

# CITY OF NEW BRAUNFELS, TEXAS TRAFFIC SIGNAL INSTALLATION

FOR THE INTERSECTION OF:  
**SH 46 AT PIEPER RD**  
OCTOBER 2022

MAYOR

RUSTY BROCKMAN

CITY MANAGER

ROBERTO CAMARENO

MAYOR PRO-TEM

HARRY BOWERS, DISTRICT 3

TRANSPORTATION & CAPITAL

IMPROVEMENTS DIRECTOR

GARY FORD, JR., P.E., PTOE

CITY COUNCIL

ANDRES CAMPOS, DISTRICT 1

CHRISTOPHER WILLIS, DISTRICT 2

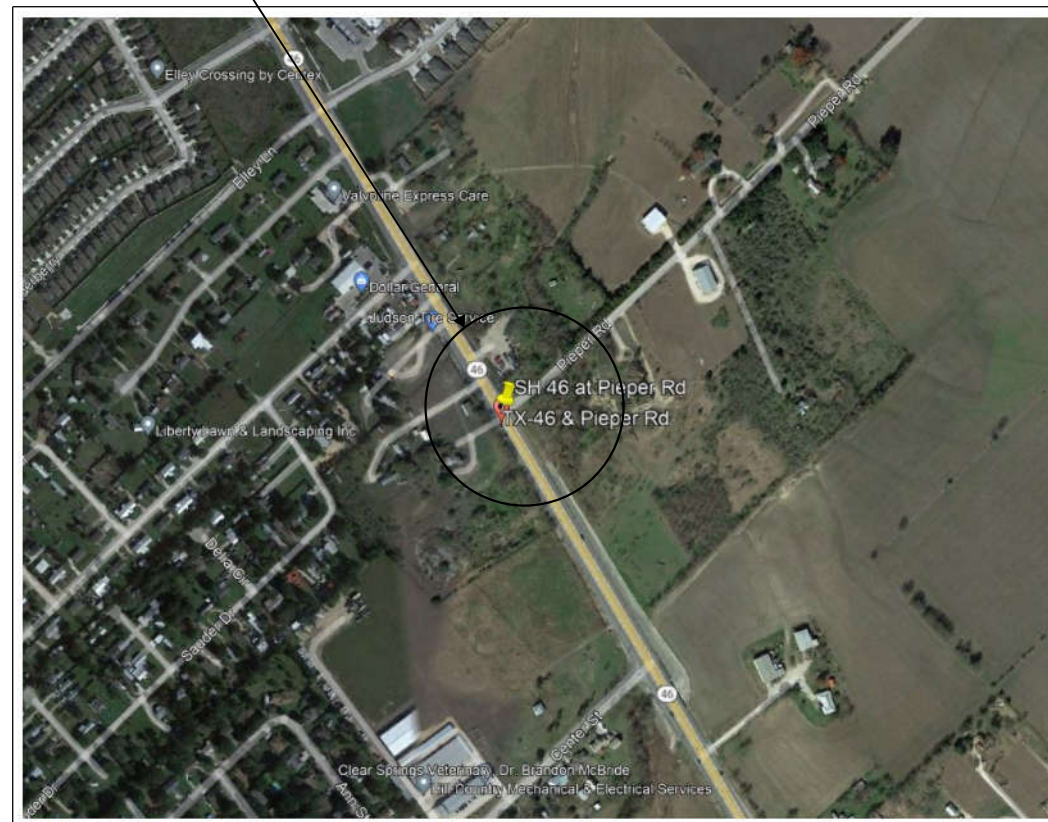
LAWRENCE SPRADLEY, DISTRICT 4

JASON HURTA, DISTRICT 5

JAMES BLAKEY, DISTRICT 6

LOCATION OF INSTALLATION  
OF TRAFFIC SIGNAL

PROJECT MAP

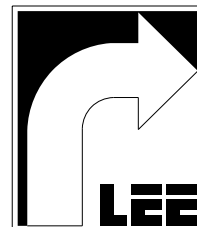


SEE SHEET TS-1 FOR INDEX OF SHEETS

All construction within the City of New Braunfels Right-of-Way will require compliance to TxDOT Standard Specifications, Standard Plans, and Texas Manual on Uniform Traffic Control Devices.

Specifications adopted by the Texas Department of Transportation, November 1, 2014, and Specification Items listed as follows shall govern on this project for all work within the State right-of-way.

Prepared By:

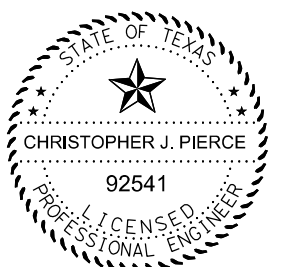


9901 IH 10W  
SUITE 680  
SAN ANTONIO, TEXAS 78230  
210-625-7418  
TBPE FIRM REGISTRATION NO. F-450

**LEE ENGINEERING**

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:11:  
21



INDEX OF SHEETS

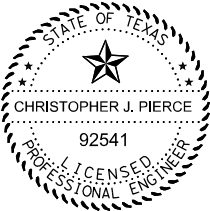
<u>SHEET NO.</u>	<u>DESCRIPTION</u>
	TITLE SHEET
TS-1	INDEX OF SHEETS
TS-2	QUANTITY SUMMARY
TS-3 THRU TS-5	TRAFFIC SIGNAL GENERAL NOTES
TS-6	EXISTING CONDITIONS & REMOVAL LAYOUT
TS-7	TRAFFIC SIGNAL LAYOUT
TS-8 THRU TS-12	TRAFFIC SIGNAL TABLES (5 SHEETS)
TS-13 THRU TS-14	SIGNAL POLE ELEVATIONS (2 SHEETS)
TS-15	PAVEMENT MARKING LAYOUT
TS-16	TS-FD-12
TS-17	SMA-80 (1)-12
TS-18	SMA-80 (2)-12
TS-19	MA-C-12
TS-20	MA-D-12
TS-21	MA-DPD-20
TS-22	LUM-A-12
TS-23	CFA-12
TS-24	RID(1)-20
TS-25	ED (1)-14
TS-26 THRU TS-29	ED (3)-14 THRU ED(6)-14
TS-30 THRU TS-31	ED (8)-14 THRU ED(9)-14
TS-32	TS-BP-20
TS-33	MTS-18 (SAT)
TS-34	RPDD-RADD-20 (SAT)
TS-35	TS-CF-21
TS-36	PM (1)-20
TS-37	PM (3)-20
TS-38	SUMMARY OF SMALL SIGNS
TS-39	WZ (BTS-1)-13
TS-40	WZ (BTS-2)-13
TS-41	WZ (RS)-22

STANDARD SHEETS SPECIFICALLY IDENTIFIED AS SHEETS TS-16 - TS-41 HAVE BEEN  
SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS  
PROJECT.

CHRISTOPHER J. PIERCE, P.E., PTOE



Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:  
12:09



CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

INDEX OF SHEETS

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-1

SH 46 at Pieper Rd Signal Installation Estimate of Quantities				
TxDOT Spec No.	Desc. Code	Description	Unit	Total Quantity
416	6031	DRILL SHAFT (TRF SIG POLE) (30 IN)	LF	11
416	6032	DRILL SHAFT (TRF SIG POLE) (36 IN)	LF	39
500	6001	MOBILIZATION	LS	1
502	6001	BARRICADES, SIGNS, AND TRAFFIC HANDLING	MO	3
618	6023	CONDUIT (PVC) (SCHD 40) (2")	LF	45
618	6029	CONDUIT (PVC) (SCHD 40) (3")	LF	130
618	6033	CONDUIT (PVC) (SCHD 40) (4")	LF	80
618	6034	CONDUIT (PVC) (SCHD 40) (4") (BORE)	LF	255
620	6008	ELEC CONDUCTOR (NO. 8) INSULATED	LF	440
620	6009	ELEC CONDUCTOR (NO. 6) BARE	LF	510
620	6010	ELEC CONDUCTOR (NO. 6) INSULATED	LF	90
624	6010	GROUND BOX TY D (162922) W/APRON	EA	5
628	6187	ELEC SRV TY D 120/240 070 (NS)SS(E)PS(U)	EA	1
666	6036	REFL PAV MRK TY I (W) 8" (SLD) (100 MIL)	LF	100
666	6048	REFL PAV MRK TY I (W) 24" (SLD) (100 MIL)	LF	96
666	6054	REFL PAV MRK TY I (W) (ARROW) (100 MIL)	EA	3
666	6078	REFL PAV MRK TY I (W) (WORD) (100 MIL)	EA	3
672	6007	REFL PAV MRKR TY I-C	EA	5
677	6001	ELIM EXT PAV MRK & MRKS (4")	LF	240
677	6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA	2
677	6012	ELIM EXT PAV MRK & MRKS (WORD)	EA	2
678	6004	PAV SURF PREP FOR MRK (8")	LF	100
678	6008	PAV SURF PREP FOR MRK (24")	LF	96
678	6009	PAV SURF PREP FOR MRK (ARROW)	EA	3
678	6016	PAV SURF PREP FOR MRK (WORD)	EA	3

SH 46 at Pieper Rd Signal Installation Estimate of Quantities, Cont.				
TxDOT Spec No.	Desc. Code	Description	Unit	Total Quantity
680	6002	INSTALL HWY TRAF SIG (ISOLATED)	EA	1
682	6001	VEH SIG SEC (12") LED (GRN)	EA	8
682	6002	VEH SIG SEC (12") LED (GRN ARW)	EA	2
682	6003	VEH SIG SEC (12") LED (YEL)	EA	8
682	6004	VEH SIG SEC (12") LED (YEL ARW)	EA	4
682	6005	VEH SIG SEC (12") LED (RED)	EA	8
682	6006	VEH SIG SEC (12") LED (RED ARW)	EA	2
682	6018	PED SIG SEC (LED) (COUNTDOWN)	EA	2
682	6051	BACKPLATE W/REF BRDR(3 SEC) (VENT)ALUM	EA	8
682	6052	BACKPLATE W/REF BRDR(4 SEC) (VENT)ALUM	EA	2
684	6031	TRF SIG CBL (TY A) (14 AWG) (5 CONDR)	LF	370
684	6033	TRF SIG CBL (TY A) (14 AWG) (7 CONDR)	LF	128
684	6036	TRF SIG CBL (TY A) (14 AWG) (10 CONDR)	LF	225
684	6046	TRF SIG CBL (TY A) (14 AWG) (20 CONDR)	LF	605
684	6079	TRF SIG CBL (TY C) (12 AWG) (2 CONDR)	LF	235
686	6029	INS TRF SIG PL AM (S) 1 ARM (28')	EA	1
686	6041	INS TRF SIG PL AM (S) 1 ARM (40')	EA	2
686	6051	INS TRF SIG PL AM (S) 1 ARM (48')LUM	EA	1
687	6001	PEDESTAL POLE ASSEMBLY	EA	2
688	6001	PED DETECT PUSH BUTTON (APS) - POLARA	EA	2
688	6003	PED DETECTOR CONTROLLER UNIT - POLARA	EA	1
6058	6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA	1
6292	6001	RVDS (PRESENCE DETECTION ONLY)	EA	2
6292	6003	RVDS (PRESENCE AND ADVANCE DET)	EA	2



Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:  
12:51

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

TRAFFIC SIGNAL  
QUANTITY SUMMARY

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-2

The CONTRACTOR shall notify the City of New Braunfels Public Works Department, at (830) 221-4030 and Will Lockett, P.E. with TxDOT at (830)609-0707 least one week prior to starting work on this project.

The CONTRACTOR will only be allowed to work on this project during daylight hours (8 AM to 5 PM Monday - Friday).

The CONTRACTOR shall clean up and remove from work area all loose material resulting from the contract operations each day before work is suspended.

Any obstructions to existing drainage due to the CONTRACTOR's operations will be removed by the CONTRACTOR as required by the City at the CONTRACTOR's entire expense.

THE TRAFFIC SIGNAL INSTALLATION CONSISTS OF THE FOLLOWING PRINCIPAL ITEMS:

1. Furnishing and installing a ground mounted controller cabinet assembly with an APC Battery Back-Up unit.
2. Furnishing and installing signal poles, pedestal poles, signal heads, and signal cable.
3. Furnishing and installing an Accessible Pedestrian Signal (APS) system, conduit and ground boxes.
4. Furnishing and installing radar detection system (Presence and Advance) including cable.
5. The CONTRACTOR shall also furnish and install all other items not listed above which are needed to provide the complete traffic signal installation as called for in the plans and specifications.
6. Unless directed by the City of New Braunfels, the signal shall be placed in full operation between 9:00 A.M. - 12:00 P.M. (noon) on Monday, Tuesday, or Wednesday only.

SIGNAL TECHNICIAN

A signal technician from the City of New Braunfels and TxDOT shall be present when the signals are placed in operation. The Contractor shall notify the City of New Braunfels Public Works Department at (830) 221-4030 and Will Lockett, P.E. with TxDOT at (830) 609-0707 at least 48 hours in advance of the turn on.

TEST PERIOD FOR SIGNALS

Once the permanent signals have been installed and placed in operation, they shall operate continuously for a minimum of 30 calendar days in a satisfactory manner. Equipment failures during these 30 days will cause the test period to start over.

The signal will be inspected by City of New Braunfels Traffic Signal Department and TxDOT and all punch list items will be addressed prior to acceptance of the signal by the City. Point of contact for inspection is Chris Nowak (830) 221-4049 and Will Lockett, P.E. (830) 609-0707.

PHASES OF SIGNAL OPERATION

The signal installation shall be wired to operate in accordadnce with phase diagrams in these plans. Time intervals shall be adjusted and set as directed by the City of New Braunfels.

EXISTING UTILITIES

The exact location of the underground utilities is not certain. The CONTRACTOR shall contact the City of New Braunfels and utility companies with utilities in the area for exact location prior to drilling for foundations and any other work that might interfere with or damage present utilities. Known utilities include city water and sewer lines, and AT&T/SBC telephone lines. Location of some of these utilities can be determined by calling 1-800-DIG-TESS (344-8377). No additional payment will be made for relocation of any foundations due to utilities.

Texas State Law, Article 1436C, makes unlawful the operation of equipment or machines within 10 feet of any overhead electrical line unless danger against contact with high voltage lines has been effectively guarded against pursuant to the provisions of the article. When construction operations requires working near an overhead electrical line, the CONTRACTOR shall contact the owner/operator of the overhead electrical line to make adequate arrangements and to take necessary safety precautions to ensure that all laws, electrical line owner/operator requirements and standard industry safety practices are met.

ITEM 416 - POLE FOUNDATIONS

No pedestal poles shall be placed on the foundations prior to seven (7) days following placement of concrete.

The dimensions shown on the plans for location of signal foundations, conduit, and other items may be varied to meet local conditions, subject to approval by the City.

The CONTRACTOR shall notify Garry Ford, P.E. of the City of New Braunfels at (830) 221-4645 and Will Lockett, P.E. at (860) 609-0707 at least 48 hours before placing concrete. Cylinders will be made for testing by a third party.

ITEM 416 - POLE FOUNDATIONS, CONT.

All exposed pedestal pole foundations shall receive a Class C finish as per TxDOT item 427.

Pedestal pole foundations will be paid for once regardless of extra work caused by obstructions.

Concrete removal required for installation of drilled shafts will be subsidiary to TxDOT Item 416.

ITEM 618 - CONDUIT

Use materials from prequalified material producers list as shown on the Texas Department of Transportation (TxDOT) - Construction Division's (CST) materials producers list. Category is "Roadway Illumination and Electrical Supplies."

Underground conduit for cable shall be PVC. All couplings and connections shall be tight and waterproof.

The location of conduits and ground boxes are diagrammatic only and may be shifted to accommodate field conditions as directed.

Secure permission and approval from the proper authority prior to cutting into or removing any sidewalks or curbs for installation of this item. Sidewalks and curbs shall be restored to their preconstruction condition at no expense to the City.

A continuous bare copper wire no. 6 or larger shall be installed in every PVC conduit throughout the electrical system in accordance with the electrical detail sheets, and the latest edition of the National Electrical Code.

PVC trenched conduit shall be heavywall schedule and PVC bored conduit shall be heavywall schedule 40, unless otherwise approved by the Engineer.

All conduit elbows and rigid metal extensions required to be installed on PVC conduit systems will not be paid for separately, but will be considered subsidiary to TxDOT Specification 618.

Conduit to be placed under existing pavement shall be by an approved boring method and placed at a minimum depth of 3 feet below the pavement surface. Do not place boring pits closer than 2 feet from the edge of pavement unless directed. Do not use water jetting. Do not exceed 18 inches in the vertical and horizontal tolerances as measured from the intended target point.

Do not use a pneumatically driven device for punching holes beneath the pavement (commonly known as a "missile").

Furnish and install a non-metallic mule tape in conduit runs in excess of 50 feet. Also furnish and install non-metallic mule tape in conduit installed for future use and cap using standard weather-tight conduit caps as approved. Furnish Garvin #PT-1250-3K, ComStar PUL 1250P3K, Ideal Part No. 31-315 or equal as approved by the Engineer. This work will not be paid for directly, but is subsidiary to this item.

Use a colored cleaner-primer on all PVC to PVC joints before application of PVC cement.

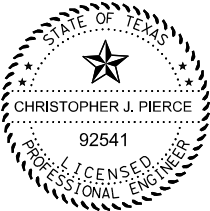
Seal all conduit ends with a permanently soft, non-toxic duct seal. Use a duct seal that does not adversely affect other plastic materials or corrode metals.

2" Schedule 80 PVC will be used at the power pole to supply electricity to underground services.



CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:  
13:35



SH 46 AT PIEPER RD

TRAFFIC SIGNAL  
GENERAL NOTES (1 OF 3)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-3



ITEM 620 - ELECTRICAL CONDUCTORS

The equipment grounding conductor shall be identified by a continuous green colored jacket insulation or bare wire. Grounded conductors (Neutral) shall be identified by a continuous white colored jacket. Ungrounded conductors (Hot) in a 120/240v or 240/480v system shall be identified by each pole or leg. For 240-volt branch circuit fed from 120/240 source and 480-volt branch circuit fed from 240/480 source, ensure one leg is identified by a continuous black colored jacket and the other leg by a continuous red colored jacket.

Grounding conductors that share the same conduit, ground box, or structure shall be bonded together at every accessible point in accordance with the NEC.

ITEM 624 - GROUND BOXES

Slack conductors required by Standard Sheet ED(3)-14 will be subsidiary to Item 624.

Concrete removal required for installation of ground boxes will be subsidiary to Item 624.

ITEM 628 - ELECTRICAL SERVICE

Contact the appropriate utility company during the first three weeks of the project lead-time period to allow adequate time for any necessary utility adjustments, transformer installation, etc.

Label the service enclosures indicating service address as well as all required information as shown on the Electrical Detail (ED) standard sheets. Labeling shall be silk screening or other acceptable method. This work will not be paid for directly, but is subsidiary to this item.

A Licensed Master Electrician shall be required for the installation of electrical services.

When concrete for service foundations is required, use Class A in accordance with Item 421, "Hydraulic Cement Concrete", except consider the concrete subsidiary to Item 628 for payment purposes. When reinforcing steel for service foundations is required, it will be in accordance with Item 440, "Reinforcing Steel", except consider the steel subsidiary to Item 628 for payment purposes.

Use only white insulated wire for neutral wire.

Once the signal installation has been formally accepted by the City, the billing for the electrical service power usage will be transferred to the City of New Braunfels.

ITEM 656 - FOUNDATIONS FOR TRAFFIC CONTROL DEVICES

Form a 3/4 inch chamfer on the top edge of each signal pole and pedestal pole foundation.

Probe for utilities and underground structures prior to drilling for foundations at the direction of the City. Foundations shall be paid for once regardless of extra work caused by obstructions.

TRAFFIC SIGNAL CONTROLLER AND CABINET ASSEMBLY

CONTRACTOR shall furnish and install a Econolite Cobalt ATC traffic signal controller assembly (TS2 Type 2) with a NEMA TS2 Type 2 controller cabinet assembly or approved equal.

The controller cabinet shall have a 16 position NEMA backpanel wired for 8 phase, 4 pedestrian, and 4 overlaps. The controller cabinet shall include an EDI MMU16-LEip malfunction management unit.

Install the signal controller cabinet in an orientation as directed.

ITEM 682 - SIGNAL HEADS

Unless otherwise shown in the plans, all signal heads shall be mounted vertically.

All signal heads shall be covered with burlap or other approved material from the time of installation until the signal is placed in operation.

LED indications shall be used and furnished and installed by the CONTRACTOR.

Pedestrian push button signs R10-3eR(L) shall be used in coordination with the COUNTDOWN HEADS.

All signal heads shall be EAGLE Black Polycarbonate signal heads. Provide backplates, louvers, and the inside of the visors with a flat black finish. Provide aluminum back plates with a 2" HIP border for all traffic signal heads.

Mount signal heads level and plumb and aim as directed.

ITEM 684 - CABLE

The CONTRACTOR shall furnish and install stranded 14 AWG Type A signal cables for LED signal heads and stranded 12 AWG Type C cables for APS units.

Identify each cable as shown on the plans (cable 1, etc.) with permanent marking labels (Panduit Type PLM standard single marker tie, Thomas & Betts Type 548M, or equal) at each ground box and controller.

Extra cable length (3 feet of slack) shall be included in each run to provide adequate slack, as determined by the City, at each ground box or foundation.

No splices shall be allowed in any cable.

ITEM 686 - POLE ASSEMBLIES

Provide 12 circuit Buchanan Type 112SN, Kulka Type 985-GP-12 CU, or equal terminal strips in the signal pole access compartment. Provide additional terminal strips of 8 circuits each when more than 12 circuits are required. The conductors for the Line and Load side of the terminal strip shall be identified with a plastic label with two straps per tag. The line side shall have each signal head, PED head, and push button identified on the tag.

Mark pole shafts and mast arms with the identification numbers from the plans to facilitate field-assembly.


Provide nuts on top and bottom (double nuts) of the base plate as shown on the plans.

Set anchor bolts for mast arm signal poles so that two are in tension and two are in compression. Obtain approval of anchor bolt placement before placing concrete.

Provide a minimum vertical clearance of 18.5 feet from the roadway to the lowest point of the signal head or mast arm. Place signal heads 40 feet minimum and 180 feet maximum from the stop line. If the nearest signal is more than 180 feet from the stop line, place a supplemental near-side signal head. Determine the field measurements and elevations from the actual field location of the poles, considering all above and below ground utilities and existing roadway elevations.

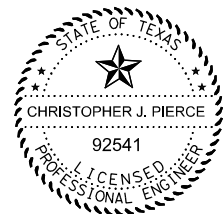
Provide vibration dampers for mast arms 28 feet to 48 feet in length. Install as shown on MA-DPD-20.

Prior to ordering equipment, the Contractor shall submit proposed signal pole and mast arm details to the City for approval.



Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:14:21

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

TRAFFIC SIGNAL  
GENERAL NOTES (2 OF 3)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-4

LUMINAIRE HEAD & MAST ARMS

Luminaire mast arms shall be positioned directly above and in line with the associated mast arm.

ITEM 688 - ACCESSIBLE PEDESTRIAN SIGNAL UNITS

The CONTRCATOR shall furnish and install a POLARA iNav Accessible Pedestrian Signal system at the subject intersection.

If a traffic or signal pole includes two APS units, or if the APS units cannot be installed a minimum of 10’ apart, speech walk messages shall be used. Each speech walk message shall be programmed to clearly state the name of the roadway to be crossed as a result of activating that particular APS unit.

Verify the location of the APS Units and the direction of the arrows on the signs prior to installation.

ITEM 6058 - BATTERY BACK-UP SYSTEM FOR SIGNAL CABINETS

CONTRACTOR shall furnish and install an APC Battery Back-Up Unit at this intersection. The BBU will be installed with the controller on the concrete pad paid for under Item 680. If a larger pad is needed to accommodate the BBU, the additional labor and material will be subsidiary to this item.

ITEM 6292 - RADAR VEHICLE DETECTION SYSTEM FOR SIGNALIZED INTERSECTION CONTROL

CONTRACTOR shall furnish and install Wavetronix Matrix Presence Radar detection and Wavetronix Advance Radar detection.

All additional items such as pole, conduit, cable, etc. required to achieve the detection specified in the plans will not be paid for separately, but will be considered subsidiary to this item.

SIGNING

All new signs shall be furnished and installed by the CONTRACTOR. Payment for the signs shall be subsidiary to Item 680.

CONTRACTOR shall verify information on the signs and the background color of the street name blades with the City prior to fabrication.

CONTRACTOR’S RESPONSIBILITY FOR THE WORK

The CONTRACTOR shall be responsible for all installations until accepted by the City as required by the general provisions and requirements. Should "knock downs" occur, the CONTRACTOR shall be responsible for all labor to reinstall said equipment at no additional cost to the City or TxDOT. If new equipment is required, asdetermined by the City or TxDOT, the CONTRACTOR shall provide replacement equipment at no additional cost to the City or TxDOT.

HANDLING OF TRAFFIC

Roads and streets shall be kept open to traffic at all times. The CONTRACTOR shall, unless otherwise directed by the City or TxDOT, arrange the work in the roadway so as to close only one lane of a roadway at a time. All construction operations shall be conducted to provide the least possible interference to traffic as provided in the specifications and/or as directed by the City or TxDOT.

The CONTRACTOR shall arrange the installation of signals, poles, and conduit so as to permit the continuous movement of the traffic in both directions at all times. A pre-construction conference including City and TxDOT staff shall outline intersection construction phases.

A Traffic Control Plan (TCP) for this project shall be as detailed on Standard Sheets WZ (BTS-1)-13 and WZ (BTS-2)-13. All construction signs shall be mounted on fixed supports (4" x 4" wood posts) unless otherwise directed by the City or TxDOT.

ITEMS SUBSIDIARY TO ITEM 680

INSTALLING TRAFFIC SIGNAL CONTROLLER CABINET ASSEMBLY - 1 EA

TRAFFIC SIGNAL CONTROLLER BASE - 1 EA

CONCRETE FOUNDATION (8’X9’X6", CLASS B) - 1 EA

REGULATORY SIGN PANEL - 3 EA

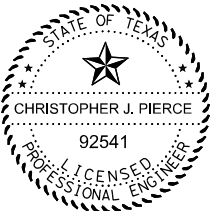
SINGLE STREET NAME SIGN PANEL - 4 EA

REMOVAL OF SIGNS - 1 EA



Digitally signed by Christopher Pierce, PE  
Date: 2022-10-21 08:15:08

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450

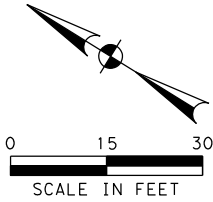


SH 46 AT PIEPER RD

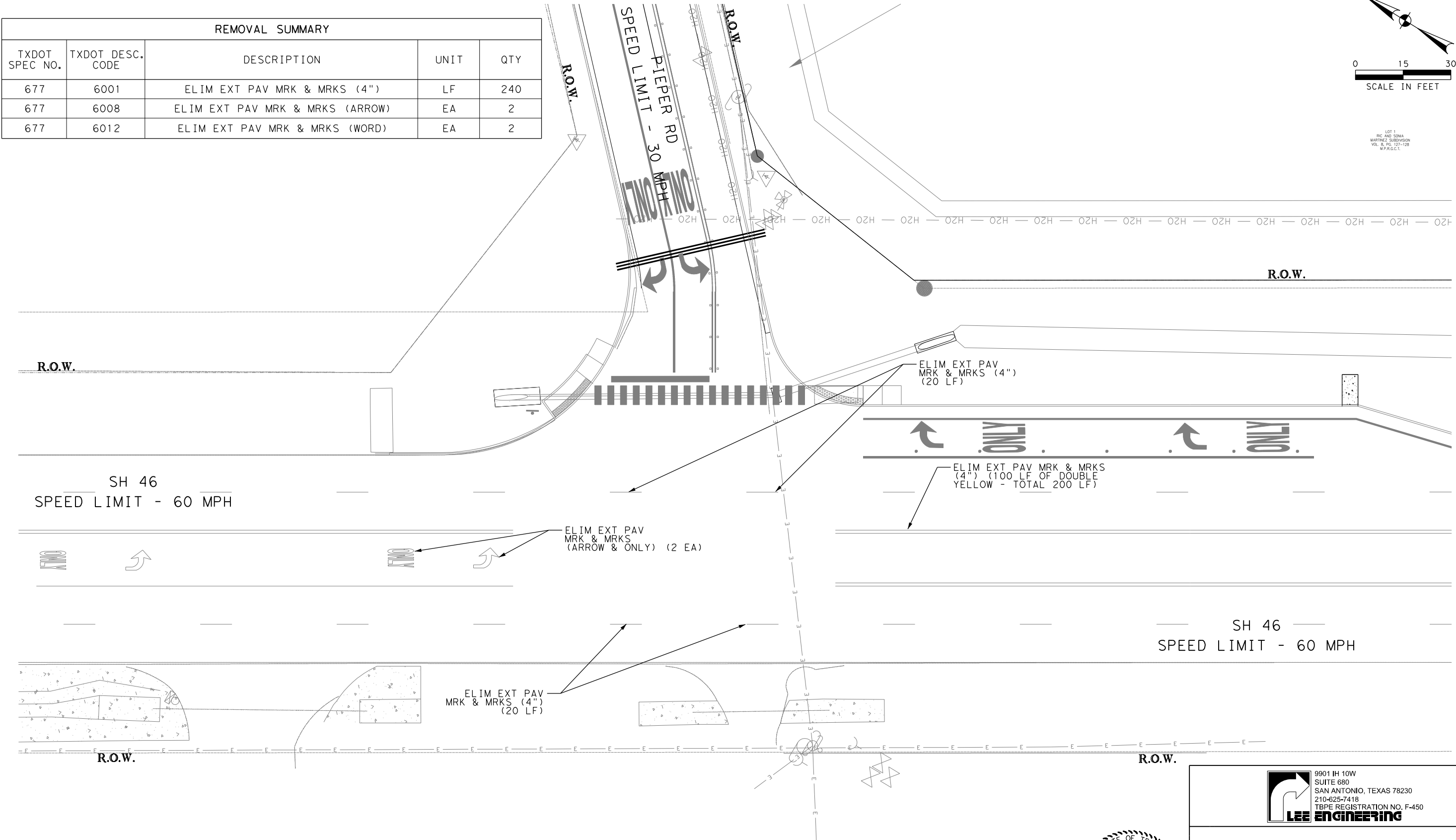
TRAFFIC SIGNAL  
GENERAL NOTES (3 OF 3)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-5

REMOVAL SUMMARY				
TXDOT SPEC NO.	TXDOT DESC. CODE	DESCRIPTION	UNIT	QTY
677	6001	ELIM EXT PAV MRK & MRKS (4")	LF	240
677	6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA	2
677	6012	ELIM EXT PAV MRK & MRKS (WORD)	EA	2

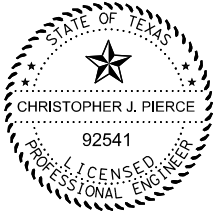


LOT 1  
RIC AND SONIA  
MARTINEZ SUBDIVISION  
VOL. 8, PG. 127-128  
M.P.R.C.C.T.



*Christopher J. Pierce*

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:  
15:50



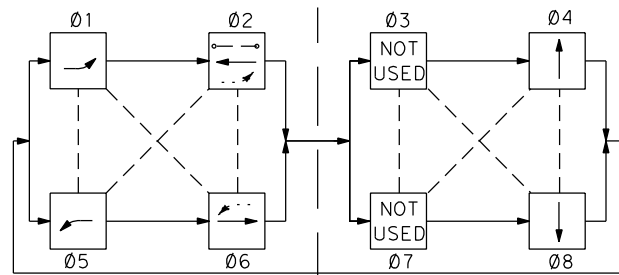
CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

EXISTING CONDITIONS &  
REMOVAL LAYOUT

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-6

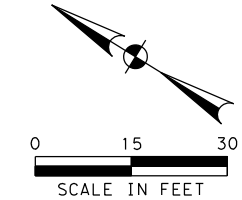


- - - Overlap Phase  
 - - - Vehicular Phase  
 - - - Pedestrian Phase

COMPATIBILITY LINE

Ø1 and Ø5 are protected/permissive left turns.  
 OLA (SBLT FYA) = Ø1 (RA, YA, FYA);  
 OLC (NBLT FYA) = Ø5 (RA, YA, FYA)

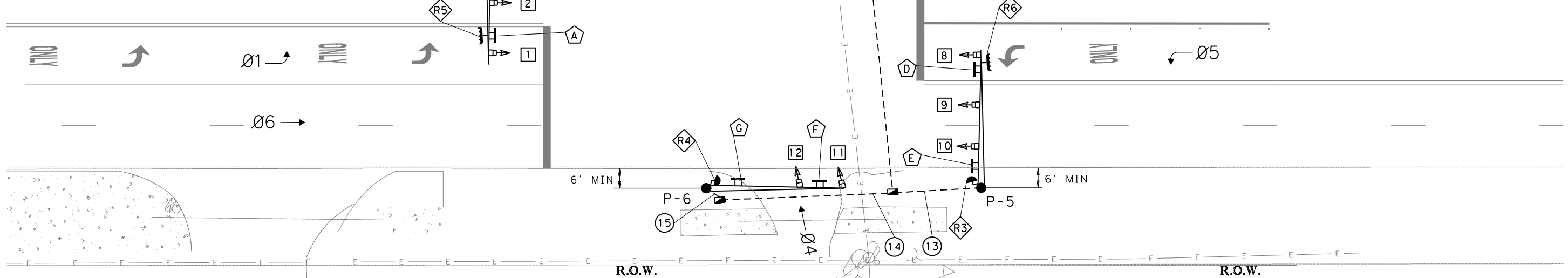
PHASE SEQUENCE



# LEGEND OF SYMBOLS

- TRAFFIC SIGNAL POLE ASSEMBLY
- VEHICLE SIGNAL HEAD
- SIGNAL HEAD NUMBERS
- POLE NUMBERS
- PEDESTAL POLE ASSEMBLY
- GROUND MOUNTED CONTROLLER CABINET ASSEMBLY
- MAST ARM MOUNTED SIGN
- NEW SIGN IDENTIFICATION
- CONDUIT RUN & NUMBER
- LUMINAIRE
- TYPE D GROUND BOX W/APRON
- RADAR PRESENCE DETECTOR
- RADAR ADVANCE DETECTOR
- RADAR IDENTIFICATION
- PEDESTAL ELECTRICAL SERVICE
- R.O.W.
- Ø2
- EXISTING POST MOUNTED SIGN
- EXISTING SIGN IDENTIFICATION

SH 46  
SPEED LIMIT - 60 MPH



NOTES:

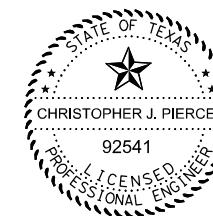
- ALL CITY STANDARD EQUIPMENT/SPECIFIED EQUIPMENT MUST BE SUBMITTED TO THE CITY FOR APPROVAL. CONTRACTOR SHALL CONTACT CHRIS NOWAK AT (830) 221-4049 FOR INSTRUCTIONS.

- PER THE LATEST EDITION OF THE TXDOT ROADWAY DESIGN MANUAL, ALL EQUIPMENT MOUNTED ON THE MAST ARM ASSEMBLY SHALL BE A MINIMUM OF 19' ABOVE THE PAVEMENT.

*Christopher J. Pierce*

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:  
16:36

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

TRAFFIC SIGNAL LAYOUT

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-7



CONDUIT RUNS AND CABLE CHART																													
RUN NO.	CONDUIT STATUS	CONDUIT PERCENT FILL	ITEM 618 CONDUIT SIZE/TYPE (FEET)				CABLE STATUS	ITEM 620 ELECTRICAL CONDUCTORS (FEET)						ITEM 684 TRAFFIC SIGNAL CABLES										ITEM 6292				TOTAL LENGTH OF RUN (FEET)	RUN NO.
			2" PVC - Trenched (SCHD 40)	3" PVC - Trenched (SCHD 40)	4" PVC - Trenched (SCHD 40)	4" PVC - Bored (SCHD 40)		NO. 6 XHHW POWER WIRE		NO. 6 BARE WIRE		NO. 8 XHHW WIRE (LUM.)		TY A 5 CNDR., CABLE (#14 AWG)		TY A 7 CNDR., CABLE (#14 AWG)		TY A 10 CNDR., CABLE (#14 AWG)		TY A 20 CNDR., CABLE (#14 AWG)		TY C 2 CNDR., CABLE (#12 AWG)		RADAR PRESENCE DETECTOR CABLE (RPDD) **		RADAR ADVANCE DETECTION CABLE (RADD) **			
DIAM. (IN.)	2.067	3.068	4.026	4.026	0.271	0.143	0.233	0.426	0.463	0.590	0.779	0.397	0.410	0.410															
---	LF	LF	LF	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF	QTY	LF			
1	I	11%		25			I			1	25	2	50						1	25			1	25	1	25	25	1	
2	I	6%		25			I			1	25							1	25			1	25			25	2		
3	I	10%				95	I			1	95	2	190					1	95	1	95	1	95	1	95	95	3		
4	I	8%		15			I			1	15									1	15			1	15		15	4	
5	I	19%			25		I			1	25							2	50	4	100					25	5		
6	I	9%			25		I			1	25	2	50								2	50	4	100	2	50	25	6	
7	I	6%	30				I	2	60	1	30	2	60													30	7		
8	I	19%			15		I			1	15							2	30	4	60					15	8		
9	I	8%			15		I			1	15										2	30	4	60	2	30	15	9	
10	I	4%	15				I	2	30	1	15															15	10		
11	I	6%		25			I			1	25							1	25			1	25			25	11		
12	I	11%				110	I			1	110									2	220			2	220	1	110	110	12
13	I	10%		30			I			1	30									1	30			1	30	1	30	30	13
14	I	5%				50	I			1	50									1	50			1	50		50	14	
15	I	8%		10			I			1	10									1	10			1	10		10	15	
SUBTOTAL	---	---	45	130	80	255	---	90		510		350		0		0		225		605		225		605		340	SUBTOTAL		
WIRE INSIDE POLE																													
P-1							P					90		88		68							20		68	VARIES	P-1		
P-2							P							10							5					VARIES	P-2		
P-3							P							79									20			VARIES	P-3		
P-4							P							10								5				VARIES	P-4		
P-5							P							76		60							20		60	VARIES	P-5		
P-6							P							107									20			VARIES	P-6		
SUBTOTAL	---	---						0		0		90		370		128		0		0		10		80		128	SUBTOTAL		
TOTAL	---	---	45	130	80	255		90		510		440		370		128		225		605		235		685		468	TOTAL		

CONDUIT / CABLE STATUS: E=EXISTING; I: INSTALL; A=ABANDON; AC=AERIAL CABLE; R=REMOVE AND SALVAGE; P=INSTALL WIRE INSIDE STEEL POLE

\*\* PAID FOR SUBSIDIARY TO ITEM 6292.



Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:17:25



CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

TRAFFIC SIGNAL TABLES  
(SHEET 1 OF 5)

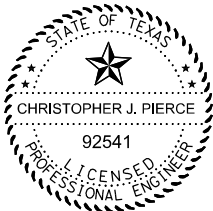
STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-8

CABLE TERMINATION CHART							
	CONDUCTOR COLOR	CABLE 1 FROM P-1 TO CNTRL 20 CNDR	CABLE 2 FROM P-2 TO CNTRL 10 CNDR	CABLE 3 FROM P-3 TO CNTRL 20 CNDR	CABLE 4 FROM P-4 TO CNTRL 10 CNDR	CABLE 5 FROM P-5 TO CNTRL 20 CNDR	CABLE 6 FROM P-6 TO CNTRL 20 CNDR
1	BLACK	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
2	WHITE	SIG COMMON	SIG COMMON	SIG COMMON	SIG COMMON	SIG COMMON	SIG COMMON
3	RED	SH 2, 3 PH 2 R	SPARE	SH 5, 6 PH 4 R	SPARE	SH 9, 10 PH 6 R	SH 11, 12 PH 8 R
4	GREEN	SH 2, 3 PH 2 G	SPARE	SH 5, 6 PH 4 G	SPARE	SH 9, 10 PH 6 G	SH 11, 12 PH 8 G
5	ORANGE	SH 2, 3 PH 2 Y	SPARE	SH 5, 6 PH 4 Y	SPARE	SH 9, 10 PH 6 Y	SH 11, 12 PH 8 Y
6	BLUE	SH 1 PH 5 GA LT	SPARE	SPARE	SPARE	SH 8 PH 1 GA LT	SPARE
7	WHITE/BLACK	SH 1 OLA YA LT	SPARE	SPARE	SPARE	SH 8 OLC YA LT	SPARE
8	RED/BLACK	SPARE	SH 4 PH 2 DW	SPARE	SH 7 PH 2 DW	SPARE	SPARE
9	GREEN/BLACK	SPARE	SH 4 PH 2 W	SPARE	SH 7 PH 2 W	SPARE	SPARE
10	ORANGE/BLACK	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
11	BLUE/BLACK	SPARE		SPARE		SPARE	SPARE
12	BLACK/WHITE	SH 1 OLA RA LT		SPARE		SH 8 OLC RA LT	SPARE
13	RED/WHITE	SPARE		SPARE		SPARE	SPARE
14	GREEN/WHITE	SPARE		SPARE		SPARE	SPARE
15	BLUE/WHITE	SPARE		SPARE		SPARE	SPARE
16	BLACK/RED	SPARE		SPARE		SPARE	SPARE
17	WHITE/RED	SH 1 OLA FYA LT		SPARE		SH 8 OLC FYA LT	SPARE
18	ORANGE/RED	SPARE		SPARE		SPARE	SPARE
19	BLUE/RED	SPARE		SPARE		SPARE	SPARE
20	RED/GREEN	SPARE		SPARE		SPARE	SPARE

R = RED BALL; Y = YELLOW BALL; G = GREEN BALL; RA = RED ARROW; YA = YELLOW ARROW; GA = GREEN ARROW; FYA = FLASHING YELLOW ARROW  
RT = RIGHT TURN ARROW; LT = LEFT TURN ARROW; W=WALK, DW=DONT WALK



Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:18:06



CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



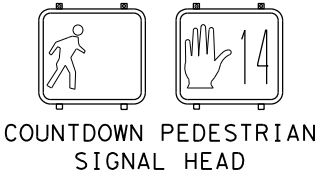
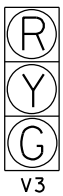
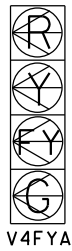
SH 46 AT PIEPER RD

TRAFFIC SIGNAL TABLES  
(SHEET 2 OF 5)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-9

ITEM 682 - SIGNAL HEADS											
SIGNAL HEAD NO.	SIGNAL HEAD TYPE	12" SIGNAL INDICATION			VEHICLE SIGNAL SECTIONS						PEDESTRIAN SIGNAL SECTIONS
		BACKPLATE			RED BALL	YELLOW BALL	GREEN BALL	RED ARROW	YELLOW ARROW	GREEN ARROW	
		3 SEC (EA)	4 SEC (EA)	5 SEC (EA)							
2, 3, 5, 6, 9, 10, 11, 12	V3	8			8	8	8				
1, 8	V4FYA		2					2	4	2	
4, 7	COUNTDOWN										2
	TOTAL	8	2	0	8	8	8	2	4	2	2

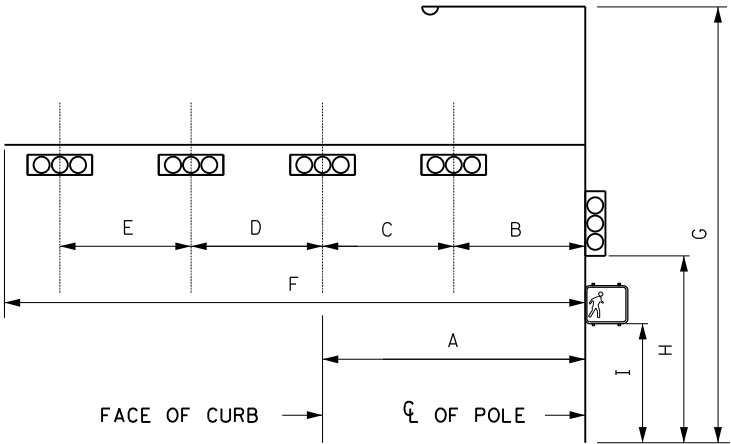
ALL SIGNAL HEADS SHALL INCLUDE ALUMINUM BACKPLATES WITH A 2" HIP BORDER.



SIGNAL HEAD AND POLE PLACEMENT (FEET)													ITEM 416 - DRILL SHAFTS (FEET)		
POLE NUMBER	DISTANCE FROM EDGE OF PAVEMENT/ CURBLINES	A	B	C	D	E	F	G	H	I	NO. OF HEADS ON MAST ARM/POLE	LUM-A	TYPE 24-A *	TYPE 30-A	TYPE 36-A
P-1	64N, 12E	12	18	12	15.5	---	48	30	---	---	3 / 0	1	---	---	13
P-2	29N, 23.5E	---	PEDESTAL POLE ASSEMBLY					10	---	10	---	---	6	---	---
P-3	8S, 30E	8	14.5	10	---	---	28	20	---	---	2 / 0	---	---	11	---
P-4	25.5S, 7E	---	PEDESTAL POLE ASSEMBLY					10	---	10	---	---	6	---	---
P-5	19.5S, 6W	6	12	12	14.5	---	40	20	---	---	3 / 0	---	---	---	13
P-6	20N, 6W	12	27	13	---	---	40	20	---	---	2 / 0	---	---	---	13
TOTAL													12	11	39

\* PAID FOR SUBSIDIARY TO ITEM 687.

- P-1: 64N, 12E = 64' NORTH OF PIEPER RD EXISTING CURBLINE EXTENSION, 12' EAST OF SH 46 EXISTING CURBLINE EXTENSION.  
P-2: 29N, 23.5E = 29' NORTH OF PIEPER RD EXISTING CURBLINE EXTENSION, 23.5' EAST OF SH 46 EXISTING CURBLINE EXTENSION.  
P-3: 8S, 30E = 8' SOUTH OF PIEPER RD EXISTING CURBLINE EXTENSION, 30' EAST OF SH 46 EXISTING CURBLINE EXTENSION.  
P-4: 25.5S, 7E = 25.5' SOUTH OF PIEPER RD EXISTING CURBLINE EXTENSION, 7' EAST OF SH 46 EXISTING CURBLINE EXTENSION.  
P-5: 19.5S, 6W = 9.5' SOUTH OF PIEPER RD EXISTING CURBLINE EXTENSION, 6' WEST OF SH 46 EXISTING EDGE OF PAVEMENT.  
P-6: 20N, 6W = 20' NORTH OF PIEPER RD EXISTING CURBLINE EXTENSION, 6' WEST OF SH 46 EXISTING EDGE OF PAVEMENT.



*Christopher J. Pierce*

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:18:44

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

TRAFFIC SIGNAL TABLES  
(SHEET 3 OF 5)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-10

ITEM 628 - ELECTRICAL SERVICE DATA											
ELECTRIC SERVICE NO.	ELECTRICAL SERVICE DESCRIPTION	SERVICE CONDUIT SIZE (PVC)	SERVICE CONDUCTORS NO./SIZE	SAFETY SWITCH AMPS	MAIN CIRCUIT BREAKER POLE/AMP	TWO-POLE CONTACTOR AMPS	PANELBD./ LOADCENTER AMP RATING	CIRCUIT NO.	BRANCH CIRCUIT BREAKER POLE/AMPS	BRANCH CIRCUIT AMPS	KVA LOAD
	SEE ED(5) & (6)-14										
1	ELEC SRV TY D 120/240 070 (NS)SS(E)PS(U)	2"	3/#6	N/A	2P/70	30	100	T.S. LIGHT	1P/50 2P/15	40 3	6.2

SIGN SUMMARY									
ID	TYPE	LEGEND	EXIST	REM	REL	REP	INST	HARDWARE & SUPPORT	LOCATION
A	R10-17T	LEFT TURN YIELD ON FLASHING YELLOW ARROW					1	1	MAST ARM P-1
B	ST NAME	PIEPER RD					1	1	MAST ARM P-1
C	ST NAME	SH 46					1	1	MAST ARM P-3
D	R10-17T	LEFT TURN YIELD ON FLASHING YELLOW ARROW					1	1	MAST ARM P-5
E	ST NAME	PIEPER RD					1	1	MAST ARM P-5
F	R3-8LR	LANE CONFIGURATION SIGN					1	1	MAST ARM P-6
G	ST NAME	SH 46					1	1	MAST ARM P-6

EXIST = EXISTING, REM = REMOVE, REL = RELOCATE, REP = REPLACE, INST = INSTALL  
CONTRACTOR SHALL VERIFY THE INFORMATION TO BE PLACED ON THE STREET NAME SIGNS PRIOR TO FABRICATION.

TMUTCD SIGN R10-17T  
SIGNS A, D

TMUTCD SIGN R3-8LR  
SIGN F

1.50" Radius, 0.50" Border, White on Green;  
[SH 46] ClearviewHwy-3-W;  
SIGNS C, G

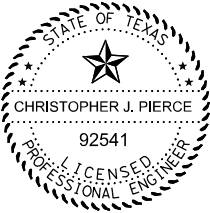
TMUTCD SIGN R10-3ER  
9"X15"  
MOUNT ON POLE P-2

TMUTCD SIGN R10-3EL  
9"X15"  
MOUNT ON POLE P-4

1.50" Radius, 0.50" Border, White on Green;  
[Pieper] ClearviewHwy-3-W; [Rd] ClearviewHwy-3-W;  
SIGNS B, E

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:19:27

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



9901 IH 10W  
SUITE 680  
SAN ANTONIO, TEXAS 78230  
210-625-7418  
TBPE REGISTRATION NO. F-450

SH 46 AT PIEPER RD

TRAFFIC SIGNAL TABLES  
(SHEET 4 OF 5)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-11



APS MESSAGE CHART			
POLE NUMBER	PEDESTRIAN MOVEMENT	FUNCTIONS	SPEECH MESSAGE/SOUND DETAILS
P-2	PHASE 2	BUTTON PUSH ON DON'T WALK	WAIT
		EXTENDED BUTTON PUSH	WAIT TO CROSS PIEPER ROAD AT STATE HIGHWAY 46.
		LOCATOR TONE	SLOW TICK
		WALK INDICATION *	RAPID TICK
P-4	PHASE 2	BUTTON PUSH ON DON'T WALK	WAIT
		EXTENDED BUTTON PUSH	WAIT TO CROSS PIEPER ROAD AT STATE HIGHWAY 46.
		LOCATOR TONE	SLOW TICK
		WALK INDICATION *	RAPID TICK

\* COUNTDOWN SPEECH MESSAGE = "OFF" FOR ALL UNITS

ITEM 688 - ACCESSIBLE PEDESTRIAN SIGNAL UNITS (APS)	
PED BUTTON PHASE	FURNISH & INSTALL
PHASE 2	2
TOTAL	2

ITEM 6292 - PRESENCE AND ADVANCE DETECTION INFORMATION			
RADAR PRESENCE DETECTION	STATUS	PHASES	LOCATION
R1	I	PH 1 & PH 6 PRESENCE	SIGNAL POLE P-1
R2	I	PH 8 PRESENCE	SIGNAL POLE P-3
R3	I	PH 2 & PH 5 PRESENCE	SIGNAL POLE P-5
R4	I	PH 4 PRESENCE	SIGNAL POLE P-6
RADAR ADVANCE DETECTION	STATUS	PHASES	LOCATION
R5	I	PH 6 SETBACK	MAST ARM P-1
R6	I	PH 2 SETBACK	MAST ARM P-5

I = INSTALL; E = EXISTING


ITEM 624 - GROUND BOX SUMMARY	
TYPE	EACH
TYPE D W/APRON	5

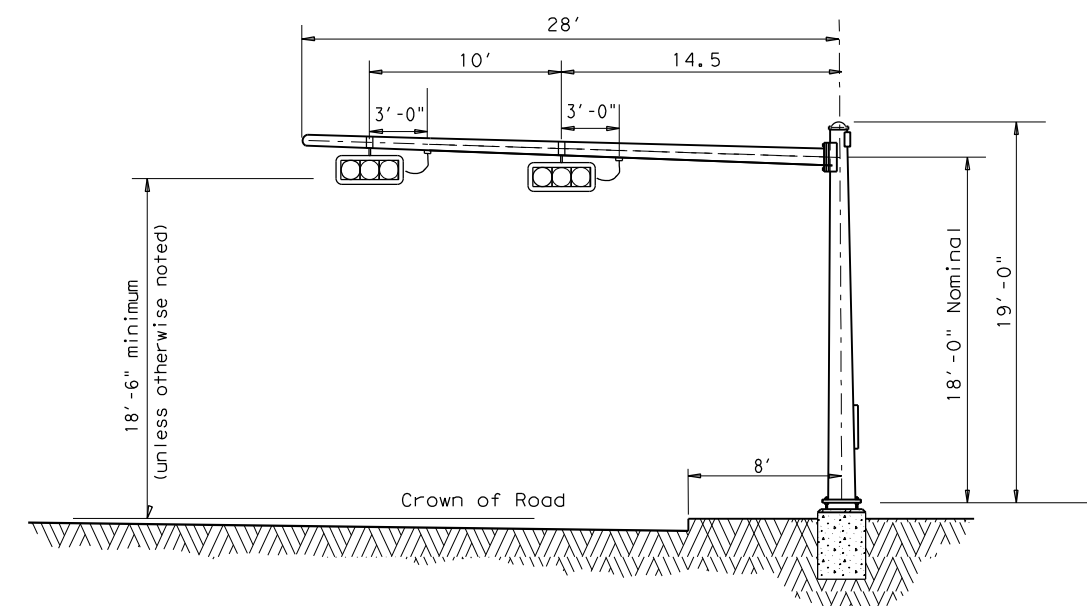
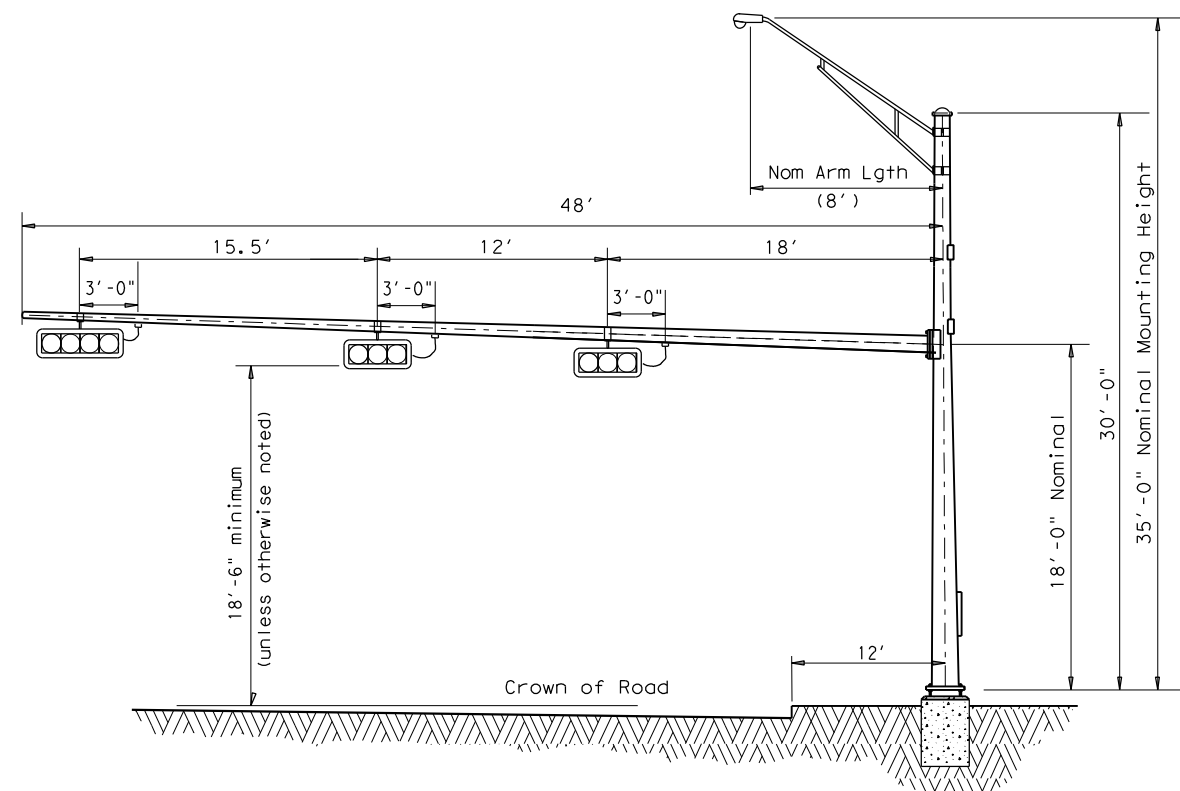


Digitally signed by Christopher Pierce, PE  
Date: 2022-10-21 08:20:06



CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450

 9901 IH 10W SUITE 680 SAN ANTONIO, TEXAS 78230 210-625-7418 TBPE REGISTRATION NO. F-450				
SH 46 AT PIEPER RD				
TRAFFIC SIGNAL TABLES (SHEET 5 OF 5)				
STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-12



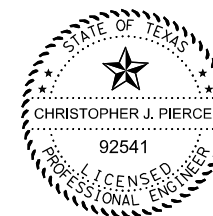
# POLE "P-1" ELEVATION

# POLE "P-3" ELEVATION

Antje Rein

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:20:  
46

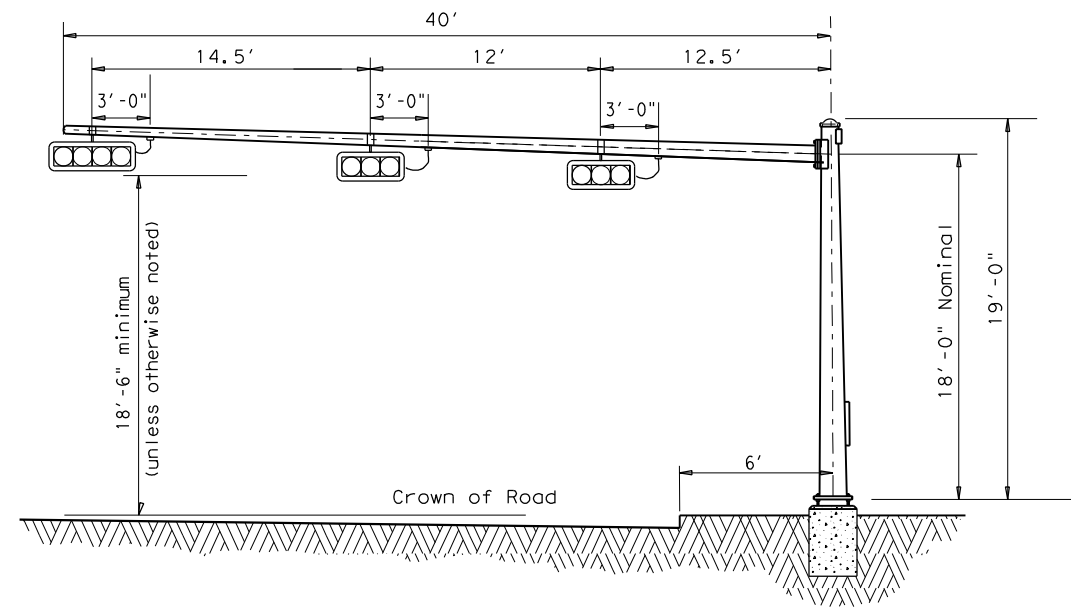
CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



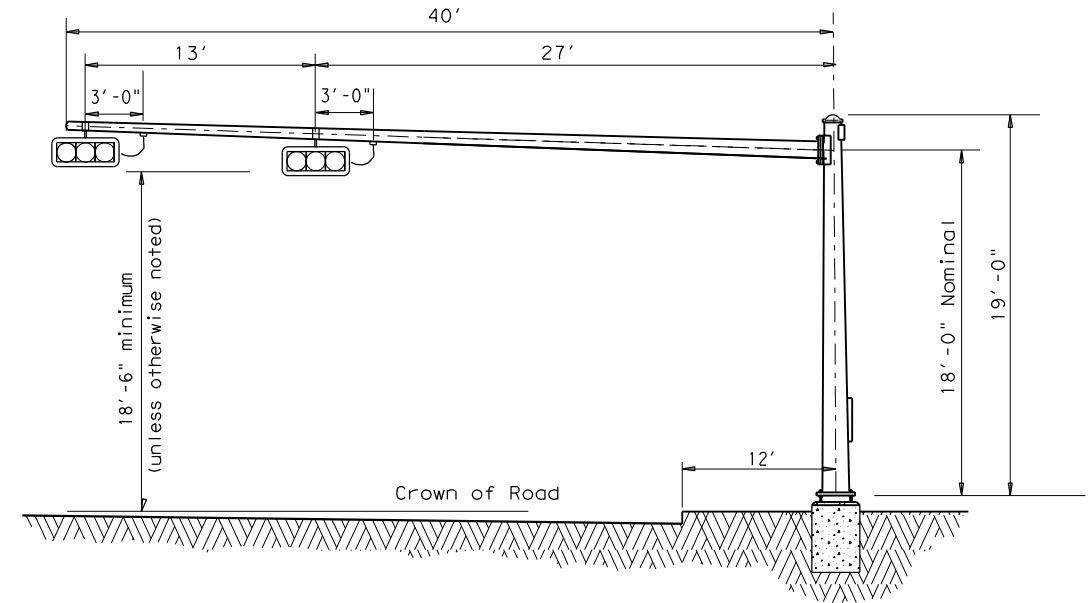
SH 46 AT PIEPER RD

SIGNAL POLE ELEVATIONS  
(SHEET 1 OF 2)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-13



POLE "P-5" ELEVATION



POLE "P-6" ELEVATION

*Christopher J. Pierce*

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:21:  
27



CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450

9901 IH 10W  
SUITE 680  
SAN ANTONIO, TEXAS 78230  
210-625-7418  
TBPE REGISTRATION NO. F-450  
**LEE ENGINEERING**

SH 46 AT PIEPER RD

SIGNAL POLE ELEVATIONS  
(SHEET 2 OF 2)

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-14

PAVEMENT MARKING SUMMARY					
ID	TXDOT SPEC NO.	TXDOT DESC. CODE	DESCRIPTION	UNIT	QTY
A	666	6048	REFL PAV MRK TY I (W) 24" (SLD) (100 MIL)	LF	96
	678	6008	PAV SURF PREP FOR MRK (24")	LF	96
B	666	6054	REFL PAV MRK TY I (W) (ARROW) (100 MIL)	EA	3
	678	6009	PAV SURF PREP FOR MRK (ARROW)	EA	3
C	666	6078	REFL PAV MRK TY I (W) (WORD) (100 MIL)	EA	3
	678	6016	PAV SURF PREP FOR MRK (WORD)	EA	3
D	666	6036	REFL PAV MRK TY I (W) 8" (SLD) (100 MIL)	LF	100
	668	6007	REFL PAV MRKR TY 1-C	EA	5
	678	6004	PAV SURF PREP FOR MRK (8")	LF	100

PAVEMENT MARKINGS LEGEND

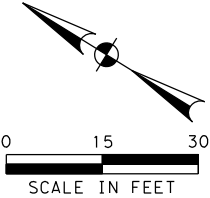
- A

REFL PAV MRK TY I (W) 24" (SLD) (100 MIL)
- B

REFL PAV MRK TY I (W) (ARROW) (100 MIL)
- C

REFL PAV MRK TY I (W) (WORD) (100 MIL)
- D

REFL PAV MRK TY I (W) 8" (SLD) (100 MIL)  
WITH TYPE I-C RAISED PAVEMENT MARKERS  
ON 20' CENTERS



LOT 1  
RIC AND SONIA  
MARTINEZ SUBDIVISION  
VOL. 8, PG. 127-128  
M.P.R.G.C.T.

R.O.W.

R.O.W.

SH 46  
SPEED LIMIT - 60 MPH

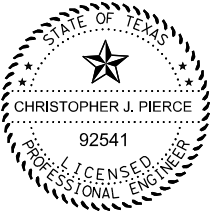
R.O.W.

R.O.W.

*Christopher J. Pierce*

Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:22:07

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C., REGISTRATION NO. F-450



SH 46 AT PIEPER RD

PAVEMENT  
MARKING LAYOUT

STATE	CITY	COUNTY	HIGHWAY NO.	SHEET NO.
TEXAS	NEW BRAUNFELS	GUADALUPE	SH 46	TS-15



**DISCLAIMER:** The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

**DISCLAIMER:**

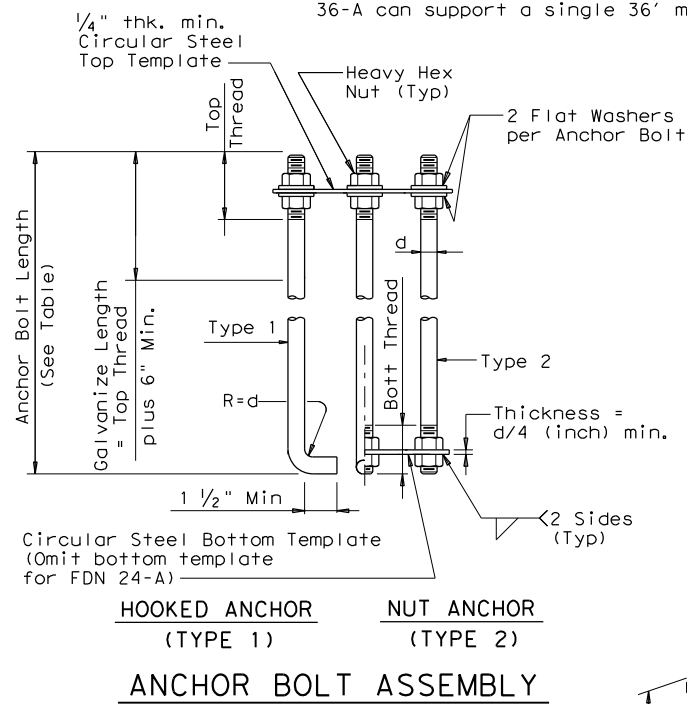
DATE: \_\_\_\_\_  
FILE: \_\_\_\_\_

FOUNDATION DESIGN TABLE													
FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL		EMBEDDED DRILLED SHAFT LENGTH-ft ④, ⑤, ⑥			ANCHOR BOLT DESIGN ①				FOUNDATION DESIGN LOAD ②		TYPICAL APPLICATION
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER N Blows/ft			ANCHOR BOLT DIA	F <sub>y</sub> (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips	
				10	15	40							
24-A	24"	4- #5	#3 @ 12"	5.7	5.3	4.5	¾"	36	12 ¾"	1	10	1	Pedestal pole, pedestal mounted controller.
30-A	30"	8- #9	#3 @ 6"	11.3	10.3	8.0	1 ½"	55	17"	2	87	3	Max arm assembly. (see Selection Table)
36-A	36"	10- #9	#3 @ 6"	13.2	12.0	9.4	1 ¾"	55	19"	2	131	5	Max arm assembly. (see Selection Table) 30' strain pole with or without luminaire.
36-B	36"	12- #9	#3 @ 6"	15.2	13.6	10.4	2"	55	21"	2	190	7	Max arm assembly. (see Selection Table) Strain pole taller than 30' & strain pole with max arm
42-A	42"	14- #9	#3 @ 6"	17.4	15.6	11.9	2 ¼"	55	23"	2	271	9	Max arm assembly. (see Selection Table)

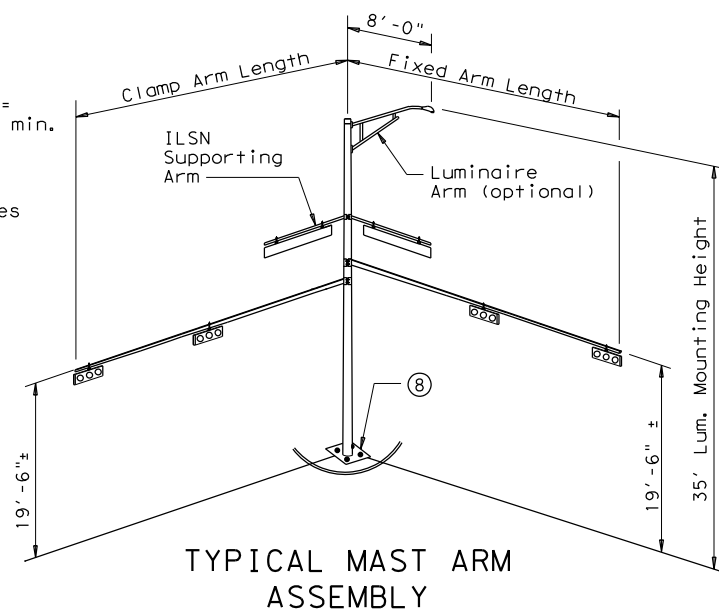
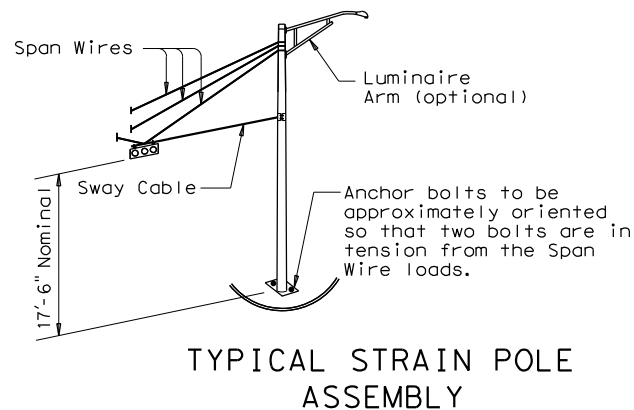
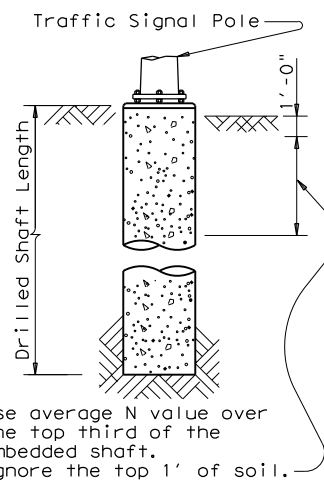
FOUNDATION SELECTION TABLE FOR STANDARD MAST ARM PLUS ILSN SUPPORT ASSEMBLIES (ft)					
		FDN 30-A	FDN 36-A	FDN 36-B	FDN 42-A
80 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH	32'	48'		
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24'			
		28' X 28'			
		32' X 28'	32' X 32'		
			36' X 36'		
			40' X 36'		
			44' X 28'	44' X 36'	
100 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH		36'	44'	
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS		24' X 24'		
			28' X 28'		
			32' X 24'	32' X 32'	
				36' X 36'	
				40' x24'	40' X 36'
					44' x 36'

EXAMPLE:

1. For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
2. For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.



⑧ Orient anchor bolts orthogonal with the fixed arm direction to ensure that two bolts are in tension under dead load.

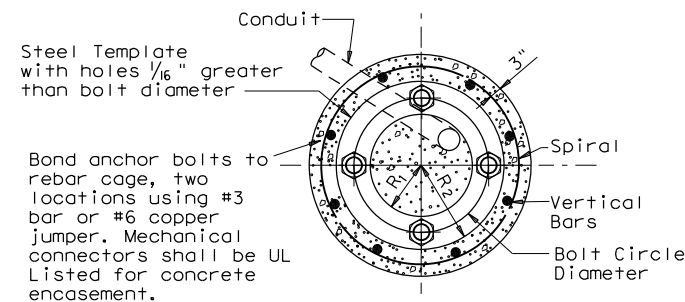


NOTES:

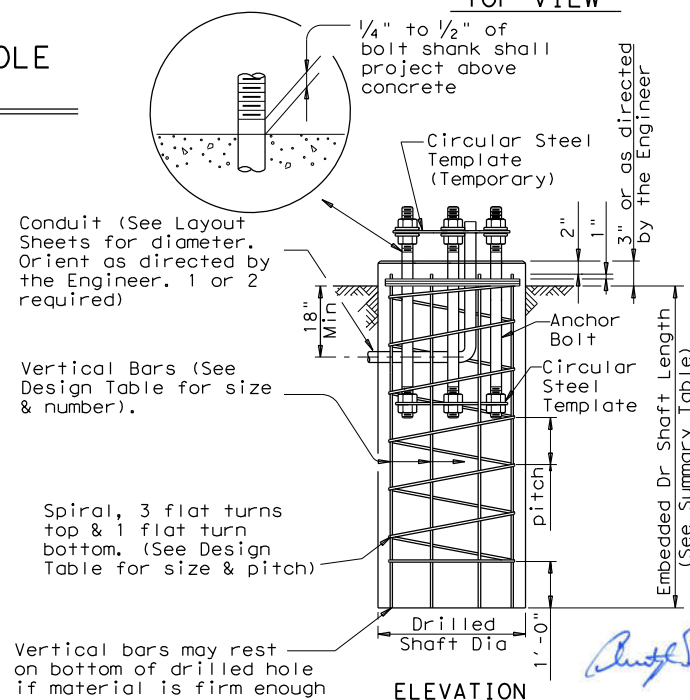
- ① Anchor bolt design develops the foundation capacity given under Foundation Design Loads.
- ② Foundation Design Loads are the allowable moments and shears at the base of the structure.
- ③ Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the Contractor's information only.
- ④ Field Penetrometer readings at a depth of approximately 3 to 5 feet may be used to adjust shaft lengths.
- ⑤ If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.
- ⑥ Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

ANCHOR BOLT & TEMPLATE SIZES						
BOLT DIA IN.	⑦ BOLT LENGTH	TOP THREAD	BOTTOM THREAD	BOLT CIRCLE	R2	R1
¾"	1' - 6"	3"	—	12 ¾"	7 ⅛"	5 ⅝"
1 ½"	3' - 4"	6"	4"	17"	10"	7"
1 ¾"	3' - 10"	7"	4 ½"	19"	11 ¼"	7 ¾"
2"	4' - 3"	8"	5"	21"	12 ½"	8 ½"
2 ¼"	4' - 9"	9"	5 ½"	23"	13 ¾"	9 ¼"

⑦ Min dimensions given,  
longer bolts are acceptable.



TOP VIEW



## FOUNDATION DETAILS

CHRISTOPHER J. PIERCE, P.E.  
LEE ENGINEERING, L.L.C.  
REGISTRATION NO. F-450

[illegible]

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and interim revisions thereto.

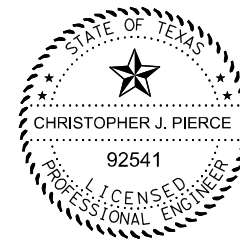
Reinforcing steel shall conform to Item 440,  
"Reinforcing Steel".

Concrete shall be Class "C".

Threads for anchor bolts and nuts shall be rolled or cut threads of 8UN series up to 2" in diameter or UNC series for all sizes. Bolts and nuts shall have Class 2A and 2B fit tolerances. Galvanized nuts shall be tapped after galvanizing.

Anchor bolts that are larger than 1" in diameter shall conform to "alloy steel" or "medium-strength mild steel" per Item 449, "Anchor Bolts". Anchor bolts that are 1" in diameter or less shall conform to ASTM A36. Galvanize a minimum of the top end thread length plus 6" for all anchor bolts unless otherwise noted. Exposed washers and exposed nuts shall be galvanized. All galvanizing shall be in accordance with Item 445, "Galvanizing".

Templates and embedded nuts need not be galvanized. Lubricate and tighten anchor bolts when erecting the structure in accordance with Item 449, "Anchor Bolts".



Digitally signed by  
Christopher Pierce, PE  
Date: 2022-10-21 08:22:  
49

 *Texas Department of Transportation*  
Traffic Operations Division

TRAFFIC SIGNAL  
POLE FOUNDATION

TS-FD-12

5-96 11-99 1-12		REVISIONS		DN: MS	CK: JSY	DW: MAO/MMF	CK:JSY/TE
		CONT	SECT	JOB		HIGHWAY	
						SH 46	
		DIST	COUNTY			SHEET NO.	
		SAT	GUADALUPE			TS-16	

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

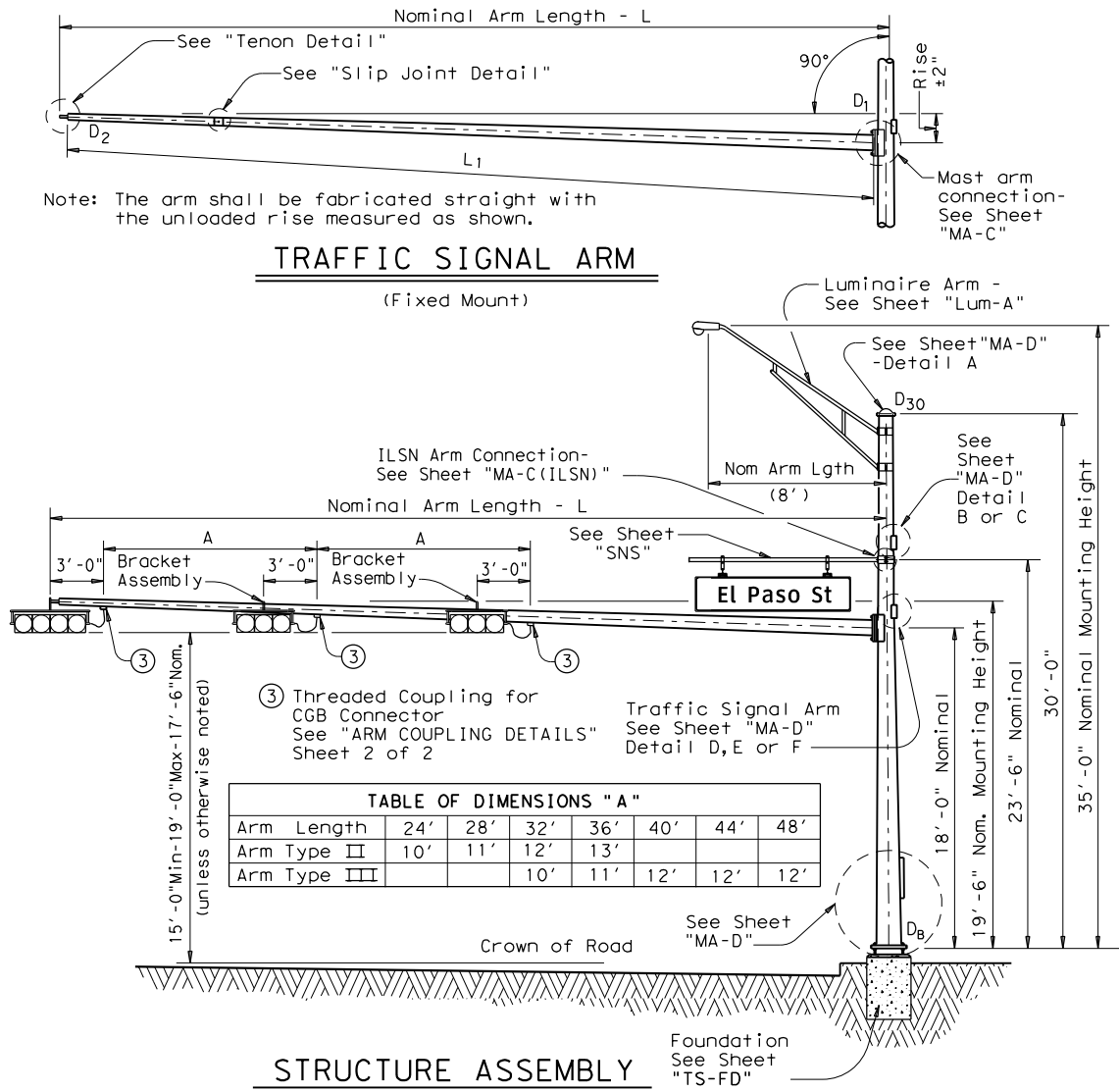
1011  
DATE:  
FILE:

Arm Length	ROUND POLES					POLYGONAL POLES					Foundation Type
	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	
ft.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
20	10.5	7.8	7.1	6.3	.179	11.5	8.5	7.7	6.8	.179	30-A
24	11.0	8.3	7.6	6.8	.179	12.0	9.0	8.2	7.3	.179	30-A
28	11.5	8.8	8.1	7.3	.179	12.5	9.5	8.7	7.8	.179	30-A
32	12.5	9.8	9.1	8.3	.179	12.0	9.0	8.2	7.3	.239	30-A
36	12.0	9.3	8.6	7.8	.239	12.5	9.5	8.7	7.8	.239	36-A
40	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
44	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
48	13.0	10.3	9.6	8.8	.239	15.0	12.0	11.2	10.3	.239	36-A

Arm Length	ROUND ARMS					POLYGONAL ARMS				
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	① thk	Rise	L <sub>1</sub>	D <sub>1</sub>	② D <sub>2</sub>	① thk	Rise
ft.	ft.	in.	in.	in.		ft.	in.	in.	in.	
20	19.1	6.5	3.8	.179	1'-9"	19.1	7.0	3.5	.179	1'-8"
24	23.1	7.5	4.3	.179	1'-10"	23.1	7.5	3.5	.179	1'-9"
28	27.1	8.0	4.2	.179	1'-11"	27.1	8.0	3.5	.179	1'-10"
32	31.0	9.0	4.7	.179	2'-1"	31.0	9.0	3.5	.179	2'-0"
36	35.0	9.5	4.6	.179	2'-4"	35.0	10.0	3.5	.179	2'-1"
40	39.0	9.5	4.1	.239	2'-8"	39.0	9.5	3.5	.239	2'-3"
44	43.0	10.0	4.1	.239	2'-11"	43.0	10.0	3.5	.239	2'-6"
48	47.0	10.5	4.1	.239	3'-4"	47.0	11.0	3.5	.239	2'-9"

- D<sub>B</sub> = Pole Base O.D.  
D<sub>19</sub> = Pole Top O.D. with no Luminaire and no ILSN  
D<sub>24</sub> = Pole Top O.D. with ILSN w/out Luminaire  
D<sub>30</sub> = Pole Top O.D. with Luminaire  
D<sub>1</sub> = Arm Base O.D.  
D<sub>2</sub> = Arm End O.D.  
L<sub>1</sub> = Shaft Length  
L = Nominal Arm Length

- ① Thickness shown are minimums, thicker materials may be used.  
② D<sub>2</sub> may be increased by up to 1" for polygonal arms.



## SHIPPING PARTS LIST

Ship each pole with the following attached: enlarged hand hole, pole cap, fixed-arm connection bolts and washers and any additional hardware listed in the table.

Nominal Arm Length	30' Poles With Luminaire		24' Poles With ILSN		19' Poles With No Luminaire and No ILSN	
	Above hardware plus: One (or two if ILSN attached) small hand hole, clamp-on simplex		Above hardware plus one small hand hole		See note above	
ft	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20L-80		20S-80		20-80	
24	24L-80		24S-80		24-80	
28	28L-80		28S-80		28-80	1
32	32L-80		32S-80		32-80	
36	36L-80		36S-80		36-80	
40	40L-80	1	40S-80		40-80	2
44	44L-80		44S-80		44-80	
48	48L-80		48S-80		48-80	

Traffic Signal Arms (1 per Pole)

Ship each arm with the listed equipment attached

Nominal Arm Length	Type I Arm (1 Signal)		Type II Arm (2 Signals)		Type III Arm (3 Signals)	
	1 CGB connector		1 Bracket Assembly and 2 CGB Connectors		2 Bracket Assemblies and 3 CGB Connectors	
ft	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20I-80					
24	24I-80		24II-80			
28	28I-80		28II-80	1		
32			32II-80		32III-80	
36			36II-80		36III-80	
40			40II-80	1	40III-80	2
44					44III-80	
48					48III-80	

Luminaire Arms (1 per 30' pole)

Nominal Arm Length	Quantity
8' Arm	1

ILSN Arm (Max. 2 per pole) Ship with clamps, bolts and washers

Nominal Arm Length	Quantity
7' Arm	
9' Arm	

Anchor Bolt Assemblies (1 per pole)

Anchor Bolt Diameter	Anchor Bolt Length	Quantity
1 1/2"	3'-4"	1
1 3/4"	3'-10"	3

Each anchor bolt assembly consists of the following: Top and Bottom templates, 4 anchor bolts, 8 nuts, 8 flat washers, and 4 nut anchor devices (Type 2) per Standard Drawing "TS-FD".

Templates may be removed for shipment.

SHEET 1 OF 2



## TRAFFIC SIGNAL SUPPORT STRUCTURES

SINGLE MAST ARM ASSEMBLY  
(80 MPH WIND ZONE)

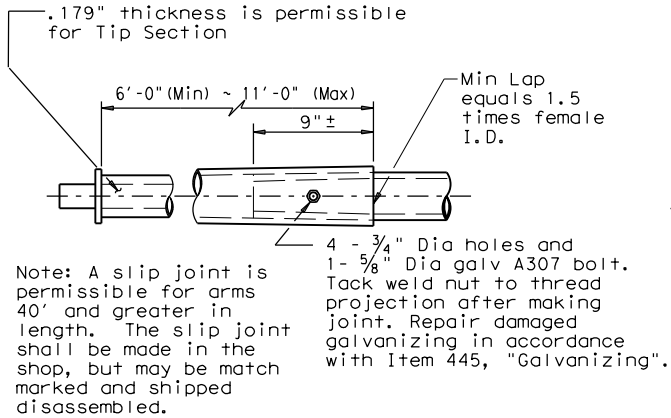
SMA-80(1)-12

© TxDOT August 1995	DN: MS	CK: JSY	DW: MMF	CK: JSY
REVISIONS	CONT	SECT	JOB	HIGHWAY
5-96				SH 46
11-99				
1-12				
	DIST	COUNTY		SHEET NO.
	SAT	GUADALUPE		TS-17

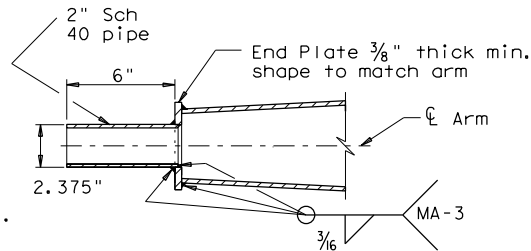
122A

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

1011  
DATE:  
FILE:



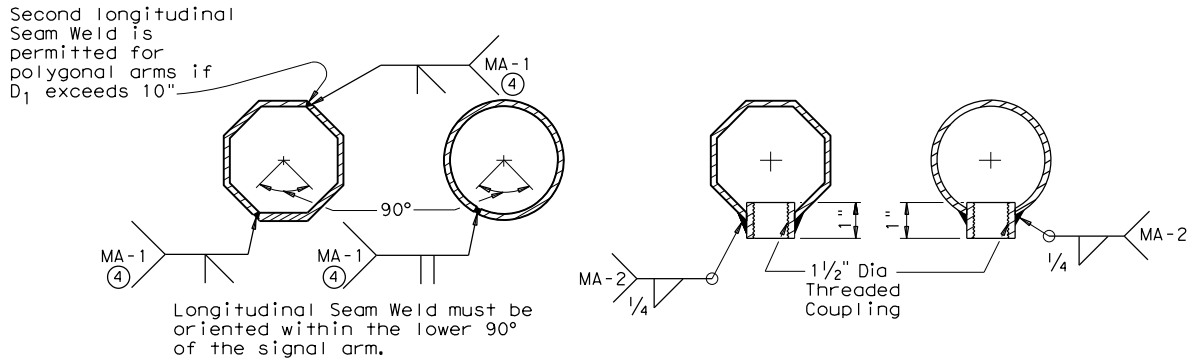
SLIP JOINT DETAIL



TENON DETAIL

Stainless steel bands (or Cables) and cast bracket as in "Astro-Brac", "Sky Bracket" or "Easy Bracket" with 1 1/2" Dia Threaded Coupling.

BRACKET ASSEMBLY



ARM WELD DETAIL

④ 60% Min. penetration  
100% penetration within 6" of circumferential base welds.

ARM COUPLING DETAILS

### VIBRATION WARNING

Mast Arms of SMA and DMA structures and clamp-on Arms of LMA structures of approximately 40 ft or longer are subject to harmonic vertical vibrations in light wind conditions due to the aeroelastic characteristics of a few of the myriads of possible combinations of the following: signal numbers, weights and positions; existence/solidity of backplates; presence of additional attachments to the arm, such as signs and cameras; arm-wind orientation; and arm-pole stiffness.

Such vibrations may cause fatigue damage to the structure and may lead to galloping in moderate wind conditions which may further damage the structure and alarm the public. Tests have indicated that when wind is blowing toward the back side of signal heads having un-vented backplates attached the probability of unacceptable harmonic vibration and/or galloping is rather high.

If backplates are not required for improved visibility they should not be applied to the signal heads or, if they must be applied, they should be vented as a first and inexpensive measure to mitigate vibrations.

The traffic signal mast arms shall be visually inspected in 5 to 20 mph wind conditions after installation of signal heads and any attachments, including any required backplates. If vertical movements with a total excursion (maximum upward excursion to maximum downward excursion) of more than approximately 8" are observed at the arm tip, a damping plate shall be fitted to the arm. See "Damping Plate Mounting Details" on standard sheet, MA-DPD-10.

This visual inspection shall be repeated after each modification of the structure that could affect its aeroelastic response. Excessive vibrations shall not be allowed to continue for more than two days.

### GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications thereto. Design Wind Speed equals 80 mph plus a 1.3 gust factor.

Poles are designed to support one 8'-0" luminaire arm, one 9'-0" internally lighted street name sign and one traffic signal arm with a length as tabulated. The specified luminaire load applied at the end of the luminaire arm equals 60 lbs vertical dead load plus the horizontal wind load on an effective projected area of 1.6 sq ft. The specified internally lighted street name sign load applied 4.5 ft from the centerline of the pole equals 85 lbs vertical dead load plus horizontal wind load on an effective projected area of 11.5 sq ft. The specified signal load applied at the end of the traffic signal arm equals 180 lbs vertical dead load plus the horizontal wind load on an effective projected area of 32.4 sq ft (actual area times drag coefficient).

See Standard Sheet "MA-D" for pole details, "MA-C" for traffic signal arm connection details, "MA-C (ILSN)" for internally lighted street name sign arm connection details, "LUM-A" for luminaire arm and connection details, "SNS" for internally lighted street name sign details, and "TS-FD" for anchor bolt and foundation details. See "MA-C" for material specifications.

Fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. Materials, fabrication tolerances, and shipping practices shall meet the requirements of this sheet and Item 686, "Traffic Signal Pole Assemblies (Steel)".

Unless otherwise noted, all parts shall be galvanized in accordance with Item 445, "Galvanizing", after fabrication.

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

SHEET 2 OF 2

 **Texas Department of Transportation**  
Traffic Operations Division

**TRAFFIC SIGNAL  
SUPPORT STRUCTURES  
SINGLE MAST ARM ASSEMBLY  
(80 MPH WIND ZONE)**

**SMA-80(2)-12**

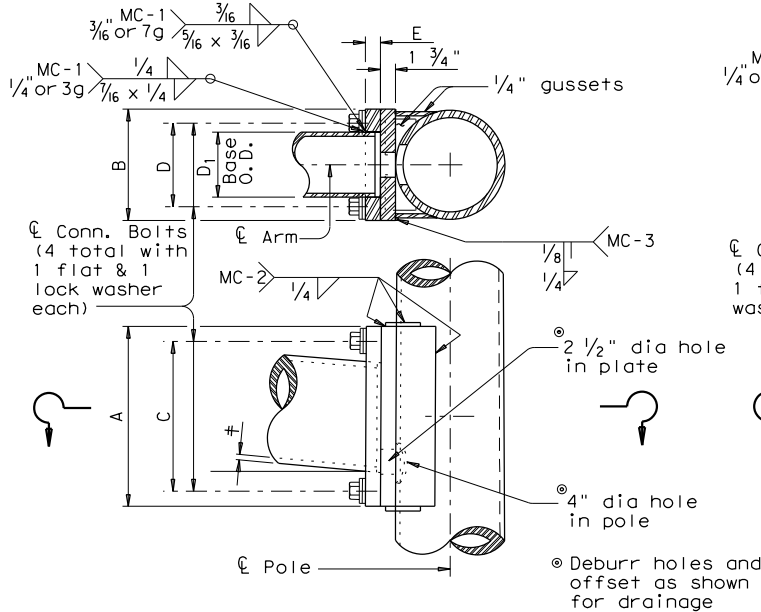
© TxDOT August 1995		DN: MS	CK: JSY	DW: MMF	CK: JSY
REVISIONS		CONT	SECT	JOB	HIGHWAY
5-96 1-12					SH 46
		DIST	COUNTY		SHEET NO.
		SAT	GUADALUPE		TS-18

122B

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

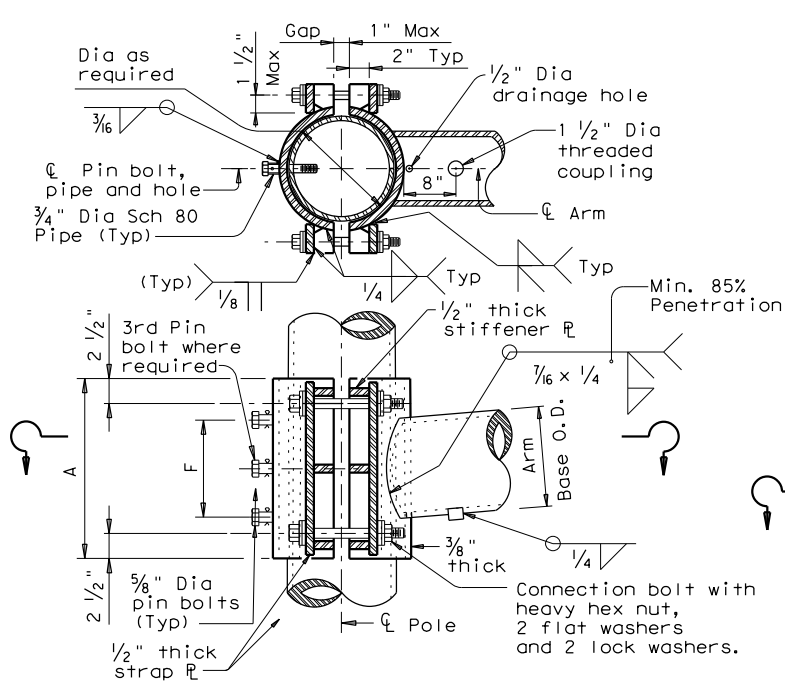
DATE:  
FILE:

ARM SIZE		A	B	C	D	E	CONN BOLT DIA
D <sub>1</sub>	#	in.	in.	in.	in.	in.	in.
6.5	.179	12	9	9	6	1 3/4	1
7.5	.179	13	9	10	6	1 3/4	1
8.0	.179	14	10	11	7	2	1 1/4
9.0	.179	16	11	13	8	2	1 1/4
9.5	.179	17	12	14	9	2	1 1/4
9.5	.239	18	12	15	9	2	1 1/4
10.0	.239	18	12	15	9	2	1 1/4
10.5	.239	18	13	15	10	3	1 1/2
11.0	.239	18	13	15	10	3	1 1/2



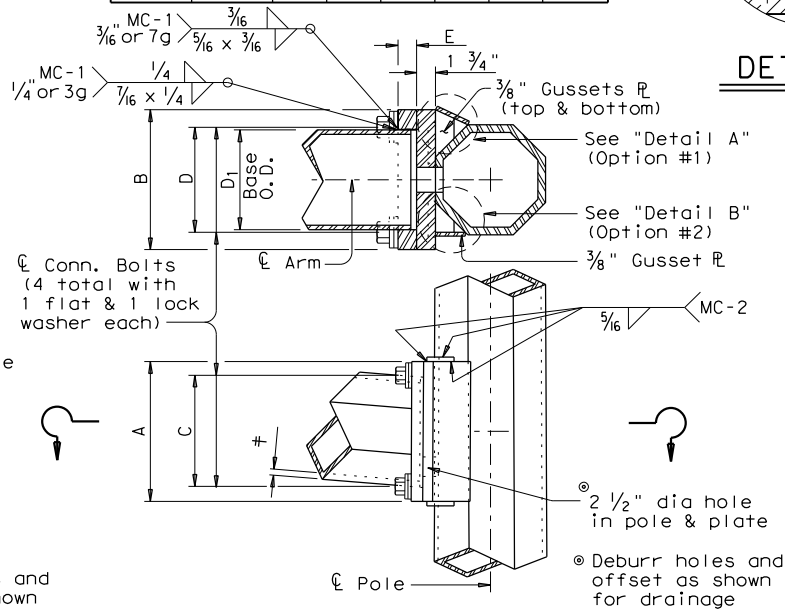
FIXED MOUNT DETAIL 1

ARM SIZE		A	F	CONN. BOLTS	PIN BOLTS
D <sub>1</sub>	#	in.	in.	No. Dia	No. Dia
6.5	.179	12	6	4	1
7.5	.179	14	8	4	1
8.0	.179	14	8	4	1
9.0	.179	16	10	4	1
9.5	.179	18	12	4	1 1/4
9.5	.239	18	12	4	1 1/4
10.0	.239	18	12	4	1 1/4



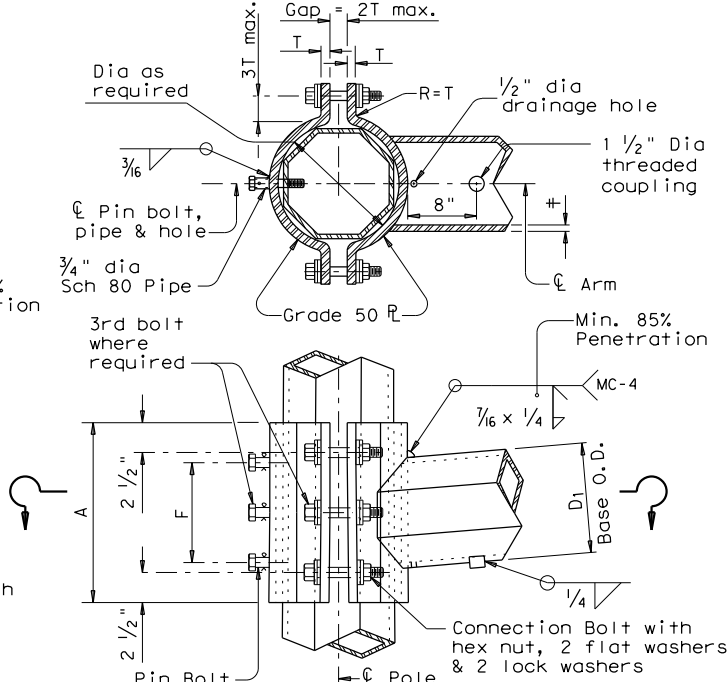
CLAMP-ON DETAIL 1

ARM SIZE		A	B	C	D	E	CONN BOLT DIA
D <sub>1</sub>	#	in.	in.	in.	in.	in.	in.
6.5	.179	11	11	8	8	1 3/4	1 1/4
7.5	.179	11	11	8	8	1 3/4	1 1/4
8.0	.179	11	11	8	8	2	1 1/4
9.0	.179	13	13	10	10	2	1 1/4
10.0	.179	13	13	10	10	2	1 1/4
9.5	.239	13	13	10	10	2	1 1/4
10.0	.239	14	14	11	11	2	1 1/2
11.0	.239	14	14	11	11	3	1 1/2
11.5	.239	14	14	11	11	3	1 1/2

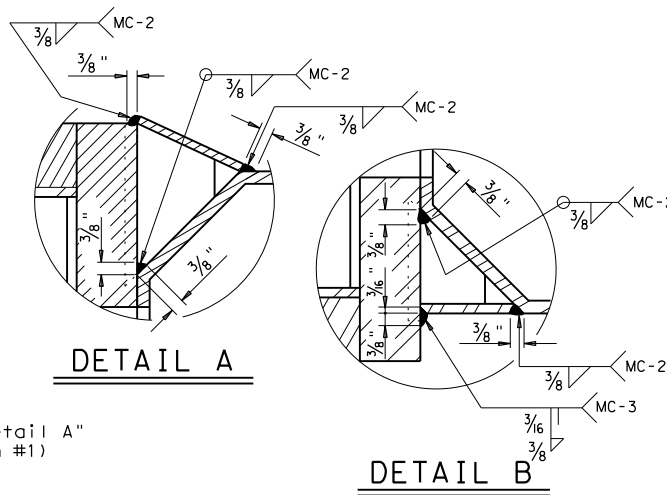


FIXED MOUNT DETAIL 2

ARM SIZE		A	F	T	CONN. BOLTS	PIN BOLTS
D <sub>1</sub>	#	in.	in.	in.	No. Dia	No. Dia
6.5	.179	12	6	3/4	4	3/4
7.5	.179	14	8	3/4	4	3/4
8.0	.179	14	8	3/4	4	3/4
9.0	.179	16	10	7/8	4	1
10.0	.179	18	10	7/8	4	1
9.5	.239	18	10	1	6	1
10.0	.239	18	10	1	6	1

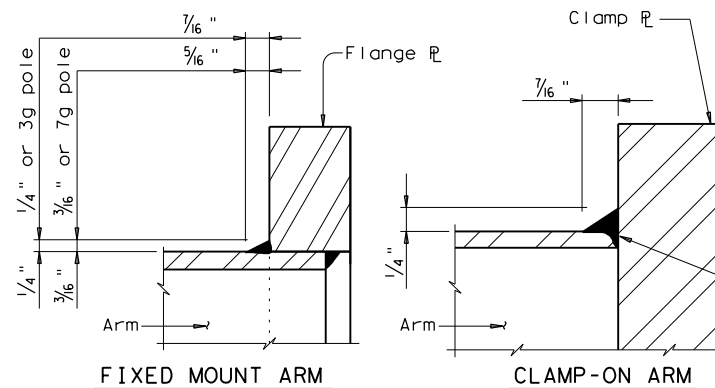


CLAMP-ON DETAIL 2



DETAIL A

DETAIL B

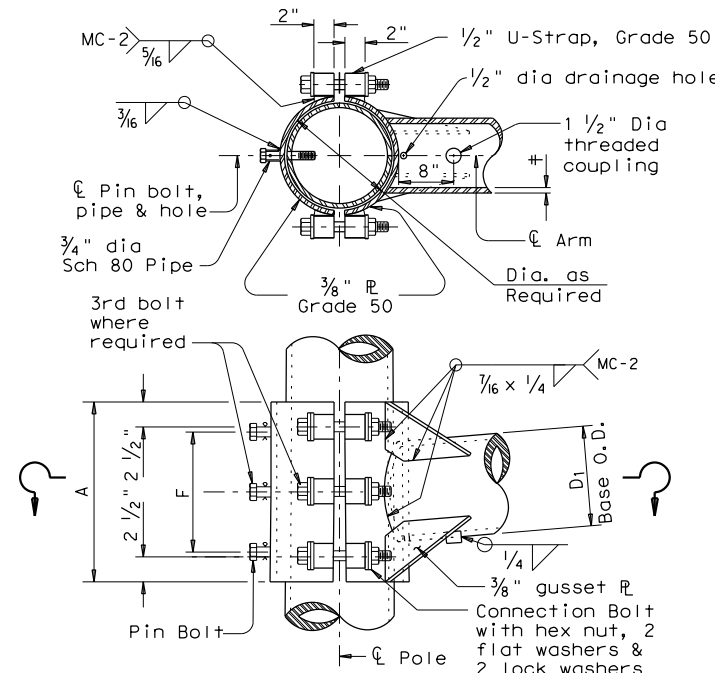


FIXED MOUNT ARM

CLAMP-ON ARM

ARM BASE WELD DETAILS

ARM SIZE		A	F	CONN. BOLTS	PIN BOLTS
D <sub>1</sub>	#	in.	in.	No. Dia	No. Dia
6.5	.179	12	6	4	1
7.5	.179	14	8	4	1
8.0	.179	14	8	4	1
9.0	.179	16	10	4	1
9.5	.179	18	12	6	1
9.5	.239	18	12	6	1
10.0	.239	18	12	6	1



CLAMP-ON DETAIL 3

## MATERIALS

Round Shafts or Polygonal Shafts <sup>①</sup>	ASTM A595 Gr.A, A588, A1008 HSLAS Gr.50 Class 2, A1011 HSLAS Gr.50 Class 2, A572 Gr.50 or A1011 SS Gr.50 <sup>②</sup>
Plates <sup>①</sup>	ASTM A36, A588, or A572 Gr.50
Connection Bolts	ASTM A325 or A449, except where noted
Pin Bolts	ASTM A325
Pipe <sup>①</sup>	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50, A1011 HSLAS-F Gr.50
Misc. Hardware	Galvanized steel or stainless steel or as noted

- ① ASTM A572, A1008 HSLAS, A1011 HSLAS, A1008 HSLAS-F, A1011 HSLAS-F or A1011 SS may have higher yield strengths but shall not have less elongation than the grade indicated.
- ② ASTM A1011 SS Gr.50 material shall also have a minimum elongation of 18 percent in 8 inches or 23 percent in 2 inches. Material thickness in excess of those stipulated under A1011 SS will be acceptable providing the material meets all other A1011 SS requirements and the requirements of this item.

## GENERAL NOTES:

Clamp-on details are used for the second arm on dual mast arm assemblies. A Maximum 1 1/2" wide vertical slotted hole shall be cut in the front clamp plate to facilitate drainage during galvanizing. The slot shall be centered behind the arm and shall be no longer than the arm diameter minus 1"

Fixed mount details are used for single mast arm assemblies and for the first arm on dual mast arm assemblies.

Where duplicate parts occur on a detail, welds shown for one part shall apply to all similar parts on the detail.

Pin bolts are required to prevent rotation of clamp-on arms under design wind forces.

## NOTE:

Pin bolts shall be A325 with threads excluded from the shear plane. Pin bolt and 3/4" dia pipe shall have 3/16" dia holes for a 1/8" dia galvanized cotter pin. Back clamp plate shall be furnished with a 3/4" dia hole for each pin bolt. An 1/16" dia hole for each pin bolt shall be field drilled through the pole after arm orientations have been approved by the Engineer.

Texas Department of Transportation  
Traffic Operations Division

## STANDARD ASSEMBLY FOR TRAFFIC SIGNAL SUPPORT STRUCTURES

### MAST ARM CONNECTIONS

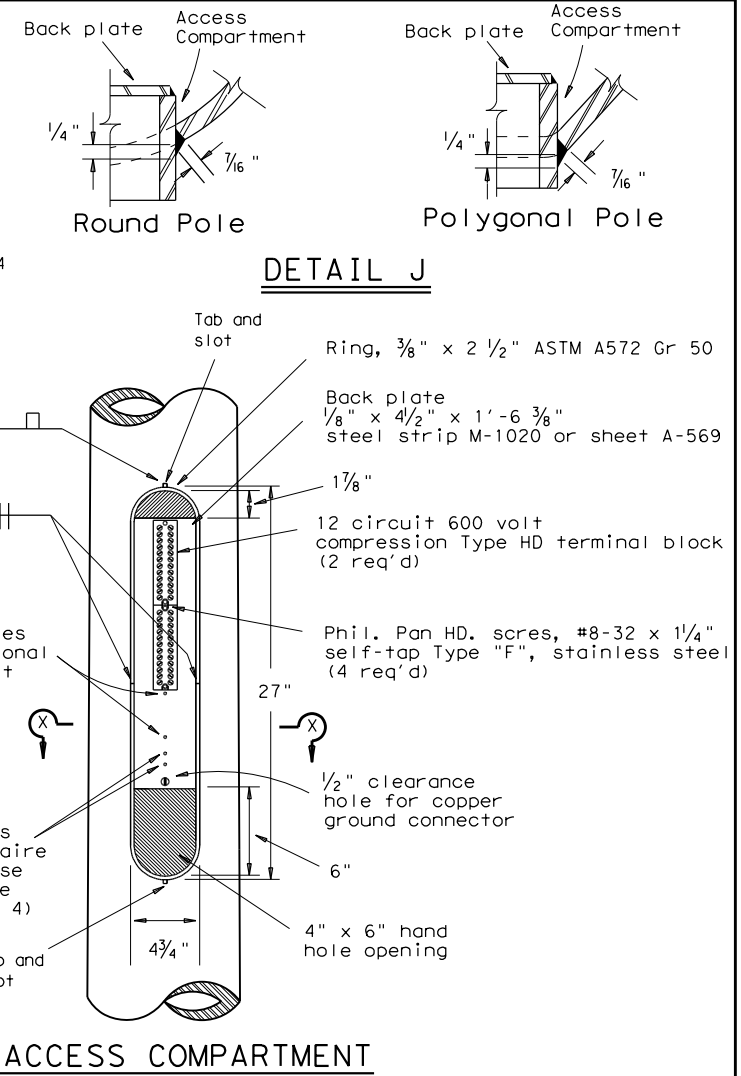
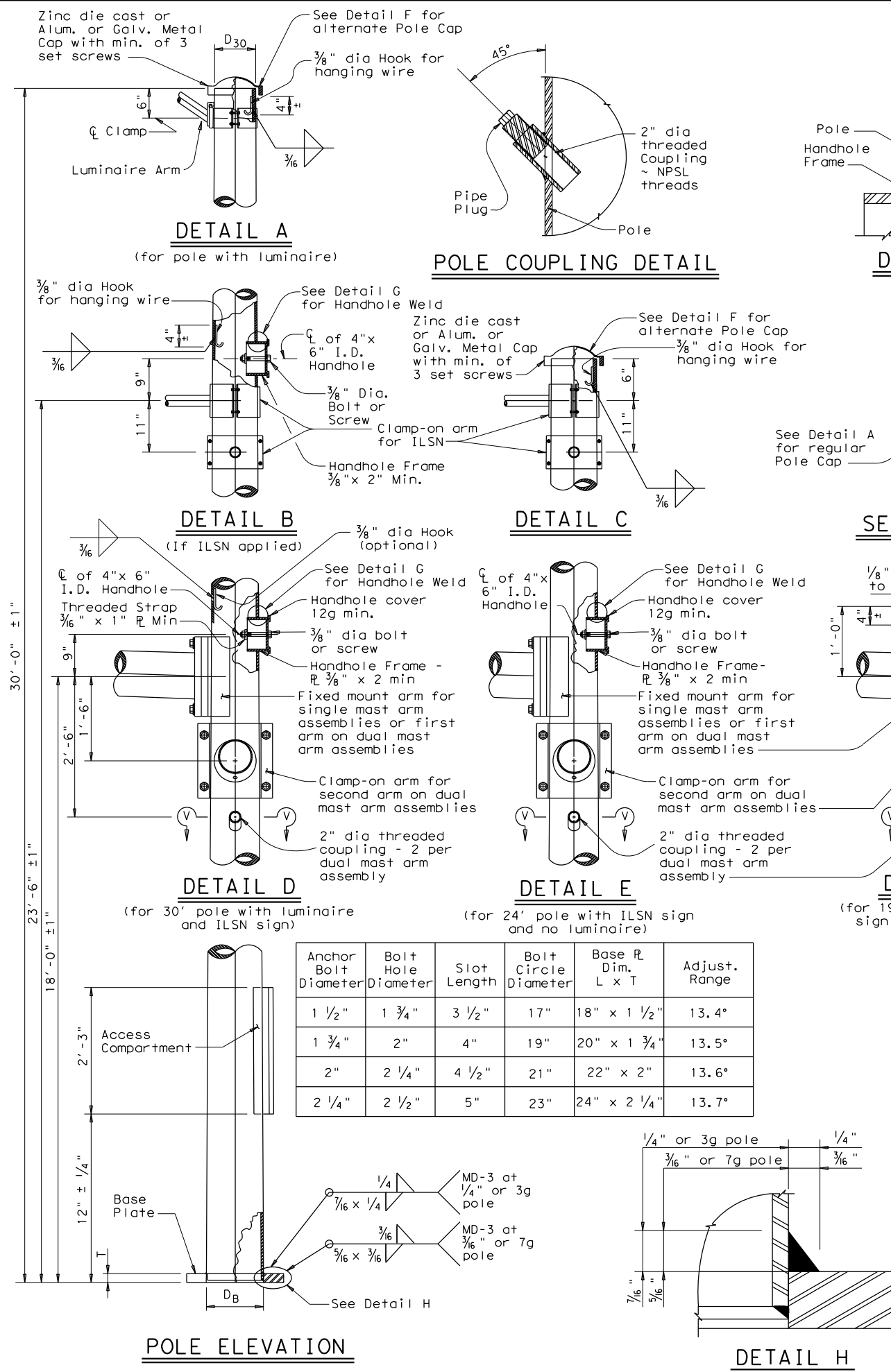
### MA-C-12

© TxDOT August 1995	DN: MS	CK: JSY	DW: MMF	CK: JSY
REVISIONS	CONT	SECT	JOB	HIGHWAY
5-96 5-09 1-12				SH 46
	DIST	COUNTY		SHEET NO.
	SAT	GUADALUPE		TS-19



DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:  
FILE:



**NOTES:**

- The cover shall be one piece formed from ABS plastic, shall be a pearl gray color, and shall be suitable for exposure to harsh sunlight and extreme weather. Cover shall latch with two screw latches and shall fit tightly to the enclosure ring to create a rainproof seal. Latch screws shall be 1/4-20 stainless flat socket head screws with tamper proof feature.
- The pole manufacturer shall provide with each pole a separate kit consisting of: one cover with two latching assemblies, two terminal strips (Marathon #985GP12CU or approved equal), four #8-32 x 1 1/4" self tapping type "F" stainless steel pan head screws, and one ground connector (Blackburn TTC, Burndy KC22J12T13, or Ilco SSS-5). The traffic signal contractor shall install the kit items in the field.
- The screw hole spacing on the enclosure back plate shall be for two Marathon #985GP12 terminal strips, one Marathon #985GP06CU terminal strip, and one Bussmann #BM6032B fuse block.
- Install one Bussmann #BM6032B, Littelfuse #L60030M-2C, or Ferraz-Shawmut #30352 fuse block for poles where luminaires are to be installed.

 Texas Department of Transportation  
Traffic Operations Division

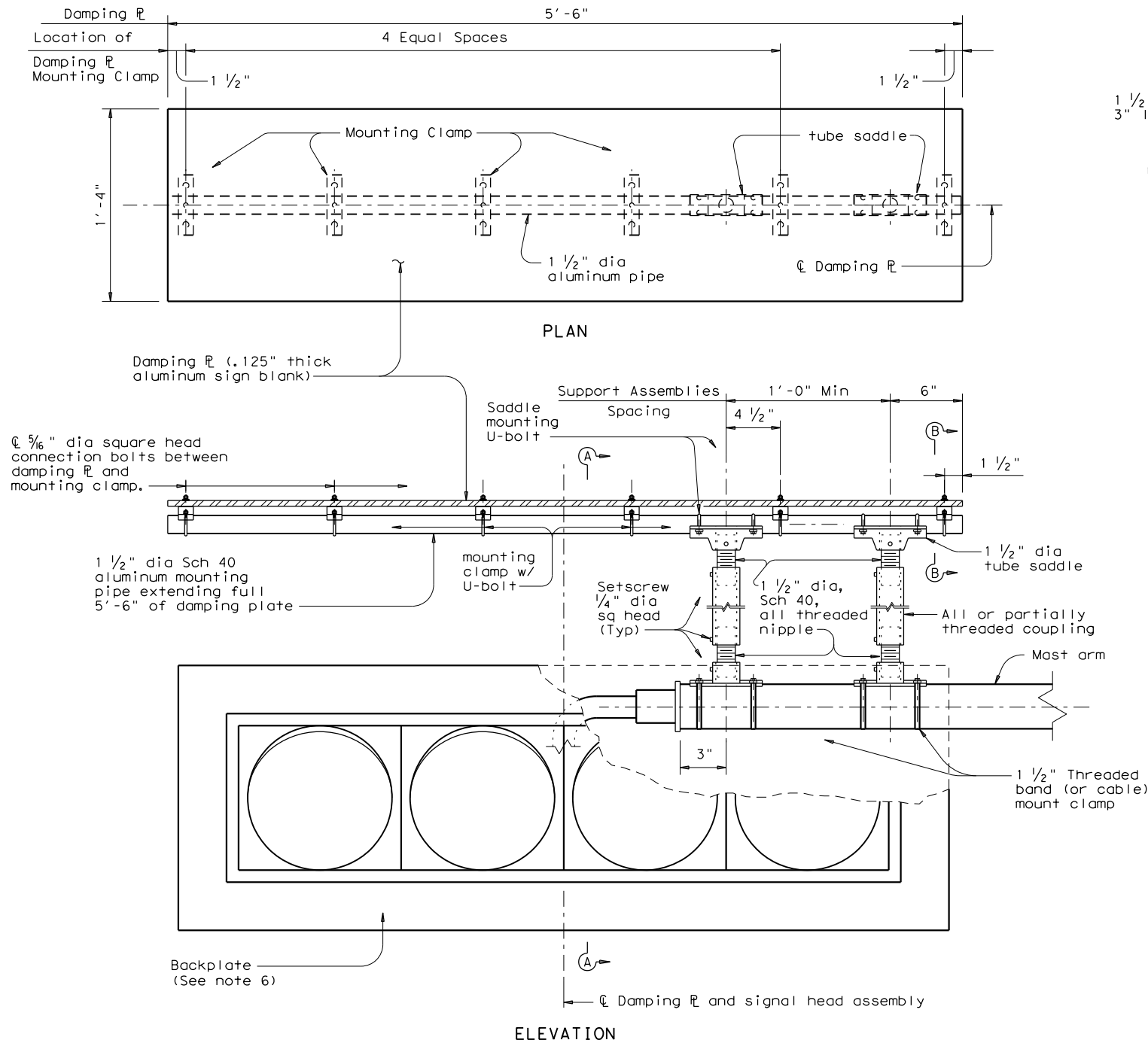
**TRAFFIC SIGNAL  
SUPPORT STRUCTURES  
MAST ARM POLE DETAILS**

MA-D-12

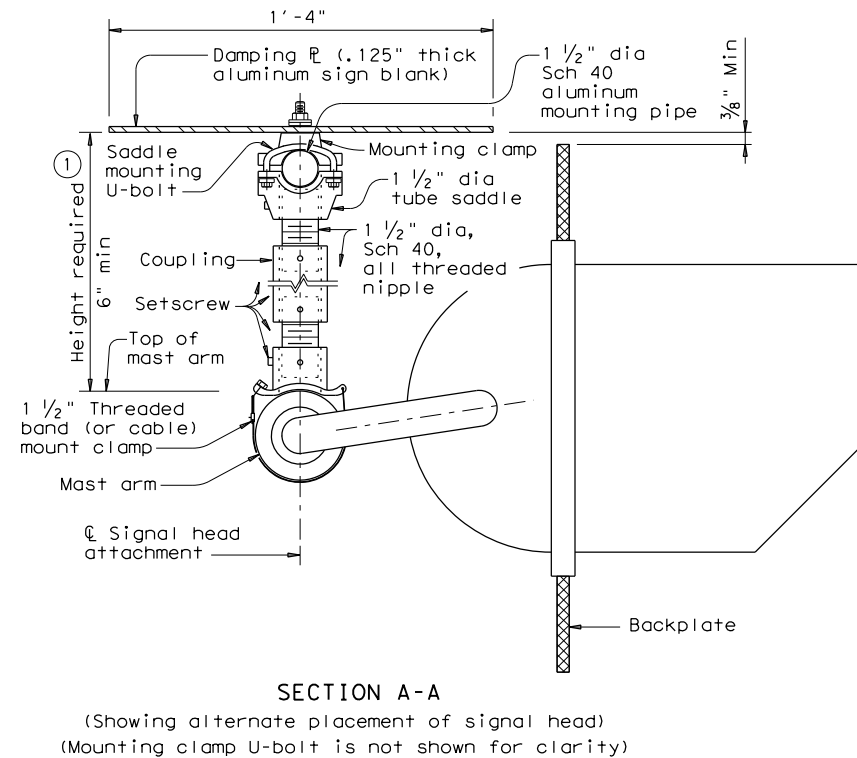
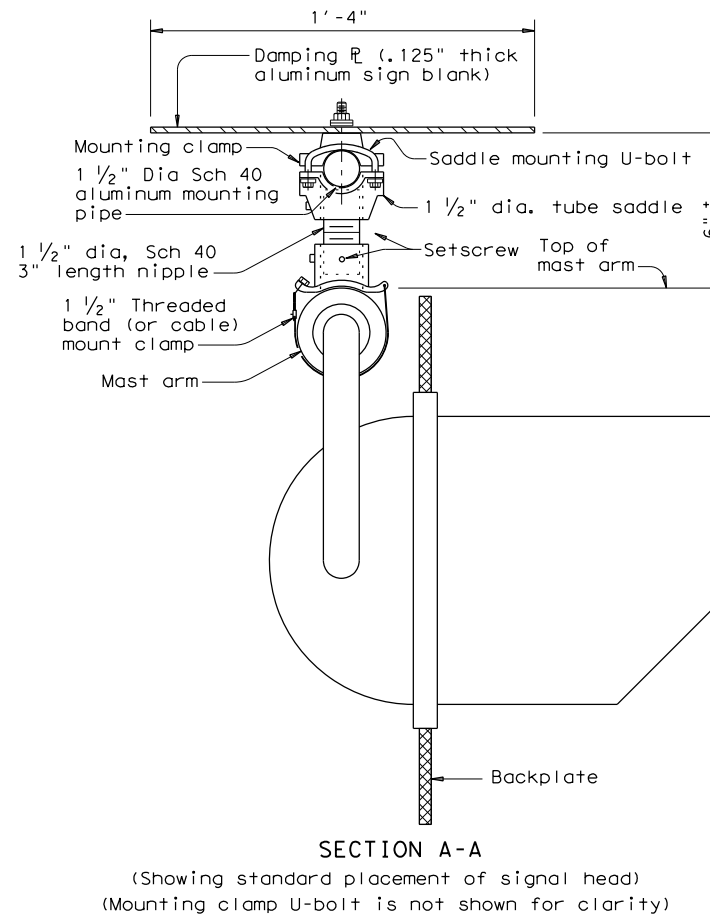
© TxDOT August 1995		DN: MS		CK: JSY	DW: FDN	CK: CAL	
8-99 1-12	REVISIONS		CONT	SECT	JOB		HIGHWAY
							SH 46
			DIST	COUNTY			SHEET NO.
			SAT	GUADALUPE			TS-20

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:  
FILE:

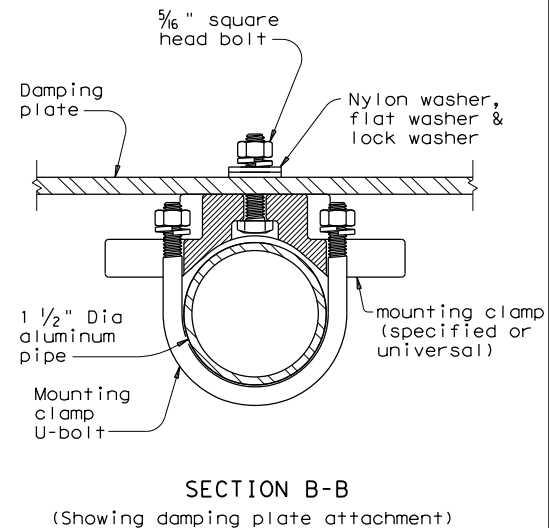


DAMPING PLATE MOUNTING DETAILS  
(Showing alternate placement of signal head)



① Recommended supporting assemblies to achieve required height for horizontal section heads			
Height required	One nipple each length	Two nipples each length plus	One coupling each length
6"-6 3/4"	3"	-	-
7"-8 1/2"	4"	-	-
9"-10 1/2"	6"	-	-
11"-15 1/2"	-	4"	5"
16"-24"	-	6"	10"

- GENERAL NOTES:
1. In accordance with the findings of TxDOT sponsored research, the installation of a damping plate in accordance with the details shown here at the end of signal mast arms of SMA and DMA standard structures reduces excessive harmonic vertical vibration, and thus fatigue damage. Any deviation from these details may reduce the effectiveness of this damping device.
  2. Aluminum sign blank for damping plate will conform to Departmental Material Specifications DMS-7110. Materials for mast arm mounting clamp and tube saddle will be aluminum castings or aluminum alloys as in accordance with manufacturers' stipulations. Mounting pipe, pipe nipple and coupling will be aluminum alloy 6061-T6 or 6063-T6. Damping plate mounting clamp and U-bolt assemblies will conform to Standard sheet SMD(GEN). U-bolts for saddle mounting will have a minimum yield strength of 36 ksi.
  3. Damping plate will be mounted horizontally. Position centerline of damping plate to align with centerline of mast arm or horizontal signal head assembly. Vertical clearance between signal head (with or without backing plate) and bottom of damping plate will be maintained as shown. The attachments shown here are examples only, other supporting details which meet both alignment and vertical clearance requirements are also acceptable.
  4. Unless stipulated by the manufacturers, all steel parts will be galvanized finish in accordance with Standard Specification Item 445, "Galvanizing".
  5. Contractor will verify applicable field dimensions before the installation.
  6. Backplates are optional for traffic signals. When backplates are used, Backplates will have a 2-inch fluorescent yellow AASHTO Type BFL or CFL retroreflective border conforming to TxDOT DMS-8300 "Sign Face Materials." See Sheet TS-BP-20 for backplate details.



Texas Department of Transportation

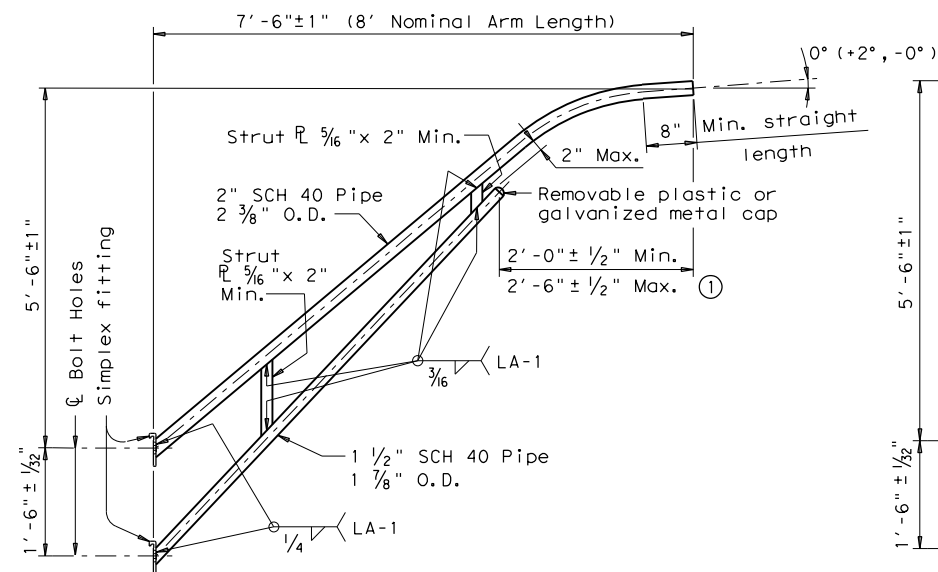
Traffic Safety Division Standard

MAST ARM DAMPING PLATE DETAILS

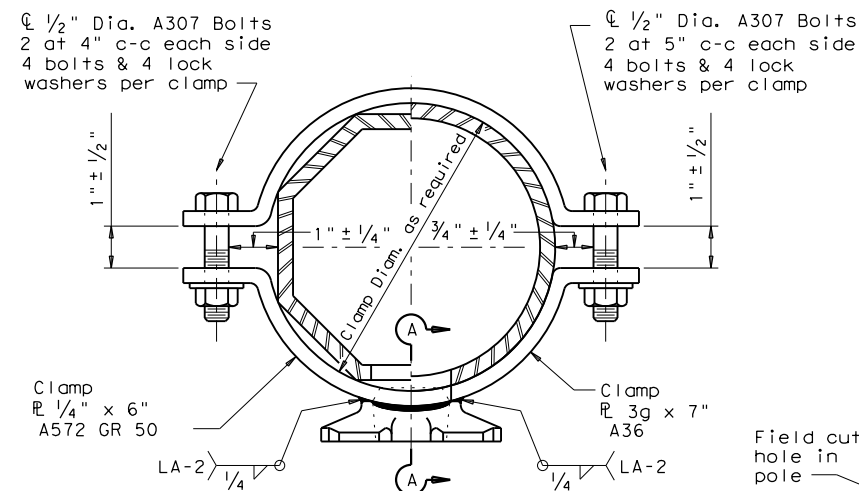
MA-DPD-20

FILE: ma-dpd-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT June 2020	CONT	SECT	JOB	HIGHWAY
4-20	REVISIONS			SH 46
6-20		DIST	COUNTY	SHEET NO.
		SAT	GUADALUPE	TS-21

DATE: \_\_\_\_\_  
FILE: \_\_\_\_\_

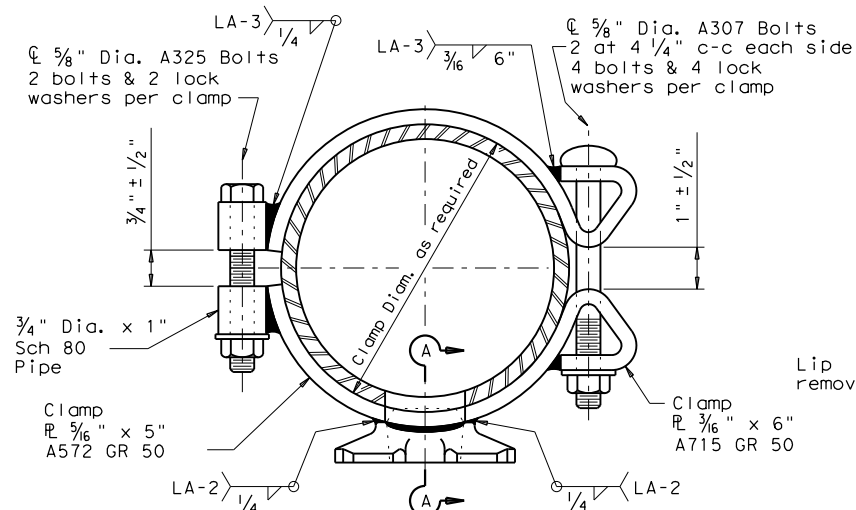


8-FOOT LUMINAIRE ARM



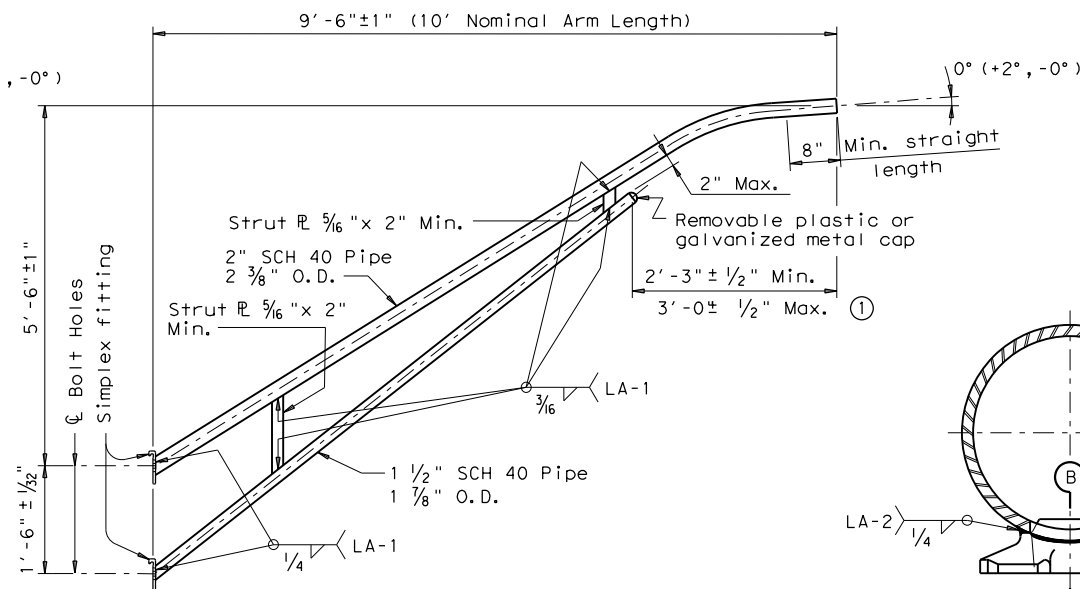
CLAMP ATTACHMENT  
DETAIL NO. 1  
(HALF SECTION)

CLAMP ATTACHMENT  
DETAIL NO.2  
(HALF SECTION)

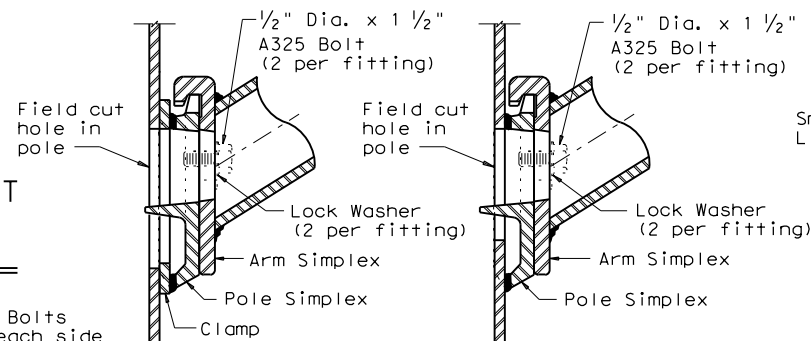


CLAMP ATTACHMENT  
DETAIL NO. 3  
(HALF SECTION)

CLAMP ATTACHMENT  
DETAIL NO. 4  
(HALF SECTION)

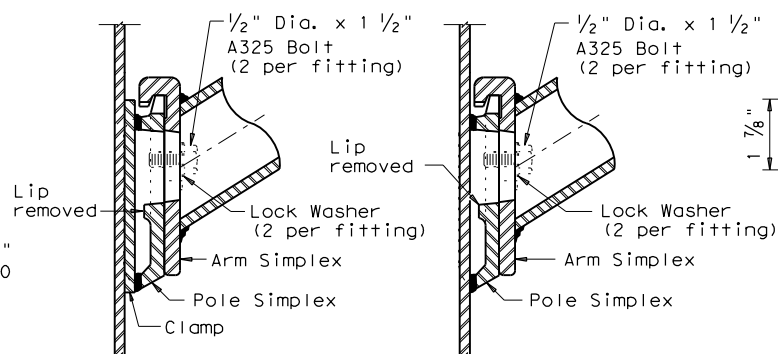


10-FOOT LUMINAIRE ARM



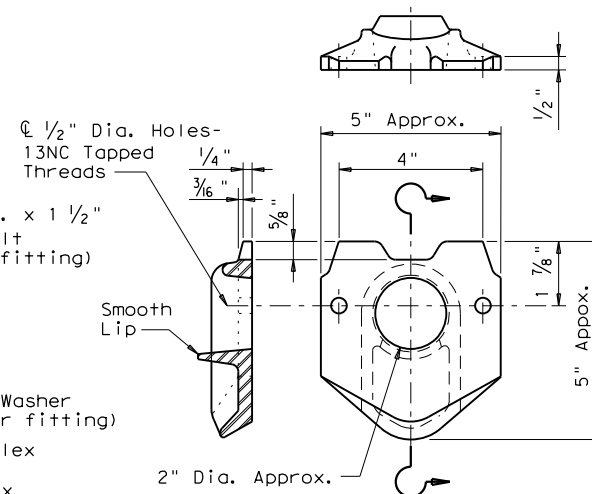
UPPER SIMPLEX FITTING

## UPPER SIMPLEX FITTING

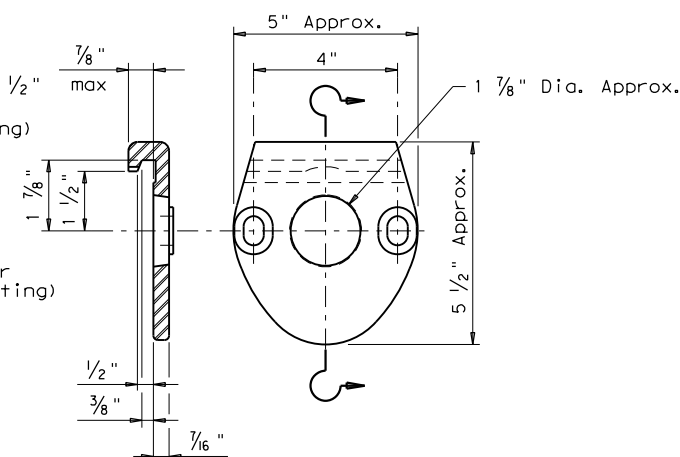


## LOWER SIMPLEX FITTING

## LOWER SIMPLEX FITTING



## POLE SIMPLEX DETAIL



## ARM SIMPLEX DETAIL

MATERIALS	
Pole or Arm Simplex	ASTM A27 Gr.65-35 or A148 Gr.80-50, A576 Gr.1021 ③, or A36 (Arm only)
Arm Pipes	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50 ④, or A1011 HSLAS-F Gr.50 ④
Arm Strut Plates ②	ASTM A36, A572 Gr.50 ④, or A588
Misc.	ASTM designations as noted

- ① Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.
- ② Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.
- ③ A576 must be suitable for forging and also meet minimum tensile strength of 65 ksi, minimum yield of 35 ksi, and elongation in 2 inches of 22 percent.
- ④ ASTM A572, A1008 HSLAS-F, and A1011 HSLAS-F may have higher yield strengths but shall not have less elongation than the grade indicated.

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminares, and Traffic Signals and Interim Revisions thereto. Design Wind Speed equals 90 mph plus a 1.3 gust factor. Arms are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq. ft.

Materials and fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absence of specified Fabricator tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.

Unless otherwise noted, all parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing".

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

Each pole simplex fitting shall be supplied with 2 ASTM A325 bolts and 2 lock washers of the size specified. The bolts and lock washers shall be secured to the pole with the other hardware items called for in the plans. When clamp attachment is specified, the Fabricator shall ship the clamp assembly securely attached to the pole at the location shown on the plans.

If clamp assemblies are ordered without poles, the Fabricator shall ship one upper and one lower clamp assembly together in a single package, including all nuts and washers required for the clamps and simplex fittings.



# STANDARD ASSEMBLY DRAWINGS FOR LUMINAIRE SUPPORT STRUCTURES

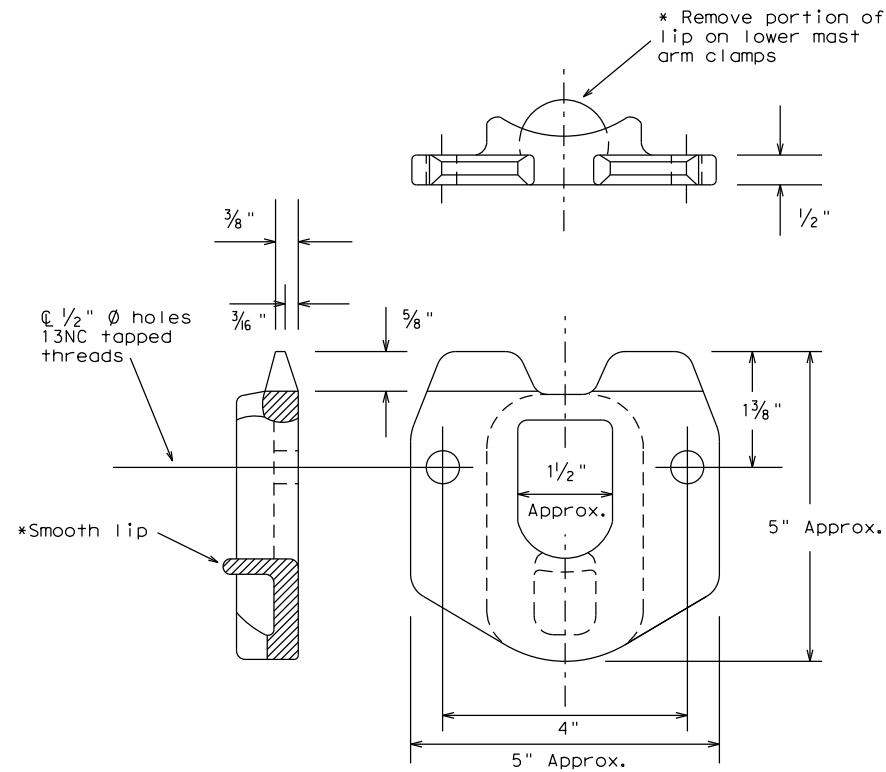
## ARM DETAILS

LUM-A-12

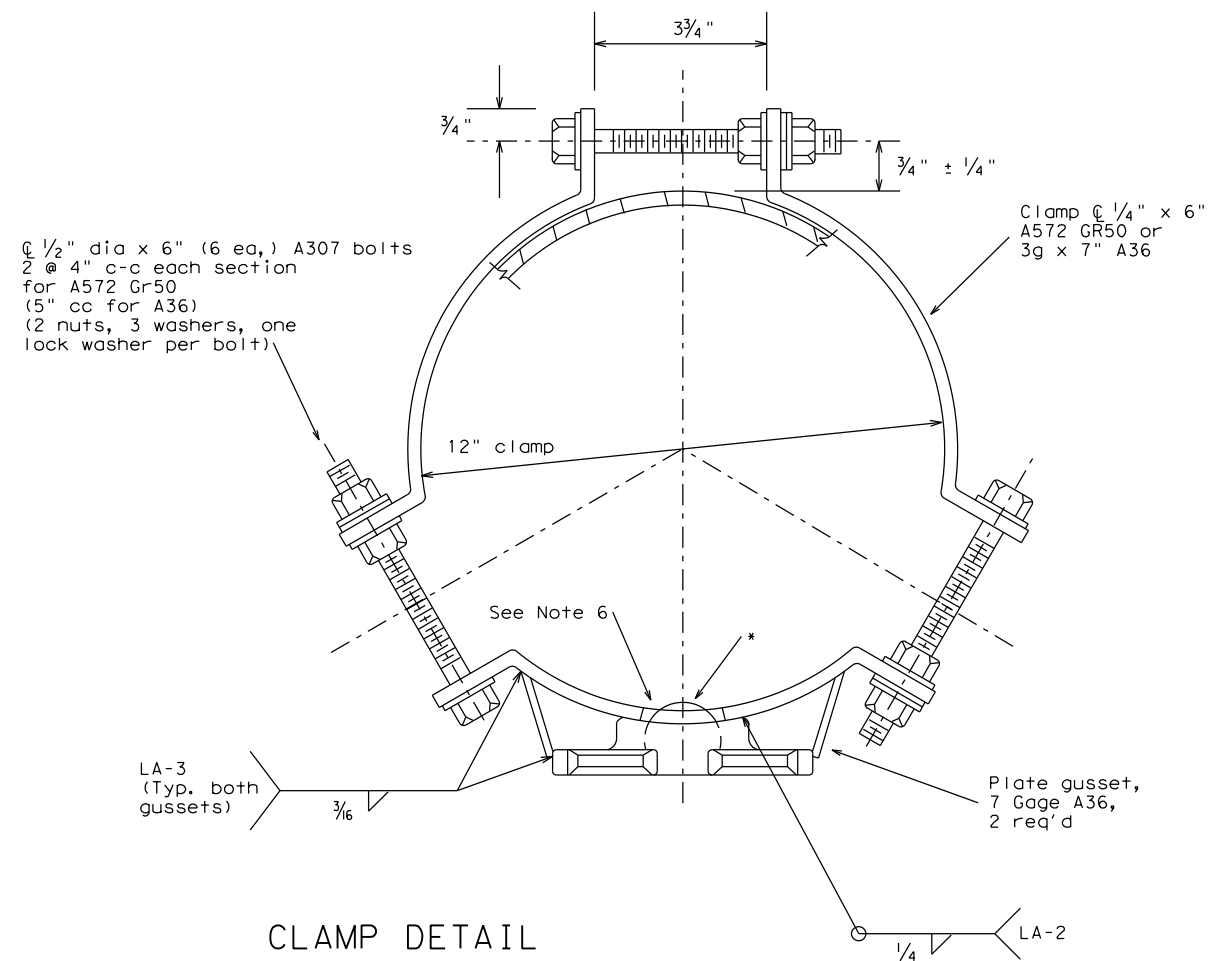
© TxDOT August 1995		DN: LEH		CK: JSY	DW: LTT	CK: TEB
5-96 1-99 1-12	REVISIONS	CONT	SECT	JOB		HIGHWAY
						SH 46
		DIST	COUNTY			SHEET NO.
		SAT	GUADALUPE			TS-22

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

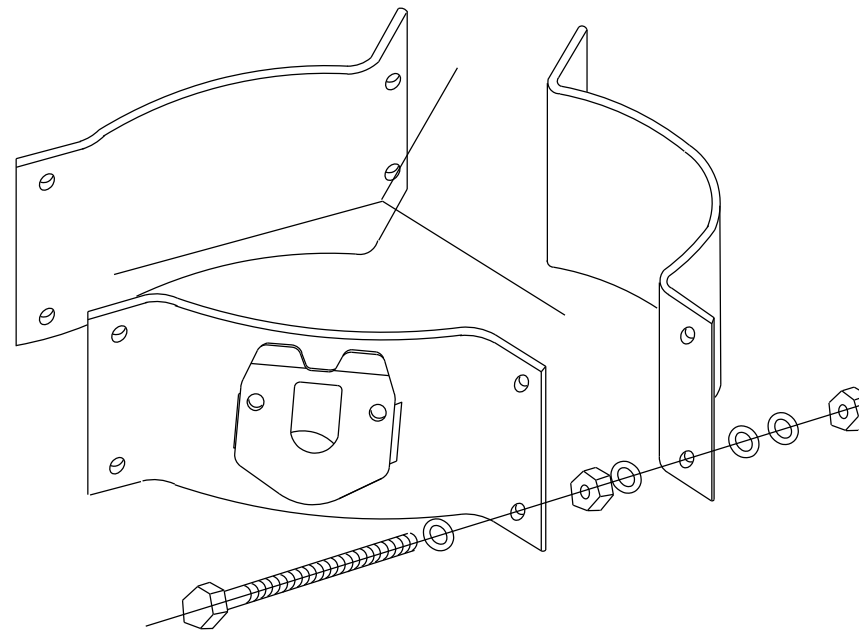
DATE:  
FILE:



POLE SIMPLEX DETAILS



CLAMP DETAIL



For 8.9 - 12 inch diameter Signal Poles  
(Two req'd for each mast arm)

OTHER MATERIALS:

1. Pole simplex shall be ASTM A27 GR65-35 or A148 GR80-50 or A576 GR1021. ASTM A576 must be suitable for forging and also meet minimum tensile of 65ksi, minimum yield of 35ksi, and a minimum elongation of 22 percent in 2 inches.
2. Welded tabs and backplates shall be ASTM A-36 steel or better.
3. Nylon insert locknuts shall conform to ASTM A563.

GENERAL NOTES:

1. Materials and fabrication shall be in accordance with Standard Sheet "MA-C" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absence of specified fabrication tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.
2. All parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing". The throat of the Simplex shall be made free of all rough or sharp edges resulting from the galvanizing process.
3. Each simplex fitting shall be supplied with 2 ASTM A325 bolts, 1/2 in. X 1 1/2 in. and 2 lock washers. The bolts and lock washers shall be secured to the clamp with the other hardware items. The Fabricator shall ship clamp assembly together in a single package, including all bolts, nuts, and washers required for the clamp and simplex fitting.
4. Design conforms to 1994 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interim revisions thereto. Design Wind Speed equals 80 mph plus a 1.3 gust factor. Clamps are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq. ft., 12 ft. maximum arm length.
5. Each assembly shall consist of one upper piece simplex fitting having a smooth lip and one lower piece simplex fitting with the lip removed.
6. Approximately 2 in. diameter hole in upper mast arm clamp.



CLAMP ON  
FITTING ASSEMBLY FOR  
LUMINAIRE MAST ARM

CFA-12

© TxDOT		DN: KAB	CK: RES	DW: FDN	CK: CAL
REVISIONS		CONT	SECT	JOB	HIGHWAY
11-99	1-12				SH 46
		DIST	COUNTY		SHEET NO.
		SAT	GUADALUPE		TS-23

**DISCLAIMER:**  
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

- DATE: \_\_\_\_\_  
FILE: \_\_\_\_\_

- ### Wiring Diagram Notes:

- Decorative LED Lighting Notes:


- 
- Diagram of a Driver Enclosure showing dimensions and components:
- 1 5/8" Strut
  - 4" min
  - 2" min
  - 2" min
  - Driver
  - Driver Enclosure

The diagram shows a cable assembly with a T-junction. A central cable descends from a horizontal support structure and splits into two parallel conductors. These conductors are labeled L1 and L2. A third conductor, labeled G, is shown as a separate line. Numbered callouts are present: (1) points to a small square symbol on the G line; (2) points to the junction where the two main conductors meet; (3) points to a small square symbol on the L1 line.

L1, L2 = Hot Conductors  
G = Grounding Conductor

### TYPICAL WIRING DIAGRAM

LUMINAIRES SERVED AT 480V ON 240/480 VOLT SERVICE OR LUMINAIRES SERVED AT 240V FOR 120/240 VOLT SERVICE.



**Texas Department of Transportation**

**Traffic  
Safety  
Division  
Standard**

# ROADWAY ILLUMINATION DETAILS

## RID(1) - 20

FILE#      rid1-20.dgn	DN#	CK#	DW#	CK#
© TxDOT      January 2007	CONT	SECT	JOB	HIGHWAY
REVISIONS  7-17 12-20			SH 46	
	DIST		COUNTY	
	SAT		GUADALUPE	
72A				TS - 24

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:  
FILE:

GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.
2. Provide new and unused materials. Ensure that all materials and installations comply with the applicable articles of the National Electrical Code (NEC), TxDOT standards and specifications, National Electrical Manufacturers Association (NEMA), and are listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Lab (NRTL). NRTLs such as Canadian Standard Association (CSA), Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Where reference is made to NEMA listed devices, International Electrotechnical Commission (IEC) listed devices will not be considered an acceptable equal to a NEMA listed device. Acceptable devices may have both a NEMA and IEC listing. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection. Replace or reinstall rejected material or equipment at no additional cost to the Department.
3. Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is 1/2 in. or less in diameter.
4. Provide the following test equipment as required by the Engineer to confirm compliance with the contract and the NEC: voltmeter, ammeter, megohm meter (1000 volt DC), ground resistance tester, torque wrenches, and torque screwdrivers. Ensure all equipment has been properly calibrated within the last year. Provide calibration certification to the Engineer upon request. Operate test equipment during inspection as requested by the Engineer.
5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic conduits; metal poles; luminaires; and metal enclosures are bonded to the equipment grounding conductor. Provide stranded bare copper or green insulated grounding conductors. Ground rods, connectors, and bonding jumpers are subsidiary to the various bid items.
6. When required by the Engineer, notify the Department in writing of materials from the Material Producers List (MPL) intended for use on each project. Prequalified materials are listed on the MPL on TxDOT's website under "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials on this list.

CONDUIT

A. MATERIALS

1. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.
2. Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.
3. Unless otherwise shown on the plans, provide junction boxes with a minimum size as shown in the following table, which applies to the greatest number of conductors entering the box through one conduit with no more than four conduits per box. When a mixture of conductor sizes is present, count the conductors as if all are of the larger size. For situations not applicable to the table, size junction boxes in accordance with NEC.


AWG	3 CONDUCTORS	5 CONDUCTORS	7 CONDUCTORS
#1	10" x 10" x 4"	12" x 12" x 4"	16" x 16" x 4"
#2	8" x 8" x 4"	10" x 10" x 4"	12" x 12" x 4"
#4	8" x 8" x 4"	10" x 10" x 4"	10" x 10" x 4"
#6	8" x 8" x 4"	8" x 8" x 4"	10" x 10" x 4"
#8	8" x 8" x 4"	8" x 8" x 4"	8" x 8" x 4"

4. Junction boxes with an internal volume of less than 100 cu. in. and supported by entering raceways must have threaded entries or hubs identified for the intended purpose and supported by connection of two or more rigid metal conduits. Secure conduit within 3 ft. of the enclosure or within 18 in. of the enclosure if all conduit entries are on the same side. Mechanically secure all junction boxes with an internal volume greater than 100 cu. inches.
5. Provide hot dipped galvanized cast iron or sand cast aluminum outlet boxes for junction boxes containing only 10 AWG or 12 AWG conductors. Do not use die cast aluminum boxes. Size outlet boxes according to the NEC.
6. Do not use intermediate metal conduit (IMC) or electrical metallic tubing (EMT) unless specifically required by the plan sheets. When EMT is called for, provide junction boxes made from galvanized steel sheeting, listed and approved for outdoor use, unless otherwise noted on the plans. Size all galvanized steel junction boxes in accordance with the NEC. Provide junction boxes for IMC conduit systems that meet the same requirements for junction boxes used with RMC systems.
7. Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC elbow is buried less than 18 in., ground the RMC elbow by means of a grounding bushing on a rigid metal extension. Grounding of the rigid metal elbow is not required if the entire RMC elbow is encased in a minimum of 2 in. of concrete. PVC extensions are allowed on these concrete encased rigid metal elbows. RMC or PVC elbows are subsidiary to various bid items.
9. When required, provide High-Density Polyethylene (HDPE) conduit with factory installed internal conductors according to Item 622 "Duct Cable." At the Contractor's request and with approval by the Engineer, substitute HDPE conduit with no conductors for bored schedule 40 or schedule 80 PVC conduit bid under Item 618. Ensure bored HDPE substituted for PVC is schedule 40 and of the same size PVC called for in the plans. Ensure the substituted HDPE meets the requirements of Item 622, except that the conduit is supplied without factory-installed conductors. Make the transition of the HDPE conduit to PVC (or RMC elbow when required) at the bore pit. Provide conduit of the size and schedule as shown on the plans. Do not extend substituted conduit into ground boxes or foundations. Provide PVC or galvanized steel RMC elbows as called for at all ground boxes and foundations.
10. Use two-hole straps when supporting 2 in. and larger conduits. On electrical service poles, properly sized stainless steel or hot dipped galvanized one-hole standoff straps are allowed on the service riser conduit.

B. CONSTRUCTION METHODS

1. Provide and install expansion joint conduit fittings on all structure-mounted conduits at the structure's expansion joints to allow for movement of the conduit. In addition, provide and install expansion joint fittings on all continuous runs of galvanized steel RMC conduit externally exposed on structures such as bridges at maximum intervals of 150 ft. When requested by the project Engineer, supply manufacturer's specification sheet for expansion joint conduit fittings. Repair or replace expansion joint fittings that do not allow for movement at no additional cost to the Department. Provide the method of determining the amount of expansion to the Engineer upon request. Do not use LFMC or LFNC as a substitute for the required expansion conduit fittings.
2. Space all conduit supports at maximum intervals of 5 ft. Install conduit spacers when attaching metal conduit to surface of concrete structures. See "Conduit Mounting Options" on ED(2). Install conduit support within 3 ft. of all enclosures and conduit terminations.
3. Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.
4. Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or after the base or surfacing operation has begun. Backfill and compact the bore pits below the conduit per Item 476 "Jacking, Boring, or Tunneling Pipe or Box" prior to installing conduit or duct cable to prevent bending of the connections.
5. When placing conduit in the sub-grade of new roadways, backfill all trenches with excavated material unless otherwise noted on the plans. When placing conduit in the sub-base of new roadways, backfill all trenches with cement-stabilized base as per requirements of Items 110 "Excavation", 400 "Excavation and Backfill for Structures", 401 "Flowable Backfill", 402 "Trench Excavation Protection", and 403 "Temporary Special Shoring."
6. Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.
7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately after installation to prevent entry of dirt, debris and animals. Temporary caps constructed of durable duct tape are allowed. Tightly fix the tape to the conduit opening. Clean out the conduit and prove it clear in accordance with Item 618 prior to installing any conductors.
8. Ensure conduit entry into the top of any enclosure is waterproof by installing conduit sealing hubs or using boxes with threaded bosses. This includes surface mounted safety switches, meter cans, service enclosures, auxiliary enclosures and junction boxes. Grounding bushings on water tight sealing hubs are not required.
9. Fit the ends of all PVC conduit terminations with bushings or bell end fittings. Provide and install a grounding type bushing on all metal conduit terminations.
10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug, or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor. Bonding of conduit used as a casing under roadways for duct cable is not required, if the duct extends the full length through the casing.
11. At all electrical services, install a 6 AWG solid copper grounding electrode conductor.
12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).
13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.
14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.



**Traffic  
Operations  
Division  
Standard**

ELECTRICAL DETAILS  
CONDUITS & NOTES

ED(1) - 14

FILE: ed1-14.dgn	DN:	CK:	DW:	CK:
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS				SH 46
	DIST	COUNTY		SHEET NO.
	SAT	GUADALUPE		TS-25

71A



DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:  
FILE:

ELECTRICAL CONDUCTORS

A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS)11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.
2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.
3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.
4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.
2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.
3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight splice. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.
4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.
5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.
6. Support conductors in illumination poles with a J-hook at the top of the pole.
7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.
8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.
9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.
10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.
11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.
2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.
3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.
4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.
5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.

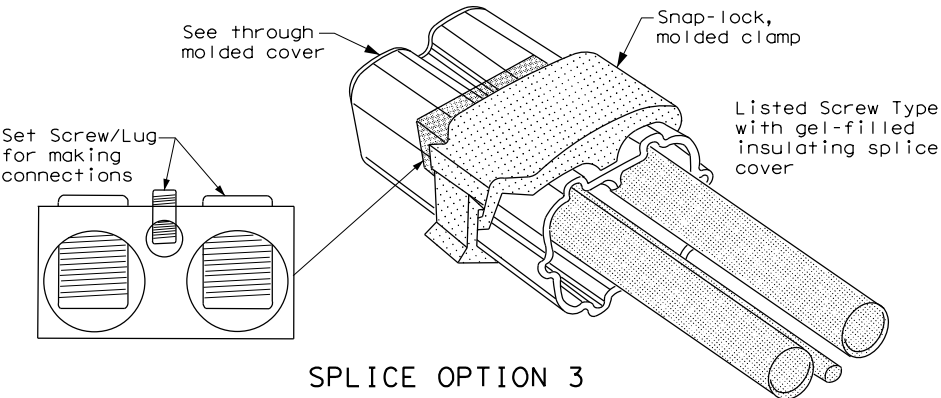
GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

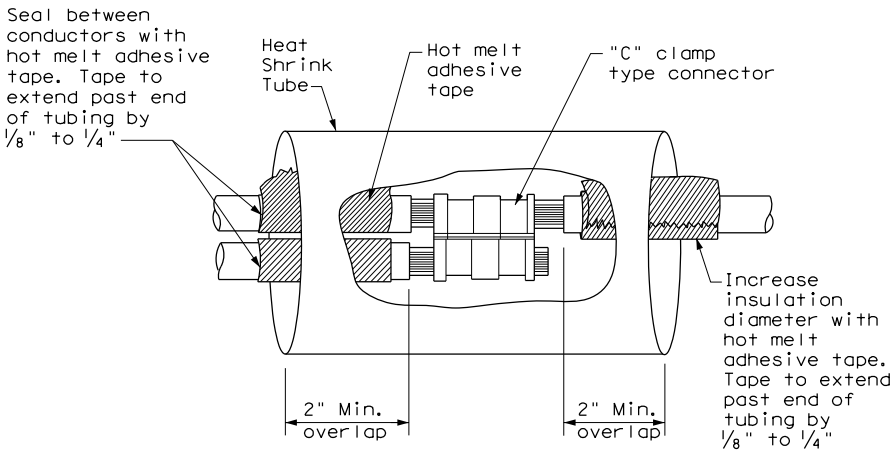
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

B. CONSTRUCTION METHODS

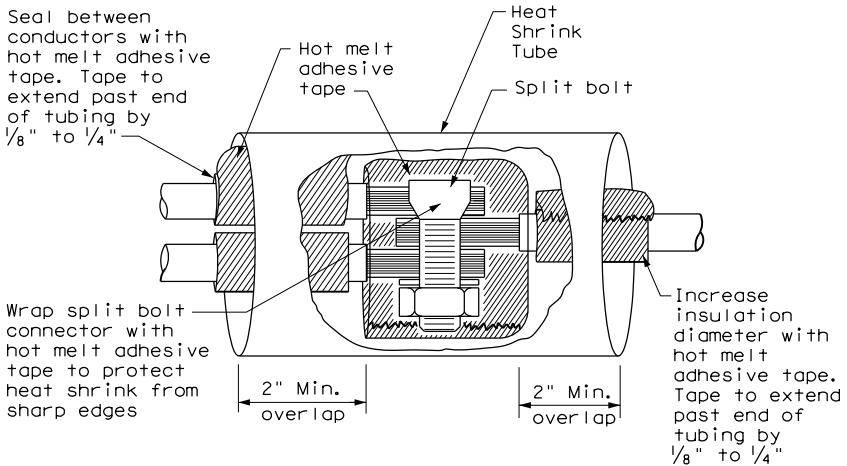
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.
2. Do not place ground rods in the same drilled hole as a timber pole.
3. Install ground rods so the imprinted part number is at the upper end of the rod.
4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.
6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.




SPLICE OPTION 3  
Listed Screw Type



SPLICE OPTION 1  
Compression Type



SPLICE OPTION 2  
Split Bolt Type



Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS

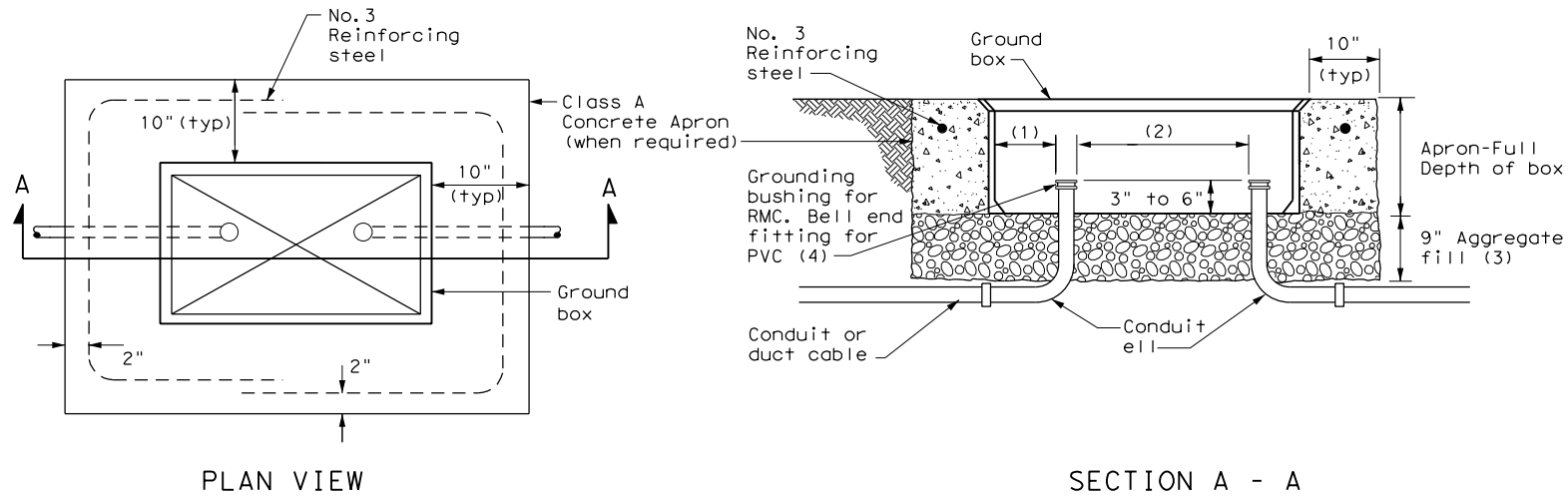
CONDUCTORS

ED (3) - 14

FILE:	ed3-14.dgn	DW:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	October 2014	CONT	SECT	JOB		HIGHWAY			
REVISIONS		0915	12	691		SH 46			
		DIST	COUNTY			SHEET NO.			
		SAT	GUADALUPE			TS-26			

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:  
FILE:



### APRON FOR GROUND BOX

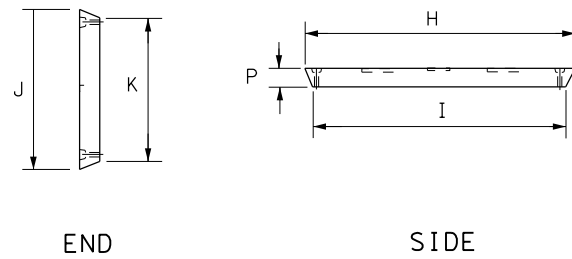
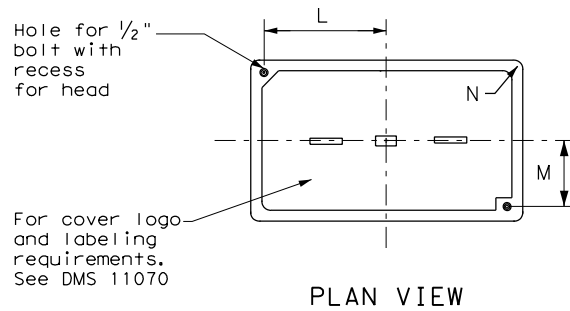
- (1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.
- (2) Maintain sufficient space between conduits to allow for proper installation of bushings.
- (3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.
- (4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

### GROUND BOX DIMENSIONS

TYPE	OUTSIDE DIMENSIONS (INCHES) (Width x Length X Depth)
A	12 X 23 X 11
B	12 X 23 X 22
C	16 X 29 X 11
D	16 X 29 X 22
E	12 X 23 X 17

### GROUND BOX COVER DIMENSIONS

TYPE	DIMENSIONS (INCHES)							
	H	I	J	K	L	M	N	P
A, B & E	23 1/4	23	13 3/4	13 1/2	9 7/8	5 1/8	1 3/8	2
C & D	30 1/2	30 1/4	17 1/2	17 1/4	13 1/4	6 3/4	1 3/8	2



### GROUND BOX COVER

### GROUND BOXES

#### A. MATERIALS


1. Provide polymer concrete ground boxes measuring 16x30x24 in. (WxLxD) or smaller in accordance with Departmental Material Specification (DMS) 11070 "Ground Boxes" and Item 624 "Ground Boxes."
2. Provide Type A, B, C, D, and E ground boxes as shown in the plans, and as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 624.

3. Ensure ground box cover is correctly labeled in accordance with DMS 11070.

4. Provide larger ground boxes in accordance with Item 624 and as shown in the plans.

#### B. CONSTRUCTION METHODS

1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the ground box. Install ground box on top of aggregate.
2. Cast ground box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Ground box aprons, including concrete and reinforcing steel, are subsidiary to ground boxes when called for by descriptive code.
3. Keep bolt holes in the box clear of dirt. Bolt covers down when not working in ground boxes.
4. Install all conduits and ells in a neat and workmanlike manner. Uniformly space conduits so grounding bushings and bell end fittings can easily be installed.
5. Temporarily seal all conduits in the ground box until conductors are installed.
6. Permanently seal conduits immediately after the completion of conductor installation and pull tests. Permanently seal the ends of all conduits with duct seal, expandable foam, or other method as approved. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a sealant.
7. When a ground rod is present in a ground box, bond all equipment grounding conductors together and to the ground rod with listed connectors.
8. When a type B or D ground box is stacked to meet volume requirements, it is allowable to cut an appropriately sized hole for conduit entry in the side wall at least 18 inches below grade.
9. If an existing ground box in the contract has a metal cover, bond the cover to the equipment grounding conductor with a 3 ft. long stranded bonding jumper the same size as the grounding conductor. The bonding jumper is subsidiary to various bid items. Verify existing ground boxes with metal covers are shown on the plans, with notes fully describing the work required.
10. If other ground boxes with metal covers are within the project limits but are not part of the contract, the Engineer may direct the Contractor to bond the metal covers, identifying the specific boxes in writing. This work will be paid for separately.
11. Bond metal ground box covers to the grounding conductor with a tank ground type lug.



Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS

GROUND BOXES

ED(4) - 14

FILE:	ed4-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT	October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS					SH 46
		DIST	COUNTY		SHEET NO.
		SAT	GUADALUPE		TS-27

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: FILE:

ELECTRICAL SERVICES NOTES

1. Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.
2. Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services," DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.
3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.
4. Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.
5. The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.
6. Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.
7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.
8. Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.
9. All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.
10. Provide rigid metal conduit (RMC) for all conduits on service, except for the 1/2 in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.
11. Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.
12. Ensure all mounting hardware and installation details of services conform to utility company specifications.
13. For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 1/2 in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.
14. When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 1/2 in. x 11 in before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.
15. Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of enclosure.
2. Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.
3. Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.
4. Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.
2. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

PHOTOELECTRIC CONTROL

1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

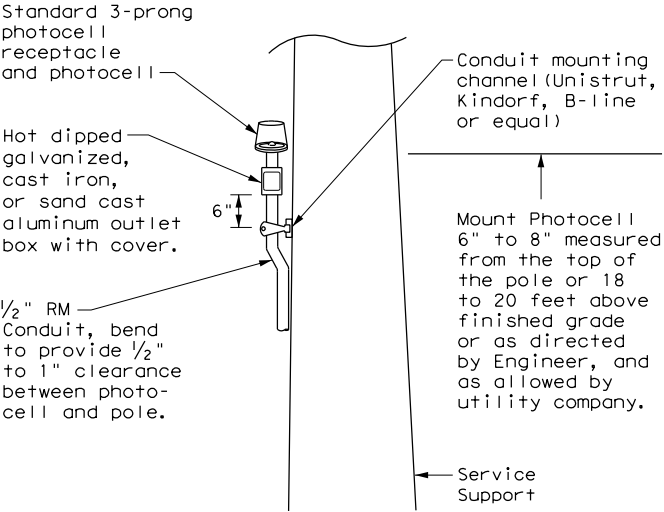
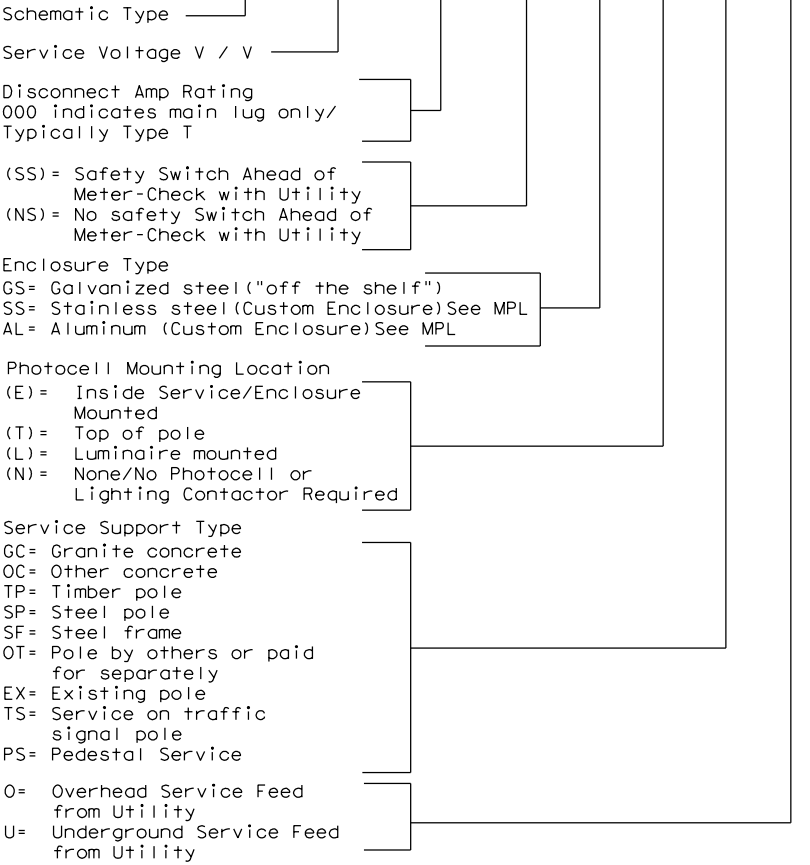
* ELECTRICAL SERVICE DATA												
Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit **Size	Service Conductors No./Size	Safety Switch Amps	Main Ckt. Bkr. Pole/Amps	Two-Pole Contractor Amps	Panelbd/ Loadcenter Amp Rating	Branch Circuit ID	Branch Ckt. Bkr. Pole/Amps	Branch Circuit Amps	KVA Load
SB 183	289	ELC SRV TY A 240/480 100(SS)AL(E)SF(U)	2"	3/#2	100	2P/100	100	N/A	Lighting NB	2P/40	26	28.1
									Lighting SB	2P/40	25	
									Underpass	1P/20	15	
NB Access	30	ELC SRV TY D 120/240 060(NS)SS(E)TS(O)	1 1/4"	3/#6	N/A	2P/60		100	Sig. Controller	1P/30	23	5.3
							30		Luminaïres	2P/20	9	
									CCTV	1P/20	3	
2nd & Main	58	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	1 1/4"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

\* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

\*\* Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National Electrical Code.

EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)



TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Traffic Operations Division Standard

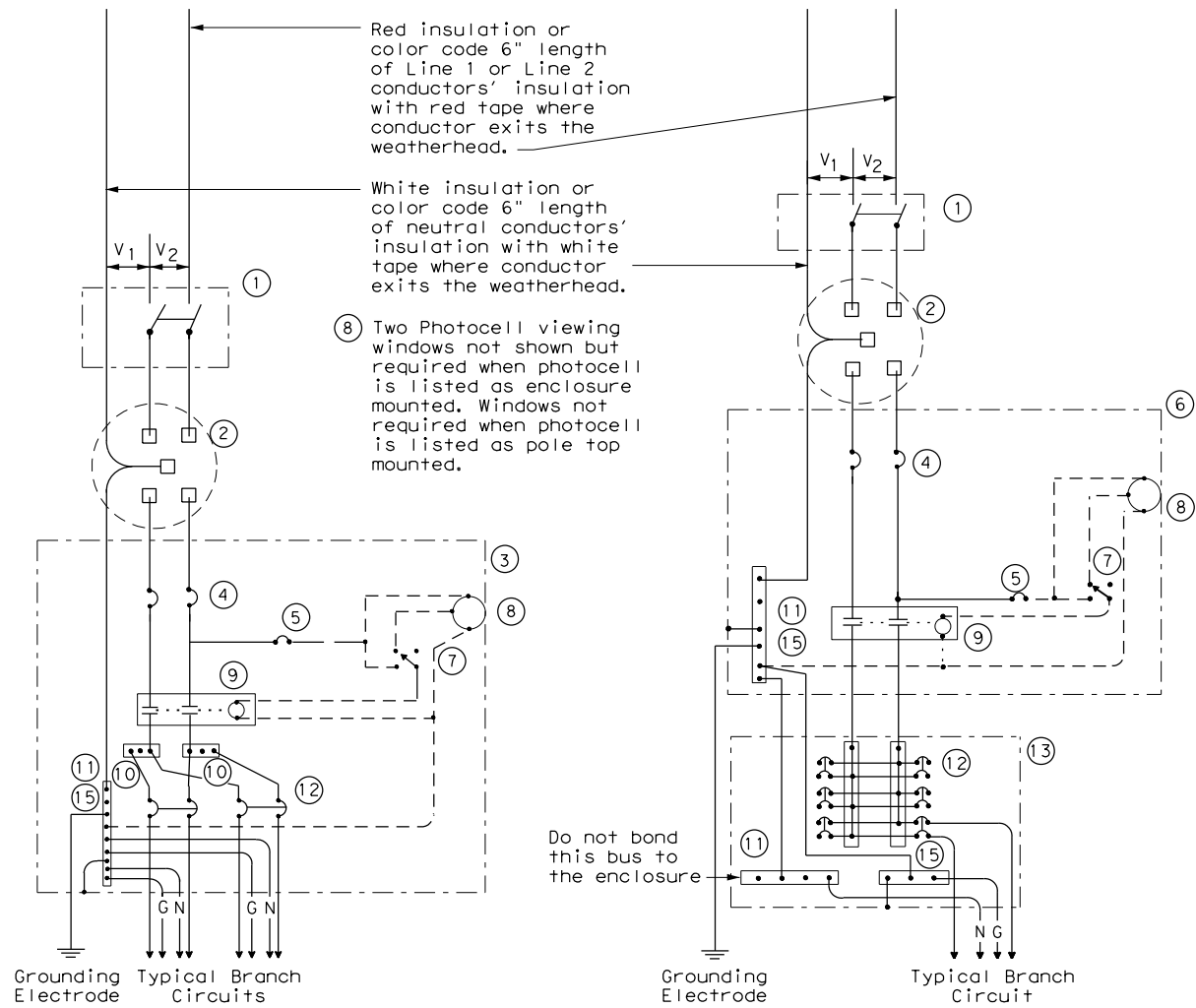
ELECTRICAL DETAILS  
SERVICE NOTES & DATA

ED(5) - 14

FILE: ed5-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0915	12	691	SH 46
	DIST	COUNTY		SHEET NO.
	SAT	GUADALUPE		TS-28

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

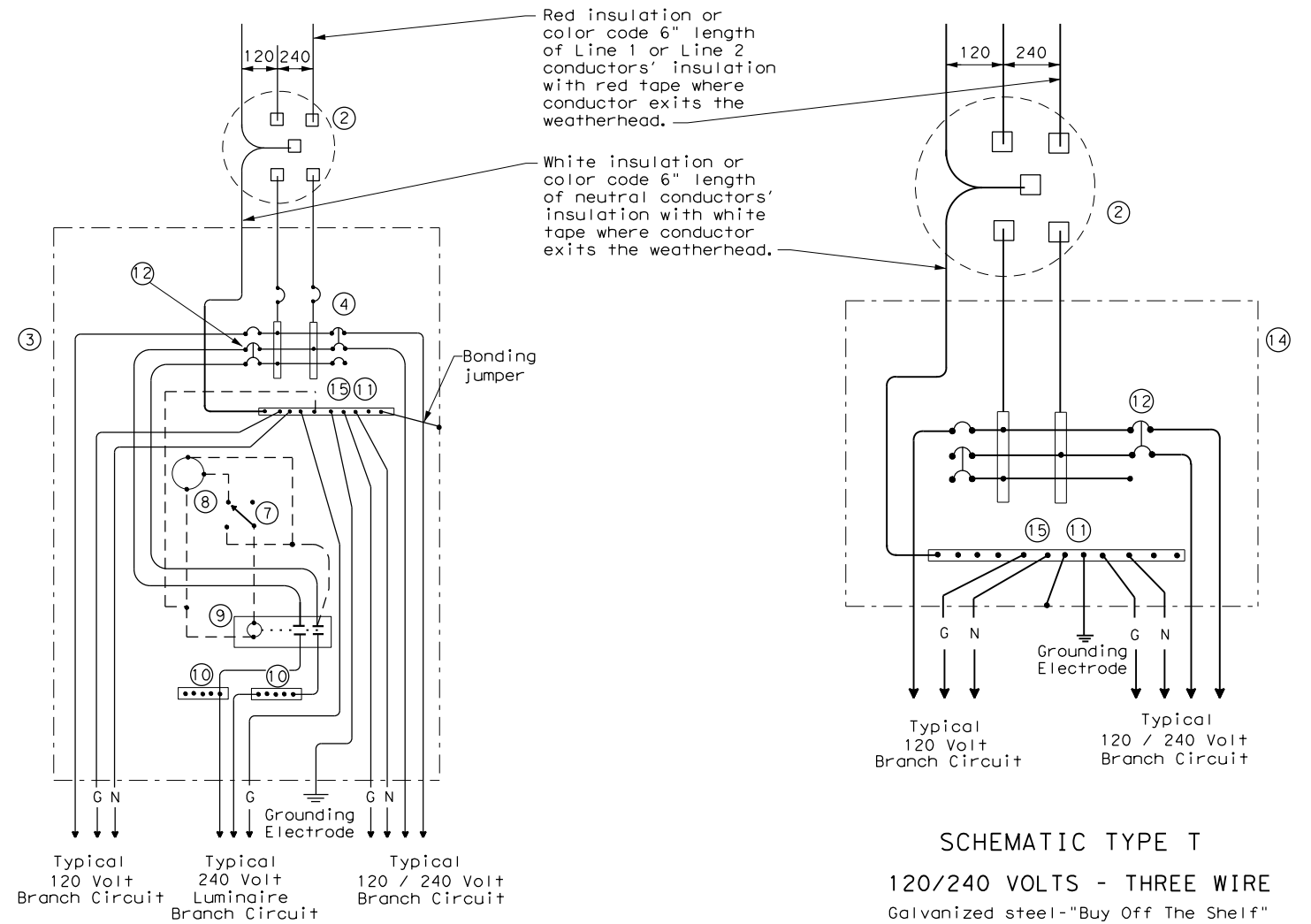
DATE:  
FILE:



SCHEMATIC TYPE A  
THREE WIRE

SCHEMATIC TYPE C  
THREE WIRE


WIRING LEGEND	
————	Power Wiring
-----	Control Wiring
—N—	Neutral Conductor
—G—	Equipment grounding conductor-always required



SCHEMATIC TYPE D - CUSTOM  
120/240 VOLTS - THREE WIRE

SCHEMATIC TYPE T  
120/240 VOLTS - THREE WIRE  
Galvanized steel-"Buy Off The Shelf" only. When required install photocell top of the pole or on luminaire only, no lighting contractor will be installed.

SCHEMATIC LEGEND	
1	Safety Switch (when required)
2	Meter (when required-verify with electric utility provider)
3	Service Assembly Enclosure
4	Main Disconnect Breaker (See Electrical Service Data)
5	Circuit Breaker, 15 Amp (Control Circuit)
6	Auxiliary Enclosure
7	Control Station ("H-O-A" Switch)
8	Photo Electric Control (enclosure-mounted shown)
9	Lighting Contactor
10	Power Distribution Terminal Blocks
11	Neutral Bus
12	Branch Circuit Breaker (See Electrical Service Data)
13	Separate Circuit Breaker Panelboard
14	Load Center
15	Ground Bus



Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS  
SERVICE ENCLOSURE  
AND NOTES  
ED (6) - 14

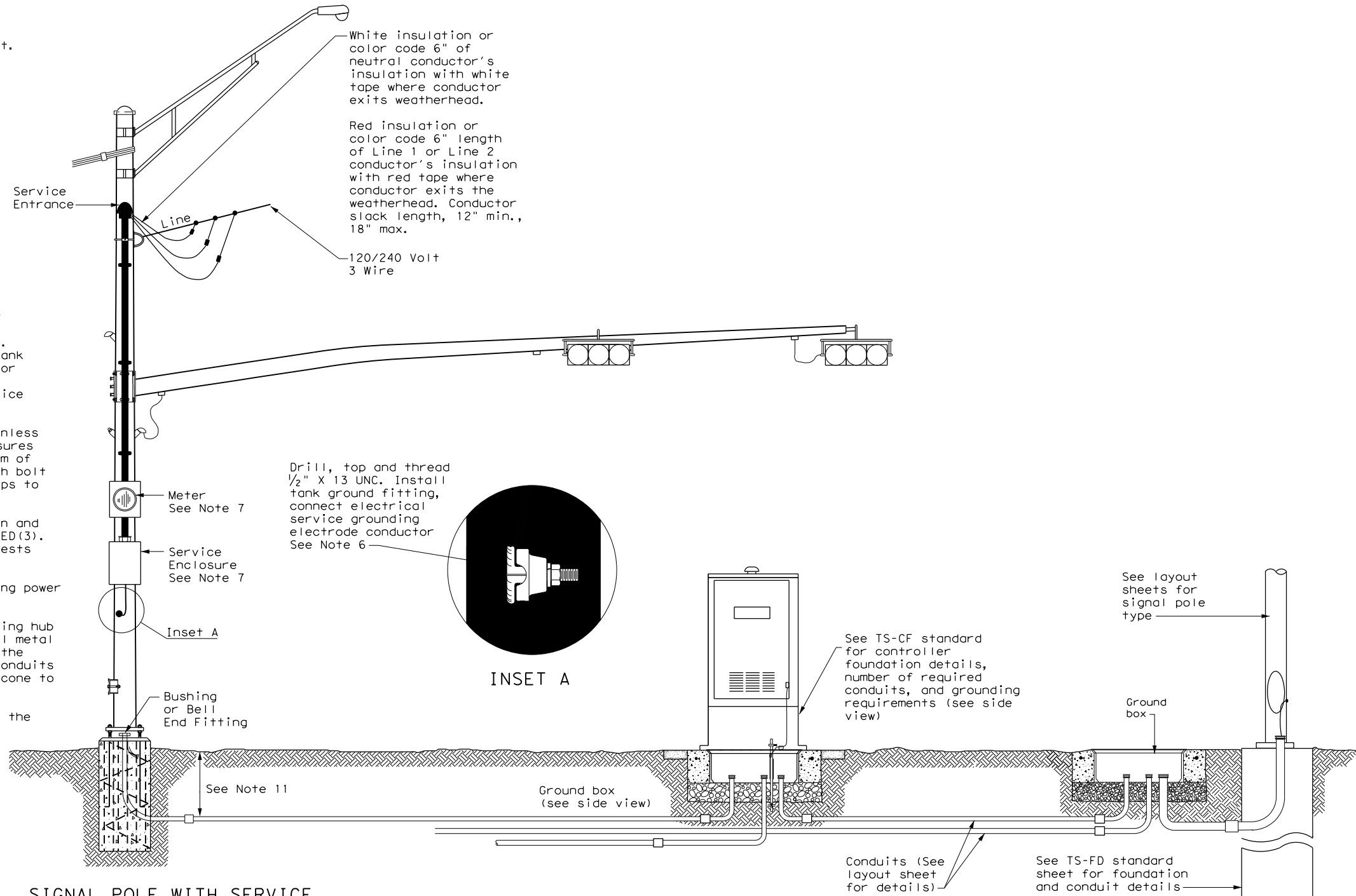
FILE:	ed6-14.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	October 2014	CONT	SECT	JOB		HIGHWAY			
REVISIONS						SH 46			
		DIST	COUNTY			SHEET NO.			
		SAT	GUADALUPE			TS-29			

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:  
FILE:

TRAFFIC SIGNAL NOTES

1. Do not pass luminaire conductors through the signal controller cabinet.
2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
3. Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies," except for performance testing of luminaires. Test installed roadway luminaires for proper operation as a part of the associated traffic signal system test.
4. If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green XHHW conductor.
5. Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors. Use listed mechanical connectors rated for embedment in concrete. See TxDOT standard TS-FD for further details.
6. Drill and tap signal poles for 1/2 in. X 13 UNC tank ground fitting. Provide and install tank ground fitting 4 in. to 6 in. directly below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Connect the electrical service grounding electrode conductor to the tank ground fitting. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. See Inset A detail for further information. Size service entrance conduit and branch circuit conduit as shown in the plans.
7. Mount electrical service enclosure and meter to signal pole with stainless steel bands. Ensure bands are a minimum width of 3/4 in. Secure enclosures to bands using two-bolt brackets. Install brackets near top and bottom of each enclosure. Install properly sized stainless steel washers on each bolt in the enclosure. Band or drill and tap properly sized stand-off straps to signal pole for attaching conduit.
8. Conduct pull tests and insulation resistance tests on all illumination and power conductors as required in Item 620 "Electrical Conductors" and ED(3). To prevent electronics damage, do not conduct insulation resistance tests on traffic signal cables after termination.
9. Lock all enclosures and bolt down all ground box covers before applying power to the signal installation.
10. Terminate conduits entering the top of enclosures with a conduit-sealing hub or threaded boss such as meter hub. Install a grounding bushing on all metal conduits not connected to conduit-sealing hub or threaded boss. Bond the grounding bushing to the ground bus with a bonding jumper. Seal all conduits entering enclosures with duct seal or expanding foam. Do not use silicone to seal conduit ends.
11. For all conduits, ensure the burial depth is a minimum of 18". Ensure the minimum burial depth for conduit placed under a roadway is 24".

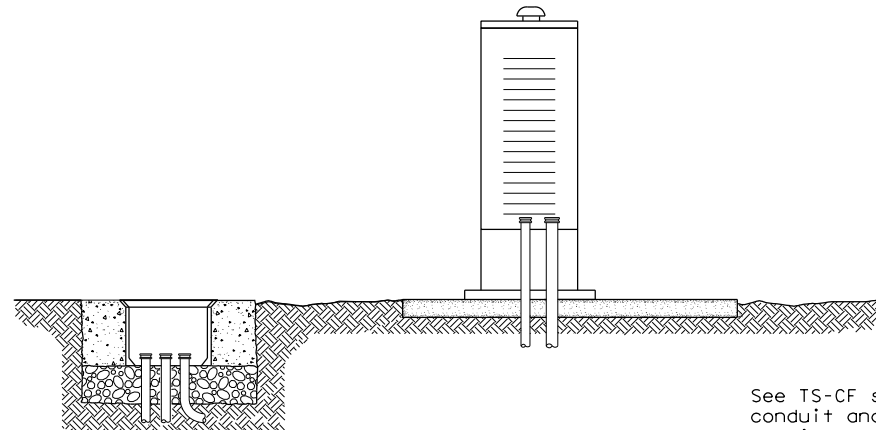


SIGNAL POLE WITH SERVICE


Type T electrical service mounted on signal pole shown as an example. See electrical details, layout sheets, and electrical service data chart for additional details.

SIGNAL CONTROLLER FRONT VIEW

SIGNAL POLE



SIGNAL CONTROLLER SIDE VIEW



Texas Department of Transportation

Traffic Operations  
Division  
Standard

ELECTRICAL DETAILS

TYPICAL TRAFFIC SIGNAL

SYSTEM DETAILS

ED (8) - 14

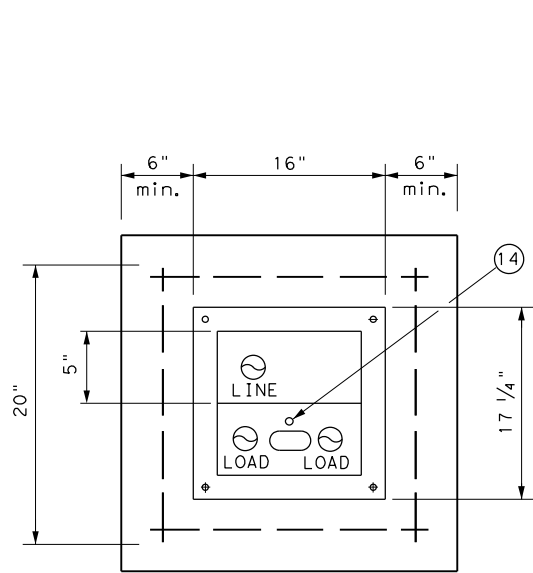
FILE: ed8-14.dgn	DW: TxDOT		CK: TxDOT		DW: TxDOT	CK: TxDOT
© TxDOT October 2014	CONT	SECT	JOB		HIGHWAY	
REVISIONS					SH 46	
	DIST	COUNTY			SHEET NO.	
	SAT	GUADALUPE			TS-30	

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

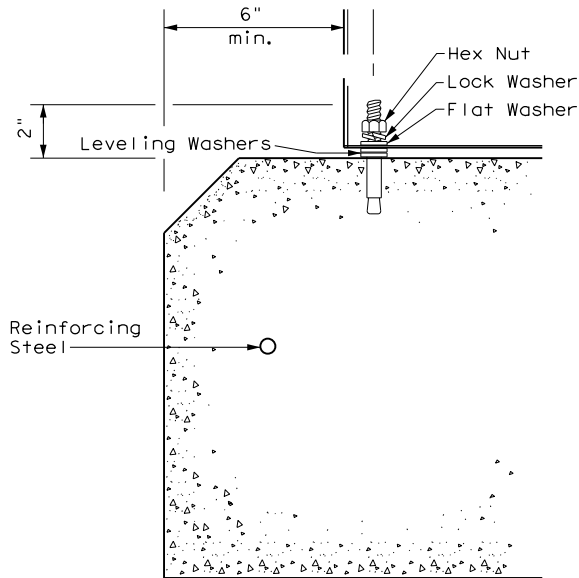
DATE:  
FILE:

PEDESTAL SERVICE NOTES

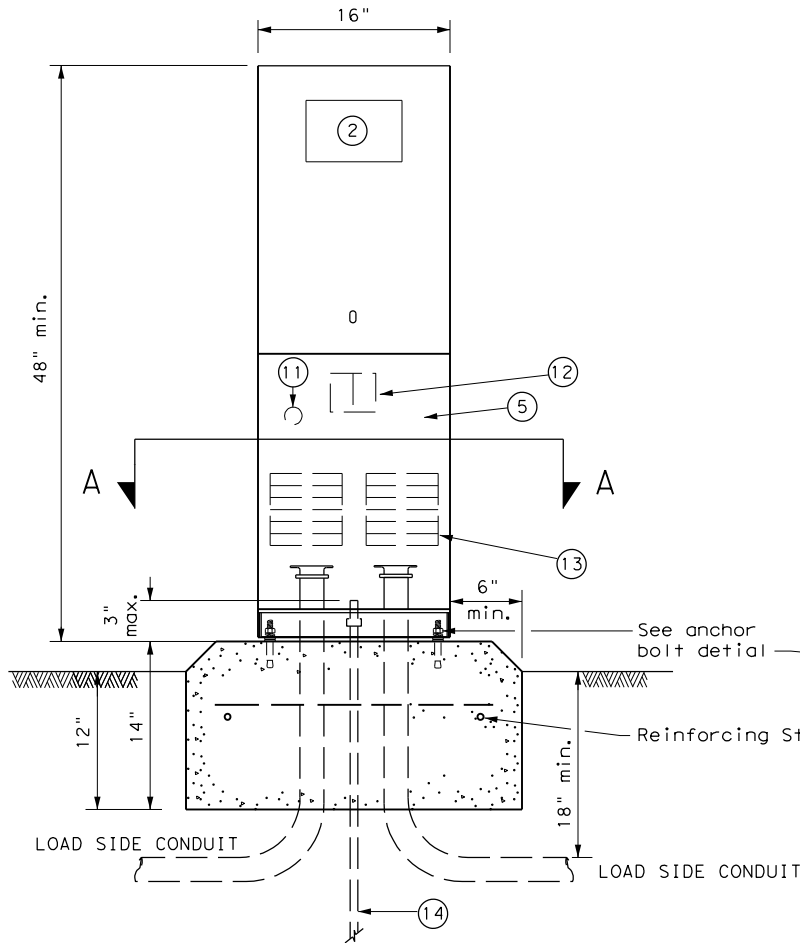
1. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS) 11080 "Electrical Services", 11085 "Electrical Services-Pedestal (PS)" and Item 628 "Electrical Services." Provide pedestal electrical services as listed on the Material Producers List (MPL) on the Department's web site under "Roadway Illumination and Electrical Supplies," Item 628. Ensure all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit any changes required by the utility company prior to manufacturing the pedestal enclosure.
2. When a meter socket is required, provide a socket with a minimum 100 amp rating that complies with local utility requirements.
3. Provide Class A or C concrete for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.
4. Provide #4 reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete."
5. Install 1/2 in. X 2 1/6 in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with a 1/2 in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.
6. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than 1/8 in. gap at any corner. Do not exceed a maximum dip or rise in the foundation of 1/8 in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within 1/4 in. Repair rocking or movement of the service enclosure at no additional cost to the department.
7. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.
8. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.



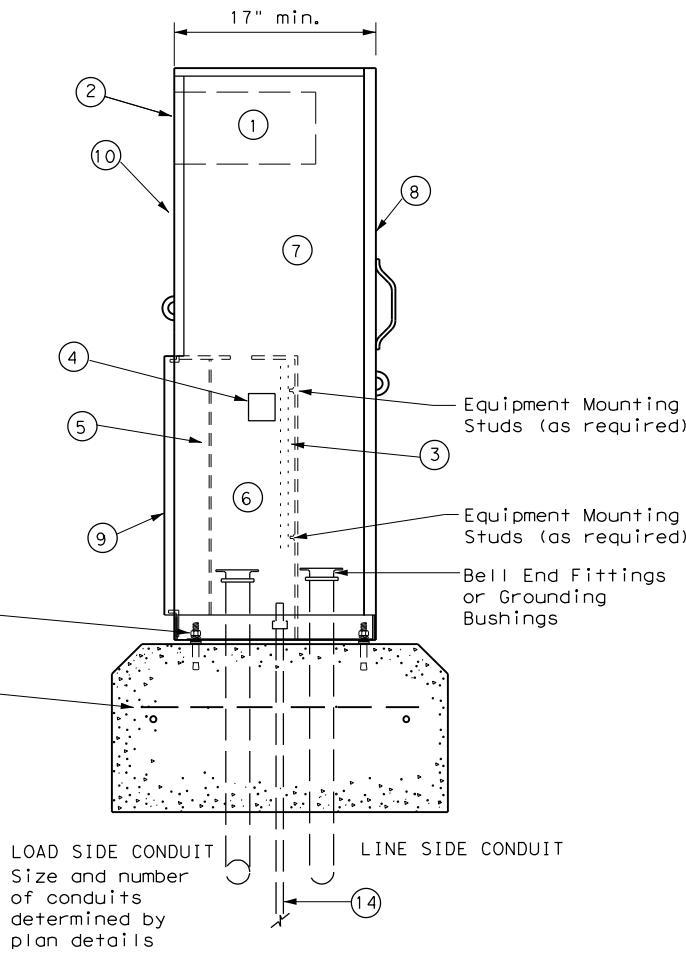
SECTION A-A



ANCHOR BOLT DETAIL



FRONT VIEW




SIDE VIEW

TYPE C shown, TYPE A similar except that TYPE A shall have individual circuit breakers (CB) mounted on an equipment mounting panel. CB Handles shall protrude through hinged deadfront trim.

LEGEND

1	Meter Socket, (when required)
2	Meter Socket Window, (when required)
3	Equipment Mounting Panel
4	Photo Electric Control Window, (When required)
5	Hinged Deadfront Trim
6	Load Side Conduit Trim
7	Line Side Conduit Area
8	Utility Access Door, with handle
9	Pedestal Door
10	Hinged Meter Access
11	Control Station (H-O-A Switch)
12	Main Disconnect
13	Branch Circuit Breakers
14	Copper Clad Ground Rod - 5/8" X 10'

**Texas Department of Transportation**

**Traffic Operations Division Standard**

**ELECTRICAL DETAILS**

**ELECTRICAL SERVICE SUPPORT**

**PEDESTAL SERVICE TYPE PS**

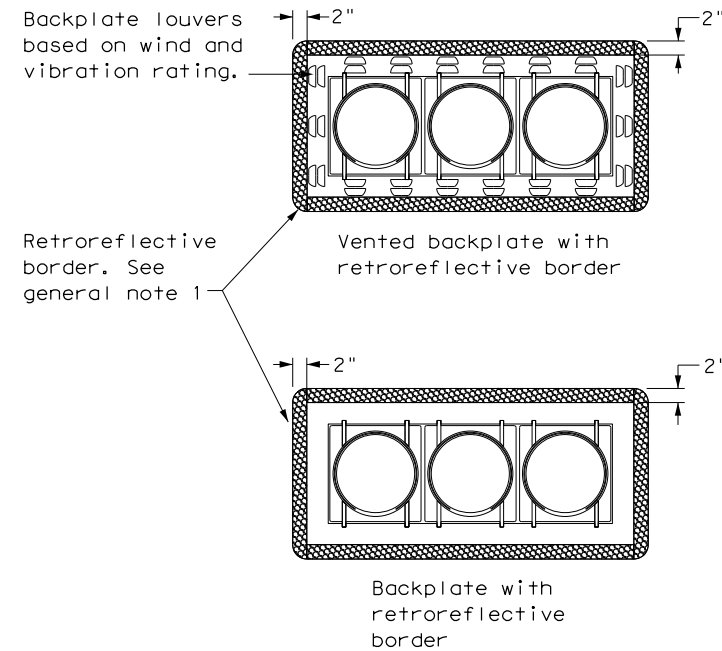
**ED(9) - 14**

FILE: ed9-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS				SH 46
	DIST	COUNTY	SHEET NO.	
	SAT	GUADALUPE	TS-31	

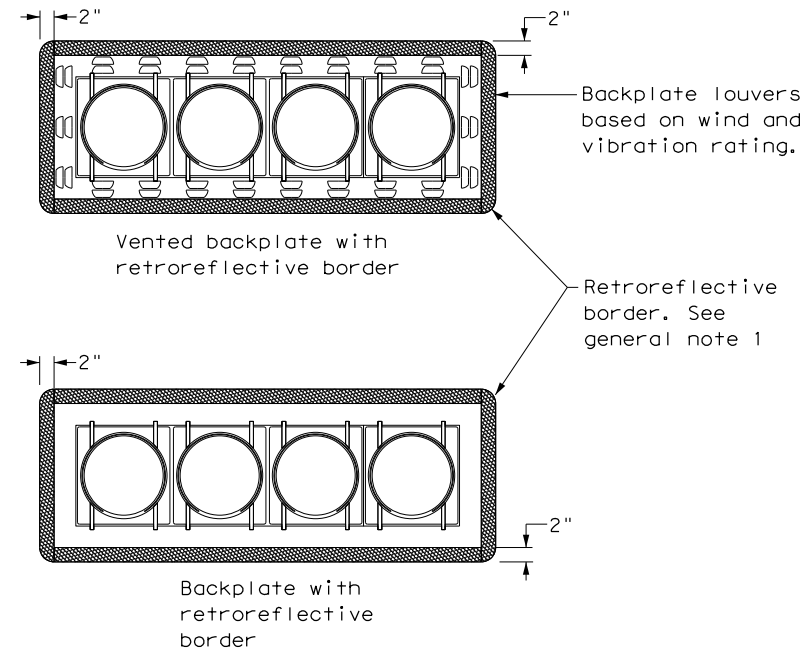


DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

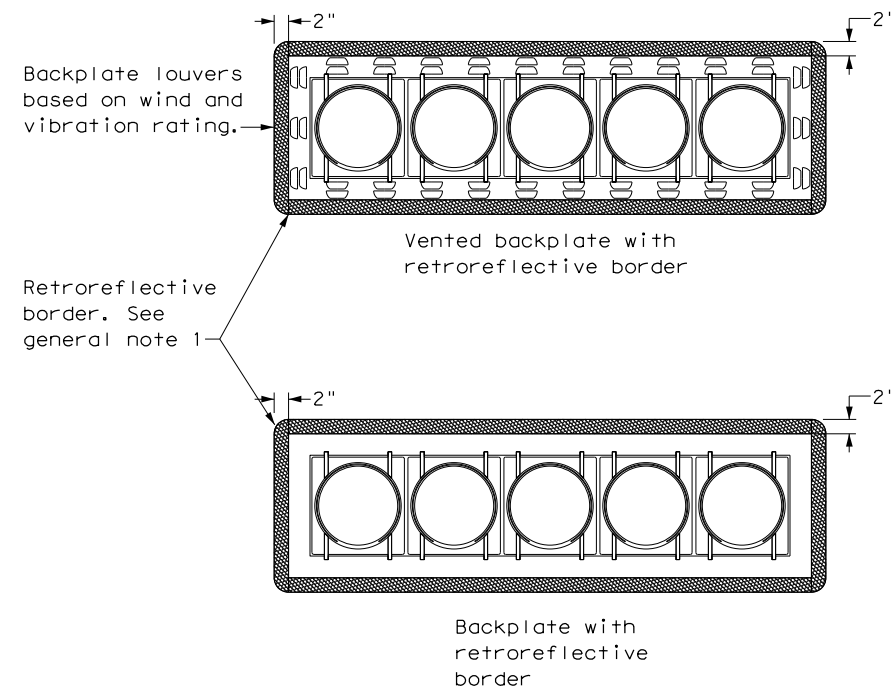
DATE:  
FILE:



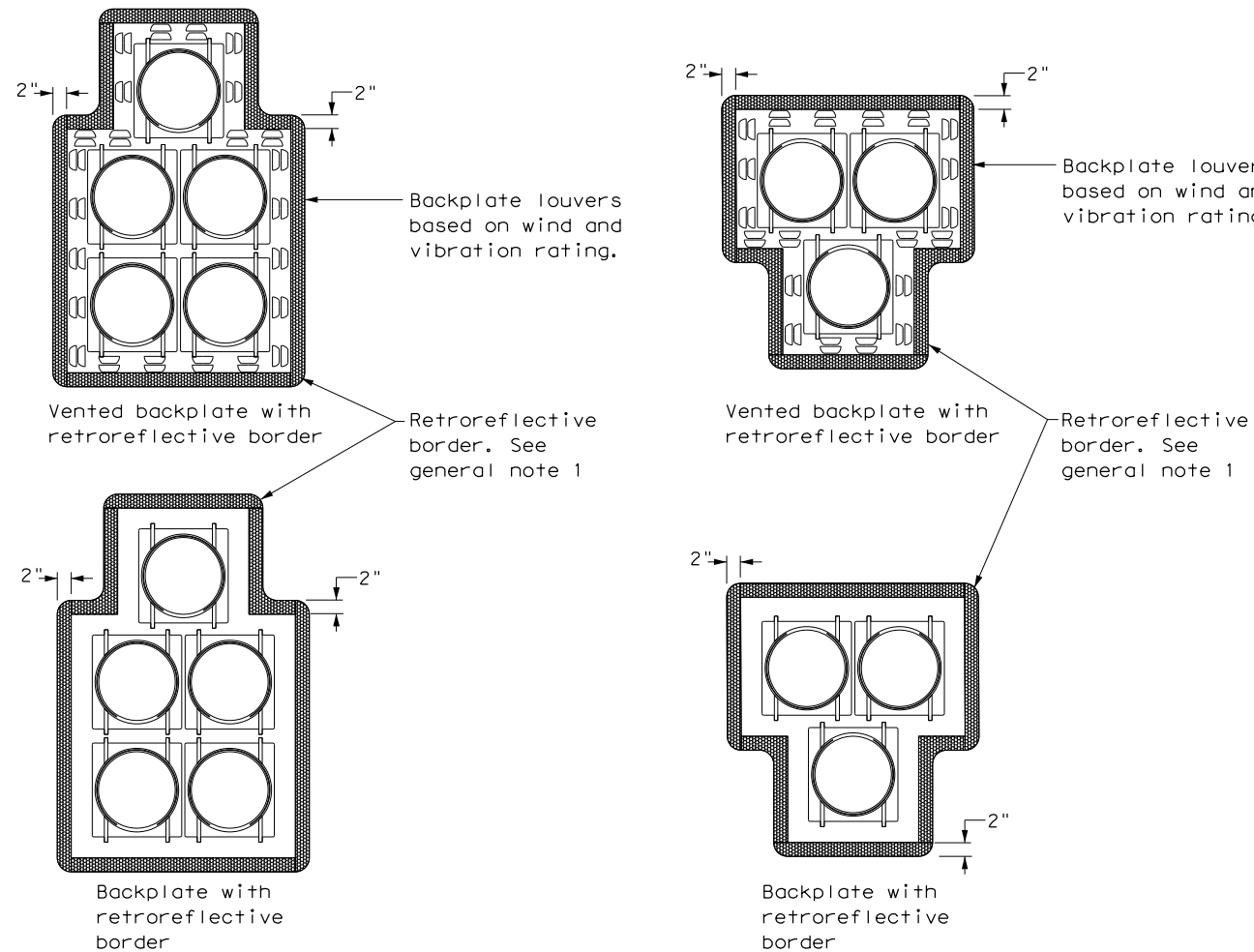
THREE-SECTION HEAD  
HORIZONTAL OR VERTICAL



FOUR-SECTION HEAD  
HORIZONTAL OR VERTICAL



FIVE-SECTION HEAD  
HORIZONTAL OR VERTICAL




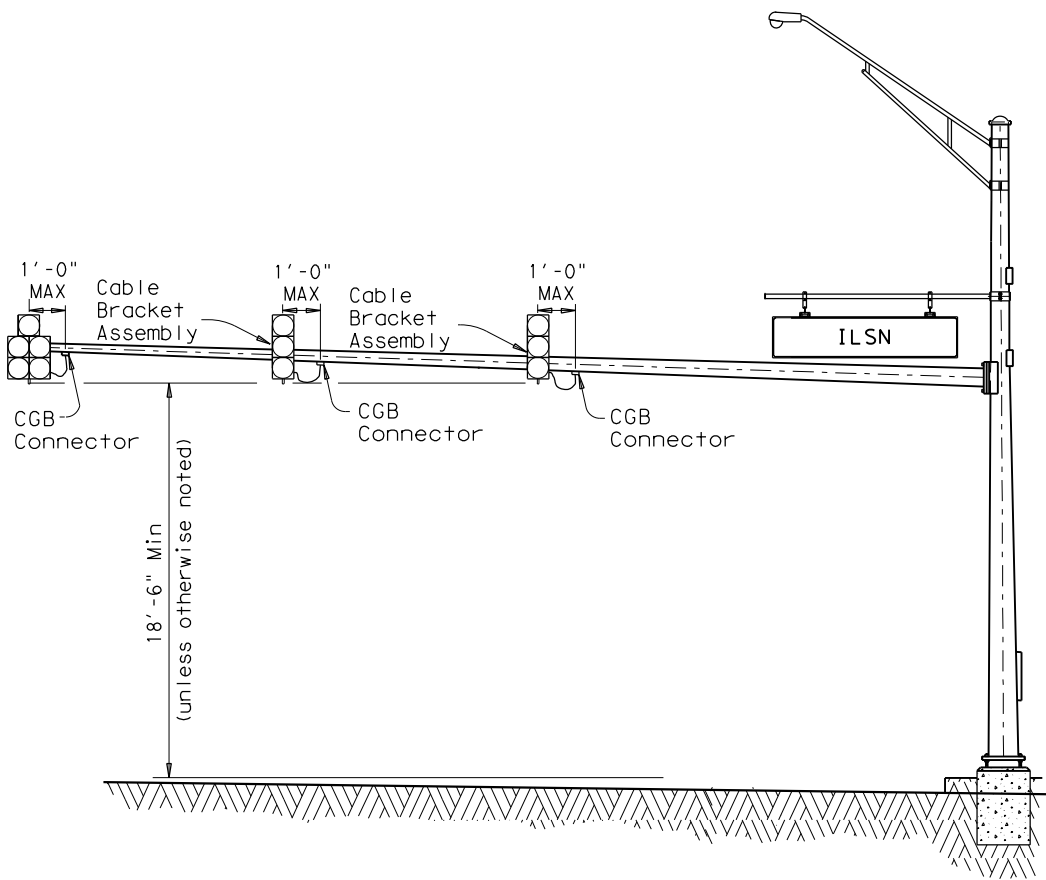
FIVE-SECTION HEAD  
CLUSTER

PEDESTRIAN HYBRID  
BEACON

#### GENERAL NOTES:

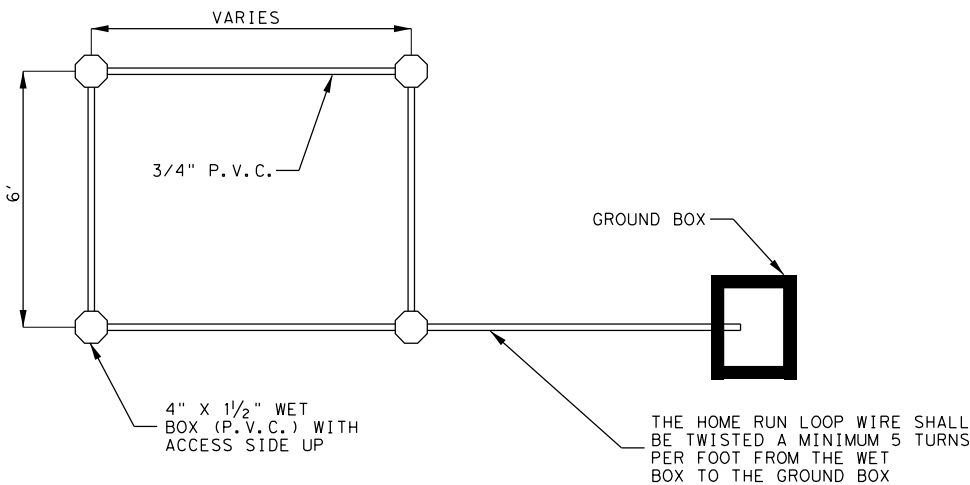
1. Backplates are optional for traffic signals and pedestrian hybrid beacons. When backplates are used, a 2-inch wide fluorescent yellow AASHTO Type B<sub>FL</sub> or C<sub>FL</sub> retroreflective border conforming to TxDOT DMS-8300 is required. Place on all approaches when used.
2. Signal head and backplate compatibility must be verified by the contractor prior to installation.
3. When using backplates on signal heads, venting is preferred to reduce cyclic vibration stress.
4. When a vented backplate is used, the retroreflective border must not be placed over the louvers.
5. This standard sheet applies to all signal heads with backplates, including but not limited to:
  - Pole mounted
  - Overhead mounted
  - Span wire mounted
  - Mast arm mounted
  - Vertical signal heads
  - Horizontal signal heads
  - Clustered signal heads
  - Pedestrian hybrid beacons

 <i>Texas Department of Transportation</i>				<i>Traffic Safety Division Standard</i>	
TRAFFIC SIGNAL HEAD WITH BACKPLATE  TS-BP-20					
FILE: ts-bp-20.dgn		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT June 2020		CONT	SECT	JOB	HIGHWAY
REVISIONS					SH 46
		DIST COUNTY			SHEET NO.
		SAT GUADALUPE			TS-32



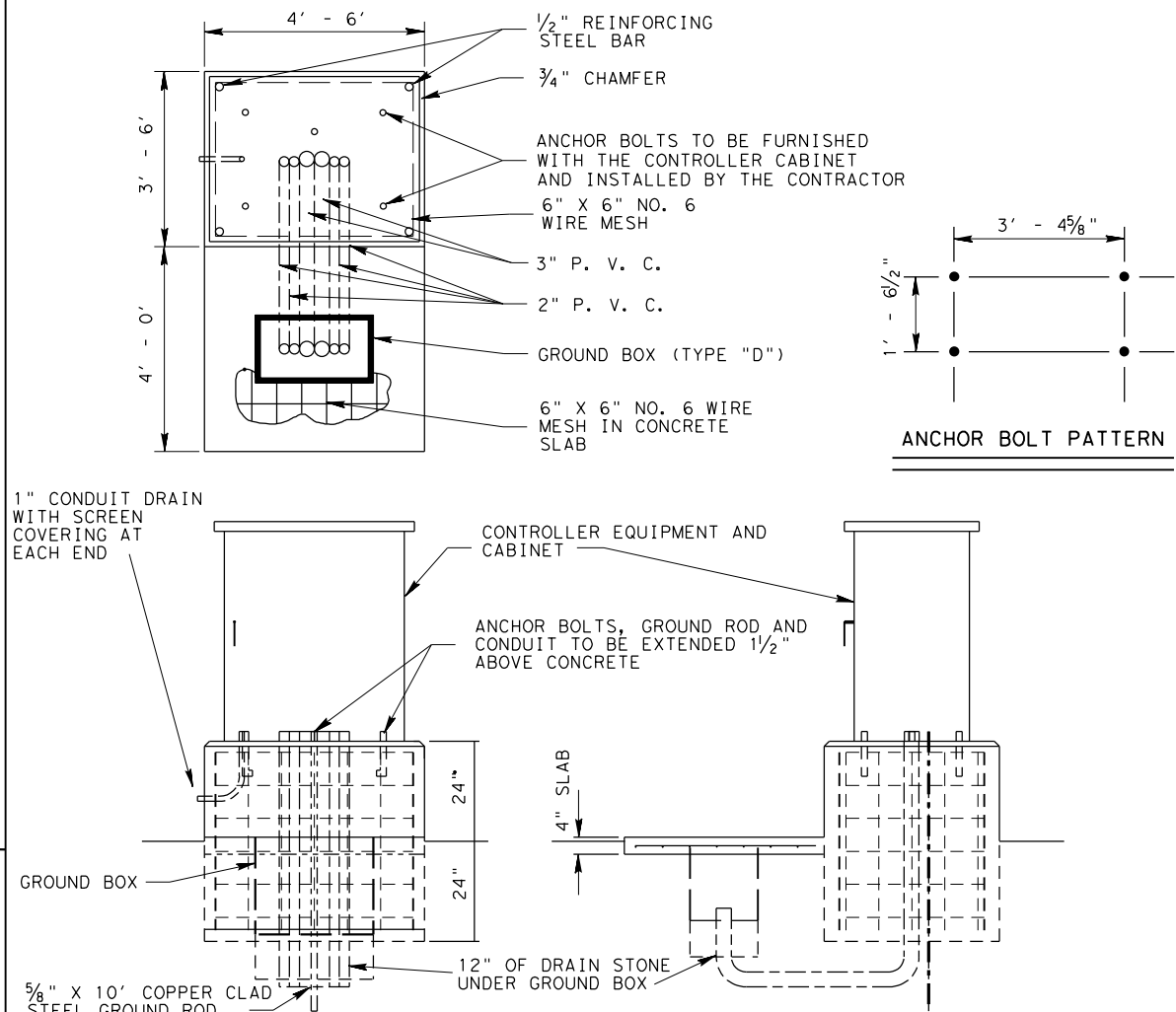
TYPICAL MAST ARM INSTALLATION

BACKPLATES ARE NOT SHOWN FOR CLARITY



NOTES:  
SHALL INSTALL CONDUIT ENCASED LOOPS AT THE LOCATIONS SHOWN ON THE PLANS USING 3/4 " DIAMETER PVC SCHEDULE 40 OR AT NO ADDITIONAL COST 1" DIAMETER PVC SCHEDULE 80.  
LOOP LOCATIONS MAY BE STAGGERED SLIGHTLY (6") TO ACCOMMODATE HOME RUN PLACEMENT.  
INDIVIDUAL HOME RUN CONDUITS SHALL BE EXTENDED TO THE GROUND BOX SHOWN ON THE PLANS FOR EACH LOOP INSTALLED.  
THE NUMBER OF LOOP WIRE TURNS SHALL BE AS SHOWN ON THE TYPICAL LOOP DETECTOR DETAILS.

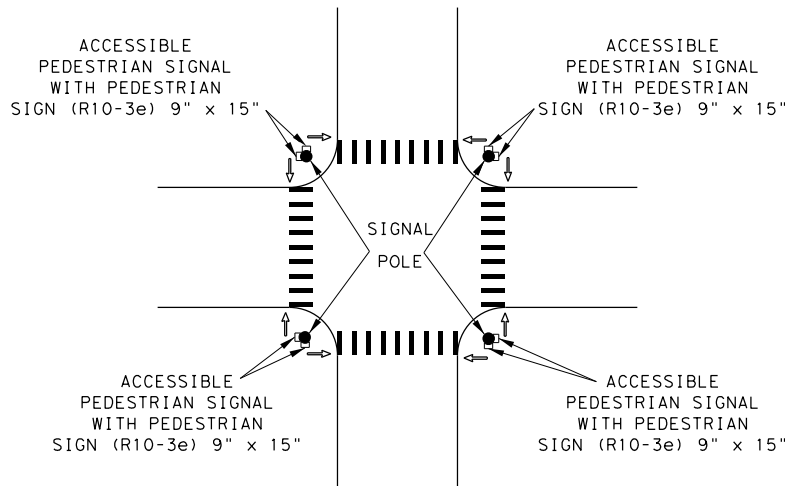
CONDUIT ENCASED LOOPS



CONTROLLER MOUNT NOTES :  
ALL WIRING TERMINATING IN THE CONTROLLER SHALL BE LABELED IN A MANNER THAT CAN BE IDENTIFIED WHEN THE CONTROLLER IS INSTALLED  
THE CONTRACTOR SHALL CONNECT THE FIELD WIRING TO THE CONTROLLER

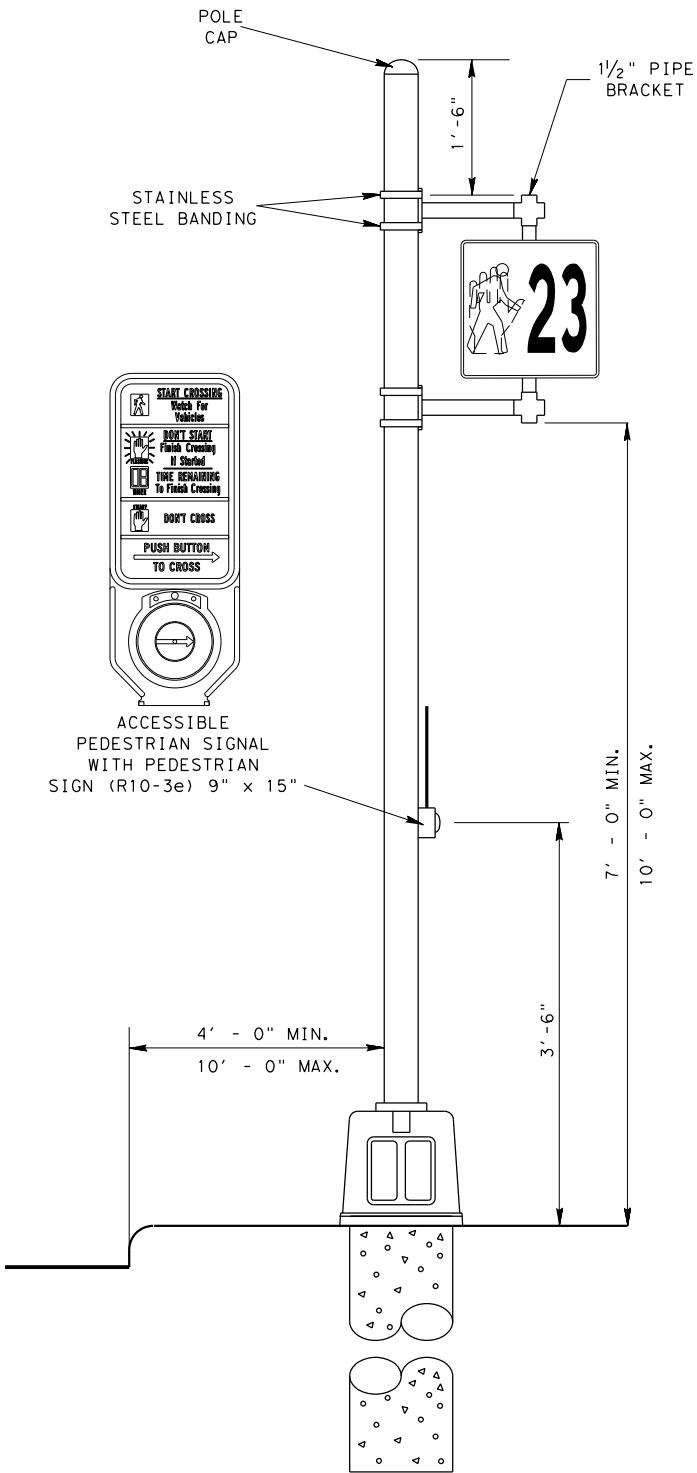
ONE 2" PVC SHALL REMAIN EMPTY FOR FUTURE USE  
CONCRETE SHALL BE TESTED AS MISCELLANEOUS CONCRETE  
ALL MATERIALS SHOWN AND LABOR TO INSTALL THE CONTROLLER FOUNDATION SHALL BE CONSIDERED SUBSIDIARY TO PERTINENT ITEMS  
CONTROLLER FOUNDATION SHALL BE AS SHOWN ON THE PLANS, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TYPICAL CONTROLLER MOUNT DETAILS




TYPICAL PED PUSH BUTTON LOCATION

THE ENGINEER SHALL VERIFY ALL PEDESTRIAN SIGNAL AND PEDESTRIAN PUSH BUTTON LOCATIONS PRIOR TO INSTALLATION.



TYPICAL PEDESTAL POLE ASSEMBLY

 Texas Department of Transportation © 2018			
San Antonio District Standard MISCELLANEOUS TRAFFIC SIGNAL DETAILS			
SCALE: NS			MTS-18
REVISIONS	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	
FEB 2006	6	SEE TITLE SHEET	
OCT 2007		STATE	DIST.
MAR 2017	2	SAT	COUNTY
MAY 2018		CONT.	SECT.
		JOB	HIGHWAY NO.
			SH 46

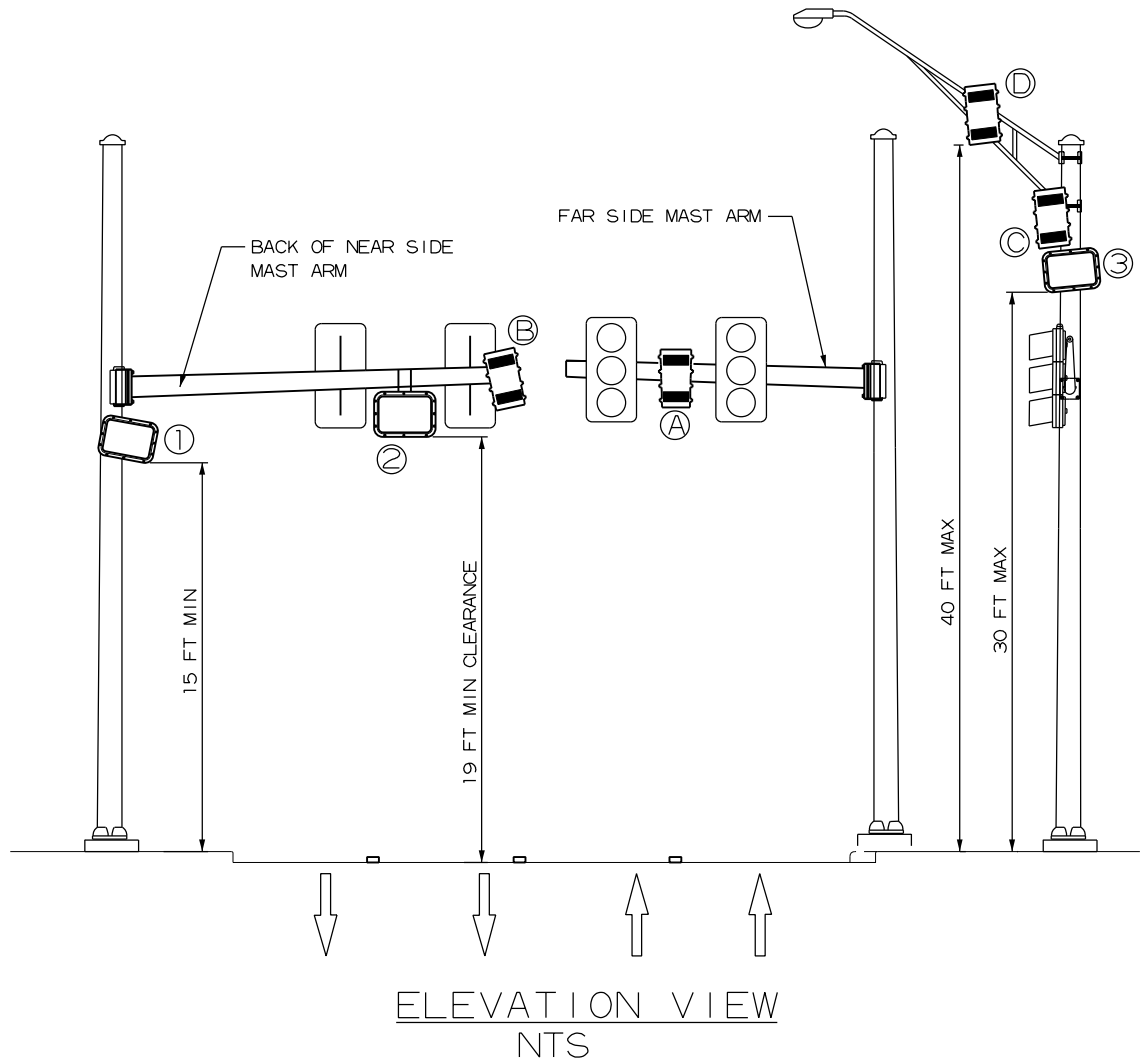
MOUNTING LOCATIONS

PRESENCE ( RPDD )

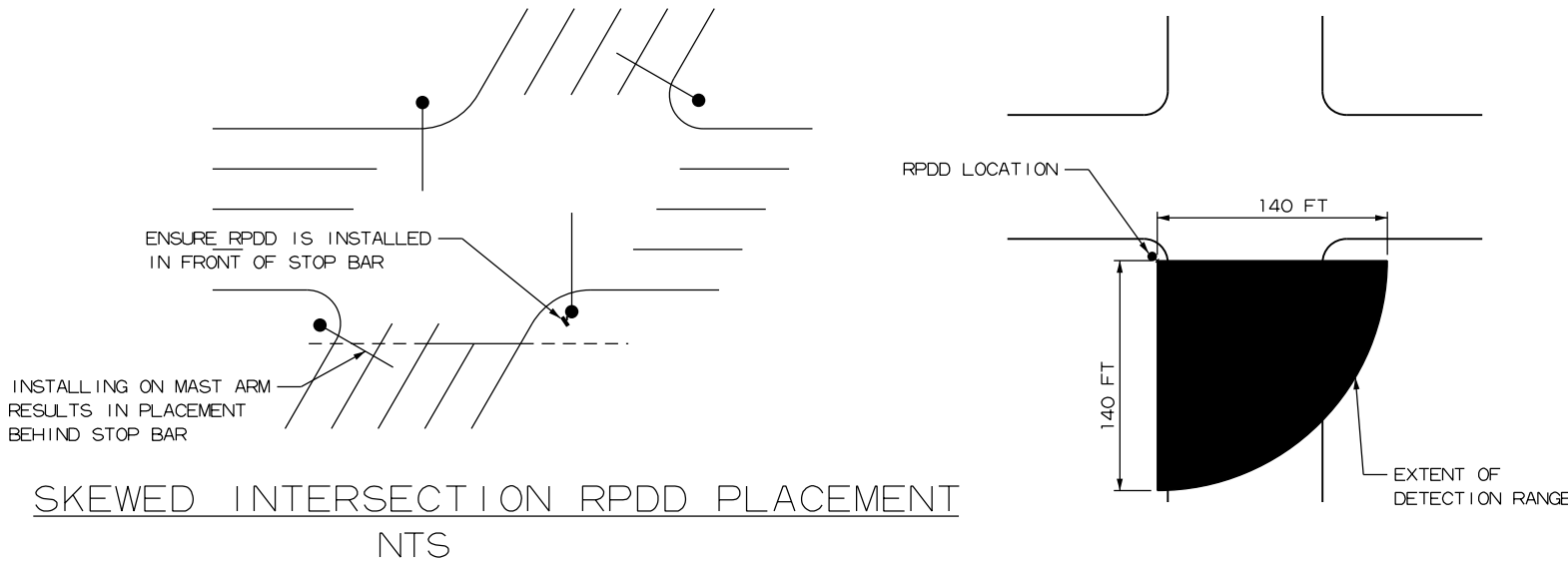
- ① PREFERRED PLACEMENT FOR MAST ARMS, STRAIN POLES AND TIMBER POLES. ON MAST ARM POLES, MOUNT BELOW CONNECTION OF MAST ARM TO A MINIMUM OF 15 FT., MOUNT AS HIGH AS POSSIBLE TO A MAXIMUM OF 30 FT ON STRAIN AND TIMBER POLES.
- ② PREFERRED PLACEMENT FOR MAST ARMS. MOUNT ON AND BELOW MAST ARM ON NEAR SIDE OF ARM.
- ③ ALTERNATE PLACEMENT LOCATION. MOUNT AS HIGH AS POSSIBLE TO A MAXIMUM OF 30 FT TO PREVENT OCCLUSION OF THE LEFT TURN LANES. THIS PLACEMENT TO BE USED ONLY IF RPDD CANNOT BE MOUNTED IN THE PREFERRED PLACEMENT LOCATIONS.

ADVANCE ( RADD )

- Ⓐ PREFERRED PLACEMENT FOR MAST ARMS. ALIGN RADD WITH CENTER OF TRAVEL LANES.
- Ⓑ ALTERNATE PLACEMENT FOR MAST ARMS. MOUNT ON BACK SIDE OF OPPOSING MAST ARM.
- Ⓒ STRAIN OR TIMBER POLE PLACEMENT. MOUNT ON NEAR SIDE POLE.
- Ⓓ ALTERNATE STRAIN OR TIMBER POLE PLACEMENT. MOUNT LUMINAIRE ARM ON NEAR SIDE POLE WITH A MAXIMUM 40 FT MOUNTING HEIGHT.

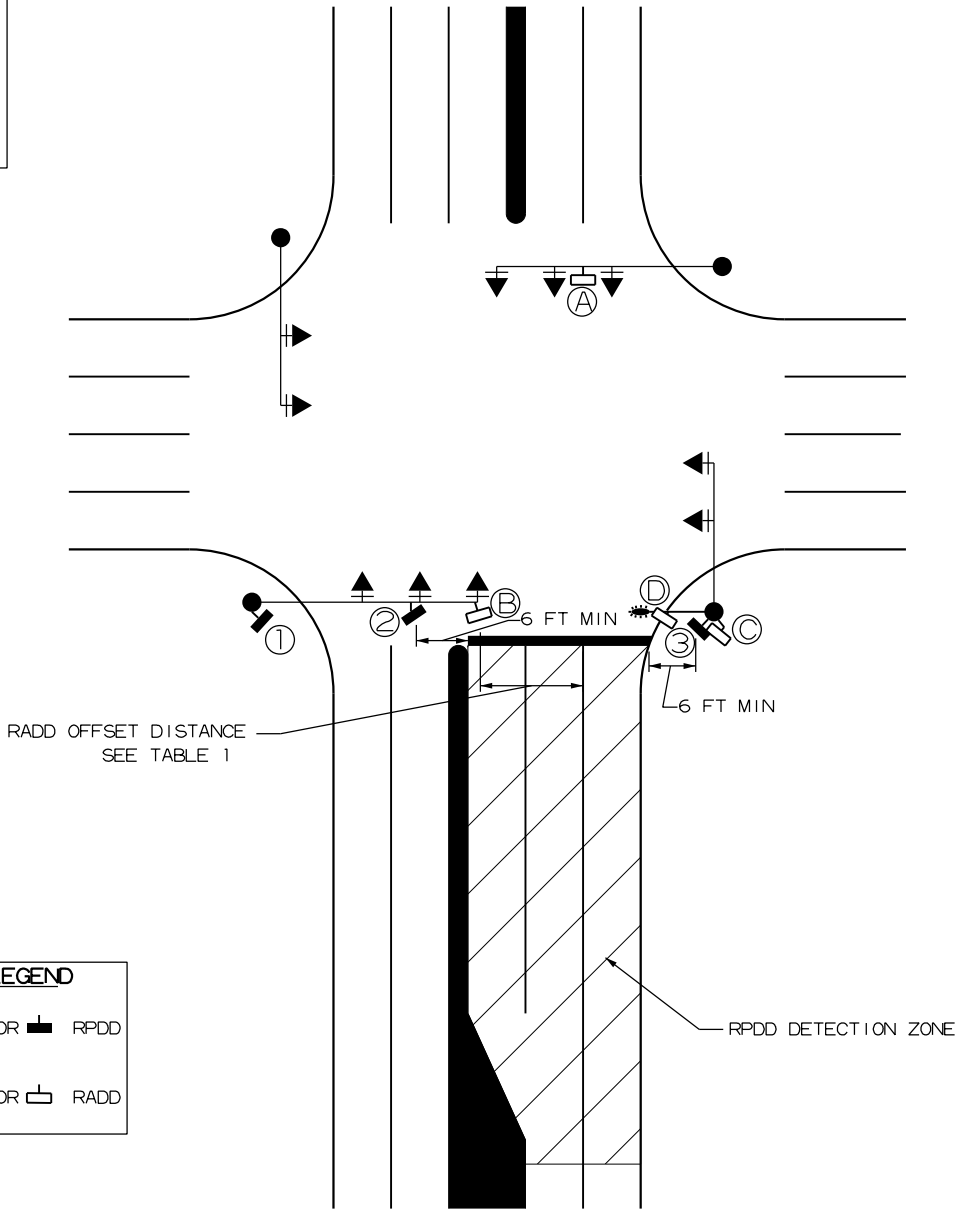


ELEVATION VIEW  
NTS



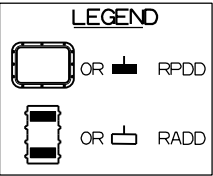
SKEWED INTERSECTION RPDD PLACEMENT  
NTS

TYPICAL RPDD DETECTION RANGE  
NTS



PLAN VIEW  
NTS

- NOTES:
- 1) A MINIMUM 6 FT HORIZONTAL OFFSET MUST BE MAINTAINED BETWEEN THE RPDD AND THE DETECTION ZONE
- 2) THE RPDD SHALL BE MOUNTED SUCH THAT AT LEAST 20 FT ALONG THE FARTHEST LANE TO BE MONITORED IS WITHIN THE FIELD OF VIEW OF THE RPDD
- 3) AIM RPDD AT THE CENTER OF THE LANES TO BE MONITORED, APPROXIMATELY 50 FT FROM THE RPDD UNIT
- 4) MOUNT RPDD SO THAT ITS FIELD OF VIEW IS NOT OCCLUDED BY POLES, SIGNS, OR OTHER STRUCTURES
- 5) RADD MOUNTING HEIGHT SHALL NOT BE LESS THAN 17 FT OR GREATER THAN 40 FT. RADD MOUNTING LOCATION SHALL HAVE A MAXIMUM 50 FT LATERAL OFFSET FROM CENTER OF TRAVEL LANES TO BE MONITORED



LEVELS DISPLAYED

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	

1:59:58 PM  
4/6/2022

\\DC5\LeeShare\0 - Projects, ACTIVE\SA153.26 - HMT, Stg Dgn, SH 46 at Pieper Road\Standards\vpdd+radd-20 (1).dgn

Texas Department of Transportation  
© 2020

San Antonio District Standard

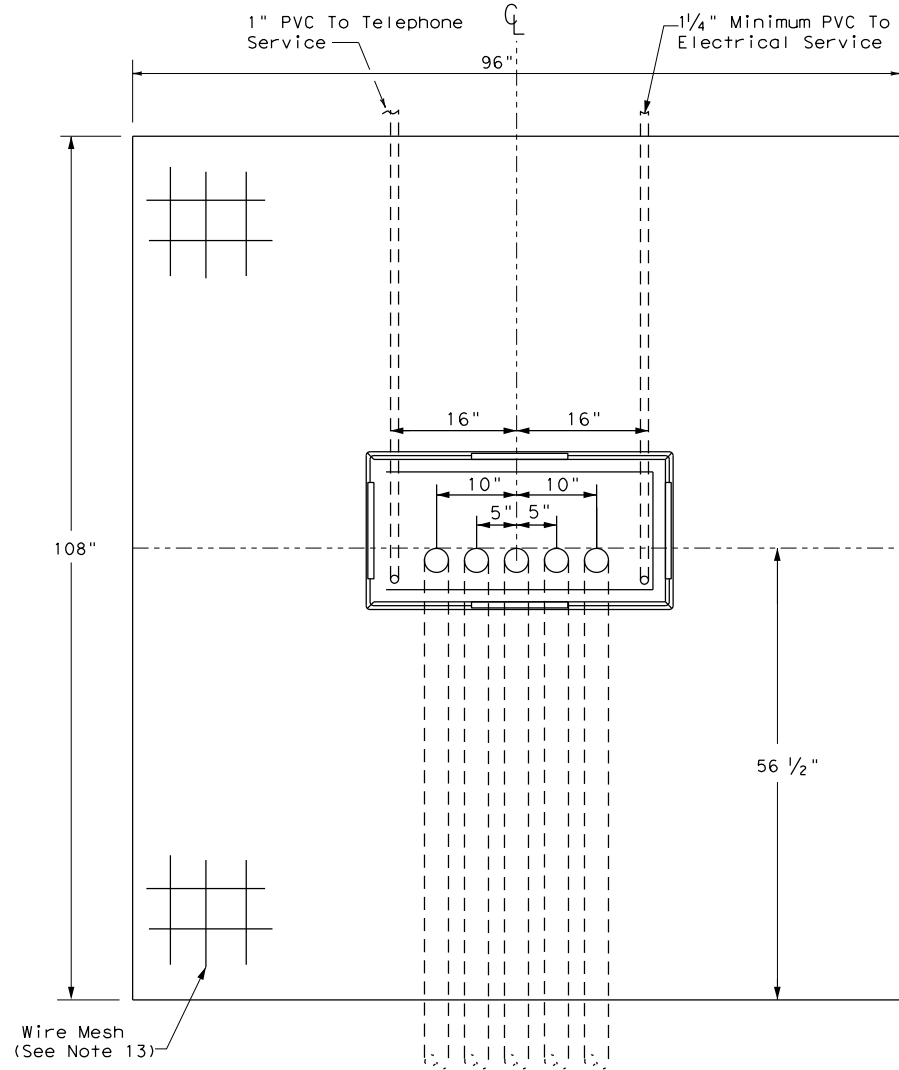
**RADAR PRESENCE DETECTOR (RPDD)  
RADAR ADVANCED DETECTION DEVICE (RADD)  
PLACEMENT**

SCALE: NS RPDD-RADD-20

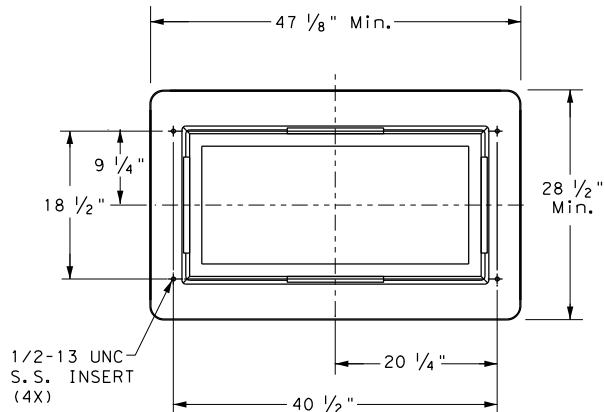
REVISIONS	FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
MAR 2020	6	SEE TITLE SHEET	TS-34
	STATE	DIST.	COUNTY
	TEXAS	SAT	GUADALUPE
	CONT.	SECT.	JOB
			HIGHWAY NO.
			SH 46

DISCLAIMER:  
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

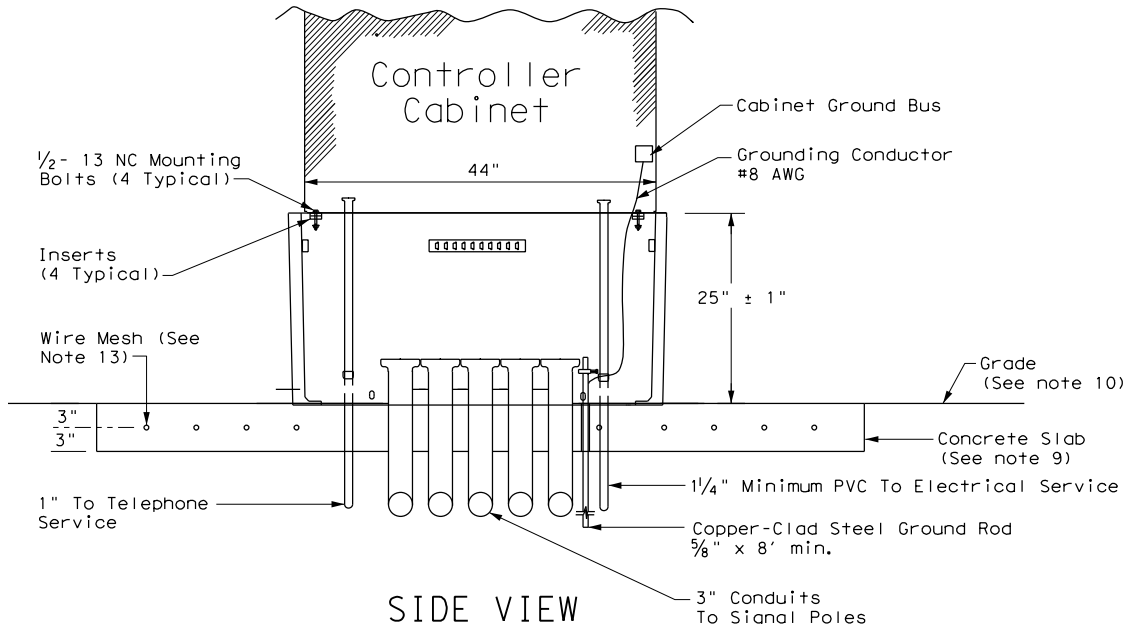
DATE:  
FILE:



TOP VIEW



CABINET BASE



SIDE VIEW

### TRAFFIC SIGNAL CONTROLLER BASE:

1. Provide a traffic signal controller base (cabinet base) manufactured of polymer concrete material consisting of calcareous and siliceous stone; glass fibers and thermoset polyester resin. The polymer concrete cabinet base must be reinforced on the inside of the cabinet base with fiberglass matting. Provide one of the following bases: Armorcast Part # A6001848X24, Quazite Model # PG3048Z709, or other as approved by TxDOT Traffic Safety Division.
2. The polymer concrete material must have a minimum compressive strength of 10,300 pounds per square inch (psi), minimum flexural strength of 3600 psi, and minimum shear strength of 3600 psi.
3. The polymer concrete cabinet base must conform to the dimensions shown and must accommodate a standard TxDOT basemount cabinet.
4. Supply the cabinet base with four 1#2"-13 UNC stainless steel inserts for attachment of the cabinet to the base. Inserts must withstand a minimum torque of 50 ft-lb and a minimum straight pull out strength of 750 lbs.
5. Provide the cabinet base with 4 cable racks mounted one on each side of the base 2" to 7" from the top edge of the base. Unless approved otherwise, cable racks must be 1-1/2 x 9#16x 3#16inch steel channel with eight T-slots spaced at 1-1/2 inches. The cable racks must easily accommodate the insertion of tie wraps to attach field wiring to the racks to serve as strain relief. Secure cable racks to the base using 1#2"-13 UNC stainless steel screws and inserts.
6. The cabinet base, when secured to the concrete slab with controller cabinet attached, must withstand a minimum wind load of 125 mph or a 850 lb force applied at 49" above the bottom of the base without causing the base or cabinet to come out of their anchored position or cause any permanent deformation. The manufacturer must supply certification by an independent testing laboratory or sealed by a Texas Licensed Professional Engineer. Provide the cabinet base with hardware for attachment to a concrete slab.
7. The traffic signal base must be permanently marked either by impress or by permanent ink with the manufacturer's model number and name or logo.
8. Seal the base to the concrete with a silicone caulk bead and fastened to the slab per manufacturer's instructions.

### CONCRETE SLAB:

9. Traffic signal controller pad must be a portland cement concrete slab poured in place, must conform to the dimensions shown, and must be level.
10. Grade earthwork such that it is flush with the concrete pad on all four sides, unless otherwise shown on the plans. Subsidiary to ITEM 680, four inch rip rap may be used in lieu of earthwork. Slopes shall gradually contour to match plans.
11. Bond a #8 AWG copper ground wire and an 8 ft ground rod bonded to the reinforcing mesh by a suitable UL Listed clamp and terminated to the cabinet grounding bus for the purpose of providing a local ground for the electrical grounding conductor. The electrical grounding conductor specified in Item 680-3.A.4 is required and must be terminated to the cabinet ground bus.
12. Install a PVC sleeve to prevent the ground rod from direct embedment in the slab.
13. Provide welded wire mesh 6X6-W2.9 X W2.9 for reinforcement. Provide joints and splices in the mesh with a minimum 6-inch overlap. Center the mesh between top and bottom and provide a minimum 3 inch cover on the edges.
14. Provide Class B concrete minimum for the slab in accordance with Item 421. Construct the slab in accordance with Item 531.
15. Stub up and run 3-inch conduits through the slab to the various traffic signal poles and ground boxes as shown on the layouts. Install the number of conduits as shown on layouts plus two additional 3 inch conduits for future use. Terminate the conduits with a bushing between 2 and 4-inches above the slab.
16. Extend conduits for future use at least 18-inches from the edge of the slab, terminate underground with a coupling, and cap and seal so that the seal can be removed without damaging the coupling. This must also apply to unused telephone conduit.
17. Stub up two separate conduits through the slab from the electrical and telephone services. Run the conduit for the electrical feed directly to the electrical service enclosure. Run the conduit for the telephone line directly to the telephone service, usually located on the same pole as the electrical service. Telephone must not under any circumstance share a conduit with any other function.
18. Terminate electric and telephone conduits above the slab with a coupling. After the base is installed, extend the conduits above the top of the base and secure to the base using a steel one-hole strap or similar suitable substitute.

### CONTROLLER CABINET:

19. Anchor the controller cabinet to the base using four stainless steel 1/2-13 NC bolts.
20. The silicone caulk bead specified in Item 680.3.B must be RTV 133.

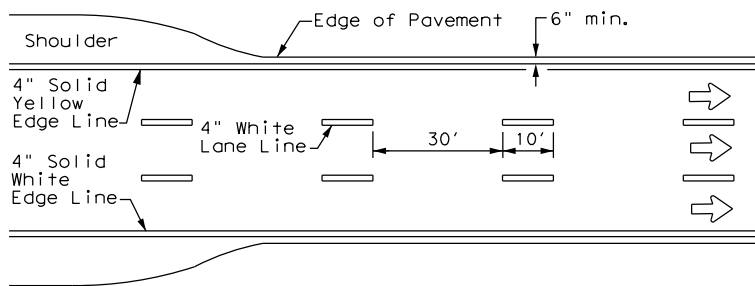
### PAYMENT:

21. Bid TS-CF as subsidiary to Item 680.

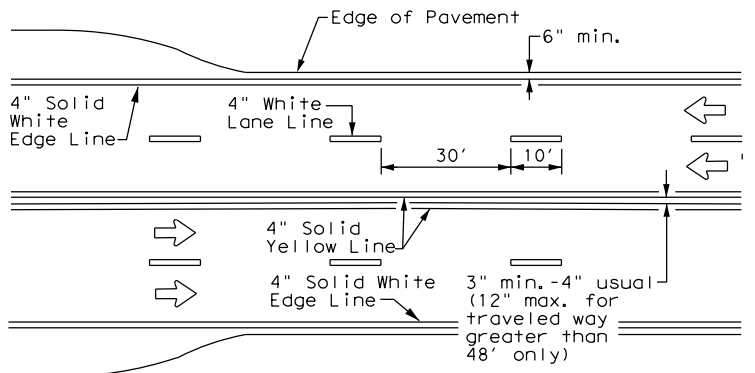
				<b>Traffic Safety Division Standard</b>	
<b>TRAFFIC SIGNAL CONTROLLER CABINET BASE AND PAD</b>					
<b>TS-CF-21</b>					
FILE: ts-cf-21.dgn	DN:	CK:	DW:	CK:	
© TxDOT October 2000	CONT	SECT	JOB	HIGHWAY	
REVISIONS				SH 46	
12-04	DIST		COUNTY	SHEET NO.	
2-21	SAT		GUADALUPE	TS-35	

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

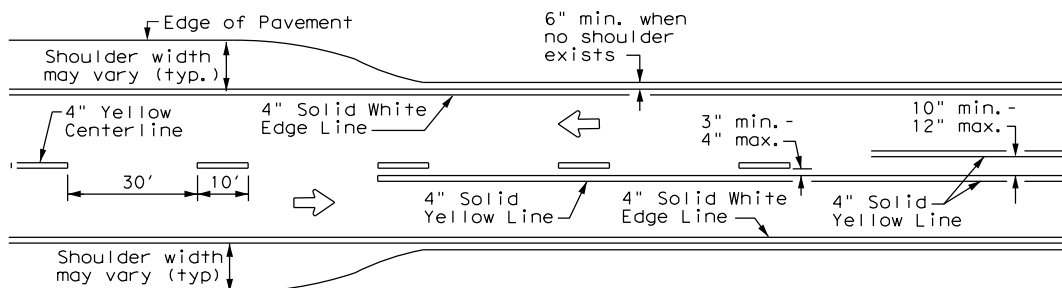
DATE:  
FILE:



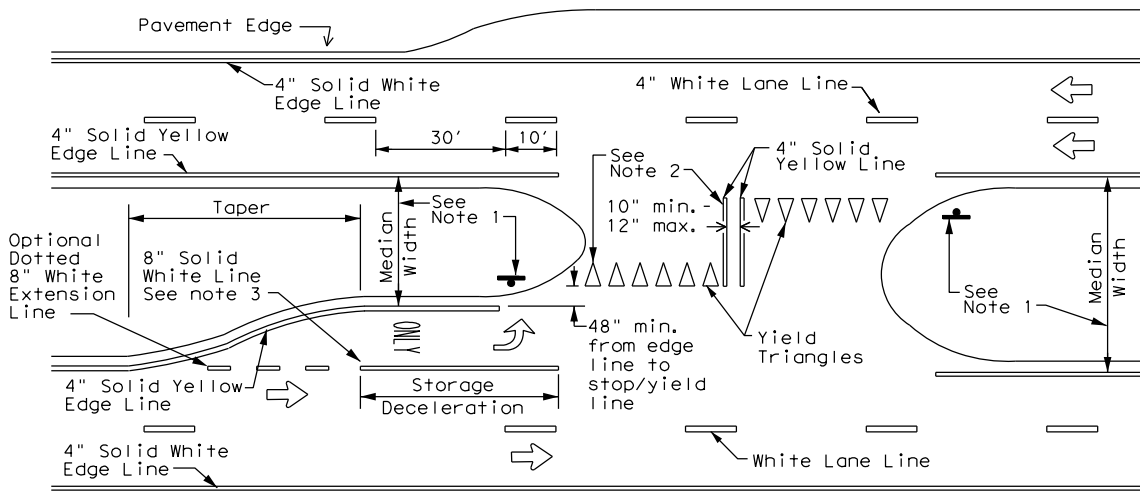
EDGE LINE AND LANE LINES  
ONE-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS



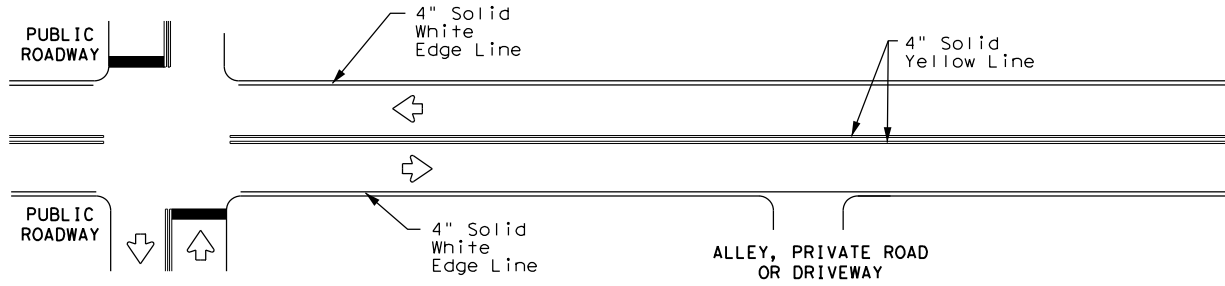
CENTERLINE AND LANE LINES  
FOUR LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS



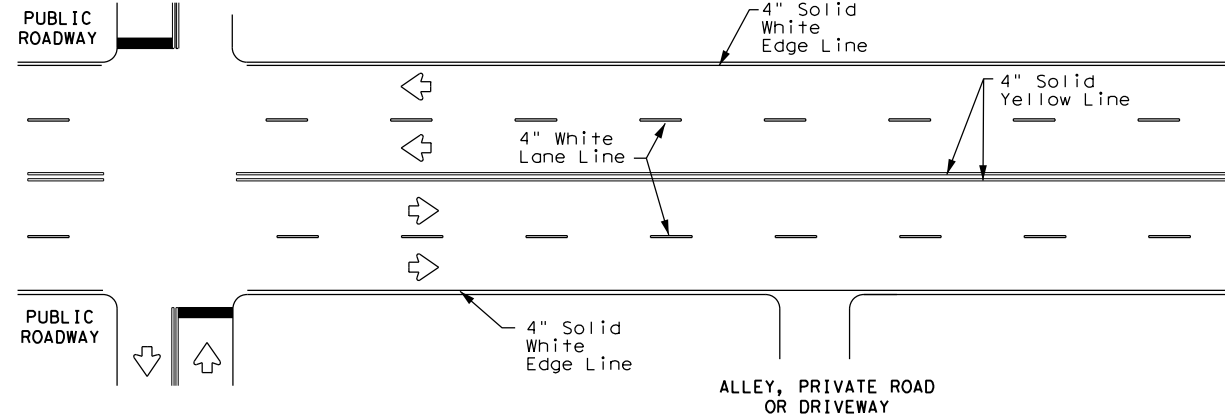
TWO LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS



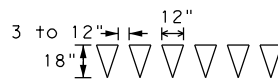
FOUR LANE DIVIDED ROADWAY CROSSOVERS



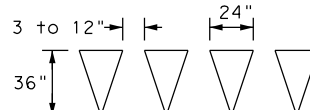
TYPICAL TWO-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS



TYPICAL MULTI-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS



For posted speed on road  
being marked equal to or  
less than 40 MPH.



For posted speed on road  
being marked equal to or  
greater than 45 MPH.

YIELD LINES

## NOTES

- Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.
- Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield triangles shall only be used with yield signs.
- Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

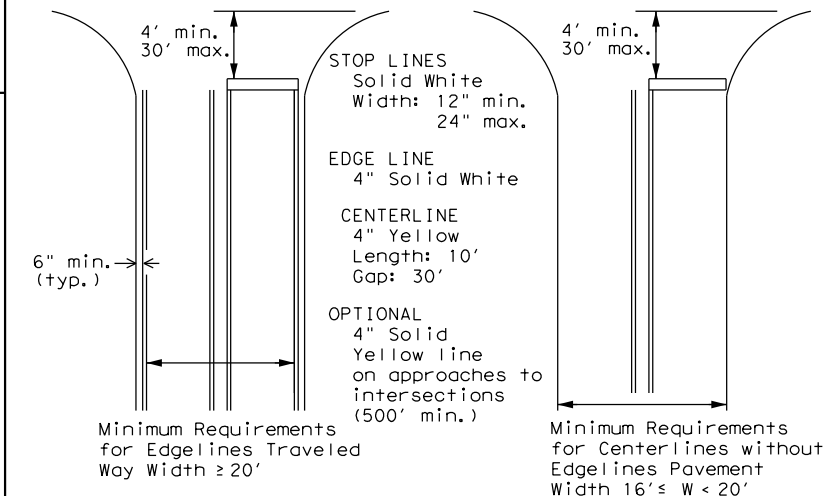
## GENERAL NOTES

- Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.
- The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

## MATERIAL SPECIFICATIONS

PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



## GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths  
for Undivided Highways



Traffic  
Safety  
Division  
Standard

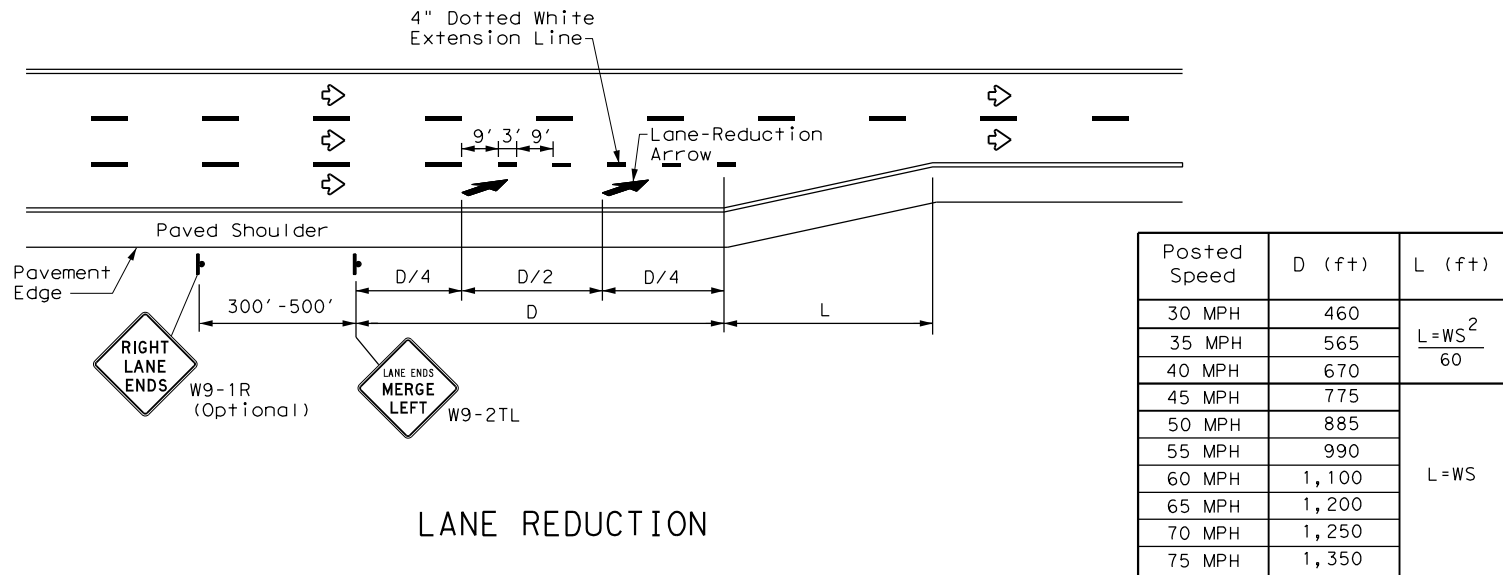
## TYPICAL STANDARD PAVEMENT MARKINGS

PM(1) - 20

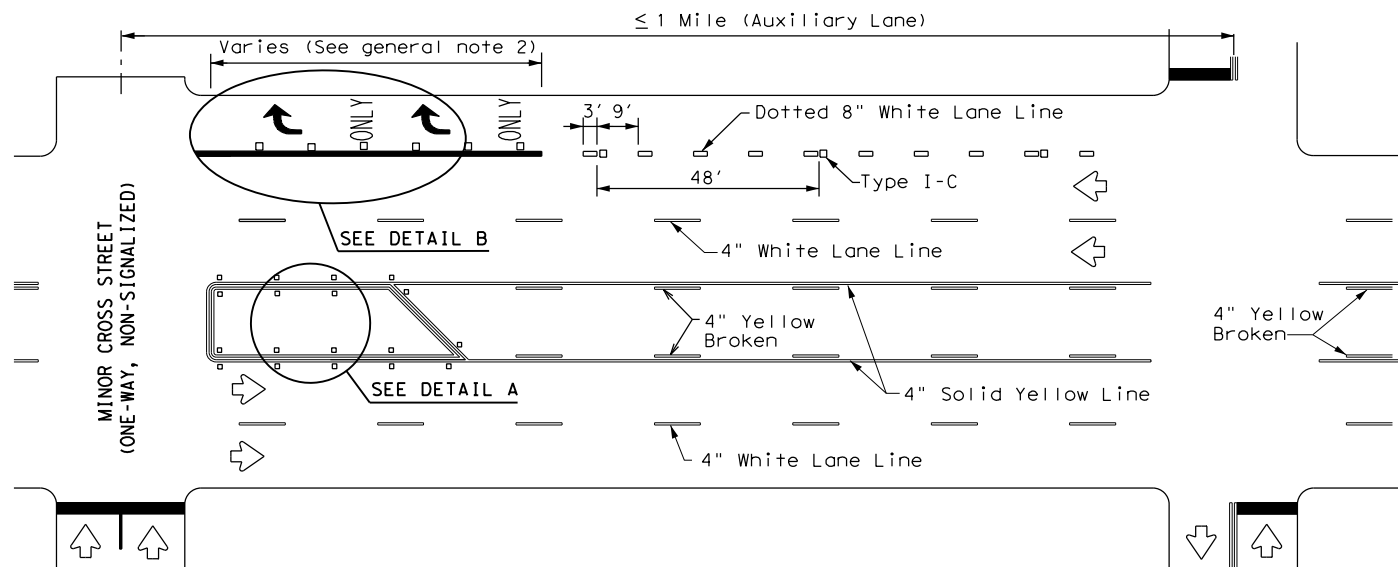
FILE:	pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT	November 1978	CONT	SECT	JOB	HIGHWAY
8-95	3-03	0915	12	691	SH 46
5-00	2-12	DIST	COUNTY	SHEET NO.	
8-00	6-20	SAT	GUADALUPE	TS-36	

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

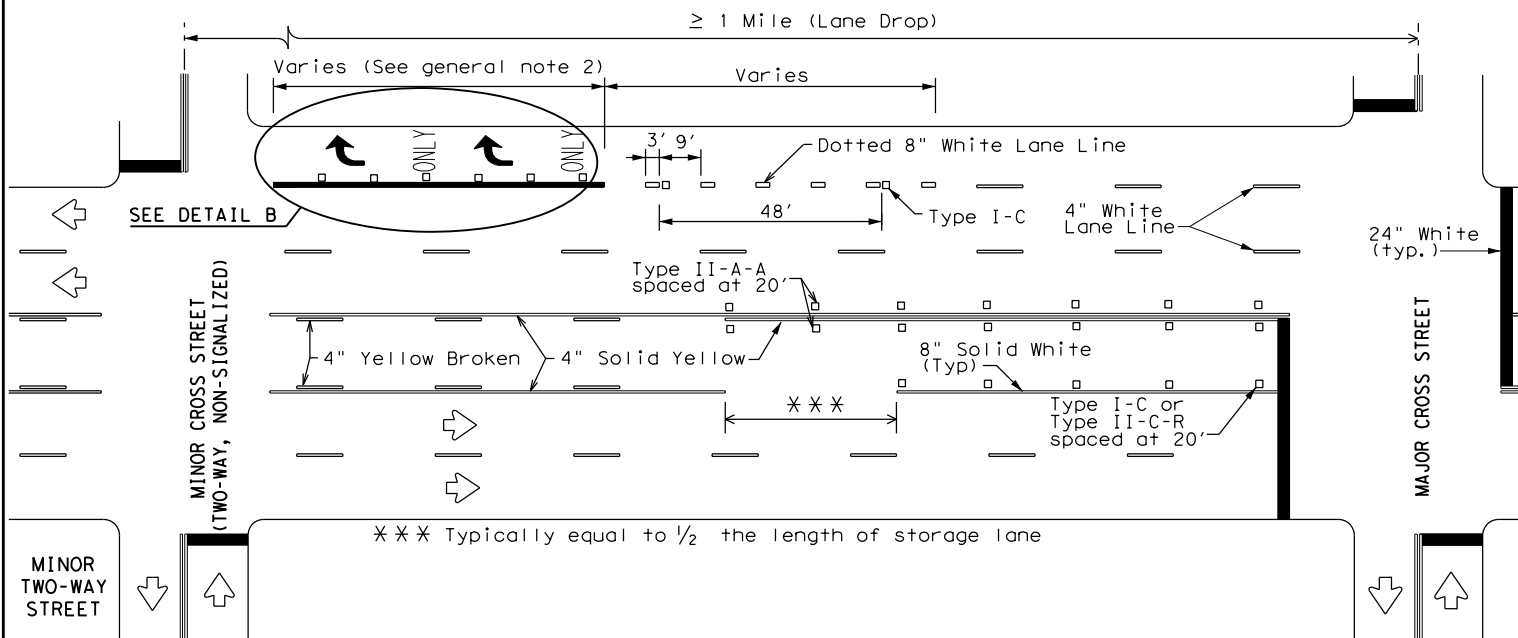
DATE:  
FILE:



## LANE REDUCTION



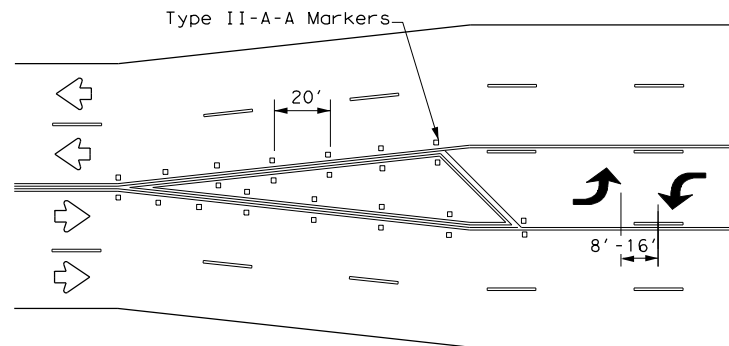
## TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



## TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP

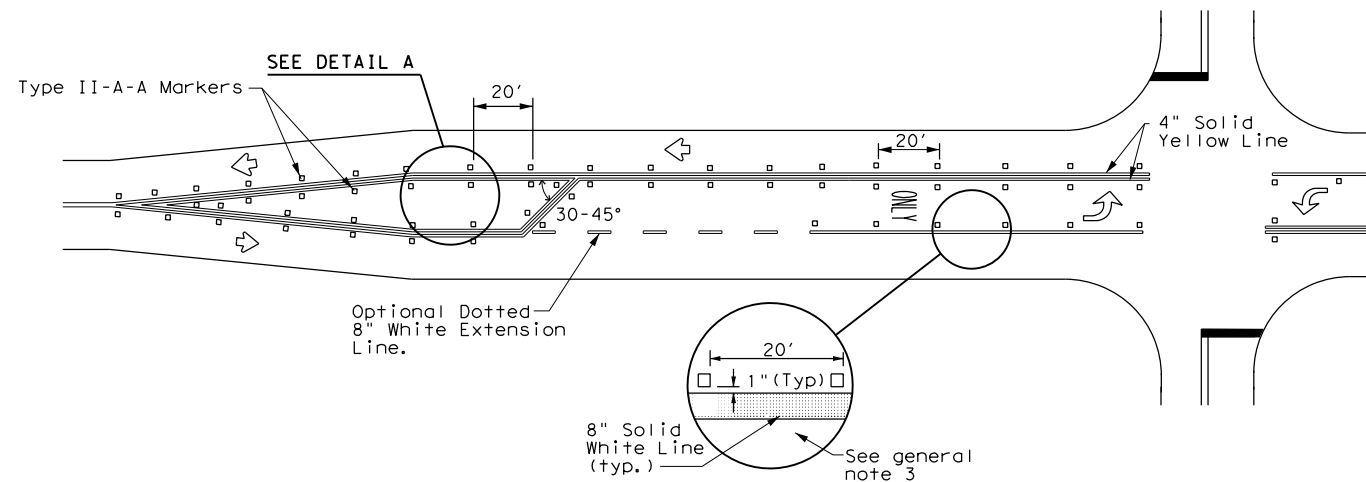
## NOTES

- Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
- On divided highways, an additional W9-1R "RIGHT LANE ENDS" sign may be installed in the median aligned with the W9-1R sign on the right side of the highway.
- Lane reduction arrows are required for speeds of 45 mph or greater. An optional third lane reduction arrow may be added based on engineering judgement. If used, the optional third lane reduction arrow should be centered between the first and last lane reduction arrows.
- For lane reductions on Freeways and Expressways, signing shall conform to the TxDOT Freeway Signing Handbook.

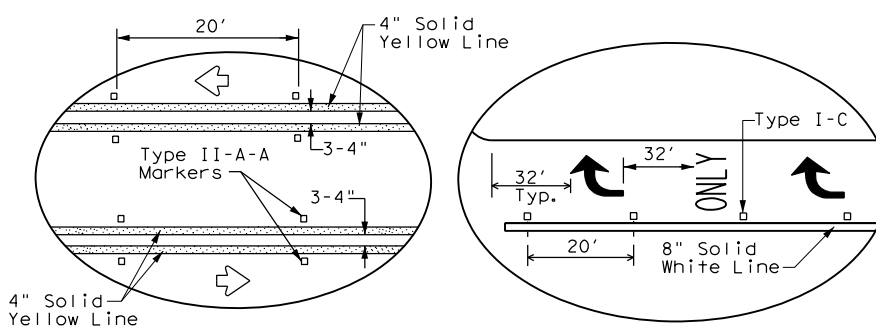


A two-way left-turn (TWLTL) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

## TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY



## TYPICAL TWO-LANE HIGHWAY INTERSECTION WITH LEFT TURN BAYS



## DETAIL A

## DETAIL B

## GENERAL NOTES

- Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows are as shown in the Standard Highway Sign Designs for Texas.
- When lane-use words and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
- Use raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.
- Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

## MATERIAL SPECIFICATIONS

PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Traffic  
Safety  
Division  
Standard

## TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS PM(3) - 20

FILE: pm3-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS				SH 46
5-00 2-10				
8-00 2-12				
3-03 6-20				
	DIST	COUNTY		SHEET NO.
	SAT	GUADALUPE		TS-37



DATE:

DISCLAIMER:

DATE:

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

<http://www.txdot.gov/>

1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS) Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD (GEN).



 <b>Texas Department of Transportation</b>	<b>Traffic Operation Division Standard</b>
---------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------

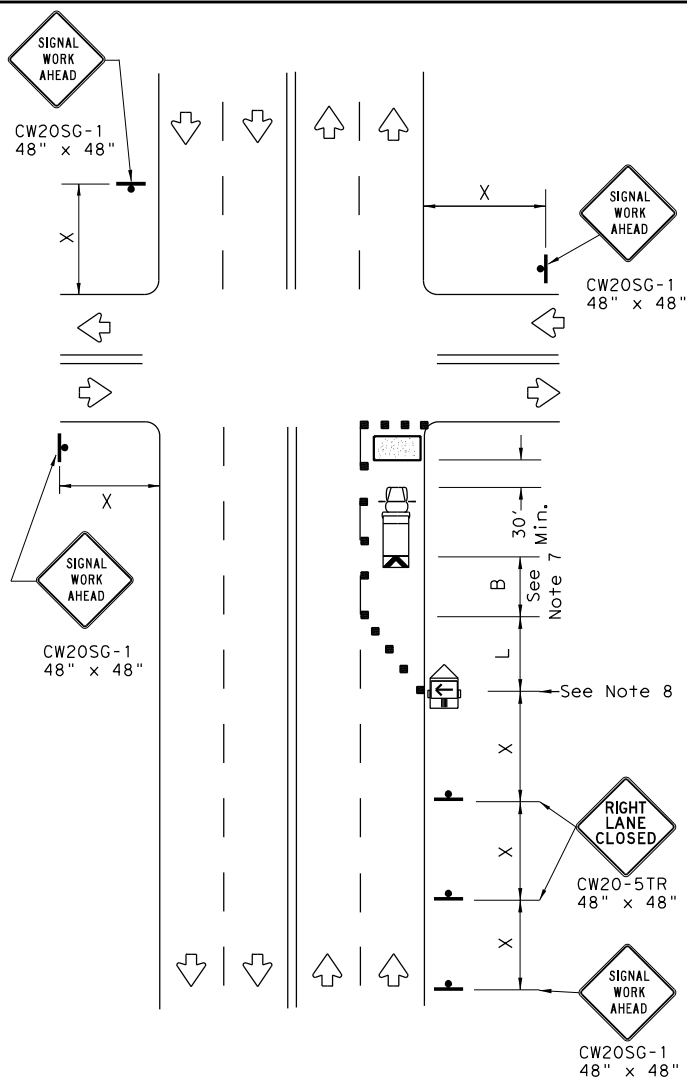
SOSS

---

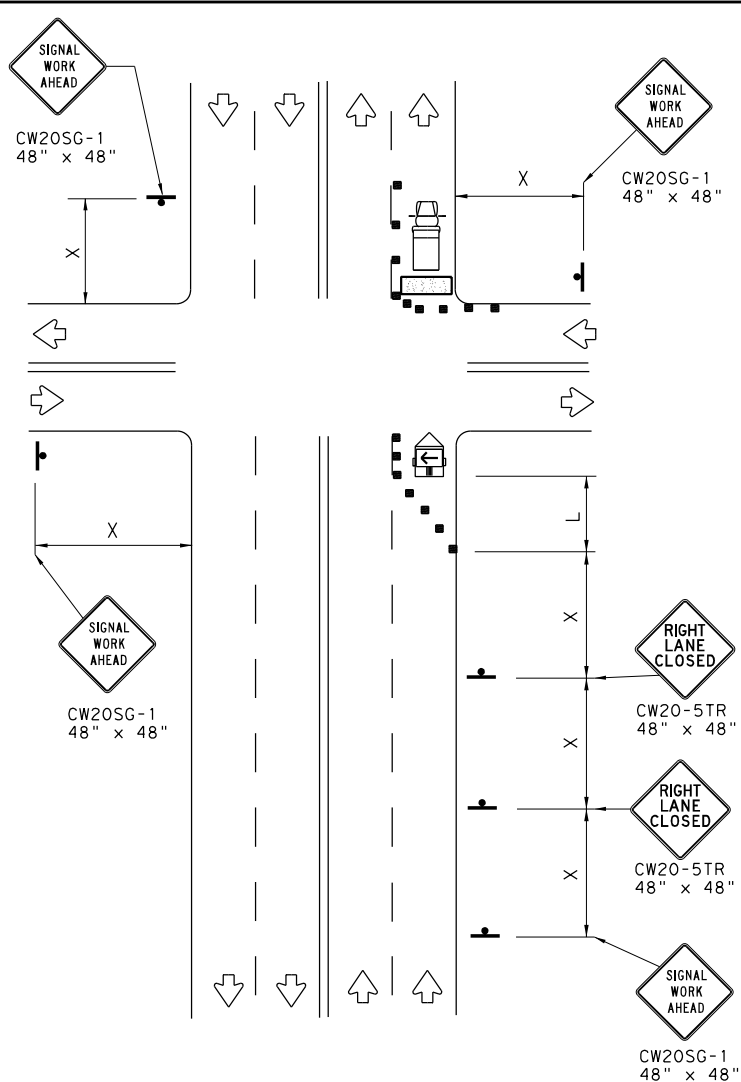
18

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

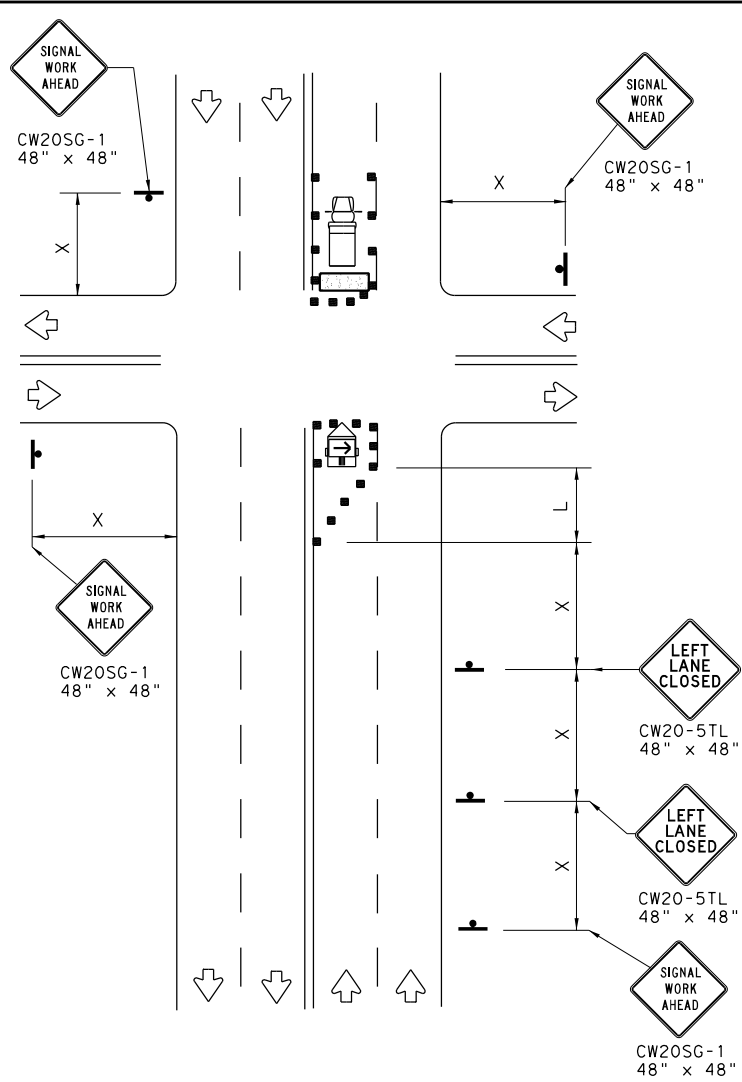
DATE:  
FILE:



NEAR SIDE LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY



FAR SIDE RIGHT LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY



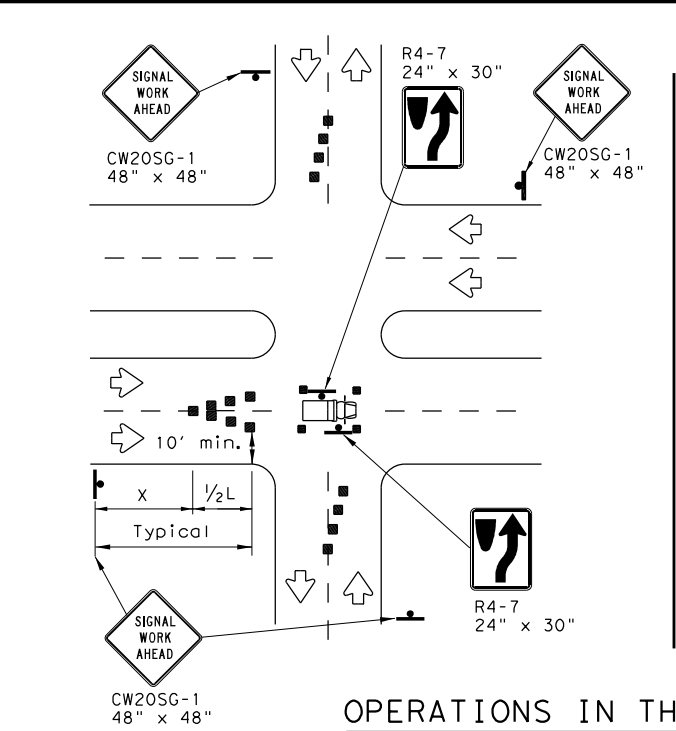
FAR SIDE LEFT LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

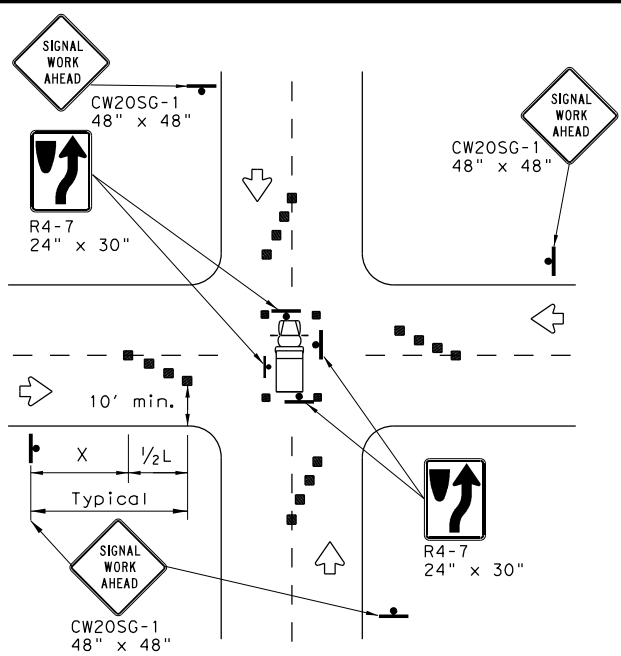
Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

\* Conventional Roads Only  
\*\* Taper lengths have been rounded off.  
L=Length of Taper (FT) W=Width of Offset (FT) S=Posted Speed (MPH)

WORKERS IN BUCKET TRUCKS SHALL NOT  
WORK ABOVE OPEN LANES OF TRAFFIC.



OPERATIONS IN THE INTERSECTION  
SHORT DURATION



#### GENERAL NOTES

- The minimum size channelizing device is the 28" cone. 42" Two-piece cones, drums, vertical panels or barricades will be required when the device must be left unattended at night.
- Obstructions or hazards at the work area shall be clearly marked and delineated at all times.
- Flaggers and Flagger Symbol (CW20-7) signs may be required according to field conditions.
- Vehicles parked in roadway shall be equipped with at least two high intensity rotating, flashing, oscillating or strobe type lights.
- High level warning devices (flag trees) may be used at corners of the vehicle.
- When work operations are performed on existing signals, the signals may be placed in flashing red mode when approved by the engineer. If existing signals do not have power, All-Way Stop (R1-1 and R1-3P) signs may be implemented when approved by the engineer.
- For Short-Term Stationary work the buffer space "B" from the above table should be used if field conditions permit. For Short Duration (less than 1 hour) any buffer space provided will enhance the safety of the setup.
- The arrow board at this location may be omitted for Short Duration work if the work vehicle has an arrow board in operation. As an option, the arrow board may be placed at the end of the taper in the closed lane if space is not available at the beginning of the taper.
- Signs and devices for the NEAR SIDE LANE CLOSURE may be altered for a left lane closure by using a LEFT LANE CLOSED (CW20-5TL) and adding channelizing devices on the centerline to protect the work space from opposing traffic.

SHEET 1 OF 2

**Texas Department of Transportation**

**Traffic Operations Division Standard**

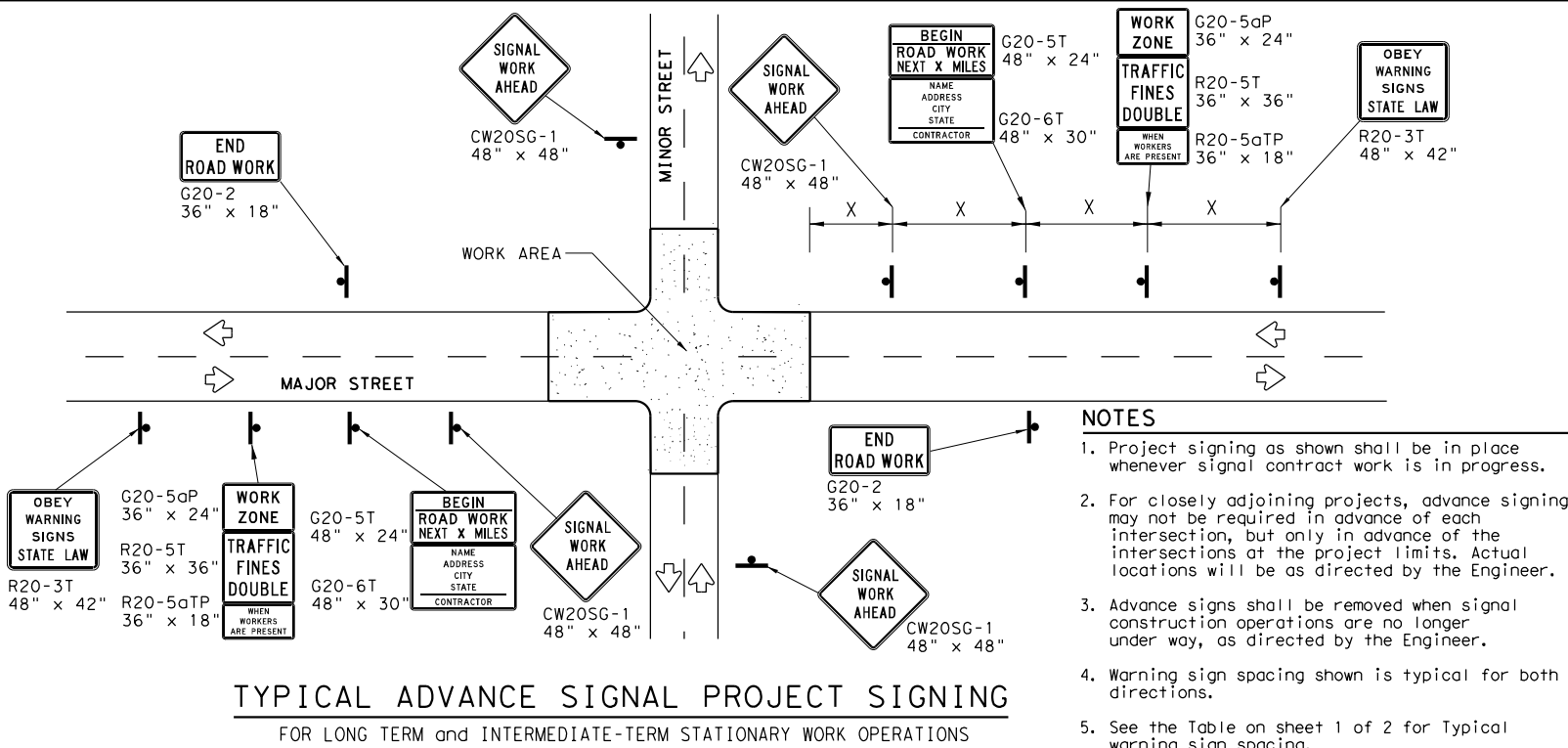
TRAFFIC SIGNAL WORK  
TYPICAL DETAILS

WZ(BTS-1)-13

FILE: wzbts-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS				SH 46
2-98 10-99 7-13	DIST	COUNTY		SHEET NO.
4-98 3-03	SAT	GUADALUPE		TS-39

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: FILE:



#### GENERAL NOTES FOR WORK ZONE SIGNS

- Signs shall be installed and maintained in a straight and plumb condition.
- Wooden sign posts shall be painted white.
- Barricades shall NOT be used as sign supports.
- Nails shall NOT be used to attach signs to any support.
- All signs shall be installed in accordance with the plans or as directed by the Engineer.
- The Contractor shall furnish the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD).
- The Contractor shall furnish sign supports and substrates listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD), installed as per the manufacturer's recommendations.
- Temporary signs that have damaged or cracked substrates and/or damaged or marred reflective sheeting shall be replaced as directed by the Engineer.
- Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1".
- Damaged wood posts shall be replaced. Splicing wood posts will not be allowed.

#### DURATION OF WORK

- Work zone durations are defined in Part 6, Section 6G.02 of the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

#### SIGN MOUNTING HEIGHT

- Sign height of Long-term/Intermediate-term warning signs shall be as shown on Figure 6F-1 of the TMUTCD.
- Sign height of Short-term/Short Duration warning signs shall be as shown on Figure 6F-2 of the TMUTCD.
- Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

#### REMOVING OR COVERING

- When sign messages may be confusing or do not apply, the signs shall be removed or completely covered, unless otherwise approved by the Engineer.
- When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night without damaging the sign sheeting. Burlap, or heavy materials such as plywood or aluminum shall not be used to cover signs.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and anchor stubs shall be removed and holes backfilled upon completion of the work.

#### REFLECTIVE SHEETING

- All signs shall be retroreflective and constructed of sheeting meeting the requirements of the DMS and color usage table shown on this sheet.

#### SIGN SUPPORT WEIGHTS

- Weights used to keep signs from turning over should be sandbags filled with dry, cohesionless material.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
- Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
- Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber, such as tire inner tubes, shall not be used.
- Rubber ballasts designed for channelizing devices should not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber bases may be used when shown on the CWZTCD list.
- Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
- Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

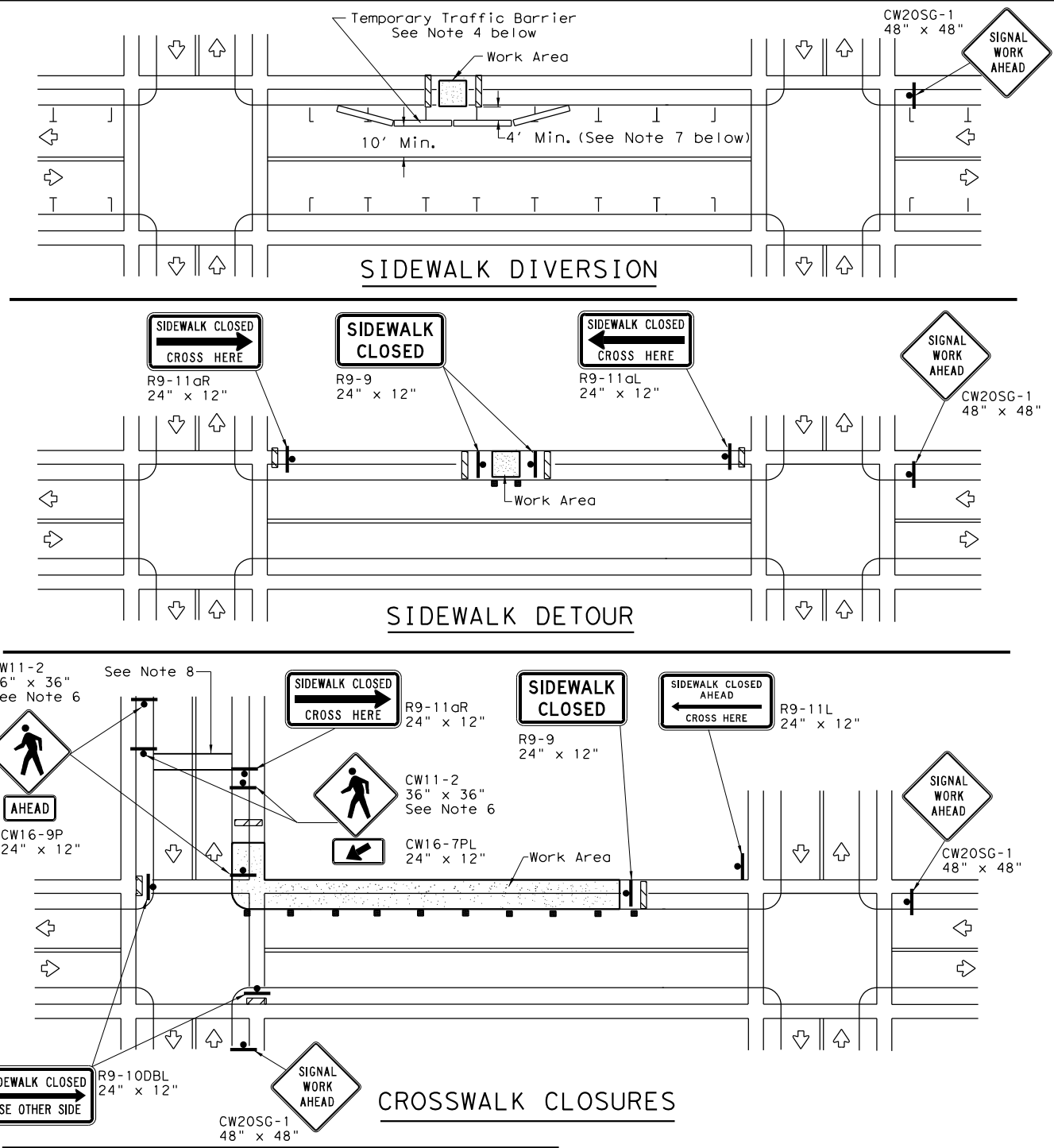
LEGEND	
	Sign
	Channelizing Devices
	Type 3 Barricade

#### DEPARTMENTAL MATERIAL SPECIFICATIONS

SIGN FACE MATERIALS	DMS-8300
FLEXIBLE ROLL-UP REFLECTIVE SIGNS	DMS-8310

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B <sub>FL</sub> OR TYPE C <sub>FL</sub> SHEETING
WHITE	BACKGROUND	TYPE A SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found at the following web address:  
[http://www.txdot.gov/txdot\\_library/publications/construction.htm](http://www.txdot.gov/txdot_library/publications/construction.htm)



#### PEDESTRIAN CONTROL

- Holes, trenches or other hazards shall be adequately protected by covering, delineating or surrounding the hazard with orange plastic pedestrian fencing or longitudinal channelizing devices, or as directed by the Engineer.
- "CROSSWALK CLOSURES" as detailed above will require the Engineer's approval prior to installation.
- R9 series signs shown may be placed on supports detailed on the BC standards or CWZTCD list, or when fabricated from approved lightweight plastic substrates, they may be mounted on top of a plastic drum at or near the location shown.
- For speeds less than 45 mph longitudinal channelizing devices may be used instead of traffic barriers when approved by the Engineer. Attenuation of blunt ends and installation of water filled devices shall be as per BC(9) and manufacturer's recommendations.
- Location of devices are for general guidance. Actual device spacing and location must be field adjusted to meet actual conditions.
- Where pedestrians with visual disabilities normally use the closed sidewalk Detectable Pedestrian Barricades should be used instead of the Type 3 Barricades shown.
- The width of existing sidewalk should be maintained if practical.
- Pavement markings for mid-block crosswalks shall be paid for under the appropriate bid items.
- When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

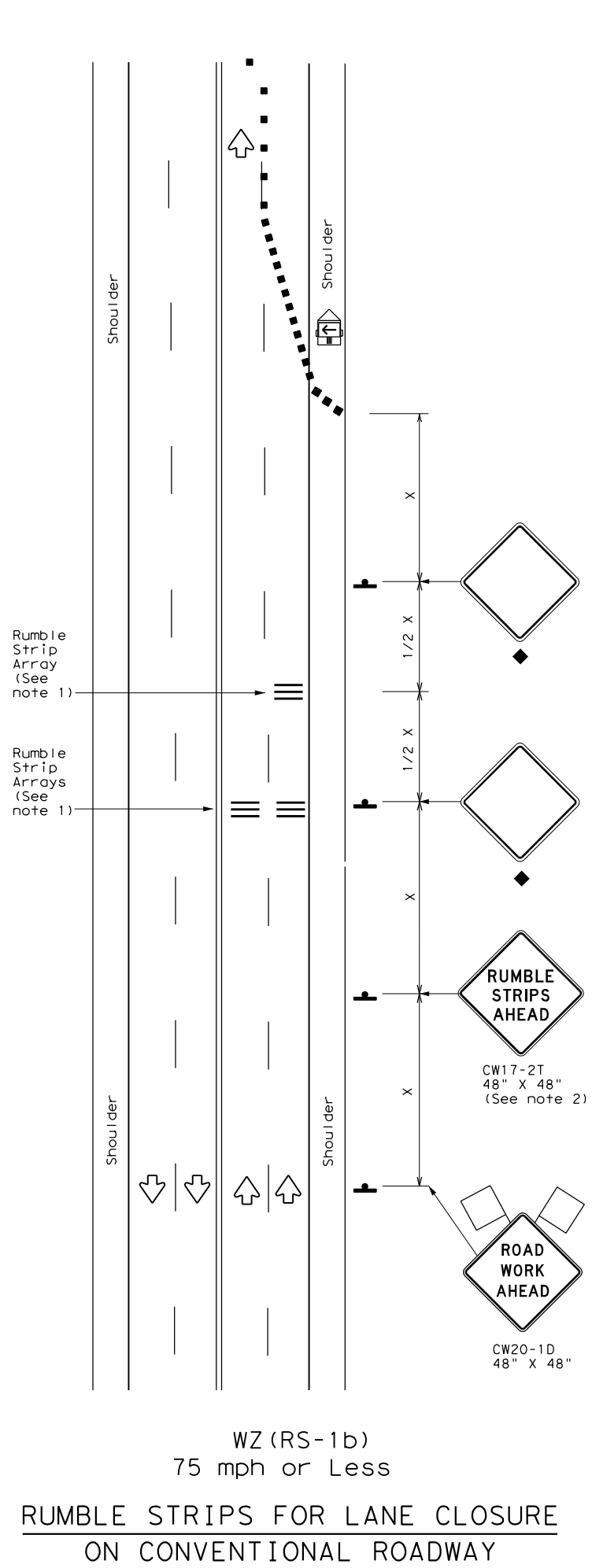
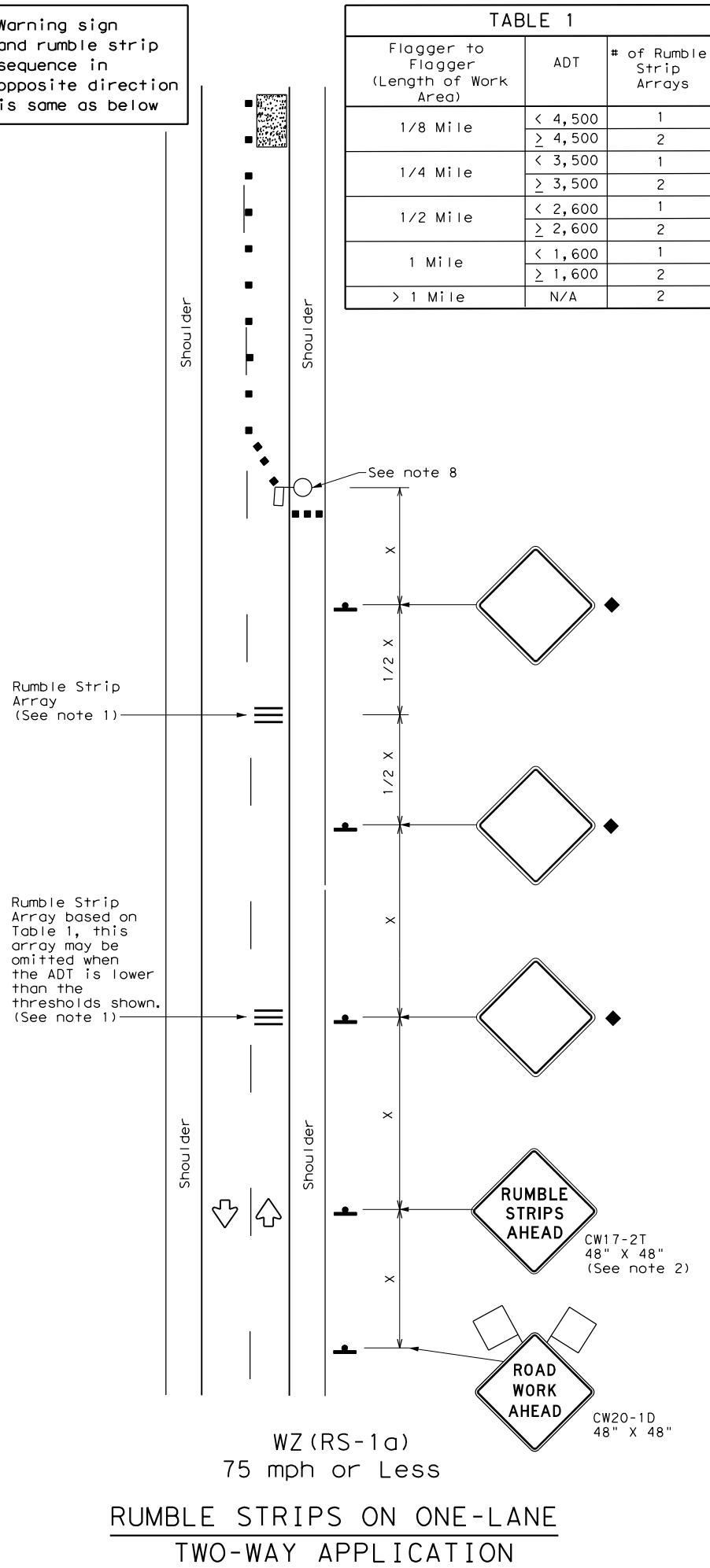
SHEET 2 OF 2

		<b>Traffic Operations Division Standard</b>	
TRAFFIC SIGNAL WORK BARRICADES AND SIGNS			
WZ(BTS-2)-13			
FILE: wzbts-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT April 1992	CONT	SECT	JOB
REVISIONS		HIGHWAY	
2-98 10-99 7-13	DIST	COUNTY	SHEET NO.
4-98 3-03	SAT	GUADALUPE	TS-40

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: FILE:

Warning sign and rumble strip sequence in opposite direction is same as below



## GENERAL NOTES

- Each Rumble Strip Array should consist of three rumble strips spaced center to center at the spacing shown in Table 2, placed transverse across the lane at locations shown.
- The CW17-2T "RUMBLE STRIPS AHEAD" sign should be located after the CW20-1D "ROAD WORK AHEAD" sign and spaced as shown. If traffic is observed to be queuing, or is expected to queue beyond the Rumble Strips, the CW17-2T sign and the first Rumble Strip Array may be located upstream of the CW20-1D sign as necessary to provide needed warning.
- Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
- Removal of the Temporary Rumble Strips should be accomplished before removing the advance warning signs.
- Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
- Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
- This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
- The one-lane two-way application may utilize a flagger, an AFAD or a portable traffic signal.
- Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment.

TABLE 2	
Speed	Approximate distance between strips in an Array
≤ 40 MPH	10'
> 40 MPH & ≤ 55 MPH	15'
> 55 MPH	20'

## LEGEND

	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Panel		Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'


\* Conventional Roads Only

\*\* Taper lengths have been rounded off.  
L=Length of Taper (FT) W=Width of Offset (FT)  
S=Posted Speed (MPH)

## TYPICAL USAGE

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

◆ Signs are for illustrative purposes only. Signs required may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.



Texas Department of Transportation

Traffic Operations Division Standard

TEMPORARY RUMBLE STRIPS

WZ (RS) - 16

FILE:	wzrs16.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	November 2012	CONT	SECT	JOB			HIGHWAY		
REVISIONS							SH 46		
2-14	4-16	DIST	COUNTY			SHEET NO.			
		SAT	GUADALUPE			TS-41			