I. GENERAL REQUIREMENTS FOR ALL ELECTRICAL WORK

Faulty fabrication or poor workmanship in any material, equipment, or installation will be considered justification for rejection. Materials and installation shall comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Where manufacturers provide warranties or guarantees as a customary trade practice, Contractor shall furnish to the State such warranties or guarantees. The location of conductors, conduit, junction boxes, duct cable, ground boxes, and electrical services are diagrammatic only and may be shifted by the Engineer to accommodate local conditions.

Grounding shall be as shown on the plans and in accordance with the NEC. Metallic conduit, lighting poles, and luminaires on bridge structures shall be grounded by connection to the grounding conductor and by installing a ground rod in each ground box or junction box, as shown on the plans, at bridge ends and in each ground box installed for underpass lighting. The grounding jumper shall be bare or, if insulated, shall be green. Ground rods, connectors, and bonding jumpers will not be paid for separately, but will be subsidiary to the various bid items.

II. CONDUIT

A. MATERIALS.

1. Conduit must be UL-approved for the intended use shown on plan sheets. Aluminum conduit will not be permitted unless shown elsewhere on the plans. EMT and IMC will not be permitted unless shown on the plans.
2. Fittings for steel conduit shall be steel or malleable iron, threaded or compression type threadless and rain-tight. Die cast, set screw, indenter or push-on (socks) fittings will not be permitted.
3. Expansion joints for metallic conduit shall be provided with a grounding strap. Expansion joints for metallic conduit shall be Appleton UNYL 50 Series, OZ AX Series, or equal.
4. Junction boxes in rigid metal conduit systems shall be cast iron, hot-dipped galvanized, or cast aluminum (surface-mounted only) unless otherwise shown on the plans.
5. Surface-mounted junction boxes for Rigid Metal conduit 1¼ inches and larger shall have a minimum wall thickness of ¼ inch. Crouse Type WAB, O-Z Type YS, Adalet Type 3R, or approved equal, with mounting lugs, minimum size 6 inches x 6 inches x 4 inches, or as otherwise required by the NEC, or as shown elsewhere on the plans. For conduit one inch or smaller, surface-mounted boxes may be 4½ inches (min.), round, square, or rectangular, and approximately 3 inches deep, Crouse Hinds Type GRFX, Appleton Type JBOX, two-gang FD, or approved equal, unless otherwise required by the NEC or the plans.
6. For rigid meatal conduit systems Flush-mounted junction boxes installed in concrete structures shall be minimum 6 inches x 6 inches x 4 inches, or as required by the NEC, Crouse Hinds Type WGB, O-Z Type YR, or approved equal.
7. Unless otherwise shown elsewhere on the plans, junction boxes in EMT conduit systems shall be made from galvanized sheeting and shall be UL listed as approved for outdoor use. Sheet metal junction boxes shall be sized in accordance with the NEC.
8. Unless otherwise shown elsewhere on the plans, junction boxes in PVC conduit systems shall be PVC, UL listed for outdoor use, and sized in accordance with the NEC.

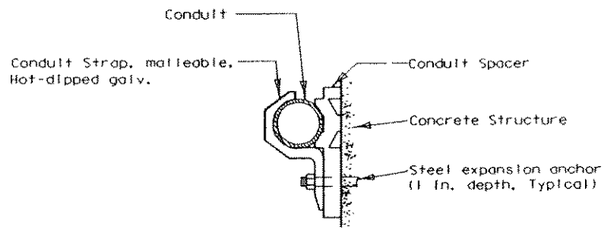
B. CONSTRUCTION METHODS.

1. Continuous runs of conduit in excess of 150 feet attached to structures shall have expansion joints at mid-span or 150 foot intervals. Conduit in structures shall have expansion joints at structure expansion joints or as shown in plans.
2. Conduit hangers or straps shall be spaced at maximum intervals of 5 feet. When shown on the plans, hangers shall be used when hanging conduit from horizontal surfaces (See detail). Conduit spacers shall be used with metal conduit placed on surfaces of concrete structures (See conduit detail).
3. Conduit hangers or straps shall not be attached directly to prestressed concrete beams except as shown in the plans and approved by the Engineer.
4. Conduit placement beneath existing roadways, driveways or sidewalks shall be accomplished by jacking or boring, unless otherwise noted on the plans or directed by the Engineer. The Contractor shall backfill and compact the bore pits to bottom of conduit prior to installing connecting conduit or duct cable, to prevent bending of this connection. Duct cable shall be extended through conduit casings in one continuous length.
5. With approval of the Engineer, conduit placed under new roadways may be trenched in subgrade and backfilled with excavated material. When approved by the Engineer, conduit may be trenched in sub-base but must be backfilled with cement-stabilized base. Conduit placed after base or surfacing operation has begun must be jacked or bored.
6. Open ends of all conduit and raceways shall be fitted with temporary caps or plugs to prevent entry of dirt, debris and rodents during construction.
7. Conduit entry into the top of junction boxes shall be made weathertight using threaded fittings into hubs, or with sealing locknuts inside and out.
8. A bonding jumper shall be installed from grounding bushing to nearest rod, grounding lug, or grounding conductor. At electrical services, bonding jumper shall be AWG Size No. 6. All other jumpers shall be minimum size AWG No. 8. Conduit used as casing under roadways for duct cable need not be grounded if duct extends full length through the casing.
9. Conduit ends shall be sealed with heat shrink boots or tubes with sealant, silicone caulking or shall be sealed by other methods approved by the Engineer. Sealing shall be done after completion of any required pull tests.
10. Where called for on the plans, trenched conduit shall be placed on a 2 inch sand cushion and backfilled with a minimum of 6 inches of additional sand fill.
11. Conduits entering ground boxes shall be placed so that the conduit ends shall be not less than 5 inches nor more than 9 inches from the box cover (See ground box detail).
12. Metal junction boxes shall be bonded to the grounding conductor.

III. ELECTRICAL CONDUCTORS

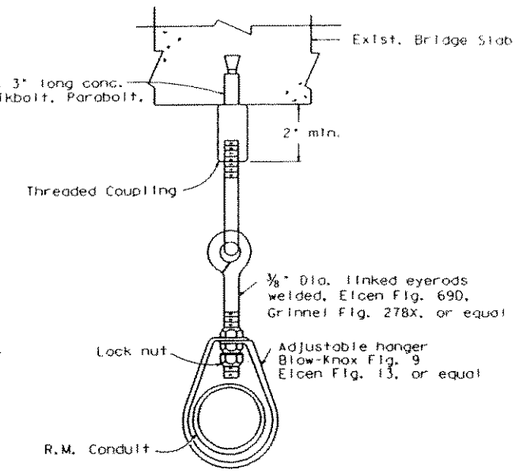
A. MATERIALS.

1. Insulated conductors NEC Type XHHW or USE (XLP). Conductors in circuits containing two or more insulated conductors shall be color-coded at each accessible point (i.e., ground boxes, pole bases, junction boxes). Color-coding for No. 10 and smaller shall be by continuous jacket color. Color-coding of electrical conductors No. 8 or larger may be by continuous jacket color or colored tape. Colored tape marker shall consist of a half-lap of tape covering a 6 inch length of conductor.
2. Bonding conductor No. 8 or smaller, tied to ground rods, shall be solid. Connection of bonding conductor to ground rod shall be made using UL listed connectors designed for such purpose.



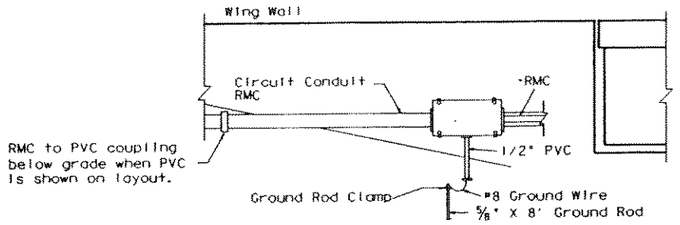
CONDUIT STRAP DETAIL

(Attachment to concrete surfaces)
(See para. II.B.2)



CONDUIT HANGER DETAIL

(Attachment to horizontal surfaces)
(See II.B.2)



NOTES

1. Conduit shall be 2" RMC for duct cable entry to junction box.
2. Ground rod clamp to be Blackburn GG 5/8H, Weaver W5/8 or equal.
3. Surface mounting shown, for conduit to be placed in structure use flush-mounted box.
4. Bond junction box to grounding conductor.

TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

STANDARD PLANS
TEXAS DEPARTMENT OF TRANSPORTATION
Traffic Operations Division

ELECTRICAL DETAILS- CONDUIT, CONDUCTORS

ED(1)-93

ORIG. STAND. DATE:	DN: KB	CK: TB	DW: RS	CK: TB	HEC NO.:
January 1992					

REVISIONS	STATE DISTRICT	FEDERAL REGION	FEDERAL AID PROJECT	SHEET
5-93 10-93	18	6	STP 96(830)MM	89
	COUNTY		CONTROL SECTION JOB	HIGHWAY
	ROCKWALL		1014 03 041	FM 740
				71A