



**SPECIAL PROVISIONS  
FOR  
INSPECTION TRAVELER**

**Scott County  
IM-NHS-074-1(198)5--03-82**

**Effective Date  
April 25, 2017**

**THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

**150211.01 DESCRIPTION.**

- A.** This work shall consist of manufacturing, delivering, installing, and testing of the inspection traveler and support rail system for use under the eastbound span of the bridge, parked at the end location indicated on the plans. The inspection traveler shall be a self-propelled, self-contained unit. The inspection traveler shall be capable of traversing the under-side of the bridge under the roadway deck on the installed support rail system that is attached to the floor beams on the under-side of the bridge superstructure.
- B.** The support rail system consists of two monorail beams for the traveler. The traveler support rails, the high strength fasteners, beveled fill plates, and shims shall be included with this work and shall be erected in coordination with the structural steel erection for the bridge superstructure.
- C.** The inspection traveler shall include a diesel engine-generator unit and an aerial inspection scissor lift platform. The traveler shall be supplied with guide tracks in the grating and electrical power to the lift along the entire length of the traveler via a traveling electrical collector with wiring supplying the scissor lift. Track guides shall be provided on the front and back of the lift and each guide shall engage a minimum of 10 inches of the track.

**150211.03 MATERIAL.**

**A. Shop Drawing Requirements.**

- 1.** The Contractor shall provide shop drawings, product literature, and catalog cuts for the various components of the inspection traveler. The Contractor shall submit sufficient details and calculations for the Engineer to review the rails and the motorized end trucks for structural adequacy. Submitted calculations shall include design loads on those items not completely specified on the contract drawings or in the specifications.

2. Electrical and mechanical components listed on the plans may be replaced by other materials with the approval of the Engineer and at no additional cost to the Department. Details and operational methods shall be compatible with the intended function of the designed inspection traveler.
- B.** Provide materials in accordance with Article 2408.02 of the Standard Specifications, except as modified or appended herein.
1. Structural Steel: ASTM A 709, Grade 50, galvanized.
  2. Stainless Steel: ASTM A 276, Type 316, Condition S (Cold Finished); unless otherwise noted.
  3. Floor Grating: Welded, galvanized steel bar grating, of the size designated on the plans with skid resistance added. Grating shall be in conformance with ANSI/NAAMM HMMA – MBG 531-09. Grating shall be galvanized in accordance with ASTM A 123 after fabrication.
  4. Wire Cloth: Welded or woven, galvanized steel wire cloth of 0.063 inch (minimum) diameter wire with 1.00 inch center to center openings. Wire cloth shall be attached to the inspection traveler per the plan details and the manufacturer's recommendations.
  5. Bolts, Nuts, and Washers: Non stainless steel bolts, nuts, and washers shall be galvanized in accordance with Article 4153.06, A, 3 of the Standard Specifications.
  6. High-Strength Bolts: ASTM A 325, galvanized.
  7. Heavy Hex Nuts: ASTM A 563, Grade DH, galvanized.
  8. Hardened Washers: ASTM F 436, galvanized.
  9. Stainless Steel Bolts: ASTM F 593, Type 316, Condition CW
  10. Stainless Steel Nuts: ASTM F 594, Type 316, Condition CW
  11. Stainless Steel Washers: Type 316, Condition CW
  12. Shims: Where shown on the plans, all machinery shims required for leveling and alignment of equipment shall be stainless steel, ASTM A 240 or A 666, Type 316, neatly trimmed to the dimensions of the assembled parts and drilled for all bolts that pass through the shims. In general, total shim thickness available shall be no less than equal to twice the nominal thickness shown on the plans, and sufficient varying thicknesses shall be furnished to secure 0.010 inch variations of the shim allowance including one shim equal to the full allowance. Shims shall be placed to provide full contact between machinery parts. Shims shall be shown in detail on the shop drawings.
  13. D-Ring with Anchorage Plate: Meets or exceeds all applicable industry standards including OSHA and ANSI/ASSE Z359 with a minimum strength of 5000 pound galvanized.
  14. Bearings and Bushings: Self-lubricating (maintenance free) bushings shall be standard products of an established manufacturer.
  15. Weldments: All parking brake weldments shall be stress relieved by heat prior to any machining. All welding shall conform to AWS D1.5 (Latest Edition) Bridge Welding Code.
  16. Fits and Finishes: All fits and finishes shall conform to AASHTO LRFD Movable Highway Bridge Design Specifications, 2<sup>nd</sup> Edition, 2007, Section 6.7.8, unless otherwise noted.

- 17. Engine-Generator:** The engine-generator shall be a 25kW, 60 Hz Diesel Engine-Generator Set. It shall have a liquid-cooled, diesel engine that powers a generator that provides 60 Hz, 3-Phase, 208/ 120 volt, 87 Amp electrical power. The diesel engine shall run on No. 1 Diesel fuel and use synthetic all-season oil.

Standard equipment of the engine-generator shall include: Four cycle diesel engine with 87 amp AC alternator, vibration isolated control panel, voltage regulator that provides immunity from silicone-controlled rectifier (SCR) loads, high ambient (50°C) cooling system, skid base that supports the engine-generator, cooling system, and battery with integral vibration isolation.

Engine-generator options shall include: NFPA 110, 12-light engine monitor, NFPA 110, AC meter package, a 12 volt, 90 AH battery with trickle charger, a double-wall in base fuel tank, 54 gallon, sized for 22 hour running time at 3/4 load, weather protection and Level 2 acoustic enclosure made of steel, with hinged service access doors, with key lockable handles, thermostatically controlled coolant heater, critical grade exhaust silencer, downward directed exhaust pipe, protected to prevent burning if accidentally touched. The manufacturer shall verify the size and ratings of the specific diesel generator set selected and confirm compatibility with the flux vector drives of the size and type to be installed. If determination is made that a larger size generator is necessary, the Contractor shall be responsible for increasing the size of the generator, associated electrical equipment, and wiring at no additional cost.

- 18. Motorized end trucks:** Motorized end trucks shall power the traveler. The traveler shall be supported by two eight wheel end trucks with four wheels on each end truck that are motorized. All trolley wheels shall be 9 inch diameter. Each end truck assembly shall have a minimum load capacity of 60,000 pounds, and be powered by two 5 HP electric motors with enclosed gearing, giving a forward or reverse traveler speed of 75 feet per minute.

The motors for the end trucks shall be totally enclosed fan cooled with a 30 minute duty cycle and shall be 208 volt, 3 phase, 60 Hz. All motors shall have spring set, electric released disc brakes, with external manual over-ride brake release lever. The manual brake release on each motor shall trip a limit switch which shall disable the electric operation of all motors if any of the motor brakes are manually released. Two motors, one on each end truck, shall have a rear shaft extension with a square end, for use with a manual hand crank for emergency operation. The shaft extension shall have a removable cover. When a cover is removed, a limit switch shall disable electric operation of all motors.

The motorized end trucks shall be a heavy duty series with a 154 inch wheelbase, underhung type, with side guide rollers to keep the main wheels centered on the support rail.

- 19. Support Rails:** The traveler patented support rails shall be made by the same manufacturer as the end trucks. The rails shall have a special rolled section welded at the bottom that the end truck wheels and side guide rollers ride on. The rails shall meet the equivalent center load 1/600th deflection criteria for 60,000 pounds reaction at each end truck with an unsupported span length of 26 feet 8 inches. The rails shall have a minimum weak axis elastic section modulus of 21.5 cubic inches. The rail shop drawings shall be reviewed by the Engineer for structural adequacy. Standard I-beam or wide flange beams shall not be acceptable as the rails. The traveler design was based upon a rail with a height of 22 1/4 inches, a special rolled section for the end truck wheels with dimension of 4 1/2 inches wide and 1 1/8 inch thick, and a weight of 81.5 pounds per foot. Rail splices shall occur only at the bridge main floor beams as indicated on the plans and shall be a standard manufacturer's splice, as detailed by the manufacturer for the support rail. In addition to the standard splice plates, two extra splice plates (1/2 inch by 4 1/2 inches by 15 inches) shall be used under the top rail flange at the floorbeam connection. The rails shall be square cut at the splice and have a maximum 1/16 inch gap between rail ends.

20. Bumpers shall be supplied at the ends of traveler runs and be of sufficient capacity to stop the traveler from full speed impact.
21. Parking Brakes: There shall be two parking brakes on the traveler, with one at each end truck as shown on the plans. The parking brakes shall be located on the same side of the traveler platform as the generator and electrical control boxes. The parking brakes shall be spring set, electro-hydraulic released by use of a standard industrial brake thruster, 208/120V, 3 Phase, 60Hz, with internal compression spring rated at approximately 700 pounds at full thruster stroke of 60 mm. When power to the thruster is off, the internal compression spring shall set the brake through a mechanical linkage, which operates the parking brake pad, forcing it against the under-side of the end truck support rail. Refer to the plans for details regarding installation and brake pad clearance adjustments.  
  
The brake pad shall be "non-asbestos" high friction molded brake and clutch material, 1/2 inch thick by 4 3/4 inch wide by 12 inch long, bonded to the pad support weldment.
22. End Truck Motor Control Station shall be NEMA 4X and as described on the plans.
23. Panelboard shall be NEMA 3S, 100 Amp for 208/120 Volt, 3 Phase service.
24. Lighting shall be as described on the plans.
25. General Electrical Material: For conduit, electrical wires, and other wiring devices (including junction boxes, receptacles, and switches) shall be as indicated on the plans and in the Special Provisions for the Bridge Electrical System.
26. The galvanized structural parts of the traveler need not be painted. The support rails, end trucks, and parking brake parts shall use the paint system for the painted parts of the bridge structural steel. Caution shall be used to avoid painting moving surfaces, motorized equipment, and stainless steel parts.
27. Warranty: The manufacturers of the engine-generator set and the motorized end trucks shall provide a 2 year warranty on all parts and labor, commencing with the opening of the bridge to traffic.

**C. Programmable Logic Controller (PLC) System.**

1. Traveler control logic functions shall be performed by a programmable logic controller. The PLC processor shall utilize ladder-logic programming, with an advanced instruction set including: file handling, sequencing, diagnostics, shift register(s), program control instructions, timing, and mathematical functions. Basic instruction speed shall be 0.30 $\mu$ s per basic instruction. PLC data bytes attributes shall be 20KB. PLC shall include built-in USB and RS232/485 ports for programming.
2. The PLC shall have 48 possible digital inputs or outputs. The PLC shall have an external 120V AC power supply. The input rating of the PLC shall be 120V AC. The PLC shall have a backup memory module with Real Time Clock. The PLC shall have 28-110V AC inputs and 20 relay outputs. The PLC shall be protected by surge suppression, UL 1449 3<sup>rd</sup> edition listed Type 4 (verifiable at UL.com) or better.
3. In general, except for specific exceptions, as may be granted by the Engineer, all control logic, timing, counting and other control functions shall be performed by the PLC. All necessary modules, interfaces internal and external to the controlled equipment, and other accessories shall be included to provide a complete working system. Interconnection between processors and I/O racks shall be via Remote I/O utilizing twin axial cable or similar reliable network media supplied by the PLC manufacturer and accepted by the Engineer.

4. The PLC logic shall assure correct sequence of manually initiated operations, and control fully automatic operations.
5. The ladder logic shown on the plans is conceptual only. Additional logic development and program writing by the control system vendor will be necessary to complete the program suitable for operating the traveler.
6. The documented ladder diagram shall be furnished with the shop drawing submittals for approval prior to the control system shop test. Control system shop drawings will not be approved without the ladder-diagram program.
7. Surge Protective Devices: General Control Circuit. Branch circuits supplying the bridge control system shall be provided with surge protective devices, connected directly to the respective branch circuit conductors on the load side of the branch circuit breaker. Surge protective device(s) shall be UL 1449 3<sup>rd</sup> edition listed Type 4 (verifiable at UL.com).
8. Relays: 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 Hz. Relay coils shall be 120 volts AC, 60Hz.
9. PLC isolation relays shall be provided for all motor starters and other large loads. Relays shall be UL listed general purpose plug-in type relays with DPDT contacts rated 10 amperes at 240 volts AC. Relay coils shall be 120 volts AC, 60Hz. Relays shall include pilot light and manual operator. Sockets suitable for DIN rail or panel mounting, with retainer clips, shall be provided for each relay.

#### **D. Flux Vector Drives.**

1. Three phase, 208V AC, 60Hz, drive providing open loop flux vector speed and torque control of an induction motor, rated for 4-5Hp motors. Drive shall accept 120V AC control logic.
2. Drive shall utilize microprocessor based control. It shall include an operator interface, with backlit LCD display and keypad; usable for drive status monitoring and adjustment of all parameters.
3. Operating modes shall be fully programmable and selectable via external control inputs as required. Drive shall be configured for operation as depicted on the drawings. Drives shall include built in communications capability including Ethernet.
4. Drive shall be able to provide a maximum operating speed of 75ft/min. Drives shall be able to smoothly accelerate and decelerate the traveler over a distance, such that the traveler does not jolt or come to an abrupt stop when a normal stop command is issued. An emergency stop shall immediately de-energize the motors and shut down the drive.
5. Drive shall be capable of producing 150% full load torque at the drive motor for 60 seconds, and at least 175% for at least 10 seconds. Drives shall include braking resistors rated for 10% duty cycle and provide 150% braking torque. The braking resistors shall be located outdoors and shall be an all stainless steel construction.
6. Drive shall include fused control transformer, interfacing control relays (with internal indicator lights), terminal blocks, and any other devices and accessories necessary to complete the drive assembly.
7. The drive shall include all necessary software to program the drive. The software shall be installed on the programming PC.

8. The complete drive package shall be assembled and configured by the control system vendor. The Control System Vendor shall provide the drives, switching contactors and enclosures, drive enclosures, dynamic braking resistors, motors, and all related components as a complete and functional package.

#### **E. Programming PC.**

1. A semi-ruggedized laptop computer shall be provided, with all necessary software, cables, and interface modules for programming the PLC. Programming capabilities shall include both on-line and off-line programming. The software and any required interface module shall be furnished by the PLC manufacturer, and shall include extensive documentation. The software shall have provisions for: programming in ladder logic, structured text, function block, address and instruction comments, program listings, cross-reference reports and contact histograms.
2. The laptop computer shall meet the following minimum requirements, unless specified otherwise by the PLC manufacturer: 2.1GHz (or higher) processor, 2Gb system RAM, minimum 100Gb shock-mounted hard drive, built in touchpad, CD-RW / DVD-R, 56Kbps internal modem, 15.6 inch 1280-800 (WXGA) outdoor-readable TFT active matrix color LCD display, and Windows 7 Professional operating system. Ports shall include USB 2.0, and 10/100 Ethernet ports. The laptop computer shall be moisture, dust, vibration, and drop-shock resistant, and designed using MIL-STD-810F test procedures. Shall include a 120 volt AC power adaptor. The laptop computer shall be mounted on a dedicated shelf inside the PLC cabinet. Laptop computer shall be Panasonic Tough book, GammaTech Durabook, Dell Latitude or approved equal. All original manuals, software packages, software license information, and packaging material for the laptop computer shall be provided.

#### **F. Preliminary Testing.**

1. The PLC, control console, flux vector drives and all other necessary components shall be used to perform the preliminary testing.
2. All PLC control logic, relays, and other internal control system components shall be assembled in the proper cabinet(s), ready for preparation for shipping (pending any corrections or adjustments necessitated by testing results) before performing this test.
3. The control console, the various motor contactors, and the flux-vector drives shall also be connected and utilized for this test. In general, the various motors need not be present, but temporary indicator lights shall be provided and energized through the power contacts of the motor contactors, and labeled according to the direction of motor rotation (raise, lower, etc) where applicable. Small motors shall be used with the flux-vector drives.
4. Toggle switches and/or selector switches, properly labeled and configured, may be substituted for limit switches for this test. All operations of the control sequence must be demonstrated for this test. Any errors found in the system shall be corrected and the test rerun, to the satisfaction of the Engineer.
5. This test shall be conducted in the presence of the Engineer's representative. Accordingly, the Engineer shall be notified at least two weeks prior to the test date.

#### **G. Installation.**

1. The PLC's, complete with required power supplies, input and output modules shall be installed in cabinets as described herein or as may be shown on the drawings, prior to shipment to the site. Cabinets shall be properly prepared for shipment to protect internal components from damage. Heavy items fastened to the back panels shall be adequately braced or temporarily removed to prevent shipping damage.

2. All terminal blocks shall be clearly labeled to facilitate field connections. Labels shall be clearly readable and smudge-free.
3. The Control System Vendor shall alert the Contractor with respect to any special requirements for grounding of the system, shielding of conductors or other isolation of equipment or conductors. The Control System Vendor shall provide instructions to accomplish special grounding or shielding requirements.

#### **H. As-Built Documentation.**

1. The Control System Vendor shall provide hard copies of the as-built PLC ladder logic program, complete with all cross references, contact labels, and rung comments. The labels on all input and output points shall match those shown on the contract drawings. One copy shall be provided for the PLC panel, and other copies shall be provided as required for the Electrical Traveler Operation and Maintenance Manual requirements. An electronic "PDF" version of the ladder logic program and Operation and Maintenance Manual shall also be provided.
2. The Control Systems Vendor shall provide an electronic backup of the PLC ladder program, contact labels, program labels, PLC configuration, and all related files in a format that can be read and downloaded by the PLC programming software. These files shall also be copied to the hard drive of the PLC Programming computer.
3. Electronic backups shall be provided on compact disk, or a media approved by the Department. Six copies shall be provided.
4. All passwords shall be provided to the Department.

#### **150211.04 CONSTRUCTION.**

- A. The motorized end trucks and the engine-generator set shall be separately tested for operational requirements by the manufacturers, prior to shipment to the final assembly location. A certified report of the operation shall be submitted to the Engineer.
- B. At field installation, the various manufacturers shall provide factory representatives to supervise installation, testing, and operation of the travelers. The traveler support rails shall be connected to the span floor beams to tolerances in straightness, elevation, distance variation between rails, and parallelism as required by the manufacturer of the rails and motorized end trucks. Center to center distance between rails attached to span floor beams must not vary by more than +/- 1/8 inch from nominal span distance.
- C. After installation, the minimum operational test shall consist of operating the traveler for three complete round trips from one end of travel to the other and return to the "home" position.
- D. The maintenance personnel from the Department shall be instructed in the complete operation and maintenance of the engine-generator, the motorized end trucks, trolley wheels, gearing, the manual operation of the inspection traveler, and the electrical control systems and wiring.
- E. Three-ring binders shall be provided as Operation and Maintenance (O&M) Manuals for the Inspection Traveler with the following portions: operating instructions, complete set of reduced size drawings, recommended spare parts, lubrication charts, and maintenance schedule. Five copies shall be provided. One copy of the O&M Manual shall be placed in a waterproof container that is secured to the inspection traveler, as approved by the Engineer. Three copies shall be given to the Engineer for distribution to the Iowa DOT's Resident Construction Engineer's Office, the Iowa DOT maintenance garage, and the Bridge Maintenance and Inspection Unit of the Iowa DOT's Office of Bridges and Structures. The final copy shall be sent to the home office of the design engineer.

- F. Lubrication shall be kept off the support rail tread surface.
- G. Two signs shall be attached to the inspection traveler indicating the maximum capacity for the traveler as 3000 pounds. The sign shall indicate that the inspection traveler is not to be used for storage of construction or maintenance equipment.

**150211.05 METHOD OF MEASUREMENT.**

None. Lump Sum Item.

**150211.06 BASIS OF PAYMENT.**

All costs associated with furnishing and installing the Inspection Traveler with scissor lift and the support rails to the span, as shown on the plans, shall be completely covered by the contract lump sum price for Inspection Traveler.