

SECTION 676 SIGNAL ASSEMBLIES

676.1 Description

- (1) This section describes furnishing and installing traffic signal assemblies.

676.2 Materials

676.2.1 General

- (1) Since overhead ramp control, display enforcement, and type 2 advance flasher signal assemblies are mounted on existing poles, the requirements specified in 676.2.2 and 676.2.3 are not applicable.

676.2.2 Traffic Signal Standards

- (1) Furnish traffic signal standards conforming to 657.2.4. Use standards with an overall length of 13 feet (4 m), except for type 1 advance flasher signal assemblies, use 15-foot (4.6 m) standards.

676.2.3 Pedestal Bases

- (1) Furnish pedestal bases conforming to 657.2.5. Use square bases with a 12 3/4-inch (325 mm) bolt circle.

676.2.4 Signal Heads

- (1) Furnish the housing, visor, optical units, lenses, reflectors, and lamp receptacle conforming to ITE standards for adjustable face vehicle traffic control signal heads.
- (2) Furnish traffic signal lamps conforming to ITE standards for traffic signal lamps.
- (3) For each lens receptacle, provide with 2 color-coded 18 AWG or larger rubber covered lead wires conforming to ASTM specifications, securely fastened to the socket, and of sufficient length to reach the terminal block.
- (4) Furnish signal indications having round lenses with a 12-inch (300 mm) or 8-inch (200 mm) nominal diameter, as the plans show.
- (5) Illuminate each lens independently of any other lens with 165 watt, 1950-lumen 8000-hour, 125 volt traffic signal lamps in all 12-inch (300 mm) lenses; 67 watt, 8000-hour, 125 volt traffic signal lamps in all 8-inch (200 mm) lenses.
- (6) Use lamp sockets for 67 watt lamps designed to place the 2 7/16-inch (62 mm) focal length lamp filament at the 3-inch (75 mm) distance as required in 8-inch (200 mm) green and yellow signal head reflectors.
- (7) Use lamp sockets for 165 watt lamps designed to place the 3-inch (75 mm) focal length filament at the 3-inch (75 mm) distance as required in 12-inch (300 mm) red signal head reflectors.
- (8) Furnish traffic signal faces from the department's approved products list.

676.2.5 Signal Mounting Brackets

- (1) For all exterior mountings and assemblies of the signal faces, use unpainted aluminum or plastic.
- (2) Adequately protect all trunions, brackets, and suspensions used for assembling and mounting traffic signal heads against atmospheric conditions, and ensure that they are entirely weather tight. All threaded signal head support hardware shall be IPS 1 1/2-inch (38 mm) pipe size. Coat all threaded assemblies of metallic parts with a rust, corrosion, and anti-seize protection compound.
- (3) Mount all vertical-mounted signal heads on 4 1/2-inch (115 mm) outside diameter signal standards on the side of the post. Use standard mounting brackets and clamps from the department's approved products list.
- (4) Install pinnacles in all holes of upper and lower signal head mounting brackets.
- (5) Where 2 brackets with 2 mounting holes in each bracket are used, secure the bracket to a wood pole or post using two 3/8-inch by 3-inch (10 x 75 mm) lag screws.
- (6) Mount brackets banded to poles or standards so the traffic signal assemblies are immovable. Use 3/4 inch (19 mm) wide, 0.025 inch (0.635 mm) thick, stainless steel banding. Use stainless steel clips.
- (7) To complete the raceway from a pole or standard mounting bracket to the signal head, use galvanized 1 1/2-inch (38 mm) elbows and tees, or engineer-approved equal. Use 1 1/2-inch (38 mm) galvanized rigid metal conduit nipples.

- (8) Furnish hardware for closing 1 1/2-inch (38 mm) openings in heads or bracket ends from the department's approved products list.
- (9) Furnish pinnacle type hardware for closing signal heads or bracket ends from the department's approved products list. Use 1 1/2-inch (38 mm) neoprene washers to seal the top of a head or the top of the top head in an array of heads, to the upper mounting bracket to keep moisture out of the heads.
- (10) Use 1 1/2-inch (38 mm) traffic signal head mounting nuts from the department's approved products list.
- (11) Use 1 1/2-inch (38 mm) by 1 3/4-inch or 2-inch (45 or 50 mm) length close nipples, as required. Use nipples with tapered pipe thread on one end and running thread on the other end.
- (12) Use spacers, when required, made of corrosion resistant material.
- (13) Use one-inch metallic conduit conforming to section 652.

676.2.6 Sidemount Sign Mounting Brackets

- (1) For all exterior sign mountings, use unpainted aluminum or plastic.
- (2) Adequately protect all trunions, brackets, and suspensions used for mounting traffic signs against atmospheric conditions, and ensure that they are entirely weather tight. All threaded support hardware shall be IPS 1 1/2-inch (38 mm) pipe size. Coat all threaded assemblies of metallic parts with a rust, corrosion, and anti-seize protection compound from the department's approved products list.
- (3) Mount brackets banded to poles or standards so the sign assemblies are immovable. Use 3/4 inch (19 mm) wide, 0.025 inch (0.635 mm) thick, stainless steel banding. Use stainless steel clips.

676.3 Construction

676.3.1 General

- (1) Perform work conforming to section 651, section 655, section 657, and section 658, the WEC, and as the plans show.
- (2) Perform work under this section using a journeyman electrician as specified in 651.3.2.
- (3) Do not erect pole shafts for the signal structures until the concrete footings have cured for at least 7 days.
- (4) Drill and tap all cast signal bases for an equipment-grounding bolt. Use a 10-32, 1/2-inch (13 mm) long brass bolt used in conjunction with a UL-approved grounding lug. Place the bolt in the left side of the base approximately 4 inches (100 mm) from the front corner of the door side and approximately 6 inches (150 mm) up from the bottom of the base. Coat the bolt with an anti-seize compound from the department's approved products list.
- (5) Ensure that the positioning, mounting height, and lateral placement of signal heads are according to the MUTCD. For overhead signals, provide a clearance from the pavement surface of the roadway to the lowest part of the mast arm, or the lowest part of any object mounted on the mast arm, between 17 feet (5.2 m) and 19 feet (5.8 m) . The contractor may be required to revisit locations to re-adjust the signal heads once the engineer observes the metering operation of the ramp.
- (6) Seal voids between the pole or mast arm and mounting bracket by using silicon or rubberized caulking, or similar engineer-approved materials.
- (7) If using 2 brackets with 2 mounting holes in each mounting bracket, use only the upper bracket, upper hole to bolt the bracket to a pole or pedestal. The mounting bolt shall be a stainless steel, hex head cap screw, 3/8-inch (10 mm), with 24 threads per one inch (25 mm). Drill or tap the pole or pedestal to match. Do not allow the cap screw to extend more than 1/4 inch (6 mm) through the wall, into the interior cavity of the pole or pedestal. Use a stainless steel flat washer sized to properly cover the bolt hole in the bracket and a stainless steel lock washer with each cap screw. Band the lower end of the upper bracket and the lower bracket to the pole or pedestal.
- (8) Ensure that the white current carrying neutral conductor and the green grounding conductor conform to the requirements of 10 AWG.
- (9) Verify the number of conductors required in the cable runs, and submit the cable arrangements to the engineer for approval. Also provide the number of excess conductors the plans show for future use. The engineer will verify conductor totals. Wrap conductors from multi-conductor cables that are spares or unused in the bases at this time back along the multi-conductor cable, and tape them to the cable. Leave

a 2-foot (600 mm) length of cable or wire in each hand hole for termination. Leave an extra 6 feet (1.8 m) of each cable in each pull box.

- (10) For traffic signal cable that extends from the signal base to the terminal strips in the signal heads, provide the number of conductors as the plans show. Match the color of the conductor to the lens color.
- (11) Where using vinyl electrical tape, provide an insulation capacity equal to that of the remainder of the conductors. Use a vinyl tape from the department's approved products list.
- (12) Cover tape with a liberal coating of an electrical varnish from the department's approved products list.
- (13) Make electric splices and connections with pressure or compression fittings from the department's approved products list.
- (14) Verify that the maximum ampere load in the hot line to the signal indications does not exceed 10.5 amperes. For the maximum current flow in the current carrying neutral from the signal indications, do not exceed 21 amperes.
- (15) Install conductors in continuous lengths without splices from terminal to terminal. Splice only at hand holes at the bases of the standards or poles. Do not splice in underground pull boxes or conduit.
- (16) Group and identify sets of conductors in signal cables, 3 each per signal phase, whether insulated with red, yellow, green, or other colors, at each pertinent termination. Use conductors colored to match lens colors first. The engineer shall approve the method of identification. Furnish 2 as-built cable layout drawings with labeling to the engineer upon completion of the work. Place one of those copies in the cabinet.
- (17) Ensure that the 14 AWG white current carrying neutral extending from the signal base to the terminal strip in the signal heads is 12 inches (300 mm) longer (on the base side) than the colored 14 AWG conductors.
- (18) Connect the white 14 AWG wires to a 10 AWG current carrying neutral. Make the connection with a wire-nut. Extend the 10 AWG wire from the current carrying neutral grounding strip in the ramp meter processor assembly cabinet, being installed from base to base to the far end of each signal conduit run.
- (19) Furnish the 10 AWG USE XLP current carrying grounded conductor in white colored insulation.
- (20) Furnish the 10 AWG USE XLP equipment-grounding wire in green colored insulation.
- (21) Make the equipment-grounding connection in the signal pedestal base or pole transformer base by way of a pigtail and wire nut to a 10 AWG copper grounding conductor. Extend the 10 AWG wire from the equipment-grounding strip in the ramp meter processor assembly cabinet, being installed from base to base to the far end of each signal conduit run. Strip bare the length of 10 AWG equipment ground conductor exposed from the raceway in each base.
- (22) For the pigtail, use a 12-inch (300 mm) bare copper wire; equip one end with a spade or eyelet, and place it under the head of a bolt tapped into the base. Attach poles with a grounding electrode at their base and attached to the pole-grounding terminal to this equipment-grounding wire.
- (23) Furnish all equipment and appliances necessary to test the complete installation of the ramp meter control signal assembly, including all electrical conductors.
- (24) Test and demonstrate to the engineer's satisfaction that the circuits are properly connected, continuous, and free from short circuits and unspecified grounds; that they are connected according to the manufacturer's wiring layout; and that each circuit is operational. The work is not complete until all electrical work is completed and all electrical systems are in proper working order.

676.3.2 Installation

- (1) Use traffic signal cable between signal assemblies and the processor assemblies conforming to section 655.
- (2) Furnish all equipment and appliances necessary to test the complete installation of the signal assemblies, including all electrical conductors.
- (3) Provide type II reflective signs, as specified in section 637.

676.4 Measurement

- (1) The department will measure the Signal Assembly bid items as each individual assembly acceptably completed.

676.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
676.0100	Signal Assembly Ramp Control Sidemount	EACH
676.0105	Signal Assembly Ramp Control Overhead	EACH
676.0200	Signal Assembly Display Enforcement	EACH
676.0300 - 0399	Signal Assembly Advance Flasher (type)	EACH

- (2) Payment for the Signal Assembly bid items is full compensation for providing traffic signal standards, pedestal bases, signal heads, signal mounting brackets, and sign mounting brackets; for providing all electrical connections and grounding; and for all testing.
- (3) The department will pay separately for cable under the appropriate Cable Traffic Signal and Electrical Wire Traffic Signals bid items as specified in 655.5.
- (4) The department will pay separately for signs and mounting those signs under the Signs Reflective Type II bid item as specified in 637.5.
- (5) Department will not pay for the first 2 trips required to revisit and readjust signal heads as required under 676.3.1. The department will pay for subsequent trips, if required, as extra work.