INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 13-06
Technical Advisory

March 27, 2013

TO: **All Design, Operations, and District Personnel, and Consultants**

FROM: ***/s/David Boruff***
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Traffic Engineering Division

SUBJECT: **Signal Electrical System**

REVISES: ***Indiana Design Manual*** **Section 77-5.05**

EFFECTIVE: **Lettings on or after September 1, 2013**

SUPERCEDES: **Design Memo 11-21**

The subject *Indiana Design Manual* section has been revised to reflect the following changes.

Significant cost savings can be achieved on a traffic signal project depending on the electrical system design. An estimate of the service connection charge from the local utility company included in the Contract Information Book can avoid expensive change orders.

Polymer concrete handholes are less expensive than concrete handholes and are appropriate for locations that are protected from heavy vehicles. INDOT *Standard Drawings* and INDOT *Standard Specifications* 805.02, 805.16 and 922.17 have been revised to allow the use of polymer concrete handholes. The revised sections will appear in the 2014 *Standard Specifications*, effective for lettings on or after September 1, 2013. A Recurring Special Provision (RSP) will not be issued. The revisions can be found in the Standards Committee Approved Minutes dated February 21, 2013 at http://www.in.gov/dot/div/contracts/standards/sc/

HDPE has been added as an acceptable material for non-metallic conduit.

Revisions to Section 77-5.05 are attached to this memo.

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77-5.05 Electrical System

The electrical system consists of electrical cables or wires, connectors, conduit, handholes, etc. Electrical connections between the power supply, controller cabinet, detectors, and signal poles are carried in conduit. The following should be considered in developing the traffic-signal wiring plan.

1. Service Connections. Service connections from the local utility lines should go directly to the service disconnect and then to the controller cabinet. The lines should be as short as practical. The service disconnect should be located as close to the controller cabinet as practical. These installations will be placed underground in separate conduits from other signal wires. Easy access to a shut-off device in the controller is required to turn the power supply off while performing system maintenance.

   The designer should contact the local utility company and obtain an estimate for the service connection cost. A unique special provision should be created for the service connection cost. The provision should indicate the estimated cost of the service connection and that the cost is included in the cost of Signal Service.

2. Electric Cables. All electric cables and connections must satisfy national, State, and local electrical codes, in addition to the NEMA criteria, except for the green wire, which is used for the green indication or interconnect function and not for the system ground. The number of conductor cables should be kept to a minimum, usually only 3 or 4 combinations, to reduce inventory requirements. A 7- or greater-conductor cable is used between the controller cabinet and the disconnect hangers or cantilever base. A 5-conductor cable is used between the disconnect hanger or cantilever base and 3-section signal indication. A 7-conductor cable is used between the disconnect hanger or cantilever base and 5-section signal indication. A 5-conductor cable is used between the controller cabinet and the pedestrian-signal indication. A 5-conductor cable is used between the controller cabinet and each pair of pedestrian push buttons located in the same corner of the intersection. Connections to flashers use only a 3-conductor cable. The INDOT *Standard Drawings* illustrate the correct procedures for wiring and splicing cables.

3. Cable Runs. All cable runs should be continuous between the following:
   a. controller cabinet to base of cantilever structure or pedestal;
   b. controller cabinet to disconnect hangers;
   c. controller cabinet to service disconnect;
   d. disconnect hanger to signal indications;
   e. base of cantilever structure to signal indications; and
   f. controller cabinet to detector housing.

4. Handhole. A handhole should be located outside the travel and shoulder pavement and adjacent to the controller cabinet, each signal pole, and each detector location. Type I handholes are made of reinforced concrete pipe and Type II handholes are made of polymer concrete. The material type that should be used will depend on the location. A Type I (concrete) handhole should be used for a location that will be closer to motor vehicles, such as in the shoulder or immediately adjacent to the unprotected edge of pavement. A Type II (polymer concrete) handhole should be used for a location that will not be exposed to motor vehicles, such as on sidewalk, behind guardrail or non-mountable curb, or as directed by the District Traffic or District Maintenance Offices. A handhole that will be placed directly in a travel or auxiliary lane should be designated as a Type III and will require a special design and plan detail that includes a means by which the cover and ring are secured to the handhole.

   The INDOT *Standard Drawings* provide additional handhole and wiring details. The maximum spacing between handholes in the same conduit run is 200 ft.

5. Underground Conduit. Underground conduit is used to connect the controller cabinet, traffic signals, and loop detectors together. Conduits run underneath the pavement and between the handholes, using a 2-in. diameter conduit. For a run with additional cables, the conduit size may need to be increased. The NEC should be checked to determine the appropriate conduit size for the number of electric cables that can be contained within the conduit. The INDOT *Standard Drawings* provide additional placement details of underground conduit.

   The designer should indicate which material type should be used. The conduit type should be determined based on the guidelines as follows:

   a. PVC Schedule 40, HDPE Schedule 40, or rigid fiberglass should be used conduit to be placed in a trench.

   b. HDPE Schedule 80 should be used for conduit to be jacked or bored, e.g., underneath pavement.

   c. Galvanized steel may be used as requested or confirmed by the district traffic engineer for a signal-modernization project to match the existing conduit or for new signal construction.

   d. PVC Schedule 80 or rigid fiberglass should be used for conduit on bridges or other structures

   As the practice of using HDPE, PVC or rigid fiberglass conduit becomes more prevalent, the need for the designer to indicate the conduit type may not be necessary, as contractors will gain experience in using the material type that is appropriate for the application.

6. Grounding. Each metal pole, cantilever structure, controller cabinet, etc., should be grounded. The INDOT *Standard Drawings* illustrate the correct methods for grounding these devices.

7. Detector Housing. A detector housing should be a cast-aluminum box encased in concrete. A detector housing is used to splice the wires from the loops to the lead-in cable to the detector amplifier. The INDOT *Standard Drawings* provide additional information on detector housings, including wiring details.

8. Disconnect Hangers. Disconnect hangers are used for a cable-span-mounted signal to provide a junction box between the signal heads and the controller.

9. Loop Tagging. Each loop-detector cable should be tagged in the controller cabinet to indicate which loop detector wire belongs to which loop detector. Each should be labeled according to street, direction, lane, and distance from the stop line, and if the loop is a count loop.

10. Interconnect Cable. A 7-conductor signal wire is used for hard-wiring interconnected signals. For a closed-loop system, the hard-wired connection should use a telecommunication cable consisting of either a fiberoptic cable or a 6-pair twisted cable.