

SECTION 671 INTELLIGENT TRANSPORTATION SYSTEMS - CONDUIT

671.1 Description

- (1) This section describes furnishing and installing conduit for ITS work and furnishing and installing permanent flexible above ground markers along a path of any fiber optic cabling and new or existing manholes.

671.2 Materials

671.2.1 Conduit

- (1) Furnish high-density polyethylene (HDPE) smooth, solid-wall conduit rated for outdoor and underground use. Ensure that the HDPE is burn resistant and conforms to Belcore GR-356-CORE and conditional requirement CR5-14. Use the size the plans show with a size-to-diameter ratio (SDR) of 11 and conforming to the following:

NOMINAL INSIDE DIAMETER	NOMINAL OUTSIDE DIAMETER
1.25 inches	1.660 inches
2 inches	2.375 inches
3 inches	3.50 inches

- (2) The construction and testing of the conduit shall comply with all applicable EIA/TIA, ANSI, and ASTM standards.
- (3) Furnish each 4-duct package individually distinct in color: blue, orange, brown, and green.
- (4) Furnish bends, adapters, couplings, fittings, and other materials used to install conduits. Meet all of the duct manufacturer's installation recommendations. Furnish anodized aluminum reverse threaded couplers sized as appropriate.

671.2.2 Woven Pull Tape

- (1) Furnish and install woven pull tape for all ducts in the run. The woven pull tape shall have documentation as duct cutting resistant, tensile strength of greater than 1100 pounds, nominal width of 1/2 inch, and maximum allowable elongation under pulling tension of 10 percent.

671.2.3 Fiber Optic Cable Marker

- (1) Furnish fiber optic cable markers made of composite reinforced thermoplastic, white and orange in color, a minimum of 62 inches long, 3 inches wide, and stamped with CAUTION FIBER OPTIC CABLE on the front and back of the marker.

671.3 Construction

671.3.1 Installing Conduit

- (1) Install conduit by plowing or trenching.
- (2) Do not exceed the minimum bending radius of the cable installed in the conduit. Do not pull cable over edges or corners, over or around obstructions, or through unnecessary curves or bends.
- (3) Use directional bore installations if the contract specifies.
- (4) Repairs are not allowed. Remove broken, chipped, cracked, or impaired lengths of fittings or conduit and replace with new materials. Do not install conduit above ground or on structures.
- (5) Provide information to the engineer as specified in [107.22](#). Expose the main to provide visual inspection by the utility owner for gas mains of 100 psi or greater, or 12 inches in diameter or greater.

671.3.2 Woven Pull Tape

- (1) Provide woven pull tape at each raceway point in acceptable to the engineer. If cables are blown directly through the ducts, woven pull tape for those sections of individual ducts is not required. All spare conduits shall have woven pull tape installed in the duct.

671.3.3 Fiber Optic Cable Marker

- (1) Provide installation at locations the plans show. Installation should be adequate so that marker cannot be pulled out or removed manually. The marker should self erect after vehicle impact.
- (2) Install markers so that all lengths of installed fiber optic cables in new conduit have a minimum of one marker. Install a minimum of 2 markers along each fiber optic cable path in new conduit so that one forward and one behind are always visible. Install a marker at each point along the fiber optic cable path where a 45-degree or greater change in direction occurs. Install a marker at each manhole at locations

where the fiber optic cabling is installed into existing conduit networks. Install markers a maximum of 24 inches lateral displacement from the actual placement of the conduit and fiber optic cabling. Install markers no later than 3 days following the installation of conduit to contain fiber optic cables, or of direct buried fiber optic cables. Safeguard the conduit and cables during the installation of the markers. Remove and replace any conduit or cables as the plans show that are damaged during marker installation at no additional cost to contract.

671.4 Measurement

- (1) The department will measure the Conduit HDPE and Conduit HDPE Directional Bore bid items by the linear foot acceptably completed, measured along the centerline of the conduit from centerline of fitting to centerline of fitting or end of conduit, or between ends of conduit, or between ducts.
- (2) The department will measure Fiber Optic Cable Marker as each individual marker acceptably completed.

671.5 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>
671.0100 - 0199	Conduit HDPE (duct) (size)	LF
671.0200 - 0299	Conduit HDPE Directional Bore (duct) (size)	LF
671.0300	Fiber Optic Cable Marker	EACH

- (2) Payment for the Conduit HDPE and Conduit HDPE Directional Bore bid items is full compensation for providing, hauling, and installing all materials including conduit, fittings, couplers, and bends; for pull wires or ropes; for expansion fittings and caps; for excavating, bedding, backfilling, and restoration of ground to original condition including sand, concrete, or other required materials; for disposing of surplus materials; and for making inspections.
- (3) Payment for Fiber Optic Cable Marker is full compensation for providing and installing all materials including restoration of ground to original condition including topsoil, sand, concrete, or other required materials; and for disposing of surplus materials.