA requirements for stationary diesel generator sets in effect at the engine build date.
- (b) The diesel generator set shall be housed in a Level 3 sound-attenuated and weather protective powder coated steel enclosure with stainless steel hardware. The generator set shall also include a dual wall sub-base fuel tank sized for 24 hour capacity at 25 percent load. Fuel tank shall include primary tank leak detection, low level fuel switch, and direct reading fuel level gauge. The cooling system shall include an integrally mounted radiator system. All inlets and outlets shall be provided with rodent barriers. Enclosure shall be equipped with exterior oil and coolant drains with interior valves for ease of service. The exhaust system shall be furnished with a residential grade silencer.
- (c) The diesel generator shall be equipped with a heavy duty 12 volt DC negative ground battery(s) for engine starting, 100 amp battery charging alternator, and 120VAC battery trickle charger. Thermostatically controlled single phase heaters shall be provided for the coolant system (208/240V) and alternator (120V). Alternator shall have class H insulation, and temperature rise shall be 125 degrees C (standby).
- (d) A generator main circuit breaker shall be furnished, having minimum ratings as shown on the Plans, and shall be U.L. 489 listed for 100% continuous operation and U.L. 869A for use as service equipment.
- (e) The generator control system shall provide total system integration, including automatic remote starting / stopping, precise frequency and voltage regulation, alarm and status message display, current protection, output metering, provisions for remote annunciator panel, and auto-shutdown at fault detection. Local control shall provide for starting and running the generators without transferring the load.

- (f) Provide and install a remote annunciator panel for the generator at location as shown on the Plans. Display shall provide generator operating and status indicators including the following:
 - (1) Common Alarm.
 - (2) Generator Running.
 - (3) Low Oil Pressure.
 - (4) High Coolant Temperature.
 - (5) Low Fuel.
 - (6) Low Battery Voltage.
 - (7) Battery Charger Malfunction.
- (g) The Contractor shall provide all fuel required for the diesel generator set up through and including testing, and shall fill the fuel tank of the new generator to full capacity after all testing and construction is completed and accepted by the Engineer.

Concrete Pad.

- (a) The Contractor shall be responsible for removing and properly disposing of existing concrete and materials required for installation of the new concrete pad.
- (b) The Contractor shall be responsible for investigating and locating any existing facilities.
- (c) Galvanized steel anchor bolts of the size and dimensions and at the locations required by the generator manufacturer shall be placed in the formwork prior to pouring the concrete.
- (d) Install grounding electrodes and conductors as shown on the Plans. Grounding electrodes and conductors shall be according to Section 1087.01. Provide and install grounding conductors as shown on the Plans to bond all chain link fence panels and gates surrounding the generator.
- (e) Power and control wiring conduits for the generator and lighting shall be stubbed up through the concrete pad to coordinate with the entry locations in the generator assembly. All raceways in the foundation shall be installed rigidly in place before concrete is deposited in the form. Bushings with grounding lugs shall be provided at the ends of metallic conduits.
- (f) All conduits for power, accessory power, and control wiring between the generator and bridge office building shall be trenched and concrete encased according to Section 810. Encased conduits shall be schedule 40 PVC.
- (g) Concrete shall be Class SI complying with Section 1020 of the Standard Specifications. Reinforcing steel shall be according to Section 1006. Subbase granular material, Type B, shall be in accordance with Section 1004.04.

Chain Link Fence.

- (a) Modify existing fence as shown on the Plans. The Contractor shall be responsible for removing and properly disposing of indicated existing fencing materials.
- (b) Materials and construction shall be according to the applicable articles of Section 664.
- (c) Gate latching hardware shall have padlock provisions. Provide two weather resistant padlocks and ten keys. Padlocks shall be keyed alike for No. 399 keys.
- (d) New and existing fencing surrounding the generator shall be bonded to the generator grounding system. Utilize cast bronze body mechanical clamps with bronze or stainless steel bolts and washers for connections to grounding conductors.

Generator Accessories.

- (a) Provide circuits as shown on the Plans for generator accessories including coolant heater, alternator heater, battery charger, utility receptacles, and lighting.
- (b) Inside the generator enclosure, provide and install two duplex receptacles in corrosion-resistant cast aluminum boxes. Utility receptacles shall be UL listed, 120V, 20 A, ground fault interrupting, premium specification grade, and shall be furnished with gasketed die-cast aluminum weatherproof covers suitable for in-use. One receptacle shall be installed on either side of the generator. Coordinate locations and mounting with the generator manufacturer.
- (c) Provide and install a dusk-to-dawn type area luminaire at the location shown on the Plans. Luminaire shall be UL listed, suitable for use in wet locations, and rated for 120VAC with high efficiency LED lamp, minimum 48W/4800 lumens, cast aluminum housing, curved mounting arm, -40 to +40 degrees Celsius ambient rated, and twist-lock long-life rated photocell control. Utilize two heavy-duty stainless steel U-bolts with stainless steel nuts, and lock washers to secure mounting arm to fence post.
- (d) All conduits installed below grade and not concrete encased shall be PVC coated rigid steel. Galvanized rigid steel conduit is permitted for above grade installation.

Coordination. Coordinate diesel engine generator with the following:

- (a) Diesel engine generator control system shall be compatible with the automatic transfer switch control system.
- (b) Diesel engine generator shall be coordinated with Joliet Bridge Office Building electric service installation work.

Spare Parts. Provide the following spare parts:

- (a) Three complete sets of all filters required by generator.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted.

- (a) Product data for new equipment including generator and all associated accessories.
- (b) Electrical drawings for new equipment.
- (c) Shop drawings detailing concrete pad, fencing, and installation details.
- (d) Conduit schedule, routing, trenching, and wall penetration details for electrical connections to building.

Installation.

- (a) Installation shall be in compliance with NFPA Standard 37, Combustion Engines, and any other local codes that may apply. Inspection and permits for use after the installation may be required by the local fire district regulating authority.
- (b) The installation of the diesel generator system shall be overseen by the diesel generator manufacturer's field service technician. Any and all adjustments necessary for a reliable and trouble free system shall be made by the service technician. The Contractor is responsible for any associated costs for the service technician.
- (c) Monitor primary leak detector during and after introduction of fuel to the empty tank. Means for tank grounding and anchoring to the concrete pad shall be provided. All fuel tanks shall be labeled by product, capacity, and manufacturer.
- (d) Vibration isolators shall be provided and installed as recommended by the manufacturer.

Training. The manufacturer's field service technician shall provide routine maintenance procedure, operation, and troubleshooting training to the Department's maintenance personnel.

On Site Testing.

- (a) When the entire installation of the Joliet Bridge Office Building electrical system is complete, the Contractor shall perform operational tests of the diesel generator and the automatic transfer switch as a complete electrical service system to demonstrate that all of the electrical service equipment functions properly.
- (b) The Contractor shall engage the manufacturer's field service technician or engineer to perform the testing of the diesel generator.
- (c) Prior to energizing, the generator shall be inspected for any unintentional grounding, phase reversal, and short circuits.
- (d) The Contractor shall furnish all materials, equipment, fuel, and labor to conduct testing.

Basis of Payment. This work will be paid for at the contract unit price per each for DIESEL ENGINE GENERATOR.

AUTOMATIC TRANSFER SWITCH

Description. This work shall consist of providing, installing, and testing an automatic transfer switch for the Joliet Bridge Office Building according to the contract plans and approved shop drawings. This work shall be according to the applicable articles of Section 800 and the following.

General. The automatic transfer switch shall meet the following requirements:

- (a) The transfer switch shall be listed under U.L. 1008 and shall be rated for 600VAC, 60Hz, and 400A. The transfer switch shall be housed in a NEMA 12 steel enclosure.
- (b) The transfer switch shall be 3-pole type with silver alloy contacts. The mechanism shall be electrically operated and mechanically held in position. Normal and generator contacts shall be positively interlocked electrically and mechanically to prevent simultaneous closing.
- (c) The transfer switch shall have a microprocessor based controller with a digital display for monitoring power conditions and adjusting transfer switch parameters. Memory and settings shall be retained if power to the controller is lost. Features shall include programmable engine start delay timer, engine stop delay timer, transfer delay timers, transition timer, and generator set exerciser. Shall include indicator LED lamps for source availability, source connected, and exercise/test mode. The controller shall use over/under voltage and frequency sensing with adjustable dropout time delays.
- (d) The transfer switch shall be from the same manufacturer as the diesel engine generator and shall be compatible with the diesel engine generator control system.

- (e) A main circuit breaker disconnect switch shall be furnished for the incoming utility service, having minimum ratings as shown on the Plans, and shall be U.L. 489 listed for 100% continuous operation and U.L. 869A for use as service equipment. The main circuit breaker shall be integral to the automatic transfer switch cabinet or optionally supplied as a separate unit in a NEMA 12 rated steel enclosure.
- (f) The transfer switch shall have a maintenance bypass/isolation switch that permits manual selection and connection of either source of power directly to load. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.

Coordination. Coordinate automatic transfer switch with the following:

- (a) Diesel engine generator electrical requirements and installation.
- (b) Automatic transfer switch shall be coordinated with Joliet Bridge Office Building electric service installation work.

Spare Parts. Provide the following spare parts:

- (a) Six fuses of each type used.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted.

- (a) Product data for the automatic transfer switch and all associated accessories.
- (b) Electrical drawings.

Installation. Installation shall be in compliance with the NEC, local utility requirements, and any other local codes that may apply.

Training. The manufacturer's field service technician shall provide routine maintenance procedure, operation, and troubleshooting training to the Department's maintenance personnel.

On Site Testing. When the entire installation of the Joliet Bridge Office Building electrical system is complete, the Contractor shall perform operational tests of the diesel generator and the automatic transfer switch as a complete electrical service system to demonstrate that all of the electrical service equipment functions properly.

Basis of Payment. This work will be paid for at the contract unit price per each for AUTOMATIC TRANSFER SWITCH.

BRIDGE ELECTRICAL INSTALLATION

Description. This work shall consist of furnishing, installing, and placing in satisfactory operating condition the complete electrical equipment for operation of the bascule spans and its auxiliaries, as indicated on the Plans, called for in these Special Provisions, or as may be required for a complete bridge electrical work. This work shall be according to the applicable articles of Section 800 and the following.

The work shall include, but not be limited to the following tasks:

- (a) Electrical demolition including removal of existing drives, bridge control system, control console, CCTV cameras and equipment, and associated raceways and conductors not intended for reuse.
- (b) Provide and install surge protective devices, power monitors, bus monitors, and related accessories.
- (c) Modify existing automatic transfer switches, panelboards, power panels, and motor control centers where shown on the Plans.
- (d) Replace existing panelboards and transformers where shown on the Plans.
- (e) Install integrated bridge control systems panels including main panels, remote I/O panels, and control consoles.
- (f) Install integrated bridge control system devices including boat detection sensors, motor speed switches, rotary cam limit switches and resolvers, lever arm limit switches, magnetic proximity switches, inclinometers, bridge warning devices, and linear actuators.
- (g) Install vector-controlled motor drives, encoders, and braking resistors.
- (h) Install DC drives.
- (i) Electrically disconnect main motors for refurbishment, and reconnect refurbished motors.
- (j) Provide and install motor disconnect switches.
- (k) Modify existing river signal lights where shown on the Plans.
- (l) Assist Systems Integrator with installation of SCADA/CCTV system racks and associated equipment.
- (m) Install CCTV cameras, cabinets, monitors, and associated equipment.
- (n) Install public address speakers, call stations, microphones, and associated equipment.

- (o) Provide, install, terminate, and test communications cables, Ethernet cables, and fiber optic cables utilized for local bridge CCTV, public address system, and control networks. Coordinate work with installation of Fiber Optic Interconnect Cabinets.
- (p) Provide and install conduits, raceways, junction boxes, pull boxes, wiring, support hardware, and all related items to connect all bridge power and control circuits as shown on the Plans.
- (q) Make repairs to existing raceways and wiring as shown on the Plans.
- (r) Add cables to existing aerial cable systems where shown on the Plans.
- (s) Provide and install new aerial cable systems where shown on the Plans.
- (t) Provide and install bridge fire alarm and intrusion detection equipment.
- (u) Make repairs and upgrades to the existing traffic gates.
- (v) Provide all necessary field testing to demonstrate that the entire electrical system is in proper working order and in accordance with the Plans and Specifications.
- (w) Coordination of Marine Navigation and all required coordination with the United States Coast Guard.

General. The work shall meet the following requirements.

- (a) The following publications form a part of these Special Provisions by this reference, and shall have the same force and effect as if printed here within full. Unless otherwise noted, the version of referenced standards or publications is the version in effect at the bid opening time for this contract.
 - (1) AASHTO LRFD Movable Highway Bridge Design Specifications.
 - (2) NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting.
 - (3) NETA Acceptance Testing Specifications.
 - (4) NFPA 70 – National Electrical Code.
 - (5) NFPA 70E – Electrical Safety Requirements for Employee Workspaces.
 - (6) All applicable state and local codes.
- (b) Additionally, all work shall comply with all additional requirements of the Authorities Having Jurisdiction. It shall be the responsibility of the Contractor to contact the proper Authorities prior to beginning work in order to determine all requirements, as well as to maintain relevant communications with such Authorities throughout construction.
- (c) The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

- (d) Contractor shall investigate spaces through which equipment must be moved. Arrange to have equipment shipped from manufacturer in crated sections of size suitable for moving through restricted available spaces.
- (e) The Contractor is alerted to the fact that a large portion of the work will need to take place when spans are blocked in the raised (open) position with temporary support systems. During such periods of time, working conditions on the spans will be difficult due to the angled position of the spans when the bridges are raised. For the Jackson, Cass, Jefferson, and McDonough bridges, the bridge machinery also moves with the span. The Contractor shall be responsible for providing any additional equipment, labor, and safety measures required to safely work during these periods of time.
- (f) The Contractor shall be responsible for the alignment and fastening of electrical equipment to be incorporated into the bridge machinery, such as motor encoders, motor speed switches, rotary cam limit switches and resolvers, limit switches, proximity switches, inclinometers, and similar devices.
- (g) Any incidental apparatus, appliance, material, or labor not herein specifically mentioned or included that may be found necessary to comply with the requirements of the related documents and referenced standards or codes shall be furnished by the Contractor just as if specifically mentioned in these Specifications and without extra cost.
- (h) The Contractor shall be responsible for verifying and obtaining all field measurements as required for the proper dimension, details, and fabrication of enclosures, brackets, and adaptors to fit existing conditions.
- (i) The Contractor is alerted to the fact that space in existing electrical rooms and bridge machinery areas may be limited. Custom enclosure sizes and other creative solutions may be required to install new enclosures while providing working clearances as required by the NEC.
- (j) The Contractor shall exercise care in the removal of existing components. The Contractor shall give the Department the option of salvaging all components that are not intended to be reused.
- (k) The Contractor shall be responsible for coordinating any temporary power interruptions required to safely perform the work with the electric utility company and with the Department.
- (l) The Contractor shall bear full responsibility for all coordination of features, ratings, etc. of products as may be required to provide complete, operational, reliable, and safe system(s) and sub-system(s) in accordance with the requirements and intent of these contract documents.
- (m) The Contractor shall bear full responsibility for all coordination necessary to perform all work, including, but not be limited to, coordination with and/or between suppliers, vendors, sub-contractors, trades, the Department, and the U.S. Coast Guard.

Qualifications.

- (a) The Contractor shall be properly licensed by the State of Illinois, and shall be primarily and regularly engaged in the installation and service of industrial and commercial electrical power distribution and control systems.
- (b) The Contractor shall have been in the business of installing and servicing industrial electrical power distribution and control systems for at least ten continuous years as of the bid date.
- (c) The Contractor shall employ on site supervisory personnel who are licensed electricians experienced in the installation and maintenance of industrial electrical power distribution and control systems.
- (d) All electrical work shall be performed by persons properly trained and qualified in the installation and maintenance of such systems.
- (e) Documentation demonstrating that the Contractor meets these requirements shall be submitted with the bid documents.

Materials.

- (a) All items shall be handled, applied or installed in strict accordance with manufacturer's recommendations and instructions and with these Special Provisions.
- (b) All products shall be properly protected until installation, including during shipment and storage.
- (c) All conductors shall be copper. Aluminum conductors shall not be used.
- (d) Wire in conduit used on power and control circuits shall have type XHHW-2 insulation, rated 600 volts minimum.
- (e) All wiring and conductors used for the aerial cable shall be high strand count, highly flexible, pre-assembled cables. Cables shall be UL type TC, or approved equivalent. All conductors shall be tinned copper with ASTM B172 and/or B174, Class K stranding. Cables shall have weather and sunlight resistant jackets, suitable for use in exposed locations and for operation from -67 degrees Fahrenheit to +194 degrees Fahrenheit.
- (f) All cables and wiring installed in exposed locations shall be furnished with a UV stabilized jacket, sunlight and weather- resistant.

- (g) Instrumentation cable shall be UL listed with sunlight and oil resistant outer jacket and contain individually shielded conductor pairs, cable rated at 600 volts. Instrumentation cable shall be listed as type TC or MC, and suitable for use in wet locations. Conductor configuration shall be as required for equipment served, minimum 16 AWG. Cable used for encoders shall be low capacitance type. The Control Systems Vendor shall verify that the selected cable meets the electrical requirements of the connected instrumentation and control equipment.
- (h) Flexible multi-conductor cables shall be highly flexible, pre-assembled cable, equivalent to UL type SOOW cable. All conductors shall be tinned copper with ASTM B174, Class K stranding with EPDM insulation. Cables shall be weather and sunlight resistant, suitable for use in exposed locations and for operation from -50 degrees Celsius to +105 degrees Celsius. Cable assembly shall be rated for 600V.
- (i) Strain relief grips shall be UL listed with insulated, stainless steel, liquid tight fitting and stainless steel mesh.
- (j) Grounding straps shall be flat heavy-duty type braided tinned copper, designed and rated for flexing applications, minimum equivalent wire size of #2.
- (k) Variable Frequency Drive Cable (VFD cable) shall be used for motor feeder cables from all variable frequency drives to their respective motors. VFD cable shall be used in conduits and in the aerial cables. Each VFD cable shall consist of three stranded copper motor feeder conductors with 2,000-volt XHHW-2 insulation, three stranded bare copper symmetrical grounds, overall foil shield plus 85% copper braid shield, 90 deg C. wet/dry.
- (l) Ethernet cable shall be 4 twisted pair, unshielded (UTP), 22 AWG to 24 AWG copper, ANSI/TIA/EIA-568-B.2-1 Category 6, UL verified to Category 6. The outer jacket material shall be outdoor rated, UV resistant (PVC-UV, UV Stabilized), and shall be rated for outdoor (above-ground) or conduit duct applications. Jacket shall be rated for 600V. Terminations shall be crimp-on RJ-45 type or other termination type as required by connected equipment.
- (m) Fiber optic cable utilized for connections between primary SCADA and CCTV Ethernet switches and the Fiber Optic Interconnect Cabinets shall be according to Section Fiber Optic Cable, Single Mode. With approval by the Engineer, pre-terminated and tested cable assemblies may optionally be used for these connections. Fiber optic cable utilized for these connections will not be measured or paid for separately, but shall be included in the cost of this item.
- (n) All fiber optic cable related work and connector selection shall be coordinated with the Systems Integrator and Control Systems Vendor and with the requirements of all connected equipment.

- (o) Fiber optic cable utilized for local bridge SCADA, PLC control, CCTV, and public address system networks shall be according to Section Fiber Optic Cable, Single Mode. With approval by the Engineer, multi mode type fiber optic cable according to Section Fiber Optic Cable, Multi Mode may optionally be used. Fiber optic cable utilized for these networks and connections will not be measured or paid for separately, but shall be included be in the cost of this item.
- (p) Cable for public address system speakers shall be rated for use with audio and intercom systems, 18 AWG stranded copper, shielded twisted pairs, plenum rated, with minimum 300V assembly rating.
- (q) Flexible cables to movable span (Jackson Street, Cass Street, Jefferson Street, and McDonough Street bridges) shall be protected by custom flexible raceway. Flexible raceway shall use general purpose water suction and discharge type hose constructed of black Versigard synthetic rubber, reinforced with spiral plied synthetic fabric with wire helix, and rated for temperatures between -40°C and 82°C. Flexible cable hose shall be Plicord con-ag water S&D by Goodyear, or approved equivalent. Fittings and hardware shall be constructed of heavy duty corrosion resistant galvanized steel or stainless steel.
- (r) Conductors for use in flexible cables to movable span shall be rated for use in wet locations, continuous flex at -25°C to 90°C, and as additionally specified herein.
- (s) Fittings, U-bolts, conduit clamps, and mounting hardware for PVC coated conduit shall have similar PVC coated construction, shall be compatible with the PVC coated conduit, and shall be provided by the same manufacturer as the conduit. Other hardware shall be constructed of stainless steel.
- (t) Junction boxes, pull boxes, and terminal cabinets shall be sized as required by the NEC, or as appropriate for the conductors and/or equipment served.
- (u) Fixed and Movable Span terminal cabinets shall be NEMA 4X stainless steel construction with inner back plate for installing terminal blocks. Cabinets shall meet all other applicable requirements of the Terminal Cabinets in section AERIAL CABLES.

Identification.

- (a) Conductor identification numbers shall be coordinated for consistency and accuracy with conductor numbers on the Contractor's approved wiring diagrams and shop drawings, field wiring diagrams, and any other diagrams containing the same respective conductor. Each conductor shall be assigned only one unique conductor number throughout the entire electrical or control system.
- (b) Conductor and cable labels shall be waterproof, non-smearing, and self-adhesive with machine-printed permanent lettering protected by a clear cover.

- (c) Conductors and cables shall be permanently and clearly tagged in accordance with the same numbers or designations appearing on the approved wiring diagrams at every terminal or connection, splice, and tap.
- (d) Each terminal of all terminal blocks shall be permanently marked with machine printed labels to show the same number or designation as appears on the wire connected thereto.
- (e) The Contractor shall number and tag spare conductors as such, and spare conductors shall be shown on all shop and record drawings.
- (f) All network cables, fiber optic cables, and individual fiber strands when broken out from a cable assembly shall be uniquely labeled in accordance with the Contractor's approved drawings.
- (g) All electrical equipment shall be clearly labeled as to function by engraved black on white plastic nameplates with minimum 1/4 inch high letters, permanently attached with stainless steel machine screws. Equipment names shall be coordinated with the Contractor's approved shop drawings.
- (h) Each new or modified MCC unit door shall have an engraved plastic nameplate corresponding to the connected device.
- (i) Provide legend plates to identify new panelboards as well as voltage, phase, number of wires, and incoming power source.
- (j) For motor disconnect switches, provide and install engraved plastic nameplate to identify corresponding motor or brake and the voltage present.
- (k) Provide and install all code-required cautionary signs and labels for new or modified equipment.

Surge Protective Device (SPD), Power Monitor, and Bus Monitor.

- (a) Providing and install a surge protective device (SPD), power monitor, and bus monitor for an existing bridge electrical service.
- (b) The Contractor shall be responsible for verifying existing service ratings and obtaining all field measurements as required for the proper dimension, details, and fabrication of enclosures to fit existing conditions.

- (c) Provide type 1 SPD rated for bridge electrical service voltage and configuration. Other requirements are as follows:
- (1) UL 1449 Third Edition Listed (Sept 2009).
 - (2) UL 96A lightning protection master label compliant.
 - (3) NEMA 4X enclosure.
 - (4) Internal over-current protection.
 - (5) Operating temperature range - 40°C to +60°C.
 - (6) 200kA per phase maximum discharge current.
 - (7) 20kA nominal discharge current.
 - (8) Form C dry alarm/service contact, rated for 120VAC.
 - (9) Normal status and alarm LED indicators.
 - (10) Voltage rating of 120V to 600V.
- (d) Power Monitor shall be a micro processor based power quality and energy metering unit to monitor the voltage and current of the bridge electrical service. Power Monitor shall be rated for bridge electrical service voltage, current, phase, and distribution system type. Other requirements are as follows:
- (1) UL listed.
 - (2) True RMS measurement.
 - (3) Accuracy of +/- 0.1% or better for volts and amps.
 - (4) ±0.05 Hz frequency accuracy at 60Hz.
 - (5) -20...70 °C (4...158 °F) operating temperature.
 - (6) Relative humidity operating range of 5...95% non-condensing.
 - (7) 120VAC Power.
 - (8) Ethernet communications.
 - (9) Data and driver compatible with bridge control PLC.
 - (10) Local display unit to provide voltage, current, and power readings.
 - (11) Provide all necessary drivers and programming/configuration software.
- (e) Bus Monitor shall be a true RMS, three phase, phase-sequence, and voltage band monitoring relay. Other requirements are as follows:
- (1) UL listed.
 - (2) Adjustable time delay.
 - (3) Automatic reset.
 - (4) Visual fault indication lights for under voltage, over voltage, and phase sequence.
 - (5) DPDT contacts, rated for 120VAC.
- (f) Provide and install appropriately sized NEMA 12 enclosure(s), current transformers, circuit protection, and other accessories required for complete installation.

Modification to Existing Automatic Transfer Switch.

- (a) Install required components to provide dry contact interface for PLC monitoring of the existing automatic transfer switch.
- (b) Existing automatic transfer switches were manufactured by Onan/Cummins. Model numbers are as follows (Contractor shall field verify):
 - (1) Ruby Street Bridge – OTC-3380274
 - (2) Jackson Street Bridge – OTC-3380274
 - (3) Cass Street Bridge – OTC-3380275
 - (4) Jefferson Street Bridge – OTC-3380274
 - (5) McDonough Street Bridge – OTC-3380274
 - (6) Brandon Road Bridge – (was OTC-3380274, replaced in 2014 with new Cummins unit with PowerCommand controller)
- (c) Provide normally open type contacts to indicate the following conditions:
 - (1) Utility Power Source Selected.
 - (2) Utility Power Source Healthy.
 - (3) Generator Power Source Selected.
 - (4) Generator Power Source Healthy.
- (d) Interface contacts shall be rated for 120VAC.

Modification to Existing Motor Control Center.

- (a) Perform modifications to existing motor control centers (Jackson Street, Cass Street, Jefferson Street, McDonough Street) as shown on the Plans.
- (b) Existing motor control centers are manufactured by Square D, model 4 series. This series of motor control centers is no longer in production. Remanufactured components are available from various suppliers.
- (c) The Contractor shall field verify existing components to be replaced or modified.
- (d) New individual components including circuit breakers, fuse holders, fuses, terminal blocks, and disconnect switches shall be UL listed. Circuit breakers shall be molded case type with a UL-listed interrupting rating of not less than 35,000 rms symmetrical amps at 480V.
- (e) Coordinate work with the electrical requirements of new transformers and vector-controlled drives to be installed.

Modification to Existing Panelboard.

- (a) Provide new breakers and relocate circuits in existing panelboards (Ruby Street, McDonough Street, and Brandon Road) as shown on the Plans.
- (b) Prior to beginning work, the Contractor shall investigate and identify all existing circuits.
- (c) Provide new breakers from the same manufacturer of and compatible with existing panelboards. New breaker ratings shall be equivalent to or shall exceed ratings of existing breakers.
- (d) Provide updated circuit legends and blank covers for unused spaces.

Panelboard.

- (a) Panelboards rated 240 VAC or less shall have short-circuit ratings as shown on the Plans, or as herein scheduled, but not less than an integrated equipment rating of 10,000 amps RMS symmetrical. All units shall bear UL label.
- (b) Panelboard shall be provided with bolt-on circuit breakers of size and rating as detailed in the panel schedule on the Plans. Breakers shall be 1, 2 or 3-pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON," "OFF," and "TRIPPED" positions. Circuit breakers shall be UL listed in accordance with UL Standard 489.
- (c) Provide surface trim kit appropriate for enclosure. The box front shall include a door and have a flush, cylinder, tumbler-type lock and catch and spring-loaded stainless steel door pull. The door shall have completely concealed hinges when closed and shall not be removable when locked. A circuit directory frame and card with a clear plastic cover shall be provided on the door interior.
- (d) Provide appropriately sized NEMA 4X stainless steel enclosures for panelboards in machinery areas as shown on the Plans.
- (e) Panelboard interiors shall be completely factory assembled with protective devices, wire connections, buses, etc.
- (f) Main, neutral, and ground lugs shall be mechanical type suitable for copper conductors.
- (g) Phase, neutral, and ground buses shall be constructed of hard-drawn copper, 98 percent conductivity.
- (h) Provide filler plates for unused spaces in panelboards.
- (i) Create and provide a typewritten or computer generated circuit directory to indicate installed circuit loads.

Transformer.

- (a) Energy efficient dry type transformers for panelboards, of size and ratings as shown on the Plans.
- (b) Other requirements are as follows:
 - (1) UL listed.
 - (2) 220°C UL component recognized insulation system.
 - (3) 150°C temperature rise above 40°C ambient.
 - (4) 90°C maximum enclosure temperature.
 - (5) Minimum of (4) 2.5% full capacity primary taps.
 - (6) Suitable for floor, wall, or "trapeze" mounting.
 - (7) NEMA 3R rated enclosures for outdoor installations.

Disconnect Switch.

- (a) Disconnect switches shall be UL listed, heavy duty, non-fused, 600-volt, NEMA 4X rated, stainless steel type.
- (b) Switch operating mechanism shall be quick-make, quick-break and horsepower rated for the load served.
- (c) The handle shall have provisions for padlocking the switch in the off position. The handle shall have a mechanical interlock to prevent the door from opening when the switch is in closed position.
- (d) Disconnect switches shall meet NEC 430 requirements for separate disconnecting means within sight of motor loads.
- (e) For all disconnect switches utilized with vector-controlled motor drives, provide auxiliary contact kits with one NO/NC (Form "C") auxiliary contact.
- (f) Disconnect switches utilized for DC drives shall be rated appropriately.
- (g) Coordinate layout and installation of switches and components with equipment served and adjacent surfaces. Maintain required workspace clearances.

Integrated Bridge Controls System.

- (a) Coordinate with the Control Systems Vendor as required for integrated bridge controls systems equipment and components.
- (b) Boat detection sensor mounting brackets shall be constructed to allow proper adjustment range and alignment of sensors. Brackets shall also be designed with a removable cover to provide physical protection of sensors from normal waterway traffic and from vandalism.
- (c) Motor speed switch mounting brackets shall be constructed to allow for proper belt tensioning.
- (d) Provide all necessary mounting brackets and adaptors for installing encoders on existing main drive motors.
- (e) Lever arm limit switch mounting brackets shall be constructed to allow adjustment of switches. Limit switch mounting and trip brackets shall be fabricated from a minimum of 1/8-inch mild steel. The brackets shall be cleaned, phosphatized, and painted with an epoxy coating that closely matches the color of the existing structure.
- (f) Magnetic proximity switch mounting brackets shall be constructed to allow field adjustment of sensing distance.
- (g) The Contractor shall be responsible for field verifying all part numbers and dimensions of installed linear actuators for span and tail locks (Brandon Road only).

LED Upgrade to Existing River Signals.

- (a) Upgrade existing river signals (Ruby Street, Jackson Street, Cass Street, Jefferson Street) as shown on the Plans.
- (b) Materials shall be according to Light Emitting Diode (LED) signal head in Sections 880 and 1078.01 of the Standard Specifications.
- (c) Provide tunnel type visors.
- (d) Housings, doors, and visors shall have dull (matte) black finish.
- (e) Signal head mounting bracket shall be of aluminum construction with enamel or polyester powder coat finish.
- (f) Braces, supports, straps, and hardware shall be stainless steel.

- (g) Flexible multi-conductor cables for connection to span shall be a minimum of 12AWG. Provide stainless steel liquid tight fittings and stainless steel wire mesh grips.
- (h) Provide and install new NEMA 4X stainless steel junction box for interface with existing wiring and conduit system.

Fire Alarm and Security System.

- (a) The Fire Alarm and Security system shall consist of a control panel, smoke detectors, intrusion detectors, heat detectors, and door switches provided at a minimum as indicated on the Plans. All Fire Alarm and Security system devices shall be wired to the fire alarm control panel to be located as shown on the Plans and shall be listed as compatible with the system.
- (b) The Fire Alarm and Security system control panel shall be addressable type, capable of integrating intrusion and fire detection into one system. Other requirements are as follows:
 - (1) UL listed.
 - (2) 120 VAC power.
 - (3) 8 zone minimum.
 - (4) Integral battery backup.
 - (5) Central station reporting by point or zone.
 - (6) Programmable via PC.
 - (7) Programmable for date setting for daylight savings time.
- (a) Smoke detectors shall be wired type commercial photoelectric. Other requirements are as follows:
 - (1) UL Listed.
 - (2) Form A/Form C dry relay contacts
 - (3) Mounting hardware adapts to standard junction boxes.
 - (4) Quick disconnect wiring harness.
 - (5) Listed for wall or ceiling mounting.
 - (6) Test switch.
- (c) Intrusion detectors shall be a combination of passive infrared and microwave technologies to avoid false activation. The sensor shall be ceiling mounted with 360° sensing coverage as needed for the specified space. Other requirements are as follows:
 - (1) UL listed.
 - (2) Form A/Form C dry relay contacts
 - (3) -40°F to 120°F operating temperature.

- (d) Heat detectors shall be rate-of-rise/fixed temperature type. Other requirements are as follows:
- (1) UL listed.
 - (2) Form A/Form C dry relay contacts
 - (3) Dual LED indicators.
- (e) Door switches shall be two piece, magnetically operated. Other requirements are as follows:
- (1) UL and CE approvals.
 - (2) Stainless steel housing, switch and magnetic actuator.
 - (3) IP67 rated.
 - (4) 0.4" operating distance.
 - (5) -10° to 55°C operating temperature.
 - (6) 1 N.C. safety contact

Repairs to Existing Traffic Gates.

- (a) Upgrade existing traffic gates (Ruby Street, Jackson Street, Cass Street, Jefferson Street, McDonough Street, Brandon Road) as shown on the Plans.
- (b) Replace existing limit switches with new micro lever arm type limit switches. Micro lever arm type limit switches shall be UL listed. Other requirements are as follows:
- (1) High shock and vibration resistant.
 - (2) Snap action contacts, 1 N.O. / 1 N.C.
 - (3) Lever arm length as required for reliable operation.
 - (4) Rated for 15 A at 250 V AC.
- (c) Field adjust limit switch mounting bracket to accommodate proper switch positioning for reliable operation.
- (d) Field adjust trip arm devices attached to gate arm shaft as necessary for reliable operation.
- (e) Replace terminal blocks. Provide and install new NEMA 4X stainless steel junction box for housing new terminal blocks. Terminal blocks shall be as described in INTEGRATED BRIDGE CONTROLS SYSTEM. Terminal box shall be sized as required for terminal count and per NEC requirements.
- (f) Provide and install new disconnect switch for traffic gate motor. Disconnect switch shall be UL listed, lockable, and rated for 600 VAC. Other requirements are as follows:
- (1) Type 4X non-metallic or stainless steel enclosure.
 - (2) Three phase, 5 HP rating at 480 VAC.

Replacement of Terminal Blocks.

- (a) Replace existing terminal blocks where shown on the Plans. Terminal blocks shall be as described in INTEGRATED BRIDGE CONTROLS SYSTEM, with the exception of the following:
 - (1) Minimally rated for 600V AC/DC

Coordination. Coordinate bridge electrical installation with all associated equipment and work as shown on the Plans and the following:

- (a) Coordination of Marine Navigation.
- (b) Temporary Support System.
- (c) Integrated Bridge Controls System.
- (d) Vector-controlled Motor Drive.
- (e) DC Drive System.
- (f) SCADA System
- (g) Systems Integration.
- (h) Ethernet Network.
- (i) Bridge Control CCTV System.
- (j) Public Address Systems.
- (k) Aerial Cables.
- (l) Fiber Optic Interconnect Cabinet.
- (m) Main Span Drive Motors

CONSTRUCTION REQUIREMENTS

Submittals. The Contract Plans and Special Provisions depict the general intent and requirements of this contract, but are not intended to be of sufficient detail to be used in lieu of shop drawings, layout drawings, and wiring diagrams generated by the Contractor. Additional detail development and coordination of components by the Contractor will be necessary to satisfy the requirements of the contract in general, and this Section in particular, and shall be provided at no additional cost.

The following shall be submitted:

- (a) Contractor qualifications.
- (b) Catalog cuts and product data for each type of equipment, raceway, cable, conductor, fiber optic cable and accessories, flexible cable to movable span, junction box, and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (c) Proposed schedules and installation procedures. Submit for approval prior to commencing work.
- (d) Proposed locations, wiring, panel layouts, and accessories for power monitoring and SPD equipment.
- (e) Proposed panelboard layout with component list and assembly ratings including short circuit rating, voltage, and continuous current.
- (f) Where applicable, provide shop drawings with revised panelboard and MCC layouts for existing equipment.
- (g) Electrical equipment and device mounting detail shop drawings.
- (h) Integrated Bridge Controls System equipment and device mounting details. Submit shop drawings for proposed locations and mounting brackets for equipment and devices. Additional requirements for individual devices are as follows:
 - (1) Boat Detection Sensor – Submit shop drawings for proposed sensor locations and mounting details. Include sensor elevation dimension in relation to river normal pool elevation.
 - (2) Motor Speed Switch - Submit shop drawings for proposed installation showing geometry of drive pulleys and drive belt.
 - (3) Rotary Cam Limit Switch - Submit shop drawings for proposed installation with existing/new brackets and dimensioned layout of assembled components.
- (i) LED upgrade to existing river signals shop drawings showing components and hardware.
- (j) Vector-Controlled Motor Drives equipment and device mounting details. Submit shop drawings for proposed locations and mounting brackets for equipment and devices. Additional requirements for individual devices are as follows:
 - (1) Encoders - Submit shop drawings for proposed mounting brackets and shaft extensions/adaptors for existing motors. Provide dimensioned layout of assembled components in relation to existing motors.

- (k) Layout and installation drawings shall be developed to show proposed locations, dimensions, clearances to floors, walls, ceilings, structural members, and other nearby objects and equipment. In some cases these drawings need not necessarily be to scale, but items must be shown in their proper relative positions and be dimensioned.
- (l) Three-line and elementary point-to-point wiring diagrams shall be submitted for approval prior to installation of conduit, cables, and wiring. All conductors and cables shall be identified on the diagrams by wire numbers that match the same respective conductors or connections shown on other component or equipment Shop Drawings. Wiring diagrams are not intended to be to scale, but shall show raceways, cabinets, and equipment enclosures, etc., and in their approximate geographic orientation to each other to the extent practical.
- (m) Conduit layout diagrams and tabulations showing each raceway utilized, with all wire numbers installed therein, in tabular or spreadsheet format. Provide similar diagrams showing cabling for networked equipment.
- (n) Product and installation information on Contractor's proposed method of wire labeling.
- (o) Nameplate lists for electrical equipment, including proposed text.
- (p) Whenever installing new overcurrent protective devices (i.e. circuit breakers) into existing branch or distribution equipment (i.e. panelboards) the new devices shall be of a frame size and type to maintain the existing AIC rating of the existing assembly. Where this information is not available perform short-circuit coordination calculations indicating the device is able to withstand the available AIC at the circuit equipment at a minimum. Submit these calculations with the device shop drawings for approval.
- (q) At the completion and acceptance of the project, the Contractor shall develop and submit as built drawings. Submit PDF format files and Microstation CAD files format on compact disc, five copies are required. Provide hard copies for Bridge Operation and Maintenance Manuals as required elsewhere in these Special Provisions.

Maintaining Existing Facilities.

- (a) The Contractor shall conduct his operations in such a manner as to maintain the existing bridge electrical equipment, systems, raceways, cables, and conductors to remain.
- (b) Contractor shall furnish and install any protective materials necessary to conform to the above requirements at no additional cost.
- (c) Prior to starting construction activities, verify and document the correct rotation direction for all three phase motors.
- (d) Any damage to existing facilities shall be repaired by the Contractor at no additional cost to the Department.

Connections to Existing Facilities. The Contractor shall make all connections required between the rehabilitated and new equipment and the existing circuits and apparatus to provide for proper operation of the span and its auxiliary equipment, in accordance with the requirements specified herein.

Cutting and Patching.

- (a) The contractor shall perform all necessary drilling, cutting, and patching required for installing his work. All cutting of concrete, structural steel, sidewalks, floor slabs, walls, and other portions shall be done by skilled personnel. All conduits and pipe sleeves shall be properly grouted in the mortar.
- (b) After completion of the work, the Contractor shall repair all damage caused by his installation or removal of items and shall finish the job in a workmanlike manner satisfactory to the Engineer. Holes in the walls, ceiling, or floor shall be patched and finished to match the existing surfaces. Painted surfaces shall be repainted after being repaired.
- (c) All patching shall be done in a manner consistent with the building material being patched.
- (d) No structural members shall be removed, cut, drilled, or otherwise modified without approval of the Engineer, and any such work shall be done in a manner as directed by the Engineer.

Installation.

- (a) Prior to doing any demolition work, the Contractor shall verify that all conductors and current carrying parts of equipment are not energized, and all power feeds have been properly locked and tagged out and/or disconnected at the source.
- (b) Prior to the removal of existing controls and drive systems, mark rotation direction of all three phase motors for bridge operations (main drive motors, brakes, locks, traffic gates, etc.).
- (c) The Contractor shall not weld to existing steel without prior approval of the Engineer.
- (d) Installers of PVC coated conduit shall be trained in the proper techniques for cutting, bending, threading, and repairing the PVC conduit. Plastic coated rigid metal conduit shall be installed using tools and methods which will not cause damage to the PVC coating. Any areas on the exterior of the conduit which have been damaged during installation shall be coated with an exterior patching compound as recommended by the conduit manufacturer.
- (e) Balance load among feeder conductors for each new and modified panelboard, and connect loads as necessary to obtain reasonable load balance on each phase.

- (f) All branch and feeder circuits requiring a neutral shall be supplied with a dedicated neutral conductor. Neutrals shall not be shared by two or more phase conductors except where all conductors are serving a single piece of equipment.
- (g) Control enclosures, drive enclosures, and electrical equipment shall be installed to provide working clearances as required by the NEC.
- (h) The Contractor shall have the necessary training, tools, and connectors to properly terminate Ethernet cable and to perform testing.
- (i) Installers of fiber optic cables shall be properly trained according to Fiber Optic Cable, Single Mode Section. This shall include knowledge of conduit installation, termination, splicing, and testing procedures. Fiber optic cable and/or pre-manufactured cabled systems installed in conduit shall follow manufacturer's guidelines to ensure that cables are not damaged during installation. The Contractor shall be responsible for replacing any fiber optic cables damaged during installation.
- (j) Fitting requirements for flexible cable hose attachment shall be per the manufacturer's recommendations.
- (k) Strain relief grips shall be provided and installed for flexible cables and conduits where shown on the Plans and where flexible cables and conduits are subject to movement.
- (l) The Contractor shall bear full responsibility for providing all temporary provisions as may be required to accomplish all work and to permit continued operation and use of existing equipment and facilities during prosecution of such work.
- (m) The Contractor shall keep the project premises, and adjoining premises, clean from excess material, debris, and rubbish caused by Contractor's operations at all times.
- (n) Automatic Transfer Switch Modifications - Provide wire labels and device labels for installed components to match manufacturer's drawings and to identify component function.
- (o) MCC modifications - MCC units shall only be removed and inserted when the MCC is not energized. All unused space shall be covered by hinged blank doors.
- (p) Lever Arm Limit Switch – Install and adjust such that they reliably trip at the points necessary for proper operation of the control system and as indicated on the Plans. The Contractor shall field fit limit switch mounting brackets and tripping devices.

- (q) Rotary Cam Limit Switch – Remove existing rotary cam limit switches. Clean existing mounting plates to remove corrosion, grease, and loose paint. Utilize stainless steel hardware for installing switches. For connection to screw-type terminals, wire ends shall be provided with compression-type, ring tongue wire connectors. Clean existing shaft ends to remove paint, grease, and corrosion. All shafts, keyways, and threaded connections shall be coated with a thin layer of anti-seize compound prior to assembly. Rotary limit switches shall be aligned to the precision and accuracy recommended by the coupling manufacturer.
- (r) Inclinator - Sensor mounting and cabling shall be performed to allow field adjustment of sensor angle position necessary to establish sensor zero.
- (s) Door Switch - Install targets on doors and switches on door frames. Install fasteners according to manufacturer's instructions and at locations necessary to allow for field adjustment of switches and targets. Install additional door stops as necessary to protect sensors and targets from damage.
- (t) Linear Actuator - Span Locks (Brandon Road Only) – Provide and install new clevis pins. Clean and inspect existing lock bars, guides, and sockets. Lubricate lock bars, guides, and sockets per Department's maintenance requirements. The Contractor shall notify the Engineer of the presence of any damage or excessive wear, and shall give the Engineer the option of inspecting the span locks after they have been cleaned.
- (u) Linear Actuator - Tail Locks (Brandon Road Only) - Provide and install new clevis pins. Clean and inspect existing rotating catch and bronze bearings. Lubricate per Department's maintenance requirements. The Contractor shall notify the Engineer of the presence of any damage or excessive wear, and shall give the Engineer the option of inspecting the tail locks after they have been cleaned
- (v) Encoders - Align to the precision and accuracy recommended by the encoder manufacturer. All shafts, keyways, and threaded connections shall be coated with a thin layer of anti-seize compound prior to assembly. The electrical connection to the encoder shall provide adequate slack to reach both encoder outputs for dual output type encoders.
- (w) LED Upgrade to Existing River Signals - Verify that modified lights and cable loops allow range of travel required to maintain lights at near horizontal position during full range of bridge motion.
- (x) Fire Alarm and Security System – The system and all its components, including control panel, smoke detectors, intrusion detectors, heat detectors, and door switches shall be installed in accordance with the manufacturer's recommendations and shall be installed and connected under the direction and supervision of a manufacturer's representative.
- (y) Underground Raceways – Installation of underground raceways shall comply with Section 810 of the Standard Specifications.

Field Testing.

- (a) The Contractor shall be responsible for performing all testing, inspections, and any resulting corrective work as may be necessary in order to ensure that all work is functioning properly, and as otherwise required elsewhere in these Special Provisions. All such testing, inspections, demonstrations, and any resulting remedial work, will be deemed a normal part of the contract work and will not be considered cause for delay or additional payment.
- (b) Voltmeters, ammeters, etc. shall be true RMS type. Where recording instruments are required, they shall be three phase, strip chart or computer based type. All tools and instruments shall be specifically designed for measuring the quantity in question and be maintained in properly calibrated condition.
- (c) Verify that all circuits are continuous and free of shorts, opens, or unintentional grounds, and all circuit conductors are properly terminated.
- (d) Check for proper tightening of mechanical lugs and terminals.
- (e) Verify correct operation and calibration of power monitoring equipment.
- (f) Prior to energizing any panelboard for the first time, verify that all bus connections are tightened to the torque levels recommended by the manufacturer and verify that the bus is free of short or unintentional grounds.
- (g) Supply voltages shall be measured and verified correct for the actual installed devices or equipment being served. Only after these preliminary checks may the circuit be energized.
- (h) Verify rotation direction and proper operation of all three phase motors including main drives, brakes, locks, and traffic gates.
- (i) Perform a complete I/O checkout of devices connected to the PLC control system with the Control Systems Vendor.
- (j) Test and verify operation of traffic signals, gate warning lights, navigation lights, and river signal lights.
- (k) Lever Arm Limit Switches – Field adjust lever arm and target for reliable operation as required.
- (l) Magnetic Proximity Switches - Test switches for reliable operation and field adjust sensing distance as required. The Contractor shall provide and install additional magnetic targets for switches that cannot be adjusted to operate reliably with the standard sensing range.

- (m) Rotary Cam Limit Switches - Verify proper alignment and range of motion of rotary cam limit switches under operating conditions.
- (n) Inclinometers - Mechanically adjust as required to set sensor zero.
- (o) Door Switches – Verify that sensors are adjusted properly for reliable operation. Ensure that doors operate properly with sensors installed.
- (p) Linear Actuators - Verify factory setting of stroke distance, and adjust as required. Adjust and test limit switches as required for correct operation.
- (q) Verify operation of all bridge warning devices.
- (r) Ethernet cables shall be tested for continuity, length, data integrity, attenuation, and crosstalk. Cables that fail testing shall be replaced or re-terminated (if applicable) at the Contractor's expense. The installation shall be certified for use with the equipment to be installed.
- (s) Single mode fiber optic cable shall be tested according to Section Fiber Optic Cable, Single Mode. Multi mode fiber optic cable shall be tested according to Section Fiber Optic Cable, Multi Mode.
- (t) Fire Alarm and Security System – Upon completion of installation, the manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system including all devices and sensors, and a written report to the contractor attesting to the proper operation of the completed system.

Warranty.

- (a) All product warranty certificates, and similar warranty information, shall be stored at a single location on the project site and be turned over to the Department prior to final acceptance of the bridge electrical installation.
- (b) Where registration is necessary as a condition of warranty coverage, warranties shall be registered to the Department.
- (c) Upon final acceptance of the completed bridge electrical installation by the Engineer, the Contractor shall warrant the satisfactory in-service operation of the completed bridge electrical installation, materials, products, and related components. This warranty shall extend for a minimum period of two-years following the date of final acceptance of the bridge electrical installation for all six bridges.

Basis of Payment. This work will be paid for at the contract unit price for each BRIDGE ELECTRICAL INSTALLATION.

TEMPORARY SUPPORT SYSTEM

Description. This item shall consist of the design and of furnishing all material, equipment, and labor to safely lock in place, at a raised position, the movable span leaves of the Ruby Street Bridge, Jackson Street Bridge, Cass Street Bridge, Jefferson Street Bridge, McDonough Street Bridge, and Brandon Road Bridge.

General. The work shall meet the following requirements:

- (a) Prior to taking a bridge out of service for electrical work, the bridge shall be raised to the open position and shall be locked into place using the machinery brakes and the approved temporary support system.
- (b) The temporary support system shall be designed to resist all wind loads as specified in the latest edition of the AASHTO Standard Specifications for Movable Bridges and any other superimposed construction loads.
- (c) The Contractor shall submit to the Engineer for approval design calculations for the bracing system prepared and signed by a Structural Engineer registered in Illinois.

CONSTRUCTION REQUIREMENTS

Submittals.

- (a) The Contractor shall submit detailed plans and computations for review and approval by the Engineer.
- (b) It is understood that the Engineer's concurrence with the shop drawings shall in no way relieve the Contractor of total responsibility for the safety of the design and the adequacy of the system to achieve satisfactory results.

Basis of Payment. This work will be paid for at the contract unit price per each for TEMPORARY SUPPORT SYSTEM.

BRIDGE OPERATION AND MAINTENANCE DURING CONSTRUCTION

Description. This work shall consist of all necessary labor and equipment to operate and maintain all bridge temporary and permanent systems, including associated traffic gates, traffic signals, navigational lights, general lighting, and other systems from the time construction is started on a bridge until such final acceptance of the overall project by the Engineer. Exception: operational control of a bridge shall be maintained by the Contractor from the time construction is started until the time of substantial completion at which time IDOT designated bridge operators will assume operation responsibilities. Substantial completion for each bridge shall be defined as the completion and acceptance of construction for the bridge, performing all required testing, and completing all operator and maintenance training.

The Contractor shall be responsible for properly maintaining all new work up to such final acceptance of the overall project by the Engineer and including the period of time of such warranties as described elsewhere herein. For individual bridges that are operational after new work has been completed, the Contractor's personnel shall coordinate and cooperate with IDOT maintenance to determine areas of maintenance responsibility, to transfer knowledge to IDOT maintenance personnel, and to ensure that bridges are kept fully operational.

Temporary, permanent, and new systems shall include closed circuit television cameras, monitors, generators and transfer switches, alarm panel and appurtenances, interconnecting cables, navigation lighting, highway lighting on the bridge, river traffic controls, conduit and wiring, circuit breakers, sump pumps, incoming electrical service feeder cable, centralized and local bridge control equipment and all appurtenances located on the various moveable bridges in the Illinois waterway in or near to Joliet, Illinois. Maintenance also includes the traffic signals and audible alerts for vehicular traffic on the moveable bridges which are powered from and controlled by the moveable bridge equipment.

General. The work shall meet the following requirements:

- (a) This item shall include all necessary operations and maintenance work to open the bridge for navigation in accordance with the US Coast Guard requirements, including any operational emergencies until work has been accepted and IDOT designated bridge operators assume operation responsibilities.
- (b) This item shall include only those openings required by regular marine traffic as requested by IDOT or as required by the US Coast Guard or other agencies having jurisdiction. Openings required for Contractor's construction work such as equipment movement of barge cranes will not be paid for under this item but will be considered incidental to that work and respective pay items. The Contractor shall contact the IDOT designated Bridge Operations Personnel to arrange for the Contractor's personnel to receive instructions and requirements on operating the existing movable bridges. Contact names and telephone numbers shall be provided by IDOT.

- (c) Prior to beginning construction work on a bridge, the Contractor shall coordinate with IDOT maintenance personnel to ensure that all the bridge's maintenance is up-to-date and to verify the operating condition of mechanical components and electrical components to remain. Any deficiencies identified shall be documented and reported to the Engineer.
- (d) IDOT Operations and Maintenance (O&M) personnel shall provide bridge openings using the existing bridge control equipment until the time that the bridge is closed to roadway and pedestrian traffic for construction activities or until the existing control equipment's function is impacted by the Contractor's work. The Contractor shall be responsible for coordinating with IDOT's personnel as required to ensure safe operations during construction.
- (e) During periods where a bridge has been closed to roadway and pedestrian traffic for construction activities, the bridge shall either be operated by the Contractor's bridge operators to accommodate marine navigation or the span shall be safely secured in the fully open position to permit unrestricted marine navigation. All Contractor required times and dates for restrictions to marine navigation shall be arranged with the USCG.
- (f) Prior to beginning construction work, the Contractor's bridge operation personnel shall work side-by-side with IDOT's O&M personnel to observe and to learn operating procedures, general maintenance procedures, and safety precautions required for each bridge.
- (g) The Contractor shall be responsible for providing any temporary means necessary to safely operate movable spans during construction and testing.
- (h) The Contractor shall be responsible for providing bridge operators to operate each rehabilitated bridge up until the time when the work for that bridge has been accepted. Adequate Contractor staffing levels shall be provided to support 24/7 bridge operations while the bridge is open to roadway traffic.
- (i) The Contractor shall also provide bridge operators for the duration of the US Coast Guard trial phase.
- (j) The Contractor shall begin training IDOT designated O&M personnel at the point where the rehabilitated bridge has been tested and is able to operate reliably in the local automatic PLC controlled mode.
- (k) When both local and centralized controls for an individual bridge have been fully tested and demonstrated to operate reliably, all related training is completed, and the work for that bridge has been accepted by the Engineer, the bridge operations shall be performed by IDOT's O&M personnel for that bridge.
- (l) US Coast Guard approved bridge navigation lighting shall be maintained by the Contractor during construction activities on each bridge.

- (m) The Contractor shall be responsible for maintaining all existing electrical system components to remain and newly installed equipment, systems, materials, and facilities. These responsibilities shall be active from the time the Contractor begins work on a particular bridge until work on all bridges has been completed and work for the overall project has been accepted by the Engineer and the Department.
- (n) The Contractor shall closely coordinate with IDOT's maintenance department to ensure maintenance responsibilities are properly executed, to provide IDOT maintenance personnel with the opportunity to observe and learn maintenance procedures required for new equipment and systems, and to ensure that all work is done safely. When a problem arises that prevents a bridge from operating correctly and/or causes a safety concern, the Contractor shall respond and troubleshoot to determine the malfunction. The Contractor shall be responsible for up to eight labor hours (for troubleshooting and repairs) for each malfunction. The Contractor shall notify the Engineer to get approval of additional labor hours (over eight) needed to complete the work for each bridge malfunction. Maintenance shall also include the removal and re-installation of new materials less than \$500 each in value to replace defective or non-functioning items (not including newly installed equipment under this contract) and the labor and equipment necessary for transportation, shipping, mailing, and handling charges. When the Contractor determines the new materials will cost over \$500 the Contractor shall automatically provide the Engineer a quote for the replacement materials and installation, but shall not proceed with the work unless approval is given by the Engineer.
- (o) IDOT maintenance shall be responsible for maintaining existing machinery and components to remain. The Contractor shall promptly notify IDOT maintenance of any problems with existing components damaged as part of the Contractor's work or otherwise identified during construction. The Contractor shall coordinate with IDOT maintenance for accessing the bridge to perform bridge lubrication and scheduled maintenance and inspections of existing machinery and components. IDOT will notify the Contractor 1 week prior to any scheduled maintenance and inspections. The Contractor shall coordinate with IDOT maintenance for proper lock out/tag out of any components or systems requiring shut down for maintenance. The Contractor shall notify IDOT of significant milestones to allow for bridge lubrication. Significant milestones for bridge lubrication shall be before the main motors are removed for refurbishment and approximately 1 to 2 days before testing. Lubrication of a bridge will not be required during the time that the bridge is out-of-service.
- (p) From the time of completion and acceptance of construction (on a particular bridge) until such final acceptance of the overall project by the Engineer, the Contractor shall perform a monthly inspection of the Bridge Control CCTV and associated equipment at all locations and list problems found, or no problems found on form XB3. The IDOT Moveable Bridge Office Engineer shall receive the original (hard) copy of the monthly inspection, and the Contractor shall transmit a copy to the Engineer in the monthly routine submittal book. The scheduled inspection date for each location (bridge) shall be listed on the Daily Agenda.
- (q) The Contractor's personnel shall be properly trained and shall follow all applicable safety regulations including the use of applicable personal protective equipment (PPE).

Coordination. Coordinate bridge operation and maintenance during construction with the following:

- (a) Coordination of Marine Navigation.
- (b) Coordination with Other Agencies.
- (c) Bridge Electrical Installation.
- (d) SCADA System.
- (e) Systems Integration.
- (f) Temporary Support System.

Basis of Payment. Payment will be made at the lump sum price for BRIDGE OPERATION AND MAINTENANCE DURING CONSTRUCTION.

INTEGRATED BRIDGE CONTROLS SYSTEM

Description. This work shall consist of providing, assembling, programming, and testing the bridge controls systems for the Ruby Street Bridge, Jackson Street Bridge, Cass Street Bridge, Jefferson Street Bridge, McDonough Street Bridge, and Brandon Road Bridge according to the contract plans and approved shop drawings. This work shall be according to the applicable articles of Section 800, these Special Provisions, and the following:

General. The bridge control system shall meet the following requirements:

- (a) The work shall be performed by a qualified Control Systems Vendor. The Control Systems Vendor shall have responsibility for the integrated functioning of all components necessary to provide a satisfactory assembled bridge control system operating in accordance with specified requirements. The Control Systems Vendor shall be responsible for providing safe and reliable control systems for each of the six movable bridges. The Control Systems Vendor shall also be responsible for the coordination necessary to integrate this work with other systems.
- (b) The Control Systems Vendor shall be responsible for the design, detailed schematics, and fabrication of the total control and power distribution system for each bridge to ensure compatibility of equipment and suitability for the intended system functionality.
- (c) It is not the intent of these specifications to minutely detail the construction of the desired system, but to clearly identify major system components, the system architecture, and to define the performance and functionality that the system shall provide. The Control Systems Vendor shall provide all equipment, accessories, and other materials required to produce the desired performance and functionality with the major components and the system architecture as defined, even if they are not specifically identified or implied in the Contract Documents.

The equipment furnished by the Control Systems Vendor shall include, but is not necessarily limited to the following:

- (1) Integrated Bridge Controls Systems.
 - (2) Laptop Computer / PLC programming software.
 - (3) Vector-controlled Motor Drive.
 - (4) DC Drives System.
- (d) Primary bridge control shall be PLC (programmable logic controller) based. The term PLC shall include controllers identified as "Programmable Automation Controllers."
- (e) PLC's shall be capable of being centrally operator controlled from the SCADA (supervisory control and data acquisition) system in the Joliet Bridge Office Building. (Centralized Automatic Control)
- (f) A local HMI (human machine interface) computer shall be provided to interface to the PLC and to provide local control of the bridge in the event of a failure of the communications network or the centralized SCADA system. (Local Automatic Control) Local HMI computers shall utilize the same software platform as the SCADA system, but shall operate completely independently from the centralized SCADA system.
- (g) A hardwired (relay based) control system shall be provided for local control of the bridge in the event that there is a failure of the PLC based portion of the bridge control system. (Local Manual Hard-Wired Control).

Qualifications.

- (a) The Control Systems Vendor shall be primarily and regularly engaged in the integration, installation, and maintenance of large industrial control systems, with a minimum of five years of applicable experience.
- (b) The Control Systems Vendor shall have experience programming PC based HMI (human machine interface) systems and industrial SCADA systems.
- (c) The Control Systems Vendor shall have experience designing and programming PLC based control systems using major brands including Allen-Bradley. The Control Systems Vendor shall also have experience designing and providing relay-based, hardwired control systems.
- (d) The Control Systems Vendor shall have experience designing and programming vector-controlled AC and DC drive systems utilizing motors up to 50 horsepower.
- (e) The Control Systems Vendor shall have experience in designing, providing, and configuring distributed industrial control system projects utilizing industrial Ethernet networking.

- (f) The Control Systems Vendor must be able to demonstrate experience in large industrial control systems by having completed ten previous successful large industrial control systems, at least three of which shall have incorporated a PLC system with vector-controlled AC variable speed drives.

CONTROL COMPONENTS

PLC System Hardware.

- (a) The PLC manufacturer shall be an industry recognized leader for providing PLC hardware and programming software.
- (b) The PLC manufacturer shall provide a network of field sales and support personnel located in key cities throughout the world. The PLC manufacturer shall also provide a field service department with experienced representatives stationed in major cities with the capability to provide telephone consultation, prompt on-site service, and field replacement stock.
- (c) The PLC processor shall be high speed, high performance type, which is capable of handling large and complex control system applications. Processor memory shall be 4MB or larger, with non-volatile secure digital program backup. The processor shall be capable of interfacing with over 120,000 digital or 4,000 analog I/O points.
- (d) The PLC processor shall have one dedicated Universal Serial Bus Type B port (USB 2.0) communicating at 12 MB/s. The USB port shall be usable for firmware updates, bridging to local modules on the backplane, programming, and data monitoring purposes.
- (e) The PLC processor shall be a self-contained unit, and will provide control program execution and support remote or local programming. This device will also supply I/O scanning and inter-controller and peripheral communication and diagnostic functions.
- (f) The PLC system shall have downward compatibility, whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence.
- (g) Two identical PLC processors shall be provided for redundancy, each with its own dedicated power supply and local rack type chassis. Both PLC processors shall be installed, wired in place, and powered on. One shall be active (primary), and the other shall be powered on and waiting in reserve (secondary). In the event of a failure of the primary PLC processor, the failure shall be detected and control shall automatically be resumed by the secondary PLC processor. A dual fiber optic connection shall be utilized for redundancy communication between chassis. All necessary specialty modules, cables, additional processor memory, and accessories required for this function shall be provided.

- (h) The switch over between primary and secondary PLC processors shall happen transparent to the user and to the application. In the event of a switchover between the primary and secondary processors, Ethernet/IP or ControlNet addresses shall automatically swap between the primary and secondary chassis. Any external device shall continue to communicate with the new primary PLC.
- (i) The PLC shall have the ability to support multiple data communication links by using EtherNet/IP, DeviceNet, ControlNet, and other third-party networks. As an optional feature, the Programmable Automation Controller shall include the capability of addressing remote input and output modules on the ControlNet, DeviceNet, EtherNet/IP, Remote I/O, HART, and FOUNDATION Fieldbus networks.
- (j) I/O cards shall be from the same product series as the PLC. PLC's and I/O cards shall utilize a rack type chassis which provides a high speed communication path between modules.
- (k) The communications network used between racks shall be dedicated for I/O communications, and shall be completely independent of other communications networks. The I/O communications network shall utilize a DLR (device level ring) type topology to provide additional fault tolerance. Provide additional taps and converters as required to implement network.
- (l) All system modules, I/O cards, and local and remote chassis shall be designed to provide for free airflow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be required.
- (m) All system modules and I/O cards may be removed from the chassis or inserted into the chassis while power is being supplied to the chassis without faulting the controller or damaging the modules. This is known as removal and insertion under power (RIUP).
- (n) Discrete I/O, analog I/O, communications, special purpose modules, chassis, and power supplies shall be provided as necessary for a complete system. Discrete input and output modules shall be rated for use with 120 volts A/C control power. Analog input and output modules shall be selectable between +/-10Vdc and 4-20mA. Discrete output modules shall be compatible with the voltage or current required by the equipment served.
- (o) Digital input/output (I/O) modules shall be used which provide LED indicating lights for each input or output point on the module. Thirty-two (32) point digital I/O modules shall not be used.
- (p) Provide a minimum of 20% spare I/O points for digital inputs and outputs in each cabinet.

- (q) All hardware of the PLC system shall operate at an ambient temperature of 0...60 °C (32...140 °F) and shall function continuously in the relative humidity range of 5...95% non-condensing. The PLC system shall be described and tested to operate in a high electrical noise environment.
- (r) The PLC system hardware shall be ControlLogix 1756 L7 series, as manufactured by Allen-Bradley, or an approved equal meeting all specifications defined herein.

HMI (Human Machine Interface) Computer.

- (a) Provide an operator interface for local bridge PLC control. HMI shall be a heavy duty industrial, integrated display type touch-screen computer.
- (b) HMI shall include SCADA software as described in Section SCADA System.
- (c) Other minimum requirements are as follows:
 - (1) IP65 front panel rating.
 - (2) Red Hat Linux operating system.
 - (3) 15" TFT display, anti-glare, 1366 x 768 or greater resolution.
 - (4) Long life LED backlight.
 - (5) Capacitive multi-touch screen.
 - (6) Intel Core i3, 1.70GHz processor, fanless design.
 - (7) A minimum of 4Gb RAM.
 - (8) Two 32Gb solid-state hard drives, easily removable, with RAID 1.
 - (9) Real time clock.
 - (10) PCI/PCIe slot.
 - (11) Two USB type A ports.
 - (12) Two USB type B ports.
 - (13) Two DisplayPort monitor outputs.
 - (14) Two 10/100MBbps Ethernet ports.
 - (15) One COM (RS-232/422/485) port.
 - (16) 24VDC power supply.
 - (17) -10 to 50 °C operating temperature.
 - (18) Relative humidity operating range of 5 to 95% non-condensing.
 - (19) Additional support software as required by SCADA software.
 - (20) PLC communications driver.

(d) SCADA software shall include the following minimum operator devices:

- (1) Pushbuttons and selector switches.
- (2) ASCII entry devices.
- (3) Diagnostic indicators.
- (4) Message displays.
- (5) Embedded numeric and ASCII variable displays.
- (6) Analog and digital gauges.
- (7) Trends.
- (8) Animation of objects.

(e) Provide all original manuals and license information. All software shall be licensed to the Department.

(f) Refer to Systems Integration Section for additional requirements.

(g) Provide an external keyboard and mouse/trackball.

Industrial Ethernet Switch.

(a) Industrial type Ethernet switches shall be provided for PLC communications as shown in the Plans and/or as otherwise required for networking PLC equipment. Industrial Ethernet switches shall be according to Section Ethernet Switch.

Fiber Optic Media Converter. Provide fiber optic media converters to convert copper media to fiber optic as shown on the Plans. Fiber optic media converters shall be according to Section Ethernet Switch and shall be compatible with PLC Ethernet communications protocols.

Industrial UPS Power Supplies.

(a) Industrial type uninterruptible power supplies (UPS) shall be provided in the PLC and I/O cabinets and control console as shown on the Plans to provide short term (5 minutes) backup power to the PLC system processors, I/O racks, network communications, and HMI display.

(b) 120VAC input and output power.

(c) UL listed or recognized.

(d) UPS shall be designed for hardwired input and output wiring with finger safe screw terminals.

- (e) UPS shall have dry contact, normally open type outputs for status monitoring by the PLC system. Dry contacts shall be rated for 120VAC, or interposing relays with 120VAC rated contacts shall be provided for interface to the PLC system. Contacts shall be as follows:
 - (1) UPS is operating on battery power.
 - (2) UPS battery is low.
- (f) -25°C to 70°C and 0-95% relative humidity operating range.
- (g) Hot swappable battery unit. Batteries shall be rated for extended temperature operating range of -20°C to 60°C.

Cabinets.

- (a) The main PLC cabinet shall be freestanding style, NEMA 12, constructed of 12 gauge steel with a gray powder coated finish, and include thermostatically controlled heating and air conditioning unit. An internal cabinet light shall be mounted at the top of the cabinet and be automatically activated by a door switch.
- (b) A NEMA 12 rated Ethernet programming port and receptacle by Grace Engineered Products, or equivalent, shall be installed on the main PLC cabinet door.
- (c) Remote I/O cabinets shall be wall mount or freestanding style, NEMA 4X, constructed of 12 gauge stainless steel, and include thermostatically controlled heating unit. An internal cabinet light shall be mounted at the top of the cabinet and be automatically activated by a door switch.
- (d) All I/O points shall be wired to terminal blocks. Pre-manufactured cable and terminal block systems shall only be used with approval by the Engineer.
- (e) All point-to-point wiring internal to the PLC and remote I/O cabinets shall be stranded copper. Control wire shall be minimum 16 AWG. Power wire shall be sized as required.
- (f) Install plastic wire duct to contain and organize all internal wiring.
- (g) Branch circuits supplying cabinets shall be provided with surge protective devices, connected directly to the respective branch circuit conductors where they enter cabinets. Surge protective device(s) shall be UL Labeled as Type 4 (verifiable at UL.com).
- (h) Coordinate requirements for fiber optic terminations with fiber optic cabling to be installed. Provide fiber optic panel housings according to Section Fiber Optic Panel Housing.

Control Console.

- (a) The control console cabinet shall be custom built as shown on the Plans with a hinged sloping top and access doors in the front. The top shall be constructed with a minimum of 12 gauge stainless steel with a brushed non-reflective finish. The base shall be constructed with a minimum of 12 gauge steel internally reinforced with angles and channels to form a rigid, freestanding console unit. The base shall have a gray powder coated finish and shall be supplied with removable inner panels for mounting electrical equipment. The enclosure rating shall be NEMA 12 equivalent.
- (b) A NEMA 12 rated data port by Grace Engineered Products, or equivalent, shall be installed on the cabinet door to provide external connections to the HMI computer. Port shall include all USB, RS-232, keyboard, and mouse connectors available on the HMI computer with all required extension cables. Label USB ports permitted for use for downloading HMI backup files or for use with external keyboards and pointing devices.
- (c) Provide pushbuttons, selector switches, indicators, legends, and operators as shown on the Plans.
- (d) Provide combination circular LED bar graph/digital displays for span position degrees open, minimum 4-1/2" square, switchboard style. The range legend shall correspond with the bridge maximum opening angle in degrees. Analog input shall be compatible with corresponding sensors or PLC analog outputs as shown in the Plans.
- (e) All I/O points shall be wired to terminal blocks. Pre-manufactured cable and terminal block systems shall only be used with approval by the Engineer.
- (f) All point-to-point wiring internal for the control console shall be stranded copper. Control wire shall be a minimum of 16 AWG. Power wire shall be sized as required.
- (g) Install plastic wire duct to contain and organize all internal wiring.

Pushbuttons and Selector Switches.

- (a) Pushbuttons and selector switches shall be UL listed industrial type, size 30.5 millimeter, with operation as indicated on the Plans. Switches shall be of die cast metallic construction with corrosion resistant plating, rated NEMA 4/13.
- (b) Contact blocks shall be screw down stackable type. Contacts shall be rated 10 amperes at 120 volts AC. Terminals shall be corrosion resistant screw type.

Indicator Lights.

- (a) Indicator lights shall be UL listed industrial type with colors as indicated on the Plans. Indicator lights shall be size 22 or 30.5 millimeter, NEMA 4/13 rated with die cast metallic housings. Lenses shall be interchangeable plastic Fresnel.
- (b) Terminals shall be corrosion resistant screw type.
- (c) Lamps shall be replaceable type, full voltage LED, 120VAC. Lamps shall be replaceable by removing the lens assembly from the front of the unit.

Labels and Identification.

- (a) Legend plates for pushbuttons, selector switches, and indicator lights shall be one piece engraved plastic type, white background with black text. Text shall be as indicated on the Plans.
- (b) Miscellaneous device labels shall be engraved plastic type, white background with black text. Labels on cabinet or enclosure exteriors shall be fastened with stainless steel machine screws. Labels mounted inside cabinets or enclosures are permitted to use adhesive backed labels.
- (c) Where possible, mount cabinet interior device labels on cabinet or panel surfaces adjacent to the device and not on wire duct covers or on the device.
- (d) All conductors shall be labeled using self sealing, adhesive type wire labels with machine printed permanent lettering at every terminal or connection. Conductor identification numbers shall be coordinated for consistency and accuracy with conductor numbers on the Contractor's approved wiring diagrams and shop drawings.

Control Relays. Control relays shall be utilized for hardwired logic functions and for switching single phase power circuits and as shown on the Plans.

- (a) Control relays shall be UL listed NEMA type machine-tool relays. Relay contacts shall be field reversible cartridge type, number as required, plus one spare contact. Contacts shall be rated at least 10 amperes at 300 volts AC, 60 hertz. Relay coils shall be 120 volts AC, 60 hertz.
- (b) IEC type control relays shall only be used with approval by the Engineer.

Interposing Relays. Isolation relays shall be used for interfacing with drives and motor controls, interfacing with other systems, or for isolating PLC inputs and outputs as shown on the Plans.

- (a) Isolation relays shall be UL listed general purpose plug-in type tube or blade style relays with DPDT contacts rated 10 amperes at 300 volts AC, 60 hertz. Relay coils shall be 120 volts AC, 60 hertz or as required by application. Relays shall include pilot light and manual flag indicators.
- (b) Sockets suitable for DIN rail or panel mounting, with retainer clips, shall be provided for each relay.

Timing Relays.

- (a) Timing relays shall be UL listed NEMA type machine-tool type with a pneumatic timing unit.
- (b) Contacts shall be rated at least 10 amperes at 300 volts AC, 60 hertz. Relay coils shall be 120 volts AC, 60 hertz.

Fuses. Control circuit conductors which extend between enclosures, such as between the MCC and PLC cabinets or to external devices, such as limit switches or sensors, shall be protected with fuses.

- (a) Fused terminal blocks shall be DIN rail mountable, finger safe, and shall be rated 30 amperes at 600 volts AC and include LED or neon blown fuse indicators.
- (b) Fuses shall be fast acting type, sized as required to prevent nuisance openings under normal operating conditions, and rated for use in control circuits.

Terminal Blocks. Terminal blocks shall be provided for each circuit conductor which extends between enclosures or to external devices, for each PLC I/O point including spares, and for internal wiring connections as required.

- (a) Terminal blocks shall be DIN rail mountable, finger safe, and shall be minimally rated for 300V AC/DC, 15 amperes.
- (b) Terminal blocks shall utilize screw connections with stainless steel corrosion resistant screws. Terminals shall be nickel plated with high copper content construction.
- (c) Provide machine printed terminal labels with text corresponding to wire identification numbers as shown on the electrical drawings.
- (d) Utilize color coded grounding type terminal blocks for ground conductors.

Supplemental Circuit Protection. Provide supplementary circuit protectors where indicated on the Plans, where required to isolate devices for maintenance, and where required by the NEC.

- (a) Circuit protectors shall be UL recognized, DIN rail mountable type with a tripping characteristic curve to match the device type to be protected.

SPD (Surge Protective Devices). Provide SPD's for incoming 120VAC power circuits utilized for control cabinets.

- (a) SPD's shall be UL 1449 Third Edition compliant, DIN rail mountable, plug in type.
- (b) Type 1 component assembly, fail-safe, self-protected design.
- (c) -40°C to 80°C operating range.
- (d) 20kA or greater discharge current.
- (e) Visual status indicator.

DC Power Supplies. Provide DC power supplies where indicated on the Plans or required by instrumentation, sensors, network/communications devices, and control equipment.

- (a) DC Power supplies shall be UL listed, with internal overload protection, and finger safe terminals.
- (b) Voltage and current ratings shall meet requirements of equipment served.
- (c) -40°C to 70°C and 0-95% relative humidity operating range for remote I/O cabinets.

BRIDGE WARNING DEVICES

Traffic Gate Warning Gong.

- (a) Rated for use as an audible traffic signaling device. Other requirements are as follows:
 - (1) Heavy duty, cast aluminum housing with weatherproof construction and gaskets.
 - (2) Motor driven 12" pressed steel bell with cast aluminum weather guard.
 - (3) 120VAC power.
 - (4) Provide mounting bracket as required for existing traffic gate.

Outdoor Warning Horn.

(a) Electric resonating horn. Other requirements are as follows:

- (1) UL Listed for outdoor use.
- (2) Corrosion-resistant cast aluminum housing with brass projector, gray enamel finish.
- (3) 120VAC power.
- (4) Minimum 105dBA @ 10' output.
- (5) With mounting bracket and standard NPT conduit fitting.

Machinery Room Warning Horn and Light.

(a) Combination audio and visual signaling device for machinery areas. Other requirements are as follows:

- (1) UL Listed.
- (2) NEMA 3R rated housing for rain tight applications.
- (3) 120VAC power.
- (4) Internal buzzer with minimum 85dBA at 10' output.
- (5) Field replaceable LED lamp with 60,000 hour lamp life, red lens.
- (6) Field adjustable flash pattern.
- (7) Operating temperature range of -31°F to 150°F.
- (8) Multiple mounting: flat surface, ½" NPT conduit, and 4-inch octagonal box.

(b) Provide appropriately sized cast aluminum electrical boxes as required for devices. Electrical boxes shall be rated for outdoor installation. Provide all necessary gaskets for installing devices on boxes.

LIMIT SWITCHES, SENSORS, AND ACTUATORS

Boat Detection Sensor.

- (a) The Control Systems Vendor shall be responsible for verifying the required product sensing range.
- (b) Two piece, transmitter-receiver microwave intrusion link. Other requirements are as follows:
 - (1) 10.5 to 14 VDC power for transmitter and receiver.
 - (2) SPDT-Form C alarm output, 2 amps at 28 VDC.
 - (3) Self Supervision: alarm on failure and remote test.
 - (4) Probability of detection: 0.99 minimum.
 - (5) Four field selectable modulation channels.
 - (6) 3 to 183 m (10 to 600 ft) sensing range.
 - (7) 40°c to +66°c (-40°F to +150°F) temperature operation range.
 - (8) 0-100% relative humidity operation range.
 - (9) Locking ball swivel mount, 20° adjustment in any direction.
 - (10) Unaffected by vibration, wind, fog, rain, snow, dust or temperature.
 - (11) Self-contained alignment circuits, LED trouble shooting indicators.
 - (12) Field adjustments can provide alarm on larger or smaller targets.
- (c) Coordinate sensor locations with waterway CCTV camera locations.
- (d) If applicable, provide appropriately rated interposing relays to interface with 120VAC control power.
- (e) Boat detection sensors shall be 300B series, as manufactured by Southwest Microwave, or an approved equal meeting all specifications defined herein.

Motor Speed Switches.

- (a) The Control Systems Vendor shall be responsible for field verifying all part numbers and dimensions of installed speed switches, drive pulleys, and drive belt.
- (b) Existing speed switch.
 - (1) Manufactured by Hubbell, Inc.
 - (2) P/N 2210-352CC13.
 - (3) Centrifugal action flywheel type.
 - (4) Light flywheel, wide range (heavy) spring.
 - (5) Snap action, 120 VAC rated contacts, NO/NC SPDT.
 - (6) NEMA 13 enclosure.
- (c) Provide new synchronous/cogged drive pulleys and drive belt. Drive pulleys shall be aluminum construction with bore and keyway to match speed switch and existing motor shaft.

- (d) Speed switch shall provide over-speed protection for existing motors. A motor speed of 975 RPM or greater shall cause the speed switch to trip.
- (e) The Control Systems Vendor may replace the existing speed switches in kind with new units or propose replacement units that duplicate the function of existing units with equivalent or superior ratings.

Lever Arm Limit Switches.

- (a) Heavy duty, NEMA style lever arm limit switch. Other requirements are as follows:
 - (1) UL listed.
 - (2) NEMA 4X rated.
 - (3) Epoxy coated zinc die cast or stainless steel housing.
 - (4) -40° to 105°C (-40° to 221°F) operating temperature.
 - (5) DPDT contacts rated minimum 10 Amp / 120 VAC.
 - (6) Quick disconnect connector and matching cord set.
 - (7) Provide corrosion resistant lever arm of type required by application.

Magnetic Proximity Switches.

- (a) Permanent magnet, snap action type switch, triggered by ferrous metal. Other requirements are as follows:
 - (1) UL listed.
 - (2) Stainless steel enclosure.
 - (3) Consume no power to operate.
 - (4) -40° to 105°C (-40° to 221°F) operating temperature.
 - (5) SPDT contacts rated minimum 4 Amp / 120 VAC, 3 Amp / 24 VDC.
 - (6) Potted sealed contact chamber, inherently intrinsically safe.
 - (7) Quick disconnect connector and matching cord set.
 - (8) End sensing or side sensing as required by location.
- (b) Provide additional ferrous or magnetic targets as required to provide reliable operation of switches and to provide extending sensing distance.
- (c) Magnetic proximity switches shall be Topworx Go Switch series, as manufactured by Emerson, or an approved equal meeting all specifications defined herein.

Rotary Cam Limit Switches / Rotary Cam Limit Switches with Resolvers.

- (a) Rotary cam limit switch requirements are as follows:
- (1) UL listed.
 - (2) NEMA 4 rated enclosure.
 - (3) 0 to 500 RPM rated switching speed, bidirectional.
 - (4) -10° to 185°F operating temperature.
 - (5) Individually adjustable cams, setting from 4° to 356°.
 - (6) Snap action DPDT contacts, rated for 10 Amp / 120 VAC.
 - (7) Repeatability +/- 1/4°.
 - (8) Provisions for installing conduit fittings.
 - (9) Internal timing dial.
 - (10) Number of cams/switches as indicated on the Plans.
 - (11) Shaft configuration and gear reducer as required by application.
- (b) Provide built-in industrial grade, single turn, absolute position resolver for switches used for bridge positioning as indicated on the Plans. Coordinate resolver electrical characteristics with corresponding bridge PLC control system.
- (c) Flexible couplings shall be provided for each rotary cam limit switch with requirements as follows:
- (1) High torsional stiffness, high torque, double disk, clamp style.
 - (2) Zero backlash.
 - (3) Maintenance free.
 - (4) Torque rated as required for rotary cam limit switch.
 - (5) Stainless steel or high strength aluminum construction.
 - (6) Rated for angular misalignment 2°.
 - (7) Provide bores and keyways as required.
- (d) Adjustable timing hub in-line couplings shall be provided for each rotary cam limit switch with requirements as follows.
- (1) Two piece design, stainless steel construction.
 - (2) Incremental adjustment = 2/3 of 1°.
 - (3) Name plate with timing identification marks.
 - (4) Provide bores and keyways as required.
- (e) Provide additional stub shafts, drive gears, keyways, and hardware as required by installation.

Inclinometer.

(a) Inclinometer sensor requirements are as follows:

- (1) No moving parts, semiconductor type.
- (2) IP64 or higher rated.
- (3) Corrosion resistant plastic or aluminum construction.
- (4) Vibration and shock resistant.
- (5) 90° measurement range.
- (6) 0.1° absolute accuracy.
- (7) 10 to 30 VDC operating voltage.
- (8) 4-20mA current output.
- (9) Reverse polarity and short circuit protected.
- (10) -30° to 70°C operating temperature.
- (11) Quick disconnect connector and matching cord set.

(b) Provide a mechanical angle indicator for installation at a suitable location within a clear line of site of the inclinometer sensors.

- (1) High visibility markings.
- (2) -30° through +90° range with 5° increments.
- (3) Weatherproof, rugged polycarbonate housing.
- (4) Vibration and shock resistant.
- (5) Clear glass tube filled with dampening fluid, with ball.
- (6) Hermetically sealed.
- (7) -50° F to +180° F operating range.
- (8) Right or left hand as required by installation.

Door Switch.

(a) Two piece, magnetically operated door switch. Other requirements are as follows:

- (1) UL and CE approvals.
- (2) Stainless steel housing, switch and magnetic actuator.
- (3) IP67 rated.
- (4) 0.4" operating distance.
- (5) -10° to 55°C operating temperature.
- (6) 1 N.C. safety contact, rated 2 Amp at 230 VAC.
- (7) Prewired cable, 3 meter.

Linear Actuator (Brandon Road only).

(a) The Control Systems Vendor shall coordinate with the Contractor to verify part numbers, dimensions, and mechanical parameters of installed linear actuator units.

(b) Existing Tail Lock linear actuators.

- (1) Manufactured by Raco International, Inc.
- (2) Type T1A2 actuator with 7.9" stroke (adjustable).
- (3) Rod eye clevis.
- (4) Thrust 175 pound, speed 3.7 inches/sec.
- (5) Type "L" Brake.
- (6) Type 1 limit switches, one pair SPDT end of stroke.
- (7) Trunnion brackets.
- (8) 3 foot motor power and accessory (limit switch) cables.
- (9) 460VAC, 3 Phase, 60Hz, IP54, class F insulation, TENV motor.
- (10) Motor thermal switches.

(c) Existing Span (Center) Lock linear actuators.

- (1) Manufactured by Raco International, Inc.
- (2) Type T1M7 actuator with 15.7" stroke.
- (3) Rod eye clevis.
- (4) Thrust 8800 pound, speed 1.4 inches/sec.
- (5) Motor Brake.
- (6) Handwheel with interlock switch.
- (7) Size D limit switch housing, one pair SPDT end of stroke.
- (8) Trunnion brackets.
- (9) 460VAC, 3 Phase, 60Hz, IP54, class F insulation, TENV motor.
- (10) Motor thermal switches.

Coordination. Coordinate bridge control system with the following:

- (a) SCADA System.
- (b) Bridge Operating Sequence.
- (c) Systems Integration.
- (d) Vector-controlled Motor Drive.
- (e) DC Drives System.
- (f) Bridge Electrical Installation.
- (g) Laptop Computer.
- (h) Bridge Control CCTV system.
- (i) Ethernet Network.
- (j) Ethernet Switch.
- (k) Public Address systems.
- (l) Aerial Cables.

Spare Parts.

- (a) Provide the following spare parts for each bridge:
 - (1) Pushbuttons – two of each type used.
 - (2) Selector switches - two of each type used.
 - (3) Indicator light assemblies - two of each color and type used, complete with lamps.
 - (4) Indicator light replacement lamps – twelve of each type and size used.
 - (5) Meters – two of each type used.
 - (6) Fuses – twelve of each type and size used.
 - (7) Control relays – four of each type used.
 - (8) Interposing relays – four of each type used, with base.
 - (9) PLC processor – two spare processors with bridge control program on non-volatile memory.
 - (10) Two spare PLC digital I/O card of each type installed.

(b) Provide the following spare parts for the overall project:

- (1) Two HMI computers, complete with all required software.
- (2) PLC communication card – four of each type installed.
- (3) PLC power supply – four of each type installed.
- (4) PLC rack – two of each size installed.
- (5) PLC analog I/O card – two of each type installed.

CONSTRUCTION REQUIREMENTS

Refer to Systems Integration Section for additional construction requirements.

Submittals. The following shall be submitted:

- (a) Concurrent with submission of the bid, each bidder shall identify the intended Control Systems Vendor, and submit a sufficient previous experience log to verify that the Vendor meets the requirements listed herein. The log shall include previous project references, including names of bridge owners and contact persons with phone numbers. Control Systems Vendors unable to demonstrate compliance with the above requirements will not be accepted, which may be deemed cause for disqualification and rejection of the bid.
- (b) Catalog cuts for PLC and HMI hardware and proposed system architecture showing racks, I/O card type and placement, and communications connections.
- (c) Catalog cuts and product data for each type of sensor, switch, warning device, actuator, and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (d) Shop drawings, assembly/layout diagrams, wiring diagrams, catalog cuts, and data sheets shall be submitted for approval for all components of the system and the cabinets. Note: Additional design detailing and circuit layout will be required by the Contractor to fabricate the intended system and provide the required submittals. Any additional detailing, circuit design, circuit layout or component layout shall be included.
- (e) Provide information on proposed bridge HMI hardware and software. Detail integration and interoperability capabilities of the bridge HMI with the bridge PLC system and the centralized SCADA system.
- (f) Submit preliminary bridge HMI design information for a typical system. Information shall include a menu structure tree showing screen navigation, example screens (color printouts) for each type to be provided, and color conventions.
- (g) For each bridge, the PLC program with complete documentation (PDF format) and color HMI graphic screen captures shall be developed and submitted for approval prior to shop testing and shipping the control cabinets.

- (h) Submit test plans and procedures for shop testing and field testing.
- (i) Bridge Operation and Maintenance Manuals - Upon completion and acceptance of the Project, the Control Systems Vendor shall develop and furnish operation and maintenance manuals for each bridge. Both hardcopy and electronic PDF format versions of manuals shall be provided. Hardcopy binders shall be hardback vinyl three ring loose-leaf type for binding 8-1/2 by 11 inch sheets. The manuals shall contain suitably arranged in multiple volumes and chapters including, but not limited to, the following:
- (1) Table of Contents.
 - (2) Introduction, including a general description of the bridge and its facilities.
 - (3) Local Bridge HMI Operating Procedure, including a simplified step-by-step, opening and closing procedure to normally operate the span using local bridge HMI (Human Machine Interface) automatic controls. This description shall be augmented and cross referenced with color printouts of associated HMI graphic screen captures, which shall be included in this section. A detailed alarm listing and corresponding operator level troubleshooting steps shall be included.
 - (4) Local Bridge Manual Operating Procedure, including a simplified step-by-step, opening and closing procedure to manually operate the bridge using the local bridge control console's hardwired controls. This description shall be augmented and cross referenced with a layout of the control console showing device locations, which shall be included in this section. A list of control console alarm lights and corresponding operator level troubleshooting steps shall be included.
 - (5) Maintenance troubleshooting procedures to be used by maintenance personnel for isolating faults to the lowest reparable limit level. It shall include HMI display information including screen menu structures and actual screen captures (in color) to illustrate the features and functions available from the HMI to identify problems.
 - (6) A complete, "as-built," PLC program listing including descriptive address comments and symbols, line comments, and cross reference listing.
 - (7) HMI information including hardware information, installed software with version and license information, network configuration and address information for each bridge, written procedure for configuring a spare HMI for use including step-by-step instructions (with color screen captures) for setting communications/network parameters and downloading bridge specific graphic/data files.
 - (8) Complete drive parameter listings for each installed drive (AC or DC as applicable) and basic troubleshooting instructions including common drive HMI error messages.
 - (9) Catalog cut sheets and users manuals for major new equipment including PLC hardware, HMI hardware, drive hardware, power monitors, etc.
 - (10) Half-size prints of "as-built" contract and shop drawings.
 - (11) Network information for control system related items including an architecture drawing showing all assigned network addresses for control system related devices, switch settings, and/or parameter listings for all programmable network switches and similar devices.
 - (12) Complete spare parts list.

- (13) Make a preliminary manual submittal for each bridge (electronic PDF format) to the engineer for review and approval.
 - (14) Final manual submittal for each bridge shall include five hard copies and five copies of electronic PDF format on a compact disc.
- (j) System Backup Files – Upon completion and acceptance of the Project, the Control Systems Vendor shall provide backup files for all programmable devices according to these Special Provisions and the following:
- (1) Backup files shall be provided on compact disc format or by other media as approved by the Engineer. Provide five copies of all backup files.
 - (2) Provide a preconfigured/cloned backup hard drive for each PC based device.
 - (3) Provide PLC program backup files with all associated documentation and configuration files, drive parameters, network device configuration files, and any related Control Systems Vendor generated documentation files (written programming or setup procedures, device setting tables, custom cable pin-out diagrams, etc.).
 - (4) Provide a complete PLC program listing with all associated documentation and cross referencing in PDF format.
 - (5) Provide backup files for power monitor and power monitor display unit.
- (k) A list of all passwords and their associated use shall be provided.

Bridge HMI Programming.

- (a) Each bridge HMI is intended to operate independently of the centralized SCADA system and vice versa. Each bridge HMI shall contain all of the necessary software licensing, application files, data files, and local disk space necessary to operate completely independently of the centralized SCADA system.
- (b) Graphic screens developed for bridge HMI's shall be permitted to be imported and modified as required for use on the centralized SCADA system. Coordinate HMI software development with SCADA system development.
- (c) All Bridge HMI and centralized SCADA graphic screens shall have the same style, color conventions, look, and feel. This shall be done to allow operators to quickly transition between using local bridge HMI control and centralized SCADA control with minimal effort and training. Likewise, individual bridge HMI and SCADA graphic screens shall be developed to ensure consistency between the HMI's for all bridges.
- (d) HMI graphic screens shall be designed primarily for use with touch-screen based touch control and data entry. HMI graphic screens shall also allow use of a PC mouse, trackball, or similar pointing device.

- (e) The HMI PC shall be configured to automatically start the HMI software when it boots up and to display a main Bridge Overview Screen. The PC shall be configured as closed desktop environment with access to the operating system limited by password protection.
- (f) Utilize a simple menu type system to organize graphic screens and to allow an operator to quickly navigate between screens. Suggested menu screen groups are as follows:
 - (1) Bridge Operations.
 - (2) Faults/Alarms.
 - (3) Maintenance.
 - (4) Main Drives.
 - (5) Power.
- (g) All screens shall have an area dedicated to show the occurrence of a new fault/alarm. Flashing red color convention shall represent new, unacknowledged faults; solid red shall represent active, acknowledged faults. Each screen shall provide the means to allow the operator to acknowledge the newest fault.
- (h) The Bridge Overview Screen shall consist of a simplified graphical representation of the bridge. For each control device on the bridge, provide color coded/text indication of the current device status.
 - (1) Analog open position for each leaf (degrees).
 - (2) Rotary cam and fully seated limit switch and states for each leaf.
 - (3) Traffic signal color.
 - (4) Raised / Lowered state of each traffic gate.
 - (5) Driven / Pulled state of each locking device.
 - (6) Set / Released / Hand-released state for each brake.
 - (7) Run Status, Direction, Speed, and Torque for each main drive.
 - (8) Navigation and river signal color.
 - (9) Boat detection sensors status.
- (i) Bridge Operation Screens shall contain the necessary controls to allow the operator to complete bridge opening and closing sequences. Screens shall include emergency stop, normal stop, and control power functions, and shall provide operator instructional and warning messages. Suggested screen groups are as follows:
 - (1) Roadway and Pedestrian Traffic Control – Provide controls for traffic light sequencing and traffic gates (raise, lower, stop).
 - (2) Bridge Operation – Provide controls, opening/closing the bridge (master raise, master lower, stop), and changing river signals. Show status indications for all conditions affecting the bridge operation (Bridge Run Permissive, boat detection, etc.) on this screen. Provide manual controls for devices when manual mode is active.
 - (3) Bypass and HMI Manual Mode – Provide controls for bypass operations and auto/manual control.

- (j) Screens in the faults/alarms group shall be as follows:
- (1) Fault history screen – Provide a chronological list of new, acknowledged and active, and cleared faults. Each line shall provide a description of the fault with the time and date stamp for when fault occurred, was acknowledged by the operator, and was cleared. Text/background color and flash properties shall be used to show the status of a fault. Provide scroll controls on the screen to allow viewing past alarms for a minimum of the past 24 hours.
 - (2) Fire and Security – Provide status of sensors and door switches.
- (k) Screens in the maintenance group shall be as follows:
- (1) Digital I/O status screens - The current on/off status of each individual PLC digital input and output shall be available from dedicated I/O list screens. A text description of each input and output point shall include the PLC address and a description of the physical device. Spare inputs and outputs shall also be included and labeled as spare.
 - (2) Analog I/O status screen – The current scaled value for each analog I/O point shall be displayed on this screen. A text description of the attached device and units shall be included for each value.
 - (3) PLC status screen – Provide information on PLC status including run/program mode, program scan time, current processor warning/fault conditions, I/O rack communications status, etc. Provide available information on backup PLC processor.
 - (4) Maintenance adjustable parameter screen – Provide a password protected screen for maintenance functions including setting the PC system clock and bridge operation parameters as required (motor running speed, creep speed, seating torque limit, seating stall time delay, etc.). User input values for operation parameters shall be limited to safe operating ranges by the HMI and/or PLC software.
- (l) Screens in the drives group shall provide current operating status information on each variable frequency AC or DC drive on the bridge. Information shall include control input and output states, speed, torque, operation status messages, and active fault messages.
- (m) Power screen(s) shall provide voltage and current readings for each phase of the incoming power from the power monitor and status indicators from the automatic transfer switch, bus monitor, surge protective device, and UPS power supplies.

Bridge PLC Programming.

- (a) Ladder logic shown on the Plans is conceptual only. Additional logic development and program writing by the Control Systems Vendor will be necessary to complete programs suitable for operating the bridges. PLC programming shall use ladder logic type programming language/format.

- (b) Bridge control systems shall have three control modes. Hardwired switches on the control console shall allow switching between the modes.
 - (1) Local hard-wired manual control (PLC monitors, but does not control).
 - (2) Local HMI control.
 - (3) Centralized SCADA control.
- (c) Electrical drawings shall include ladder logic programming tag/symbol name in addition to hardware address to assist in troubleshooting.
- (d) PLC programs shall be well documented. Provide descriptive address names/tags for all used and reserved addresses for I/O points and internal memory locations.
- (e) Line comments shall be used to provide additional explanations for complex logic, calculations/scaling and to identify sections of logic for specific purposes.
- (f) Provide all logic required to support operation of the bridge HMI and centralized SCADA system.

Shop Testing.

- (a) For each bridge, the complete control system shall be functionally tested, in the manufacturer's shop, to assure completeness and correct operation. The shop test shall be conducted prior to shipment.
- (b) Testing shall include simulation of all control functions. Inputs from field devices shall be simulated with toggle switches and outputs shall be simulated with indicator lights or relays.
- (c) Shop testing shall include testing of all control panels, control consoles, and all associated vector-controlled motor drives or DC drive systems.
- (d) All operations of the bridge operating sequence must be demonstrated for this test. Both PLC/HMI and hardwired logic control sequences shall be tested. Any errors found in the system shall be corrected and the test rerun to the satisfaction of the Engineer.
- (e) For the first bridge control system completed, shop testing shall also include testing of the centralized SCADA system control mode. Coordinate testing with the Systems Integrator to include testing of all operations of the bridge operating sequence with SCADA equipment.
- (f) The Control Systems Vendor shall prepare and submit for approval a shop test plan and procedure. The shop test procedure shall include a step-by-step description of operator actions and the expected control response, output, or sequence of outputs.

- (g) The shop test shall be witnessed by the Engineer. Following testing, the Engineer shall determine if the system is approved for shipping, or if corrections and further testing is needed. A minimum of thirty (30) calendar days advance notice shall be given to the Department and the Engineer.

Installation.

- (a) The Control Systems Vendor shall provide supervisory assistance in the installation of bridge control system equipment to ensure correct installation, maximum reliability, and ease of maintenance.
- (b) Boat Detection Sensor – Align and configure sensors as required. Verify that adjacent sensor transmitter-receiver pairs are configured to different modulation channels to minimize possibility of cross-talk and false signals.

Field Testing.

- (a) The Control Systems Vendor shall provide a factory trained field services engineer/technician to check out the control system installation on-site, including wiring interconnections to the control system, prior to the initial operation of a bridge control system. A complete PLC I/O checkout shall be performed with the Contractor to ensure that field devices are wired to the correct I/O point and to ensure that analog and programmable devices are properly configured.
- (b) Bridge local controls, including HMI (auto and manual) and hardwired modes, shall be tested and verified to be working properly prior to testing centralized SCADA operations.
- (c) The Control Systems Vendor shall coordinate as required with the Systems Integrator to test and verify the data exchange with each bridge over the fiber optic and radio networks and to verify correct operation of both local and centralized systems.
- (d) The field services engineer/technician shall remain or return on-site during system startup of local and centralized SCADA operations, and shall return for at least one additional site visit immediately prior to final acceptance of the control system to make any required final adjustments to the control system as directed by the Engineer. The Control Systems Vendor shall also make a designated representative available to be contacted by the Contractor representative, if necessary, during Contractor supervised operation of the spans.
- (e) The Control Systems Vendor's field services engineer/technician shall be properly trained, equipped and authorized to make changes and modifications to PLC, HMI, and drive programming on site as required without contacting the Control Systems Vendor's offices or supervisory personnel for prior authorization for such changes.

- (f) Boat Detection Sensors - Field adjust and verify correct alignment of sensors. Test and verify correct operation of each sensor for a minimum period of one week. During the test period, the sensors shall operate without adjustment while detecting waterway traffic with a 99% or higher accuracy.
- (g) Motor Speed Switches – Verify the correct trip setting of the speed switch and adjust as required.
- (h) Rotary Cam Limit Switches - Adjust zero position and cam settings. Verify proper zero, span, and scaling of resolver signal where applicable.
- (i) Inclinometers – Verify proper zero, span, and scaling of analog signal.
- (j) Assist the Contractor in the adjustment of all other sensors and switches.
- (k) The Control Systems Vendor shall demonstrate, to the Engineer, the correct operation of all bridge functions and indications. Testing shall include verification of all operating modes, interlocks, safety circuits, alarms/faults, and indications. The Control Systems Vendor shall prepare and submit for approval a test plan and procedure customized for each specific bridge. The shop test plan and procedure is not acceptable for the field test plan and procedure. A minimum of two weeks advance notice shall be given to the Department and the Engineer for the anticipated start of testing for each bridge.
- (l) The Control Systems Vendor shall participate in the system testing performed during the US Coast Guard trial phase.

Training. The Control Systems Vendor shall provide operator and maintenance training to IDOT's bridge Operations and Maintenance (O&M) personnel according to the following:

- (a) After the first bridge local control system has been installed, tested, and proven to operate reliably, provide local bridge control O&M training for a period of twenty (20) consecutive working days. The Trainer shall be a skilled person, competent to operate the bridge and be completely familiar with the equipment used in the bridge operation. During the period specified above, the trainer shall be in attendance at the bridge site for a normal working period of 8-hours per day. All training shall take place during the afternoon/evening shift to provide experience operating the bridges in daylight and after dark. For each subsequent bridge local control system, provide O&M local bridge control training for a period of ten (10) consecutive working days.
- (b) Training shall be designed to accommodate small groups, and shall also provide time for one-on-one training for individuals needing additional instruction.

- (c) Operator training for local bridge controls shall include the following verbal instruction along with the corresponding written material:
- (1) Modes of operation, emergency, and safety features.
 - (2) Using the HMI, menu structure and controls.
 - (3) Bridge operating sequence.
 - (4) Manual operations using the HMI and hardwired controls.
 - (5) Use of bypass functions.
 - (6) Basic interlocking.
 - (7) HMI fault/alarm messages.
 - (8) Troubleshooting using limit switch and device status animations on the HMI overview screens and PLC input and PLC output status screens.
- (d) Maintenance training for local bridge controls shall include Operator training items above, and shall also include the following:
- (1) Basic device troubleshooting instructions.
 - (2) Overview of electrical drawings.
 - (3) PLC programming – using the laptop computer to monitor the PLC and ladder logic online; basic instruction on uploading/downloading programs, file formats for backups, and instruction for replacing faulty processors and I/O cards.
 - (4) Instructions on using any specific HMI maintenance screens.
 - (5) HMI – instructions for shutting down/restarting the PC, locations for data files, and touch-screen calibration instructions.
 - (6) Vector-Controlled Motor Drive / DC Drive – general instructions on viewing/modifying drive parameter settings, viewing drive status, and interpreting fault messages using the local drive display and the drive manufacturer’s software.
 - (7) Power Monitor – basic instructions for configuring and using the unit.
- (e) Operator Training Materials.
- (1) Provide binders suitable for assembling training materials. Binders shall be hardback vinyl three ring loose-leaf type for binding 8-1/2 by 11 inch sheets.
 - (2) For each bridge, provide labeled index tabs. Provide color screen prints of local HMI screens along with written bridge operating procedures with the corresponding training sessions.
 - (3) Provide a complete training manual and material for each operator - a minimum of thirty copies.
 - (4) Provide training materials in electronic (.PDF) format.

(f) Maintenance Training Materials.

- (1) Provide binders suitable for assembling training materials. Binders shall be hardback vinyl three ring loose-leaf type for binding 8-1/2 by 11 inch sheets.
- (2) For each bridge, provide labeled index tabs. Provide color screen prints of local HMI screens along with written bridge operating procedures.
- (3) Provide written instructions for using the Laptop computer and PLC programming software for troubleshooting and uploading/downloading programs.
- (4) Provide written instructions for diagnosing HMI errors and proper procedures for restarting/resetting the HMI.
- (5) Provide written instructions with color screen capture prints for downloading backup files to HMI displays and for configuring spare HMI displays.
- (6) Provide written instructions for Vector-Controlled Motor Drive / DC Drive troubleshooting and instructions for adjusting drive parameters on the local drive display and keypad. Also provide written instructions for using drive manufacturer's software package to restore drive parameters from backup files.
- (7) Provide a complete training manual and material for each maintenance personnel and supervisor - a minimum of ten copies.
- (8) Provide training materials in electronic (.PDF) format.

Technical Support.

- (a) Upon final acceptance of the completed integrated bridge control system for all six bridges by the Engineer, the Control Systems Vendor shall provide technical support to IDOT's Maintenance personnel for a period of two years. Technical support shall consist of phone and Internet support. Coordinate with SCADA system technical support.
- (b) During the standard Monday through Friday work week, the Control System Vendor shall have qualified staff available for a normal 8-hour work day corresponding with IDOT's day shift.

Warranty.

- (a) Upon final acceptance of the completed integrated bridge control system for all six bridges by the Engineer, the Control Systems Vendor staff shall provide on-call warranty service for a period of two years. Field staff shall be capable of responding to an emergency within eight (8) hours.
- (b) When requested by the Department, within two years of the date of final acceptance, provide a minimum of four Project-site visits to adjust and calibrate components, make programming adjustments and revisions, and assist the Owner's personnel in making program changes and in adjusting equipment and controls. Provide up to 40 hours of services per bridge, exclusive of travel time, for these purposes.

Basis of Payment. This work will be paid for at the contract lump sum price for INTEGRATED BRIDGE CONTROLS SYSTEM.

SCADA SYSTEM

Description. This work shall consist of providing, assembling, programming, and testing a SCADA system for centralized control of the Joliet movable bridges according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions, and the following:

General. The work shall meet the following requirements:

- (a) The work shall be performed by a qualified Systems Integrator. The Systems Integrator shall have overall project responsibility for the integrated functioning of all components necessary to provide a satisfactory assembled SCADA (Supervisory Control And Data Acquisition) system operating in accordance with specified requirements.
- (b) These specifications describe the general architecture of a Supervisory Control And Data Acquisition (SCADA) system. It is not the intent of these specifications to minutely detail the construction of the desired system, but to clearly identify major system components, the system architecture, and to define the performance and functionality that the system shall provide.
- (c) The SCADA system shall also provide the ability to monitor and control CCTV cameras according to the requirements of Section Bridge Control CCTV System.

Qualifications. Systems Integrator's qualifications shall be according to Section Systems Integration.

SCADA Software Criteria.

The SCADA software shall be a proven package suitable for the application. The SCADA software shall have proven high reliability, availability, and performance. The SCADA software shall utilize an open architecture such that third party software can extract and exchange data using industry standard methods.

The SCADA software shall have the following features:

- (a) Utilize a fault tolerant architecture, which minimizes the impact of a single point of failure and provides for central system expansion and upgrades.
- (b) Provide a seamless integration between all subsystems and programs.
- (c) Utilize a fully integrated graphical user interface that provides the operator with real time information and control through the use of maps and schematic displays containing dynamic objects.
- (d) Provide multi-user and multi-workstation capability without operator restrictions other than password and access rights.

- (e) Provide standard interfaces to monitor and control a variety of SCADA field equipment from a variety of manufacturers.
- (f) Provide industry standard protocols to support communications with Programmable Logic Controllers and other facilities management devices including Allen Bradley Control Logix PLC's.
- (g) Provide access to real time and historical data through on-line applications as well as logging, report generation and charting.
- (h) Provide real-time monitoring and logging of equipment status and state.
- (i) Collect, store, and process real-time vehicle detector data at a minimum rate of once per minute.
- (j) Control both analog and digital video camera pan/tilt/zoom, video switches, and video recorders.
- (k) Control and monitor other control devices such as gates, beacons, over-height detectors, movable barriers, traffic signals, etc.
- (l) Provide table driven and dynamically created response plans that can incorporate any type of field device, operator input, and response.
- (m) Provide an interface to manage audio devices such as PA systems, emergency telephones, and PBX systems.
- (n) SCADA software shall provide a fully integrated interface for Public Address Subsystem Management. It shall enable a User to Control and Monitor the PA Subsystem from a single workstation, generate an alarm indication PA Subsystem faults, and log operator requests and commands including pre-recorded messages, live-to-air messages, and stop broadcast commands.
- (o) Provide the ability to add and modify SCADA devices using data entry templates while the system is online and operational.
- (p) Provide a scripting language that can be used to create control of SCADA control devices
- (q) Support continuous operation with availability at least 99.99%
- (r) SCADA software shall be designed for use in Red Hat Enterprise Linux with an Apache Tom cat application server.

Performance and Capacity Criteria.

The SCADA software shall meet the throughput, capacity, and availability requirements specified hereunder without any loss of critical data and without loss of operator control. At a minimum, the system shall meet the following criteria:

Workstations directly connected to the SCADA server via a local area network:

- (a) The operator shall be able to start any application on the workstation within five (5) seconds of logging in.
- (b) Acknowledge entered commands within one second of command entry.
- (c) Update the appropriate transaction data in the database within two seconds of the command entry.
- (d) All graphic displays shall be updated once per second without redrawing the entire screen. All displays shall allow smooth scrolling, panning, and zooming (maps may be zoomed to fixed zoom levels) functions with barely perceptible redrawing of the image on the screen.
- (e) All alarm conditions shall be displayed to the operator within two (2) seconds after they are received at the server or are generated by the server.
- (f) Prepare and display report information to the requestor within 60 seconds of request.

Overall system performance criteria shall be as follows:

- (a) The average processor utilization of any server computer required to operate the SCADA shall not exceed 40% over a typical 5-minute period under normal loading conditions when all devices and system elements are in operation.
- (b) Network traffic on any LAN segment shall not exceed 5% average utilization over a typical 5-minute period under normal loading conditions when all devices and system elements are in operation.
- (c) Communications between the central servers and field devices shall be at data rates that are compatible with the performance requirements as specified for normal field equipment operation.
- (d) System failover to backup servers and network shall be completed within 10 seconds after initiation.

When any SCADA server approaches 100% CPU or network utilization over a short or extended period, the system shall not crash or cease to operate but will slowly degrade its responsiveness while still providing highest priority to operator input. All internal queues and buffers shall be protected from overflow or overrun conditions such that predetermined information will be lost (for example, the oldest entries). An alarm message shall be generated if any queue or buffer reaches a programmed limit or overflow condition.

System Expansion.

The SCADA software shall be designed to serve a wide range of applications from small local systems to large regional TMC applications. The SCADA software shall be based on database tables that can be sized and configured to meet the needs of any size project. The table size shall automatically expand to accommodate additional workstations, field devices, log entries, communication channels, roadways, historical data, and other configuration information. The number of graphics, reports, or other files in the system shall be limited only by the available disk space allowing easy expansion by the addition of disk storage.

No software modifications shall be required to support hardware expansion such as additional processors, main memory, disk storage and communication channels.

Software Licensing.

The System Integrator shall provide the Customer with a non-exclusive, perpetual, irrevocable, royalty-free license to use the SCADA software and related third-party software. This license shall be valid for all sites specified in this document. The software shall contain no license key or other mechanisms preventing the user from expanding or utilizing the software to its fully licensed capabilities.

This license shall not artificially limit the expansion of the system by the addition of workstations, SCADA control devices, graphics, reports, etc. This license shall allow the software to be installed and run on upgraded hardware to provide more capacity.

To protect the Customer against future lack of support, all source code for the core SCADA software owned by the vendor shall be provided to the Customer under the terms of a confidentiality agreement.

Hardware Architecture.

The hardware for the SCADA software shall consist of redundant centralized servers and multiple workstations providing an integrated operator interface. Functions may be distributed over multiple servers, but all critical functions shall be implemented with fully redundant equipment.

All servers shall be current multicore systems running a current 64 bit operating system. Servers shall have multiple 1 Gbps network interfaces, RAID 1 or 0 configured hot swappable disk drives, and multiple hot swappable power supplies. The server shall have at least 50% expansion capability for main memory (RAM) and disk storage.

The workstations shall be standard PCs running the current Microsoft Windows operating system (Windows 10 or later). Each local workstation shall be configured with dual Ethernet interfaces with automatic failover to the second network connection. The workstations shall be capable of supporting up to four monitors in a large screen virtual format such that the mouse can be moved into any monitor. The workstations shall be capable of supporting multiple video inputs displayed in a window. Software shall be provided in the workstations to support streaming video in standard video compression formats including MJPEG, MPEG-4 and H.264.

The system shall support multiple printers connected to the network that can be accessed from any workstation. Printers shall support color screen copies, reports and event logs.

The local area network (LAN) shall be based on redundant 1 Gbps (or greater) Ethernet switches and dual network interfaces on all servers and workstations. The system shall continue to operate after the complete failure of one Ethernet switch. Failover to the second network interface on any computer shall be fully automatic and shall not require any operator intervention.

Remote operator workstations shall be available at designated locations. The software shall be able to restrict the functionality of remote workstations independent of the user logon. These workstations shall be capable of operating on a broadband connection at a nominal bandwidth of 1 Mbps or greater.

Standards.

The SCADA software shall be designed to take full advantage of all appropriate standards whether de facto or based on various standards organizations. As a minimum, the following standards should be incorporated into the SCADA software:

- (a) Ethernet and TCP/IP networking standards.
- (b) ODBC and SQL database standards. Generic support for any relational database.
- (c) HTML, DHTML, HTML5 Javascript, JSP, etc. standards for web based application servers and documentation.
- (d) Modbus protocol for data acquisition devices using both serial and TCP/IP communications.
- (e) Java Platform 2 Enterprise Edition client/server architecture.
- (f) Lightweight Directory Access Protocol (LDAP) and integration with Microsoft Active Directory.
- (g) Simple Network Management Protocol (SNMP) – the system shall support basic polling of all network devices for status information.

- (h) Network Time Protocol for time synchronization.
- (i) Web Services, REST, JSON, SOAP, WSDL for interfaces to subsystems.
- (j) All reports shall be created as pdf format files.
- (k) Database and configuration files shall be in a standard XML format.

Operating System Software.

The Operating System Software running on the central servers shall provide a general purpose, multi-user 64 bit operating system that runs in production and development environments. The operating system shall have the capability to be tuned for a combined I/O intensive, real-time, and computation intensive environment.

The operating system software shall be an industry standard, in general use, and shall be supplied as provided by the hardware vendor with no special modifications. The operating system shall be available from multiple major hardware manufacturers and supported on multiple hardware platforms. The graphical user interface shall either be integrated with the operating system or provided as a separate commercially available product that shall form the basis of the operator interface within the SCADA software.

SCADA Software Requirements.

The SCADA software shall be DYNAC ES, as manufactured by Kapsch TrafficCom USA Inc., or an approved equal, meeting all specifications defined herein.

The SCADA software shall be a standard product with proven operational installations on similar projects in the United States. The SCADA software shall use a client-server architecture based on Java 2 Enterprise Edition (J2EE), or other similar technologies, to support a three-tier system of database server, application server, and client. Clients shall use a web browser to access the system and download applications from the server that will offload processing to the client. All graphics intensive processing shall be performed on the client workstation with no limit to the number of workstations that may be connected to the server.

The software shall be written in C++, Java, or other standard, object-orientated programming language that is fully supported by the operating system used for the servers and workstations. The software shall be modular and table driven such that new features and interfaces can be added without changing the basic software architecture. The SCADA software and all configuration files shall be controlled using a configuration management tool, such as subversion, that will maintain a complete history of all modifications and allow a rollback to a previous version of the software and configuration.

The software shall be scalable and have no artificial (license-based) limits on the addition of additional devices, workstations, graphics, reports, etc.

All system functions shall be available to an operator on any workstation with functionality limited only by the password protected access level and workstation configuration. Any additional functions (e.g., CCTV, Public Address Systems, etc.) shall be integrated into the software and available on all workstations.

Workstations shall not require the installation of any proprietary SCADA software to support the functions described in this specification.

User Interface.

The user interface shall consist of various applications displayed and managed on any workstation that supports a Java Virtual Machine (JVM) including Windows 10, Linux, Unix, etc. It shall be possible to restrict the user from accessing any client operating system features such as the start menu, desktop icons, etc. such that the operator can only interact with the allowed SCADA applications.

All applications shall have a consistent user interface with commonly used options placed at the same position on all windows. Applications shall be designed to support multiple screen resolutions from 1024x768 and higher. The user interface shall be clearly and cleanly designed, shall not require the operator to memorize commands, and shall contain context sensitive help features. The cursor-pointing device (mouse, trackball or touch-screen) shall be the primary means of interfacing with the software. Pull-down lists, radio buttons, value sliders, and other standard graphical user interface selection methods shall be used whenever possible to minimize the use of the keyboard for data entry.

The SCADA software shall not limit the number of functionally equivalent workstations that can be used with the system. The software shall support multiple operators with adequate interlocking to prevent two operators from simultaneously modifying the same parameters, controlling the same device, or managing the same incident. A failure at any one workstation shall not cause any degradation or loss of functionality at other workstations.

The user interface shall start automatically whenever a workstation is booted to the point of requiring the operator to enter a name and password. The operator shall not be required to enter a Windows name/password or select any special programs from the Windows Start menu other than a web browser. The login shall provide support for external authentication using LDAP from Microsoft Active Directory. The login shall accommodate other two factor authentication methods such as a RSA card, finger print reader, etc.

The application shall check all user input data to ensure that it is a valid input within the accepted range for that particular data. All applications shall ensure that erroneous data input cannot cause a software failure, a buffer overflow, or a corruption of any database.

System Database.

The SCADA software shall be based on a relational or object-oriented database that shall contain all traffic configuration data and all acquired and processed traffic information. The SCADA software shall not require a specific relational database engine but shall support any SQL compliant database such as Oracle, PostgreSQL, MySQL, SQL Server, etc. Real-time and other non-persistent information may be stored in a proprietary memory resident database to optimize system performance. In any case, all data shall be available to SCADA applications, and a documented database interface shall be provided to allow new applications to be developed. Appropriate information shall be made available to external programs, such as report generators, using the open database connection (ODBC) standard.

The SCADA software shall provide a fully functional 'turn-key' database that the System Integrator shall use for the development, implementation, installation, debugging, and fine-tuning to support full operation of the system. GUI (graphical user interface) templates shall be provided to allow the user to enter and modify database information on a running system. A batch load mechanism using standard spreadsheet files (Microsoft Excel) shall be provided to create database load files in XML format. A database export program and database input program shall be provided that stores all configuration information in XML files.

All entities in the SCADA shall be defined in a common database with a common set of properties. Each type of entity (object) shall have additional properties and commands that support the capabilities of the specific entity. Each entity shall have the following standard database properties:

- (a) Operational status that can be used to alarm a failed device.
- (b) One or more Domain assignments that can be used to categorize entities by functional, geographic or other category.
- (c) An associated graphic display that contains information or links to the entity.
- (d) An associated camera and pre-shot that can be used to display the entity.
- (e) Commands that can be sent to the entity.
- (f) A configurable set of tags that can be applied to individual properties of the entity.
- (g) Notes that can be applied to the entity.
- (h) Special processing scripts that can be used to generate derived properties and alarms for an entity.

Graphical Display System.

The SCADA software shall provide a comprehensive graphical display application that can display any information from the real-time database, the historical files, and the configuration database. The graphical display shall support both vector graphics and maps rendered from a GIS database. The display software shall allow any drawing object to be linked to another display, another application, or a user defined function. The displays shall consist of a static image (scalable vector based) that is fully scalable with unlimited dynamic links to the SCADA database, other graphic displays, and other applications. The graphical displays shall be updated in real time as dynamically linked data changes in the database. An on-line graphical editor application shall be provided to create the static image and configure the dynamic linkages. The graphical editor application shall be custom tailored to support the functionality of the SCADA software. A generic package, such as AutoCAD or Illustrator, shall not be used to create graphics but can be used to import static portions of the display using the scalable vector graphics (SVG) format.

The following general display capabilities shall be provided:

- (a) Base layer maps rendered from GIS database.
- (b) Vector graphics overlaid on maps.
- (c) Panning of the display using either re-centering or dragging in any direction.
- (d) Zooming to any arbitrary magnification level over a range of at least 1:1000.
- (e) Predefined views (zoom and pan) selectable from a menu.
- (f) Reset display to default view defined by the display editor.
- (g) Multiple layers that can be optionally selected for the default view and can be controlled from the display application.
- (h) De-cluttering function that uses user selectable visibility functions for layers based on zoom level.
- (i) Fixed layer that is not changed by the pan/zoom functions.
- (j) Navigation window that shows the currently displayed region of the entire display. This window can be used to select other regions of the display for view.

The following edit capabilities shall be provided for creating the static image:

- (a) Interactive WYSIWYG (“what you see is what you get”) editor with “rubber banding” of drawing objects.
- (b) Basic drawing objects including line, rectangle, circle, ellipse, arc and polygon.
- (c) Object delete, copy and duplicate (by distance) functions.
- (d) At least 16 million colors selectable for objects, fills, and background using red/green/blue or hue/saturation/brightness palette.
- (e) Multiple line widths, line endings (arrows) and line types (dashed).
- (f) Curve smoothing and fitting for polygons.
- (g) Support TrueType fonts at any size and rotation angle.
- (h) Import of Scalable Vector Graphic (SVG) files.
- (i) Import of PNG, animated GIF and JPEG format graphic files.
- (j) Rotation, scaling, and mirroring of any drawing object.
- (k) Library of commonly used static and dynamic objects organized in categories.
- (l) User created object library of predefined graphic files with dynamics.
- (m) Grid snapping option.
- (n) Object ordering functions.
- (o) Vertical and horizontal alignment along edges and centers.
- (p) Distribution of objects horizontally, vertically, and user specified.
- (q) Unlimited undo and redo capability.
- (r) Gradient fill using two colors; linear or radial fill.
- (s) Fill with any image (gif or jpeg).
- (t) Connectors that automatically move with the object.

- (u) Bevel attributes on any object.
- (v) A configurable number of previous versions of all graphics shall be maintained to prevent loss of data.

The dynamic links in a display shall support the following functions:

- (a) Any drawing object can be linked to a property of an object in the database.
- (b) Dynamics include: color, visibility, blink, rotation, fill, scale, path move, icons, and text.
- (c) One object can have multiple dynamics linked to different dynamic values. For example, an object can change color, blink, rotate, and move on a path based on four different independent dynamic inputs.
- (d) Data values can be represented as a value/state. The format of the numeric value or state name can be specified.
- (e) Calculations based on other linked values and static data can be imbedded in the graphic.
- (f) Color can be used to represent data quality or current value/state.
- (g) States can be represented by a set of graphic objects from a user defined object library.
- (h) Objects can be linked to layers in the graphic, other graphic displays, to popup windows containing any graphic display, another application with startup data, or to any valid URL (local, web server or Internet).
- (i) A simulation mode for testing the dynamics.
- (j) Animated "gif" images that can be enabled/disabled using database values.
- (k) An object can be linked to a specific program for manipulating the object. e.g. a camera icon can be linked to the CCTV control application.
- (l) Embedded frames supporting display of other graphics or applications shall be supported.

Display of Graphic Files.

A display application shall provide a means of viewing the graphic displays, providing the real-time dynamics and interaction with devices. The graphic display shall overlay vector graphics with dynamics onto an optional map rendered from the GIS database. Icons representing system objects shall be assigned latitude/longitude positions and overlaid on the map.

The operator shall be able to access any graphics display by entering the name of the display or selecting from an expandable “tree view” of the directory structure. A list of recently accessed graphic files shall be maintained. There shall be forward and backward functions to move among all previously viewed graphic files.

When the operator selects an object linked to the Device database, a window displaying the attributes of the Device shall be displayed. The options in this window shall include control (if available), tag changes (control inhibit, disabled, user entry), database changes, alarm parameters, user data entry, and general notes entry. Database parameter changes shall be allowed only for privileged users.

The display software shall allow an object to be linked to any other application in the software. Specific objects such as cameras, program logic controllers, etc. shall be linked directly to the application supporting control of the device.

The SCADA software shall be delivered with a fully functional ‘turn-key’ set of graphic displays of the complete geographic area and all functional areas of the project. This work shall include the development, implementation, installation, debugging, and fine-tuning of a complete set of displays to support full operation of the system.

The following dynamic linkages shall be provided from any entity (or group of entities) displayed on the graphic:

- (a) Link to an associated graphic (if defined).
- (b) Link to an associated camera (if defined).
- (c) Link to a summary of all alarms for the entity.
- (d) Link to a summary of all events (including alarms) for the entity.
- (e) Link to a list of user defined trends showing history of one or more properties of the entity.
- (f) Link to a list of user defined reports containing information on the device.

Support for GIS.

The graphic display system shall support the display of standard map files such as ESRI shape files. The database SCADA bridge devices shall support latitude and longitude to automatically geo-locate these devices on a map based display. The user shall be able to specify the icon to be used to represent each type of device. The icon shall be linked to the associated user interface used to manage and control the device. The icon shall also be capable of supporting dynamics such as a dynamic graphic at its geographic location on the roadway. Icons shall be selected, scaled, and offset for each zoom level independently. The offset of the icon and the angle shall be used to draw a line (pointer) from the object to the geo location on the map.

The map database shall support the addition, movement, and deletion of roads. It shall be possible to define how any object is rendered on the map including color, width, and style (dotted) attributes. The map editor shall allow individual map elements to be renamed, assigned feature and sub-feature types, assigned linear reference attributes, and drawing order (z order).

The SCADA shall support the display of satellite imagery from public sources that can be displayed on a layer under the rendered map data.

Data Processing.

The SCADA shall be capable of processing continuous and discrete input information provided from generic data acquisition devices as well as field equipment described in this section.

- (a) Device Database -The SCADA servers shall provide communications drivers for all field devices including programmable logic controllers (PLCs), CCTV controllers, etc. Status information from all devices shall be stored in a common database (Device database) that is accessible by the graphical display system. Analog values shall be converted from raw measurements into meaningful values (engineering units) by means of standard algorithms:
 - (1) Linear conversion ($a + b*x$).
 - (2) Square root conversion.
 - (3) Digital filtering.
 - (4) Scripts supporting any conversion algorithm.
- (b) Device templates shall be provided that map input bits to states, output bits to commands, and commands to state. These templates shall be used for all devices that have the same configuration of inputs and outputs.
- (c) Calculated, derived, and manual data inputs shall also be stored in the Device database.
- (d) Data Flags - Each device in the Device database shall have an associated set of attributes that define the quality of the data. As a minimum, flags should indicate the following conditions:
 - (1) Value is not current.
 - (2) Device has an existing alarm condition.
 - (3) Device in alarm and has not been acknowledged.
 - (4) Device value is calculated or derived from other device values.

- (e) Tags - Tags are attributes that are manually applied to Devices. The tag name, behavior, and display methods shall be configurable for an unlimited number of tags. The tag behaviors are:
- (1) Control inhibit.
 - (2) Manual data entry.
 - (3) Out of service.
 - (4) Information or maintenance.
- (f) The tagging software shall allow multiple types of each tag to be applied to any property of any Device. Control (output commands) shall not be allowed if a Device has any control inhibit tags set. A manual data entry tag shall allow an operator to manually enter a value or state for the Device. A database shall be maintained of all tagging operations with a time stamp, operator name, and reason for the tagging action. A standard report format shall be provided to display and print the current tagging information.

Alarm Processing.

It shall be possible to configure any number of alarms processing actions on any property of an object. If the value meets the conditions for an alarm then a predefined set of actions will be initiated based on the priority defined for the device. The actions that are determined by the device priority are:

- (a) Printing of alarm on a logging device.
- (b) Display of alarm on a workstation.
- (c) Audible alarm annunciation.

There shall be a minimum of eight different alarm priority levels that can be used to select the alarm actions and shall be used to categorize alarms for reports and other uses. Any alarm condition shall have the following types of filters that can be associated with the alarm:

- (a) Alarm silence filter – silence the alarm based on the state of another device property.
- (b) Command filter – send a command (output) to this or another device.
- (c) Alarm disable filter – disable alarming based on the state of another device property.
- (d) Delay filter – delay processing the alarm for a set period of time.
- (e) Notification filter – send a notification message if the alarm occurs.

It shall be possible to set a delay on any alarm condition so that the alarm is not generated until the alarm condition has existed for a preset period of time. This time shall be individually adjustable for each device.

All unacknowledged alarms shall be indicated by a blinking object or symbol on the Alarm application and on any display that shows an object linked to the alarm. All alarms shall require acknowledgement by the operator from the Alarm application or from any display that shows the alarm condition. The acknowledgment shall cause the blinking to cease and shall generate a message in the event log.

If an alarm does not clear after a user selectable time the alarm shall be regenerated causing the alarm to enter the unacknowledged blinking state. This attribute shall be user selected for any device in the system. The following types of alarm processing shall be provided:

- (a) Aggregate alarm – combine many individual alarm conditions into a single alarm.
- (b) Boolean alarm – a true/false condition alarm.
- (c) Command Timeout alarm – Expected state after a command is not reached without a set time.
- (d) Communication alarm – Alarm on various communication parameters.
- (e) Deviation alarm – Alarm when a value deviates from a setpoint value.
- (f) Limit alarm – Three pairs of high and low limit alarms.
- (g) Text alarm – Alarm when a string value equals (or does not equal) a defined value.
- (h) Uncommanded Change alarm – Alarm a device state that changes when no command (manual or by script) is given.
- (i) Value alarm – Alarm using comparison (equal, greater than, etc) with a value.

The Alarm application shall display a reverse chronological list of all current active alarms with the priority, current status, a time-stamp, and a description of the alarm condition. Alarms that have been acknowledged and returned to normal shall optionally be automatically removed from the current alarm list. The current alarm list shall have a filtering capability to select only those alarms with the following combination of attributes:

- (a) Alarms unacknowledged.
- (b) Alarms at a specified priority.
- (c) Alarms that have returned to normal (no longer active).
- (d) Alarms for a specified group or area of the system as designated by a Domain.
- (e) Alarms for devices with names that match a pattern.

A page-acknowledge and a page-remove function shall be provided to remove all alarms currently visible in the Alarm application. Only those alarms that are in Domains that match the Domains assigned to the logged in user shall be displayed or annunciated.

Analog Point Device Processing.

Each analog value received by the server shall be optionally processed for the following alarm conditions:

- (a) Exceeds the bounds of the instrumentation or other validity ranges.
- (b) Exceeds the bounds of up to three sets of high and low limits.
- (c) Exceeds a rate of change limit in the positive or negative direction. The time range used to calculate the rate of change shall be user specified for each point device.
- (d) Exceed a set point value by a set amount.
- (e) A dead band shall be applied to all alarm limit checks to remove oscillations from normal to alarm about an alarm limit.

Each condition listed above shall have a separate priority and independent list of filters.

Discrete Point Device Processing.

Up to three discrete values shall be combined as specified in the database to create up to eight states. These states shall be checked for the following alarm conditions:

- (a) Defined alarm state.
- (b) Undefined illegal state.
- (c) Change of state without associated supervisory command.
- (d) Failure to change to commanded state after an associated timeout.

Each condition listed above shall have a separate priority and independent list of filters.

Notifications.

The Notification database shall support the entry of multiple fax and text messaging (SMS) phone numbers and email addresses for both internal users and external agencies. This database shall also provide for the entry of mail (SMTP) server addresses, for the grouping of notifications, and the entry of specific messages. Notifications shall be automatically generated based on alarm conditions and sent to the recipients specified in the Notification database.

Event Logging.

All alarms, operator actions, and other important system events shall be written to a log file and optionally logged on one or more system printers. Each log file shall contain one record per event with the following information:

- (a) Time stamp of event to nearest second.
- (b) Message name used to categorize different types of events and specific messages.
- (c) Name of operator and workstation if generated by operator action.
- (d) Alarm events shall have the alarm priority, area of responsibility, and alarm message.
- (e) Messages indicating a database change shall show the old data and the new data values.
- (f) Events related to a value in the Device database shall contain the device name and description.
- (g) Events related to communication errors shall contain the name of the communication channel and the device name.

The event log file shall be sized to contain at least the last 10,000 event messages. At a programmable period of time, all event messages for the period shall be written to an archive file that is uniquely named. The event log display software shall provide a means to display all or selected messages from the active message log file or any archived file. The selection criteria shall be:

- (a) Alarm messages.
- (b) Time Period.
- (c) Specific operator.
- (d) Specific workstation.
- (e) Specific real-time database device or group of devices.
- (f) Specific area of responsibility.
- (g) Specific message name.

Security.

System security shall be evaluated and implemented based on best practices in critical infrastructure projects. The NERC CIP (critical infrastructure protection) standards for electric grid reliability approved by the Federal Energy Regulatory Commission (FERC) shall be applied to the SCADA. CIP-002 through CIP-009 shall be used as the guidelines to evaluate the vulnerabilities of the SCADA.

User Authentication -The SCADA software shall have login security features that allow the system manager to define the applications that can be accessed and the actions that can be taken by the operators. At a minimum, each operator shall require a user name and password to “login” to the system. A user account policy shall provide the following features:

- (a) Password expiration time (in days or never).
- (b) Minimum characters in password.
- (c) Required characters: lower case, upper case, numbers, and special characters.
- (d) User lockout after programmable number of failed login attempts.
- (e) Lockout reset period.

The following information shall be defined for each user:

- (a) The startup configuration when the user logs on.
- (b) The area of responsibility for the user. This may be functional and/or geographical.
- (c) The ability to login to multiple workstations simultaneously.
- (d) The requirement to change the password at the next logon.
- (e) A list of functions that can be accessed and the parameters that can be changed.

The security system shall be general enough that a change to a certain class of operator does not require a change to be made for every operator in the class. The assignment of operator access to specific functions should be made through a group of functions that can then be assigned to individual operators.

It shall be possible to restrict both an operator and a specific workstation from certain displays and functions. A master user shall be built into the system to prevent locking out all users from access to the user definition application. All passwords stored in the software shall be encrypted when transmitted and stored.

When an operator logs into the system certain applications and functions shall be activated to provide a custom desktop unique to each operator. The operator may change and save the login configuration if this function is allowed.

The software shall provide an optional log out of an operator after a specified period of inactivity. An operator must log out before a new operator can login to a given workstation. An optional logout prompt shall be configurable to display a list of unacknowledged alarms and open incidents.

The security system shall be implemented by the System Integrator and be ready to fully support operations. This includes developing and implementing an initial set of user accounts, passwords, user privileges, and workstation privileges.

Network Security.

The SCADA shall provide firewall and intrusion detection/prevention appliances (Unified Threat Management) between the SCADA and any external computer systems not part of the SCADA. Traffic between external systems and the SCADA shall be controlled at the firewall by IP address and port number to allow only those users and services that are required.

Server Security.

The Operating System on the SCADA servers shall be configured using best available practices. The following specific issues shall be addressed:

- (a) Remove all user accounts that are not required for the SCADA.
- (b) Change all account passwords from the defaults.
- (c) Disable all unused services.
- (d) Remove all unnecessary scheduled (cron) jobs.
- (e) Set file permissions to most secure level allowed by the SCADA software.
- (f) Confirm that only one root/administrator account is configured.
- (g) Enable logging for all system and security logs.

Equipment Rack.

- (a) Provide four post 19" standard EIA racks for SCADA equipment. Other requirements are as follows:
- (1) Suitable for standard 29 inch depth equipment.
 - (2) Powder coated steel construction, minimum 16 gauge.
 - (3) 2500 lb static load rating.
 - (4) EIA universal standard hole progression on front channels and rear mount rails.
 - (5) Front and rear doors with lockable latches.
 - (6) Fully bonded cabinet complete with ground bar system and jumpers.
 - (7) Paint piercing washers to ground rack components.
 - (8) Cable management for copper and fiber media.
 - (9) Cable ties constructed of elastic flexible material with releasable locking head.
 - (10) Cable tie mounts utilizing screw fastening.
 - (11) Provide blanking panels as required for proper air flow.
 - (12) Provide power distribution accessories with auxiliary circuit breakers as required to distribute available power feeds.
 - (13) 120VAC Power Outlet Units (POUs) as required for rack equipment.
 - (14) Provide all necessary hardware, patch cords, and accessories.

UPS Power Supply.

- (a) Provide rack mount uninterruptible power supplies (UPS) for SCADA system equipment. The UPS shall sustain operation during short-term power failures and shall provide power for an orderly shutdown to prevent the loss of data during power failure.
- (b) The UPS shall be sized to sustain a connected full load for a minimum period of 5 minutes (enough time for generator transfer) in an operating environment of 70°F. Final UPS sizing will be the responsibility of the Systems Integrator.
- (c) Other requirements are as follows:
- (1) UL Listed.
 - (2) Suitable for 19" standard EIA rack mounting.
 - (3) Microprocessor controlled with LED or LCD status display.
 - (4) Audible and visual alarms.
 - (5) Computer grade sine wave power with 5 percent or less total harmonic distortion.
 - (6) Regulated output to 120 VAC \pm 3%
 - (7) Frequency regulation \pm 5% synchronized to utility, \pm 0.5 Hz on battery.
 - (8) Operating temperature range 0°C to +40°C.
 - (9) Relative humidity operation range 0-90%.
 - (10) Built in battery charger, with battery management to extend battery life.
 - (11) Internal maintenance free, sealed type batteries.
 - (12) Provisions for adding additional external batteries as required.
 - (13) Lightning and surge tested per ANSI/IEEE C62.41.
 - (14) Forced air cooled by an internally mounted fan(s).
 - (15) 10/100Mbit Ethernet communication option.

Ethernet Switch for SCADA Network.

- (a) Ethernet switches shall be according to Section Ethernet Switch.

Fiber Optic Termination Housings. Provide the appropriate quantity of fiber optic terminations for rack mounted equipment and the corresponding fiber optic cable connections required.

- (a) Fiber optic termination housings shall be modular rack mounted type according to Section Fiber Optic Interconnect Cabinet. Provide types and configurations as required for equipment and fiber optic cables.

Server.

- (a) Provide business class server computers for SCADA system. In addition to requirements listed below, provide all features and accessories required by the SCADA software manufacturer for the SCADA system as shown on the Plans and according to these Special Provisions:

- (1) Suitable for 19" standard EIA rack mounting.
- (2) 120 VAC dual, hot plug, redundant power supplies.
- (3) Dual Intel Xeon family processors, Quad core, 2 GHz or greater.
- (4) 4GB RAM or greater memory, expandable to a minimum of 16GB.
- (5) Two 500GB or larger capacity hard drives, RAID 1 or 0 configured, hot swappable.
- (6) Red Hat Enterprise Linux, x64 operating system.
- (7) 1Gb Network Interface Card, quad port.
- (8) CD\DVD R/W drive.
- (9) Other hardware, software, and components as required for SCADA software.
- (10) All required video and communications cables.

Data Historian Server.

- (a) Provide dedicated server computer to provide data storage for the SCADA system. In addition to the requirements listed above for Server, provide the following features:

- (1) Two 1TB or larger capacity hard drives, RAID 1 or 0 configured, hot swappable.
- (2) Dual, hot-plug, redundant power supplies.
- (3) Commercial RDBMS (Oracle, SQL-Server, PostgreSQL, etc.) software as required by SCADA system.

Desktop Workstation PC.

- (a) Provide business class desktop computers for SCADA operator workstations. In addition to requirements listed below, provide all features and accessories required by the SCADA software manufacturer for the SCADA system as shown on the Plans and according to these Special Provisions:
- (1) 120 VAC power supply.
 - (2) Intel Pentium Core processor, 3 GHz or greater.
 - (3) 4GB RAM or greater.
 - (4) 250GB hard drive.
 - (5) Current Microsoft Windows Operating System (Windows 10 or later).
 - (6) Non-Microsoft Application Software – JAVA.
 - (7) Video graphics card with support for four monitors.
 - (8) 1Gb Network Interface Card, dual port.
 - (9) CD\DVD R/W drive.
 - (10) Keyboard shall be washable, sealed medical grade with antimicrobial protection, USB wired interface.
 - (11) Optical Mouse shall be washable, sealed medical grade with antimicrobial protection, two button with scrolling wheel, with USB wired interface.
- (b) Provide and install a licensed copy of hard drive imaging software - Norton Ghost or equivalent.

Desktop Monitor.

- (a) Desktop Monitors shall be a minimum size of 21.5”, high definition LED monitor according to Section Bridge Control CCTV System.

Rack Mount Monitor, Keyboard, Mouse.

- (a) Provide monitor with keyboard and pointer for racks as shown on the Plans. Other requirements are as follows:
- (1) Clamshell design, 1 RU (rack unit).
 - (2) 19” LCD monitor, 1280 x 1024 maximum resolution, SXGA, DVI and VGA inputs.
 - (3) Touchpad pointing device.
 - (4) Low profile keyboard.
 - (5) KVM (keyboard, video, mouse) switch to allow use with up to 8 computers.
 - (6) Integrated power switch.
 - (7) 90-240VAC, 50-60Hz power.
 - (8) With all video, keyboard, and pointing device cables as required for computers in the rack.

Printer.

- (a) Provide business-class, desktop, black and white laser printer for small workgroup or small office applications. Other requirements are as follows:
 - (1) Compatible with SCADA system Linux operating system, with drivers.
 - (2) 120 VAC power.
 - (3) Hi-Speed USB 2.0, Ethernet 10/100/1000T, and Wireless 802.11b/g/n connectivity.
 - (4) 35 pages per minute print speed.
 - (5) 50,000 pages (letter) monthly duty cycle.
 - (6) Up to 1200 by 1200 dpi print quality.
 - (7) Standard printer languages including HP PCL 5e & 6, HP postscript, direct PDF.
 - (8) 50 sheet multipurpose tray and 250 sheet tray.
 - (9) Automatic duplexer for two-sided printing.
 - (10) Touch-screen control panel.
 - (11) ENERGY STAR® qualified with built in energy saving features.
 - (12) Ten spare toner cartridges.
 - (13) Provide power cord and network connection cables.

Identification.

- (a) Cable identification numbers shall be coordinated for consistency and accuracy with conductor numbers on Contractor's approved drawings, field wiring diagrams, and any other diagrams containing the same respective cable.
- (b) Labels shall be waterproof, non-smearing, and self-adhesive with machine-printed permanent lettering protected by a clear cover.
- (c) Cables shall be permanently and clearly tagged in accordance with the same numbers or designations appearing on the approved drawings at every connection, splice, and tap.
- (d) All network cables, fiber optic cables, and individual fiber strands, when broken out from a cable assembly, shall be uniquely labeled in accordance with the Contractor's approved drawings.
- (e) All equipment shall be clearly labeled as to function by engraved black on white plastic nameplates with a minimum of 1/4 inch high letters, attached with self adhesive backing. Equipment names shall be coordinated with the Contractor's approved drawings.

Coordination. Coordinate SCADA System with the following:

- (a) Systems Integration.
- (b) Integrated Bridge Controls System.
- (c) Bridge Operating Sequence.
- (d) Bridge Control CCTV system.
- (e) Public Address systems.
- (f) Ethernet Network.
- (g) Ethernet Switch.
- (h) Fiber Optic Interconnect Cabinet.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted.

- (a) Catalog cuts and product data for each type of component and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (b) Provide proposed SCADA system architecture drawings showing equipment, physical layout, and cables. Drawings shall include Contractor's proposed identification numbers for cables and names for devices.
- (c) Provide information on proposed SCADA software. Detail integration and interoperability capabilities of the SCADA system with the bridge HMI and bridge PLC system.
- (d) Submit preliminary SCADA design information. Information shall include a menu structure tree showing graphic screen navigation, example graphic screens (color printouts) for each type to be provided, color conventions, and SCADA system architecture showing all PC's with associated software components, hardware, and interconnections.
- (e) Color SCADA graphic screen captures shall be developed and submitted for approval prior to shop testing and shipping SCADA system.
- (f) Submit test plans and procedures for shop testing and field testing.

- (g) SCADA System Operation and Maintenance Manual - Upon completion and acceptance of the Project, the Systems Integrator shall develop and furnish the operation and maintenance manual for the SCADA system. Both hardcopy and electronic PDF format versions of the manual shall be provided. Hardcopy binders shall be hardback vinyl, three ring, loose-leaf type for binding 8-1/2 by 11 inch sheets. The manual shall contain suitably arranged in multiple volumes and chapters including, but not limited to, the following:
- (1) Table of Contents.
 - (2) Introduction, including a general description of the SCADA system and its facilities.
 - (3) Centralized Bridge Operating Procedure, including a simplified step-by-step, opening and closing procedure to normally operate each bridge using centralized SCADA controls. This description shall be augmented and cross referenced with color printouts of associated SCADA graphic screen captures, which shall be included in this section. A detailed alarm listing and corresponding operator level troubleshooting steps shall be included.
 - (4) Overall system network information for the SCADA system including architecture drawing(s) showing all assigned network addresses for SCADA equipment and all connected bridge control system devices
 - (5) Network switch settings and/or parameter listings for all programmable network switches and similar devices.
 - (6) For each installed PC, provide hardware information, list of all installed supplementary hardware, list of installed software with versions and license information, folder names and structure for where SCADA project and data files are located, and network configuration information including screen captures of network settings and addressing.
 - (7) Color SCADA graphic screen captures of all operator and maintenance SCADA system screens. Provide a menu tree diagram to show screen hierarchy and navigation.
 - (8) Communications/device driver setup information.
 - (9) Complete spare parts list.
 - (10) Make a preliminary manual submittal (electronic PDF format) to the engineer for review and approval.
 - (11) The final manual submittal shall include five hard copies and five copies of electronic PDF format manuals on a compact disc.
- (h) System Backup Files – Upon completion and acceptance of the Project, provide backup files for all programmable devices according to these Special Provisions and the following.
- (1) Backup files shall be provided on compact disc format or by other media as approved by the Engineer. Provide five copies of all backup files.
 - (2) Provide project and data backup files for SCADA system including graphic files, database files, and configuration files. Provide all files required to restore the system.
 - (3) Provide one spare preconfigured/cloned backup hard drive for each non-server PC.

- (i) A list of all passwords and their associated use shall be provided.

SCADA Programming.

- (a) The SCADA graphic screens shall be designed to closely follow the conventions of the individual bridge HMI screens. All Bridge HMI and centralized SCADA graphic screens shall have the same style, color conventions, look, and feel. This shall be done to allow operators to quickly transition between using local bridge HMI control and centralized SCADA control with minimal effort and training.
- (b) Graphic screens developed for bridge HMI's are permitted to be imported and modified as required for use on the centralized SCADA system.
- (c) Graphic screens shall be developed using consistent and industry standard color conventions for animation of objects and states. Where possible, state specific text notations (on/off, running/stopped, raised/lowered, etc.) shall be included.
- (d) From any one of the three SCADA operator workstations, it shall be possible to operate any of the six bridges.
- (e) The SCADA system shall be configured to provide separate password protected logon accounts for each bridge operator. Up to fifty user accounts shall be provided, with a separate account provided for systems administration. Each user account shall be customizable, including screen settings, camera views and layout, etc. Upon user login, these customized views and settings shall be automatically loaded accordingly per each user personalized settings.
- (f) Although normally an operator will only operate one bridge at a time, the system shall allow an operator to have multiple bridges in various states at one time. During the time that a bridge is in an operating sequence (opening/closing), the SCADA system shall prevent the operator from switching to another bridge until the operating sequence has completed or is stopped.
- (g) All SCADA fault/alarm messages and descriptions shall include the name of the bridge where the alarm condition has occurred.
- (h) For screens used to control and monitor a specific bridge, provide separate fault indications for faults for that bridge and faults from the other five bridges.
- (i) SCADA graphic screens shall include messages to prompt the operator to view CCTV cameras and perform other checks during bridge operations. Messages shall need to be acknowledged by the operator before operations can be resumed.

- (j) Provide a System Overview Screen showing the general status of all six bridges. The screen shall include the following information for each bridge:
- (1) E-Stop status.
 - (2) Control Power on/off status.
 - (3) Control mode selected.
 - (4) Analog open position for each leaf (degrees).
 - (5) Rotary cam and fully seated limit switch and states for each leaf.
 - (6) Traffic signal status.
 - (7) River signal status.
 - (8) Boat detection sensors status.
 - (9) Bus Monitor Status
 - (10) ATS Status
- (k) Provide a System Fault History screen – Provide a chronological list of new, acknowledged and active, and cleared faults. Each line shall provide a description of the fault with the time and date stamp for when fault occurred, was acknowledged by the operator, and was cleared. Text/background color and flash properties shall be used to show the status of a fault. Provide scroll controls on the screen to allow viewing past alarms for a minimum of the past 60 days.
- (l) The SCADA system shall collect and store bridge operating data. Bridge operating data for each bridge shall be collected and stored for all three control modes of operation (Local hard-wired manual control, Local HMI control, and Centralized SCADA control). Historical operating data for each bridge shall be available for viewing on separate screens. Data shall include time, date stamp, and the logon identity of the bridge operator associated with the bridge operation, if applicable. For each bridge, collect the following data:
- (1) Operator Emergency Stop / Emergency Stop reset.
 - (2) Operator Control power On/Off.
 - (3) Operator Bypass usage.
 - (4) Operator Manual mode usage.
 - (5) Operator initiated red traffic signal command.
 - (6) Traffic signals transitions to yellow, red, green.
 - (7) Traffic signal, total time red light condition is present.
 - (8) Operator initiated traffic gate raise/lower commands.
 - (9) Operator initiated bridge master raise / master lower / stop commands.
 - (10) Total time to raise (fully seated to fully open/partial open) for each span.
 - (11) Total time to lower (partial open/fully open to fully seated) for each span.
 - (12) Maximum torque for each span during raise and during lower.
 - (13) Maximum velocity for each span during raise and during lower.
 - (14) Angular span positions for each span at 3 second intervals when span is in motion between fully seated and fully open.
- (m) The SCADA system shall provide capabilities for generating hard-copy reports of operating data and alarm data for user selected time periods and criteria filters.

Installation.

- (a) The Systems Integrator shall be responsible for the assembly, installation, and testing of SCADA equipment in the IDOT bridge office building.

Shop Testing.

- (a) The SCADA system shall be functionally tested to assure completeness and correct operation. The SCADA system shall be shop tested in conjunction with at least one bridge integrated control system prior to shipment. Shop testing shall be coordinated with the shop testing of the first bridge control system completed by the Control Systems Vendor and shall be conducted at the same facility.
- (b) Shop testing shall also include testing of a complete set of bridge CCTV cameras, complete bridge public address system, and the corresponding software.
- (c) Testing shall include simulation of all centralized control functions from the SCADA system. Any errors found in the system shall be corrected and the test rerun to the satisfaction of the Engineer.
- (d) The Systems Integrator shall prepare and submit for approval a shop test plan and procedure. The shop test procedure shall include a step-by-step description of operator actions and the expected control response, output, or sequence of outputs.
- (e) The shop test shall be witnessed by the Engineer. Following testing, the Engineer shall determine if the system is approved for shipping, or if corrections and further testing is needed. A minimum of thirty (30) calendar days advance notice shall be given to the Department and the Engineer.

Field Testing for SCADA System.

- (a) The Systems Integrator shall provide a factory trained field services engineer/technician to provide testing for the SCADA system installation, including wiring interconnections, and terminations.
- (b) The Systems Integrator shall coordinate as required with the Control Systems Vendor to test and verify the data exchange with each bridge over the fiber optic and wireless radio networks.
- (c) The Systems Integrator shall demonstrate, to the Engineer, the correct operation of all bridge functions and indications. Testing shall include verification of all operating modes, interlocks, alarms/faults, and indications. The Systems Integrator shall prepare, and submit for approval, a test plan and procedure customized for each specific bridge. The shop test plan and procedure is not acceptable for the field test plan and procedure. A minimum of two weeks advance notice shall be given to the Department and the Engineer for the anticipated start of testing for each bridge.

- (d) The Systems Integrator shall participate in system testing performed during the US Coast Guard trial phase.

Training. The Systems Integrator shall provide operator and maintenance training to IDOT's bridge Operations and Maintenance (O&M) personnel according to the following:

- (a) After the centralized SCADA Controls are installed, tested, and proven to operate reliably for the first bridge, provide O&M training for a period of twenty (20) consecutive working days. The Trainer shall be a skilled person competent to operate the bridge and be completely familiar with the equipment used in the bridge operation. During the period specified above, the trainer shall be in attendance at the bridge office for a normal working period of 8-hours per day. All training shall take place during the afternoon/evening shift to provide experience operating the bridges in daylight and after dark. For each subsequent bridge added to the centralized control system, provide O&M bridge control training for a period of ten (10) consecutive working days.
- (b) Training shall be designed to accommodate small groups, and shall also provide time for one-on-one training for individuals needing additional instruction.
- (c) Operator and Maintenance training for centralized bridge SCADA control shall include the following verbal instruction along with the corresponding written material:
 - (1) Using the SCADA, menu structures, and controls.
 - (2) Review of bridge operating sequence.
 - (3) Manual and bypass operations.
 - (4) SCADA error messages, fault acknowledge, and fault history.
 - (5) System log-on procedure and PC shutdown/restart procedures.
 - (6) Procedures for setup and use of CCTV cameras and equipment. Coordinate requirements with Section Bridge Control CCTV System.
- (d) Operator Training Materials.
 - (1) Provide binders suitable for assembling training materials. Binders shall be hardback vinyl, three ring, loose-leaf type for binding 8-1/2 by 11 inch sheets.
 - (2) For each bridge, provide labeled index tabs. Provide color screen prints of SCADA screens along with written bridge operating procedures with the corresponding training sessions.
 - (3) Provide a complete training manual and material for each operator, minimum of thirty copies.
 - (4) Provide training materials in electronic (.PDF) format.

(e) Maintenance Training Materials.

- (1) Provide binders suitable for assembling training materials. Binders shall be hardback vinyl, three ring, loose-leaf type for binding 8-1/2 by 11 inch sheets.
- (2) For each bridge, provide labeled index tabs. Provide color screen prints for SCADA screens along with written bridge operating procedures.
- (3) Provide a SCADA system block diagram identifying each PC, Server, and major system component. Provide a written explanation of each PC and Server function within the SCADA system.
- (4) Provide written instructions for diagnosing basic SCADA problems and proper procedures for restarting/resetting individual PCs and Servers, including necessary sequencing of device startup.
- (5) Provide a complete training manual and material for each maintenance personnel and supervisor, minimum of ten copies.
- (6) Provide training materials in electronic (.PDF) format.

Technical Support.

- (a) Upon final acceptance of the completed SCADA work for all six bridges by the Engineer, the Systems Integrator shall provide technical support to IDOT's Maintenance personnel for a period of two years. Technical support shall consist of phone and Internet support. Coordinate with Integrated Bridge Control System technical support.
- (b) During the standard Monday through Friday work week, the Systems Integrator shall have qualified staff available for a normal 8-hour work day corresponding with IDOT's day shift.

Warranty.

- (a) Upon final acceptance of the completed SCADA system for all six bridges by the Engineer, the Systems Integrator's staff shall provide on-call warranty service for a period of two years. Field staff shall be capable of responding to an emergency within eight (8) hours.
- (b) When requested by the Department, within two years of the date of final acceptance, provide a minimum of four Project-site visits to make programming adjustments and revisions, to answer technical questions, and to assist Owner's personnel in making program changes. Provide up to 200 hours of services, exclusive of travel time, for these purposes.

Basis of Payment. Payment will be made at the lump sum price for SCADA SYSTEM.

BRIDGE OPERATING SEQUENCE

Description. This Section summarizes the proposed sequence of operation of each bridge using the IDOT Bridge Office building SCADA system (Centralized Automatic Control) as shown in the Plans and according to these Special Provisions.

Definitions.

- (a) SCADA – Supervisory Control and Data Acquisition.
- (b) CCTV – Closed Circuit Television.
- (c) HMI – Human Machine Interface.
- (d) PLC – Programmable Logic Controller.
- (e) PTZ – Pan-tilt-zoom.

General. Although there are some minor differences between the bridges, the intent is to follow the same general sequence of operation to the extent possible for all bridges. The following operating differences and similarities should be noted:

- (a) Ruby Street Bridge has a single motor driven span lock.
- (b) Jackson Street Bridge, Cass Street Bridge, Jefferson Street Bridge, and McDonough Street Bridge can operate almost identically. The only minor difference is the traffic gate sequencing for the one way traffic on Cass Street and Jefferson Street. These bridges have a mechanical (non-motorized) span lock that requires the near and far leafs lowering operation to be sequenced from intermediate positions.
- (c) Brandon Road Bridge has two motor driven span locks and is the only bridge with motor driven tail locks. This bridge is also the only bridge without river signals.

Centralized bridge operations will be performed by three operators from the new control room in the IDOT Bridge Office building. An Operator Station shall be provided for each operator for bridge control and monitoring of the bridge operations.

Each Operator Station shall consist of a desk area with a SCADA computer, monitors, and input devices; a CCTV computer, monitors, and input devices; a public address system microphone/headset; and a marine radio with a handset. Additionally, several large CCTV monitors installed on floor mounted stands shall be positioned to allow viewing by all three operators.

For centralized SCADA operation, the Remote/Local key switch on the corresponding bridge's operator house control console must be in the "Remote" position. Additionally the control console's E-Stop (emergency stop) push-button must be not pressed.

Operator Preparations and Bridge Selection.

- (a) Initial radio contact is made with the river vessel and/or sequential bridge openings are coordinated verbally between the three bridge operators.
- (b) Using the SCADA system CCTV controls, the operator has the ability to select the camera views associated with the bridge to be operated. Normally, two of the four monitors at each operator's station would be used to display CCTV images. User friendly menu type controls allow the operator to display preconfigured groups of cameras. At any time, the operator can also display selected CCTV images on the video wall monitors with the SCADA system.
- (c) Using the SCADA system menu, the operator selects which bridge is to be operated. The SCADA system displays the control screens for the selected bridge and automatically displays the bridge's CCTV cameras on the operator's desktop monitors if they have not already been selected by the operator.
- (d) For all bridges, the operators will have the ability to interrupt automatic operations and perform manual control of individual devices when necessary.
- (e) Through the SCADA system, the operator will have the ability to enlarge an individual camera view to observe individual traffic gate operations or to identify potential pedestrian / vehicular problems.
- (f) At any time, the operator will also have the ability to utilize the bridge public address system to communicate with pedestrians as required and/or to audibly monitor bridge activity.

RUBY STREET BRIDGE

Opening Sequence.

- (a) From the Ruby Street Bridge's SCADA overview screen, the operator does the following:
 - (1) Verify that there are no active alarm conditions for the bridge.
 - (2) Check remote/local indication to verify that the bridge control system is in the "Remote" mode.
 - (3) Verify that no emergency stop pushbuttons are pressed at the bridge, and reset the emergency stop circuit if required.
 - (4) Turn on the bridge control power and wait for indication that control power is on.

- (b) The SCADA system displays the CCTV pedestrian camera view group (4 pedestrian camera views displayed) and the traffic gate view group (4 traffic gate camera views displayed). Optionally, the 2 upper (above bridge) PTZ cameras could be displayed by the operator to evaluate traffic/pedestrian conditions and to verify that there are no abnormal or dangerous conditions present (traffic stoppage/accidents on bridge span or approaches, etc.). Individual camera controls are available for pan-tilt or pan-tilt-zoom cameras to allow the operator to manipulate these cameras.
- (c) If any abnormal conditions are present that would prohibit a bridge opening, the operator would be required to make radio contact with the river vessel to advise of the circumstances.
- (d) If the operator observes no abnormal or dangerous pedestrian and roadway traffic conditions, the operator starts the red traffic light sequence from the SCADA system.
- (e) The bridge warning horns are sounded by the PLC for approximately 15 seconds, the bridge traffic lights transition from green to yellow to red, and the traffic gate gongs and flashing lights are activated. Optionally, the operator would have the ability to play pre-recorded warning messages through the bridge's public address system.
- (f) The SCADA system displays a message to prompt the operator to view the appropriate cameras to verify that traffic has stopped. The operator visually verifies that roadway and pedestrian traffic has stopped and acknowledges the message on the SCADA system before proceeding.
- (g) The operator lowers each on-going traffic gate from the SCADA system. Each gate shall have separate lower, raise, and stop controls. Once the procedure to lower a gate is started, it will continue until it reaches fully lowered position (limit switch), it is stopped by the operator, or a timeout alarm occurs.
- (h) After all on-going traffic gates have been lowered, the operator verifies that vehicular/pedestrian traffic has cleared the bridge using the CCTV system.
- (i) The operator lowers each off-going traffic gate from the SCADA system. The flashing gate lights are still activated as long as the gates are lowered.
- (j) When all gates are lowered, the "Bridge Run Permissive" is determined by the bridge PLC and appears on the SCADA system screen alerting the operator that the bridge can be operated.
- (k) The SCADA system displays a message to prompt the operator to view the CCTV pedestrian and traffic gate view groups to verify that the bridge is clear of pedestrians. The operator acknowledges the message before proceeding.

- (l) The operator uses the SCADA system to start the “Master Raise” sequence. Once the sequence has started, it will continue until the bridge is fully open, a fault condition occurs, or until stopped by the operator through the SCADA system. The operator has the option to stop the sequence at any time. The SCADA system will prohibit the operator from switching to another bridge while the Master Raise sequence is in progress.
- (m) The PLC Master Raise sequence unlocks the span locks. The operator can observe the status of the locks on the SCADA system.
- (n) When all traffic gates are lowered and the span locks are pulled, the traffic gate gongs are disabled.
- (o) The bridge warning horns and warning horns in the bridge machinery areas are sounded by the PLC for approximately 15 seconds.
- (p) After the warning horn timer has expired, the PLC releases the motor and machinery brakes, accelerates the variable speed drives to a preset maximum speed, and begins raising the near and far leaves.
- (q) The PLC continuously monitors the bridge position switches and sensors, and the current bridge position information is displayed on the SCADA system.
- (r) At the near open position, the PLC decelerates the leaf’s drive to a slow speed.
- (s) The operator can switch the river signals to green on the HMI when both leaves are above near open or at full open.
- (t) At full open position, the PLC stops the leaf’s drive and sets the leaf’s motor and machinery brakes.
- (u) When both leaves are at full open, the span navigation lights turn from red to green.
- (v) When both leaves are at full open and all brakes have been set, the Master Raise sequence is complete.

Closing Sequence.

- (a) The operator verifies that the river traffic is clear of the bridge using radio contact, by viewing the CCTV waterway camera view group (2 lower PTZ and 2 thermal PT camera views displayed), and by using the 2 upper view PTZ cameras.
- (b) From the Ruby Street Bridge's overview screen on the SCADA system, the operator does the following:
 - (1) Verify that there is no "boat detection" indication from the bridge sensors.
 - (2) Verify that there are no active alarm conditions for the bridge.
 - (3) Verify that control power is on.
- (c) The operator switches the river signals to red from the SCADA system.
- (d) The operator uses the SCADA system to start the "Master Lower" sequence. Once the sequence has started, it will continue until the bridge is fully closed and the span locks are driven, a fault condition occurs, or until stopped by the operator through the SCADA system. The operator has the option to stop the sequence at any time. The SCADA system will prohibit the operator from switching to another bridge while the Master Lower sequence is in progress.
- (e) The SCADA system displays the CCTV waterway camera view group and prompts the operator to check the river traffic for boats under the bridge. Using the CCTV system, the operator visually re-checks the position of the river traffic and acknowledges the message on the SCADA system before proceeding.
- (f) The warning horns at the bridge and warning horns in the bridge machinery areas are sounded by the PLC for approximately 15 seconds. Optionally, the operator would have the ability to play pre-recorded warning messages through the bridge's public address system.
- (g) After the warning horn timer has expired, the PLC releases the motor and machinery brakes, accelerates the variable speed drives to a preset maximum speed, and begins lowering the near and far leaves.
- (h) The span navigation lights switch from green to red as soon as the bridge lowers from the fully open position.
- (i) The PLC continuously monitors the bridge position switches and sensors, and the current bridge position information is displayed on the SCADA system.
- (j) If at any time during the closing sequence a boat is detected by the bridge boat detection sensors, the closing operation is stopped and the bridge automatically opens to fully open position.

- (k) At the near closed position, the PLC decelerates the leaf's drive to a slow speed.
- (l) At the fully closed position, the PLC switches the drive to a reduced torque mode and stalls the leaf for a short time delay to fully seat the bridge.
- (m) After the seating time delay, the motor and machinery brakes are set. When the brakes have been verified to be set, the PLC stops the leaf's drive.
- (n) The PLC Master Lower sequence determines that the bridge is fully seated and locks the span locks. The operator can observe the status of the locks on the SCADA system.
- (o) When both leaves are seated, all brakes are set, and the span locks are driven, the Master Lower sequence is complete.
- (p) The SCADA system displays the CCTV pedestrian and the traffic gate view groups. Using the CCTV system, the operator visually verifies that the bridge is fully seated and the status of pedestrian and vehicular traffic. The SCADA message is acknowledged before proceeding.
- (q) The operator opens the off-going traffic gates from the SCADA system.
- (r) The operator opens the on-going traffic gates from the SCADA system. The gate lights are deactivated when all gates are open.
- (s) The operator turns the traffic lights to green from the SCADA system to allow vehicular traffic to resume.
- (t) If it will be some time until the next planned bridge opening, the operator turns off the control power for the bridge from the SCADA system.

JACKSON, CASS, JEFFERSON, AND McDONOUGH STREET BRIDGES

Opening Sequence.

- (a) From the Bridge's SCADA overview screen, the operator does the following:
 - (1) Verify that there are no active alarm conditions for the bridge.
 - (2) Check remote/local indication to verify that bridge control system is in the "Remote" mode.
 - (3) Verify that no emergency stop pushbuttons are pressed at the bridge, and reset the emergency stop circuit if required.
 - (4) Turn on the bridge control power and wait for indication that control power is on.

- (b) The SCADA system displays the CCTV pedestrian camera view group (4 pedestrian camera views displayed) and the traffic gate view group (4 traffic gate camera views displayed). Optionally, the 2 upper (above bridge) PTZ cameras could be displayed by the operator to evaluate traffic/pedestrian conditions and to verify that there are no abnormal or dangerous conditions present (traffic stoppage/accidents on bridge span or approaches, etc.). Individual camera controls are available for pan-tilt or pan-tilt-zoom cameras to allow the operator to manipulate these cameras.
- (c) If any abnormal conditions are present that would prohibit a bridge opening, the operator would be required to make radio contact with the river vessel to advise of the circumstances.
- (d) If the operator observes no abnormal or dangerous pedestrian and roadway traffic conditions, the operator starts the red traffic light sequence from the SCADA system.
- (e) The bridge warning horns are sounded by the PLC for approximately 15 seconds, the bridge traffic lights transition from green to yellow to red, and the traffic gate gongs and flashing lights are activated. Optionally, the operator would have the ability to play pre-recorded warning messages through the bridge's public address system.
- (f) The SCADA system displays a message to prompt the operator to view the appropriate cameras to verify that traffic has stopped. The operator visually verifies that roadway and pedestrian traffic has stopped and acknowledges the message on the SCADA system before proceeding.
- (g) The operator lowers each on-going traffic gate from the SCADA system. Each gate shall have separate lower, raise, and stop controls. Once the procedure to lower a gate is started, it will continue until it reaches fully lowered position (limit switch), it is stopped by the operator, or a timeout alarm occurs.
- (h) After all on-going traffic gates have been lowered, the operator verifies that vehicular/pedestrian traffic has cleared the bridge using the CCTV system.
- (i) The operator lowers each off-going traffic gate from the SCADA system. The flashing gate lights are still activated as long as the gates are lowered.
- (j) When all gates are lowered, the traffic gate gongs are disabled. The "Bridge Run Permissive" is determined by the bridge PLC and appears on the SCADA system screen alerting the operator that the bridge can be operated.
- (k) The SCADA system displays a message to prompt the operator to view the CCTV pedestrian and traffic gate view groups to verify that the bridge is clear of pedestrians. The operator acknowledges the message before proceeding.

- (l) The operator uses the SCADA system to start the “Master Raise” sequence. Once the sequence has started, it will continue until the bridge is fully open, a fault condition occurs, or until stopped by the operator through the SCADA system. The operator has the option to stop the sequence at any time. The SCADA system will prohibit the operator from switching to another bridge while the Master Raise sequence is in progress.
- (m) The bridge warning horns and warning horns in the bridge machinery areas are sounded by the PLC for approximately 15 seconds.
- (n) After the warning horn timer has expired, the PLC releases the motor and machinery brakes, accelerates the variable speed drives to a preset maximum speed, and begins raising the near and far leaves.
- (o) The PLC continuously monitors the bridge position switches and sensors, and the current bridge position information is displayed on the SCADA system.
- (p) At the near open position, the PLC decelerates the leaf’s drive to a slow speed.
- (q) The operator can switch the river signals to green on the HMI when both leaves are above near open or at full open.
- (r) At full open position, the PLC stops the leaf’s drive and sets the leaf’s motor and machinery brakes.
- (s) When both leaves are at full open, the span navigation lights turn from red to green.
- (t) When both leaves are at full open and all brakes have been set, the Master Raise sequence is complete.

Closing Sequence.

- (a) The operator verifies that the river traffic is clear of the bridge using radio contact, by viewing the CCTV waterway camera view group (2 lower PTZ and 2 thermal PT camera views displayed), and by using the 2 upper view PTZ cameras.
- (b) From the Bridge’s overview screen on the SCADA system, the operator does the following:
 - (1) Verify that there is no “boat detection” indication from the bridge sensors.
 - (2) Verify that there are no active alarm conditions for the bridge.
 - (3) Verify that control power is on.
- (c) The operator switches the river signals to red from the SCADA system.

- (d) The operator uses the SCADA system to start the “Master Lower” sequence. Once the sequence has started, it will continue until the bridge is fully closed, a fault condition occurs, or until stopped by the operator through the SCADA system. The operator has the option to stop the sequence at any time. The SCADA system will prohibit the operator from switching to another bridge while the Master Lower sequence is in progress.
- (e) The SCADA system displays the CCTV waterway camera view group and prompts the operator to check the river traffic for boats under the bridge. Using the CCTV system, the operator visually re-checks the position of the river traffic and acknowledges the message on the SCADA system before proceeding.
- (f) The warning horns at the bridge and warning horns in the bridge machinery areas are sounded by the PLC for approximately 15 seconds. Optionally, the operator would have the ability to play pre-recorded warning messages through the bridge’s public address system.
- (g) After the warning horn timer has expired, the PLC releases the motor and machinery brakes, accelerates the variable speed drives to a preset maximum speed, and begins lowering the near and far leaves.
- (h) The span navigation lights switch from green to red as soon as the bridge lowers from the fully open position.
- (i) The PLC continuously monitors the bridge position switches and sensors, and the current bridge position information is displayed on the SCADA system.
- (j) If at any time during the closing sequence a boat is detected by the bridge boat detection sensors, the closing operation is stopped, and the bridge automatically opens to fully open position.
- (k) The PLC decelerates and stops the near and far leaf drives at a predefined angular stopping point. After both leaves have stopped and the correct angular positions have been verified by the PLC, the PLC accelerates both drives to engage the lock and continue the lowering operation.
- (l) At the near closed position, the PLC decelerates the leaf’s drive to a slow speed.
- (m) At the fully closed position, the PLC switches the drive to a reduced torque mode and stalls the leaf for a short time delay to fully seat the bridge.
- (n) After the seating time delay, the motor and machinery brakes are set. When the brakes have been verified to be set, the PLC stops the leaf’s drive.
- (o) When both leaves are seated and all brakes are set, the Master Lower sequence is complete.

- (p) The SCADA system displays the CCTV pedestrian and the traffic gate view groups. Using the CCTV system, the operator visually verifies that the bridge is fully seated and the status of pedestrian and vehicular traffic. The operator acknowledges the message before proceeding.
- (q) The operator opens the off-going traffic gates from the SCADA system.
- (r) The operator opens the on-going traffic gates from the SCADA system. The gate lights are deactivated when all gates are open.
- (s) The operator turns the traffic lights to green from the SCADA system to allow vehicular traffic to resume.
- (t) If it will be some time until the next planned bridge opening, the operator turns off the control power for the bridge from the SCADA system.

BRANDON ROAD BRIDGE

Opening Sequence.

- (a) From the Brandon Road Bridge's SCADA overview screen, the operator does the following:
 - (1) Verify that there are no active alarm conditions for the bridge.
 - (2) Check remote/local indication to verify that bridge control system is in the "Remote" mode.
 - (3) Verify that no emergency stop pushbuttons are pressed at the bridge, and reset the emergency stop circuit if required.
 - (4) Turn on the bridge control power and wait for indication that control power is on.
- (b) The SCADA system displays the CCTV pedestrian camera view group (4 pedestrian camera views displayed) and the traffic gate view group (4 traffic gate camera views displayed). Optionally, the 2 upper (above bridge) PTZ cameras could be displayed by the operator to evaluate traffic/pedestrian conditions and to verify that there are no abnormal or dangerous conditions present (traffic stoppage/accidents on bridge span or approaches, etc.). Individual camera controls are available for pan-tilt or pan-tilt-zoom cameras to allow the operator to manipulate these cameras.
- (c) If any abnormal conditions are present that would prohibit a bridge opening, the operator would be required to make radio contact with the river vessel to advise of the circumstances.
- (d) If the operator observes no abnormal or dangerous pedestrian and roadway traffic conditions, the operator starts the red traffic light sequence from the SCADA system.

- (e) The bridge warning horns are sounded by the PLC for approximately 15 seconds, the bridge traffic lights transition from green to yellow to red, and the traffic gate gongs and flashing lights are activated. Optionally, the operator would have the ability to play pre-recorded warning messages through the bridge's public address system.
- (f) The SCADA system displays a message to prompt the operator to view the appropriate cameras to verify that traffic has stopped. The operator visually verifies that roadway and pedestrian traffic has stopped and acknowledges the message on the SCADA system before proceeding.
- (g) The operator lowers each traffic gate from the SCADA system. Each gate shall have separate lower, raise, and stop controls. Once the procedure to lower a gate is started, it will continue until it reaches the fully lowered position (limit switch), it is stopped by the operator, or a timeout alarm occurs.
- (h) After all on-going traffic gates have been lowered, the operator verifies that vehicular/pedestrian traffic has cleared the bridge using the CCTV system. The flashing gate lights are still activated as long as the gates are lowered.
- (i) When all gates are lowered, the "Bridge Run Permissive" is determined by the bridge PLC and appears on the SCADA system screen alerting the operator that the bridge can be operated.
- (j) The SCADA system displays a message to prompt the operator to view the CCTV pedestrian and traffic gate view groups to verify that the bridge is clear of pedestrians. The operator acknowledges the message before proceeding.
- (k) The operator uses the SCADA system to start the "Master Raise" sequence. Once the sequence has started, it will continue until the bridge is fully open, a fault condition occurs, or until stopped by the operator through the SCADA system. The operator has the option to stop the sequence at any time. The SCADA system will prohibit the operator from switching to another bridge while the Master Raise sequence is in progress.
- (l) The PLC Master Raise sequence unlocks the span locks. The operator can observe the status of the locks on the SCADA system.
- (m) The PLC Master Raise sequence unlocks all the tail locks simultaneously. The operator can observe the status of the locks on the SCADA system.
- (n) When all gates are lowered and all locks are pulled, the traffic gate gongs are disabled.
- (o) The bridge warning horns and warning horns in the bridge machinery areas are sounded by the PLC for approximately 15 seconds.

- (p) After the warning horn timer has expired, the PLC releases the motor and machinery brakes, accelerates the variable speed drives to a preset maximum speed, and begins raising the near and far leaves.
- (q) The PLC continuously monitors the bridge position switches and sensors, and the current bridge position information is displayed on the SCADA system.
- (r) At the near open position, the PLC decelerates the leaf's drive to a slow speed.
- (s) At full open position, the PLC stops the leaf's drive and sets the leaf's motor and machinery brakes.
- (t) When both leaves are at full open, the span navigation lights turn from red to green.
- (u) When both leaves are at full open and all brakes have been set, the Master Raise sequence is complete.

Closing Sequence.

- (a) The operator verifies that the river traffic is clear of the bridge using radio contact, by viewing the CCTV waterway camera view group (4 lower PTZ and 2 thermal PT camera views displayed), and by using the 2 upper view PTZ cameras.
- (b) From the Brandon Road Bridge's overview screen on the SCADA system, the operator does the following:
 - (1) Verify that there is no "boat detection" indication from the bridge sensors.
 - (2) Verify that there are no active alarm conditions for the bridge.
 - (3) Verify that control power on.
- (c) The operator uses the SCADA system to start the "Master Lower" sequence. Once the sequence has started, it will continue until the bridge is fully closed and all locks are driven, a fault condition occurs, or until stopped by the operator through the SCADA system. The operator has the option to stop the sequence at any time. The SCADA system will prohibit the operator from switching to another bridge while the Master Lower sequence is in progress.
- (d) The SCADA system displays the CCTV waterway camera view group and prompts the operator to check the river traffic for boats under the bridge. Using the CCTV system, the operator visually re-checks the position of the river traffic and acknowledges the message on the SCADA system before proceeding.
- (e) The warning horns at the bridge and warning horns in the bridge machinery areas are sounded by the PLC for approximately 15 seconds. Optionally, the operator would have the ability to play pre-recorded warning messages through the bridge's public address system.

- (f) After the warning horn timer has expired, the PLC releases the motor and machinery brakes, accelerates the variable speed drives to a preset maximum speed, and begins lowering the near and far leaves.
- (g) The span navigation lights switch from green to red as soon as the bridge lowers from the fully open position.
- (h) The PLC continuously monitors the bridge position switches and sensors, and the current bridge position information is displayed on the SCADA system.
- (i) If at any time during the closing sequence a boat is detected by the bridge boat detection sensors, the closing operation is stopped, and the bridge automatically opens to fully open position.
- (j) At the near closed position, the PLC decelerates the leaf's drive to a slow speed.
- (k) At the fully closed position, the PLC switches the drive to a reduced torque mode and stalls the leaf for a short time delay to fully seat the bridge.
- (l) After the seating time delay, the motor and machinery brakes are set. When the brakes have been verified to be set, the PLC stops the leaf's drive.
- (m) The PLC Master Lower sequence determines that the bridge is fully seated and locks all the tail locks simultaneously. The operator can observe the status of the locks on the SCADA system.
- (n) The PLC Master Lower sequence locks the span locks. The operator can observe the status of the locks on the SCADA system.
- (o) When both leaves are seated, all brakes are set, and all locks are driven, the Master Lower sequence is complete.
- (p) The SCADA system displays the CCTV pedestrian and the traffic gate view groups. Using the CCTV system, the operator visually verifies that the bridge is fully seated and the status of pedestrian and vehicular traffic. The SCADA message is acknowledged before proceeding.
- (q) The operator opens both traffic gates at once from the SCADA system.
- (r) The gate lights are deactivated when all gates are open.
- (s) The operator turns the traffic lights to green from the SCADA system to allow vehicular traffic to resume.
- (t) If it will be some time until the next planned bridge opening, the operator turns off the control power for the bridge from the SCADA system.

Coordination. Coordinate with the following:

- (a) SCADA System.
- (b) Integrated Bridge Controls System.
- (c) Systems Integration.
- (d) Bridge Control CCTV system.
- (e) Public Address systems.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the bid prices for the INTEGRATED BRIDGE CONTROLS SYSTEM, SCADA SYSTEM, and SYSTEMS INTEGRATION.

SYSTEMS INTEGRATION

Description. This work shall consist of the coordination and oversight of all work required to provide a harmonious, safe, and reliable overall system according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

Definitions.

- (a) Systems Integration – The bringing together of components of several systems containing interacting components to achieve the indicated functional operation of combined systems.
- (b) CCTV – Closed Circuit Television.
- (c) HMI – Human Machine Interface.
- (d) PA system – Public Address System.
- (e) PLC – Programmable Logic Controller.
- (f) SCADA – Supervisory Control and Data Acquisition.

General. The work shall meet the following requirements:

- (a) The Contractor shall be responsible for ensuring that systems integration work shall be performed by qualified personnel herein identified as the Systems Integrator. Systems integration work shall be performed by one Contractor or Sub-Contractor who shall have single point responsibility for the integrated functioning of all components to provide a satisfactory assembled system operating in accordance with specified requirements.

- (b) The Systems Integrator shall provide an integrated, end-to-end centralized control system that encompasses installation and integration of the SCADA system, integrated bridge controls systems for all six bridges, network and communications equipment, CCTV cameras and equipment, public address system equipment, and ancillary equipment as shown on the Plans and according to these Special Provisions.
- (c) Systems integration work shall include design, selection of materials and equipment, configuration, software, construction oversight, testing, and certification of all communications networks necessary to support the Project. This shall include all hardwired (copper based), fiber optic, and wireless networks.
- (d) The systems integrator shall be responsible for the design of the overall fiber optic network that interconnects all six bridges and the bridge office building. This shall include coordination with the separate IDOT contract to install fiber optic cabling between bridges. Coordination shall include fiber optic material requirements, termination connector requirements, cable identification/labeling, work schedule coordination, and testing.
- (e) The Systems Integrator shall be responsible for providing the centralized bridge control SCADA system, for performing all programming, configuration, and testing for the SCADA system, and providing the coordination necessary to integrate this work with other systems. The Systems Integrator shall design, furnish, install, test, tune, and warranty a fully integrated Supervisory Control And Data Acquisition (SCADA) system with the operational capability described herein.
- (f) The Systems Integrator shall provide all equipment, accessories, and other materials required to produce the desired performance and functionality with the major components and the system architecture as defined, even if they are not specifically identified or implied in the Contract Documents.
- (g) The Systems Integrator shall design, supply components, and manage the installation of Bridge Control CCTV systems and the Public Address systems.

Qualifications.

- (a) The Systems Integrator shall be primarily and regularly engaged in the integration, installation, and maintenance of industrial and/or transportation SCADA systems, with demonstrable experience in the integration, installation, and startup of large SCADA systems.
- (b) Systems Integrator shall employ personnel that have documented experience exercising full responsibility for overall systems integration for the types of SCADA and control systems similar in material, design, scope, and complexity to this Project, and whose work has resulted in construction with a record of successful in-service performance.

- (c) Systems Integrator shall have documented experience in communications network design, configuration, and testing. This shall include experience using hardwired (copper based), fiber optic, and wireless media to implement Ethernet networks.
- (d) The Systems Integrator shall also demonstrate applicable experience designing and programming both PLC based control systems and distributed/network based CCTV systems.
- (e) The Systems Integrator shall be able to provide industrial control panel design, fabrication, and testing capabilities. Panel fabrication capabilities shall be permitted to be either in-house or using an outside fabricator who has an on-going business relationship with the Systems Integrator and has successfully completed multiple projects with the Systems Integrator.
- (f) The Systems Integrator must be able to demonstrate experience programming large SCADA systems by having completed at least five previous successful projects with multiple PLC's and multiple SCADA control stations.
- (g) The Systems Integrator must be an approved certified Control System Integrator and must carry and provide the certification recognized by the Control System Integrators Association (CSIA).

Work for Hire.

- (a) Any and all configuration, programming, setup or other software functions (SOFTWARE) performed on all intelligent devices provided as part of this Project is to be considered "Work for Hire" under the 1976 Copyright Act as amended (title 17 of the United States Code). The SOFTWARE shall be owned by IDOT and shall be turned over to IDOT fully documented as the work is completed.
- (b) IDOT intends only to obtain the SOFTWARE for its own use.
- (c) IDOT will not prevent the SOFTWARE supplier from reuse of the SOFTWARE concepts and ideas for other projects. Any reuse of the SOFTWARE concepts and ideas generated under this Project is solely the responsibility of the SOFTWARE supplier. The SOFTWARE supplier shall defend, indemnify, and hold harmless IDOT from all claims, damages, and expenses (including reasonable litigation costs), arising out of any use, misuse, or misapplication of SOFTWARE concepts and ideas.
- (d) All equipment, cables, hardware, and all components and material required to produce a complete functioning system in compliance with the Contract Documents shall become and remain the property of the Department.

Coordination. Coordinate Systems Integration with the following:

- (a) SCADA System.
- (b) Integrated Bridge Controls System.
- (c) Bridge Operating Sequence.
- (d) Bridge Electrical Installation.
- (e) Ethernet Network.
- (f) Ethernet Switch.
- (g) Bridge Control CCTV system.
- (h) Public Address systems.
- (i) Radio Network systems.
- (j) Fiber Optic Interconnect Cabinet.
- (k) Fiber Optic Cable, Single Mode.
- (l) Fiber Optic Cable, Multi Mode.
- (m) Aerial Cables.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Concurrent with submission of the bid, each bidder shall identify the intended Systems Integrator, and submit a sufficient previous experience log to verify that the Systems Integrator meets the requirements listed herein. The log shall include previous project references, including names of companies/organizations, and contact persons with phone numbers. Systems Integrators unable to demonstrate compliance with the above requirements will not be accepted, which may be deemed cause for disqualification and rejection of the bid.

Installation.

- (a) The Systems Integrator shall provide supervisory assistance as required for all construction activities to ensure the correct installation of equipment and ancillary components.
- (b) The Systems Integrator shall be responsible for installing all rack mounted SCADA, CCTV, Ethernet network, radio network, and public address system equipment as well as workstation computers, monitors, and accessories.
- (c) Systems Integrator shall supervise, assist with, and/or install additional equipment as described elsewhere in these Special Provisions.
- (d) The Systems Integrator shall be responsible for coordination with the separate IDOT contract to install fiber optic cabling between bridges.

Shop Testing.

- (a) Coordinate and perform shop testing of SCADA system and other systems as described elsewhere in these Special Provisions.

Field Testing. The Systems Integrator shall provide qualified factory trained personnel for field testing and system startup activities.

- (a) The Systems Integrator shall develop a specific plan for the testing and startup of new equipment at each bridge location and at the IDOT bridge office when the corresponding bridge is added to the SCADA system.
- (b) Perform testing of all Ethernet Networks including fiber optic network and radio network connections to the bridge office building and to all bridges.
- (c) Perform field testing of SCADA system and Integrated Bridge Control Systems.
- (d) Perform field testing of CCTV and Public Address Systems.
- (e) The Systems Integrator shall correct or rectify any deficiencies that are noted during field testing at no additional cost to the Department.

Basis of Payment. Payment will be made at the lump sum price for SYSTEMS INTEGRATION.

LAPTOP COMPUTER

Description. This work shall consist of providing, configuring, and testing a laptop computer for use in performing PLC program and related programming maintenance of bridge control systems. Provide all necessary software, cables, and interface modules for programming the installed PLC's. This work shall be according to the following:

General. The laptop computer shall meet the following requirements:

- (a) The laptop computer shall be semi-ruggedized type (moisture, dust, vibration, and drop-shock resistant; designed using MIL-STD-810F test procedures).
- (b) The laptop computer shall meet the following minimum requirements, unless specified otherwise by the PLC manufacturer: 2.0GHz (or higher) Intel Core processor, 8Gb system RAM, minimum 128Gb shock-mounted solid state hard drive, built in touchpad, CD-RW / DVD-R, 14" HD LCD display, Windows 10 Professional operating system, and Microsoft Office software. Ports shall include (2) USB 2.0, (2) USB 3.0, 10/100/1000 Ethernet, DB9 serial, and integrated 802.11a/b/g/n/ac wireless. The laptop shall include a 120-volt AC power adaptor and protective carry bag.
- (c) PLC Programming Software capabilities shall include both on-line and off-line full programming capability with the ability to upload and download PLC programs. The software and any required interface module shall be furnished by the PLC manufacturer, and shall include extensive documentation. Provide all required cables.
- (d) All necessary PLC Programming Software accessory programs shall be installed including communications drivers and programming documentation editors.
- (e) Provide and install non-microsoft application software – JAVA as required to allow the laptop to function as a SCADA software client.
- (f) Provide and install vector-controlled drive and DC drive parameter configuration and backup software.
- (g) A licensed copy of hard drive imaging software, Norton Ghost or equivalent, shall be provided and installed on the laptop. A hard drive image file for the configured laptop shall be provided on compact disks. A spare cloned hard drive shall also be provided and tested.
- (h) Provide all original manuals, software packages with license information, and original packaging materials. All software shall be licensed to the Owner.

Submittals. Submit catalog cuts and product data for laptop computer, PLC programming software, HMI development software, and accessories.

Basis of Payment. Payment for the laptop computer will be made at the contract unit price for each LAPTOP COMPUTER including all operating system and support software, programming software, documentation, accessories, and labor as detailed in the contract documents for this bid item.

VECTOR-CONTROLLED MOTOR DRIVES

Description. This work shall consist of providing, programming, and testing vector-controlled motor drives according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. The work shall meet the following requirements:

- (a) The Control Systems Vendor is alerted to the fact that space in existing electrical rooms is limited. Custom enclosure sizes and other creative solutions may be required to install new enclosures while providing working clearances as required by the NEC.
- (b) The complete drive package shall be assembled and configured by the drive manufacturer or the Control Systems Vendor. The drives, contactors, drive enclosures, dynamic braking modules and resistors, encoders, and all related components shall be furnished as a complete integrated and functional package for use with existing motors.
- (c) Drives shall include circuit protection, line side contactors, line and load side reactors, control transformer, relays, terminal blocks, and any other devices and accessories necessary to complete the drive assembly.
- (d) Drive enclosure door shall include pilot lights and control switches as indicated on the Plans.
- (e) The Contractor is alerted to the fact that the Jackson Street, Cass Street, Jefferson Street, and McDonough Street bridges have utility power that is a three phase 480VAC grounded B phase type service. Flux Vector AC drives shall be compatible with this type of electrical service.

Flux Vector AC Drives.

- (a) Flux vector drives shall be variable frequency AC drives featuring true field oriented flux vector control. Drives shall be suitable for operation on 480 volts AC, 60 hertz, three-phase systems, with ratings as indicated on the plan. All Drives shall be rated for heavy duty loads. Drives shall provide true closed loop (encoder feedback) flux vector speed and torque control.
- (b) Drives shall utilize microprocessor based control. They shall include an operator interface, with backlit LCD display and keypad, usable for drive status monitoring and entry of all drive parameters. The operator interface shall include all necessary cables and hardware required to mount it on the enclosure door.

- (c) All parameters shall be viewable and adjustable through the drive operator interface and with the drive manufacturer's software package. Parameters shall be stored in nonvolatile memory.
- (d) The drives shall be configured for operation as depicted on the Plans. Drive control shall be performed with dry contact inputs and outputs with the bridge PLC control system.
- (e) The drives shall have programmable analog outputs to allow PLC monitoring of speed and torque as shown on the Plans.
- (f) The drives shall include a built-in communications capability, including Ethernet with common Industrial Protocol. The drives shall have provisions to allow the bridge control system PLC to monitor operation data and alarm messages. All drive control shall be performed with hardwired dry contact inputs and outputs. The Ethernet communications connection shall be used for monitoring only.
- (g) The drives shall provide for at least three (3) preset speeds selectable via external discrete control inputs, independently adjustable acceleration and deceleration times, and two (2) independently adjustable torque limits selectable via external discrete control inputs to allow for a reduced bridge seating torque.
- (h) The drives shall provide active electronic load sharing function that allows two or more mechanically coupled motors to be controlled in a master/slave torque control fashion.
- (i) The drives shall permit a stalled motor operation for up to 10 seconds while producing positive reduced torque (up to 50% FLT) for bridge seating without faulting.
- (j) The drives shall provide an internal, adjustable electronic thermal overload relay for motor overload protection.
- (k) Drives will be controlling rewound AC wound-rotor induction motors which will have had their slip rings internally shorted to eliminate external rotor resistors and effectively perform as squirrel cage motors. Contractor shall coordinate drives manufacturer with motor rewind vendor for any special requirements and exchange of data involving the refurbishment of the wound rotor motors to ensure compatible motor/drive systems.
- (l) Other requirements are as follows:
 - (1) UL Listed.
 - (2) 0° to 40°C operating temperature without derating.
 - (3) 5-95% relative humidity operation range, non-condensing.
 - (4) Speed regulation of 0.01% or better with encoder feedback.
 - (5) Adjustable carrier frequency with a minimum of four settings.
 - (6) Safe torque off function, to safety category 3, SIL CL2 or higher.
 - (7) 150% rated motor full load torque for 60 seconds.

- (m) Provide the drive manufacturer's software package and necessary programming cables for the configuration, backup, and restoration of drive parameters. The software package shall be installed on the laptop computer and shall be licensed to the Department.

Drive Enclosure.

- (a) The drive enclosure shall be a heavy duty, free standing NEMA 12 industrial control enclosure constructed with a minimum of 12 gauge steel with a gray powder coated finish. Due to space constraints in existing control houses, custom sized enclosures may be required.
- (b) The enclosure shall have a flange mounted disconnect switch for incoming power. The disconnect operator shall be mechanically interlocked with the cabinet door and lockable in the off position.
- (c) For installations utilizing tapped power connections, provide circuit breaker protection as required by the NEC.
- (d) Provide high speed current limiting fuses as recommended by the drive manufacturer.
- (e) Provide an enclosure 120VAC utility receptacle and door activated internal LED cabinet light.
- (f) Provide a control power transformer mounted and wired inside the enclosure. The control power transformer shall be sized as required by the drive and enclosure components.
- (g) The enclosure shall have a cooling fan/filter kit and an anti-condensation heater. A thermostat controller shall be used to control the cooling fan and heater operation. Both devices shall be interlocked so that they cannot operate at the same time, and there shall be a small temperature dead-band where neither device shall operate.
- (h) Provide and install power distribution blocks for drive enclosures as shown on the Plans. Distribution blocks shall be sized as required per feed and tap conductor sizes. Power distribution block shall be UL listed, finger safe, and rated for use with copper conductors.
- (i) The drive shall be provided with line and load reactors sized as required by the drive manufacturer. The line and load reactors shall be specifically designed for electronic motor drive service.
- (j) Contactors shall be NEMA rated, with current and voltage ratings as required by loads served. Provide terminal covers as required to provide a finger-safe rating.

- (k) All point-to-point wiring internal for the drive enclosure shall be stranded copper. Control wire shall be a minimum of 14 AWG. Power wire shall be sized as required.
- (l) All conductors shall be labeled using self sealing, adhesive type wire labels with machine printed permanent lettering at every terminal or connection. Conductor identification numbers shall be coordinated for consistency and accuracy with conductor numbers on the Contractor's approved wiring diagrams and shop drawings.
- (m) Install plastic wire duct to contain and organize internal control wiring.
- (n) Pushbuttons, selector switches, indicator lights, relays, terminal blocks, DC power supplies, legend plates, device labels, and related devices shall be as described in the Integrated Bridge Controls System Special Provisions.

Braking Resistors.

- (a) For each drive, provide appropriately sized braking resistors. Resistors shall be sized to provide a braking torque of at least 150 percent rated motor full load torque.
- (b) Resistors shall be sized for a duty cycle consisting of 30 seconds on at 150 percent, then four and one-half minutes off.
- (c) Resistors shall be edge-wound stainless steel, mounted in ventilated enclosures. Openings shall be screened or otherwise protected to prevent entry of small rodents. All hardware shall be stainless steel or similarly corrosion resistant.
- (d) Where shown on the Plans or where approved by the Engineer, resistors shall be permitted to be installed in outdoor locations. For resistors installed in outdoor locations, enclosures shall be suitably rated for outdoor installation (NEMA 3R), shall be constructed from stainless steel, and shall include rain hoods.
- (e) Resistors shall be wired to terminal blocks with high temperature silicone or Teflon wire rated for 150 degrees Celsius or higher.
- (f) Resistors shall include a built-in over-temperature sensor which shall be interconnected to the drive to initiate alarm and drive stop in the event of a resistor over-temperature condition.

Encoders.

- (a) Encoders shall be coupled to each existing main drive motor to provide feedback for vector-controlled motor drives.
- (b) Encoders shall be severe mill duty, magnetic, incremental type. Encoders shall be compatible with vector-controlled motor drives. Other requirements are as follows:
 - (1) NEMA 4, IP66 rated.
 - (2) Heavy duty bearings, 5/8" shaft.
 - (3) -40° to 80°C operating temperature.
 - (4) Minimum resolution of 1024 pulses/revolution.
 - (5) 5-24 VDC operating voltage.
 - (6) Dual encoder modules, with sealed industrial connectors.
 - (7) High output line drivers rated for cable lengths up to 1,000 feet.
- (c) Low capacitance double shielded cable shall be used with the encoders, suitable for 1,000 foot circuit length with the encoders selected, installed as one continuous run without splices.
- (d) Flexible couplings shall be provided for each encoder with requirements as follows:
 - (1) High torsional stiffness, high torque, double disk, clamp style.
 - (2) Zero backlash.
 - (3) Maintenance free.
 - (4) Torque rated as required for encoder.
 - (5) Stainless steel or high strength aluminum construction.
 - (6) Rated for angular misalignment 2°.
 - (7) Provide bores and keyways as required.

Coordination. Coordinate with the following:

- (a) Bridge Electrical Installation.
- (b) Integrated Bridge Controls System.
- (c) Systems Integration.
- (d) Laptop Computer.
- (e) Main Span Drive Motors.

Spare Parts.

- (a) Provide the following spare parts:
 - (1) Drive current limiting fuses – six.
 - (2) Fuses – six of each type and size used.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of drive, encoder, braking resistor, and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes. Submit specific drive information detailing how load sharing and reduced torque mode is implemented.
- (b) Submit shop drawings for proposed drive cabinet sizes. Provide dimensioned plan and elevation drawings showing proposed cabinet locations in the bridge control house.
- (c) Submit calculations verifying braking resistor sizing and selection.
- (d) Submit manufacturer's installation and operation manuals for all drive components for inclusion in Bridge Operation and Maintenance Manuals.
- (e) Submit a complete listing of drive programmable parameters showing the proposed setting(s) for each. Where necessary, provide commentary to explain purpose of settings.
- (f) Backup Files – Upon completion and acceptance of the Project, provide electronic backup files of drive parameters.
 - (1) Backup files shall be provided on compact disc format or by other media as approved by the Engineer. Provide five copies of all backup files.
 - (2) Provide backup files in a format suitable for downloading with drive manufacturer's software.
 - (3) Provide a listing of all drive parameters in PDF format. The listing shall include identification number/tag of parameter, parameter setting, and applicable units.
 - (4) Provide configured memory card backup of drive parameters when available from the drive manufacturer.
- (g) A list of all passwords and their associated use shall be provided.

Shop Testing.

- (a) Drives shall be tested as part of the corresponding integrated bridge controls system shop test.
- (b) The operation of drives shall be shop tested using small motors.

Installation.

- (a) The Control Systems Vendor shall provide supervisory assistance in the installation of drive equipment to ensure correct installation, maximum reliability, and ease of maintenance.

Field Testing.

- (a) The Control Systems Vendor shall acquire the services of the drive manufacturer's field services engineer/technician for commissioning and startup of the drives.
- (b) The field services engineer/technician shall thoroughly evaluate all power and control wiring prior to the first application of power to the drives and correct any errors found. The field services engineer/technician shall make any final adjustments as may be necessary for proper and reliable operation, and as may be directed by the Engineer.
- (c) The field services engineer/technician shall adjust the drive parameters as necessary for use with existing motors.
- (d) The Control Systems Vendor's field services engineer/technician shall be properly trained, equipped, and authorized to make changes and modifications to drive programming on site as required without contacting the Control Systems Vendor's offices or supervisory personnel for prior authorization for such changes.
- (e) Verify proper alignment and free motion of encoders under operating conditions.

Training.

- (a) Provide training as required by Integrated Bridge Controls System Special Provision Section.

Basis of Payment. This work will be paid for at the contract unit price per each for VECTOR-CONTROLLED MOTOR DRIVES.

DC DRIVE SYSTEM

Description. This work shall consist of providing, programming, and testing DC (direct current) motor drives and switching controls according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. The DC drive system for the Ruby Street Bridge shall consist of three drives and switching controls as shown on the Plans. The work shall meet the following requirements:

- (a) The Control Systems Vendor is alerted to the fact that space in existing electrical rooms is limited. Custom enclosure sizes and other creative solutions may be required to install new enclosures while providing working clearances as required by the NEC.
- (b) The complete DC drive system package shall be assembled and configured by the drive manufacturer or the Control Systems Vendor. The drives, contactors, drive enclosures, and all related components shall be furnished as a complete integrated and functional package for use with existing motors.
- (c) Drives shall include circuit protection, contactors, a control transformer, relays, terminal blocks, and any other devices and accessories necessary to complete the drive assembly.
- (d) Each drive enclosure door shall include pilot lights and control switches as indicated on the Plans.
- (e) The Contractor is alerted to the fact that the Ruby Street utility power is a three phase 480VAC grounded B phase type service. DC drives shall be compatible with this type electrical service.

DC Drive.

- (a) DC drives shall utilize digital microprocessor based control. They shall include an operator interface, with backlit LCD display and keypad, usable for drive status monitoring and entry of all drive parameters. The operator interface shall include all necessary cables and hardware required to mount it on the enclosure door.
- (b) All parameters shall be viewable and adjustable through the drive operator interface and with the drive manufacturer's software package. Parameters shall be stored in nonvolatile memory.
- (c) The drive shall be configured for operation as depicted on the Plans. Drive control shall be performed with dry contact inputs and outputs with the bridge PLC control system.
- (d) The drive shall have programmable analog outputs to allow PLC monitoring of speed and torque as shown on the Plans.

- (e) The drive shall include a built-in communications capability including Ethernet with common Industrial Protocol. The drive shall have provisions to allow the bridge control system PLC to monitor operation data and alarm messages. All drive control shall be performed with hardwired dry contact inputs and outputs. The Ethernet communications connection shall be used for monitoring only.
- (f) Drives shall provide for at least three (3) preset speeds selectable via external discrete control inputs, independently adjustable acceleration and deceleration times, and two (2) independently adjustable torque limits selectable via external discrete control inputs to allow for a reduced bridge seating torque.
- (g) The drive shall provide internal, adjustable electronic thermal overload relay for motor overload protection.
- (h) Other requirements are as follows:
 - (1) UL Listed.
 - (2) 0° to 40°C operating temperature without derating.
 - (3) 5-95% relative humidity operation range, non-condensing.
 - (4) 150% motor full load torque for 60 seconds.
- (i) Provide drive manufacturer's software package and necessary programming cables for the configuration, backup, and restoration of drive parameters. The software package shall be installed on the laptop computer and shall be licensed to the Department.

Drives and Switching Enclosures.

- (a) Enclosures shall be heavy duty, free standing NEMA 12 industrial control enclosure constructed with a minimum of 12 gauge steel with a gray powder coated finish. Due to space constraints in existing control houses, custom sized enclosures may be required.
- (b) Enclosures shall have a flange mounted disconnect switch for incoming power. The disconnect operator shall be mechanically interlocked with the cabinet door and lockable in the off position.
- (c) Provide circuit breaker and/or fuse protection as recommended by the drive manufacturer.
- (d) Provide an enclosure 120VAC utility receptacle and door activated internal cabinet light.
- (e) Provide a control power transformer mounted and wired inside the enclosure. The control power transformer shall be sized as required by the drive and enclosure components.

- (f) The enclosure shall have a cooling fan/filter kit and an anti-condensation heater. A thermostat controller shall be used to control the cooling fan and heater operation. Both devices shall be interlocked so that they cannot operate at the same time, and there shall be a small temperature dead-band where neither device shall operate.
- (g) Contactors shall be NEMA type, with current and voltage ratings as required by loads served. Provide terminal covers as required to provide a finger-safe rating.
- (h) Drives shall be provided with line reactors sized as required by the drive manufacturer. Line reactors shall be specifically designed for electronic motor drive service.
- (i) All point-to-point wiring internal for the drive cabinets shall be stranded copper. Control wire shall be a minimum of 14 AWG. Power wire shall be sized as required.
- (j) All conductors shall be labeled using self sealing, adhesive type wire labels with machine printed permanent lettering at every terminal or connection. Conductor identification numbers shall be coordinated for consistency and accuracy with conductor numbers on the Contractor's approved wiring diagrams and shop drawings.
- (k) Install plastic wire duct to contain and organize internal control wiring.
- (l) Pushbuttons, selector switches, indicator lights, relays, terminal blocks, DC power supplies, legend plates, device labels, and related devices shall be as described in the Integrated Bridge Controls System Special Provisions.

Coordination. Coordinate with the following:

- (a) Bridge Electrical Installation.
- (b) Integrated Bridge Controls System.
- (c) Systems Integration.
- (d) Laptop Computer.
- (e) Main Span Drive Motors.

Spare Parts.

- (a) Provide the following spare parts:
 - (1) Fuses – six of each type and size used.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of drive and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (b) Submit shop drawings for proposed drive and switching cabinet sizes. Provide dimensioned plan and elevation drawings showing proposed cabinet locations in bridge control house.
- (c) Submit the manufacturer's installation and operation manuals for all drive components for inclusion in the Bridge Operation and Maintenance Manuals.
- (d) Submit a complete listing of drive programmable parameters showing the proposed setting(s) for each. Where necessary, provide commentary to explain purpose of settings.
- (e) Backup Files – Upon completion and acceptance of the Project, provide electronic backup files of drive parameters.
 - (1) Backup files shall be provided in compact disc format or by other media as approved by the Engineer. Provide five copies of all backup files.
 - (2) Provide backup files in a format suitable for downloading with drive manufacturer's software.
 - (3) Provide a listing of all drive parameters in PDF format. The listing shall include identification numbers/tag of the parameters, parameter settings, and applicable units.
 - (4) Provide configured memory card backup of drive parameters when available from the drive manufacturer.
- (f) A list of all passwords and their associated use shall be provided.

Shop Testing.

- (a) Drives shall be tested as part of the corresponding integrated bridge controls system shop test.
- (b) The operation of drives shall be shop tested using small DC motors.

Installation.

- (a) The Control Systems Vendor shall provide supervisory assistance in the installation of drive equipment to ensure correct installation, maximum reliability, and ease of maintenance.
- (b) Prior to the removal of existing drive systems, verify DC polarity, and mark the rotation direction of all drive motors.
- (c) Drive enclosures shall be installed to provide working clearances as required by the NEC.

Field Testing.

- (a) The Control Systems Vendor shall acquire the services of the drive manufacturer's field services engineer/technician for commissioning and startup of the drives.
- (b) The field services engineer/ technician shall thoroughly evaluate all power and control wiring prior to the first application of power to the drives and correct any errors found. The field services engineer/technician shall make any final adjustments as may be necessary for proper and reliable operation, and as may be directed by the Engineer.
- (c) The field services engineer/technician shall adjust the drive parameters as necessary for use with existing motors.
- (d) The Control Systems Vendor's field services engineer/technician shall be properly trained, equipped, and authorized to make changes and modifications to drive programming on site as required without contacting the Control Systems Vendor's offices or supervisory personnel for prior authorization for such changes.

Training.

- (a) Provide training as required by the Integrated Bridge Controls System Special Provision Section.

Basis of Payment. This work will be paid for at the contract unit price per each for DC DRIVE SYSTEM.

MAIN SPAN DRIVE MOTORS

Description. This work shall consist of removing, transporting, refurbishing, testing, and reinstalling existing main span drive motors. This work shall be according to these Special Provisions and the following:

General. The work shall meet the following requirements:

- (a) The motor repair vendor shall provide engineering design services to ensure refurbished motors provide starting torque, NEMA design classification, and operating characteristics comparable with those with existing motor controls and to ensure that motors are compatible with new drive systems as described elsewhere in these Special Provisions.
- (b) The motor repair vendor shall be EASA certified.
- (c) All motors for a particular bridge shall be repaired by the same motor repair vendor. To the extent possible, motors for a given bridge shall all be repaired at the same time as a group.
- (d) Measure and record baseline motor run currents and operating speed with existing motor control system prior to removal.
- (e) Carefully document and photograph existing motor construction and windings before disassembly. Perform electrical tests to document existing electrical parameters including insulation resistance to ground and winding resistances.
- (f) The motor housings shall be thoroughly cleaned, degreased, and any loose point and corrosion shall be removed. Prior to painting, all shafts, nametags, and lubrication ports shall be masked. The motor housings shall be primed and painted with premium, high performance epoxy paint system rated for outdoor and marine environment applications.
- (g) The motor stators and rotors shall be rewound. All windings shall be replaced to provide the same number of turns as the existing windings. Dynamometer test all refurbished motors to verify and document speed/torque and current characteristics
- (h) Replace motor lead wires with flexible stranded copper conductors, with insulation type meeting or exceeding the motor's temperature and voltage class.
- (i) Replace the hardware and gasket for the motor terminal box.
- (j) Ensure that the original motor nameplate is cleaned and restored to preserve original motor data to the extent possible. Provide and install a new permanent nameplate with the motor repair vendor's name, shop order number, date, and applicable revised motor data.

- (k) Replace all gaskets and seals.
- (l) Replace all bearing assemblies in kind with the same type as originally used.
- (m) Repair all worn parts including shaft surfaces, keyways, and bearing journals.
- (n) Dynamically balance rotor assemblies with a half key in the keyway(s) per ISO 1940-1, Grade G1.0 tolerance for two pole rotors / Grade 2.5 for rotors with 4 or more poles.
- (o) AC motors shall be refurbished for use with flux vector type AC drives as described elsewhere in these Special Provisions. Additional requirements for AC motors are as follows:
 - (1) Magnet wire shall be rated for inverter duty, minimum class F insulation (or Class H if permitted by motor geometry).
 - (2) Wound rotor type motors shall be re-wound to provide the slip circuit necessary to reproduce the equivalent NEMA Design type starting torque characteristics of the original motor.
 - (3) Wound rotor slip rings shall be shorted to eliminate need for external rotor resistors. Brush holder assemblies shall be removed. Shorting means shall be via brazing three copper bars spanning all three slip rings, spaced 120 degrees apart circumferentially. Bars shall be sized to carry the rated rotor current. Bars shall also be attached with bronze machine screws sized for strength of attachment at running speeds. Other alternative methods may be submitted for approval.
- (p) DC motors shall be refurbished for use with the DC drive systems as described elsewhere in these Special Provisions. Additional requirements for DC motors are as follows:
 - (1) Magnet wire shall be rated for inverter duty, minimum class F insulation (class H if permitted by motor geometry).
 - (2) Clean and check brush holders, and replace any damaged or weak springs.
 - (3) Replace all brushes with new brushes of the same size, type, and hardness as originally installed. Adjust and fit the brushes per ANSI/EASA standards.
 - (4) Clean and renew commutator per ANSI/EASA standards.
- (q) Windings shall be vacuum pressure impregnated (VPI) then baked for a minimum of one cycle in accordance with resin manufacturer's recommendations. Follow up with a second VPI/bake cycle or an immersion/bake cycle.

Existing Motor Information. The following motor information is provided for estimating purposes. All motor nameplate information shall be field verified by the Contractor.

- (a) Ruby Street has a total of four (4) DC motors, two for each leaf. This is the only bridge that has DC motors.

Harnischfeger, model M13/Unknown, shunt, 50 horsepower, 850 rpm, 185A/230VDC

- (b) Jackson Street has a total of four (4) motors, two for each leaf - AC wound rotor.

General Electric, model 5 MR 505 A1, 35 horsepower, 580 rpm, 64A/440VAC, Frame 505Z

- (c) Cass Street has a total of four (4) motors, two for each leaf - AC wound rotor.

General Electric, model 94-E-333 G1, 50 horsepower, 575 rpm, 80A/440VAC, Frame 554 2Y

- (d) Jefferson Street has a total of four (4) motors, two for each leaf - AC wound rotor.

General Electric, model 94-E-333 G1, 50 horsepower, 565 rpm, 75A/440VAC, Frame 554 2Y

- (e) McDonough Street has a total of four (4) motors, two for each leaf - AC wound rotor.

General Electric, model 5 MR 445 BB 1, 40 horsepower, 870 rpm, 66.5A/440VAC, Frame 445Z

- (f) Brandon Road has a total of two (2) motors, one for each leaf - AC wound rotor.

P&H, model 444M 1206 A / HEW-444X, 30 horsepower, 575 rpm, 45A/460VAC, Frame 444

Coordination. Coordinate with the following:

- (a) Bridge Electrical Installation.
(b) Integrated Bridge Controls System.
(c) Vector Controlled Motor Drives.
(d) DC Drive System.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Motor repair vendor's experience and qualifications including previous project references, previous experience with wound rotor and DC motors, engineering capabilities, typical repair turn-around times, testing equipment capabilities, certifications, and contact persons with phone numbers.
- (b) Product data for all replacement components and materials.
- (c) Paint and primer system product data.
- (d) Repair procedures for mechanical repairs including metal flame spraying, welding, and sleeving of worn parts.
- (e) Lubrication and maintenance information.
- (f) Motor removal, installation, and alignment procedures.
- (g) Complete test data for each motor.

Shop Testing.

- (a) Each refurbished motor shall be shop tested. Test methods and parameters shall conform to ANSI/EASA AR100-2015 standards.
- (b) The Engineer and the Department shall be permitted to witness and inspect motor repair work and testing at any time. Advance notice of two weeks shall be given to the Department for testing schedule.
- (c) Perform phase balance/winding surge comparison testing before impregnation.
- (d) Test insulation resistance to ground for windings and applicable accessories. Provide raw data at ambient temperature and 40 degrees Celsius corrected data.
- (e) Perform high-potential testing of winding insulation resistance.
- (f) Perform full voltage, no load run testing of the motor. Run the motor until bearing temperatures stabilize, measure and record all applicable voltages, currents, vibration parameters, operating speed, and temperatures.
- (g) After successfully completing the above testing, each motor shall be shop tested with a representative drive corresponding with section Vector Controlled Motor Drives or DC Drive System to ensure compatibility and to establish the correct drive parameters for the motor.

Installation.

- (a) The Contractor shall be responsible for providing all equipment and labor required to remove, transport, and reinstall motors and for coordinating the repair of motors with the overall construction schedule. It shall be the Contractor's responsibility to temporarily disassemble any existing machinery houses as required to allow for the removal of motors and for the in-kind restoration of the machinery houses after motors have been reinstalled.
- (b) Verify and document the rotation direction of each motor prior to removal.
- (c) Existing motor couplings shall be refurbished and repaired as required for reuse. Provide and install new keys to provide fits meeting AASHTO requirements.
- (d) Installation and adjustment of motors shall be performed by certified millwrights experienced in shafts and shaft couplings alignment. Motors shall be accurately aligned to provide alignment within the misalignment tolerance of motor couplings.
- (e) Shims shall be ASTM A240 or A666, type 316, neatly trimmed to the dimensions of the assembled parts and drilled for all bolts that pass through the shims.
- (f) Verify refurbished motor rotation direction prior to coupling the motor to the machinery.

Field Testing.

- (a) Test and verify correct operation of refurbished motors with bridge machinery and new drive systems.
- (b) Measure and record the refurbished motor run currents and operating speed. Ensure that testing equipment is capable of correctly measuring data from variable frequency drives of the type installed.

Warranty. The motor repair vendor shall supply a warranty for each motor for a period of one year from the date of shipment.

Basis of Payment. This work will be paid for at the contract unit price per each for MAIN SPAN DRIVE MOTORS.

RADIO TRANSCEIVER

Description. This work shall consist of providing and installing marine radio equipment according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. VHF radio transceiver for shore-to-vessel communications. The work shall meet the following requirements:

- (a) Provide and install a fixed mount type VHF FM transceiver designed for use in the frequency range of 156.025 to 163.275MHz. The radio transceiver shall comply with the FCC (Federal Communication Commission) requirements that regulate the Maritime Radio Service.
- (b) Other requirements are as follows:
 - (1) Dual power, selectable to one (1) or 25 watts output.
 - (2) -20° to 60°C operating temperature.
 - (3) Microphone/Speaker with auxiliary controls.
 - (4) Antenna socket.
 - (5) 120VAC power supply.
 - (6) Minimum 3 year warranty.

Coordination. Coordinate with the following:

- (a) Bridge Electrical Installation.
- (b) Radio Antenna.
- (c) Radio Network Systems.
- (d) Workstation Furniture, IDOT District 1.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of radio and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

Installation.

- (a) For bridge installations, coordinate installation with the new bridge control console.
- (b) Perform the setup/programming of the radio as required to accommodate requirements of local marine traffic and USCG.
- (c) Provide a laminated hard-copy listing of programmed channel assignments.

Field Testing.

- (a) Test and verify the correct operation of radio equipment.

Basis of Payment. This work will be paid for at the contract unit price per each for RADIO TRANSCEIVER.

RADIO ANTENNA

Description. This work shall consist of providing and installing a marine radio antenna according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. Marine VHF radio base station type antenna shall be rated for use with radio transceivers as defined elsewhere in these Special Provisions. The work shall meet the following requirements:

- (a) Provide an exterior mounting bracket in the location required for clear communications with marine traffic.
- (b) Other requirements are as follows:
 - (1) Weatherproof and corrosion resistant construction.
 - (2) 156-163 MHz frequency range.
 - (3) Internally supported copper alloy radiating elements.
 - (4) White UV inhibited fiberglass radome.
 - (5) Wind rated for 100 MPH minimum.
 - (6) Type N female connector.

Coordination. Coordinate with the following:

- (a) Bridge Electrical Installation.
- (b) Radio Transceiver.
- (c) Radio Network Systems.
- (d) Electrical Work Bridge Office.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of radio and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (b) Provide shop drawings with the mounting location, mounting details/hardware, and cabling.

Installation.

- (a) Provide and install coax cable and connectors as recommended by equipment manufacturer. Cable installed in outside locations shall be appropriately rated for outdoor installation.
- (b) Provide and install all necessary brackets and installation hardware.
- (c) Provide and install equipment grounding.
- (d) Coordinate antenna locations with antennas used for radio network systems. Provide adequate clearances, plan and elevation, between antennas to prevent signal interference.

Field Testing.

- (a) Test and verify correct operation of the antenna and cabling with radio equipment.

Basis of Payment. This work will be paid for at the contract unit price per each for RADIO ANTENNA.

BRIDGE CONTROL CCTV SYSTEM

Description. This work shall consist of providing, programming, and testing the bridge control CCTV systems for the Ruby Street Bridge, Jackson Street Bridge, Cass Street Bridge, Jefferson Street Bridge, McDonough Street Bridge, Brandon Road Bridge, and the IDOT Bridge Office Building according to the contract plans and approved shop drawings. This work shall be according to the applicable articles of Section 800, these Special Provisions, and the following:

General. The Bridge Control CCTV system shall meet the following requirements:

- (a) The Bridge Control CCTV System (BCCS) shall be an IP network-based, fully distributed digital video system. The CCTV system will utilize local area networks (LAN) as a transmission medium for video, pan-tilt-zoom camera control, camera configuration, as well as storage of all data.
- (b) The BCCS shall be a fully integrated portion of the SCADA system. The SCADA software shall provide all of the necessary functionality for control of CCTV cameras and for managing the video images produced by the CCTV cameras. The requirements for the software shall be according to Section SCADA System.
- (c) For each of the six movable bridges, a local BCCS system shall provide the ability to view and control all of the cameras associated with that bridge utilizing two ceiling/wall mounted monitors over the bridge's operator console. The local systems shall be configured to operate independently of the IDOT bridge office building SCADA system. Local systems shall provide the following capabilities:
 - (1) Provide user-friendly, intuitive, menu type interface for navigating between screens and for performing control and configuration functions. During normal system operation, the operator should not be required to directly use the computer's operating system.
 - (2) Utilize a PC mouse or similar pointing device in conjunction with on screen controls to perform a majority of user functions. Also, permit the use of a keyboard for advanced and maintenance functions.
 - (3) Display video from any of the bridge's cameras to a specific monitor and/or screen division (single image, split screen, quad screen, etc.), including changing screen division views.
 - (4) Provide the ability to quickly arrange, edit, name, save, and recall screen division layouts.
 - (5) Reset each monitor to its default screen division and camera images.
 - (6) Provide digital zoom controls for fixed lens cameras.
 - (7) Provide pan-tilt-zoom controls for PTZ cameras, including saving and recalling pre-set views.
 - (8) Provide automatic recovery from the loss of power; the system shall automatically boot, start all required software, and display default screen division layouts and images without any operator intervention.

- (9) Allow the user to record an event from any indicated video source.
 - (10) Display network status, camera diagnostics information, camera faults, and system alarms.
 - (11) Provide data logging with time stamps for alarms, user actions, and events.
 - (12) With the appropriate user permission/privilege, view and change individual camera configuration software settings, perform maintenance functions, provide ability to setup/configure new or replacement cameras, and access the operating system.
- (d) Three operator stations at the IDOT bridge office shall provide the ability to view and control all of the cameras for the six movable bridges. Each of the operator stations will have two desktop monitors normally dedicated for viewing cameras as well as shared monitors on a video wall. The IDOT bridge office BCCS system shall provide the following capabilities:
- (1) Within the SCADA system, provide user-friendly, intuitive menu type interface for navigating between screens, and for performing control and configuration functions.
 - (2) Utilize the workstation mouse and keyboard in conjunction with on screen controls to perform user functions.
 - (3) Provide a single virtual workspace at each workstation using all desktop monitors. The user of each workstation shall have the ability to simultaneously control a bridge operation with the SCADA system while being able to view and manipulate the bridge's CCTV cameras.
 - (4) Display video from any of the cameras on the six movable bridges to a specific desktop monitor and/or screen division (single image, split screen, quad screen, etc.), including changing screen division views.
 - (5) Provide menu controls to allow a workstation user to select only one bridge's camera images for display on that workstation's desktop monitors. This is intended to allow an operator to quickly view the cameras on the bridge that is being operated through the SCADA system.
 - (6) Provide the ability to quickly arrange, edit, name, save, and recall screen division layouts.
 - (7) Provide digital zoom controls for all fixed lens cameras.
 - (8) Provide pan-tilt-zoom controls for PTZ cameras, including saving and recalling pre-set views.
 - (9) Allow the user to record an event from any indicated video source.
 - (10) Display camera diagnostics information, camera faults, and system alarms.
 - (11) With the appropriate user permission/privilege, view and change individual camera configuration software settings, and perform maintenance functions.
 - (12) Provide network access to the video wall controller software allowing each user to select what video is displayed, manipulate screen division, save screen arrangements, and recall previously saved arrangements.
 - (13) Provide contention management between multiple users attempting to manipulate an individual PTZ camera or the video wall display.

- (e) Codes and Standards. Work shall be performed in accordance with the applicable national and local codes or standards current at the commencement of installation. Where more than one code or regulation is applicable, the more stringent regulation shall apply. The following list summarizes applicable standards:
- (1) National Electrical Safety Code, current edition.
 - (2) National Fire Protection Association National Fire Codes, current edition.
 - (3) EIA/TIA – 568: Commercial Building Telecommunications Wiring Standard.
 - (4) EIA/TIA – 569: Commercial Building Standard for Telecommunications Pathways and Spaces.
 - (5) EIA/TIA – 606: Administrative Standards for the Telecommunications Infrastructure of Commercial Buildings.
 - (6) IEEE, RS 170 Variable Standard.
 - (7) NTSC
 - (8) IEEE 802.3 digital data network standard.
 - (9) Premises cabling standard EIT/TIA568A.
 - (10) Member, MPEG-4 Industry Forum
 - (11) Member, Universal Plug and Play (UPnP) Forum
 - (12) Member, Universal Serial Bus (USB) Implementers Forum
 - (13) Contributor, International Standards for Organization/Electrotechnical Commission (ISO/IEC) Joint Technical Committee 1 (JTC1), “Information Technology” Subcommittee 29, Working Group 11
 - (14) Compliance, ISO/IEC 14496 standard (also known as MPEG-4)
 - (15) Compliance, International Telecommunication Union (ITU) Recommendation G.711, “Pulse Code Modulation (PCM) of Voice Frequencies”
- (f) The Systems Integrator shall have overall system responsibility and the responsibility for providing a complete and fully operational system.

Video Management System Capabilities. The following describes the general architecture and requirements for the BCCS:

- (a) The BCCS shall be built upon open, industry standards and facilitate integration with IT infrastructures and other digital and analog systems.
- (b) The BCCS shall be compliant with NTCIP (National Transportation Communications for Intelligent Transportation System Protocol) standards.
- (c) The BCCS shall provide support for IP cameras from multiple manufacturers.
- (d) The BCCS shall support standard resolution and megapixel IP cameras.
- (e) The system shall be fully distributed in nature so that each system device can remain operational in a majority of modes without dependence on other devices.

- (f) Multiple users shall be able to simultaneously view the same camera view or sequence. The system shall utilize multicast streaming video to allow multiple users to view the same video stream, though not necessarily synchronized with each other, without affecting the bandwidth of the network.
- (g) The system shall provide video decoding functionality to decode MPEG-4 and H.264 baseline, main, and high profile encoded video streams. Each workstation shall have the ability to drive a minimum of two high-resolution monitors for displaying the video from multiple cameras. Permitted screen divisions on each monitor shall include:
 - (1) 1 image (1 x 1),
 - (2) 4 images (2 x 2),
 - (3) 6 images (3 x 2),
 - (4) 9 images (3 x 3).
- (h) The system shall be capable of customizing each workstation's display area to suit user preferences. All aspects of the graphical user interface shall be capable of being resized, torn-off and moved to other monitors, or minimized. The system shall allow customizable workspaces to be created and loaded with camera groups to facilitate easy and efficient monitoring.
- (i) All cameras shall be capable of being recorded at their native resolutions, 30 images per second. Workstations shall be capable of saving video and still images in standard video formats, including AVI, MPEG (MP4), BMP, and JPG.

Fixed Camera.

- (a) The network camera shall be NTCIP 1205 compliant over IP, meeting the latest NTCIP requirements.
- (b) The network camera shall combine HD image quality, bandwidth efficient H.264 compression, and IP67 protection.
- (c) The network camera shall include optical zoom, delivering full frame rate HD images over the entire zoom range.
- (d) The network camera shall utilize true day/night technology, removable IR cut filter producing exceptional low light sensitivity down to 0.005 lux.
- (e) The network camera shall provide image stabilization assuring a steady, clear image for installations subject to wind or vibration, allowing existing bridge structures to be used for camera mounting.
- (f) The network camera shall provide multiple video stream capability; two independently configured H.264 streams or an H.264 with MJPEG output.

- (g) The network camera shall provide a full function web server, allowing complete administrative and operator control capabilities. Administrative features shall include configuring network settings, user password assignments, setting video stream properties, configuring camera imaging properties, and assigning camera ID labels.
- (h) The network camera shall support industry standard Power over Ethernet (PoE) IEEE 802.3at/f to supply power to the camera over the network.
- (i) The network camera shall meet or exceed the following design and performance specifications:
 - (1) Camera Specifications:
 - a) Sensor Type: 1/3-inch CCD or CMOS
 - b) Scanning System: Progressive
 - c) Active Resolution: 1920 x 1080
 - d) Frame Rate: 1 to 30 fps
 - e) Camera Type: Day/Night (IR Cut Filter)
 - f) Day/Night Modes: Auto, Color, B/W
 - (2) Lens/Optics:
 - a) Lens Type: Built-in (varifocal) or zoom
 - b) Aperture (f stop): 1.4 -> 4.6 (4.4 to 132mm, 1.6 (9 to 22mm), or 1.2 (3 to 9mm)
 - c) Focus: Autofocus
 - d) Iris: Auto
 - e) Digital Zoom: 2x
 - (3) Image Processing:
 - a) Image Stabilization: Yes
 - b) Dynamic Range Mode: WDR (Wide Dynamic Range)
 - c) Shutter/Integration: 1/2 -> 1/10,000
 - d) S/N Ratio: > 20 db
 - (4) IP Video:
 - a) Streams: Two (2) individually configurable streams
 - b) Codecs: H.264 and MJPEG
 - c) Configurations:
 - i) H.264 + H.264
 - ii) H.264 + MJPEG
 - d) Data Rates: 256 Kbps to 8 Mbps

(5) Video Connections:

- a) RTP/RTSP: Eight (8) H.264, Eight (8) MJPEG
- b) RTSP/Interleave: Eight (8) H.264, Eight (8) MJPEG
- c) RTSP Multicast: Eight (8) H.264, Eight (8) MJPEG
- d) HTTP Multicast: Unlimited, H.264 and MJPEG
- e) HTTP Tunneling: Two (2) H.264, Ten (10) MJPEG
- f) MPEG2 TS: Unlimited, H.264 and MJPEG

(6) Network Interface:

- a) Network Format: Ethernet 802.3 (100BaseT-TX)
- b) Network Protocol: TCP, UDP, IPv4, ICMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, ONVIF Profile S
- c) ONVIF Support: Profile S
- d) Camera Protocols: Cohu T, Profile S, NTCIP 1205
- e) Security: Yes, password protected

(7) Mechanical:

- a) Construction: Powder coated aluminum. External parts corrosion protected with stainless steel fasteners.

(8) Electrical:

- a) Input Voltage: PoE+ 802.3at/f
- b) Power: 10 W

(9) Environmental:

- a) Protection Rating: IP66, Pressurized with Dry Nitrogen
- b) Operating Temp: -40°F to 165°F (-40°C to 74°C) Per NEMA TS2
- c) Humidity: 10-95% non condensing
- d) Shock and Vibration: Per Nema-TS2 para 2.1.10, 2.2.4 or per IEC 60068: 2-6 and 2-27
- e) Corrosion Protection: Per Nema 250-2003, para 5.10

(10) Certifications:

- a) FCC Class A
- b) CE Class A
- c) Compliant with applicable immunity sections
- d) ASTM-B117 Marine

Fixed Camera Enclosure. The fixed camera enclosure shall be a device to protect the fixed CCTV cameras in an outdoor environment. Coordinate enclosure accessory power requirements with available circuits/power for each bridge.

- (a) The fixed camera enclosure shall include a sun shroud.
- (b) The fixed camera enclosure shall include a heater-defroster.
- (c) The fixed camera enclosure shall include a blower kit.
- (d) The fixed camera enclosure shall meet or exceed the following design and performance specifications:
 - (1) Physical Specifications:
 - a) Environment: Indoor/outdoor -10° to 120°F (-23° to 49°C)
 - b) Construction: Extruded and die-cast aluminum
 - c) Finish: Gray polyester powder coat
- (e) Accessories:
 - (1) Blower Kit: Continuous duty, 120 VAC, 4W, 10 cfm @ 60 Hz
 - (2) Heater-Defroster: 120 VAC, 13W
 - (3) Sun Shroud

Pan-Tilt-Zoom (PTZ) Camera.

- (a) The PTZ dome camera shall be NTCIP 1205 compliant over IP, meeting the latest NTCIP requirements.
- (b) The PTZ dome camera shall combine HD image quality, bandwidth efficient H.264 compression, and IP68 pressurized ingress protection.
- (c) The PTZ dome camera shall include 30x optical zoom, delivering full frame rate HD images over the entire zoom range.
- (d) The PTZ dome camera shall utilize true day/night technology, removable IR cut filter to produce exceptional low light sensitivity down to 0.015 lux.
- (e) The PTZ dome camera shall provide image stabilization assuring a steady, clear image for installations subject to wind or vibration, allowing existing bridge structures to be used for camera mounting.
- (f) The PTZ dome camera shall include a defog image processing capability.
- (g) The PTZ dome camera shall include a variable hi-speed pan and tilt drive, with 360° continuous pan and +5° to -85° tilt.

- (h) The network camera shall provide a multiple video stream capability; two independently configured H.264 streams, an H.264 with MJPEG output, or an H.264 with analog output.
- (i) The network camera shall provide a full function web server, allowing complete administrative and operator control capabilities. Administrative features shall include configuring network settings, user password assignments, setting video stream properties, configuring camera imaging properties, and assigning camera ID labels.
- (j) The network camera shall meet or exceed the following design and performance specifications:
 - (1) Camera Specifications:
 - a) Sensor Type: 1/2.8-inch CMOS
 - b) Scanning System: Progressive
 - c) Active Resolution: 1920 x 1080
 - d) Frame Rate: 30 fps
 - e) Camera Type: Day/Night (IR Cut Filter)
 - f) Day/Night Modes: Auto, Color, B/W
 - (2) Lens/Optics:
 - a) Zoom Lens: 30x, 4.4 to 129mm
 - b) Aperture (f stop): 1.6 -> 4.6
 - c) HAFOV: 59.5° to 2.1°
 - (3) Image Processing:
 - a) Image Stabilization: EIS (Electronic Image Stabilization)
 - b) Dynamic Range Mode: WDR > 80dB
 - c) Back Light Comp Mode: On/Off
 - d) Active Noise Filtering/Reduction
 - (4) IP Video:
 - a) Streams: Two (2) individually configurable streams
 - b) Codecs: H.264 and MJPEG
 - c) Frame Rates: 1 to 30

- (5) Dome Drive:
- a) Pan Range: 360° continuous rotation
 - b) Tilt Range: Minimum +5° to -85° unobstructed
 - c) Manual Pan Speed: 0.1° to 40°/second
 - d) Manual Tilt Speed: 0.1° to 30°/second
 - e) Peak Preset Speed: 100°/second
 - f) Repeatability: +/- 0.1°
 - g) Resolution: +/- 0.1°
- (6) Video Connections:
- a) RTP/RTSP: Eight (8) H.264, Eight (8) MJPEG
 - b) RTSP/Interleave: Eight (8) H.264, Eight (8) MJPEG
 - c) RTSP Multicast: Eight (8) H.264, Eight (8) MJPEG
 - d) HTTP Multicast: Unlimited, H.264 and MJPEG
 - e) HTTP Tunneling: Two (2) H.264, Ten (10) MJPEG
 - f) MPEG2 TS: Unlimited, H.264 and MJPEG
- (7) Network Interface:
- a) Network Format: Ethernet 802.3 (100BaseT-TX)
 - b) Network Protocol: TCP, UDP, IPv4, IGMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, ONVIF Profile S, NTCIP 1205 v1.08
 - c) ONVIF Support: Profile S
 - d) Security: Yes, password protected
- (8) Mechanical:
- a) Construction: Powder coated or die-cast aluminum. External parts corrosion protected with stainless steel fasteners.
- (9) Electrical:
- a) Input Voltage: 120 Vac / 24 Vac / PoE++, as required for heater
 - b) Power: As required for heater operation (model dependent)

(10) Environmental:

- a) Protection Rating: IP68, Pressurized with Dry Nitrogen, 3.5 psi
- b) Operating Temp: -30°F to 165°F (-40°C to 74°C) Per NEMA TS2
- c) Water Spray: Per IEC 60529+A1, 1999, Para 14.2.6, Solid water stream delivered through 12.5mm nozzle @ 25 gallons/minute @ 9 ft. for 3 minutes
- d) Humidity: 0-100%
- e) Vibration: Compliant to NEMA TS2 Para 2.1.9, 2.2.3, 2.2.8
- f) Shock: Compliant to NEMA TS2 Para 2.1.10, 2.2.4, 2.2.9
- g) Corrosion Protection: Per NEMA 250-2003, Para 5.10

(11) Certifications:

- a) FCC Class A
- b) ASTM-B117 Marine

Thermal Camera.

- (a) The thermal camera shall be NTCIP 1205 compliant over IP, meeting the latest NTCIP requirements.
- (b) The thermal camera shall offer uncooled VOx 320p30 and 640p30 LWIR FPA detectors and a wide selection of hard carbon coated lenses.
- (c) The thermal camera shall be capable of high quality video in extreme conditions, such as total darkness, smoke, atmospheric haze or dust, rain, light foliage, and fog.
- (d) The thermal camera shall include a variable hi-speed pan and tilt drive, with 360° continuous pan and ±90° tilt movements. Fast positioning speeds of up to 80°/sec shall be capable of 180° movements in less than 3 seconds.
- (e) The thermal camera control functions shall be accomplished over IP or the RS422 serial interface.
- (f) The thermal camera shall provide a multiple video stream capability; two independently configured H.264 streams, an H.264 with MJPEG output, or an H.264 with analog output.
- (g) The thermal camera administrative features shall include configuring network settings, user password assignments, setting video stream properties, configuring camera imaging properties, defining camera positioning presets/tours, and assigning camera ID labels.
- (h) The thermal camera shall be rated for IP67 and IP66 protection, water intrusion, pollutants and corrosives, extreme temperatures, and weather.

(i) The thermal camera shall meet or exceed the following design and performance specifications:

(1) Camera Specifications:

- a) Detector: Uncooled VOx Microbolometer
- b) Image Resolution: 640x480, 320x240
- c) Pixel:
 - i) 17 μ m (640 core)
 - ii) 25 μ m (320 core)
- d) Spectral Band: 7.5-13.5 μ m
- e) Sensitivity(NEdT): <50 mK @ F1.0 w/noise reduction
- f) Time to Image: <60 Seconds
- g) Frame Rate: 30Hz or 7.5Hz
- h) Digital Zoom:
 - i) 2x, 4x, 8x (640 core)
 - ii) 2x, 4x (320 core)
- i) Palettes: 12, (White Hot, Black Hot, 10 Color Palletes)
- j) Image Orientation: Normal, Invert, Revert, Both
- k) Scene Range: -40°F to 320°F (-40°C to 160°C)
- l) Supplemental Offset: Selectable ON or OFF
- m) Detail Enhancement: Adjustable from 1 to 63
- n) Flat Field Correction: External, Manual/Auto (Interval/Temp Change)
- o) Auto Gain:
 - i) Plateau Value: 10 to 1000
 - ii) ITT Mean: 0 to 255
- p) Max AGC: 0 to 255
- q) AGC Presets:
 - i) Default Values
 - ii) Low Scene Contrast
 - iii) Indoors

(2) Lens Specifications:

- a) Lens Type: Athermalized, Hard Carbon Coated
- b) Ingress Protection: IP67
- c) Focus Type: Motorized (Near/Far control, with preset pots)
- d) Lens Options:

i) 35mm, F1.25:

a. Field of View (35mm f/1.2)

- i. 320x240: 13.0° x 9.8°
- ii. 640x480: 17.7° x 13.3°

ii) 60mm, F1.25:

a. Field of View (60mm f/1.25)

- iii. 320x240: 7.6° x 5.7°
- iv. 640x480: 10.4° x 7.8°

iii) 100mm, F1.6:

b. Field of View (100mm f/1.6)

- v. 320x240: 4.6° x 3.4°
- vi. 640x480: 6.2° x 4.7°

(3) Positioner:

- a) Pan Range: 360° continuous rotation
- b) Tilt Range: +90° to -90°
- c) Pan Speed: 0.1° to 80°/second
- d) Tilt Speed: 0.1° to 34°/second
- e) Preset Speed: < 3 seconds for 180° movement
- f) Repeatability: ± 0.25°
- g) Resolution: ± 0.1°
- h) Presets: 64; includes pan, tilt, focus, and preset ID
- i) Tours: 8; includes 32 presets with individual dwell times
- j) Auto Park: Returns to a preset or tour after timer expires, Timer Value (Off, 1 minute to 999 hours)
- k) Sector Zones: 8, includes left/right boundary, enable/disable state, 24 character title
- l) Privacy Zones: 8, includes left/right boundary, enable/disable state, blanks out video
- m) Inverted Mounting: Field Configurable

- (4) IP Video:
- a) Streams: Two (2) individually configurable streams
 - b) Codecs: H.264 and MJPEG
 - c) Configurations:
 - i) H.264 + H.264
 - ii) H.264 + MJPEG
 - iii) H.264 + Analog
 - iv) MJPEG + Analog
 - d) Resolutions:
 - i) Stream 1 (D1)
 - ii) Stream 2 (D1, CIF)
 - e) Frame Rates: 30, 15, 7.5, 6, 5, 3.75, 3, 2, 1.875, 1
 - f) Data Rates:
 - i) Stream 1 (4 Mb to 256 Kb)
 - ii) Stream 2 (2 Mb to 256 Kb)
- (5) Video Connections:
- a) RTP/RTSP: Eight (8) H.264, Eight (8) MJPEG
 - b) RTSP/Interleave: Eight (8) H.264, Eight (8) MJPEG
 - c) RTSP Multicast: Eight (8) H.264, Eight (8) MJPEG
 - d) HTTP Multicast: Unlimited, H.264 and MJPEG
 - e) HTTP Tunneling: Two (2) H.264, Ten (10) MJPEG
 - f) MPEG2 TS: Unlimited, H.264 and MJPEG
- (6) Network Interface:
- a) Network Format: Ethernet 802.3 (100BaseT-TX)
 - b) Network Protocol: TCP, UDP, IPv4, IGMP, ICMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, ARP, ONVIF Profile S
 - c) Media Players: VLC, Quick Time or any media player compliant with RFC 2326, 3984, 3550, 2435, ISO/IEC 13818-1
 - d) ONVIF Support: Profile S
 - e) Camera Protocols: Cohu T, Profile S, NTCIP 1205
 - f) Security: Yes, 4 Levels

(7) Event Management:

a) Digital I/O:

- i) Digital Inputs: Two (2) Sensor Inputs, Dry contact, N.O. or N.C
- ii) Digital Outputs: One (1) Control Output, Open collector

b) Triggers:

- i) Internal Timer:
 - (a) Interval (Off, 1 second to 999 hours)
 - (b) Duration (Off, 1 second to indefinite)
- ii) Digital Inputs: Active Input Triggers Action

c) Actions:

- i) Presets: Activates a Camera Preset
- ii) FTP Snapshot: Captures Image and sends to FTP site folder
- iii) Digital Output: Activates a Digital Output
- iv) EMAIL: Sends message to EMAIL address

(8) Mechanical:

- a) Construction: Powder coated aluminum. External parts corrosion protected with stainless steel fasteners.
- b) Connector Type: 18 Pin MS

(9) Electrical:

- a) Input Voltage: 120 Vac or 24 Vac (Model dependent)
- b) Power: 160 W with P/T Heater option
- c) Line Variation: 120 Vac complies with NEMA TS2 para 2.1.2

(10) Environmental:

a) Protection Rating:

- i) Camera: IP67
- ii) Positioner Body: IP66

- b) Operating Temp: -40°F to 165°F (-40°C to 74°C) Per NEMA TS2
- c) Water Spray: Per IEC 60529+A1, 1999, Para 14.2.6
- d) Humidity: 0-100%, per MIL-E-5400T, paragraphs 3.3.24.4
- e) Vibration: Compliant to NEMA TS2 Para 2.1.9, 2.2.3, 2.2.8
- f) Shock: Compliant to NEMA TS2 Para 2.1.10, 2.2.4
- g) Corrosion Protection: Per NEMA 250-2003, Para 5.10
- h) External Icing: Per NEMA-TS2 250-2003, paragraphs 5.6 (requires P/T Heater Option)

(11) Certifications:

- a) FCC Class A
- b) ASTM-B117 Marine

CCTV Camera Power Supply.

- (a) The power supply shall be a device to power the pan-tilt-zoom and thermal CCTV cameras in an outdoor environment.
- (b) The power supply shall output a voltage of 24V to provide power for the specified cameras.
- (c) The power supply shall meet or exceed the following design and performance specifications:

(1) Physical Specifications:

- a) Environment: Outdoor
- b) Operating Range: -50° to 122°F (-45.56° to 50°C)
- c) Construction: Aluminum
- d) Finish: Gray polyester powder coat

(2) Power Specifications:

- a) Input Voltage: 120VAC, 60 Hz
- b) Output Voltage: 24/26/28 VAC
- c) Required Input Current: 1 A
- d) Output Fuse Ratings: 4A
- e) Input Connectors: Screw-type barrier strips
- f) Output Connectors: Screw-type barrier strips; WCS4-20B is suitable for Class 2 wiring
- g) Input Wire Size: 12-16 gauge solid wire
- h) Output Wire Size: 16-20 gauge solid or stranded wire
- i) Certifications/Ratings:
 - i) UL/cUL Listed
 - ii) Meets NEMA Type 4X and IP66 standards

Supplemental Camera Lighting. Provide additional camera illuminators as required to provide sufficient night time illumination for pedestrian walkway cameras.

- (a) Light angle matched to camera field of view.
- (b) High efficiency LED's, IR 850nm.
- (c) IP66 or NEMA 4X rated, vandal resistant enclosure.
- (d) -50°C to 50°C (-58°F to 122°F) operating range.
- (e) 100-240VAC power supply.
- (f) Adjustable power output and photocell control.
- (g) Corrosion resistant mounting brackets and hardware.

Surge Protection Devices (SPD). Provide SPD's for incoming 120VAC circuits utilized for CCTV camera power.

- (a) SPD's shall be UL 1449 Third Edition compliant, DIN rail mountable, plug in type.
- (b) Type 1 component assembly, fail-safe, self-protected design.
- (c) -40°C to 80°C operating range.
- (d) 20kA or greater discharge current.
- (e) Visual status indicator.
- (f) Operating temperature of -40 °C to 80 °C.

Ethernet SPD. Provide surge protective devices to protect the CAT-5/6 Ethernet cable for each camera. Ethernet SPD shall be according to Section Ethernet Switch.

Rack Mounted Workstation Computer.

- (a) Provide a rack mounted business class workstation computer for monitoring and controlling CCTV equipment at each of the six movable bridges as shown on the Plans. Computers shall meet the following minimum requirements:
- (11) Suitable for 19" standard EIA rack mounting.
 - (12) Intel Xeon family processor, Quad core, 1.6 GHz.
 - (13) 8GB 2133MHz DDR4 RDIMM ECC memory, expandable.
 - (14) Two SATA/SSD 2.5" 1TB hard drives.
 - (15) Integrated hard drive controllers, SATA, Software RAID 0/1/5/10.
 - (16) Windows 10 Professional, 64-bit, English, operating system.
 - (17) Non-Microsoft Application Software – JAVA.
 - (18) (4x1Gbit) Quad Port Network Card.
 - (19) DVD+/-RW drive.
 - (20) Two redundant, hot-pluggable 120 VAC power supplies.
 - (21) Serial port PCIe card.
 - (22) Two USB 2.0 ports.
 - (23) Two USB 3.0 ports.
 - (24) Graphic Cards: Dual NVIDIA® Quadro® NVS 310 512MB (4 DP-DVI adapters).
 - (25) Video, power, and communications cables.
 - (26) 3 Year hardware warranty.
 - (27) Other hardware, software, and components as required for SCADA system software and CCTV requirements.

High Definition Desktop Monitor.

- (a) Provide professional class, high definition LCD monitor for workstations at the IDOT bridge office.
- (b) Other requirements are as follows:
- (1) 21.5 inch (minimum) diagonal screen.
 - (2) 10 Point Touch touchscreen capability.
 - (3) IPS (In-Plane Switching) type screen, anti glare with LED backlight.
 - (4) 16.7 million colors.
 - (5) Full HD (1920 x 1080) resolution, 16:9 aspect ratio.
 - (6) Response time of 8ms or faster.
 - (7) Ultra-wide 178° (H) / 178° (V) viewing angle.
 - (8) Minimum brightness rating of 250 cd/m² (typical).
 - (9) HDMI, DisplayPort, DVI-D, VGA inputs (coordinate with requirements of workstation PC video cards).

- (10) 100–240VAC, 50/60 Hz power.
- (11) USB 2.0 Port(s) : 1 x upstream, 4 x downstream.
- (12) VESA mountable.
- (13) Rugged desktop mounting, dual monitor type stand that, in conjunction with the monitor design, provides quick user height and tilt adjustment.
- (14) Meets the latest regulatory and environmental standards.
- (15) Minimum three year warranty.
- (16) Provide power and video cables and all required accessories.

High Definition Wall Mount Monitor.

- (a) Provide industrial environment, high definition LCD monitors for viewing cameras at each of the movable bridges.
- (b) Other requirements are as follows:
 - (1) 31.5 inch (minimum) diagonal screen.
 - (2) IPS (In-Plane Switching) type screen, anti glare with LED backlight.
 - (3) Full HD (1920 x 1080) resolution, 16:9 aspect ratio.
 - (4) Response time of 8ms or faster.
 - (5) Ultra-wide 178° (H) / 178° (V) viewing angle.
 - (6) Brightness rating of 500 cd/m² (typical).
 - (7) Operating temperature: 0°C to 50°C (32F to 122F).
 - (8) Composite, Component, HDMI, and VGA inputs (coordinate with requirements of CCTV PC video cards).
 - (9) 100–240VAC, 50/60 Hz power.
 - (10) VESA mountable.
 - (11) Heavy duty ceiling or wall mount mounting bracket as required for location, with mounting hardware
 - (12) Automatic low power standby setting.
 - (13) Minimum 2 year warrantee.
 - (14) Provide power and video cables an all required accessories.

Video Wall Monitors and Components.

- (a) Provide a video wall system for the IDOT bridge office for displaying camera video. The system shall be specifically designed for control room and/or traffic management type applications from a manufacturer that has been manufacturing video wall systems for at least five years.
- (b) The system shall permit a simultaneous display of a minimum of thirty-six H.264 or MPEG-4 encoded video streams from CCTV cameras on any of the six movable bridges. The system shall also permit the display of video streams from SCADA system computers.

- (c) A video wall controller computer shall control the video wall displays including selecting input video sources for images, sizing images, arranging images on individual screens, and adjusting monitor operating parameters.
- (d) The software shall allow the controller computer to be controlled remotely from multiple workstations/users and shall be fully compatible with SCADA system software.
- (e) Video Monitors shall be rated for 24 hour/7day continuous use. Other requirements are as follows:
 - (1) Minimum 55" diagonal screen size.
 - (2) Commercial grade LCD display.
 - (3) 1920 x 1080 resolution, full HD.
 - (4) Ultra narrow bezel design, 3.5mm nominal or less.
 - (5) Direct LED backlight rated for 50,000 hours (50% brightness).
 - (6) Anti-glare coating.
 - (7) 500 nits (cd/m²) maximum brightness.
 - (8) 12ms response time.
 - (9) 178° h/v viewing angle (CR 10:1).
 - (10) Signal inputs: DisplayPort, HDMI(HDCP)x2, DVI(HDCP), Component, VGA, S-video, Composite.
 - (11) Signal outputs: DVI(HDCP), VGA, Composite.
 - (12) Control inputs: RS-232, RS-485.
 - (13) Control outputs: RS-485.
 - (14) Auto scan source selection.
 - (15) Designed to allow for quick replacement of serviceable components.
 - (16) Advanced cooling design.
 - (17) 100-240 VAC @ 50/60Hz power.
 - (18) High energy efficiency with less than or equal to 0.5W standby.
 - (19) Standard VESA mount.
 - (20) Configurable power on delay.
 - (21) On-screen display (OSD) controls using (IR) remote control.
 - (22) Provide all required cables and accessories.
- (f) A video Wall Controller Computer shall be a server grade computer with hardware and software required to control video wall displays. Minimum requirements are as follows:
 - (1) Rack mount chassis with mounting hardware.
 - (2) Microsoft Windows 7 Ultimate (x64) operating system.
 - (3) Quad Core Intel Xeon Processor, 2.4GHz.
 - (4) 12GB DDR3 SDRAM Memory.
 - (5) 1TB SATA hard drive.
 - (6) DVD/RW SATA optical drive.
 - (7) Dual Gigabit Ethernet RJ-45 ports (1000Base-T).
 - (8) Minimum of eight display output channels, max resolution/channel (digital) of 4096 by 2160 @ 60Hz.

- (9) 100-240 VAC @ 50/60Hz power.
 - (10) High reliability with MTBF rating greater than 50,000 hours for major modules.
 - (11) Four USB 2.0 ports, one RS-232 serial port video-wall control.
- (g) A video Wall Control Software shall provide a user-friendly control interface that is designed to manage the placement and sizing of images on the video wall. Other requirements are as follows:
- (1) The software shall provide the ability to quickly save and recall video wall image layouts, change individual images, and relocate or rearrange images.
 - (2) The software shall allow media cropping, zooming, and scaling.
 - (3) Multiple authorized users shall be able to configure and modify the video wall over a network.
- (h) Provide floor mount pedestals and a framing system specifically designed for supporting video wall equipment and compatible with video wall monitors. The pedestal elevation shall be coordinated with the workstation furniture and the available ceiling height of the IDOT bridge office control room.
- (1) Constructed from heavy duty formed steel, with a black powder coated finish.
 - (2) Adjustable leveling feet.
 - (3) Designed to permit airflow around monitors.
 - (4) The frame shall permit individual monitors to be extended and tilted for service.
 - (5) Provide trim for all exposed framing on the front (viewing side) and sides.
 - (6) External braces and/or supports shall be provided as recommended by the manufacturer to prevent tipping due to unforeseen circumstances.
 - (7) Provide all required hardware and brackets.

Uninterruptable Power Supply (UPS).

- (a) Provide rack mounted UPS power supplies for CCTV Ethernet switches and system equipment as shown on the Plans. Rack mounted UPS power supply shall be according to SCADA System Section.
- (b) Provide industrial type UPS power supplies for remote cabinets as shown on the Plans. Industrial UPS power supplies shall be according to Integrated Bridge Controls System Section. Power supplies and batteries shall be sized to provide short term (5 minutes) backup power for connected components.

Ethernet Switches for CCTV Network. Provide Ethernet switches as shown on the Plans.

- (b) Ethernet switches shall be according to Section Ethernet Switch.
- (c) Provide industrial type switches for remote (farside) cabinets.
- (d) Where shown on the Plans or otherwise required for cameras and related equipment installed, provide PoE (Power over Ethernet) midspan power supplies and/or Ethernet switches according to Section Ethernet Switch.

Fiber Optic Termination Housings. Provide the appropriate quantity of fiber optic terminations for rack mounted equipment and the corresponding fiber optic cable connections required.

- (b) Fiber optic termination housings shall be modular rack mounted type according to Section Fiber Optic Interconnect Cabinet. Provide types and configurations as required for equipment and fiber optic cables.

Miscellaneous System Components. Provide all additional components required for a complete operational system. Coordinate installation of local bridge system components with CCTV/SCADA Network Rack and Farside CCTV/P.A. Cabinet as shown on the Plans. Provide all necessary installation hardware and accessories.

- (a) The equipment rack shall be as described in Section SCADA System.
- (b) Farside bridge cabinets shall be NEMA 4X rated stainless steel industrial control enclosures, with a minimum of 14 gauge construction. The enclosures shall be finished in a white powder coating inside and out. The cabinet doors shall be hinged with a stainless steel handle utilizing an internal three point latching mechanism. The door handle shall be pad lockable. Provide a back panel, side panels, and all components as shown on the Plans or otherwise required for installed equipment. Fiber optic panel housings shall be according to Section Fiber Optic Panel Housing. Coordinate the size with requirements for Public Address System and Wireless Backup Network equipment.
- (c) Supplemental circuit protectors, terminal blocks, and additional DC power supplies shall be according to Integrated Bridge Controls System Section.
- (d) Install cord grips for cable connections to cameras where shown on the Plans. Cord grips shall be UL listed, liquid tight, constructed of UV resistant Polyvinylidene (PVDF) with thermoplastic elastomer insert, rated IP68 and NEMA 4X for outdoor use from -40°C to 130°C.

Software. Provide original manuals, software packages with license information, and original packaging materials. All software shall be licensed to the Owner. At the completion of the project, the Systems Integrator shall be responsible for ensuring that all installed software has been updated to the most current version available that is compatible with installed hardware.

Coordination. Coordinate Bridge Control CCTV System with the following:

- (a) Systems Integration.
- (b) SCADA System.
- (c) Integrated Bridge Controls System.
- (d) Ethernet Network.
- (e) Ethernet Switch.
- (f) Wireless Backup Network.
- (g) Bridge Electrical Installation.
- (h) Public Address Systems.
- (i) Fiber Optic Interconnect Cabinet.
- (j) Video Server.

CONSTRUCTION REQUIREMENTS

Submittals. It is the Contractors responsibility to submit for approval the complete designed system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein for the completely integrated system proposed for installation. The following shall be submitted:

- (a) Product Data: Include detailed manufacturer's product specifications for each component and software package specified. Include data sheets reflecting the model numbers, features, ratings, performance, power requirements, and dimensions.
- (b) Submit an overall CCTV system architecture drawing showing all major components and overall system design. Include the number/labeling scheme used to identify cameras and equipment.
- (c) Provide dimensioned layout drawings for rack mounted components and stand-alone enclosures. Include an itemized parts list for each location.
- (d) Provide complete point-to-point wiring diagrams for equipment installed at each bridge and at the IDOT bridge office. Differentiate between manufacturer-installed and field-installed wiring.
- (e) Submit typical mounting details for cameras. Mounting details shall illustrate how cameras are to be field adjusted.

- (f) Calculations: The Contractor shall submit the calculations used, plans, and diagrams for the field of view calculations for each camera, the bandwidth calculations for each local bridge network, and the overall BCCS system network. Calculations shall also include and address low level lighting, backlight compensation, and lens conformance.
- (g) Submit example operator interface screen-shots for CCTV camera control and setup software for both local and centralized systems. Screen shots shall be in full color and shall illustrate menus and screen navigation, how operators will control/view individual cameras, how multiple camera images can be viewed together on one screen at the same time, how to build custom screens to view groups of cameras, and how camera functions are integrated into the overall SCADA system.
- (h) Submit shop drawings detailing the video wall mounting system, including the plan and elevation of the pedestal and framing system. Show how the video wall will integrate into the overall control room layout and the workstation furniture.
- (i) Coordination Drawings: Plans drawn to scale and coordinating locations of BCCS equipment. Provide locations of items requiring installation coordination including cameras, power supplies, racks, and cabinets.
- (j) Preliminary Field Test Reports with full color camera images for each bridge.
- (k) Submit test plans and procedures for shop testing and field testing.
- (l) Maintenance Data: Maintenance Data for BCCS equipment and components shall be assembled in manual format. The final manual submittal shall include ten hard copies and five copies of electronic PDF format on a compact disc or other approved media. Manuals shall include the following:
 - (1) As built system architecture drawings.
 - (2) Detailed system operating instructions for local (on bridge) and centralized systems covering operation under both normal and abnormal conditions.
 - (3) Routine maintenance requirements for system components.
 - (4) Lists of spare parts and replacement components recommended.
 - (5) For each camera, provide a complete manufacturer part number for the camera, lens, enclosure, and all installed accessories. Provide as-built camera configuration information including network address assignment and all other programmed or hardware settings.
 - (6) For each type of camera installed, provide an illustrated, step by step procedure for replacement of the camera including hardware/software configuration, lens installation procedure, lens adjustment procedure, and site aiming/alignment procedure.
 - (7) Backup and restoration procedures for all system computers.
 - (8) Backup and/or archive procedures for any applicable video storage.
 - (9) Recommended battery service and replacement intervals for UPS power supplies.

- (m) System Backup Files – Upon completion and acceptance of the Project, provide backup files for all programmable devices according to these Special Provisions and the following:
- (1) Backup files shall be provided on compact disc format or by other media as approved by the Engineer. Provide five copies of all backup files.
 - (2) Provide preconfigured/cloned backup hard drives for all PC based devices.
 - (3) Where available, provide backup configuration files for individual CCTV cameras.
- (n) A list of all passwords and their associated use shall be provided.

Shop Testing. Coordinate shop testing with SCADA system shop testing. Testing shall be performed utilizing a complete set of cameras representative of the cameras to be installed on a bridge.

- (a) Test and demonstrate the local bridge CCTV system with two monitors. Verify that all cameras images can be manipulated using the local system, and all PTZ cameras can be operated through the system. Provide temporary wiring and power as required to test all rack mounted components and far side cabinets.
- (b) Test and demonstrate that the CCTV system operates correctly as part of the SCADA system for the IDOT bridge office. Verify that all cameras images can be manipulated using the SCADA system, and all PTZ cameras can be operated through the system.
- (c) Test configuration and operation of the video wall with CCTV camera images through the SCADA system.

Installation.

- (a) The Systems Integrator shall be responsible for coordinating and overseeing the installation of the bridge CCTV cameras and all related equipment with Bridge Electrical Installation.
- (b) Individuals installing CCTV cameras, equipment, and accessories shall be properly trained and shall have documented experience installing CCTV cameras, enclosures, and equipment.
- (c) To the extent possible, cameras shall not be permanently installed until major construction activities on the corresponding bridge have been completed. Installed cameras shall be appropriately protected from damage while construction is still underway.
- (d) Cables and wiring installed in outdoor locations shall be installed in conduit, except where not permitted by equipment design. Any exposed cable lengths shall be kept to a minimum, shall be rated for outdoor use, and shall be mechanically protected against vandalism where cameras could be readily accessed by vandals or thrown objects.

Video and control data cable shall not be contained in any conduits with high voltage. Bending and pulling tensions shall not be exceeded per the cable manufacturer's recommendations.

- (e) Surge protection shall be provided and installed for each circuit utilized for CCTV equipment. Insure that surge protection is installed and grounded according to manufacturer's recommendations.
- (f) All cameras, equipment, wiring, and cabling must be clearly labeled according to the approved drawings.

Field Testing.

- (a) For each bridge, perform preliminary field testing of cameras to evaluate camera types used for each position, evaluate lenses, and determine camera locations. For applications where specified lenses do not produce acceptable camera images, the Contractor shall be allowed to propose alternative lenses. Submit sample representative images for each camera location for varying light conditions including nighttime.
- (b) After the completion of the CCTV equipment installation on each bridge, test and verify the operation of local BCCS system. Verify that the system satisfies all requirements of these Special Provisions.
- (c) After completion of the local system testing for each bridge, test and verify the operation of each bridge's cameras with the IDOT bridge office SCADA system. Verify that the system satisfies all requirements of these Special Provisions.
- (d) Test and verify operation of video wall system with the IDOT bridge office SCADA system.
- (e) The Systems Integrator shall be responsible for making all corrections and adjustments necessary for the intended operation to the satisfaction of the owner.
- (f) Coordinate testing as required with Video Server.

Training. In conjunction with the SCADA systems training, the Systems Integrator shall provide operator and maintenance training to IDOT's bridge Operations and Maintenance (O&M) personnel according to the following:

- (a) Operator training shall include the following:
 - (1) Detailed instructions for using local bridge BCCS systems.
 - (2) Detailed instructions for using the IDOT bridge office BCCS system.
 - (3) Detailed instructions for using and configuring the IDOT bridge office video wall.

- (b) Maintenance training shall include all operator training and the following:
- (1) Basic troubleshooting of cameras and system devices, including network components.
 - (2) Procedure for replacement and setup/programming of each type of camera installed. Include details for aiming cameras and adjustment of lenses.
 - (3) Routine maintenance requirements for system components including recommended cleaning intervals, battery replacement where applicable, and replacement of wear items.
 - (4) Backup and restoration procedures for system computers.
 - (5) For each type of computer, basic instructions for accessing and using the operating system for system maintenance, troubleshooting, and accessing data files.
 - (6) Maintenance instructions for monitors including video wall monitors.
- (c) Provide hardcopy Operator and Maintenance training materials. Coordinate requirements with sections Integrated Bridge Controls System and SCADA System.

Warranty.

- (a) All CCTV cameras and system components shall be fully warranted for parts and labor for a minimum of two years from the final successful acceptance of the overall project.
- (b) The Systems Integrator shall be responsible for ensuring that software/firmware versions and/or any other replaceable programming be updated to the latest version during the warranty period.

Basis of Payment. Payment will be made at the contract unit price for each BRIDGE CONTROL CCTV SYSTEM including all equipment, material, testing, documentation, and labor detailed in the contract documents for this bid item.

VIDEO SERVER

Description. This work shall consist of providing, programming, and testing the Video Server for the future use of the City of Joliet according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. This work shall include all equipment and programming required to allow the City of Joliet to access all live camera images for all six bridges.

- (a) Perform all programming, configuration, and testing necessary for the Bridge Control CCTV Systems to provide IP video streams for the City of Joliet.
- (b) The Systems Integrator shall coordinate with the City of Joliet for specific requirements. The current City of Joliet video surveillance network is based on services and equipment supplied by Genetec Inc.
- (c) The City of Joliet's access to cameras shall be limited to view only capability. No camera control or configuration capabilities shall be provided.

Router and Accessories. Provide Router and any additional network security devices as required for future connection to City of Joliet.

- (a) Rack mount or DIN rail mount with rack mount frame. Other requirements are as follows:
 - (1) High-performance integrated router/firewall/VPN.
 - (2) Minimum of four RJ45 ports, 10/100 MBit/s, one dedicated for management.
 - (3) SFP fiber ports as required for local and remote connections and cable types.
 - (4) VPN with 3DES, AES128, AES256 support.
 - (5) Configurable stateful firewall with NAT.
 - (6) SNMPv3 access security.
 - (7) Filtering for MAC and IP addresses, ports, protocols.
 - (8) Web based management interface with diagnostics tools, logging, and alarms.
 - (9) -40°C to +85°C operating temperature, fanless design.
 - (10) Dual hot-swappable power supply, 85-264VAC.

Fiber Optic Termination Housings. Provide the quantity of fiber optic terminations shown in the Plans for future use.

- (a) The fiber optic termination housings shall be modular rack mounted type according to Section Fiber Optic Interconnect Cabinet. Provide the type as required by the City of Joliet and for installed equipment.

Coordination. Coordinate Video Server with the following:

- (a) Systems Integration.
- (b) Bridge Control CCTV System.
- (c) Ethernet Network.
- (d) Ethernet Switch.
- (e) Wireless Backup Network.
- (f) Fiber Optic Interconnect Cabinet.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Product Data: Include the detailed manufacturer's product specifications for each component specified. Include data sheets reflecting the model numbers, features, ratings, performance, power requirements, and dimensions.
- (b) Hardcopy as-built device settings and/or as-built electronic backup files for each programmable device including all DIP switch/hardware settings, address assignments, and programmed settings. Provide spare, pre-configured flash memory cards for all devices that provide a memory card configuration backup option.
- (c) Applicable written procedures for enabling functionality of the video server and making physical connections to equipment.

Installation.

- (a) The Systems Integrator shall be responsible for coordinating and overseeing the installation and testing of the Video Server.

Site Testing.

- (a) The operation of the Video Server equipment shall be tested with a simulated remote connection.
- (b) Coordinate with the City of Joliet for testing. The City of Joliet shall be permitted to witness and participate in the testing.
- (c) Provide any supplemental documentation necessary to identify each camera by bridge, camera type, and installed location/camera view.

Basis of Payment. Payment will be made at the contract unit price for each VIDEO SERVER including all equipment, material, testing, documentation, and labor detailed in the contract documents for this bid item.

PUBLIC ADDRESS SYSTEMS

Description. This work shall consist of providing, programming, and testing the public address systems for the Ruby Street Bridge, Cass Street Bridge, Jefferson Street Bridge, McDonough Street Bridge, Brandon Road Bridge, and IDOT Bridge Office Building according to the contract plans and approved shop drawings.

IP Audio System Server Software. The IP Audio Control Server Software shall facilitate the management and routing of the IP audio communications to the IP Audio Modules. The IP Audio System Server Software shall meet the following requirements:

- (a) Client-server software shall run in a Windows Server environment.
- (b) It shall run as a service that registers when the machine is initialized and automatically re-launches itself when the machine restarts.
- (c) It shall support multiple independent console connections simultaneously.
- (d) The software shall provide rules-based queue management.
- (e) It shall support the monitoring of device health and availability.
- (f) It shall feature an integrated digital audio recorder capable of archiving all audio passed through the server.
- (g) It shall feature a system audit log of all messages and events passed through the server.
- (h) It shall feature a support console capable of logging all network and application traffic to and from the server for enhanced troubleshooting.
- (i) The software shall enable a user to configure the PA zones across the bridge or other facility where the PA message is to be played.
- (j) The software shall enable a user to play back, stop (on completion of message), and immediately stop playing live-to-air messages sent across the PA subsystem.
- (k) The software interface shall allow a user to configure the repeats, direction, and interval for the playback of PA messages.

- (l) The software interface shall allow a user to create (microphone recording and file import), replace, update, and delete pre-recorded files to be played across the PA subsystem

- (m) The administrator interface shall allow the provisioning of IP Audio Modules and console users meeting the following requirements:
 - (1) It shall allow for the discovery and configuration of IP Audio Modules.
 - (2) It shall function such that each user can be assigned specific rights to communicate with the IP Audio Modules available in the system, and only those available to them will be shown in the Operator Console interface.
 - (3) It shall allow call queues to be defined from available devices.
 - (4) It shall allow each user to be assigned specific call queues.
 - (5) It shall facilitate the recording of messages to be played by Operator Consoles at the user's discretion.
 - (6) It shall allow the configuration of IP Audio Modules into groups for paging zone capabilities.

- (n) The software shall support the automatic triggering of predetermined events based on user defined soft and hard triggers while meeting the following requirements:
 - (1) It shall accept event trigger inputs of the following type:
 - a) IP Audio Module Sensor Activated.
 - b) IP Audio Module Sensor Deactivates.
 - c) IP Audio Module PTT Triggers.

 - (2) It shall output event triggers of the following type:
 - a) Play pre-defined audio files to predefined IP Audio Module.,
 - b) Play pre-defined text files as audio messages to predefined IP Audio Modules using a text-to-speech engine.
 - c) Trigger Relay output of predefined IP Audio Module.

 - (3) Events shall have time based conditional parameters.

- (o) Text to Speech Application: The Text-To-Speech Application shall support the automated generation of audio messaging from text files using a text-to-speech engine and meet the following requirements:
 - (1) Active monitoring of a pre-defined folder for the addition of a .txt file which will generate an audio message to be sent to a predefined set of IP Audio Modules.
 - (2) Automated reading of the .txt file generating an intelligible audio message for broadcast.

- (p) The operator console interface shall operate in a client-server model and meet the following requirements:
- (1) Each instance of the Console shall facilitate the communications of a single operator to multiple IP Audio Modules in a one-to-one, one-to-many "grouped," and one-to-all "Page All" model.
 - (2) It shall support the playback of prerecorded messages to IP Audio Modules in an individual, grouped, or page-all model.
 - (3) It shall support two-way audio communications in a one-to-one model with IP Audio Modules that support such features.
 - (4) It shall support multiple Server IP Addresses - one for Primary use, and multiple secondary servers that the console will "Fail Forward" to in the event that the primary server becomes unreachable.
 - (5) It shall allow the user to monitor the audio levels of connected devices with a visual VU meter as well as listen to a summed audio stream of selected devices.
 - (6) It shall display the IP Audio Modules "Friendly" Name, MAC address, IP Address, Connection Status, and Relay Status if equipped.
- (q) Provide additional software and drivers as required to interface with public address system with the SCADA system.

IP Audio Amplifier Module.

- (a) IP Audio Amplifier Modules shall meet the following requirements:
- (1) Durable industrial design, DIN rail or surface mount.
 - (2) 10/100 Base-T Ethernet interface with RJ-45 connector.
 - (3) TCP, UDP, RTP, ARP, ICMP, IGMP MULTICAST network protocols.
 - (4) VoIP SIP 2.0 protocol.
 - (5) G.711.8/16bit PCM/uLaw audio protocol.
 - (6) Static and DHCP assigned IP addresses.
 - (7) 8K Voice sampling rate / 22K background music.
 - (8) < 200ms audio latency.
 - (9) Short circuit and thermal protection.
 - (10) LED status indicators and remote diagnostics over Ethernet.
 - (11) Operating temperature range of -30°C to +70°C.
 - (12) Available in multiple power outputs to match speaker requirements up to 40W (8 Ohm / 25-70V Line).
 - (13) Class D amplifier.
 - (14) 24VDC or PoE power supply.
 - (15) Support for multiple server IP addresses.
 - (16) Flash programmable via USB or Ethernet.
 - (17) Electret or dynamic microphone support for intercom modules.
 - (18) Minimum two (2) year warranty in design and manufacture.

Distribution Transformer. Provide audio distribution transformers as required for high output speakers and multiple speaker applications. The audio distribution transformer shall meet the following requirements:

- (a) Transformer Rating: 40 Watts (Maximum Average Power)
- (b) Output Tap: 70 Vrms.
- (c) Frequency Response: 50 Hz to 15k Hz \pm 1dB @ 8 Ω
- (d) Insertion Loss: 0.5 dB

Two Way Speaker – Horn Speaker/Microphone. The two-way speaker shall meet the following requirements:

- (a) Frequency range shall be 400 – 6800 Hz (\pm 6 dB). Sound pressure level (1W/1M) shall be 109 dB.
- (b) Power handling capability shall be 16 watts continuous duty.
- (c) Talk-Back sensitivity as microphone: Reference 94 dB SPL, 700-2000 Hz.
- (d) Operation from -30°F to +160°F.
- (e) All materials shall resist damage from extreme weather exposure.
- (f) The horn and cover shall be made of impact and UV resistant ABS.
- (g) The mounting system and other critical parts shall be high stability, UV resistant polycarbonate.

One Way Speaker – 32 Watt Horn Speaker. The one-way speaker shall meet the following requirements:

- (a) Frequency range shall be 370 – 6800 Hz (\pm 6 dB). Sound pressure level (1W/1M) shall be 110 dB.
- (b) Power handling capability shall be 32 watts continuous duty.
- (c) Operation from -30°F to +160°F.
- (d) All materials shall resist damage from extreme weather exposure.
- (e) The horn and cover shall be made of impact and UV resistant ABS.
- (f) The mounting system and other critical parts shall be high stability, UV resistant polycarbonate.

DC Power Supply. Provide industrial type DC power supplies as required for public address system equipment. Voltage and current ratings shall meet requirements of equipment served. The Power Supply shall meet or exceed the following design and performance specifications:

- (a) DC Power Supplies shall meet or exceed the following design and performance specifications:
- (1) UL listed.
 - (2) Internal overload protection.
 - (3) DIN rail mount with finger safe terminals.
 - (4) Status indicator LED's.
 - (5) 100-240VAC input.
 - (6) Operating temperature range of -40 °C to 60 °C / 5 to 95% RH for cabinets located in outdoor areas.
 - (7) Operating temperature range of -20 °C to 60 °C / 20 to 90% RH for indoor cabinets.

Operator Intercom Module / Microphone / Speaker. Provide operator intercom modules at each bridge and at each of the three operator workstations in the bridge control office.

- (a) The Operator Intercom System shall comply with the following:
- (1) Desktop or wall mount.
 - (2) High quality voice/audio with simple push-to-talk button / speaker interface.
 - (3) Volume control and monitor/open buttons.
 - (4) 3.5mm microphone and speaker jacks for an external interface.

Outdoor P.A. Intercom Panel/Call Station.

- (a) Intercom Panel/ Call Station shall meet the following requirements:
- (1) Hardened design, rated for demanding outdoor environments, weatherproof.
 - (2) Vandal resistant, stainless steel construction.
 - (3) Full duplex, with talk button for microphone.
 - (4) Minimum 1 Watt speaker power rating, 200Hz – 4kHz frequency response.
 - (5) Heavy duty stainless steel NEMA 4X or 3R enclosure, sized as required for call station.

Rack Mounted Workstation Computer.

- (a) Provide a rack mounted, business class workstation computer for controlling public address system equipment at each of the six movable bridges and at the bridge office as shown on the Plans. Computers shall meet the following minimum requirements:
- (1) Suitable for 19" standard EIA rack mounting.
 - (2) Intel Xeon family processor, Quad core, 1.6 GHz.
 - (3) 8GB 2133MHz DDR4 RDIMM ECC memory, expandable.
 - (4) Two SATA/SSD 2.5" 256GB hard drives.
 - (5) Integrated hard drive controllers, SATA, Software RAID 0/1/5/10.
 - (6) Windows 10 Professional, 64-bit, English, operating system.
 - (7) Non-Microsoft Application Software – JAVA.
 - (8) (4x1Gbit) Quad Port Network Card.
 - (9) DVD+/-RW drive.
 - (10) Two redundant, hot-pluggable 120 VAC power supplies.
 - (11) Serial port PCIe card.
 - (12) Two USB 2.0 ports.
 - (13) Two USB 3.0 ports.
 - (14) Graphic Card: NVIDIA® Quadro® NVS 310 512MB (2 DP-DVI adapters).
 - (15) Video, power, and communications cables.
 - (16) 3 Year hardware warranty.
 - (17) Other hardware, software, and components as required for a public address system/audio system server software, and to interface with SCADA system.

Miscellaneous System Components. Provide all additional components required for a complete operational system. Coordinate installation of local bridge system components with CCTV/SCADA Network Rack and Farside CCTV/P.A. Cabinet as shown on the Plans. Provide all necessary installation hardware and accessories.

- (a) Supplemental circuit protectors, SPD's, terminal blocks, and additional power supplies shall be according to the Integrated Bridge Controls System Section.
- (b) Industrial Ethernet switches shall be according to Section Ethernet Switch.
- (c) Speaker lightning and surge protection shall be UL Listed and specifically rated for use with outdoor speakers and public address equipment.
- (d) Provide stand alone PoE (Power Over Ethernet) midspan power supply modules as required for public address system equipment. PoE modules shall be according to Section Ethernet Switch.

Coordination. Coordinate Public Address Systems with the following:

- (a) SCADA System.
- (b) Ethernet Network.
- (c) Ethernet Switch.
- (d) Bridge Electrical Installation.
- (e) Bridge Control CCTV System.
- (f) Systems Integration.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Product data for the Public Address System equipment, software, and all associated accessories.
- (b) Electrical drawings for systems at each bridge and overall system architecture.
- (c) Recommended equipment testing procedures and testing intervals.
- (d) Hardcopy as-built configuration settings for each programmable device. Where available, provide electronic backup files. Provide all programming software and cables necessary for configuring devices.

Installation. Installation shall be in compliance with the NEC, local utility requirements, and any other local codes that may apply.

Training. Provide routine maintenance procedure, operation, and troubleshooting training to the Department's maintenance personnel. Training shall include procedures for replacing and configuring each type of programmable device.

On Site Testing. When the entire installation of the Public Address System is complete, the Contractor shall perform operational tests of the complete system to demonstrate that all of the Public Address equipment functions properly. Testing shall include testing of the local bridge operation as well as centralized operation from the IDOT Bridge Office building for all operator stations.

Basis of Payment. This work will be paid for at the contract unit price per each for PUBLIC ADDRESS SYSTEMS.

WIRELESS BACKUP NETWORK

Description. This work shall consist of providing, programming, and testing the wireless backup network systems for the Ruby Street Bridge, Jackson Street Bridge, Cass Street Bridge, Jefferson Street Bridge, McDonough Street Bridge, I-80 Bridge, and Brandon Road Bridge according to the contract plans and approved shop drawings.

General. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install a wireless telemetry system as detailed herein and shown on the Plans.

(a) The hardware required for the wireless telemetry system is shown in the contract documents and is comprised of the following types of major equipment:

- (1) Radios.
- (2) Radio Power Supply
- (3) Antenna and cabling, including mounting hardware.
- (4) Surge protection for antenna.

(b) Codes and Standards. Surge protective devices and the installation and interconnection of the devices shall comply with applicable provisions of the following standards, codes and regulations:

- (1) National Fire Protection Association 79, Annex "D" Standards, (NFPA).
- (2) National Electrical Code, (NEC).
- (3) National Electrical Manufacturer's Association Standards, (NEMA).
- (4) International Society of Automation (ISA).
- (5) SPDs shall be listed in accordance with UL 1449 Third Edition, Standard for Safety Surge Protective Devices (SPDs).
- (6) International Electrotechnical Commission (IEC).
- (7) Institute of Electrical and Electronics Engineers (IEEE).
- (8) State and Local code requirements.
- (9) Where any conflict arises between codes or standards, the more stringent requirement shall apply.

900MHz/2.4GHz Wireless Ethernet Network. The number of sites and coverage area is shown on the Plans. The IACS Supplier shall provide all necessary 900 MHz and 2.4 GHz wireless Ethernet networks as shown on the Plans. All wiring, hardware, and connection means shall be in compliance with the National Electrical Code and/or applicable local codes.

(a) Mounting and wiring:

- (1) All radios shall be mounted on a DIN rail conforming to DIN EN50022. The mounting feet of the radios shall be constructed of metal.
- (2) Radios shall be capable of being installed side by side, with no gap or air space required for heat dissipation, and no loss of accuracy.
- (3) Radios will be installed in an approved control cabinet that provides appropriate protection from environmental influences.
- (4) Mounting guidelines will be followed as indicated in the installation instructions provided by the manufacturer.
- (5) Wires shall be attached to the modules by pluggable terminal blocks that accept wire sizes from 24 to 14 AWG.
- (6) Pluggable terminal blocks will be keyed to help prevent incorrect positioning of the plug in the modules.
- (7) The terminal blocks will be clearly numbered to provide easy reference.

(b) 900 MHz Radio features:

- (1) Transmit power shall be adjustable from 10 mW to 1 W in one -dBm increments.
- (2) The radio shall be approved for use in Class I, Div. 2, Groups A, B, C, and D hazardous locations. UL Listed and CSA Approved.
- (3) Shall be approved for use in the 902- 928 MHz frequency range, under FCC rules part 15.247.
- (4) Shall incorporate Frequency Hopping Spread Spectrum for transmitting radio signals.
- (5) To ensure that communication is secure and interoperable, the module must support 128/192/256-bit AES encryption.
- (6) The radio shall be configured through an embedded web server that is accessed through a standard browser on a PC.
- (7) The radio shall have two interfaces to support RS-232 and RS-422/RS-485 to allow serial devices to be accessed via wireless network. The device servers must have the ability to convert Modbus RTU to Modbus TCP.
- (8) The radio shall have an Ethernet 10/100 Mbps port that supports TCP/IP, UDP, and IPv4 protocols.
- (9) The radio shall support an Input/Output (I/O) bus to allow discrete and analog inputs and outputs to be read from a master PLC. Maximum number of I/O modules per radio shall be eight (8).
- (10) The radio shall support firmware upgrades via wireless and Ethernet connections.
- (11) The radio shall support master, repeater, or slave for application diversity with data rates up to 500 kbps over 902-928 MHz frequency bands. The use of two radios as a repeater shall not be permissible.

- (12) The radio shall incorporate a test point for measuring RSSI.
- (13) The radio shall support the ability to configure the receive sensitivity and throughput from 125 kbps to 500 kbps.
- (14) The radio shall have a visual indicator displaying link status and WAN link and speed.
- (15) The radio shall support the ability to block up to three frequencies that create interferences.
- (16) The radio shall have the ability to be registered via embedded software to receive firmware updates.
- (17) Input power: 24 VDC nominal, range of 12 VDC – 30 VDC.
- (18) Operating temperature: -40 °C to 65 °C
- (19) Relative Humidity: 10-95% non-condensing

(c) 2.4 GHz Radio features

- (1) Operating temperature: -25°C to 60°C.
- (2) Operating humidity: 10% - 95% non-condensing.
- (3) Ethernet connection: RJ45 (2).
- (4) Wireless designation: Wireless LAN.
- (5) Wireless standard: IEEE 802.11a/b/g/n.
- (6) Wireless card: 2.4 GHz, MIMO technology up to 300 Mbps.
- (7) Antenna connection: 3.
- (8) Transmission power: maximum 23 dBm (EIRP).
- (9) Input voltage: 24VDC.
- (10) Operating modes: Access point/client adapter/repeater/WDS bridge.
- (11) Configuration: Cluster management, web-based management, WPS.
- (12) Mounting type: DIN rail.
- (13) Shock test: 30g.
- (14) Vibration test: 5g.
- (15) Approvals: UL listed.

(d) 900 MHz Omnidirectional Antenna features:

- (1) Frequency Range: 900 MHz.
- (2) Gain: 8.0 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 360°.
- (5) Vertical beam width: 15°.
- (6) Wind velocity rating: 125 km/h.
- (7) Connector: Type N (female connector).
- (8) Degree of protection: IP65.
- (9) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (10) Operating temperature: -40 °C to 80 °C.

(e) 900 MHz Low Gain Directional YAGI Antenna features:

- (1) Frequency Range: 900 MHz.
- (2) Gain: 5 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 168°.
- (5) Vertical beam width: 78°.
- (6) Wind velocity rating: 200 km/h.
- (7) Connector: Type N (female connector).
- (8) Degree of Protection IP65
- (9) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (10) Operating temperature: -40 °C to 80 °C

(f) 900 MHz Medium Gain Directional YAGI Antenna features:

- (1) Frequency Range: 900 (868 - 960) MHz.
- (2) Gain: 8.5 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 100°.
- (5) Vertical beam width: 62°.
- (6) Wind velocity rating: 200 km/h.
- (7) Connector: Type N (female connector).
- (8) Degree of Protection IP65
- (9) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (10) Operating temperature: -40 °C to 80 °C

(g) 900 MHz High Gain Directional YAGI Antenna features:

- (1) Frequency Range: 900 (868 - 960) MHz.
- (2) Gain: 12.15 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 56°.
- (5) Vertical beam width: 46°.
- (6) Wind velocity rating: 200 km/h.
- (7) Connector: Type N (female connector).
- (8) Degree of Protection IP65
- (9) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (10) Operating temperature: -40 °C to 80 °C

(h) 2.4 GHz Omnidirectional Antenna features:

- (1) Frequency Range: 2.4 GHz.
- (2) Gain: 9 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 360°.
- (5) Vertical beam width: 15°.
- (6) Wind velocity rating: 125 km/h.
- (7) Connector: Type N (female connector).
- (8) Degree of Protection IP65
- (9) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (10) Operating temperature: -40 °C to 75 °C

(i) 2.4 GHz Directional Panel (Linear Vertical) Antenna features:

- (1) Frequency Range: 2.4 (2.3-2.8) GHz.
- (2) Gain: 8 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 75°.
- (5) Vertical beam width: 70°.
- (6) Wind velocity rating: 160 km/h.
- (7) Connector: Type SMA (female connector).
- (8) Degree of Protection IP55
- (9) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (10) Operating temperature: -40 °C to 75 °C

(j) 2.4 GHz Parabolic Dish Antenna features:

- (1) Frequency Range: 2.4 GHz.
- (2) Gain: 19 dBi.
- (3) Impedance: 50 Ohms.
- (4) Horizontal beam width: 17°.
- (5) Vertical beam width: 11°.
- (6) Degree of Protection: IP65.
- (7) Mounting Hardware: Clamps, standoff hardware as recommended by the antenna manufacturer.
- (8) Operating temperature: -40°C to 70°C.
- (9) The parabolic antenna may only be used with unidirectional transmitter and bidirectional receivers in conjunction with extension cable producing maximum permissible value of 20 dB for emitted power.

(k) Surge Protective Device: Provide for each antenna.

- (1) Insertion loss: <0.15 dB, maximum.
- (2) Impedance: 50 ohms.
- (3) Maximum Discharge Surge Current (8/20) μ s: 10 kA.

(l) Antenna Cable features (900 MHz):

- (1) Type: LMR-DB.
- (2) Attenuation: < 4 dB.
- (3) Impedance: 50 Ohms.
- (4) Construction: watertight, UV resistant polyethylene jacket.
- (5) Connections: As required for equipment.
- (6) Weatherproofing: Seal connections with approved UV resistant, weather proof, cold shrink sealing tape.

(m) Antenna Cable features (2.4 GHz):

- (1) Type: LMR-DB.
- (2) Attenuation: < 1.6 dB.
- (3) Impedance: 50 Ohms.
- (4) Construction: watertight, UV resistant polyethylene jacket.
- (5) Connections: As required for equipment.
- (6) Weatherproofing: Seal connections with approved UV resistant, weather proof, cold shrink sealing tape.
- (7) The length of the cable from antenna to radio shall not exceed 25 feet.

(n) Radio Power Supply:

- (1) The power Supply shall be UL listed as a low or high voltage model as required for the available power source.
- (2) For locations where radios will be installed in outdoor cabinets, the power supply shall have a protective coating to protect against extreme ambient conditions, such as dust, pollution, corrosive gases and 100% humidity.
- (3) The power supply shall be rated for operating in an ambient temperature range between -40°C and 70°C.
- (4) Preventive function monitoring warns against critical operating states before errors occur.

(5) Input Data:

- a) Nominal input voltage range:
 - i) Low Voltage: 100 VAC – 240 VAC
 - ii) High Voltage: 3x 400 VAC – 500 VAC
- b) Input voltage range:
 - i) Low Voltage: 85 VAC – 264 VAC
 - ii) High Voltage: 3x 320 VAC – 575 VAC
- c) Frequency Range: 45 – 65 Hz
- d) Current Consumption:
 - i) Low Voltage: 2.24 A (120 VAC), 1.33 A (230 VAC)
 - ii) High Voltage: 3x 1.6 A (400 VAC), 3x 1.3 A (500 VAC)

(6) Output Data:

- a) Nominal output voltage: 24 VDC \pm 1%
- b) Setting range of output voltage: 18 – 29.5 VDC (>24 V constant capacity)
- c) Output current:
 - i) Low Voltage: 10 A, 15 A, 60 A
 - ii) High Voltage: 20 A, 26 A, 120 A
- d) Max power dissipation:
 - i) Low Voltage: 9.1 W, 22 W
 - ii) High Voltage: 11 W, 40 W

Wireless Radio Cabinet. Provide a NEMA 4X, stainless steel enclosure, pre-wired with terminal blocks and space to mount the radio and supporting components as shown on the Plans. This item shall be typical of the I-80 Repeater Radio Cabinet. Enclosure shall have provisions for installing a padlock.

(a) Features shall include the following:

- a) 24 VDC power supply with 24 VDC UPS and battery.
- b) Surge protection for the power and antenna.
- c) Terminal blocks and wire duct for power and signal distribution.
- d) Sufficient space on DIN-rail for radio and accessories.
- e) Step down transformer as required for available power, with primary and secondary over-current protection.

Miscellaneous System Components. Provide all additional components required for a complete operational system. Coordinate installation of the local bridge system and bridge control office components with the CCTV/SCADA Network Rack as shown on the Plans. Provide all necessary installation hardware and accessories.

- (a) Supplemental circuit protectors, SPD's, and terminal blocks shall be according to Integrated Bridge Controls System Section.

Spare Parts.

- (a) Provide the following spare parts:
 - (1) One of each type of radio installed.
 - (2) One of each type of antenna installed.
 - (3) Two spare antenna surge protectors.

Coordination. Coordinate Wireless Backup Network with the following:

- (a) SCADA System.
- (b) Bridge Control CCTV System.
- (c) Public Address Systems.
- (d) Ethernet Network.
- (e) Ethernet Switch.
- (f) Systems Integration.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Path Study and Site Testing Report with recommendations.
- (b) Product Data: Include detailed manufacturer's product specifications for each component specified. Include data sheets reflecting the model numbers, features, ratings, performance, power requirements, and dimensions.
- (c) Overall system architecture drawing showing all major components and overall system design.
- (d) Plan and elevation drawings detailing antenna locations, antenna type for each location, and routing of antenna cables. Provide details for all applicable mounting brackets, cables, connectors, and hardware.

- (e) Layout drawings and parts lists for rack mounted components and radio equipment enclosures.
- (f) For each location, provide point-to-point wiring diagrams showing power, network, and antenna wiring and cabling. Differentiate between manufacturer-installed and field-installed wiring.
- (g) Field test Reports: Indicate and interpret test results for compliance with performance requirements of installed systems.
- (h) Maintenance Data: Maintenance Data for Wireless Network Systems equipment and components shall include the following:
 - (17) Hardcopy as-built configuration settings for each radio. Where available, provide electronic backup files.
 - (18) Detailed operating instructions covering operation under both normal and abnormal conditions including troubleshooting steps.
 - (19) Written instructions for configuring and installing a new radio.
 - (20) Routine maintenance requirements for system components.
 - (21) Lists of recommended spare parts and replacement components.

Path Study and Site Testing.

- (a) Prior to specifying and ordering equipment, develop a path study and perform field testing of the proposed radio equipment using the actual components to be provided. Test shall prove the feasibility of the system proposed by testing from-to each radio path over the specified frequency. Radio performance, including maximum throughput shall be documented. All background noise or frequency unavailability which may interfere with the system operation shall be monitored and recorded.
- (b) If the testing indicates inadequacies in the operation of the system, develop and test alternative solutions until the function of the system is satisfactory for use. Furnish a report of the test results verifying the suitability of the radio system for the proposed systems for review prior to providing the system.

Installation.

- (a) The installation shall follow the wireless network manufacturer's recommended installation practices and comply with all applicable codes. In any case of dispute between the Plans and the manufacturer's recommended installation practices, the more stringent requirement shall apply.
- (b) Upon completion of the installation, provide the services of a factory-certified field testing service technician to perform start-up testing. Record test results and compare to factory testing to confirm proper operation of equipment. Submit test results with operation and maintenance manuals.

- (c) Coordinate the installation and testing of the wireless backup network equipment with the corresponding installation of the fiber optic network equipment and SCADA systems at each bridge and the bridge office.

Training. Provide training on routine maintenance procedures, radio setup/configuration procedures for each type of radio, and basic troubleshooting to the Department's maintenance personnel. Develop a written procedure for regularly scheduled testing of wireless backup equipment, at a minimum of once per quarter, including testing centralized bridge operations using wireless networking. Train operators on procedures required for switching to and from wireless networking and any specialized operating procedures required for SCADA and CCTV systems when wireless networks are utilized.

Basis of Payment. Payment will be made at the contract unit price per each WIRELESS BACKUP NETWORK including all equipment, material, testing, documentation, and labor detailed in the contract documents for this bid item.

ETHERNET NETWORK

Description. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install a fully functional control system network based on an Ethernet platform.

The hardware and architecture of the system shall be the components of the SCADA or CCTV system as required.

The overall concept is to provide a control system network with all devices on an Ethernet platform communicating to the Bridge Control Room servers through a single communication protocol.

General. The major hardware components required for the networks is shown on the One Line Diagram drawings and are comprised of the following types of equipment:

- (a) Fiber Optic cabling system including cables, interconnect cabinets, termination housings, patch cables, and connectors.
- (b) Network communication devices including various types of Ethernet switches and protocol converters.
- (c) Wireless network equipment.
- (d) Network security devices, including firewalls and routers.

SCADA/CCTV Network. Furnish and install an Ethernet based ring topology fiber optic network as shown. The network shall be arranged such that future nodes can be added at any point(s) along the network without overloading the system or requiring re-routing of the highway cable being installed under this contract. The Fiber Optic Network shall have the following required features:

- (a) The network shall be based on open standards and shall provide a redundant backbone.
- (b) The network shall be a high-throughput network based on Ethernet.
- (c) The network shall not rely on proprietary hardware or software.
- (d) The network devices shall individually connect to Ethernet switches and routers through appropriate media.
- (e) The net effective communications rate shall be nearly 1,000 Mbps. An analog or digital variable shall be input, output, calculated, or sent to any device on the network within 100 – 500 milliseconds.
- (f) The CONTRACTOR shall provide cable meeting all transmission requirements for the system supplied. Since communication protocols vary from supplier to supplier, achieving the minimum transmission rate specified does not relieve the CONTRACTOR from conforming to all specific performance requirements.
- (g) The operator shall be able to verify from the central location, the presence, type and well-being of all devices on the network. All devices on the network shall be capable of switching between the two ring terminations. The switching shall be automatic, so that in the event of a line break, there shall be no depreciable degradation in system performance. The equipment shall recognize that a line break has occurred and shall provide an appropriate alarm output.
- (h) The failure of any single component anywhere on the highway network shall not prevent or degrade system performance. The network shall allow expansion while remaining on-line.
- (i) The communications protocol shall be based on the following communication standard: TCP/IP or EtherNet IP.
- (j) Extensive error checking shall be provided to verify that accepted messages contain the same data that was sent from the original source and to verify that noise or hardware failure has not incorporated erroneous data in the received message.
- (k) The network and devices on the network shall be compliant with IEC 61000-6-2, 6-3 and 6-4 for electromagnetic compatibility (EMC).

Environmental Conditions. The control system network will be used in a transportation environment where there will be high energy AC fields, DC control pulses, and varying ground potentials between the transducers or input contact locations and the system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations. The network components shall be designed and constructed for satisfactory operation and long, low maintenance service.

Coordination. Coordinate Ethernet Network with the following:

- (n) Ethernet Switch.
- (o) Systems Integration.
- (p) SCADA System.
- (q) Bridge Control CCTV System.
- (r) Wireless Backup Network.
- (s) Integrated Bridge Controls System.
- (t) Public Address Systems.
- (u) Bridge Electrical Installation.
- (v) Fiber Optic Cable, Single Mode.
- (w) Fiber Optic Interconnect Cabinet.
- (x) Aerial Cables.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Product data for all components and all associated accessories.
- (b) Overall system architecture drawing documenting fiber optic cable routings between all cabinets and connections to primary SCADA and CCTV Ethernet switches. Develop and submit an identification numbering scheme for all fiber optic cables, individual fibers, and patch cables.
- (c) Individual site architecture drawings for each bridge documenting all interconnections between devices and an identification numbering scheme for all Ethernet cables, fiber optic cables, individual fibers, and patch cables.
- (d) Network IP address numbering scheme and address assignments for all networked devices.

Installation. Installation shall be in compliance with the NEC, all applicable industry standards, and any other local codes that may apply.

Training. The manufacturer's field service technician shall provide routine maintenance procedure, operation, and troubleshooting training to the Department's maintenance personnel.

On Site Testing. When the entire installation of the system is complete, the Contractor shall perform operational tests as a complete system to demonstrate that all of the equipment functions properly.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the Contract bid prices.

ETHERNET SWITCH

Description. Furnish and install various types of Ethernet switches and accessories required to provide Ethernet communications networks as shown on the Plans. The use of hubs shall not be permitted.

Fiber Optic Network SCADA and CCTV network Ethernet switches. Managed type Ethernet switches for connection to the fiber optic networks interconnecting the six movable bridges and the bridge control office. The fiber optic network Ethernet switch shall have the following features:

- (a) 19" EIA rack mount type or DIN rail mount with all necessary hardware and brackets for rack mounting.
- (b) UL listed with modular construction.
- (c) Minimum of ten (10) RJ-45 ports. Ethernet ports shall be expanded as needed to interconnect all system components. At least one spare port shall be provided for setup/configuration.
- (d) Minimum of four (4) Small Form-factor Pluggable (SFP) fiber optic ports providing the capability for a redundant Gigabit fiber ring, and Gigabit connectivity to other devices. Fiber optic ports shall be capable of interfacing with single-mode or multimode fiber and shall be fully compatible with connected fiber optic cable type and network optical transmission characteristics. Fiber optic ports shall be expanded as needed to interconnect all system components.
- (e) Supply voltage range of 18 VDC to 30 VDC, nominal 24 VDC. Capable of accepting redundant power inputs. Provide a dedicated 24VDC power supply having an equivalent operating temperature and relative humidity range.
- (f) 10/100/1000 base-T(X), auto-negotiation, and auto-crossing.
- (g) Supports the use of Rapid Spanning Tree (RSTP) 802.1w and Large Tree Support.
- (h) Supports the use of IGMP for multicast traffic.
- (i) Supports Quality of Service (QoS) prioritization.
- (j) Supports VLAN as defined in IEEE802.1Q.
- (k) Supports the use of SNMP v3 management.
- (l) Supports a Command Line Interface (CLI)
- (m) Supports Link Aggregation according to IEEE 802.3ad on up to four ports

- (n) Supports IEEE 802.1x user authentication
- (o) Compliant with IEEE 802.3.
- (p) Compliant with EN 55022 for emissions interference.
- (q) Capable of being configured via integrated web server. Provide management software for multilevel security and remote monitoring.
- (r) Two LEDs status indicators for each port.
- (s) Alarm LED indicator and contact.
- (t) LCD display for diagnostics and configuration parameters.
- (u) Memory card slot to backup configuration data and to provide Layer 3 functions, with a spare configured card.
- (v) Operating temperature of -20°C to 55°C.
- (w) Protocol compatibility with all connected devices.

Local SCADA and CCTV network Ethernet switches. Managed type Ethernet switches for connection to local devices at each of the six movable bridges or the bridge control office. The local network Ethernet switch shall have all of the features as the Fiber Optic Network SCADA and CCTV network Ethernet switch with the following changes:

- (a) In lieu of standard Ethernet RJ45 connector modules, provide PoE (Power over Ethernet) modules with RJ45 connectors as required for attached CCTV cameras. PoE shall be according to IEEE 802.3af.

Industrial Ethernet Switch. DIN rail mount Ethernet switches for use in industrial control cabinets and providing extended temperature and humidity operating capabilities. The Industrial type Ethernet switch shall have the following features:

- (b) UL listed, unmanaged or managed type.
- (c) 120VAC or 12-32VDC power. Provide a 24VDC power supply having an equivalent operating temperature and relative humidity range for DC powered units.
- (d) Operating temperature range of -40C to 60C and relative humidity range 5-95% non-condensing.
- (e) Minimum of four RJ45 ports. Additional Ethernet ports shall be provided as required to interconnect all system components. At least one spare port shall be provided for setup/configuration.

- (f) Minimum of (1) fiber optic port. Fiber optic ports shall be fully compatible with connected fiber optic cable type and network optical transmission characteristics. Additional fiber optic ports shall be provided as required to interconnect all system components.
- (g) Diagnostic LED status indicators for each port and device alarm condition.
- (h) Hardware fault relay with alarm contact for remote monitoring.
- (i) Managed type switches shall provide a memory card slot to backup configuration data with a spare configured card.
- (j) Protocol compatibility with all connected devices.

PoE (Power over Ethernet) modules. Where required for CCTV cameras and public address system equipment, provide stand alone midspan PoE power supplies and/or additional PoE Ethernet switches. PoE modules shall have the following features:

- (a) DIN rail mountable.
- (b) Convert standard Ethernet RJ45 to PoE RJ45 according to IEEE 802.3af/at.
- (c) 24VDC power.
- (d) Operating temperature range of -40 to +70°C and relative humidity range 5-95% non-condensing.
- (e) Indicator LEDs for status.
- (f) For locations with multiple devices, optionally supply an industrial unmanaged PoE type Ethernet switch having the features listed above.

Fiber Optic Media Converter/Adaptor. Provide a fiber optic media converter to convert copper media to fiber optic where shown on the Plans. Fiber-to-copper media converters shall have the following features:

- (a) DIN rail mountable.
- (b) RJ45 copper port, full-duplex 10/100 Mbps Ethernet operation.
- (c) Meets IEC 61850-3 and IEEE 1613 standards.
- (d) -40 to 60 °C operating temperature.
- (e) 5 - 95% non-condensing relative humidity operating range.
- (f) Supply voltage of 18 to 30 VDC, nominal 24 VDC.
- (g) Indicator LEDs for link status on Ethernet and FO.
- (h) Singlemode or multimode fiber optic port. The fiber optic port shall be fully compatible with connected fiber optic cable type and network optical transmission characteristics.

Ethernet SPD. Provide surge protective devices to protect CAT-5/6 Ethernet data signals for field devices where shown on the Plans.

- (a) Other requirements are as follows:
 - (1) Surge protection in accordance with Class EA (CAT6A), for Gigabit Ethernet (up to 10 Gbps)
 - (2) UL Listed.
 - (3) DIN rail mounting, with rail ground connection and separate grounding cable.
 - (4) RJ45 input and output sockets.
 - (5) Operating temperature of -40 °C to 70 °C.
 - (6) Suitable for Power over Ethernet (PoE+) “Mode A” and “Mode B”.
 - (7) Total surge current (8/20 μ s): 10 kA.
 - (8) Line-Line & Line-Ground/Shield protection.

Coordination. Coordinate Ethernet Switch with the following:

- (a) Ethernet Network.
- (b) Systems Integration.
- (c) SCADA System.
- (d) Bridge Control CCTV System.
- (e) Wireless Backup Network.
- (f) Integrated Bridge Controls System.
- (g) Public Address Systems.
- (h) Bridge Electrical Installation.
- (i) Fiber Optic Cable, Single Mode.
- (j) Fiber Optic Interconnect Cabinet.

Spare Parts.

- (a) Provide the following spare parts:
 - (1) One of each type of Ethernet switch installed.
 - (2) For modular type switches, provide two spare interface modules of each type installed.
 - (3) Two of each type of PoE module installed.
 - (4) Two of each type of fiber optic media converters installed.
 - (5) Five of each type of Ethernet SPD.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Product data for all components and all associated accessories.
- (b) Electrical drawings showing fiber optic and copper interconnections to other networked equipment.
- (c) Hardcopy as-built device settings for each Ethernet switch including all DIP switch/hardware settings, address assignments, and programmed settings.
- (d) As-built electronic backup files for programmed Ethernet switches. Provide all programming software and cables necessary for configuring switches.
- (e) Provide spare, pre-configured flash memory cards for all Ethernet switches that provide a memory card configuration backup option.
- (f) Written procedures for replacing each type of switch supplied. Include details for installing any accessories required.

Installation. Install Ethernet switches according to the manufacturer's recommended procedures. Ensure that the Ethernet switches are properly grounded and bonded, and proper clearances are maintained for air circulation.

Training. Provide training on routine maintenance procedures, switch setup/configuration procedures for each type of switch, and basic troubleshooting to the Department's maintenance personnel.

On Site Testing. Before connecting each bridge to the main fiber optic SCADA and CCTV networks, perform local testing to ensure the correct operation of local networks and to verify address assignments. Likewise, perform local testing of the bridge control office Ethernet switches. When the entire installation of the system is complete, the Contractor shall perform operational tests of the switches as a complete system to demonstrate that all of the equipment functions properly.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the bid prices for the SCADA SYSTEM, INTEGRATED BRIDGE CONTROLS SYSTEM, BRIDGE CONTROL CCTV SYSTEM, and PUBLIC ADDRESS SYSTEMS.

FIBER OPTIC INTERCONNECT CABINET

Description. Provide and install fiber optic interconnect cabinets at each of the six movable bridge operator houses and at the IDOT Bridge Office building. Cabinets shall be provided as required to terminate and interconnect all main fiber network cables and to terminate and interconnect required local fiber optic cables associated with the main SCADA and CCTV networks. Conceptual cabinet layouts are shown in the Plans, but the Contractor is alerted to the fact that available space is limited inside bridge operator houses. The Contractor may optionally submit for approval multiple smaller cabinets to better accommodate available space. Any additional cabinets provided shall be included in the costs of the original pay items and shall not be paid for separately.

Identification.

- (a) Cable labels shall be waterproof, non-smearing, and self-adhesive with machine-printed permanent lettering protected by a clear cover.
- (b) All fiber optic cables and individual fiber strands, when broken out from a cable assembly, shall be uniquely labeled in accordance with the Contractor's approved drawings. All spare fibers shall be numbered and tagged as such, and shall be shown on all shop and record drawings.
- (c) Each tray, cassette, and connector panel shall be permanently marked with machine printed labels to show the corresponding number or designation as appears on the fiber optic cable connected thereto.

Indoor Rack Cabinet. The cabinet shall provide housing for fiber optic cables, splice trays, connector panels, patch cables, and accessories.

- (a) Cabinet enclosure.
 - (1) Powder coated steel construction, minimum 14 gauge body, 16 gauge doors and cover panels.
 - (2) Size shall be sufficient to store all slack cable, fiber windings, and splices. The Contractor may, with approval from the Engineer, use additional enclosures or commercially available components for slack cable storage at no additional cost to the Department.
 - (3) Lockable door latches, minimum of (8) spare keys.
 - (4) Casters and leveling feet (free standing enclosures).
 - (5) 1500 lb static load rating (free standing enclosures).
 - (6) Grounding studs on the frame, doors, and panels, with bonding jumpers.
 - (7) Exterior warning labels with applicable safety precautions.

(b) Integrated 19" standard EIA rack. Other requirements are as follows:

- (1) EIA universal standard hole progression zinc-plated mounting rails - minimum 12 gauge.
- (2) EIA-310-D compliant 10-32 tapped holes.
- (3) Provisions for grounding.
- (4) Cable management for fiber media.
- (5) Cable ties constructed of elastic flexible material with a releasable locking head.
- (6) Cable tie mounts utilizing screw fastening.
- (7) Provide all necessary hardware and accessories.

Outdoor Rack Cabinet. The outdoor cabinet shall provide secure and weather-resistant housing for fiber optic cables, splice trays, connector panels, patch cables, and accessories.

(a) Cabinet enclosure.

- (1) NEMA 4X rated industrial enclosure, front and rear single access doors.
- (2) Heavy duty, 316 stainless steel construction - minimum 12 gauge.
- (3) Stainless steel, pad -lockable door latches with three point mechanism.
- (4) Grounding lugs on doors, with bonding jumpers.
- (5) Removable hidden hinges with corrosion resistant construction.

(b) Internal rail system for 19" standard EIA racks. Other requirements are as follows:

- (1) EIA universal standard hole progression zinc-plated mounting rails - minimum 12 gauge.
- (2) EIA-310-D compliant 10-32 tapped holes.
- (3) Provisions for grounding.
- (4) Cable management for fiber media.
- (5) Cable ties constructed of elastic flexible material with a releasable locking head.
- (6) Cable tie mounts utilizing screw fastening.
- (7) Provide all necessary hardware and accessories.

(c) Outdoor rack cabinet shall be installed on the appropriately sized concrete foundation. Concrete foundation is paid for separately.

Rack mount fiber optic components. Fiber optic terminations and interconnections shall utilize modular rack mounted components. Components shall be Closet Connector Housings (CCH) series by Corning or equivalent.

(a) Rack mount termination housings.

- (1) Accepts connector adaptor panels, modules, and cassettes to accommodate a variety of field-termination options.
- (2) Interconnect and cross-connect capability.
- (3) Meets ANSI/TIA/EIA-568A and 606, UL Listed.
- (4) Adaptable for use as modular splice housing.
- (5) With strain-relief brackets, routing clips and guides, mounting brackets, documentation labels, and installation hardware.

(b) Splice cassette.

- (1) Modular design to allow access to an individual cassette without disturbing other fibers in the housing.
- (2) Supports fusion splicing of up to 24 individual fibers or six ribbon fibers
- (3) Provides space and is designed to manage heat-shrinks, pig tail slack, and cable slack.
- (4) Designed to permit splicing to be done away from the rack housing in a suitable workspace as needed.
- (5) With required mounting hardware, grommets, and cable protection components.
- (6) Adaptor connector panel with single mode ST connectors meeting requirements of Section Fiber Optic Cable, Single Mode.
- (7) Other adaptor connector type panels as required for local bridge connections.

Coordination. Coordinate the fiber optic interconnect cabinet with all associated equipment and work as shown on the Plans and with the following:

- (a) Fiber Optic Cable, Single Mode.
- (b) Bridge Electrical Installation.
- (c) Integrated Bridge Controls System.
- (d) SCADA System.
- (e) Systems Integration.
- (f) Bridge Control CCTV System.
- (g) Ethernet Network.

- (h) Concrete Foundation.
- (i) Aerial Cables (Jackson & McDonough).
- (j) Electrical Work Bridge Office.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Submit drawings showing cabinet sizes, layouts, mounting locations, and bill of materials for each location.
- (b) Product data for all components and all associated accessories.
- (c) Documentation for cable and fiber assignments corresponding to connector positions and placement of interconnections / jumpers.

Installation. Cabinets shall be bonded and grounded as required by the NEC.

Optical patch cords and pigtails shall be installed per the requirements of Section Fiber Optic Cable, Single Mode, and shall be paid for via the pay item for the corresponding Fiber Optic Cable, Single Mode.

Provide and install temporary patch cables as required to facilitate testing of individual fiber optic network segments and to accommodate the construction sequence.

On Site Testing. Cabinets shall be tested in conjunction with the associated fiber optic cables and as part of overall fiber optic network testing. The Contractor shall replace or repair any faulty components failing testing at no additional cost to the Department - both labor and materials.

Basis of Payment. This work will be paid for at the contract unit price per each for FIBER OPTIC INTERCONNECT CABINET.

CONCRETE FOUNDATIONS (SPECIAL)

Description. This item shall consist of constructing a concrete foundation for the installation of a fiber optic interconnect cabinet, or a similar cabinet, including anchor bolts and a ground rod. The work shall conform in all respects to the lines and grades dimensions shown on the Plans or as directed by the Engineer and shall be in accordance with the following requirements and the applicable portions of Section 878 of the Standard Specifications:

Materials. The materials shall conform to the specifications of Class SI concrete and concrete Reinforcement Bars in the Standard Specifications. Conduit and fittings shall be schedule 40 PVC, rigid, and nonmetallic meeting the requirements of Section 1088, sizes and quantities as shown on the Plans.

Anchor bolts shall meet the requirements of Section 505 and the material shall conform to the requirements of Article 1006.09 of the Standard Specifications. A ground rod shall be installed in each foundation and shall conform to Section 806. Unless otherwise indicated in the Plans, ground rods shall be one piece copper-clad steel rods 3/4" x 10' (2cm x 3 m).

Coordination. Coordinate Concrete Foundation with the following:

- (a) Fiber Optic Interconnect Cabinet.
- (b) Underground Fiber Optic Conduit Bank.

CONSTRUCTION REQUIREMENTS

Concrete foundations shall be installed at location as shown on the Plans or as otherwise directed by the Engineer. The top of the foundation shall be finished level. Shimming will not be permitted. All edges along the top of the foundation shall be given a 1 inch (25mm) bevel. A form extending a minimum of 9 inches (225mm) below the top surface of the foundation is required. The form shall be set level, and means shall be provided for holding the form rigidly in place while the concrete is being deposited. Whenever the excavation is irregular, a form shall be used to provide the proper dimension of the entire foundation below the ground surface. Where a concrete foundation is contiguous to a sidewalk, a preformed joint filler of 1/2 inch (12mm) thickness shall be placed between the foundation and the sidewalk.

All conduits in the foundation shall be installed rigidly in place before concrete is deposited in the form. Insulated bushings shall be provided at the ends of conduit. Anchor bolts shall be set in place before the concrete is deposited by means of a template constructed to space the anchor bolts in accordance with the pattern of the bolt holes in the base.

The required number and size of conduits shall be installed in every concrete foundation as shown on the plans. Large radius conduit elbows shall be used. An excess of conduits shall be installed in every concrete foundation. These excess stubs shall be 2 inches (50 mm) in diameter. Placement and quantity shall be determined by the Engineer, and the ends of the stubs shall be capped. After installation of cables, all conduit openings in foundations shall be sealed with an approved mastic material.

Incidental to the cost of each control box foundation, the Contractor shall construct a 5" (125 mm) P.C.C. sidewalk of a rectangular area 3 ft (1 mm.) by 4 ft (1.2 meter.) immediately adjacent to the cabinet door, with the 4' (1.2 meter) dimension of the rectangle parallel to the cabinet door when closed. This paragraph shall be applicable at all cabinet foundation locations included in this Section. The only situations where this paragraph shall not apply are as follows: When the foundation is immediately adjacent to or within a paved sidewalk or shoulder area and no further surfacing is required. The Engineer shall be the sole judge as to the applicability of this paragraph in all questions arising therefrom.

Basis of Payment. This work will be paid for at the contract unit price per each for CONCRETE FOUNDATIONS (SPECIAL), which price shall be payment in full for all necessary excavating, backfilling, disposal of surplus material and formwork and furnishing all materials, anchor bolts, stubs, and ground rods within the limits of the foundation.

FIBER OPTIC PANEL HOUSING

Description. Provide compact fiber optic termination housings as required to terminate and interconnect local fiber optic cables associated with local bridge networks.

Single Panel Housing. Provide a compact wall mount / cabinet mount fiber optic termination housing for locations shown on the Plans or otherwise required for local bridge fiber optic interconnections. Components shall be Closet Connector Housings (CCH) series by Corning or equivalent.

(a) Housings.

- (1) Accepts connector adaptor panels, with built in splice tray and organizer accommodating up to 12 splices.
- (2) Durable metal housing with black powder coat finish.
- (3) DIN rail mountable.
- (4) Stackable up to three housings.
- (5) With mounting brackets, documentation labels, and installation hardware.

(b) Adaptor connector housing.

- (1) Adaptor connector panel with connector type panels as required for local bridge connections.

Coordination. Coordinate fiber optic panel housing with the requirements of interconnected equipment and with the fiber optic cabling system utilized.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Product data for all components and all associated accessories.
- (b) Documentation for cable and fiber assignments corresponding to connector positions and placement of interconnections / jumpers.

Installation. Housings shall be bonded and grounded as required by the NEC. Housings used in outdoor locations shall be installed inside appropriately rated cabinets or enclosures. Verify that housings are installed with manufacturer's recommended clearances to allow installation of fiber optic cables.

On Site Testing. Test in conjunction with fiber optic cable and Ethernet network testing.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the bid prices for the INTEGRATED BRIDGE CONTROLS SYSTEM, BRIDGE CONTROL CCTV SYSTEM, RUBY STREET AERIAL CABLES, JACKSON STREET AND MCDONOUGH STREET AERIAL CABLES, CASS AND JEFFERSON STREET AERIAL CABLES, BRANDON ROAD AERIAL CABLES.

WORKSTATION FURNITURE, IDOT DISTRICT 1

Description. This work shall consist of providing and installing bridge office operator workstations according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. Workstation furniture shall be designed specifically for a 24/7 type operating environment. Office quality furniture will not be acceptable. The work shall also meet the following requirements:

- (a) Workstation furniture shall be modular in design for ease of reconfiguration and upgrading.
- (b) There shall be no obstructions for side-to-side movement by the user within the workstation footprint.
- (c) Workstation furniture shall have integral cable management to provide full workstation perimeter cable routing. Coordinate locations of cable entries with floor plan and corresponding locations for cable entry.

- (d) Workstation furniture shall have a unified frame design that provides optimal structural integrity and locks each element of the workstation subsurface into a contiguous whole, stabilizing all movement.
- (e) Each modular workstation furniture unit shall include articulating monitor mounts suitable for mounting four 21.5" computer monitors.
- (f) Each modular workstation furniture unit shall be 72" wide, 28"-30" high, and 28"-36" deep.
- (g) Provide (3) modular workstation furniture units for bridge operations.
- (h) Provide (1) modular desk unit for system maintenance and auxiliary tasks.

Materials.

- (a) Workstation frame shall utilize fully welded steel construction with a fingerprint resistant black textured powder coat finish.
- (b) All monitor and input surfaces shall be a minimum of 45 lb. density, 1-1/8" thick wood core material, pressure bonded with a high-pressure horizontal grade laminate top, and sealing horizontal grade backing sheet of laminate on the underside to prevent deflection.
- (c) Workstation side panels shall be of solid wood core materials - a minimum of 1" thickness with high-pressure laminate surfaces.
- (d) High pressure laminate shall meet ANSI/ASME A 17.1; 1986 requirements for Class "B" laminate, providing a non-glare matte finish. Thickness shall be a minimum of .0625". Thermally fused laminate shall meet NEMA LI-1-1998. Low pressure laminate is not acceptable.
- (e) Vinyl edging material shall be a minimum of 2mm thick thermoplastic vinyl extrusion with self-healing properties against abrasion for all undercarriage, pedestals, and monitor surfaces and a minimum of 13mm thick for all input platforms.
- (f) Workstations shall include adjustable leveling feet with locknuts.
- (g) Monitor mounts shall be VERSA compliant.

Chairs.

- (a) 24/7 type chair designed for demanding control room operations. Ergonomic design to promote user attention and reduce operator fatigue.
- (b) Minimum 15 year warranty on mechanicals based on 24/7, 365 day use. 5 year warranty on cushions and casters.
- (c) Provide (5) chairs.
- (d) Other requirements are as follows:
 - (11) Arm rests adjustable for height and width.
 - (12) Position sensitive headrest.
 - (13) Adjustable seat height 16" to 21", with pivoting responsive backrest.
 - (14) Heavy duty castors.
 - (15) 300 lb weight capacity.

Coordination. Coordinate with the following:

- (a) Electrical Work Bridge Office.
- (b) Mechanical HVAC Work Bridge Office.
- (c) SCADA System.
- (d) Bridge Control CCTV System.
- (e) Public Address Systems.
- (f) Systems Integration.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of desk and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (b) Color samples for all finishes and fabrics.
- (c) Provide shop drawings with dimensioned plan and elevation views and isometric views of assembled workstations. Drawings shall show workstations in relation to the bridge office building control room layout and shall incorporate a proposed arrangement of SCADA and CCTV computers, monitors, and input devices.

Installation.

- (a) Install workstations according to manufacturer's recommended procedures.
- (b) The Contractor shall exercise care in installing workstations so as to protect mechanical finishes of exposed surfaces. The Contractor shall be responsible for replacing any components that are damaged during installation or by any construction activities.

Basis of Payment. This work will be paid for at the contract lump sum price for WORKSTATION FURNITURE, IDOT DISTRICT 1.

CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT

Effective: March 1, 2010

Description. This item shall consist of furnishing and installing a conventional type round tapered aluminum pole complete with a CCTV camera mount and all required hardware including bolt covers as specified herein.

Materials.

Pole Shaft. Unless otherwise indicated, the shaft shall be made of aluminum alloy conforming to current ASTM designation B 221, alloy 6063 with final temper T6. The shaft shall be spun drawn to a smooth circular, tubular, seamless, tapered design.

Unless otherwise indicated, the pole shall be designed and manufactured to withstand loadings of up to and including a 34.019 kg (75 pound) camera having an effective projected area of 0.149 m² (1.6 ft²) on each of two 4 foot arms (twin), oriented at any angle from 45 to 180 degrees apart, meeting the criteria of AASHTO for 128.748 kmph (80 mph) wind loading with 167.371 km/h (104 mph) gusts. These loading requirements shall include all camera and arm combinations possible for the given pole height, up to and including the limits given. Information submitted for approval shall document satisfaction of this requirement.

The actual pole height shall be chosen per camera location based on the specified mounting height of each camera above pool elevation as indicated on the Contract Drawings. This shall determine the required length of the pole shaft regardless of the actual mounting method of the pole. Pole shaft lengths and camera mounting heights at each pole mounted camera location shall be submitted to the Engineer for approval.

Unless otherwise indicated, poles for mounting heights of 10.668 m (35 feet) or less shall have a single piece shaft with a 203.2 mm (8 inch) outside bottom diameter tapering to a 114.3 mm (4.5 inch) outside top diameter. The shafts shall be designed to accommodate loading of the arm configuration indicated, but the minimum design criteria shall be to accommodate loading on a single arm of length from 1.219 m to 3.048 m (4 to 10 feet) and loading on twin arms of length from 1.219 m to 1.829 m (4 to 6 feet) oriented 180 degrees apart, all with a minimum wall thickness of 5.563 mm (0.219 inch). Where the indicated arm configuration exceeds these minimum criteria, the wall thickness shall be increased to satisfy the design loading requirements.

Unless otherwise indicated, poles for mounting heights greater than 10.668 (35 feet) but less than 12.07m (47.5 feet) shall have a single piece shaft with a 254.0 mm (10 inch) outside bottom diameter tapering to a 127.7 mm (6 inch) outside top diameter. The shafts shall be designed to accommodate loading of the arm configuration indicated, but the minimum design criteria shall be to accommodate loading on a single arm of length from 1.219 m to 4.572 m (4 to 15 feet) and loading on twin arms of length from 1.219 m to 3.658 m (4 to 12 feet) oriented 180 degrees apart, all with a minimum wall thickness of 6.35 mm (0.250 inch). Where the indicated arm configuration exceeds these minimum criteria, the wall thickness shall be increased to satisfy the design loading requirements.

Unless otherwise indicated, poles for mounting heights of 14.478 m (47.5 feet) shall have a 254.0 mm (10 inch) outside bottom diameter tapering to a 152.4 mm (6 inch) outside top diameter. The shafts shall be designed to accommodate loading of the arm configuration indicated, but the minimum design criteria shall be to accommodate loading on a single arm of length from 1.219 m to 4.572 m (4 to 15 feet) and loading on twin arms of length from 1.219 m to 3.658 m (4 to 12 feet) oriented 180 degrees apart, all with a minimum wall thickness of 6.35 mm (0.250 inch). Where the indicated arm configuration exceeds these minimum criteria, the wall thickness shall be increased to satisfy the design loading requirements.

Unless otherwise indicated, poles for mounting heights greater than 14.478 m (47.5 feet) but less than 19.812 m (65 feet) shall have a 304.8 mm (12 inch) outside bottom diameter tapering to a 114.3 mm (4.5 inch) outside top diameter. The shafts shall be designed to accommodate loading of the arm configuration indicated, but the minimum design criteria shall be to accommodate loading on a single arm of length from 1.219 m to 4.572 m (4 to 15 feet) and loading on twin arms of length from 1.219 m to 3.658 m (4 to 12 feet) oriented 180 degrees apart, all with a minimum wall thickness of 6.35 mm (0.250 inch). Where the indicated arm configuration exceeds these minimum criteria, the wall thickness shall be increased to satisfy the design loading requirements.

Handhole. There shall be an oval shaped opening in the side of the shaft for the purpose of a handhole. Unless otherwise indicated, the centerline of the handhole shall be 457.2 mm (18 inches) from the bottom of the shaft. The handhole shall be 101.6 mm X 203.2 mm (4 x 8 inches) in size with the 203.2 mm (8 inch) dimension being situated vertically and in the same plane as any one of the sides of the base.

The opening in the shaft shall be reinforced with a handhole frame situated on the inside of the shaft and welded to the shaft. A 12.7 mm (1/2 inch)-13 tapped hole shall be provided in the frame for attaching a mechanical grounding connector. The handhole cover shall be fastened to the frame with 25.4 mm (1/4 inch)-20 size steel core nylon hex-head screws, and the holes for the screws shall be tapped to match the screws. Unless otherwise indicated, the orientation of the handhole shall be such that its pole face shall be opposite to the pole face exposed to oncoming traffic and unless otherwise indicated, the handhole shall be oriented on a face 90 degrees from arm orientation.

All exposed surfaces of the shaft shall be of a smooth, even texture, free from marks and imperfections. The pole shall have a satin ground finish - 100 grit or finer.

Cap. Top of the shaft shall be enclosed with a removable cap. The cap shall be secured in place with 300 series stainless steel screws. The design of the cap shall be such that it shall not permit entry of water into the shaft.

Grommets at the top portion of the shaft; two 38.1 mm (1 1/2 inch) diameter openings shall be made, and two 31.75 mm (1 1/4 inch) inside diameter rubber grommets shall be provided for wiring purposes through the top member(s) of the arm(s). The grommet openings shall be at 90 degree angles from the position of the handhole, i.e., there shall be two (2) grommet openings for each shaft, 180 degrees apart from each other and at 90 degrees apart from the handhole, unless otherwise indicated.

Base Plate. The bottom portion of the shaft shall be fitted with a base. The base shall be a permanent mold casting of aluminum alloy conforming to current Aluminum Association designations 356.0 or 4356.0, with final temper T6. The base shall be welded to the shaft by the inert gas shielded arc method. All welds shall be free from cracks and pores. All shafts with base plates shall be heat treated after welding. The base shall be equipped with anchor bolt covers. Anchor bolt slots shall be provided in the base to accommodate the required bolt circle diameter. Unless otherwise indicated, poles for mounting heights of 10.668 m (35 feet) or less shall have 292.1 mm (11 1/2 inch) bolt circles, and poles for mounting heights greater than 10.668 m (35 feet) shall have 381.0 mm (15 inch) bolt circles. The size of the slots shall be 1 1/4 inch by 2 inches as detailed on the pole drawing.

Anchor Bolt Covers. The anchor bolt covers shall be made from aluminum, conforming to current ASTM B 108, S5A F or, B 26, SG70A. The anchor bolt covers shall be fastened to the base with 6.35 mm (1/4 inch) 20 threaded steel reinforced plastic fasteners. The fasteners shall be threaded with 6.35 mm (1/4 inch) 20 threaded holes for bolt covers.

Vibration Damper. The pole shall be coordinated with all cameras being provided on this project to be free of susceptibility to harmful harmonics and vibrations. The pole shall incorporate an internal vibration damper. The material submitted for approval shall address this requirement.

Bundling. The shafts shall be shipped in bundles without any wrapping on the individual shafts or the entire bundle. Appropriate bundling materials shall be used to make a rigid, long lasting bundle capable of being handled, shipped and stored without the shifting or breaking of contents.

All hardware shall be anodized aluminum conforming to the current ASTM Designation B 211, 2024 T4, or 300 series stainless steel.

Vibration Requirements. The detailed design and fabrication of the shaft shall be such as to withstand 128.748 kmph (80 MPH) AASHTO criteria for wind and vibrations, caused by the wind pressure.

There shall be no excessive vibrations in the shaft under moderate wind pressure, where damage may result to the camera(s) and/or its component parts, and/or arms(s). A dampening device, as an integral part of the shaft, shall be installed in the shaft to alleviate such excessive vibrations. The proposed vibration dampening device shall be submitted for Engineer's approval.

No information contained herein shall be construed to relieve the Contractor of the above requirements.

Certification and Guarantee. The submittal information shall include a written certification of compliance with the contract requirements from the Manufacturer. The certification shall specifically identify the project route, location, section number, and contract number, as applicable, and shall identify specifically the equipment covered by the certification. The certification shall be made on the Manufacturer's corporate stationary and it shall be dated and signed by a responsible officer of the company, with the signee's title listed.

In addition, submittal information shall include the guarantee as specified under General Electrical Provisions.

Installation. The pole shall be set plumb on the foundation without the use of shims, grout or any other leveling devices under the pole base. The leveling area of the camera shall be set in a plane parallel to the roadway taking into consideration the up-grade or down grade and the super elevation of the roadway.

This item shall be coordinated with the applicable camera (with pole wire and fusing), foundation and anchor bolts, and breakaway device (as applicable) which shall be provided under separate pay items, as applicable.

Poles shall not be installed until cameras are available for installation at the same time the poles are installed. Poles shall not be installed and left standing without a coordinated installation of the arm and camera. POLES SHALL NOT BE PAID UNLESS THE COORDINATED ASSEMBLY IS COMPLETE.

Basis of Payment. This item shall be paid for at the contract unit price each for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE, 50 FT. MOUNTING HEIGHT, which shall be payment in full for the work as described herein.

CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER

Description. This item shall consist of the construction of a steel reinforced concrete foundation, of the dimensions indicated, complete with raceways. The foundation depth shall be as indicated in the Foundation Depth Table on the Plans (where applicable) or as otherwise shown on the Contract Drawings or as directed by the Engineer.

The foundation shall include excavation, reinforcement, concrete, anchor bolts, nuts, washers and raceways as well as clean up and restoration of the location when such work is not provided under other paid items.

Materials. Concrete shall be Class SI complying with Section 1020 of the Standard Specifications. Reinforcement bars and anchor bolts shall comply with Section 1006 of the Standard Specifications. The entire length of the anchor bolts as well as the nuts and washers shall be hot dip galvanized in accordance with the requirements of ASTM F 2329.

Unless otherwise indicated, conduit raceways shall be rigid, nonmetallic conduit, Schedule 40, according to Section 1088. Raceways shall be of the number and size as indicated.

Construction requirements. The foundation depths shall be as directed by the Engineer based upon evaluation of the soil conditions encountered. The Engineer may determine soil condition by visual inspection or, where practical, by the use of a pocket penetrometer and will establish a foundation depth based upon the Foundation Depth Table shown on the Plans, where applicable.

The hole for the foundation shall be made by drilling with an auger, of the same diameter as the foundation. The foundation shall be cast in place and allowed to cure for 10 days minimum before the light pole is erected. If soil conditions require the use of a liner to form the hole, the liner shall be withdrawn as the concrete is deposited. The top of the foundation shall be constructed level. A liner or form shall be used to produce a uniform smooth side to the top of the foundation. The foundation top shall be chamfered 19.05 mm (3/4 inch) unless otherwise indicated.

Extreme care shall be used in establishing the top elevation of concrete foundations, especially when foundations are installed before final grading is complete. Foundations shall not protrude above grade more than the limits indicated on the Plans, except for specifically indicated locations, and where not otherwise indicated, foundation shall not protrude above grade more than 101.6 mm (4 inches) above a 1524.0 mm (60 inch) chord centered at the foundation, at any point around the circumference. Where foundation heights extend beyond specified limits, the Engineer may direct replacement of the foundation, and the incorrect foundation will not be measured for payment.

The steel reinforcement, the raceway conduits, and the anchor bolts shall be secured in place to each other and properly positioned in the augered hole so at the time of pouring of the concrete in place, the above said components retain their proper positions. Special attention shall be paid to the positioning of the anchor bolts. It is of utmost importance that the anchor bolt projections on top of the foundation, after placement of the concrete, remain in a perfectly vertical position.

Method of Measurement. The foundation shall be measured for payment in linear feet of the foundation in place, in accordance with the total length of concrete pier required, indicated as foundation depth, in the Foundation Depth Table on the Plans and as directed by the Engineer, i.e., extra foundation depth, beyond the directive of the Engineer, will not be measured for payment. Where extension above grade is required, this distance shall be measured for payment.

Basis of Payment. This work will be paid for at the contract unit price per linear foot for CLOSED CIRCUIT TELEVISION CAMERA STRUCTURE FOUNDATION, 30" DIAMETER, which shall be payment in full for the work as shown on the Plans and described herein.

AERIAL CABLES

Description. This work shall consist of designing, providing, and installing new aerial cables for the Ruby Street Bridge; removing existing aerial cables and designing, providing, and installing new aerial cables for the Jackson Street, Cass Street, Jefferson Street, and McDonough Street Bridges; and providing and installing additional aerial cables for the Brandon Road Bridge according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. The work shall meet the following requirements:

- (d) Aerial cable systems shall be designed according to requirements of National Electrical Safety Code, C2-2012. Ice and wind loadings shall be considered in the design with no overstress in the cables or components.
- (e) Minimum content for aerial cable(s) shall be as shown on the Plans. The Contractor shall review the aerial cable design with the Systems Integrator and all other involved parties to verify that the cable has adequate conductors, cables, and spares for the bridge control system, CCTV system, and all other supporting systems as shown on the Plans and required by these Special Provisions.
- (f) The overall aerial cable system design for the Ruby Street Bridge shall be performed to provide the capacity for and with the necessary provisions for the future installation of additional cables to replace the existing submarine cables.
- (g) System design and installation shall include all components required for proper grounding of structures and cables as required by the NEC.

Hardware and Components.

- (g) Provide utility grade hardware and fittings for messenger. Provide hardware and fittings of sufficient strength to exceed the breaking strength of the messenger with which they are used.
- (h) Provide only hardware and fittings made of galvanized steel, stainless steel, or non-corrosive metal.
- (i) Deadends shall be heavy duty, bolted quadrant type or shall be assembled utilizing heavy duty pre-formed steel thimbles. All components shall be sized and rated as required for messenger cable strength, size, and construction.
- (j) Shackles and similar components shall be forged steel, hot-dip galvanized construction. Pins and bolts shall be high strength steel, hot-dip galvanized. Cotter pins and safety wire shall be stainless steel, sized as required.
- (k) Wire rope clips shall be galvanized steel with drop forged base manufactured in accordance with Federal Specification FF-C-450-D, Type 1, Class 1.
- (l) Where installed on aerial cable support systems, conduits shall be PVC coated rigid steel. Fittings, U-bolts, conduit clamps, and mounting hardware for PVC coated conduit shall have similar PVC coated construction, shall be compatible with the PVC conduit, and shall be provided by the same manufacturer as the conduit. Other hardware shall be constructed of stainless steel.

Aerial Cable.

- (a) Provide custom manufactured aerial cable(s) designed for bridge aerial cable or utility type applications.
- (b) Overall outer jacket shall be arctic rated, heavy duty, and UV-resistant low density polyethylene (LDPE) per ICEA S-95-658, NEMA WC-70. Cable rating shall be 600V or higher.
- (c) Cable jacket reinforcement shall have two layers of Kevlar aramid fibers applied helically in reverse directions under the jacket.
- (d) Cable components are cabled together with non-hydroscopic fillers as required by application. The cable core is wrapped with moisture resistant binder tape.
- (e) Conductors shall be annealed, uncoated copper in accordance with ASTM B-172/174 for 10 AWG and smaller or ASTM B-172 for 9 AWG or larger, class K stranding, and section 2 of ICEA S-95-658.

- (f) Insulation shall be ethylene propylene rubber (EPR) meeting the Type II requirements of ICEA S-73-532, NEMA WC-57 Table 3-2 (22 to 16 AWG), 600 volt or ICEA S-95- 658, NEMA WC-70, Table 3-1 (14 AWG or larger, 600 to 2,000V).
- (g) For the Jackson Street and McDonough Street Bridges – Aerial cables shall include 96 fiber optic cables for primary fiber optic networks interconnecting bridges. The Contractor shall submit any additional requirements or deviations for fiber optic cable utilized for aerial cables. Provide additional lengths of fiber optic cable on both ends of aerial cables as required to accommodate routing of cables through conduit to locations of Fiber Optic Interconnect Cabinets or intermediate splicing cabinet locations and to provide sufficient cable slack required for splicing or termination. 96 fiber optic cable, termination, and testing shall be according to Section Fiber Optic Cable, Single Mode, but shall be paid for as part of the corresponding aerial cable pay item.
- (h) Fiber optic cable utilized for local bridge network connections shall be according to Section Fiber Optic Cable, Single Mode or Section Fiber Optic Cable, Multi Mode.
- (i) Instrumentation and variable frequency drive cable shall be according to Integrated Bridge Controls System Section. The Contractor shall submit any additional requirements or deviations for instrumentation cables utilized for aerial cables.
- (j) Individual conductors and component cables shall be identified with a surface printed legend with an unique identification number / label.
- (k) The supported section shall have an extra high strength grade galvanized strand messenger. The support binder shall be stainless steel Type 302 tape helically wound around cable assemblies.
- (l) Cables shall be continuous with no splices.
- (m) Each cable shall be wound onto a suitable reel capable of supporting the weight of the cable during transportation and normal handling. The ends of each cable shall be suitably sealed to prevent moisture ingress during shipment and storage.

Terminal Cabinets.

- (a) Terminal cabinets shall be NEMA 4X stainless steel construction with an inner back plate for installing terminal blocks and related components.
- (b) Cabinets shall have provisions for installing a padlock with stainless steel hardware.
- (c) Sufficient terminal blocks shall be installed for termination of all spare conductors and other conductors to be terminated inside the cabinet.
- (d) Terminal blocks for individual conductors shall be UL Listed or recognized IEC style, rated for 600V, 90 degrees C. Terminal blocks shall be screw type, constructed from corrosion resistant materials, and shall be suitable for solid or stranded copper wire. Provide all necessary mounting rails, end blocks, barriers, and accessories.
- (e) Provide modular, DIN rail-mounted, IEC style, screw type terminals for instrument cables. Terminal blocks shall include provisions for cable shields. Provide all necessary mounting rails, end blocks, barriers, and accessories.
- (f) Adequate space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.
- (g) All terminal blocks shall be clearly labeled with machine printed labels. All conductors and cables shall be consistently labeled in accordance with the requirements of Bridge Electrical Installation Section.
- (h) Cabinets shall include fiber optic termination housings as required for local fiber optic interconnections on the bridge. Housings shall be according to Section Fiber Optic Panel Housing.
- (i) Provide fiber optic media converters according to Section Ethernet Switch for Jackson Street, Cass Street, Jefferson Street, and McDonough Street terminal cabinets. Provide a dedicated 24VDC power supply having an equivalent operating temperature and relative humidity range as required for fiber optic media converters.
- (j) Size cabinets as required by the NEC and as appropriate for the conductors and equipment served.

Coordination. Coordinate with the following:

- (a) Aerial Cable Support System. (Ruby Street Bridge)
- (b) Coordination of Marine Navigation.
- (c) Coordination with Other Agencies.
- (d) Bridge Electrical Installation.
- (e) Integrated Bridge Controls System.
- (f) Systems Integration.
- (g) Bridge Control CCTV System.
- (h) Public Address Systems.
- (i) Fiber Optic Panel Housing.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of product and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- (b) Submit cable and messenger calculations including design criteria for all bridges.
- (c) Submit Structural calculations verifying that existing structures have sufficient capacity to support additional loading required for new aerial cables. Calculations shall be signed and sealed by a Structural Engineer licensed in the State of Illinois.
- (d) Complete descriptive data for each aerial cable, messenger, as well as the component conductors and cables. Provide shop drawings and specifications for the aerial cable including a cross section drawing to identify the quantity and positions of the various component conductors and cables, reinforcement and outer jacket thicknesses, outer diameter of the assembled cable, and approximate weight per foot of the overall cable.
- (e) Lightning protection, grounding, and bonding components and assembly shop drawings.
- (f) Shop drawings showing cable methods of attachment and support hardware assemblies.
- (g) Dimensioned terminal cabinet layouts with bill of material.

Factory Testing.

- (a) Prior to assembly and fabrication of the aerial cables, the individual insulated conductors to be incorporated in the cables shall be tested to demonstrate the quality of the production run. The conductors and insulating compounds shall meet the minimum physical and electrical requirements set forth in ICEA S-95-658, NEMA WC70, UL Standard 44 and referenced standards.
- (b) All cable at the factory shall be tested in accordance with the latest test methods of ICEA/NEMA Standards for the types of cable and insulating materials specified and shall meet or exceed the minimum requirements and criteria for acceptance as set forth therein.
- (c) Test fiber optic and instrumentation cables in assembled aerial cables to verify that they are continuous and perform according to the original manufacturer's specifications and the applicable sections of these Special Provisions.
- (d) Record and submit all testing results.

Installation.

- (a) The Contractor shall bear full responsibility for coordinating the installation of the aerial cables with the United States Coast Guard and all other federal, state, and/or local regulatory agencies having jurisdiction, all necessary permitting, and all costs associated therewith.
- (b) The Contractor shall coordinate with the United States Coast Guard for any waterway closures needed to perform this work.
- (c) Aerial cables shall be installed to provide minimum clearance from the waterway as shown on the Plans. All cable clearances shall be approved by the United States Coast Guard.
- (d) Obtain and meet all provisions of the National Electrical Safety Code, C2-2012 regarding clearance from electric lines, contacting of utility owners, and safety requirements prior to span wire installation.
- (e) Verify that wire rope clamps are installed in the correct orientation and spacing is according to the manufacturer's recommendations.
- (f) Torque all bolted connections according to product manufacturer's recommendations.

Field Testing.

- (a) Test individual conductors for AC RMS voltage withstand and insulation resistance of installed cable in accordance with ICEA S-95-658 / NEMA WC-70. Record and submit all testing results.
- (b) Verify that all conductors are continuous and free of shorts, opens, or unintentional grounds, and all circuit conductors are properly terminated.
- (c) Test individual instrumentation cables to verify that they are continuous and perform according to the original manufacturer's specifications.
- (d) Fiber optic cable shall be tested according to applicable requirements of Fiber Optic Cable, Single Mode Section.
- (e) Should the tests and inspections show that any part of the aerial cable system, in the judgment of the Engineer, is defective or functions improperly, such adjustments, touch-ups and/or replacements shall be made by the Contractor as to make the installation satisfactory to the Engineer and at no extra cost.

Basis of Payment. This work will be paid for at the contract lump sum price for RUBY STREET AERIAL CABLES, for JACKSON STREET AND MCDONOUGH STREET AERIAL CABLES, for CASS STREET AND JEFFERSON STREET AERIAL CABLES, or for BRANDON ROAD AERIAL CABLES.

AERIAL CABLE SUPPORT SYSTEM

Description. This work shall consist of designing, furnishing, and installing a complete aerial cable support system for the Ruby Street Bridge according to the contract plans and approved shop drawings. This work shall include the towers, guy wires, lightning rods and conductors, cross arms, messengers, cable support, climbing rungs, all anchor bolts, nuts and incidentals, and tower and guy foundations. This work shall be according to these Special Provisions and the following:

General. The towers shall be engineered structures of tubular steel construction and as shown on the Plans. The east tower shall be anchored to the north side of the east pier as shown on the Plans. An existing AC unit is present in this location and may require relocation within the same area. The east guy shall be anchored near the existing billboard behind the east abutment on the north side of Ruby Street. The west tower and guy foundations shall be located behind the existing river wall on the north side of the west bridge abutment. A drilled shaft foundation is suggested for this tower. Conventionally reinforced concrete foundations are suggested for the east and west guy foundations. Foundation details shown on the Plans are for quantity estimating purposes only. The described system shall be designed by the Contractor. The Contractor may propose an alternate type of system to be approved by the Engineer. The towers shall have a galvanized finish according to ASTM A123. The Contractor shall submit the appropriate documents to the Engineer for approval. The Contractor shall not fabricate any parts of the system before receiving written approval of all required documents from the Engineer.

Loadings. The aerial cable support system design shall accommodate the proposed and future electrical cables as shown on the Plans. The towers, foundations, and their anchoring systems shall be designed to withstand the force of a 90 MPH wind without dependence on a transverse guying system. Ice and other loads and load combinations shall be as specified in the National Electrical Safety Code, C2-2012. Ice on cables and guys plus wind on the structure, cables, and guys shall be considered in the design with no overstress in the members or components. Longitudinal guys may be used as shown on the Plans to compensate for loads imposed by the aerial cables. The west guy may require a skew of up to 10 degrees with the messenger in order to remain within the available ROW.

Codes and Standards. The towers and foundations shall be engineered in accordance with the National Electrical Safety Code, C2-2012, NFPA-70-National Electrical Code and ASTM Standards.

Manufacturer. The towers and their accessories shall be manufactured by an IDOT approved manufacturer.

Coordination. The Contractor shall ensure coordination between the tower manufacturer and the aerial cable manufacturer. The tower shall be provided with messenger and cable supports as approved by the cable manufacturer for supporting the cable on the cross arms and down the tower to the conduit riser. The following coordination is also required:

- (a) Aerial Cables. (Ruby Street Bridge)
- (b) Coordination of Marine Navigation.
- (c) Bridge Electrical Installation.
- (d) Integrated Bridge Controls System.
- (e) Systems Integration.
- (f) Bridge Control CCTV System.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted to the Engineer for approval:

- (a) Structural calculations and design drawings signed and sealed by a Structural Engineer licensed in the State of Illinois (for towers, foundations, anchor bolts, guys, messengers and any stressed members)
- (b) Cable data
- (c) OHGW data
- (d) Ice and wind Loading data (towers, foundations and cables)
- (e) Tower fabrication details
- (f) Anchor bolt details
- (g) Guying and anchoring details
- (h) Cable supports
- (i) Lightning rod and lightning rod anchor details
- (j) Foundations details (towers and guys)
- (k) Reinforcement and dimensions

(l) Material and finish specifications

(m) Field assembly methods

(n) Quantity calculations (CONCRETE STRUCTURES, REINFORCEMENT BARS (EPOXY COATED), STRUCTURE EXCAVATION and ROCK EXCAVATION)

Installation. All materials brought to the site shall be inspected and approved by the Engineer before assembly on site. Any existing systems that require relocation or adjustment shall be relocated or adjusted before any erection of structural elements. Any relocation or adjustments shall be included in this work.

The towers shall be installed on leveling nuts so they are plumb. The Contractor shall submit the method of field assembly of the pole sections to the Engineer for approval. The centerline alignment of the assembled pole shall not vary from the centerline joining base and tip section by more than three inches. The plumbing shall be accomplished with an approved surveying instrument. The tower will be considered plumb when the center of the top is directly over the center of the base.

After the Engineer has approved the installation for plumb, absence of a lip in the wireway entrances, and tightness of all nuts, the space between the foundation and the base of the tower shall be filled with non-shrink grout.

After the anchor bolts have been tightened in accordance with the manufacturer's recommendations, the top nut shall be secured with a lock nut.

Basis of Payment. This work will be paid for at the contract lump sum price for AERIAL CABLE SUPPORT SYSTEM. Foundations for aerial cable towers and guy wires shall be paid for at the contract unit price for CONCRETE STRUCTURES, REINFORCEMENT BARS (EPOXY COATED), STRUCTURE EXCAVATION and ROCK EXCAVATION FOR STRUCTURES.

CLEARING AND GRUBBING

Description. This work shall consist of clearing and grubbing existing woody plant material and tree removal at the Brandon Road/U.S. Route 6 intersection, at the North Joliet/ Ruby Street intersection, and at CCTV Camera structure (pole) locations as indicated on the Contract Drawings. The work shall be completed in accordance with Section 201 of the Standard Specifications except as specified herein and as directed by the Engineer.

General. The work shall meet the following requirements:

- (a) The Contractor is advised that it is the intent of this provision that the designated areas be cleared of all trees, shrubs, brush, and rubbish.
- (b) The Contractor is advised to inspect the various areas involved prior to bidding, as no additional compensation will be allowed on this item.
- (c) Prior to beginning work at CCTV Camera structure (pole) locations, the Contractor shall submit clearing and grubbing plans to the Engineer for approval.

CONSTRUCTION REQUIREMENTS

This work shall be performed in accordance with the Standard Specifications.

Method of Measurement. The contract unit price for clearing and grubbing shall include removal and disposal of all material per the Standard Specifications for the areas as indicated on the Plans, including all materials, labor, or equipment required to complete this work. This work will be measured for payment in square yards

Basis of Payment. This work shall be paid for at the contract unit price per square yard for CLEARING AND GRUBBING, and no additional compensation will be allowed.

COMMUNICATIONS VAULT

Description. This work shall consist of providing and installing a composite concrete handhole and cover according to the contract plans and approved shop drawings. This work shall be according to these Special Provisions and the following:

General. The work shall meet the following requirements:

- (a) The composite concrete handhole and two-piece vault cover shall be constructed of polymer concrete material, and shall be gray in color.
- (b) The composite concrete handhole shall be 48 inches x 48 inches and shall have an effective depth of 36 inches.
- (c) The composite concrete handhole and cover shall have a design/test loading of 22,500/33,750 lbs respectively. Provide appropriately rated flange beam or tubing cover support as required.
- (d) The cover shall have a permanently recessed logo that reads "IDOT COMMUNICATIONS", or as otherwise designated by the Engineer.
- (e) The composite concrete handhole cover shall have two ½ x 4 inch pull slots. The cover surface shall have a coefficient of friction of 0.50 in accordance with ASTM C-1028.
- (f) The Contractor shall provide and install manufacturer-approved gasketing between the lid and the handhole to prevent water from entering the composite concrete handhole.
- (g) The composite concrete handhole lid shall be secured to the vault with two 3/8 inch NC stainless steel penta-head bolts and washers to lock the lid. In addition, a "lock tool" shall be provided for composite concrete handhole entry.
- (h) A fiber optic cable support assembly shall be recommended by the manufacturer and approved by the Engineer for fiber optic cable and splice enclosures used in the vault. Each support assembly shall consist of multiple brackets, racks, and/or rails required to suspend the required surplus cabling and any splice enclosures required.
- (i) The support assembly shall be made from or coated with weather resistant material such that there is no corrosion of the supports. The support assemblies shall be anchored to the vault using stainless steel hardware. The fiber optic cable support assemblies shall be included in the contract unit price for the communications vault.

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Catalog cuts and product data for each type of product and accessory proposed for installation. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

Installation.

- (a) Composite concrete handholes shall be installed in accordance with applicable requirements of Section 800 of the Standard Specifications and as provided herein.
- (b) A manufacturer-approved knockout punch driver shall be used to provide openings in the vaults for conduit, or the required openings may be machined at the time of stackable vault fabrication. Voids between entering conduits and punch driven or machined openings shall not exceed ½ inch.
- (c) Void areas between openings and conduit shall be filled with self-curing caulking consisting of a permanent, flexible rubber, which is unaffected by sunlight, water, oils, mild acids or alkalis. The caulking shall be mildew resistant and non-flammable. The material shall provide a permanent bond between the conduit entering the vault and the polymer concrete. The caulking shall be gray in color.
- (d) Any void areas shall be caulked from the interior and exterior of the composite concrete handhole. The caulk shall be allowed to fully cure per the manufacturer's specifications, prior to backfilling.
- (e) The composite concrete handhole shall be placed on 12 inches of coarse aggregate, CA-5 or CA 7 Class A, as specified in Section 1004 of the Standard Specifications. Seal and flash test the vault per the manufacturer's recommendations.
- (f) When fiber optic cable is installed, a minimum of 50 feet of excess cable per cable run shall be coiled in each composite concrete handhole containing splices to allow moving the splice enclosure to the splicing vehicle unless otherwise indicated in the Plans.

Basis of Payment. This work will be paid for at the contract unit price each for COMMUNICATIONS VAULT of the size indicated, which shall be payment in full for all material and work as specified herein.

FIBER OPTIC CABLE, SINGLE MODE

Description. The Contractor shall furnish and install loose-tube, single-mode, fiber optic cable of the number of fibers specified as shown in the Plans and as directed by the Engineer.

Other ancillary components required to complete the fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, fan-out kits, pigtail connectors, optical patch cords, etc., shall be included in the cost of fiber optic cable and will not be paid for separately.

Materials. The single-mode, fiber optic cable shall incorporate a loose, buffer-tube design. The cable shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1999 for a single sheathed, non-armored cable, and shall be new, unused, and of current design and manufacture.

Fibers. The cables shall use dispersion unshifted fibers. The optical and physical characteristics of the un-cabled fibers shall include:

The single-mode fiber shall meet EIA/TIA-492CAAA, "Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers," and ITU recommendation G.652.D, "Characteristics of a single-mode optical fiber cable."

Physical Construction			
Requirement		Units	Value
Cladding Diameter		(μm)	125.0 \pm 0.7
Core-to-Cladding Concentricity		(μm)	\leq 0.5
Cladding Non-Circularity			\leq 0.7 %
Mode Field Diameter	1310 nm	(μm)	9.2 \pm 0.4
	1550 nm		10.4 \pm 0.5
Coating Diameter		(μm)	245 \pm 5
Colored Fiber Nominal Diameter		(μm)	253 - 259
Fiber Curl radius of curvature		(m)	> 4.0 m

Optical Characteristics				
Requirement		Units	Value	
Cabled Fiber Attenuation	1310 nm	(dB/km)	≤ 0.4	
	1550 nm		≤ 0.3	
Point discontinuity	1310 nm	(dB)	≤ 0.1	
	1550 nm		≤ 0.1	
Macrobend Attenuation	Turns	Mandrel OD		
	1		32 ± 2 mm	< 0.05 at 1550 nm
	100		50 ± 2 mm	< 0.05 at 1310 nm
	100		50 ± 2 mm	< 0.10 at 1550 nm
	100		60 ± 2 mm	< 0.05 at 1550 nm
	100		60 ± 2 mm	< 0.05 at 1625 nm
Cable Cutoff Wavelength (λ_{ccf})		(nm)	< 1260	
Zero Dispersion Wavelength (λ_0)		(nm)	1302 ≤ λ_0 ≤ 1322	
Zero Dispersion Slope (S_0)		(ps/(nm ² •km))	≤ 0.089	
Total Dispersion	1550 nm	(ps/(nm•km))	≤ 3.5	
	1285-1330 nm		≤ 17.5	
	1625 nm		≤ 21.5	
Cabled Polarization Mode Dispersion		(ps/km ⁻²)	≤ 0.2	
IEEE 802.3 GbE - 1300 nm Laser Distance		(m)	up to 5000	
Water Peak Attenuation: 1383 ± 3 nm		(dB/km)	≤ 0.4	

Cable Construction. The number of fibers in each cable shall be as specified on the Plans.

Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm. Each buffer tube shall contain up to 12 fibers. The fibers shall not adhere to the inside of the buffer tube.

Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding." The fibers shall be colored with ultraviolet (UV) curable inks.

Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding." Buffer tube colored stripes shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

For cables containing more than 12 buffer tubes, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only and shall begin with the first tube. If fillers are required, they shall be placed in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and shall not be subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900.

Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed. Fillers shall be placed so that they do not interrupt the consecutive positioning of the buffer tubes. In dual layer cables, any fillers shall be placed in the inner layer. Fillers shall be nominally 2.5 mm or 3.0 mm in outer diameter.

The central member shall consist of a dielectric, glass reinforced plastic (GRP) rod (optional steel central member). The purpose of the central member is to provide tensile strength and prevent buckling. The central member shall be overcoated with a thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

Each buffer tube shall contain a water-swellaable yarn for water-blocking protection. The water-swellaable yarn shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. It shall also be free from dirt or foreign matter. This yarn will preclude the need for other water-blocking material; the buffer-tube shall be gel-free. The optical fibers shall not require cleaning before placement into a splice tray or fan-out kit.

Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process.

Water swellaable yarn(s) shall be applied longitudinally along the central member during stranding.

Two polyester yarn binders shall be applied contrahelically with sufficient tension to secure each buffer tube layer to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking, and dielectric with low shrinkage.

For single layer cables, a water swellaable tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The water swellaable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water swellaable tape shall be applied longitudinally over both the inner and outer layer. The water swellaable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

The cables shall contain one ripcord under the sheath for easy sheath removal.

Tensile strength shall be provided by the central member, and additional dielectric yarns as required.

The dielectric yarns shall be helically stranded evenly around the cable core.

The cables shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members (as required) and water swellable tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

The jacket or sheath shall be free of holes, splits, and blisters.

The cable jacket shall contain no metal elements and shall be of a consistent thickness.

Cable jackets shall be marked with the manufacturer's name, month and year of manufacture, sequential meter or foot markings, a telecommunication handset symbol as required by Section 350G of the National Electrical Safety Code (NEC), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more co-extruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890N (200 lbf) long term installed.

The shipping, storage, and operating temperature range of the cable shall be -40°C to +70°C. The installation temperature range of the cable shall be -30°C to +70°C.

General Cable Performance Specifications. The fiber optic cable manufacturer shall provide documentation and certify that the fiber optic cable complies with the following EIA-455-xxx Fiber Optic Test Procedures (FOTP):

- (a) When tested in accordance with FOTP-3, "*Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components,*" the change in attenuation at extreme operational temperatures (-40°C and +70°C) shall not exceed 0.15 dB/km at 1550 nm for single-mode fiber and 0.3 dB/km at 1300 nm for multimode fiber.
- (b) When tested in accordance with FOTP-82, "*Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable,*" a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.
- (c) When tested in accordance with FOTP-81, "*Compound Flow (Drip) Test for Filled Fiber Optic Cable,*" the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 70°C.

- (d) When tested in accordance with FOTP-41, "*Compressive Loading Resistance of Fiber Optic Cables*," the cable shall withstand a minimum compressive load of 220 N/cm (125 lbf/in) applied uniformly over the length of the sample. The 220 N/cm (125 lbf/in) load shall be applied at a rate of 2.5 mm (0.1 in) per minute. The load shall be maintained for a period of 1 minute. The load shall then be decreased to 110 N/cm (63 lbf/in). Alternatively, it is acceptable to remove the 220 N/cm (125 lbf/in) load entirely and apply the 110 N/cm (63 lbf/in) load within five minutes at a rate of 2.5 mm (0.1 in) per minute. The 110 N/cm (63 lbf/in) load shall be maintained for a period of 10 minutes. Attenuation measurements shall be performed before release of the 110 N/cm (63 lbf/in) load. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fibers and 0.30 dB at 1300 nm for multimode fiber.
- (e) When tested in accordance with FOTP-104, "*Fiber Optic Cable Cyclic Flexing Test*," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.
- (f) When tested in accordance with FOTP-25, "*Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies*," except that the number of cycles shall be two at three locations along a one meter cable length and the impact energy shall be at least 4.4 Nm (in accordance with ICEA S-87-640)", the change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.
- (g) When tested in accordance with FOTP-33, "*Fiber Optic Cable Tensile Loading and Bending Test*," using a maximum mandrel and sheave diameter of 560 mm, the cable shall withstand a rated tensile load of 2670N (601 lbf) and residual load of 30% of the rated installation load. The axial fiber strain shall be $\leq 60\%$ of the fiber proof level after completion of 60 minute conditioning and while the cable is under the rated installation load. The axial fiber strain shall be $\leq 20\%$ of the fiber proof level after completion of 10 minute conditioning and while the cable is under the residual load. The change in attenuation at residual load and after load removal shall not exceed 0.15 dB at 1550 nm for single mode fiber and 0.30 dB at 1300 nm for multimode fiber.
- (h) When tested in accordance with FOTP-85, "*Fiber Optic Cable Twist Test*," a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.
- (i) When tested in accordance with FOTP-37, "*Low or High Temperature Bend Test for Fiber Optic Cable*," the cable shall withstand four full turns around a mandrel of ≤ 20 times the cable diameter after conditioning for four hours at test temperatures of -30°C and $+60^{\circ}\text{C}$. Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears, or other openings. The change in attenuation shall not exceed 0.30 dB at 1550 nm for single mode fiber and 0.50 dB at 1300 nm for multimode fiber.

Quality Assurance Provision. All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel. The cable manufacturer shall be TL 9000 registered.

Packaging. Top and bottom ends of the cable shall be available for testing. Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:

- (a) Cable Number
- (b) Gross Weight
- (c) Shipped Cable Length in Meters
- (d) Job Order Number
- (e) Product Number
- (f) Customer Order Number
- (g) Date Cable was Tested
- (h) Manufacturer Order Number
- (i) Cable Length Markings
 - (1) Top (inside end of cable)
 - (2) Bottom (outside end of cable)

The reel (one flange) marking shall include:

- (a) Manufacturer
- (b) Country of origin
- (c) An arrow indicating proper direction of roll when handling
- (d) Fork lift-handling illustration
- (e) Handling Warnings.

Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:

- (a) Manufacturer Cable Number
- (b) Manufacturer Product Number
- (c) Manufacturer Factory Order Number
- (d) Customer Name
- (e) Customer Cable Number
- (f) Customer Purchase Order Number
- (g) Mark for Information
- (h) Ordered Length
- (i) Maximum Billable Length
- (j) Actual Shipped Length
- (k) Measured Attenuation of Each Fiber

The cable shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 10 times its outer diameter during operation without changing the characteristics of the optical fibers.

The cable shall meet all of specified requirements under the following conditions:

- (a) Shipping/storage temperature: -58° F to +158° F (-50° C to +70° C)
- (b) Installation temperature: -22° F to +158° F (-30° C to +70° C)
- (c) Operating temperature: -40° F to +158° F (-40° C to +70° C)
- (d) Relative humidity from 0% to 95%, non-condensing

Optical Patch Cords and Pigtails. The optical patch cords and pigtails shall comply with the following:

- (a) The optical patch cords shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- (b) The factory installed connector furnished as part of the optical patch cords and pigtails shall meet or exceed the requirements for approved connectors specified herein.
- (c) The fiber portion of each patch cord and pigtail shall be a single, jacketed fiber with optical properties identical to the optical cable furnished under this contract.
- (d) The twelve fiber single-mode fiber optic cable shall be installed as a pigtail with factory installed ST compatible connectors.
- (e) The patch cords shall comply with Telcordia GR-326-CORE

Connectors.

- (a) The optical connectors shall comply with the following:
- (b) All connectors shall be factory installed ST compatible connectors. Field installed connectors shall not be allowed.
- (c) Maximum attenuation 0.4dB, typical 0.2dB.
- (d) No more than 0.2dB increase in attenuation after 1000 insertions.
- (e) Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- (f) All fibers shall be connectorized at each end.
- (g) All fibers shall terminate at a fiber optic termination housing or patch panel.
- (h) Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- (i) Termination shall be facilitated by splicing factory OEM pigtails on the end of the bare fiber utilizing the fusion splicing method. Pigtails shall be one meter in length.

CONSTRUCTION REQUIREMENTS

Experience Requirements. Personnel involved in the installation, splicing, and testing of the fiber optic cables shall meet the following requirements:

- (a) A minimum of three (3) years experience in the installation of fiber optic cables, including fusion splicing, terminating, and testing single mode fibers.
- (b) Install two systems where fiber optic cables are outdoors in conduit and where the systems have been in continuous satisfactory operation for at least two years. The Contractor shall submit as proof photographs or other supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installed fiber optic systems.
- (c) One fiber optic cable system (which may be one of the two in the preceding paragraph), which the Contractor can arrange for demonstration to the Department representatives and the Engineer.

Installers shall be familiar with the cable manufacturer's recommended procedures for installing the cable. This shall include knowledge of splicing procedures for the fusion splicer being used on this project and knowledge of all hardware such as breakout (furcation) kits and splice closures. The Contractor shall submit documented procedures to the Engineer for approval and to be used by Construction inspectors.

Personnel involved in testing shall have been trained by the manufacturer of the fiber optic cable test equipment to be used in fiber optic cable testing procedures. Proof of this training shall be submitted to the Engineer for approval. In addition, the Contractor shall submit documentation of the testing procedures and a copy of the test equipment operation manual for approval by the Engineer.

Installation in Raceways. The Contractor shall provide a cable-pulling plan, identifying where the cable will enter the underground system and the direction of pull. This plan will address locations where the cable is pulled out of a handhole, coiled in a figure eight, and pulled back into the hand hole. The plan shall address the physical protection of the cable during installation and during periods of downtime. The cable-pulling plan shall be provided to the Engineer for approval a minimum of 15 working days prior to the start of installation. The Engineer's approval shall be for the operation on the freeway and does not include an endorsement of the proposed procedures. The Contractor is responsible for the technical adequacy of the proposed procedures.

During cable pulling operations, the Contractor shall ensure that the minimum bending of the cable is maintained during the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the handhole conduit ports. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation-bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the cable manufacturers specifically approve the array.

The pulling tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable. Fuse links and breaks can be used to ensure that the cable tensile strength is not exceeded. The pulling system shall have an audible alarm that sounds whenever a pre-selected tension level is reached. Tension levels shall be recorded continuously and shall be given to the Engineer.

The cable shall be pulled into the conduit as a single component, absorbing the pulling force in all tension elements. The central strength member and Aramid yarn shall be attached directly to the pulling eye during cable pulling. "Basket grip" or "Chinese-finger type" attachments, which only attach to the cable's outer jacket, shall not be permitted. A breakaway swivel, rated at 95% of the cable manufacturer's approved maximum tensile loading, shall be used on all pulls. When simultaneously pulling fiber optic cable with other cables, separate grooved rollers shall be used for each cable.

To minimize the exposure of the backbone cable and to facilitate the longer lengths of fiber optic cable, the Contractor shall use a "blown cable" (pneumatically assisted) technique to place the fiber optic cable.

Where cable is to be pulled through existing conduit which contains existing cables, optical or other, the existing cables shall be removed and reinstalled with the fiber optic cable as indicated on the Plans. The removal of the cable(s) shall be paid for separately. Reinstallation of the existing cables, if indicated on the Plans, along with the fiber optic cable shall be included in this item for payment.

Where conduits containing fiber enter cabinets, vaults, and pull boxes, seal conduits with a removable mastic material to prevent entry by rodents.

Tracer Wire. A tracer wire shall be installed with all underground fiber optic cable runs. One tracer wire shall be installed along with the fiber optic cable in each raceway. If a raceway has more than one fiber optic cable, only one tracer wire per raceway is required. If there are parallel raceways, a tracer wire is required in each raceway that contains a fiber optic cable. Tracer wire shall be installed in raceway segments which are metallic to provide a continuous tracer wire system.

The tracer wire shall be a direct burial rated, number 12 AWG (minimum) solid (.0808" diameter), steel core, soft drawn, high strength tracer wire. The wire shall have a minimum 380 pound average tensile break strength. The wire shall have a 30 mil high density yellow polyethylene (HDPE) jacket complying with ASTM-D-1248, and a 30 volt rating.

Connection devices used shall be as approved by the tracer wire manufacturer, except wire nuts of any type are not acceptable and shall not be used.

The cost of the tracer wire shall be included in the cost of the fiber optic cable and not paid for separately.

Construction Documentation Requirements. Installation Practices for Outdoor Fiber Optic Cable Systems

The Contractor shall examine the proposed cable plant design. At least one month prior to starting installation of the fiber optic cable plant, the Contractor shall prepare and submit to the Engineer for review and approval, ten (10) copies of the Contractor's "Installation Practices for Outdoor Fiber Optic Cable Systems" manual. This manual shall address the Contractor's proposed practices covering all aspects of the fiber optic cable plant. This submittal shall include all proposed procedures, a list of installation equipment, and splicing and test equipment. Test and quality control procedures shall be detailed as well as procedures for corrective action.

Operation and Maintenance Documentation. After the fiber optic cable plant has been installed, ten (10) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

- (a) Complete and accurate as-built diagrams showing the entire fiber optic cable plant design including cable, individual fiber naming/numbering convention, and locations of all splices and terminations.
- (b) Final copies of all approved test procedures
- (c) Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.
- (d) Complete parts list including names of vendors.

Testing Requirements. The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and unterminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an Optical Time Domain Reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

Fibers which are not to be terminated shall be tested with a temporary fusion spliced pigtail fiber. **Mechanical splice or bare fiber adapters are not acceptable.**

The Contractor shall provide the date, time, and location of any tests required by this specification to the Engineer at least 5 days before performing the test. Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A Certified Technician utilizing an Optical Time Domain Reflectometer (OTDR) and Optical Source/Power Meter shall conduct the installation test. The Technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers.

All testing shall be witnessed by the IDOT Engineer, and a copy of the test results (CD ROM or USB Drive) shall be submitted on the same day of the test. Hardcopies shall be submitted as described herein with copies on CD ROM.

At the completion of the test, the Contractor shall provide two copies of documentation of the test results to the Project Engineer. The test documentation shall be submitted as both a bound copy and a CDROM and shall include the following:

(a) Cable & Fiber Identification:

- (1) Cable ID
- (2) Cable Location (beginning and end point)
- (3) Fiber ID, including tube and fiber color
- (4) Wavelength
- (5) Pulse Width (OTDR)
- (6) Refractory Index (OTDR)
- (7) Operator Name
- (8) Date and Time
- (9) Setup Parameters
- (10) Range (OTDR)
- (11) Scale (OTDR)
- (12) Setup Option chosen to pass OTDR "dead zone"

(b) Test Results shall include:

- (1) OTDR Test Results
- (2) Total Fiber Trace
- (3) Splice Loss/Gain
- (4) Events > 0.10 dB
- (5) Measured Length (Cable Marketing)
- (6) Total Length (OTDR)
- (7) Optical Source/Power Meter Total Attenuation (dB/km)

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

The OTDR test results file format must be Bellcore/Telcordia compliant according to GR-196-CORE Issue 2, OTDR Data Standard, GR 196, Revision 1.0, GR 196, Revision 1.1, GR 196, Revision 2.0 (SR-4731) in a “.SOR” file format. A copy of the test equipment manufacture’s software to read the test files, OTDR, and power, shall be provided to the Department. These results shall also be provided in tabular form, see sample below:

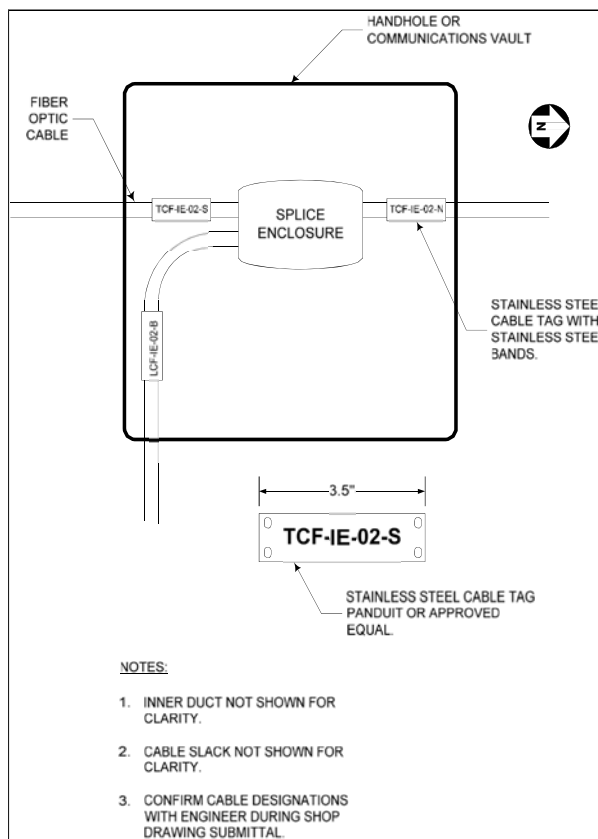
Sample OTDR Summary					
Cable Designation:	TCF-IK-03	OTDR Location:	Pump Sta. 67	Date:	1/1/00
Fiber Number	Event Type	Event Location	Event Loss (dB)		
			1310 nm	1550 nm	
1	Splice	23500 Ft.	.082	.078	
1	Splice	29000 Ft.	.075	.063	
2	Splice	29000 Ft.	.091	.082	
3	Splice	26000 Ft.	.072	.061	
3	Bend	27000 Ft.	.010	.009	

The following shall be the criteria for the acceptance of the cable:

- (a) The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.
- (b) The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.5 dB/km at both 1310 and 1550 nm. If the total loss exceeds these specifications, the Contractor shall replace or repair that cable run at no additional cost to the state, both labor and materials. Elevated attenuation due to exceeding the pulling tension during installation shall require the replacement of the cable run at no additional cost to the State, including labor and materials.

Slack Storage of Fiber Optic Cables. Included as a part of this item, slack fiber shall be supplied as necessary to allow for splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored underground in handholes or in the raised base adapters of ground mounted cabinets in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be 100 feet for each cable at each splice location, above or below ground. Fiber optic cable slack shall be 50 feet for each cable at access points, above or below ground, where splicing is not involved. This slack shall be measured for payment.

Fiber optic cable shall be tagged inside handholes with yellow tape containing the text: "CAUTION - FIBER OPTIC CABLE." In addition, permanent tags, as approved by the engineer, shall be attached to all cable in a hand hole or other break-out environment. These tags shall be stainless steel, nominally 0.75" by 1.72", and permanently embossed. These tags shall be attached with stainless steel straps and shall identify the cable number, the number of fibers, and the specific fiber count. Tags and straps shall be Panduit or approved equal. See figure below:



Label the destination of each trunk cable onto the cable in each handhole, vault, or cable termination panel.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the bid prices for the BRIDGE ELECTRICAL INSTALLATION, INTEGRATED BRIDGE CONTROLS SYSTEM, SCADA SYSTEM, BRIDGE CONTROL CCTV SYSTEM, RUBY STREET AERIAL CABLES, JACKSON STREET AND MCDONOUGH STREET AERIAL CABLES, CASS AND JEFFERSON STREET AERIAL CABLES, BRANDON ROAD AERIAL CABLES.

FIBER OPTIC CABLE, MULTI MODE

Description. The Contractor shall furnish and install multi-mode, fiber optic cable as required for local fiber optic network interconnections on each of the six movable bridges and within the bridge control office. Multi-mode fiber optic cable specifications shall be closely coordinated with the requirements of all associated connected equipment and Ethernet switches.

General. Cable overall jackets shall be color coded per TIA-598C standards. Individual fibers within cable assemblies shall follow current TIA/EIA standard color codes. Connector bodies and boots shall follow TIA-568 standards. Cables shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 10 times its outer diameter during operation without changing the characteristics of the optical fibers. Manufacturers of fiber optic cables and related components must utilize the most advanced commercial materials and manufacturing process and must be ISO 9001 certified.

Loose Tube Fiber Optic Cable. Loose tube type cable shall be used for multi-mode fiber optic cable installed in conduit when installed in an outdoor area or a machinery area subject to possible exposure to moisture. Cables shall be suitable for installation in conduit. Other requirements are as follows:

- (a) 12 fiber cable, water and fungus resistant materials.
- (b) OM3/OM4 – 50/125 um laser optimized, 850/1300 nm operating wavelength.
- (c) 3.0/1.0 dB/km maximum attenuation.
- (d) 1 Gigabit Serial Ethernet length of 1000/550m or better.
- (e) Operating temperature range of -40°C to 70°C (-40°F to 158°F).
- (f) Gel-free construction utilizing water blocking yarn and tape.
- (g) Individual fiber strands and or groupings color coded per ANSI/TIA/EIA guidelines.

Breakout Fiber Optic Cable. Breakout type cable shall be permitted to be used for fiber optic cable segments contained completely within bridge operator houses or within a building. Cables shall have jacket fire resistance ratings required for riser applications per applicable UL and NEC requirements. Other requirements are as follows:

- (a) Fiber count as required by application; cable shall include a minimum of two spare fibers.
- (b) OM3/OM4 – 50/125 um laser optimized, 850/1300 nm operating wavelength.
- (c) 3.0/1.0 dB/km maximum attenuation.
- (d) 1 Gigabit Serial Ethernet length of 1000/550m or better.
- (e) Operating temperature range of -20°C to 70°C (-4°F to 158°F).
- (f) Individual fibers suitable for direct-termination with standard connectors.

General Cable Performance Specifications. General cable performance specifications shall be as defined in Section Fiber Optic Cable, Single Mode.

Fan-out Kits. Provide breakout type kits for loose tube cable terminations. Kits shall be compatible with loose tube fiber optic cable and connectors. Other requirements are as follows:

- (a) Color coded tubes for 12 fibers per TIA/EIA standards - minimum 47" length.
- (b) Operating temperature range of -40°C to 70°C (-40°F to 158°F).

Optical Patch Cords. For connections between devices within the same cabinet, utilize pre-fabricated, high quality optical patch cords. Optical patch cords shall comply with the following:

- (a) The optical patch cords shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends. The fiber type shall match the type of fiber utilized in the local network and shall be compatible with connected devices.
- (b) The factory installed connectors furnished as part of the optical patch cords shall be the correct matching type for connected equipment. Duplex type cords shall provide an identification marking / striping scheme to differentiate the individual fibers.
- (c) Provide patch cables of sufficient length to allow neat cable routing between devices without excessive bending or kinking.
- (d) Patch cable jackets, connector bodies, and boots shall be color coded per industry standards.
- (e) Insertion loss: 0.35dB typical, 0.5dB maximum.
- (f) 100% factory tested for insertion loss with factory certification.

Connectors. Provide field installed connectors as required for connected devices.

- (a) Connector performance shall meet or exceed performance requirements of ANSI/TIA/EIA 568-C.
- (b) Insertion loss: 0.35dB typical, 0.5dB maximum.
- (c) ST connectors compliant to TIA/EIA-604-2 (FOCIS-2).
- (d) SC connectors compliant to TIA/EIA-604-3 (FOCIS-3).
- (e) LC connectors compliant to TIA/EIA-604-10 (FOCIS-10).
- (f) Operating temperature range of -40°C to 75°C (-40°F to 167°F).

CONSTRUCTION REQUIREMENTS

Submittals. The following shall be submitted:

- (a) Product data for all cable types, connectors, and all associated accessories.
- (b) Fiber optic cable plant design including cable and an individual fiber naming/numbering convention.
- (c) The Contractor's documentation on qualifications and experience for fiber optic installations.
- (d) For all fiber optic segments that involve field installed fiber optic cables, provide loss budget calculations based on approved cables and components.
- (e) Testing procedures and equipment information.

Experience Requirements. Personnel involved in the installation, splicing, and testing of the fiber optic cables shall meet the following requirements:

- (a) A minimum of five (5) years experience in the installation of fiber optic cables, including terminating and testing multi mode fibers.
- (b) Installed a minimum of three systems where fiber optic cables are installed outdoors in conduit and where the systems have been in continuous satisfactory operation for at least two years. The Contractor shall submit as proof, photographs or other supporting documents and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installed fiber optic systems.

Installers shall be familiar with the cable manufacturer's recommended procedures for installing the cable. This shall include knowledge of splicing procedures, and knowledge of all hardware such as fan-out / breakout (furcation) kits, splice closures, and connectors.

Personnel involved in testing shall have been trained by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training shall be submitted to the Engineer for approval. In addition, the Contractor shall submit documentation of the testing procedures and a copy of the test equipment specification sheet for approval by the Engineer.

Installation in Raceways.

During cable pulling operations, the Contractor shall ensure that the minimum bending of the cable is maintained during the pulling and unreeling operations. Do not exceed the maximum pulling tension rating. Follow all applicable cable manufacturer guidelines for pulling techniques, pulling tension ratings, and lubricant use to minimize pulling friction. Pre-terminated cable assemblies installed in conduit shall include factory installed pulling eyes and protective boots for connectors.

Ensure that conduits are sized properly to accommodate cables, and sufficient pull boxes are provided in order to facilitate installation of cables. Where conduits containing fiber enter cabinets and enclosures, conduits shall be sealed with a removable mastic material to prevent entry by rodents.

Termination.

Field installed connectors and connectors on patch cords shall be inspected and cleaned prior to being connected. Follow connector manufacturer procedures for installing connectors and use recommended tools, adhesives, and accessories. Coordinate connector types with the requirements of connected equipment and fiber optic panel housings. All fibers shall be connectorized at each end. Unused fibers shall be protected with a plastic cap.

Prepare fiber optic cables for breakout kits and install kits according to the manufacturer's instructions.

When used to organize cables inside cabinets and enclosures, cable ties should be hand tightened to be snug but loose enough to be moved along the cable by hand. Excess length of the tie should be cut off to prevent future tightening. Hook-and-loop fastener ties are preferred for fiber optic cables, as they cannot apply crush loads sufficient to harm the cable.

Testing Requirements. Test all terminated cables for continuity, polarity, and end-to-end insertion losses. Test all multi mode fibers in all cables for losses using an OLTS power meter and source in accordance with TIA OFSTP-14. Compare measured loss for each segment to the calculated loss budget to ensure that losses are within acceptable industry standards. Replace any connectors identified to be defective.

Test patch cords per standard test FOTP-171. Patch cords failing testing shall be inspected, cleaned, and retested. Patch cables failing retesting shall be rejected.

The Contractor shall replace or repair any cables failing testing at no additional cost to the Department, both labor and materials.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the bid prices for the BRIDGE ELECTRICAL INSTALLATION, INTEGRATED BRIDGE CONTROLS SYSTEM, SCADA SYSTEM, BRIDGE CONTROL CCTV SYSTEM, RUBY STREET AERIAL CABLES, JACKSON STREET AND MCDONOUGH STREET AERIAL CABLES, CASS AND JEFFERSON STREET AERIAL CABLES, BRANDON ROAD AERIAL CABLES.

TRAFFIC CONTROL AND PROTECTION, (SPECIAL)

Description. This work shall consist of furnishing, installing, maintaining and removing all traffic control items as shown on the Detour Plans, or as directed by the Engineer, for each of the six bridge closures. With the exception of the items noted below, this work includes all labor, equipment and materials necessary to implement the Detour Plans. Items include, but are not limited to, the following: signs, drums, barricades, warning lights, fencing, covering of existing signs, permanent pavement marking removal and installation, and temporary pavement marking installation and removal. The work also includes all items required for IDOT Traffic Control Standards referenced within the Detour Plans.

Temporary Traffic Signal Timing, Changeable Message Signs, and Temporary Information Signing as shown on the Detour Plans will be paid for separately.

It is assumed that all work at each bridge requiring traffic control and protection will be accomplished during the respective bridge closures. Requests for additional traffic control and protection to perform work prior to or following the respective bridge closures shall be submitted to the Engineer for review and approval and will not be a basis for additional payment.

Basis of Payment. This work will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION, (SPECIAL).

OVERALL CONSTRUCTION SEQUENCE

Description. 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.

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's actual sequence of construction shall comply with the requirements of the Contract Documents and all applicable federal, U.S. Coast Guard, state, and local laws and regulations. The Contractor's actual sequence of construction must be submitted and approved prior to commencing on-site activities.

Bridge Roadway Closures. Due to existing traffic patterns and conditions, only one of the six movable bridges shall be closed to roadway traffic during any given period of time. The only exception is that the Brandon Road Bridge could potentially be closed at the same time as the Ruby Street Bridge, the Jackson Street Bridge, or the Cass Street Bridge. If two bridges were closed at the same time, the Contractor would be required to provide additional labor so that the maximum closure time per bridge would not be significantly more than the closure time required for work on a single bridge. The maximum time for closure of an individual bridge shall not exceed 60 Calendar Days.

Fiber Optic Network Construction. Coordinate project work with separate IDOT contract to install fiber optic network.

- (a) Coordinate overall fiber optic network design.
- (b) Network segments construction shall be coordinated with bridge construction activities to allow bridges to be connected to the network as bridge construction is completed.
- (c) Coordinate fiber optic field termination at individual bridges and testing.

City of Joliet. The Contractor shall communicate with the City of Joliet prior to developing the sequence of construction to coordinate construction activities with the City's anticipated construction projects and major events. The Contractor's sequence of construction and major revisions to the sequence of construction shall be communicated to the City of Joliet. The Contractor shall inform the City of Joliet of times when individual bridges will be closed to vehicular and/or pedestrian traffic.

Suggested Sequence of Construction. The following sequence of construction is provided solely to illustrate a potential sequence for performing the work. The Contractor shall bear full responsibility for determining the actual sequence of construction in accordance with the requirements of this section, but is encouraged to use the recommended sequence given here as a guide in doing so. The Contractor's actual sequence of construction shall comply with the explicit and implicit requirements of this Section, as well as the general intent of the sequence outlined here.

(a) Phase 1 – Mobilization and Preliminary work.

- (1) Develop construction schedule.
- (2) Coordination activities as required with USCG, USACE, and other agencies. Allow for time required for reviewing and approving documents.
- (3) Begin submittal and submittal review process.
- (4) Contractor Mobilization.
- (5) Purchase, fabricate, and transport materials.
- (6) Renovation work on the IDOT Bridge Office Building.

(b) Phase 2 – Jackson Street Bridge. The Jackson Street Bridge is the recommended bridge to begin construction due to the proximity to the Bridge Office Building. The project will install the fiber optic cables between the Jackson Street Bridge and the Bridge Office Building to permit full testing of the centralized control operation of the Jackson Street Bridge.

- (1) Jackson Street Bridge Construction.
- (2) Install IDOT Bridge Office SCADA system, CCTV system, operator stations, and supporting network equipment.

(c) Phase 3 – Jackson Street Bridge Testing.

- (1) Test and debug Jackson Street Bridge on-bridge controls.
- (2) Test and debug Jackson Street Bridge centralized SCADA controls and wireless backup network; train operators.
- (3) Perform U.S. Coast Guard trial period for Jackson Street centralized SCADA testing.

(d) Phase 4 – Cass Street Bridge. The Cass Street Bridge is very similar to the Jackson Street Bridge as well as the Jefferson Street and McDonough Street Bridges.

- (1) Cass Street Bridge Construction.
- (2) Test and debug Cass Street Bridge on-bridge and centralized SCADA controls.

(e) Phase 5 – Jefferson Street Bridge.

- (1) Jefferson Street Bridge Construction.
- (2) Test and debug Jefferson Street Bridge on-bridge and centralized SCADA controls.

(f) Phase 6 – McDonough Street Bridge.

- (1) McDonough Street Bridge Construction.
- (2) Begin preliminary work on Ruby Street Bridge for the new aerial cable system.
- (3) Test and debug McDonough Street Bridge on-bridge and centralized SCADA controls.

(g) Phase 7 – Ruby Street Bridge and Brandon Road Bridge. Working on the northern most and southern most bridges at the same time is proposed to minimize roadway traffic impact.

- (1) Ruby Street Bridge Construction and Brandon Road Bridge Construction.
- (2) Test and debug Brandon Road Bridge on-bridge and centralized SCADA controls
- (3) Test and debug Ruby Street Bridge on-bridge and centralized SCADA controls.

(h) Phase 8 – Complete punch list items.

Construction Schedule. The Contractor's sequence of construction shall be developed to meet the completion date specified in the contract. The Contractor shall be responsible for providing and scheduling all work required to meet the schedule including multiple shift, weekend, and holiday work.

Submittals. The Contractor shall submit the actual sequence of construction to the Department. The actual sequence of construction must be approved by the Department prior to commencing on-site activities. The Contractor's individual site activities at each bridge, the I-80 bridge wireless repeater, and the bridge office shall be coordinated with and approved by IDOT's Resident Engineer. 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 harmless 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.

Basis of Payment. This work will not be measured or paid for separately, but shall be considered included in the bid prices for the Contract.

UNDERGROUND FIBER OPTIC CONDUIT BANK

Description. The Contractor shall install an underground fiber optic conduit bank in accordance with Section 810 of the Standard Specifications and the following. Where required to avoid existing underground utilities and when approved by the Engineer, the Contractor shall be permitted to install an underground fiber optic conduit bank in an alternate orientation as shown on the Plans.

Upon completing the installation, the Contractor shall be responsible for insuring the integrity of the conduits and for demonstrating that no obstructions or defects are present that would restrict the available cross-sectional area of the conduits or otherwise interfere with the installation of cables. Pull aluminum or wood test mandrel through each continuous section of conduit to prove joint integrity and test for out-of-round conditions. Provide mandrel equal to 80 percent fill of conduit size installed. If obstructions and/or defects are indicated, The Contractor shall be responsible for repairing any damaged sections of the underground conduit bank to the satisfaction of the Engineer and for retesting the repaired conduits at no additional costs to the Department.

Provide as-built scaled plan drawings documenting route of underground conduit bank in relation to all access vaults, junction boxes, buildings, and other stationary reference points. Coordinate with electrical work for the Bridge Office building generator.

Basis of Payment. This work will be paid for at the contract unit price per linear foot for the particular type of CONDUIT ENCASED.

ELECTRIC SERVICE INSTALLATION, SPECIAL

Description. This item shall consist of all material and labor required to extend, connect or modify the electric services, as indicated or specified, which is over and above the work performed by the utility. Unless otherwise indicated, the cost for the utility work, if any, will be reimbursed to the Contractor separately under ELECTRIC SERVICE CONNECTION. This item may apply to the work at more than one service location and each will be paid separately.

Materials. Materials shall be in accordance with the Standard Specifications.

CONSTRUCTION REQUIREMENTS

General. The electric service installation shall extend beyond utility owned facilities as shown on the Plans. The Contractor shall ascertain the work being provided by the electric utility and shall provide all additional material and work not included by other contract pay items required to complete the electric service work in complete compliance with the requirements of the utility.

No additional compensation will be allowed for work required for the electric service, even though not explicitly shown on the Plans or specified herein.

Basis of Payment. This work will be paid for at the contract unit price for each ELECTRIC SERVICE INSTALLATION, SPECIAL which shall be payment in full for the work specified herein.

ELECTRICAL SERVICE CONNECTION

Description. This item shall consist of payment for work performed by ComEd in providing or modifying electric service as indicated. This includes electric service utility work at two separate locations:

- Replace existing overhead service at Bridge Control Office with new underground service as shown on the Plans.
- Provide new service at an existing COMED utility pole located on US Route 6/Railroad Street approximately 80 feet southwest of the I-80 Eastbound Bridge as shown on the Plans.

CONSTRUCTION REQUIREMENTS

General. It shall be the Contractor's responsibility to contact ComEd. The Contractor shall coordinate his work fully with ComEd both as to the work required and the timing of the installation. No additional compensation will be granted under this or any other item for extra work caused by failure to meet this requirement. **Please contact ComEd, New Business Center Call Center, at 866 NEW ELECTRIC (1-866-639-3532) to begin the service connection process. The Call Center Representatives will create a work order for the service connection. The representative will ask the requestor for information specific to the request. The representative will assign the request based upon the location of project.**

The Contractor should make particular note of the need for the earliest attention to arrangements with ComEd for service. In the event of delay by ComEd, no extension of time will be considered applicable for the delay unless the Contractor can produce written evidence of a request for electric service within 30 days of execution.

For bidding purposes, this item shall be estimated as \$5,000.00 for each location.

Basis of Payment. This work will be paid for at the contract unit price per each location for ELECTRICAL SERVICE CONNECTION which shall be reimbursement in full for electric utility service charges. Work provided by the Contractor for electric service will be paid separately as described under ELECTRIC SERVICE INSTALLATION, SPECIAL. No extra compensation shall be paid to the Contractor for any incidental materials and labor required to fulfill the requirements as shown on the Plans and specified herein.

ELECTRICAL SERVICE DISCONNECT

Description. This item shall consist of furnishing and installing a service disconnect for the I-80 Bridge Wireless Backup Network utility power as specified below, as shown on the Plans, and as directed by the Engineer. This item shall include furnishing and installing conduit and wiring on the load side of the service disconnect up to and including the weatherhead for transitioning to aerial cables.

Materials. The service disconnect shall be a heavy-duty, enclosed circuit breaker type safety switch, UL listed as suitable for service entrance application, continuously rated for 30 amperes. The enclosure shall be NEMA 4X stainless steel, tamper proof with provisions for locking in the ON and OFF positions and interlocking to prevent the door from opening when the breaker is ON.

Circuit Breaker shall be 2-pole, 120/240 volt, thermal magnetic bolt-on type with a minimum interrupt capacity of 25,000 symmetrical amperes at 240 volts. Breakers shall be lockable in the off position for lockout/tag-out compliance.

Bus bars, connectors, and lugs shall be copper, insulated and isolated, and configured to prevent shorted conditions from tightening terminations. Lugs and connectors shall be rated for 75°C. Overall bus sections shall be configured behind an insulating barrier shield which is removable for access to connections. The circuit breakers and bus may be part of an approved panel board assembly.

Service disconnect surge protective device (SPD) shall be equipped with a NEMA 4X rated enclosure and suitable for 240/120 volt single phase 60Hz, AC electrical service. SPD shall have minimum short-circuit current rating of 100kA with LED operating indicators. SPD shall be rated -25 to 60°C, and shall be UL listed per UL 1449.

Conduit, wire, grounding electrodes, and weatherhead to complete the installation of the service disconnect shall be included as part of this item, as required and as indicated in accordance with the Standard Specifications.

Combination ground and neutral bar shall be configured with separate ground and neutral sections and spare terminals. The heads of grounding screws shall be painted green. The heads of neutral screws shall be painted white.

A plastic laminated layout and circuit diagram shall be affixed to the interior side of the enclosure door.

A 2-color engraved plastic nameplate, attached with screws and engraved as indicated, shall be provided for the circuit breaker.

The exact mounting height for the Electrical Service Disconnect shall be field determined and marked by the Engineer.

Electrical service shall be of the voltage indicated. Where 120 volt service is indicated, service drop cable shall be installed accordingly and lighting main breaker and all other service appurtenances shall be included regardless of the service voltage applied to the installation. Electrical service shall be paid for separately as described under ELECTRIC SERVICE INSTALLATION, SPECIAL.

The electric service disconnect equipment assembly shall be UL labeled, suitable for use as service equipment.

Stainless steel strut type channel shall be used to support the disconnect.

Electric Utility charges will be paid separately and are not part of this item.

Installation: The Electrical Service Disconnect shall be installed as shown in the Plans. All work shall be fully coordinated with the electric utility company by the Contractor.

Basis of Payment. This item shall be paid for at the contract unit price, each, for ELECTRICAL SERVICE DISCONNECT, which shall be payment in full for the work.

COMPENSABLE DELAY COSTS (BDE)

Effective: June 2, 2017

Revise Article 107.40(b) of the Standard Specifications to read:

“(b) Compensation. Compensation will not be allowed for delays, inconveniences, or damages sustained by the Contractor from conflicts with facilities not meeting the above definition; or if a conflict with a utility in an unanticipated location does not cause a shutdown of the work or a documentable reduction in the rate of progress exceeding the limits set herein. The provisions of Article 104.03 notwithstanding, compensation for delays caused by a utility in an unanticipated location will be paid according to the provisions of this Article governing minor and major delays or reduced rate of production which are defined as follows.

- (1) Minor Delay. A minor delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two hours, but not to exceed two weeks.
- (2) Major Delay. A major delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two weeks.
- (3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the rate of production on the work in conflict with the utility in an unanticipated location decreases by more than 25 percent and lasts longer than seven calendar days.”

Revise Article 107.40(c) of the Standard Specifications to read:

“(c) Payment. Payment for Minor, Major, and Reduced Rate of Production Delays will be made as follows.

(1) Minor Delay. Labor idled which cannot be used on other work will be paid for according to Article 109.04(b)(1) and (2) for the time between start of the delay and the minimum remaining hours in the work shift required by the prevailing practice in the area.

Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).

(2) Major Delay. Labor will be the same as for a minor delay.

Equipment will be the same as for a minor delay, except Contractor-owned equipment will be limited to two weeks plus the cost of move-out to either the Contractor's yard or another job and the cost to re-mobilize, whichever is less. Rental equipment may be paid for longer than two weeks provided the Contractor presents adequate support to the Department (including lease agreement) to show retaining equipment on the job is the most economical course to follow and in the public interest.

(3) Reduced Rate of Production Delay. The Contractor will be compensated for the reduced productivity for labor and equipment time in excess of the 25 percent threshold for that portion of the delay in excess of seven calendar days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Payment for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be determined according to Article 109.13.”

Revise Article 108.04(b) of the Standard Specifications to read:

“(b) No working day will be charged under the following conditions.

(1) When adverse weather prevents work on the controlling item.

(2) When job conditions due to recent weather prevent work on the controlling item.

(3) When conduct or lack of conduct by the Department or its consultants, representatives, officers, agents, or employees; delay by the Department in making the site available; or delay in furnishing any items required to be furnished to the Contractor by the Department prevents work on the controlling item.

- (4) When delays caused by utility or railroad adjustments prevent work on the controlling item.
- (5) When strikes, lock-outs, extraordinary delays in transportation, or inability to procure critical materials prevent work on the controlling item, as long as these delays are not due to any fault of the Contractor.
- (6) When any condition over which the Contractor has no control prevents work on the controlling item.”

Revise Article 109.09(f) of the Standard Specifications to read:

“(f) **Basis of Payment.** After resolution of a claim in favor of the Contractor, any adjustment in time required for the work will be made according to Section 108. Any adjustment in the costs to be paid will be made for direct labor, direct materials, direct equipment, direct jobsite overhead, direct offsite overhead, and other direct costs allowed by the resolution. Adjustments in costs will not be made for interest charges, loss of anticipated profit, undocumented loss of efficiency, home office overhead and unabsorbed overhead other than as allowed by Article 109.13, lost opportunity, preparation of claim expenses and other consequential indirect costs regardless of method of calculation.

The above Basis of Payment is an essential element of the contract and the claim cost recovery of the Contractor shall be so limited.”

Add the following to Section 109 of the Standard Specifications.

“**109.13 Payment for Contract Delay.** Compensation for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be allowed when such costs result from a delay meeting the criteria in the following table.

Contract Type	Cause of Delay	Length of Delay
Working Days	Article 108.04(b)(3) or Article 108.04(b)(4)	No working days have been charged for two consecutive weeks.
Completion Date	Article 108.08(b)(1) or Article 108.08(b)(7)	The Contractor has been granted a minimum two week extension of contract time, according to Article 108.08.

Payment for each of the various costs will be according to the following.

- (a) **Escalated Material and/or Labor Costs.** When the delay causes work, which would have otherwise been completed, to be done after material and/or labor costs have increased, such increases will be paid. Payment for escalated material costs will be limited to the increased costs substantiated by documentation furnished by the Contractor. Payment for escalated labor costs will be limited to those items in Article 109.04(b)(1) and (2), except the 35 percent and 10 percent additives will not be permitted.

(b) Extended Project Overhead. For the duration of the delay, payment for extended project overhead will be paid as follows.

(1) Direct Jobsite and Offsite Overhead. Payment for documented direct jobsite overhead and documented direct offsite overhead, including onsite supervisory and administrative personnel, will be allowed according to the following table.

Original Contract Amount	Supervisory and Administrative Personnel
Up to \$5,000,000	One Project Superintendent
Over \$ 5,000,000 - up to \$25,000,000	One Project Manager, One Project Superintendent or Engineer, and One Clerk
Over \$25,000,000 - up to \$50,000,000	One Project Manager, One Project Superintendent, One Engineer, and One Clerk
Over \$50,000,000	One Project Manager, Two Project Superintendents, One Engineer, and One Clerk

(2) Home Office and Unabsorbed Overhead. Payment for home office and unabsorbed overhead will be calculated as 8 percent of the total delay cost.

(c) Extended Traffic Control. Traffic control required for an extended period of time due to the delay will be paid. For working day contracts the payment will be made according to Article 109.04. For completion date contracts, an adjustment will be determined as follows.

Extended Traffic Control occurs between April 1 and November 30:

$$\text{ETCP Adjustment (\$)} = \text{TE} \times (\% / 100 \times \text{CUP} / \text{OCT})$$

Extended Traffic Control occurs between December 1 and March 31:

$$\text{ETCP Adjustment (\$)} = \text{TE} \times 1.5 (\% / 100 \times \text{CUP} / \text{OCT})$$

Where: TE = Duration of approved time extension in calendar days.
 % = Percent maintenance for the traffic control, % (see table below).
 CUP = Contract unit price for the traffic control pay item in place during the delay.
 OCT = Original contract time in calendar days.

Original Contract Amount	Percent Maintenance
Up to \$2,000,000	65%
\$2,000,000 to \$10,000,000	75%
\$10,000,000 to \$20,000,000	85%
Over \$20,000,000	90%

When an ETCP adjustment is paid under this provision, an adjusted unit price as provided for in Article 701.20(a) for increase or decrease in the value of work by more than ten percent will not be paid.

Upon payment for a contract delay under this provision, the Contractor shall assign subrogation rights to the Department for the Department's efforts of recovery from any other party for monies paid by the Department as a result of any claim under this provision. The Contractor shall fully cooperate with the Department in its efforts to recover from another party any money paid to the Contractor for delay damages under this provision."

CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)

Effective: June 1, 2010

Revised: November 1, 2014

The reduction of emissions of particulate matter (PM) for off-road equipment shall be accomplished by installing retrofit emission control devices. The term “equipment” refers to diesel fuel powered devices rated at 50 hp and above, to be used on the jobsite in excess of seven calendar days over the course of the construction period on the jobsite (including rental equipment).

Contractor and subcontractor diesel powered off-road equipment assigned to the contract shall be retrofitted using the phased in approach shown below. Equipment that is of a model year older than the year given for that equipment’s respective horsepower range shall be retrofitted:

Effective Dates	Horsepower Range	Model Year
June 1, 2010 ^{1/}	600-749	2002
	750 and up	2006
June 1, 2011 ^{2/}	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006
June 1, 2012 ^{2/}	50-99	2004
	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006

- 1/ Effective dates apply to Contractor diesel powered off-road equipment assigned to the contract.
- 2/ Effective dates apply to Contractor and subcontractor diesel powered off-road equipment assigned to the contract.

The retrofit emission control devices shall achieve a minimum PM emission reduction of 50 percent and shall be:

- a) Included on the U.S. Environmental Protection Agency (USEPA) *Verified Retrofit Technology List* (<http://www.epa.gov/cleandiesel/verification/verif-list.htm>), or verified by the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>); or
- b) Retrofitted with a non-verified diesel retrofit emission control device if verified retrofit emission control devices are not available for equipment proposed to be used on the project, and if the Contractor has obtained a performance certification from the retrofit device manufacturer that the emission control device provides a minimum PM emission reduction of 50 percent.

Note: Large cranes (Crawler mounted cranes) which are responsible for critical lift operations are exempt from installing retrofit emission control devices if such devices adversely affect equipment operation.

Diesel powered off-road equipment with engine ratings of 50 hp and above, which are unable to be retrofitted with verified emission control devices or if performance certifications are not available which will achieve a minimum 50 percent PM reduction, may be granted a waiver by the Department if documentation is provided showing good faith efforts were made by the Contractor to retrofit the equipment.

Construction shall not proceed until the Contractor submits a certified list of the diesel powered off-road equipment that will be used, and as necessary, retrofitted with emission control devices. The list(s) shall include (1) the equipment number, type, make, Contractor/rental company name; and (2) the emission control devices make, model, USEPA or CARB verification number, or performance certification from the retrofit device manufacturer. Equipment reported as fitted with emissions control devices shall be made available to the Engineer for visual inspection of the device installation, prior to being used on the jobsite.

The Contractor shall submit an updated list of retrofitted off-road construction equipment as retrofitted equipment changes or comes on to the jobsite. The addition or deletion of any diesel powered equipment shall be included on the updated list.

If any diesel powered off-road equipment is found to be in non-compliance with any portion of this special provision, the Engineer will issue the Contractor a diesel retrofit deficiency deduction.

Any costs associated with retrofitting any diesel powered off-road equipment with emission control devices shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall not be grounds for a claim.

Diesel Retrofit Deficiency Deduction

When the Engineer determines that a diesel retrofit deficiency exists, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

The deficiency will be based on lack of diesel retrofit emissions control.

If a Contractor accumulates three diesel retrofit deficiency deductions for the same piece of equipment in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of the contract time, waiver of penalties, or be grounds for any claim.

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (BDE)

Effective: September 1, 2000

Revised: April 2, 2018

FEDERAL OBLIGATION. The Department of Transportation, as a recipient of federal financial assistance, is required to take all necessary and reasonable steps to ensure nondiscrimination in the award and administration of contracts. Consequently, the federal regulatory provisions of 49 CFR Part 26 apply to this contract concerning the utilization of disadvantaged business enterprises. For the purposes of this Special Provision, a disadvantaged business enterprise (DBE) means a business certified by the Department in accordance with the requirements of 49 CFR Part 26 and listed in the Illinois Unified Certification Program (IL UCP) DBE Directory.

STATE OBLIGATION. This Special Provision will also be used by the Department to satisfy the requirements of the Business Enterprise for Minorities, Females, and Persons with Disabilities Act, 30 ILCS 575. When this Special Provision is used to satisfy state law requirements on 100 percent state-funded contracts, the federal government has no involvement in such contracts (not a federal-aid contract) and no responsibility to oversee the implementation of this Special Provision by the Department on those contracts. DBE participation on 100 percent state-funded contracts will not be credited toward fulfilling the Department's annual overall DBE goal required by the US Department of Transportation to comply with the federal DBE program requirements.

CONTRACTOR ASSURANCE. The Contractor makes the following assurance and agrees to include the assurance in each subcontract that the Contractor signs with a subcontractor.

The Contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of contracts funded in whole or in part with federal or state funds. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (a) Withholding progress payments;
- (b) Assessing sanctions;
- (c) Liquidated damages; and/or
- (d) Disqualifying the Contractor from future bidding as non-responsible.

OVERALL GOAL SET FOR THE DEPARTMENT. As a requirement of compliance with 49 CFR Part 26, the Department has set an overall goal for DBE participation in its federally assisted contracts. That goal applies to all federal-aid funds the Department will expend in its federally assisted contracts for the subject reporting fiscal year. The Department is required to make a good faith effort to achieve the overall goal. The dollar amount paid to all approved DBE companies performing work called for in this contract is eligible to be credited toward fulfillment of the Department's overall goal.

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined that the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. The determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates that, in the absence of unlawful discrimination, and in an arena of fair and open competition, DBE companies can be expected to perform **10.00%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work. A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set for in this Special Provision:

- (a) The bidder documents that enough DBE participation has been obtained to meet the goal or,
- (b) The bidder documents that a good faith effort has been made to meet the goal, even though the effort did not succeed in obtaining enough DBE participation to meet the goal.

DBE LOCATOR REFERENCES. Bidders shall consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217) 785-4611, or by visiting the Department's website at:

<http://www.idot.illinois.gov/doing-business/certifications/disadvantaged-business-enterprise-certification/il-ucp-directory/index>.

BIDDING PROCEDURES. Compliance with this Special Provision is required prior to the award of the contract and the failure of the low bidder to comply will render the bid not responsive.

In order to assure the timely award of the contract, the low bidder shall submit:

- (a) The bidder shall submit a DBE Utilization Plan on completed Department forms SBE 2025 and 2026.
 - (1) The final Utilization Plan must be submitted within five calendar days after the date of the letting in accordance with subsection (a)(2) of Bidding Procedures herein.
 - (2) To meet the five day requirement, the bidder may send the Utilization Plan electronically by scanning and sending to **DOT.DBE.UP@illinois.gov** or faxing to (217) 785-1524. The subject line must include the bid Item Number and the Letting date. The Utilization Plan should be sent as one .pdf file, rather than multiple files and emails for the same Item Number. It is the responsibility of the bidder to obtain confirmation of email or fax delivery.

Alternatively, the Utilization Plan may be sent by certified mail or delivery service within the five calendar day period. If a question arises concerning the mailing date of a Utilization Plan, the mailing date will be established by the U.S. Postal Service postmark on the certified mail receipt from the U.S. Postal Service or the receipt issued by a delivery service when the Utilization Plan is received by the Department. It is the responsibility of the bidder to ensure the postmark or receipt date is affixed within the five days if the bidder intends to rely upon mailing or delivery to satisfy the submission day requirement. The Utilization Plan is to be submitted to:

Illinois Department of Transportation
Bureau of Small Business Enterprises
Contract Compliance Section
2300 South Dirksen Parkway, Room 319
Springfield, Illinois 62764

The Department will not accept a Utilization Plan if it does not meet the five day submittal requirement and the bid will be declared not responsive. In the event the bid is declared not responsive due to a failure to submit a Utilization Plan or failure to comply with the bidding procedures set forth herein, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty, and may deny authorization to bid the project if re-advertised for bids. The Department reserves the right to invite any other bidder to submit a Utilization Plan at any time for award consideration.

- (b) The Utilization Plan shall indicate that the bidder either has obtained sufficient DBE participation commitments to meet the contract goal or has not obtained enough DBE participation commitments in spite of a good faith effort to meet the goal. The Utilization Plan shall further provide the name, telephone number, and telefax number of a responsible official of the bidder designated for purposes of notification of Utilization Plan approval or disapproval under the procedures of this Special Provision.
- (c) The Utilization Plan shall include a DBE Participation Commitment Statement, Department form SBE 2025, for each DBE proposed for the performance of work to achieve the contract goal. For bidding purposes, submission of the completed SBE 2025 forms, signed by the DBEs and scanned or faxed to the bidder will be acceptable as long as the original is available and provided upon request. All elements of information indicated on the said form shall be provided, including but not limited to the following:
- (1) The names and addresses of DBE firms that will participate in the contract;
 - (2) A description, including pay item numbers, of the work each DBE will perform;
 - (3) The dollar amount of the participation of each DBE firm participating. The dollar amount of participation for identified work shall specifically state the quantity, unit price, and total subcontract price for the work to be completed by the DBE. If partial pay items are to be performed by the DBE, indicate the portion of each item, a unit price where appropriate and the subcontract price amount;
 - (4) DBE Participation Commitment Statements, form SBE 2025, signed by the bidder and each participating DBE firm documenting the commitment to use the DBE subcontractors whose participation is submitted to meet the contract goal;
 - (5) If the bidder is a joint venture comprised of DBE companies and non-DBE companies, the Utilization Plan must also include a clear identification of the portion of the work to be performed by the DBE partner(s); and,
 - (6) If the contract goal is not met, evidence of good faith efforts; the documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor is selected over a DBE for work on the contract.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan submitted by the apparent successful bidder is approved. All information submitted by the bidder must be complete, accurate and adequately document that enough DBE participation has been obtained or document that good faith efforts of the bidder, in the event enough DBE participation has not been obtained, before the Department will commit to the performance of the contract by the bidder. The Utilization Plan will be approved by the Department if the Utilization Plan documents sufficient commercially useful DBE work to meet the contract goal or the bidder submits sufficient documentation of a good faith effort to meet the contract goal pursuant to 49 CFR Part 26, Appendix A. The Utilization Plan will not be approved by the Department if the Utilization Plan does not document sufficient DBE participation to meet the contract goal unless the apparent successful bidder documented in the Utilization Plan that it made a good faith effort to meet the goal. This means that the bidder must show that all necessary and reasonable steps were taken to achieve the contract goal. Necessary and reasonable steps are those which, by their scope, intensity and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not successful. The Department will consider the quality, quantity, and intensity of the kinds of efforts that the bidder has made. Mere *pro forma* efforts, in other words, efforts done as a matter of form, are not good faith efforts; rather, the bidder is expected to have taken genuine efforts that would be reasonably expected of a bidder actively and aggressively trying to obtain DBE participation sufficient to meet the contract goal.

- (a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases, and will be considered by the Department.
 - (1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.
 - (2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime Contractor might otherwise prefer to perform these work items with its own forces.
 - (3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

- (4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.
 - b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable. In accordance with subsection (c)(6) of the above Bidding Procedures, the documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.
- (5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
 - (6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
 - (7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.
 - (8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.

- (b) If the Department determines that the apparent successful bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided that it is otherwise eligible for award. If the Department determines that the bidder has failed to meet the requirements of this Special Provision or that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification shall include a statement of reasons for the determination. If the Utilization Plan is not approved because it is deficient as a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no more than a five calendar day period in order to cure the deficiency.
- (c) The bidder may request administrative reconsideration of a determination adverse to the bidder within the five working days after the receipt of the notification date of the determination by delivering the request to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764 (Telefax: (217) 785-1524). Deposit of the request in the United States mail on or before the fifth business day shall not be deemed delivery. The determination shall become final if a request is not made and delivered. A request may provide additional written documentation or argument concerning the issues raised in the determination statement of reasons, provided the documentation and arguments address efforts made prior to submitting the bid. The request will be forwarded to the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person in order to consider all issues of documentation and whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for reconsideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

CALCULATING DBE PARTICIPATION. The Utilization Plan values represent work anticipated to be performed and paid for upon satisfactory completion. The Department is only able to count toward the achievement of the overall goal and the contract goal the value of payments made for the work actually performed by DBE companies. In addition, a DBE must perform a commercially useful function on the contract to be counted. A commercially useful function is generally performed when the DBE is responsible for the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The Department and Contractor are governed by the provisions of 49 CFR Part 26.55(c) on questions of commercially useful functions as it affects the work. Specific counting guidelines are provided in 49 CFR Part 26.55, the provisions of which govern over the summary contained herein.

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.

- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.
- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the prime Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:
 - (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
 - (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission is receives as a result of the lease arrangement.
- (e) DBE as a material supplier:
 - (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.
 - (2) 100 percent goal credit for the cost of materials of supplies obtained from a DBE manufacturer.
 - (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a DBE regular dealer or DBE manufacturer.

CONTRACT COMPLIANCE. Compliance with this Special Provision is an essential part of the contract. The Department is prohibited by federal regulations from crediting the participation of a DBE included in the Utilization Plan toward either the contract goal or the Department's overall goal until the amount to be applied toward the goals has been paid to the DBE. The following administrative procedures and remedies govern the compliance by the Contractor with the contractual obligations established by the Utilization Plan. After approval of the Utilization Plan and award of the contract, the Utilization Plan and individual DBE Participation Statements become part of the contract. If the Contractor did not succeed in obtaining enough DBE participation to achieve the advertised contract goal, and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of DBE work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the amended contract goal. All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the DBE Participation Commitment Statement.

- (a) NO AMENDMENT. No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be submitted to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764. Telephone number (217) 785-4611. Telefax number (217) 785-1524.
- (b) CHANGES TO WORK. Any deviation from the DBE condition-of-award or contract plans, specifications, or special provisions must be approved, in writing, by the Department as provided elsewhere in the Contract. The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract. Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of Subcontractor, Department form BC 260A or AER 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, than a new Request for Approval of Subcontractor shall not be required. However, the Contractor must document efforts to assure that the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.
- (c) SUBCONTRACT. The Contractor must provide DBE subcontracts to IDOT upon request. Subcontractors shall ensure that all lower tier subcontracts or agreements with DBEs to supply labor or materials be performed in accordance with this Special Provision.

- (d) ALTERNATIVE WORK METHODS. In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals. Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:
- (1) That the replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award; or
 - (2) That the DBE is aware that its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
 - (3) That the DBE is not capable of performing the replacement work or has declined to perform the work at a reasonable competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.
- (e) TERMINATION AND REPLACEMENT PROCEDURES. The Contractor shall not terminate or replace a DBE listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in this Special Provision. The Contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the Contractor obtains the Department's written consent as provided in subsection (a) of this part. Unless Department consent is provided for termination of a DBE subcontractor, the Contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the DBE in the Utilization Plan.

As stated above, the Contractor shall not terminate or replace a DBE subcontractor listed in the approved Utilization Plan without prior written consent. This includes, but is not limited to, instances in which the Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Written consent will be granted only if the Bureau of Small Business Enterprises agrees, for reasons stated in its concurrence document, that the Contractor has good cause to terminate or replace the DBE firm. Before transmitting to the Bureau of Small Business Enterprises any request to terminate and/or substitute a DBE subcontractor, the Contractor shall give notice in writing to the DBE subcontractor, with a copy to the Bureau, of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor shall give the DBE five days to respond to the Contractor's notice. The DBE so notified shall advise the Bureau and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Bureau should not approve the Contractor's action. If required in a particular case as a matter of public necessity, the Bureau may provide a response period shorter than five days.

For purposes of this paragraph, good cause includes the following circumstances:

- (1) The listed DBE subcontractor fails or refuses to execute a written contract;
- (2) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the prime contractor;
- (3) The listed DBE subcontractor fails or refuses to meet the prime Contractor's reasonable, nondiscriminatory bond requirements;
- (4) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (5) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1200 or applicable state law.
- (6) You have determined that the listed DBE subcontractor is not a responsible contractor;
- (7) The listed DBE subcontractor voluntarily withdraws from the projects and provides to you written notice of its withdrawal;
- (8) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (9) A DBE owner dies or becomes disabled with the result that the listed DBE subcontractor is unable to complete its work on the contract;

- (10) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the prime Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the prime Contractor can self-perform the work for which the DBE contractor was engaged or so that the prime Contractor can substitute another DBE or non-DBE contractor after contract award.

When a DBE is terminated, or fails to complete its work on the Contract for any reason the Contractor shall make a good faith effort to find another DBE to substitute for the original DBE to perform at least the same amount of work under the contract as the terminated DBE to the extent needed to meet the established Contract goal. The good faith efforts shall be documented by the Contractor. If the Department requests documentation under this provision, the Contractor shall submit the documentation within seven days, which may be extended for an additional seven days if necessary at the request of the Contractor. The Department shall provide a written determination to the Contractor stating whether or not good faith efforts have been demonstrated.

- (f) FINAL PAYMENT. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than thirty calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Resident Engineer. If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes that the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the DBE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (h) of this part.
- (g) ENFORCEMENT. The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.

- (h) **RECONSIDERATION.** Notwithstanding any other provision of the contract, including but not limited to Article 109.09 of the Standard Specifications, the Contractor may request administrative reconsideration of a decision to deduct the amount of the goal not achieved as liquidated damages. A request to reconsider shall be delivered to the Contract Compliance Section and shall be handled and considered in the same manner as set forth in paragraph (c) of “Good Faith Effort Procedures” of this Special Provision, except a final decision that a good faith effort was not made during contract performance to achieve the goal agreed to in the Utilization Plan shall be the final administrative decision of the Department. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.

EQUIPMENT PARKING AND STORAGE (BDE)

Effective: November 1, 2017

Replace the first paragraph of Article 701.11 of the Standard Specifications with the following.

“701.11 Equipment Parking and Storage. During working hours, all vehicles and/or nonoperating equipment which are parked, two hours or less, shall be parked at least 8 ft (2.5 m) from the open traffic lane. For other periods of time during working and for all nonworking hours, all vehicles, materials, and equipment shall be parked or stored as follows.

- (a) When the project has adequate right-of-way, vehicles, materials, and equipment shall be located a minimum of 30 ft (9 m) from the pavement.
- (b) When adequate right-of-way does not exist, vehicles, materials, and equipment shall be located a minimum of 15 ft (4.5 m) from the edge of any pavement open to traffic.
- (c) Behind temporary concrete barrier, vehicles, materials, and equipment shall be located a minimum of 24 in. (600 mm) behind free standing barrier or a minimum of 6 in. (150 mm) behind barrier that is either pinned or restrained according to Article 704.04. The 24 in. or 6 in. measurement shall be from the base of the non-traffic side of the barrier.
- (d) Behind other man-made or natural barriers meeting the approval of the Engineer.”

LIGHTS ON BARRICADES (BDE)

Effective: January 1, 2018

Revise Article 701.16 of the Standard Specifications to read:

“701.16 Lights. Lights shall be used on devices as required in the plans, the traffic control plan, and the following table.

Circumstance	Lights Required
Daylight operations	None
First two warning signs on each approach to the work involving a nighttime lane closure and “ROUGH GROOVED SURFACE” (W8-I107) signs	Flashing mono-directional lights
Devices delineating isolated obstacles, excavations, or hazards at night (Does not apply to patching)	Flashing bi-directional lights
Devices delineating obstacles, excavations, or hazards exceeding 100 ft (30 m) in length at night (Does not apply to widening)	Steady burn bi-directional lights
Channelizing devices for nighttime lane closures on two-lane roads	None
Channelizing devices for nighttime lane closures on multi-lane roads	None
Channelizing devices for nighttime lane closures on multi-lane roads separating opposing directions of traffic	None
Channelizing devices for nighttime along lane shifts on multilane roads	Steady burn mono-directional lights
Channelizing devices for night time along lane shifts on two lane roads	Steady burn bi-directional lights
Devices in nighttime lane closure tapers on Standards 701316 and 701321	Steady burn bi-directional lights
Devices in nighttime lane closure tapers	Steady burn mono-directional lights
Devices delineating a widening trench	None
Devices delineating patches at night on roadways with an ADT less than 25,000	None
Devices delineating patches at night on roadways with an ADT of 25,000 or more	None

Batteries for the lights shall be replaced on a group basis at such times as may be specified by the Engineer.”

Delete the fourth sentence of the first paragraph of Article 701.17(c)(2) of the Standard Specifications.

Revise the first paragraph of Article 603.07 of the Standard Specifications to read:

“603.07 Protection Under Traffic. After the casting has been adjusted and Class SI concrete has been placed, the work shall be protected by a barricade for at least 72 hours.”

PAYMENTS TO SUBCONTRACTORS (BDE)

Effective: November 2, 2017

Add the following to the end of the fourth paragraph of Article 109.11 of the Standard Specifications:

“If reasonable cause is asserted, written notice shall be provided to the applicable subcontractor and/or material supplier and the Engineer within five days of the Contractor receiving payment. The written notice shall identify the contract number, the subcontract or material purchase agreement, a detailed reason for refusal, the value of payment being withheld, and the specific remedial actions required of the subcontractor and/or material supplier so that payment can be made.”

PORTABLE CHANGEABLE MESSAGE SIGNS (BDE)

Effective: November 1, 2016

Revised: April 1, 2017

Revise the second paragraph of Article 701.20(h) of the Standard Specifications to read:

“For all other portable changeable message signs, this work will be paid for at the contract unit price per calendar day for each sign as CHANGEABLE MESSAGE SIGN.”

Revise this second sentence of the first paragraph of Article 1106.02(i) of the Standard Specifications to read:

“The message panel shall be a minimum of 7 ft (2.1 m) above the edge of pavement in urban areas and a minimum of 5 ft (1.5 m) above the edge of pavement in rural areas, present a level appearance, and be capable of displaying up to eight characters in each of three lines at a time.”

PORTLAND CEMENT CONCRETE (BDE)

Effective: November 1, 2017

Revise the Air Content % of Class PP Concrete in Table 1 Classes of Concrete and Mix Design Criteria in Article 1020.04 of the Standard Specifications to read:

"TABLE 1. CLASSES OF CONCRETE AND MIX DESIGN CRITERIA		
Class of Conc.	Use	Air Content %
PP	Pavement Patching Bridge Deck Patching (10)	4.0 - 8.0"
	PP-1	
	PP-2	
	PP-3	
	PP-4	
	PP-5	

Revise Note (4) at the end of Table 1 Classes of Concrete and Mix Design Criteria in Article 1020.04 of the Standard Specifications to read:

“(4) For all classes of concrete, the maximum slump may be increased to 7 in (175 mm) when a high range water-reducing admixture is used. For Class SC, the maximum slump may be increased to 8 in. (200 mm). For Class PS, the maximum slump may be increased to 8 1/2 in. (215 mm) if the high range water-reducing admixture is the polycarboxylate type.”

PORTLAND CEMENT CONCRETE SIDEWALK (BDE)

Effective: August 1, 2017

Revise the first paragraph of Article 424.12 of the Standard Specifications to read:

“**424.12 Method of Measurement.** This work will be measured for payment in place and the area computed in square feet (square meters). Curb ramps, including side curbs and side flares, will be measured for payment as sidewalk. No deduction will be made for detectable warnings located within the ramp.”

PROGRESS PAYMENTS (BDE)

Effective: November 2, 2013

Revise Article 109.07(a) of the Standard Specifications to read:

- “(a) Progress Payments. At least once each month, the Engineer will make a written estimate of the quantity of work performed in accordance with the contract, and the value thereof at the contract unit prices. The amount of the estimate approved as due for payment will be vouchered by the Department and presented to the State Comptroller for payment. No amount less than \$1000.00 will be approved for payment other than the final payment.

Progress payments may be reduced by liens filed pursuant to Section 23(c) of the Mechanics’ Lien Act, 770 ILCS 60/23(c).

If a Contractor or subcontractor has defaulted on a loan issued under the Department’s Disadvantaged Business Revolving Loan Program (20 ILCS 2705/2705-610), progress payments may be reduced pursuant to the terms of that loan agreement. In such cases, the amount of the estimate related to the work performed by the Contractor or subcontractor, in default of the loan agreement, will be offset, in whole or in part, and vouchered by the Department to the Working Capital Revolving Fund or designated escrow account. Payment for the work shall be considered as issued and received by the Contractor or subcontractor on the date of the offset voucher. Further, the amount of the offset voucher shall be a credit against the Department’s obligation to pay the Contractor, the Contractor’s obligation to pay the subcontractor, and the Contractor’s or subcontractor’s total loan indebtedness to the Department. The offset shall continue until such time as the entire loan indebtedness is satisfied. The Department will notify the Contractor and Fund Control Agent in a timely manner of such offset. The Contractor or subcontractor shall not be entitled to additional payment in consideration of the offset.

The failure to perform any requirement, obligation, or term of the contract by the Contractor shall be reason for withholding any progress payments until the Department determines that compliance has been achieved.”

SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)

Effective: April 2, 2018

Add the following to Section 109 of the Standard Specifications.

“109.14 Subcontractor and Disadvantaged Business Enterprise Payment Reporting.
 The Contractor shall report all payments made to the following parties:

- (a) first tier subcontractors;
- (b) lower tier subcontractors affecting disadvantaged business enterprise (DBE) goal credit;
- (c) material suppliers or trucking firms that are part of the Contractor’s submitted DBE utilization plan.

The report shall be made through the Department’s on-line subcontractor payment reporting system within 21 days of making the payment.”

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: November 2, 2017

Replace the second paragraph of Article 109.12 of the Standard Specifications with the following:

“This mobilization payment shall be made at least 14 days prior to the subcontractor starting work. The amount paid shall be at the following percentage of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor’s work.

Value of Subcontract Reported on Form BC 260A	Mobilization Percentage
Less than \$10,000	25%
\$10,000 to less than \$20,000	20%
\$20,000 to less than \$40,000	18%
\$40,000 to less than \$60,000	16%
\$60,000 to less than \$80,000	14%
\$80,000 to less than \$100,000	12%
\$100,000 to less than \$250,000	10%
\$250,000 to less than \$500,000	9%
\$500,000 to \$750,000	8%
Over \$750,000	7%”

TRAINING SPECIAL PROVISIONS (BDE)

Effective: October 15, 1975

This Training Special Provision supersedes Section 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities," and is in implementation of 23 U.S.C. 140(a).

As part of the Contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. The number of trainees to be trained under this contract will be **8**. In the event the Contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also insure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within the reasonable area of recruitment. Prior to commencing construction, the Contractor shall submit to the Illinois Department of Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority trainees and women (e.g. by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used, the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by the Illinois Department of Transportation and the Federal Highway Administration. The Illinois Department of Transportation and the Federal Highway Administration shall approve a program, if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved by not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Illinois Department of Transportation and the Federal Highway Administration. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee's wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirement of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program.

It is not required that all trainees be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The Contractor shall furnish the trainee a copy of the program he will follow in providing the training. The Contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The Contractor shall provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

Method of Measurement. The unit of measurement is in hours.

Basis of Payment. This work will be paid for at the contract unit price of 80 cents per hour for TRAINEES. The estimated total number of hours, unit price, and total price have been included in the schedule of prices.

IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION

Effective: August 1, 2012

Revised: February 2, 2017

In addition to the Contractor's equal employment opportunity (EEO) affirmative action efforts undertaken as required by this Contract, the Contractor is encouraged to participate in the incentive program described below to provide additional on-the-job training to certified graduates of the IDOT pre-apprenticeship training program, as outlined in this Special Provision.

IDOT funds, and various Illinois community colleges operate, pre-apprenticeship training programs throughout the State to provide training and skill-improvement opportunities to promote the increased employment of minority groups, disadvantaged persons and women in all aspects of the highway construction industry. The intent of this IDOT Pre-Apprenticeship Training Program Graduate (TPG) special provision (Special Provision) is to place these certified program graduates on the project site for this Contract in order to provide the graduates with meaningful on-the-job training. Pursuant to this Special Provision, the Contractor must make every reasonable effort to recruit and employ certified TPG trainees to the extent such individuals are available within a practicable distance of the project site.

Specifically, participation of the Contractor or its subcontractor in the Program entitles the participant to reimbursement for graduates' hourly wages at \$15.00 per hour per utilized TPG trainee, subject to the terms of this Special Provision. Reimbursement payment will be made even though the Contractor or subcontractor may also receive additional training program funds from other non-IDOT sources for other non-TPG trainees on the Contract, provided such other source does not specifically prohibit the Contractor or subcontractor from receiving reimbursement from another entity through another program, such as IDOT through the TPG program. With regard to any IDOT funded construction training program other than TPG, however, additional reimbursement for other IDOT programs will not be made beyond the TPG Program described in this Special Provision when the TPG Program is utilized.

No payment will be made to the Contractor if the Contractor or subcontractor fails to provide the required on-site training to TPG trainees, as solely determined by IDOT. A TPG trainee must begin training on the project as soon as the start of work that utilizes the relevant trade skill and the TPG trainee must remain on the project site through completion of the Contract, so long as training opportunities continue to exist in the relevant work classification. Should a TPG trainee's employment end in advance of the completion of the Contract, the Contractor must promptly notify the IDOT District EEO Officer for the Contract that the TPG's involvement in the Contract has ended. The Contractor must supply a written report for the reason the TPG trainee involvement terminated, the hours completed by the TPG trainee on the Contract, and the number of hours for which the incentive payment provided under this Special Provision will be, or has been claimed for the separated TPG trainee.

Finally, the Contractor must maintain all records it creates as a result of participation in the Program on the Contract, and furnish periodic written reports to the IDOT District EEO Officer that document its contractual performance under and compliance with this Special Provision. Finally, through participation in the Program and reimbursement of wages, the Contractor is not relieved of, and IDOT has not waived, the requirements of any federal or state labor or employment law applicable to TPG workers, including compliance with the Illinois Prevailing Wage Act.

METHOD OF MEASUREMENT: The unit of measurement is in hours.

BASIS OF PAYMENT: This work will be paid for at the contract unit price of \$15.00 per hour for each utilized certified TPG Program trainee (TRAINEES TRAINING PROGRAM GRADUATE). The estimated total number of hours, unit price, and total price must be included in the schedule of prices for the Contract submitted by Contractor prior to beginning work. The initial number of TPG trainees for which the incentive is available for this contract is 8.

The Department has contracted with several educational institutions to provide screening, tutoring and pre-training to individuals interested in working as a TPG trainee in various areas of common construction trade work. Only individuals who have successfully completed a Pre-Apprenticeship Training Program at these IDOT approved institutions are eligible to be TPG trainees. To obtain a list of institutions that can connect the Contractor with eligible TPG trainees, the Contractor may contact: HCCTP TPG Program Coordinator, Office of Business and Workforce Diversity (IDOT OBWD), Room 319, Illinois Department of Transportation, 2300 S. Dirksen Parkway, Springfield, Illinois 62764. Prior to commencing construction with the utilization of a TPG trainee, the Contractor must submit documentation to the IDOT District EEO Officer for the Contract that provides the names and contact information of the TPG trainee(s) to be trained in each selected work classification, proof that the TPG trainee(s) has successfully completed a Pre-Apprenticeship Training Program, proof that the TPG is in an Apprenticeship Training Program approved by the U.S. Department of Labor Bureau of Apprenticeship Training, and the start date for training in each of the applicable work classifications.

To receive payment, the Contractor must provide training opportunities aimed at developing a full journeyworker in the type of trade or job classification involved. During the course of performance of the Contract, the Contractor may seek approval from the IDOT District EEO Officer to employ additional eligible TPG trainees. In the event the Contractor subcontracts a portion of the contracted work, it must determine how many, if any, of the TPGs will be trained by the subcontractor. Though a subcontractor may conduct training, the Contractor retains the responsibility for meeting all requirements imposed by this Special Provision. The Contractor must also include this Special Provision in any subcontract where payment for contracted work performed by a TPG trainee will be passed on to a subcontractor.

Training through the Program is intended to move TPGs toward journeyman status, which is the primary objective of this Special Provision. Accordingly, the Contractor must make every effort to enroll TPG trainees by recruitment through the Program participant educational institutions to the extent eligible TPGs are available within a reasonable geographic area of the project. The Contractor is responsible for demonstrating, through documentation, the recruitment efforts it has undertaken prior to the determination by IDOT whether the Contractor is in compliance with this Special Provision, and therefore, entitled to the Training Program Graduate reimbursement of \$15.00 per hour.

Notwithstanding the on-the-job training requirement of this TPG Special Provision, some minimal off-site training is permissible as long as the offsite training is an integral part of the work of the contract, and does not compromise or conflict with the required on-site training that is central to the purpose of the Program. No individual may be employed as a TPG trainee in any work classification in which he/she has previously successfully completed a training program leading to journeyman status in any trade, or in which he/she has worked at a journeyman level or higher.

WEEKLY DBE TRUCKING REPORTS (BDE)

Effective: June 2, 2012

Revised: April 2, 2015

The Contractor shall submit a weekly report of Disadvantaged Business Enterprise (DBE) trucks hired by the Contractor or subcontractors (i.e. not owned by the Contractor or subcontractors) that are used for DBE goal credit.

The report shall be submitted to the Engineer on Department form "SBE 723" within ten business days following the reporting period. The reporting period shall be Monday through Sunday for each week reportable trucking activities occur.

Any costs associated with providing weekly DBE trucking reports shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

STEEL COST ADJUSTMENT (BDE)

Effective: April 2, 2004

Revised: August 1, 2017

Description. Steel cost adjustments will be made to provide additional compensation to the Contractor, or a credit to the Department, for fluctuations in steel prices when optioned by the Contractor. The bidder shall indicate with their bid whether or not this special provision will be part of the contract. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment.

Types of Steel Products. An adjustment will be made for fluctuations in the cost of steel used in the manufacture of the following items:

- Metal Piling (excluding temporary sheet piling)
- Structural Steel
- Reinforcing Steel

Other steel materials such as dowel bars, tie bars, mesh reinforcement, guardrail, steel traffic signal and light poles, towers and mast arms, metal railings (excluding wire fence), and frames and grates will be subject to a steel cost adjustment when the pay items they are used in have a contract value of \$10,000 or greater.

The adjustments shall apply to the above items when they are part of the original proposed construction, or added as extra work and paid for by agreed unit prices. The adjustments shall not apply when the item is added as extra work and paid for at a lump sum price or by force account.

Documentation. Sufficient documentation shall be furnished to the Engineer to verify the following:

- (a) The dates and quantity of steel, in lb (kg), shipped from the mill to the fabricator.
- (b) The quantity of steel, in lb (kg), incorporated into the various items of work covered by this special provision. The Department reserves the right to verify submitted quantities.

Method of Adjustment. Steel cost adjustments will be computed as follows:

$$SCA = Q \times D$$

Where: SCA = steel cost adjustment, in dollars
Q = quantity of steel incorporated into the work, in lb (kg)
D = price factor, in dollars per lb (kg)

$$D = MPI_M - MPI_L$$

Where: MPI_M = The Materials Cost Index for steel as published by the Engineering News-Record for the month the steel is shipped from the mill. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

MPI_L = The Materials Cost Index for steel as published by the Engineering News-Record for the month prior to the letting for work paid for at the contract price; or for the month the agreed unit price letter is submitted by the Contractor for extra work paid for by agreed unit price,. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

The unit weights (masses) of steel that will be used to calculate the steel cost adjustment for the various items are shown in the attached table.

No steel cost adjustment will be made for any products manufactured from steel having a mill shipping date prior to the letting date.

If the Contractor fails to provide the required documentation, the method of adjustment will be calculated as described above; however, the MPI_M will be based on the date the steel arrives at the job site. In this case, an adjustment will only be made when there is a decrease in steel costs.

Basis of Payment. Steel cost adjustments may be positive or negative but will only be made when there is a difference between the MPI_L and MPI_M in excess of five percent, as calculated by:

$$\text{Percent Difference} = \{(MPI_L - MPI_M) \div MPI_L\} \times 100$$

Steel cost adjustments will be calculated by the Engineer and will be paid or deducted when all other contract requirements for the items of work are satisfied. Adjustments will only be made for fluctuations in the cost of the steel as described herein. No adjustment will be made for changes in the cost of manufacturing, fabrication, shipping, storage, etc.

The adjustments shall not apply during contract time subject to liquidated damages for completion of the entire contract.

Attachment

Item	Unit Mass (Weight)
Metal Piling (excluding temporary sheet piling)	
Furnishing Metal Pile Shells 12 in. (305 mm), 0.179 in. (3.80 mm) wall thickness)	23 lb/ft (34 kg/m)
Furnishing Metal Pile Shells 12 in. (305 mm), 0.250 in. (6.35 mm) wall thickness)	32 lb/ft (48 kg/m)
Furnishing Metal Pile Shells 14 in. (356 mm), 0.250 in. (6.35 mm) wall thickness)	37 lb/ft (55 kg/m)
Other piling	See plans
Structural Steel	See plans for weights (masses)
Reinforcing Steel	See plans for weights (masses)
Dowel Bars and Tie Bars	6 lb (3 kg) each
Mesh Reinforcement	63 lb/100 sq ft (310 kg/sq m)
Guardrail	
Steel Plate Beam Guardrail, Type A w/steel posts	20 lb/ft (30 kg/m)
Steel Plate Beam Guardrail, Type B w/steel posts	30 lb/ft (45 kg/m)
Steel Plate Beam Guardrail, Types A and B w/wood posts	8 lb/ft (12 kg/m)
Steel Plate Beam Guardrail, Type 2	305 lb (140 kg) each
Steel Plate Beam Guardrail, Type 6	1260 lb (570 kg) each
Traffic Barrier Terminal, Type 1 Special (Tangent)	730 lb (330 kg) each
Traffic Barrier Terminal, Type 1 Special (Flared)	410 lb (185 kg) each
Steel Traffic Signal and Light Poles, Towers and Mast Arms	
Traffic Signal Post	11 lb/ft (16 kg/m)
Light Pole, Tenon Mount and Twin Mount, 30 - 40 ft (9 - 12 m)	14 lb/ft (21 kg/m)
Light Pole, Tenon Mount and Twin Mount, 45 - 55 ft (13.5 - 16.5 m)	21 lb/ft (31 kg/m)
Light Pole w/Mast Arm, 30 - 50 ft (9 - 15.2 m)	13 lb/ft (19 kg/m)
Light Pole w/Mast Arm, 55 - 60 ft (16.5 - 18 m)	19 lb/ft (28 kg/m)
Light Tower w/Luminaire Mount, 80 - 110 ft (24 - 33.5 m)	31 lb/ft (46 kg/m)
Light Tower w/Luminaire Mount, 120 - 140 ft (36.5 - 42.5 m)	65 lb/ft (97 kg/m)
Light Tower w/Luminaire Mount, 150 - 160 ft (45.5 - 48.5 m)	80 lb/ft (119 kg/m)
Metal Railings (excluding wire fence)	
Steel Railing, Type SM	64 lb/ft (95 kg/m)
Steel Railing, Type S-1	39 lb/ft (58 kg/m)
Steel Railing, Type T-1	53 lb/ft (79 kg/m)
Steel Bridge Rail	52 lb/ft (77 kg/m)
Frames and Grates	
Frame	250 lb (115 kg)
Lids and Grates	150 lb (70 kg)

404 PERMIT



REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
231 SOUTH LA SALLE STREET
CHICAGO, ILLINOIS 60604-1437

April 11, 2016

Technical Services Division
Regulatory Branch
LRC-2012-00572

SUBJECT: Authorization for the Installation of Fiber Optic Cable along Various Movable Bridges for Remote Operations from Ruby Street to Brandon Road along the Des Plaines River in Joliet, Will County, Illinois

John Fortmann
Illinois Department of Transportation
201 West Center Court
Schaumburg, Illinois 60196-1096

Dear Mr. Fortmann:

This office has verified that your proposed activity complies with the terms and conditions of Regional Permit 8 (Utility Line Projects), Category I of the Regional Permit Program (RPP).

This verification expires three (3) years from the date of this letter and covers only your activity as described in your notification and as shown on the plans titled "Various Routes in the City of Joliet – Section 2011-045-I – Project No. – Various Moveable Bridges, Local Centralized Control and Operation – Will County – C91-578-11" dated February 11, 2016. Caution must be taken to prevent construction materials and activities from impacting waters of the United States beyond the scope of this authorization. If you anticipate changing the design or location of the activity, you should contact this office to determine the need for further authorization.

The activity may be completed without further authorization from this office provided the activity is conducted in compliance with the terms and conditions of the RPP, including conditions of water quality certification issued under Section 401 of the Clean Water Act by the Illinois Environmental Protection Agency (IEPA). If the design, location, or purpose of the project is changed, you should contact this office to determine the need for further authorization.

The following special conditions are a requirement of your authorization:

1. You are required to retain a qualified Independent SESC Inspector (ISI). The following requirements apply:
 - a. You shall contact this office and the ISI at least 10 calendar days prior to the preconstruction meeting so that a representative of this office may attend. The meeting agenda will include a discussion of the SESC plan and the installation

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- and maintenance requirements of the SESC practices on the site;
- b. Prior to commencement of any in-stream work, you shall submit construction plans and a detailed narrative to this office that disclose the contractor's preferred method of cofferdam and dewatering method;
 - c. The ISI will perform weekly inspections of the implemented SESC measures to ensure proper installation and regular maintenance of the approved methods. The ISI contact information form shall be submitted to this office via e-mail and/or hard copy prior to commencement of the permitted work;
 - d. The ISI shall submit to the Corps an inspection report with digital photographs of the SESC measures on a weekly basis during the active and non-active phases of construction. An inspection report shall also be submitted at the completion of the project once the SESC measures have been removed and final stabilization has been completed; and
 - e. Field conditions during project construction may require the implementation of additional SESC measures not included in the SESC plans for further protection of aquatic resources. You shall contact this office immediately in the event of any changes or modifications to the approved plan set or non-compliance of an existing SESC method. Upon direction of the Corps, corrective measure shall be instituted at the site to resolve the problem along with a plan to protect and/or restore the impacted jurisdictional area(s). If you fail to implement corrective measures, this office may require more frequent site inspections to ensure the installed SESC measures are acceptable.
2. This site is within the aboriginal homelands of several American Indian Tribes. If any human remains, Native American cultural items falling under the Native American Graves Protection and Repatriation Act (NAGPRA), or archaeological evidence are discovered during any phase of this project, interested Tribes request immediate consultation with the entity of jurisdiction for the location of discovery. In such case, please contact Mr. Soren Hall by telephone at 312-846-5532, or email at Soren.G.Hall@usace.army.mil.
 3. You are responsible for all work authorized herein and for ensuring that all contractors are aware of the terms and conditions of this authorization.
 4. A copy of this authorization must be present at the project site during all phases of construction.
 5. You shall notify this office of any proposed modifications to the project, including revisions to any of the plans or documents cited in this authorization. You must receive approval from this office before work affected by the proposed modification is performed.
 6. You shall notify this office prior to the transfer of this authorization and liabilities associated with compliance with its terms and conditions.
 7. The permittee understands and agrees that, if future operations by the United States

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require removal, relocation, or other alteration of the structure or work authorized herein, or if, in the opinion of the Secretary of the Army or his authorized representative said structure or work shall cause unreasonable obstruction to the free navigation of the navigable water, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

The authorization is without force and effect until all other permits or authorizations from local, state, or other Federal agencies are secured. Please note that IEPA has issued Section 401 Water Quality Certification for this RP. These conditions are included in the enclosed fact sheet. If you have any questions regarding Section 401 certification, please contact Mr. Dan Heacock at IEPA's Division of Water Pollution Control, Permit Section #15, by telephone at (217) 782-3362.

Once you have completed the authorized activity, please sign and return the enclosed compliance certification. If you have any questions, please contact Mr. Soren Hall of my staff by telephone at 312-846-5532, or email at Soren.G.Hall@usace.army.mil.

Sincerely,



Keith L. Wozniak
Chief, West Section
Regulatory Branch

Enclosures

Copy Furnished:

Huff & Huff (Alycia Klauenberg)



**PERMIT COMPLIANCE
CERTIFICATION**

Permit Number: LRC-2012-00572
Permittee: John Fortmann
Illinois Department of Transportation
Date: April 11, 2016

I hereby certify that the work authorized by the above-referenced permit has been completed in accordance with the terms and conditions of said permit and if applicable, compensatory wetland mitigation was completed in accordance with the approved mitigation plan.¹

PERMITTEE

DATE

Upon completion of the activity authorized by this permit and any mitigation required by the permit, this certification must be signed and returned to the following address:

U.S. Army Corps of Engineers
Chicago District, Regulatory Branch
231 South LaSalle Street, Suite 1500
Chicago, Illinois 60604-1437

Please note that your permitted activity is subject to compliance inspections by Corps of Engineers representatives. If you fail to comply with this permit, you may be subject to permit suspension, modification, or revocation.

¹If compensatory mitigation was required as part of your authorization, you are certifying that the mitigation area has been graded and planted in accordance with the approved plan. You are acknowledging that the maintenance and monitoring period will begin after a site inspection by a Corps of Engineers representative or after thirty days of the Corps' receipt of this certification. You agree to comply with all permit terms and conditions, including additional reporting requirements, for the duration of the maintenance and monitoring period.

GENERAL CONDITIONS



US Army Corps of Engineers®
Chicago District

GENERAL CONDITIONS APPLICABLE TO THE 2012 REGIONAL PERMIT PROGRAM

The permittee shall comply with the terms and conditions of the Regional Permits and the following general conditions for all activities authorized under the RPP:

1. State 401 Water Quality Certification - Water quality certification under Section 401 of the Clean Water Act may be required from the Illinois Environmental Protection Agency (IEPA). The District may consider water quality, among other factors, in determining whether to exercise discretionary authority and require an Individual Permit. Please note that Section 401 Water Quality Certification is a requirement for projects carried out in accordance with Section 404 of the Clean Water Act. Projects carried out in accordance with Section 10 of the Rivers and Harbors Act of 1899 do not require Section 401 Water Quality Certification

On March 2, 2012, the IEPA granted Section 401 certification, with conditions, for all Regional Permits, except for activities in certain waterways noted under RPs 4 and 8. The following conditions of the certification are hereby made conditions of the RPP:

1. The applicant shall not cause:
 - a) a violation of applicable water quality standards of the Illinois Pollution Control Board Title 35, Subtitle C: Water Pollution Rules and Regulations;
 - b) water pollution defined and prohibited by the Illinois Environmental Protection Act;
 - c) interference with water use practices near public recreation areas or water supply intakes;
 - d) a violation of applicable provisions of the Illinois Environmental Protection Act.
2. The applicant shall provide adequate planning and supervision during the project construction period for implementing construction methods, processes and cleanup procedures necessary to prevent water pollution and control erosion.
3. Except as allowed under condition 9, any spoil material excavated, dredged or otherwise produced must not be returned to the waterway but must be deposited in a self-contained area in compliance with all State statutes, regulations and permit requirements with no discharge to waters of the State unless a permit has been issued by the Illinois EPA. Any backfilling must be done with clean material placed in a manner to prevent violation of applicable water quality standards.
4. All areas affected by construction shall be mulched and seeded as soon after construction as possible. The applicant shall undertake necessary measures and procedures to reduce erosion during construction. Interim measures to prevent soil erosion during construction shall be taken and may include the installation of sedimentation basins and temporary mulching. All construction within the waterway shall be conducted during zero or low flow conditions. The applicant shall be responsible for obtaining a NPDES Stormwater Permit prior to initiating construction if the construction activity associated with the project will result in the disturbance of (1) one or more acres, total land area. A NPDES Stormwater Permit may be obtained by submitting a properly completed Notice of Intent (NOI) form by certified mail to the Illinois EPA's Division of Water Pollution Control, Permit Section.
5. The applicant shall implement erosion control measures consistent with the Illinois Urban Manual (IEPA/USDA, NRCS; 2011, <http://aiswcd.org/IUM/index.html>).
6. The applicant is advised that the following permits(s) must be obtained from the Illinois EPA: The applicant must obtain permits to construct sanitary sewers, water mains, and related facilities prior to construction.
7. Backfill used in the stream-crossing trench shall be predominantly sand or larger size material, with less than 20% passing a #230 U.S. sieve.
8. Any channel relocation shall be constructed under dry conditions and stabilized to prevent erosion prior to the diversion of flow.
9. Backfill used within trenches passing through surface waters of the State, except wetland areas, shall be clean course aggregate, gravel or other material which will not cause siltation, pipe damage during placement, or chemical corrosion in place. Excavated material may be used only if:
 - a) particle size analysis is conducted and demonstrates the material to be at least 80% sand or larger size material, using #230 U.S. sieve; or
 - b) excavation and backfilling are done under dry conditions.
10. Backfill used within trenches passing through wetland areas shall consist of clean material which will not cause siltation, pipe damage during placement, or chemical corrosion in place. Excavated material shall be used to the extent practicable, with the upper six (6) to twelve (12) inches backfilled with the topsoil obtained during trench excavation.
11. Any applicant proposing activities in a mined area or previously mined area shall provide to the IEPA a written determination regarding the sediment and materials used which are considered "acid-producing material" as defined in 35 Il. Adm. Code,

Subtitle D. If considered "acid-producing material," the applicant shall obtain a permit to construct pursuant to 35 Il. Adm. Code 404.101.

12. Asphalt, bituminous material and concrete with protruding material such as reinforcing bar or mesh shall not be 1) used for backfill, 2) placed on shorelines/stream banks, or 3) placed in waters of the State.
 13. Applicants that use site dewatering techniques in order to perform work in waterways for construction activities approved under Regional Permits 1 (Residential, Commercial and Institutional Developments), 2 (Recreation Projects), 3 (Transportation Projects), 7 (Temporary Construction Activities), 9 (Maintenance) or 12 (Bridge Scour Protection) shall maintain flow in the stream during such construction activity by utilizing dam and pumping, fluming, culverts or other such techniques.
 14. In addition to any action required of the Regional Permit 13 (Cleanup of Toxic and Hazardous Materials Projects) applicant with respect to the "Notification" General Condition 22, the applicant shall notify the Illinois EPA Bureau of Water, of the specific activity. This notification shall include information concerning the orders and approvals that have been or will be obtained from the Illinois EPA Bureau of Land (BOL) for all cleanup activities under BOL jurisdiction, or for which authorization or approval is sought from BOL for no further remediation. This Regional Permit is not valid for activities that do not require or will not receive authorization or approval from the BOL.
2. Threatened and Endangered Species - If the District determines that the activity may affect Federally listed species or critical habitat, the District will initiate section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) in accordance with the Endangered Species Act of 1973, as amended (Act). Applicants shall provide additional information that would enable the District to conclude that the proposed action will have no effect on federally listed species.

The application packet shall indicate whether resources (species, their suitable habitats, or critical habitat) listed or designated under the Act, may be present within areas affected (directly or indirectly) by the proposed project. Applicants shall provide a section 7 species list for the action area using the on-line process at the USFWS website. You can access "U.S. Fish and Wildlife Service Endangered Species Program of the Upper Midwest" website at www.fws.gov/midwest/Endangered. Click on the section 7 Technical Assistance green shaded box in the lower right portion of the screen and follow the instructions to completion. Review all documentation pertaining to the species list, provide the rationale for your effects determination for each species, and send the information to this office for review.

If no species, their suitable habitats, or critical habitat are listed, then a "no effect" determination can be made, and section 7 consultation is not warranted. If species or critical habitat appear on the list or suitable habitat is present within the action area, then a biological assessment or biological evaluation will need to be completed to determine if the proposed action will have "no effect" or "may effect" the species or suitable habitat. The District will request initiation of section 7 consultation with the USFWS upon agreement with the applicant on the effect determinations in the biological assessment or biological evaluation. If the issues are not resolved, the analysis of the situation is complicated, or impacts to listed species or critical habitat are found to be greater than minimal, the District will consider reviewing the project under the Individual Permit process.

Projects in Will, DuPage, or Cook Counties that are located in the recharge zones for Hine's emerald dragonfly critical habitat units may be reviewed under the RPP, with careful consideration due to the potential impacts to the species. All projects reviewed that are located within 3.25 miles of a critical habitat unit will be reviewed under Category II of the RPP. Please visit the following website for the locations of the Hine's emerald dragonfly critical habitat units in Illinois.
<http://www.fws.gov/midwest/endangered/insects/hed/FRHinesFinalRevisedCH.html>

3. Historic Properties - In cases where the District determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity may require an Individual Permit. A determination of whether the activity may be authorized under the RPP instead of an Individual Permit will not be made until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the District with the appropriate documentation to demonstrate compliance with those requirements.

Non-Federal permittees must include notification to the District if the authorized activity may have the potential to cause effects to any historic properties listed, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the permit application must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing permit submittals, the District will comply with the current procedures for addressing the requirements of Section 106 of the National Historic Preservation Act. Based on the information submitted and these efforts, the District shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties which the activity may have the potential to cause effects and so notified the District, the non-Federal applicant shall not begin the activity until notified by the District either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.

The District will take into account the effects on such properties in accordance with 33 CFR Part 325, Appendix C, and 36 CFR 800. If all issues pertaining to historic properties have been resolved through the consultation process to the satisfaction of the District, Illinois Historic Preservation Agency (IHPA) and Advisory Council on Historic Preservation, the District may, at its discretion, authorize the activity under the RPP instead of an Individual Permit.

Applicants are encouraged to obtain information on historic properties from the IHPA and the National Register of Historic Places at the earliest stages of project planning. For information, contact:

Illinois Historic Preservation Agency
1 Old State Capitol Plaza
Springfield, IL 62701-1507
(217) 782-4836
www.illinoishistory.gov

If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity, you must immediately notify this office of what you have found, and to the maximum extent practicable, stop activities that would adversely affect those remains and artifacts until the required coordination has been completed. We will initiate the Federal, Tribal and State coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. Soil Erosion and Sediment Control - Measures shall be taken to control soil erosion and sedimentation at the project site to ensure that sediment is not transported to waters of the U.S. during construction. Soil erosion and sediment control measures shall be implemented before initiating any clearing, grading, excavating or filling activities. All temporary and permanent soil erosion and sediment control measures shall be maintained throughout the construction period and until the site is stabilized. All exposed soil and other fills, and any work below the ordinary high water mark shall be permanently stabilized at the earliest practicable date.

Applicants are required to prepare a soil erosion and sediment control (SESC) plan including temporary BMPs. The plan shall be designed in accordance with the Illinois Urban Manual, 2011 (<http://aiswcd.org/TUM/index.html>). Practice standards and specifications for measures outlined in the soil erosion and sediment control plans will follow the latest edition of the "Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement." Additional Soil Erosion and Sediment Control (SESC) measures not identified in the Illinois Urban Manual may also be utilized upon District approval.

At the District's discretion, an applicant may be required to submit the SESC plan to the local Soil and Water Conservation District (SWCD), or the Lake County Stormwater Management Commission (SMC) for review. When the District requires submission of an SESC plan, the following applies: An activity may not commence until the SESC plan for the project site has been approved; The SWCD/SMC will review the plan and provide a written evaluation of its adequacy; A SESC plan is considered acceptable when the SWCD/SMC has found that it meets technical standards. Once a determination has been made, the authorized work may commence unless the SWCD/SMC has requested that they be notified prior to commencement of the approved plans. The SWCD/SMC may attend pre-construction meetings with the permittee and conduct inspections during construction to determine compliance with the plans. Applicants are encouraged to begin coordinating with the appropriate SWCD/SMC office at the earliest stages of project planning. For information, contact:

Kane-DuPage SWCD
2315 Dean Street, Suite 100
St. Charles, IL 60174
(630) 584-7961 ext.3
www.kanedupageswcd.org

McHenry-Lake County SWCD
1648 South Eastwood Dr.
Woodstock, IL 60098
(815) 338-0099 ext.3
www.mchenryswcd.org

North Cook SWCD
899 Jay Street
Elgin, IL 60120
(847) 468-0071
www.northcookswcd.org

Lake County SMC
500 W. Winchester Rd, Suite 201
Libertyville, IL 60048
(847) 377-7700
www.lakecountyil.gov/stormwater

5. Total Maximum Daily Load - For projects that include a discharge of pollutant(s) to waters for which there is an approved Total Maximum Daily Load (TMDL) allocation for any parameter, the applicant shall develop plans and BMPs that are consistent with the assumptions and requirements in the approved TMDL. The applicant must incorporate into their plans and BMPs any conditions applicable to their discharges necessary for consistency with the assumptions and requirements of the TMDL within any timeframes established in the TMDL. The applicant must carefully document the justifications for all BMPs and plans, and install, implement and maintain practices and BMPs that are consistent with all relevant TMDL allocations and with all relevant conditions in an implementation plan. Information regarding the TMDL program, including approved TMDL allocations, can be found at the following website: www.epa.state.il.us/water/tmdl/

6. Floodplain - Discharges of dredged or fill material into waters of the United States within the 100-year floodplain (as defined by the Federal Emergency Management Agency) resulting in permanent above-grade fills shall be avoided and minimized to the maximum extent practicable. When such an above-grade fill would occur, the applicant may need to obtain approval from the Illinois

Department of Natural Resources, Office of Water Resources, (IDNR-OWR) which regulates activities affecting the floodway and the local governing agency (e.g., Village or County) with jurisdiction over activities in the floodplain. Compensatory storage may be required for fill within the floodplain. Applicants are encouraged to obtain information from the IDNR-OWR and the local governing agency with jurisdiction at the earliest stages of project planning. For information on floodway construction, contact:

IDNR/OWR
2050 Stearns Road
Bartlett, IL 60103
(847) 608-3100
<http://dnr.state.il.us/owr/>

For information on floodplain construction, please contact the local government and/or the Federal Emergency Management Agency. Pursuant to 33 CFR 320.4(j), the District will consider the likelihood of the applicant obtaining approval for above-ground permanent fills in floodplains in determining whether to issue authorization under the RPP.

7. Navigation - No activity may cause more than a minimal adverse effect on navigation. Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

8. Proper Maintenance - Any authorized structure or fill shall be properly maintained, including that necessary to ensure public safety.

9. Aquatic Life Movements - No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody, including species that normally migrate through the area, unless the activity's primary purpose is to impound water.

10. Equipment - Soil disturbance and compaction shall be minimized through the use of matting for heavy equipment, low ground pressure equipment, or other measures as approved by the District.

11. Wild and Scenic Rivers - No activity may occur in a component of the National Wild and Scenic River System or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status. Information on Wild and Scenic Rivers may be obtained from the appropriate land management agency in the area, such as the National Park Service and the U.S. Forest Service.

12. Tribal Rights - No activity or its operation may impair reserved tribal rights, such as reserved water rights, treaty fishing and hunting rights.

13. Water Supply Intakes - No discharge of dredged or fill material may occur in the proximity of a public water supply intake except where the discharge is for repair of the public water supply intake structures or adjacent bank stabilization.

14. Shellfish Production - No discharge of dredged or fill material may occur in areas of concentrated shellfish production.

15. Suitable Material - No discharge of dredged or fill material may consist of unsuitable material and material discharged shall be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act). Unsuitable material includes trash, debris, car bodies, asphalt, and creosote treated wood.

16. Spawning Areas - Discharges in spawning areas during spawning seasons shall be avoided to the maximum extent practicable.

17. Obstruction of High Flows - Discharges shall not permanently restrict or impede the passage of normal or expected high flows. All crossings shall be culverted, bridged or otherwise designed to prevent the restriction of expected high water flows, and shall be designed so as not to impede low water flows or the movement of aquatic organisms.

18. Impacts From Impoundments - If the discharge creates an impoundment of water, adverse impacts on aquatic resources caused by the accelerated passage of water and/or the restriction of its flow shall be avoided to the maximum extent practicable.

19. Waterfowl Breeding Areas - Discharges into breeding areas for migratory waterfowl shall be avoided to the maximum extent practicable.

20. Removal of Temporary Fills - Any temporary fill material shall be removed in its entirety and the affected area returned to its pre-existing condition.

21. Mitigation - All appropriate and practicable steps must first be taken to avoid and minimize impacts to aquatic resources. For unavoidable impacts, compensatory mitigation is required to replace the loss of wetland, stream, and/or other aquatic resource functions (33 CFR 332). The proposed compensatory mitigation shall utilize a watershed approach and fully consider the ecological needs of the watershed. Where an appropriate watershed plan is available, mitigation site selection should consider recommendations in the plan. The applicant shall describe in detail how the mitigation site was chosen and will be developed, based on the specific

resource need of the impacted watershed. Permit applicants are responsible for proposing an appropriate compensatory mitigation option to offset unavoidable impacts. However, the District is responsible for determining the appropriate form and amount of compensatory mitigation required when evaluating compensatory mitigation options, and determining the type of mitigation that would be environmentally preferable. In making this determination, the District will assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed. Methods of providing compensatory mitigation include aquatic resource restoration, establishment, enhancement, and in certain circumstances, preservation. Compensatory mitigation will be accomplished by establishing a minimum ratio of 1.5 acres of mitigation for every 1.0 acre of impact to waters of the U.S. Furthermore, the District has the discretion to require additional mitigation to ensure that the impacts are no more than minimal. Further information is available at www.lrc.usace.army.mil/Missions/Regulatory/Illinois/Mitigation.aspx

22. **Notification** - The applicant shall provide written notification (i.e., a complete application) for a proposed activity to be authorized under the RPP prior to commencing a proposed activity. The District's receipt of the complete application is the date when the District receives all required notification information from the applicant (see below). If the District informs the applicant within 60 calendar days that the notification is incomplete (i.e., not a complete application), the applicant shall submit to the District, in writing, the requested information to be considered for review under the Regional Permit Program. A new 60 day review period will commence when the District receives the requested information. Applications that involve unauthorized activities that are completed or partially completed by the applicant are not subject to the 60-day review period.

For all activities, notification shall include:

- a. A cover letter providing a detailed narrative of the proposed activity describing all work to be performed, a clear project purpose and need statement, the Regional Permit(s) to be used for the activity, the area (in acres) of waters of the U.S. to be impacted (be sure to specify if the impact is permanent or temporary, and identify which area it affects), and a statement that the terms and conditions of the RPP will be followed.
- b. A completed joint application form for Illinois signed by the applicant or agent. The application form is available at www.lrc.usace.army.mil/Portals/36/docs/regulatory/forms/appform.pdf. If the applicant does not sign the joint application form, notification shall include a signed, written statement from the applicant designating the agent as their representative.
- c. A delineation of waters of the U.S., including wetlands, for the project area, and for areas adjacent to the project site (off-site wetlands shall be identified through the use of reference materials including review of local wetland inventories, soil surveys and the most recent available aerial photography), shall be prepared in accordance with the current U.S. Army Corps of Engineers methodology (www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/reg_supp.aspx) and generally conducted during the growing season.* Our wetland delineation standards are available at www.lrc.usace.army.mil/Portals/36/docs/regulatory/pdf/Delineations.pdf. For sites supporting wetlands, the delineation shall include a Floristic Quality Assessment (Swink and Wilhelm. 1994, latest edition, Plants of the Chicago Region). The delineation shall also include information on the occurrence of any high-quality aquatic resources (see Appendix A), and a listing of waterfowl, reptile and amphibian species observed while at the project area. The District reserves the right to exercise judgment when reviewing submitted wetland delineations. Flexibility of the requirements may be determined by the District on a case-by-case basis only.
- d. A street map showing the location of the project area.
- e. Latitude and longitude for the project in decimal degrees format (i.e. 41.88377N, -87.63960W).
- f. Preliminary engineering drawings sized 11" by 17" (full-sized may be requested by the project manager and you may also submit plans in PDF format on a disc) showing all aspects of the proposed activity and the location of waters of the U.S. to be impacted and not impacted. The plans shall include grading contours, proposed and existing structures such as buildings footprints, roadways, road crossings, stormwater management facilities, utilities, construction access areas and details of water conveyance structures. The plans shall also depict buffer areas, outlots or open space designations, best management practices, deed restricted areas and restoration areas, if required under the specific RP.
- g. Submittal of soil erosion and sediment control (SESC) plans that identify all SESC measures to be utilized during construction of the project.
- h. The application packet shall indicate whether resources (species, their suitable habitats, or critical habitat) listed or designated under the Endangered Species Act of 1973, as amended, may be present within areas affected (directly or indirectly) by the proposed project. Applicants shall provide a section 7 species list for the action area using the on-line process at the USFWS website. You can access "U.S. Fish and Wildlife Service Endangered Species Program of the Upper Midwest" website at www.fws.gov/midwest/Endangered. Click on the section 7 Technical Assistance green shaded box in the lower right portion of the screen and follow the instructions to completion. Print all documentation pertaining to the species list, include the rationale for your effects determination for each species, and forward the information to this office for review.

* If a wetland delineation is conducted outside of the growing season, the District will determine on a case-by-case basis whether sufficient evidence is available to make an accurate determination. If the District finds that the delineation lacks sufficient evidence, the application will not be considered complete until the information is provided. This may involve re-delineating the project site during the growing season.

In the event there are no species, their suitable habitats, or critical habitat, then a “no effect” determination can be made and section 7 consultation is not warranted. If species or critical habitat appear on the list, or suitable habitat is present within the action area, then a biological assessment or biological evaluation will need to be completed to determine if the proposed action will have “no effect” or “may effect” on the species or suitable habitat. The District will request initiation of section 7 consultation with the USFWS upon agreement with the applicant on the effect determinations in the biological assessment or biological evaluation. If the issues are not resolved, the analysis of the situation is complicated, or impacts to listed species or critical habitat are found to be greater than minimal, the District will consider reviewing the project under the Individual Permit process.

- i. A determination of the presence or absence of any State threatened or endangered species. Please contact the Illinois Department of Natural Resources (IDNR) to determine if any State threatened and endangered species could be in the project area. You can access the IDNR’s Ecological Compliance Assessment Tool (EcoCAT) at the following website: <http://dnrecocat.state.il.us/ecopublic/>. Once you complete the EcoCAT and consultation process, forward all resulting information to this office for consideration. The report shall also include recommended methods as required by the IDNR for minimizing potential adverse effects of the project.
- j. A statement about the knowledge of the presence or absence of Historic Properties, which includes properties listed, or properties eligible to be listed in the National Register of Historic Places. A letter from the Illinois Historic Preservation Agency (IHPA) can be obtained indicating whether your project is in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. The permittee shall provide all pertinent correspondence with the IHPA documenting compliance. The IHPA has a checklist of documentation required for their review located here: www.illinoishistory.gov/PS/rcdocument.htm.
- k. Where an appropriate watershed plan is available, the applicant shall address in writing how the proposed activity is aligned with the relevant water quality, hydrologic, and aquatic resource protection recommendations in the watershed plan.
- l. A discussion of measures taken to avoid and/or minimize impacts to aquatic resources on the project site.
- m. A compensatory mitigation plan for all impacts to waters of the U.S. (if compensatory mitigation is required under the specific RP).
- n. A written narrative addressing all items listed under the specific RP.

For Category II activities, the District will provide an Agency Request for Comments (ARC) which describes the proposed activity. The ARC will be sent to the following agencies: United States Fish & Wildlife Service (USFWS), United States Environmental Protection Agency (USEPA), Illinois Department of Natural Resources (IDNR), Illinois Department of Natural Resources/Office of Water Resources (IDNR/OWR), Illinois Environmental Protection Agency (IEPA), Illinois Historic Preservation Agency (IHPA), Illinois Nature Preserves Commission (INPC) and U.S. Coast Guard (Section 10 activities only). Additional entities may also be notified as needed. These agencies have ten (10) calendar days from the date of the ARC to contact the District and either provide comments or request an extension not to exceed fifteen (15) calendar days. The District will fully consider agency comments received within the specified time frame. If the District determines the activity complies with the terms and conditions of the RPP and impacts on aquatic resources are minimal, the District will notify the applicant in writing and include special conditions if deemed necessary. If the District determines that the impacts of the proposed activity are more than minimal, the District will notify the applicant that the project does not qualify for authorization under the RPP and instruct the applicant on the procedures to seek authorization under an Individual Permit.

23. Compliance Certification - Any permittee who has received authorization under the RPP from the District shall submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the District with the authorization letter and will include: a) a statement that the authorized work was done in accordance with the District’s authorization, including any general or specific conditions; b) a statement that any required mitigation was completed in accordance with the permit conditions and; c) the signature of the permittee certifying the completion of the work and mitigation.

24. Multiple use of Regional Permits - In any case where a Regional Permit is combined with any other Regional Permit to cover a single and complete project (except where prohibited under specific Regional Permits), the applicant shall notify the District in accordance with General Condition 22. If multiple Regional Permits are used, the total impact may not exceed the maximum allowed by the Regional Permit with the greatest impact threshold.

25. Other Restrictions - Authorization under the RPP does not obviate the need to obtain other Federal, State or local permits, approvals, or authorizations required by law nor does it grant any property rights or exclusive privileges, authorize any injury to the property or rights of others or authorize interference with any existing or proposed Federal project.

Approved by:

//ORIGINAL SIGNED//

Frederic A. Drummond, Jr.
Colonel, U.S. Army
District Commander

February 24, 2012

Date

UTILITY LINE PROJECTS

8. UTILITY LINE PROJECTS

RP8 authorizes the construction, maintenance and repair of utility line activities and associated facilities in waters of the United States. This includes trenching and backfilling activities for utility lines and fill activities for construction of substations and related appurtenances (temporary and permanent access roads, construction pads, stormwater management facilities, fencing, parking lots, etc.), poles, pads, anchors, outfall structures, and foundations for overhead utility line towers, utility lines under (e.g., through directional drilling) or over navigable waters (regulated under Section 10 waters only), and outfalls and associated intakes which are authorized, conditionally authorized, specifically exempted, or are otherwise in compliance with the National Pollutant Discharge Elimination System program (Section 402 of the Clean Water Act).

Authorization under RP8 is subject to the following requirements which shall be addressed in writing and submitted with the notification:

- a. Projects that impact no more than 0.5 acres of waters of the U.S., and do not impact a high-quality aquatic resource, will be processed under Category I.
- b. Projects that impact over 0.5 acres and up to 1.0 acre of waters of the U.S., or impact a high-quality aquatic resource, will be processed under Category II.
- c. The impact to waters of the U.S. shall not exceed 1.0 acre. For projects that impact over 0.10 acres of waters of the U.S., the permittee is required to provide compensatory mitigation.
- d. Authorization under RP8 pursuant to Section 404 of the Clean Water Act is subject to individual water quality certification under Section 401 of the Clean Water Act when there is a discharge of dredged and/or fill material to the waters listed below. Return flows from dredging operations to the waters listed below are considered Section 404 discharges. However, as determined on a case-by-case basis by the District, individual water quality certification may not be required for the installation of outfall structures in these waters if there will be no more than minimal disturbance to the sediment and substrate during construction activities;
 - 1) Chicago Sanitary and Ship Canal
 - 2) Calumet-Sag Channel
 - 3) Little Calumet River
 - 4) Grand Calumet River
 - 5) Calumet River
 - 6) Chicago River (main stem)
 - 7) South Branch of the Chicago River (including South Fork)
 - 8) North Branch of the Chicago River (including East and West Forks and Skokie Lagoons)
 - 9) Lake Calumet
 - 10) Des Plaines River
 - 11) Fox River (including the Fox Chain of Lakes)
 - 12) Lake Michigan
 - 13) Pettibone Creek
 - 14) Kankakee River
- e. For the installation of outfall structures in waters as listed above, there shall be no more than minimal disturbance to the sediment and substrate during construction activities. The implementation of soil erosion and sediment control measures prior to and during construction is required for any outfall installation.

- f. For a project site adjacent to a conservation area, the permittee shall request a letter from the organization responsible for management of the area. The response letter should identify recommended measures to protect the area from impacts that may occur as a result of the development. A copy of the request and any response received from the organization shall be submitted to the District with the notification.
- g. Stormwater management facilities shall not be constructed in a linear body of water such as a river, or perennial, intermittent or ephemeral stream or creek, unless there is substantial evidence that the project will provide a benefit to the aquatic system. Potential benefits could include water quality improvements at headwaters of the watershed, or promote wildlife habitat, feeding and breeding areas.
- h. The project should be designed such that stormwater does not directly discharge into waters of the U.S. All water shall be infiltrated or detained and treated prior to discharging into waters of the U.S. In addition, stormwater should be discharged using methods that promote infiltration and water quality treatment, such as level spreaders, infiltration trenches and vegetated swales.
- i. The permittee shall establish and/or enhance an upland buffer of appropriate native plants adjacent to all created, restored, enhanced or preserved waters of the U.S., including but not limited to: wetlands, rivers, streams, creeks, ponds and lakes. However, the construction or installation of the support towers, poles, footing, anchors and appurtenant structures for overhead and/or underground utility lines are exempt from this upland buffer requirement.
- j. No discharge of dredged or fill material may consist of unsuitable material. Material discharged shall be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act). Unsuitable materials include but are not limited to: trash, debris, asphalt, and creosote treated wood (i.e. for support poles and towers).
- k. The permittee is required to restore the construction area to pre-construction conditions, including grading the disturbed areas to the original contours and revegetating with appropriate native vegetation to all disturbed areas immediately upon completion of the project. The restoration plan, shall be submitted with the notification. A 1-foot contour topographic map of the project area may be required on a case-by-case basis.
- l. The area of waters of the U.S. to be impacted shall be limited to the minimum necessary to construct the utility line.
- m. The construction zone for linear utility line projects shall be limited to a width of 50 feet. All designated work area(s), including construction staging areas, shall be drawn onto the submitted construction plans and clearly labeled. Equipment storage or staging areas shall not occur in wetlands or waters of the U.S.
- n. Mechanized clearing of vegetation in the utility corridor shall be conducted no more than seven (7) calendar days preceding installation of the utility line in that segment of the corridor. Vegetation shall not be cleared along the entire corridor prior to installation of the utility line.
- o. For utility line projects, directional drilling (regulated in Section 10 waters only) or dry crossing techniques, such as fluming, shall be used for utility line projects if the waterbody to be crossed contains perennial flow. The construction drawings and project narrative shall depict the location of all construction access areas, dewatering pits, jacking and receiving pits and shall discuss the potential need for utility checks within the regulated area. Steps taken shall be taken for the removal and disposal of bentonite slurry, a by-product of installation.
- p. Notification shall include a contingency plan if the project involves the use of directional drilling in navigable waters (Section 10 waters only). The contingency plan shall discuss actions to stabilize the

work area (prior, during and post- construction), to employ alternative construction methods, and the process to obtain additional permits necessary to complete the project.

- q. Material resulting from trench excavation may be temporarily (up to 30 days) sidecast into wetlands provided that the material is contained using appropriate soil erosion and sediment control measures. Excavated materials shall not be temporarily sidecast in waterways. Revegetation of all disturbed areas is required.
- r. Utility lines shall not adversely alter the existing hydrology of waters of the U.S., including wetlands. In wetland areas, utility line trenches shall be lined with clay or other impervious materials or structures (such as cut-off walls) to ensure that the utility trench does not alter the hydrology nor drain waters of the U.S. In order to prevent a french drain effect, gravel bedding cannot be used as backfill material in the trench. The method chosen to prevent the draining of wetlands shall be drawn onto the constructions plans and clearly labeled.
- s. In wetland areas, the trench shall be backfilled with topsoil excavated from the trench in the same stratification in which it was removed. For example, the upper horizon of the wetland soil shall be placed back at the ground surface to allow for successful revegetation of wetland plants.
- t. All disturbed areas of the project (i.e. utility corridor, construction access and storage areas, disturbed slopes and streambanks, etc.) shall be stabilized (e.g., blanketed and seeded) immediately upon completion of construction activities in any one segment of the project. In no case shall soil stabilization be delayed until the project is completed.
- u. All temporary construction activities shall adhere to the requirements of items c through i of Regional Permit 7 (Temporary Construction Activities) and shall be addressed in writing and submitted with the notification.

Note: Utility lines constructed in, over, or under Section 10 waters, and without a discharge of dredged or fill material, require a Section 10 permit if the proposed activity has the potential to affect the course, condition or capacity of navigation. Utility lines constructed through a Section 10 water with a discharge of dredged or fill material requires a Section 404 permit in addition to a Section 10 permit.

**REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS**

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor

performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection

for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#).

The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each

classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a

separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice

performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one

and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contractor). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contractor). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of

Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of

Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

Contract Provision - Cargo Preference Requirements

In accordance with Title 46 CFR § 381.7 (b), the contractor agrees—

“(1) To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.

(2) To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b) (1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract.”

Provisions (1) and (2) apply to materials or equipment that are acquired solely for the project. The two provisions do not apply to goods or materials that come into inventories independent of the project, such as shipments of Portland cement, asphalt cement, or aggregates, when industry suppliers and contractors use these materials to replenish existing inventories.

