

## **SECTION 630 CONDUIT**

### **630-1 Description.**

Install conduit for traffic signals and other electrically powered or operated traffic control devices as shown in the plans and Design Standards, Index No. 17721.

### **630-2 Materials.**

Use materials meeting the requirements of Section A630 of the current Minimum Specifications for Traffic Control Signal Devices (MSTCSD), except as provided in 603-2.2.

### **630-3 Installation Requirements.**

**630-3.1 General:** Consider the locations of conduit as shown on the plans as approximate. Construct conduit runs as straight as possible, and obtain the Engineer's approval of all major deviations in conduit locations from those shown on the plans.

Do not place more than the equivalent of four quarter bends or 360 degree of bends, including the termination bends, between the two points of termination in the conduit, without a pullbox. Obtain the Engineer's approval to use corrugated flexible conduits for short runs 6 feet or less.

Use only intermediate metal conduit, rigid galvanized conduit, rigid aluminum conduit or PVC coated intermediate metal conduit for above-ground or underground electrical power service installations. Meet the requirements of Section 562 for coating all field cut and threaded galvanized pipe.

Use either schedule 80 PVC or fiberglass reinforced epoxy conduit for installations on bridge decks.

Use either schedule 40 PVC or fiberglass reinforced epoxy, conduit for underground and under pavement installations, except for electrical power service.

When the installation of a conduit requires jacking under paved surfaces, railroads, etc., use an intermediate metal conduit as the sleeve for the underground conduit. Install the underground conduit as shown in the Design Standards, Index No. 17721.

When a conduit installation changes from underground to above-ground, make the change a minimum of 6 inches below finished grade.

Install a No. 12 AWG pull wire or polypropylene cord the full length of all conduits that are designated for future use. Ensure that a minimum of 24 inches of pull line approved by the Engineer is accessible at each conduit termination.

Install an expansion fitting when conduit crosses an expansion joint of a structure.

Use couplings and expansion joints made of the same material as the conduit.

Ensure that all joints are made as specified by the manufacturer and are waterproof.

For installations not specifically shown, install the conduit in accordance with NEC and/or National Electrical Safety Code requirements.

When earth backfill and tamping is required, place backfill material as per Section 120 in layers approximately 12 inches thick, and tamp each layer to a density equal to or greater than the adjacent soil.

When trenching, saw cut and repair all pavement and sidewalks encountered.

When backfilling trenches in existing pavement, use a commercially available sand-cement (approximately 10:1 mix ratio).

Provide a standard clearance between underground control cable and electrical service cable or another parallel underground electrical service cable that meets National Electrical Safety Code requirements.

**630-3.1.1 Fiber Optic Cable Conduit:** Prevent the ingress of water, dirt, sand, and other foreign materials into the conduit prior to, during and after construction. Exclude water and debris from buried conduit and from the top riser assembly of aboveground conduit using a foam-sealing material, rubber plug, or other device designed for this application and approved by the Engineer. Use a UV-rated flexible conduit to protect the cable from the top of the conduit riser to the span messenger where the cable is to be lashed.

Ensure that the conduit fill ratio (outer cable diameter to inner conduit/duct diameter) does not exceed 50%.

Install the conduit system so the fiber optic cable maintains a minimum bend radius of 20 times the cable diameter.

Install the conduit as shown in the plans. Provide all fittings and incidental materials necessary to construct a complete installation. Use approved methods for connecting inner duct or conduit within or between plowed portions, trenched portions, and bored portions. Submit the conduit manufacturer's coupling method and material to the Department's Project Manager for approval.

**630-3.1.2 Fiber Optic Cable Locate Wire:** Bury locate wire along the centerline of the top outer surface of installed conduit, as shown in the plans, or as directed by the Engineer. Install locate wire in the trench or bore with all underground conduits to provide end-to-end electrical continuity for electronically locating the underground conduit system. Do not install locate wire in a conduit with fiber optic cable.

Do not run locate wires into field cabinets. Terminate locate wires at the first and last pull boxes in the conduit run or as shown in the plans. Ensure that wire termination occurs only at the top of a pull box.

In a trenching operation, install the locate wire no more than 3 inches above the conduit. Ensure that the locate wire enters all pull boxes and splice boxes, and that a minimum of 10 feet of slack locate wire is coiled and neatly stored in each box.

In a boring operation, install the locate wire in an encasement.

Drill a hole in the pull box or splice box for wire entry as shown in the plans. Fill any gaps between the locate wire and the hole it passes through with nonshrink grout or a similar sealant suitable for the application and approved by the Engineer.

Perform continuity tests and insulation resistance tests on all locate wires. Provide the Engineer with all test results. Replace or repair defective locate wire at no additional cost.

Make locate wire splices in a flush grade-level box. Ensure that locate wire splices are waterproof and suitable for direct burial. Ensure that locate wire splices at the pull box meet NEC requirements. Ensure that locate wire splices include a mechanical crimp connection with a butt sleeve, an oxide-preventing aerosol lacquer, mastic electrical splicing tape, and standard electrical tape using methods and materials approved by the Engineer. At the completion of the installation, provide the Engineer with as-built drawings that document all splice locations.

**630-3.2 Conduit Sizes:** Size the conduit to be used on all installations, unless otherwise shown in the Contract Documents. Use conduit of sufficient size to allow the conductor to be installed without any damage and meeting NEC requirements. Use conduit that is at least 1 inch in diameter, except for the conduit protecting the ground wire on the side of a pole, use conduit that is at least 1/2 inch in diameter.

**630-3.3 Conduit Joints:** Make conduit joints using materials as specified by the manufacturer. As an exception to the threaded coupling for intermediate metal conduit, at locations where it is not possible to screw the threaded coupling properly, the Contractor may use a waterproof slip-joint coupling approved by the Engineer. Secure the joint, and tighten threaded connections.

Prior to insertion into the coupling, clean, prime and coat the ends of PVC conduit with a solvent-type cement as specified by the manufacturer.

**630-3.4 PVC Coating:** Apply the PVC coating to the entire surface of the conduit, except for the threads, to attain a nominal thickness of 40 mils. Ensure that the coating is free of sags and/or drips. Ensure that the bond between the PVC coating and the conduit is greater than the tensile strength of the PVC coating.

Attach the coupling to the conduit prior to the application of the coating for conduit of 1 inch diameter or less.

Use a coupling with sleeve extensions on conduit larger than 1 inch. Ensure that the sleeve extensions on all threaded female openings have a length equal to the diameter of the conduit up to and including size number 53.

**630-3.5 Conduit Terminations:** Fit the terminating ends of all metal conduit and metal conduit sleeves with an appropriate bushing.

For conduit to be encased in concrete, wrap with tape or otherwise protect all terminations to prevent the entrance of concrete.

Connect new underground conduit(s) to existing underground conduit(s) with a pull box.

Install conduit terminating in a concrete strain pole through the cable entry hole and up the center of the pole to a location approximately 6 inches below the handhole.

Seal conduits terminating in a controller base, pole, pull box, junction box, or pedestal base with Appleton Duct Seal, Permagem Duct Seal, GB Duct Seal, or an equivalent moisture resistant sealant approved by the Engineer.

For a controller base, pole or pedestal base, and junction boxes, terminate conduit runs into the center of the base or box at least 2 inches above the surface of the base.

**630-3.6 Existing Underground Facilities:** Coordinate with any potential conflicting underground utilities prior to starting all excavating or jacking operations at the project site.

**630-3.7 Restoration of Trench Areas:** Restore the conduit trench construction area to an acceptable condition. Such work includes replacement of all pavement areas, sidewalks, curbs, structures, or grass areas disturbed by the conduit trench.

**630-3.8 Jacking Conduit:** Use either intermediate metal conduit or rigid galvanized conduit as the sleeve when installation of a conduit requires jacking under paved surfaces, railroads, etc., with either polyvinyl chloride or fiberglass reinforced epoxy conduit installed in the jacked sleeve. Do not disturb any pavement without the approval of the Engineer.

**630-3.9 Above-Ground Installation:** Securely attach above-ground conduit installations to the surface of the supporting structure using conduit straps. As a minimum, use conduit straps located on 5 feet centers. Use galvanized metal conduit straps when installing intermediate metal

conduit, fiberglass reinforced epoxy conduit, rigid galvanized conduit, rigid aluminum conduit or PVC coated intermediate metal conduit above ground.

Use the same PVC coating for the metal straps as the conduit, when using PVC coated intermediate metal conduit.

**630-3.10 Elbows:** Use only preformed or field constructed conduit elbows. The radius of curvature of the inner edge of any bend shall not be less than shown below:

Size	Standard Radius
1/2 inch	4 inches
3/4 inch	4 1/2 inches
1 inch	5 1/2 inches
1 1/4 inches	7 1/4 inches
1 1/2 inches	8 1/4 inches
2 inches	9 1/2 inches
2 1/2 inches	10 1/2 inches
3 inches	13 inches
3 1/2 inches	15 inches
4 inches	16 inches
5 inches	24 inches
6 inches	30 inches

**630-4 Method of Measurement.**

**630-4.1 General:** Measurement for payment will be in accordance with the following work tasks.

**630-4.2 Furnish and Install:** The Contract unit price per foot of conduit, furnished and installed, will include furnishing all hardware and materials as specified in the Contract Documents, and all labor, trenching, backfilling, and restoration materials necessary for a complete and accepted installation.

Payment for conduit placed in the ground or used on bridge decks will be based on the horizontal path of the installed conduit as measured in a straight line between the centers of pull boxes, cabinets, poles, etc. No allowance will be made for sweeps or vertical distances above or below the ground or the bridge deck.

Due to conditions which may exist on the project site, the Contractor may furnish conduit in variable lengths.

Furnishing and installing the locate wire is included in the cost of the conduit.

Conduit used for fiber optic cable includes the cost of furnishing and installing the locate wire and the cost of conducting the continuity test and the insulation resistance test.

**630-4.3 Furnish:** The Contract unit price per foot of Conduit, furnished, will include the cost of materials, and hardware as specified in the Contract Documents, plus all shipping and handling cost involved in delivery as specified in the Contract Documents.

The Contractor shall furnish conduit in 20 foot sections with one coupling per section.

**630-4.4 Install:** The Contract unit price per foot of conduit, installed, will include all miscellaneous hardware and materials, labor, trenching, backfilling, and restoration materials necessary for a complete and accepted installation.

The Engineer will supply conduit in sections with one coupling per section and elbows as required.

Payment for conduit placed in the ground or used on bridge decks will be based on the horizontal path of the installed conduit as measured in a straight line between the centers of pull boxes, cabinets, poles, etc. No allowance will be made for sweeps or vertical distances above or below the ground or the bridge deck.

Installing the locate wire is included in the cost of the conduit. Conduit used for fiber optic cable includes the cost of installing the locate wire and the cost of conducting the continuity test and the insulation resistance test.

**630-5 Basis of Payment.**

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 630- 1-      Conduit - per foot.