Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
RAIL BRIDGE LIGHTING - ELECTRICAL UPGRADE
(KEOKUK MUNICIPAL BRIDGE – CITY OF KEOKUK)

LEE COUNTY
ESL-000R(4)--7S-56

Effective Date
January 20, 2010

090027.01 DESCRIPTION.

A. General.

This work consists of the electrical system upgrades for the rail bridge as shown on the plans and described in this Special Provision. The work consists of providing the equipment, materials and labor for the following summary of work:

1. New 480 volt, three phase, four wire electric service, including meter and metering cabinet, metering transformers, and circuit breaker.
2. New electric service feeder from new service metering cabinet to bridge, including service conductors, buried conduit, exposed conduit, aerial cable, flexible cable loop at overhead turnstile on swing bridge, and new guy wires on structure.
3. New programmable AC flux vector drive for variable speed control of existing AC wound rotor drive motor, with new pedestal mounted control panel, and new fixed motor secondary resistor for existing AC drive motor.
4. New electrically operated 480 volt, three phase non-automatic transfer switch.
5. New 120/240 volt single phase panel board and rewiring in operator room of control house. Includes replacing existing ebonite mounting boards with new painted plywood mounting boards, and arc flash hazard analysis.
6. Relocation of the existing 25 KVA dry type transformer in equipment room of control house to different location in same room.
7. New railway deck walkway lighting.
8. Replacement of three navigation lights on the swing span.
9. Replacement of two existing red/green railroad signal lights.
10. New rail seated limit switches for the rail joints at both ends of the swing span, including wiring and conduit back to the control house.

All references herein or on the plans to “the Engineer” shall be understood as referring to the Director of Public Works, City of Keokuk, or his/her designated representative.

Any discrepancies between the contract plans, specifications, and the referenced publications shall be brought to the attention of the Engineer for resolution prior to performing the respective work or purchasing the associated equipment and materials.

The Contractor shall be responsible for all required coordination with the electric service utility, Alliant Energy. All costs and fees related to providing the new electric service shall be the responsibility of the Contractor.

The Contractor shall coordinate all work with the U.S. Army Corps of Engineers at the existing lock and dam facility and with the U.S. Coast Guard so as to not interfere with or disrupt marine traffic or waterway operations in any way. All coordination with the U.S.Coast Guard shall be through the City of Keokuk Department of Public Works.

Daily reports of on-site activities by the Contractor will be required to be submitted to the City of Keokuk Department of Public Works each day. Such reports shall include a listing of all activities that occurred that particular day, the number of workers on site during the day, and any other information concerning on-site activity requested by the City for its required daily security reporting to the U.S. Coast Guard. The daily reports shall be submitted at such time of day, each day, as designated by the City.

The Contractor shall coordinate his activities with the Keokuk Junction Railway so as to not interfere with train movements. The Contractor shall anticipate and allow for passage of two trains each day, one eastbound and one westbound. It shall be the responsibility of the Contractor to arrange an alternate means of electrically or mechanically opening and closing the bridge, if necessary, during any phase of the electrical work that would render the bridge inoperable. Any such alternate means of operation shall be submitted to the City for review and approval prior to implementation.

B. Reference Standards.

All electrical system equipment used for this project shall be constructed and applied in accordance with all applicable UL, NEMA, NFPA, ANSI, IEEE, OSHA, and U.S. Coast Guard regulations and standards, and satisfy all applicable NEC and AREMA Manual of Railway Engineering requirements. Specifically, the standards, guides, and specifications applicable to this project shall include, but not be limited to, the following:

ANSI C80.1	RIGID STEEL CONDUIT – ZINC COATED
ASTM B8	STANDARD SPECIFICATION FOR CONCENTRIC-LAY-STRANDED COPPER CONDUCTORS, HARD, MEDIUM-HARD, OR SOFT
ASTM B174	STANDARD SPECIFICATION FOR BUNCH-STRANDED COPPER CONDUCTORS FOR ELECTRICAL CONDUCTORS
AREMA MANUAL, CHAPTER 15, PART 6	MOVABLE BRIDGES
NECA 1	STANDARD PRACTICES FOR GOOD WORKMANSHIP IN ELECTRICAL CONTRACTING
NEMA RN 1	POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID STEEL CONDUIT AND INTERMEDIATE METAL CONDUIT
NFPA 70	NATIONAL ELECTRICAL CODE (NEC), 2008
UL 50	ENCLOSURES FOR ELECTRICAL EQUIPMENT
UL 67	PANELBOARDS
UL 1449	TRANSIENT VOLTAGE SURGE SUPPRESSORS

090027.02 MATERIALS, EQUIPMENT AND PROCESSES.

A. General.

In addition to the materials, equipment and processes shown and described on the plans and in these specifications, all additional junction boxes, conductors, conduits, fittings, connectors, and appurtenant hardware as may be necessary to provide a complete bridge electrical and control system shall be provided.

The following paragraph numbering corresponds to the work item numbering in section 090027.01 A. above.

1. New Electric Service. The new electric service shall be 277/480 volts, three phase, four wire grounded neutral. This item shall include the meter, metering cabinet, metering transformers, disconnect circuit breaker in NEMA 4 enclosure, and mounting frame. Mounting frame shall consist of two vertical 4 x 4 treated lumber posts embedded at least three feet into the ground, and projecting at least five feet above ground, with hot-dip galvanized steel channels (Unistrut, Kindorf or B-Line type) attached horizontally between them at spacing required for mounting the various cabinets and enclosures. Contractor may utilize front and back of frame for a more compact arrangement. Arrangement of components and precise location shall be coordinated with the electric utility company.

2. New Electric Service Feeder. The new electric service feeder shall extend from the new electric service metering location to the operator house on the swing span. The new feeder shall consist of the following five segments as shown on the plans: 1) underground in conduit to structure, 2) exposed in conduit on structure to gantry frame, 3) quadruplex aerial cable to turnstile at center of swing span, 4) exposed flexible loop transition from turnstile to top of swing span, 5) exposed in conduit from top of swing span down to operator house.

Aerial cable shall include all necessary guying/back stay cables to balance the tension forces induced in the existing support structures and turnstile by the new aerial cable. Such guy wires and back stay cables shall consist of 7/16 inch hot dip galvanized IWRC wire rope of 20,000 pound nominal breaking strength, with all necessary hot-dip galvanized or stainless steel hardware. Each span of guy or back stay cable shall include one or more turnbuckles for adjusting cable tension.

The exposed flexible loop transition cable at the swing span turnstile shall be approximately ten feet each of four conductors of AWG 1/0 Type W portable power cable, with 259 strand count and type RHW weather and sunlight resistant insulation.

3. New AC Flux Vector Drive. The flux vector drive shall be a UL listed variable frequency AC drive featuring true field oriented flux vector control. Drive shall be suitable for operation on a 480 volts AC, 60 hertz, three-phase system. Drive shall be rated not less than 60 HP at 480 volts, or 83 amps minimum continuous. Drive shall be suitable for operation from 0 to 40 degrees C. without de-rating. The drive shall be programmable, shall include a key pad and digital display for programming the operating parameters, and shall include drive fault indication and alarm . The drive shall be Unidrive SP by Emerson Industrial Automation, the G7 by Yaskawa Electric America, or PowerFlex 700 by Allen-Bradley/Rockwell Automation.

Drive shall be mounted in a free standing single-door cabinet not to exceed 72 inches high, 30 inches wide and 20 inches deep, and shall include the drive, line side circuit breaker, line side contactor, and any required control relays, control transformers, control fuses and terminal strips. A safety interlock handle shall prevent the door from being opened until the internal line-side circuit breaker is tripped off. Drive door shall include a clear window sized and positioned to allow unrestricted viewing of the digital display on the drive, an ammeter showing motor current, and the following indicator lights labeled with engraved nameplates: 1) green drive energized via the line-side contactor, 2) amber

drive running in open direction, 3) amber drive running in close direction, and 4) red drive fault. The drive fault shall also light a remote drive fault indicator light on the pedestal mounted control panel.

The AC flux vector drive shall be configured to operate in open-loop vector mode.

Drive shall be capable of producing full rated motor torque with the existing 40 HP drive motor from zero to rated motor speed and at least 150% rated torque for one minute, and 175% torque for 5 seconds.

Existing drive motor information: 40 HP AC Wound Rotor Motor, Full Load RPM 690, 440 volts, 63 amps, Secondary volts 130, Secondary amps 123, Service Factor 1.15.*

A fixed secondary resistor for the drive motor shall be provided, sized for approximately 10% slip at full load torque and rated for full secondary amps at 50% duty cycle. Secondary resistors shall be stainless steel, enclosed in a NEMA 3R cabinet suitable for outdoor mounting. Wiring for secondary resistors shall comply with wiring requirements stated below for the dynamic breaking resistor.

Drive shall provide National Electrical Code required motor overload protection in accordance with UL 991. The inverter logic shall use microprocessor based control, and be fully isolated from all power circuits.

Drive operating parameters shall be programmable via a keypad with a digital display located on the front of the drive. Programmable drive operating parameters shall include, but not be limited to, stop mode, acceleration and deceleration rates, current limit, torque limit, run direction, and running speed. All parameters shall be viewable and adjustable through a digital interface on the drive and be stored in nonvolatile memory.

Drive shall include all analog and discrete inputs and outputs required for interfacing to pedestal mounted controls and door mounted indicators as described herein. Analog output shall be 0 to 10 volts DC or 4 to 20 milliamps DC, and shall provide a directly proportional motor current signal for use by the door mounted ammeter.

A heavy duty single axis crane style joystick potentiometer controller, located on the new pedestal-mounted control panel in the operator's room, shall be provided to control the drive speed by providing an analog input signal to the drive. The joystick shall be spring return to a center detent position, at which point there shall be a zero speed deadband (null) and microswitch contacts to ensure that the drive is not powering the motor when the joystick is released. Pushing the joystick forward shall be for open direction, pulling the joystick back shall be for close direction. Separate microswitch contact(s) in the joystick shall be utilized to enable each direction of motion. Joystick handle shall project no less than five inches above panel and rotate at least 35 degrees from center in each direction. Joystick shall be PRO-5 Single Axis Controller by J.R.Merritt Controls Inc.

A three-position maintained selector switch (Close-Off-Open) on the operator's control panel shall be used to select the direction of operation, and shall be utilized by the drive in conjunction with the microswitches in the joystick.

The drive's internal acceleration and deceleration ramp times shall initially be set at ten seconds for acceleration, and five seconds for deceleration. The normal running mode motor torque limit shall initially be set at 150% of rated motor full load torque. Maximum drive motor running speed shall initially be set at approximately 500 RPM. The drive shall be configured to stop and hold the bridge stationary for at least 5 seconds (adjustable) with joystick in center (Off) position and then automatically release, without a drive fault. The above values shall be adjusted as necessary at the direction of the

Engineer during the system start-up.

The drive shall be provided with dynamic braking components capable of producing braking torque of 150% rated motor torque at approximately 35-40% duty cycle. Dynamic braking equipment shall be resistor type.

The dynamic braking module, if external, shall be by the same manufacturer as the drive and designed for use with the specific drive provided. Module shall include all inputs and outputs required for proper interfacing with the drive. Module overload protection shall be included. Module fault contact and resistor temperature switch shall be interfaced with the drive such that a module fault or resistor over-temperature will initiate a drive fault.

Resistors shall be designed for use in dynamic braking applications and sized to provide the above stated braking torque at the stated duty cycle. Resistor assembly shall be fully compatible with the dynamic braking module of the Drive. The braking resistor elements shall be stainless steel and mounted in a single NEMA 3R hot-dip galvanized or stainless steel enclosure and shall include appropriate cooling provisions. Cooling fans, if used, shall be metal bladed fans situated to force air across the resistor assembly during braking, and shall be wired to turn on when drive is switched to Ready mode, and continue running for 5 minutes after Drive is shut off. Resistor assembly shall be pre-installed in the enclosures and factory wired using Teflon or silicone insulated copper wire rated 150 degrees Celsius or better, and shall include field wiring terminals in boxes arranged to allow the use of 90 degrees Celsius rated wire.

Isolation, interface and auxiliary relays used in the drive cabinet shall be UL listed general purpose plug-in type relays in clear plastic cases with DPDT contacts rated 10 amperes at 300 volts AC, 60 hertz. Relay coils shall be 120 volts AC, 60 hertz. Relays shall include pilot light and manual over-ride operator. Sockets suitable for DIN rail or panel mounting, with retainer clips, shall be provided for each relay.

The drive shall be internally wired to be completely de-energized by a line-side contactor actuated by an On-Off maintained position key switch on the pedestal mounted control panel. Key shall be removable only in the Off position.

4. New Transfer Switch. A new non-automatic, electrically operated, 480 volt, 150-amp three-phase switched neutral transfer switch shall be provided. Electrical operator switching mechanism shall automatically utilize the power from the source to which the connection is being switched. The transfer switch shall include a NEMA 1 or NEMA 12 indoor enclosure. The transfer switch shall have the following door mounted labeled indicators and controls: indicator light for normal power available (amber), indicator light for standby power available (amber), indicator light for switched to normal power (green), indicator light for switched to standby power (red), and a selector switch for switching to normal or standby power. Transfer switch shall also include a dead-front manual backup operating handle allowing hand operation without exposure to live electrical terminals.

5. New Panel Board. A new 120/240 volt, 100 amp main breaker, single phase panel board suitable for indoor surface mounting shall be provided. Panel board shall include no less than 20 spaces for branch circuits. A NEMA 1 junction box shall be provided above the panel board for extending existing circuits that may not reach the branch breakers in the new panel board. Branch circuit breakers shall be provided, sized as required per NEC for the all new and existing 240 volt and 120/240 volt circuits presently utilizing separate fuse boxes or breakers, in both the upper control house room and the lower control house room, which are fed from the existing 25 KVA single phase.

6. Equipment for Relocation of Existing 25 KVA Transformer. Contractor shall furnish all materials and hardware required for the relocation of the 25 KVA dry type transformer to new location within the same room, as shown on the plans, including galvanized

mounting channels (Unistrut, Kindorf or B-Line type) extending vertically on the wall from the floor to the mounting height. These mounting channels shall bear on the floor so that the wall attachments do not carry the full weight of the transformer. Contractor shall also provide all necessary wiring, conduit, and junction boxes as may be required to extend the circuits to the transformer's new location.

7. New Railway Deck Lighting. New railway bridge deck lighting fixtures shall be outdoor, corrosion resistant, wall mount type lighting fixtures suitable for 120 volt, 300 watt rated, medium-base incandescent lamps. Fixtures shall be cast aluminum with stainless steel mounting hardware and provided with 100 watt incandescent vibration resistant industrial rough-service lamps.

8. New Swing Span Navigation Lights. Three new swing-span mounted navigation lights shall be provided as replacements for the existing three navigation lights. Navigation lights shall conform to the U.S. Coast Guard requirements of the Code of Federal Regulations, 33 CFR 118.70 and publication "Bridge Lighting and Other Signals" by U.S. Coast Guard, Bridge Administration. Swing span navigation light fixtures shall be manufactured of corrosion resistant materials, either cast aluminum, bronze, or UV-stabilized fiberglass/polyester resin. Lenses shall be either 155 mm or 200 mm Fresnel type, showing alternating red and green through 90 degree segments. The manufacturer of the fixtures shall be Tideland Signal, Automatic Power or B & B Roadway, Inc.

When lamps operating at voltages other than 120 volts AC are utilized in the navigation lights, multi-lamp automatic lamp changers with 120 volt AC power adapters shall be incorporated into the fixture bases. Lamp changers shall automatically stop rotating after the last working lamp is engaged. Lens and wiring fittings shall be watertight marine duty. Any necessary adapter plates shall be steel plate, minimum ¼ inch thick, primed and painted with three coats of epoxy/urethane outdoor rated enamel. All fasteners shall be stainless steel.

9. New Railroad Track Signals. Two new railway track signal light fixtures shall be provided, one at each of the two locations. Signal light fixtures shall be two-light fixtures, with one red and one green eight-inch LED signal light in each fixture box to control train movements on the bridge. Signal fixtures shall be constructed of cast aluminum, Lexan, or other corrosion-resistant material. Signals shall be powered by the exsting 120 volt AC system that powers the existing fixtures. Contractor shall supply all necessary mounting hardware and any adapter plates or brackets required to mount the new signal light boxes on the existing mounting brackets on the bridge. Signals shall comply with the Federal Railroad Administration's regulations as found in the Code of Federal Regulations 49 CFR Part 236.

The new track signals shall also include new wireless remote control transmitter-receiver units, consisting of one transmitter and one receiver for each signal light box, for controlling the signals wirelessly from the bridge operator house. Receiver units shall be Remtron model 22R08A Receivers in NEMA 4 enclosures for mounting at the signal light boxes. Transmitters shall be Remtron model 22T10A, configured similarly to existing transmitters. Both transmitters shall be identical, each with two channels, capable of independently controlling each receiver.

10. New Rail Seated Limit Switches. Four new 120 volt AC, two or three-wire, weatherproof, shielded, inductive proximity limit switches, rated for operation in -40 to +70 degrees C. ambient, with normally open contacts shall be installed for detecting rails fully seated. Limit switches shall have 7 mm or greater nominal sensing distance, be installed as shown on the plans and adjusted so that switch circuits are open until rails are within 1/8 inch of being seated. Repeater relays shall be furnished in NEMA 4 boxes near the limit switches, bolted onto the structural columns of the trusses, if wiring distances exceed the manufacturer's maximum recommended wire lengths for the specific switches selected.

In such case, one relay box shall be provided at each end of the swing span for both switches at the respective end. Wiring to the operator house shall be run inside the lower cord member of the structure.

Rail seated limit switches shall include a common indicator panel, consisting of a NEMA 1 enclosure with indicator lights mounted near the new circuit breaker panel board as directed by the Engineer. Indicator panel shall include four 120 volt AC indicator lights, one light for each end of the swing span, interconnected with the proximity switches on a terminal strip. Each indicator shall be lighted when the respective rail seated limit switch is tripped, indicating that the rail is seated. Indicator lights shall be the same as used on the new flux vector drive cabinet door, as described above, with green lenses, and labeled with engraved nameplates according to the limit switch location.

B. Hardware Vibration Resistance.
All bolted connections shall utilize lock washers or locking nuts.

C. Hardware Corrosion Resistance.
All enclosures, boxes, cabinets, brackets, and hardware shall be corrosion resistant. Boxes, cabinets and enclosures shall be galvanized steel, stainless steel or steel with factory applied powder coat, epoxy or baked enamel finish. In outdoor or exposed locations, all such cabinets, boxes and enclosures shall be field-painted with an additional coat of grey epoxy or urethane enamel rust-inhibiting paint.

D. Wiring.
Except for the new electric service aerial cable, all conductors shall be copper with ASTM B8, Class B stranding. Wire and cable used on power and control circuits shall be rated for wet locations, with XHHW, XHHW-2 or RHW insulation rated 600 volts and at least 75 degrees Celsius. All wiring that is not in conduit or metal wireway shall be jacketed multi-conductor. All wiring installed in exposed locations shall be furnished with a UV stabilized jacket, sunlight and weather-resistant.

New electric service aerial cable to the swing span overhead turnstile shall be AWG 2/0 1350-H19 aluminum conductor quadruplex cable with aluminum clad steel reinforced (ACSR) messenger rated 2500 lbs breaking strength and 60 mil minimum cross-linked polyethylene insulation, rated for outdoor exposed overhead service drop application. Connections to the aluminum quadruplex cable shall be via Kup-L-Tap, B-Tap or ILSCO insulation piercing aluminum/copper compatible connectors.

Minimum conductor sizes for all circuits shall be in accordance with the NEC or as otherwise indicated on the plans.

090027.03 CONSTRUCTION.

A. General.
The contract plans and specifications depict the general intent and minimum requirements of this contract and are not intended to be of sufficient detail to be used in lieu of Contractor-generated shop drawings, layout drawings, wiring diagrams and catalog cuts. It shall be the responsibility of the Contractor to provide additional detailing and coordination as necessary to provide a complete, reliable, working system in conformance with the concepts and intent set forth on the plans and in the specifications. All such additional detailing, coordination, labor, and miscellaneous hardware and materials are considered incidental to this work and shall be furnished as required to properly complete the installation at no extra cost.

Where locations of electrical components are not shown or specified, the Contractor shall propose a suitable location in the field in coordination with, and with the approval of, the Engineer.

The Contractor shall be responsible for supplying all tools necessary for proper installation and testing of all materials and equipment. All tools shall be used in accordance with their intended purpose and shall be appropriate for the materials and equipment being installed. All materials and

equipment shall be installed using appropriate methods and in accordance with generally accepted practices of electrical construction and maintenance (such as NECA 1) and manufacturers' recommendations.

The Contractor shall bear all costs and/or damages which may result from the use of inappropriate tools, methods or workmanship.

All obstructions to the railway and/or waterway due to either existing or new systems or components being inoperative as a result of the Contractor's work shall be coordinated in advance with the Railroad, the Engineer, the U.S. Army Corps of Engineers (for the adjacent lock operations) and the U.S. Coast Guard. All such coordination with the U.S.Coast Guard shall be accomplished a minimum of 30 days in advance of the respective activities.

B. Electrical Equipment.
Panelboards, circuit breakers, disconnect switches, transformers, cabinets, enclosures, light fixtures and all other electrical equipment shall be installed in conformance to manufacturers' instructions and recommended procedures.

To the extent possible, conduit and wiring shall enter outdoor boxes, enclosures and fixtures only through the bottom. Where bottom entry is not possible, side entries with weather proof sealant shall be utilized. Top entry shall not be utilized except with those fixtures whose manufacturers provide top entry only.

C. Conduits and Raceways.
Conduits and any other type of raceways shall be supported at intervals not to exceed six feet. Vertical conduits shall be installed plumb, and horizontal conduits shall be installed level. Where conduits are installed in exposed locations, expansion-deflection fittings shall be installed at all expansion points in the structure, where conduits cross piers from one span to the next, at maximum 100 foot intervals in long runs, and as necessary to prevent damage to the conduit system due to normal expansion and contraction of the surrounding structure.

Conduits shall be deburred and filed smooth at both ends prior to assembly or installation so that no sharp edges can contact the wiring during wire and cable installation. All field cut threads shall be coated with a zinc-rich cold galvanizing compound. All conduit and conduit fitting threads shall be coated with a waterproof, conductive thread sealant specifically manufactured for the conduit material used.

Conduits shall be supported at intervals not to exceed six feet.

Provide a 3/16 inch drain hole in bottom corner(s) of all outdoor enclosures, boxes and cabinets. Deburr and paint with rust inhibiting paint the edges of all drilled drain holes.

D. Contractor-Assisted Bridge Operation During Construction.
The Contractor shall provide a designated representative to assist the bridge operator in the operation of the swing span with the existing electric motor from the time the existing motor control system is disrupted until such time as the new AC flux vector drive is installed and fully functional and the existing control is removed. The Contractor's representative shall be a registered electrician experienced in industrial electrical systems and capable of making any necessary adjustments or corrections to the bridge electrical and motor control system. The Contractor's designated representative shall be present with the bridge operator, on the bridge, during all bridge operations throughout the duration of the above stated requirement.

At any time the bridge is operated by alternate means other than the existing electric motor, the Contractor shall perform such operations entirely with his own staff.

The Contractor shall bear full legal and financial responsibility for all fines or penalties incurred for

disruption of the railroad or waterway operations, or any damages to waterway vessels or trains caused by his activities.

E. Sequence of Construction.
The Contractor shall properly sequence and coordinate all work to comply with the project schedule and to minimize disruption to normal rail and waterway traffic. Specific staging and coordination requirements are as follows:

a. Work on any portion of the existing and new navigation lighting shall be performed in a manner such that no navigation light is taken out of service between sundown and sunup.

b. The new electrical service shall be complete, installed, tested and in service prior to switching motor control over to the new AC flux vector drive.

c. The new AC flux vector drive shall be installed and tested with temporary wiring to the existing drive motor prior to removing the existing motor control components and wiring.

F. Aerial Cable Installation.
The Contractor shall employ a qualified rigger to install the aerial cable and associated guy cables. Procedures shall be implemented to ensure that at all times during the installation process the guy cables are tensioned precisely such that no unbalanced horizontal forces are transferred to the structural support frames on the approach spans or turnstile atop the swing span.

Prior to installation, the Contractor shall submit a detailed procedure for approval which clearly shows the step by step process through which the aerial cable and the guy/stay cables will be installed and tensioned. The detailed procedure shall identify the means of measuring the tensions and monitoring the structural wire support frames and turnstile throughout the installation process to ensure that they are not being deflected. No work shall commence on the aerial cable installation until written approval for the procedure is issued by the Engineer.

Aerial cable final installed tension in absence of wind, ice and snow shall be adjusted to approximately 400 pounds. Contractor shall verify that cable sag in the final installed configuration does not interfere with nearby cables, guy cables, or any structural framing or other projections on the swing span throughout the full operation range of the swing span.

The transition flexible loop at the swing span turnstile shall be arranged so that the loop flexes without rubbing or snagging on adjacent supports, and without twisting of the conductors throughout the operation of the swing span.

G. Arc Flash Hazard Identification.
The Contractor shall utilize the services of a qualified provider of arc flash hazard analysis for the identification of the appropriate hazard category for the new service disconnect circuit breakers, the new transfer switch, the new flux vector drive, and any other new power cabinets or enclosures installed as a result of this project. All such electrical cabinets and enclosures shall be provided with the appropriate arc flash hazard warning labels indicating the arc flash hazard category for each, in compliance with the applicable provisions of NFPA 70E and NEC 2008.

090027.04 METHOD OF MEASUREMENT.
RAIL BRIDGE LIGHTING-ELECTRICAL UPGRADE, with all equipment and components completely installed, final adjusted, tested and demonstrated to be functioning properly, shall be measured as a single unit.

090027.05 BASIS OF PAYMENT.
RAIL BRIDGE LIGHTING-ELECTRICAL UPGRADE, shall be paid for as a lump sum item.