

**INDEX OF SHEETS**

SHEET NO. DESCRIPTION

SEE SHEET 2

**PROJECT LOCATION REFERENCE**

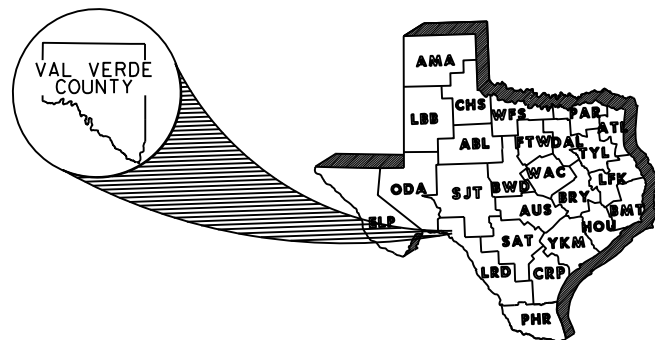
SEE SHEET 3

LOCATION REFERENCE #1  
 CONTROL SECTION JOB0022-10-076  
 ROADWAY=1,056.00 FT = 0.200 MI  
 BRIDGE=0.00 FT = 0.00 MI  
 TOTAL=1,056.00 FT = 0.200 MI

LOCATION REFERENCE #2  
 CONTROL SECTION JOB0300-01-108  
 ROADWAY=2,661.12 FT = 0.504 MI  
 BRIDGE=0.00 FT = 0.00 MI  
 TOTAL=2,661.12 FT = 0.504 MI

LOCATION REFERENCE #3  
 CONTROL SECTION JOB0300-01-109  
 ROADWAY=1,066.56 FT = 0.202 MI  
 BRIDGE=0.00 FT = 0.00 MI  
 TOTAL=1,066.56 FT = 0.202 MI

LOCATION REFERENCE #4  
 CONTROL SECTION JOB1229-01-076  
 ROADWAY=1,056.00 FT = 0.200 MI  
 BRIDGE=0.00 FT = 0.00 MI  
 TOTAL=1,056.00 FT = 0.200 MI



STATE OF TEXAS  
 DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED  
 STATE HIGHWAY IMPROVEMENTS

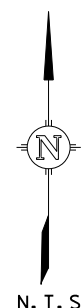
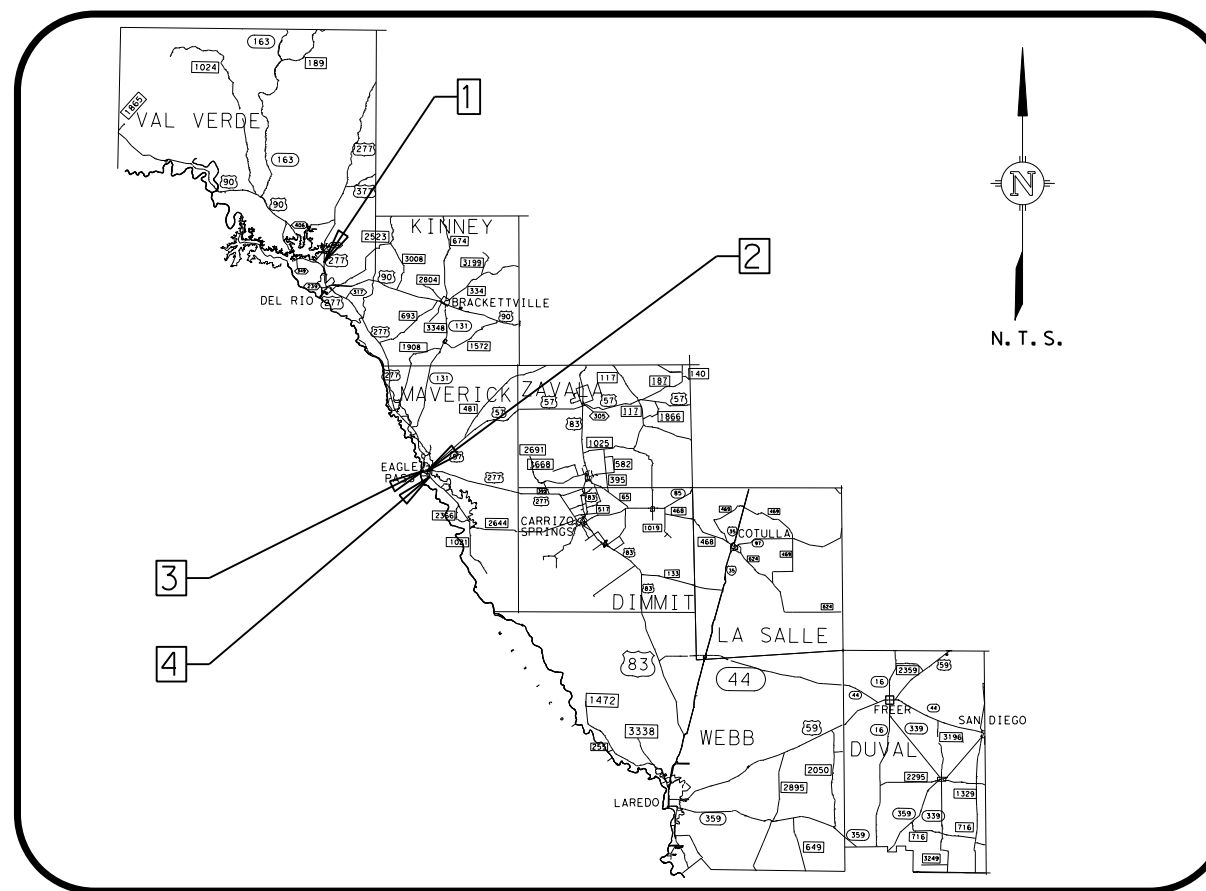
FEDERAL AID PROJECT No. STP 2022 (660) HES

**US 90, ETC.  
 VAL VERDE, ETC.  
 CSJ:0022-10-076, ETC**

NET LENGTH OF PROJECT : 5,839.68 FT = 1.106 MI [ ROADWAY = 5839.68 FT = 1.106 MILES  
 BRIDGE = 0.00 FT = 0.00 MILES

CONTROLLING LIMITS: FROM: 0.1 MI N OF KINGSWAY  
 TO: 0.1 MI S OF KINGSWAY

**FOR THE CONSTRUCTION OF INSTALLING ADVANCED WARNING SIGNALS  
 CONSISTING OF INSTALL/REPLACE SIGNS**



EQUATIONS: NONE  
 EXCEPTIONS: NONE  
 RAILROAD CROSSINGS: NONE

FEDROAD DIV NO	STATE	FEDERAL AID PROJECT NO	SHEET NO
6	TEXAS	STP 2022 (660) HES	1
STATE DIST NO	COUNTY	STATE CONTROL NO	HIGHWAY NO
22	VAL VERDE, ETC.	0022-10-076	US 90

DESIGN CRITERIA: HE-HAZARD ELIMINATION PROGRAM  
 ADT (XXXX): N/A  
 ADT (XXXX): N/A  
 % TRUCK IN ADT: N/A  
 FUNCTIONAL CLASS: PRINCIPAL ARTERIAL  
 DESIGN SPEED: N/A  
 TDLR REQUIRED YES NO

**FINAL PLANS**

LETTING DATE: \_\_\_\_\_  
 DATE CONTRACTOR BEGAN WORK: \_\_\_\_\_  
 DATE WORK WAS ACCEPTED: \_\_\_\_\_  
 CONTRACTOR: \_\_\_\_\_  
 TOTAL CONTRACTOR COST: \_\_\_\_\_

**FINALS AS BUILTS**

THE CONSTRUCTION WAS PERFORMED UNDER MY SUPERVISION IN ACCORDANCE WITH THE PLANS AND CONTRACT

AREA ENGINEER \_\_\_\_\_  
 DATE \_\_\_\_\_

SUBMITTED 7/25/2022  
 FOR LETTING: \_\_\_\_\_  
 DocuSigned by: Rafael Guzman  
 TRANSPORTATION ENGINEER  
 5CB9C1491FA342A...

RECOMMENDED 7/25/2022  
 FOR LETTING: \_\_\_\_\_  
 DocuSigned by: Vanessa Rosales-Herrera  
 AREA ENGINEER  
 70CAB6EAB8F3B42B...

RECOMMENDED 7/27/2022  
 FOR LETTING: \_\_\_\_\_  
 DocuSigned by: Humberto Gonzalez Jr, P.E  
 DIRECTOR OF TRANSPORTATION,  
 PLANNING, & DEVELOPMENT

APPROVED 7/27/2022  
 FOR LETTING: \_\_\_\_\_  
 DocuSigned by: David Salazar  
 DISTRICT ENGINEER  
 B741E64FAD82411...

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL - AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, JULY 5, 2022).

\$DATE\$ \$USER\$ \$FILE\$

6/24/2022 CSJ\*0022-10-076\* Index.dgn

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11-12	COMBINED QUANTITIES
13-15	ESTIMATE & QUANTITY

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**ENVIRONMENTAL ISSUES**

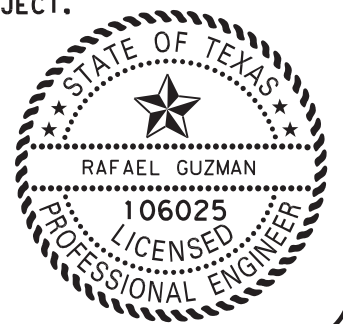
92	ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS
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**ENVIRONMENTAL ISSUES STANDARDS**

93	EC (1)-16
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STANDARD SHEETS SPECIFICALLY IDENTIFIED ON THE "INDEX OF SHEETS" HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

DocuSigned by:  
*Rafael Guzman*, P. E.  
 5CB9C1491FA542A...  
 6/29/2022  
 \_\_\_\_\_  
 DATE



**INDEX OF SHEETS**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER				SHEET NO.
CR: G. R.	CK: G. R.	TEXAS	SHEET 1 OF 1				
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.	
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.	2

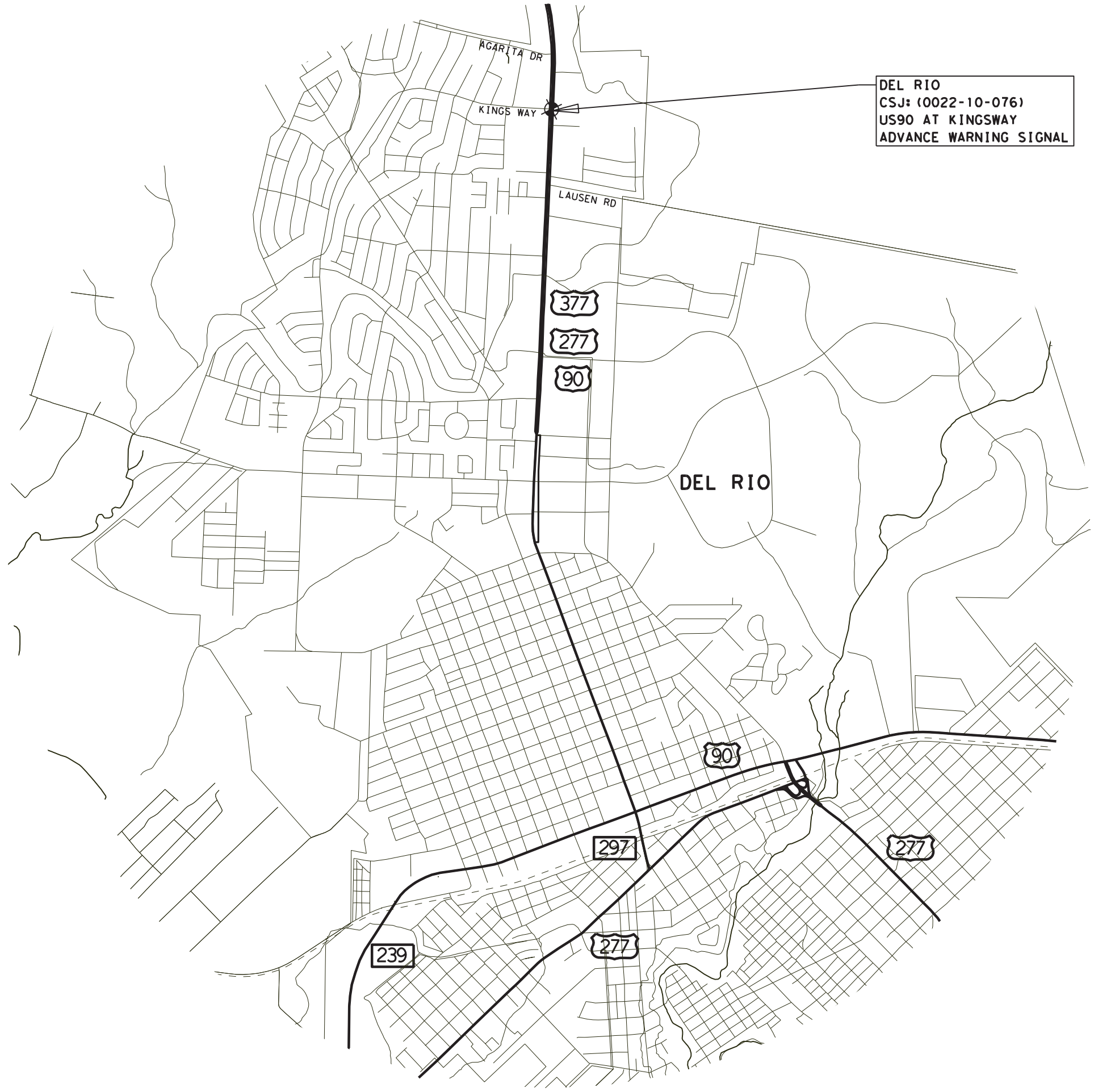
COUNTY	LOCATION	PROJECT CSJ	HIGHWAY	LENGTH		TYPE OF WORK	PROJECT LIMITS	REFERENCE MARKER
				FEET	MILES			
VAL VERDE	1	0022-10-076	US 90	1,056.00	0.200	INSTALL/REPLACE SIGNS	FROM: 0.1 MI N OF KINGSWAY	416 + 0.926
							TO: 0.1 MI S OF KINGSWAY	416 + 1.126
MAVERICK	2	0300-01-108	US 57	2,661.12	0.504	TRAFFIC SIGNAL INTERCONNECT	FROM: MAIN ST	370 + 1.393
							TO: US 277	370 + 1.897
	3	0300-01-109	US 57	1,066.56	0.202	TRAFFIC SIGNAL IMPROVEMENTS	FROM: 0.1 MI W OF MONROE ST	370 + 0.210
							TO: 0.1 MI E OF MONROE ST	370 + 0.412
4	1229-01-076	FM 1021	1,056.00	0.200	TRAFFIC SIGNAL IMPROVEMENTS	FROM: 0.1 WEST OF FM 3443	550 + 2.253	
						TO: 0.1 EAST OF FM 3443	550 + 2.453	
<b>TOTAL</b>				<b>5,839.68</b>	<b>1.106</b>			

NOTE:  
FOR CONSTRUCTION PURPOSES REFER TO  
REFERENCE MARKERS FOR PROJECT LIMITS.



**PROJECT LOCATION  
REFERENCE**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: L. C.	CK: L. C.	TEXAS	SHEET 1 OF 1			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.



VAL VERDE  
COUNTY

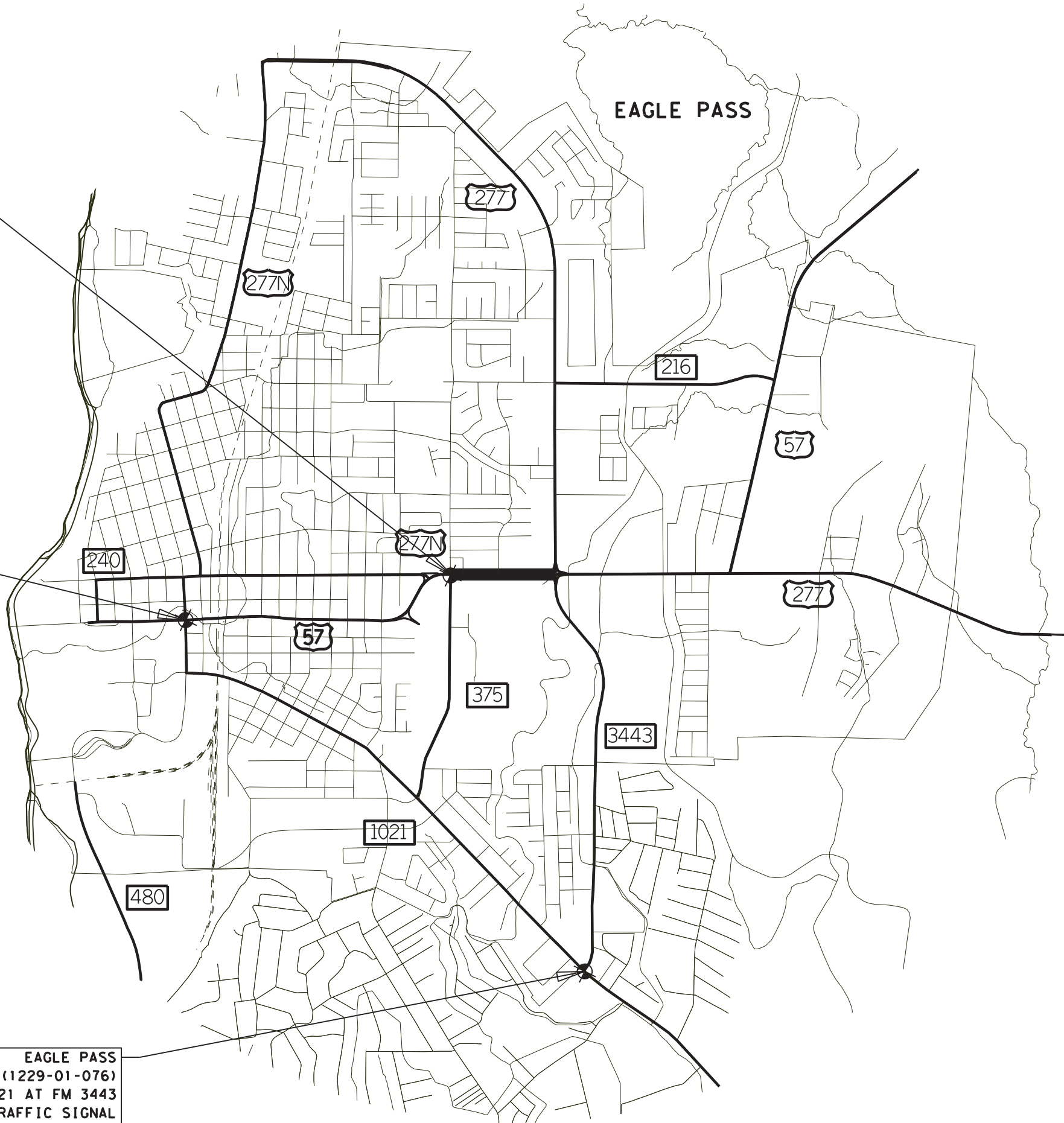
6/24/2022 FRAM052 Project Location Map.dgn

NOT TO SCALE



PROJECT LOCATION MAP

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CR: GR	CK: GR	TEXAS	SHEET 1 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.



EAGLE PASS  
 CSJ: (0300-01-108)  
 US 57 AT MAIN ST  
 TRAFFIC SIGNAL  
 INTERCONNECT

EAGLE PASS  
 CSJ: (0300-01-109)  
 US57 AT MONROE ST  
 TRAFFIC SIGNAL  
 IMPROVEMENT

EAGLE PASS  
 CSJ: (1229-01-076)  
 FM1021 AT FM 3443  
 TRAFFIC SIGNAL  
 IMPROVEMENT



MAVERICK  
 COUNTY

NOT TO SCALE



**PROJECT LOCATION MAP**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CR: GR	CR: GR	TEXAS	SHEET 2 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

6/24/2022 FRAM052 Project Location Map.dgn

**Project Number:****Sheet 6****County:** VAL VERDE, ETC.**Control:** 0022-10-076, ETC.**Highway:** US 90, ETC**GENERAL NOTES:**

Contractor questions on this project are to be addressed to the following individual(s):

Antonio Reyna – [Antonio.Reyna1@txdot.gov](mailto:Antonio.Reyna1@txdot.gov)

Alberto Chavez – [Alberto.Chavez@txdot.gov](mailto:Alberto.Chavez@txdot.gov)

Contractor questions will be accepted through email , phone, and in person by the above individuals.

All contractor questions will be reviewed by the Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following address:  
<https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/>

All questions submitted that generate a response will be posted through this site. The site is organized by the District, Project Type (Construction or Maintenance), Letting Date, CCSJ/Project Name.

**Item 5 - Control of the Work**

The Contractor shall maintain and preserve the integrity of all “existing survey markers” by avoiding the disturbance of such markers; which include all control points (horizontal and/or vertical), stakes, marks, and right-of-way markers. The Department will repair all Contractor disturbed control points, stakes, marks, and right-of-way markers. The cost for any and all repairs to the “existing survey markers” will be deducted from money due or to become due to the Contractor.

Contact the Laredo District Signal Section (956-712-7770) for coordination with TxDOT underground lines and/or facilities.

Prior to construction must call 811 to verify any utilities located within project limits. Contractor will also coordinate with utility owners listed below for any adjustments needed to sanitary sewer manholes, water valves, gas valve, telecommunication, television manhole located within project limits. The utility company is responsible for any adjustment when necessary. The work should be performed in a manner as to not delay construction contractor work activity.

Contractor will make necessary arrangements with the utility owner(s) when utility adjustments are required, as a result of construction activities.

<u>Utility Owner</u>	<u>Phone Number</u>	<u>City/County</u>
TxDOT	(956) 712-7400	Laredo/Webb
AEP TEXAS	(361) 881-5532	Corpus Christi/Nueces
City of Del Rio (Gas System)	(830) 774-8622	Del Rio/Val Verde

**Item 6 - Control of Materials**

Contact the project engineer to request material a minimum of one work day prior to pick up. Load material with contract personnel. Store material in a safe location off TxDOT property or Right of Way, unless otherwise approved by the Engineer. Use material furnished by TxDOT only on the TxDOT project(s) intended. Return any unused material as soon as possible.

**Item 7 - Legal Relations and Responsibilities**

No significant traffic generator events identified.

Jurisdictional Waters of the United States and Project Specific Locations (PSL) Coordination - This project requires permit(s) with environmental resource agencies. There is a high probability that environmentally sensitive areas will be encountered on contractor designated project specific locations (PSLS) for the project (including but not limited to haul roads, equipment staging areas, parking areas, etc.).

Requirements for Work within Jurisdictional Waters of the United States: The department has been authorized to perform work within designated areas of the project under U.S. Army Corps of Engineers (USACE) nationwide permit (NWP) #14 and/or #3a and/or #3b.

The contractor will not initiate activities in a project specific location (PSL) associated with a U.S. Army Corps of Engineers (USACE) permit area (i.e. an area where the USACE has jurisdiction) that has not been previously evaluated by the USACE as part of the permitting for this project. Such activities include, but are not limited to, haul roads, equipment staging areas, borrow and disposal sites. Associated defined here includes materials delivered to or from the PSL. The permit area includes all waters of the U.S. and their associated wetlands affected by activities associated with this project. Special restrictions may be required for such work in these USACE jurisdictional areas. The contractor will be responsible for any and all consultations with the USACE regarding activities, including PSLs, which have not been previously evaluated by the USACE. The

**Project Number:****Sheet** 7**County:** VAL VERDE, ETC.**Control:** 0022-10-076, ETC.**Highway:** US 90, ETC

Contractor will provide the department with a copy of all consultation(s) or approval(s) from the USACE prior to initiating activities.

The contractor may proceed with activities in PSLs that do not affect a USACE permit area if a self determination has been made that the PSL is non-jurisdictional or proper USACE clearances have been obtained in jurisdictional areas or have been previously evaluated by the USACE as part of the permit review of this project. The contractor is solely responsible for documenting any determination(s) that their activities do not affect a USACE permit area. The contractor will maintain copies of their determination(s) for review by the department and/or any regulatory agency.

The disturbed area for all project locations in the Contract, and the Contractor project specific locations (PSLs) within 1 mile of the project limits for the Contract, will further establish the authorization requirements for storm water discharges. The Department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction activities shown on the plans. The Contractor is to obtain required authorization from the TCEQ for Contractor PSLs for construction support activities on or off the ROW. When the total area disturbed in the Contract and PSLs within 1 mile of the project limits exceeds 5 acres, the Contractor shall provide a copy of the Contractor Notice of Intent (NOI) for the PSLs to the Engineer and to the local government operating a municipal separate storm sewer system (MS4) if applicable. If the total area of project disturbed areas and PSLs total between 1-acre but less than 5-acres, the Contractor shall post the appropriate Contractor Construction Site Notice for all Contractor PSLs to be in compliance with TCEQ storm water regulations.

In order to expedite the approval process for PSLs or to eliminate or minimize potential impacts to project progress, initiate coordination efforts with the U.S.A.C.E. within 30 days from the date of "authorization to begin work" for all PSLs that are in areas where the USACE has jurisdiction (i.e. USACE permit areas). If this is not done, the contractor waives the right to request any contract time considerations if project progress is impacted and PSL'S approval is still pending.

Requests submitted to the area engineer will be evaluated on this basis, and will require documentation showing substantial early coordination efforts to expedite the approval process as herein stated. The request will include a detailed chronological summary status with dates of coordination activities with the resource agencies, including those occurring after the initial coordination, to be reviewed and confirmed by the district's environmental section.

For PSLs that fall within USACE permit areas, the Contractor must document and coordinate with the USACE, if required, before any excavation hauled from or embankment hauled into a USACE permit area by either (1) or (2) below.

1. Restricted Use of Materials for Previously Evaluated Permit Areas. The Contractor will document both the project specific location (PSL) and their authorization and the Contractor will maintain copies for review by the Department and/or any regulatory agency. When an area within the project limits has been evaluated by the USACE as part of the permit process for this project, then:
  - a. Suitable excavation of required material in the areas shown on the plans and cross sections as specified in Item 110 is used for permanent or temporary fill (Item 132, Embankment) within a USACE permit area may be restricted;
  - b. Suitable embankment (Item 132) from within the USACE permit area is used as fill within a USACE evaluated area may be restricted; and,
  - c. Unsuitable excavation or excess excavation ["Waste"] (Item 110) that is disposed of at an approved location within a USACE evaluated area may be restricted.
2. Contractor Materials from Areas Other than Previously Evaluated Areas. The Contractor will provide the Department with a copy of all USACE coordination or approvals before initiating any activities for an area within the project limits that has not been evaluated by the USACE or for any off right-of-way locations used for the following, but not limited to, haul roads, equipment staging areas, borrow and disposal sites, including:
  - a. Item 132, Embankment, used for temporary or permanent fill within a USACE permit area; and,
  - b. Unsuitable excavation or excess excavation ["Waste"] (Item 110, Excavation) that is disposed of outside a USACE evaluated area.

#### Storm Water Regulations Requirements:

The Contractor shall be responsible for (off ROW) PSLs applicable to the TCEQ Construction General Permit (CGP) requirements and will notify the Engineer of the disturbed acreage within one (1) mile of the project limits. The Contractor shall obtain any required authorization form the TCEQ for any Contractor PSLs for construction support activities on or off ROW.

The total disturbed areas within the ROW are anticipated at less than one (1) acre and/or this project is classified as "surface work" consisting of an asphalt overlay of an existing roadway without shoulder-up disturbances. Due to this

**Project Number:****Sheet 8****County:** VAL VERDE, ETC.**Control:** 0022-10-076, ETC.**Highway:** US 90, ETC

type of construction, the project qualifies for exclusion under the *Construction General Permit (CGP)* issued by the Texas Commission on Environmental Quality (TCEQ) on February 15, 2008. However; should the sum of the Engineer's anticipated disturbances and all of the Contractor's (On ROW and off ROW) PSLs equal or exceed the one (1) acre threshold, both TxDOT and the Contractor shall have project responsibilities under the CGP that reverts to non-exclusion status. To insure project compliance with all applicable water quality regulations, the Contractor shall obtain Engineer approval for all non-depicted areas of disturbance that increases the Engineer's initial soil and vegetation disturbed area estimates before associated work operations start.

**Item 8 - Prosecution and Progress**

No closures will be allowed on the weekends which include the following holidays: January 1, the last Monday in May, July 4, the first Monday in September, the fourth Thursday in November, December 25 and Easter weekend.

**Item 9 - Measurement and Payment**

Coordinate and provide off-duty law enforcement officers with officially marked vehicles (if patrol cruisers are available from the enforcement agency involved) during the following operations: traffic signal upgrades and lane closures For payment through TxDOT state force account method, complete the weekly tracking forms provided by the department and submit invoices that agree with the tracking form for payment at the end of each month approved services were provided.

Submit Material on hand (MOH) payment requests at least 5 working days prior to the end of the month for payment on that month's estimate. For out of town MOH submit requests at least 10 working days prior to the end of the month.

**Item 416 - Drilled Shaft Foundations**

Place the grounding rods for the traffic signal poles at the nearest ground box. The ground rod will be 5/8" x 10 feet. A continuous bare or green insulated copper wire (no. 6) will be installed from the ground rod to the base of the traffic signal.

**Item 421 - Hydraulic Cement Concrete**

Sulfate resistant cement concrete shall be used in all situations for structural elements in contact with the natural ground. These includes, but is not limited to, all reinforced concrete pipe, concrete box culverts, drill shafts, bridge columns, bridge abutments, wingwalls, approach slabs, inlets, manholes, junction boxes, ground boxes and all concrete riprap.

Air entrainment is not required. If concrete is supplied with air entrainment, the concrete must adhere to the requirements of item 421.4.2.4.

**Item 500 - Mobilization**

"Materials-on-Hand" payments will not be considered in determining percentages used to compute mobilization payments.

**Item 502 - Barricades, Signs, and Traffic Handling**

Designate, as the Contractor Responsible Person (CRP), an English speaking employee on-call nights and weekends (or any other time that work is not in progress) with a local address and telephone number for maintenance of signs and barricades. This employee will be located within one (1) hour of traveling time to the project site. Notify the Engineer in writing of the name, address and telephone number of this employee. Furnish this information to local law enforcement officials.

The time frame for the Contractor to provide properly maintained traffic control devices before they are considered to be in non-compliance with this Item, is 48 hours regardless of the days of the week involved after notification is done in writing by the Engineer.

When advanced warning flashing arrow panel(s) is/are specified, maintain one standby unit in good condition at the job site ready for immediate use is required.

Notify the Engineer (956-712-7770) at least two weeks prior to a proposed traffic pattern change(s) that will require a revision to traffic signals. This is required to provide the State/City time to perform a traffic study, determine the new signal timing and phasing settings that need to be implemented with the traffic change.

The Contractor will be paid for 5 months of Barricades, Signs, and Traffic Handling per signal work order location.



**Project Number:****Sheet 9****County:** VAL VERDE, ETC.**Control:** 0022-10-076, ETC.**Highway:** US 90, ETC

Whenever it is necessary for the signals to be turned off, when directed/approved by the Engineer, hire off-duty law enforcement officers as covered by Item 9 to control the traffic until the signals are back in satisfactory condition.

Traffic control required for this project will not be paid for directly, but will be considered subsidiary to the various bid items.

Provide two-way radios in areas where flagmen do not have visual contact with one another or cannot communicate with one another.

Limit lane closures to a maximum of 2 miles. If more than one lane closure location is desired, provide a minimum of a 2 mile passing zone between locations. Provide a separate sign set up for each location.

Ensure equipment not in use, stockpile aggregate, and other working materials are:

A minimum of 30 feet from the edge of the travel lane;  
Do not obstruct traffic or sight distance;  
Do not interfere with the access from abutting property; or  
Do not interfere with roadway drainage.

Erect signs in locations not obstructing the traveling public's view of the normal roadway signing or necessary sight distance at intersections and curves.

During the holiday time frame of December 21<sup>st</sup> through January 1st, every effort should be taken to ensure that all travel lanes remain open where possible.

The Contractor Force Account "Safety Contingency" that has been established for this project is intended to be utilized for work zone enhancements, to improve the effectiveness of the Traffic Control Plan, that could not be foreseen in the project planning and design stage. These enhancements will be mutually agreed upon by the Engineer and the Contractor's Responsible Person based on weekly or more frequent traffic management reviews on the project. The Engineer may choose to use existing bid items if it does not slow the implementation of enhancement.

**Item 506 - Temporary Erosion, Sedimentation, and Environmental Controls**

It is not anticipated that any erosion, sedimentation, or environmental control devices will be needed on this project. However, in the event that such controls are necessary, the SW3P for this project shall consist of the use of any temporary erosion control measures deemed necessary by the Engineer and as

provided under this item. Payment for this work will be determined in accordance with Article 4.4, "Changes in the Work".

**Item 618 - Conduit**

Place conduit in an area not exceeding 2 feet in any direction from a straight line and the depth of the conduit will be 2 feet, except when crossing a roadway, where the depth will not be more than 3 feet or less than 1 foot below the bottom of the base material in the roadway when placed by the jacking or boring method.

**Item 624 - Ground Boxes**

Do not place ground boxes in driveways or wheelchair ramps. Alternate ground box locations will be as directed. Ground box aprons will have a 2% slope.

**Item 636 - Signs**

Salvage and deliver all aluminum sign faces to the local TxDOT maintenance office.

**Item 644 - Small Roadside Sign Assemblies**

Salvage and deliver all aluminum sign faces to the local TxDOT maintenance office.

**Item 666 – Reflectorized Pavement Markings**

Reflectivity requirements for Type I will be as per Item 666.

Payment on Type I markings requiring retroreflective testing will be made at a 75% rate until passing test results are received.

**Item 680 - Highway Traffic Signals**

All workers installing electrical materials, including conduit in trenches, services poles and all others system electrical apparatus, will be directly supervised by persons who have completed a TxDOT approved course in electrical underground installations. Furnish evidence of satisfactory completion of the underground electrical installation for roadway illumination and signal control course for all personnel responsible for direct supervision of electrical installation work.

**Project Number:****Sheet 10****County:** VAL VERDE, ETC.**Control:** 0022-10-076, ETC.**Highway:** US 90, ETC

The signal installation will be wired to operate in accordance with the wiring diagram shown in the plans. The contractor will ensure that the timing and phasing are the same as shown in the plans. All timing and phasing will be approved and/or provided by the Transportation Operations Engineer prior to downloading to the controller.

On the terminal block, use the left side for the home runs and the right side for the signal heads. This pattern will be used in all signal installations. For grounding and bonding install a green insulated copper wire no. 6.

**Item 682 - Vehicle and Pedestrian Signal Heads**

All new signal heads will be covered with burlap from the time of installation until the signal is placed in operation. Position all vehicle signal section heads and pedestrian signal heads to provide the best view for motorists and pedestrians.

**Item 684 - Traffic Signal Cables**

For each traffic signal installation where signal cable is required, provide a minimum length of 5 feet for each conductor terminating in the controller.

Label all traffic signal cables, vehicle detector cables, and pedestrian signal cables terminating in the controller with marker ties and permanent markers.

**Item 690 - Maintenance of Traffic Signals**

Prior to construction, meet with the District Transportation Operations Section to determine salvageable traffic signal equipment. Dispose of all other equipment not deemed salvageable by the Engineer or his representative in a manner approved by the Engineer.

**Item 6001 - Portable Changeable Message Sign**

Provide TWO (2) electronic portable changeable message signs as required by the Engineer. Provide backups and keep operational and available on the jobsite at all times during traffic control operations. The electronic portable changeable message signs will be made available for utilization for the entire duration of the project, including all alternative locations.

**Item 6185 – Truck Mounted Attenuator (TMA) and Trailer**

Provide one (1) Truck Mounted Attenuator as required by the Engineer. Provide backup and keep operational and available on the jobsite at all times during traffic control operations. The Truck Mounted Attenuator will be made available for utilization for the entire duration of the project, including all alternative locations.

**Item 6306 – Video Imaging Vehicle Detection System**


Place a 5-foot camera support plumb; this item and its installation will be considered subsidiary to this bid item.

Program and input the detection zones as shown on the plans. Adjust the focus and zoom the camera to achieve the best picture quality.

Detection accuracy must be a minimum of 95% on each lane.

7/6/2022 FRAM052 CSJ\*0022-10-076\*Summary of Quantities.dgn

ITEM NO.	DESC NO.	DESCRIPTION	UNIT	US 90 AT KINGSWAY	INTERCONNECT US 57 AT MAIN	INTERCONNECT US 57 AT HAROLD	INTERCONNECT US 57 AT VETERANS	INTERCONNECT EAGLE PASS OFFICE TOWER	US 57 AT MONROE	FM 1021 AT FM 3443	TOTAL:
		<b>PLAN SHEET</b>		41	43	44	45	46-47	49-51	52-53	
500	6001	MOBILIZATION	LS								<b>1</b>
502	6002	BARRICADES, SIGNS AND TRAFFIC HANDLIN	MO								<b>5</b>
618	6023	CONDT (PVC) (SCH 40) (2")	LF	161							<b>161</b>
618	6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	89							<b>89</b>
620	6009	ELEC CONDR (NO.6) BARE	LF	260					612	637	<b>1509</b>
620	6010	ELEC CONDR (NO.6) INSULATED	LF	20						16	<b>36</b>
621	6002	TRAY CABLE (3 CONDR) (12 AWG)	LF							245	<b>245</b>
624	6008	GROUND BOX TY C (162911)W/APRON	EA	2							<b>2</b>
628	6002	REMOVE ELECTRICAL SERVICES	EA							1	<b>1</b>
628	6124	ELC SRV TY D 120/240 060(NS)GS(L)SP(O)	EA							1	<b>1</b>
628	6307	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	EA	2							<b>2</b>
636	6001	ALUMINUM SIGNS (TY A)	SF	36							<b>36</b>
644	6076	REMOVE SM RD SN SUP&AM	EA	2							<b>2</b>
666	6036	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	LF						250	380	<b>630</b>
666	6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	LF						450	280	<b>730</b>
666	6054	REFL PAV MRK TY I (W)(ARROW)(100MIL)	EA						6	7	<b>13</b>
666	6078	REFL PAV MRK TY I (W)(WORD)(100MIL)	EA						4	4	<b>8</b>
666	6147	REFL PAV MRK TY I (Y)24"(SLD)(100MIL)	LF						100	100	<b>200</b>
666	6224	PAVEMENT SEALER 4"	LF						5050	1430	<b>6480</b>
666	6226	PAVEMENT SEALER 8"	LF						250	380	<b>630</b>
666	6230	PAVEMENT SEALER 24"	LF						550	280	<b>830</b>
666	6231	PAVEMENT SEALER (ARROW)	EA						6	7	<b>13</b>
666	6232	PAVEMENT SEALER (WORD)	EA						4	4	<b>8</b>
666	6300	RE PM W/RET REQ TY I (W)4"(BRK)(100MIL)	LF						400	670	<b>1070</b>
666	6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF						4400	3170	<b>7570</b>
666	6312	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)	LF						500	235	<b>735</b>
666	6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF						4300	1450	<b>5750</b>
672	6007	REFL PAV MRKR TY I-C	EA						40	35	<b>75</b>
672	6009	REFL PAV MRKR TY II-A-A	EA						102	112	<b>214</b>
677	6001	ELIM EXT PAV MRK & MRKS (4")	LF						5300	1430	<b>6730</b>
677	6003	ELIM EXT PAV MRK & MRKS (8")	LF						250	380	<b>630</b>
677	6007	ELIM EXT PAV MRK & MRKS (24")	LF						550	280	<b>830</b>
677	6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA						6	7	<b>13</b>
677	6012	ELIM EXT PAV MRK & MRKS (WORD)	EA						4	4	<b>8</b>
678	6001	PAV SURF PREP FOR MRK (4")	LF						5300	1430	<b>6730</b>
678	6004	PAV SURF PREP FOR MRK (8")	LF						250	380	<b>630</b>
678	6008	PAV SURF PREP FOR MRK (24")	LF						550	280	<b>830</b>
678	6009	PAV SURF PREP FOR MRK (ARROW)	EA						6	7	<b>13</b>
678	6016	PAV SURF PREP FOR MRK (WORD)	EA						4	4	<b>8</b>



**TEXAS DEPARTMENT OF TRANSPORTATION**  
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**COMBINED QUANTITIES**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: G. R.	CK: G. R.	TEXAS	SHEET 1 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

7/6/2022 FRAM052 CSJ\*0022-10-076\*Summary of Quantities.dgn

ITEM NO.	DESC NO.	DESCRIPTION	UNIT	US 90 AT KINGSWAY	INTERCONNECT US 57 AT MAIN	INTERCONNECT US 57 AT HAROLD	INTERCONNECT US 57 AT VETERANS	INTERCONNECT EAGLE PASS OFFICE TOWER	US 57 AT MONROE	FM 1021 AT FM 3443	TOTAL:
<b>PLAN SHEET</b>											
680	6011	INSTALL HWY TRF SIG (UPGRADE)	EA	41	43	44	45	46-47	49-51	52-53	
	***	TRAFFIC SIGNAL CABINET AND CONTROLLE	EA				1		1		2
682	6001	VEH SIG SEC (12")LED(GRN)	EA						9	6	15
682	6002	VEH SIG SEC (12")LED(GRN ARW)	EA						4	1	5
682	6003	VEH SIG SEC (12")LED(YEL)	EA	8					9	6	23
682	6004	VEH SIG SEC (12")LED(YEL ARW)	EA						8	2	10
682	6005	VEH SIG SEC (12")LED(RED)	EA						9	6	15
682	6006	VEH SIG SEC (12")LED(RED ARW)	EA						4	1	5
682	6018	PED SIG SEC (LED)(COUNTDOWN)	EA							8	8
682	6054	BACKPLATE W/REF BRDR(3 SEC)(VENT)ALUM	EA						9	6	15
682	6055	BACKPLATE W/REF BRDR(4 SEC)(VENT)ALUM	EA						4	1	5
684	6007	TRF SIG CBL (TY A)(12 AWG)(2 CONDR)	LF						1002	582	1584
684	6008	TRF SIG CBL (TY A)(12 AWG)(3 CONDR)	LF	250							250
684	6009	TRF SIG CBL (TY A)(12 AWG)(4 CONDR)	LF						807	210	1017
684	6010	TRF SIG CBL (TY A)(12 AWG)(5 CONDR)	LF						186	426	612
684	6012	TRF SIG CBL (TY A)(12 AWG)(7 CONDR)	LF						174	348	522
684	6014	TRF SIG CBL (TY A)(12 AWG)(9 CONDR)	LF						516	578	1094
685	6001	INSTALL RDS FLASH BEACON ASSEMBLY	EA	4							4
687	6001	PED POLE ASSEMBLY	EA							1	1
688	6001	PED DETECT PUSH BUTTON (APS)	EA							4	4
688	6003	PED DETECTOR CONTROLLER UNIT	EA							1	1
690	6009	REMOVAL OF CABLES	LF						3290	6370	9660
690	6024	REMOVAL OF SIGNAL HEAD ASSM	EA						13	11	24
690	6027	REMOVAL OF SIGNAL RELATED SIGNS	EA							7	7
690	6029	INSTALL OF SIGNAL RELATED SIGNS	EA							4	4
690	6030	REMOVAL OF PEDESTRIAN PUSH BUTTONS	EA							4	4
690	6086	REMOVE VID IMAGE VEH DET SYS (VIVDS)	EA							4	4
690	6097	REMOVE SPREAD SPECTRUM ANTENNA	EA							1	1
6001	6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA								2
6010	6002	CCTV FIELD EQUIPMENT (DIGITAL)	EA						1	1	2
6010	6004	CCTV MOUNT (POLE)	EA						1	1	2
6027	6003	CONDUIT (PREPARE)	LF		90	25	45	10	582		752
6027	6008	GROUND BOX (PREPARE)	EA		3	2	2		5	6	18
6058	6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA				1		1	1	3
6062	6017	ITS RADIO (SNGL)(5 GHZ)-I-O	EA		1	2	1	2			6
6185	6002	TMA (STATIONARY)	DAY	18	4	4	4		19	21	70
6185	6003	TMA (MOBILE OPERATION)	HR						24	24	48
6306	6001	VIVDS PROSR SYS	EA			1	1		1	1	4
6306	6004	VIVDS CAM ASSY 360	EA			1	1		1	1	4
6306	6005	VIVDS CNTRL SOFTWARE	EA			1	1		1	1	4
6306	6007	VIVDS CABLING	LF			200	200		102	16	518
6306	6018	VIVDS CAM ASSY (REMOVE)	EA						4		4
6306	6020	VIVDS CABLING (REMOVE)	LF						200		200
6423	6007	FIELD HARDENED ETH SW (INSTALL ONLY)	EA		1	1	1	2			5
6423	6008	ETHERNET SURGE PROTECTOR(INSTALL	EA		1	2	1	1			5
6423	6014	CELLULAR MODEM RELOCATE	EA						1		1

STATE FORCE ACCOUNT (TXDOT PROVIDED)

ITEM NO.	DESC NO.	DESCRIPTION	UNIT	US 90 AT KINGSWAY	INTERCONNECT US 57 AT MAIN	INTERCONNECT US 57 AT HAROLD	INTERCONNECT US 57 AT VETERANS	INTERCONNECT EAGLE PASS OFFICE TOWER	US 57 AT MONROE	FM 1021 AT FM 3443	TOTAL:
	***	FIELD HARDENED ETHERNET SWITCH	EA		1	1	1	2			5
	***	ETHERNET SURGE PROTECTOR	EA		1	2	1	1			5

\*\*\* FOR CONTRACTOR INFORMATION ONLY



**COMBINED QUANTITIES**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: G. R.	CK: G. R.	TEXAS	SHEET 2 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0022-10-076

DISTRICT Laredo  
HIGHWAY FM 1021, US 57, US 90

COUNTY Maverick, Val Verde

CONTROL SECTION JOB				0022-10-076		0300-01-108		0300-01-109		1229-01-076		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00180050		A00180048		A00184459		A00179928			
COUNTY				Val Verde		Maverick		Maverick		Maverick			
HIGHWAY				US 90		US 57		US 57		FM 1021			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	500-6001	MOBILIZATION	LS	0.190		0.190		0.340		0.280		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	5.000								5.000	
	618-6023	CONDT (PVC) (SCH 40) (2")	LF	161.000								161.000	
	618-6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	89.000								89.000	
	620-6009	ELEC CONDR (NO.6) BARE	LF	260.000						637.000		897.000	
	620-6010	ELEC CONDR (NO.6) INSULATED	LF	20.000				612.000		16.000		648.000	
	621-6002	TRAY CABLE (3 CONDR) (12 AWG)	LF							245.000		245.000	
	624-6008	GROUND BOX TY C (162911)W/APRON	EA	2.000								2.000	
	628-6002	REMOVE ELECTRICAL SERVICES	EA							1.000		1.000	
	628-6124	ELC SRV TY D 120/240 060(NS)GS(L)SP(O)	EA							1.000		1.000	
	628-6307	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	EA	2.000								2.000	
	636-6001	ALUMINUM SIGNS (TY A)	SF	36.000								36.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	2.000								2.000	
	666-6036	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	LF					250.000		380.000		630.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	LF					450.000		280.000		730.000	
	666-6054	REFL PAV MRK TY I (W)(ARROW)(100MIL)	EA					6.000		7.000		13.000	
	666-6078	REFL PAV MRK TY I (W)(WORD)(100MIL)	EA					4.000		4.000		8.000	
	666-6147	REFL PAV MRK TY I (Y)24"(SLD)(100MIL)	LF					100.000		100.000		200.000	
	666-6224	PAVEMENT SEALER 4"	LF					5,050.000		1,430.000		6,480.000	
	666-6226	PAVEMENT SEALER 8"	LF					250.000		380.000		630.000	
	666-6230	PAVEMENT SEALER 24"	LF					550.000		280.000		830.000	
	666-6231	PAVEMENT SEALER (ARROW)	EA					6.000		7.000		13.000	
	666-6232	PAVEMENT SEALER (WORD)	EA					4.000		4.000		8.000	
	666-6300	RE PM W/RET REQ TY I (W)4"(BRK)(100MIL)	LF					400.000		670.000		1,070.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF					4,400.000		3,170.000		7,570.000	
	666-6312	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)	LF					500.000		235.000		735.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF					4,300.000		1,450.000		5,750.000	
	672-6007	REFL PAV MRKR TY I-C	EA					40.000		35.000		75.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA					102.000		112.000		214.000	
	677-6001	ELIM EXT PAV MRK & MRKS (4")	LF					5,300.000		1,430.000		6,730.000	
	677-6003	ELIM EXT PAV MRK & MRKS (8")	LF					250.000		380.000		630.000	
	677-6007	ELIM EXT PAV MRK & MRKS (24")	LF					550.000		280.000		830.000	
	677-6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA					6.000		7.000		13.000	
	677-6012	ELIM EXT PAV MRK & MRKS (WORD)	EA					4.000		4.000		8.000	
	678-6001	PAV SURF PREP FOR MRK (4")	LF					5,300.000		1,430.000		6,730.000	
	678-6004	PAV SURF PREP FOR MRK (8")	LF					250.000		380.000		630.000	
	678-6008	PAV SURF PREP FOR MRK (24")	LF					550.000		280.000		830.000	



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0022-10-076

DISTRICT Laredo  
HIGHWAY FM 1021, US 57, US 90

COUNTY Maverick, Val Verde

CONTROL SECTION JOB				0022-10-076		0300-01-108		0300-01-109		1229-01-076		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00180050		A00180048		A00184459		A00179928			
COUNTY				Val Verde		Maverick		Maverick		Maverick			
HIGHWAY				US 90		US 57		US 57		FM 1021			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	678-6009	PAV SURF PREP FOR MRK (ARROW)	EA					6.000		7.000		13.000	
	678-6016	PAV SURF PREP FOR MRK (WORD)	EA					4.000		4.000		8.000	
	680-6011	INSTALL HWY TRF SIG (UPGRADE)	EA					1.000				1.000	
	682-6001	VEH SIG SEC (12")LED(GRN)	EA					9.000		6.000		15.000	
	682-6002	VEH SIG SEC (12")LED(GRN ARW)	EA					4.000		1.000		5.000	
	682-6003	VEH SIG SEC (12")LED(YEL)	EA	8.000				9.000		6.000		23.000	
	682-6004	VEH SIG SEC (12")LED(YEL ARW)	EA					8.000		2.000		10.000	
	682-6005	VEH SIG SEC (12")LED(RED)	EA					9.000		6.000		15.000	
	682-6006	VEH SIG SEC (12")LED(RED ARW)	EA					4.000		1.000		5.000	
	682-6018	PED SIG SEC (LED)(COUNTDOWN)	EA							8.000		8.000	
	682-6054	BACKPLATE W/REF BRDR(3 SEC)(VENT)ALUM	EA					9.000		6.000		15.000	
	682-6055	BACKPLATE W/REF BRDR(4 SEC)(VENT)ALUM	EA					4.000		1.000		5.000	
	684-6007	TRF SIG CBL (TY A)(12 AWG)(2 CONDR)	LF					1,002.000		582.000		1,584.000	
	684-6008	TRF SIG CBL (TY A)(12 AWG)(3 CONDR)	LF	250.000								250.000	
	684-6009	TRF SIG CBL (TY A)(12 AWG)(4 CONDR)	LF					807.000		210.000		1,017.000	
	684-6010	TRF SIG CBL (TY A)(12 AWG)(5 CONDR)	LF					186.000		426.000		612.000	
	684-6012	TRF SIG CBL (TY A)(12 AWG)(7 CONDR)	LF					174.000		348.000		522.000	
	684-6014	TRF SIG CBL (TY A)(12 AWG)(9 CONDR)	LF					516.000		578.000		1,094.000	
	685-6001	INSTALL RDS FLASH BEACON ASSEMBLY	EA	4.000								4.000	
	687-6001	PED POLE ASSEMBLY	EA							1.000		1.000	
	688-6001	PED DETECT PUSH BUTTON (APS)	EA							4.000		4.000	
	688-6003	PED DETECTOR CONTROLLER UNIT	EA							1.000		1.000	
	690-6009	REMOVAL OF CABLES	LF					3,290.000		6,370.000		9,660.000	
	690-6024	REMOVAL OF SIGNAL HEAD ASSM	EA					13.000		11.000		24.000	
	690-6027	REMOVAL OF SIGNAL RELATED SIGNS	EA							7.000		7.000	
	690-6029	INSTALL OF SIGNAL RELATED SIGNS	EA							4.000		4.000	
	690-6030	REMOVAL OF PEDESTRIAN PUSH BUTTONS	EA							4.000		4.000	
	690-6086	REMOVE VID IMAGE VEH DET SYS (VIVDS)	EA							4.000		4.000	
	690-6097	REMOVE SPREAD SPECTRUM ANTENNA	EA							1.000		1.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA					2.000				2.000	
	6010-6002	CCTV FIELD EQUIPMENT (DIGITAL)	EA					1.000		1.000		2.000	
	6010-6004	CCTV MOUNT (POLE)	EA					1.000		1.000		2.000	
	6027-6003	CONDUIT (PREPARE)	LF			170.000		582.000				752.000	
	6027-6008	GROUND BOX (PREPARE)	EA			7.000		5.000		6.000		18.000	
	6058-6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA			1.000		1.000		1.000		3.000	
	6062-6017	ITS RADIO (SNGL)(5 GHZ)-I-O	EA			6.000						6.000	
	6185-6002	TMA (STATIONARY)	DAY	18.000		12.000		19.000		21.000		70.000	



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0022-10-076

DISTRICT Laredo  
HIGHWAY FM 1021, US 57, US 90

COUNTY Maverick, Val Verde

CONTROL SECTION JOB				0022-10-076		0300-01-108		0300-01-109		1229-01-076		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00180050		A00180048		A00184459		A00179928			
COUNTY				Val Verde		Maverick		Maverick		Maverick			
HIGHWAY				US 90		US 57		US 57		FM 1021			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	6185-6003	TMA (MOBILE OPERATION)	HR					24.000		24.000		48.000	
	6306-6001	VIVDS PROSR SYS	EA			2.000		1.000		1.000		4.000	
	6306-6004	VIVDS CAM ASSY 360	EA			2.000		1.000		1.000		4.000	
	6306-6005	VIVDS CNTRL SOFTWARE	EA			2.000		1.000		1.000		4.000	
	6306-6007	VIVDS CABLING	LF			400.000		102.000		16.000		518.000	
	6306-6018	VIVDS CAM ASSY (REMOVE)	EA					4.000				4.000	
	6306-6020	VIVDS CABLING (REMOVE)	LF					200.000				200.000	
	6423-6007	FIELD HARDENED ETH SW (INSTALL ONLY)	EA			5.000						5.000	
	6423-6008	ETHERNET SURGE PROTECTOR (INSTALL ONLY)	EA			5.000						5.000	
	6423-6014	CELLULAR MODEM RELOCATE	EA					1.000				1.000	
	11	STATE FORCE ACCOUNT WORK (PARTICIPATING)	LS			1.000						1.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000								1.000	
		LAW ENFORCEMENT: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000								1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000								1.000	


# TCP GENERAL NOTES:

1. This is a suggested Traffic Control Plan (TCP). The Contractor may submit an alternate Traffic Control Plan, signed and sealed by a Licensed Professional Engineer in Texas, for approval by the Engineer. When mutually beneficial changes are proposed to the existing Traffic Control Plan and are agreed upon by the Contractor and the Department, the plan sheets may be developed and signed and sealed by the Engineer.
2. Refer to Item 8 "Prosecution and Progress" and project general notes for additional information regarding the Traffic Control Plan.
3. Furnish and install all Traffic Control Plans devices, including but not limited to barricades, signs, and work zone markings, in compliance with the latest version of the Texas Manual on Uniform Traffic Control Devices (TxMUTCD), the State Standard Traffic Control Plans (TCP) sheets, and the Barricades and Construction (BC) sheets. Refer to the project general notes for additional information regarding the Traffic Control Plan.
4. Limit the length of lane closures to maximum of two miles. Refer to sequence of construction for further information. Allow for all lanes open to traffic during non-working hours unless otherwise specified in the sequence of construction. Any additional overnight lane closures not specified in the sequence of construction will require approval by the engineer.
5. Verify the location and spacing of signs, barricades, and channelizing devices prior to their placement along vertical curves, horizontal curves, and other geometric constraints to assure visibility to all motorists.
6. The work has been identified by reference location numbers. Various reference locations can be worked on simultaneously when approved by the engineer. Once work has begun at a reference location, it must be worked on continuously through completion. Additional signing to safely guide traffic through the work area will be required as directed by the engineer.
7. Place the traffic control devices only while work is actually in progress or a definite need exists. Always have enough barricades, channelizing devices, and signs at all times to replace those damaged.
8. Cover all existing signs that conflict with the Traffic Control Plan and uncover during non-working hours or as directed by the Engineer. Partial coverage of the sign or coverage by material that will not cover the entire sign all the time is not permitted.
9. Vary the spacing of signs to meet traffic conditions or as directed by the engineer and assure that all traffic control devices and work zone pavement markings are kept in a highly visible condition (clean, upright and at proper location).
10. Conduct construction operations so as to provide the least possible interference to traffic and to permit the continuous movement of traffic in all allowable directions at all times or as permitted by the sequence of construction. Provide for safe and convenient access to abutting property, highways, public roads, and street crossings except as otherwise shown on the sequence of construction. The contractor will maintain at all times two-way traffic or a minimum of one lane using a pilot vehicle and flaggers.
11. Place all stockpiled material, waste material, signs, barricades, channelizing devices and work vehicles not in use, at a minimum of 30 feet from the outer edge of the nearest travel lane.
12. Handle excavated and stockpiled material in such a way that it will not block drainage.
13. Regulate all construction traffic so as to cause a minimal inconvenience to the traveling public. At the times when it is necessary for trucks to stop, unload or cross roadways under traffic, provide warning signs and flaggers as needed to adequately protect the traveling public.
14. During the holiday time frame of December 21st through January 1st, every effort should be taken to ensure that all travel lanes remain open where possible.
15. Remove from the work area all loose materials and debris resulting from construction operations at the end of each work day.
16. Maintain a minimum of one through lane open in each direction during working hours except as directed by the Engineer.
17. Moving an existing sign to a temporary location is subsidiary to this item. Installations with permanent supports at permanent locations will be paid for under the applicable bid item(s).
18. Use of portable changeable message sign as advance notice of lane closures will be required, as directed by the engineer. For locations that are adjacent to each other, a single sign in advance of the entire work area is acceptable.
19. Place portable changeable message boards at locations requiring lane closures for 1 week before the closures or as directed by the engineer.
20. Additional signs, barricades and channelizing devices may be required to maintain traffic during construction, as shown on TCP standards. Additional signs, barricades, etc. (if any), will be subsidiary to items 502 "Barricades, Signs and Traffic Handling".
21. If the contractor chooses to work multiple locations in urban/rural areas simultaneously, contractor will be responsible for providing all applicable traffic control devices, including portable changeable message boards, and truck mounted attenuators at their own expense.
22. Use of truck mounted attenuators as noted on plans, TxDOT traffic control plan standards, or as directed by the engineer. For locations that are adjacent to each other, a single truck mounted attenuator of the entire work area is acceptable.
23. Refer to BC(6)-21 Portable Changeable Message Sign (PCMS) Standards for a listing of abbreviated words and two-word phrases that are acceptable for use on PCMS. Submit the suggested message for the board to the Engineer for approval.
24. Use plastic drums to channelize traffic when existing pavement markings have been obliterated.
25. Limit the length of daily work to that area of operation that can be completed in one work day in order to allow for two-way traffic at night. Such area must not exceed two (2) miles, unless approved by the engineer. Within the 2 mile section, only close off the area where actual work is being performed.
26. Provide full-time off-duty uniformed peace officers in officially marked vehicles as part of traffic control operations. the peace officers must supply proof of certification by the texas commission on law enforcement standards. this work will be paid for under the provisions of item 9.



THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY RAFAEL GUZMAN, P.E. 106025. ON 6/29/2022

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TEXAS DEPARTMENT OF TRANSPORTATION  
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**TCP  
GENERAL NOTES**

DN: GR	DW: GR	STATE	SHEET NUMBER			SHEET NO.
CK:	CK:	TEXAS	SHEET 1 OF 1			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.



# SEQUENCE OF CONSTRUCTION

## GENERAL INSTRUCTIONS

THE FOLLOWING WORK WILL BE PERFORMED ON THE ROADWAY AND NEAR THE SHOULDER. REFER TO THE TCP PHASES, TCP GENERAL NOTES, AND CORRESPONDING PLAN SHEETS FOR MORE DETAILED INFORMATION.

INSTALL ALL APPLICABLE BARRICADES, SIGNS, AND WORK ZONE MARKINGS IN ACCORDANCE WITH TCP, BC AND WZ TxDOT STANDARD SHEETS FOR TRAFFIC CONTROL SETUP.

INSTALL REQUIRED SW3P MEASURES WITHIN CONSTRUCTION LIMITS AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

## GENERAL SEQUENCE OF CONSTRUCTION

PHASE I - INSTALL PROPOSED TRAFFIC SIGNAL IMPROVEMENTS, ADVANCE WARNING SIGNS & FLASHERS, AND TRAFFIC SIGNAL INTERCONNECT.

PHASE II - PERFORM FINAL CLEAN UP.

## PHASE I

PLACE ADVANCE WARNING SIGNS AND TRAFFIC CONTROL DEVICES AS SPECIFIED ON THE TCP, BC, WZ TxDOT STANDARD SHEETS.

PROPOSED ELECTRICAL SERVICES ARE TO BE INSTALLED AS SHOWN IN THE PLANS. COORDINATE WITH UTILITY COMPANY AS NEEDED.

INSTALL PROPOSED TRAFFIC SIGNAL IMPROVEMENTS, ADVANCE WARNING SIGNS & FLASHERS, AND TRAFFIC SIGNAL INTERCONNECT AS SHOWN IN THE PLANS.

REMOVE AND INSTALL PAVEMENT MARKINGS AS SHOWN IN PLANS.

## PHASE II

PERFORM FINAL CLEAN UP AND REMOVE ALL BARRICADES AS DIRECTED BY THE ENGINEER.



THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY RAFAEL GUZMAN, P.E. 106025. ON 6/29/2022

DocuSigned by:

*Rafael Guzman*

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## SEQUENCE OF CONSTRUCTION

DN:	GR	DW:	GR	STATE	SHEET NUMBER			SHEET NO.
CK:	GR	CK:	GR	TEXAS	SHEET 1 OF 1			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.		
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.		

**BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:**

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. The development and design of the Traffic Control Plan (TCP) is the responsibility of the Engineer.
3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.
4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.
5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets," the TxDOT "Roadway Design Manual" or engineering judgment.
6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.
7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.
9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.
10. Where highway construction or maintenance work is being undertaken, other than mobile operations as defined by the Texas Manual on Uniform Traffic Control Devices, CSJ limit signs are required. CSJ limit signs are shown on BC(2). The OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits. For mobile operations, CSJ limit signs are not required.
11. Traffic control devices should be in place only while work is actually in progress or a definite need exists.
12. The Engineer has the final decision on the location of all traffic control devices.
13. Inactive equipment and work vehicles, including workers' private vehicles must be parked away from travel lanes. They should be as close to the right-of-way line as possible, or located behind a barrier or guardrail, or as approved by the Engineer.

**WORKER SAFETY NOTES:**

1. Workers on foot who are exposed to traffic or to construction equipment within the right-of-way shall wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel," or equivalent revisions, and labeled as ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. Class 3 garments should be considered for high traffic volume work areas or night time work.
2. Except in emergency situations, flagger stations shall be illuminated when flagging is used at night.

**COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES**

1. Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources.
2. Work zone traffic control devices shall be compliant with the Manual for Assessing safety Hardware (MASH).

<p><b>THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT</b>  <a href="http://www.txdot.gov">http://www.txdot.gov</a></p>
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)
MATERIAL PRODUCER LIST (MPL)
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"
STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS (SHSD)
TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD)
TRAFFIC ENGINEERING STANDARD SHEETS

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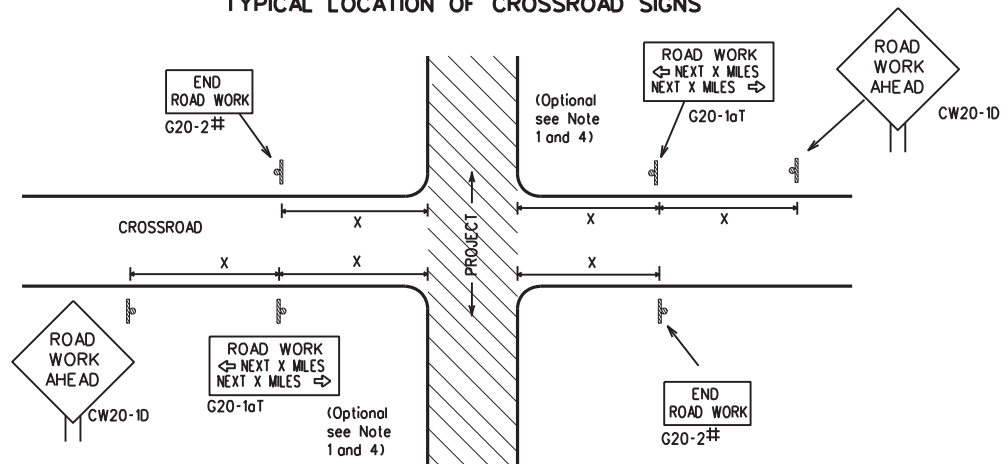


**BARRICADE AND CONSTRUCTION  
GENERAL NOTES  
AND REQUIREMENTS**

**BC(1)-21**

FILE:	bc-21.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0022	010	076	US90, etc.				
4-03	7-13	DIST		COUNTY	SHEET NO.				
9-07	8-14								
5-10	5-21	22	VAL	VERDE, etc.	18				

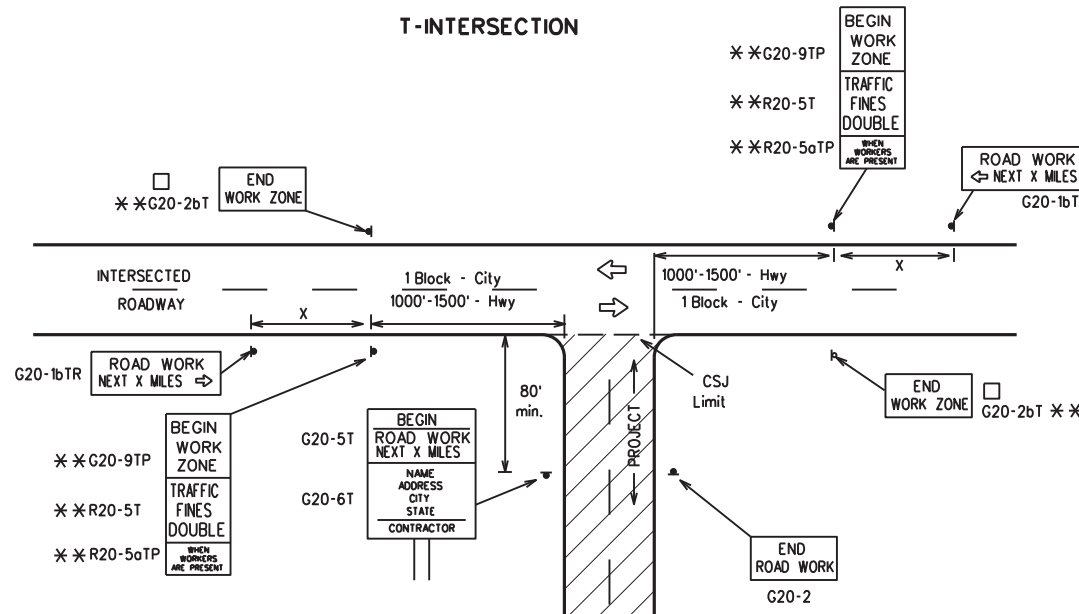
TYPICAL LOCATION OF CROSSROAD SIGNS



# May be mounted on back of "ROAD WORK AHEAD"(CW20-1D) sign with approval of Engineer. (See note 2 below)

- The typical minimum signing on a crossroad approach should be a "ROAD WORK AHEAD" (CW20-1D) sign and a (G20-2) "END ROAD WORK" sign, unless noted otherwise in plans.
- The Engineer may use the reduced size 36" x 36" ROAD WORK AHEAD (CW20-1D) sign mounted back to back with the reduced size 36" x 18" "END ROAD WORK"(G20-2) sign on low volume crossroads (see Note 4 under "Typical Construction Warning Sign Size and Spacing"). See the "Standard Highway Sign Designs for Texas" manual for sign details. The Engineer may omit the advance warning signs on low volume crossroads. The Engineer will determine whether a road is low volume as per TMUTCD Part 5. This information shall be shown in the plans.
- Based on existing field conditions, the Engineer/Inspector may require additional signs such as FLAGGER AHEAD, LOOSE GRAVEL, or other appropriate signs. When additional signs are required, these signs will be considered part of the minimum requirements. The Engineer/Inspector will determine the proper location and spacing of any sign not shown on the BC sheets, Traffic Control Plan sheets or the Work Zone Standard Sheets.
- The "ROAD WORK NEXT X MILES"(G20-1aT) sign shall be required at high volume crossroads to advise motorists of the length of construction in either direction from the intersection. The Engineer will determine whether a roadway is considered high volume.
- Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
- When work occurs in the intersection area, appropriate traffic control devices, as shown elsewhere in the plans or as determined by the Engineer/Inspector, shall be in place.

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

- The Engineer will determine the types and location of any additional traffic control devices, such as a flagger and accompanying signs, or other signs, that should be used when work is being performed at or near an intersection.
- If construction closes the road at a T-intersection, the Contractor shall place the "CONTRACTOR NAME"(G20-6T) sign behind the Type 3 Barricades for the road closure (see BC(10) also). The "ROAD WORK NEXT X MILES" left arrow(G20-1bTL) and "ROAD WORK NEXT X MILES" right arrow (G20-1bTR)" signs shall be replaced by the detour signing called for in the plans.

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING 1.5.6

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/ Freeway	Posted Speed MPH	Sign * Spacing "X" Feet (Apprx.)
CW20 <sup>4</sup>	48" x 48"	48" x 48"	30	120
CW21			35	160
CW23			40	240
CW25	36" x 36"	48" x 48"	45	320
CW1, CW2, CW7, CW8, CW9, CW11, CW14			50	400
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12			55	500 <sup>2</sup>
			60	600 <sup>2</sup>
			65	700 <sup>2</sup>
	70	800 <sup>2</sup>		
	75	900 <sup>2</sup>		
	80	1000 <sup>2</sup>		
*			*	* <sup>3</sup>

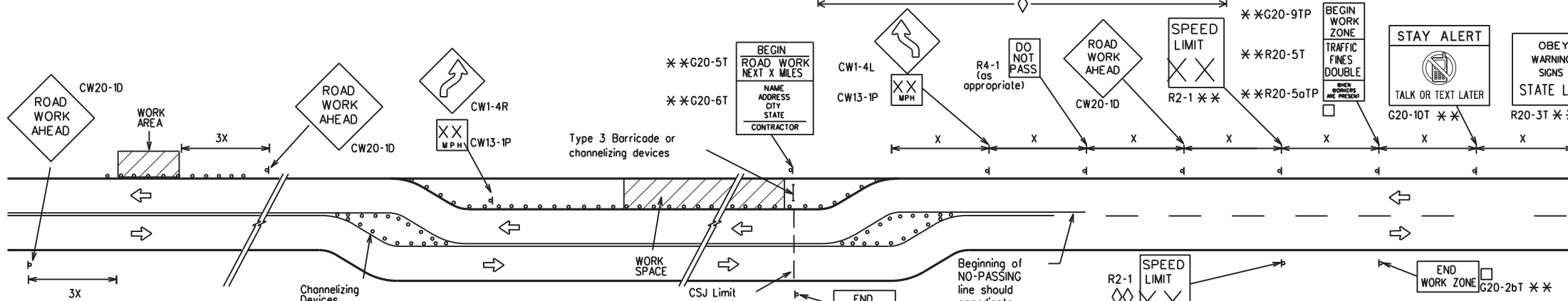
\* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

\* Minimum distance from work area to first Advance Warning sign nearest the work area and/or distance between each additional sign.

GENERAL NOTES

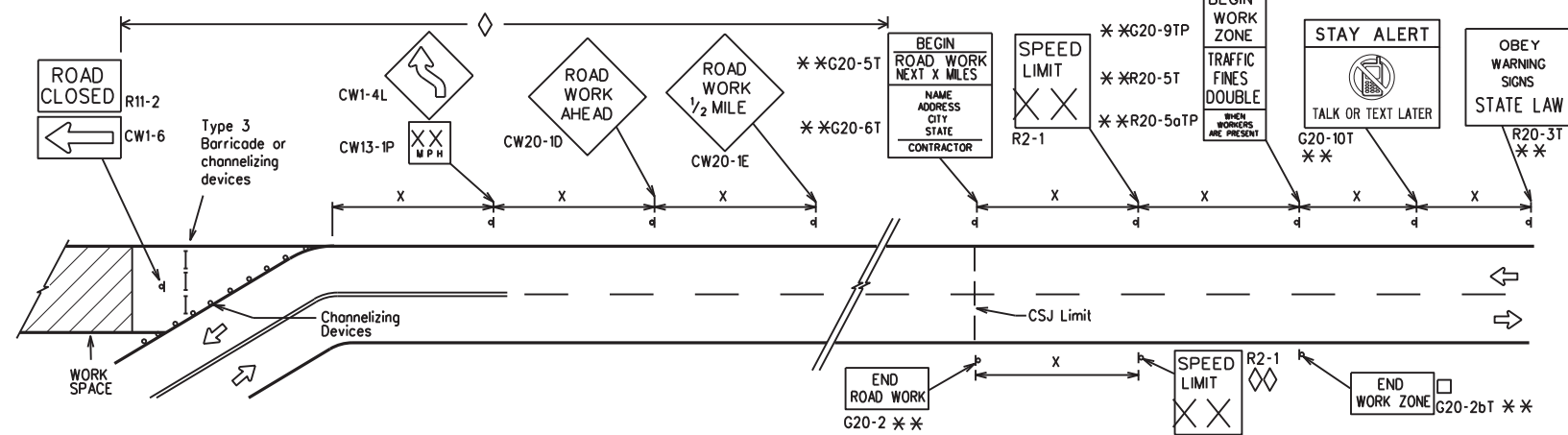
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be used on low volume crossroads at the discretion of the Engineer as per TMUTCD Part 5. See Note 2 under "Typical Location of Crossroad Signs".
- Only diamond shaped warning sign sizes are indicated.
- See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

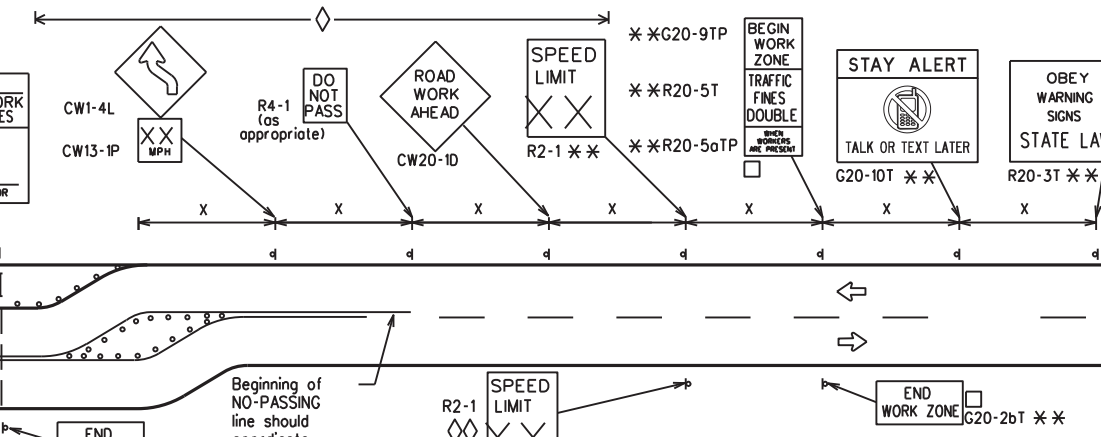


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing of signs and channelizing devices.

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING DOWNSTREAM OF THE CSJ LIMITS



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



NOTES

The Contractor shall determine the appropriate distance to be placed on the G20-1 series signs and "BEGIN ROAD WORK NEXT X MILES"(G20-5T) sign for each specific project. This distance shall replace the "X" and shall be rounded to the nearest whole mile with the approval of the Engineer. No decimals shall be used.

- The "BEGIN WORK ZONE"(G20-9TP) and "END WORK ZONE" (G20-2bT) shall be used as shown on the sample layout when advance signs are required outside the CSJ Limits. They inform the motorist of entering or leaving a part of the work zone lying outside the CSJ Limits where traffic fines may double if workers are present.
- CSJ limit signing is required for highway construction and maintenance work, with the exception of mobile operations.
- Area for placement of "ROAD WORK AHEAD" (CW20-1D) sign and other signs or devices as called for on the Traffic Control Plan.
- Contractor will install a regulatory speed limit sign at the end of the work zone.

LEGEND

—	Type 3 Barricade
○ ○ ○	Channelizing Devices
■	Sign
X	See Typical Construction Warning Sign Size and Spacing chart or the TMUTCD for sign spacing requirements.

SHEET 2 OF 12



BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
9-07	8-14			
7-13	5-21			
DIST	COUNTY		SHEET NO.	
22	VAL VERDE, etc.		19	

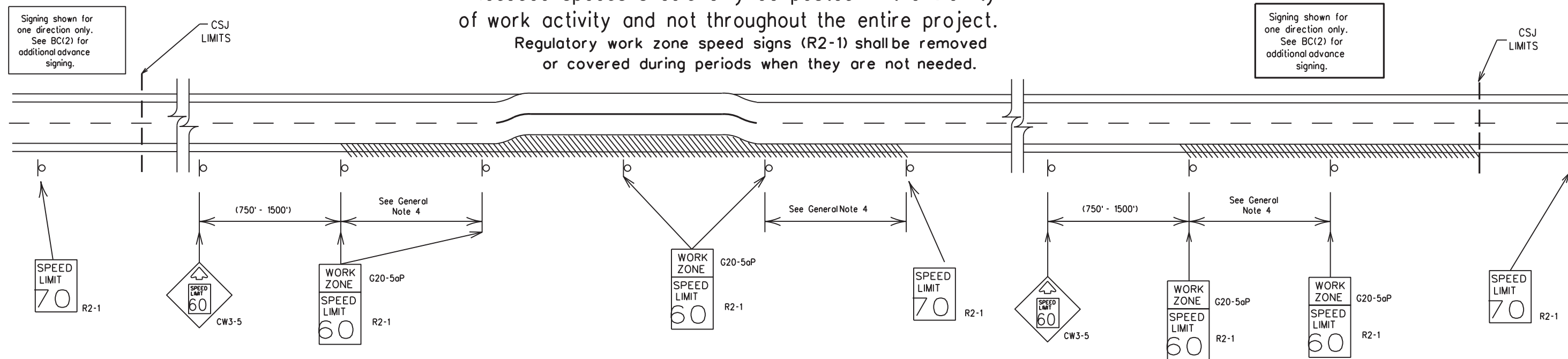
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# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

Work zone speed limits shall be regulatory, established in accordance with the "Procedures for Establishing Speed Zones," and approved by the Texas Transportation Commission, or by City Ordinance when within Incorporated City Limits.

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project. Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



## GUIDANCE FOR USE:

### LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit should be included on the design of the traffic control plans when restricted geometrics with a lower design speed are present in the work zone and modification of the geometrics to a higher design speed is not feasible.

Long/Intermediate Term Work Zone Speed Limit signs, when approved as described above, should be posted and visible to the motorist when work activity is present.

Work activity may also be defined as a change in the roadway that requires a reduced speed for motorists to safely negotiate the work area, including:

- a) rough road or damaged pavement surface
- b) substantial alteration of roadway geometrics (diversions)
- c) construction detours
- d) grade
- e) width
- f) other conditions readily apparent to the driver

As long as any of these conditions exist, the work zone speed limit signs should remain in place.

### SHORT TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit may be included on the design of the traffic control plans when workers or equipment are not behind concrete barrier, when work activity is within 10 feet of the traveled way or actually in the traveled way.

Short Term Work Zone Speed Limit signs should be posted and visible to the motorists only when work activity is present. When work activity is not present, signs shall be removed or covered. (See Removing or Covering on BC(4)).

## GENERAL NOTES

1. Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
2. Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
3. Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
4. Frequency of work zone speed limit signs should be:
  - 40 mph and greater 0.2 to 2 miles
  - 35 mph and less 0.2 to 1 mile
5. Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
6. Fabrication, erection and maintenance of the "ADVANCE SPEED LIMIT" (CW3-5) sign, "WORK ZONE" (G20-5aP) plaque and the "SPEED LIMIT" (R2-1) signs shall not be paid for directly, but shall be considered subsidiary to Item 502.
7. Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
8. Techniques that may help reduce traffic speeds include but are not limited to:
  - A. Low enforcement.
  - B. Flagger stationed next to sign.
  - C. Portable changeable message sign (PCMS).
  - D. Low-power (drone) radar transmitter.
  - E. Speed monitor trailers or signs.
9. Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
10. For more specific guidance concerning the type of work, work zone conditions and factors impacting allowable regulatory construction speed zone reduction see TxDOT form \*1204 in the TxDOT e-form system.

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SHEET 3 OF 12

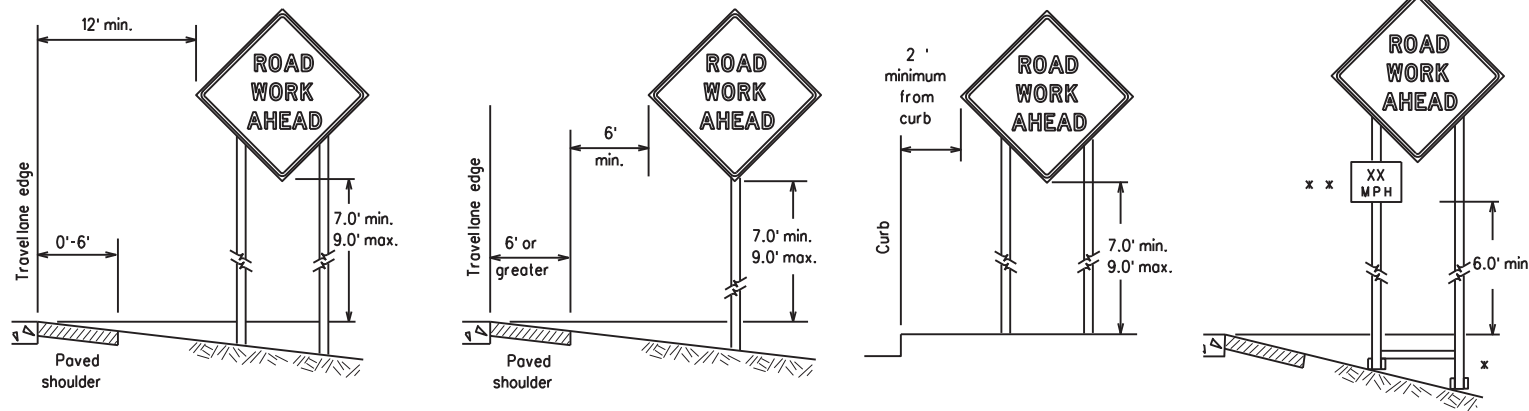


## BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

### BC(3)-21

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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0022	010	076	US90, etc.				
9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13	5-21	22	VAL VERDE, etc.	20					

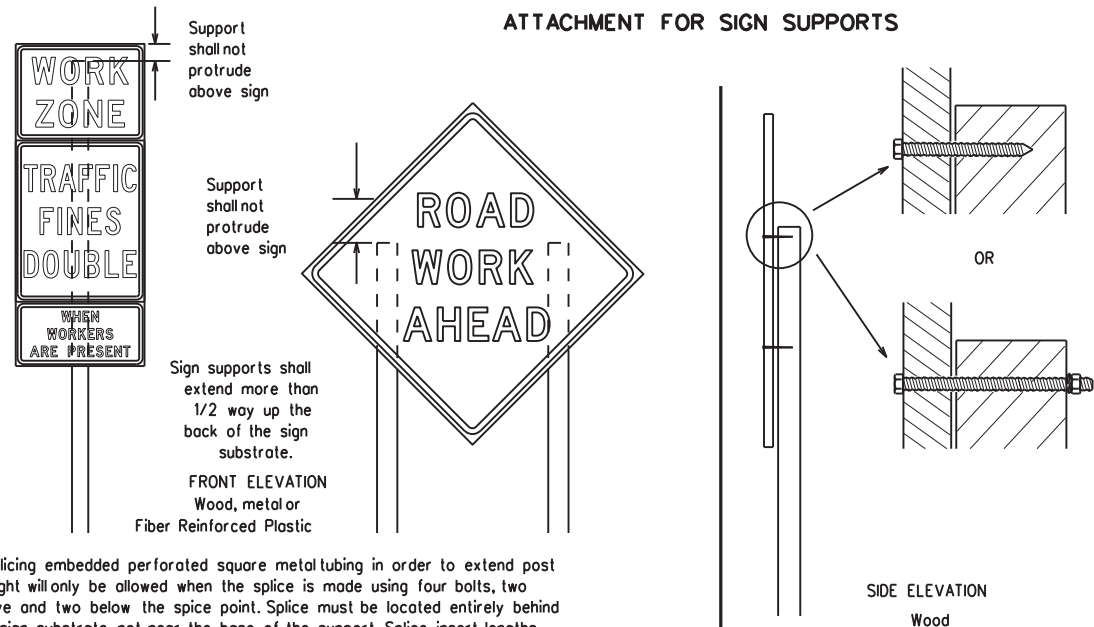
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



\* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

\* \* When plaques are placed on dual-leg supports, they should be attached to the upright nearest the travel lane. Supplemental plaques (advisory or distance) should not cover the surface of the parent sign.

**ATTACHMENT FOR SIGN SUPPORTS**



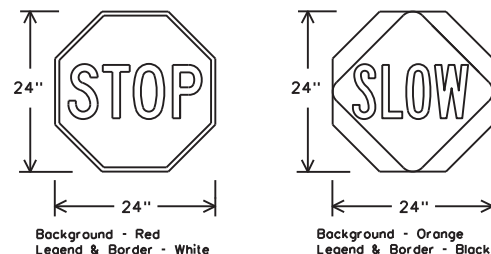
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

Nois shall NOT be allowed. Each sign shall be attached directly to the sign support. Multiple signs shall not be joined or spliced by any means. Wood supports shall not be extended or repaired by splicing or other means.

Splicing embedded perforated square metal tubing in order to extend post height will only be allowed when the splice is made using four bolts, two above and two below the splice point. Splice must be located entirely behind the sign substrate, not near the base of the support. Splice insert lengths should be at least 5 times nominal post size, centered on the splice and of at least the same gauge material.

**STOP/SLOW PADDLES**

1. STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24".
2. STOP/SLOW paddles shall be retroreflectORIZED when used at night.
3. STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
4. Any lights incorporated into the STOP or SLOW paddle faces shall only be as specifically described in Section 6E.03 Hand Signaling Devices in the TMUTCD.



SHEETING REQUIREMENTS (WHEN USED AT NIGHT)		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	ORANGE	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND & BORDER	WHITE	TYPE B OR C SHEETING
LEGEND & BORDER	BLACK	ACRYLIC NON-REFLECTIVE FILM

**CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS**

1. Permanent signs are used to give notice of traffic laws or regulations, call attention to conditions that are potentially hazardous to traffic operations, show route designations, destinations, directions, distances, services, points of interest, and other geographical, recreational, specific service (LOGO), or cultural information. Drivers proceeding through a work zone need the same, if not better route guidance as normally installed on a roadway without construction.
2. When permanent regulatory or warning signs conflict with work zone conditions, remove or cover the permanent signs until the permanent sign message matches the roadway condition. For details for covering large guide signs see the TS-CD standard.
3. When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
4. If existing signs are to be relocated on their original supports, they shall be installed on crashworthy bases as shown on the SMD Standard sheets. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards. This work should be paid for under the appropriate pay item for relocating existing signs.
5. If permanent signs are to be removed and relocated using temporary supports, the Contractor shall use crashworthy supports as shown on the BC standard sheets, TLRS standard sheets or the CWZTCD list. The signs shall meet the required mounting heights shown on the BC, or the SMD standard sheets during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
6. Any sign or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced as soon as possible by the Contractor to ensure proper guidance for the motorists. This will be subsidiary to Item 502.

**GENERAL NOTES FOR WORK ZONE SIGNS**

1. Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. All signs shall be installed in accordance with the plans or as directed by the Engineer. Signs shall be used to regulate, warn, and guide the traveling public safely through the work zone.
5. The Contractor may furnish either the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD). The Engineer/Inspector may require the Contractor to furnish other work zone signs that are shown in the TMUTCD but may have been omitted from the plans. Any variation in the plans shall be documented by written agreement between the Engineer and the Contractor's Responsible Person. All changes must be documented in writing before being implemented. This can include documenting the changes in the Inspector's TxDOT diary and having both the Inspector and Contractor initial and date the agreed upon changes.
6. The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD) for small roadside signs. Supports for temporary large roadside signs shall meet the requirements detailed on the Temporary Large Roadside Signs (TLRS) standard sheets. The Contractor shall install the sign support in accordance with the manufacturer's recommendations. If there is a question regarding installation procedures, the Contractor shall furnish the Engineer a copy of the manufacturer's installation recommendations so the Engineer can verify the correct procedures are being followed.
7. The Contractor is responsible for installing signs on approved supports and replacing signs with damaged or cracked substrates and/or damaged or marred reflective sheeting as directed by the Engineer/Inspector.
8. 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 inch.
9. The Contractor shall replace damaged wood posts. New or damaged wood sign posts shall not be spliced.

**DURATION OF WORK (as defined by the "Texas Manual on Uniform Traffic Control Devices" Part 6)**

1. The types of sign supports, sign mounting height, the size of signs, and the type of sign substrates can vary based on the type of work being performed. The Engineer is responsible for selecting the appropriate size sign for the type of work being performed. The Contractor is responsible for ensuring the sign support, sign mounting height and substrate meets manufacturer's recommendations in regard to crashworthiness and duration of work requirements.
  - a. Long-term stationary - work that occupies a location more than 3 days.
  - b. Intermediate-term stationary - work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than one hour.
  - c. Short-term stationary - daytime work that occupies a location for more than 1 hour in a single daylight period.
  - d. Short, duration - work that occupies a location up to 1 hour.
  - e. Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes.)

**SIGN MOUNTING HEIGHT**

1. The bottom of Long-term/Intermediate-term signs shall be at least 7 feet, but not more than 9 feet, above the paved surface, except as shown for supplemental plaques mounted below other signs.
2. The bottom of Short-term/Short Duration signs shall be a minimum of 1 foot above the pavement surface but no more than 2 feet above the ground.
3. Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
4. Short-term/Short Duration signs shall be used only during daylight and shall be removed at the end of the workday or raised to appropriate Long-term/Intermediate sign height.
5. Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

**SIZE OF SIGNS**

1. The Contractor shall furnish the sign sizes shown on BC (2) unless otherwise shown in the plans or as directed by the Engineer.

**SIGN SUBSTRATES**

1. The Contractor shall ensure the sign substrate is installed in accordance with the manufacturer's recommendations for the type of sign support that is being used. The CWZTCD lists each substrate that can be used on the different types and models of sign supports.
2. "Mesh" type materials are NOT an approved sign substrate, regardless of the tightness of the weave.
3. All wooden individual sign panels fabricated from 2 or more pieces shall have one or more plywood cleat, 1/2" thick by 6" wide, fastened to the back of the sign and extending fully across the sign. The cleat shall be attached to the back of the sign using wood screws that do not penetrate the face of the sign panel. The screws shall be placed on both sides of the splice and spaced at 6" centers. The Engineer may approve other methods of splicing the sign face.

**REFLECTIVE SHEETING**

1. All signs shall be retroreflective and constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 for rigid signs or DMS-8310 for roll-up signs. The web address for DMS specifications is shown on BC(1).
2. White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
3. Orange sheeting, meeting the requirements of DMS-8300 Type B or Type C, shall be used for rigid signs with orange backgrounds.

**SIGN LETTERS**

1. All sign letters and numbers shall be clear, and open rounded type uppercase alphabet letters as approved by the Federal Highway Administration (FHWA) and as published in the "Standard Highway Sign Design for Texas" manual. Signs, letters and numbers shall be of first class workmanship in accordance with Department Standards and Specifications.

**REMOVING OR COVERING**

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
2. Long-term stationary or intermediate stationary signs installed on square metal tubing may be turned away from traffic 90 degrees when the sign message is not applicable. This technique may not be used for signs installed in the median of divided highways or near any intersections where the sign may be seen from approaching traffic.
3. Signs installed on wooden skids shall not be turned at 90 degree angles to the roadway. These signs should be removed or completely covered when not required.
4. 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.
5. Burlap shall NOT be used to cover signs.
6. Duct tape or other adhesive material shall NOT be affixed to a sign face.
7. Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

**SIGN SUPPORT WEIGHTS**

1. Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
2. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
3. Rock, concrete, iron, steel or other solid objects shall not be permitted for use as sign support weights.
4. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
5. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall NOT be used.
6. 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.
7. 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.
8. Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

**FLAGS ON SIGNS**

1. Flags may be used to draw attention to warning signs. When used, the flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color. Flags shall not be allowed to cover any portion of the sign face.

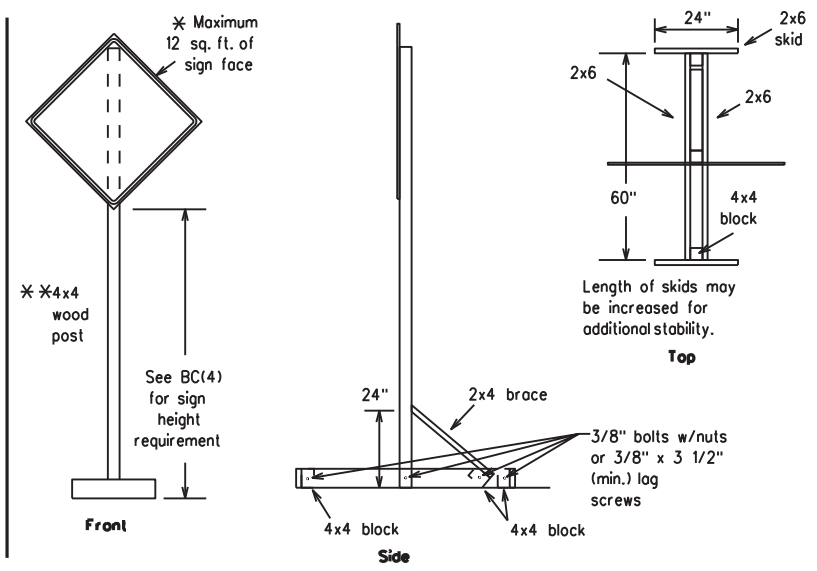
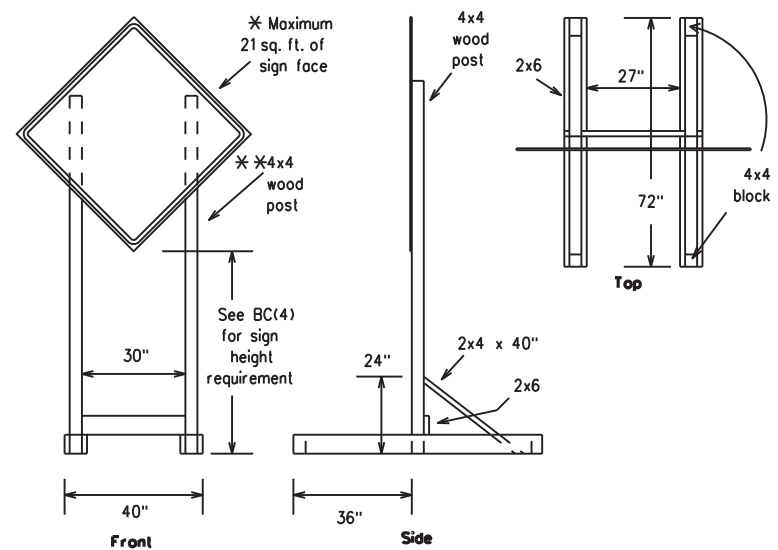


**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

**BC(4)-21**

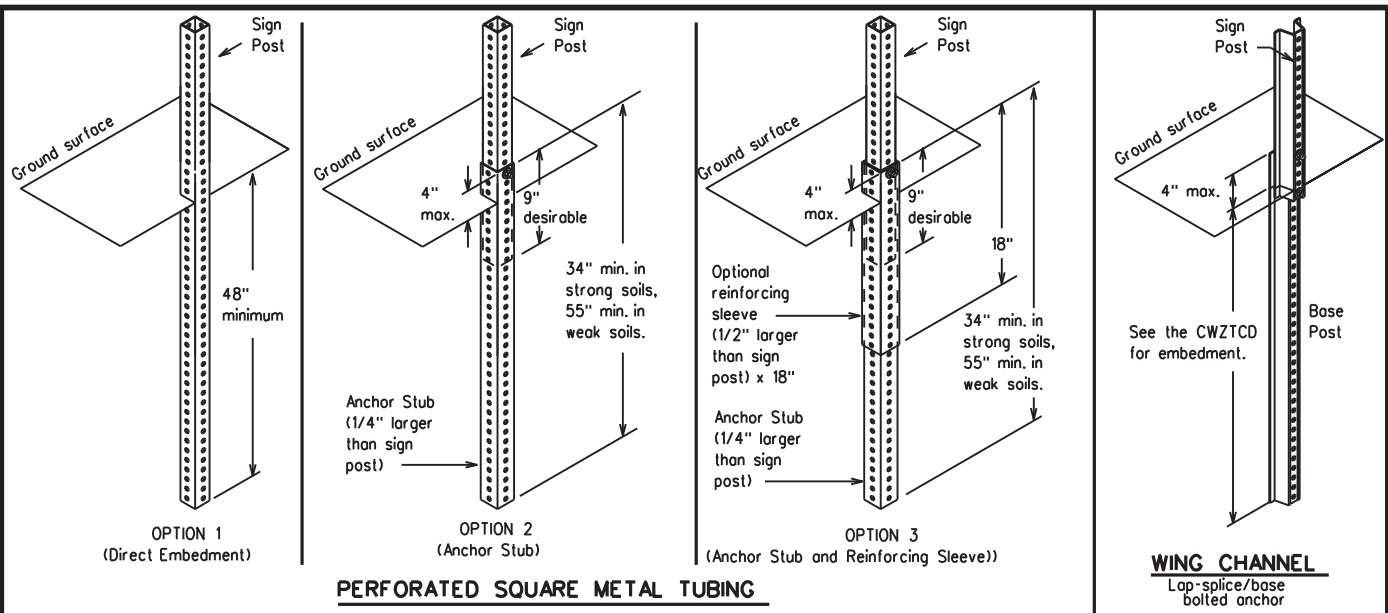
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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	22	VAL VERDE, etc.	21	

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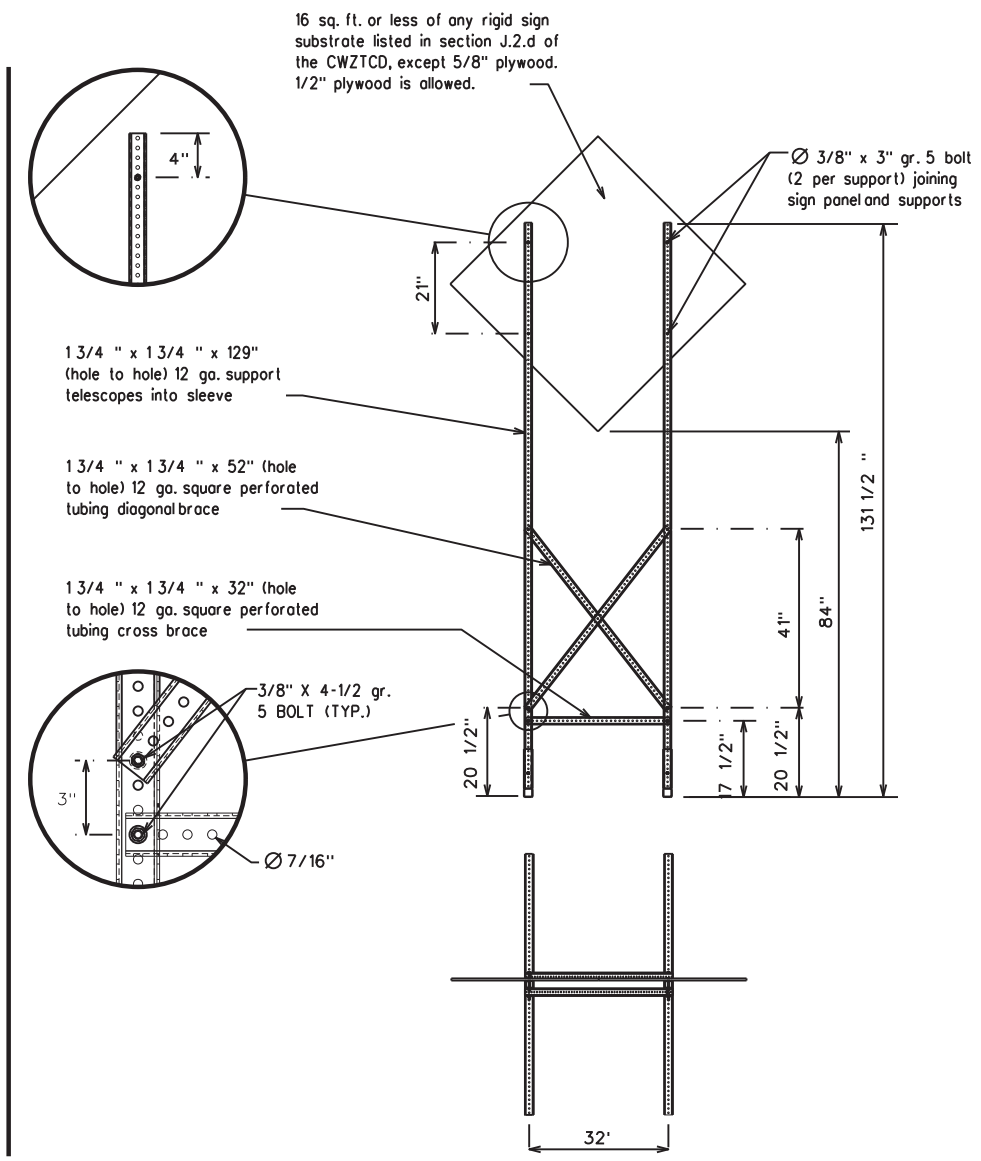
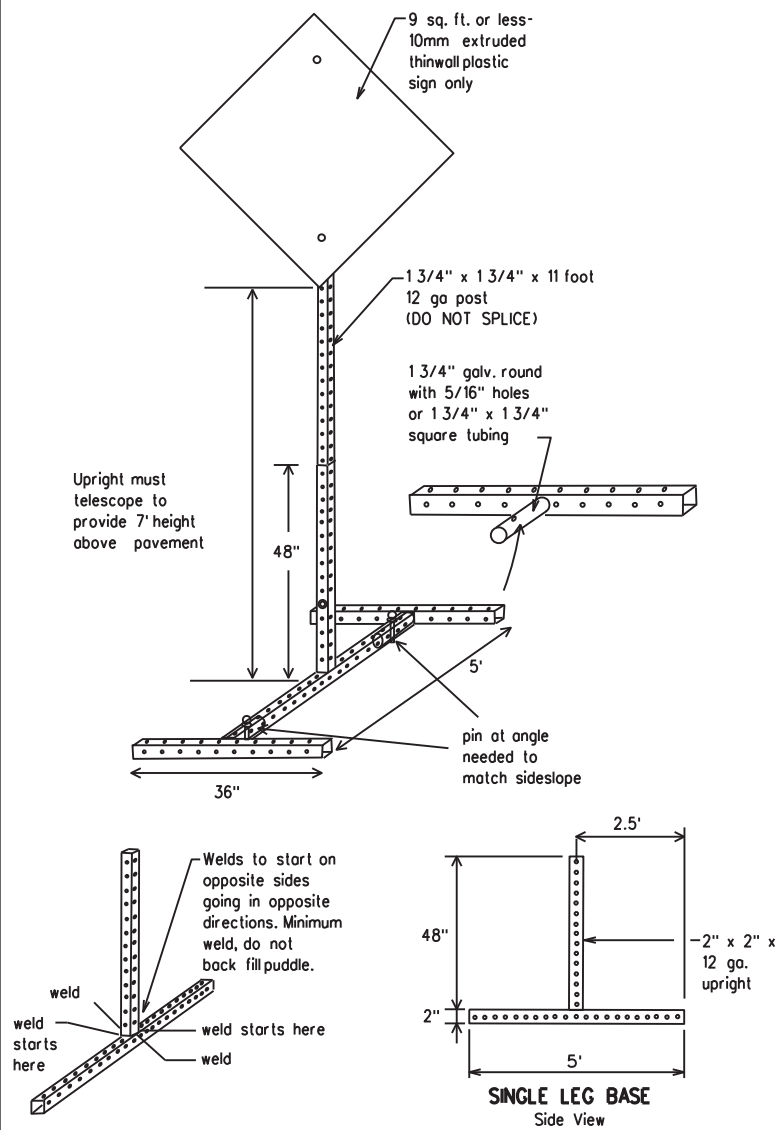
**SKID MOUNTED WOOD SIGN SUPPORTS**

\* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS



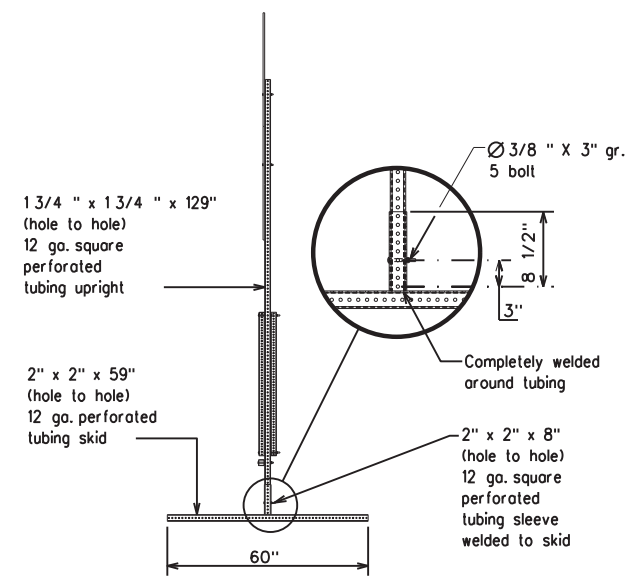
**GROUND MOUNTED SIGN SUPPORTS**

Refer to the CWZTCD and the manufacturer's installation procedure for each type sign support. The maximum sign square footage shall adhere to the manufacturer's recommendation. Two post installations can be used for larger signs.



**SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS**

\* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS



**WEDGE ANCHORS**

Both steel and plastic Wedge Anchor Systems as shown on the SMD Standard Sheets may be used as temporary sign supports for signs up to 10 square feet of sign face. They may be set in concrete or in sturdy soils if approved by the Engineer. (See web address for "Traffic Engineering Standard Sheets" on BC(1)).

**OTHER DESIGNS**

MORE DETAILS OF APPROVED LONG/INTERMEDIATE AND SHORT TERM SUPPORTS CAN BE FOUND ON THE CWZTCD LIST. SEE BC(1) FOR WEBSITE LOCATION.

**GENERAL NOTES**

- Nails may be used in the assembly of wooden sign supports, but 3/8" bolts with nuts or 3/8" x 3 1/2" lag screws must be used on every joint for final connection.
  - No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
  - When project is completed, all sign supports and foundations shall be removed from the project site. This will be considered subsidiary to Item 502.
- \* See BC(4) for definition of "Work Duration."
  - \*\* Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.
  - See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

SHEET 5 OF 12



**BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT**

**BC(5)-21**

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WHEN NOT IN USE, REMOVE THE PCMS FROM THE RIGHT-OF-WAY OR PLACE THE PCMS BEHIND BARRIER OR GUARDRAIL WITH SIGN PANEL TURNED PARALLEL TO TRAFFIC

**PORTABLE CHANGEABLE MESSAGE SIGNS**

- The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
- Messages on PCMS should contain no more than 8 words (about four to eight characters per word), not including simple words such as "TO," "FOR," "AT," etc.
- Messages should consist of a single phase, or two phases that alternate. Three-phase messages are not allowed. Each phase of the message should convey a single thought, and must be understood by itself.
- Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
- Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
- When in use, the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
- The message term "WEEKEND" should be used only if the work is to start on Saturday morning and end by Sunday evening at midnight. Actual days and hours of work should be displayed on the PCMS if work is to begin on Friday evening and/or continue into Monday morning.
- The Engineer/Inspector may select one of two options which are available for displaying a two-phase message on a PCMS. Each phase may be displayed for either four seconds each or for three seconds each.
- Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
- Do not present redundant information on a two-phase message; i.e., keeping two lines of the message the same and changing the third line.
- Do not use the word "Danger" in message.
- Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
- Do not display messages that scroll horizontally or vertically across the face of the sign.
- The following table lists abbreviated words and two-word phrases that are acceptable for use on a PCMS. Both words in a phrase must be displayed together. Words or phrases not on this list should not be abbreviated, unless shown in the TMUTCD.
- PCMS character height should be at least 18 inches for trailer mounted units. They should be visible from at least 1/2 (.5) mile and the text should be legible from at least 600 feet at night and 800 feet in daylight. Truck mounted units must have a character height of 10 inches and must be legible from at least 400 feet.
- Each line of text should be centered on the message board rather than left or right justified.
- If disabled, the PCMS should default to an illegible display that will not alarm motorists and will only be used to alert workers that the PCMS has malfunctioned. A pattern such as a series of horizontal solid bars is appropriate.

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WORD OR PHRASE	ABBREVIATION	WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD	Major	MAJ
Alternate	ALT	Miles	MI
Avenue	AVE	Miles Per Hour	MPH
Best Route	BEST RTE	Minor	MNR
Boulevard	BLVD	Monday	MON
Bridge	BRDG	Normal	NORM
Cannot	CANT	North	N
Center	CTR	Northbound	(route) N
Construction Ahead	CONST AHD	Parking	PKING
CROSSING	XING	Road	RD
Detour Route	DETOUR RTE	Right Lane	RT LN
Do Not	DONT	Saturday	SAT
East	E	Service Road	SERV RD
Eastbound	(route) E	Shoulder	SHLDR
Emergency	EMER	Slippery	SLIP
Emergency Vehicle	EMER VEH	South	S
Entrance, Enter	ENT	Southbound	(route) S
Express Lane	EXP LN	Speed	SPD
Expressway	EXPWY	Street	ST
XXXX Feet	XXXX FT	Sunday	SUN
Fog Ahead	FOG AHD	Telephone	PHONE
Freeway	FRWY, FWY	Temporary	TEMP
Freeway Blocked	FWY BLKD	Thursday	THURS
Friday	FRI	To Downtown	TO DWNTN
Hazardous Driving	HAZ DRIVING	Traffic	TRAF
Hazardous Material	HAZMAT	Travelers	TRVLRs
High Occupancy Vehicle	HOV	Tuesday	TUES
Highway	HWY	Time Minutes	TIME MIN
Hour(s)	HR, HRS	Upper Level	UPR LEVEL
Information	INFO	Vehicles (s)	VEH, VEHs
It Is	ITS	Warning	WARN
Junction	JCT	Wednesday	WED
Left	LFT	Weight Limit	WT LIMIT
Left Lane	LFT LN	West	W
Lane Closed	LN CLOSED	Westbound	(route) W
Lower Level	LWR LEVEL	Wet Pavement	WET PVMT
Maintenance	MAINT	Will Not	WONT

Roadway designation • IH-number, US-number, SH-number, FM-number

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

(The Engineer may approve other messages not specifically covered here.)

## Phase 1: Condition Lists

### Road/Lane/Ramp Closure List

FREEWAY CLOSED X MILE
ROAD CLOSED AT SH XXX
ROAD CLSD AT FM XXXX
RIGHT X LANES CLOSED
CENTER LANE CLOSED
NIGHT LANE CLOSURES
VARIOUS LANES CLOSED
EXIT CLOSED
MALL DRIVEWAY CLOSED
XXXXXXXX BLVD CLOSED

### Other Condition List

FRONTAGE ROAD CLOSED
SHOULDER CLOSED XXX FT
RIGHT LN CLOSED XXX FT
RIGHT X LANES OPEN
DAYTIME LANE CLOSURES
I-XX SOUTH EXIT CLOSED
EXIT XXX CLOSED X MILE
RIGHT LN TO BE CLOSED
X LANES CLOSED TUE - FRI

\* LANES SHIFT in Phase 1 must be used with STAY IN LANE in Phase 2.

## Phase 2: Possible Component Lists

### Action to Take/Effect on Travel List

MERGE RIGHT
DETOUR NEXT X EXITS
USE EXIT XXX
STAY ON US XXX SOUTH
TRUCKS USE US XXX N
WATCH FOR TRUCKS
EXPECT DELAYS
REDUCE SPEED XXX FT
USE OTHER ROUTES
STAY IN LANE

### Location List

AT FM XXXX
BEFORE RAILROAD CROSSING
NEXT X MILES
PAST US XXX EXIT
XXXXXXXX TO XXXXXXX
US XXX TO FM XXXX

### Warning List

SPEED LIMIT XX MPH
MAXIMUM SPEED XX MPH
MINIMUM SPEED XX MPH
ADVISORY SPEED XX MPH
RIGHT LANE EXIT
USE CAUTION
DRIVE SAFELY
DRIVE WITH CARE

### x x Advance Notice List

TUE -FRI XX AM - X PM
APR XX - XX X PM - X AM
BEGINS MONDAY
BEGINS MAY XX
MAY X - X XX PM - XX AM
NEXT FRI - SUN
XX AM TO XX PM
NEXT TUE AUG XX
TONIGHT XX PM - XX AM

x x See Application Guidelines Note 6.

### APPLICATION GUIDELINES

- Only 1 or 2 phases are to be used on a PCMS.
- The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
- A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
- A Location Phase is necessary only if a distance or location is not included in the first phase selected.
- If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS shall be limited to two phases, and should be understandable by themselves.
- For advance notice, when the current date is within seven days of the actual work date, calendar days should be replaced with days of the week. Advance notification should typically be for no more than one week prior to the work.

### WORDING ALTERNATIVES

- The words RIGHT, LEFT and ALL can be interchanged as appropriate.
- Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
- EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
- Highway names and numbers replaced as appropriate.
- ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
- AHEAD may be used instead of distances if necessary.
- FT and MI, MILE and MILES interchanged as appropriate.
- AT, BEFORE and PAST interchanged as needed.
- Distances or AHEAD can be eliminated from the message if a location phase is used.

PCMS SIGNS WITHIN THE R.O.W. SHALL BE BEHIND GUARDRAIL OR CONCRETE BARRIER OR SHALL HAVE A MINIMUM OF FOUR (4) PLASTIC DRUMS PLACED PERPENDICULAR TO TRAFFIC ON THE UPSTREAM SIDE OF THE PCMS, WHEN EXPOSED TO ONE DIRECTION OF TRAFFIC. WHEN EXPOSED TO TWO WAY TRAFFIC, THE FOUR DRUMS SHOULD BE PLACED WITH ONE DRUM AT EACH OF THE FOUR CORNERS OF THE UNIT.

### FULL MATRIX PCMS SIGNS

- When Full Matrix PCMS signs are used, the character height and legibility/visibility requirements shall be maintained as listed in Note 15 under "PORTABLE CHANGEABLE MESSAGE SIGNS" above.
- When symbol signs, such as the "Flagger Symbol" (CW20-7) are represented graphically on the Full Matrix PCMS sign and, with the approval of the Engineer, it shall maintain the legibility/visibility requirement listed above.
- When symbol signs are represented graphically on the Full Matrix PCMS, they shall only supplement the use of the static sign represented, and shall not substitute for, or replace that sign.
- A full matrix PCMS may be used to simulate a flashing arrow board provided it meets the visibility, flash rate and dimming requirements on BC(7), for the same size arrow.

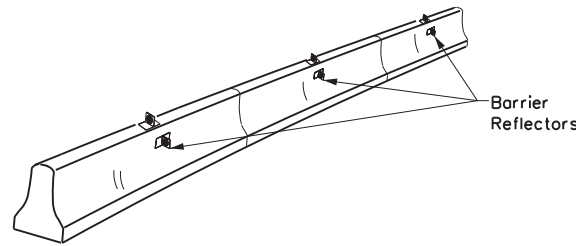


## BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

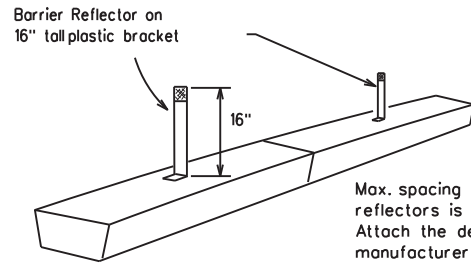
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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



**CONCRETE TRAFFIC BARRIER (CTB)**

- Where traffic is on one side of the CTB, two (2) Barrier Reflectors shall be mounted in approximately the midsection of each section of CTB. An alternate mounting location is uniformly spaced at one end of each CTB. This will allow for attachment of a barrier grapple without damaging the reflector. The Barrier Reflector mounted on the side of the CTB shall be located directly below the reflector mounted on top of the barrier, as shown in the detail above.
- Where CTB separates two-way traffic, three barrier reflectors shall be mounted on each section of CTB. The reflector unit on top shall have two yellow reflective faces (Bi-Directional) while the reflectors on each side of the barrier shall have one yellow reflective face, as shown in the detail above.
- When CTB separates traffic traveling in the same direction, no barrier reflectors will be required on top of the CTB.
- Barrier Reflector units shall be yellow or white in color to match the edgeline being supplemented.
- Maximum spacing of Barrier Reflectors is forty (40) feet.
- Pavement markers or temporary flexible-reflective roadway marker tabs shall NOT be used as CTB delineation.
- Attachment of Barrier Reflectors to CTB shall be per manufacturer's recommendations.
- Missing or damaged Barrier Reflectors shall be replaced as directed by the Engineer.
- Single slope barriers shall be delineated as shown on the above detail.

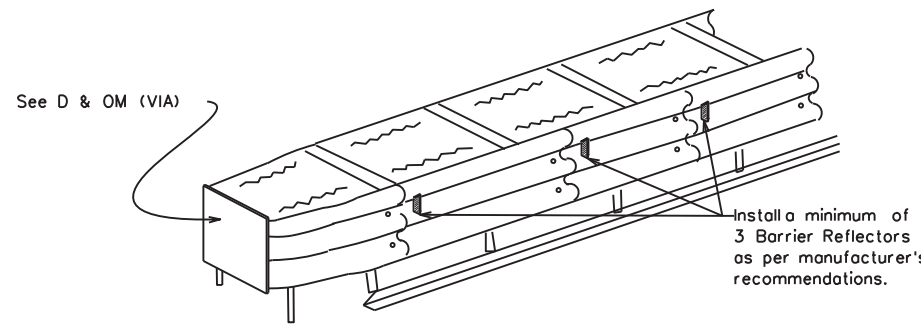


**LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES**

LPCB is approved for use in work zone locations, where the posted speed is 45mph, or less. See Roadway Standard Sheet LPCB.

Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

**LOW PROFILE CONCRETE BARRIER (LPCB)**



**DELINEATION OF END TREATMENTS**

**END TREATMENTS FOR CTB'S USED IN WORK ZONES**

End treatments used on CTB's in work zones shall meet the appropriate crashworthy standards as defined in the Manual for Assessing Safety Hardware (MASH). Refer to the CWZTCD List for approved end treatments and manufacturers.

**BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS**

**WARNING LIGHTS**

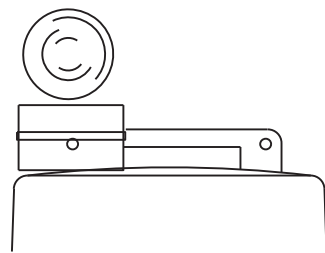
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "FL". The Type A Warning Lights shall not be used with signs manufactured with Type B or C sheeting, meeting the requirements of Departmental Material Specification DMS-8300.
- Type-C and Type D 360 degree Steady Burn Lights are intended to be used in a series for delineation to supplement other traffic control devices. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "SB".
- The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
- When required by the Engineer, the Contractor shall furnish a copy of the warning lights certification. The warning light manufacturer will certify the warning lights meet the requirements of the latest ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights.
- When used to delineate curves, Type-C and Type D Steady Burn Lights should only be placed on the outside of the curve, not the inside.
- The location of warning lights and warning reflectors on drums shall be as shown elsewhere in the plans.

**WARNING LIGHTS MOUNTED ON PLASTIC DRUMS**

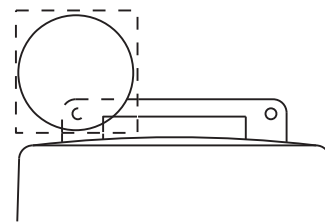
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing devices to form a merging taper may be used for delineation. If used, the successive flashing of the sequential warning lights should occur from the beginning of the taper to the end of the merging taper in order to identify the desired vehicle path. The rate of flashing for each light shall be 65 flashes per minute, plus or minus 10 flashes.
- Type C and D steady-burn warning lights are intended to be used in a series to delineate the edge of the travel lane on detours, on lane changes, on lane closures, and on other similar conditions.
- Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
- Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
- The maximum spacing for warning lights on drums should be identical to the channelizing device spacing.

**WARNING REFLECTORS MOUNTED ON PLASTIC DRUMS AS A SUBSTITUTE FOR TYPE C (STEADY BURN) WARNING LIGHTS**

- A warning reflector or approved substitute may be mounted on a plastic drum as a substitute for a Type C, steady burn warning light at the discretion of the Contractor unless otherwise noted in the plans.
- The warning reflector shall be yellow in color and shall be manufactured using a sign substrate approved for use with plastic drums listed on the CWZTCD.
- The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
- Round reflectors shall be fully reflectorized, including the area where attached to the drum.
- Square substrates must have a minimum of 30 square inches of reflectorized sheeting. They do not have to be reflectorized where it attaches to the drum.
- The side of the warning reflector facing approaching traffic shall have sheeting meeting the color and retroreflectivity requirements for DMS 8300-Type B or Type C.
- When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
- The warning reflector should be mounted on the side of the handle nearest approaching traffic.
- The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.



Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



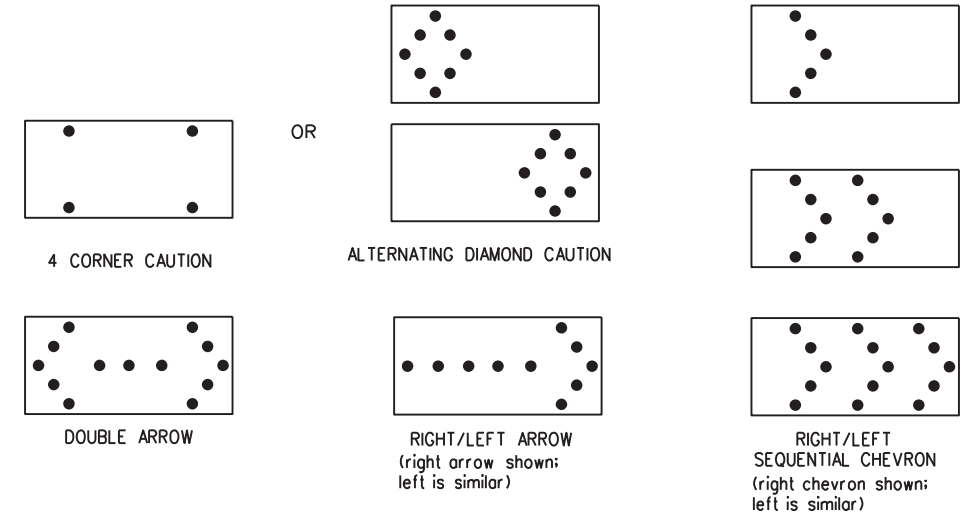
Warning reflector may be round or square. Must have a yellow reflective surface area of at least 30 square inches

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Arrow Boards may be located behind channelizing devices in place for a shoulder taper or merging taper, otherwise they shall be delineated with four (4) channelizing devices placed perpendicular to traffic on the upstream side of traffic.

- The Flashing Arrow Board should be used for all lane closures on multi-lane roadways, or slow moving maintenance or construction activities on the travel lanes.
- Flashing Arrow Boards should not be used on two-lane, two-way roadways, detours, diversions or work on shoulders unless the "CAUTION" display (see detail below) is used.
- The Engineer/Inspector shall choose all appropriate signs, barricades and/or other traffic control devices that should be used in conjunction with the Flashing Arrow Board.
- The Flashing Arrow Board should be able to display the following symbols:



- The "CAUTION" display consists of four corner lamps flashing simultaneously, or the Alternating Diamond Caution mode as shown.
- The straight line caution display is NOT ALLOWED.
- The Flashing Arrow Board shall be capable of minimum 50 percent dimming from rated lamp voltage. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute.
- Minimum lamp "on time" shall be approximately 50 percent for the flashing arrow and equal intervals of 25 percent for each sequential phase of the flashing chevron.
- The sequential arrow display is NOT ALLOWED.
- The flashing arrow display is the TxDOT standard; however, the sequential chevron display may be used during daylight operations.
- The Flashing Arrow Board shall be mounted on a vehicle, trailer or other suitable support.
- A Flashing Arrow Board SHALL NOT BE USED to laterally shift traffic.
- A full matrix PCMS may be used to simulate a Flashing Arrow Board provided it meets visibility, flash rate and dimming requirements on this sheet for the same size arrow.
- Minimum mounting height of trailer mounted Arrow Boards should be 7 feet from roadway to bottom of panel.

REQUIREMENTS			
TYPE	MINIMUM SIZE	MINIMUM NUMBER OF PANEL LAMPS	MINIMUM VISIBILITY DISTANCE
B	30 x 60	13	3/4 mile
C	48 x 96	15	1 mile

**ATTENTION**  
Flashing Arrow Boards shall be equipped with automatic dimming devices.

WHEN NOT IN USE, REMOVE THE ARROW BOARD FROM THE RIGHT-OF-WAY OR PLACE THE ARROW BOARD BEHIND CONCRETE TRAFFIC BARRIER OR GUARDRAIL.

**FLASHING ARROW BOARDS**

SHEET 7 OF 12

**TRUCK-MOUNTED ATTENUATORS**

- Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the Manual for Assessing Safety Hardware (MASH).
- Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
- Refer to the CWZTCD for a list of approved TMAs.
- TMAs are required on freeways unless otherwise noted in the plans.
- A TMA should be used anytime that it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
- The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.



**BARRICADE AND CONSTRUCTION ARROW PANEL, REFLECTORS, WARNING LIGHTS & ATTENUATOR**

**BC(7)-21**

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	22	VAL VERDE, etc.	24	



**GENERAL NOTES**

1. For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
2. For intermediate term stationary work zones on freeways, drums should be used as the primary channelizing device but may be replaced in tangent sections by vertical panels, or 42" two-piece cones. In tangent sections, one-piece cones may be used with the approval of the Engineer but only if personnel are present on the project at all times to maintain the cones in proper position and location.
3. For short term stationary work zones on freeways, drums are the preferred channelizing device but may be replaced in tapers, transitions and tangent sections by vertical panels, two-piece cones or one-piece cones as approved by the Engineer.
4. Drums and all related items shall comply with the requirements of the current version of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
5. Drums, bases, and related materials shall exhibit good workmanship and shall be free from objectionable marks or defects that would adversely affect their appearance or serviceability.
6. The Contractor shall have a maximum of 24 hours to replace any plastic drums identified for replacement by the Engineer/Inspector. The replacement device must be an approved device.

**GENERAL DESIGN REQUIREMENTS**

Pre-qualified plastic drums shall meet the following requirements:

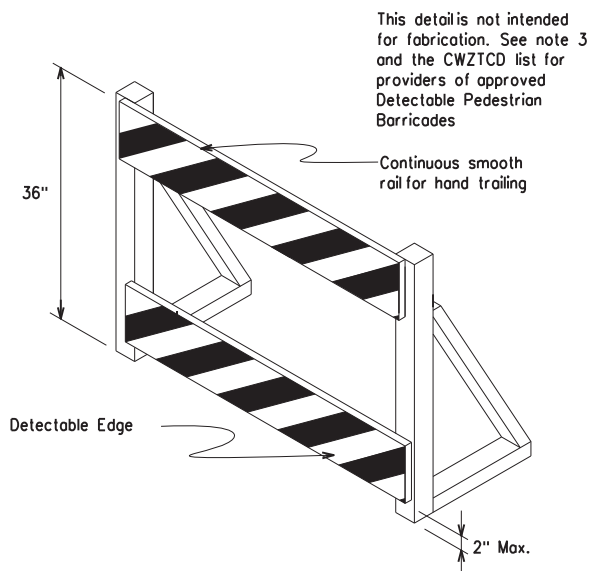
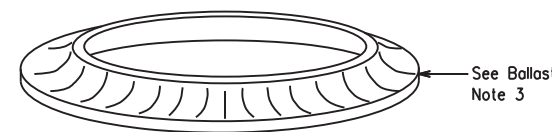
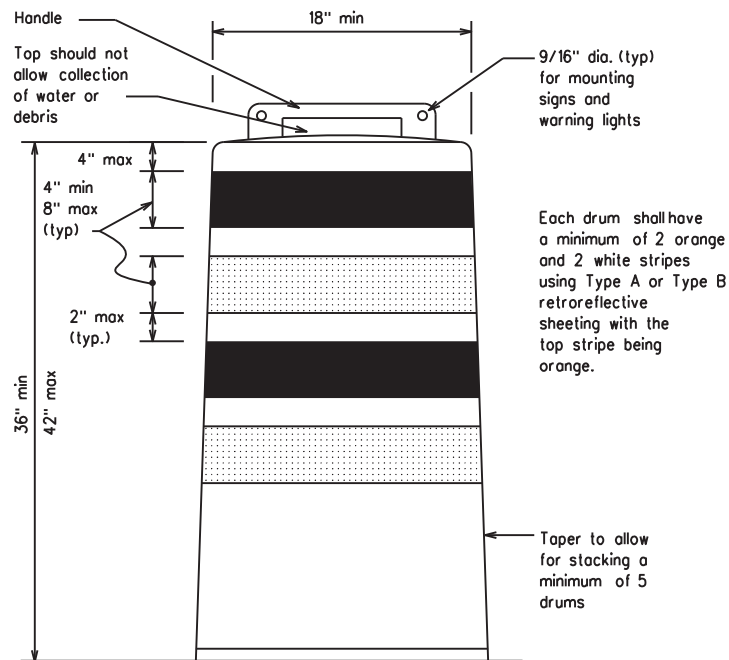
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
3. Plastic drums shall be constructed of lightweight flexible, and deformable materials. The Contractor shall NOT use metal drums or single piece plastic drums as channelization devices or sign supports.
4. Drums shall present a profile that is a minimum of 18 inches in width at the 36 inch height when viewed from any direction. The height of drum unit (body installed on base) shall be a minimum of 36 inches and a maximum of 42 inches.
5. The top of the drum shall have a built-in handle for easy pickup and shall be designed to drain water and not collect debris. The handle shall have a minimum of two widely spaced 9/16 inch diameter holes to allow attachment of a warning light, warning reflector unit or approved compliant sign.
6. The exterior of the drum body shall have a minimum of four alternating orange and white retroreflective circumferential stripes not less than 4 inches nor greater than 8 inches in width. Any non-reflectORIZED space between any two adjacent stripes shall not exceed 2 inches in width.
7. Bases shall have a maximum width of 36 inches, a maximum height of 4 inches, and a minimum of two footholds of sufficient size to allow base to be held down while separating the drum body from the base.
8. Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
9. Drum body shall have a maximum unballasted weight of 11 lbs.
10. Drum and base shall be marked with manufacturer's name and model number.

**RETROREFLECTIVE SHEETING**

1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall be suitable for use on and shall adhere to the drum surface such that, upon vehicular impact, the sheeting shall remain adhered in-place and exhibit no delaminating, cracking, or loss of retroreflectivity other than that loss due to abrasion of the sheeting surface.

**BALLAST**

1. Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other ballasting devices as approved by the Engineer. Stacking of sandbags will be allowed, however height of sandbags above pavement surface may not exceed 12 inches.
2. Bases with built-in ballast shall weigh between 40 lbs. and 50 lbs. Built-in ballast can be constructed of an integral crumb rubber base or a solid rubber base.
3. Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
4. The ballast shall not be heavy objects, water, or any material that would become hazardous to motorists, pedestrians, or workers when the drum is struck by a vehicle.
5. When used in regions susceptible to freezing, drums shall have drainage holes in the bottoms so that water will not collect and freeze becoming a hazard when struck by a vehicle.
6. Ballast shall not be placed on top of drums.
7. Adhesives may be used to secure base of drums to pavement.

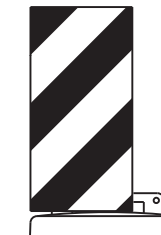


**DETECTABLE PEDESTRIAN BARRICADES**

1. When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Refer to WZ(BTS-2) for Pedestrian Control requirements for Sidewalk Diversions, Sidewalk Detours and Crosswalk Closures.
2. Where pedestrians with visual disabilities normally use the closed sidewalk, a Detectable Pedestrian Barricade shall be placed across the full width of the closed sidewalk instead of a Type 3 Barricade.
3. Detectable pedestrian barricades similar to the one pictured above, longitudinal channelizing devices, some concrete barriers, and wood or chain link fencing with a continuous detectable edging can satisfactorily delineate a pedestrian path.
4. Tape, rope, or plastic chain strung between devices are not detectable, do not comply with the design standards in the "Americans with Disabilities Act Accessibility Guidelines (ADAAG)" and should not be used as a control for pedestrian movements.
5. Warning lights shall not be attached to detectable pedestrian barricades.
6. Detectable pedestrian barricades should use 8" nominal barricade rails as shown on BC(10) provided that the top rail provides a smooth continuous rail suitable for hand trailing with no splinters, burrs, or sharp edges.



18" x 24" Sign  
(Maximum Sign Dimension)  
Chevron CW1-8, Opposing Traffic Lane Divider, Driveway sign D70a, Keep Right R4 series or other signs as approved by Engineer



12" x 24" Vertical Panel  
mount with diagonals sloping down towards travel way

Plywood, Aluminum or Metal sign substrates shall NOT be used on plastic drums

**SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS**

1. Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
2. Chevrons and other work zone signs with an orange background shall be manufactured with Type B or Type C Orange sheeting meeting the color and retroreflectivity requirements of DMS-8300, "Sign Face Material," unless otherwise specified in the plans.
3. Vertical Panels shall be manufactured with orange and white sheeting meeting the requirements of DMS-8300 Type A or Type B. Diagonal stripes on Vertical Panels shall slope down toward the intended traveled lane.
4. Other sign messages (text or symbolic) may be used as approved by the Engineer. Sign dimensions shall not exceed 18 inches in width or 24 inches in height, except for the R9 series signs discussed in note 8 below.
5. Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
6. Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
7. Chevrons may be placed on drums on the outside of curves, on merging tapers or on shifting tapers. When used in these locations, they may be placed on every drum or spaced not more than on every third drum. A minimum of three (3) should be used at each location called for in the plans.
8. R9-9, R9-10, R9-11 and R9-11a Sidewalk Closed signs which are 24 inches wide may be mounted on plastic drums, with approval of the Engineer.

SHEET 8 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

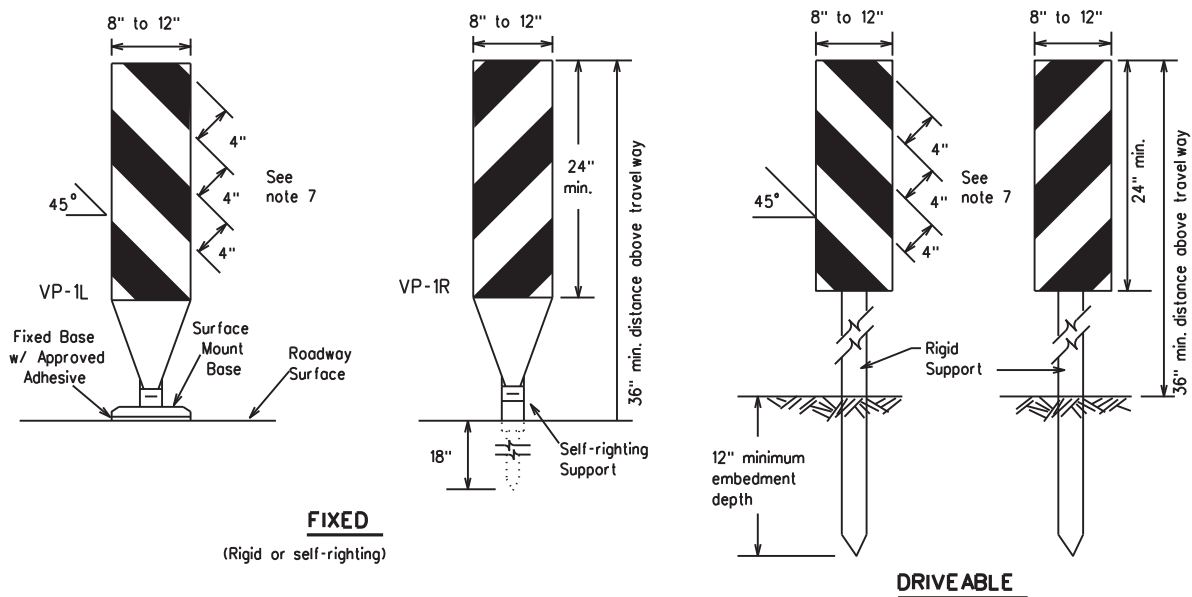
**BC(8)-21**

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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
4-03 8-14	DIST	COUNTY	SHEET NO.	
9-07 5-21	22	VAL VERDE, etc.	25	
7-13				

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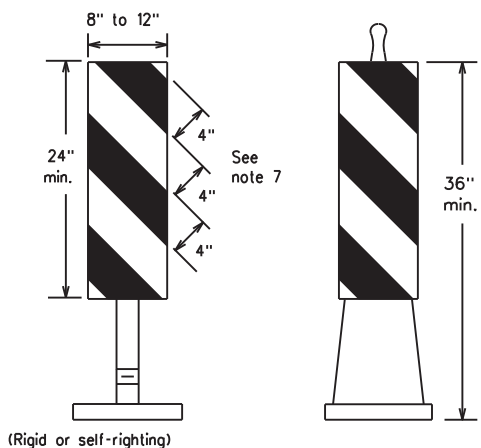
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**FIXED**  
(Rigid or self-righting)

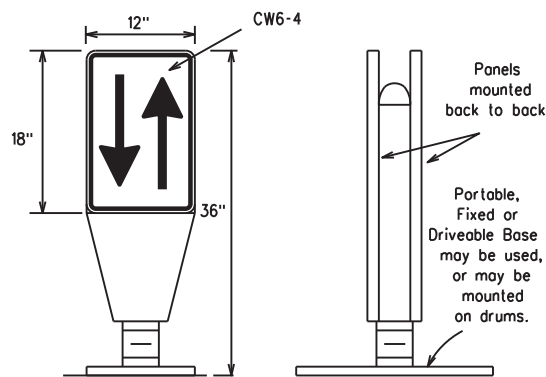
**DRIVEABLE**



**PORTABLE**

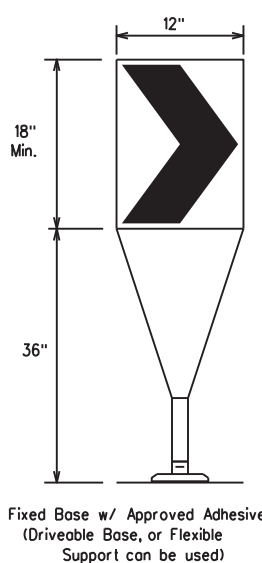
**VERTICAL PANELS (VPs)**

1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual for additional requirements on the use VP's for drop-offs.
3. VP's should be mounted back to back if used at the edge of cuts adjacent to two-way two lane roadways. Stripes are to be reflective orange and reflective white and should always slope downward toward the travel lane.
4. VP's used on expressways and freeways or other high speed roadways, may have more than 270 square inches of retroreflective area facing traffic.
5. Self-righting supports are available with portable base. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
6. Sheeting for the VP's shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
7. Where the height of reflective material on the vertical panel is 36 inches or greater, a panel stripe of 6 inches shall be used.



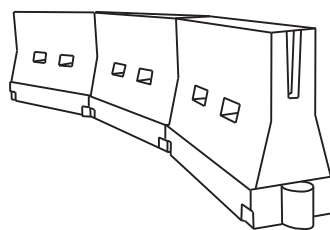
**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**

1. Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base is secured to the pavement with an adhesive or rubber weight to minimize movement caused by a vehicle impact or wind gust.
2. The OTLD may be used in combination with 42" cones or VPs.
3. Spacing between the OTLD shall not exceed 500 feet. 42" cones or VPs placed between the OTLD's should not exceed 100 foot spacing.
4. The OTLD shall be orange with a black non-reflective legend. Sheeting for the OTLD shall be retroreflective Type B or Type C conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



1. The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
2. Chevrons are intended to give notice of a sharp change of alignment with the direction of travel and provide additional emphasis and guidance for vehicle operators with regard to changes in horizontal alignment of the roadway.
3. Chevrons, when used, shall be erected on the outside of a sharp curve or turn, or on the far side of an intersection. They shall be in line with and at right angles to approaching traffic. Spacing should be such that the motorist always has three in view, until the change in alignment eliminates its need.
4. To be effective, the chevron should be visible for at least 500 feet.
5. Chevrons shall be orange with a black nonreflective legend. Sheeting for the chevron shall be retroreflective Type B or Type C conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.
6. For Long Term Stationary use on tapers or transitions on freeways and divided highways, self-righting chevrons may be used to supplement plastic drums but not to replace plastic drums.

**CHEVRONS**



**LONGITUDINAL CHANNELIZING DEVICES (LCD)**

1. LCDs are crashworthy, lightweight, deformable devices that are highly visible, have good target value and can be connected together. They are not designed to contain or redirect a vehicle on impact.
2. LCDs may be used instead of a line of cones or drums.
3. LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
5. LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
6. LCDs used as barricades placed perpendicular to traffic should have at least one row of reflective sheeting meeting the requirements for barricade rails as shown on BC(10). Place reflective sheeting near the top of the LCD along the full length of the device.

**WATER BALLASTED SYSTEMS USED AS BARRIERS**

1. Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate Manual for Assessing Safety Hardware (MASH) crashworthiness requirements based on roadway speed and barrier application.
2. Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
3. Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
5. When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to a point outside the clear zone.

If used to channelize pedestrians, longitudinal channelizing devices or water ballasted systems must have a continuous detectable bottom for users of long canes and the top of the unit shall not be less than 32 inches in height.

**HOLLOW OR WATER BALLASTED SYSTEMS USED AS LONGITUDINAL CHANNELIZING DEVICES OR BARRIERS**

**GENERAL NOTES**

1. Work Zone channelizing devices illustrated on this sheet may be installed in close proximity to traffic and are suitable for use on high or low speed roadways. The Engineer/Inspector shall ensure that spacing and placement is uniform and in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. Channelizing devices shown on this sheet may have a driveable, fixed or portable base. The requirement for self-righting channelizing devices must be specified in the General Notes or other plan sheets.
3. Channelizing devices on self-righting supports should be used in work zone areas where channelizing devices are frequently impacted by errant vehicles or vehicle related wind gusts making alignment of the channelizing devices difficult to maintain. Locations of these devices shall be detailed elsewhere in the plans. These devices shall conform to the TMUTCD and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
4. The Contractor shall maintain devices in a clean condition and replace damaged, nonreflective, faded, or broken devices and bases as required by the Engineer/Inspector. The Contractor shall be required to maintain proper device spacing and alignment.
5. Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh a minimum of 30 lbs.
6. Pavement surfaces shall be prepared in a manner that ensures proper bonding between the adhesives, the fixed mount bases and the pavement surface. Adhesives shall be prepared and applied according to the manufacturer's recommendations.
7. The installation and removal of channelizing devices shall not cause detrimental effects to the final pavement surfaces, including pavement surface discoloration or surface integrity. Driveable bases shall not be permitted on final pavement surfaces. The Engineer/Inspector shall approve all application and removal procedures of fixed bases.

Posted Speed	Formula	Minimum Desirable Taper Lengths x x			Suggested Maximum Spacing of Channelizing Devices	
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent
30	L = WS <sup>2</sup> / 60	150'	165'	180'	30'	60'
35		205'	225'	245'	35'	70'
40		265'	295'	320'	40'	80'
45	L = WS	450'	495'	540'	45'	90'
50		500'	550'	600'	50'	100'
55		550'	605'	660'	55'	110'
60		600'	660'	720'	60'	120'
65		650'	715'	780'	65'	130'
70		700'	770'	840'	70'	140'
75		750'	825'	900'	75'	150'
80		800'	880'	960'	80'	160'

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

**SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS**

SHEET 9 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(9)-21**

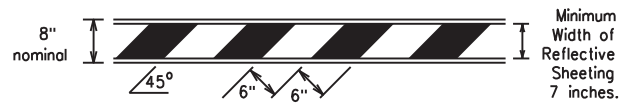
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© TxDOT	November 2002	CONT:	SECT:	JOB:	HIGHWAY:				
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9-07	8-14	DIST:	COUNTY:	SHEET NO.					
7-13	5-21	22	VAL VERDE, etc.	26					

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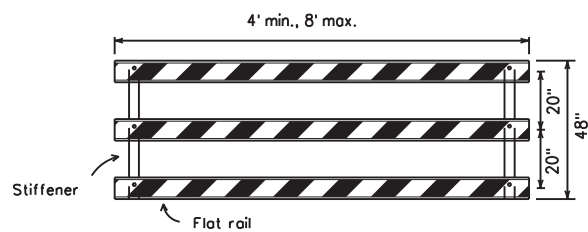
**TYPE 3 BARRICADES**

1. Refer to the Compliant Work Zone Traffic Control Devices List (CWZTCD) for details of the Type 3 Barricades and a list of all materials used in the construction of Type 3 Barricades.
2. Type 3 Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending across a roadway should have stripes that slope downward in the direction toward which traffic must turn in detouring. When both right and left turns are provided, the chevron striping may slope downward in both directions from the center of the barricade. Where no turns are provided at a closed road, striping should slope downward in both directions toward the center of roadway.
4. Striping of rails, for the right side of the roadway, should slope downward to the left. For the left side of the roadway, striping should slope downward to the right.
5. Identification markings may be shown only on the back of the barricade rails. The maximum height of letters and/or company logos used for identification shall be 1".
6. Barricades shall not be placed parallel to traffic unless an adequate clear zone is provided.
7. Warning lights shall NOT be installed on barricades.
8. Where barricades require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight. Sand bags shall not be stacked in a manner that covers any portion of a barricade rails reflective sheeting. Rock, concrete, iron, steel or other solid objects will NOT be permitted. 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 for sandbags. Sandbags shall only be placed along or upon the base supports of the device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners.
9. Sheeting for barricades shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.

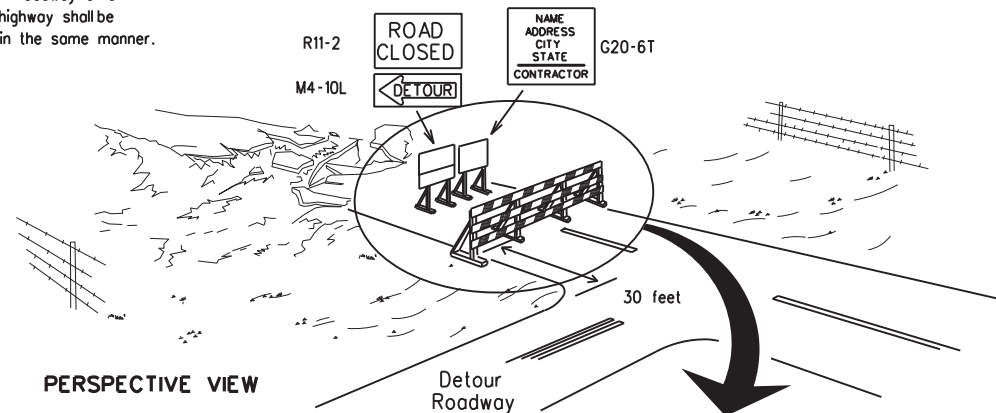


**TYPICAL STRIPING DETAIL FOR BARRICADE RAIL**



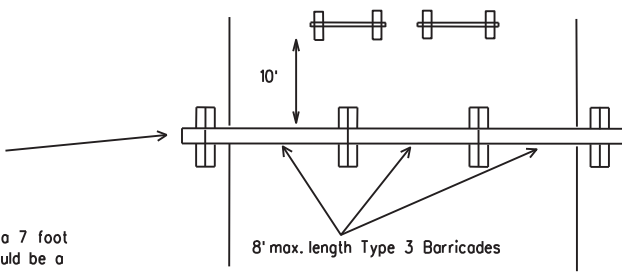
**TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES**

Each roadway of a divided highway shall be barricaded in the same manner.



PERSPECTIVE VIEW

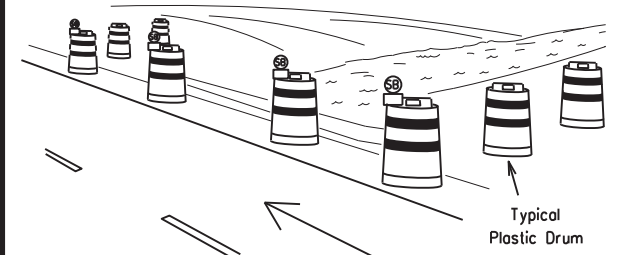
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



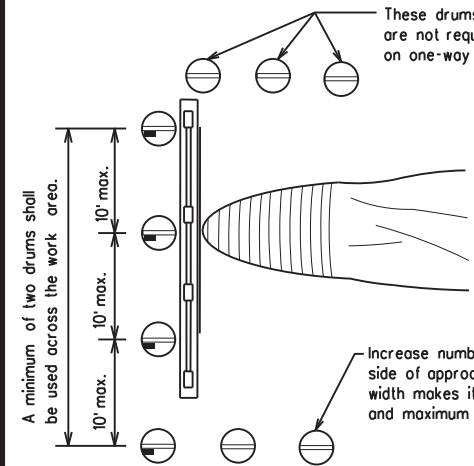
PLAN VIEW

1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

**TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION**



PERSPECTIVE VIEW

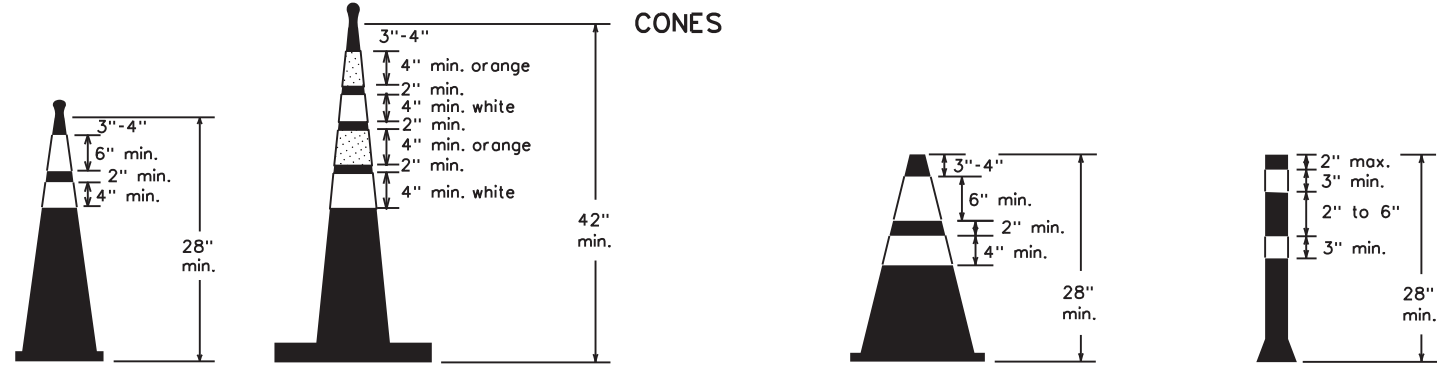


PLAN VIEW

1. Where positive redirection capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder width is greater than 12 feet, steady-burn lights may be omitted if drums are used.
5. Drums must extend the length of the culvert widening.

LEGEND	
	Plastic drum
	Plastic drum with steady burn light or yellow warning reflector
	Steady burn warning light or yellow warning reflector

**CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS**

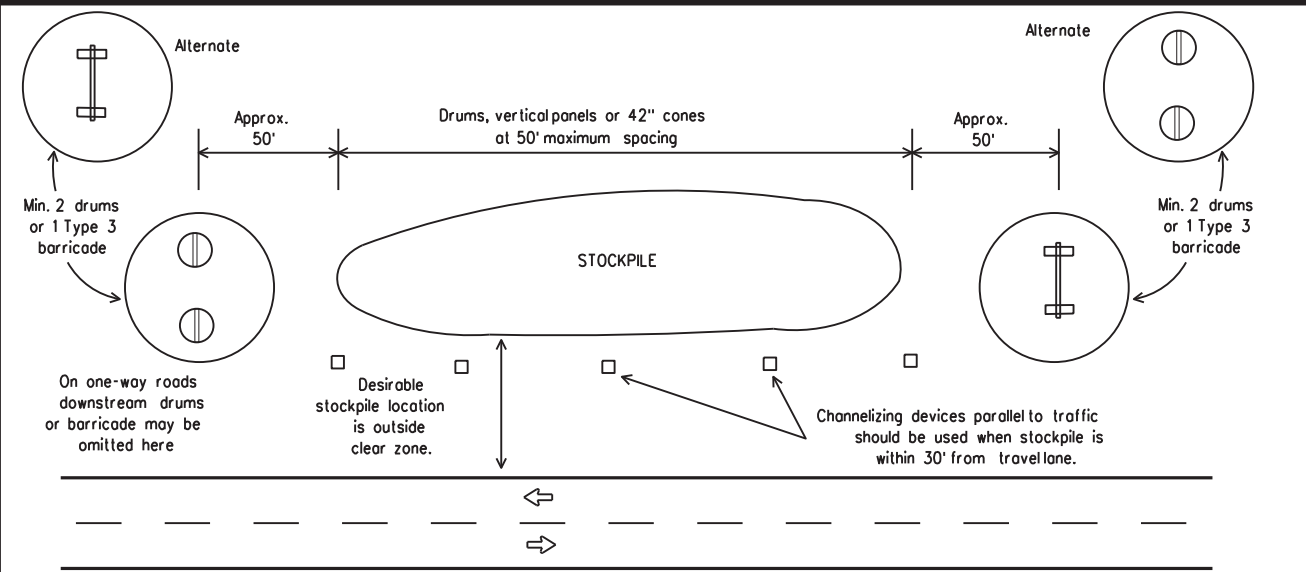


Two-Piece cones

One-Piece cones

Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.  
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.



**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**

1. Traffic cones and tubular markers shall be predominantly orange, and meet the height and weight requirements shown above.
2. One-piece cones have the body and base of the cone molded in one consolidated unit. Two-piece cones have a cone shaped body and a separate rubber base, or ballast, that is added to keep the device upright and in place.
3. Two-piece cones may have a handle or loop extending up to 8" above the minimum height shown, in order to aid in retrieving the device.
4. Cones or tubular markers shall have white or white and orange reflective bands as shown above. The reflective bands shall have a smooth, sealed outer surface and meet the requirements of Departmental Material Specification DMS-8300 Type A or Type B.
5. 28" cones and tubular markers are generally suitable for short duration and short-term stationary work as defined on BC(4). These should not be used for intermediate-term or long-term stationary work unless personnel is on-site to maintain them in their proper upright position.
6. 42" two-piece cones, vertical panels or drums are suitable for all work zone durations.
7. Cones or tubular markers used on each project should be of the same size and shape.



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(10)-21**

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	22	VAL VERDE, etc.	27	

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DATE: 6/24/2022 2:59:17 PM  
FILE: bc-21.dgn

## WORK ZONE PAVEMENT MARKINGS

### GENERAL

- The Contractor shall be responsible for maintaining work zone and existing pavement markings, in accordance with the standard specifications and special provisions, on all roadways open to traffic within the CSJ limits unless otherwise stated in the plans.
- Color, patterns and dimensions shall be in conformance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
- Additional supplemental pavement marking details may be found in the plans or specifications.
- Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
- When short term markings are required on the plans, short term markings shall conform with the TMUTCD, the plans and details as shown on the Standard Plan Sheet WZ(STPM).
- When standard pavement markings are not in place and the roadway is opened to traffic, DO NOT PASS signs shall be erected to mark the beginning of the sections where passing is prohibited and PASS WITH CARE signs at the beginning of sections where passing is permitted.
- All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

### RAISED PAVEMENT MARKERS

- Raised pavement markers are to be placed according to the patterns on BC(12).
- All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and Departmental Material Specification DMS-4200 or DMS-4300.

### PREFABRICATED PAVEMENT MARKINGS

- Removable prefabricated pavement markings shall meet the requirements of DMS-8241.
- Non-removable prefabricated pavement markings (foil back) shall meet the requirements of DMS-8240.

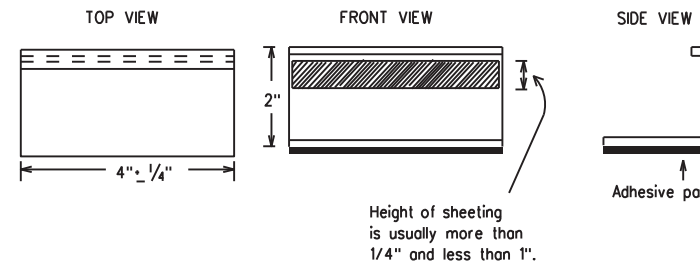
### MAINTAINING WORK ZONE PAVEMENT MARKINGS

- The Contractor will be responsible for maintaining work zone pavement markings within the work limits.
- Work zone pavement markings shall be inspected in accordance with the frequency and reporting requirements of work zone traffic control device inspections as required by Form 599.
- The markings should provide a visible reference for a minimum distance of 300 feet during normal daylight hours and 160 feet when illuminated by automobile low-beam headlights at night, unless sight distance is restricted by roadway geometrics.
- Markings failing to meet this criteria within the first 30 days after placement shall be replaced at the expense of the Contractor as per Specification Item 662.

### REMOVAL OF PAVEMENT MARKINGS

- Pavement markings that are no longer applicable, could create confusion or direct a motorist toward or into the closed portion of the roadway shall be removed or obliterated before the roadway is opened to traffic.
- The above shall not apply to detours in place for less than three days, where floggers and/or sufficient channelizing devices are used in lieu of markings to outline the detour route.
- Pavement markings shall be removed to the fullest extent possible, so as not to leave a discernable marking. This shall be by any method approved by TxDOT Specification Item 677 for "Eliminating Existing Pavement Markings and Markers".
- The removal of pavement markings may require resurfacing or seal coating portions of the roadway as described in Item 677.
- Subject to the approval of the Engineer, any method that proves to be successful on a particular type pavement may be used.
- Blast cleaning may be used but will not be required unless specifically shown in the plans.
- Over-painting of the markings SHALL NOT BE permitted.
- Removal of raised pavement markers shall be as directed by the Engineer.
- Removal of existing pavement markings and markers will be paid for directly in accordance with Item 677, "ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS," unless otherwise stated in the plans.
- Black-out marking tape may be used to cover conflicting existing markings for periods less than two weeks when approved by the Engineer.

## Temporary Flexible-Reflective Roadway Marker Tabs



**STAPLES OR NAILS SHALL NOT BE USED TO SECURE  
TEMPORARY FLEXIBLE-REFLECTIVE ROADWAY MARKER  
TABS TO THE PAVEMENT SURFACE**

- Temporary flexible-reflective roadway marker tabs used as guidemarks shall meet the requirements of DMS-8242.
- Tabs detailed on this sheet are to be inspected and accepted by the Engineer or designated representative. Sampling and testing is not normally required, however at the option of the Engineer, either "A" or "B" below may be imposed to assure quality before placement on the roadway.
  - Select five (5) or more tabs at random from each lot or shipment and submit to the Construction Division, Materials and Pavement Section to determine specification compliance.
  - Select five (5) tabs and perform the following test. Affix five (5) tabs at 24 inch intervals on an asphaltic pavement in a straight line. Using a medium size passenger vehicle or pickup, run over the markers with the front and rear tires at a speed of 35 to 40 miles per hour, four (4) times in each direction. No more than one (1) out of the five (5) reflective surfaces shall be lost or displaced as a result of this test.
- Small design variances may be noted between tab manufacturers.
- See Standard Sheet WZ(STPM) for tab placement on new pavements. See Standard Sheet TCP(7-1) for tab placement on seal coat work.

### RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

- Raised pavement markers used as guidemarks shall be from the approved product list, and meet the requirements of DMS-4200.
- All temporary construction raised pavement markers provided on a project shall be of the same manufacturer.
- Adhesive for guidemarks shall be bituminous material hot applied or butyl rubber pad for all surfaces, or thermoplastic for concrete surfaces.

Guidemarks shall be designated as:  
 YELLOW - (two amber reflective surfaces with yellow body).  
 WHITE - (one silver reflective surface with white body).

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
TRAFFIC BUTTONS	DMS-4300
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY REMOVABLE, PREFABRICATED PAVEMENT MARKINGS	DMS-8241
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS	DMS-8242

A list of prequalified reflective raised pavement markers, non-reflective traffic buttons, roadway marker tabs and other pavement markings can be found at the Material Producer List web address shown on BC(1).

SHEET 11 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

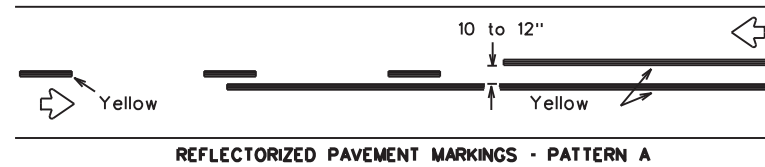
**BC(11)-21**

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS		0022	010	076
2-98	9-07	5-21		
1-02	7-13			
11-02	8-14			
	DIST	COUNTY	SHEET NO.	
	22	VAL VERDE, etc.	<b>28</b>	

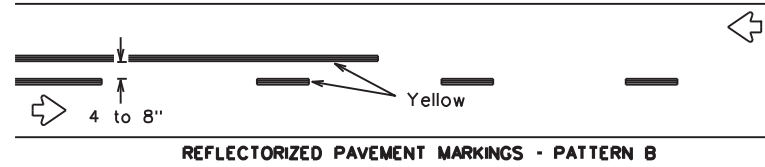
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### PAVEMENT MARKING PATTERNS

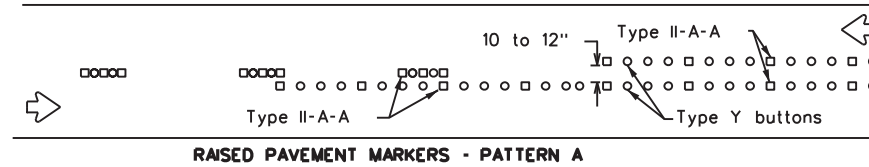


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

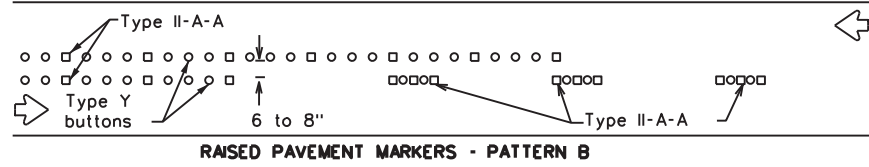


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

Pattern A is the TXDOT Standard, however Pattern B may be used if approved by the Engineer. Prefabricated markings may be substituted for reflectORIZED pavement markings.

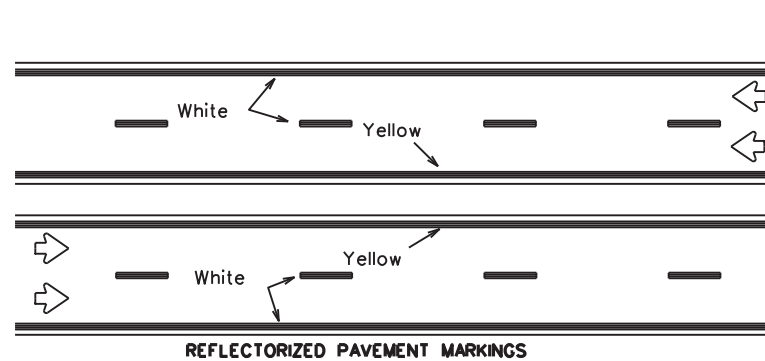


RAISED PAVEMENT MARKERS - PATTERN A



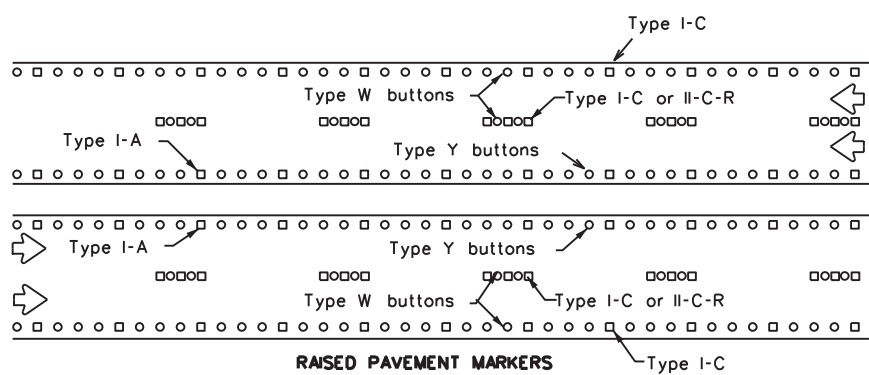
RAISED PAVEMENT MARKERS - PATTERN B

### CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO-LANE, TWO-WAY HIGHWAYS



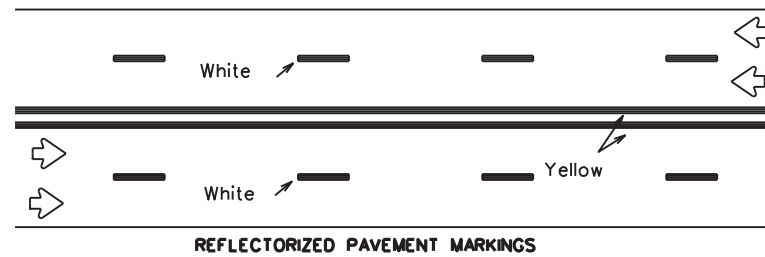
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



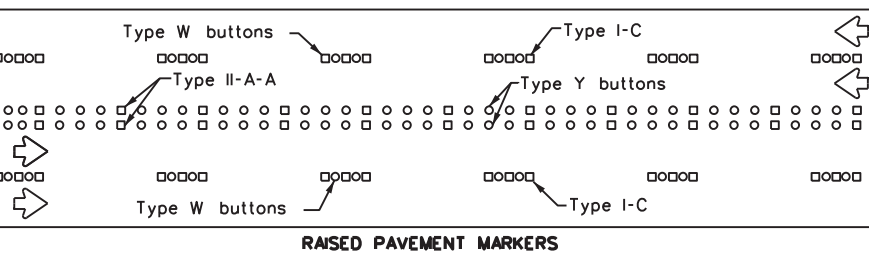
RAISED PAVEMENT MARKERS

### EDGE & LANE LINES FOR DIVIDED HIGHWAY



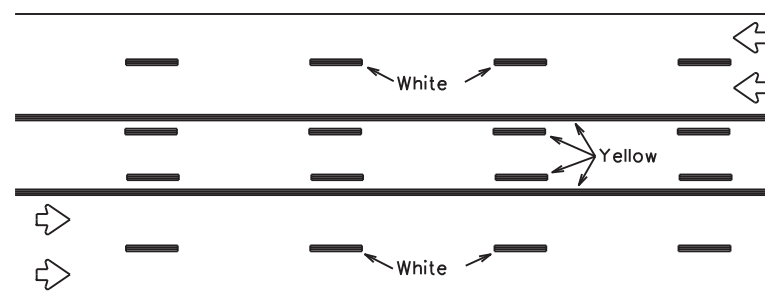
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



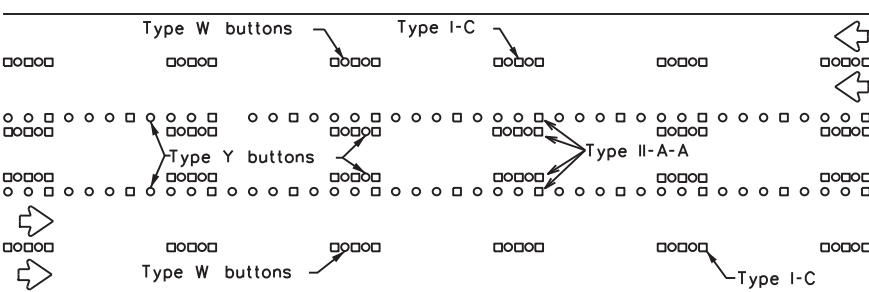
RAISED PAVEMENT MARKERS

### LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

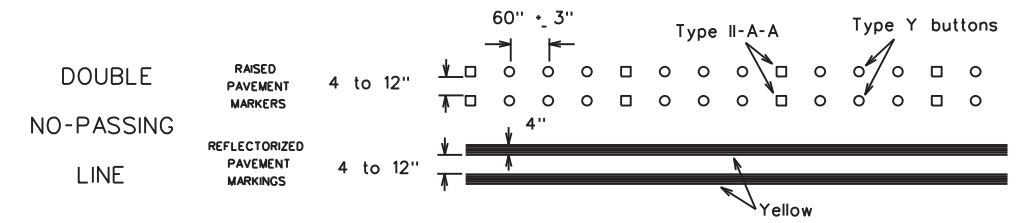
Prefabricated markings may be substituted for reflectORIZED pavement markings.



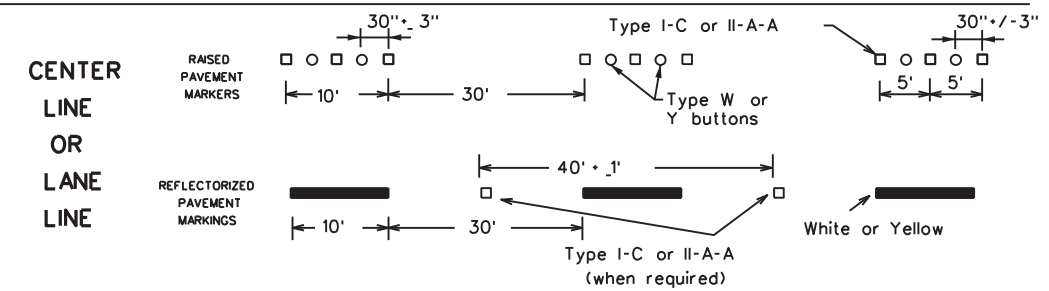
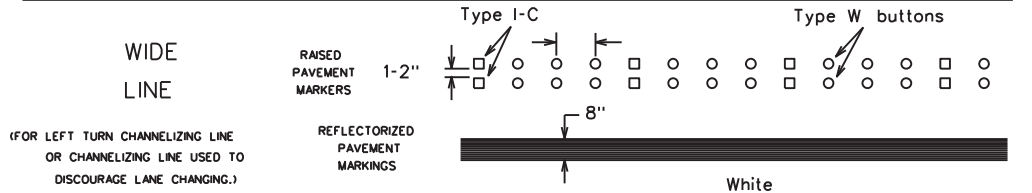
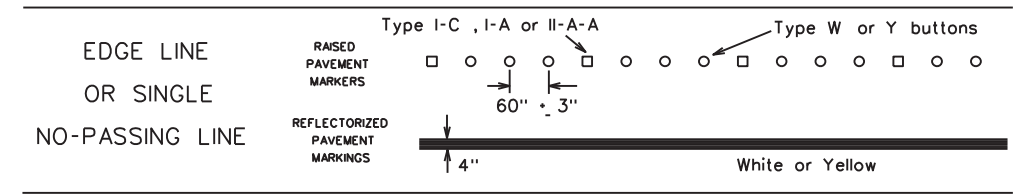
RAISED PAVEMENT MARKERS

### TWO-WAY LEFT TURN LANE

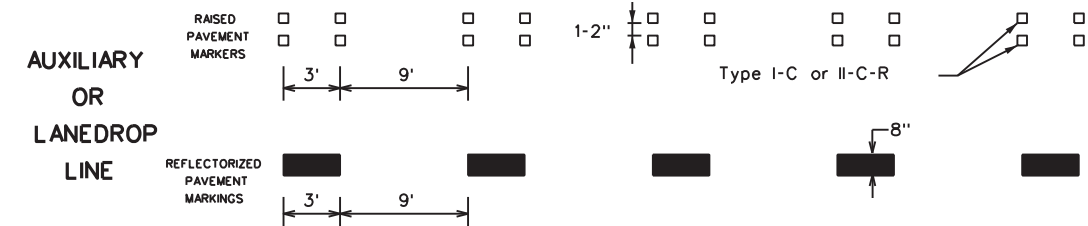
### STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



#### SOLID LINES

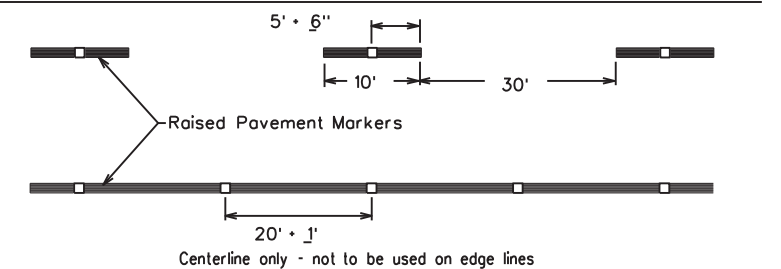


#### BROKEN LINES



#### REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

If raised pavement markers are used to supplement REMOVABLE markings, the markers shall be applied to the top of the tape at the approximate mid length of tape used for broken lines or at 20 foot spacing for solid lines. This allows an easier removal of raised pavement markers and tape.



SHEET 12 OF 12



### BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

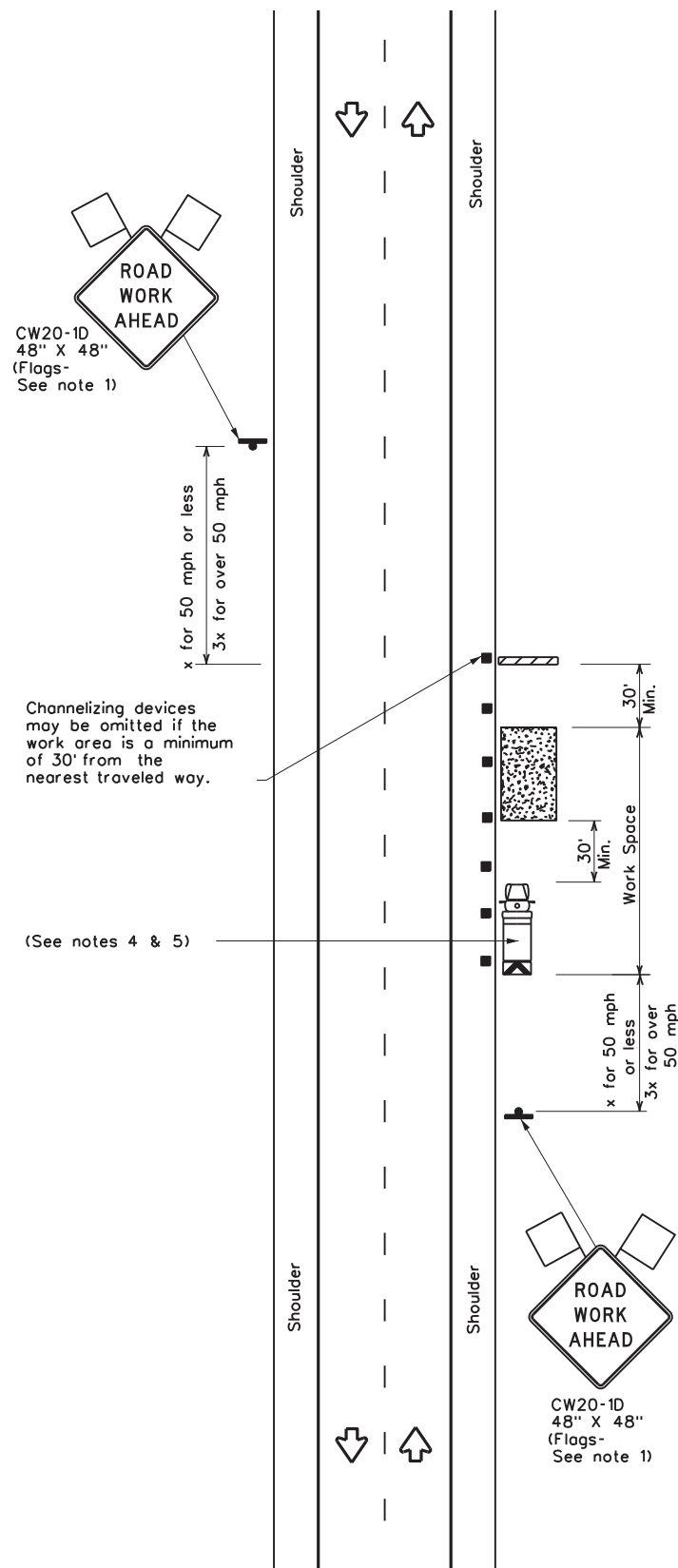
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© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
1-97 9-07 5-21	DIST	COUNTY	SHEET NO.	
2-98 7-13	22	VAL VERDE, etc.	29	
11-02 8-14				

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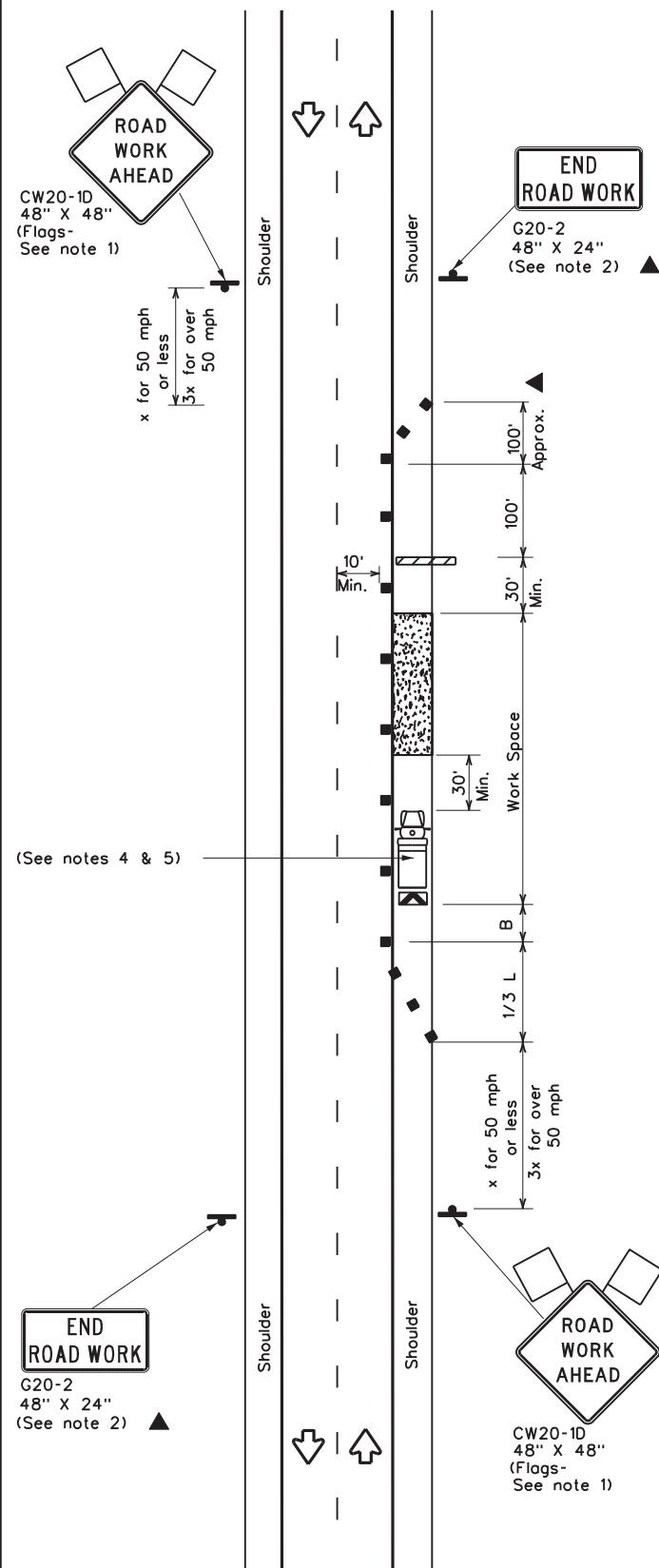
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DATE: 6/24/2022 2:59:18 PM  
FILE: tcp2-1-18.dgn



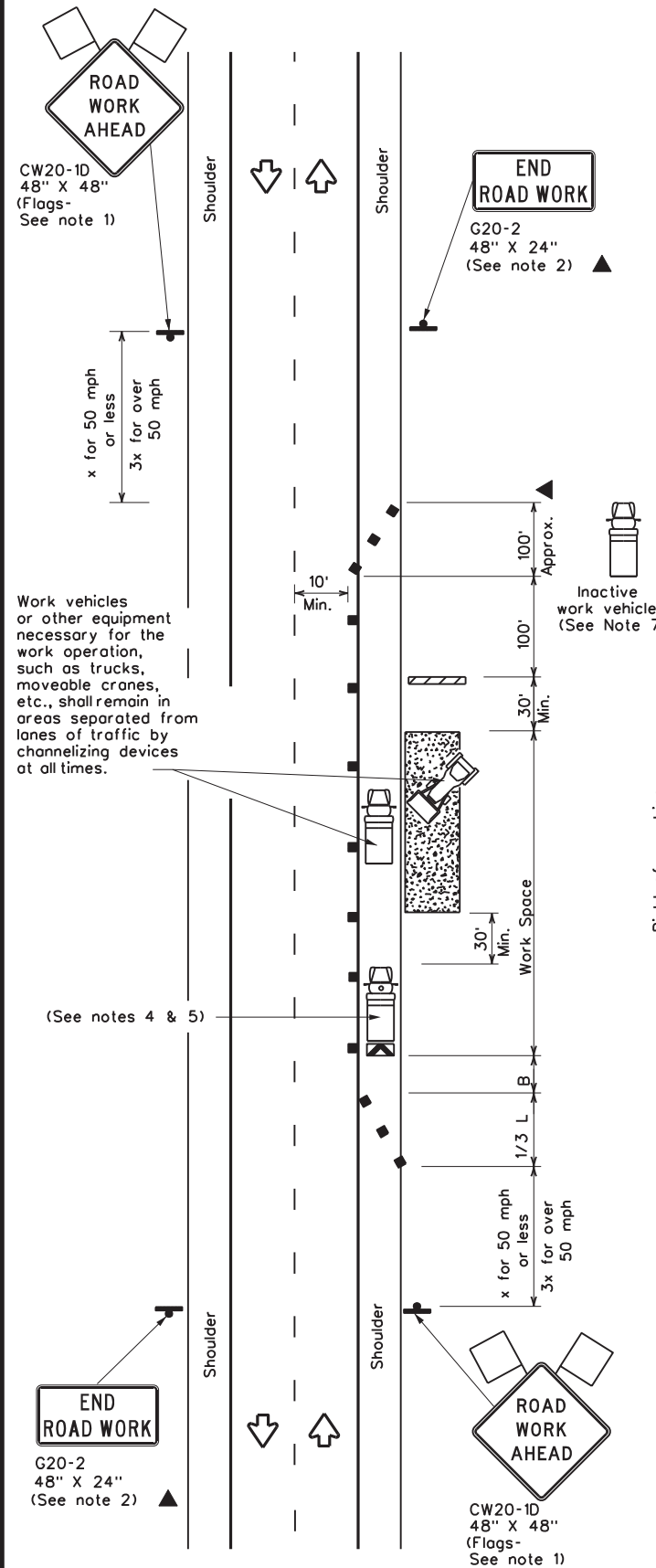
TCP (2-1a)

**WORK SPACE NEAR SHOULDER**  
Conventional Roads



TCP (2-1b)

**WORK SPACE ON SHOULDER**  
Conventional Roads



TCP (2-1c)

**WORK VEHICLES ON SHOULDER**  
Conventional Roads

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 x	Formula	Minimum Desirable Taper Lengths x x			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	$L = \frac{W \cdot S^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40	L = WS	265'	295'	320'	40'	80'	240'	155'
45		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
	✓	✓	✓	✓

**GENERAL NOTES**

- Flags attached to signs where shown, are REQUIRED.
- All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated in the plans, or for routine maintenance work, when approved by the Engineer.
- Stockpiled material should be placed a minimum of 30 feet from nearest traveled way.
- Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
- Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
- See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
- Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
- CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

Texas Department of Transportation  
Traffic Operations Division Standard

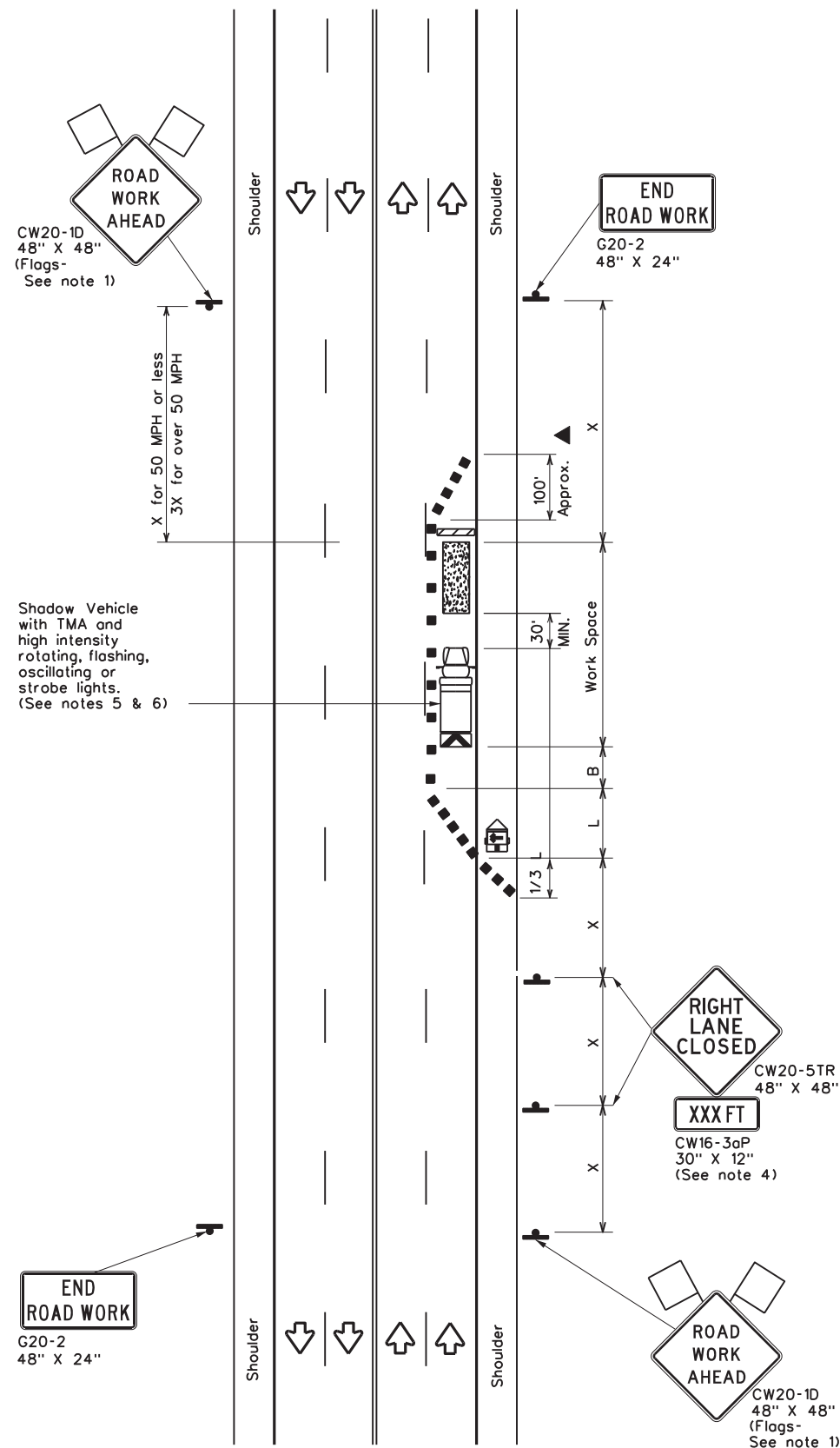
**TRAFFIC CONTROL PLAN**  
**CONVENTIONAL ROAD**  
**SHOULDER WORK**

**TCP(2-1)-18**

FILE: tcp2-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 2-12	22	VAL VERDE, etc.	30	
1-97 2-18				

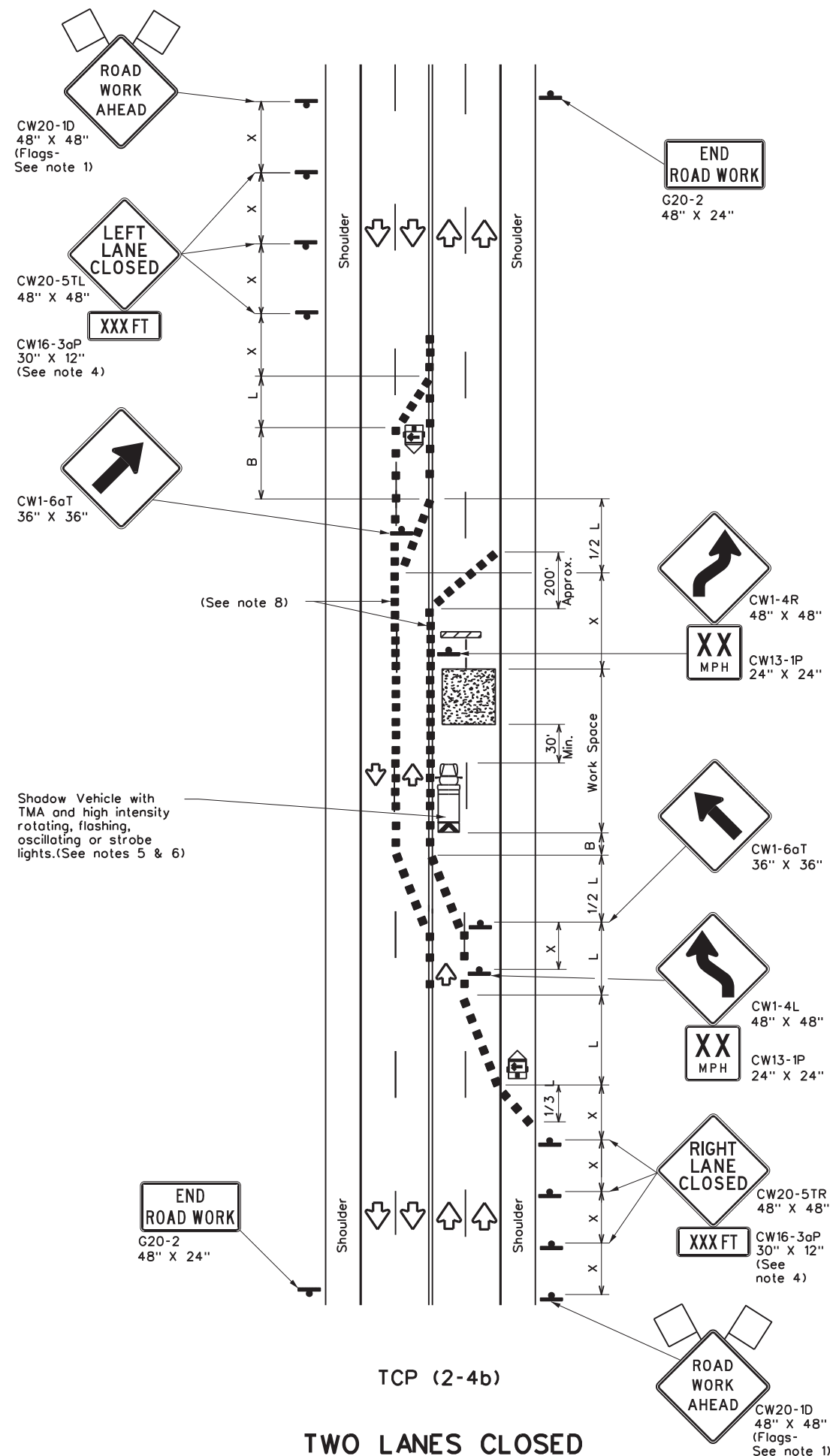
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FILE: tcp2-4-18.dgn



TCP (2-4a)

**ONE LANE CLOSED**



TCP (2-4b)

**TWO LANES CLOSED**

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 * x	Formula L = WS <sup>2</sup> / 60	Minimum Desirable Taper Lengths x x			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		150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45		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
		✓	✓	

**GENERAL NOTES**

- Flags attached to signs where shown, are REQUIRED.
- All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
- The downstream taper is optional. When used, it should be 100 feet minimum length per lane.
- For short term applications, when post mounted signs are not used, the distance legend may be shown on the sign face rather than on a CW16-3aP supplemental plaque.
- A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
- Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

**TCP (2-4a)**

- If this TCP is used for a left lane closure, CW20-5TL "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline to protect the work space from opposing traffic with the arrow board placed in the closed lane near the end of the merging taper.

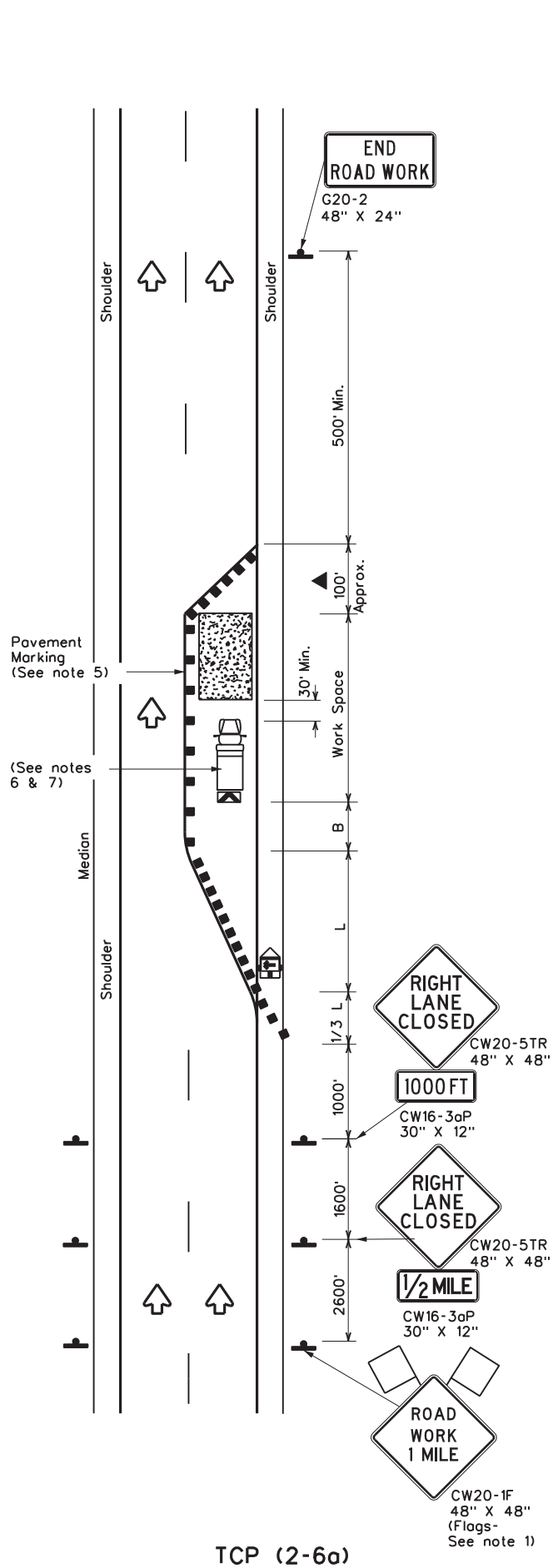
**TCP (2-4b)**

- For shorter durations where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20' or 15' if posted speeds are 35 mph or slower, and for tangent sections, at 1/2(S) where S is the speed in mph. This tighter devices spacing is intended for the area of conflicting markings, not the entire work zone.

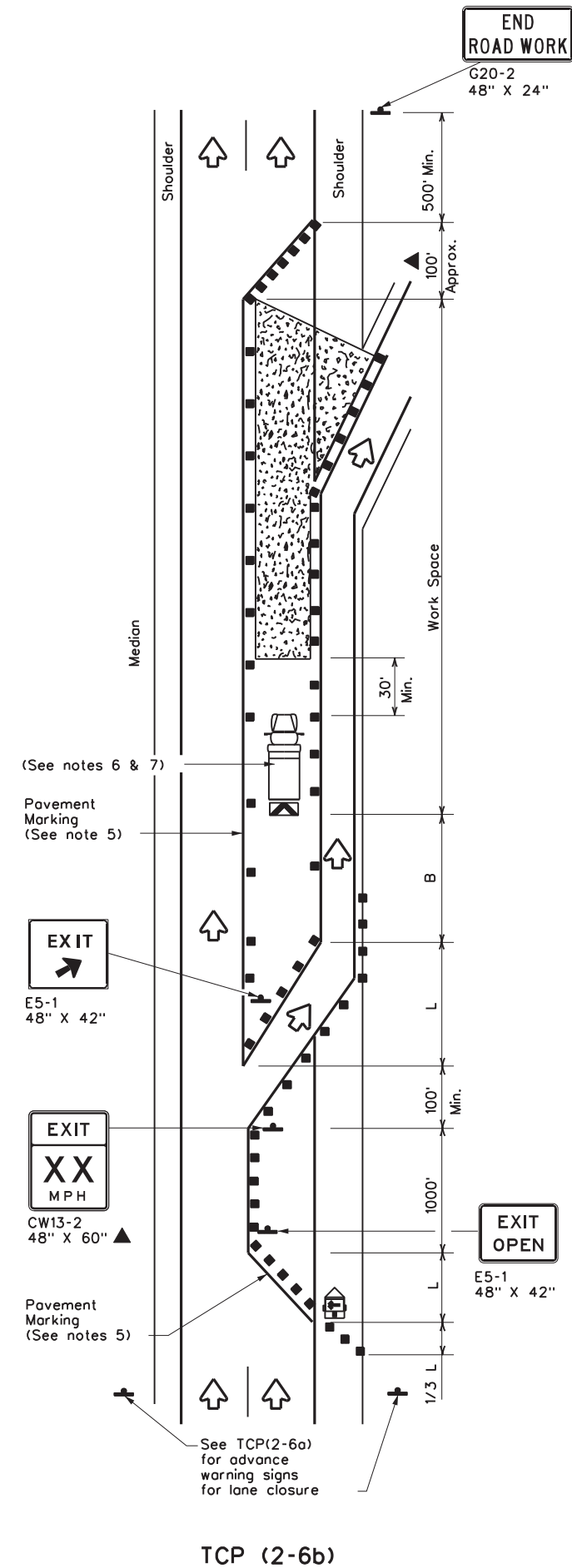
		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS</b>			
<b>TCP(2-4)-18</b>			
FILE: tcp2-4-18.dgn	DN: December 1985	CK: 010	DW: 076
© TxDOT		CON: 0022	SECT: 010
REVISIONS		JOB: US90, etc.	
8-95 3-03		DIST: 22	COUNTY: VAL VERDE, etc.
1-97 2-12			SHEET NO. 31
4-98 2-18			

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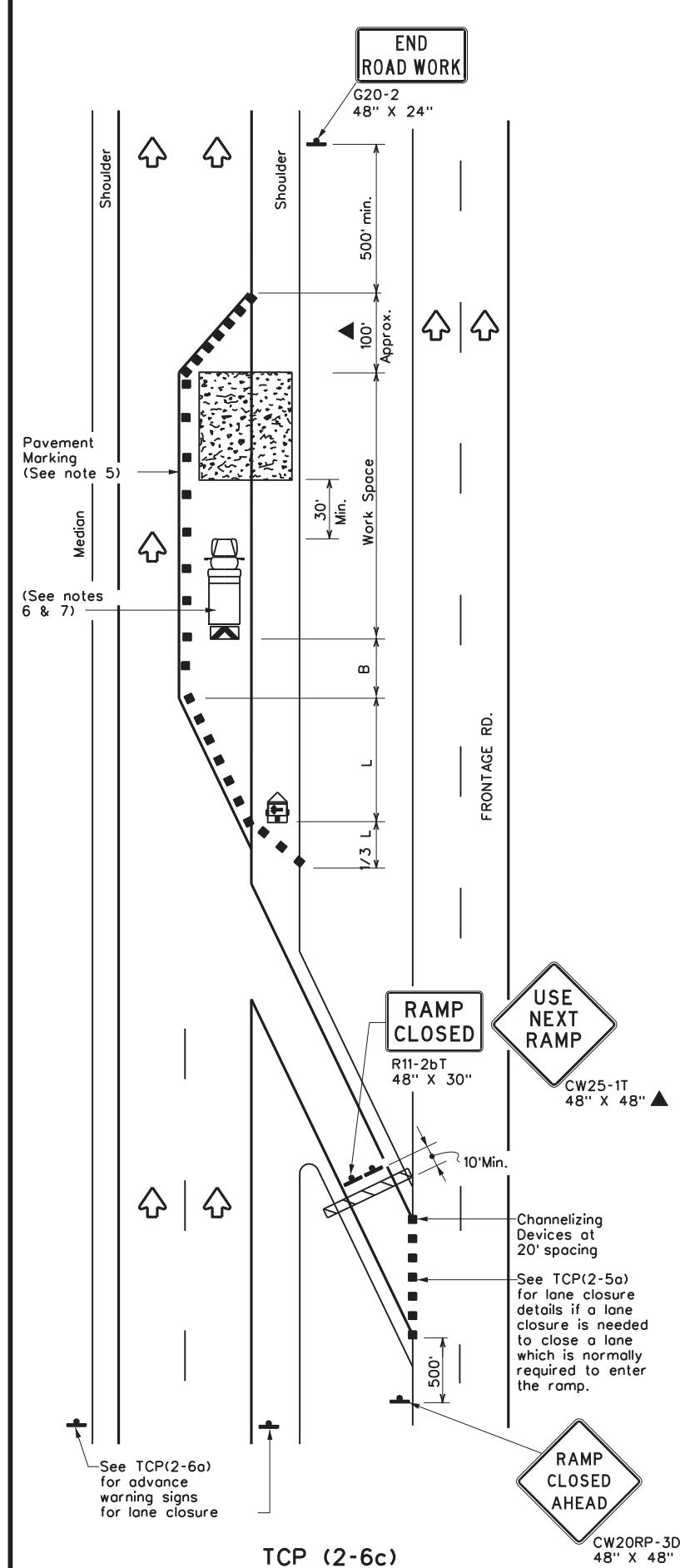
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FILE: tcp2-6-18.dgn



TCP (2-6a)  
**ONE LANE CLOSURE**



TCP (2-6b)  
**LANE CLOSURE NEAR EXIT RAMP**



TCP (2-6c)  
**LANE CLOSURE NEAR ENTRANCE RAMP**

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 x	Formula	Minimum Desirable Taper Lengths x x			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
			✓	✓

**GENERAL NOTES**

- Flags attached to signs where shown, are REQUIRED.
- All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
- Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
- Channelizing devices used along the work space or along tangent sections may be supplemented with vertical panels (VP) placed on every other channelizing device. If night time conditions make it difficult to see at least two VPs, the VPs may be placed on each channelizing device.
- The placement of pavement markings may be omitted on intermediate-term stationary work zones with the approval of the Engineer.
- Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
- Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

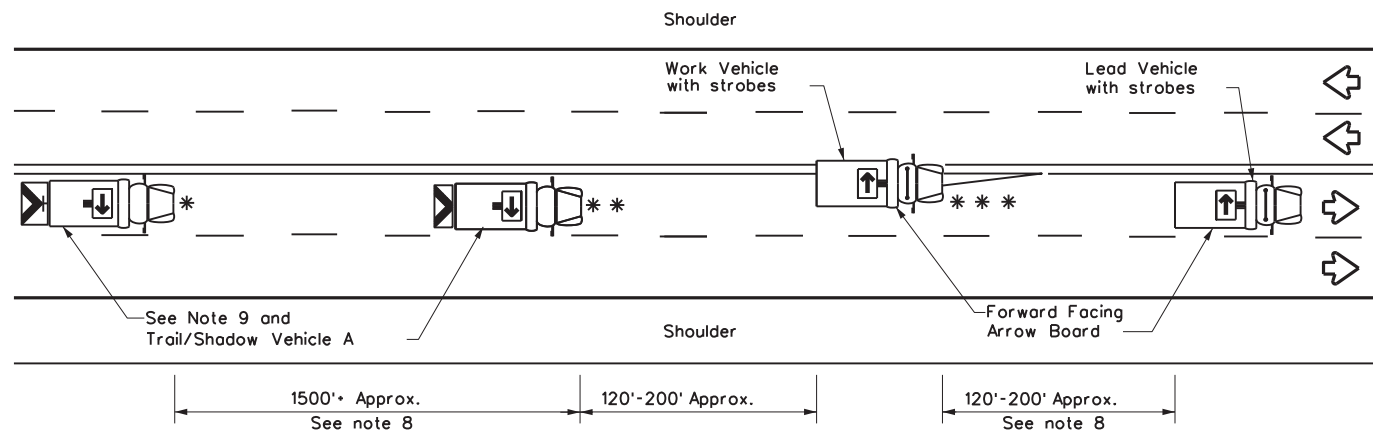
Texas Department of Transportation  
 Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN**  
**LANE CLOSURES ON**  
**DIVIDED HIGHWAYS**  
**TCP(2-6)-18**

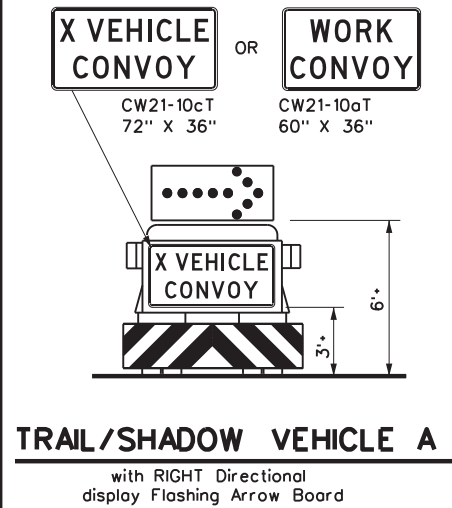
FILE: tcp2-6-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT:	SECT:	JOB:	HIGHWAY:
REVISIONS	0022	010	076	US90, etc.
2-94 4-98	DIST:	COUNTY:	SHEET NO.:	
8-95 2-12	22	VAL VERDE, etc.	32	
1-97 2-18				



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**TCP (3-1a)**  
**UNDIVIDED MULTILANE ROADWAY**



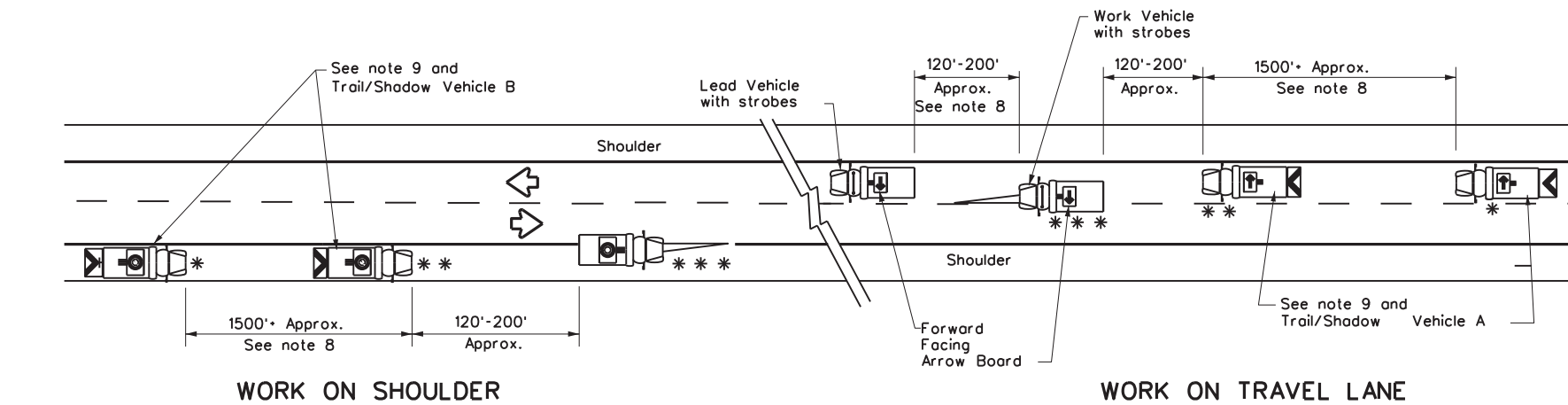
**TRAIL/SHADOW VEHICLE A**  
with RIGHT Directional display Flashing Arrow Board

LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

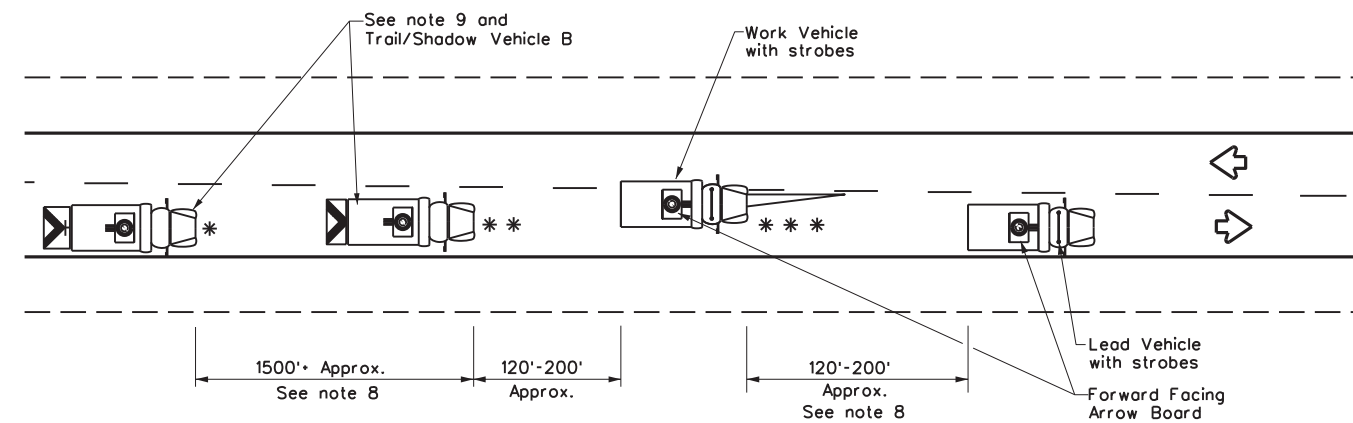
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**GENERAL NOTES**

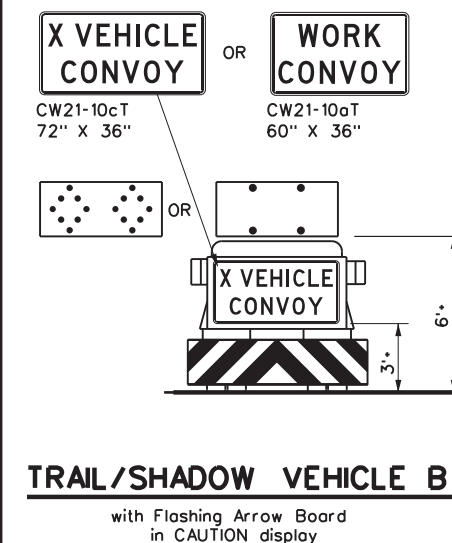
1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
2. The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
3. The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE and TRAIL VEHICLE are required.
4. Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.
5. Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.
6. Each vehicle shall have two-way radio communication capability.
7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
8. Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.
9. "X VEHICLE CONVOY" (CW21-10cT) or "WORK CONVOY" (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" X 48" diamond shaped "WORK CONVOY" (CW21-10T) or "X VEHICLE CONVOY" (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The "X VEHICLE CONVOY" sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
10. On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a "DO NOT PASS" (R4-1) sign should be placed on the back of the rearmost protection vehicle.



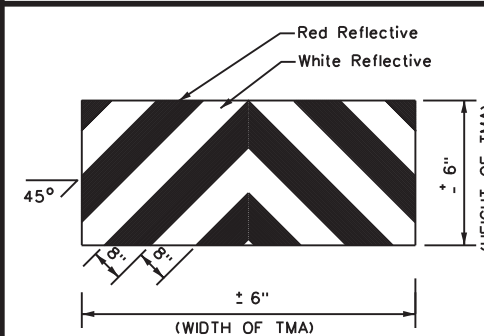
**TCP (3-1b)**  
**TWO-WAY ROADWAY WITH PAVED SHOULDERS**



**TCP (3-1c)**  
**TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS**



**TRAIL/SHADOW VEHICLE B**  
with Flashing Arrow Board in CAUTION display



**STRIPING FOR TMA**



**TRAFFIC CONTROL PLAN  
MOBILE OPERATIONS  
UNDIVIDED HIGHWAYS**

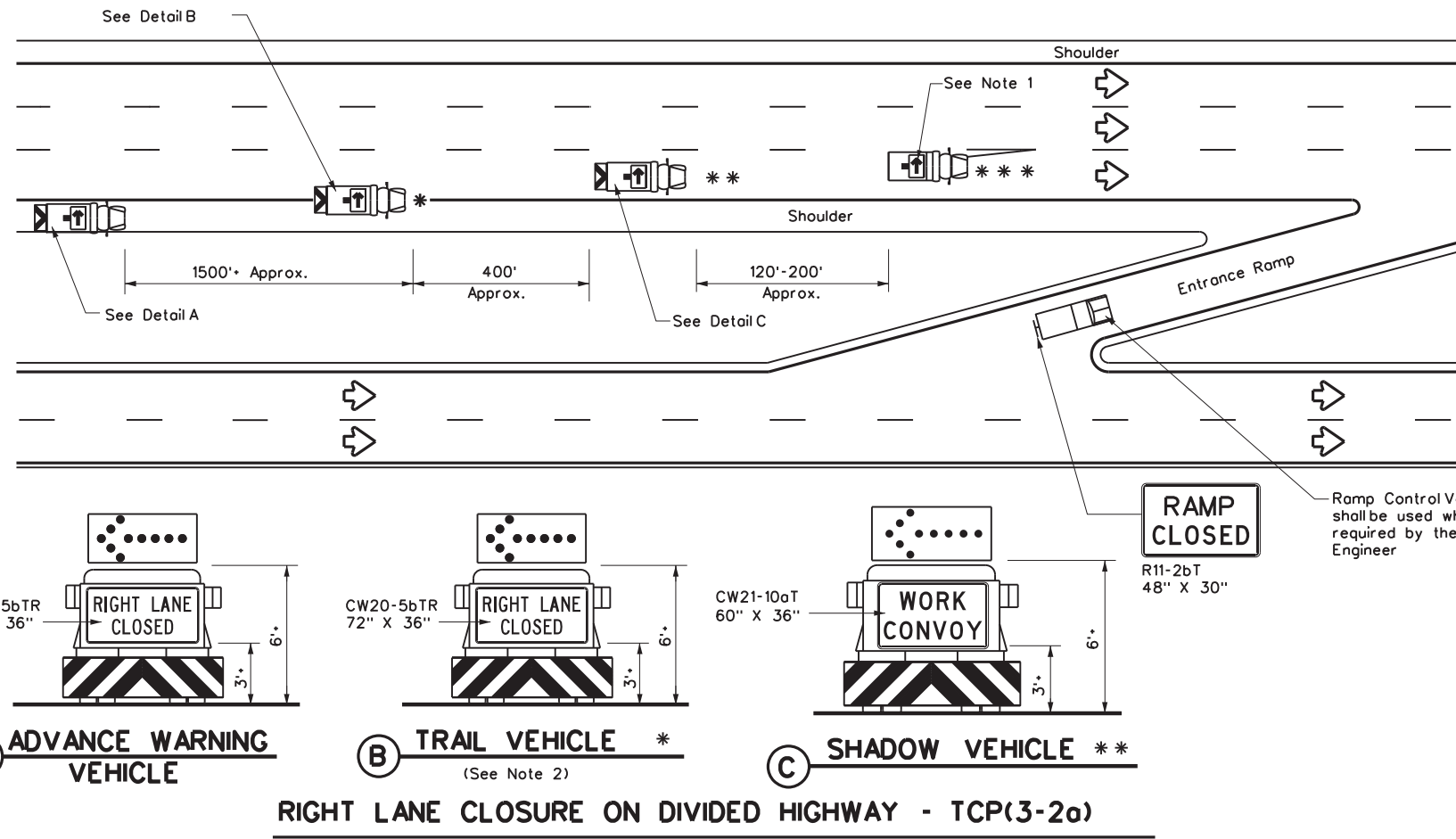
**TCP(3-1)-13**

FILE: tcp3-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	22	VAL VERDE, etc.	33	
1-97				

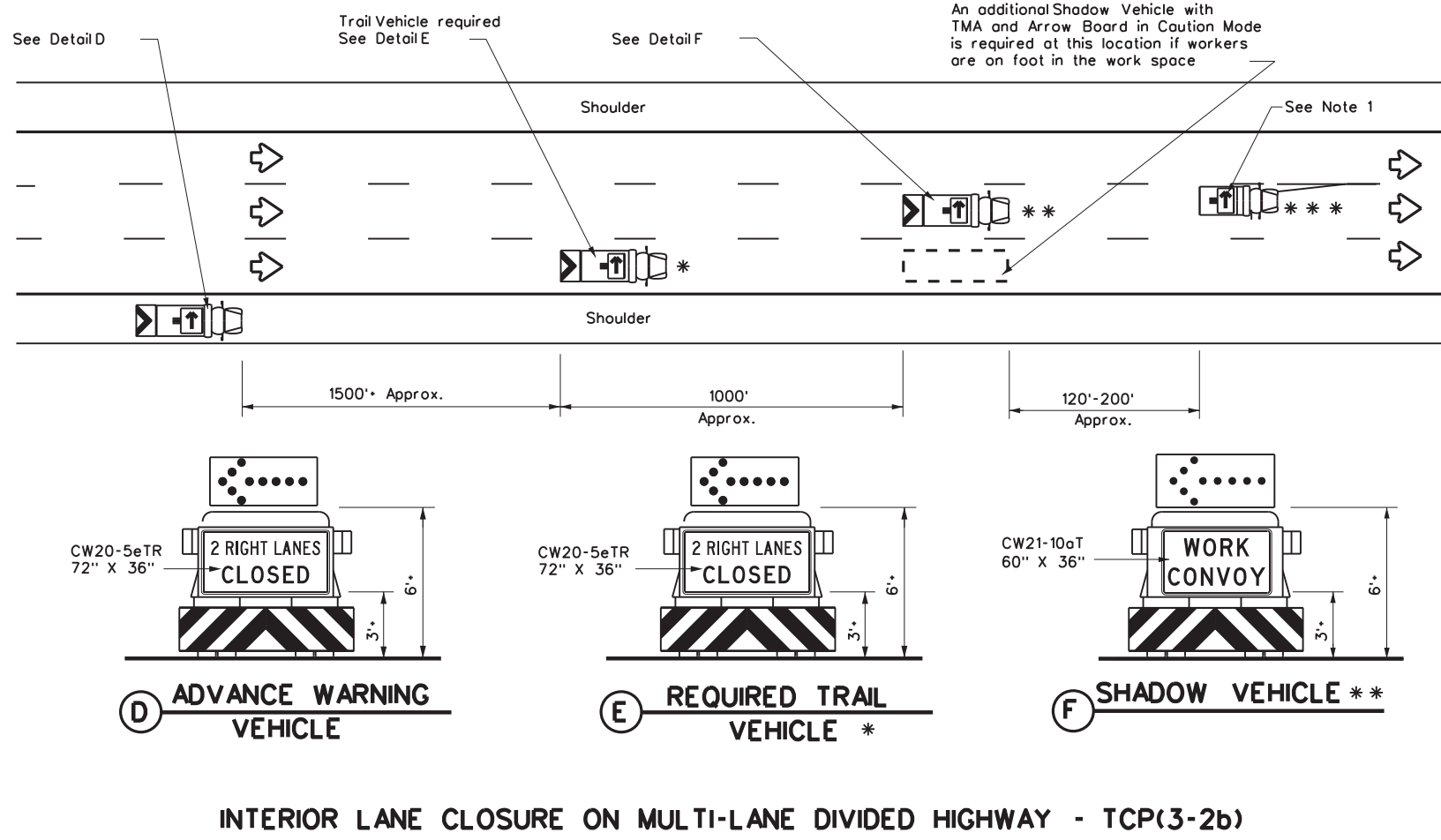
DATE: 6/24/2022 2:59:19 PM  
FILE: tcp3-1.dgn

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DATE: 6/24/2022 2:59:19 PM  
FILE: tcp3-2.dgn



**RIGHT LANE CLOSURE ON DIVIDED HIGHWAY - TCP(3-2a)**



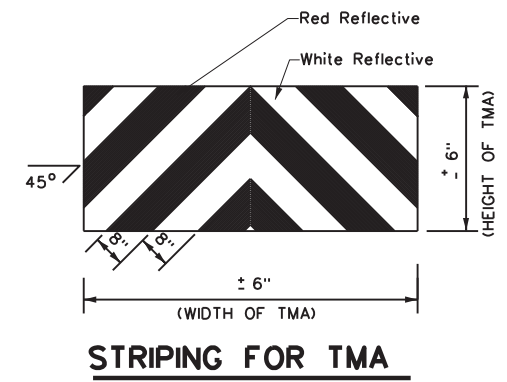
**INTERIOR LANE CLOSURE ON MULTI-LANE DIVIDED HIGHWAY - TCP(3-2b)**

LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle	→	RIGHT Directional
☐	Heavy Work Vehicle	←	LEFT Directional
⚠	Truck Mounted Attenuator (TMA)	↔	Double Arrow
⬅	Traffic Flow	⚠	CAUTION (Alternating Diamond or 4 Corner Flash)

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

**GENERAL NOTES**

- ADVANCE WARNING, TRAIL and SHADOW vehicles shall be equipped with Type B or Type C flashing arrow boards as per the Barricade and Construction (BC) standards. Arrow boards on WORK vehicles will be optional based on the type of work being performed. The arrow boards shall be operated from inside the vehicle.
- For TCP(3-2a) the Engineer will determine if the TRAIL VEHICLE is required based on prevailing roadway conditions, traffic volume, and sight distance restrictions. All other vehicles shown for both TCP(3-2a) and TCP(3-2b) are required.
- The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- The use of truck mounted attenuators (TMA) on the ADVANCE WARNING, SHADOW, and TRAIL vehicles are required.
- Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DMS 8300, Type A.
- Each vehicle shall have two-way radio communication capability.
- When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
- Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE may vary according to terrain, work activity and other factors.
- Standard 48" X 48" diamond shaped warning signs with the same message as those shown may be used where adequate mounting space exists.
- The signs shown should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or a truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board, must be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
- Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
- The principles on this sheet may be used to close lanes from the left side of the roadway considering the number of lanes, shoulder width, sight distance, and ramp frequency.
- Signs and flashing arrow board modes shall be appropriately altered when implementing left lane closures or interior closures which close the left lanes.
- The Advance Warning Vehicle may straddle the edgeline when shoulder width makes it necessary.

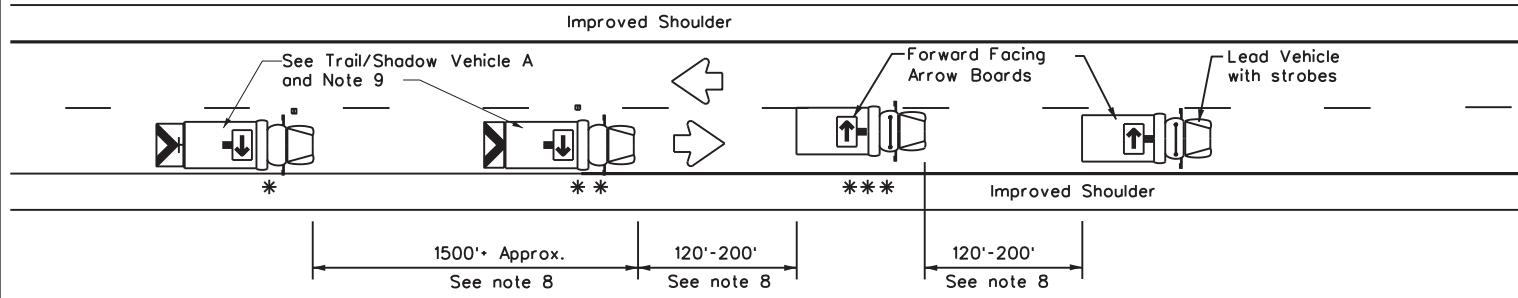


**STRIPING FOR TMA**

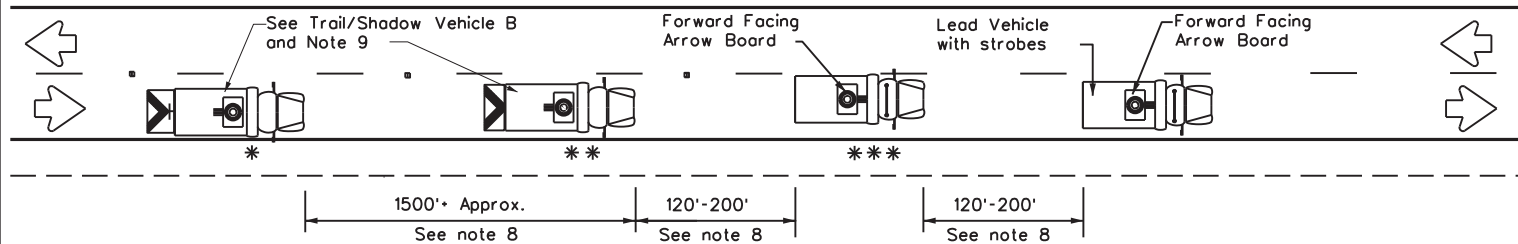
		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN MOBILE OPERATIONS DIVIDED HIGHWAYS</b>			
<b>TCP(3-2)-13</b>			
FILE: tcp3-2.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT December 1985	CONT: 0022	SECT: 010	JOB: 076
REVISIONS:	0022	010	076
2-94 4-98			
8-95 7-13			
1-97			
DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO.: 34	

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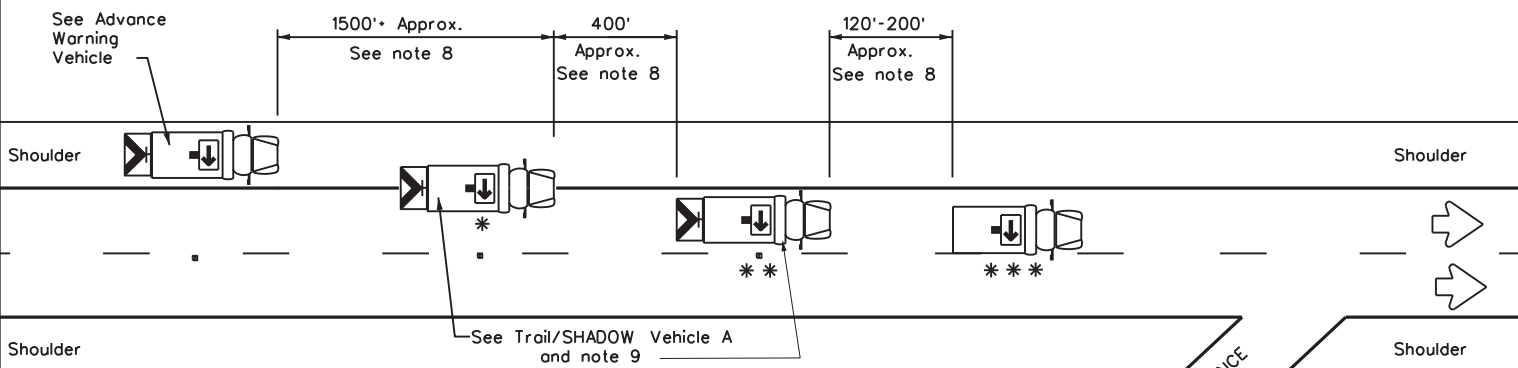
DATE: 6/24/2022  
FILE: tcp3-3.dgn  
2:59:19 PM



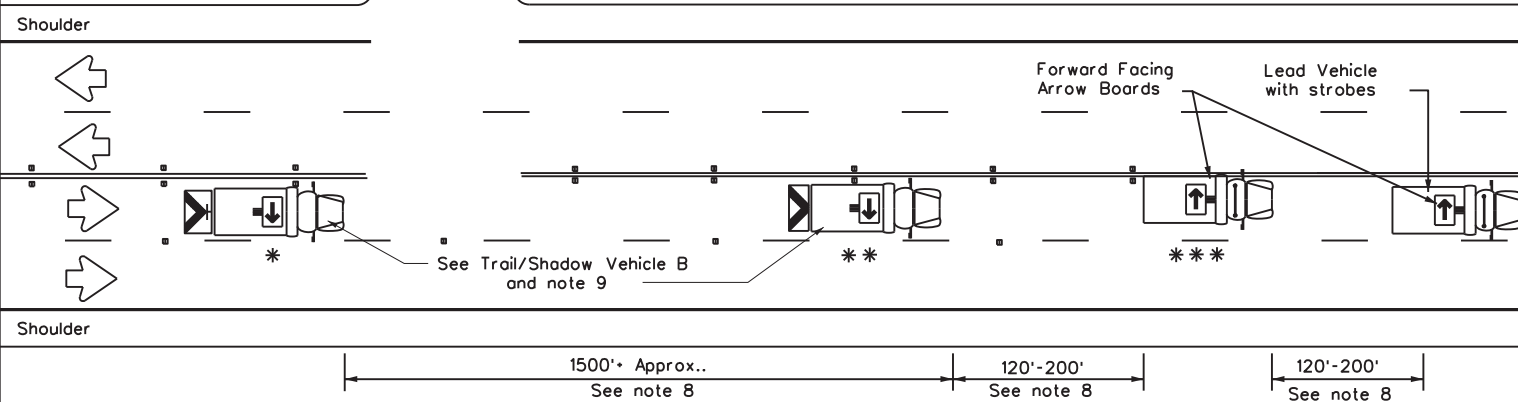
**TCP (3-3a)**  
**TWO LANE HIGHWAY WITH PAVED SHOULDERS**  
**(WORK ON TRAVEL LANE)**



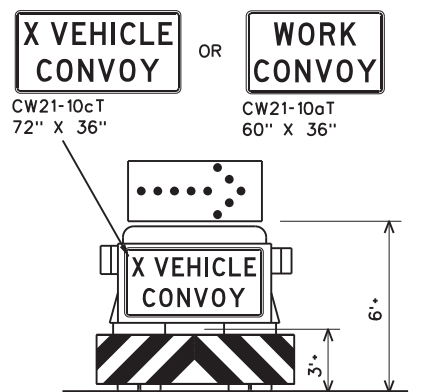
**TCP (3-3b)**  
**TWO LANE HIGHWAY WITHOUT PAVED SHOULDERS**  
**(WORK ON TRAVEL LANE)**



**TCP (3-3c)**  
**DIVIDED MULTILANE HIGHWAY**

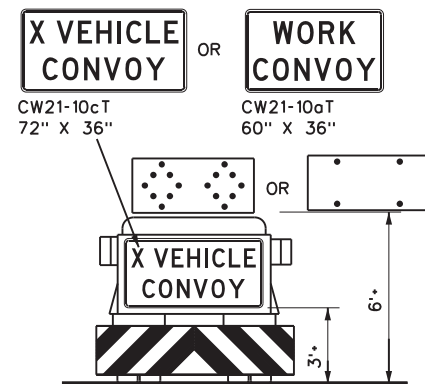


**TCP (3-3d)**  
**UNDIVIDED MULTILANE HIGHWAY**



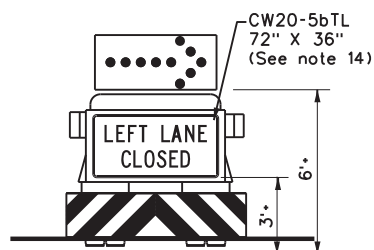
**TRAIL/SHADOW VEHICLE A**

with RIGHT Directional display  
Flashing Arrow Board

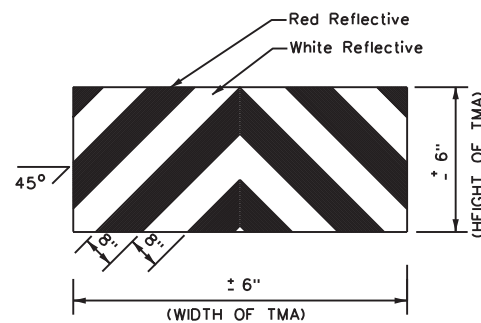


**TRAIL/SHADOW VEHICLE B**

with Flashing Arrow Board  
in Caution Mode



**ADVANCE WARNING VEHICLE**



**STRIPING FOR TMA**

LEGEND			
* Trail Vehicle		ARROW BOARD DISPLAY	
** Shadow Vehicle			
*** Work Vehicle		RIGHT	Directional
	LEFT	Directional	
	DOUBLE	Arrow	
	CAUTION (Alternating Diamond or 4 Corner Flash)		

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**GENERAL NOTES**

- TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used on two way roads the WORK vehicle must have an arrow board. For divided roadways, the arrow board on the WORK vehicle is optional based on the type of work being performed. The Engineer will determine if the LEAD vehicle and/or TRAIL vehicle are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
- The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating, or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE, ADVANCE WARNING and TRAIL VEHICLE are required.
- Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.
- Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.
- Each vehicle shall have two-way radio communication capability.
- When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
- Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.
- X VEHICLE CONVOY (CW21-10cT) or WORK CONVOY (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" x 48" diamond shaped WORK CONVOY (CW21-10T) or X VEHICLE CONVOY (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The X VEHICLE CONVOY sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
- For divided highways with two or three lanes in one direction, the appropriate LEFT LANE CLOSED (CW20-5bTL), RIGHT LANE CLOSED (CW20-5bTR), or CENTER LANE CLOSED (CW20-5dT) sign should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board may be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
- A double arrow shall not be displayed on the arrow board on the Advance Warning Vehicle.
- For divided highways with three or four lanes in each direction, use TCP(3-2).
- Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
- The Advance Warning Vehicle may straddle the edgeline when Shoulder width makes it necessary.
- On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a DO NOT PASS (R4-1) sign should be placed on the back of the rearmost protection vehicle.

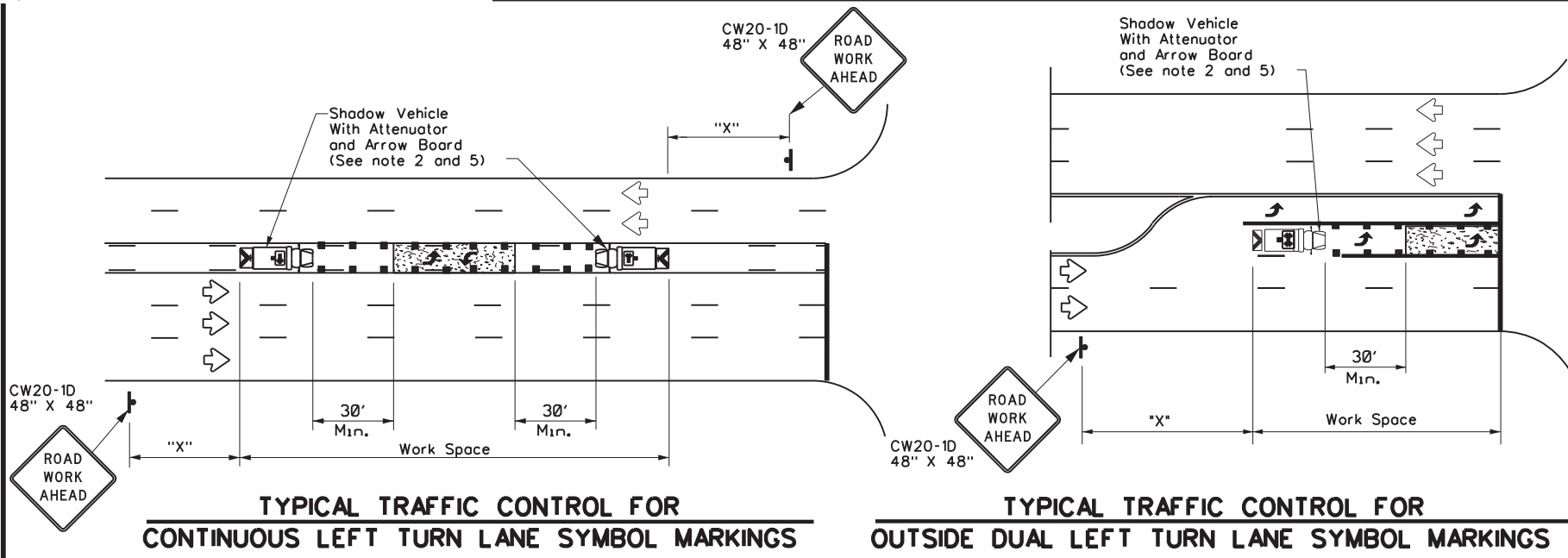
Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN  
MOBILE OPERATIONS  
RAISED PAVEMENT  
MARKER INSTALLATION/  
REMOVAL  
TCP(3-3)-14**

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	22	VAL VERDE, etc.	35	
1-97 7-14				

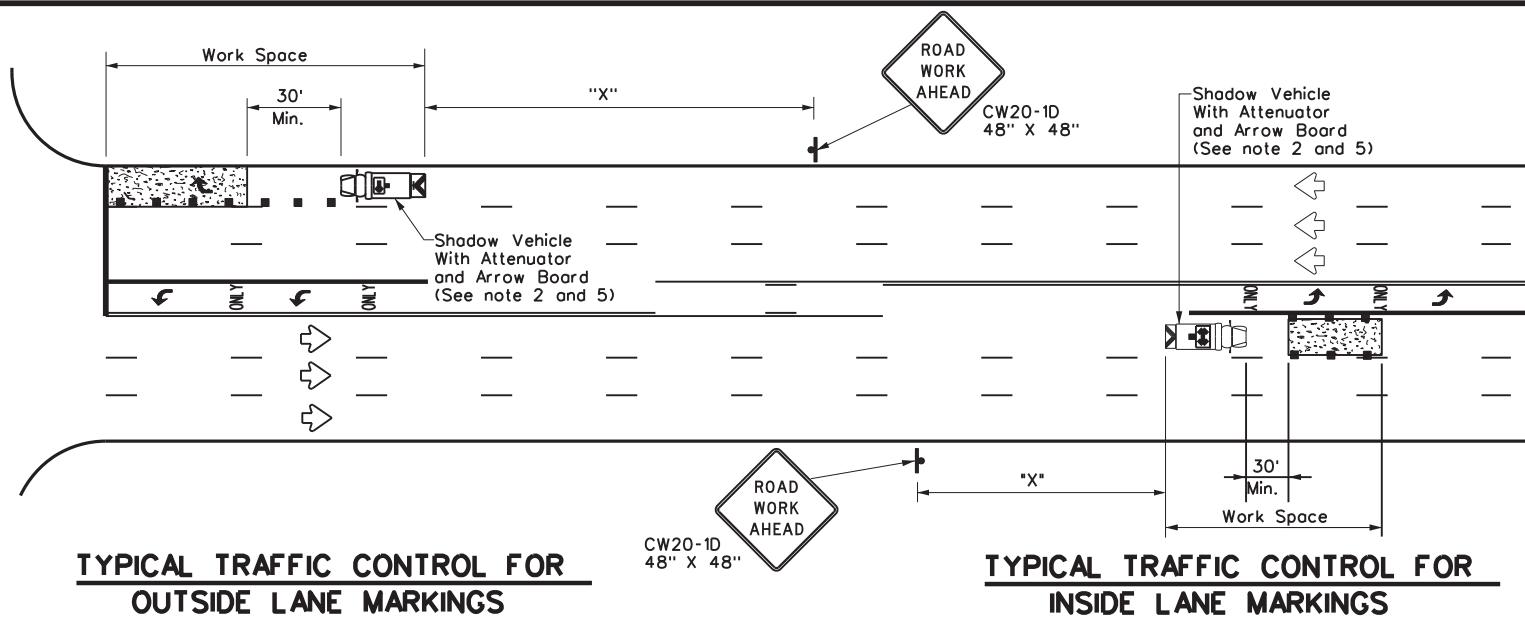
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DATE: 6/24/2022 2:59:20 PM  
FILE: tcp3-4.dgn



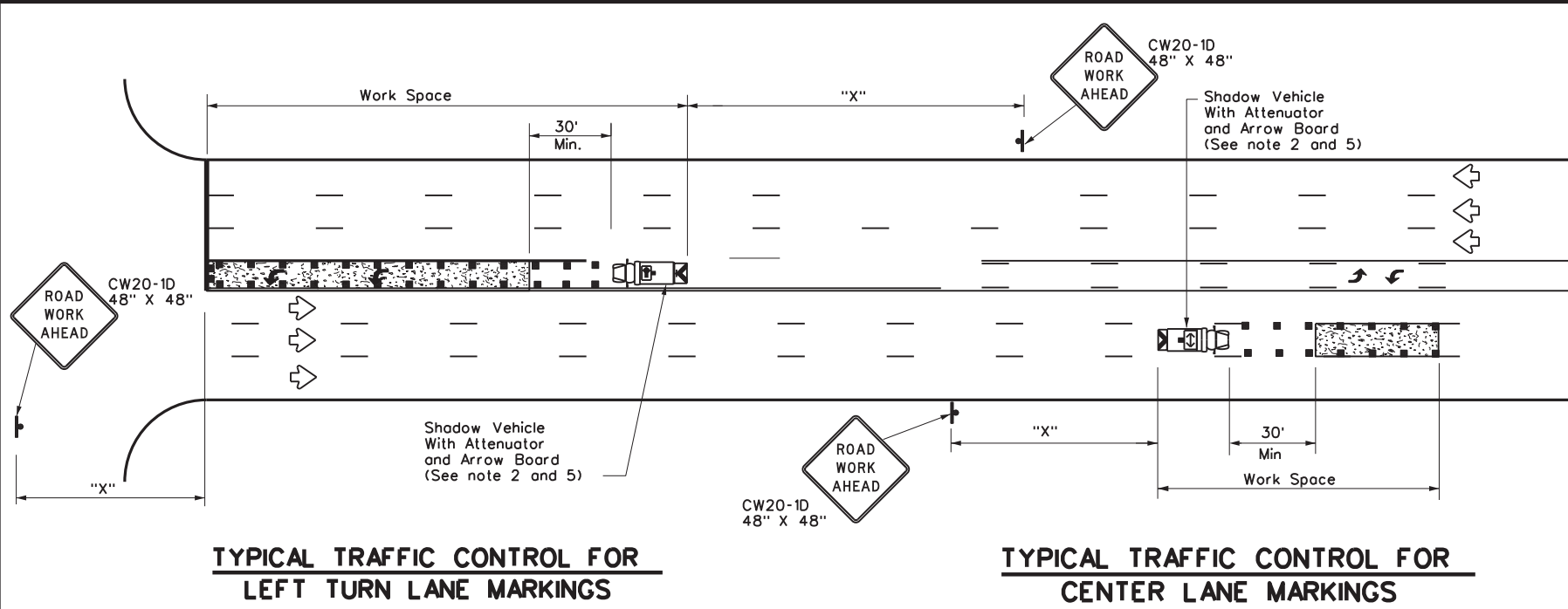
**TYPICAL TRAFFIC CONTROL FOR CONTINUOUS LEFT TURN LANE SYMBOL MARKINGS**

**TYPICAL TRAFFIC CONTROL FOR OUTSIDE DUAL LEFT TURN LANE SYMBOL MARKINGS**



**TYPICAL TRAFFIC CONTROL FOR OUTSIDE LANE MARKINGS**

**TYPICAL TRAFFIC CONTROL FOR INSIDE LANE MARKINGS**



**TYPICAL TRAFFIC CONTROL FOR LEFT TURN LANE MARKINGS**

**TYPICAL TRAFFIC CONTROL FOR CENTER LANE MARKINGS**

LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		Channelizing Devices

Posted Speed x	Formula	Minimum Desirable Taper Lengths x x			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'

x Conventional Roads Only

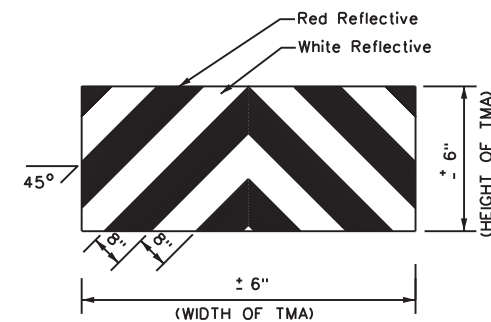
xx Taper lengths have been rounded off.

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
✓				

**GENERAL NOTES**

- This traffic control plan is for use on conventional roads posted at 45 mph or less and is intended for mobile operations that move continuously or intermittently (stopping up to approximately 15 minutes) such as short-line striping and in-lane rumble strips. When activities are anticipated to take longer amounts of time or traffic conditions warrant, a short duration or short-term stationary traffic control plan should be used.
- A Truck Mounted Attenuator shall be used on Shadow Vehicle. Striping on the back panel of all truck mounted attenuators shall be 8" red and white reflective sheeting placed in an inverted "V" design. Reflective sheeting shall meet or exceed the reflectivity and color requirements of departmental material specification DMS-8300, Type A.
- All traffic control devices shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD), latest edition.
- The use of yellow rotating beacons or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the drivers side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- Flashing arrow board shall be used on Shadow Vehicle. Flashing arrow board shall be Type B or Type C as per BC Standards. The arrow board operation shall be controlled from inside the truck.

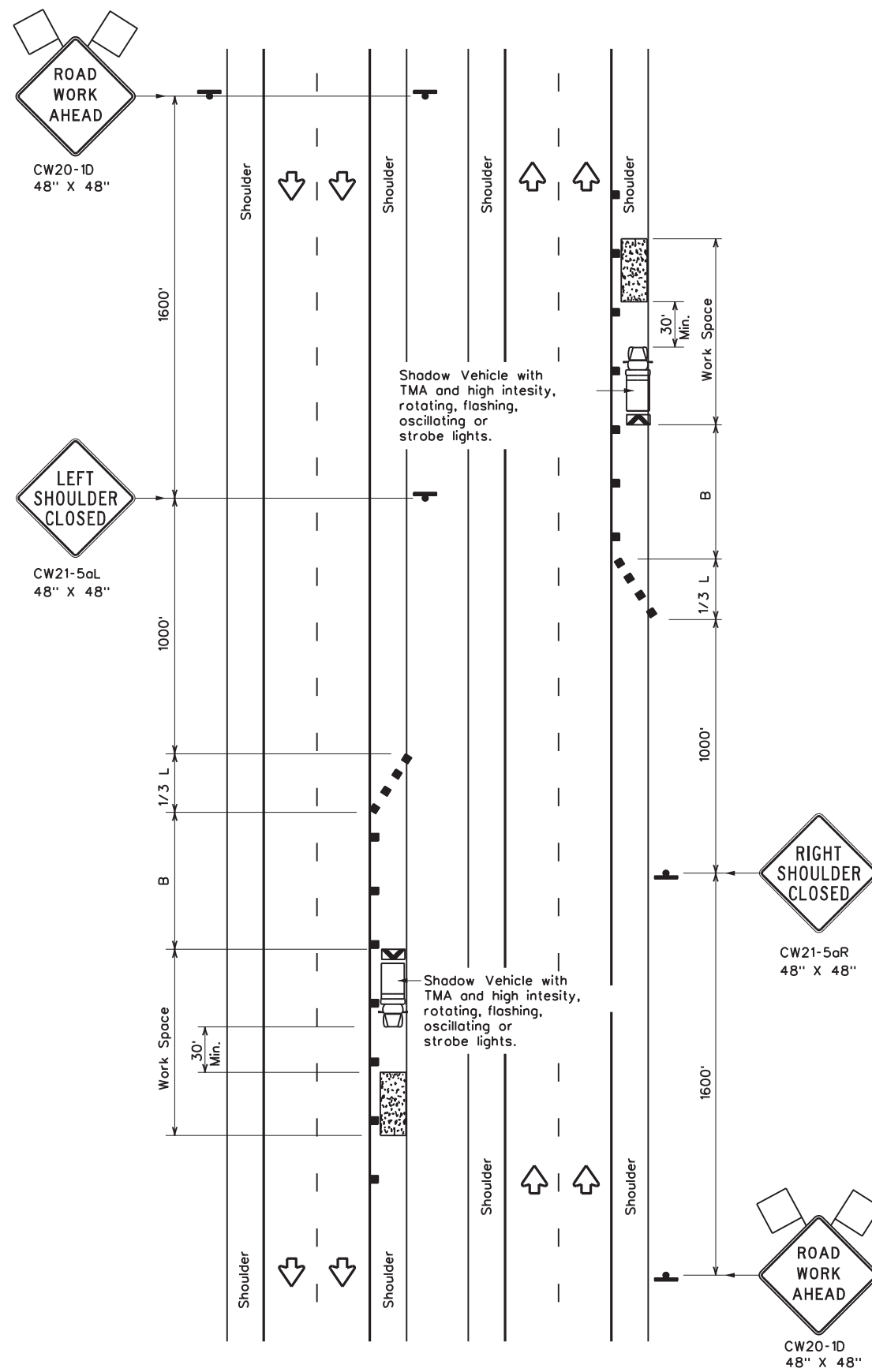


**STRIPING FOR TMA**

				Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN MOBILE OPERATIONS FOR ISOLATED WORK AREAS UNDIVIDED HIGHWAYS TCP(3-4)-13</b>					
FILE: tcp3-4.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
© TxDOT July, 2013	CONT: 0022	SECT: 010	JOB: 076	HIGHWAY: US90, etc.	
REVISIONS	DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO.: 36		

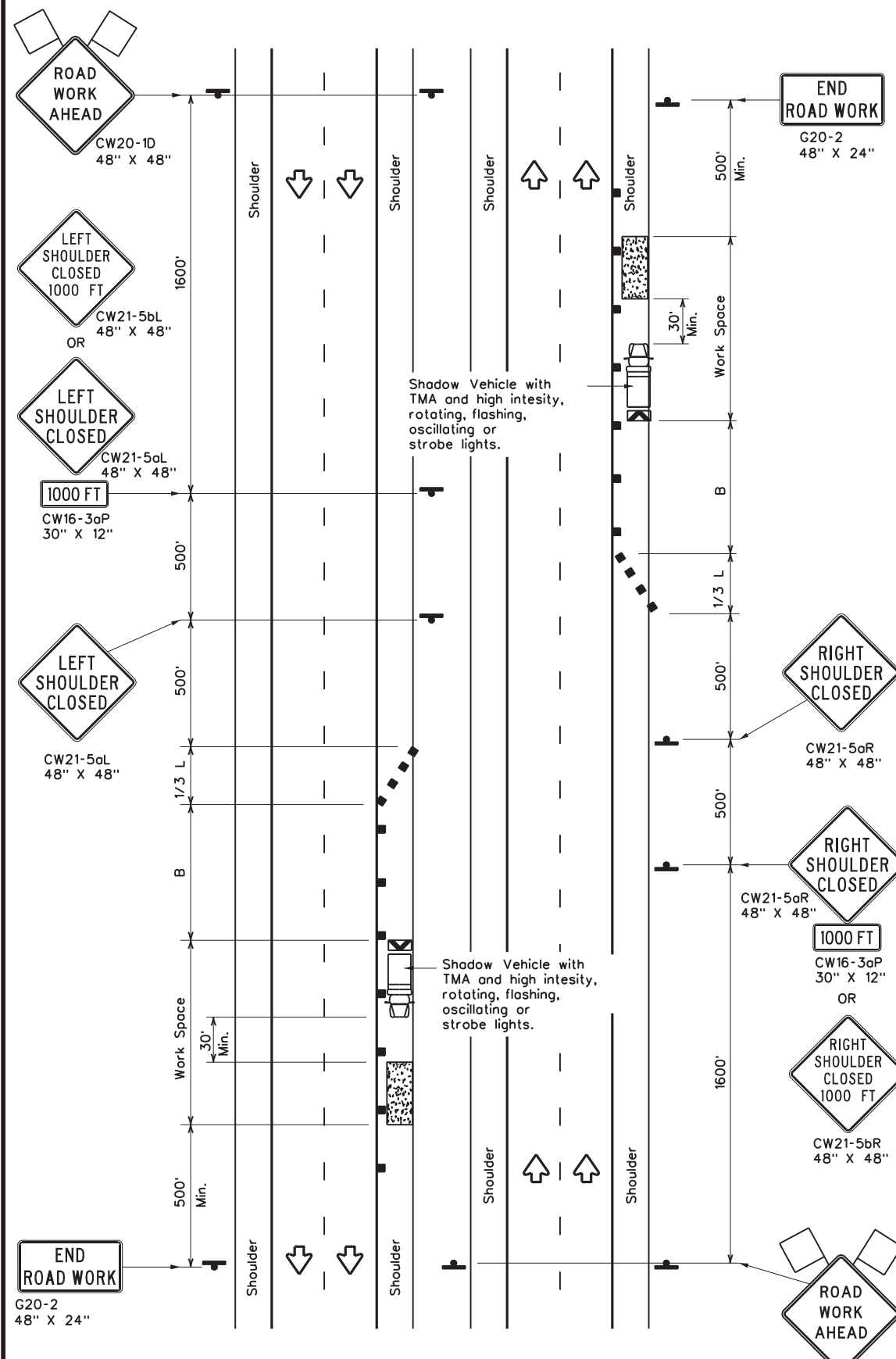
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DATE: 6/24/2022 2:59:20 PM  
FILE: tcp5-1-18.dgn



TCP (5-1a)

**WORK AREA ON SHOULDER**



TCP (5-1b)

**WORK AREA ON SHOULDER**

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 * x	Formula	Minimum Desirable Taper Lengths x x			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
30	L = WS <sup>2</sup> / 60	150'	165'	180'	30'	60'	90'
35		205'	225'	245'	35'	70'	120'
40		265'	295'	320'	40'	80'	155'
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

\* 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
	TCP(5-1a)	TCP(5-1b)	TCP(5-1b)	

**GENERAL NOTES**

- A Shadow Vehicle with a TMA should be used anytime it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the performance or quality of the work. Type 3 barricades or drums may be substituted when workers on foot are no longer present when approved by the Engineer.
- 28" tall or taller one-piece cones will be allowed only for Short Duration or Short Term stationary operations when workers are present to maintain the devices upright and in proper location. Intermediate Term stationary work areas should use Drums, Vertical Panels or 42" tall two-piece cones.

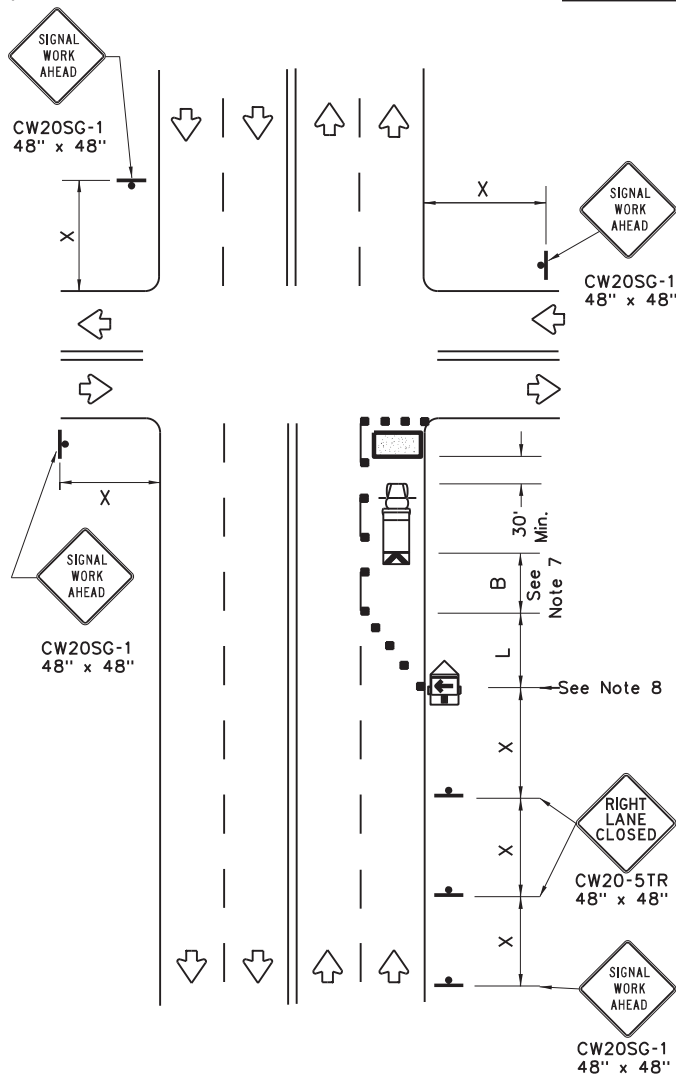


**TRAFFIC CONTROL PLAN  
SHOULDER WORK FOR  
FREEWAYS / EXPRESSWAYS**

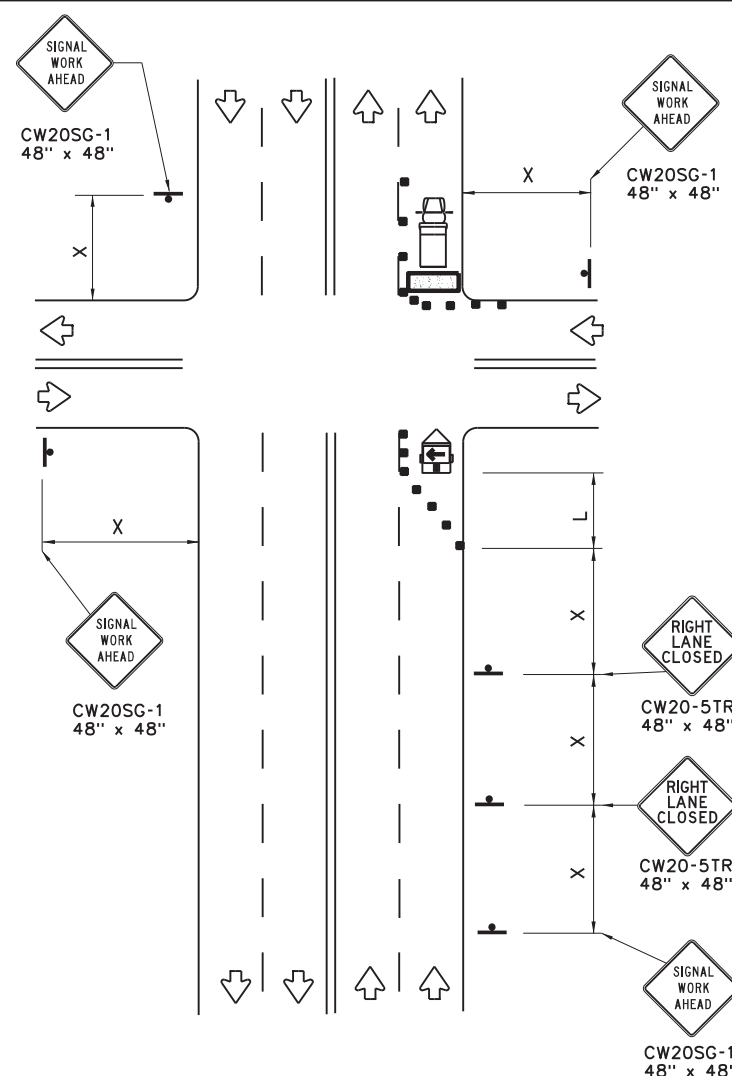
**TCP(5-1)-18**

FILE: tcp5-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
2-18	DIST	COUNTY	SHEET NO.	
	22	VAL VERDE, etc.	37	

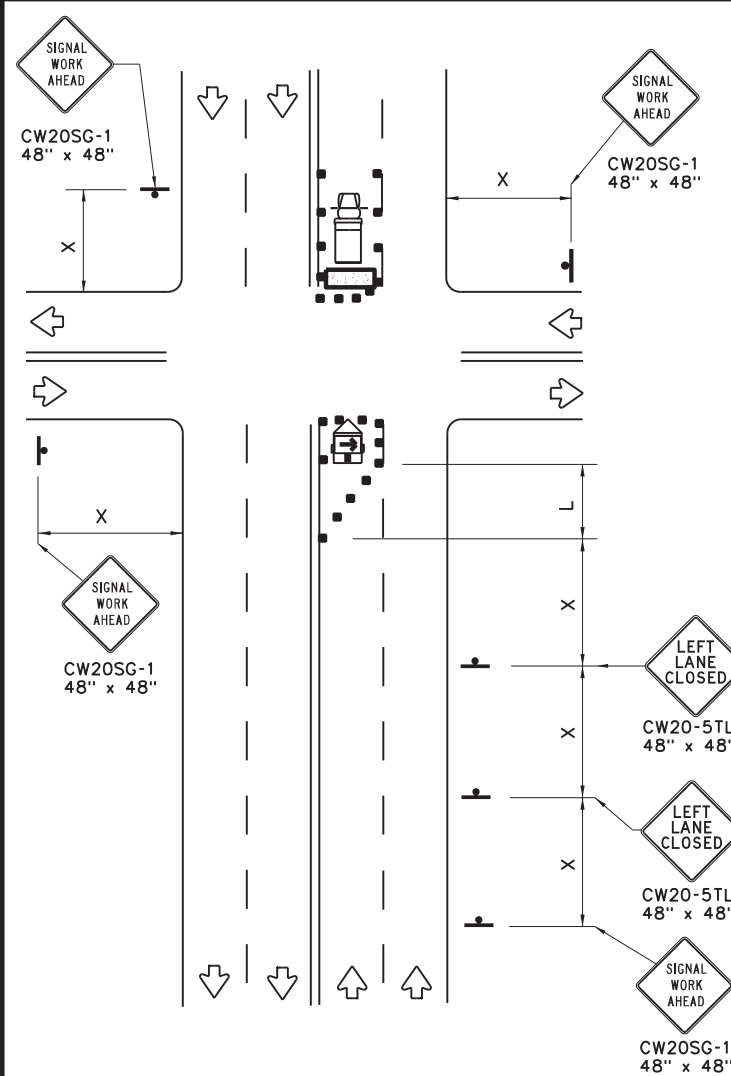
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**NEAR SIDE LANE CLOSURE**  
SHORT DURATION OR SHORT TERM STATIONARY



**FAR SIDE RIGHT LANE CLOSURE**  
SHORT DURATION OR SHORT TERM STATIONARY



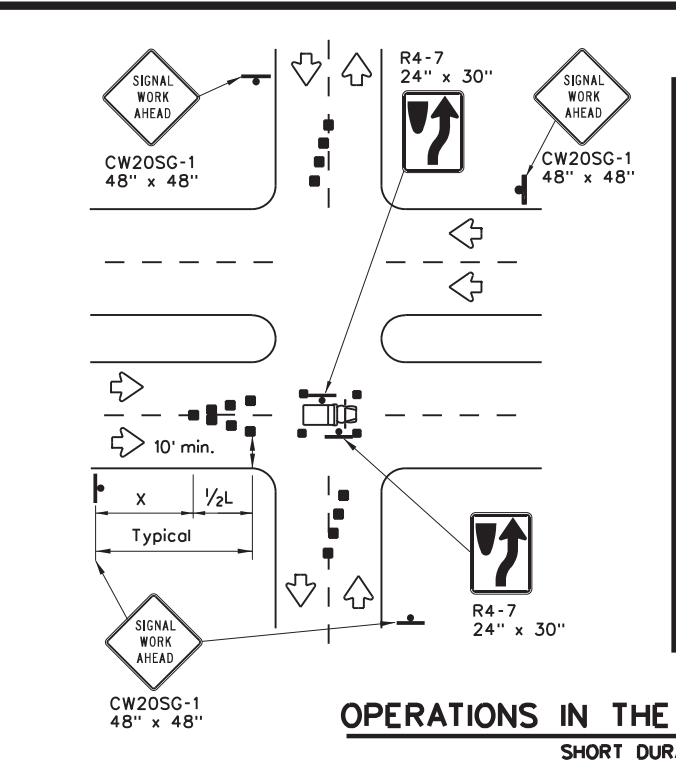
**FAR SIDE LEFT LANE CLOSURE**  
SHORT DURATION OR SHORT TERM STATIONARY

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

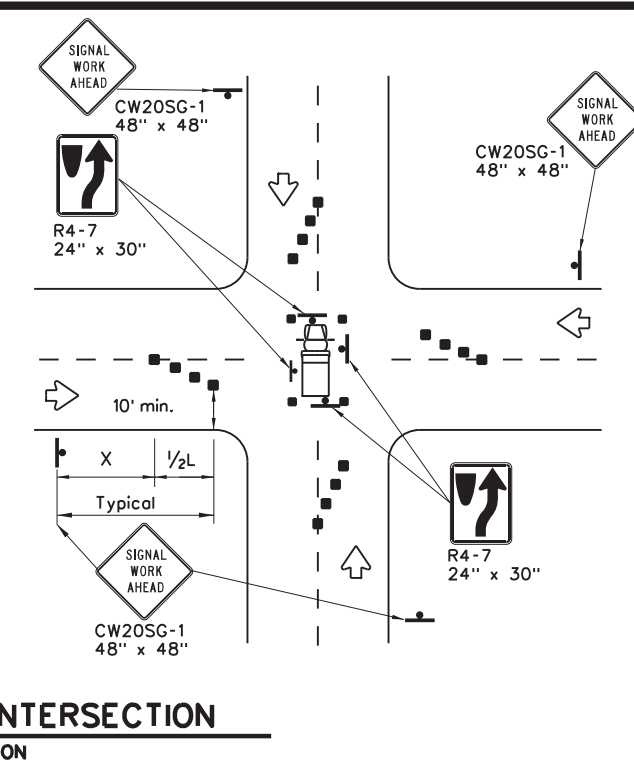
Posted Speed x	Formula	Minimum Desirable Taper Lengths x x			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x"	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	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



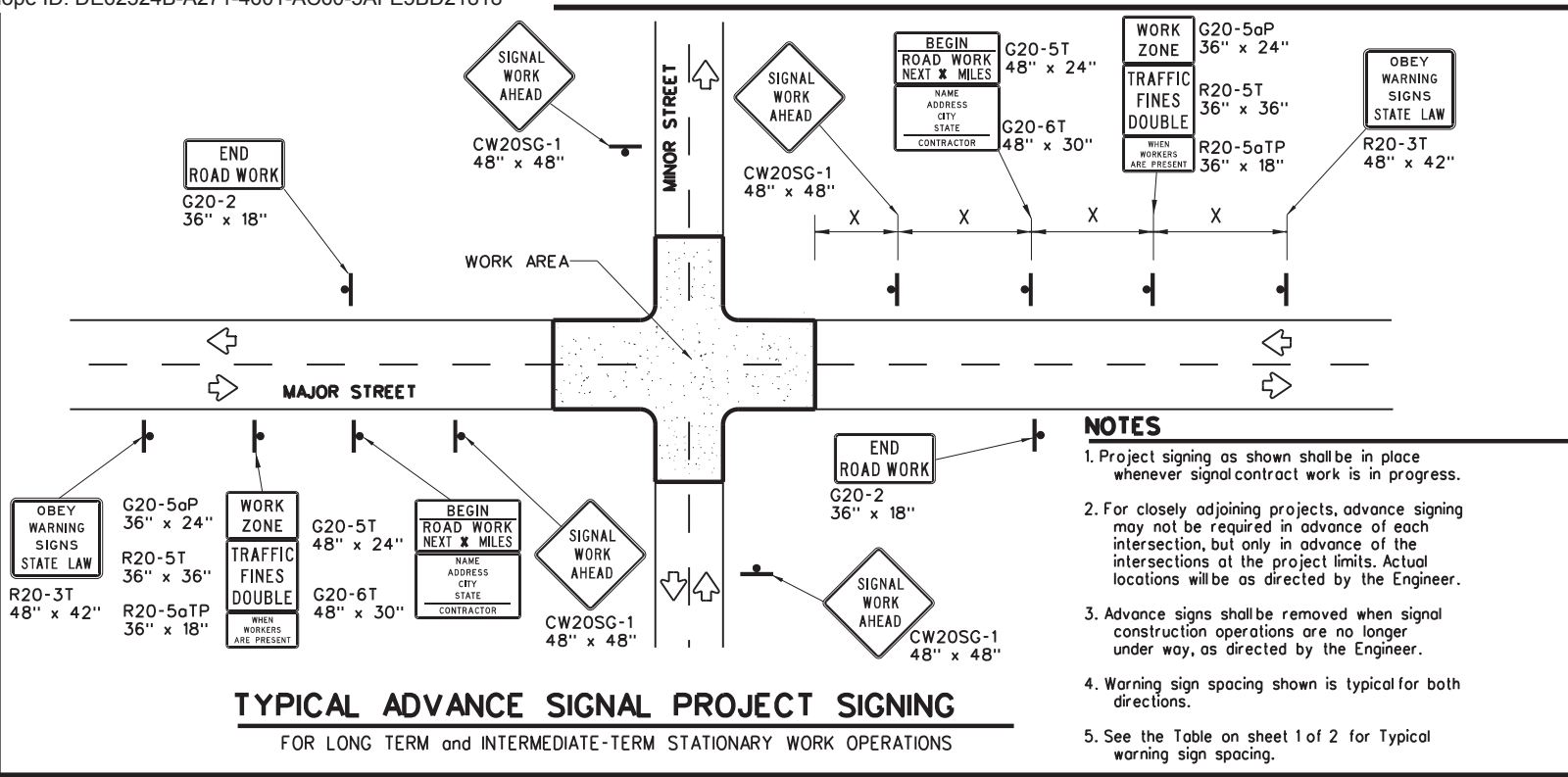
**TRAFFIC SIGNAL WORK TYPICAL DETAILS**

**WZ(BTS-1)-13**

FILE: wzbt-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
2-98 10-99 7-13	DIST	COUNTY	SHEET NO.	
4-98 3-03	22	VAL VERDE, etc.	38	

DATE: 6/24/2022 2:59:20 PM  
 FILE: wzbt-13.dgn

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- NOTES**
- Project signing as shown shall be in place whenever signal contract work is in progress.
  - For closely adjoining projects, advance signing may not be required in advance of each intersection, but only in advance of the intersections at the project limits. Actual locations will be as directed by the Engineer.
  - Advance signs shall be removed when signal construction operations are no longer under way, as directed by the Engineer.
  - Warning sign spacing shown is typical for both directions.
  - See the Table on sheet 1 of 2 for Typical warning sign spacing.

**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 back filled 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.

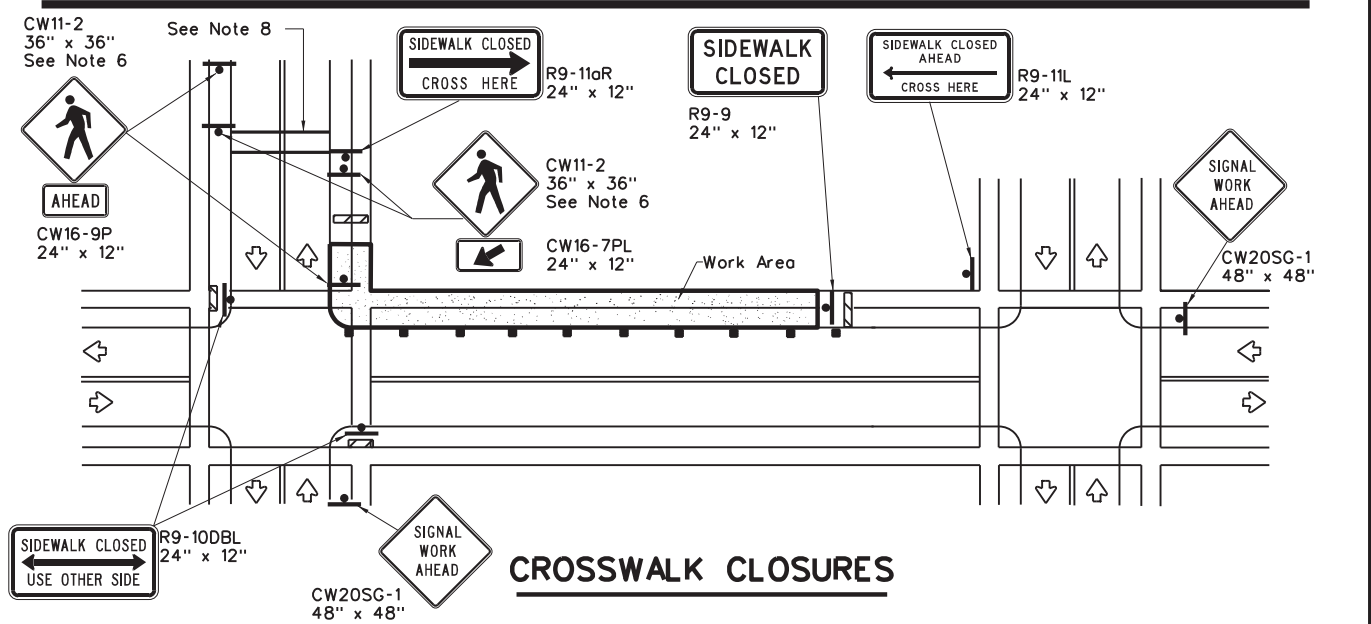
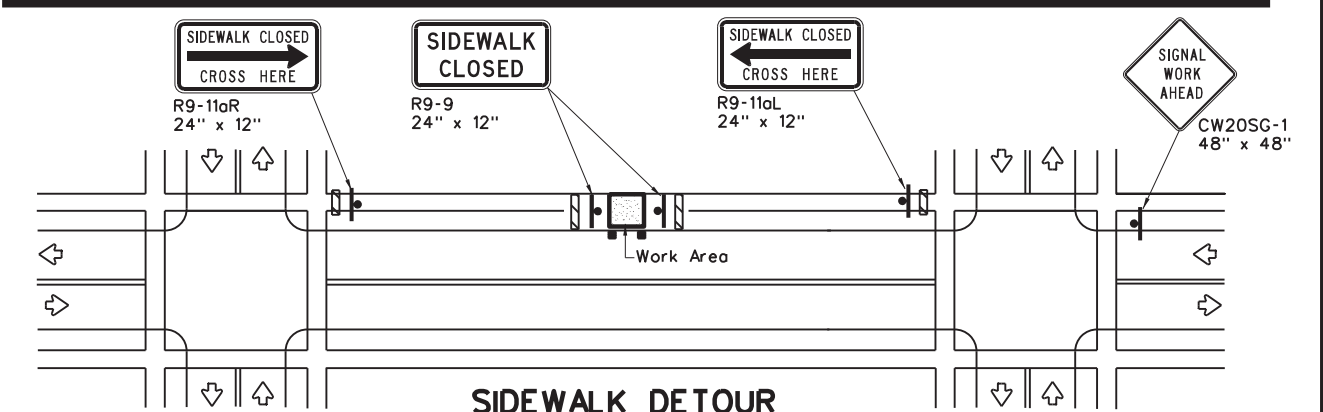
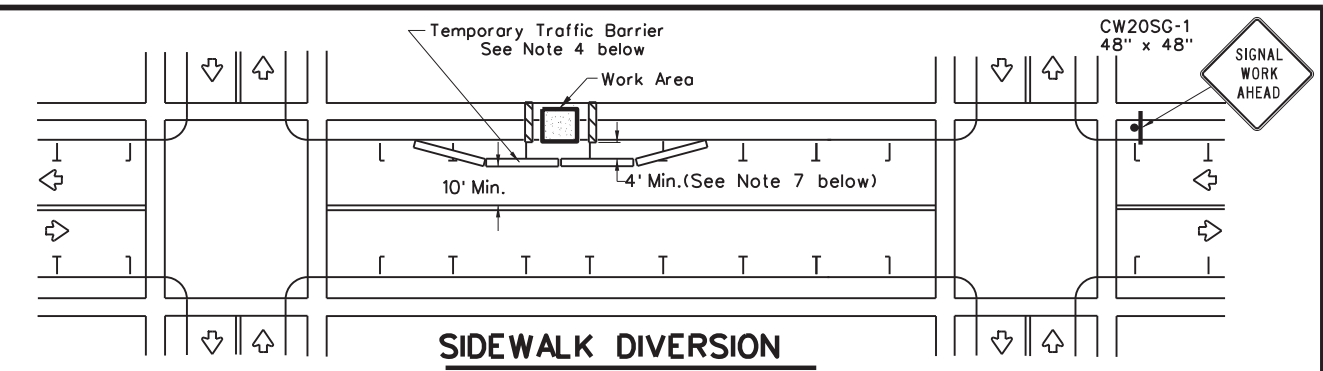
LEGEND	
	Sign
	Channelizing Devices
	Type 3 Barricade

**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.

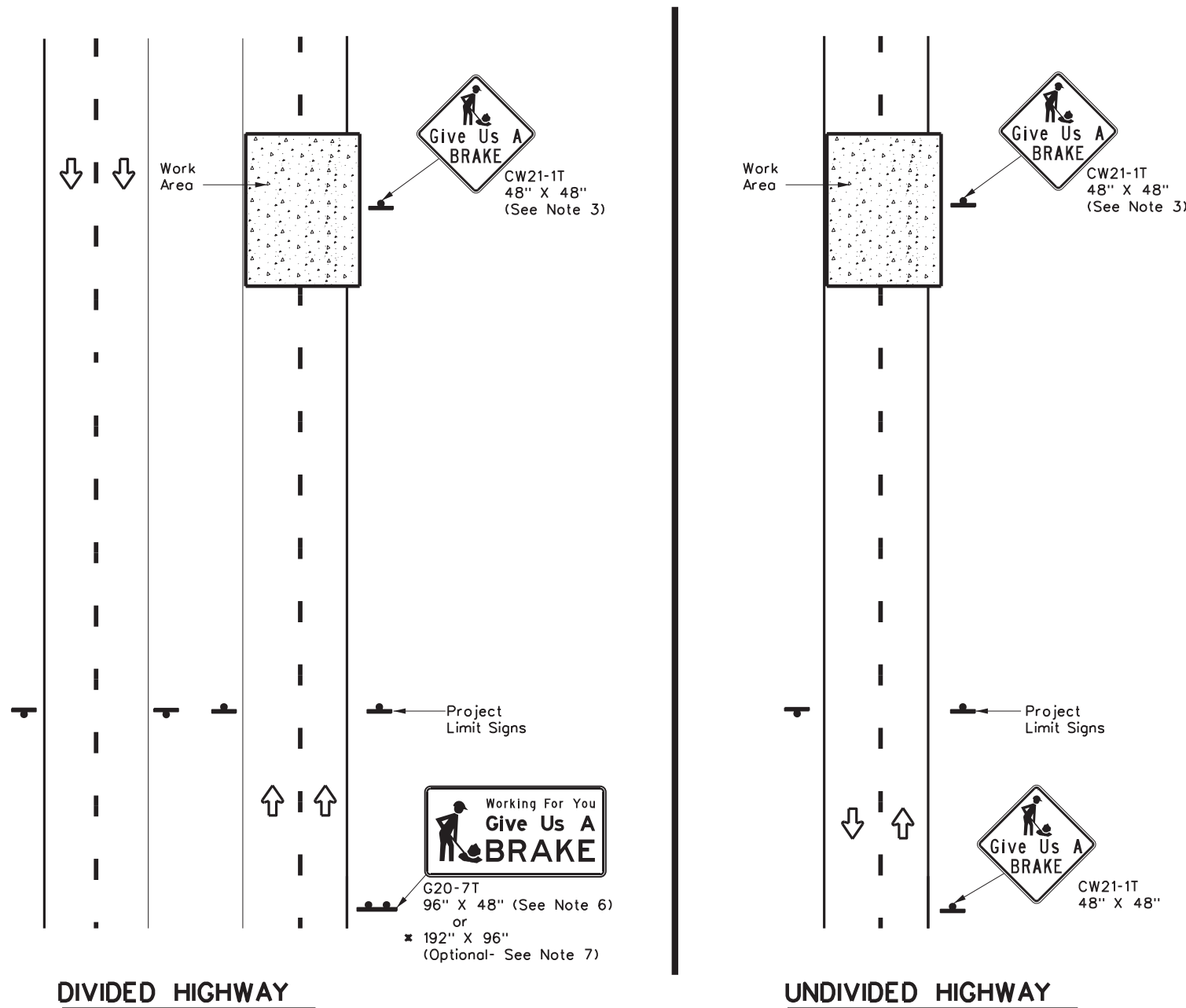
SHEET 2 OF 2

		<b>Traffic Operations Division Standard</b>	
<h2>TRAFFIC SIGNAL WORK BARRICADES AND SIGNS</h2>			
<h3>WZ(BTS-2)-13</h3>			
FILE: wzbts-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT April 1992	CONT: 0022	SECT: 010	JOB: 076
REVISIONS	0022	010	076
2-98 10-99 7-13	DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO. 39
4-98 3-03			

DATE: 6/24/2022 2:59:21 PM  
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FILE: wzbrk-13.dgn



SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

\* When the optional larger WORKING FOR YOU GIVE US A BRAKE (G20-7T) 192" x 96" sign is required, the locations shall be noted elsewhere in the plans.

SUMMARY OF LARGE SIGNS								
BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SO FT	GALVANIZED STRUCTURAL STEEL		DRILLED SHAFT
						Size	(LF)	
							①	②
Orange	G20-7T		96" X 48"	Type B <sub>FL</sub> or C <sub>FL</sub>	32	▲	▲	▲
Orange	G20-7T		192" X 96"	Type B <sub>FL</sub> or C <sub>FL</sub>	128	W8x18	16	17

▲ See Note 6 Below

LEGEND	
	Sign
	Large Sign
	Traffic Flow

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PLYWOOD SIGN BLANKS	DMS-7100
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

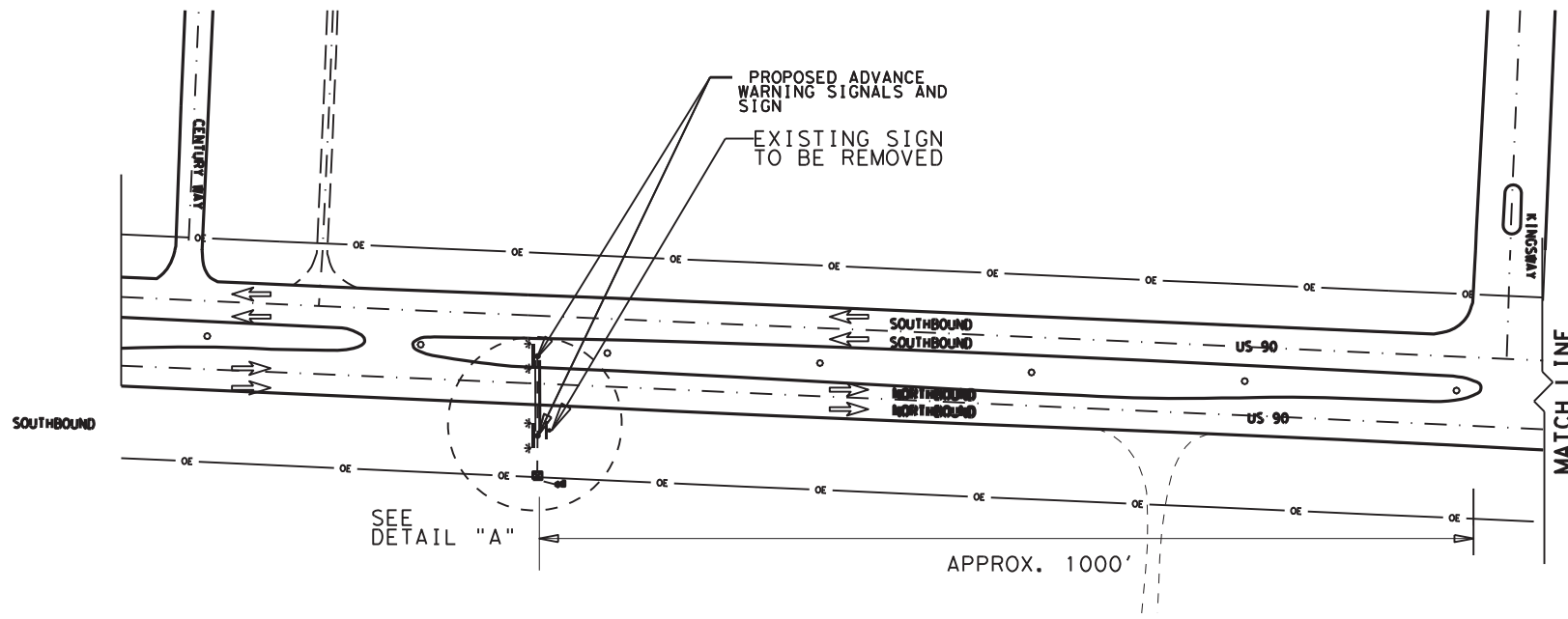
COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B <sub>FL</sub> OR TYPE C <sub>FL</sub>
BLACK	LEGEND & BORDERS	NON-REFLECTIVE ACRYLIC FILM

**GENERAL NOTES**

- See BC and SMD sheets for additional sign support details.
- Sign locations shall be approved by the Engineer.
- For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
- Work zone speed limits are sometimes used in conjunction with GIVE US A BRAKE signing. See BC(3) for location and spacing of construction speed zone signing when required.
- Give Us a Brake (CW21-1T) signs and supports shall be considered subsidiary to Item 502, "Barricades, Signs and Traffic Handling."
- The 96" X 48" Working For You Give Us A BRAKE (G20-7T) may use a 1/2" or 5/8" plywood substrate or 0.125" aluminum sheeting substrate and may be supported by two 4" x 6" wood posts with drilled holes for breakaway as per BC(5) and will be subsidiary to Item 502.
- The Working For You Give Us A BRAKE (G20-7T) 192" X 96" sign shall be paid for under the following specification items:  
Item 636 - Aluminum Signs  
Item 647 - Large Roadside Sign Supports and Assemblies.  
Item 416 - Drilled Shaft Foundations
- All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.

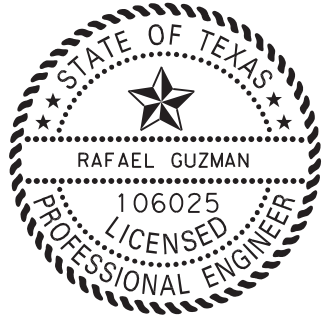
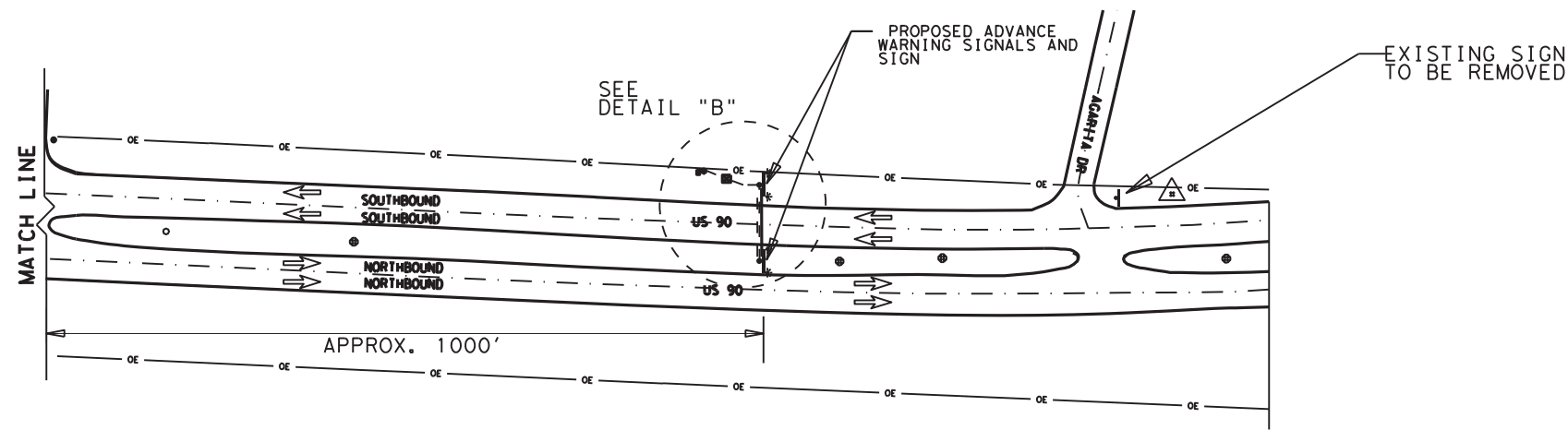
				Traffic Operations Division Standard	
<b>WORK ZONE "GIVE US A BRAKE" SIGNS</b>					
<b>WZ(BRK)-13</b>					
FILE: wzbrk-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
© TxDOT August 1995	CONT	SECT	JOB	HIGHWAY	
REVISIONS		0022	010	076	US90, etc.
6-96	5-98	7-13			
8-96	3-03				
	DIST	COUNTY	SHEET NO.		
	22	VAL VERDE, etc.	40		





LEGEND

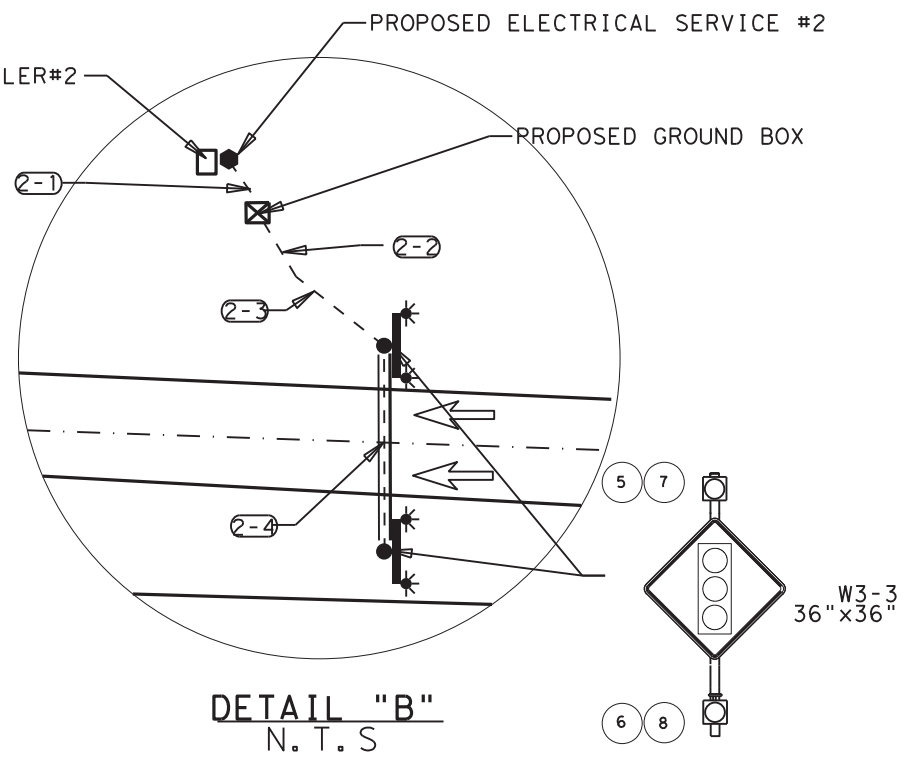
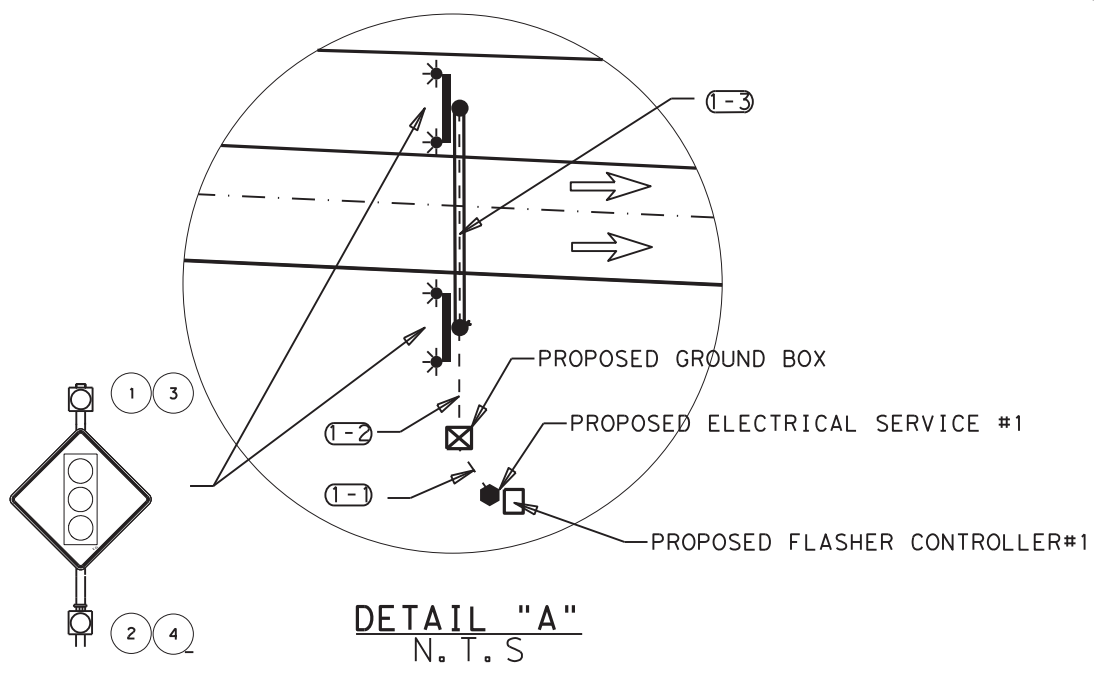
- PROPOSED GROUND BOX TY C
- PROPOSED ELECTRICAL SERVICE
- PROPOSED STATIC SIGN W/FLASHING BEACONS
- EXISTING SIGN
- WIRE RUN DESIGNATION
- DIRECTION OF TRAFFIC FLOW
- EXISTING SMALL SIGN TO BE REMOVED
- CONDUIT TRENCH
- CONDUIT BORE
- FLASHER CONTROLLER
- OVERHEAD POWERLINES



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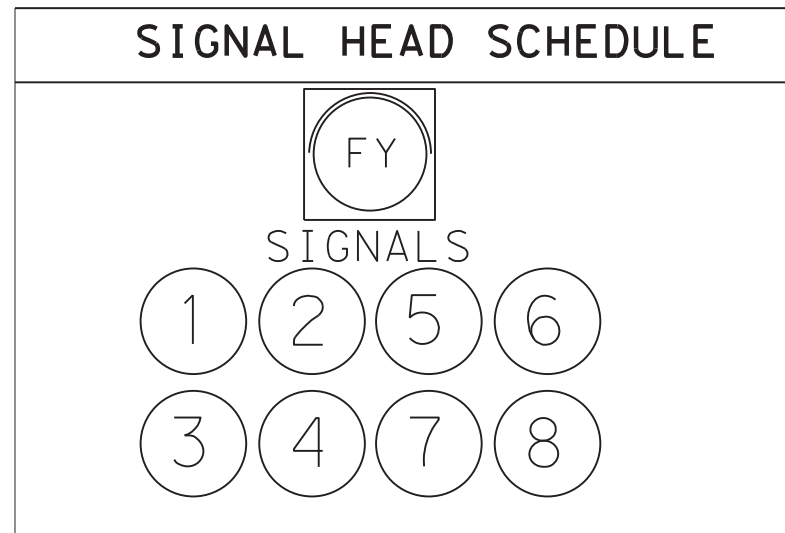
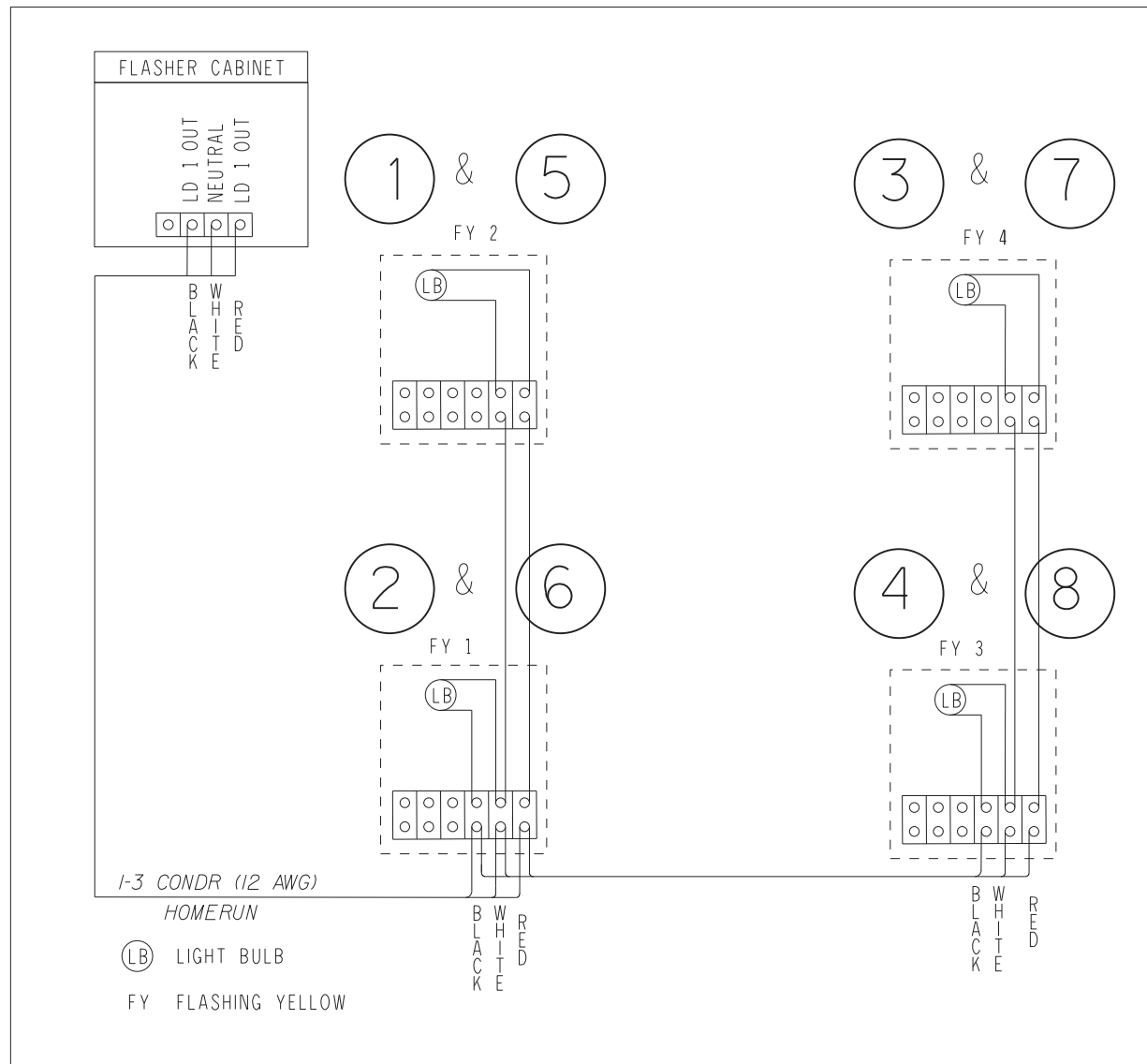
**US 90 AT KINGSWAY  
ADVANCE WARNING SIGNALS  
LAYOUT**

DN: F.R.	DW: F.R.	STATE	SHEET NUMBER		SHEET NO.
CK: G.R.	CK: G.R.	TEXAS	SHEET 1 OF 1		
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB
6	22	VAL VERDE, etc.	0022	010	076
					HIGHWAY NO.
					US90, etc.

41

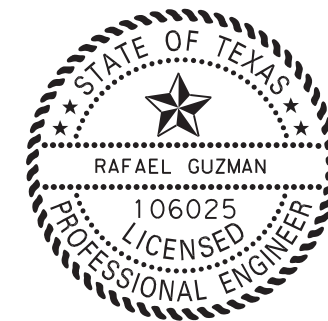
6/24/2022 FRAM052 CSJ\*0022-10-076\*US90 at Kingsway\*LAYOUT.dgn

# TYPICAL WIRING DIAGRAM



PROPOSED ELECTRICAL SERVICE DATA													
SERVICE POLE NO.	SERVICE POLE DESCRIPTION	SERVICE CONDUIT SIZE	SERVICE CONDUCTORS NO./SIZE	SAFETY SWITCH AMPS	MAIN			TWO-POLE CONTR. ACTOR AMPS	PANELBD./ LOADCENTER AMP RATING (MIN)	CIRCUIT NO.	BRANCH CKT. BKR POLE/AMPS	BRANCH CIRCUIT AMPS	KVA LOAD
					SWITCH AMP/F USE	CKT. BKR. POLE/ AMP							
US 90 /KINGSWAY 1	TY T 120/240 000 (NS) GS (N) SP (O)	1 1/2"	3/#4 AWG	N/A	N/A	N/A	N/A	100	FLASHING BEACON	1P/20	2	0.24	
US90 /KINGSWAY 2	TY T 120/240 000 (NS) GS (N) SP (O)	1 1/2"	3/#4 AWG	N/A	N/A	N/A	N/A	100	FLASHING BEACON	1P/20	2	0.24	

ITEM	RUN NUMBER	ELECTRICAL RUNS								EXTRA (LF)	TOTAL
		1-1	1-2	1-3	2-1	2-2	2-3	2-4			
CONDUIT	COND T (PVC) (SCHD 40) (2")	1	78	46	5	26	44	43	0	161	
	COND T (PVC) (SCHD 80) (2") (BORE)	0	0	1	0	0	0	1	0	89	
SIGNAL CABLE	TRF SIG CBL (TY A) (12 AWG) (3 CONDR)	1	1	1	1	1	1	1		250	
CONDUCTOR	ELEC CONDR (NO. 6) BARE	1	1	1	1	1	1	1	10	260	
	ELEC CONDR (NO. 6) INSULATED	0	0	0	0	0	0	0	20	20	



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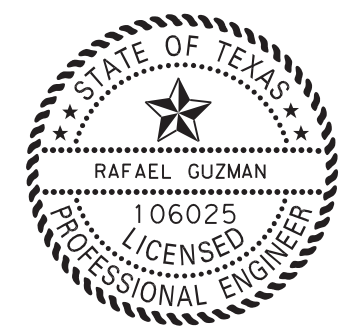
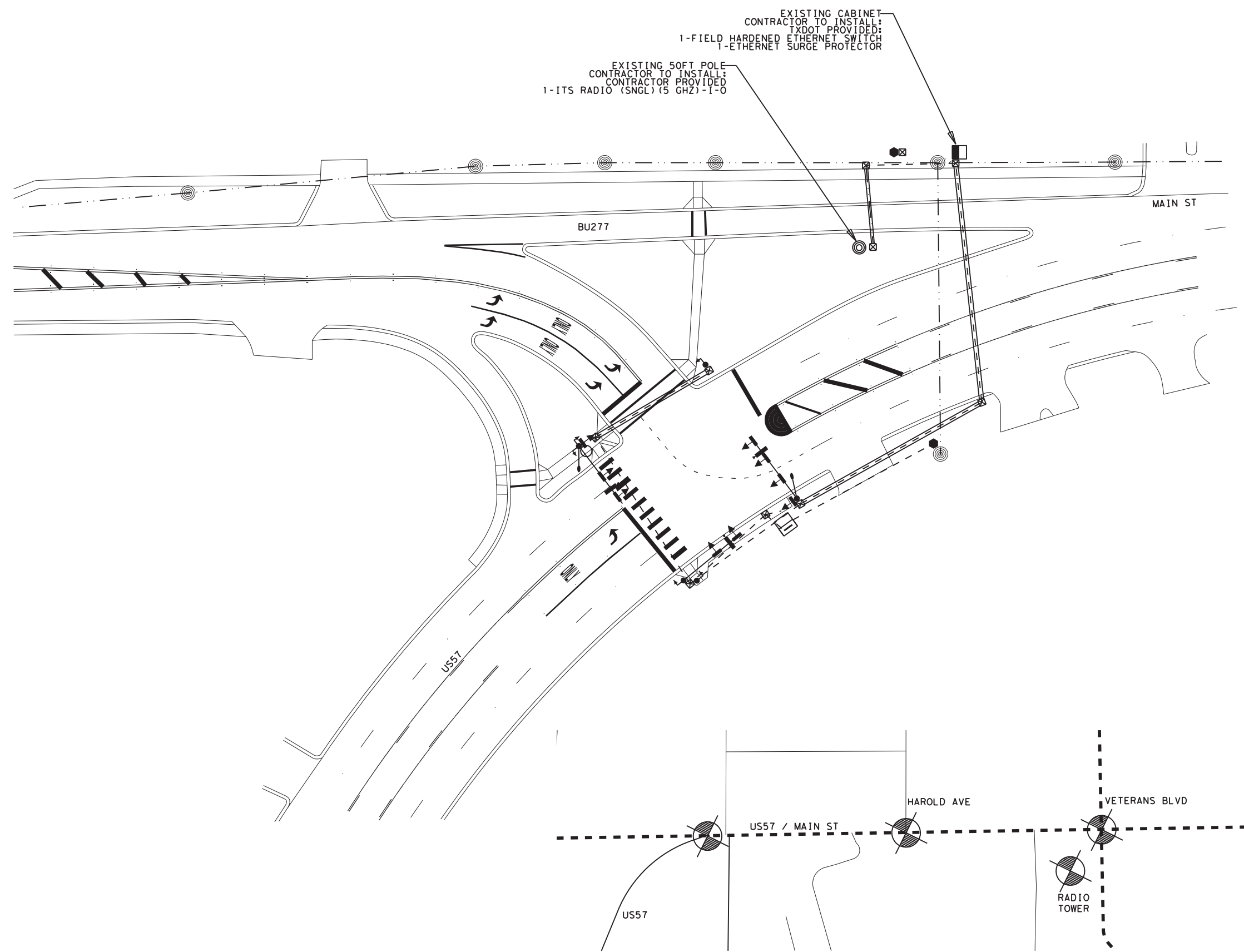
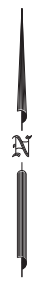


### US 90 AT KINGSWAY ADVANCE WARNING SIGNALS WIRING DIAGRAM

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
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FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

**LEGEND**

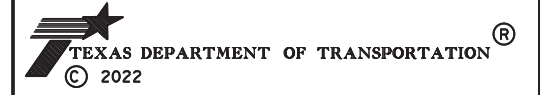
- EXISTING CONDUIT
- EXISTING MAST ARM POLE
- ⊕ EXISTING TRAFFIC SIGNAL HEAD
- ▣ EXISTING GROUND CABINET
- ≡≡≡ EXISTING BORE CONDUIT
- ⊗ EXISTING GROUND BOX
- EXISTING VIVDS CAMERA
- ⊙ EXISTING CCTV POLE
- ◆ PROPOSED ITS RADIO



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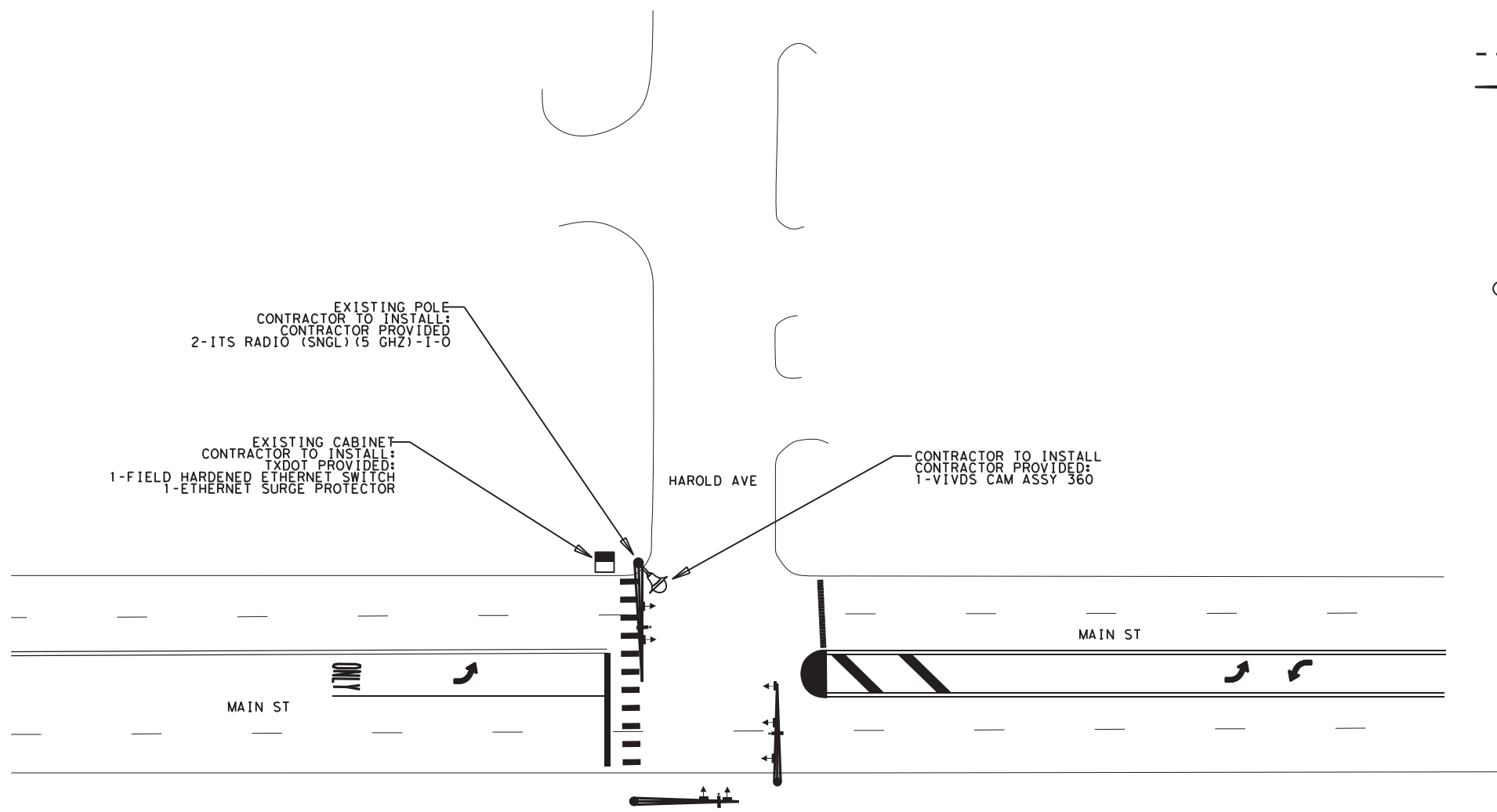
**US57 AT MAIN ST INTERCONNECT**

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FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

6/24/2022 FRAM052 CSJ#0300-01-108\*US57 at US277 Interconnect.dgn

**LEGEND**

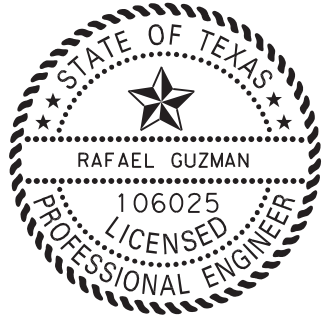
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- EXISTING MAST ARM POLE
- ⊕ EXISTING TRAFFIC SIGNAL HEAD
- EXISTING GROUND CABINET
- ≡ EXISTING BORE CONDUIT
- ⊠ EXISTING GROUND BOX
- ⊔ EXISTING VIVDS CAMERA
- ⊕ PROPOSED 360 VIVDS
- ◆ PROPOSED ITS RADIO



EXISTING POLE  
CONTRACTOR TO INSTALL:  
CONTRACTOR PROVIDED  
2-ITS RADIO (SNGL) (5 GHZ)-1-0

EXISTING CABINET  
CONTRACTOR TO INSTALL:  
TXDOT PROVIDED:  
1-FIELD HARDENED ETHERNET SWITCH  
1-ETHERNET SURGE PROTECTOR

CONTRACTOR TO INSTALL  
CONTRACTOR PROVIDED:  
1-VIVDS CAM ASSY 360

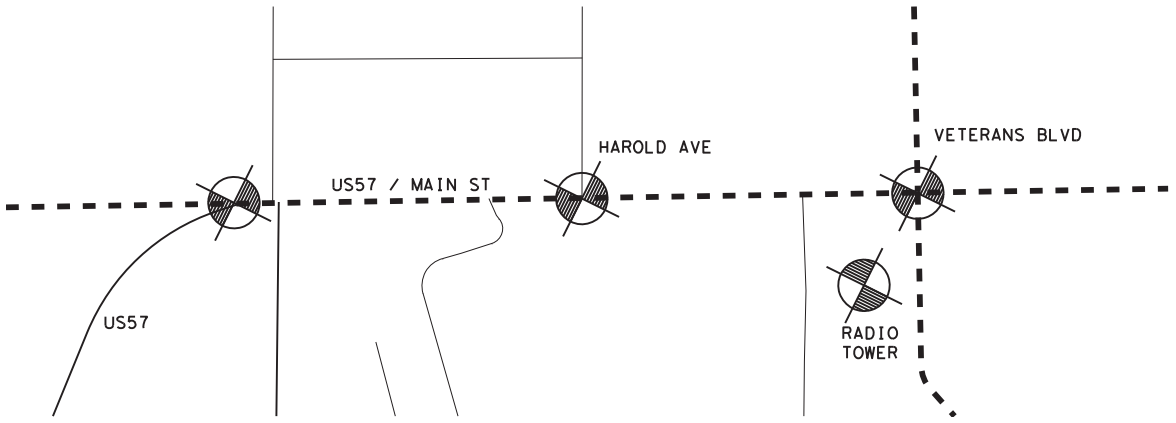


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**NOTES:**

1. CONTRACTOR SHALL INSTALL THE FOLLOWING TXDOT PROVIDED EQUIPMENT IN EXISTING POLES & CABINET: FIELD HARDENED ETHERNET SWITCH, AND ETHERNET SURGE PROTECTORS.
2. FOR PROPOSED WIRELESS COMMUNICATION PATH & PROPOSED RADIO @ EAGLE PASS TOWER SEE COMMUNICATION LAYOUT SHEET.
3. VIVDS CAM ASSY 360 CAMERA TO BE INSTALLED AS SHOWN IN THE LAYOUT OR AS DIRECTED BY THE ENGINEER. INSTALL COMMUNICATION CABLE FROM PROPOSED CAMERA TO SIGNAL CONTROLLER. CAMERA TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
4. VERIFY WITH ALL UTILITY COMPANIES THE EXACT LOCATIONS OF EXISTING UNDERGROUND UTILITIES PRIOR TO ANY CONSTRUCTION TO AVOID CONFLICT OR DAMAGE TO THESE UTILITIES.



NOT TO SCALE



**US 57 AT HAROLD AVE INTERCONNECT**

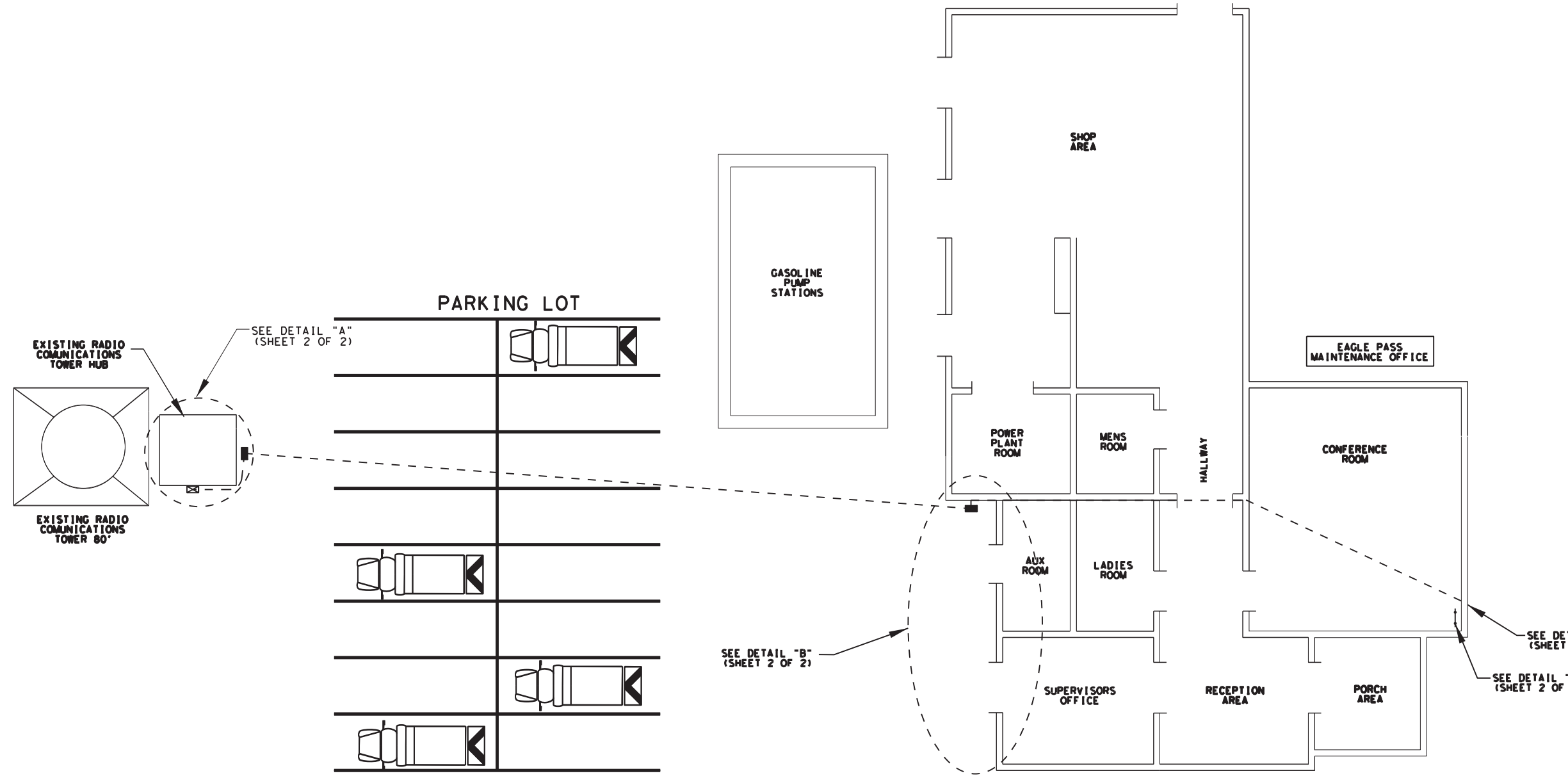
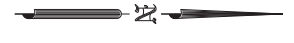
DN: F. R.	DW: F. R.	STATE	SHEET NUMBER		SHEET NO.		
CK: G. R.	CK: G. R.	TEXAS	SHEET 1 OF 1				
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.	44
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.	

6/24/2022 6:05:22 AM CSJ#0300-01-108\*US57 at US277 Interconnect.dgn

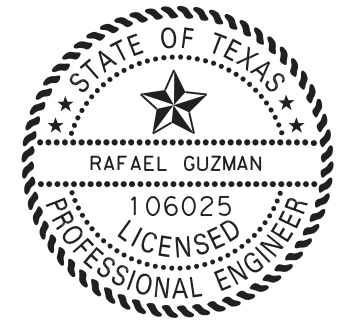


**LEGEND**

- - - EXISTING CONDUIT
- EXISTING GROUND BOX
- ◆ PROPOSED ITS RADIO

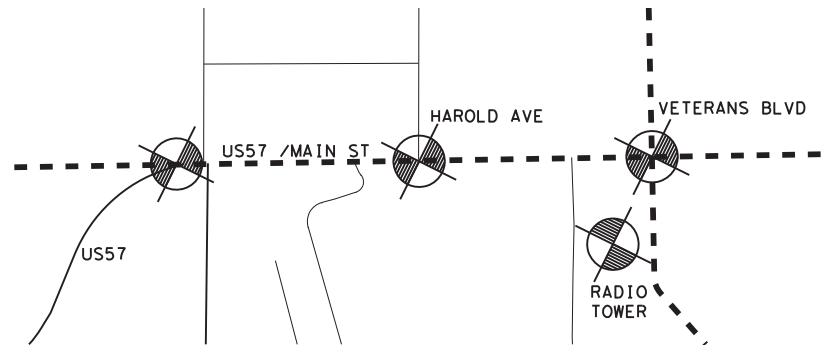


6/24/2022 FRAM052 CSJ#0300-01-108\*US57 at US277 Interconnect.dgn



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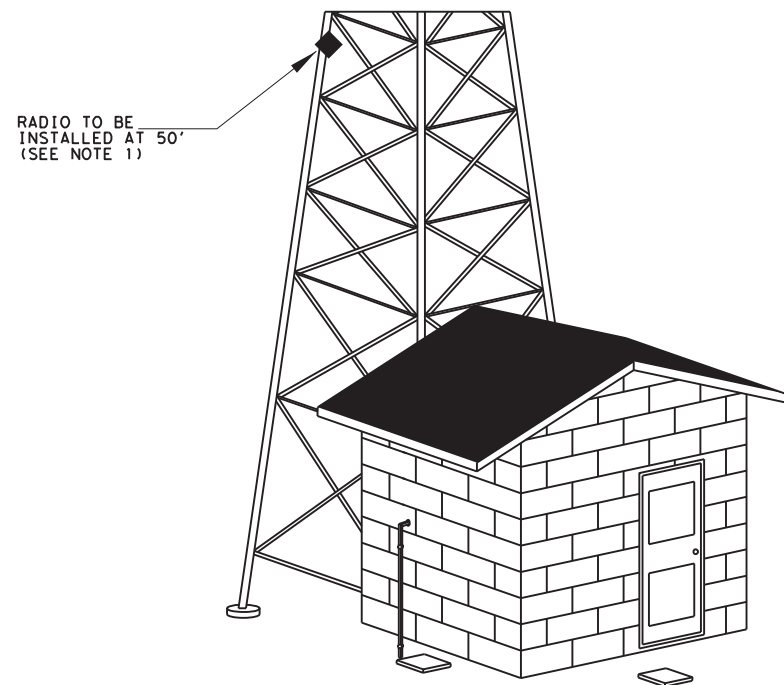


TEXAS DEPARTMENT OF TRANSPORTATION  
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**EAGLE PASS OFFICE TOWER INTERCONNECT**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: G. R.	CK:	TEXAS	SHEET 1 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

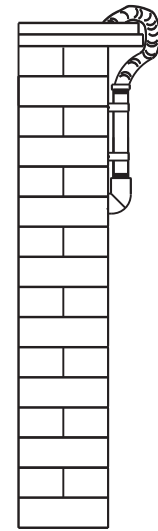
46



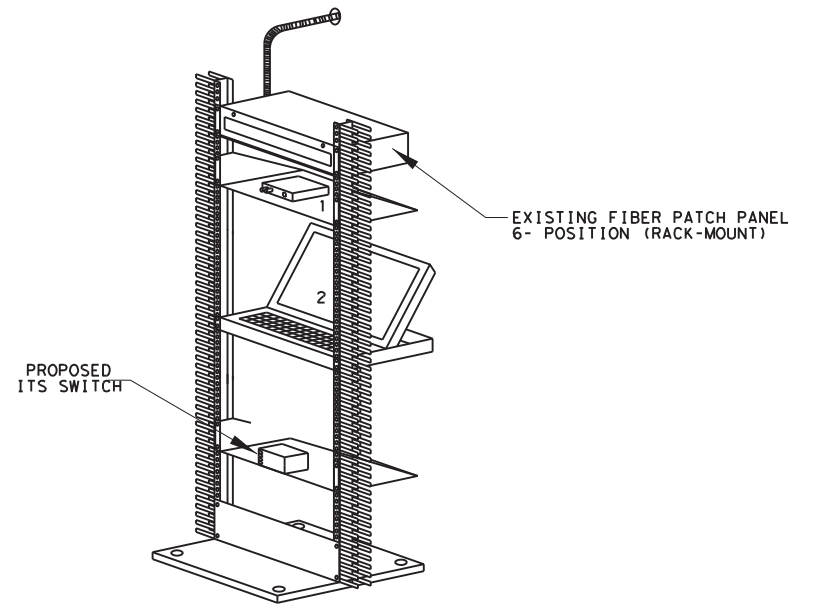
RADIO TO BE INSTALLED AT 50' (SEE NOTE 1)

RADIO COMMUNICATION TOWER HUB

DETAIL "A"  
N. T. S.



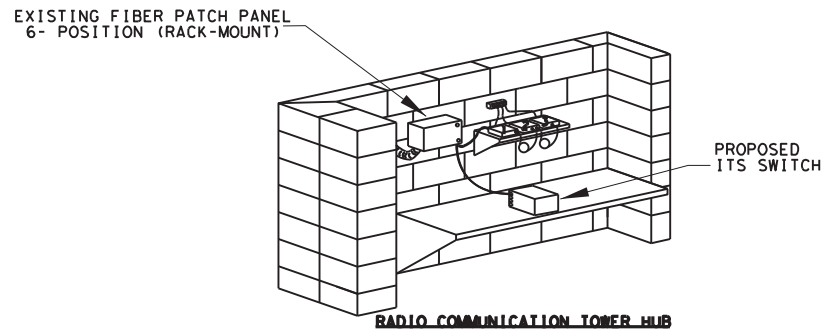
DETAIL "C"  
N. T. S.



PROPOSED ITS SWITCH

EXISTING FIBER PATCH PANEL 6- POSITION (RACK-MOUNT)

DETAIL "D"  
N. T. S.

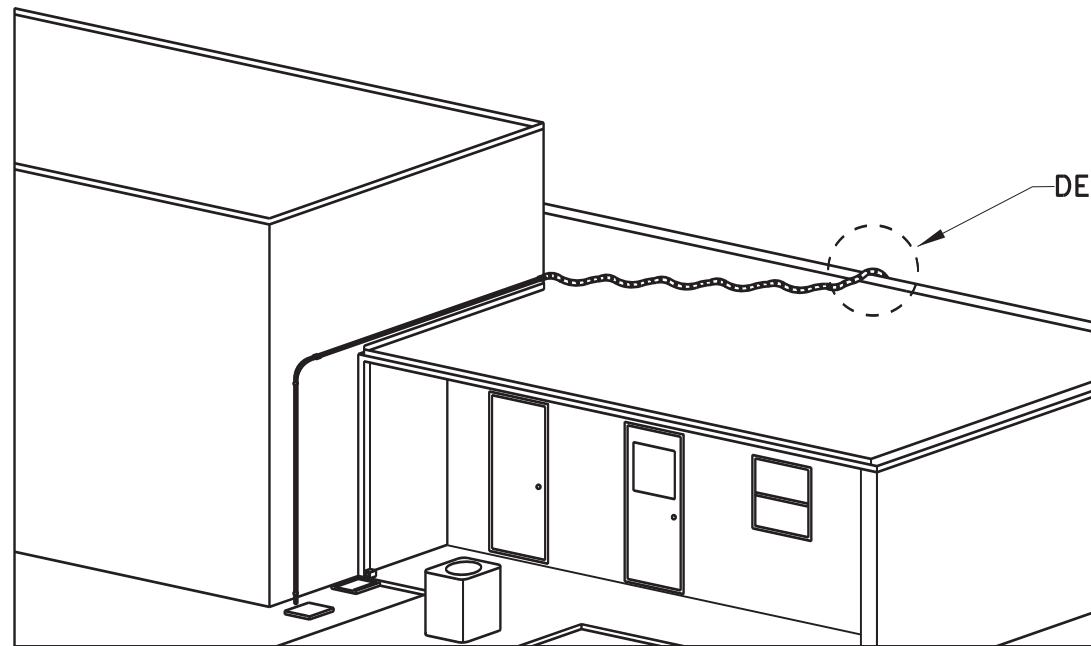


EXISTING FIBER PATCH PANEL 6- POSITION (RACK-MOUNT)

PROPOSED ITS SWITCH

RADIO COMMUNICATION TOWER HUB

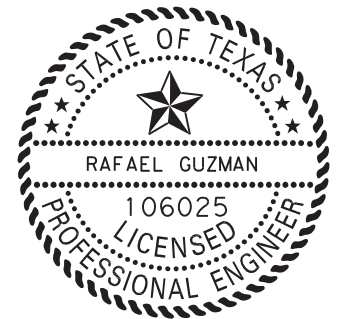
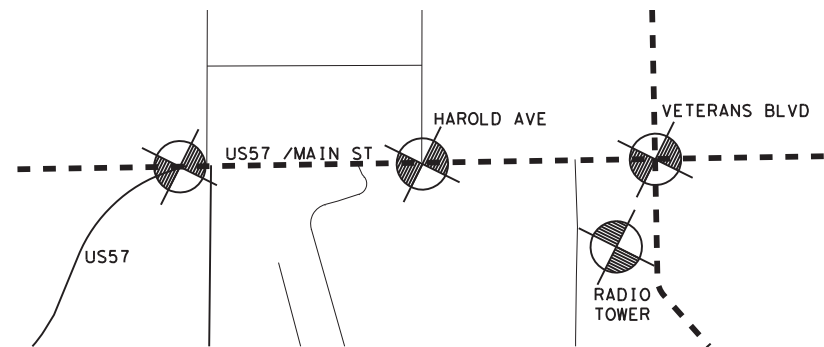
BUILDING INTERIOR  
N. T. S.



DETAIL "C"

EAGLE PASS MAINTENANCE OFFICE

DETAIL "B"  
N. T. S.



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NOTES:

1. RADIO MOUNTING HARDWARE AND MOUNTING ON EXISTING TOWER TO BE SUBSIDIARY TO ITEM (6062-6017) ITS RADIO (SNGL) (5 GHZ) I-O

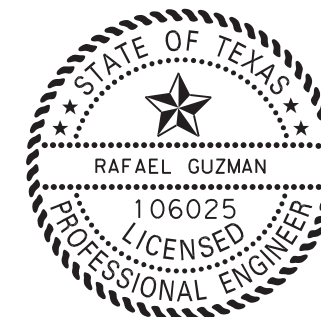
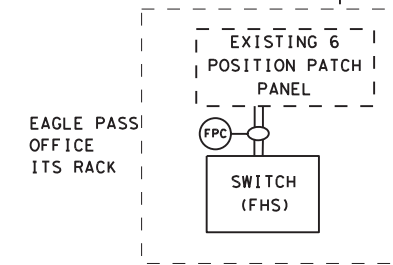
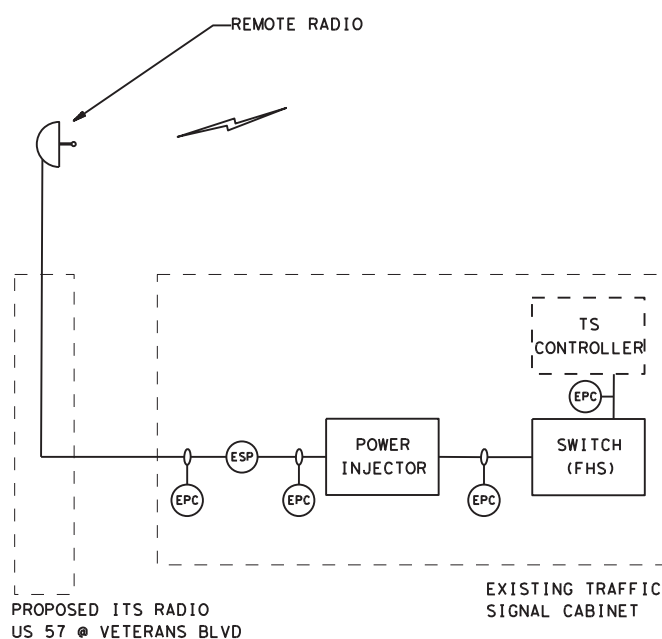
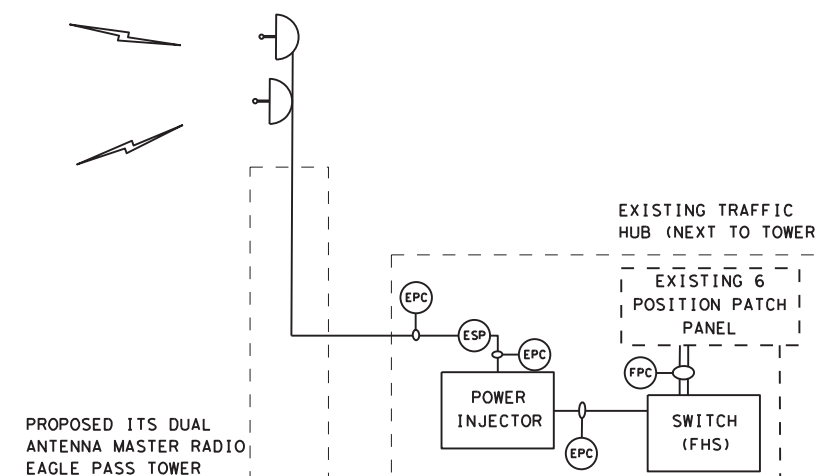
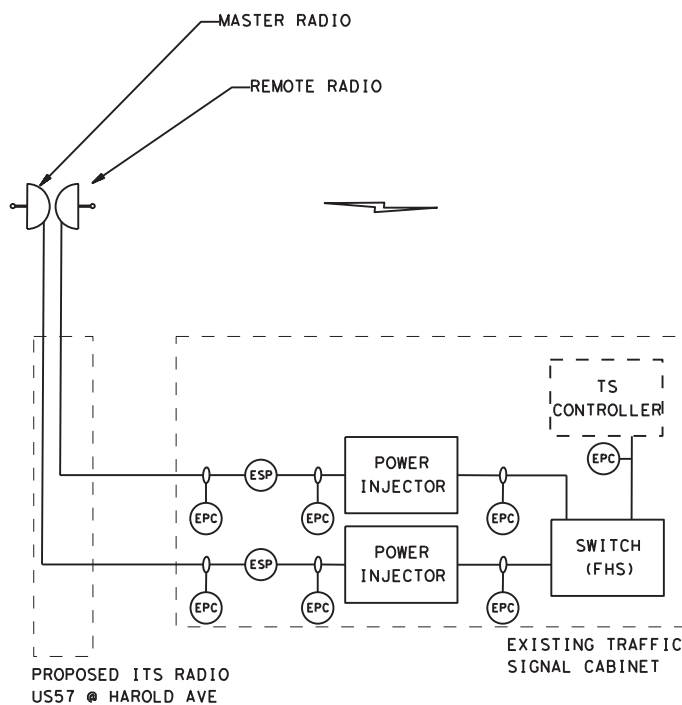
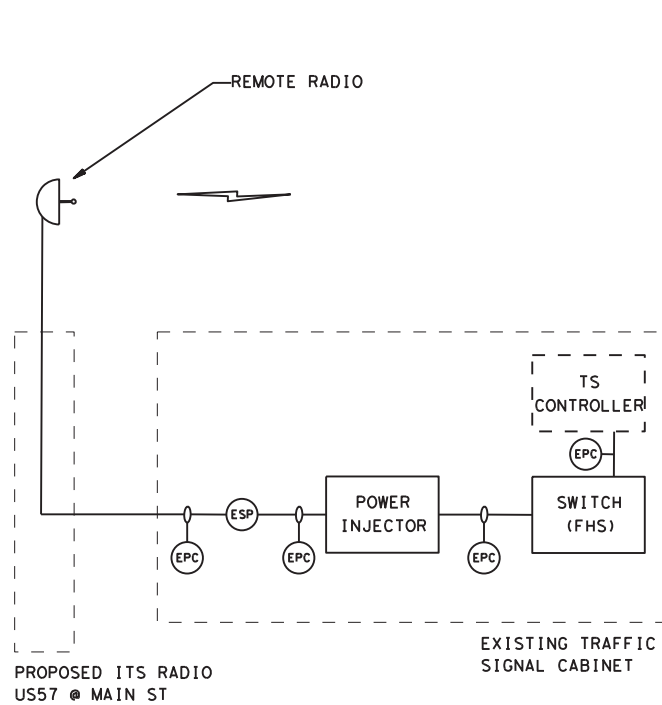


EAGLE PASS OFFICE TOWER INTERCONNECT

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: G. R.	CK:	TEXAS	SHEET 2 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

### LEGEND

- ↻ WIRELESS RADIO ANTENNA
- EPC ETHERNET PATCH CORD
- ESP ETHERNET SURGE PROTECTOR
- FHS FIELD HARDENED SWITCH
- FPC FIBER PATCH CABLE
- ▭ NEW EQUIPMENT
- ▭ EXISTING EQUIPMENT



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### US 57 INTERCONNECT COMMUNICATION LAYOUT

### INTERCONNECT EAGLE PASS OFFICE TOWER

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER		SHEET NO.
CK: G. R.	CK: G. R.	TEXAS	SHEET 1 OF 1		
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB
6	22	VAL VERDE, etc.	0022	010	076
					HIGHWAY NO.
					US90, etc.
					48

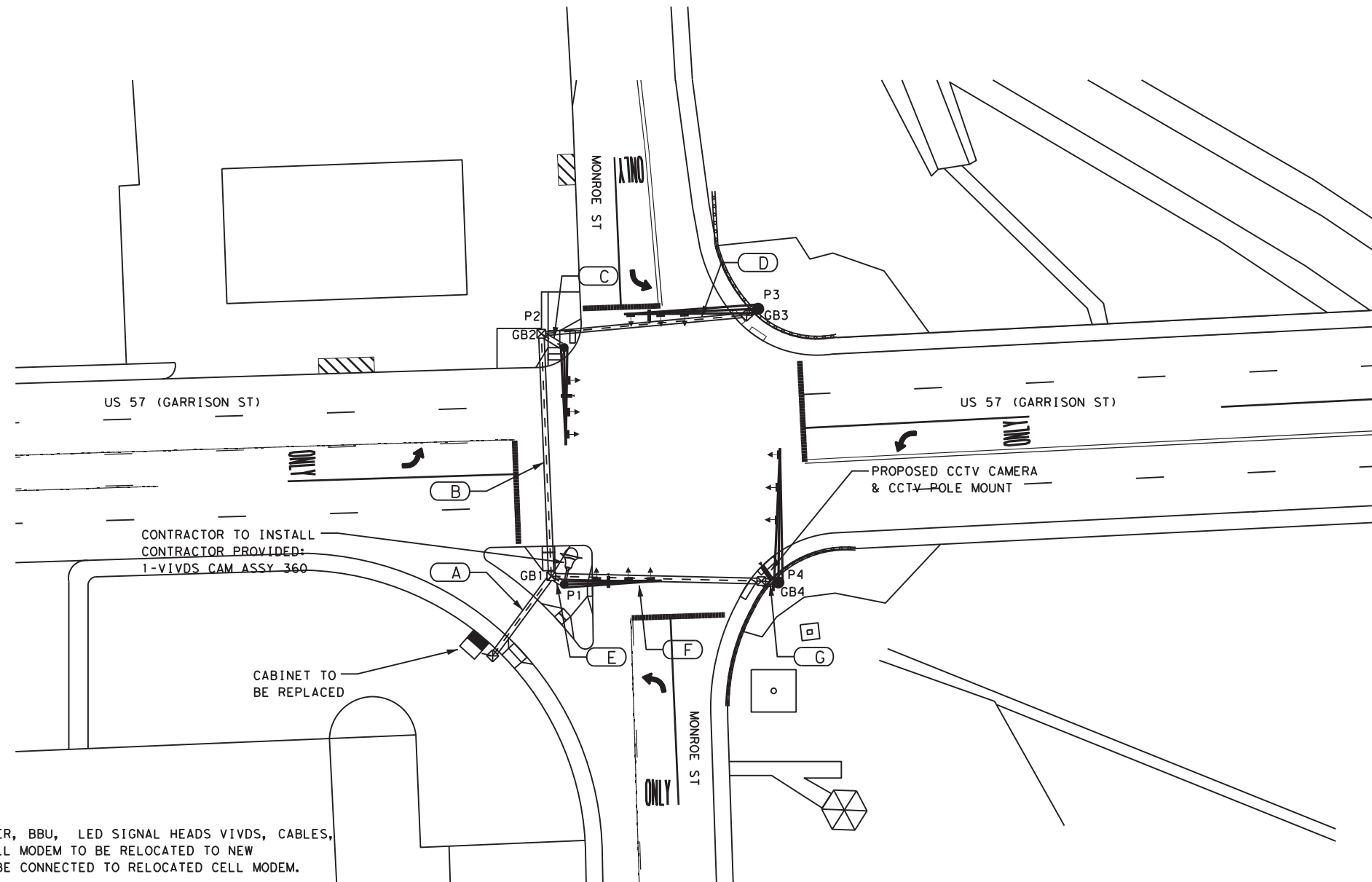
6/24/2022 FRAM052 CSJ#0300-01-108\*US57 at US277 Interconnect.dgn





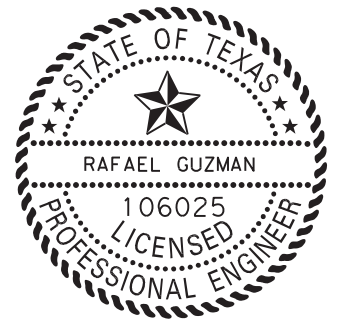
### LEGEND

- EXISTING CONDUIT
- EXISTING MAST ARM POLE
- ⬆ EXISTING TRAFFIC SIGNAL HEAD
- ▣ EXISTING GROUND CABINET
- ▤ EXISTING BORE CONDUIT
- ⊠ EXISTING GROUND BOX
- ⬆ EXISTING VIVDS CAMERA
- ⦿ PROPOSED 360 VIVDS
- ⬆ PROPOSED CCTV CAMERA



1. FURNISH AND INSTALL CABINET, CONTROLLER, BBU, LED SIGNAL HEADS VIVDS, CABLES, AND CCTV FIELD EQUIPMENT. EXISTING CELL MODEM TO BE RELOCATED TO NEW CONTROLLER CABINET. PROPOSED CCTV TO BE CONNECTED TO RELOCATED CELL MODEM.
2. EXISTING VIVDS CAMERAS AND ALL CABLES TO BE REMOVED.
3. ALL SIGNAL HEADS WILL HAVE BACKPLATES WITH 2" YELLOW REFLECTOR TAPE.
4. VIVDS CAM ASSY 360 CAMERA TO BE INSTALLED AS SHOWN IN THE LAYOUT OR AS DIRECTED BY THE ENGINEER. INSTALL COMMUNICATION CABLE FROM PROPOSED CAMERA TO SIGNAL CONTROLLER. CAMERA TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. VERIFY WITH ALL UTILITY COMPANIES THE EXACT LOCATIONS OF EXISTING UNDERGROUND UTILITIES PRIOR TO ANY CONSTRUCTION TO AVOID CONFLICT OR DAMAGE TO THESE UTILITIES.

\*\* LIMITS FOR PAVEMENT MARKINGS IS APPROX. 500' IN EACH DIRECTION FROM THE INTERSECTION



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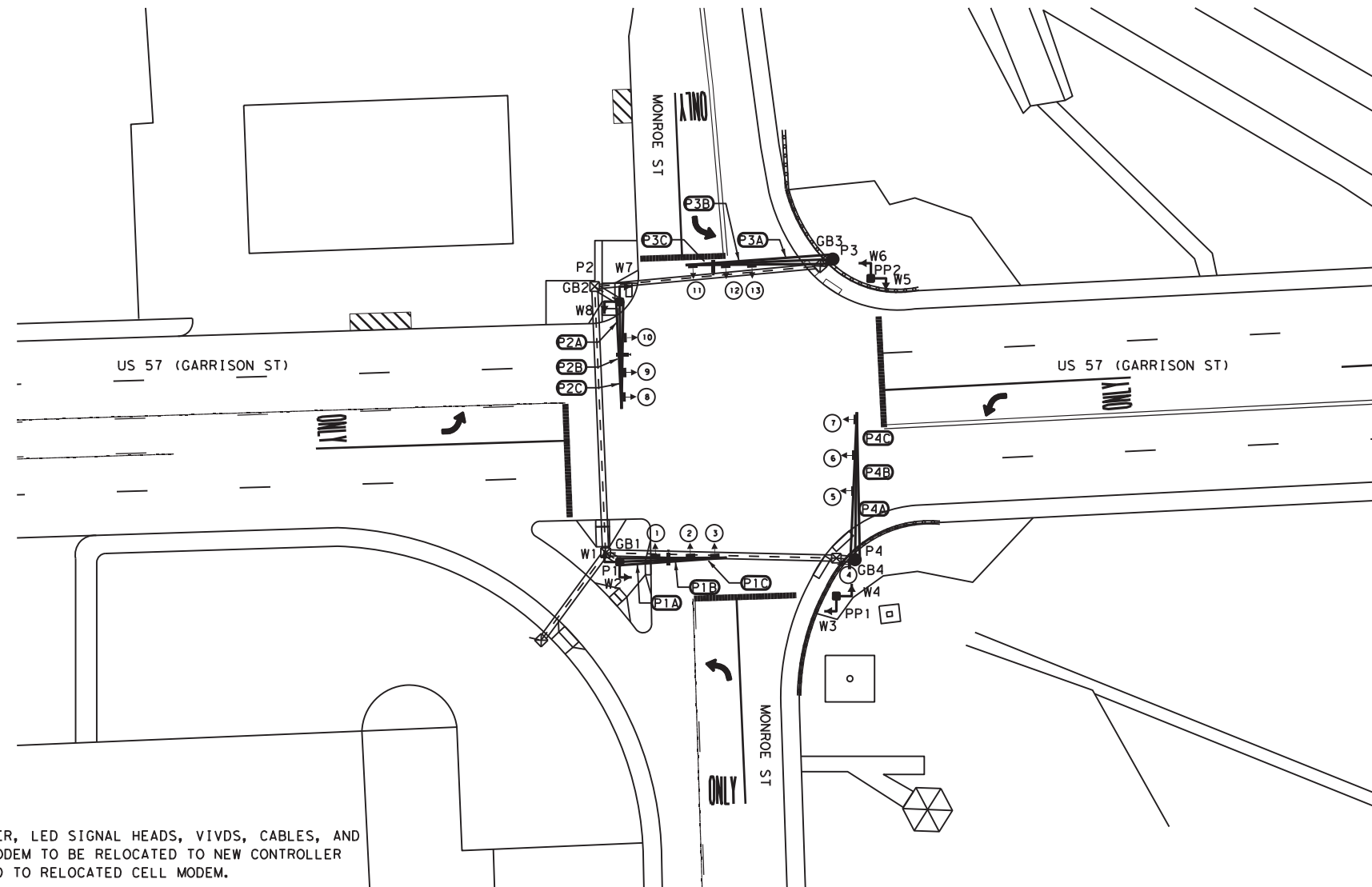
## US 57 AT MONROE ST TRAFFIC SIGNAL IMPROVEMENT

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: G. R.	CK: G. R.	TEXAS	SHEET 1 OF 3			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

6/24/2022 FRAM052 CSJ#0300-01-109\*Monroe at Garrison\*Layout.dgn



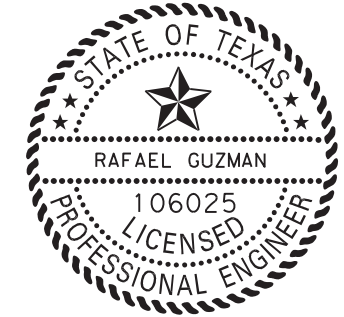
- ### LEGEND
- EXISTING CONDUIT
  - EXISTING MAST ARM POLE
  - ⊕ EXISTING TRAFFIC SIGNAL HEAD
  - ▣ EXISTING GROUND CABINET
  - ≡≡≡ EXISTING BORE CONDUIT
  - ⊠ EXISTING GROUND BOX
  - ⊕ EXISTING VIVDS CAMERA
  - ⊕ PROPOSED 360 VIVDS
  - ⊕ PROPOSED ITS CAMERA



NOTES:

1. FURNISH AND INSTALL CABINET, CONTROLLER, LED SIGNAL HEADS, VIVDS, CABLES, AND CCTV FIELD EQUIPMENT. EXISTING CELL MODEM TO BE RELOCATED TO NEW CONTROLLER CABINET. PROPOSED CCTV TO BE CONNECTED TO RELOCATED CELL MODEM.
2. EXISTING VIVDS CAMERAS AND ALL CABLES TO BE REMOVED.
3. ALL SIGNAL HEADS WILL HAVE BACKPLATES WITH 2" YELLOW REFLECTOR TAPE.
4. VIVDS CAM ASSY 360 CAMERA TO BE INSTALLED AS SHOWN IN THE LAYOUT OR AS DIRECTED BY THE ENGINEER. INSTALL COMMUNICATION CABLE FROM PROPOSED CAMERA TO SIGNAL CONTROLLER. CAMERA TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. VERIFY WITH ALL UTILITY COMPANIES THE EXACT LOCATIONS OF EXISTING UNDERGROUND UTILITIES PRIOR TO ANY CONSTRUCTION TO AVOID CONFLICT OR DAMAGE TO THESE UTILITIES.

\*\* LIMITS FOR PAVEMENT MARKINGS IS APPROX. 500' IN EACH DIRECTION FROM THE INTERSECTION



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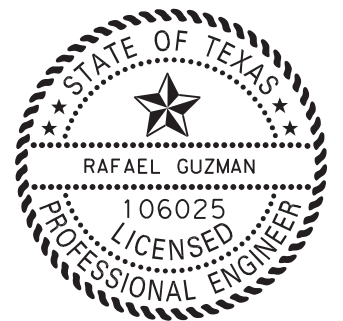
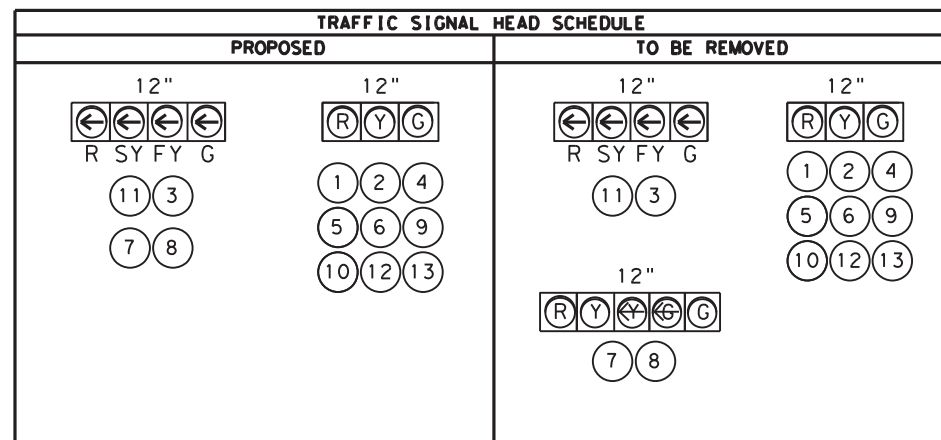
## US 57 AT MONROE ST TRAFFIC SIGNAL IMPROVEMENT

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER		SHEET NO.
CK: G. R.	CK: G. R.	TEXAS	SHEET 2 OF 3		
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB
6	22	VAL VERDE, etc.	0022	010	076
					HIGHWAY NO.
					US90, etc.
					50

6/24/2022 FRAM052 CSJ#0300-01-109\*Monroe at Garrison\*Layout.dgn

ELECTRICAL SCHEDULE TABLE																					
DESCRIPTION	RUN NUMBER	A	B	C	D	E	F	G	P1A	P1B	P1C	P2A	P2B	P2C	P3A	P3B	P3C	P4A	P4B	P4C	TOTAL QTY
	RUN LENGTH (LF)	35	90	7	70	7	75	7	12	12	12	12	12	12	12	12	12	12	12	12	
SIGNAL CABLE	TRF SIG CBL (TY A) (12 AWG) (2 CONDR)	8	4	2	2	2	2	2													* 1002
	TRF SIG CBL (TY A) (12 AWG) (4 CONDR)	5	3	2	2	2	2	2													* 807
	TRF SIG CBL (TY A) (12 AWG) (5 CONDR)								2	1		2	1		2	1		3	1		* 186
	TRF SIG CBL (TY A) (12 AWG) (7 CONDR)								1	1	1	1	1	1	1	1	1	1	1	1	* 174
	TRF SIG CBL (TY A) (12 AWG) (9 CONDR)	4	2	1	1	1	1	1	1												
GROUND CABLE	ELEC CONDR (NO. 6) BARE	2	2	2	2	2	2	2													* 612
VIVDS	VIVDS 360 COMM CABLE	1				1															* 102
CCTV CAMERA	CCTV CAMERA CABLE**	1					1	1													* 177
REMOVE CABLES	REMOVAL OF CABLES																				3290
CONDUIT	CONDUIT (PREPARE)	2	2	2	2	2	2	2													582

\* QUANTITIES INCLUDE CABLE IN CABINET, GROUND BOXES, MAST ARMS, AND POLE HEIGHTS.  
 \*\* FOR CONTRACTORS INFORMATION ONLY.



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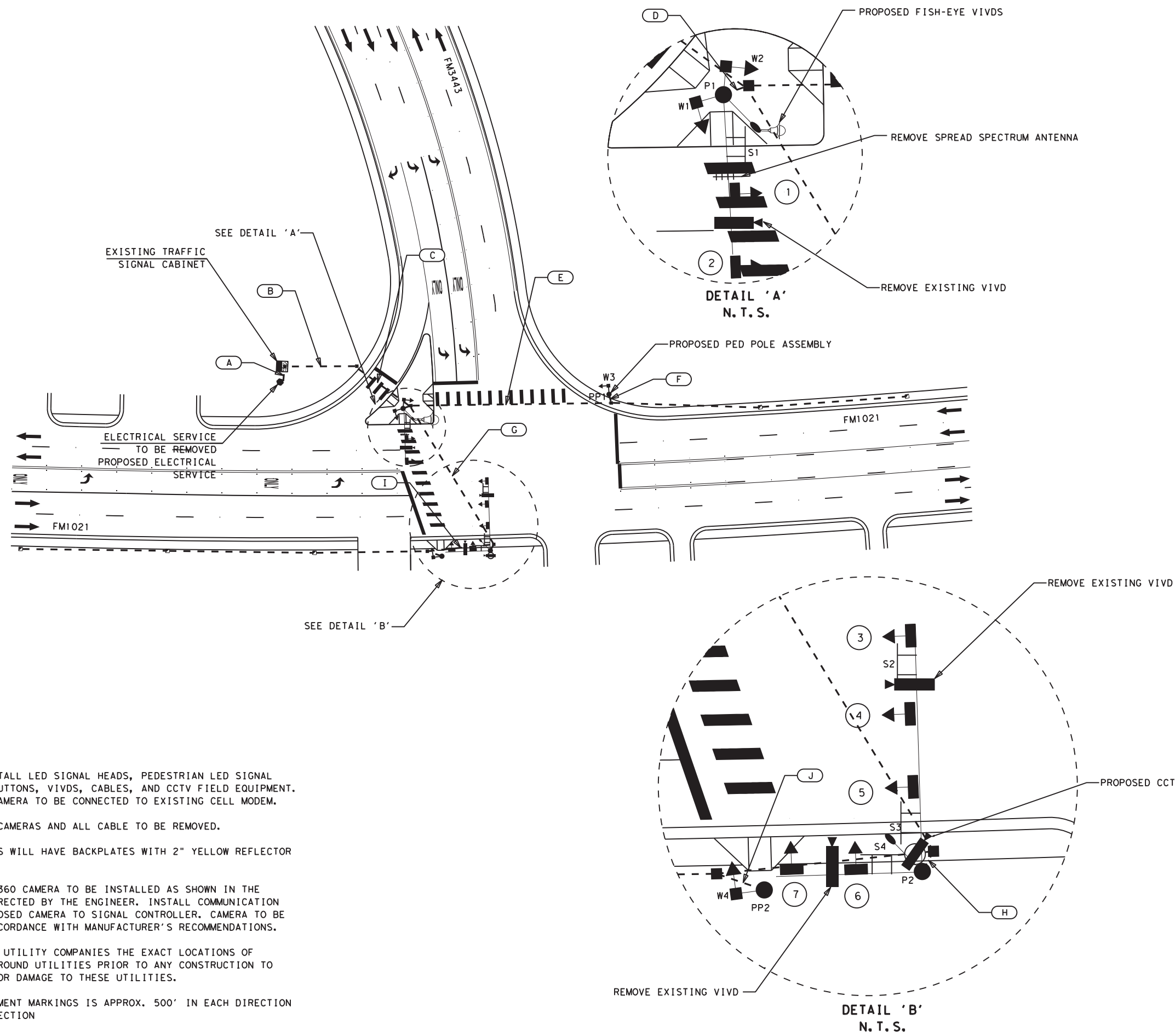
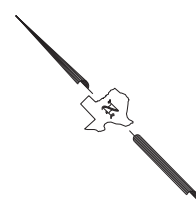
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**US 57 AT MONROE ST TRAFFIC SIGNAL IMPROVEMENT**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER		SHEET NO.		
CK: G. R.	CK: G. R.	TEXAS	SHEET 3 OF 3				
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.	51
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.	

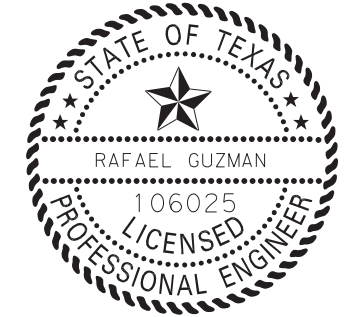


**LEGEND**

	EXISTING GROUND BOX
	PROPOSED TRAFFIC SIGNAL HEAD
	EXISTING ELECTRICAL SERVICE
	PROPOSED ELECTRICAL SERVICE
	EXISTING TRAFFIC SIGNAL POLE
	EXISTING TRAFFIC SIGNAL CABINET
	EXISTING VIVDS
	PROPOSED 360 VIVDS
	PROPOSED CCTV CAMERA
	EXISTING SPREAD SPECTRUM ANTENNA
	EXISTING SIGN
	PROPOSED SIGN
	DIRECTION OF TRAFFIC
	EXISTING TRAFFIC SIGNAL ARM

**NOTES:**

- FURNISH AND INSTALL LED SIGNAL HEADS, PEDESTRIAN LED SIGNAL HEADS AND PUSHBUTTONS, VIVDS, CABLES, AND CCTV FIELD EQUIPMENT. PROPOSED CCTV CAMERA TO BE CONNECTED TO EXISTING CELL MODEM.
  - EXISTING VIVDS CAMERAS AND ALL CABLE TO BE REMOVED.
  - ALL SIGNAL HEADS WILL HAVE BACKPLATES WITH 2" YELLOW REFLECTOR TAPE.
  - VIVDS CAM ASSY 360 CAMERA TO BE INSTALLED AS SHOWN IN THE LAYOUT OR AS DIRECTED BY THE ENGINEER. INSTALL COMMUNICATION CABLE FROM PROPOSED CAMERA TO SIGNAL CONTROLLER. CAMERA TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
  - VERIFY WITH ALL UTILITY COMPANIES THE EXACT LOCATIONS OF EXISTING UNDERGROUND UTILITIES PRIOR TO ANY CONSTRUCTION TO AVOID CONFLICT OR DAMAGE TO THESE UTILITIES.
- \*\* LIMITS FOR PAVEMENT MARKINGS IS APPROX. 500' IN EACH DIRECTION FROM THE INTERSECTION



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**FM 1021 AT FM 3443 TRAFFIC SIGNAL IMPROVEMENT**

DW: F. R.	DW: F. R.	STATE	SHEET NUMBER			SHEET NO.
CK: G. R.	CK: G. R.	TEXAS	SHEET 1 OF 2			
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.

6/24/2022 FRAMOS2 CSJ\*1229-01-076\*FM 1021 at FM 3443\* LAYOUT.dgn

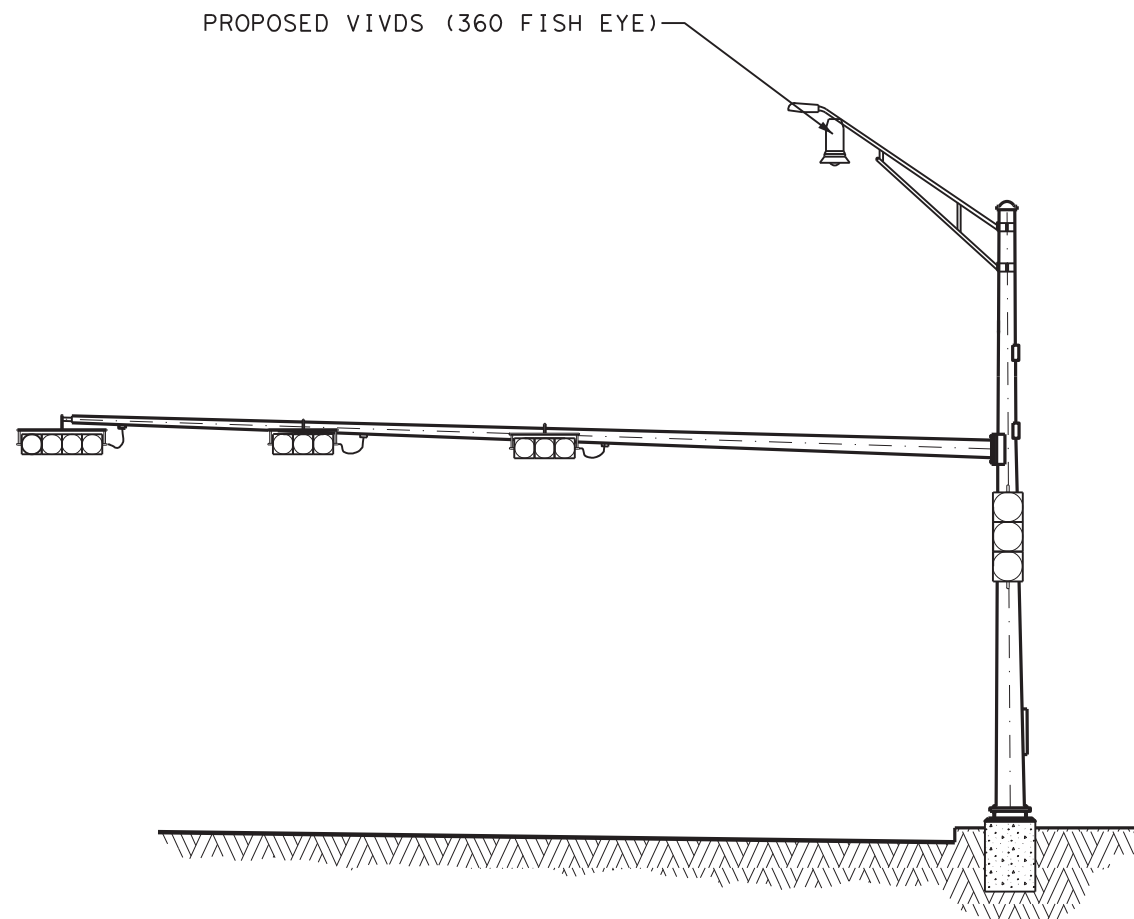
ELECTRICAL SCHEDULE TABLE															
DESCRIPTION	RUN NUMBER	A	B	C	D	E	F	G	H	I	J	P1	P2	TOTAL QTY	
												30	30		
VIVDS CABLE	VIVDS 360 COMM CABLE		1	1	1								1		* 112
ITS CCTV CABLE	CCTV CAMERA CABLE**		1	1				1	1					1	* 202
ILLUMINATION	TRAY CABLE (3 CONDR) (12 AWG)	1	1	1	1			1	1				1	1	* 245
POWER	ELEC CONDR (NO. 6) INSULATED	2													* 16
	ELEC CONDR (NO. 6) BARE	1	2	2	2	2	1	2	2	1	1				* 637
SIGNAL CABLE	TRF SIG CBL (TY A) (12 AWG) (2 CONDR)		4	4	4	1	1	1		1	1				* 582
	TRF SIG CBL (TY A) (12 AWG) (4 CONDR)		4	4	4	1	1	1		1	1				* 582
	TRF SIG CBL (TY A) (12 AWG) (5 CONDR)												2	4	* 180
	TRF SIG CBL (TY A) (12 AWG) (7 CONDR)													1	* 30
	TRF SIG CBL (TY A) (12 AWG) (9 CONDR)		3	3	1			2	2						* 426
REMOVE CABLES	REMOVAL OF CABLES														3730
CONDUIT	CONDUIT (PREPARE)	1	2	2	2	2	1	2	2	1	1				637

\* QUANTITIES INCLUDE CABLE IN CABINET, GROUND BOXES, MAST ARMS, AND POLE HEIGHTS.  
 \*\* FOR CONTRACTORS INFORMATION ONLY.

SIGN SCHEDULE	
TO BE REMOVED	PROPOSED
<p>VETERANS BLVD [S1][S3]</p> <p>EL INDIO HWY [S4]</p>	<p>Veterans Hwy [S1][S3] D3-1 18"X84"</p> <p>El Indio Blvd [S4] D3-1 18"X78"</p>
<p>PUSH BUTTON FOR [W1-W4]</p>	<p>LEFT TURN YIELD ON FLASHING YELLOW ARROW R10-17T 30"X30" [S2]</p>
	<p>START CROSSING WATCH FOR VEHICLES DON'T START Flash Crossing 1.5 S TIME REMAINING DON'T CROSS PUSH BUTTON TO CROSS [W1-W4]</p>

PROPOSED VIVDS (360 FISH EYE)

TRAFFIC SIGNAL HEAD SCHEDULE			
PROPOSED		TO BE REMOVED	
12" SY FY [4]	12" R Y G [1][2][3] [5][6][7]	12" R Y G [4]	12" R Y G [1][2][3] [5][6][7]
PEDESTRIAN SIGNALS W1 THRU W4 [4]		18"X16" PEDESTRIAN SIGNALS W1 THRU W4 [W1-W4]	



TYPICAL VIVDS INSTALLATION



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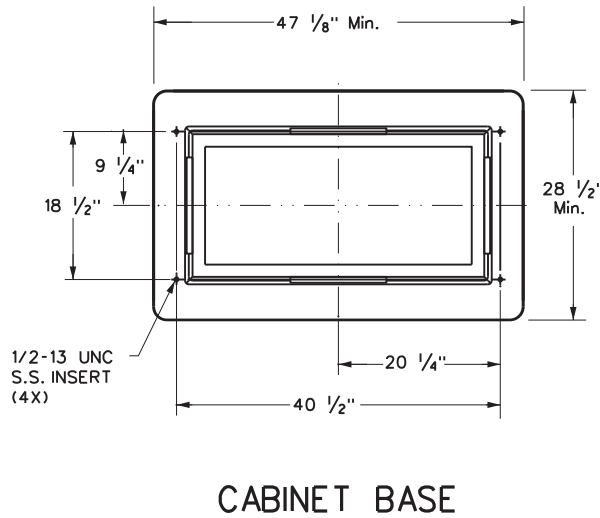
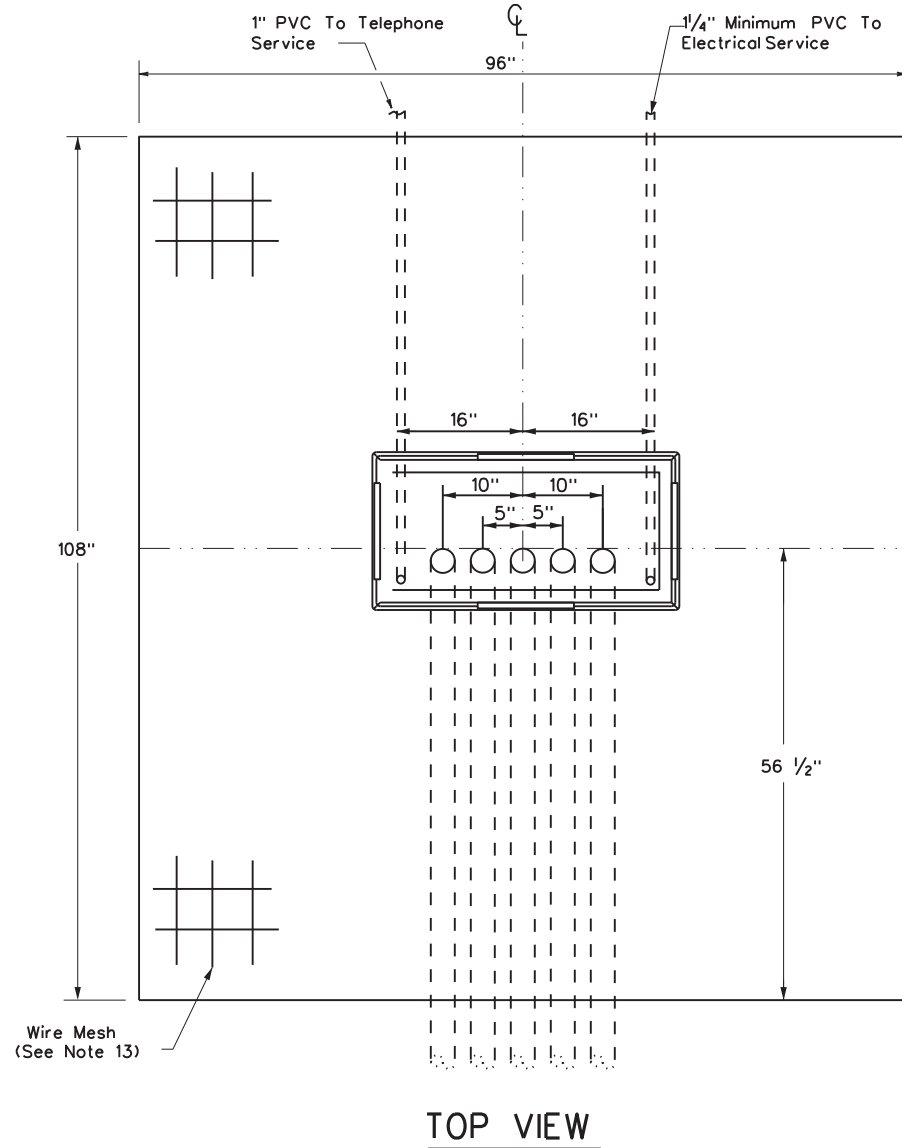


**FM 1021 AT FM 3443  
TRAFFIC SIGNAL  
IMPROVEMENT**

DN: F. R.	DW: F. R.	STATE	SHEET NUMBER		SHEET NO.		
CK: G. R.	CK: G. R.	TEXAS	SHEET 2 OF 2				
FED. RD. DIV. NO.	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.	53
6	22	VAL VERDE, etc.	0022	010	076	US90, etc.	

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**CABINET BASE**

**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 pullout 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.

**CONDUITS:**

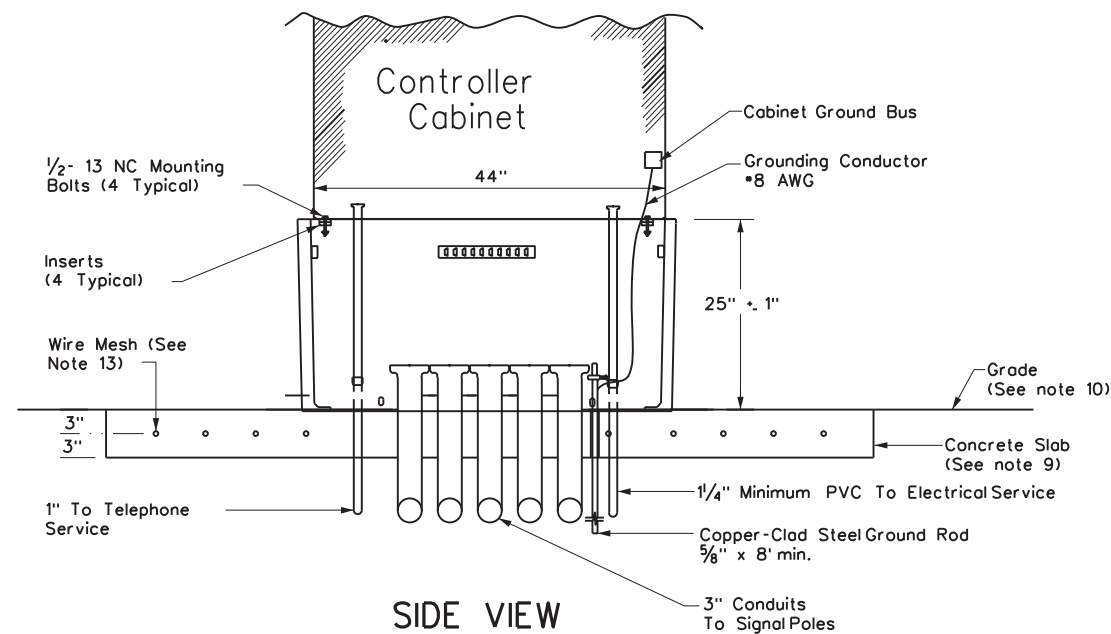
15. Stub up and run 3-inch conduits through the slab to the various traffic signal poles and ground boxes as shown on the layouts. Install the number of conduits as shown on layouts plus two additional 3 inch conduits for future use. Terminate the conduits with a bushing between 2 and 4-inches above 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.



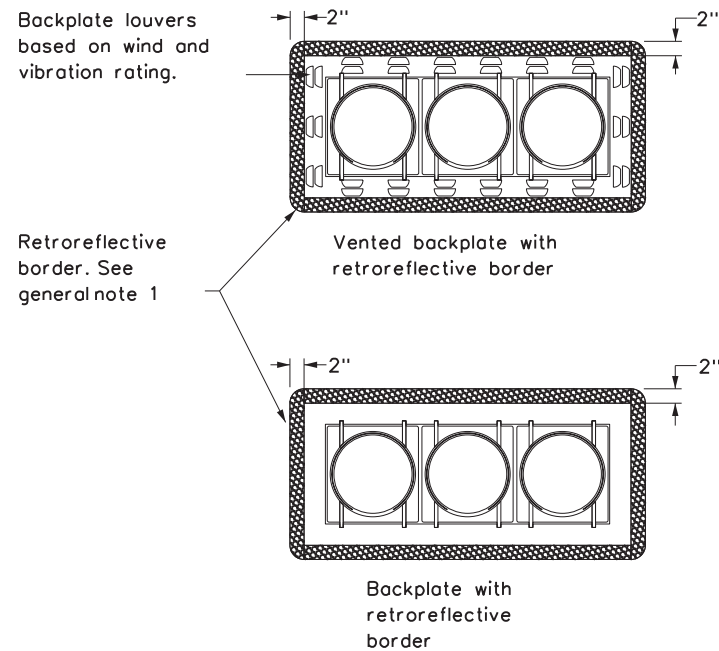
**SIDE VIEW**

<p><b>TRAFFIC SIGNAL CONTROLLER CABINET BASE AND PAD</b></p> <p><b>TS-CF-21</b></p>			
FILE: ts-cf-21.dgn	DN:	CK:	DW:
© TxDOT October 2000	CONT	SECT	JOB
REVISIONS	0022	010	076
12-04	DIST	COUNTY	SHEET NO.
2-21	22	VAL VERDE, etc.	54

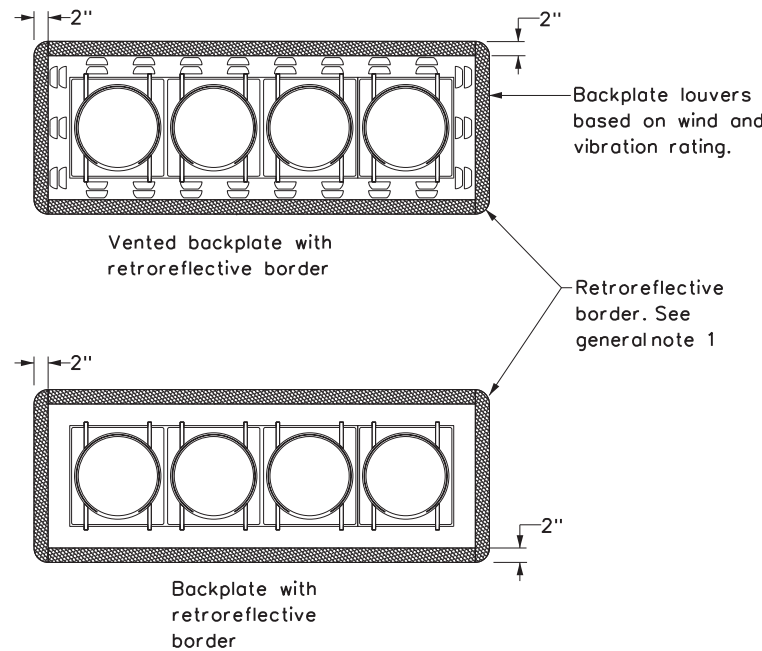
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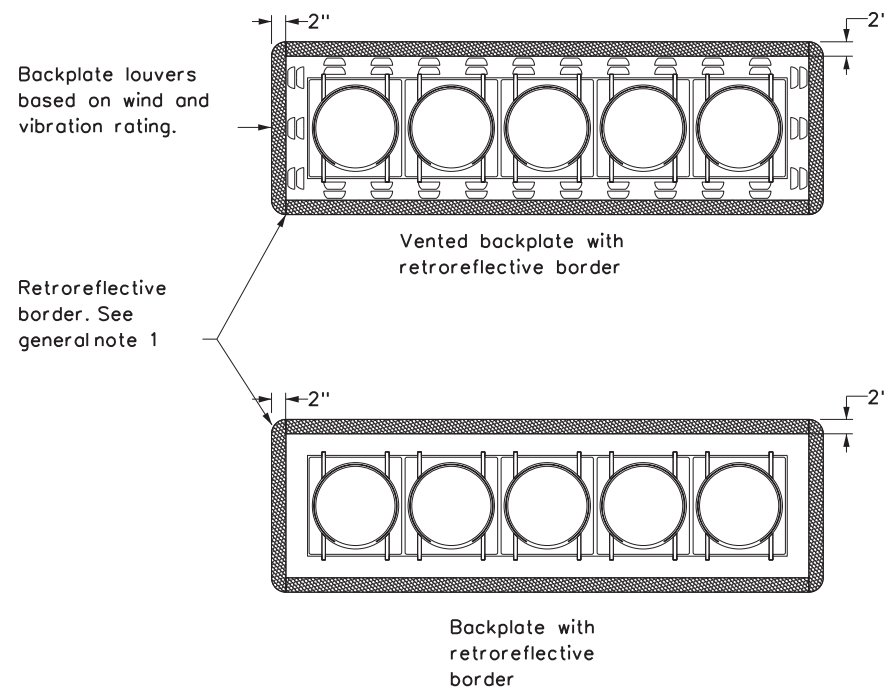
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FILE: ts-bp-20.dgn



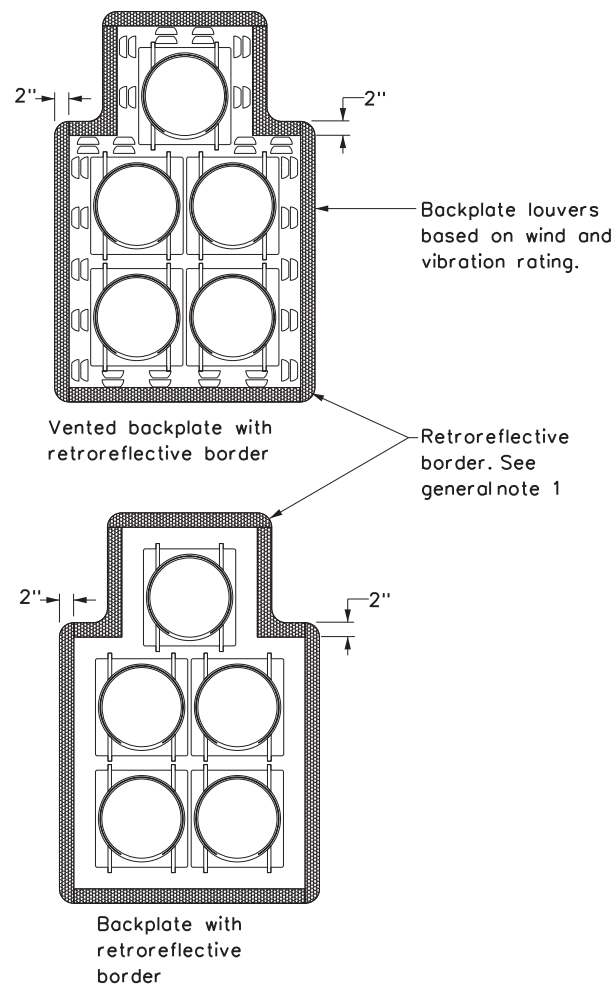
**THREE-SECTION HEAD**  
HORIZONTAL OR VERTICAL



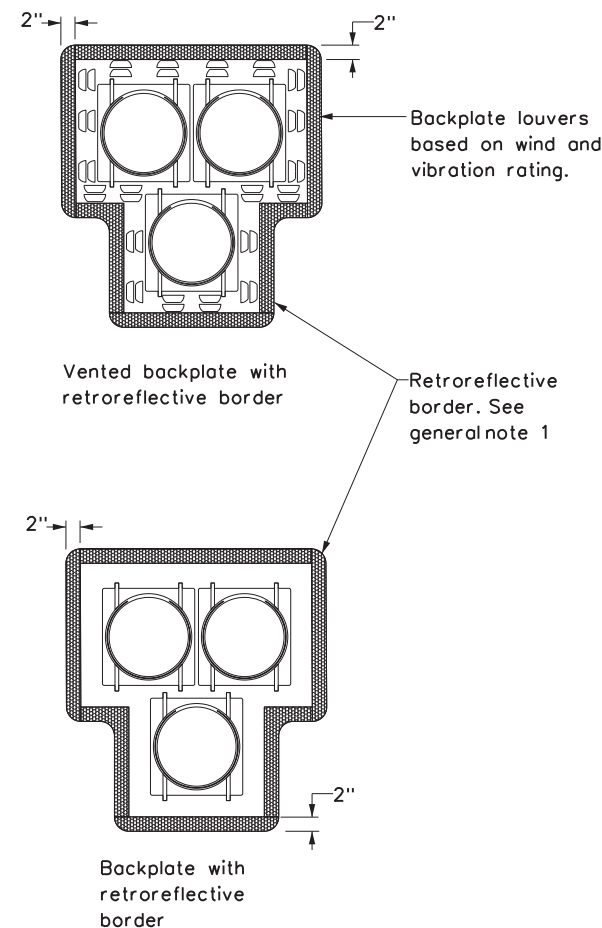
**FOUR-SECTION HEAD**  
HORIZONTAL OR VERTICAL



**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 or  $\bar{A}$  retroreflective border conforming to TxDOT DMS-8300 is required. Place on all approaches when used.
2. Signalhead and backplate compatibility must be verified by the contractor prior to installation.
3. When using backplates on signalheads, 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 signalheads 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

		<b>Traffic Safety Division Standard</b>	
<b>TRAFFIC SIGNAL HEAD WITH BACKPLATE</b> <b>TS-BP-20</b>			
FILE: ts-bp-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT June 2020	CONT: 0022	SECT: 010	JOB: 076
REVISIONS	DIST: 22		COUNTY: VAL VERDE, etc.
			SHEET NO.: 55

### SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

SM RD SGN ASSM TY XXXXX(X)XX(X-XXXX)

**Post Type**

- FRP - Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
- TWT - Thin-Walled Tubing (see SMD(TWT))
- 10BWG - 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
- S80 - Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

**Number of Posts (1 or 2)**

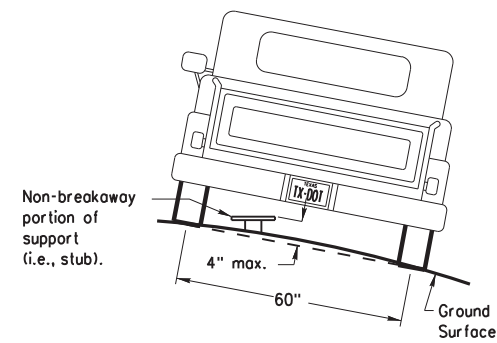
**Anchor Type**

- UA - Universal Anchor - Concreted (see SMD(FRP) and (TWT))
- UB - Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
- WS - Wedge Anchor Steel - (see SMD(TWT))
- WP - Wedge Anchor Plastic (see SMD(TWT))
- SA - Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
- SB - Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

**Sign Mounting Designation**

- P - Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
- T - Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
- U - Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
- IF REQUIRED
- TEXT or 2EXT - Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
- BM - Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
- WC - 1.12 "/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
- EXAL - Extruded Aluminum Sign Panels (see SMD(SLIP-3))

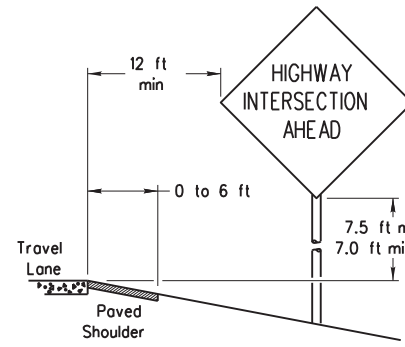
### REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheelpaths).

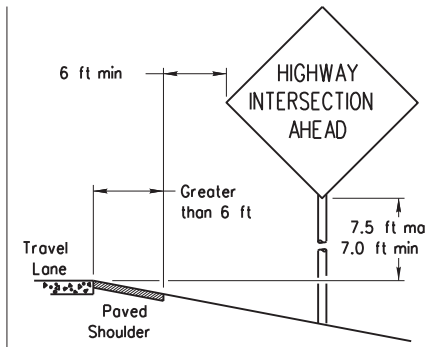
### SIGN LOCATION

**PAVED SHOULDERS**



**LESS THAN 6 FT. WIDE**

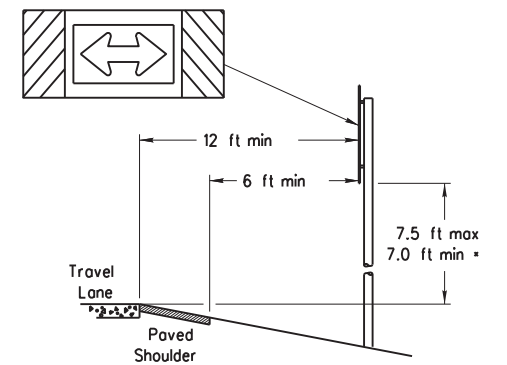
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



**GREATER THAN 6 FT. WIDE**

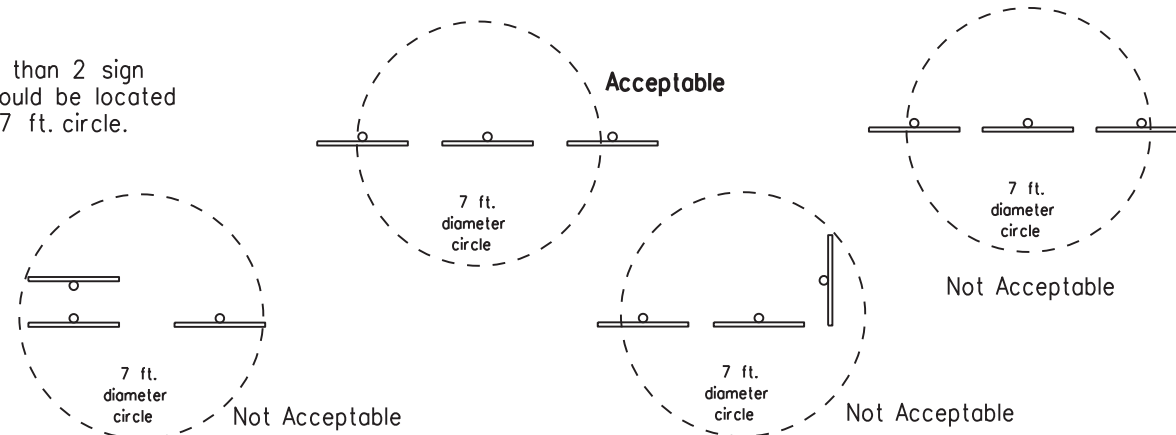
When the shoulder is greater than 6 ft. in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

**T-INTERSECTION**

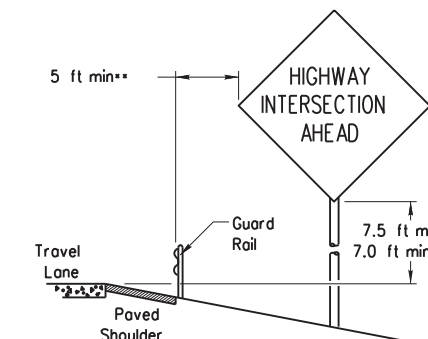


When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.

No more than 2 sign posts should be located within a 7 ft. circle.

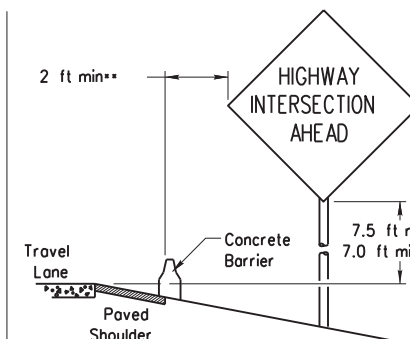


**BEHIND BARRIER**



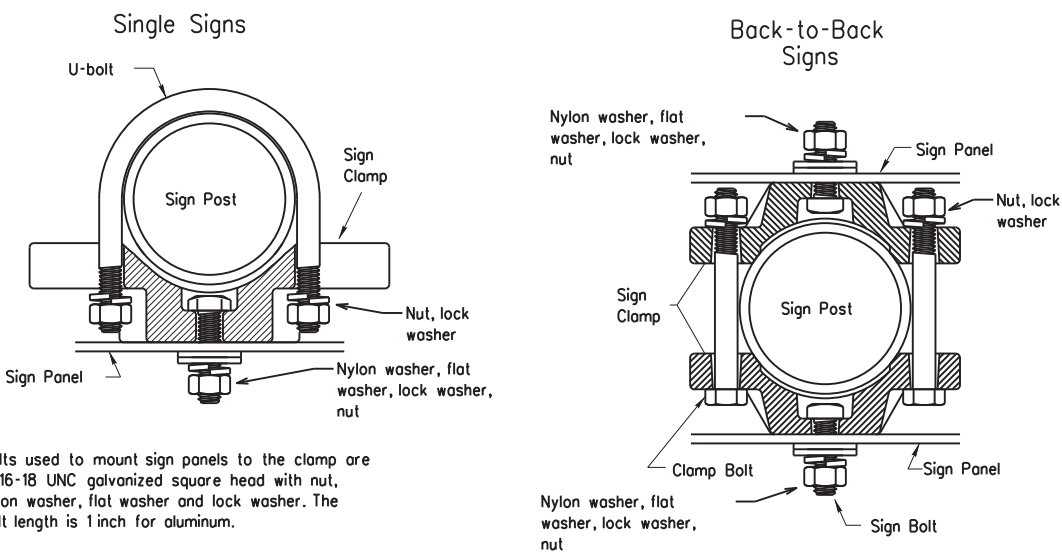
**BEHIND GUARDRAIL**

\*\*Sign clearance based on distance required for proper guard rail or concrete barrier performance.



**BEHIND CONCRETE BARRIER**

### TYPICAL SIGN ATTACHMENT DETAIL



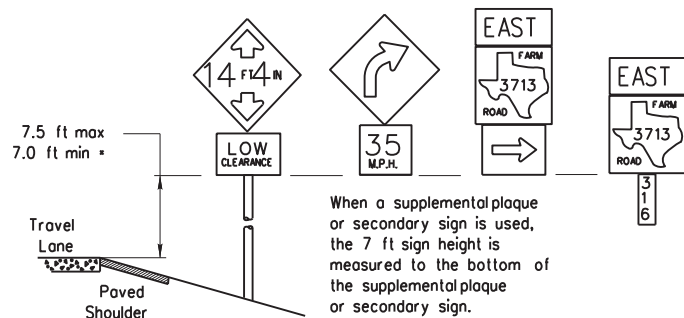
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

Sign clamps may be either the specific size clamp or the universal clamp.

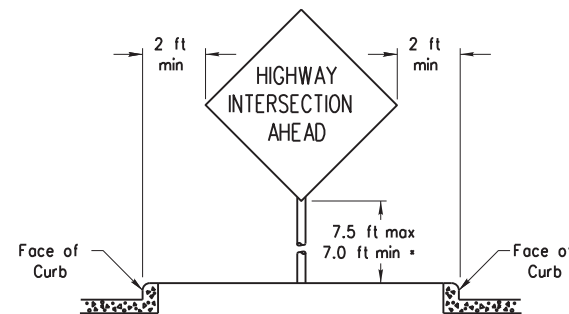
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

### SIGNS WITH PLAQUES

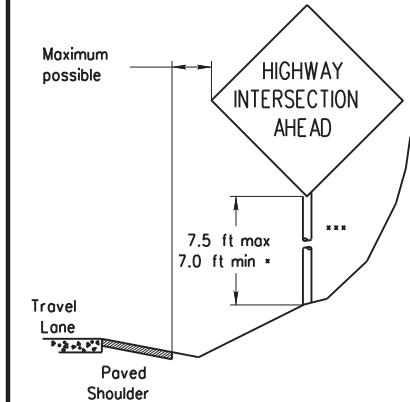


When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

### CURB & GUTTER OR RAISED ISLAND



### RESTRICTED RIGHT-OF-WAY (When 6 ft min. is not possible.)



Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

\*\*\* Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

- \* Signs shall be mounted using the following condition that results in the greatest sign elevation:
  - (1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or
  - (2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.
- The maximum values may be increased when directed by the Engineer.
- See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.
- The website address is: <http://www.txdot.gov/publications/traffic.htm>



## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

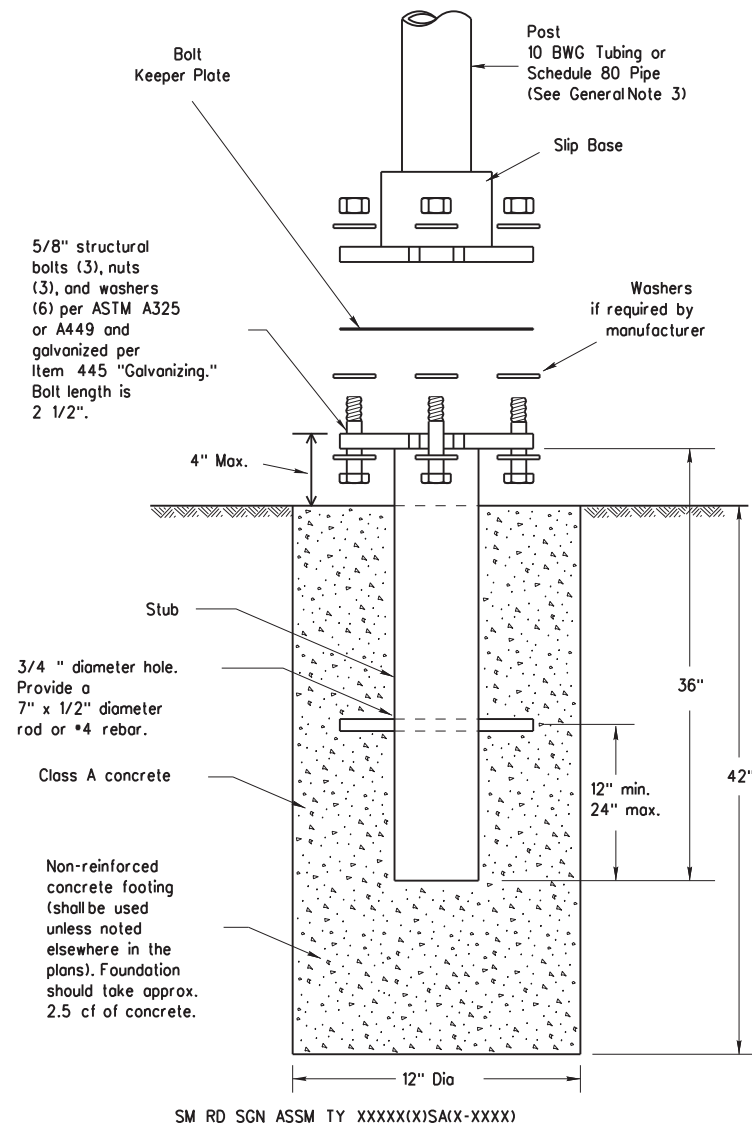
**SMD(GEN)-08**

© TxDOT July 2002	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	REVISIONS	CONTRACT NO. 0022010	SECTION 076	JOB NO. US90, etc.
		DIST. 22	COUNTY VAL VERDE, etc.	SHEET NO. 56

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# TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



5/8" structural bolts (3), nuts (3), and washers (6) per ASTM A325 or A449 and galvanized per Item 445 "Galvanizing." Bolt length is 2 1/2".

3/4" diameter hole. Provide a 7" x 1/2" diameter rod or #4 rebar.

Class A concrete

Non-reinforced concrete footing (shall be used unless noted elsewhere in the plans). Foundation should take approx. 2.5 cf of concrete.

SM RD SGN ASSM TY XXXXX(X)SA(X-XXXX)

## NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. [http://www.txdot.gov/business/producer\\_list.htm](http://www.txdot.gov/business/producer_list.htm) The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

## GENERAL NOTES:

- Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
- Material used as post with this system shall conform to the following specifications:
  - 10 BWG Tubing (2.875" outside diameter)
    - 0.134" nominal wall thickness
    - Seamless or electric-resistance welded steel tubing or pipe
    - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
    - Other steels may be used if they meet the following:
      - 55,000 PSI minimum yield strength
      - 70,000 PSI minimum tensile strength
      - 20% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
    - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
    - Galvanization per ASTM A123 or ASTM A653 G210. For pre-coated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
  - Schedule 80 Pipe (2.875" outside diameter)
    - 0.276" nominal wall thickness
    - Steel tubing per ASTM A500 Gr C
    - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
      - 46,000 PSI minimum yield strength
      - 62,000 PSI minimum tensile strength
      - 21% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
    - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
    - Galvanization per ASTM A123
- See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: <http://www.txdot.gov/publications/traffic.htm>
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

## ASSEMBLY PROCEDURE

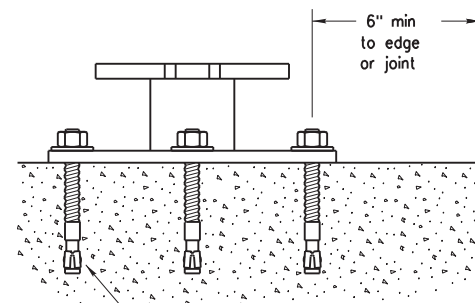
### Foundation

- Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
- The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
- Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
- Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
- The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

### Support

- Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
- Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

## CONCRETE ANCHOR




5/8" diameter Concrete Anchor - 8 places (embed a minimum of 5 1/2" and torque to min. of 50 ft-lbs). Anchor may be expansion or adhesive type.

SM RD SGN ASSM TY XXXXX(X)SB(X-XXXX)

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxyes and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

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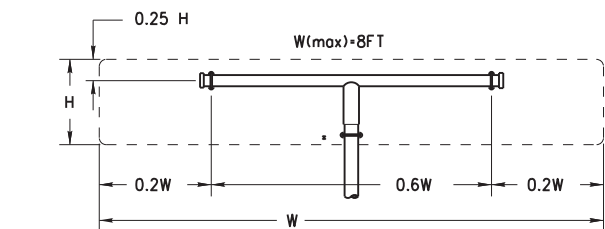
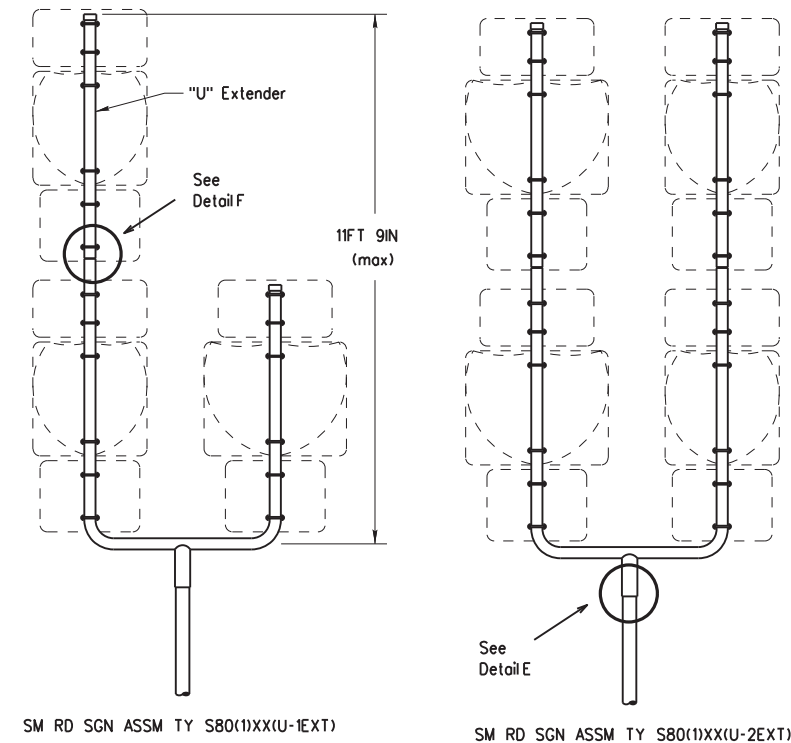
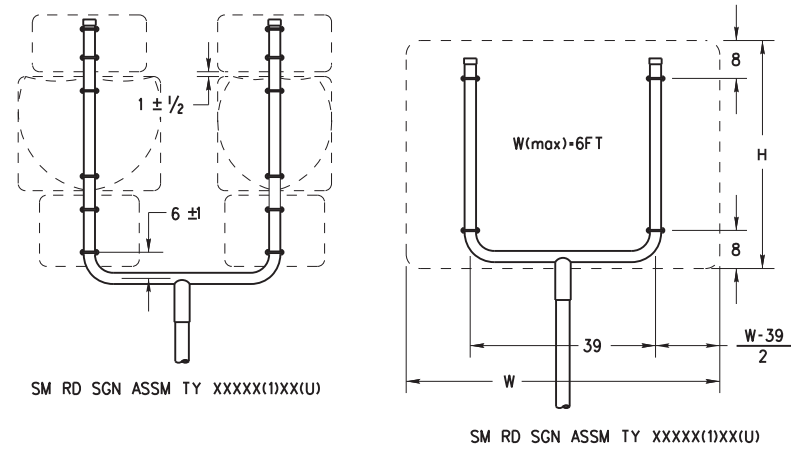
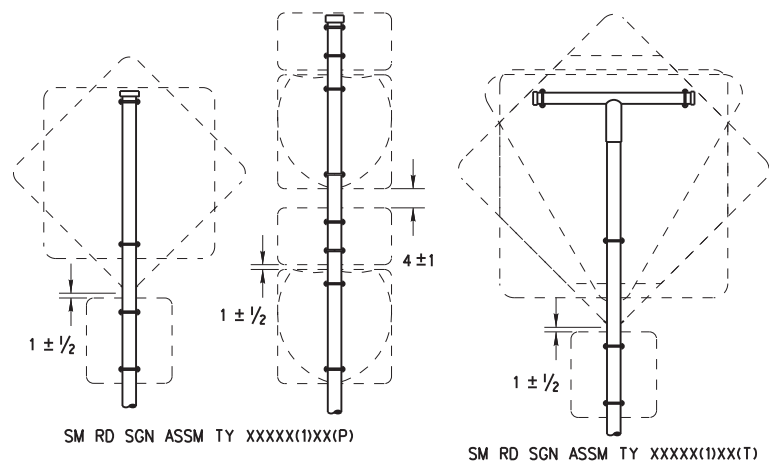
**Texas Department of Transportation**  
Traffic Operations Division

**SIGN MOUNTING DETAILS**  
**SMALL ROADSIDE SIGNS**  
**TRIANGULAR SLIPBASE SYSTEM**

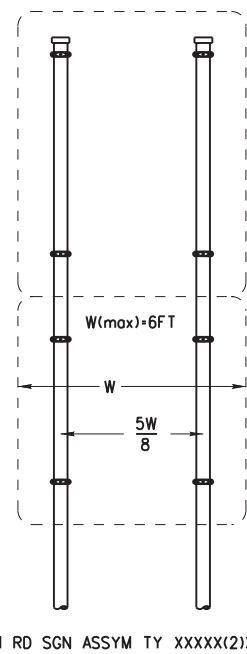
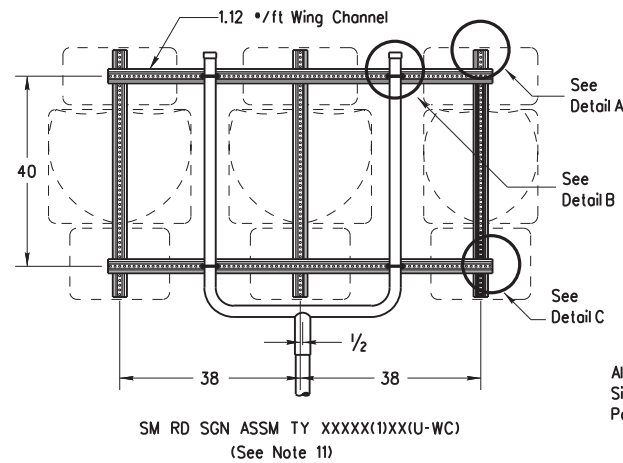
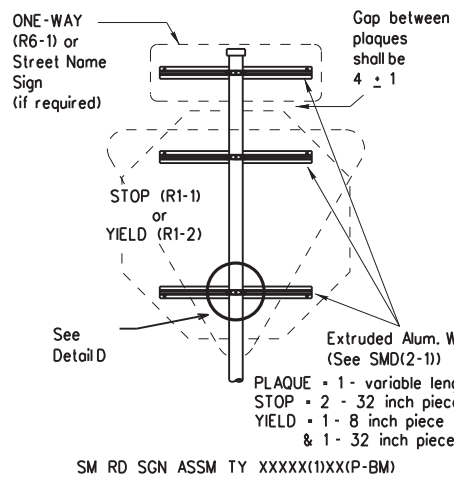
**SMD(SLIP-1)-08**

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9-08	REVISIONS		CONT	SECT	JOB
			0022	010	076
			DIST	COUNTY	SHEET NO.
		22	VAL VERDE, etc.	57	

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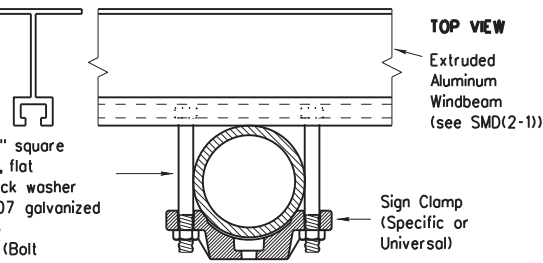


All dimensions are in english unless detailed otherwise.

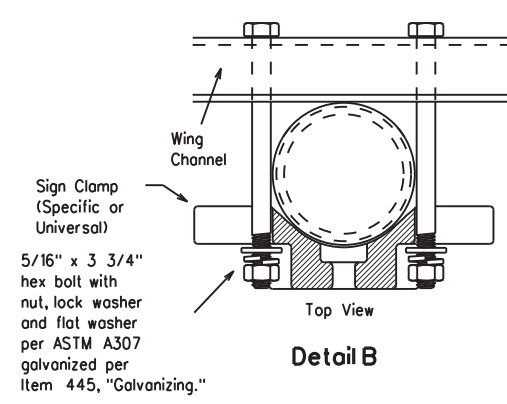
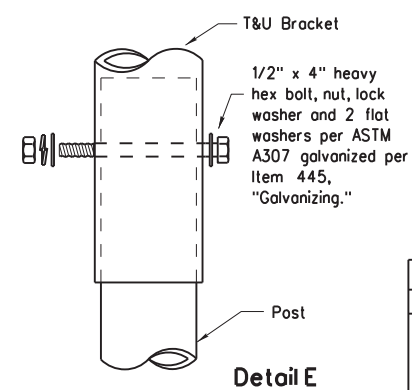
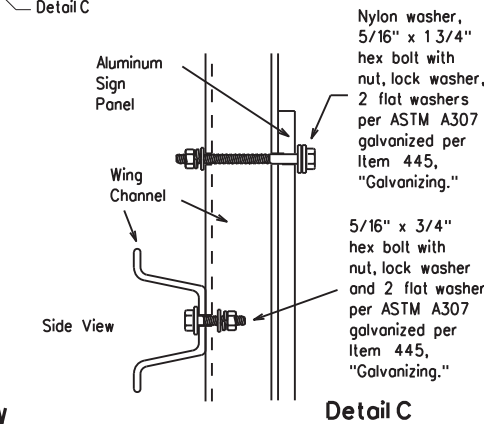
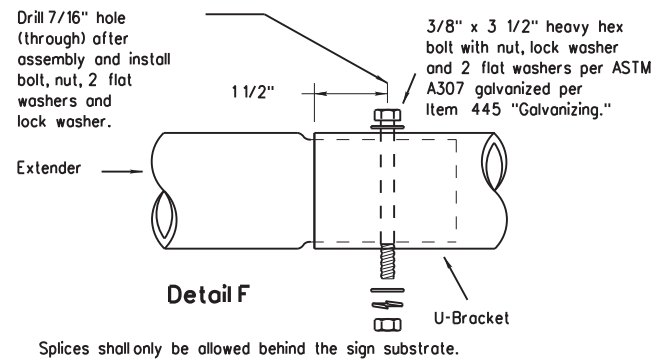
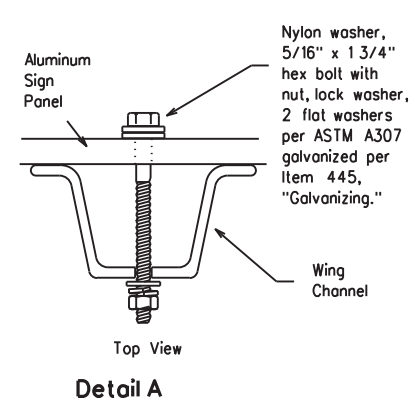
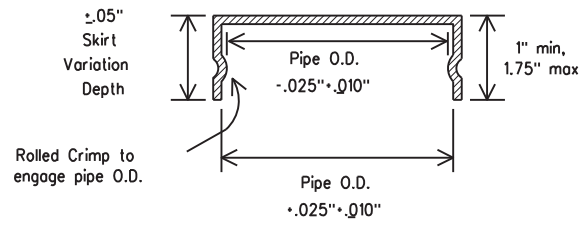


**SIDE VIEW**

3/8" x 3 1/2" square head bolt, nut, flat washer and lock washer per ASTM A307 galvanized per Item 445 "Galvanizing." (Bolt length may vary depending on sign clamp type and pipe diameter.)



**FRICTION CAP DETAIL**



**GENERAL NOTES:**

- | SIGN SUPPORT | OF POSTS | MAX. SIGN AREA |
|--------------|----------|----------------|
| 10 BWG       | 1        | 16 SF          |
| 10 BWG       | 2        | 32 SF          |
| Sch 80       | 1        | 32 SF          |
| Sch 80       | 2        | 64 SF          |
- The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
- Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
- For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
- When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
- Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
- Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
- Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
- Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
- Post open ends shall be fitted with Friction Caps.
- Sign blanks shall be the sizes and shapes shown on the plans.

REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
Warning	48x60-inch signs	TY S80(1)XX(T)
	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

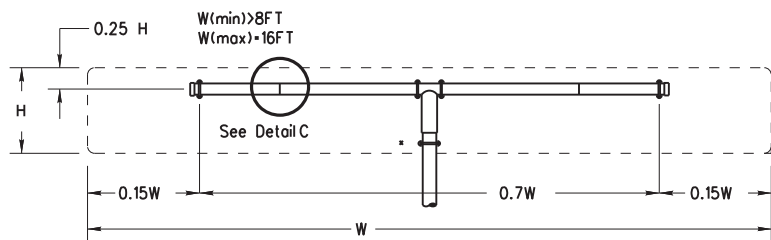


**SIGN MOUNTING DETAILS  
SMALL ROADSIDE SIGNS  
TRIANGULAR SLIPBASE SYSTEM  
SMD(SLIP-2)-08**

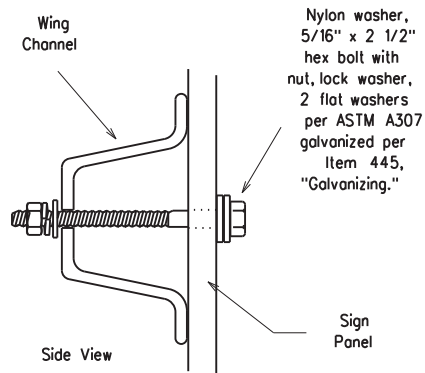
Friction caps may be manufactured from hot rolled or cold rolled steelsheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes. The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture. Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

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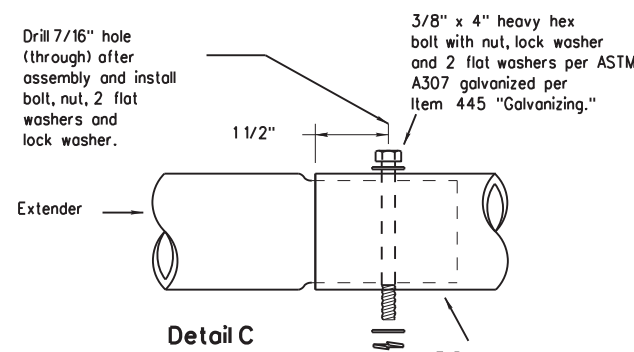
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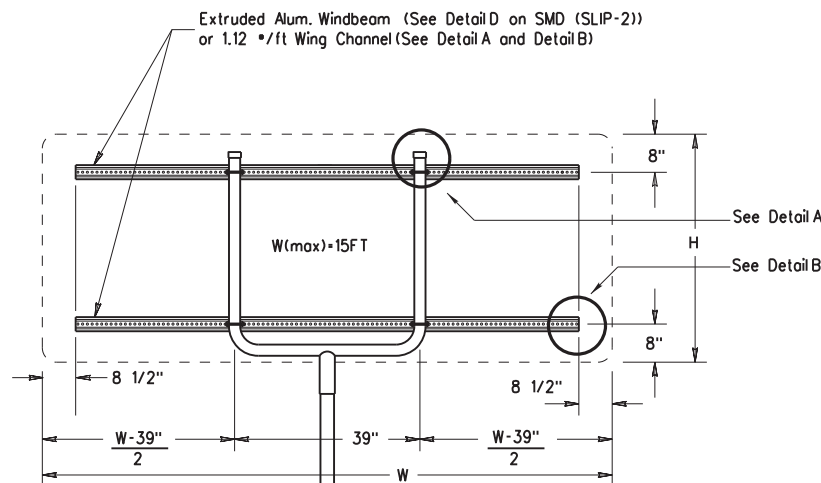
SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)  
(\* - See Note 12)



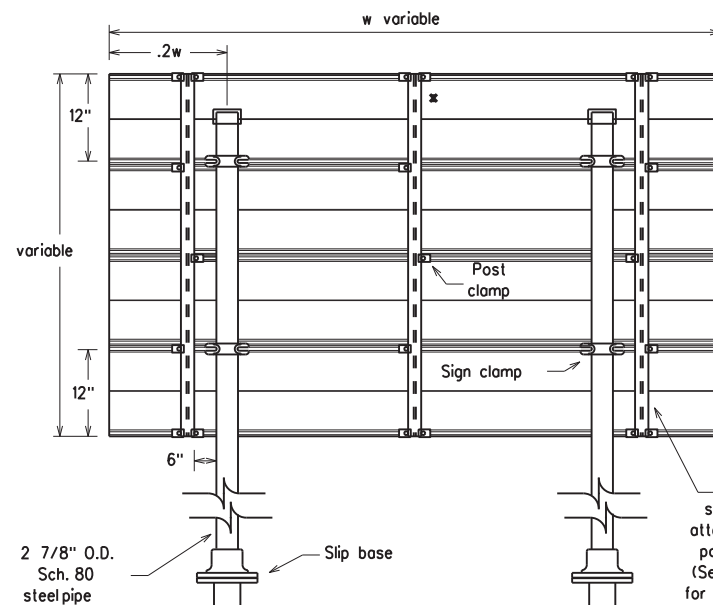
Detail B



Splices shall only be allowed behind the sign substrate.



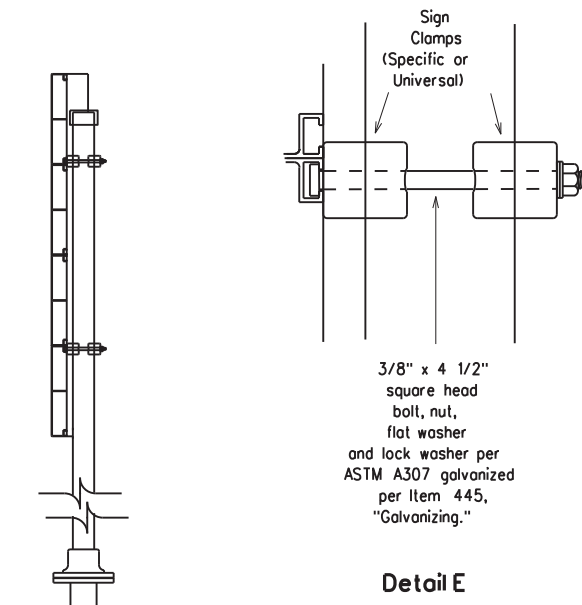
SM RD SGN ASSM TY XXXXX(1)XX(U-XX)



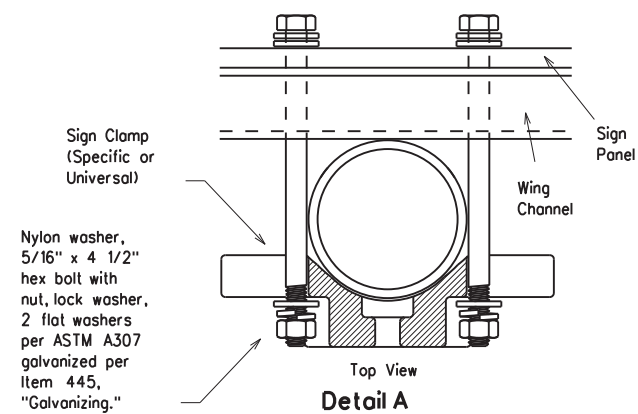
Typical Sign Mount

SM RD SGN ASSM TY S80(2)XX(P-EXAL)

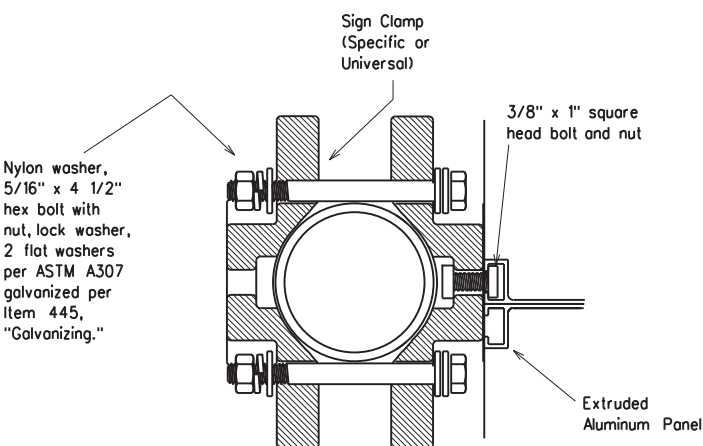
\* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.



Detail E

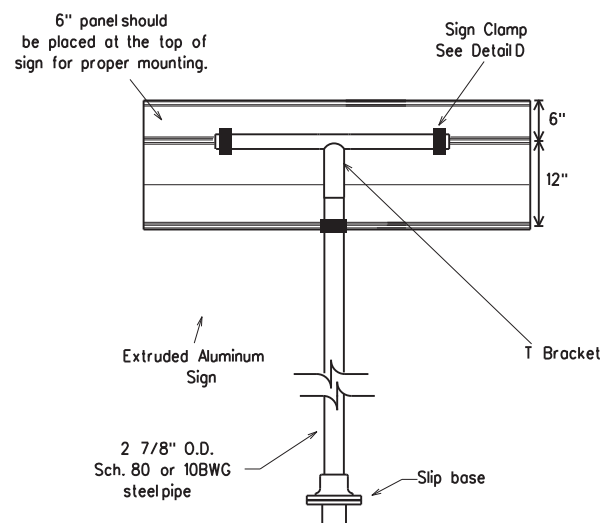


Detail A

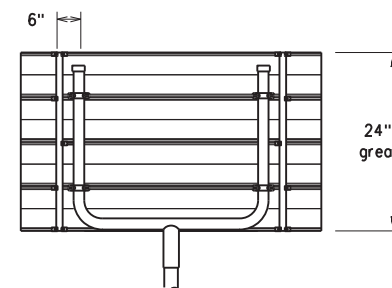


Detail D

EXTRUDED ALUMINUM SIGN WITH T BRACKET



Extruded Aluminum Sign With T Bracket



Use Extruded Alum. Windbeam as stiffeners See SMD (2-1) for additional details  
See Detail E for clamp installation

GENERAL NOTES:

- | SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|--------------|------------|----------------|
| 10 BWG       | 1          | 16 SF          |
| 10 BWG       | 2          | 32 SF          |
| Sch 80       | 1          | 32 SF          |
| Sch 80       | 2          | 64 SF          |
- The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
  - Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
  - Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
  - Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
  - For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
  - When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
  - Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
  - Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
  - Sign blanks shall be the sizes and shapes shown on the plans.
  - Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
  - Post open ends shall be fitted with Friction Caps.

REQUIRED SUPPORT		
SIGN DESCRIPTION	SUPPORT	
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
Warning	48x60-inch signs	TY S80(1)XX(T)
	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)	

Texas Department of Transportation  
Traffic Operations Division

SIGN MOUNTING DETAILS  
SMALL ROADSIDE SIGNS  
TRIANGULAR SLIPBASE SYSTEM  
SMD(SLIP-3)-08

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9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		0022	010	076	US90, etc.
		DIST	COUNTY		SHEET NO.
		22	VAL VERDE, etc.		59

**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 polyvinylchloride (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.

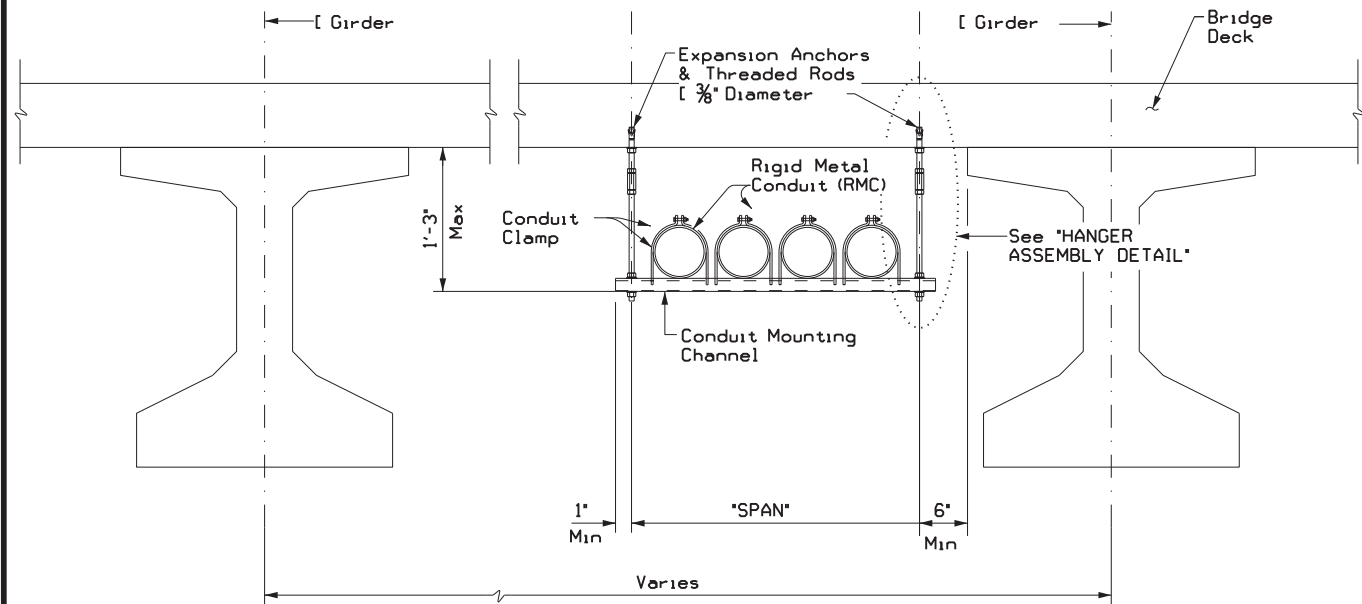
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<h2>ED(1)-14</h2>					
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© TxDOT	October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS		0022	010	076	US90, etc.
		DIST	COUNTY		SHEET NO.
		22	VAL VERDE, etc.		60

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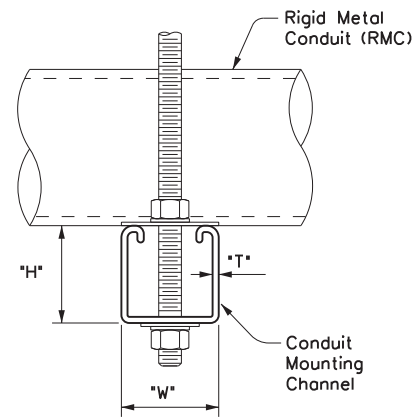
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CONDUIT HANGING DETAIL

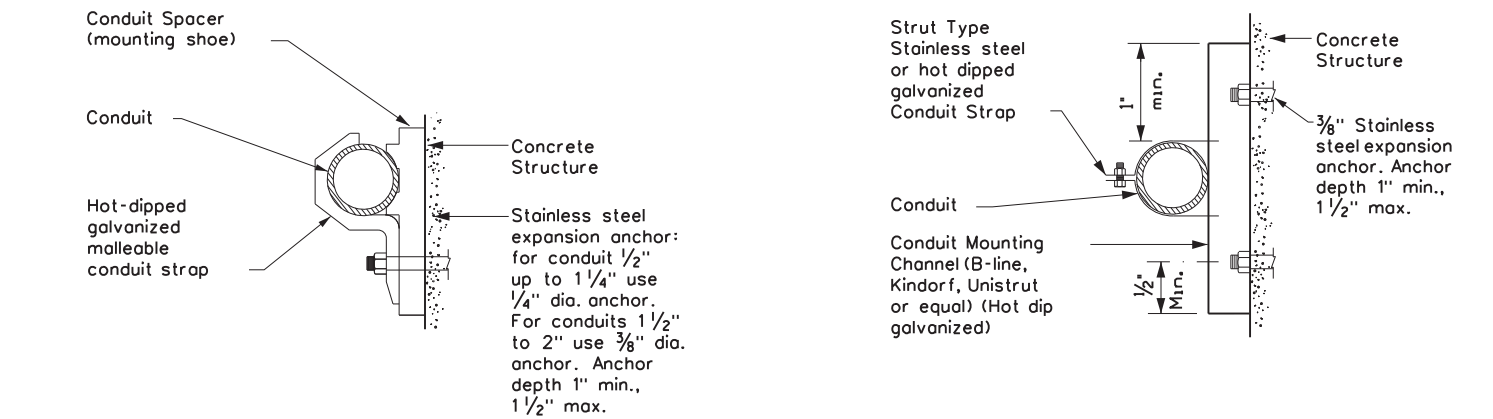
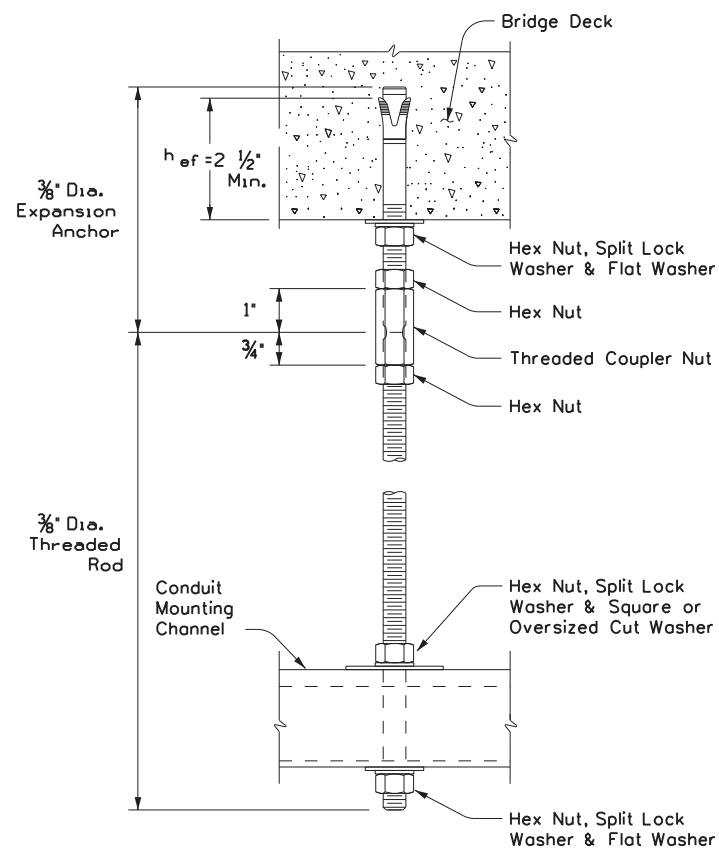
CONDUIT MOUNTING CHANNEL		
"SPAN"	"W" x "H"	"T"
less than 2'	1 5/8" x 1 3/8"	12 Ga.
2'-0" to 2'-6"	1 5/8" x 1 5/8"	12 Ga.
>2'-6" to 3'-0"	1 5/8" x 2 7/16"	12 Ga.

Channels with round or short slotted hole patterns are allowed, if the load carrying capacity is not reduced by more than 15%.



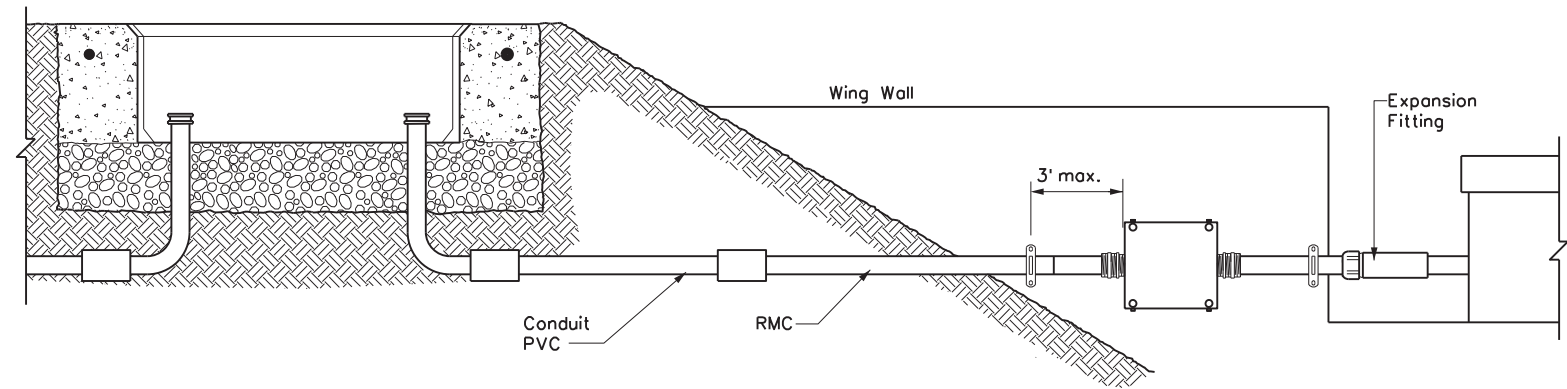
HANGER ASSEMBLY DETAIL

ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT



CONDUIT MOUNTING OPTIONS

Attachment to concrete surfaces  
See ED(1)B.2



TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

EXPANSION ANCHOR NOTES FOR BRIDGE DECK ATTACHMENT

1. Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.
2. Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.
3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environment, both the anchor body and expansion wedge shall be stainless steel.
4. Install anchors as shown on the plans and in accordance with the anchor manufacturer's published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.
5. Prior to hole drilling, use rebar locator to ensure clearing of existing deck strands or reinforcement. Install anchors to ensure a minimum effective embedment depth, (ef)<sup>1</sup> as shown. Increase (ef)<sup>2</sup> as needed to ensure sufficient thread length for proper torqueing and tightening of anchors.
6. Use anchors of minimum 1600 Lbs tensile capacity (minimum of steel, concrete breakout, and concrete pullout strengths as determined by ACI 318 Appendix D) at the required minimum embedment depth (ef). No lateral loads shall be introduced after conduit installation.

		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS CONDUIT SUPPORTS</h2>			
<h3>ED(2)-14</h3>			
FILE: ed2-14.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CONT: 0022	SECT: 010	JOB: 076
REVISIONS	DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO.: 61

**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 in 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.

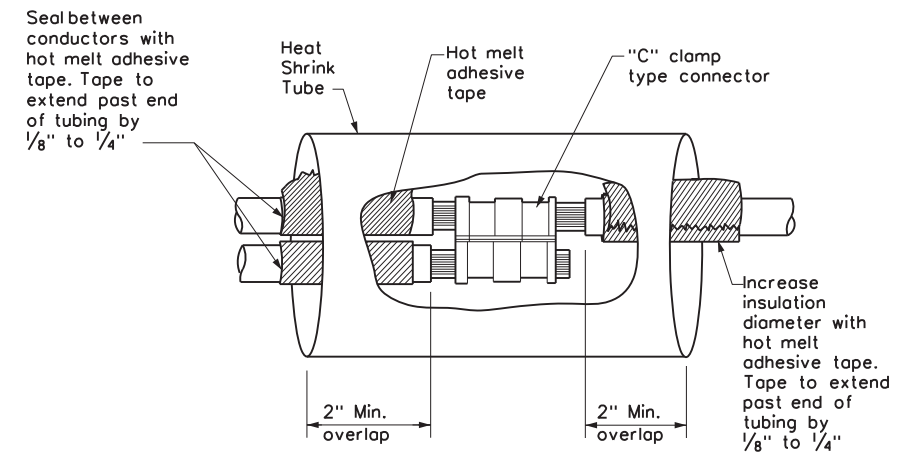
**GROUND RODS & GROUNDING ELECTRODES**

**A. MATERIAL INFORMATION**

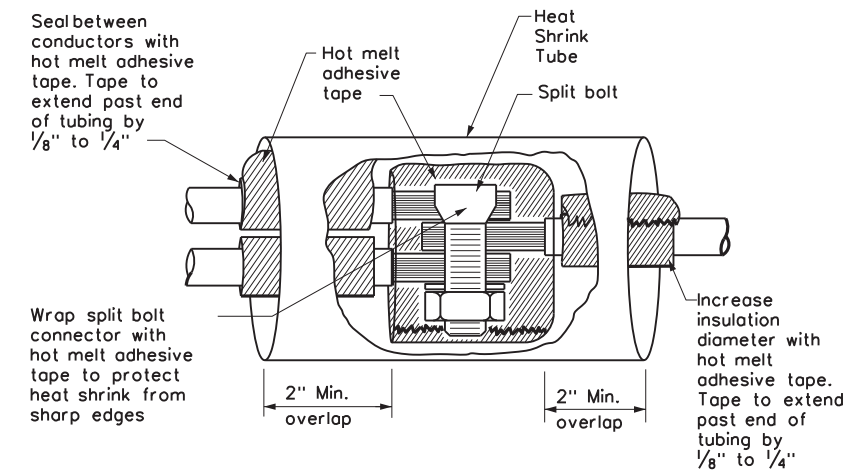
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in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

**B. CONSTRUCTION METHODS**

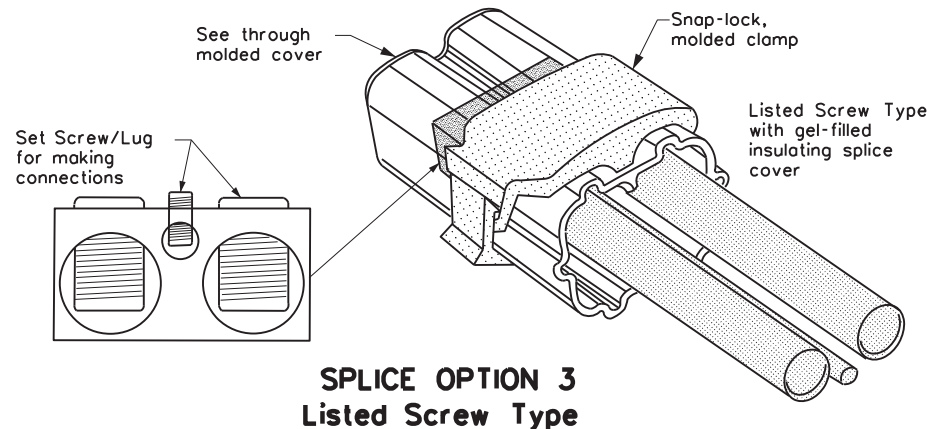
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, 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 1  
Compression Type**



**SPLICE OPTION 2  
Split Bolt Type**



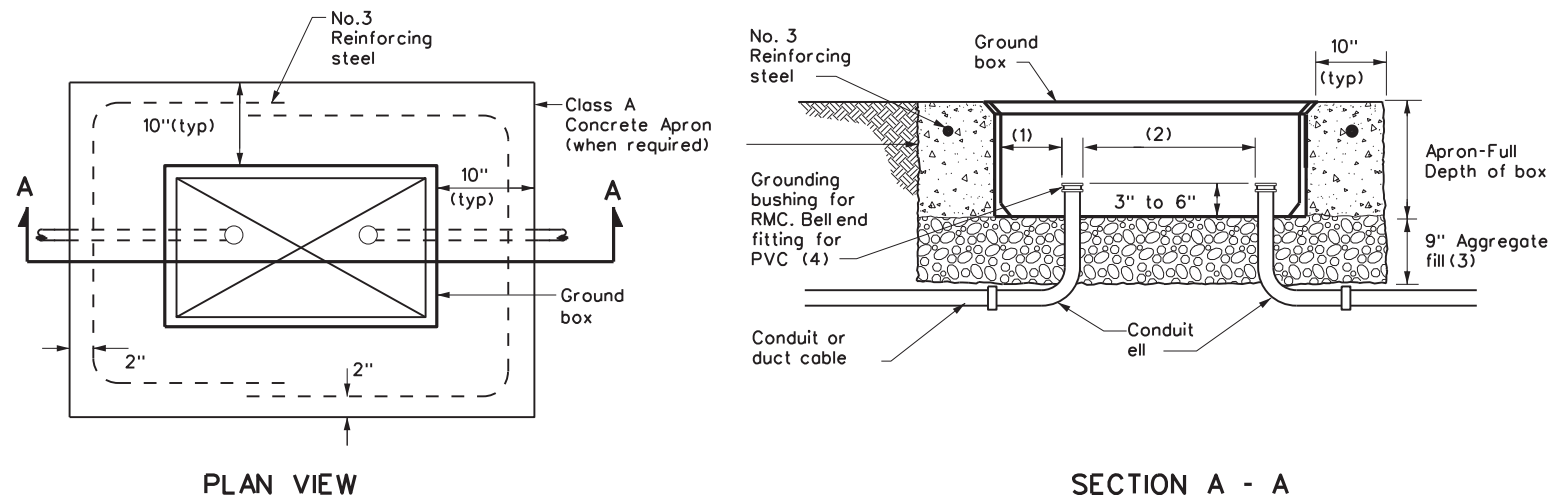
**SPLICE OPTION 3  
Listed Screw Type**

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				Traffic Operations Division Standard	
<h1>ELECTRICAL DETAILS CONDUCTORS</h1> <h2>ED(3)-14</h2>					
FILE:	ed3-14.dgn	DN:	TxDOT	CK:	TxDOT
© TxDOT	October 2014	CONT:	0022	SECT:	010
REVISIONS:		JOB:	076	HIGHWAY:	US90, etc.
		DIST:	22	COUNTY:	VAL VERDE, etc.
				SHEET NO.:	62

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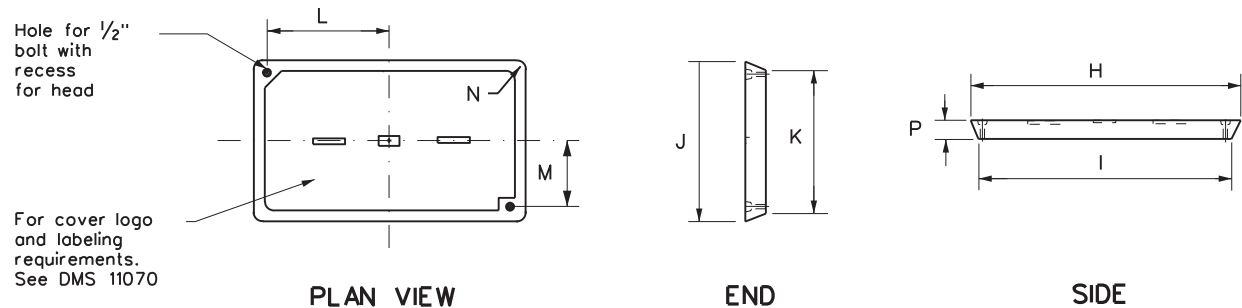


**APRON FOR GROUND BOX**

- (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 bushing.
- (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.

				Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS GROUND BOXES</h2>					
<h3>ED(4)-14</h3>					
FILE: ed4-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0022	010	076	US90, etc.	
	DIST	COUNTY		SHEET NO.	
	22	VAL VERDE, etc.		63	

**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 materials 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**

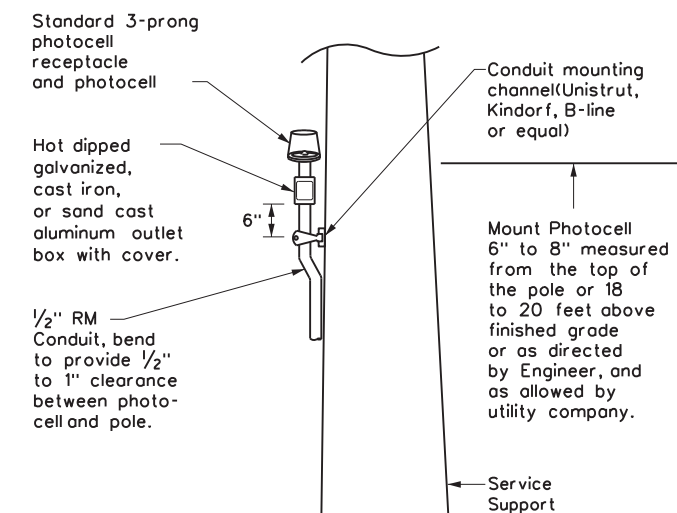
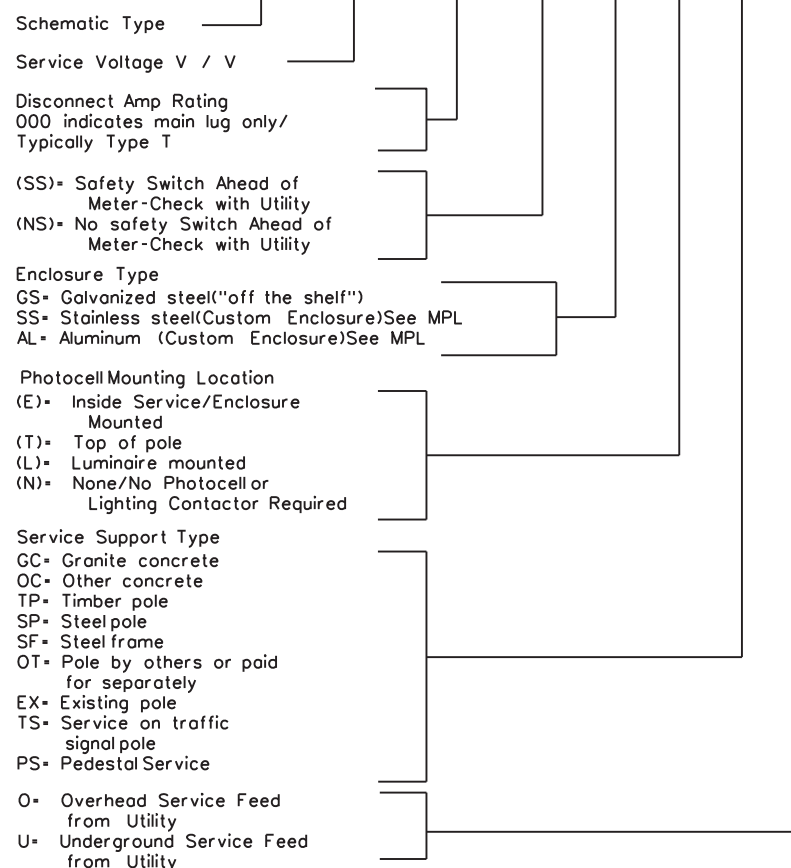
1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

* ELECTRICAL SERVICE DATA												
Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit * x 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		Luminaires	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.

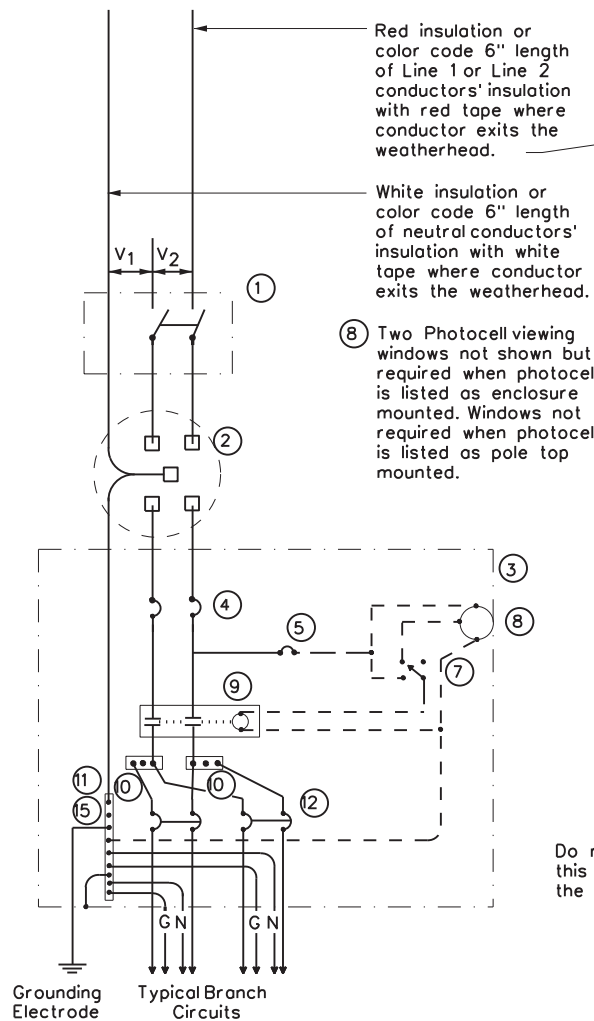
		<b>Traffic Operations Division Standard</b>	
<h2>ELECTRICAL DETAILS SERVICE NOTES &amp; DATA</h2>			
<h3>ED(5)-14</h3>			
FILE: ed5-14.dgn	DW: TxDOT	CK: TxDOT	PL: TxDOT
© TxDOT October 2014	CONT: 0022	SECT: 010	JOB: 076
REVISIONS:			HS90, etc.
DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO. 64	

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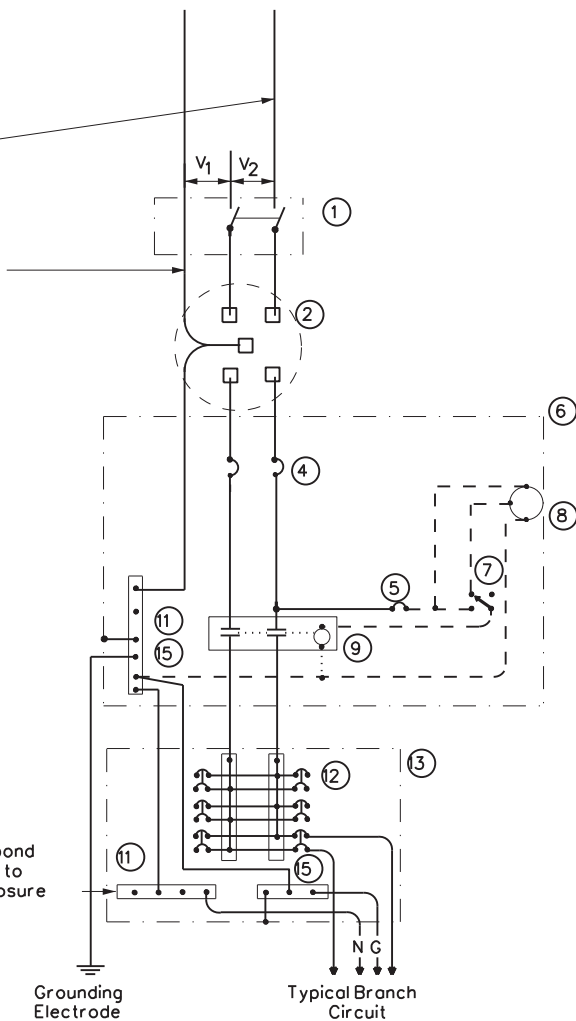
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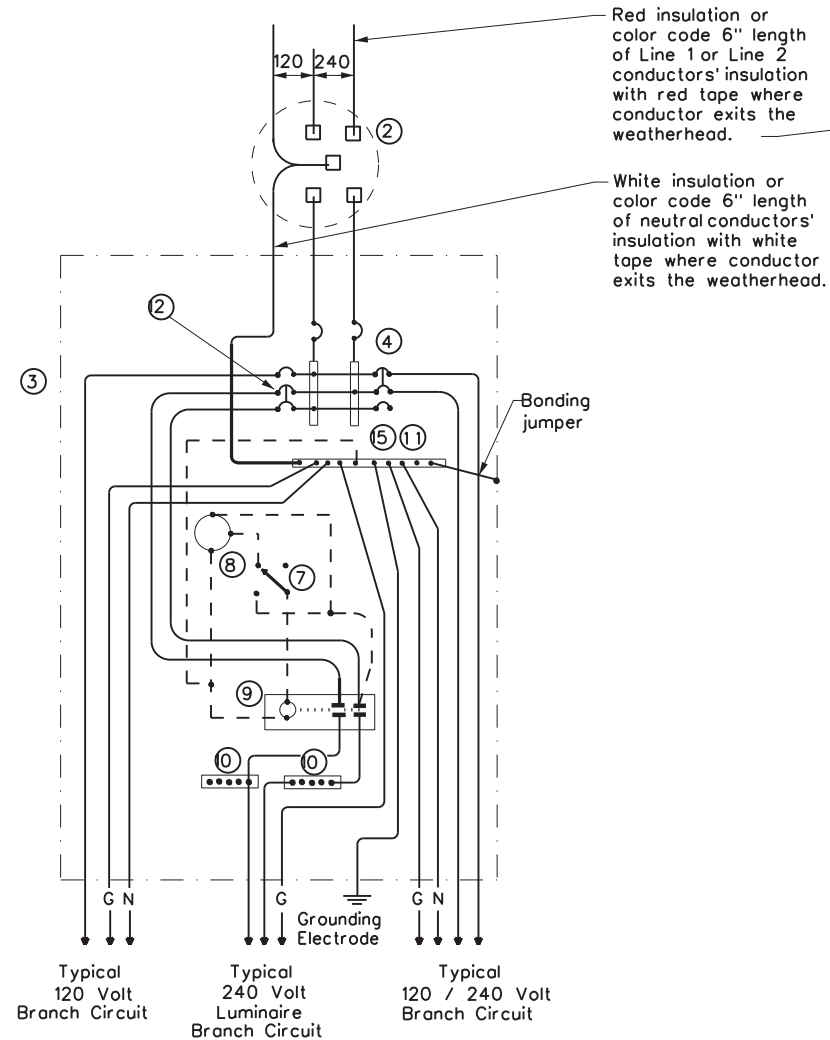
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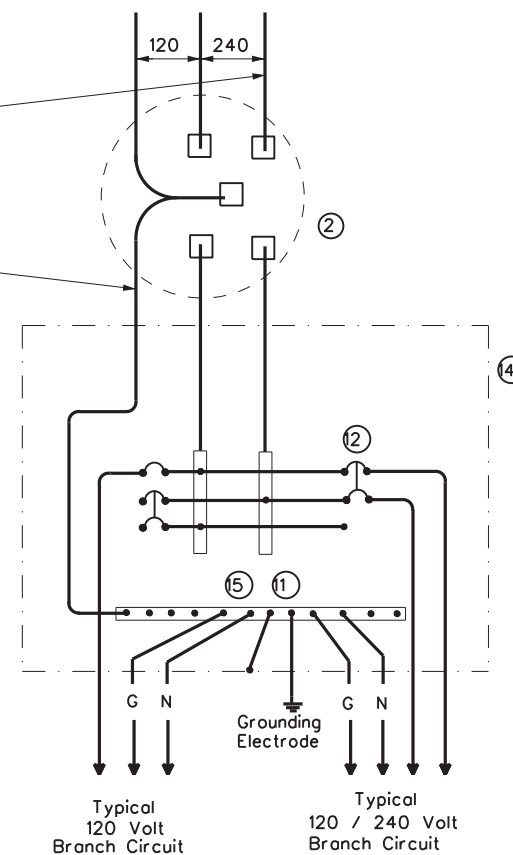
**SCHEMATIC TYPE A**  
THREE WIRE



**SCHEMATIC TYPE C**  
THREE WIRE



**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.

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

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

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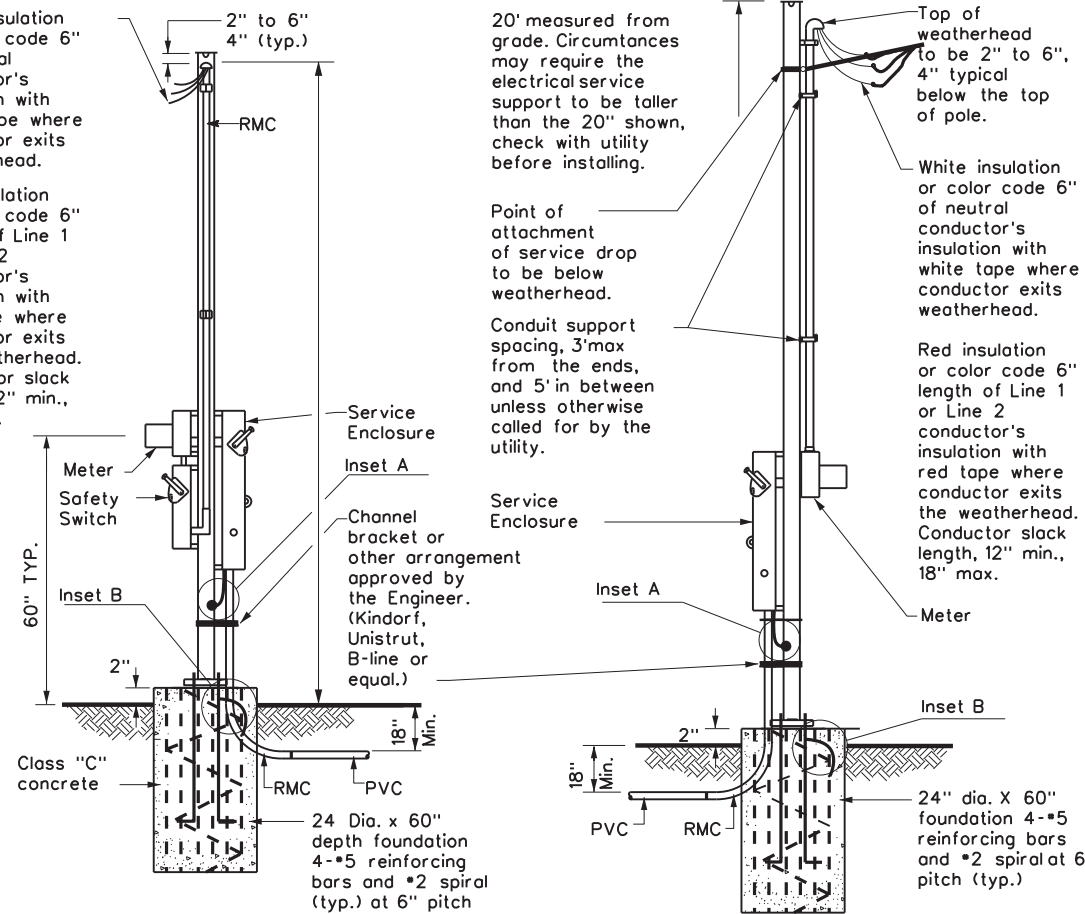
				Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES</b>					
<b>ED(6)-14</b>					
FILE: ed6-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
© TxDOT October 2014	CONT: 0022	SECT: 010	JOB: 076	HIGHWAY: US90, etc.	
REVISIONS	DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO.: 65		

**SUPPORT TYPE STEEL POLE (SP) AND STEEL FRAME (SF)**

1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (DMS) 11080 "Electrical Services." Mount all equipment and conduit on 12 gauge galvanized steel or stainless steel channel strut, 1 1/2 in. or 1 3/8 in. wide by 1 in. up to 3 3/4 in. deep Unistrut, Kindorf, B-line or equal. Bolt or weld all channel and hardware to vertical members as approved. Do not stack channel. File smooth and paint field cut ends of all channel with zinc-rich paint before installing.
2. Provide poles for overhead service with an eyebolt or similar fitting for attachment of the service drop to the pole in conformance with the electric utility provider's specifications.
3. Provide and install galvanized 3/4 in. x 18 in. x 4 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized 3/4 in. x 56 in. x 4 in. anchor bolts for overhead service supports. Ensure anchor bolts have 3 in. of thread, with 3 1/4 in. to 3 1/2 in. of the exposed anchor bolt projecting above finished foundation. Provide and install leveling nuts for all anchor bolts.
4. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.
5. Furnish and install rigid metallic ells in all steel pole and steel frame foundations for all conduits entering the service from underground.
6. Use class C concrete for foundations. Ensure reinforcing steel is Grade 60 with 3" of unobstructed concrete cover.
7. Drill and top steel poles and frames for 1/2 in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. For steel frame service supports, provide and install tank ground fitting on steel frame post. Install service grounding electrode conductor in a non-metallic conduit or tubing from the enclosure to the steel frame post. Connect electrical service grounding electrode conductor to the tank ground fitting. See steel frame and steel pole details and Inset A for more information. Size service entrance conduit and branch circuit conduit as shown in the plans. For underground conduit runs from the electrical service, extend RMC from the service enclosure to an RMC elbow, and then connect the schedule type and size of conduit shown in the plans. Provide and install grounding bushings where RMC terminates in the enclosure. Grounding bushings are not required when RMC is fitted into a sealing hub or threaded boss.
8. If Steel pole or frame is painted, bond each separate painted piece with a bonding jumper attached to a tapped hole.
9. Provide 1/4" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.
10. Avoid contact of the service drop and service entrance conductors with the metal pole to prevent abrasion of the insulated conductors.
11. Shop drawings are not required for service support structure unless specifically stated elsewhere or directed by the Engineer.

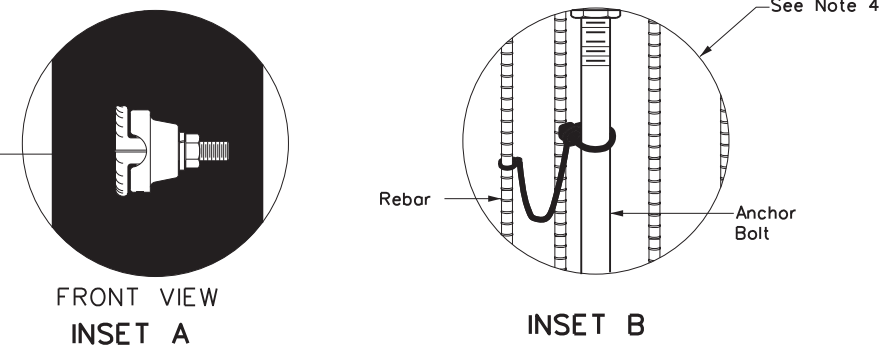
White insulation or color code 6" of neutral conductor's insulation with white tape where conductor exits weatherhead.

Red insulation or color code 6" length of Line 1 or Line 2 conductor's insulation with red tape where conductor exits the weatherhead. Conductor slack length, 12" min., 18" max.

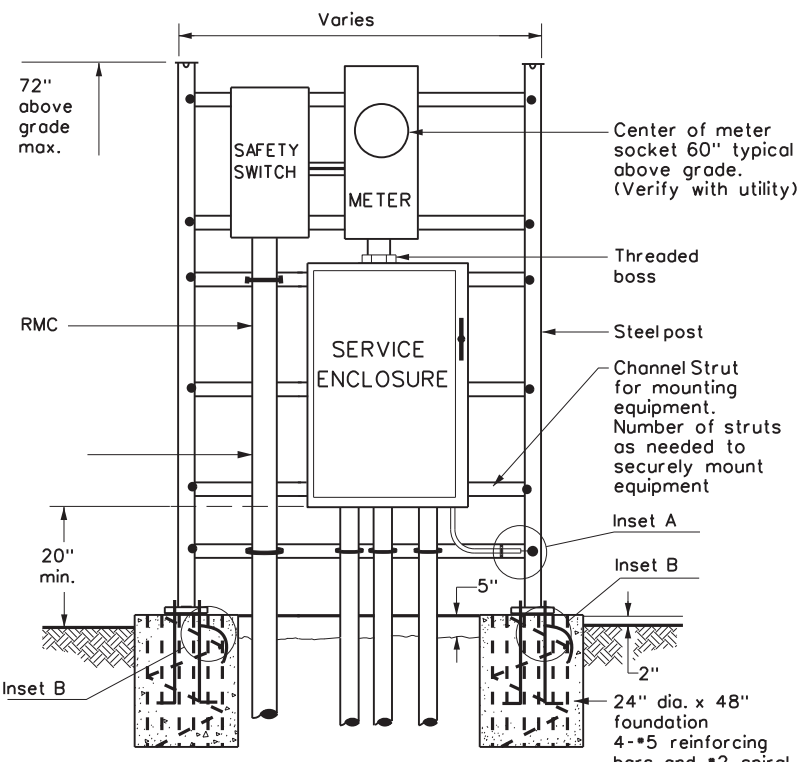


WITH SAFETY SWITCH      WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE**

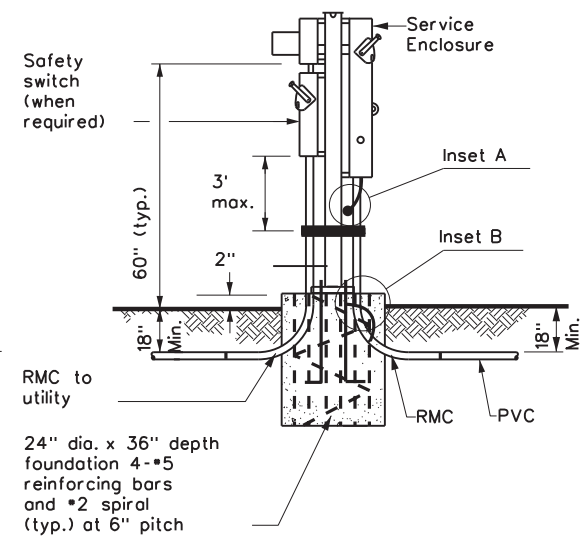
Drill, top, and thread 1/2" X 13 UNC. Install tank ground fitting, connect electrical service grounding electrode conductor. See Note 7.



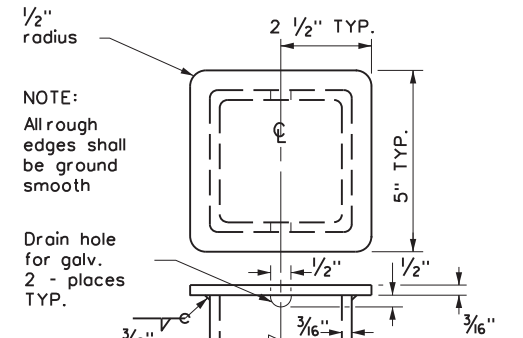
FRONT VIEW INSET A      INSET B



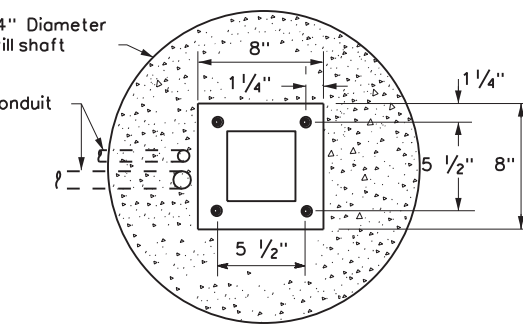
WITH SAFETY SWITCH      WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SF (U) - UNDERGROUND SERVICE**



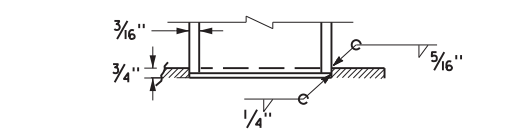
WITH SAFETY SWITCH      HOOKED ANCHOR DETAIL  
**SERVICE SUPPORT TYPE SP (U) - UNDERGROUND SERVICE**



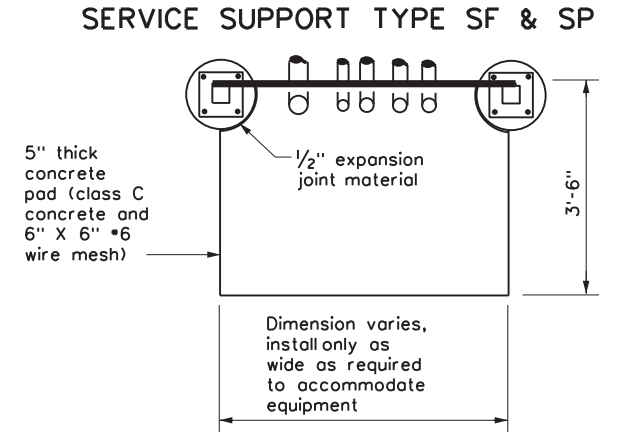
**POLE TOP PLATE**



**BASE PLATE DETAIL**



**BOTTOM OF POLE**



**TOP VIEW**  
**SERVICE SUPPORT TYPE SF (O) & SF (U)**

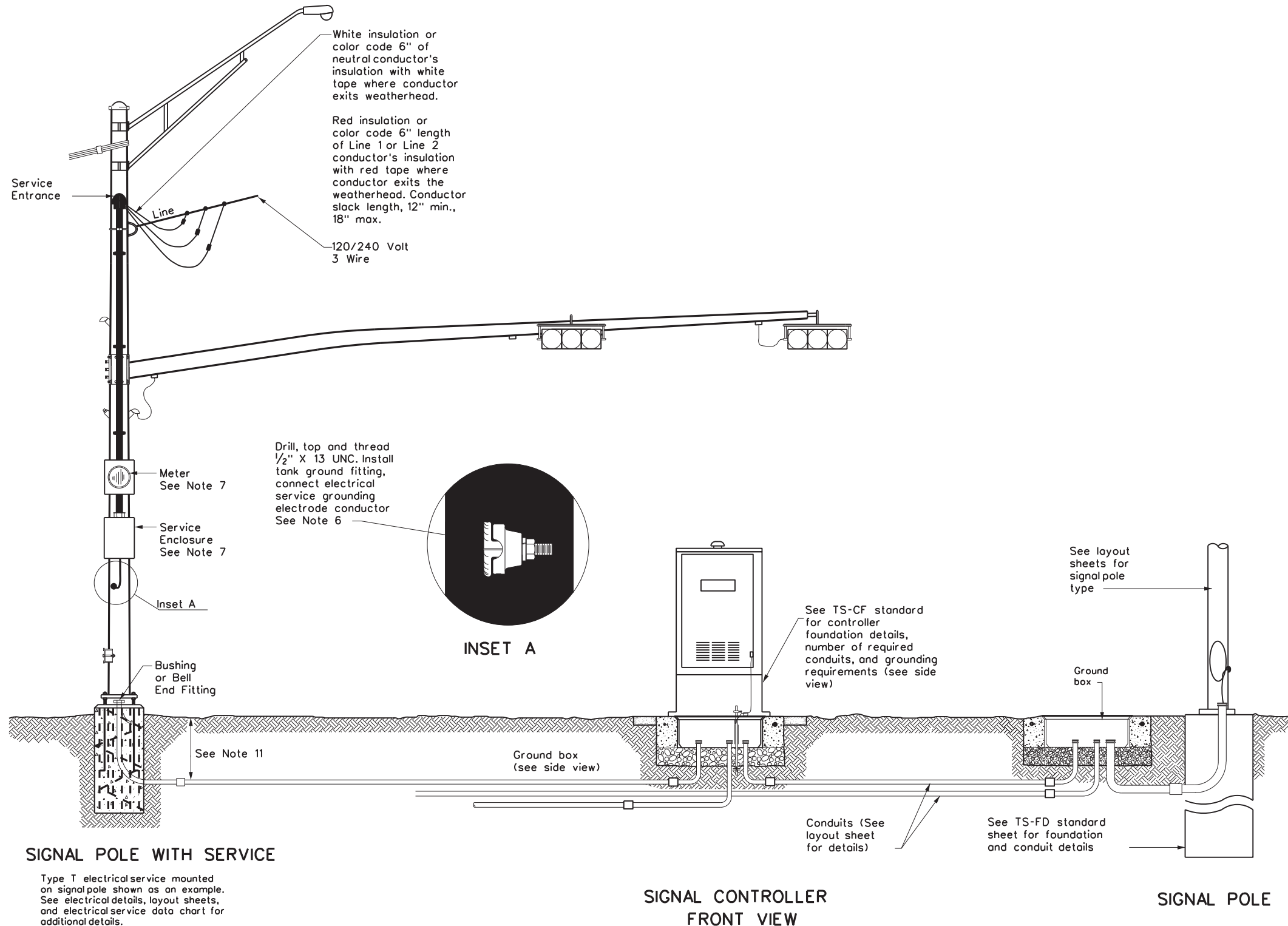
		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS</b> <b>SERVICE SUPPORT</b> <b>TYPES SF &amp; SP</b> <b>ED(7)-14</b>			
FILE: ed7-14.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CON: 0022	SECT: 010	JOB: 076
REVISIONS	DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO.: 66

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**TRAFFIC SIGNAL NOTES**

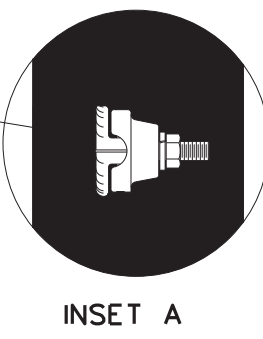
1. Do not pass luminaire conductors through the signal controller cabinet.
2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
3. Provide roadway luminaires, when required, in accordance with the material 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".



White insulation or color code 6" of neutral conductor's insulation with white tape where conductor exits weatherhead.

Red insulation or color code 6" length of Line 1 or Line 2 conductor's insulation with red tape where conductor exits the weatherhead. Conductor slack length, 12" min., 18" max.

Drill, tap and thread 1/2" X 13 UNC. Install tank ground fitting, connect electrical service grounding electrode conductor See Note 6

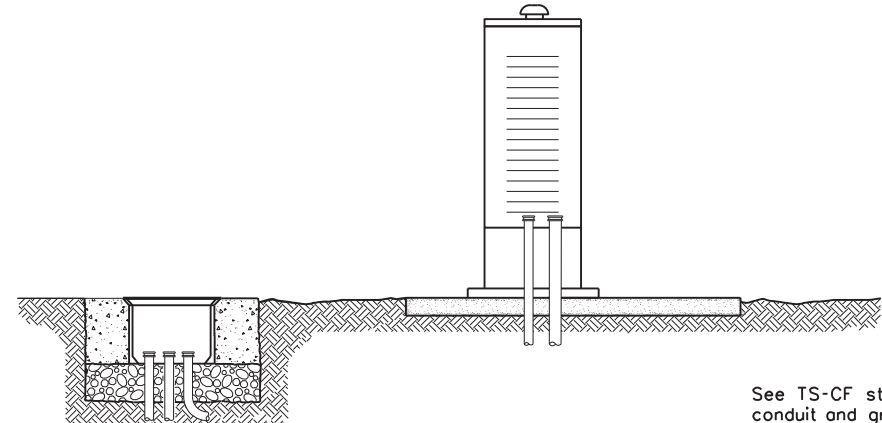


**SIGNAL POLE WITH SERVICE**

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**

See TS-CF standard for conduit and grounding requirements. See layout sheets for ground box locations and any additional conduits that are required.

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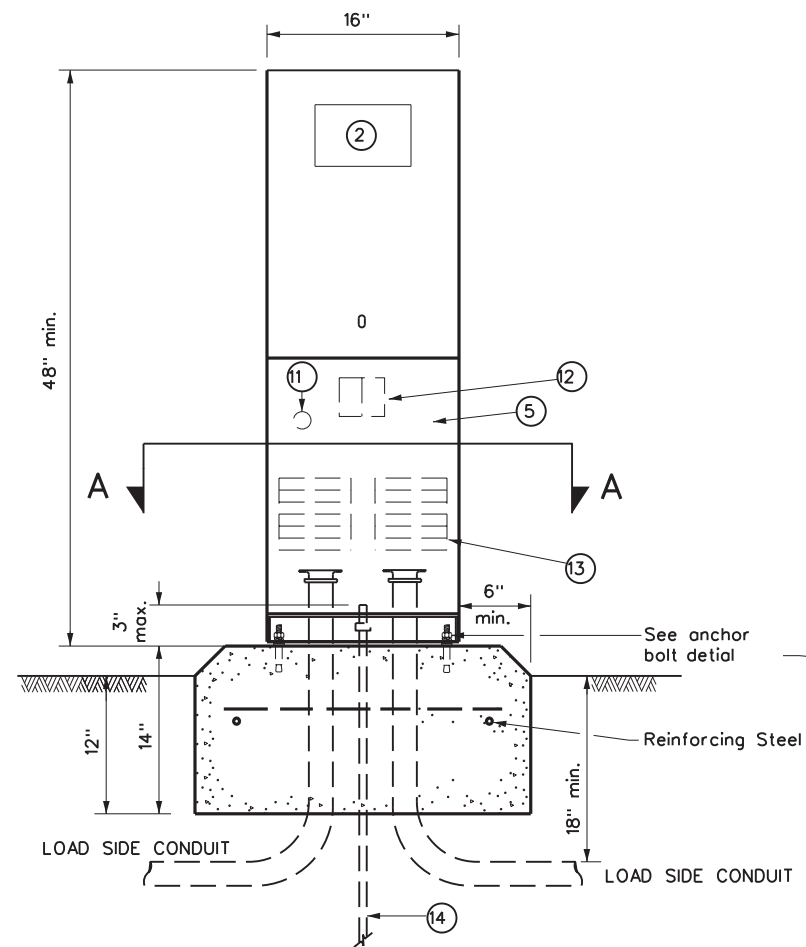
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		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS TYPICAL TRAFFIC SIGNAL SYSTEM DETAILS</b>			
<b>ED(8)-14</b>			
FILE: ed8-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CONT: 0022	SECT: 010	JOB: 076
REVISIONS	DIST: 22		COUNTY: VAL VERDE, etc.
			SHEET NO.: 67

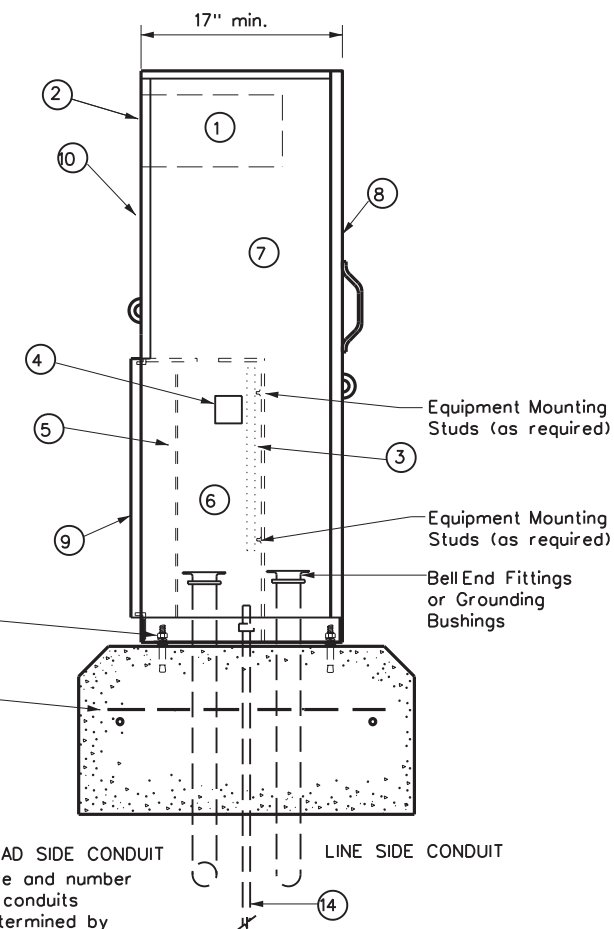
**PEDESTAL SERVICE NOTES**

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 1/16 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.

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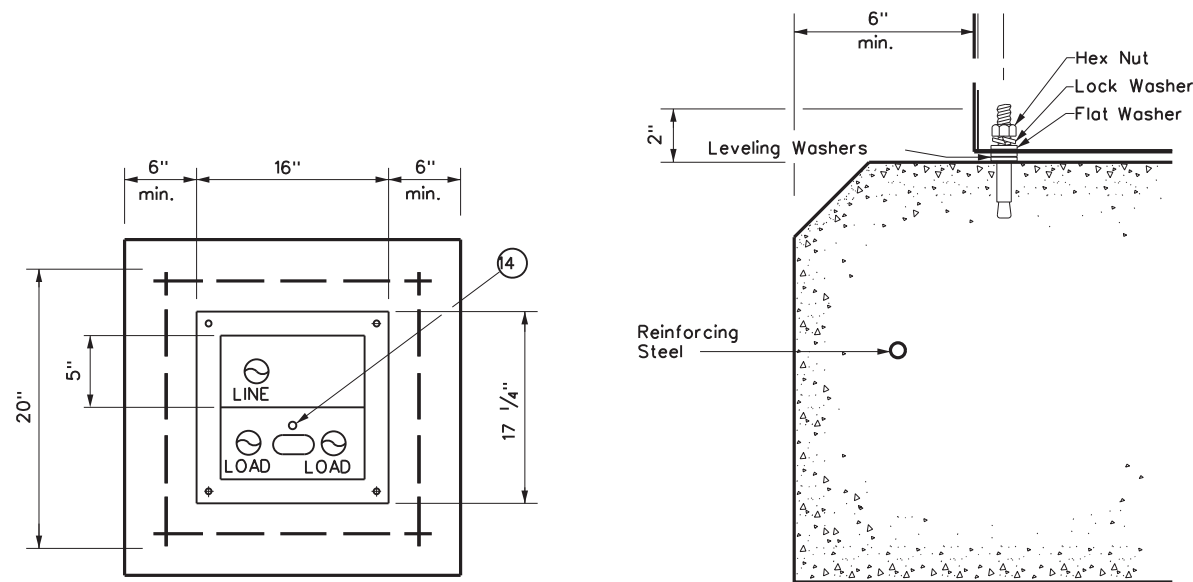


**FRONT VIEW**



**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.



**SECTION A-A**

**ANCHOR BOLT DETAIL**

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'

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FILE: ed9-14.dgn

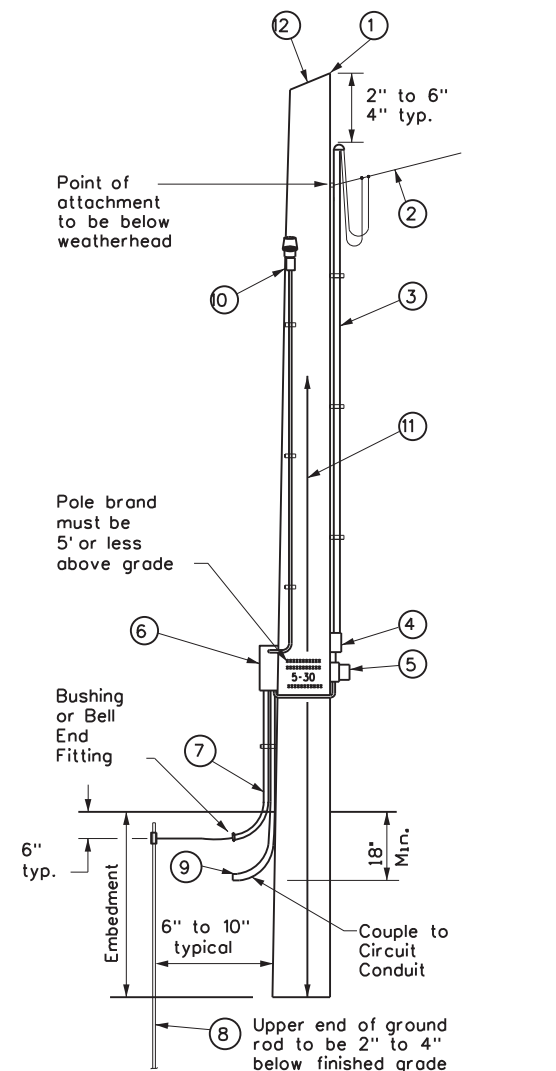
		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS ELECTRICAL SERVICE SUPPORT PEDESTAL SERVICE TYPE PS</b>			
<b>ED(9)-14</b>			
FILE: ed9-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
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REVISIONS	DIST: 22	COUNTY: VAL VERDE, etc.	HIGHWAY: US90, etc.
			SHEET NO.: 68

**TIMBER POLE(TP)SERVICE SUPPORT NOTES**

1. Ensure electrical service support is a class 5 treated timber pole as per Item 627 "Treated Timber Poles." Embed timber pole to depth required in Item 627.
2. Conduit and electrical conductors attached to the electrical service pole and underground within 12 in. of service pole are not paid for directly but are subsidiary to the electrical service.
3. Install pole-top mounted photocell (T) on north side of pole, or in service enclosure (E) as required. See Electrical Service Data chart in plan set.
4. Gain pole as required to provide flat surface for each channel. Gain timber pole to 5/8 in. max. depth and 1 1/8 in. max. height. Gain pole in a neat and workmanlike manner.
5. Mount meter and service equipment on stainless steel or galvanized channel (Unistrut, Kindorf, or equal). Provide channelsized 1 in. to 3 3/4 in. maximum depth, and 1/2 in. to 1 5/8 in. maximum width. File smooth the cut ends of galvanized channel and point with zinc rich point before installing on pole. Secure each channel section to timber pole with two galvanized or SS lag bolts, 1/4 in. minimum diameter by 1/2 in. minimum length. Use a galvanized or SS flat washer on each lag bolt. Do not stack channel.
6. When excess length must be trimmed from poles, trim from the top end only.

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- 1 Class 5 pole, height as required
- 2 Service drop from utility company (attached below weatherhead)
- 3 Service conduit (RMC) and service entrance conductors - One Red, One Black, One White (See Electrical Service Data)
- 4 Safety switch (when required)
- 5 Meter (when required)
- 6 Service enclosure
- 7 6 AWG bare grounding electrode conductor in 1/2 in. PVC to ground rod - extend 1/2 in. PVC 6 in. underground.
- 8 5/8 in. x 8 ft. Copper clad ground rod - drive ground rod to a depth of 2 in. to 4 in. below grade.
- 9 RMC same size as branch circuit conduit.
- 10 See pole-top mounted photocell detail on ED(5).
- 11 When required by the serving utility provide bare 6 AWG copper conductor. Run wire from pole top to butt wrap or copper butt plate. Protect conductor with non-conductive material to a height of 8 ft. above finished grade.
- 12 When required by utility, cut top of pole at an angle to enhance rain run off.

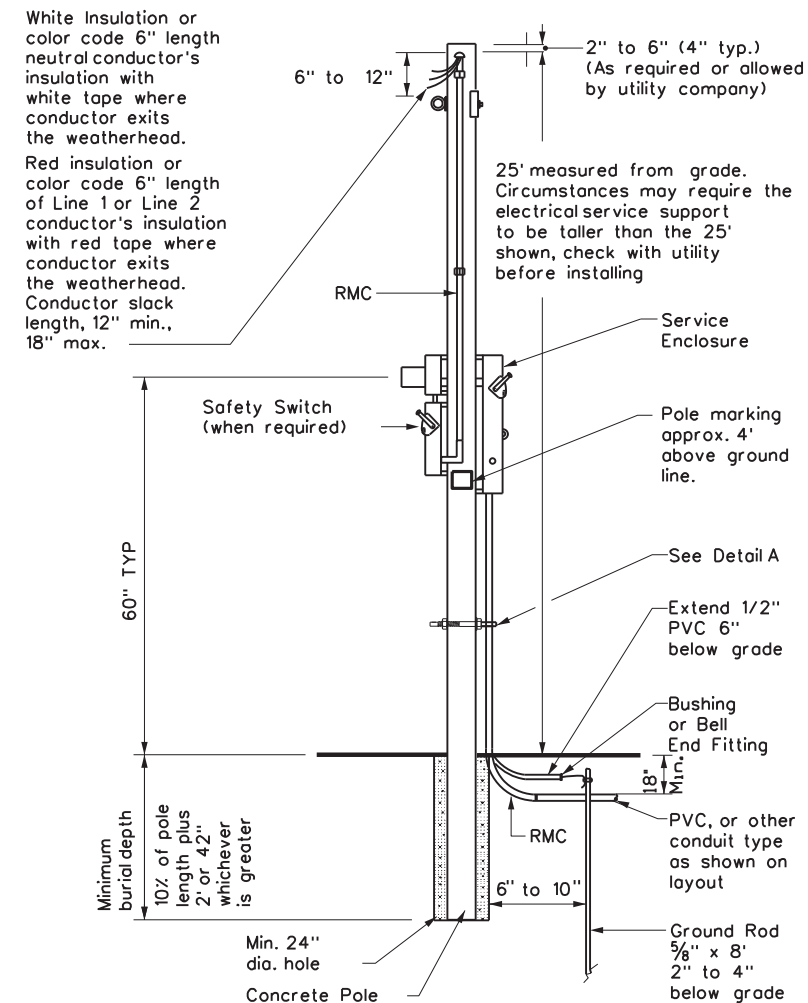


**SERVICE SUPPORT TYPE TP (O)**

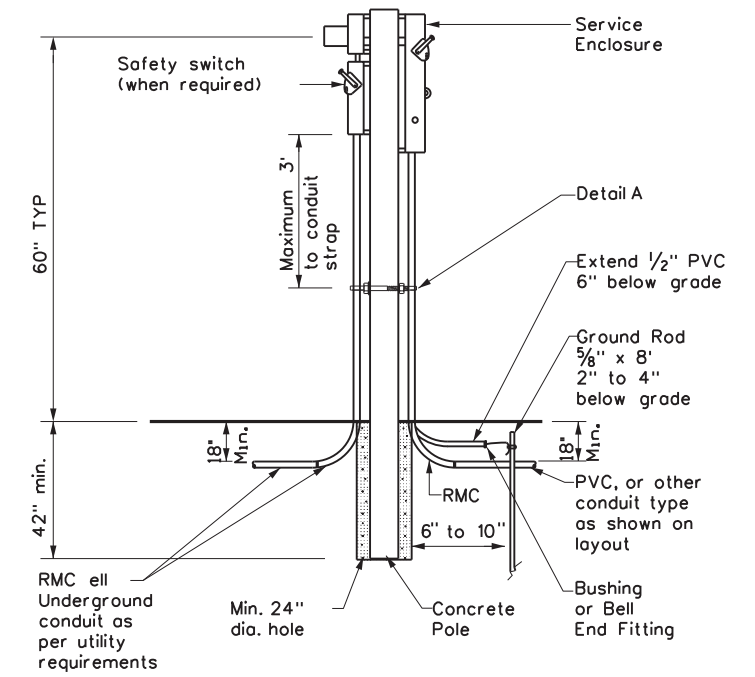
**GRANITE CONCRETE(GC)& OTHER CONCRETE(OC)NOTES**

Ensure electrical service support structures bid as type Granite Concrete (GC) or Other Concrete (OC) meet the following requirements.

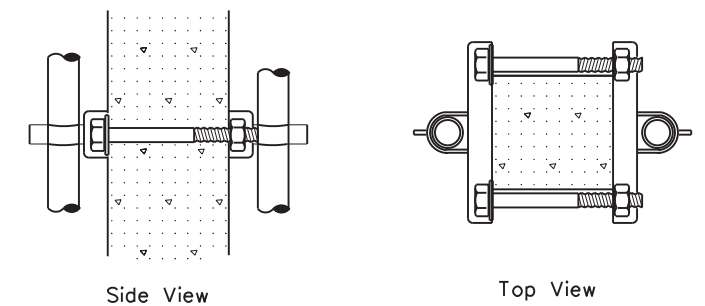
1. Provide GC and OC poles that meet the requirements of DMS 11080 "Electrical Services."
2. Provide prestressed concrete poles suitable for direct embedment into the ground without special foundations.
3. Verify poles are marked as required on DMS 11080. Location of marking should be approximately 4' above final grade. Use the two-point pickup locations when handling pole in horizontal position, and one-point pickup location for use in raising the pole to a vertical position. These marks are small but conspicuous.
4. Embed poles 42 in. or 10% of the length plus 2 ft., whichever is greater.
5. Ensure all installation details of services are in accordance with utility company specifications.
6. Install a one point rack or eye bolt bracket 6 inches to 12 inches below the weatherhead as an overhead service drop anchoring point for the electric utility.
7. Furnish and install galvanized or stainless steel channel strut 1 1/2 in. or 1 5/8 in. wide by 1 in. up to 3 3/4 in. deep (Unistrut, Kindorf, B-line or equal). Attach channel strut with stainless steel concrete anchors (max. 1" depth), square U-bolts or back to back channel strut with long bolts, or other secure mounting as approved by the Engineer. Ensure bolts are galvanized in accordance with ASTM A153. Do not stack channel struts.
8. Backfill the holes thoroughly by tamping in 6 in. lifts. After tamping to grade, place additional backfill material in a 6 inch high cone around the pole to allow for settling. Use material equal in composition and density to the surrounding area. Backfilling will not be paid for directly but is subsidiary to various bid items.



**CONCRETE SERVICE SUPPORT Overhead(O)**



**CONCRETE SERVICE SUPPORT Underground(U)**



**DETAIL A**

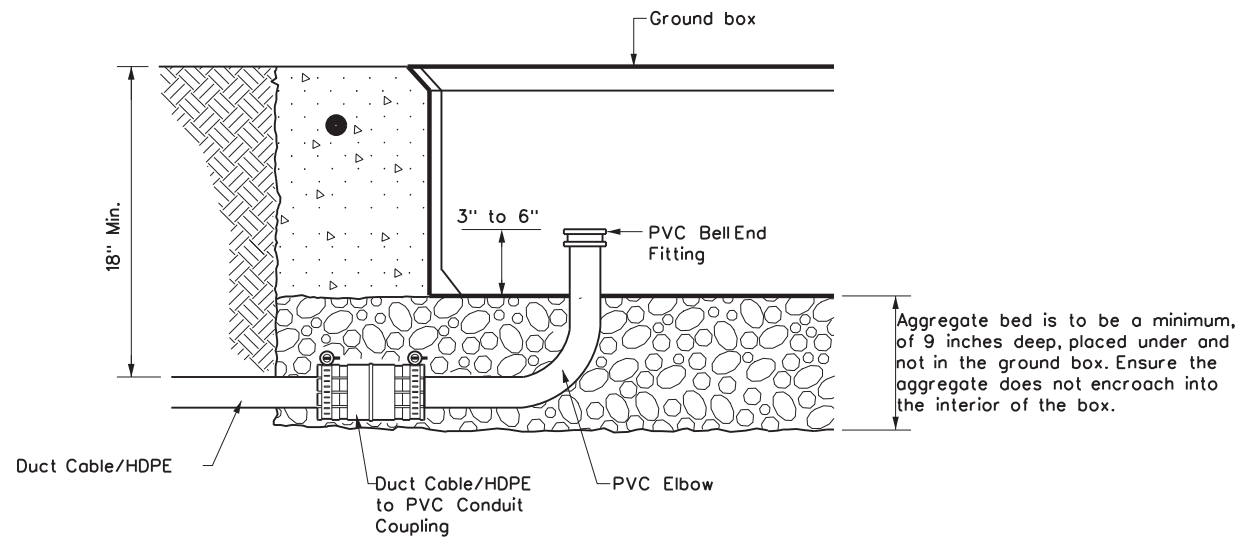
See Note 7. Before installing channel that has been cut, file sharp edges and point with zinc-rich point. Ensure there is no paint splatter on the pole.

		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE SUPPORT TYPES GC, OC, &amp; TP</b>			
<b>ED(10)-14</b>			
FILE: ed10-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
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REVISIONS:	DIST: 22	COUNTY: VAL VERDE, etc.	US90, etc.
			SHEET NO. 69

**DUCT CABLE & HDPE CONDUIT NOTES**

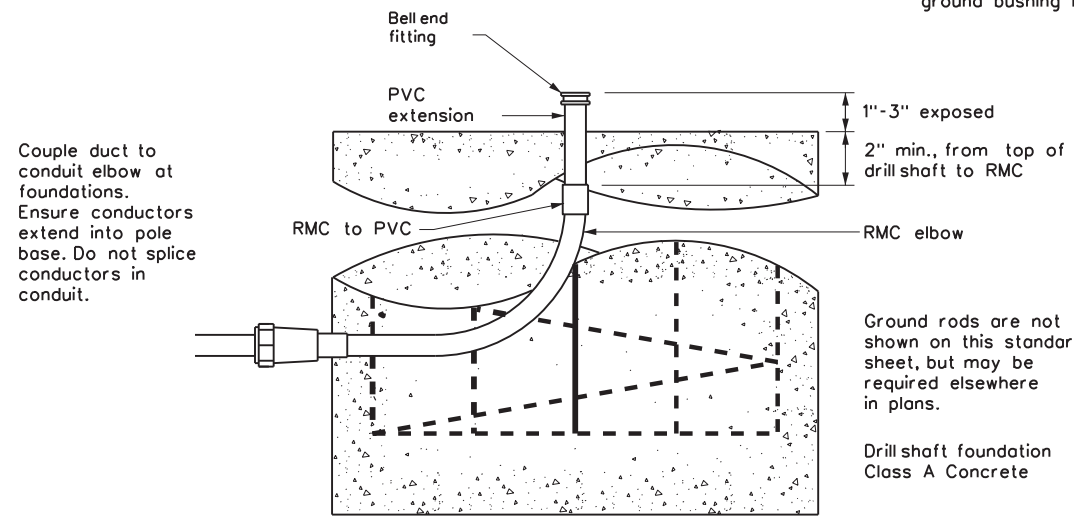
1. Provide duct cable in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.
2. Provide High-Density Polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 618, "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies," Item 618.
3. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. for 2 in. duct. Follow manufacturers' recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.
4. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.
5. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Article, "Nonmetallic Underground Conduit with Conductors: Type NUCC."
6. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.
7. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.
8. Provide minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.
9. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of conduit. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings; connected with listed tie-wrap fittings; connected using listed coupling made of HDPE with stainless steel external banding clamps and locking rings; connected with approved electrofusion conduit couplings; or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE couplings and connectors all installed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conduit with heat shrink tubing.

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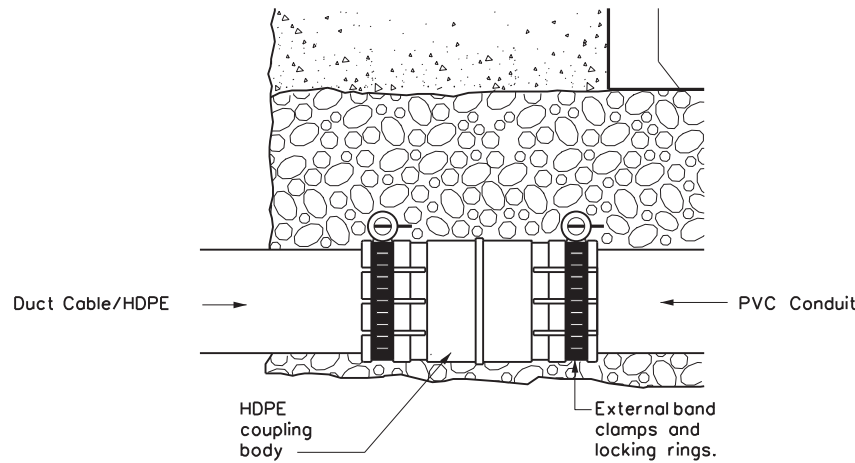


**DUCT CABLE/HDPE AT GROUND BOX**

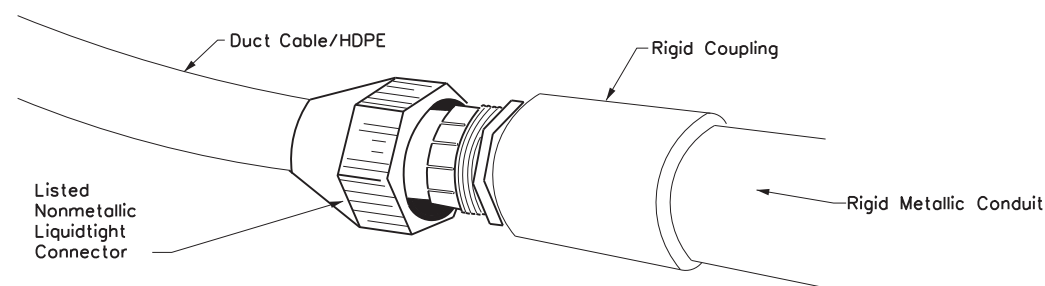
When the upper end of an RMC Elbow does not enter the ground box, it may be extended with a SCH-40 PVC conduit nipple and bell end, provided there is a minimum of 18" of cover over all parts of the elbow. If not, a rigid extension and ground bushing is required.



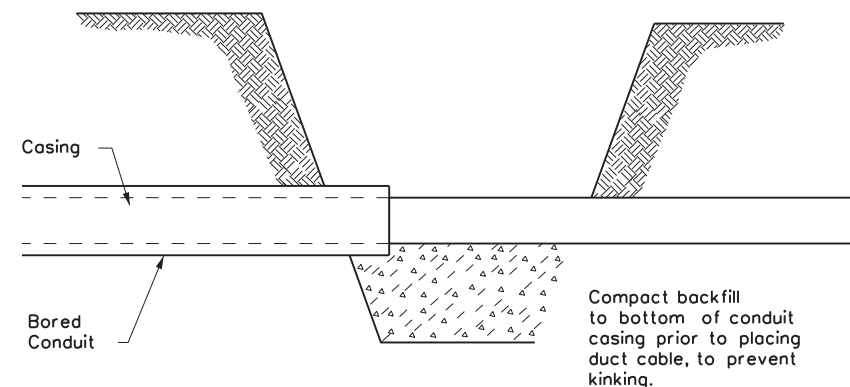
**DUCT CABLE / HDPE AT FOUNDATION**



**DUCT CABLE/HDPE TO PVC**



**DUCT CABLE/HDPE TO RMC**



**BORE PIT DETAIL**

		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS DUCT CABLE / HDPE CONDUIT</b>			
<b>ED(11)-14</b>			
FILE: ed11-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
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**BATTERY BOX GROUND BOXES NOTES**

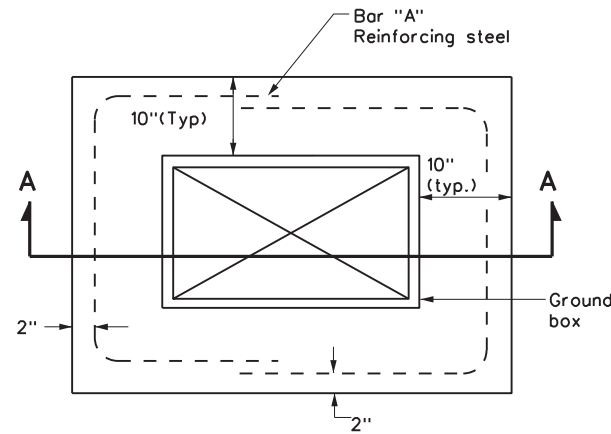
**A. MATERIALS**

1. Provide polymer concrete or fiberglass reinforced plastic (FRP) battery box ground box and cover in accordance with Departmental Material Specification (DMS) 11071 "Battery Box Ground Boxes." Battery box will accommodate up to 4 batteries, each measuring 8 in. x 13.5 in. x 10 in. (W x L x D). Label battery box ground box cover in accordance with DMS 11071.

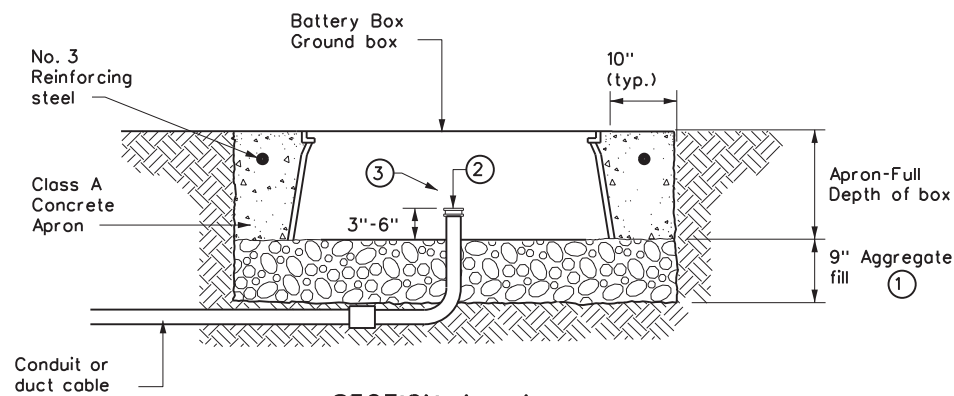
2. Supply a marine grade batteries with covers. Secure the marine grade batteries with covers to the stainless steel rack in the bottom of the ground box with tie down straps.

**B. CONSTRUCTION METHODS**

1. Ensure conduit entry will not interfere with placement of the batteries in the battery box ground box.
2. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting battery box ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure the aggregate bed is in place and is a minimum of 9 in. deep prior to setting the box. Install battery box ground box on top of aggregate.
3. Cast battery 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. Battery box ground box aprons, including concrete and reinforcing steel, are subsidiary to battery box ground boxes when called for by descriptive code.
4. Bolt covers down when not working in battery box ground boxes. Keep bolt holes in the box clear of dirt.



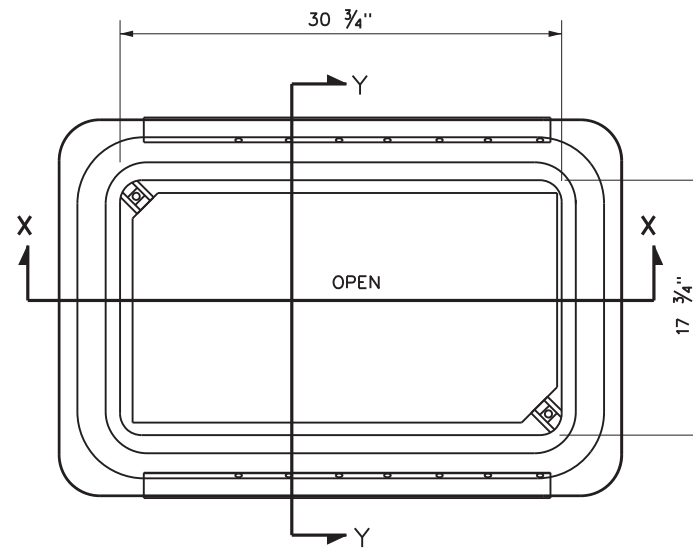
**PLAN VIEW**



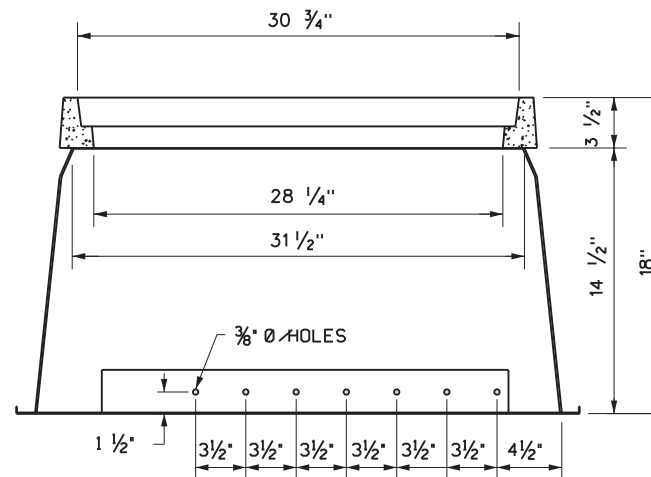
**SECTION A - A**

**APRON FOR BATTERY BOX GROUND BOXES**

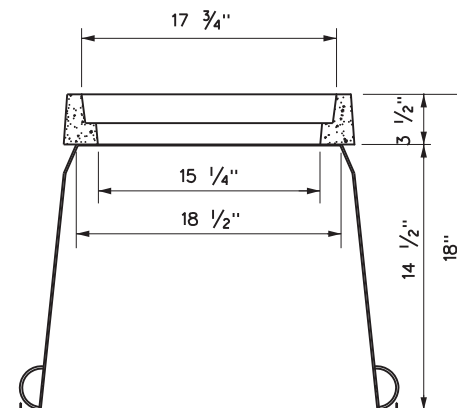
- ① Place aggregate under the box and not in the box. Aggregate should not encroach on the interior volume of the box.
- ② Install bushing or bell end fitting on the upper end of all ells.
- ③ Install all conduits in a neat and workmanlike manner.



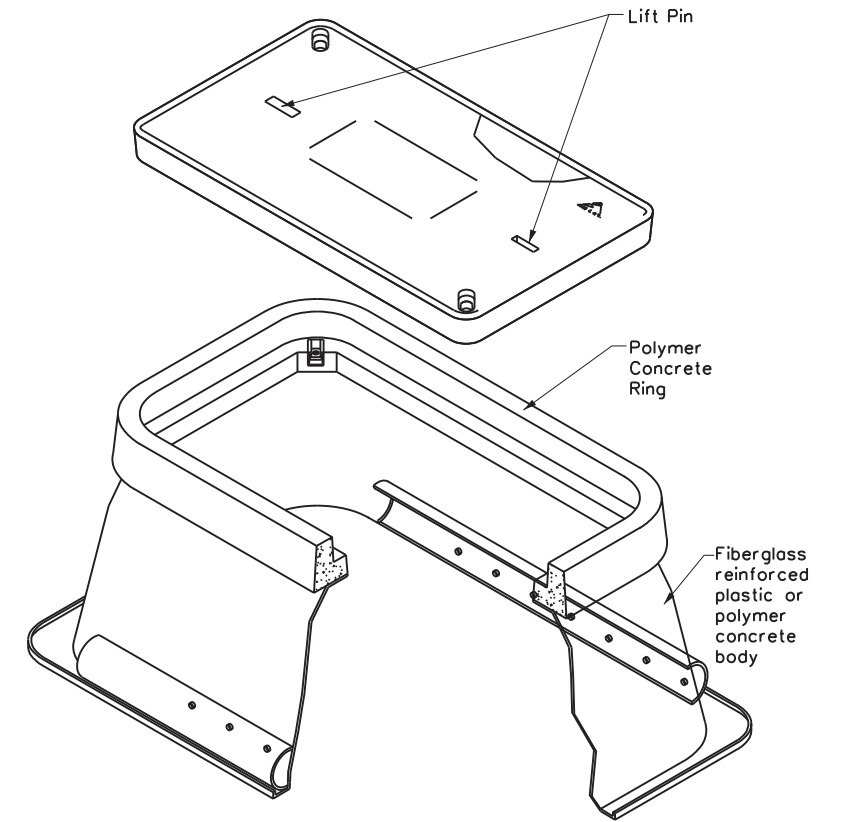
**BATTERY BOX TOP VIEW**



**SECTION X-X**



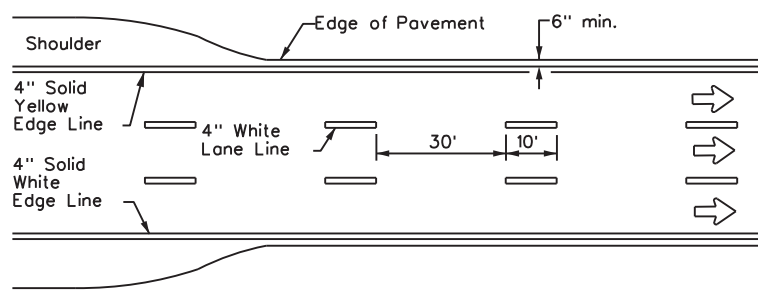
**SECTION Y-Y**



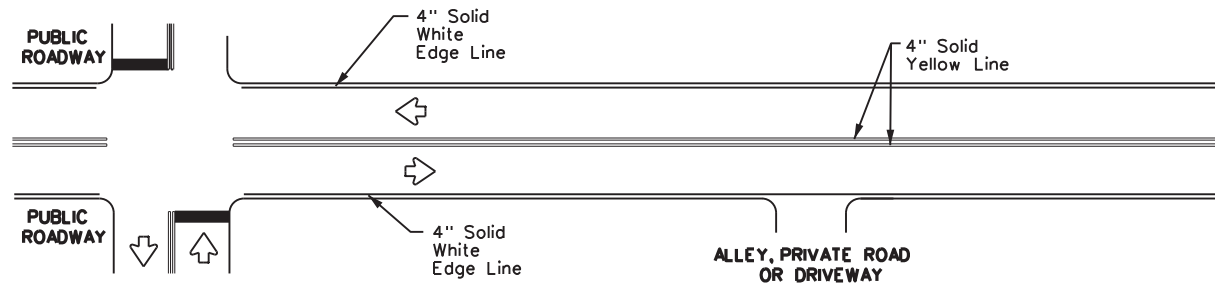
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<b>ELECTRICAL DETAILS BATTERY BOX GROUND BOXES</b>					
<b>ED(12)-14</b>					
FILE: ed12-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
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REVISIONS	0022	010	076	US90, etc.	
	DIST	COUNTY		SHEET NO.	
	22	VAL VERDE, etc.		71	

DATE: 6/24/2022 3:00:00 PM  
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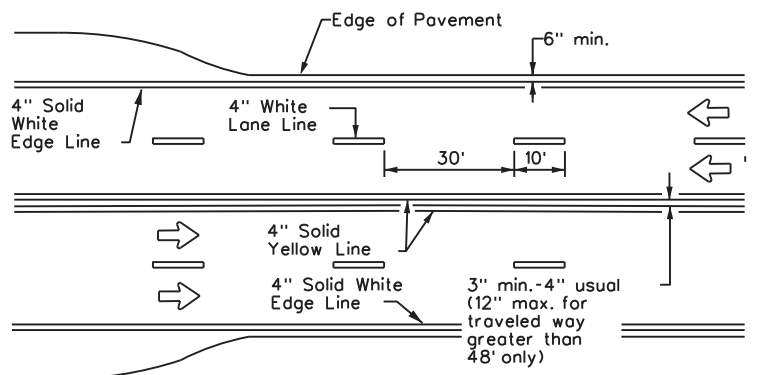
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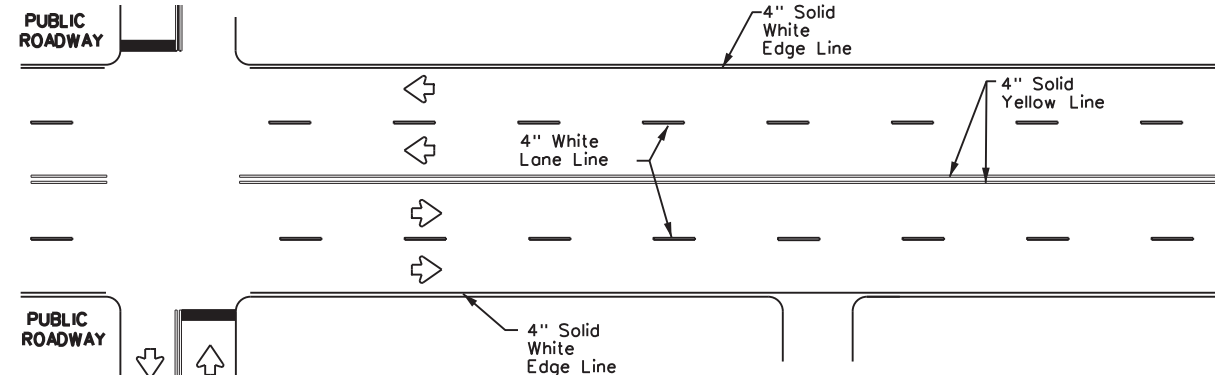
**EDGE LINE AND LANE LINES  
ONE-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



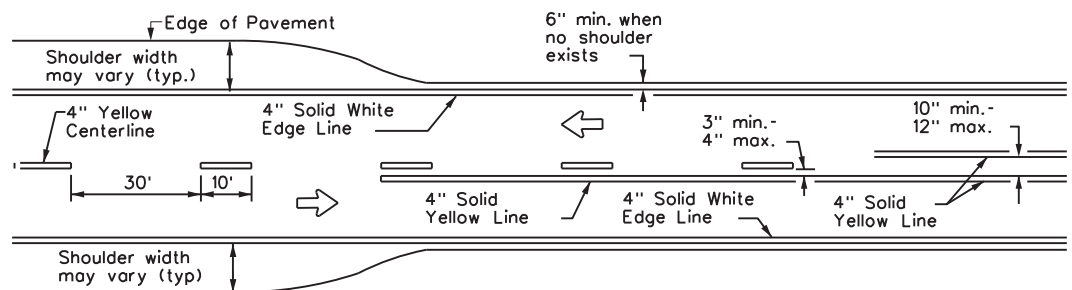
**TYPICAL TWO-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



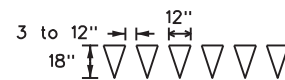
**CENTERLINE AND LANE LINES  
FOUR LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



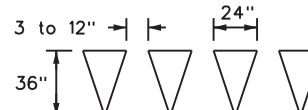
**TYPICAL MULTI-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



**TWO LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**

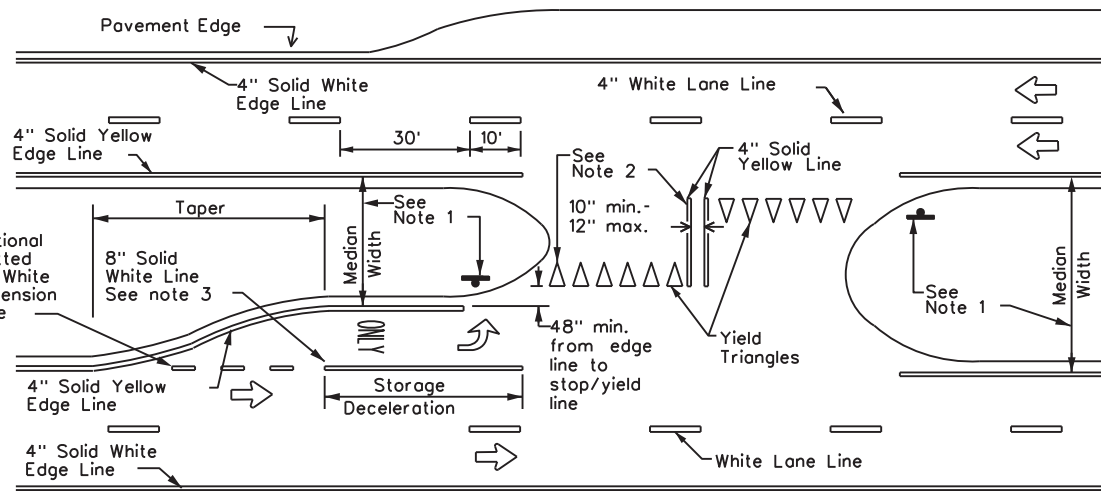


For posted speed on road being marked equal to or less than 40 MPH.



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

**YIELD LINES**



**FOUR LANE DIVIDED ROADWAY CROSSOVERS**

**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.

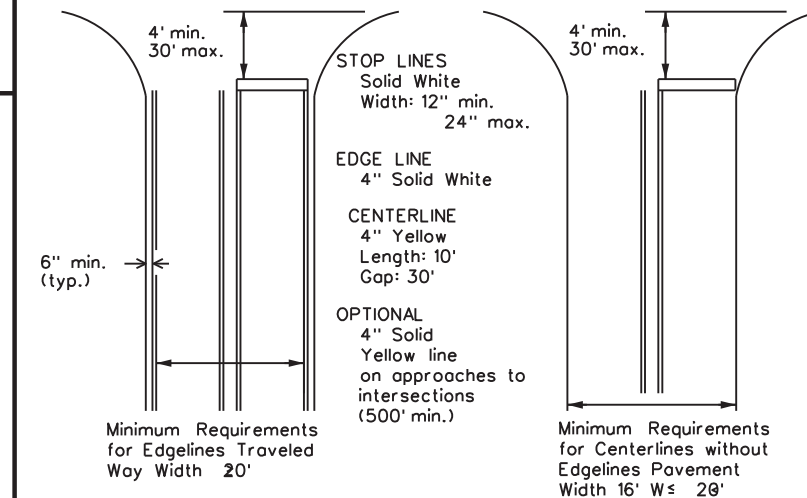
**GENERAL NOTES**

- 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**

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



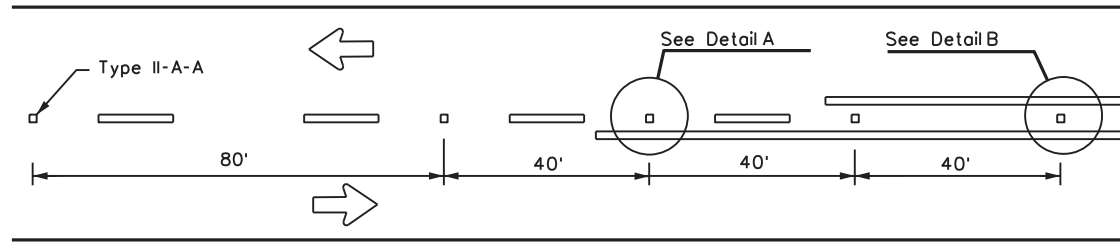
**TYPICAL STANDARD  
PAVEMENT MARKINGS**

**PM(1)-20**

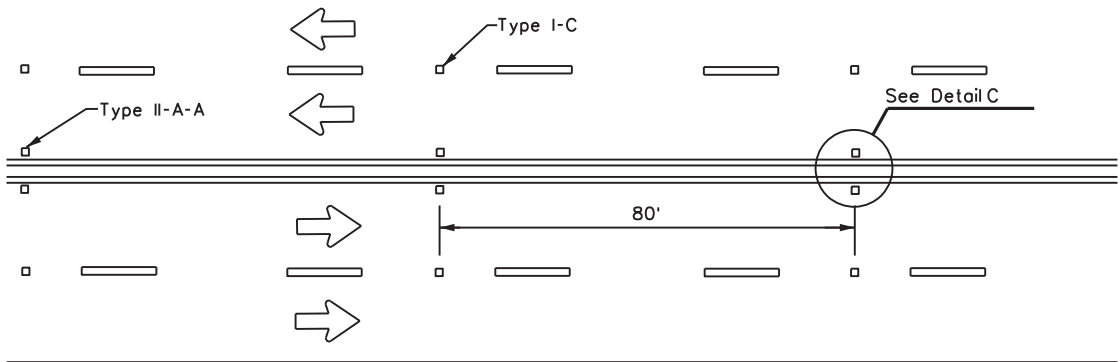
FILE: pml-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
8-95 3-03 REVISIONS	0022	010	076	US90, etc.
5-00 2-12	DIST	COUNTY	SHEET NO.	
8-00 6-20	22	VAL VERDE, etc.	72	



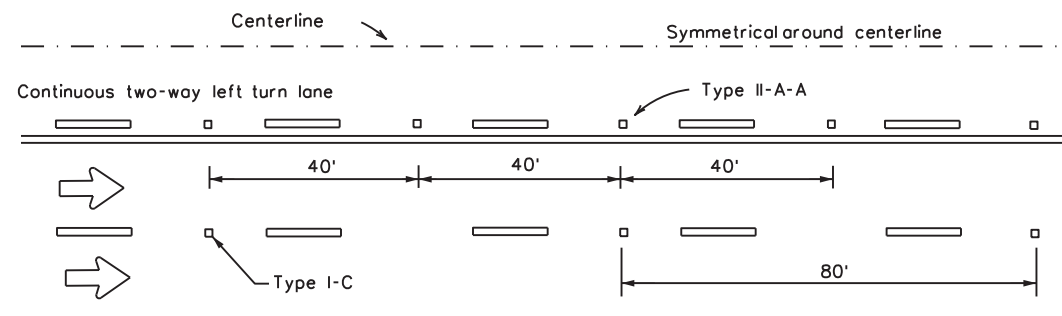
## REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



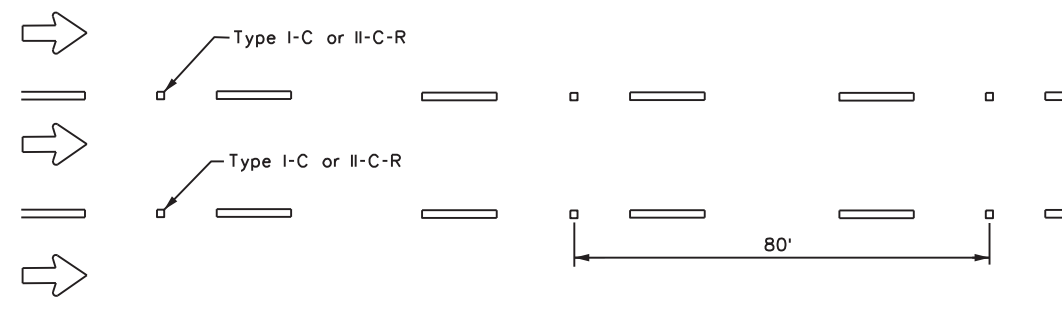
**CENTERLINE FOR ALL TWO LANE ROADWAYS**



**CENTERLINE & LANE LINES  
FOR FOUR LANE TWO-WAY HIGHWAYS**

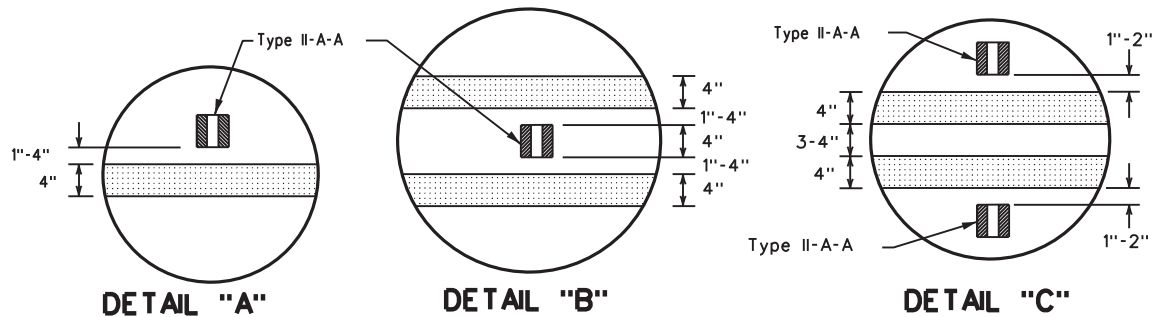


**CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE**



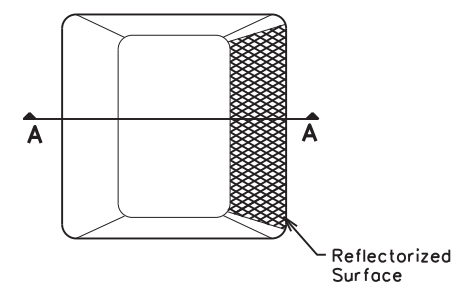
**LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)**

Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

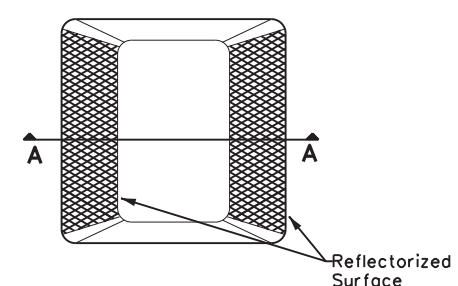


MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

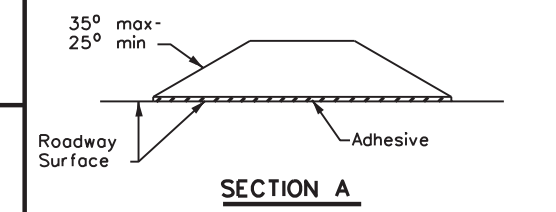
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



**Type I (Top View)**



**Type II (Top View)**



**SECTION A**

### RAISED PAVEMENT MARKERS

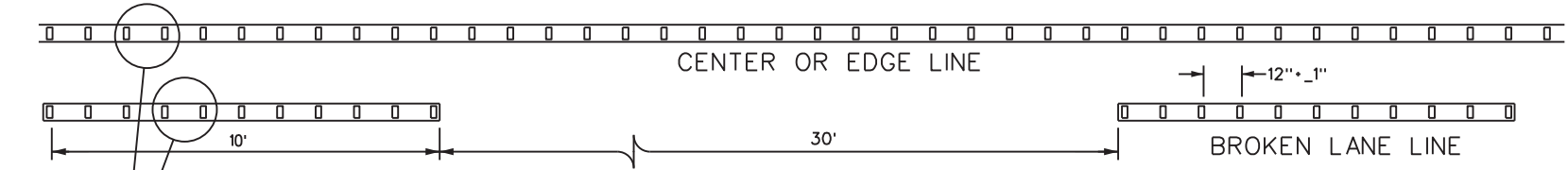


## POSITION GUIDANCE USING RAISED MARKERS REFLECTORIZED PROFILE MARKINGS PM(2)-20

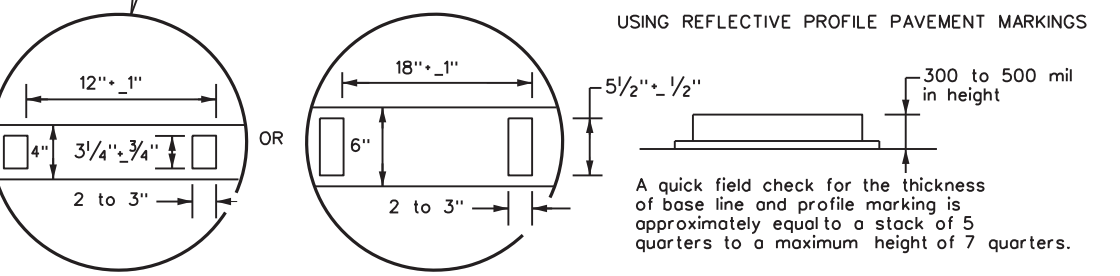
FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
4-92 2-10 REVISIONS	0022	010	076	US90, etc.
5-00 2-12	DIST	COUNTY	SHEET NO.	
8-00 6-20	22	VAL VERDE, etc.	73	

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DATE: 6/24/2022 3:00:00 PM  
FILE: pm2-20.dgn



**REFLECTORIZED PROFILE  
PATTERN DETAIL**  
USING REFLECTIVE PROFILE PAVEMENT MARKINGS

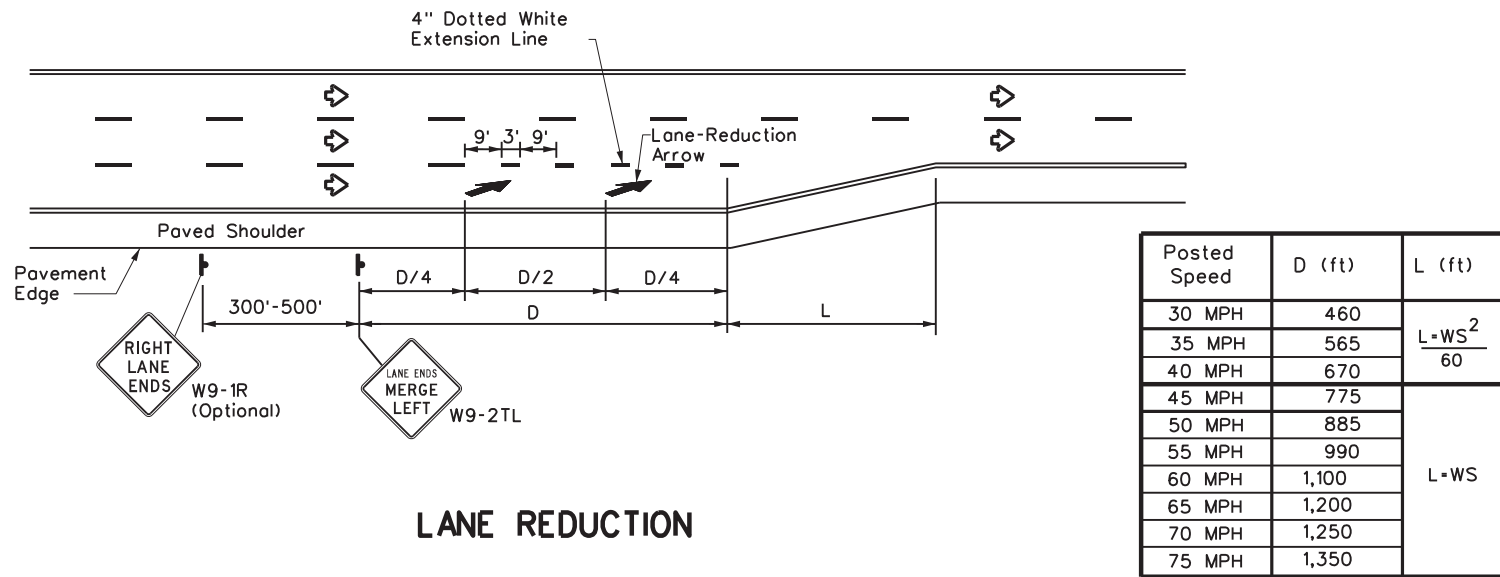


**NOTE**  
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

### GENERAL NOTES

- All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
- On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

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**LANE REDUCTION**

**NOTES**

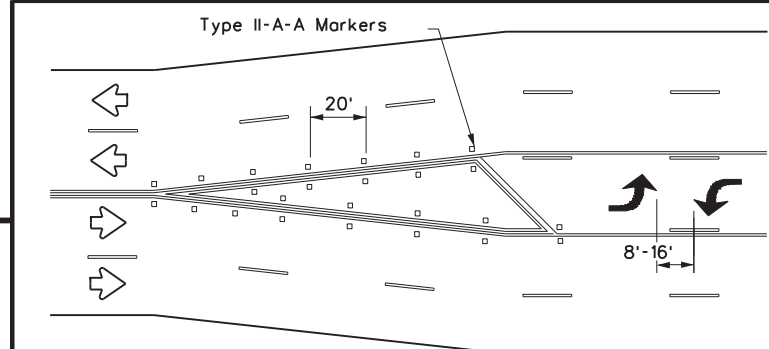
- Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
- On divided highways, an 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.

**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.

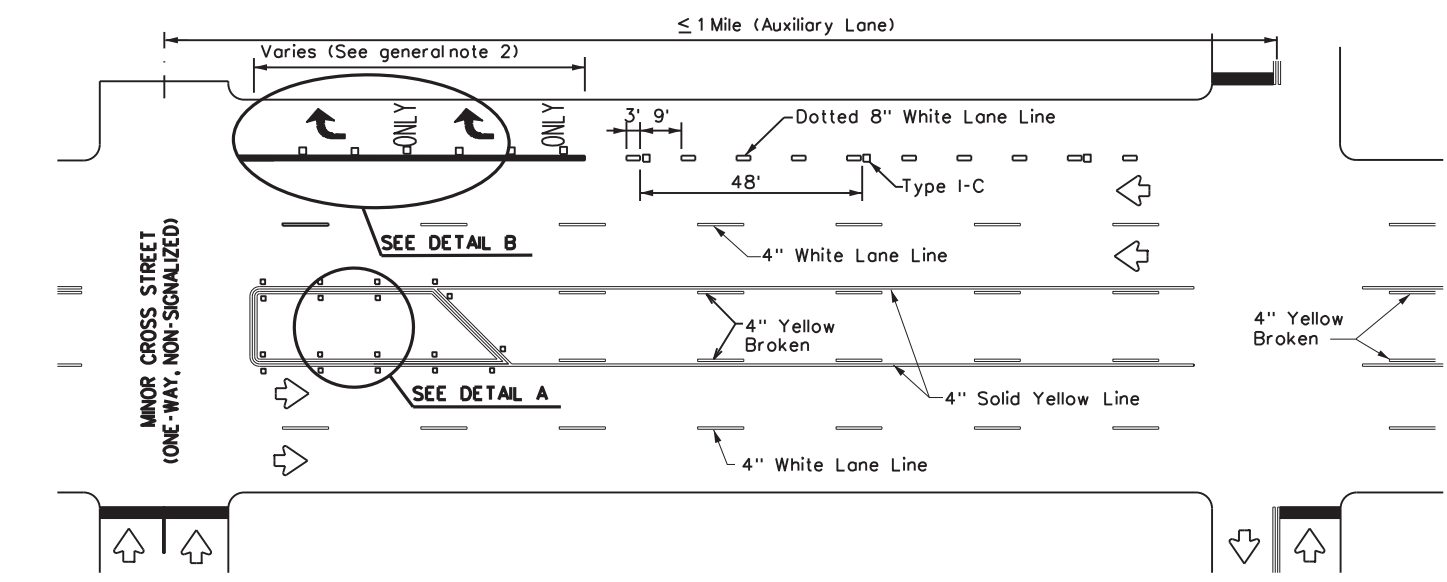
MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

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

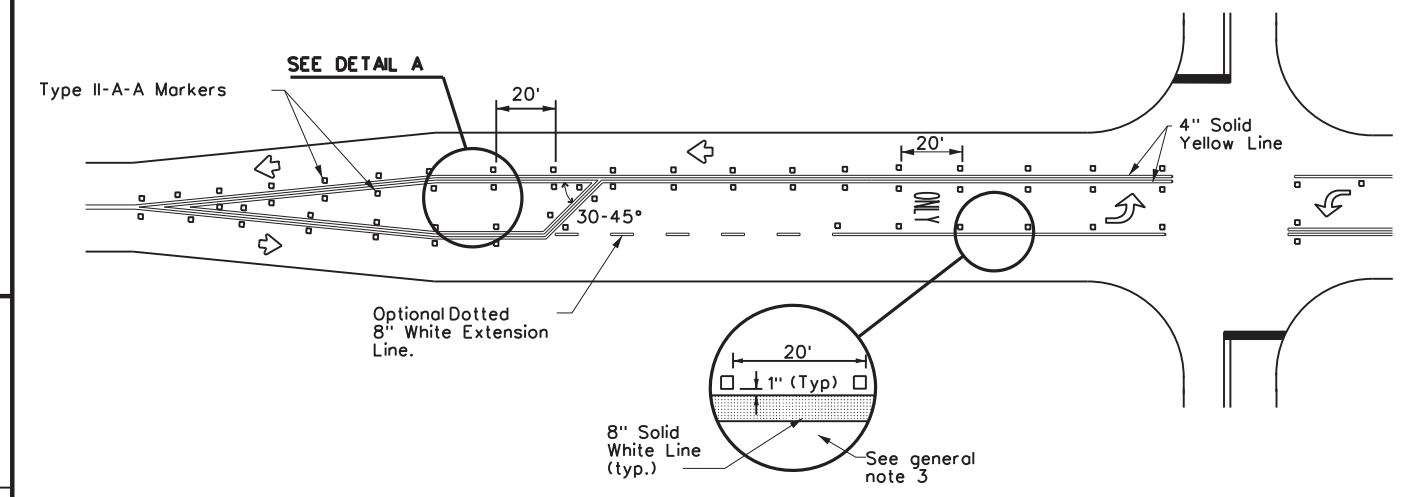


A two-way left-turn (TWLTL) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

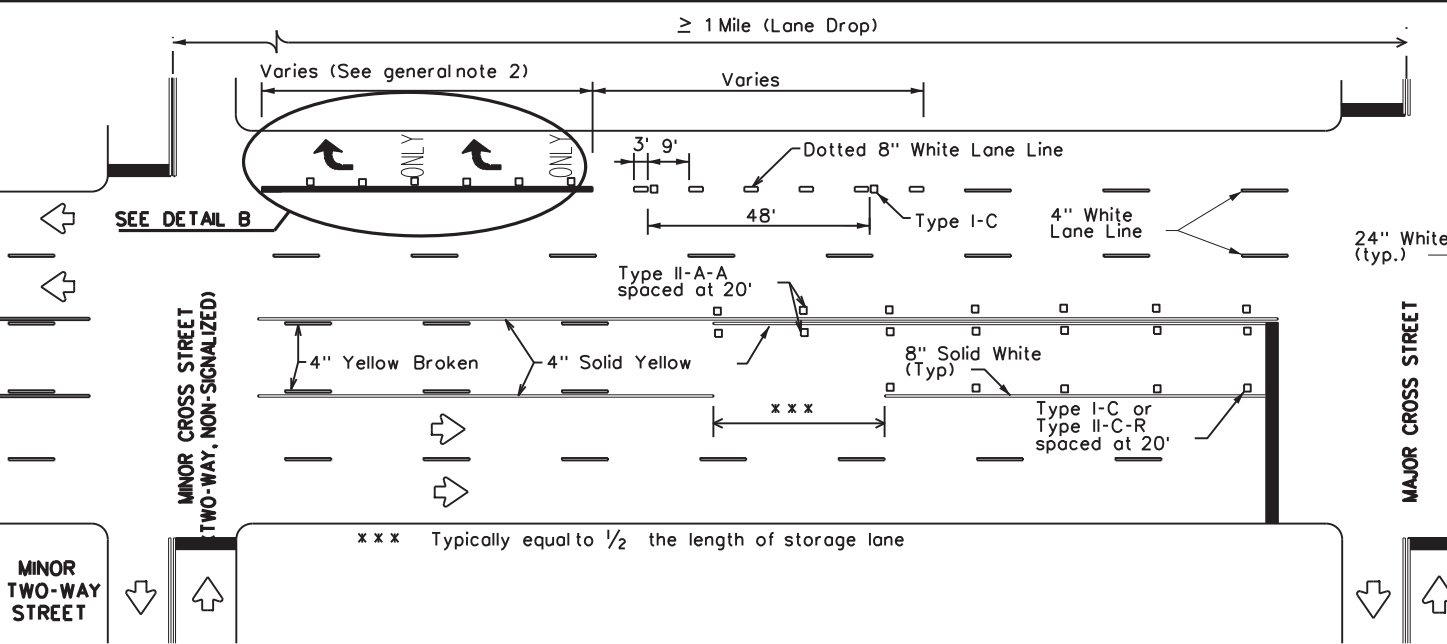
**TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY**



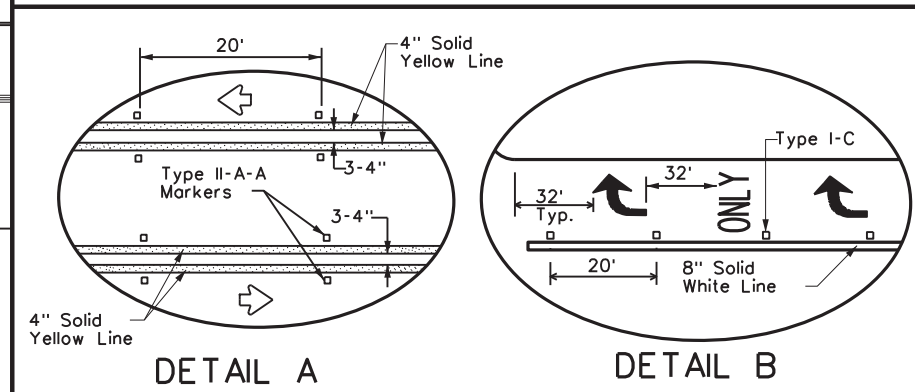
**TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE**



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



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



DETAIL A

DETAIL B

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: 0022	SECT: 010	JOB: 076	HIGHWAY: US90, etc.
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8-00 2-12			SHEET NO. 74	
3-03 6-20				

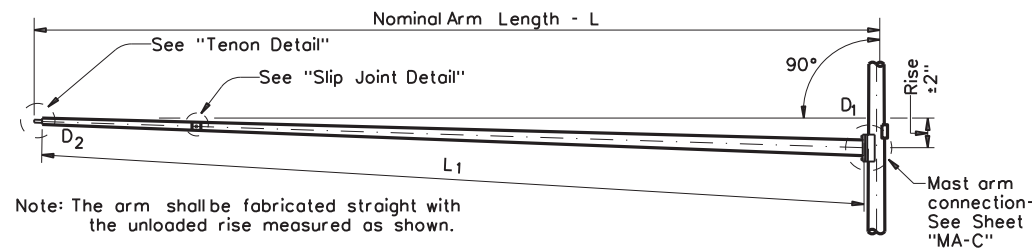
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Arm Length	ROUND POLES					POLYGONAL POLES					Foundation Type
	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	
ft.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
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

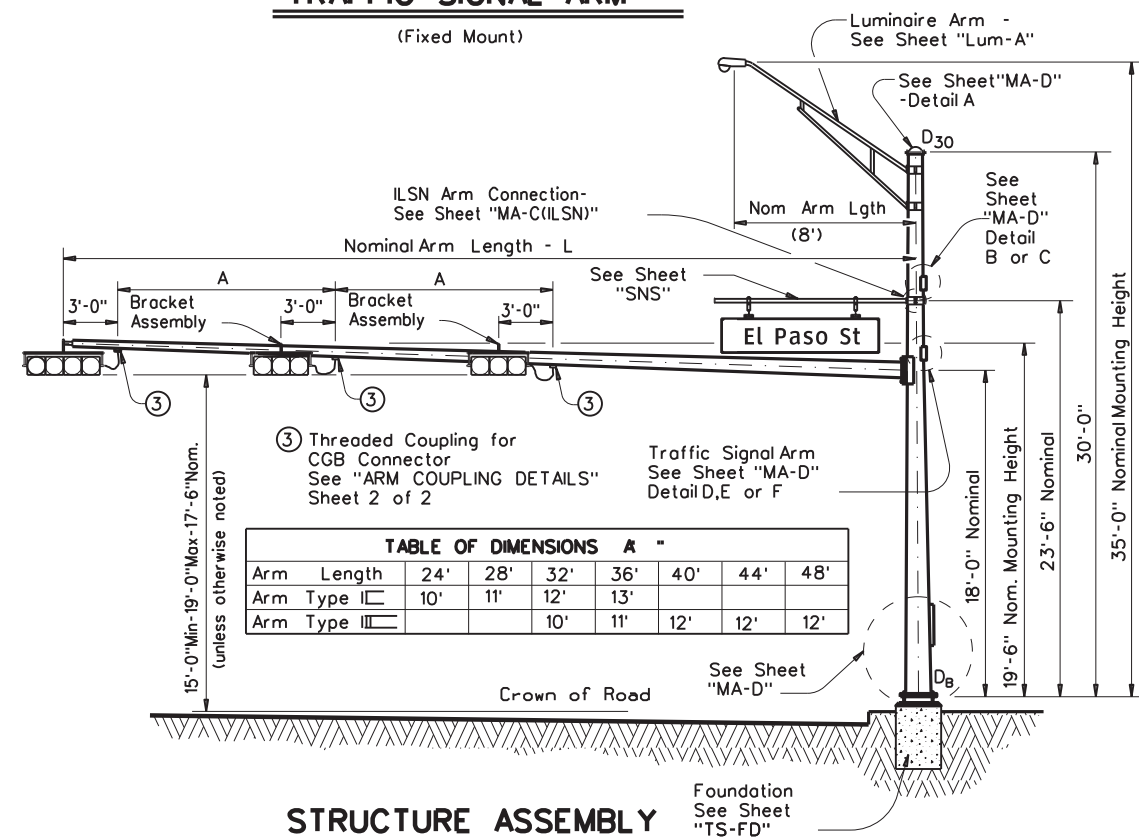
Arm Length	ROUND ARMS					POLYGONAL ARMS				
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	① thk	Rise	L <sub>1</sub>	D <sub>1</sub>	② D <sub>2</sub>	① thk	Rise
ft.	ft.	in.	in.	in.		ft.	in.	in.	in.	
20	19.1	6.5	3.8	.179	1'-9"	19.1	7.0	3.5	.179	1'-8"
24	23.1	7.5	4.3	.179	1'-10"	23.1	7.5	3.5	.179	1'-9"
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.



Note: The arm shall be fabricated straight with the unloaded rise measured as shown.

**TRAFFIC SIGNAL ARM**  
(Fixed Mount)



**STRUCTURE ASSEMBLY**

**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	
	Designation	Quantity	Designation	Quantity	Designation	Quantity
ft	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	
20	20L-80		20S-80		20-80	
24	24L-80		24S-80		24-80	
28	28L-80		28S-80		28-80	
32	32L-80		32S-80		32-80	
36	36L-80		36S-80		36-80	
40	40L-80		40S-80		40-80	
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)	
	Designation	Quantity	Designation	Quantity	Designation	Quantity
ft	1 CGB connector		1 Bracket Assembly and 2 CGB Connectors		2 Bracket Assemblies and 3 CGB Connectors	
20	20I-80					
24	24I-80		24II-80			
28	28I-80		28II-80			
32			32II-80		32III-80	
36			36II-80		36III-80	
40					40III-80	
44					44III-80	
48					48III-80	

Luminaire Arms (1 per 30' pole)

Nominal Arm Length	Quantity
8' Arm	

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 3/4"	3'-10"	

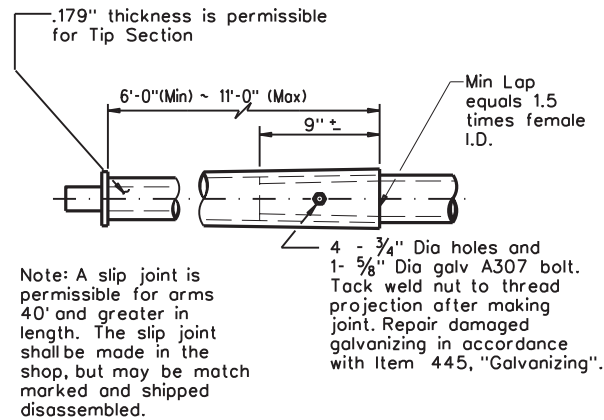
Each anchor bolt assembly consists of the following: Top and Bottom templates, 4 anchor bolts, 8 nuts, 8 flat washers, and 4 nut anchor devices (Type 2) per Standard Drawing "TS-FD".

Templates may be removed for shipment.

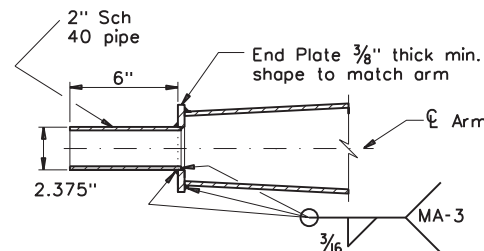
**TRAFFIC SIGNAL SUPPORT STRUCTURES**  
**SINGLE MAST ARM ASSEMBLY**  
**(80 MPH WIND ZONE)**  
**SMA-80(1)-12**

© TxDOT August 1995		DN: MS	CK: JSY	DW: MMF	CK: JSY
REVISIONS					
5-96	0022	010	076	US90, etc.	
11-99	DIST	COUNTY	SHEET NO.		
1-12	22	VAL VERDE, etc.			75

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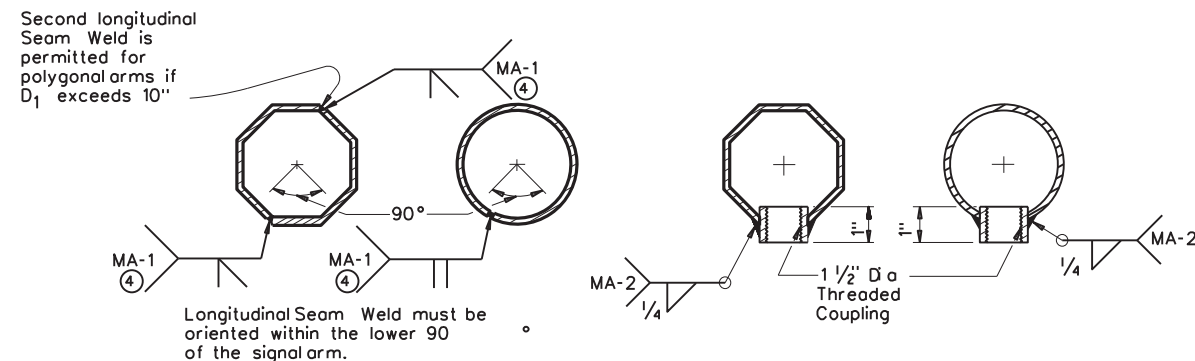
**SLIP JOINT DETAIL**



**TENON DETAIL**

Stainless steelbands (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**

**ARM COUPLING DETAILS**

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

**VIBRATION WARNING**

Most 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.

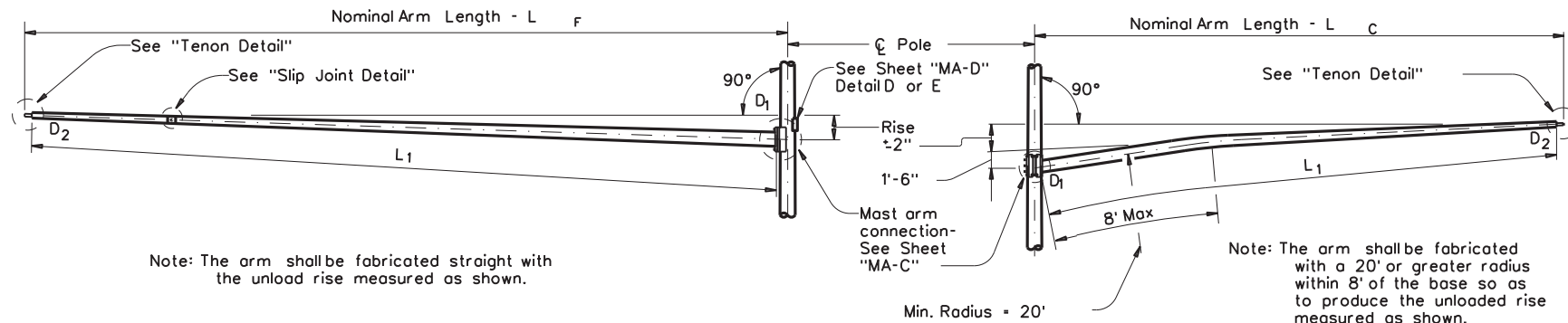
Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.



**TRAFFIC SIGNAL  
SUPPORT STRUCTURES  
SINGLE MAST ARM ASSEMBLY  
(80 MPH WIND ZONE)  
SMA-80(2)-12**

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5-96 1-12	REVISIONS	CONT	SECT	JOB
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		DIST	COUNTY	SHEET NO.
		22	VAL VERDE, etc.	76

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**FIXED MOUNT TRAFFIC SIGNAL ARM**

**CLAMP-ON TRAFFIC SIGNAL ARM**

**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. Designs are based on an arm included angle of 90 degrees or more. Angles of less than approximately 75 degrees will require a special design.

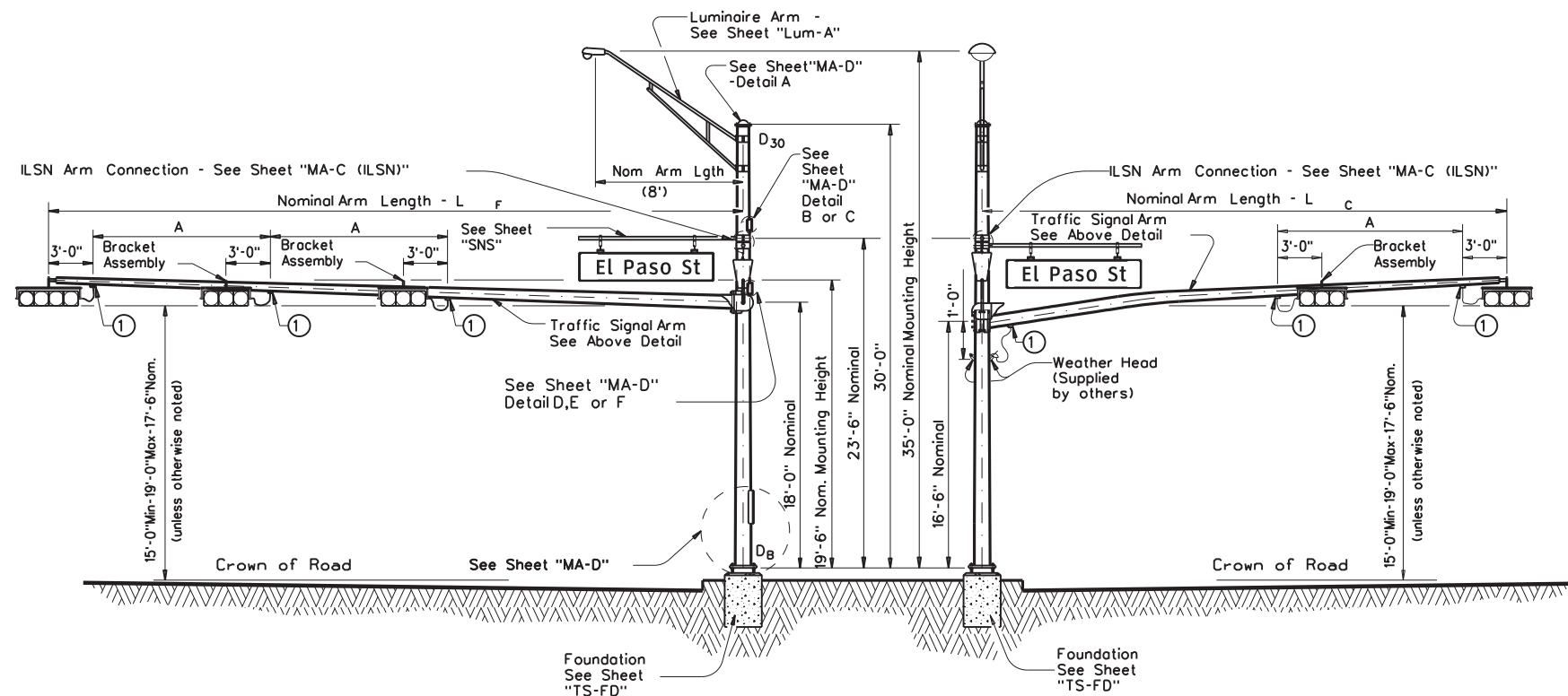
Poles are designed to support one 8'-0" luminaire arm, two 9'-0" internally lighted street name signs and two traffic signal arms with length combinations as tabulated. The specified luminaire load applied at the end of luminaire arm equals 60 lbs vertical dead load plus the horizontal wind load on an effective projected area of 1.6 sq ft. The specified internally lighted street name sign applied 4'-6" from the centerline of the pole equals 85 lbs vertical dead load plus the 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 material specifications. See "MA-C" for anchor bolt and foundation details.

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.



**ELEVATION**

(Showing fixed mount arm)

**STRUCTURE ASSEMBLY**

① Threaded Coupling for CGB Connector See "ARM COUPLING DETAILS" Sheet 2 of 3

**ELEVATION**

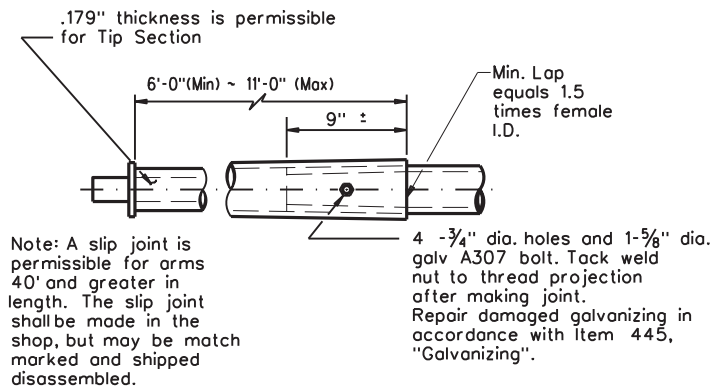
(Showing clamp mount arm)

TABLE OF DIMENSIONS "A"						
Arm Length	24'	28'	32'	36'	40'	44'
Arm Type I	10'	11'	12'	13'		
Arm Type II			10'	11'	12'	12'

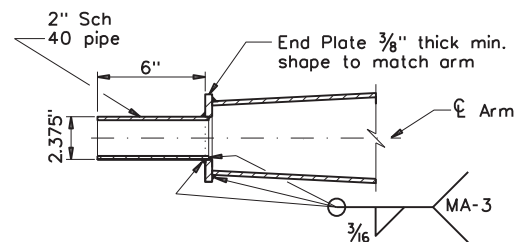
Texas Department of Transportation  
Traffic Operations Division  
**TRAFFIC SIGNAL SUPPORT STRUCTURES**  
**DUAL MAST ARM ASSEMBLY**  
**(80 MPH WIND ZONE)**  
**DMA-80 (1)-12**

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5-96 1-12	REVISIONS	CONT	SECT	JOB
		0022	010	076
		DIST	COUNTY	SHR. NO.
		22	VAL VERDE, etc.	77

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**SLIP JOINT DETAIL**



**TENON DETAIL**

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

**BRACKET ASSEMBLY**

**VIBRATION WARNING**

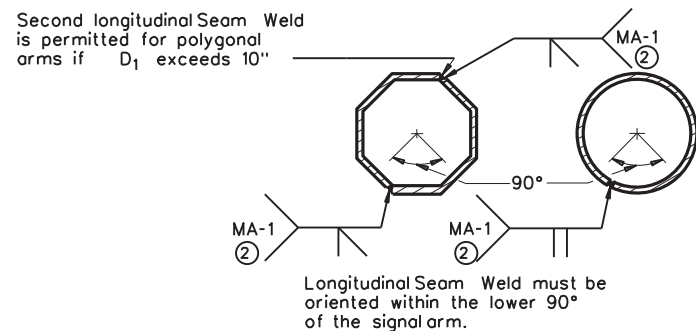
Most Arms of SMA and DMA structures and clamp-on Arms of LMA structures of approximately 40 ft or longer are subject to harmonic vertical vibrations in light wind conditions due to the aeroelastic characteristics of a few of the myriads of possible combinations of the following: signal numbers, weights 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 signalheads or, if they must be applied, they should be vented as a first and inexpensive measure to mitigate vibrations.

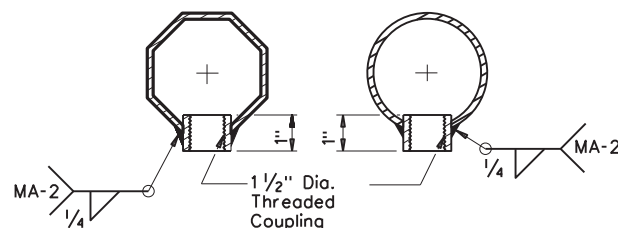
The traffic signalmast arms shall be visually inspected in 5 to 20 mph wind conditions after installation of signalheads and any attachments, including any required backplates. If vertical movements with a total excursion (maximum upward excursion to maximum downward excursion) of more than approximately 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.



**ARM WELD DETAIL**

- ② 60% Min. penetration
- 100% penetration within 6" of circumferential base welds.



**ARM COUPLING DETAILS**

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FILE: dma-80.dgn

**Texas Department of Transportation**  
 Traffic Operations Division  
**TRAFFIC SIGNAL SUPPORT STRUCTURES**  
**DUAL MAST ARM ASSEMBLY**  
**(80 MPH WIND ZONE)**  
**DMA-80 (2)-12**

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			0022	010	076
			DIST	COUNTY	
		22	VAL VERDE, etc.		SHEET NO. 78

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### 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		
	LF	Lc	See note above plus one (or two if ILSN attached) small hand hole, clamp-on simplex		See note above		
ft.	ft.	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20	2020L-80		2020S-80		2020-80	
24	24	2420L-80		2420S-80		2420-80	
24	24	2424L-80		2424S-80		2424-80	
28	20	2820L-80		2820S-80		2820-80	
28	24	2824L-80		2824S-80		2824-80	
28	28	2828L-80		2828S-80		2828-80	
32	20	3220L-80		3220S-80		3220-80	
32	24	3224L-80		3224S-80		3224-80	
32	28	3228L-80		3228S-80		3228-80	
32	32	3232L-80		3232S-80		3232-80	
36	20	3620L-80		3620S-80		3620-80	
36	24	3624L-80		3624S-80		3624-80	
36	28	3628L-80		3628S-80		3628-80	
36	32	3632L-80		3632S-80		3632-80	
36	36	3636L-80		3636S-80		3636-80	
40	20	4020L-80		4020S-80		4020-80	
40	24	4024L-80		4024S-80		4024-80	
40	28	4028L-80		4028S-80		4028-80	
40	32	4032L-80		4032S-80		4032-80	
40	36	4036L-80		4036S-80		4036-80	
44	20	4420L-80		4420S-80		4420-80	
44	24	4424L-80		4424S-80		4424-80	
44	28	4428L-80		4428S-80		4428-80	
44	32	4432L-80		4432S-80		4432-80	
44	36	4436L-80		4436S-80		4436-80	

Traffic Signal Arms (Fixed Mount) (1 per pole) Ship each arm w/ 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			
32			32II-80		32III-80	
36			36II-80		36III-80	
40					40III-80	
44					44III-80	

Traffic Signal Arms (Clamp-On Mount) (1 per pole) Ship each arm w/ the listed equipment attached

Nominal Arm Length	Type I Arm (1 Signal)		Type II Arm (2 Signals)		Type III Arm (3 Signals)	
	2 CGB connector and 1 clamp w/bolts and washers		1 Bracket Assembly, 3 CGB Connectors, and 1 clamp w/bolts and washers		2 Bracket Assemblies, 4 CGB Connectors, and 1 clamp w/bolts and washers	
ft.	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20I-80					
24	24I-80		24II-80			
28	28I-80		28II-80			
32			32II-80		32III-80	
36			36II-80		36III-80	

Luminaire Arms (1 per 30' pole)

Nominal Arm Length	Quantity
8' Arm	

ILSN Arm (1 or 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 3/4"	3'-10"	
2"	4'-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.


ARMS		ROUND POLES					POLYGONAL POLES					Foundation Type
LF	Lc	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	③ thk	D <sub>B</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	③ thk	
ft.	ft.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
20	20	11.5	8.8	8.1	7.3	.179	12.5	9.5	8.7	7.8	.179	30-A
24	20	12.0	9.3	8.6	7.8	.179	13.0	10.0	9.2	8.3	.179	30-A
24	24	12.0	9.3	8.6	7.8	.179	13.0	10.0	9.2	8.3	.239	30-A
28	20	12.5	9.8	9.1	8.3	.179	12.0	9.0	8.2	7.3	.239	30-A
28	24	12.5	9.8	9.1	8.3	.179	12.0	9.0	8.2	7.3	.239	30-A
28	28	13.0	10.3	9.6	8.8	.179	12.5	9.5	8.7	7.8	.239	30-A
32	20	13.0	10.3	9.6	8.8	.179	12.5	9.5	8.7	7.8	.239	30-A
32	24	13.0	10.3	9.6	8.8	.179	12.5	9.5	8.7	7.8	.239	30-A
32	28	12.0	9.3	8.6	7.8	.239	13.0	10.0	9.2	8.3	.239	30-A
32	32	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
36	20	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
36	24	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
36	28	12.5	9.8	9.1	8.3	.239	13.5	10.5	9.7	8.8	.239	36-A
36	32	12.5	9.8	9.1	8.3	.239	13.5	10.5	9.7	8.8	.239	36-A
36	36	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
40	20	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
40	24	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
40	28	13.0	10.3	9.6	8.8	.239	14.0	11.0	10.2	9.3	.239	36-A
40	32	13.0	10.3	9.6	8.8	.239	15.0	12.0	11.2	10.3	.239	36-A
40	36	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
44	20	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
44	24	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
44	28	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
44	32	14.0	11.3	10.6	9.8	.239	15.5	12.5	11.7	10.8	.239	36-B
44	36	14.0	11.3	10.6	9.8	.239	15.5	12.5	11.7	10.8	.239	36-B

Arm L <sub>F</sub> or L <sub>C</sub>	ROUND ARMS					POLYGONAL ARMS				
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	③ thk	Rise	L <sub>1</sub>	D <sub>1</sub>	④ D <sub>2</sub>	③ 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"

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<sub>F</sub> = Fixed Arm Length  
 L<sub>C</sub> = Clamp-on Arm Length (36' Max)

③ Thickness shown are minimums, thicker materials may be used.  
 ④ D<sub>2</sub> may be increased by up to 1.0" for polygonal arms.

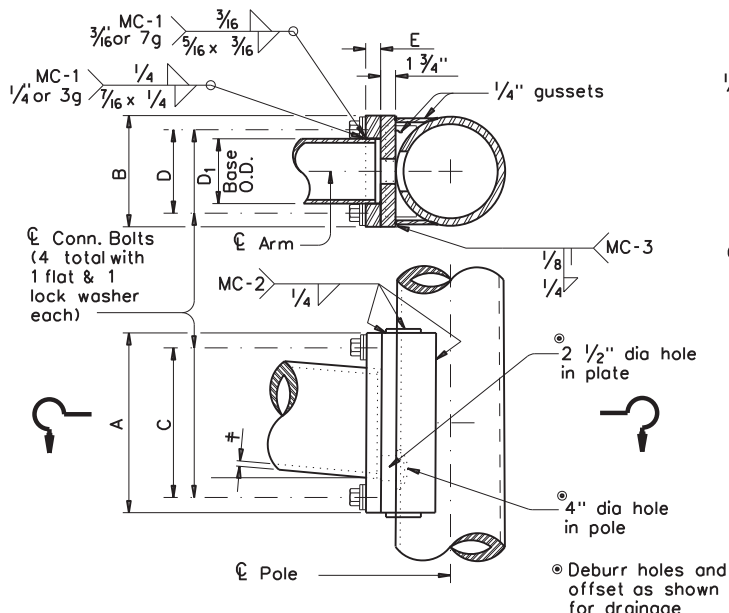

**Texas Department of Transportation**  
 Traffic Operations Division  
**TRAFFIC SIGNAL SUPPORT STRUCTURES**  
**DUAL MAST ARM ASSEMBLY**  
**(80 MPH WIND ZONE)**  
**DMA-80 (3)-12**

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DIST	COUNTY		SHEET NO.	
22	VAL VERDE, etc.		79	

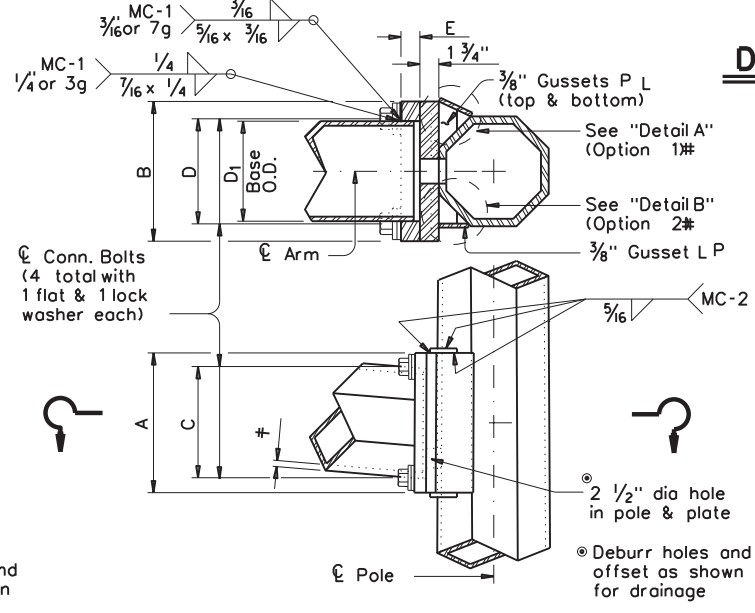
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ARM SIZE		A	B	C	D	E	CONN BOLT DIA
D <sub>1</sub>	φ	in.	in.	in.	in.	in.	in.
6.5	.179	12	9	9	6	1 3/4	1
7.5	.179	13	9	10	6	1 3/4	1
8.0	.179	14	10	11	7	2	1 1/4
9.0	.179	16	11	13	8	2	1 1/4
9.5	.179	17	12	14	9	2	1 1/4
9.5	.239	18	12	15	9	2	1 1/4
10.0	.239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

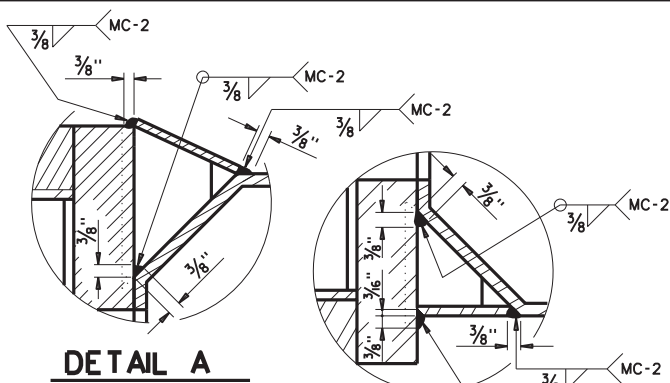
ARM SIZE		A	B	C	D	E	CONN BOLT DIA
D <sub>1</sub>	φ	in.	in.	in.	in.	in.	in.
7.0	.179	11	11	8	8	1 3/4	1 1/4
7.5	.179	11	11	8	8	1 3/4	1 1/4
8.0	.179	11	11	8	8	2	1 1/4
9.0	.179	13	13	10	10	2	1 1/4
10.0	.179	13	13	10	10	2	1 1/4
9.5	.239	13	13	10	10	2	1 1/4
10.0	.239	14	14	11	11	2	1 1/2
11.0	.239	14	14	11	11	3	1 1/2
11.5	.239	14	14	11	11	3	1 1/2



**FIXED MOUNT DETAIL 1**

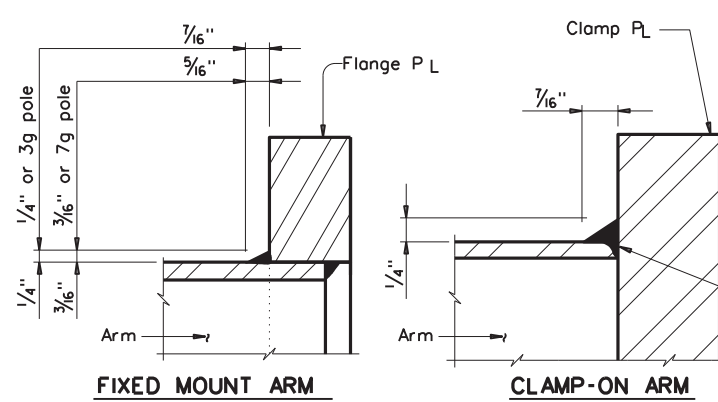


**FIXED MOUNT DETAIL 2**



**DETAIL A**

**DETAIL B**



**FIXED MOUNT ARM CLAMP-ON ARM**

**ARM BASE WELD DETAILS**

MATERIALS	
Round Shafts or Polygonal Shafts ①	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 ②
Plates ①	ASTM A36, A588, or A572 Gr.50
Connection Bolts	ASTM A325 or A449, except where noted
Pin Bolts	ASTM A325
Pipe ①	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 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 most arm assemblies and for the first arm on dual most 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.

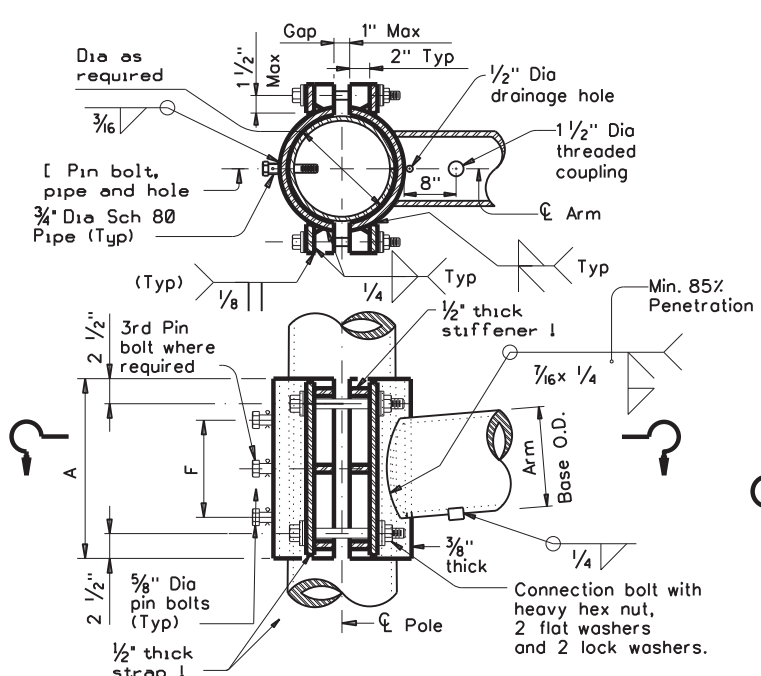
**NOTE:**

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.

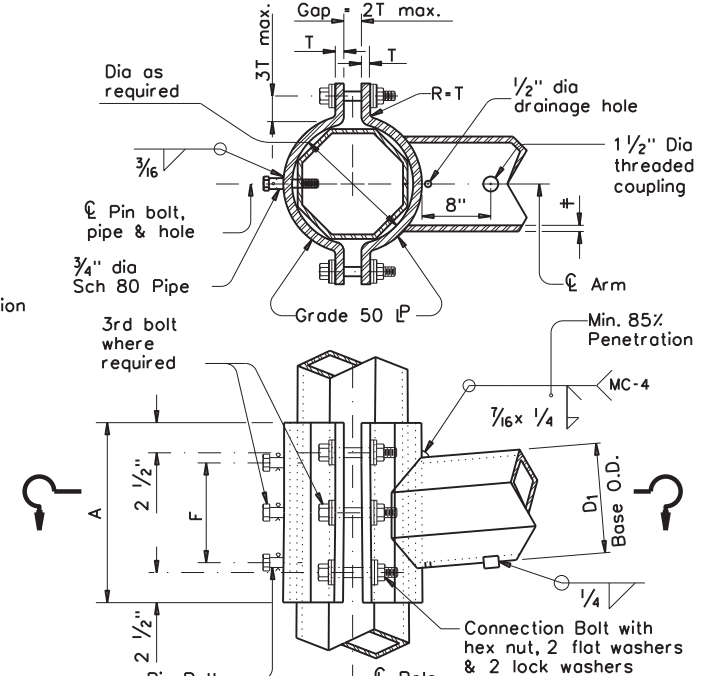
ARM SIZE		A	F	CONN. BOLTS	PIN BOLTS
D <sub>1</sub>	φ	in.	in.	No. Dia	No. Dia
6.5	.179	12	6	4 1/2	2 5/8
7.5	.179	14	8	4 1/2	2 5/8
8.0	.179	14	8	4 1/2	2 5/8
9.0	.179	16	10	4 1/2	2 5/8
9.5	.179	18	12	4 1/4	3 5/8
9.5	.239	18	12	4 1/4	3 5/8
10.0	.239	18	12	4 1/4	3 5/8

ARM SIZE		A	F	T	CONN. BOLTS	PIN BOLTS
D <sub>1</sub>	φ	in.	in.	in.	No. Dia	No. Dia
7.0	.179	12	6	3/4	4 3/4	2 5/8
7.5	.179	14	8	3/4	4 3/4	2 5/8
8.0	.179	14	8	3/4	4 3/4	2 5/8
9.0	.179	16	10	7/8	4 1/2	2 5/8
10.0	.179	18	10	7/8	4 1/2	2 5/8
9.5	.239	18	10	1	6 1/2	3 5/8
10.0	.239	18	10	1	6 1/2	3 5/8

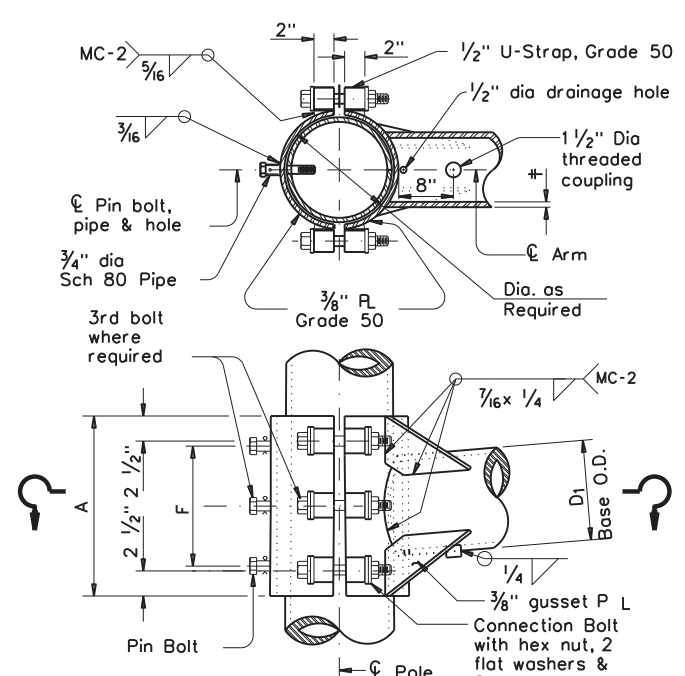
ARM SIZE		A	F	CONN. BOLTS	PIN BOLTS
D <sub>1</sub>	φ	in.	in.	No. Dia	No. Dia
6.5	.179	12	6	4 1/2	2 5/8
7.5	.179	14	8	4 1/2	2 5/8
8.0	.179	14	8	4 1/2	2 5/8
9.0	.179	16	10	4 1/2	2 5/8
9.5	.179	18	12	6 1/2	3 5/8
9.5	.239	18	12	6 1/2	3 5/8
10.0	.239	18	12	6 1/2	3 5/8



**CLAMP-ON DETAIL 1**



**CLAMP-ON DETAIL 2**



**CLAMP-ON DETAIL 3**

DATE: 6/24/2022 3:00:02 PM FILE: moc.dgn

**Texas Department of Transportation**  
Traffic Operations Division

**STANDARD ASSEMBLY FOR TRAFFIC SIGNAL SUPPORT STRUCTURES**

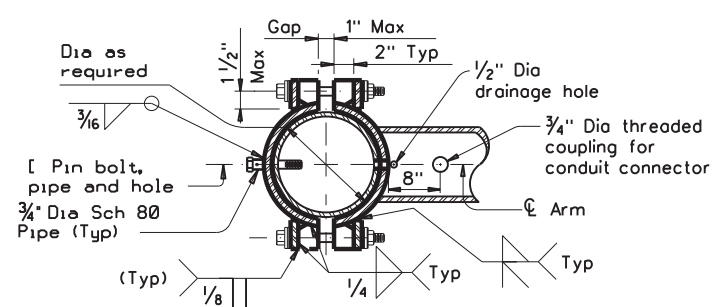
**MA-C-12**

© TxDOT August 1995		DN: MS	CK: JSY	DW: MMF	CK: JSY
REVISIONS		CONT	SECT	JOB	HIGHWAY
5-96 5-09 1-12		0022	010	076	US90, etc.
		DIST	COUNTY		SHEET NO.
		22	VAL VERDE, etc.		80

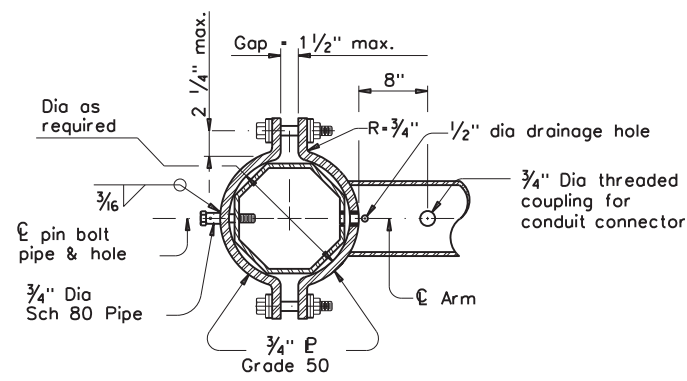


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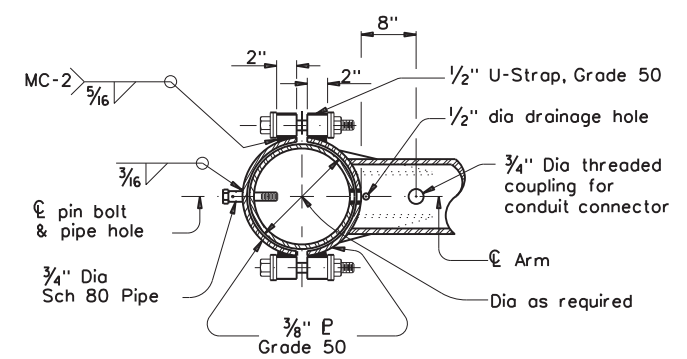
TABLE OF DIMENSIONS for ILSN Support Arm Clamp-on Details 1, 2 and 3						
ILSN ARM SIZE	A	F	CONN. BOLTS		PIN BOLTS	
	in.	in.	No.	Dia	No.	Dia
3 in. dia Schedule 40 Pipe	10	4	4	3/4	2	5/8



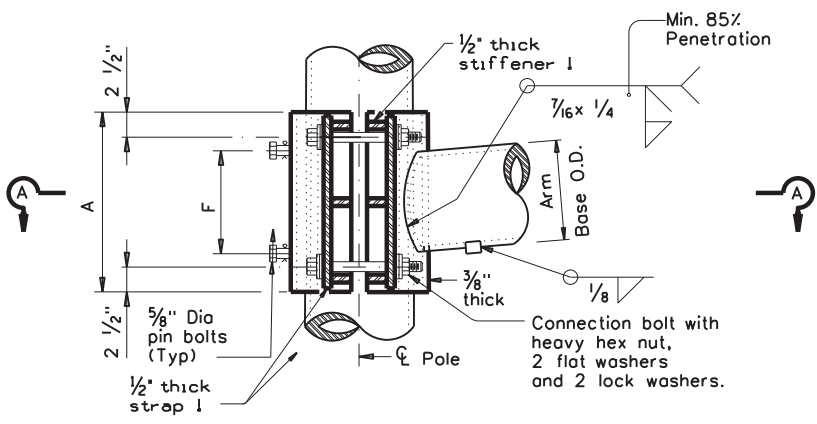
**SECTION A-A**



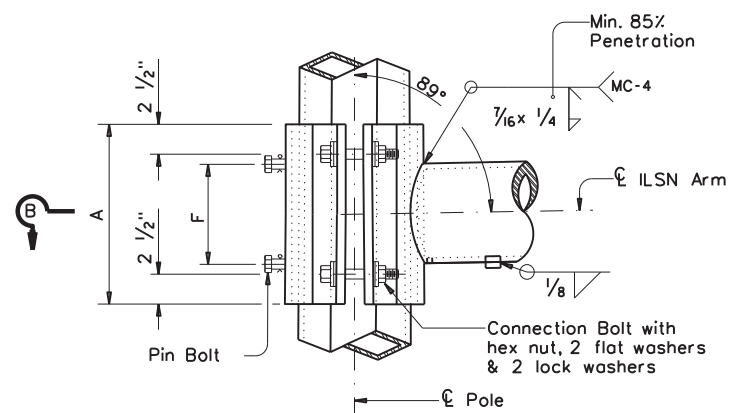
**SECTION B-B**



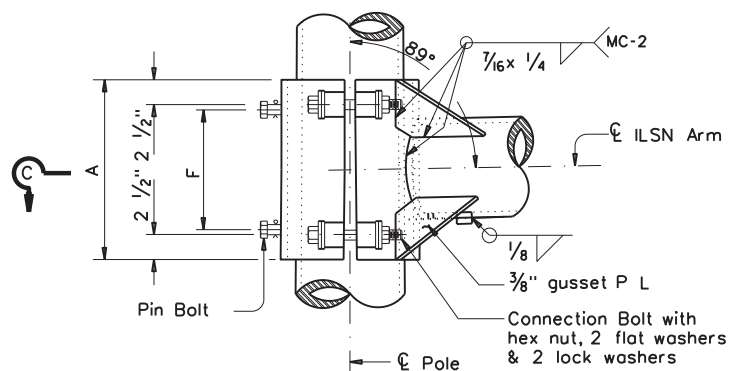
**SECTION C-C**



**ILSN CLAMP-ON DETAIL 1**



**ILSN CLAMP-ON DETAIL 2**



**ILSN CLAMP-ON DETAIL 3**

**GENERAL NOTES:**

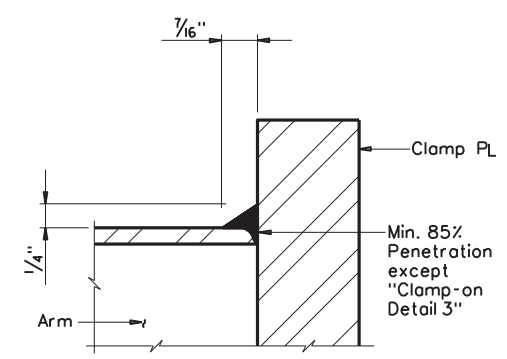
Clamp-on details shall be used for ILSN support arm assemblies. A 1 1/2 inch diameter hole shall be cut in the front clamp plate for wiring access. A matched hole shall be field drilled through the pole to provide wire access after arm is oriented. Deburr both holes.

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

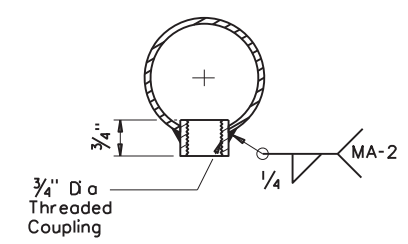
Pin bolts are required to prevent rotation of clamp-on arms under design wind forces.

**NOTE:**

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



**CLAMP-ON ARM**



**ILSN ARM COUPLING DETAIL**

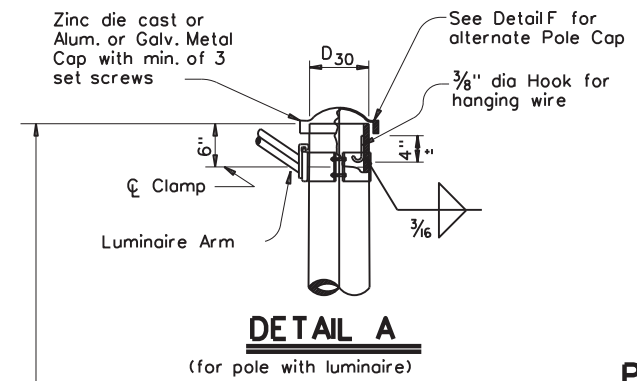
**ARM BASE WELD DETAILS**

Texas Department of Transportation  
 Traffic Operations Division  
**STANDARD ASSEMBLY  
 FOR TRAFFIC SIGNAL  
 SUPPORT STRUCTURES**  
 MAST-ARM CONNECTIONS  
**MA-C(ILSN)-12**

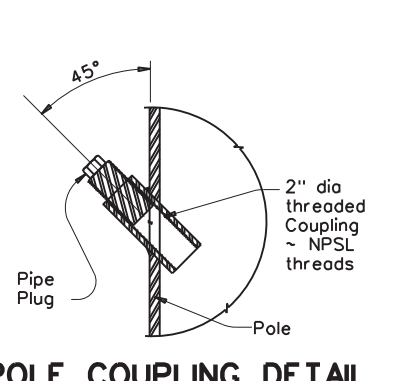
© TxDOT August 1995		DN: MS	CK: JSY	DW: MMF	CK: JSY
REVISIONS					
5-96	0022	010	076	HIGHWAY	
1-12	DIST		COUNTY	SHEET NO.	
	22	VAL VERDE, etc.		81	

DATE: 6/24/2022 3:00:02 PM  
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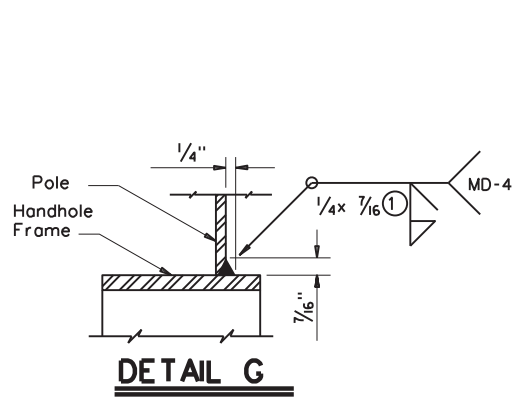
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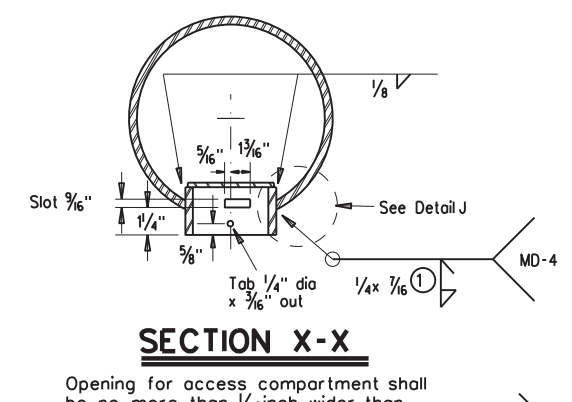
**DETAIL A**  
(for pole with luminaire)



**POLE COUPLING DETAIL**

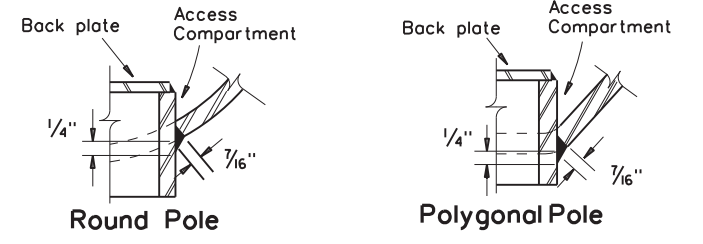


**DETAIL G**

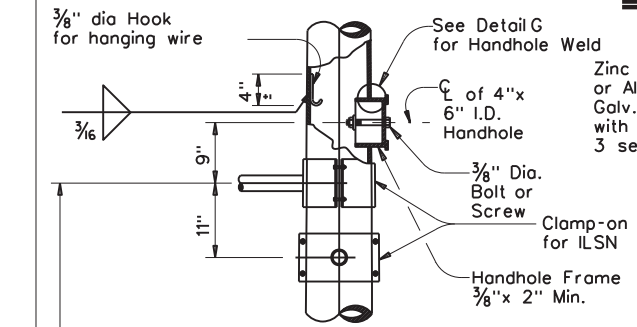


**SECTION X-X**

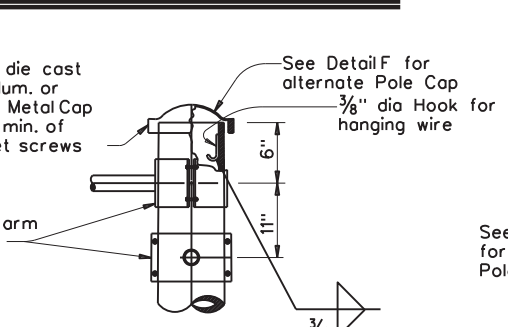
Opening for access compartment shall be no more than 1/16 inch wider than the access compartment itself.



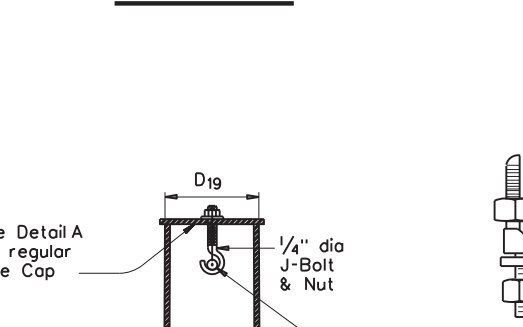
**DETAIL J**



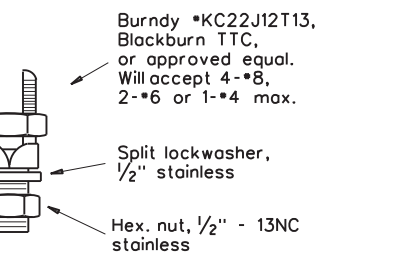
**DETAIL B**  
(if ILSN applied)



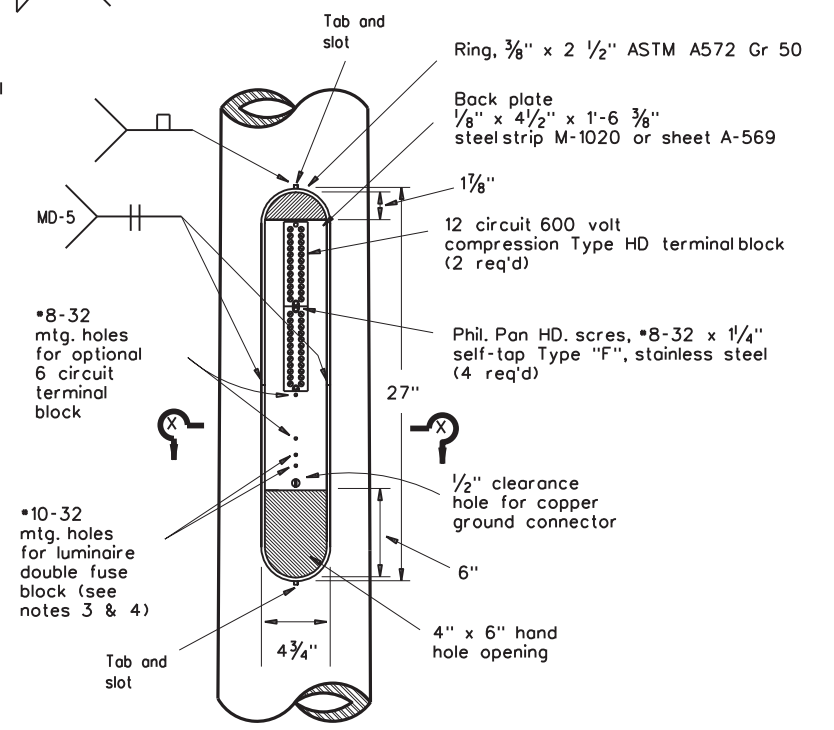
**DETAIL C**



**SECTION Y-Y**



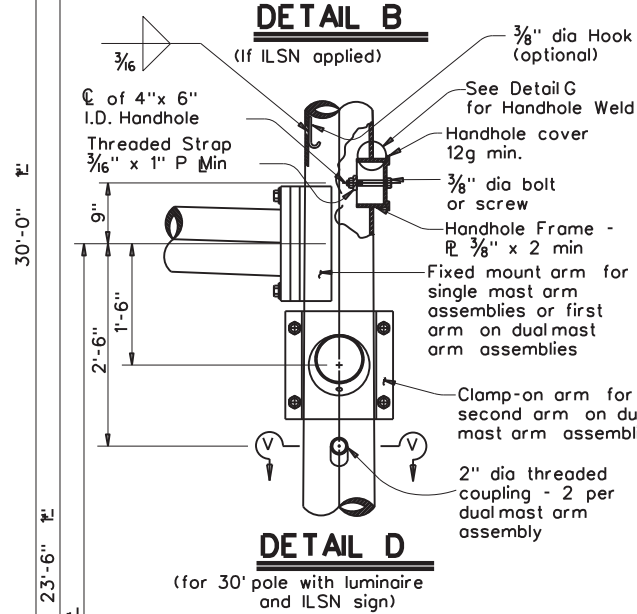
**COPPER GROUND CONNECTOR**



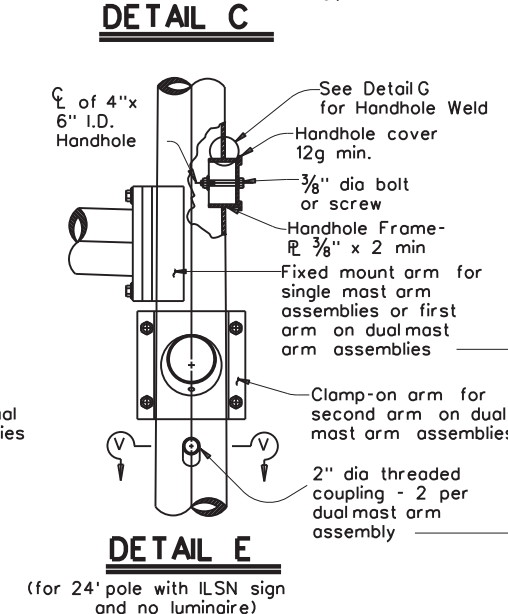
**ACCESS COMPARTMENT**

**NOTES:**

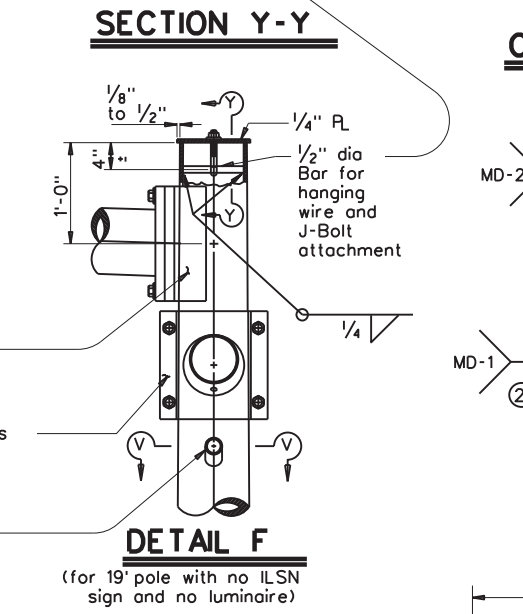
- The cover shall be one piece formed from ABS plastic, shall be a pearl gray color, and shall be suitable for exposure to harsh sunlight and extreme weather. Cover shall latch with two screw latches and shall fit tightly to the enclosure ring to create a rainproof seal. Latch screws shall be 1/4-20 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 1/4" 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.



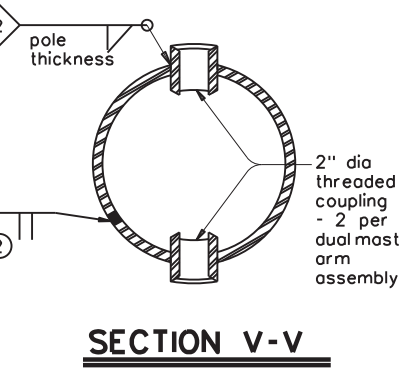
**DETAIL D**  
(for 30" pole with luminaire and ILSN sign)



**DETAIL E**  
(for 24" pole with ILSN sign and no luminaire)

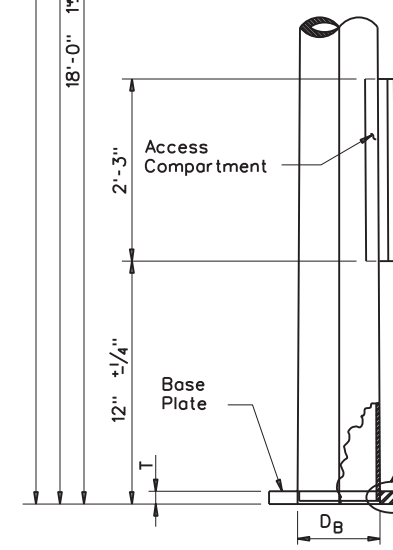


**DETAIL F**  
(for 19" pole with no ILSN sign and no luminaire)

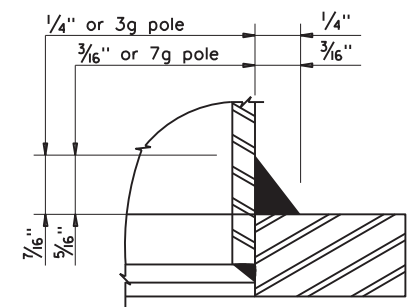


**SECTION V-V**

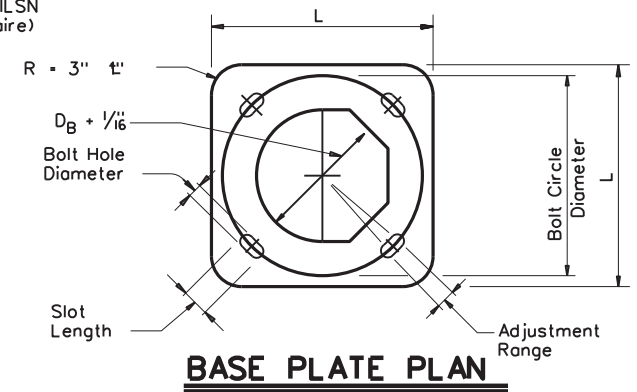
Anchor Bolt Diameter	Bolt Hole Diameter	Slot Length	Bolt Circle Diameter	Base PL Dim. L x T	Adjust. Range
1 1/2"	1 3/4"	3 1/2"	17"	18" x 1 1/2"	13.4°
1 3/4"	2"	4"	19"	20" x 1 3/4"	13.5°
2"	2 1/4"	4 1/2"	21"	22" x 2"	13.6°
2 1/4"	2 1/2"	5"	23"	24" x 2 1/4"	13.7°



**POLE ELEVATION**



**DETAIL H**



**BASE PLATE PLAN**

- ① 85% Min. penetration
- ② 60% Min. penetration 100% penetration within 6" of circumferential base welds.

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**Texas Department of Transportation**  
Traffic Operations Division

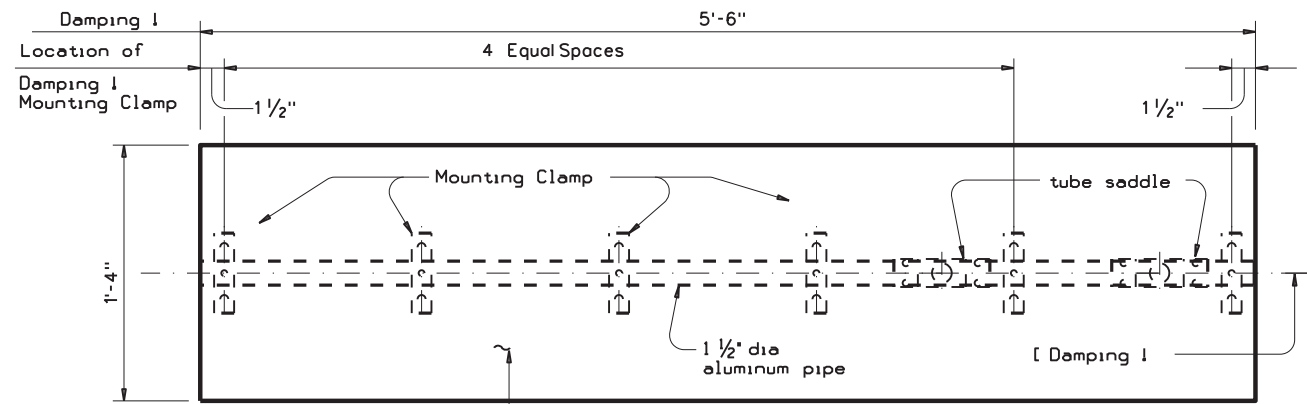
**TRAFFIC SIGNAL SUPPORT STRUCTURES MAST ARM POLE DETAILS**

**MA-D-12**

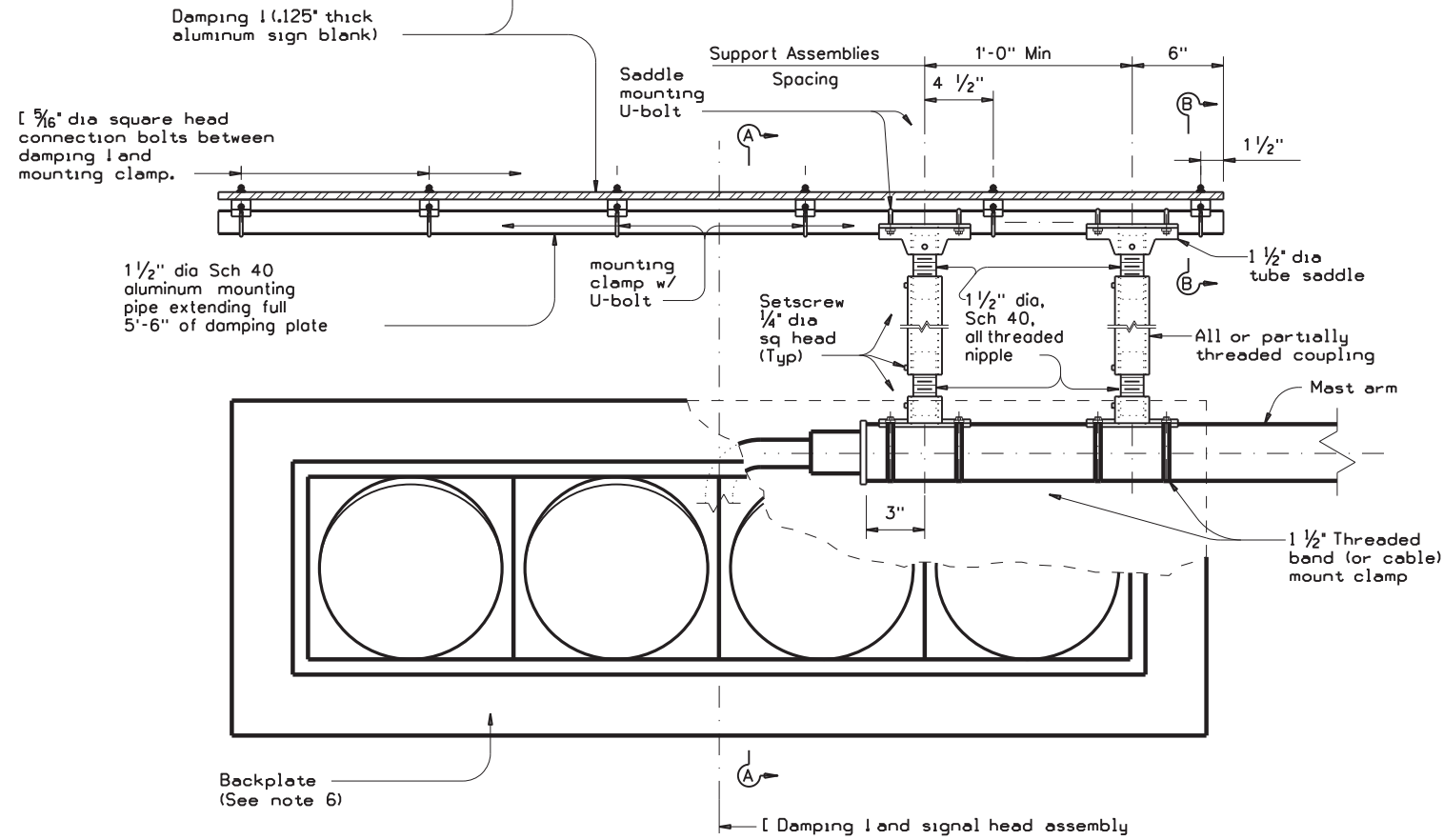
© TxDOT August 1995		DN: MS	CK: JSY	DW: FDN	CK: CAL
REVISIONS		CONT	SECT	JOB	HIGHWAY
8-99 1-2		0022	010	076	US90, etc.
		DIST	COUNTY	SHEET NO.	
		22	VAL VERDE, etc.	82	

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FILE: ma-dpd-20.dgn



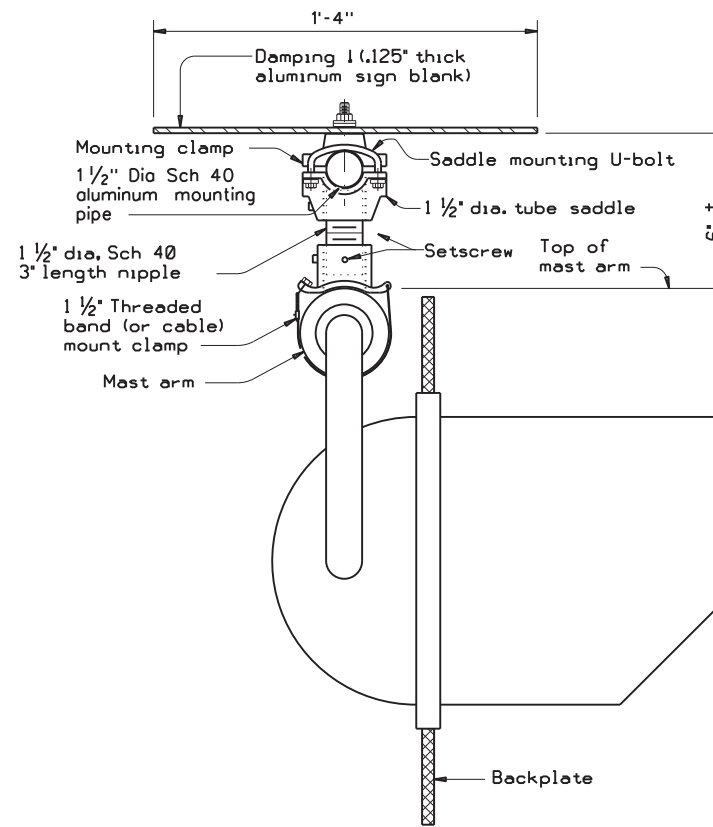
PLAN



ELEVATION

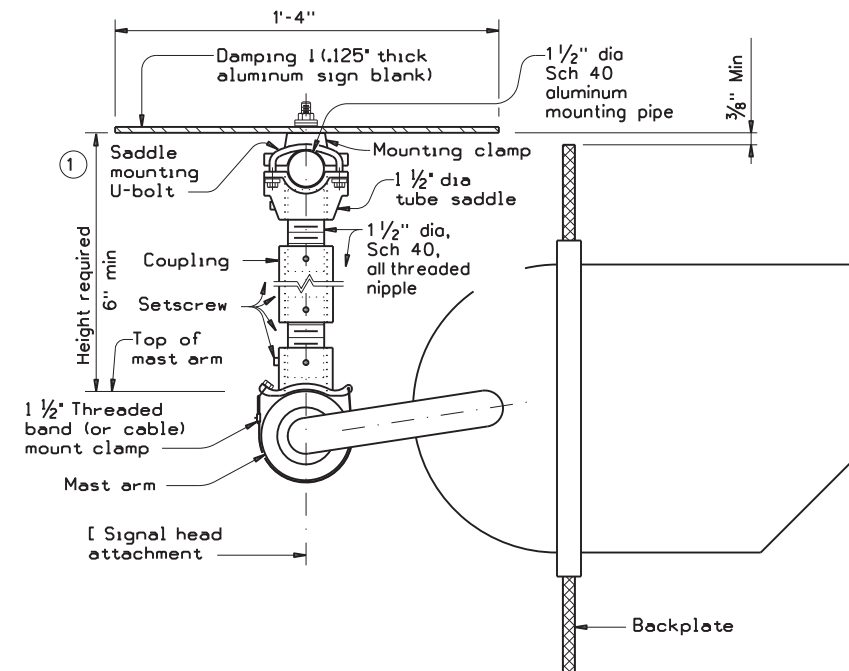
**DAMPING PLATE MOUNTING DETAILS**

(Showing alternate placement of signal head)



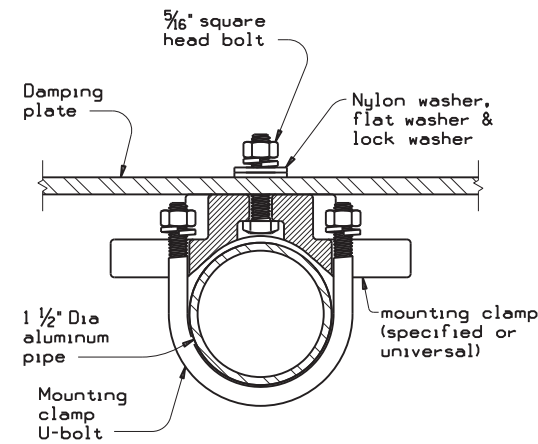
SECTION A-A

(Showing standard placement of signal head)  
(Mounting clamp U-bolt is not shown for clarity)



SECTION A-A

(Showing alternate placement of signal head)  
(Mounting clamp U-bolt is not shown for clarity)



SECTION B-B

(Showing damping plate attachment)

**GENERAL NOTES:**

- 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.
- 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.
- 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.
- Unless stipulated by the manufacturers, all steel parts will be galvanized finish in accordance with Standard Specification Item 445, "Galvanizing".
- Contractor will verify applicable field dimensions before the installation.
- Backplates are optional for traffic signals. When backplates are used, Backplates will have a 2-inch fluorescent yellow AASHTO Type B or C or FL retroreflective border conforming to TxDOT DMS-8300 "Sign Face Materials." See Sheet TS-BP-20 for backplate details.

① Recommended supporting assemblies to achieve required height for horizontal section heads			
Height required	One nipple each length	Two nipples each length	One coupling plus 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"

Texas Department of Transportation
Traffic Safety Division Standard

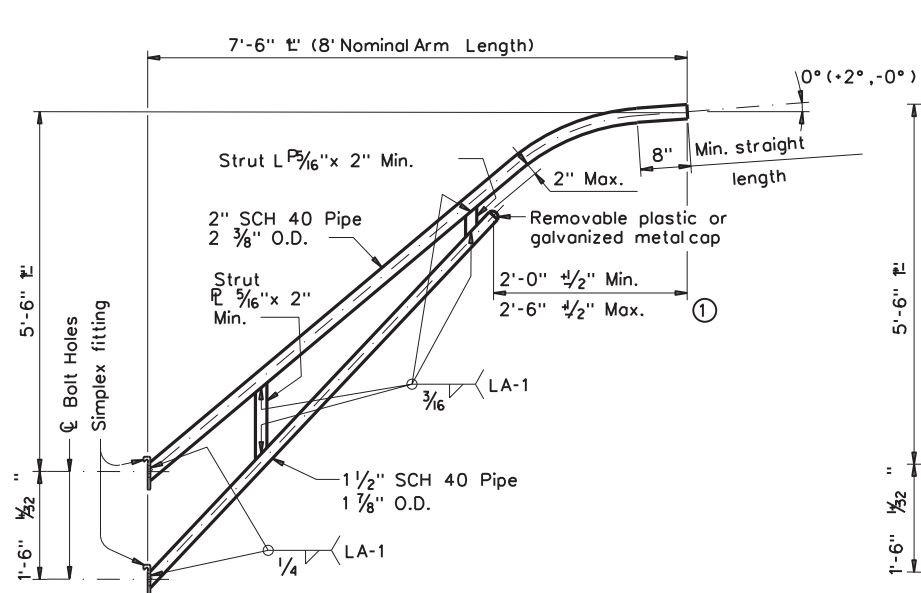
## MAST ARM DAMPING PLATE DETAILS

### MA-DPD-20

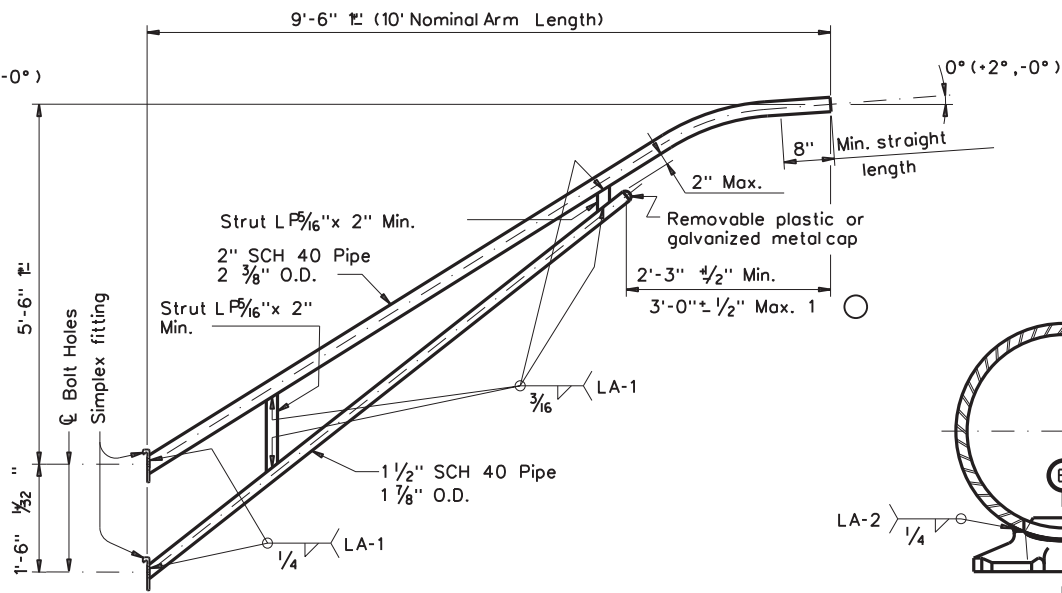
FILE: ma-dpd-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT January 2012	CONT	SECT	JOB	HIGHWAY
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DIST	COUNTY	SHEET NO.		83
22	VAL VERDE, etc.			



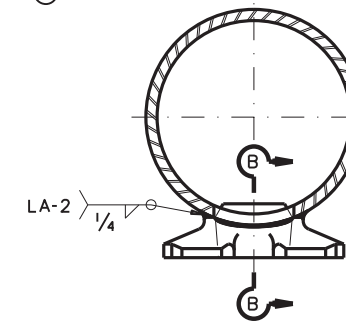
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**8-FOOT LUMINAIRE ARM**



**10-FOOT LUMINAIRE ARM**



**DIRECT ATTACHMENT 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   |
- 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.
  - Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.
  - 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.
  - 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, Luminaires, 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.

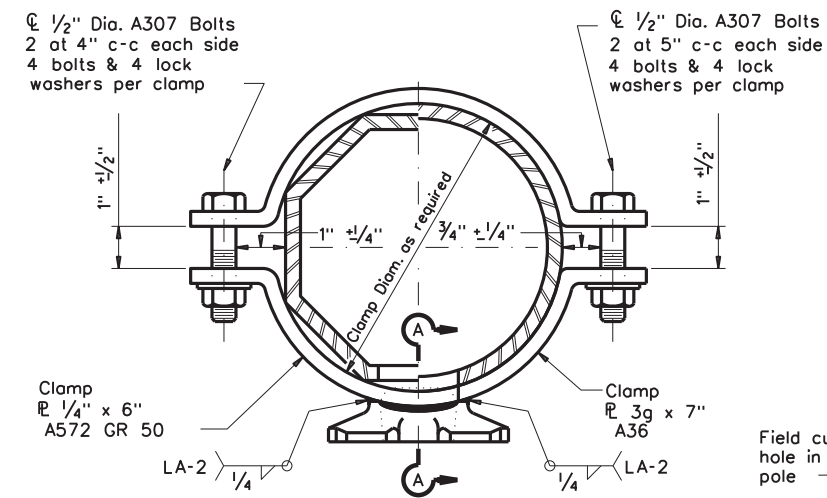
Materials and fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absence of specified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

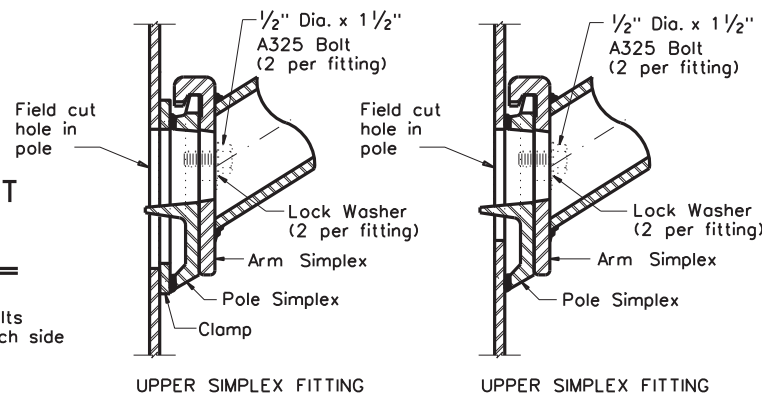
Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

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.

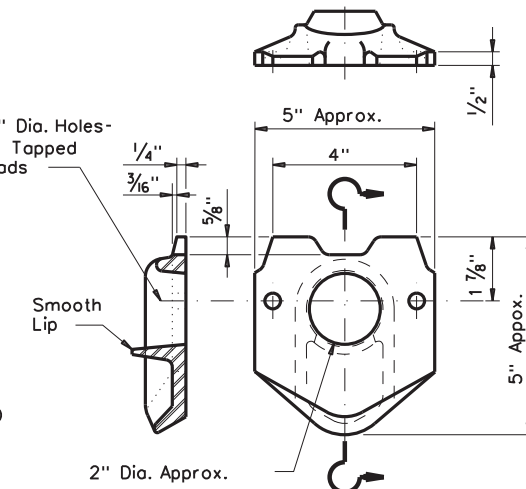
If clamp assemblies are ordered without poles, the Fabricator shall ship one upper and one lower clamp assembly together in a single package, including all nuts and washers required for the clamps and simplex fittings.



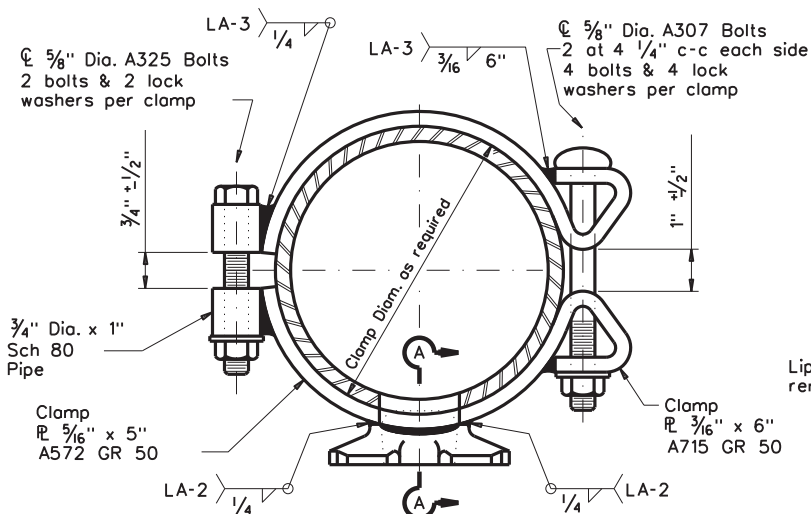
**CLAMP ATTACHMENT DETAIL NO.1 (HALF SECTION)**      **CLAMP ATTACHMENT DETAIL NO.2 (HALF SECTION)**



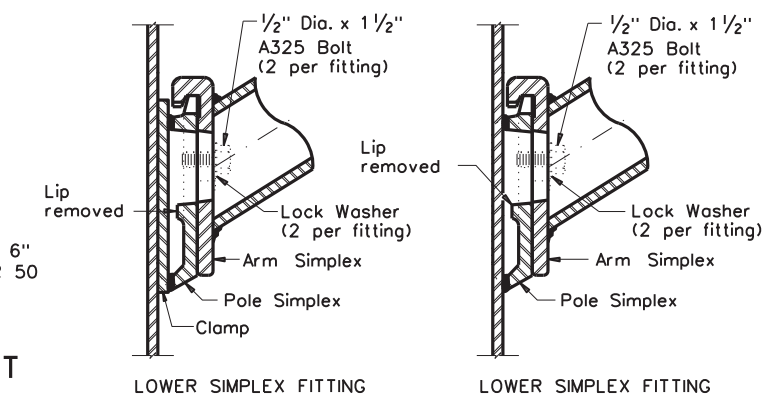
**UPPER SIMPLEX FITTING**      **LOWER SIMPLEX FITTING**



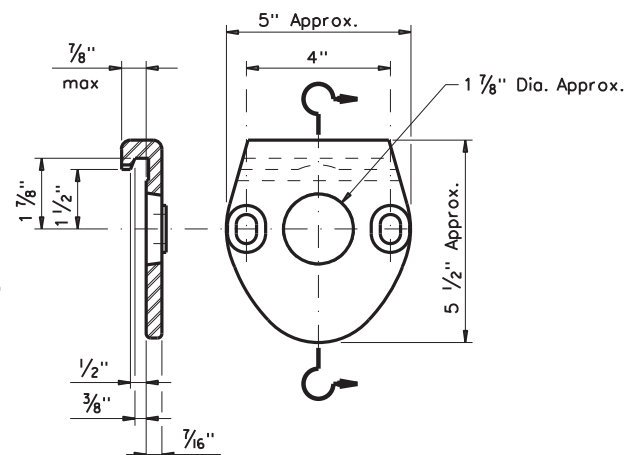
**POLE SIMPLEX DETAIL**



**CLAMP ATTACHMENT DETAIL NO.3 (HALF SECTION)**      **CLAMP ATTACHMENT DETAIL NO.4 (HALF SECTION)**



**SECTION A-A**      **SECTION B-B**

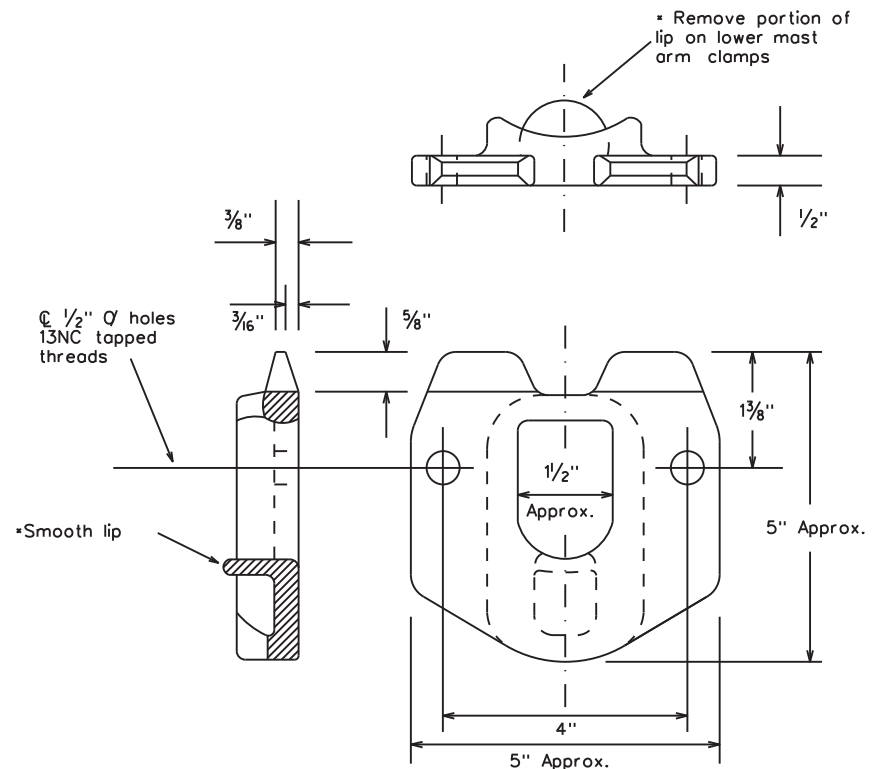


**ARM SIMPLEX DETAIL**

**Texas Department of Transportation**  
Traffic Operations Division  
**STANDARD ASSEMBLY DRAWINGS FOR LUMINAIRE SUPPORT STRUCTURES**  
**ARM DETAILS**  
**LUM-A-12**

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1-12		DIST	COUNTY	SHEET NO.	
		22	VAL VERDE, etc.		85

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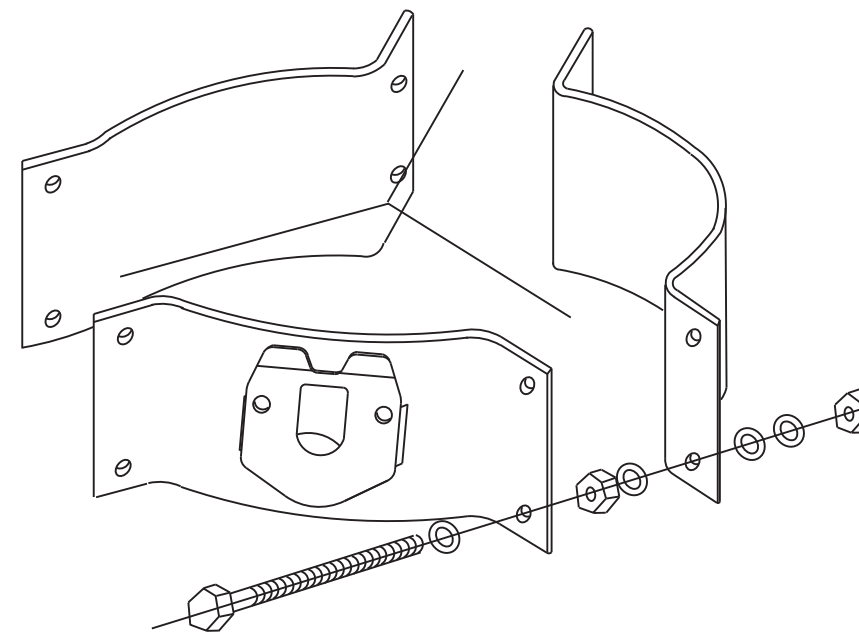
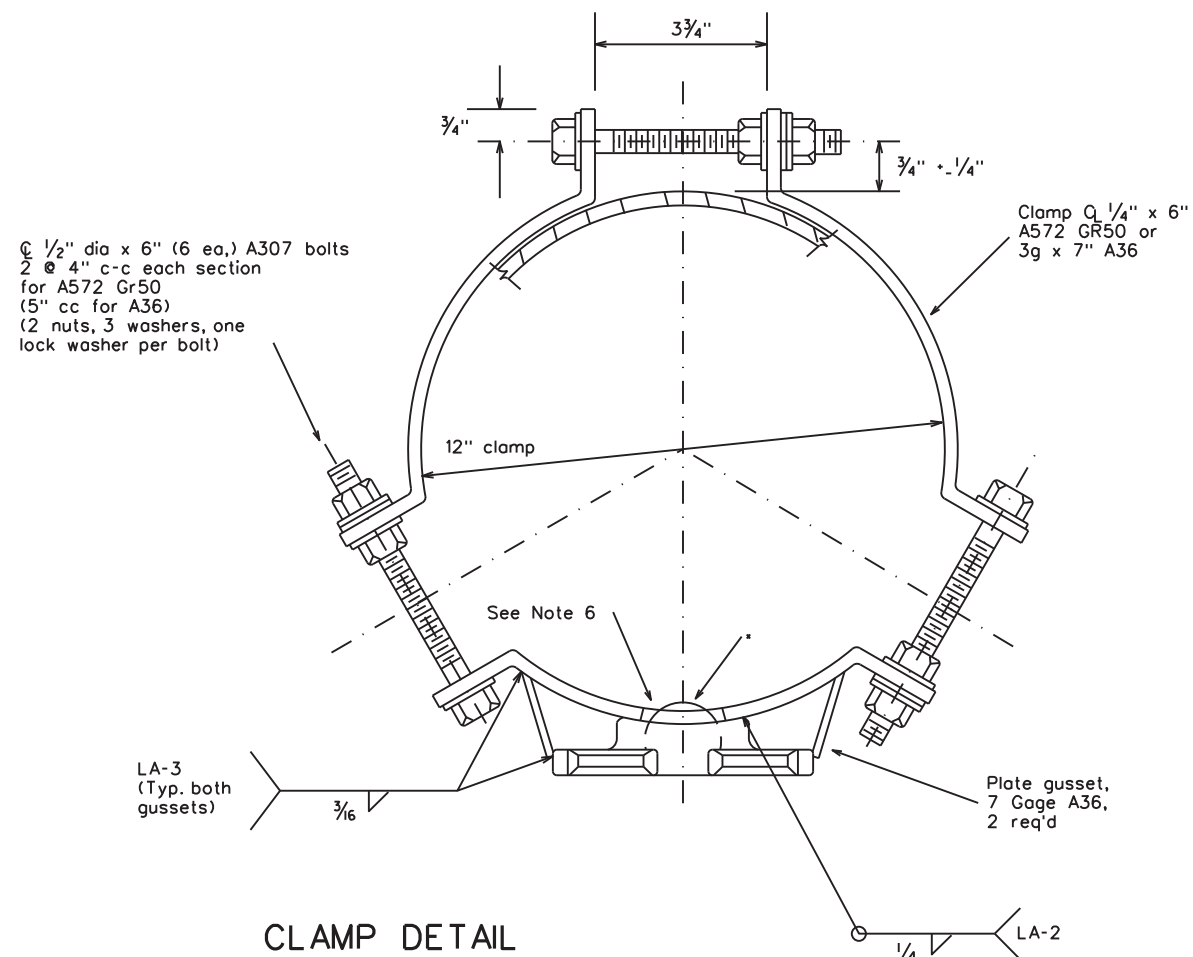


OTHER MATERIALS:

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.



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

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FILE: cfo.dgn

Texas Department of Transportation  
Traffic Operations Division

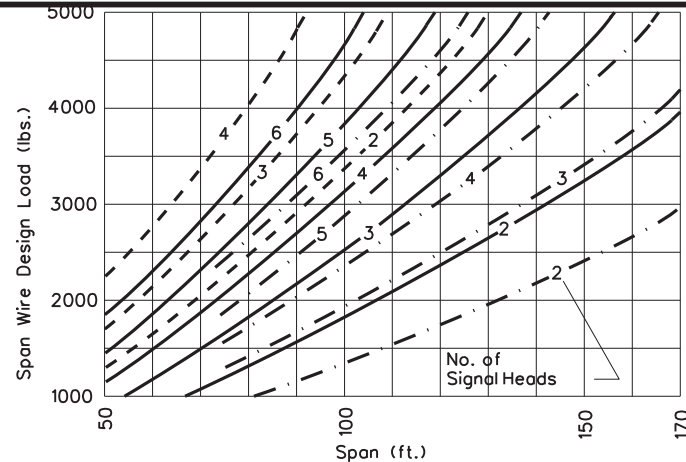
CLAMP ON FITTING ASSEMBLY FOR LUMINAIRE MAST ARM

CFA-12

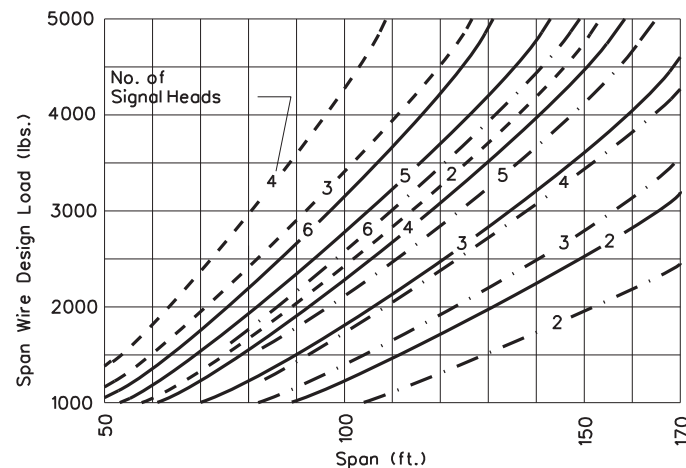
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REVISIONS		CONT	SECT	JOB	HIGHWAY
11-99	0022	010	076	US90, etc.	
1-12	DIST	COUNTY	SHEET NO.		
	22	VAL VERDE, etc.	86		

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STRAIN POLE DESCRIPTION	Pole Type	Founda-tion Type	Maximum Permissible Span Wire Load (lbs.)
26' Pole	A	36-A	5200
30' Pole	B	36-A	4600
30' Pole with Lum.	B	36-A	4400
30' Pole with 20' Mast Arm	C	36-B	5600
30' Pole with 24' Mast Arm	C	36-B	5500
30' Pole with 28' Mast Arm	C	36-B	5300
30' Pole with 32' Mast Arm	C	36-B	5100
30' Pole with 36' Mast Arm	C	36-B	4900
30' Pole with 20' Mast Arm & Lum.	C	36-B	5300
30' Pole with 24' Mast Arm & Lum.	C	36-B	5200
30' Pole with 28' Mast Arm & Lum.	C	36-B	5000
30' Pole with 32' Mast Arm & Lum.	C	36-B	4800
30' Pole with 36' Mast Arm & Lum.	C	36-B	4500
34' Pole	D	36-B	5600
34' Pole with Lum.	D	36-B	5400



② SIGNALS WITH 12-INCH LENS



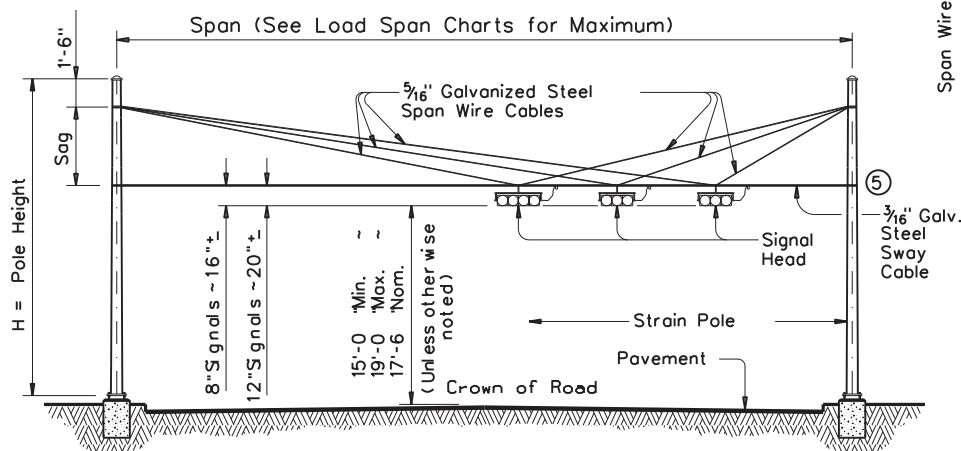
② SIGNALS WITH 8-INCH LENS

Signal Head Type	Wt. Per Head	Wind Area
5-Section, 12" Lens	125 lbs	9.6 sq. ft.
5-Section, 8" Lens	70 lbs	4.8 sq. ft.
3-Section, 12" Lens	75 lbs	5.64 sq. ft.
3-Section, 8" Lens	45 lbs	3.0 sq. ft.

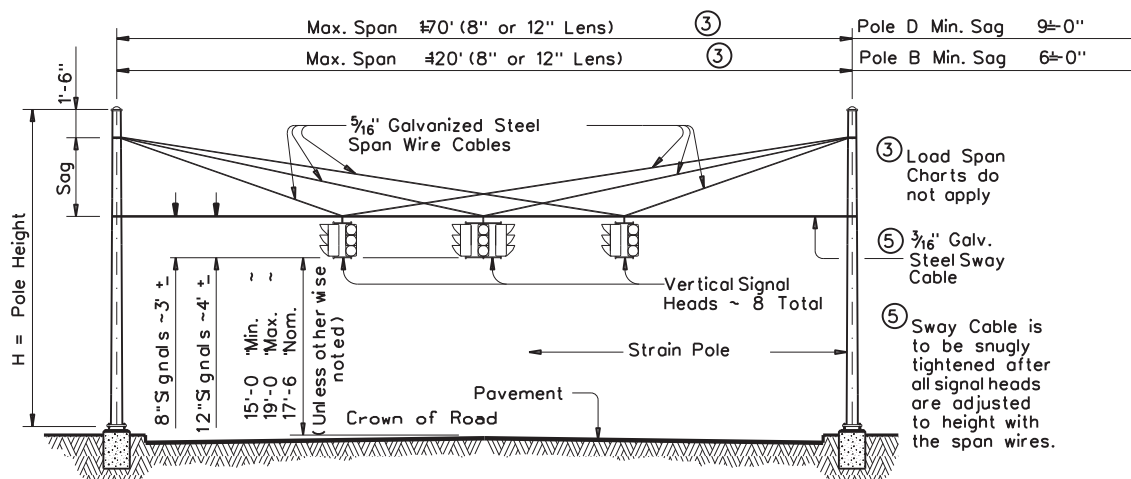
◆ Effective projected design wind area (actual area times drag coefficient)

- Sag = 4'-6" (26' or 30' Pole)
- Sag = 8'-0" (30' or 34' Pole)
- - - Sag = 11'-6" (34' Pole)

② Numbers on Load Span Charts indicate the number of signal heads on the span. The total span wire design load is based on one 5-section head and one or more additional 3-section head(s). Design wind pressures on cables are assumed as 1.0 lb/ft. Weight of span wire cables (one per signal head) is assumed as 0.65 lb/ft which includes an allowance for conductor cables and miscellaneous hardware. The effect of the sway cable on load distribution is ignored as it is assumed to break at design wind conditions. When a pole supports 2 spans, the span wire design loads for both spans should be added vectorially to determine the design load for that pole.



STRAIN POLE ELEVATIONS HORIZONTAL SIGNALS



STRAIN POLE ELEVATIONS VERTICAL SIGNALS

(Most arms are not used with vertical signals)

SHIPPING PARTS LIST

Poles (Without Traffic Signal Arm)						
Pole Type	Strain poles with Luminaire			Strain poles without Luminaire		
	Description	Designation	Quantity	Description	Designation	Quantity
A				26' Strain Pole	SP 26 A-80	
B	30' Strain Pole	SPL 30 B-80		30' Strain Pole	SP 30 B-80	
D	34' Strain Pole	SPL 34 D-80		34' Strain Pole	SP 34 D-80	

Poles (With Traffic Signal Arm)						
Pole Type	Strain poles with Luminaire			Strain poles without Luminaire		
	Description	Designation	Quantity	Description	Designation	Quantity
C	30' SPw/TS Arm	SPL 30 C-80		30' SPw/TS Arm	SP 30 C-80	

Traffic Signal Arms (For Type C poles)						
Nominal Arm Length	Type I Arm (1 Signal)		Type II Arm (2 Signals)		Type III Arm (3 Signals)	
	Description	Quantity	Description	Quantity	Description	Quantity
20	20 I-80					
24	24 I-80		24 II-80			
28	28 I-80		28 II-80			
32			32 II-80		32 III-80	
36			36 II-80		36 III-80	

Anchor Bolt Assemblies (1 per pole)		
Anchor Bolt Diameter	Anchor Bolt Length	Quantity
1 3/4"	3'-10"	
2"	4'-3"	

Luminaire Arms	
Nominal Arm Length	Quantity
8' Arm	

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".

① See Sheet "DMA-80"

Pole Type	ROUND POLES				POLYGONAL POLES			
	D <sub>B</sub>	D <sub>T</sub>	(4)thk	H	D <sub>B</sub>	D <sub>T</sub>	(4)thk	H
A	12.5	8.9	.239	26	13.0	9.0	.239	26
B	13.5	9.3	.239	30	14.0	9.0	.239	30
C	15.5	11.3	.239	30	16.0	11.0	.239	30
D	15.5	10.7	.239	34	16.0	11.0	.239	34

D<sub>B</sub> = Pole Base O.D. D<sub>T</sub> = Pole Top O.D. H = Pole Height

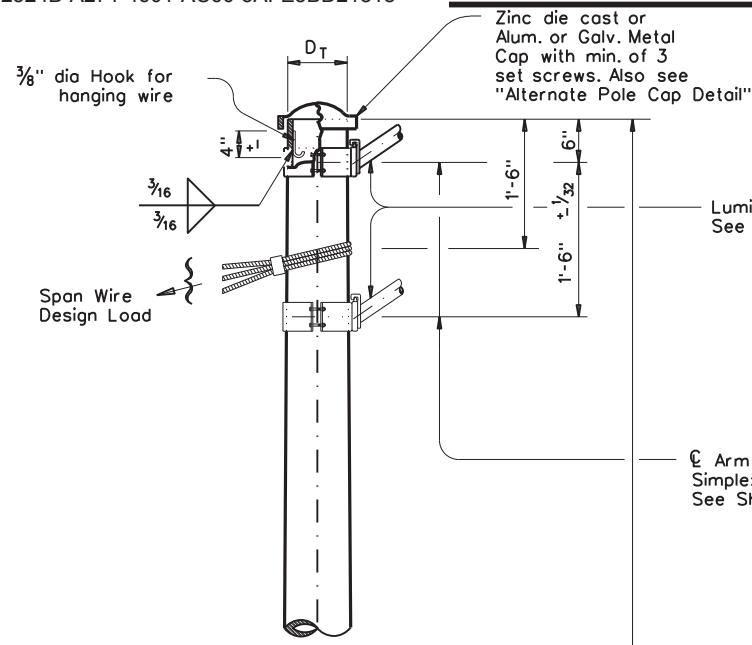
④ Thickness shown are minimum, thicker materials may be used.

**TRAFFIC SIGNAL SUPPORT STRUCTURES STRAIN POLE ASSEMBLIES**
  
 (80 MPH WIND ZONE)
   
**SP-80(1)-12**

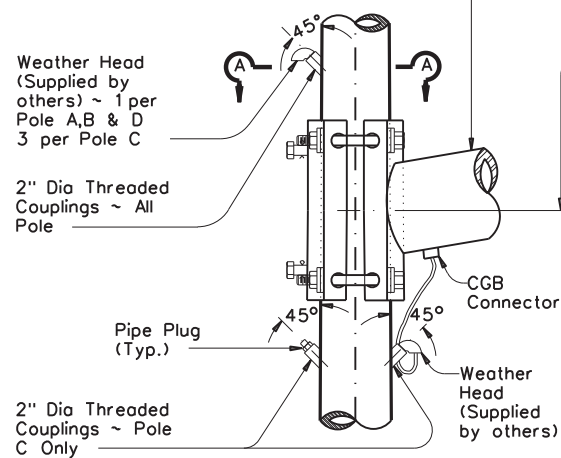
© TxDOT March 1996		DN: MS	CK: JSY	DW: BR	CK: JSY
REVISIONS		CONT	SECT	JOB	HIGHWAY
6-96 1/2		0022	010	076	US90, etc.
		DIST	COUNTY	SHEET NO.	
		22	VAL VERDE, etc.	87	

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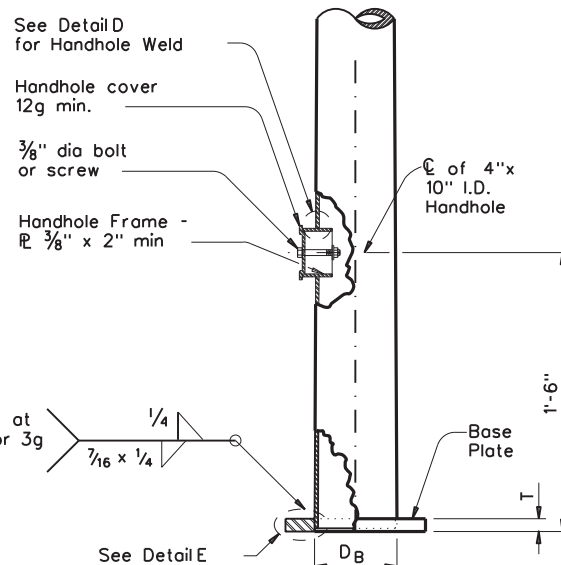
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FILE: sp80.dgn



**DETAIL A**

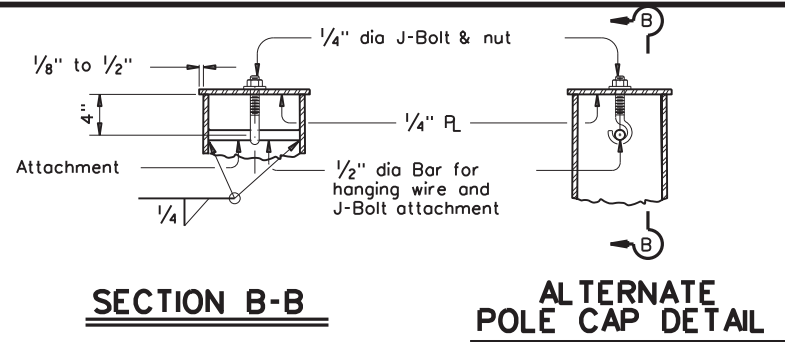


**DETAIL B**



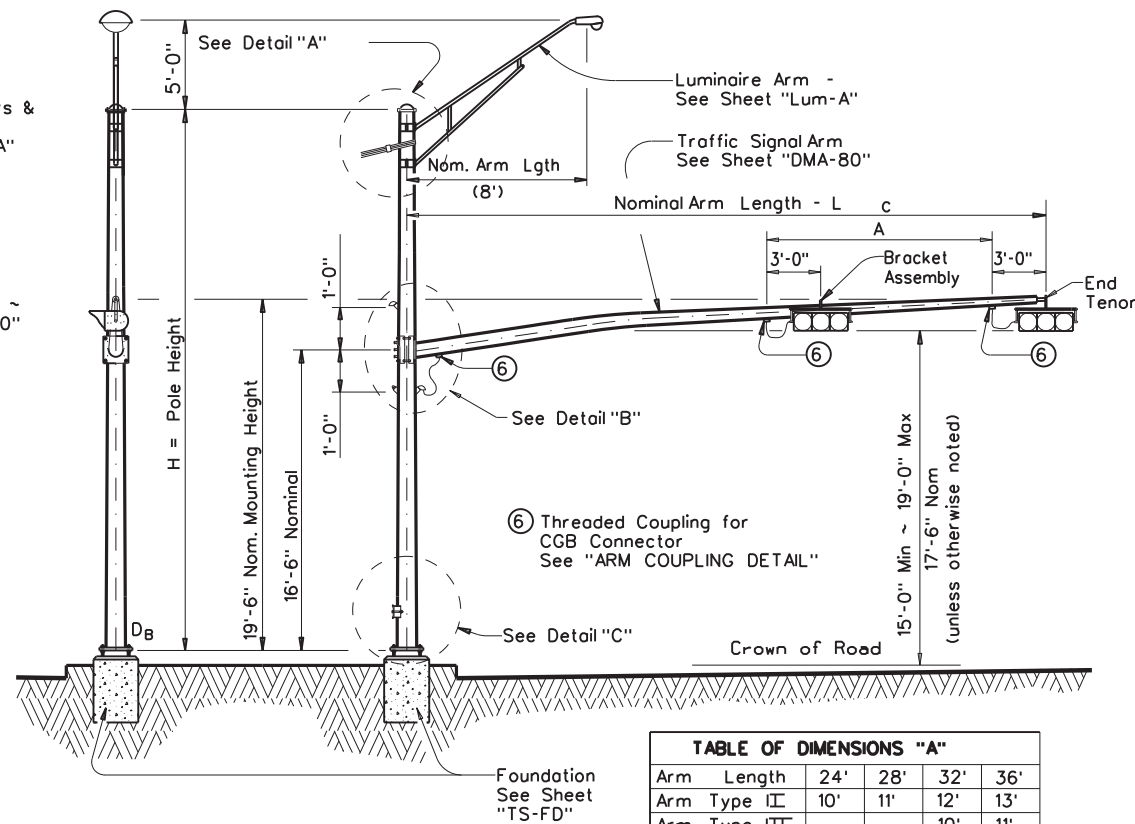
**DETAIL C**

**POLE ELEVATION**



**SECTION B-B**

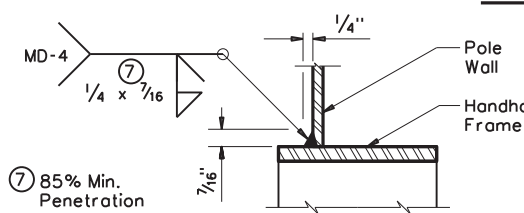
**ALTERNATE POLE CAP DETAIL**



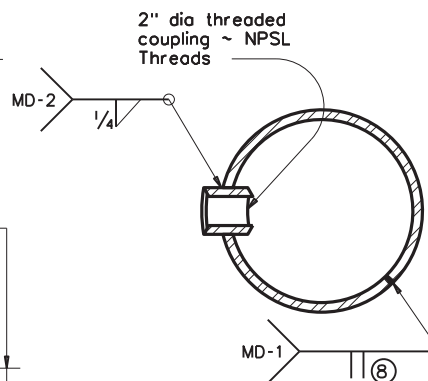
**TABLE OF DIMENSIONS "A"**

Arm Length	24'	28'	32'	36'
Arm Type I	10'	11'	12'	13'
Arm Type II			10'	11'

**STRUCTURE ASSEMBLY**



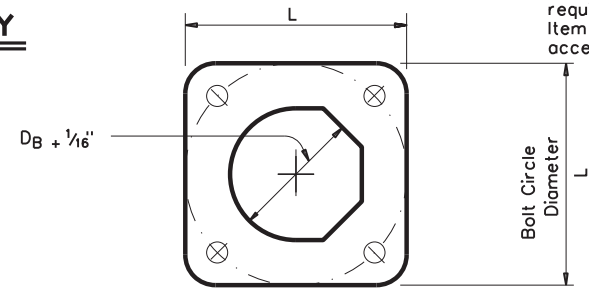
**DETAIL D**



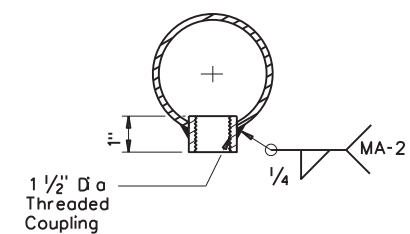
**SECTION A-A**

(Pole Coupling and Seam Weld Details)  
8 60% Min. penetration, except 100% penetration within 6" of circumferential base welds.

**DETAIL E**



**BASE PLATE PLAN**



**ARM COUPLING DETAIL**

**MATERIALS**

Round Shafts or Polygonal Shafts 9	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 10
Plates 9	ASTM A36, A588, or A572 Gr.50
Connection Bolts	ASTM A325 except where noted
Pin Bolts	ASTM A325
Pipe 9	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50, A1011 HSLAS-F Gr.50
Steel Cable	ASTM A475, 7 Wire Utilities Grade
Misc. Hardware	Galvanized steel or stainless steel or as noted

9 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.

10 ASTM A1011 SS Gr.50 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**

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. The maximum permissible span wire design loads tabulated are calculated at a stress load of 1.4 times the basic allowable stress. A simultaneous wind on the pole, mast arm, and luminaire is also included.

See standard sheet "DMA-80" for details of clamp-on traffic signal arms, sheet "MA-C" for traffic signal arm connection details, sheet "LUM-A" for luminaire arm and connection details, and sheet "TS-FD" for anchor bolt and foundation details.

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.

Foundation Type	Anchor Bolt Diameter	Bolt Hole Diameter	Bolt Circle Diameter	Base PL Dim. L x T
36-A	1 3/4"	2"	19"	19" x 1 3/4"
36-B	2"	2 1/4"	21"	21" x 2"

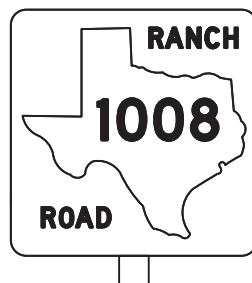
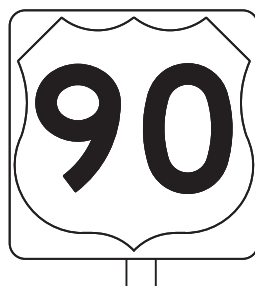
Texas Department of Transportation  
Traffic Operations Division  
**TRAFFIC SIGNAL SUPPORT STRUCTURES STRAIN POLE ASSEMBLIES**  
(80 MPH WIND ZONE)  
**SP-80(2)-12**

© TxDOT March 1996		DN: MS	CK: JSY	DW: BR	CK: JSY
6-96	1-12	REVISIONS	CONTRACT	SECTION	JOB
			0022	010	076
			DIST	COUNTY	SHEET NO.
			22	VAL VERDE, etc.	88



## REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

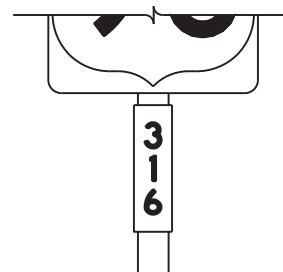
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B OR C SHEETING



TYPICAL EXAMPLES

## REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND, SYMBOLS & BORDERS	ALL OTHERS	TYPE B OR C SHEETING



TYPICAL EXAMPLES

## GENERAL NOTES

- Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
- White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white Federal Highway Administration (FHWA) Standard Highway Alphabets, when not specified in the SHSD, or in the plans.
 

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W
- Route sign legend (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets B, C, D, E, Emod or F).
- Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
- Independent mounted route sign with white or colored legend and borders shall be applied by screening process with transparent color ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof. White legend, symbols and borders on all other signs shall be cut-out white sheeting applied to colored background sheeting.
- Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius should be trimmed or rounded.
- Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
- Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080
7.5 to 15	0.100
Greater than 15	0.125

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

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



## TYPICAL SIGN REQUIREMENTS

### TSR(3)-13

FILE:	tsr-3-13.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	October 2003	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0022	010	076	US90, etc.				
12-03	7-13	DIST	COUNTY	SHEET NO.					
9-08		22	VAL VERDE, etc.	89					

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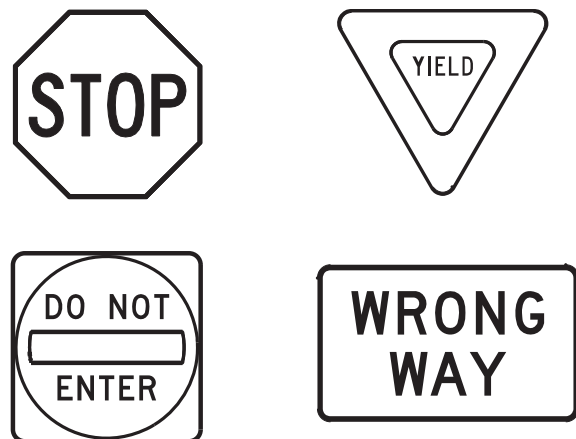
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DATE: 6/24/2022 3:00:05 PM  
 FILE: tsr-4-13.dgn

### REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

### REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

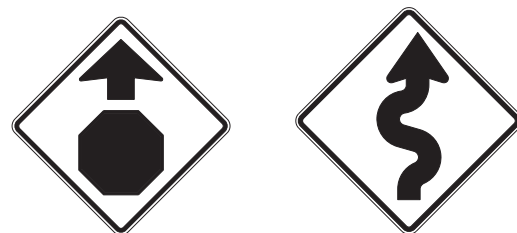
(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND, BORDERS AND SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

### REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

### REQUIREMENTS FOR SCHOOL SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

### GENERAL NOTES

- Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
- Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
- Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
- Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
- White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
- Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
- Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
- Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080
7.5 to 15	0.100
Greater than 15	0.125

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website:  
<http://www.txdot.gov/>

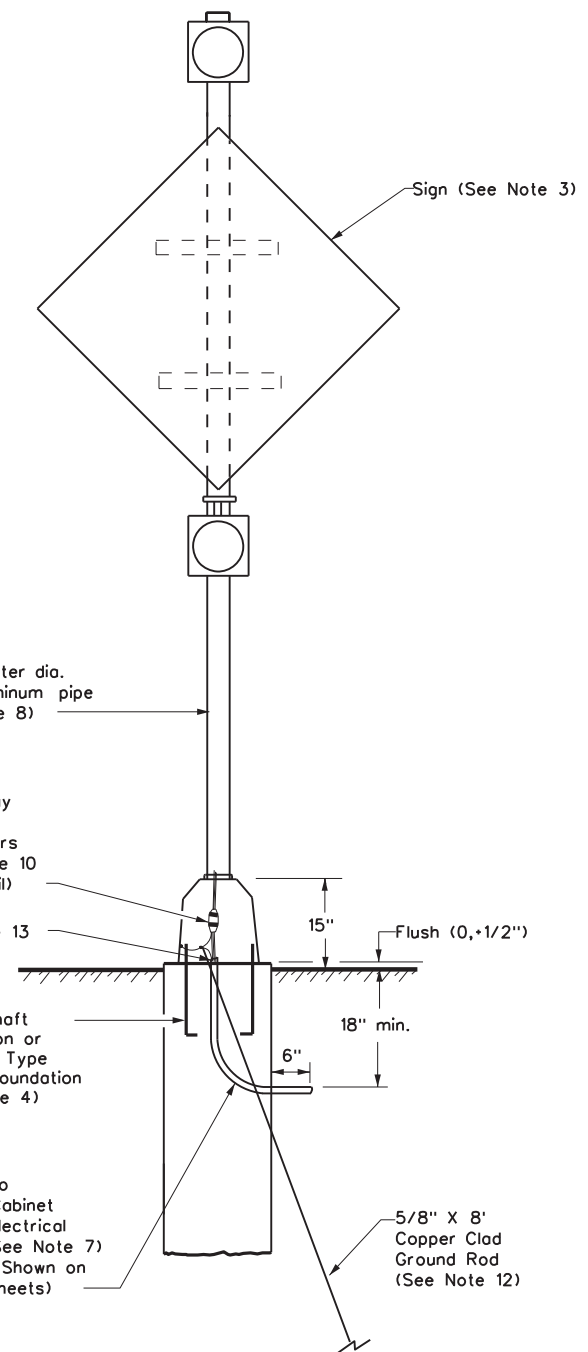
Texas Department of Transportation		Traffic Operations Division Standard	
<h2>TYPICAL SIGN REQUIREMENTS</h2>			
<h3>TSR(4)-13</h3>			
FILE: tsr-4-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2003	CONT: 0022	SECT: 010	JOB: 076
REVISIONS: 12-03 7-13 9-08	DIST: 22	COUNTY: VAL VERDE, etc.	SHEET NO.: 90

**GENERAL NOTES:**

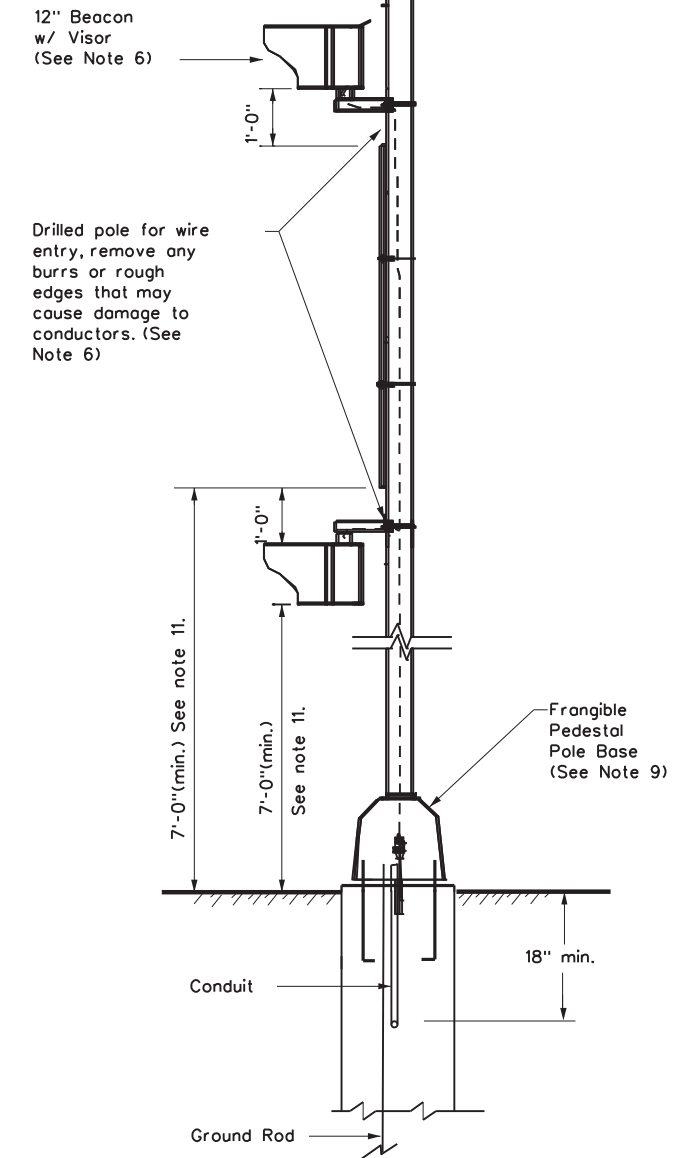
1. Details show a typical warning sign with two flashing beacon heads, other arrangements are possible. When only one beacon is required, install the upper beacon.
2. See Item 685, "Roadside Flashing Beacon Assemblies" for further requirements.
3. See SMD standard sheets for lateral and vertical clearances and sign mounting details. Install signs as shown on the sign layout sheets.
4. Use either a Screw-In Type Anchor Foundation or a Drilled Shaft Foundation as shown elsewhere in the plans. When plans require a Drilled Shaft Foundation, see standard sheet TS-FD. Install the Screw-In Type Anchor Foundation as per manufacturer's recommendations. On a slope, install one edge at ground level. Screw-In/Drilled Shaft Foundation is subsidiary to Item 685. Installation of a ground rod is not required for solar powered flashing beacon assemblies.
5. When used, provide Screw-In Type Anchor Foundations as shown on TxDOT's Material Producer List (MPL) in the file "Highway Traffic Signals".
6. Install beacon heads as shown here, as shown elsewhere on the plans, or as directed. Use hardware specifically designed for mounting beacon heads on poles.
7. Conduit in foundation and within 6 in. of foundation is subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies."
8. Unless otherwise shown on the plans, pole shaft shall be one piece, Schedule 40 Aluminum pipe, ASTM B429 or B221 (Alloy 6061-T6 only). Aluminum conduit will not develop the necessary strength and will not be allowed.
9. Per manufacturer's recommendations, engage all threads on the pedestal pole base and pipe unless the pipe is fully seated into base. In high winds, use a pole and base collar assembly to add strength and prevent loosening of connection.
10. Provide single pole non-fused watertight breakaway electrical connectors for frangible pedestal pole bases, as shown on TxDOT's MPL in the file "Roadway Illumination and Electrical Supplies." Approved models are listed under Item 685. For ungrounded (hot) conductors, install a breakaway connector with a dummy fuse slug. For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).
11. Provide clearance as shown above the sidewalk or pavement grade at the edge of the road. When a bottom beacon is not used, mount the bottom of the sign at least 7 ft. above the sidewalk or pavement grade at the edge of the road.
12. Make connections to ground rods according to NEC. Ground rod clamps shall be listed for their intended purpose.
13. Ensure height of conduit and ground rod is below top of anchor bolts.

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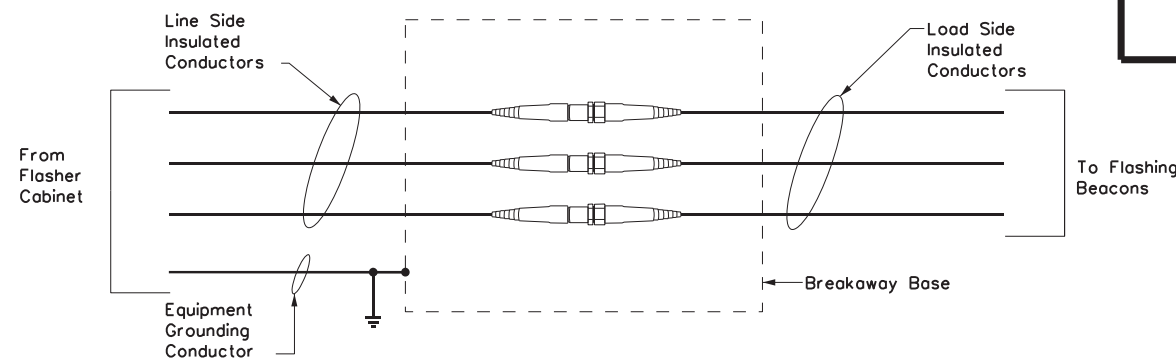
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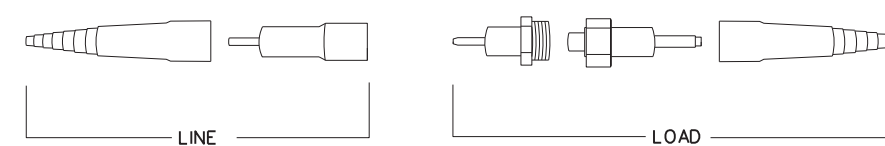
**FRONT**



**SIDE**



**NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS**



**NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS  
EXPLODED VIEW**

**ROADSIDE FLASHING BEACON ASSEMBLY**

**RFBA-13**

FILE: rfb-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT January 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0022	010	076	US90, etc.
5-93 12-04	DIST	COUNTY	SHEET NO.	
10-93 3-13	22	VAL VERDE, etc.	91	
4-98				

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DATE: 6/24/2022  
FILE: epic.dgn

**I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402**

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

- 1.
2.  No Action Required  Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

**II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404**

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

- No Permit Required
- Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)
- Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)
- Individual 404 Permit Required
- Other Nationwide Permit Required: NWP# \_\_\_\_\_

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

- 1.
- 2.
- 3.
- 4.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

**Best Management Practices:**

<b>Erosion</b>	<b>Sedimentation</b>	<b>Post-Construction TSS</b>
<input type="checkbox"/> Temporary Vegetation	<input checked="" type="checkbox"/> Silt Fence	<input type="checkbox"/> Vegetative Filter Strips
<input type="checkbox"/> Blankets/Matting	<input type="checkbox"/> Rock Berm	<input type="checkbox"/> Retention/Irrigation Systems
<input type="checkbox"/> Mulch	<input type="checkbox"/> Triangular Filter Dike	<input type="checkbox"/> Extended Detention Basin
<input type="checkbox"/> Sodding	<input type="checkbox"/> Sand Bag Berm	<input type="checkbox"/> Constructed Wetlands
<input type="checkbox"/> Interceptor Swale	<input type="checkbox"/> Straw Bale Dike	<input type="checkbox"/> Wet Basin
<input type="checkbox"/> Diversion Dike	<input type="checkbox"/> Brush Berms	<input type="checkbox"/> Erosion Control Compost
<input type="checkbox"/> Erosion Control Compost	<input type="checkbox"/> Erosion Control Compost	<input type="checkbox"/> Mulch Filter Berm and Socks
<input type="checkbox"/> Mulch Filter Berm and Socks	<input type="checkbox"/> Mulch Filter Berm and Socks	<input type="checkbox"/> Compost Filter Berm and Socks
<input type="checkbox"/> Compost Filter Berm and Socks	<input type="checkbox"/> Compost Filter Berm and Socks	<input checked="" type="checkbox"/> Vegetation Lined Ditches
	<input type="checkbox"/> Stone Outlet Sediment Traps	<input type="checkbox"/> Sand Filter Systems
	<input type="checkbox"/> Sediment Basins	<input type="checkbox"/> Grassy Swales

**III. CULTURAL RESOURCES**

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.

- No Action Required  Required Action

Action No.

- 1.
- 2.
- 3.
- 4.

**IV. VEGETATION RESOURCES**

Preserve native vegetation to the extent practical. Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

- No Action Required  Required Action

Action No.

- 1.
- 2.
- 3.
- 4.

**V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS.**

- No Action Required  Required Action

Action No.

- 1.
- 2.
- 3.
- 4.

If any of the listed species are observed, cease work in the immediate area, do not disturb species or habitat and contact the Engineer immediately. The work may not remove active nests from bridges and other structures during nesting season of the birds associated with the nests. If caves or sinkholes are discovered, cease work in the immediate area, and contact the Engineer immediately.

**LIST OF ABBREVIATIONS**

BMP: Best Management Practice	SPCC: Spill Prevention Control and Countermeasure
CGP: Construction General Permit	SW3P: Storm Water Pollution Prevention Plan
DSHS: Texas Department of State Health Services	PCN: Pre-Construction Notification
FHWA: Federal Highway Administration	PSL: Project Specific Location
MOA: Memorandum of Agreement	TCEQ: Texas Commission on Environmental Quality
MOU: Memorandum of Understanding	TPDES: Texas Pollutant Discharge Elimination System
MS4: Municipal Separate Stormwater Sewer System	TPWD: Texas Parks and Wildlife Department
MBTA: Migratory Bird Treaty Act	TxDOT: Texas Department of Transportation
NOT: Notice of Termination	T&E: Threatened and Endangered Species
NWP: Nationwide Permit	USACE: U.S. Army Corps of Engineers
NOI: Notice of Intent	USFWS: U.S. Fish and Wildlife Service

**VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES**

General (applies to all projects):

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used. Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act. Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:

- \* Dead or distressed vegetation (not identified as normal)
- \* Trash piles, drums, canister, barrels, etc.
- \* Undesirable smells or odors
- \* Evidence of leaching or seepage of substances

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structures not including box culverts)?

- Yes  No

If "No", then no further action is required.

If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

- Yes  No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

- No Action Required  Required Action

Action No.

- 1.
- 2.
- 3.


**VII. OTHER ENVIRONMENTAL ISSUES**

(includes regional issues such as Edwards Aquifer District, etc.)

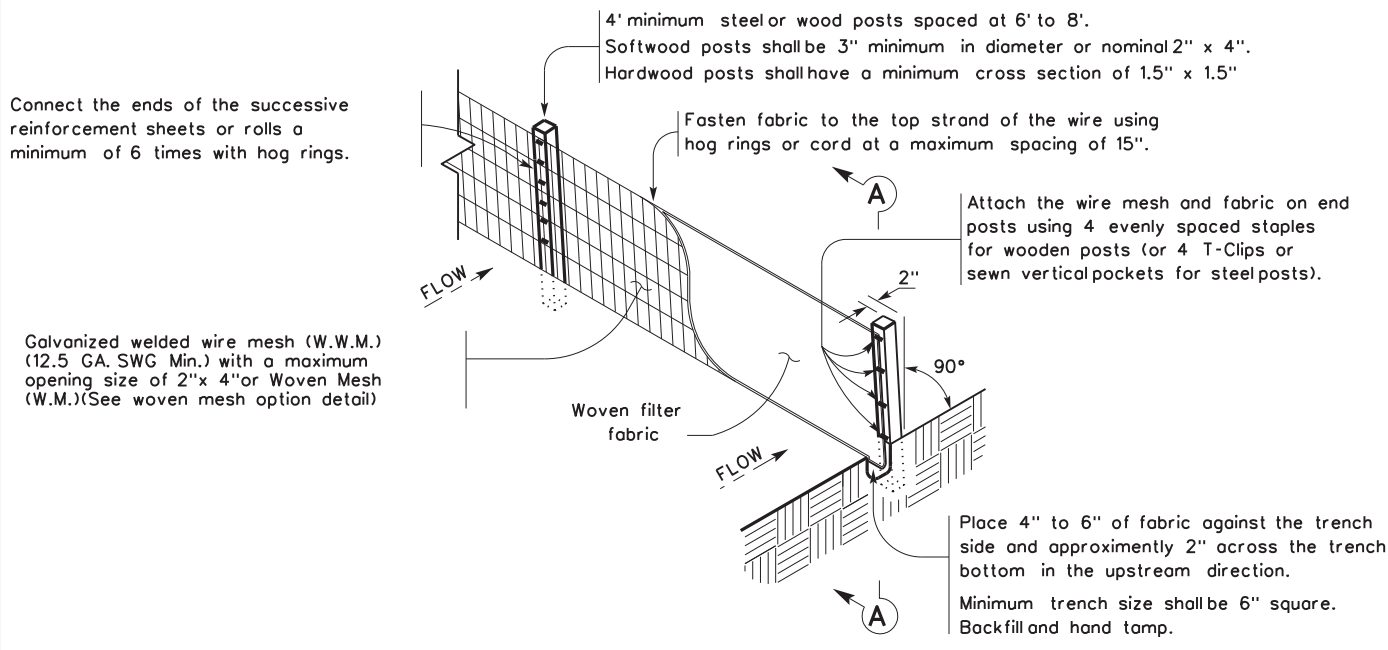
- No Action Required  Required Action

Action No.

- 1.
- 2.
- 3.

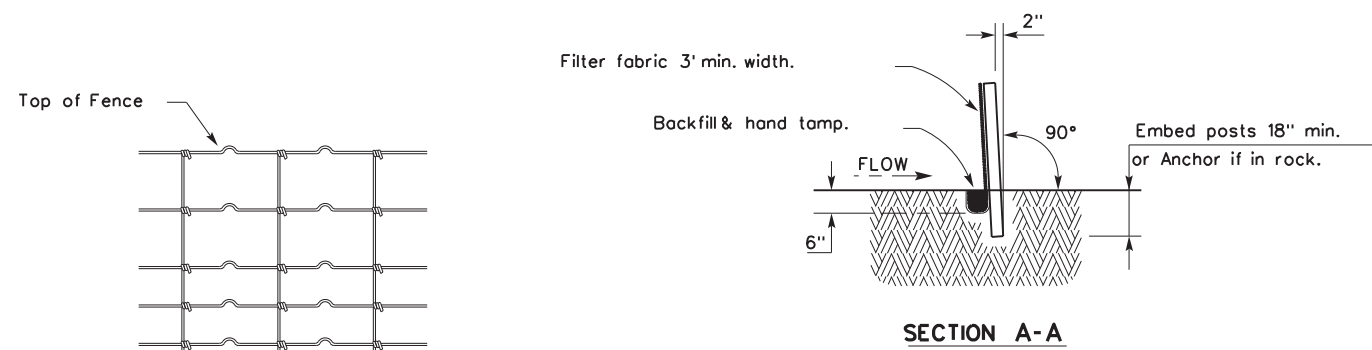
 Texas Department of Transportation		<i>Design Division Standard</i>	
<b>ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS</b>			
<b>EPIC</b>			
FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP
©TxDOT: February 2015	CONT	SECT	JOB
12-12-2011 (DS) REVISIONS	0022010	076	US90, etc.
05-07-14 ADDED NOTE SECTION IV.	DIST	COUNTY	SHEET NO.
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	22	VAL VERDE, etc.	92

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**TEMPORARY SEDIMENT CONTROL FENCE**

SCF



**HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL**

Galvanized hinge joint knot woven mesh (12.5 GA. SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

**SEDIMENT CONTROL FENCE USAGE GUIDELINES**

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

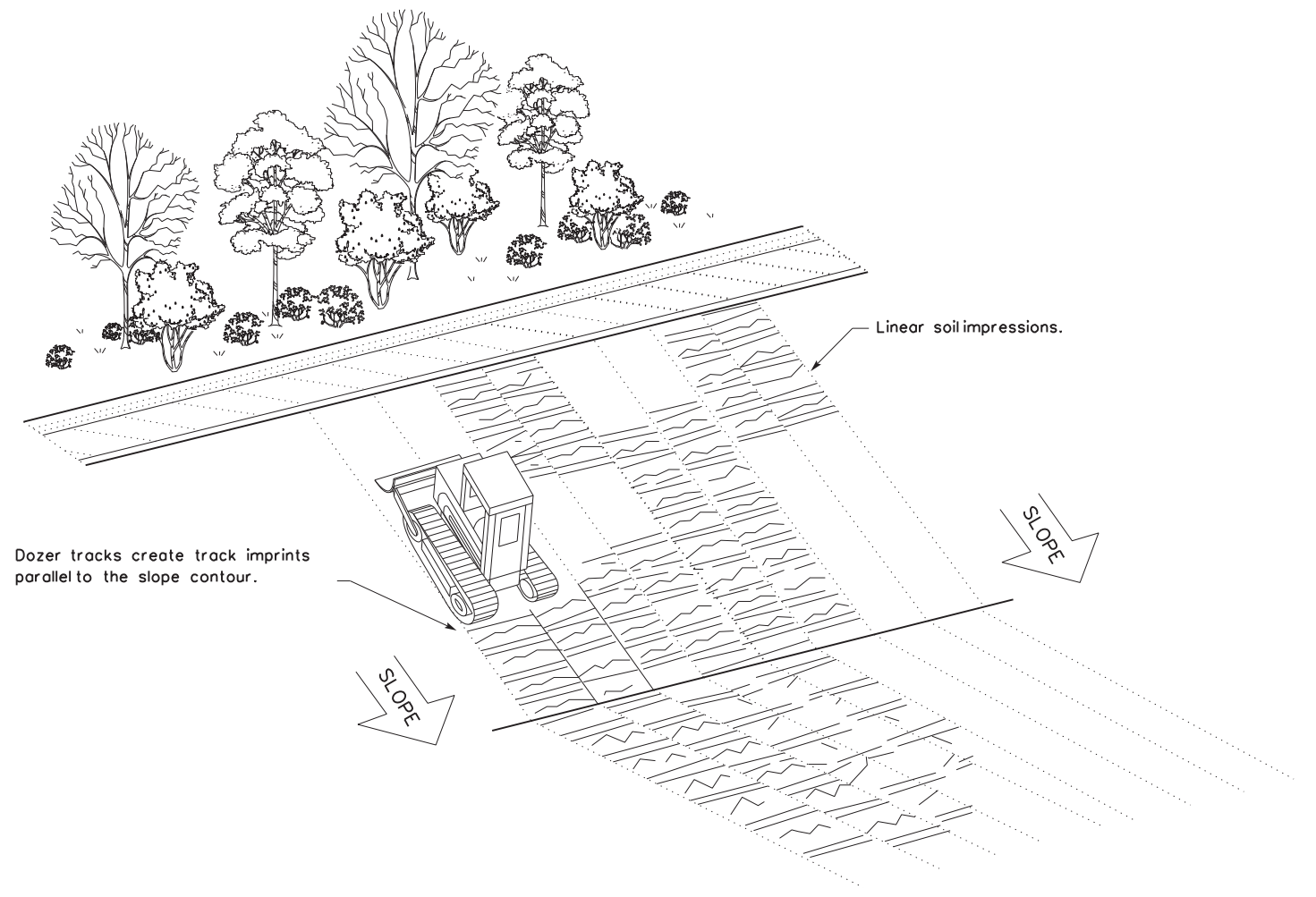
Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

**LEGEND**

Sediment Control Fence  
 SCF

**GENERAL NOTES**

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continuous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



**VERTICAL TRACKING**

Texas Department of Transportation				Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE &amp; VERTICAL TRACKING EC(1)-16</b>					
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0022	010	076	US90, etc.	
	DIST	COUNTY	SHEET NO.		
	22	VAL VERDE, etc.	93		