

# STATE OF TEXAS DEPARTMENT OF TRANSPORTATION

PROJECT NO.			
RMC 6466-55-001			
CONT	SECT	JOB	HIGHWAY
6466	55	001	US 59, ETC.
DIST		COUNTY	SHEET NO.
LFK		ANGELINA, ETC.	1

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## PLANS OF PROPOSED STATE HIGHWAY ROUTINE MAINTENANCE CONTRACT

TYPE OF WORK:

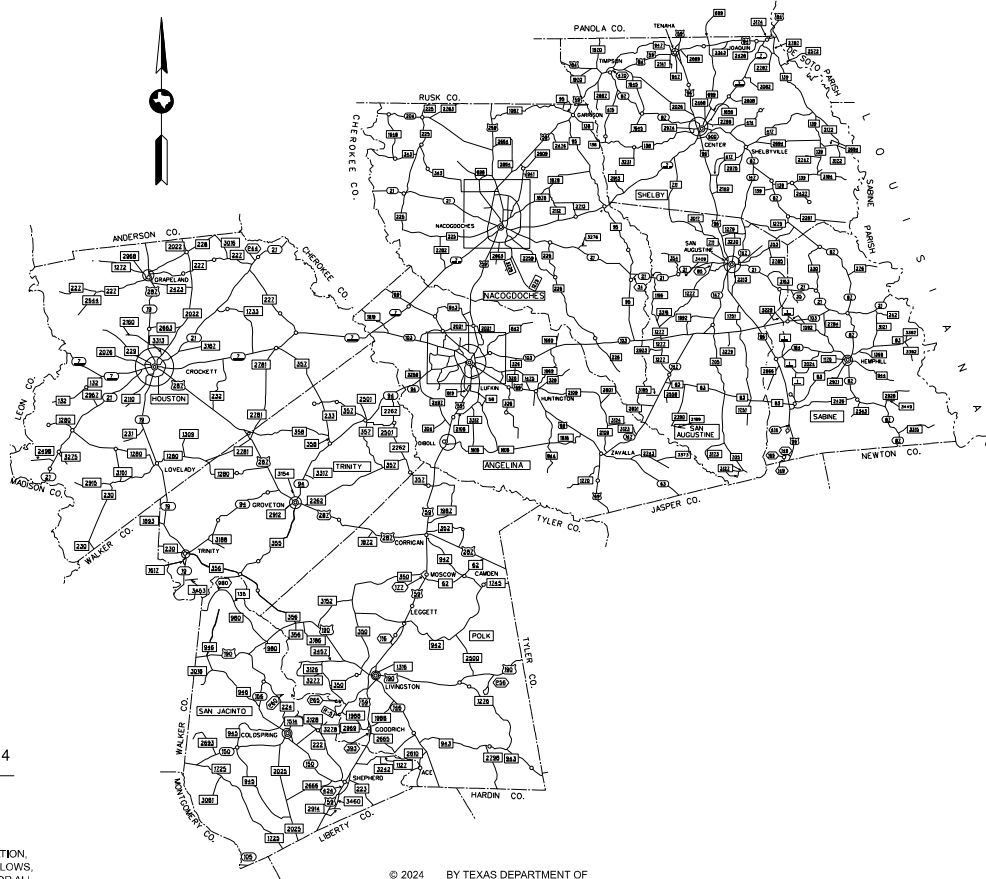
### DISTRICTWIDE TRAFFIC SIGNAL MAINTENANCE

RMC 6466-55-001

US 59, ETC.

ANGELINA COUNTY, ETC.

LIMITS: VARIOUS LOCATIONS DISTRICTWIDE



**BARRICADES AND WARNING SIGNS**  
PROJECT LIMIT BARRICADES WILL NOT BE REQUIRED. THE CONTRACTOR SHALL PROVIDE AND ERECT WARNING SIGNS IN ACCORDANCE WITH THE BARRICADE & CONSTRUCTION STANDARDS, TCP STANDARDS, THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND AS DIRECTED.



DocuSigned by:  
*Jeremy King, P.E.*, P.E. 6/3/2024

IF THE SIGNATURE IS NOT ELECTRONICALLY IDENTIFIED ABOVE HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

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 (FROM FHWA 1273, OCTOBER 2023)

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RECOMMENDED FOR LETTING:  
*Jeremy King, P.E.* 6/3/2024  
DISTRICT MAINTENANCE ENGINEER DATE

APPROVED FOR LETTING:  
*Kevin Duranaktin* 6/3/2024  
DIRECTOR OF MAINTENANCE DATE

**Project Number:** RMC 6466-55-001

**County:** Angelina, etc.

**Highway:** US 59, etc.

**Control:** 6466-55-001

#### **GENERAL NOTES:**

Commence work within 72 hours of receiving a work order unless otherwise approved by the Engineer. Failure to commence work within the specified time period or to work continuously until the work order has been completed will be cause to declare the contract in default. Exception from declaring default will be if the Contractor has obtained written permission from the Engineer prior to leaving the project. In the event that all contract funds or 365 calendar days have been expended, the contract will be considered complete.

This contract is to provide Signal Maintenance at various locations within the Lufkin District, which consists of the following nine counties: Angelina, Houston, Nacogdoches, Polk, Sabine, San Augustine, San Jacinto, Shelby and Trinity.

No lane closures will be allowed on US 59 after 12:00 PM (Noon) on Fridays or on days preceding Major Holidays, unless otherwise approved.

Use approved safety and personal protection equipment (PPE) as directed. Non-compliance with the Safety, Qualification and Certification requirements will be grounds for suspension of work.

Maintenance needs and repairs will be provided to the Contractor by Lufkin Traffic Operations Office.

Questions may be submitted via the Letting Pre-Bid Q&A web page. This webpage can be accessed from the Notice to Contractors dashboard located at the following Address: <https://tableau.txdot.gov/views/ProjectInformationDashboard/NoticetoContractors>

All contractor questions will be reviewed by the Engineer. All questions and any corresponding responses that are generated will be posted through the same Letting Pre-Bid Q&A web page.

The Letting Pre-Bid Q&A web page for each project can be accessed by using the dashboard to navigate to the project you are interested in by scrolling or filtering the dashboard using the controls on the left. Hover over the blue hyperlink for the project you want to view the Q&A for and click on the link in the window that pops up.

The contractor's attention is directed to the EPIC sheet(s) included in this plan set for additional information regarding environmental permits, issues, and commitments.

#### **Item 4: Scope of Work**

The contract may be extended if in the judgment of the Engineer, the Contractor has satisfactorily fulfilled the terms and conditions of the contract. The extension must be agreed upon in writing by both parties to the contract and may be extended for an additional period of time not to exceed the original contract time period. The extended contract may be for additional quantities up to the original bid quantities plus any quantities added by an approved change order. The extensions will meet the terms and conditions of the original contract or any mutually

**General Notes**

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**Sheet 2**

**Control:** 6466-55-001

agreed modifications to the said terms and conditions by one or more cumulative change orders. The Engineer will set a deadline for completing the agreements. This deadline will be based on the time needed to re-let and award a new contract if no extension is agreed upon.

#### **Item 5: Control of the Work**

Contact appropriate utility companies to locate underground utilities prior to drilling foundations, installing or removing underground conduits, or any other excavating. Use care when working near utilities or existing storm sewers to prevent damage. Use One-Call for locates.

If unforeseen utility adjustments are encountered during construction operations, alter operations and continue to prosecute the contract in such a manner that will allow utility adjustments to be made by others. An extension of working time may be granted for any delays caused by the utility adjustments, if deemed necessary.

All litter within the project limits that may be deposited by construction operations or the traveling public will be collected and disposed of at the end of each workday, unless otherwise directed. Do not dump or stockpile collected litter on State property. Litter pickup will not be measured or paid for directly, but will be subsidiary to various bid items.

#### **Item 7: Legal Relations and Responsibilities**

The proposed work of this project is to perform traffic signal maintenance at various locations throughout the Lufkin District. This activity maintains the original line and grade, hydraulic capacity and original purpose to the site. Therefore, this project meets the definition of a routine maintenance activity as defined in the TPDES General Permit No. TXR150000 issued March 5, 2023 and TCEQ's TPDES CGP does not apply.

Contractor to repair or replace in kind, at their own expense, any historic materials damaged (buildings, historical markers, etc.) in the course of executing the work. Contractor is responsible for locating replacement source for historic materials damaged in the course of the work. TxDOT-Environmental Affairs Division is to be informed of proposed repairs to facilitate consultation with Texas Historical Commission prior to execution of repairs.

#### **Item 421: Hydraulic Cement Concrete**

Curing facilities and strength testing equipment, for acceptance testing, will be provided at the District's Signal Shop located in Lufkin at 1805 N. Timberland Drive.

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**Item 502: Barricades, Signs And Traffic Handling**

**Traffic Control Plan (TCP):**

Furnish and maintain all required traffic control, warning signs, flaggers, channelizing devices, etc., in compliance with Item 502, the "Texas Manual on Uniform Traffic Control Devices", applicable standards, and as directed, except for measurement and payment.

In general, restrict construction work to single lane widths. Control traffic in accordance with standard drawings WZ (BTS-1) "Traffic Signal Installation Typical Details"; WZ (BTS-2) "Traffic Signal Installation Barricades And Signs"; and, Part VI of the "Texas Manual On Uniform Traffic Control Devices For Streets And Highways". Unless otherwise approved, use an advance warning, flashing arrow panel in addition to the necessary signs, barricades, or other traffic control devices at the work area.

Plan the sequence of work to minimize the time lane closures are in place. Install lane closures only where construction operations are anticipated to start within 1 hour, unless otherwise directed or approved.

All workers on TxDOT right-of-way must wear reflective clothing meeting ANSI Class II requirements during the day and ANSI Class III requirements during the night.

Use additional flaggers at roadway intersections to direct traffic entering the work area, when deemed necessary by the Engineer.

Provide adequate flaggers to protect the traveling public. All flaggers shall wear approved hardhats and reflective vests while flagging. Safety vests shall be clean and worn fully fastened.

Open all traffic lanes to traffic at the close of work each day.

No overnight closures will be permitted.

Provide temporary Rumble Strips as shown on WZ (RS)-22.

Provide one high-intensity yellow, rotating dome-light on all equipment such as drill truck, bucket truck, backhoes, etc. Mount lights high enough to be visible from all directions and operating when the equipment is within 30 ft. of the travel way. On all other equipment such as trucks, trailers, automobiles, etc. use emergency flashers while within the work zone.

Notify the Engineer prior to placing any materials or equipment on the right of way. Locate equipment, stockpiles or other materials not in use as far as possible from the driving lanes and in no case closer than 30 ft. unless otherwise authorized. Any equipment, stockpiles, or materials placed within 30 ft. of the driving lane must have adequate signs, barricades or other warning devices as approved. As a minimum place an 8 ft. wide TY III Barricade or barrels on the approach side of each site that is within 30 ft. of the driving lane. Use TY III Barricade or

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**County:** Angelina, etc.

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barrels for the site similarly on the departure side if the location is within 30 ft. of the opposing traffic lane.

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

Due to the limited soil disturbing nature of this project, temporary erosion control work has not been included. Should this work become necessary, it will be paid for in accordance with Article 4.4, "Changes in the Work".

**Item 531: Sidewalks**

Welded wire fabric will not be allowed for reinforcing sidewalks. Use reinforcing steel consisting of No. 3 or 4 bars meeting the requirements of grade 60 reinforcing steel. Place bars on 12 in. centers in each direction, supported on reinforcing chairs.

Unless otherwise directed, install 1/2 in. pre-molded expansion joint material between existing concrete and new concrete.

**Item 618: Conduit**

Place conduit to a minimum depth of 3 ft., where obstructions prevent laying at this depth, place as directed.

Where a trench for laying conduit is cut through pavement, surfaced shoulder, median or driveway, replace the base and surfacing with similar materials equal in appearance and quality to the original construction. Replacing base and surfacing will be subsidiary to Item 618.

Place conduit under existing pavement by boring unless otherwise directed. Pits for boring must not be closer than 2 ft. from edge of pavement, unless otherwise approved. Water jetting will not be permitted. At the close of work each day, cover all open pits and barricade for safety.

Use of a pneumatically driven device for punching holes beneath pavement (commonly known as a "missile") will not be permitted on this project.

When boring is used for under-pavement conduit installations, maximum allowable overcut will be 1 in. diameter.

When conduits are bored, vertical and horizontal tolerances must not exceed 18 inches as measured from the intended target point.

All underground conduit bends of 45° or more in PVC conduit systems, including bends into ground boxes, will be made with rigid metal conduit. Where rigid metal conduits is exposed at any point and where rigid metal conduits extends into ground boxes, bond the metal conduit to the grounding conduction with grounding type bushings or by other approved UL listed grounding connectors. Rigid metal bends will not be paid for separately but will be incidental to the PVC conduit system.

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**Item 620: Electrical Conductors**

Provide breakaway electrical connectors for breakaway poles. Use Bussman HEBW, Littlefuse LEB, Ferraz-Shawmut FEB, or equal on ungrounded conductors. For grounded conductors, use Bussman Het, Littlefuse Let, Ferraz-Shawmut Febn, or equal. These breakaway connectors have a white colored marking and a permanently installed solid neutral. The splice must be a fused breakaway connector as described elsewhere in the plans, or as directed.

Do not use non-certified persons to perform electrical work. See Article 7.18., "Electrical Requirements" for additional details.

**Item 624: Ground Boxes**

Provide Type "C" Ground Boxes at Traffic Signal Controller foundations and Type "A" Ground Boxes for all other locations, unless otherwise directed or approved.

**Item 628: Electrical Services**

Comply with local standards and practices for proper installation of electrical service. Service entrance to be 2 AWG XHHW stranded copper. In addition to the TxDOT specified Ufer grounding, the electrical services must also include the grounding rods. Grounding wire shall be #6 gauge solid copper, run in 1/2" conduit from the service enclosure through the foundation to the grounding rod.

**Item 656: Foundations for Traffic Control Devices**

Consult with appropriate utilities before excavating for foundations, and take adequate precautions, by probing or uncovering by hand, to protect utilities or appurtenances. Use One-Call for locates.

Foundations for Roadside Flashing Beacon Assemblies will be Screw-In Type unless otherwise directed.

**Item 680: Installation of Highway Traffic Signals**

If traffic signal maintenance becomes necessary to repair, replace or install a fully operational signalized intersection, ensure the existing traffic signal remains in full operation. Existing traffic signal devices may be turned off only for brief periods of time to allow for installation of new devices. Power may be turned off only during off-peak periods from 9:00 A.M. until 11:00 A.M. and 1:00 P.M. until 3:00 P.M. Provide temporary signing, flaggers or additional traffic control as directed, so that traffic can be moved through the intersection safely.

The Department will furnish the Traffic Signal Controller Assemblies for this project. Furnish all other materials, tools, equipment and labor necessary to complete the work.

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**Sheet 2B**

**County:** Angelina, etc.

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**Highway:** US 59, etc.

Install the Traffic Signal Controller Assembly on the foundation, using anchor bolts and template supplied by the Department. Connect field wiring to the controller assembly back panel, install the conflict monitor, timer and other equipment, and turn on the signal system using settings supplied by the Department.

Perform all necessary work to provide for a fully functioning traffic signal installation.

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

Cover all signal heads securely with burlap and keep covered until placed in operation.

Provide necessary mounting hardware to insure proper mounting of all signal heads.

Provide Articulating Brackets when required.

Alternate signal head mounting hardware may be used when approved.

Mount all signal heads so they hang level and plumb.

Unless otherwise approved, use stainless steel hardware for all miscellaneous assembly items not specifically identified on the plans.

**Item 684: Traffic Signal Cables**

Furnish stranded No. 14 AWG XHHW and No. 16 AWG XHHW conductors.

Identify each cable as shown in the plans (Cable 1, etc.) with permanent marking labels (Panduit Type PLM standard single marker tie, Thomas and Betts TY 548M, or equivalent) at each ground box, pole base and controller.

Terminate all wiring from each signal head in the terminal block in the pole base where such terminal blocks are provided by the manufacturer. Splice wire runs to signal poles with breakaway bases in the pole base. The splice must be a fused breakaway connector as described elsewhere in the plans, or as directed. Otherwise, wire runs must be continuous to the controller.

No extra compensation will be allowed for fulfilling the requirements stated above.

Furnish a written summary of the wire tests. This summary must indicate a description of each wire run, length, and test readings for each test procedure. Additional information such as make, model and type of testing equipment used for each test and the name and title of the individual who performed the tests must be included. Certify the test results as being true and correct prior to submission to the Engineer. Upon detection of a failed wire run test, forward documentation of the failed test to the Engineer and replace the wire run.

**Item 685: Roadside Flashing Beacon Assemblies**

Furnish and install flasher controller assemblies on service poles as directed or approved.

**General Notes**

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**Sheet 2C**

**County:** Angelina, etc.

**Control:** 6466-55-001

**Highway:** US 59, etc.

Flashing beacons shall be flashed alternately.

**Item 688: Pedestrian Detectors and Vehicle Loop Detectors**

Furnish new pedestrian signal units and materials and install as directed. Equipment and materials must meet the requirements of DMS-11132, "Accessible Pedestrian Signals (APS)". This equipment must be compatible with the controller assembly equipment and setup. Do not order any equipment or materials and commence work for this installation without the approval of the Engineer.

**Item 690: Maintenance of Traffic Signals**

Unless otherwise directed, furnish all wood and steel poles required for this project.

All existing material deemed unsalvageable will become the property of the Contractor and removed from the worksite and disposed of as outlined under Article 690.2., "Materials", and pertinent requirements of various other items, unless otherwise directed or approved.

Unless specifically identified and included as a pay item for "Removal", unsalvageable material removed from the worksite will not be paid for separately.

Return unused or removed salvageable material to the District's Signal Shop located in Lufkin at 1805 N. Timberland Drive, and stockpile as directed.

Unless otherwise directed, when existing sod is disturbed, provide Bermuda block sod unless St. Augustine is the prevailing grass cover, and then provide St. Augustine block sod at those locations. Fertilize sodded areas as directed. Water all newly placed sodded areas the same day of installation. Continue to water these areas as directed, to prevent them from becoming dry to the condition that water stress is evident. This work will not be measured or paid for separately, but is subsidiary to pertinent items in this contract.

**Item 6185: Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)**

Two (2) TMAs (Stationary) will be required for this project. The contractor will be responsible for determining if multiple operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

Truck Mounted Attenuators (TMA's) shall meet the requirements of this item and the Department's Compliant Work Zone Traffic Control Device List.

Truck Mounted Attenuators (TMA's) as shown on the TCP's shall be used. Whether shown on the TCP's or added by the Department, TMA's shall be paid for under Item 6185, "Truck Mounted Attenuator" for the type of operation being performed.

**General Notes**



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 6466-55-001

DISTRICT Lufkin  
HIGHWAY US0059

COUNTY Angelina

CONTROL SECTION JOB				6466-55-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00209248			
COUNTY				Angelina			
HIGHWAY				US0059			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	500-6033	MOBILIZATION (CALLOUT)	EA	6.000		6.000	
	531-6001	CONC SIDEWALKS (4")	SY	20.000		20.000	
	618-6046	CONDT (PVC) (SCH 80) (2")	LF	150.000		150.000	
	618-6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	300.000		300.000	
	618-6058	CONDT (PVC) (SCH 80) (4")	LF	150.000		150.000	
	618-6059	CONDT (PVC) (SCH 80) (4") (BORE)	LF	300.000		300.000	
	620-6007	ELEC CONDR (NO.8) BARE	LF	1,500.000		1,500.000	
	620-6008	ELEC CONDR (NO.8) INSULATED	LF	1,000.000		1,000.000	
	620-6010	ELEC CONDR (NO.6) INSULATED	LF	300.000		300.000	
	624-6010	GROUND BOX TY D (162922)W/APRON	EA	3.000		3.000	
	628-6002	REMOVE ELECTRICAL SERVICES	EA	5.000		5.000	
	628-6188	ELC SRV TY D 120/240 070(NS)SS(E)SP(O)	EA	3.000		3.000	
	628-6307	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	EA	3.000		3.000	
	628-6309	ELC SRV TY T 120/240 000(NS)GS(N)TP(O)	EA	3.000		3.000	
	682-6018	PED SIG SEC (LED)(COUNTDOWN)	EA	10.000		10.000	
	682-6049	BACKPLATE W/REFL BRDR(4 SEC)	EA	15.000		15.000	
	682-6050	BACKPLATE W/REFL BRDR(5 SEC)	EA	15.000		15.000	
	682-6060	BACKPLATE W/REFL BRDR(3 SEC)	EA	30.000		30.000	
	684-6028	TRF SIG CBL (TY A)(14 AWG)(2 CONDR)	LF	2,000.000		2,000.000	
	684-6029	TRF SIG CBL (TY A)(14 AWG)(3 CONDR)	LF	1,000.000		1,000.000	
	684-6030	TRF SIG CBL (TY A)(14 AWG)(4 CONDR)	LF	2,000.000		2,000.000	
	684-6033	TRF SIG CBL (TY A)(14 AWG)(7 CONDR)	LF	1,000.000		1,000.000	
	685-6001	INSTALL RDS FLASH BEACON ASSEMBLY	EA	1.000		1.000	
	690-6006	REMOVAL OF GROUND BOXES	EA	5.000		5.000	
	690-6018	INSTALL OF SPAN CABLE ASSM	LF	500.000		500.000	
	690-6025	REPLACE OF SIGNAL HEAD ASSM	EA	50.000		50.000	
	690-6031	REPLACE OF PEDESTRIAN PUSH BUTTONS	EA	8.000		8.000	
	690-6036	INSTALL OF FND FOR GROUND MNT CABINETS	EA	2.000		2.000	
	690-6042	REPLACE OF CONTROL CABINET(POLE MNT)	EA	1.000		1.000	
	690-6052	REPLACE OF SIGNAL POLE ASSM	EA	2.000		2.000	
	690-6063	REMOVAL OF CONCRETE FOUNDATIONS	EA	3.000		3.000	
	690-6071	INS OF TRF SIG PL FND (30" DRIL SHFT)	LF	33.000		33.000	
	690-6072	INS OF TRF SIG PL FND (36" DRIL SHFT)	LF	30.000		30.000	
	690-6087	INSTL PED POLE ASSM	EA	3.000		3.000	
	690-6137	VIVDS CABLE (INSTALL)	LF	1,500.000		1,500.000	
	6000-6084	REPLACE BREAKAWAY FUSE HOLDER	EA	50.000		50.000	
	6058-6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA	2.000		2.000	



DISTRICT	COUNTY	CCSJ	SHEET
Lufkin	Angelina	6466-55-001	3



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 6466-55-001

DISTRICT Lufkin  
HIGHWAY US0059

COUNTY Angelina

CONTROL SECTION JOB				6466-55-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00209248			
COUNTY				Angelina			
HIGHWAY				US0059			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	6058-6003	REPLACE BBU BATTERIES	EA	6.000		6.000	
	6185-6002	TMA (STATIONARY)	DAY	20.000		20.000	
	7052-6044	LANE CLOSURE (SETUP AND REMOV)(TY 3)	EA	2.000		2.000	
	7052-6050	LANE CLOSURE (SETUP AND REMOV)(TY 9)	EA	2.000		2.000	
	7052-6053	LANE CLOSURE (SETUP AND REMOV)(TY 12)	EA	2.000		2.000	
	7052-6061	LANE CLOSURE (MAINTENANCE) (TY 3)	HR	8.000		8.000	
	7052-6067	LANE CLOSURE (MAINTENANCE) (TY 9)	HR	8.000		8.000	
	7052-6070	LANE CLOSURE (MAINTENANCE) (TY 12)	HR	8.000		8.000	

DISTRICT	COUNTY	CCSJ	SHEET
Lufkin	Angelina	6466-55-001	3A

**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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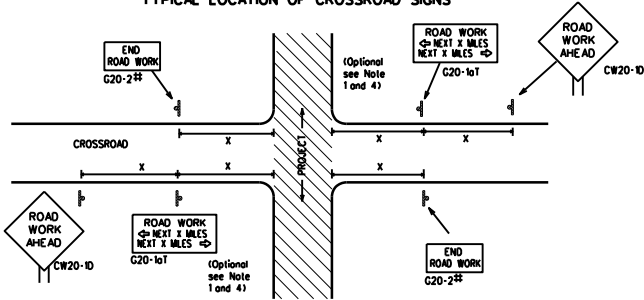
**BARRICADE AND CONSTRUCTION  
 GENERAL NOTES  
 AND REQUIREMENTS**

**BC(1)-21**

FILE:	bc-21.dgn	DN:	TxDOT	DN:	TxDOT	DN:	TxDOT	DN:	TxDOT
REVISED:	November 2002	CONT:	55	SECT:	001	JOB:	US 59, ETC.	HIGHWAY:	
4-03	7-13	DIST:	LFK	COUNTY:	ANGELINA, ETC.	SHEET NO.:	4		
9-07	8-14								
5-10	5-21								



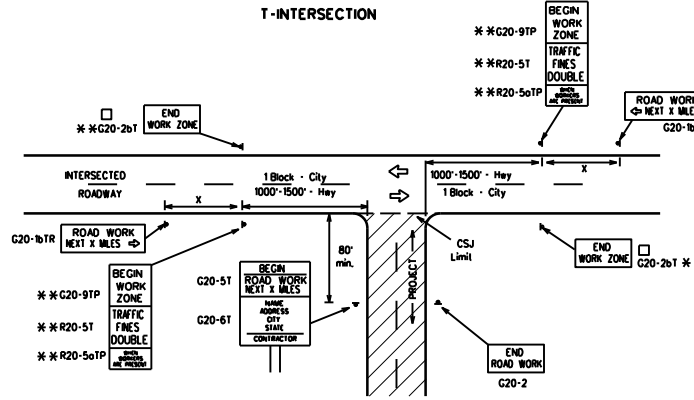
**TYPICAL LOCATION OF CROSSROAD SIGNS**



\*\* 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 and "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"(G20-1T) 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 (see BC10) 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**

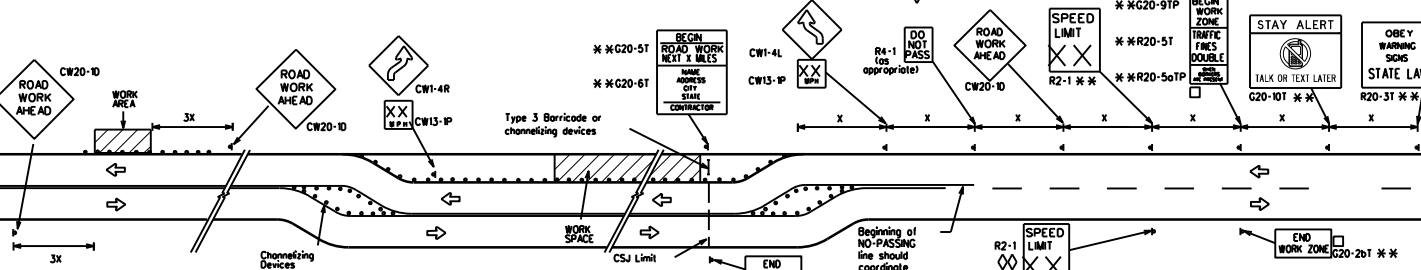
Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Spacing "X" Feet (Approx.)
CW20 <sup>4</sup>	48" x 48"	48" x 48"	30	120
CW22			35	160
CW23			40	240
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	45	320
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12			50	400
			55	500 <sup>2</sup>
	48" x 48"	48" x 48"	60	600 <sup>2</sup>
			65	700 <sup>2</sup>
			75	900 <sup>2</sup>
			80	1000 <sup>2</sup>
			#	# 3

- 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**

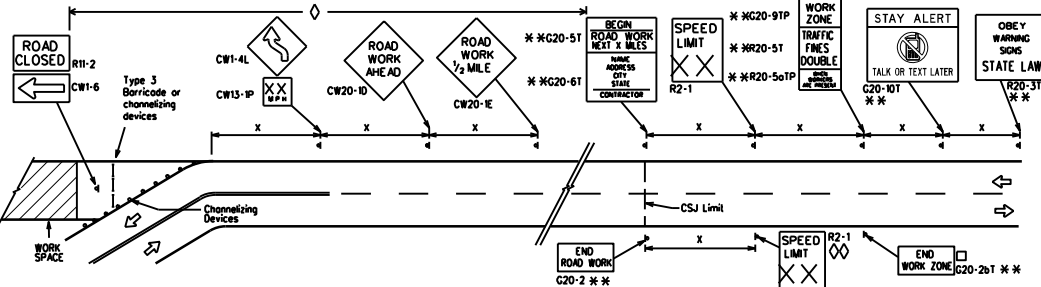
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be 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**

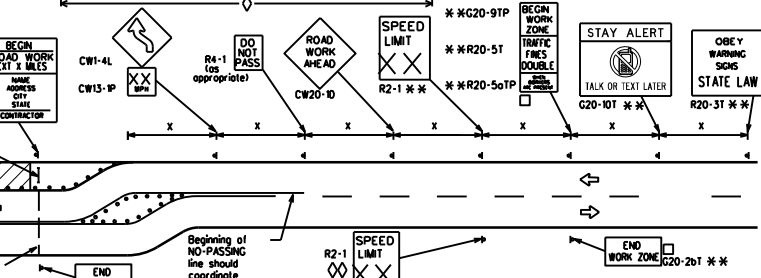


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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



**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**

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REVISIONS	NO.	DATE	BY	JOB	DESCRIPTION
1	6466	55	001	US 59, ETC.	
2	9-07	8-14			
3	7-13	5-21			
	DIST	COUNTY			SHEET NO.
	LFK	ANGELINA, ETC.			5

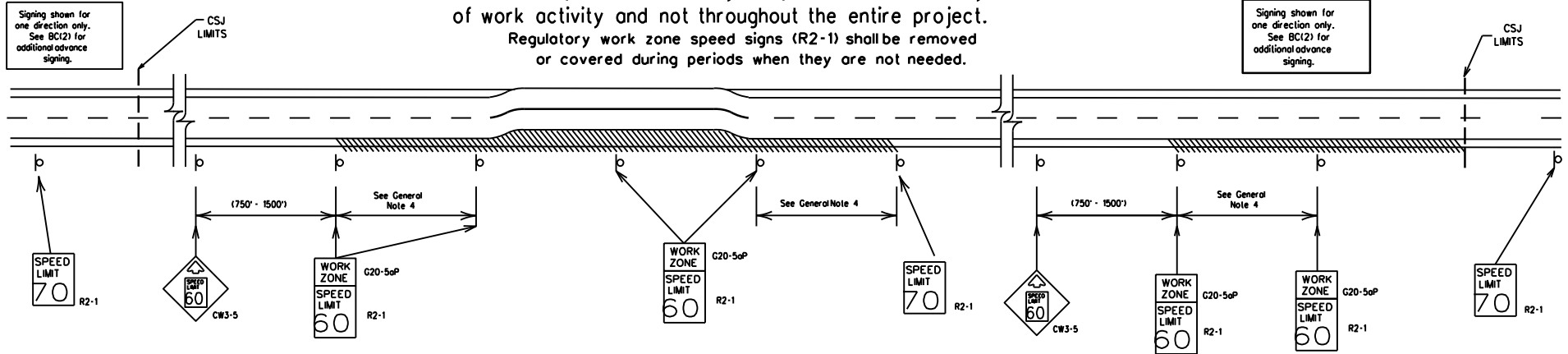
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## TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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 controls 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. Flogger 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



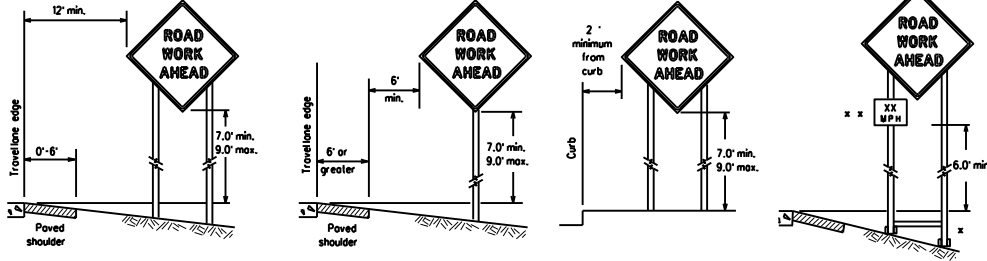
Traffic Safety Division Standard

## BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

**BC(3)-21**

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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY
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7-13	5-21	DIST	COUNTY	SHEET NO.	
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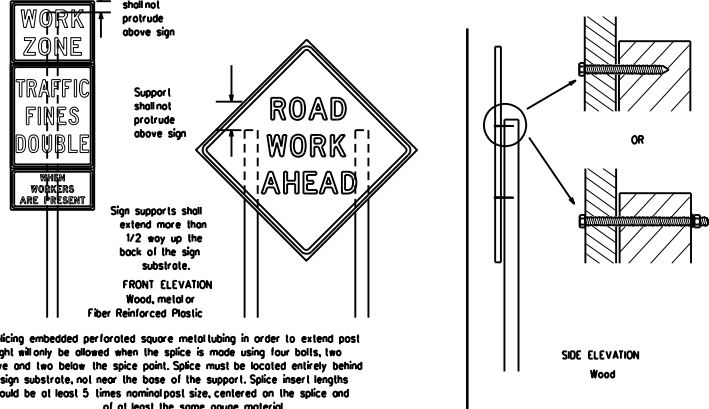
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



x When placing skid supports on uneven 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.

x x When plaques are placed on dual-leg supports, they should be attached to the upright nearest the travelway. 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

**Nails 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.

**GENERAL NOTES FOR WORK ZONE SIGNS**

- Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
- Wooden sign posts shall be painted white.
- Barricades shall NOT be used as sign supports.
- 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.
- 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 change 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.
- 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.
- 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.
- 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.
- 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 Uniform Traffic Control Devices" Part 6)**

- 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.
  - Long-term stationary - work that occupies a location more than 3 days.
  - Intermediate-term stationary - work that occupies a location more than one day/night period up to 3 days, or nighttime work lasting more than one hour.
  - Short-term stationary - daytime work that occupies a location for more than 1 hour in a single day/night period.
  - Short, duration - work that occupies a location up to 1 hour.
  - Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes).

**SIGN MOUNTING HEIGHT**

- 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.
- 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.
- Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
- 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.
- 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**

- 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**

- 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.
- "Mesh" type materials are NOT an approved sign substrate, regardless of the lightness of the weave.
- 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**

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

**SIGN LETTERS**

- All sign letters and numbers shall be clear, and open rounded type uppercase alphanumerical 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**

- When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
- 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.
- 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.
- When signs are covered, the material used shall be opaque, such as heavy 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 shall NOT be used to cover signs.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and anchor studs shall be removed and holes backfilled upon completion of work.

**SIGN SUPPORT WEIGHTS**

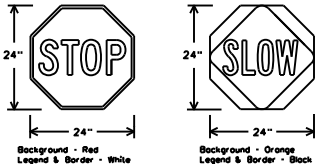
- Where sign supports require the use of weights to keep from turning over, the use of sandbags with 6" x 6" catchbasins sand shall be used.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects shall not be permitted for use as sign support weights.
- Sandbags shall 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 fire inner tubes) shall NOT be used.
- Rubber ballists designed for churning devices shall not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber hoses 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.

**FLAGS ON SIGNS**

- 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.

**STOP/SLOW PADDLES**

- STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24".
- STOP/SLOW paddles shall be retro-reflectORIZED when used at night.
- STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
- Any lights incorporated into the STOP or SLOW paddle faces shall only be as specifically described in Section 6C.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>1</sub> OR C <sub>1</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**

- 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.
- 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.
- When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
- 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.
- 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.
- 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.

Texas Department of Transportation  
Traffic Safety Division Standard

**BARRICADE AND CONSTRUCTION  
TEMPORARY SIGN NOTES**

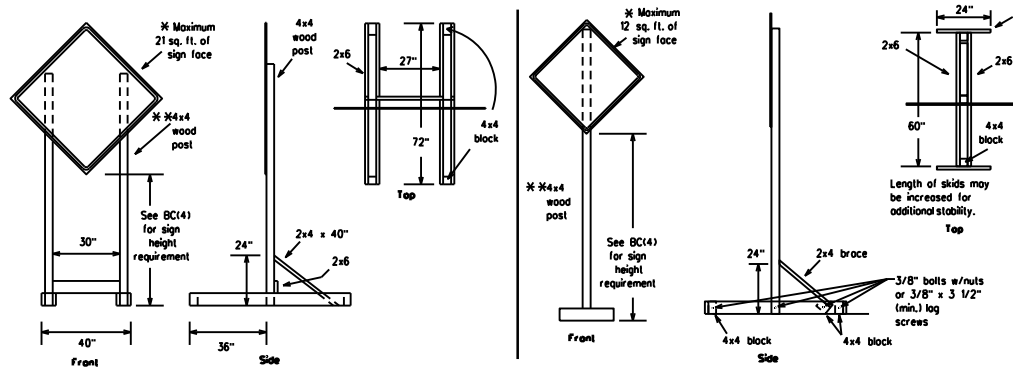
**BC(4)-21**

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DATE:	7-13	8-21	LFK	ANGELINA, ETC.					7

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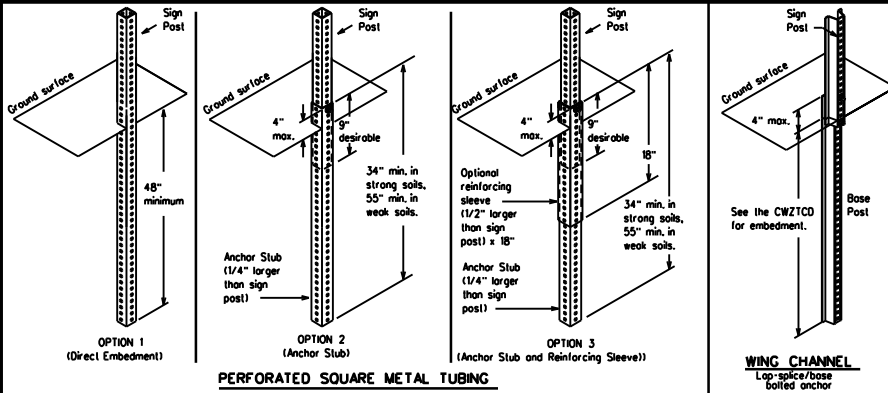
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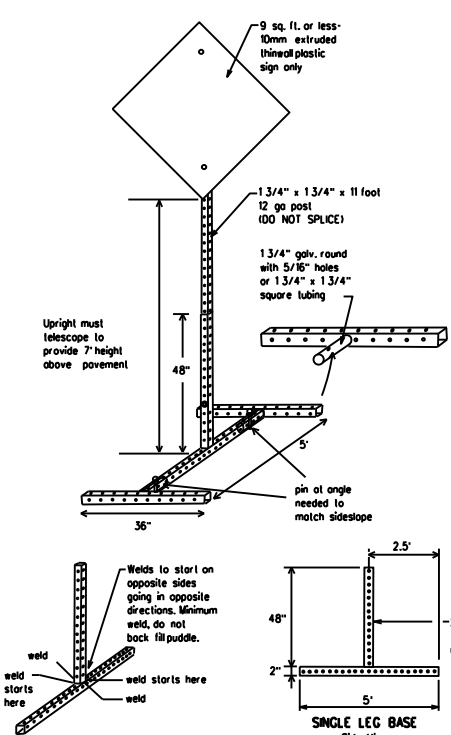
**SKID MOUNTED WOOD SIGN SUPPORTS**

LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS



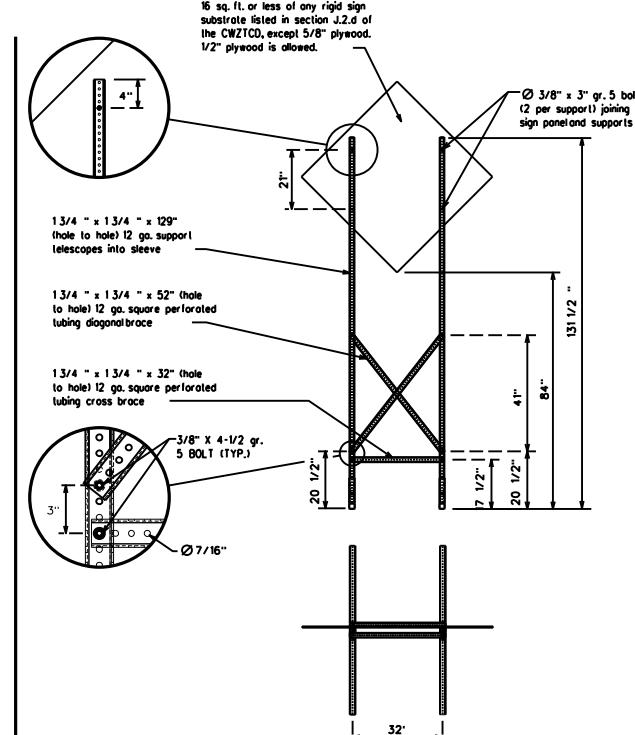
**GROUND MOUNTED SIGN SUPPORTS**

Refer to the CWZTCO 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 CWZTCO 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 CWZTCO 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 pointed white.  
 See the CWZTCO for the type of sign substrate that can be used for each approved sign support.

SHEET 5 OF 12  
 Texas Department of Transportation  
 Traffic Safety Division Standard

**BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT**

**BC(5)-21**

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7-13 5-21	LFK	ANGELINA, ETC.		8

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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 phrase, or two phrases 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 (H, 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 a 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 "TWOCD" column.
- 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.

**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	FRONTAGE ROAD CLOSED
ROAD CLOSED AT SH XXX	SHOULDER CLOSED XXX FT
ROAD CLSD AT FM XXXX	RIGHT LN CLOSED XXX FT
RIGHT X LANES CLOSED	RIGHT X LANES OPEN
CENTER LANE CLOSED	DAYTIME LANE CLOSURES
NIGHT LANE CLOSURES	I-XX SOUTH EXIT CLOSED
VARIOUS LANES CLOSED	EXIT XXX CLOSED X MILE
EXIT CLOSED	RIGHT LN TO BE CLOSED
MALL DRIVEWAY CLOSED	X LANES CLOSED TUE - FRI
XXXXXXXX BLVD CLOSED	

**Other Condition List**

ROADWORK XXX FT	ROAD REPAIRS XXXX FT
FLAGGER XXXX FT	LANE NARROWS XXXX FT
RIGHT LN NARROWS XXXX FT	TWO-WAY TRAFFIC XX MILE
MERGING TRAFFIC XXXX FT	CONST TRAFFIC XXX FT
LOOSE GRAVEL XXXX FT	UNEVEN LANES XXXX FT
DETOUR X MILE	ROUGH ROAD XXXX FT
ROADWORK PAST SH XXXX	ROADWORK NEXT FRI-SUN
BUMP XXXX FT	US XXX EXIT X MILES
TRAFFIC SIGNAL XXXX FT	LANES SHIFT

\* 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	FORM X LANES RIGHT
DETOUR NEXT X EXITS	USE XXXXX RD EXIT
USE EXIT XXX	USE EXIT I-XX NORTH
STAY ON US XXX SOUTH	USE I-XX E TO I-XX N
TRUCKS USE US XXX N	WATCH FOR TRUCKS
WATCH FOR TRUCKS	EXPECT DELAYS
EXPECT DELAYS	PREPARE TO STOP
REDUCE SPEED XXX FT	END SHOULDER USE
USE OTHER ROUTES	WATCH FOR WORKERS
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
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**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
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**\*\* Advance Notice List**

TUE-FRI XX AM-X PM	APR 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
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\*\* See Application Guidelines Note 6.

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WORD OR PHRASE	ABBREVIATION	WORD OR PHRASE	ABBREVIATION
Access Road	ACS RD	Major	MAJ
Alternate	ALT	Miles	MI
Avenue	AVE	Miles Per Hour	MPH
Best Route	BEST RTE	Minor	MINR
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	ENTR	Southbound (route) S	
Express Lane	EXP LN	Speed	SPD
Expressway	EXPRY	Street	ST
XXXX Feet	XXXX FT	Sunday	SUN
Fog Ahead	FOG AHD	Telephone	PHONE
Freeway	FRWY, FWY	Temporary	TEMP
Freeway Blocked	FRWY BLKD	Thursday	THURS
Friday	FRI	To Downtown	TO DWTN
Hazardous Driving	HAZ DRIVING	Traffic	TRAF
Hazardous Material	HAZMAT	Travelers	TRVLRS
High Occupancy	HOV	Tuesday	TUES
Vehicle Highway	Hwy	Time Minutes	TIME MIN
Hour(s)	HR, HRS	Upper Level	UPR LEVEL
Information	INFO	Vehicles (a)	VEH, VEHs
It Is	IT IS	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	LRR LEVEL	Will Postment	WET PVTM
Maintenance	MAINT	Won't	WONT

roadway designation = H=number, US=number, SH=number, FM=number

**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 1st phase selected.
- If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS should 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 H, 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 M, 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(17), for the same size arrow.



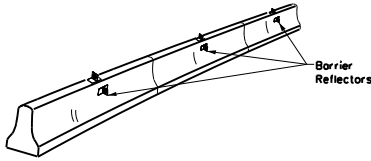
**BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)**

**BC(6)-21**

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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	6466	55	001	US 59, ETC.
9-07	8-14		DIST	COUNTY
7-13	5-21		LFK	ANGELINA, ETC.
				SHEET NO. 9

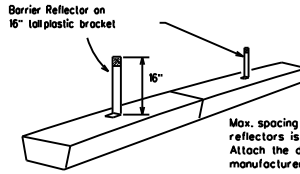
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors shall be as specified in the TMTUCD. 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 (B-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 edge line 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.

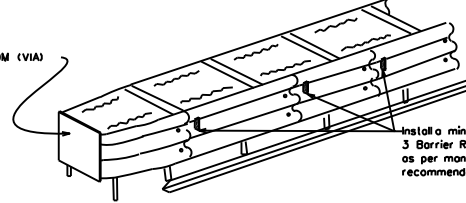


LOW PROFILE CONCRETE BARRIER (LPCB)

**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.



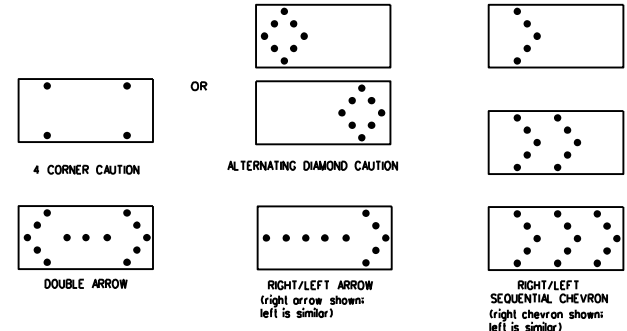
**DELINEATION OF END TREATMENTS**

**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.

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.

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

**WARNING LIGHTS**

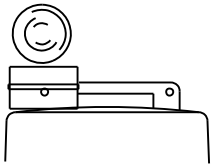
- Warning lights shall meet the requirements of the TMTUCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet 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**

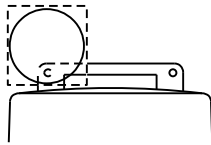
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing 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 travelway.



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

**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.



Traffic Safety Division Standard

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

BC(7)-21

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REVISED: November 2002	CONT: 55	SECT: 001	JOB: US 59, ETC.	HIGHWAY: SHEET NO.
9-07 8-14	DIST: LFK	COUNTY: ANGELINA, ETC.	10	

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**GENERAL NOTES**

- For long term stationary work zones on freeways, drums should be used as the primary channelizing device.
- 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, 42" two-piece cones, or 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.
- 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.
- Drums and 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).
- 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.
- 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:

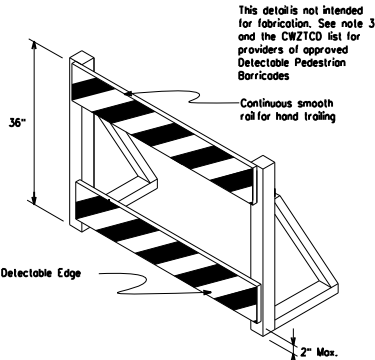
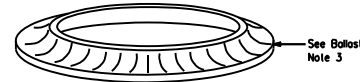
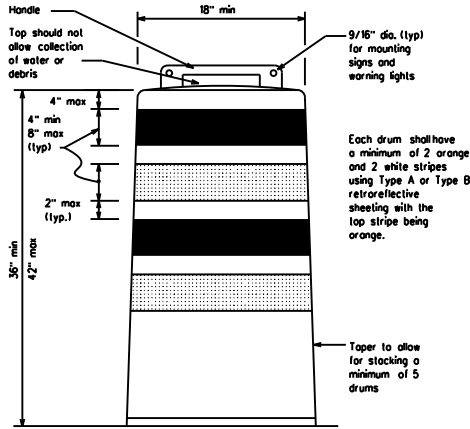
- Plastic drums shall be a two-piece design: the "body" of the drum shall be the top portion and the "base" shall be the bottom.
- The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
- Plastic drums shall be constructed of lightweight flexible, and deformable materials. The Contractor shall NOT use metal drums or single piece plastic drums as channelizing devices or sign supports.
- 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.
- 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.
- 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.
- 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.
- Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
- Drum body shall have a maximum unboltsed weight of 11 lbs.
- Drum and base shall be marked with manufacturer's name and model number.

**RETROREFLECTIVE SHEETING**

- 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.
- 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.

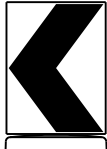
**BALLAST**

- Unboltsed bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, shall 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. Slacking of sandbags will be allowed, however height of sandbags above pavement surface may not exceed 12 inches.
- 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.
- Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
- 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.
- 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.
- Ballast shall not be placed on top of drums.
- Adhesives may be used to secure base of drums to pavement.

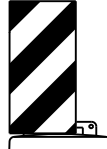


**DETECTABLE PEDESTRIAN BARRICADES**

- 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 Contrarequirements for Sidewalk Divisions, Sidewalk Detours and Crosswalk Closures.
- 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.
- 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.
- 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.
- Warning lights shall not be attached to detectable pedestrian barricades.
- Detectable pedestrian barricades should use 8" nominal barricade rolls as shown on BC(10) provided that the top roll provides a smooth continuous roll 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, Driveaway sign D700, Keep Right R4 series or other signs as approved by Engineer




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

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

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

- Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
- 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.
- 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 travel lane.
- 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.
- Signs shall be installed using a 1/2 inch ball (nominal) and nut, two washers, and one locking washer for each connection.
- Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
- 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.
- R9-9, R9-10, R9-11 and R9-1a SideWalk Closed signs which are 24 inches wide may be mounted on plastic drums, with approval of the Engineer.

SHEET 8 OF 12



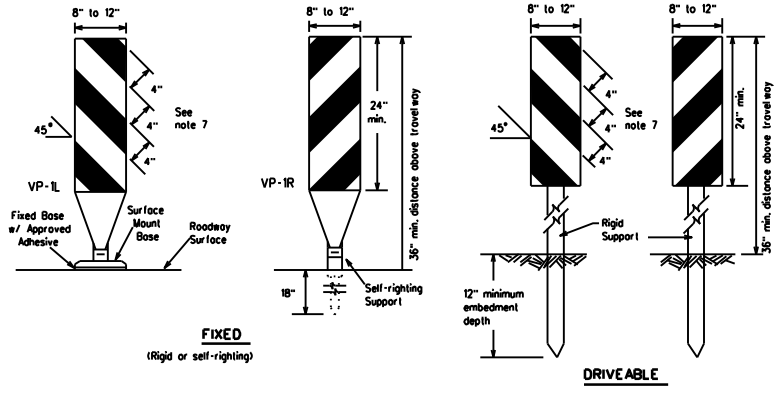
Texas Department of Transportation  
Traffic Safety Division Standard

**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

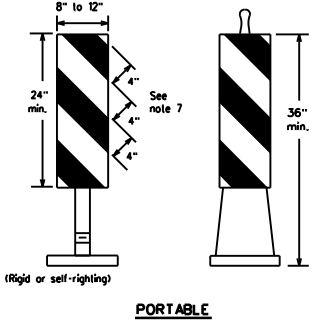
**BC(8)-21**

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REV: 03 9-07	REV: 04 5-21			

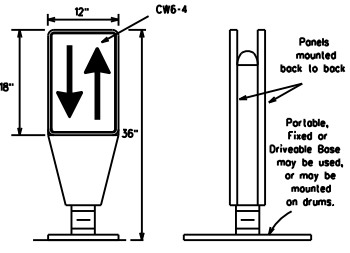
DISCLAIMER: This standard is approved by the Texas Engineering Practice Act. No warranty of any kind is made by TxDOT for use of this standard for any other purpose, or for any incorrect results or damages resulting from its use.



- Vertical Panels (VPs) are normally used to channelize traffic or divide opposing lanes of traffic.
- VPs 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.
- VPs 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.
- VPs used on expressways and freeways or other high speed roadways, may have more than 270 square inches of retroreflective area facing traffic.
- Self-righting supports are available with portable bases. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
- Sheeting for the VP's shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
- Where the height of reflective material on the vertical panels is 36 inches or greater, a panel stripe of 6 inches shall be used.

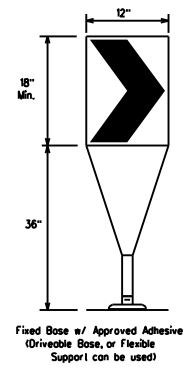


**VERTICAL PANELS (VPs)**



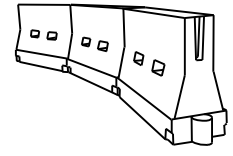
- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base is secured to the pavement with an adhesive or rubber weight to minimize movement caused by a vehicle impact or wind gust.
- The OTLD may be used in combination with 42\"/>

**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**



- The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
- 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.
- 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.
- To be effective, the chevron should be visible for at least 500 feet.
- 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.
- For Long Term Stationary use on lapses 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)**

- 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.
- LCDs may be used instead of a line of cones or drums.
- LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
- LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
- LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
- LCDs used as barricades placed perpendicular to traffic should have at least one row of reflective sheeting meeting the requirements for barricade rolls 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**

- 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.
- 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.
- 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.
- 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.
- When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flored 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 cones 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**

- 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).
- 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.
- 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).
- 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.
- Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall have a minimum of 30 lbs.
- 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.
- 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			Suggested Maximum Spacing of Channelizing Devices	
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent
30	L - WS 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 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

FILE: bc-21.dgn	DN: TxDOT	OK: TxDOT	DN: TxDOT	OK: TxDOT
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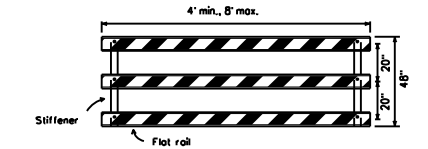
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**TYPE 3 BARRICADES**

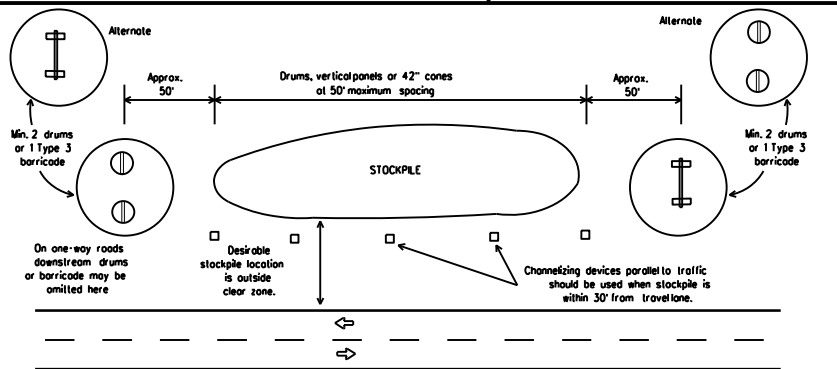
1. Refer to the *Compliant Work Zone Traffic Control Devices List (CWZTCD)* for details of the Type 3 Barricades and a list of all materials used in the construction of Type 3 Barricades.
2. Type 3 Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending 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 shall 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 liners) 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.



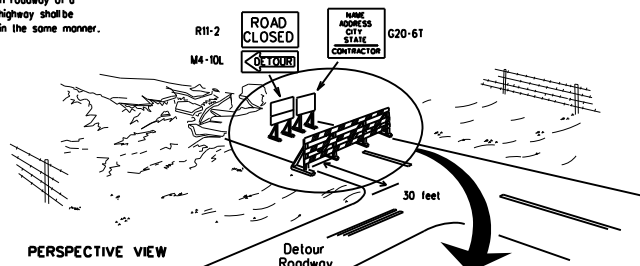
Stiffener may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

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



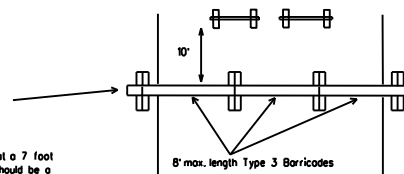
**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**

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



PERSPECTIVE VIEW

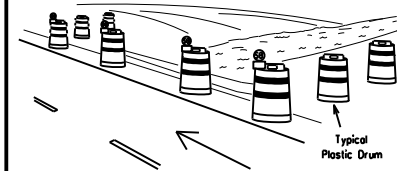
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



PLAN VIEW

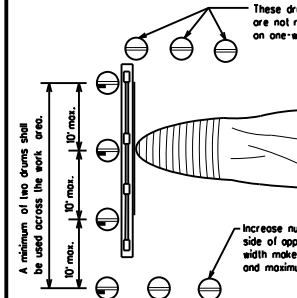
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

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



PERSPECTIVE VIEW

These drums are not required on one-way roadway



PLAN VIEW

Increase number of plastic drums on the side of approaching traffic if the crown width makes it necessary (minimum of 2 and maximum of 4 drums)

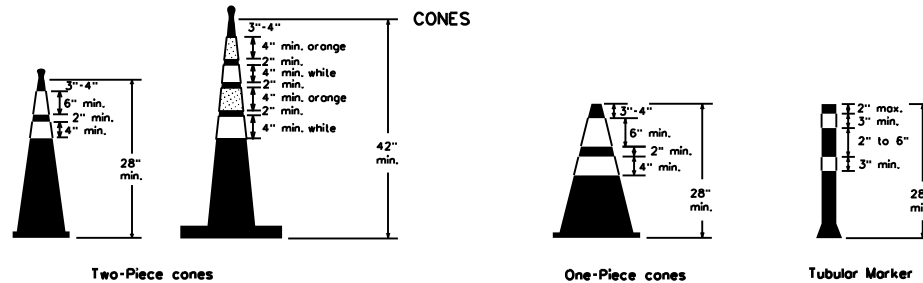
1. Where positive redirection capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder 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**

**CONES**



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.

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 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.



Texas Department of Transportation  
Traffic Safety Division  
Standard

**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(10)-21**

FILE: bc-21.dgn	DN: TxDOT	CR: TxDOT	DR: TxDOT	OK: TxDOT
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DATE: 5/21/2004 9:52:04 AM	REV: 02	DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO. 13

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**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 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(S17PM).
- 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 BC112.
- 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 (for back) shall meet the requirements of DMS-8240.

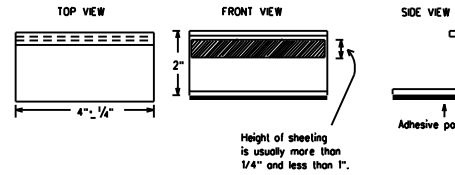
**MAINTAINING WORK ZONE PAVEMENT MARKINGS**

- The Contractor shall 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 material 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 flaggers 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.
- Blot 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.
- Block-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.
- 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 lab manufacturers.
- See Standard Sheet WZ(S17PM) for tab placement on new pavements. See Standard Sheet TC(P17-1) 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 BC111.

SHEET 11 OF 12



**BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS**

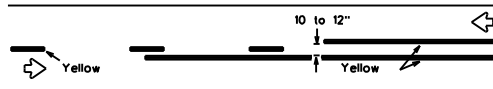
**BC(11)-21**

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© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
2-98	9-07	6466	55	001
1-02	7-15	DIST	COUNTY	SHEET NO.
11-02	8-14	LFK	ANGELINA, ETC.	14

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### PAVEMENT MARKING PATTERNS

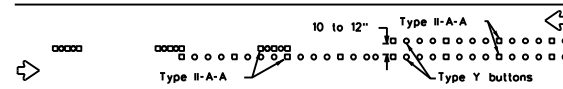


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

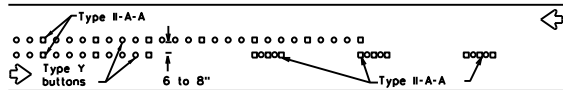


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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.

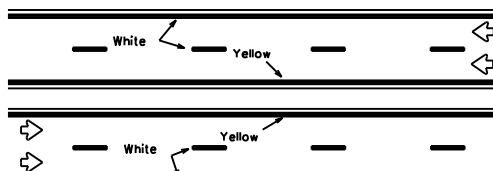


RAISED PAVEMENT MARKERS - PATTERN A



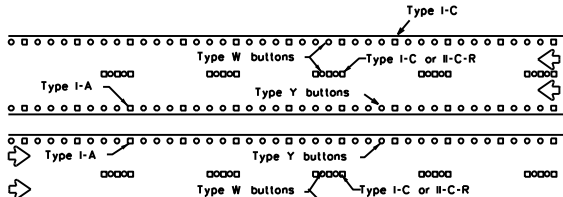
RAISED PAVEMENT MARKERS - PATTERN B

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



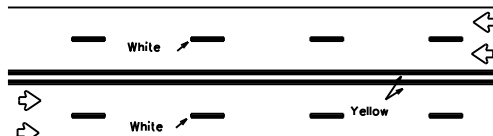
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



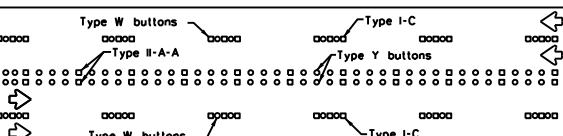
RAISED PAVEMENT MARKERS

### EDGE & LANE LINES FOR DIVIDED HIGHWAY



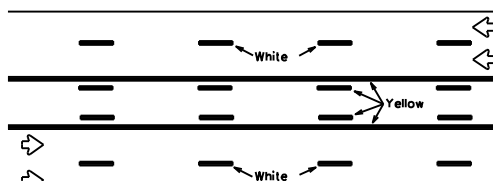
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



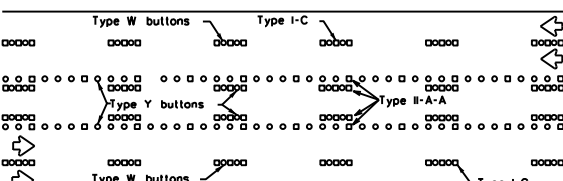
RAISED PAVEMENT MARKERS

### LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

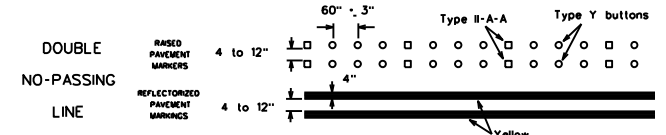
Prefabricated markings may be substituted for reflectORIZED pavement markings.



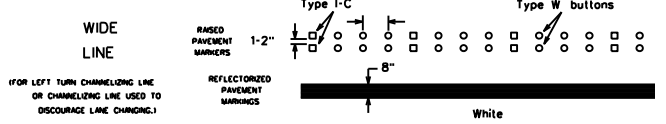
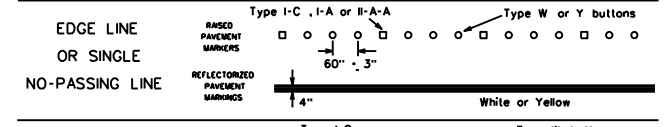
RAISED PAVEMENT MARKERS

### TWO-WAY LEFT TURN LANE

### STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

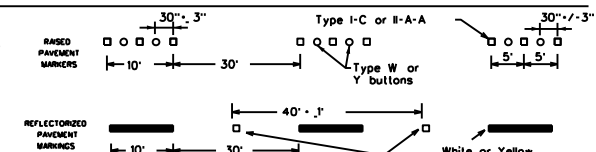


### SOLID LINES

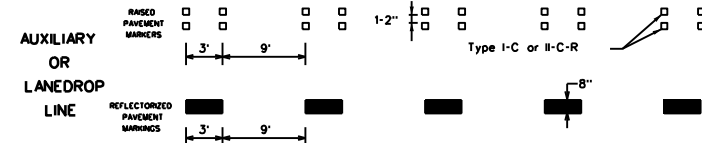


(FOR LEFT TURN CHANNELIZING LINE OR CHANNELIZING LINE USED TO DISCOURAGE LINE CHANGING.)

### CENTER LINE OR LANE LINE

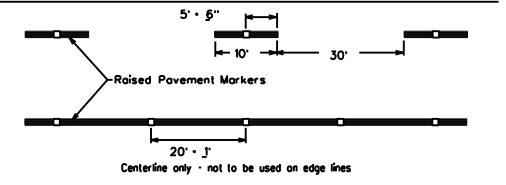


### BROKEN LINES



### 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."

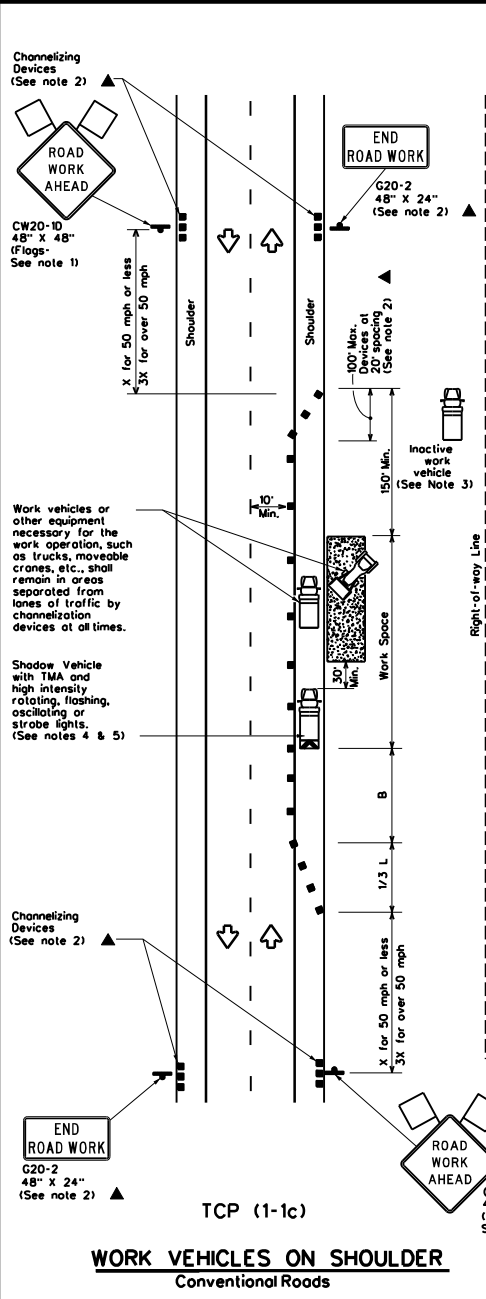
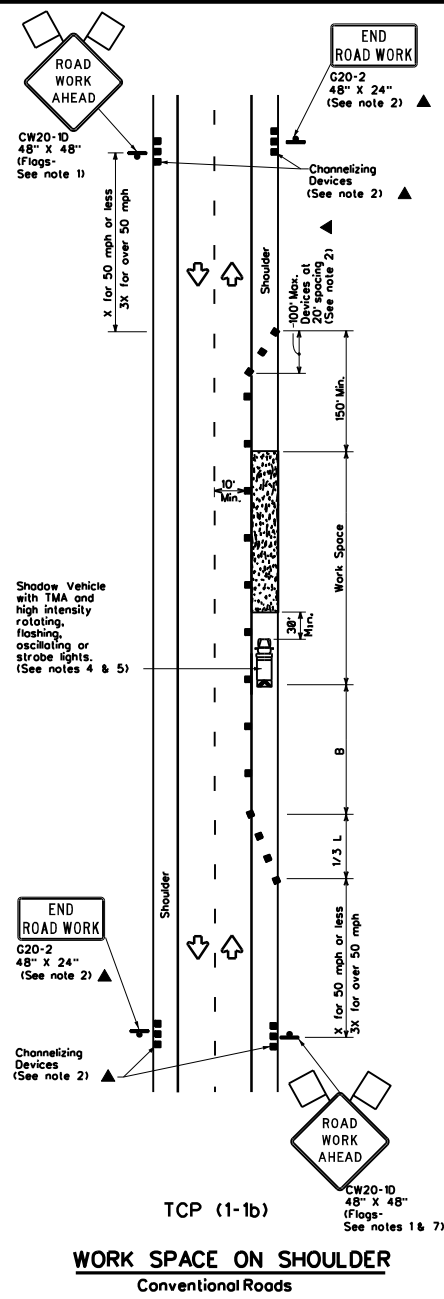
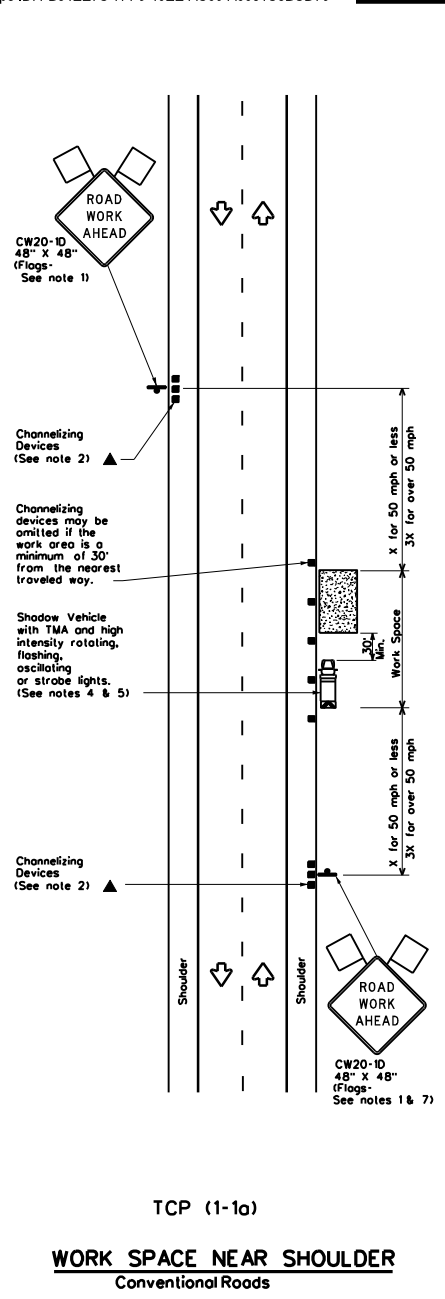
FILE: bc-21.dgn	DN: TxDOT	OK: TxDOT	DN: TxDOT	OK: TxDOT
© TxDOT February 1998	CONT SECT	JOB	HIGHWAY	
1-97 9-07 5-21	6466	55	001	US 59, ETC.
2-98 7-13	DIST	COUNTY		SHEET NO.
11-02 8-14	LFK	ANGELINA, ETC.		15

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DATE: 5/21/2024 9:52:05 AM  
FILE: T:\LFK\TROP\Maintenance contracts\PIANS\2024 Jobs\NMC-6466-55-001 (TxDOT)\Signal Maintenance\21 Standards\BC-21.dgn

DSC# 4469: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for any errors or omissions in this standard.

DATE: 5/21/2024 9:52:05 AM  
 FILE: T:\LFK\TROPs\maintenance\_contracts\PLANS\2024\_Jobs\TMC-6466-55-001\T-01-18.dgn



**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 =			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 = WS / 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	L = WS	500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60	L = WS	600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70	L = WS	700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

x = Conventional Roads Only  
 x = 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.
- Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
- 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 wider work spaces.
- See TCPP15-1 for shoulder work on divided highways, expressways and freeways.
- 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

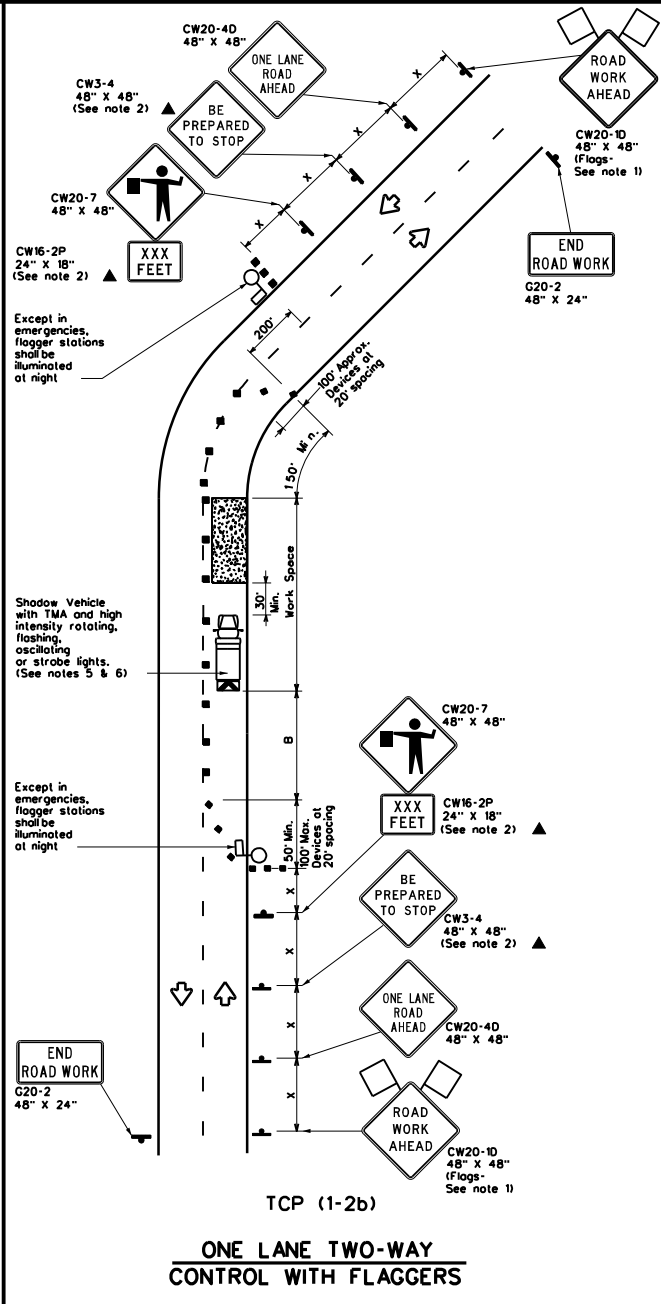
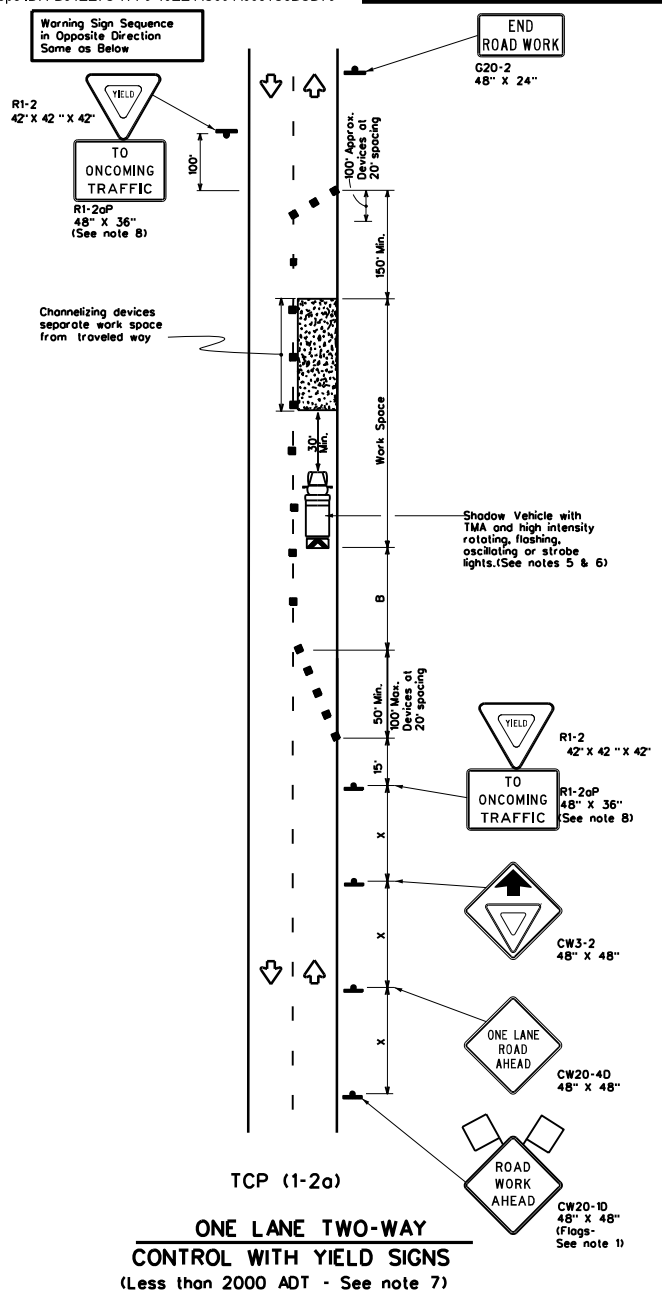
**TRAFFIC CONTROL PLAN  
 CONVENTIONAL ROAD  
 SHOULDER WORK**

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

FILE: tcpl-1-18.dgn	DATE: 12/18/95	CONTRACT: 6466	SECTION: 55	JOB: 001	HIGHWAY: US 59, ETC.
REVISIONS:		DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO.: 16	

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DATE: 5/21/2024 9:52:06 AM  
 FILE: T:\LFK\TRPS\maintenance\_contracts\PLANS\2824\_Jobs\RMC-6466-55-001\T-017.dgn



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		Flogger

Posted Speed x	Formula	Minimum Desirable Taper Lengths x =			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x"	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	L - WS 60	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L + WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

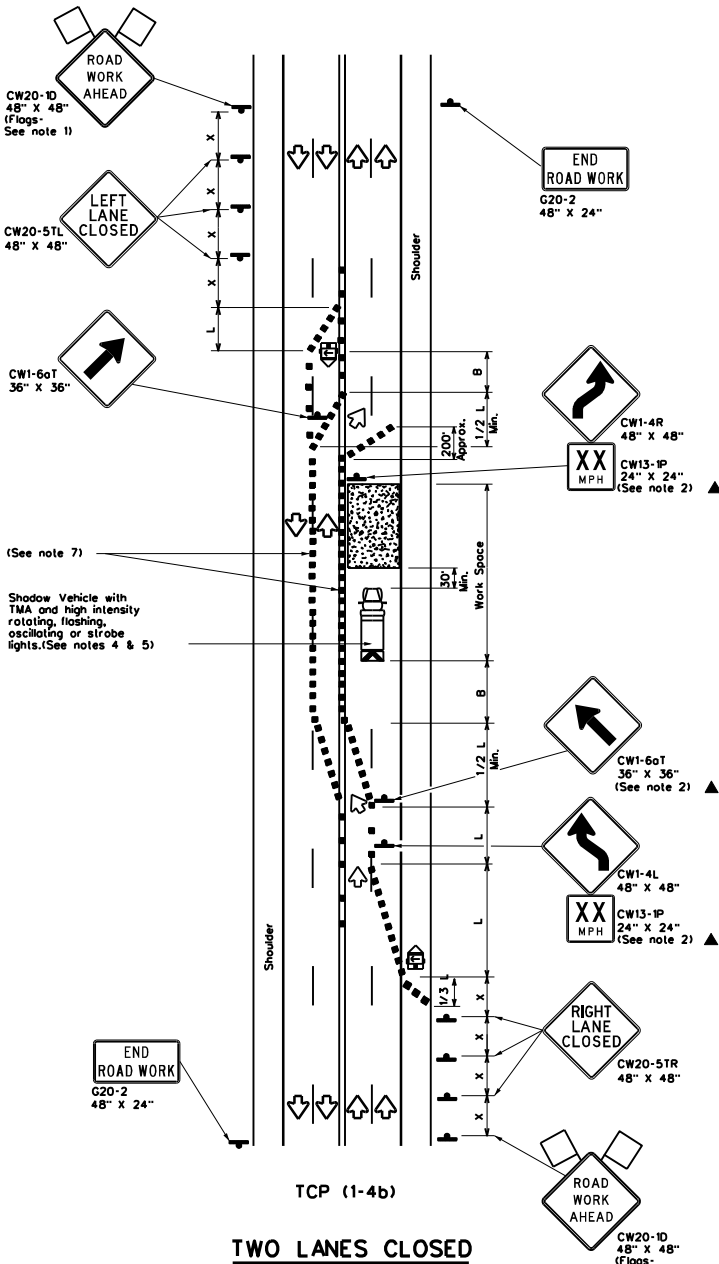
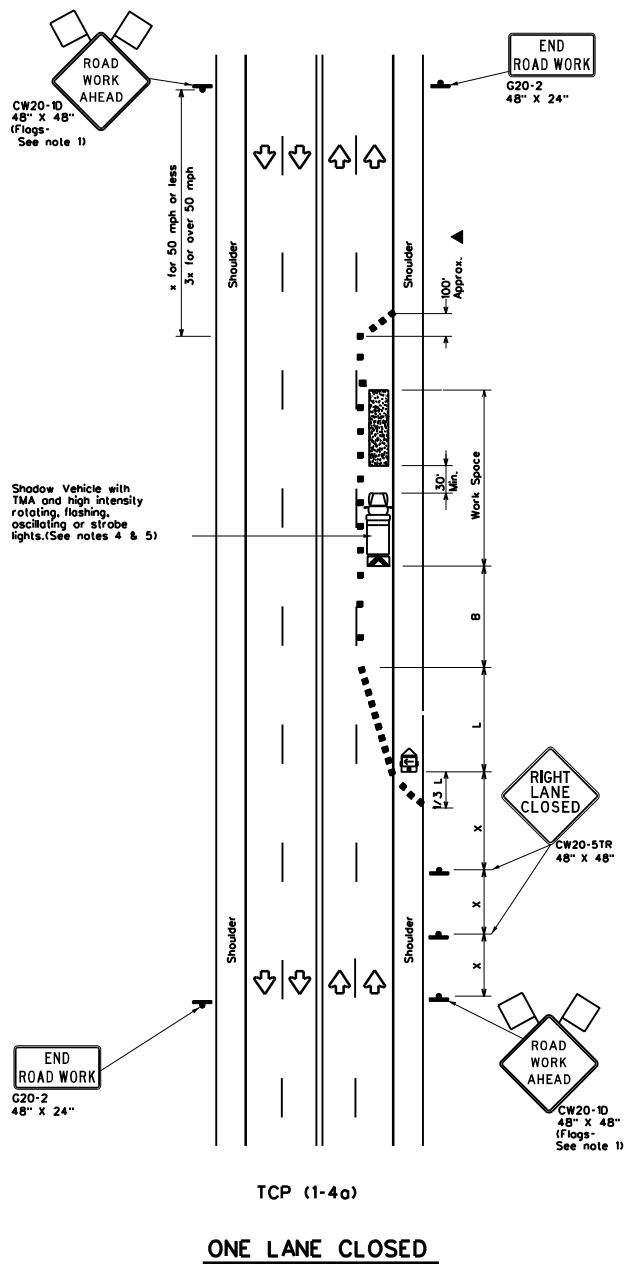
	TYPICAL USAGE			
	MOBILE	SHORT DURATION	SHORT TERM STATIONARY	LONG TERM STATIONARY
		✓	✓	

- 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 CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign, but proper sign spacing shall be maintained.
  - Sign spacing may be increased or an additional CW20-1D "ROAD WORK AHEAD" sign may be used if advance warning ahead of the flogger or R1-2 "YIELD" sign is less than 1500 feet.
  - 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 wider work spaces.
- TCP (1-2a)**
- "YIELD" sign traffic control may be used on projects with approaches that have adequate sight distance. For projects in urban areas, work spaces should be no longer than one half city block. In rural areas on roadways with less than 2000 ADT, work spaces should be no longer than 400 feet.
  - R1-2 "YIELD" sign with R1-2aP "TO ONCOMING TRAFFIC" plaque shall be placed on a support at a 7 foot minimum mounting height.
- TCP (1-2b)**
- Flaggers should use two-way radios or other methods of communication to control traffic.
  - Length of work space should be based on the ability of flaggers to communicate.
  - If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain adequate stopping sight distance to the flogger and a queue of stopped vehicles (see table above).
  - Channelizing devices on the center-line may be omitted when a pilot car is leading traffic and approved by the Engineer.
  - Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.

Texas Department of Transportation		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN</b> <b>ONE-LANE TWO-WAY</b> <b>TRAFFIC CONTROL</b>			
<b>TCP(1-2)-18</b>			
FILE: tcp1-2-18.dgn	DATE: December 1985	CONT SECT:	JOB:
4-90 4-98 REVISIONS	6466 55	001	US 59, ETC.
2-94 2-12	DIST:	COUNTY:	SHEET NO.
1-97 2-18	LFK	ANGELINA, ETC.	17

DSC# 4469.  
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DATE: 5/21/2024 9:52:06 AM  
 FILE: T:\LFR\TRIPS\maintenance\contracts\PIANS\2024\Jobs\RMC-6466-55-001\T-C-17.dwg



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			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	12' Offset	1/2 L Min.	On a Taper	On a Tangent		
30	L = WS <sup>2</sup> / 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	L = WS	550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65	L = WS	650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75	L = WS	750'	825'	900'	75'	150'	900'	540'
80		800'	880'	960'	80'	160'	1000'	610'

x Conventional Roads Only  
 \*\* Taper lengths have been rounded off.  
 L=Length of Taper(F) W=Width of Offset(F) 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 CW20-1D "ROAD WORK AHEAD" sign may be repeated if the visibility of the work zone is less than 1500 feet.
  - 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 wider work spaces.
- TCP (1-4g)**
- If this TCP is used for a left lane closure, CW20-51L "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline where needed to protect the work space from opposing traffic with the arrow panel placed in the closed lane near the end of the merging taper.
- TCP (1-4b)**
- 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 device spacing is intended for the areas of conflicting markings, not the entire work zone.

Traffic Operations Division Standard

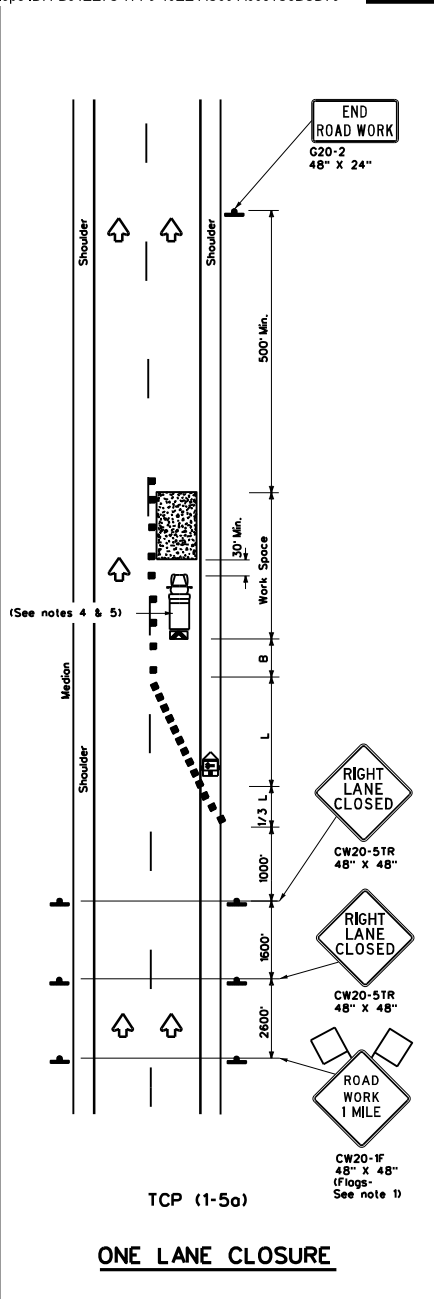
TRAFFIC CONTROL PLAN  
 LANE CLOSURES ON MULTILANE  
 CONVENTIONAL ROADS

TCP(1-4)-18

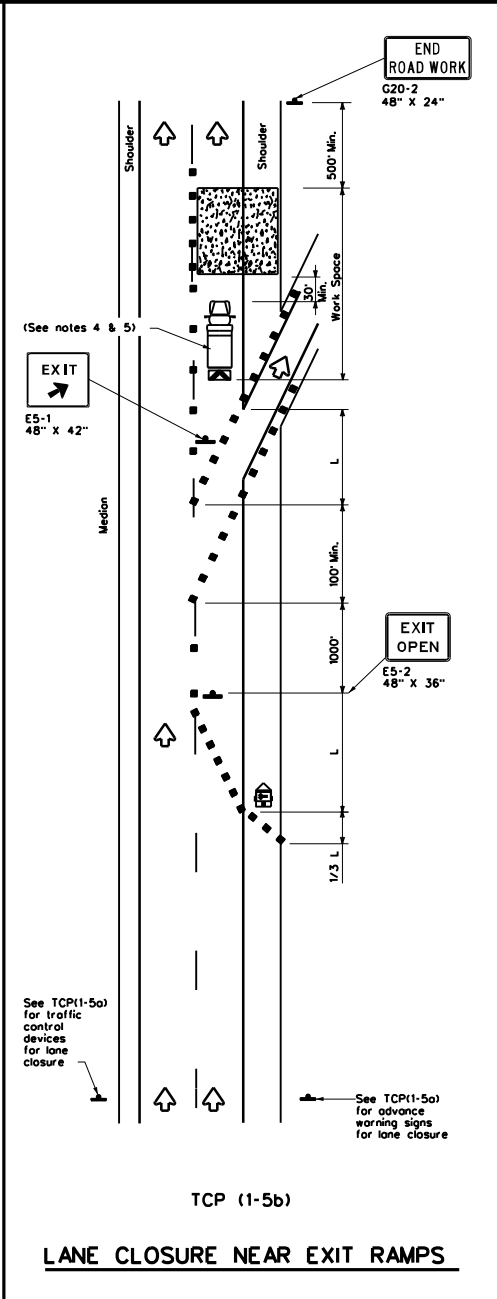
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REVISIONS		DATE	BY	DESCRIPTION	
2-94	4-99	8-95	2-12	1-97	2-18
DIST		COUNTY		SHEET NO.	
LFK		ANGELINA, ETC.		18	

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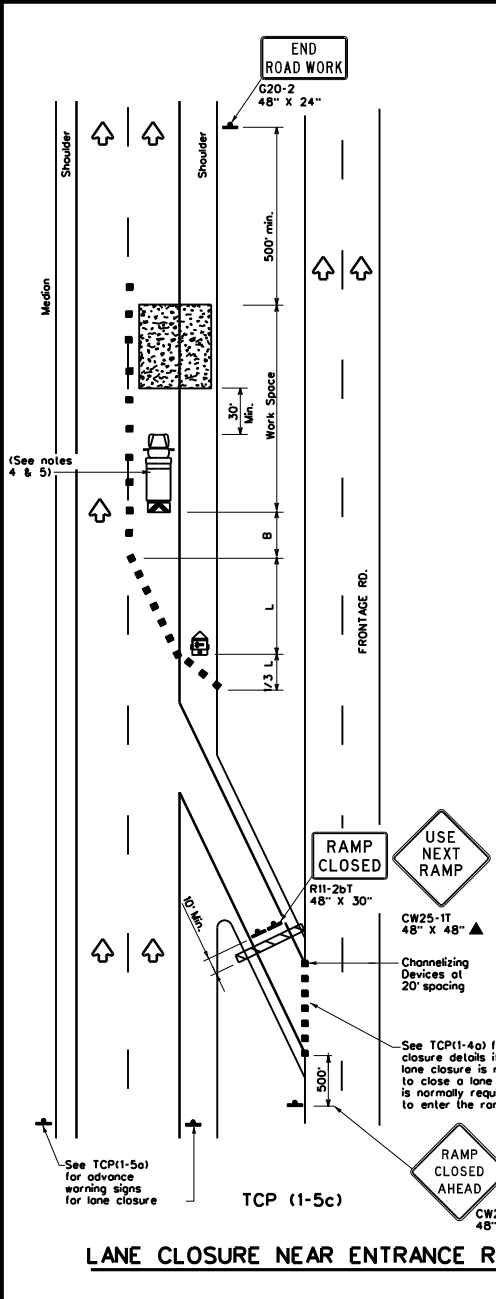
DATE: 5/21/2024 9:52:07 AM  
 FILE: T:\LFK\TROPs\maintenance\_contracts\PLANS\2024\_Jobs\RMC-6466-55-001 (T-rd) - 18.dgn



**ONE LANE CLOSURE**



**LANE CLOSURE NEAR EXIT RAMP**



**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 =			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	L = WS / 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
		✓		

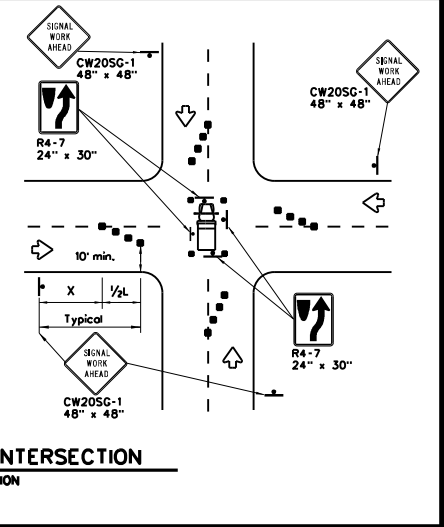
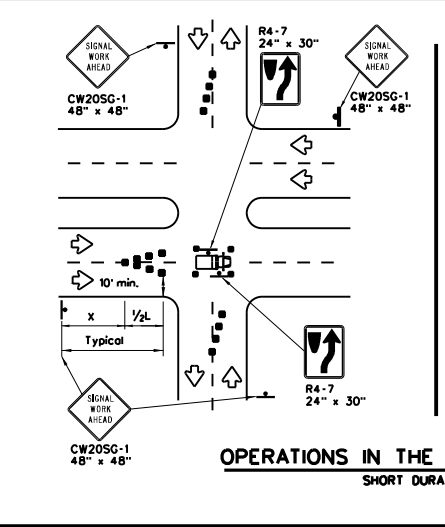
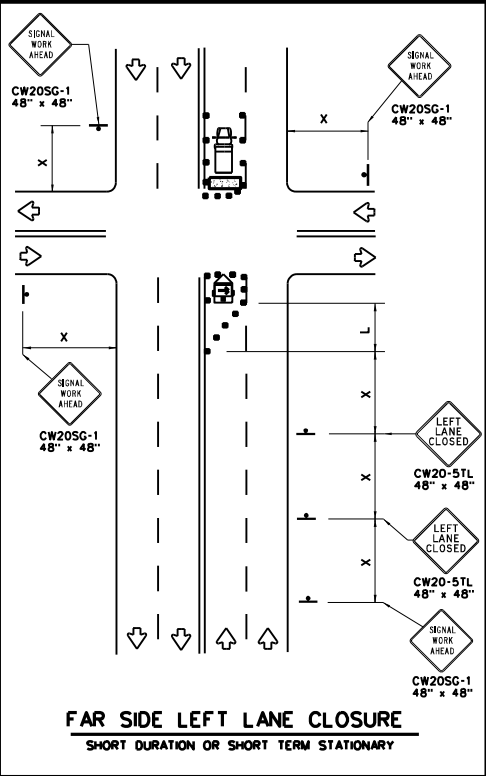
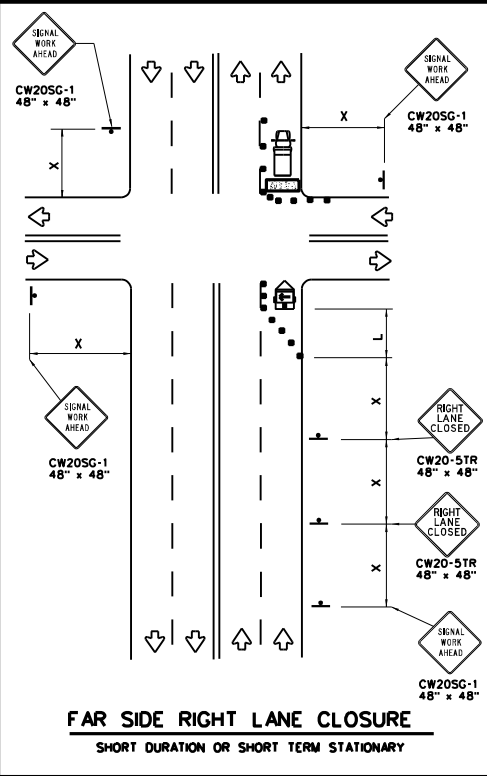
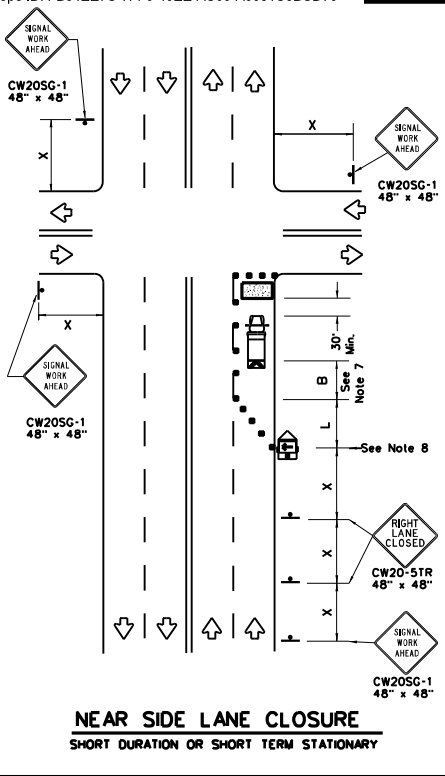
- GENERAL NOTES**
- Flags attached to signs where shown, are REQUIRED.
  - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
  - Channelizing 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.
  - 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.

**TRAFFIC CONTROL PLAN**  
**LANE CLOSURES FOR**  
**DIVIDED HIGHWAYS**  
**TCP(1-5)-18**

FILE: tcp1-5-18.dgn	DATE: February 2012	REV: 001	JOB: US 59, ETC.
6466	55	001	US 59, ETC.
DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO: 19	

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DATE: 5/21/2024 9:52:07 AM  
 FILE: T:\LFK\RDPS\Maintenance\_contract\plans\LANIS\2024\_Jobs\RM-C-6465-55-001 (TxDOT)



**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.

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Portable Changeable Message Sign (PCMS)
	Signal		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 * WS / 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  
 x x 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.**

SHEET 1 OF 2

Traffic Operations Division Standard

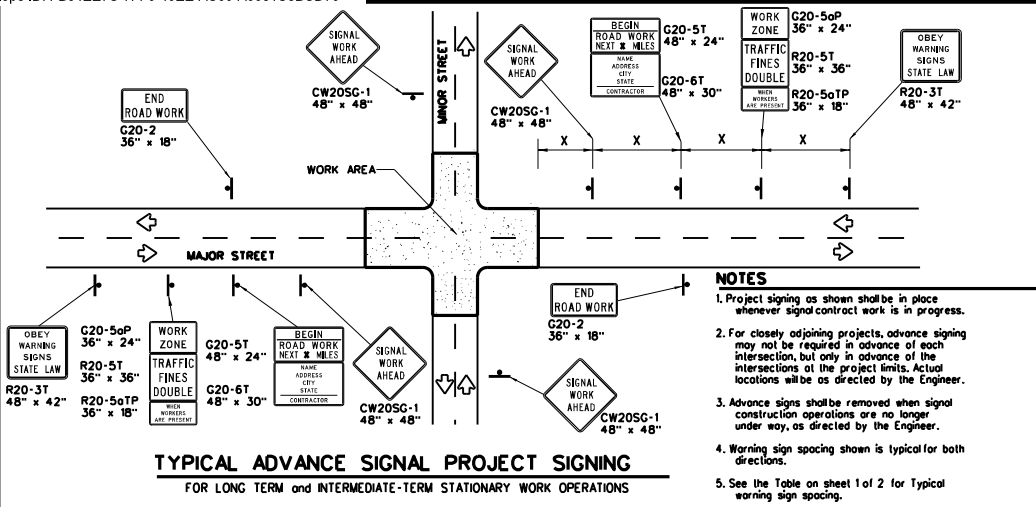
**TRAFFIC SIGNAL WORK TYPICAL DETAILS**

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

FILE: wzbts-13.dgn	DN: TxDOT	OK: TxDOT	DN: TxDOT	OK: TxDOT
© TxDOT April 1992	CONT: SECT	JOB:	HS-WAY	
REVISIONS	6466	55	001	US 59, ETC.
2-98 10-99 7-15	DIST:	COUNTY:	SHEET NO.:	
4-98 3-03	LFK	ANGELINA, ETC.	20	



DSC# 4469: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for any errors or omissions in this standard. The user assumes all liability for any damage resulting from its use.



- 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.

**TYPICAL ADVANCE SIGNAL PROJECT SIGNING**  
FOR LONG TERM and INTERMEDIATE-TERM STATIONARY WORK OPERATIONS

**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 6C.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 skirts to weigh down the sign support.
- Sandbags shall NOT be placed under the skirt and shall not be used to level sign supports placed on slopes.

**LEGEND**

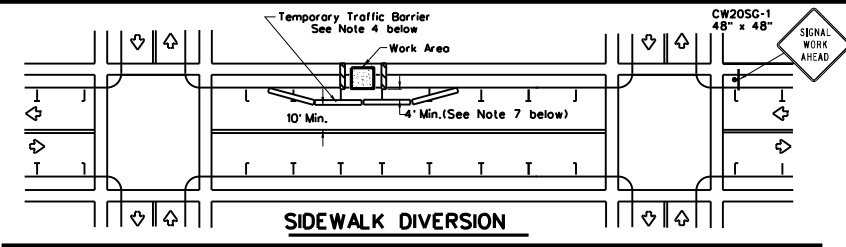
	Sign
	Channelizing Devices
	Type 3 Barricade

**DEPARTMENTAL MATERIAL SPECIFICATIONS**

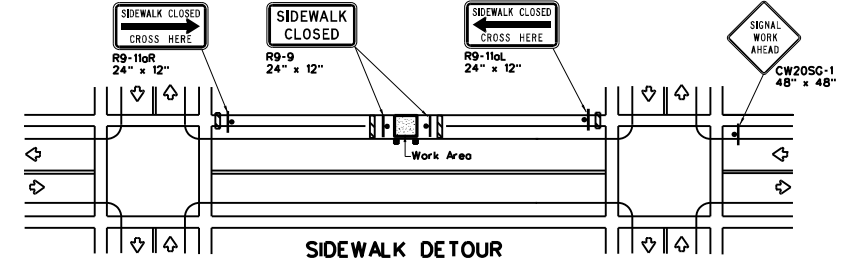
<b>SIGN FACE MATERIALS</b>	DMS-B300
<b>FLEXIBLE ROLL-UP REFLECTIVE SIGNS</b>	DMS-B310

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

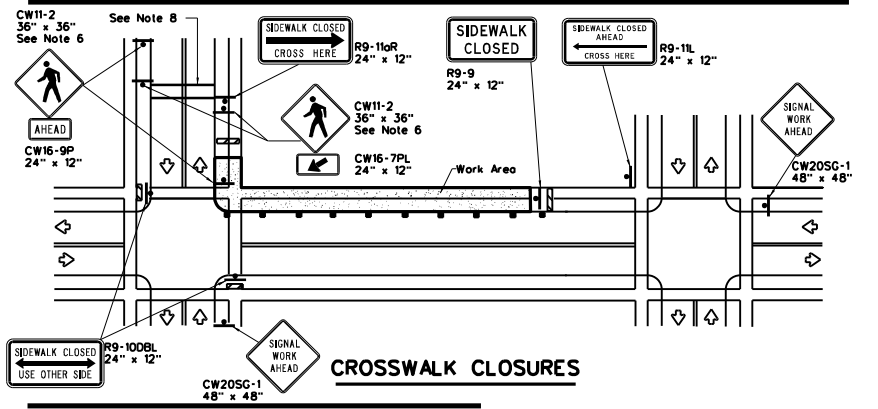
Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found at the following web address:  
[http://www.txdot.gov/txdot\\_library/publications/construction.htm](http://www.txdot.gov/txdot_library/publications/construction.htm)



**SIDEWALK DIVERSION**



**SIDEWALK DETOUR**



**CROSSWALK CLOSURES**

**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.
- When 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.



**TRAFFIC SIGNAL WORK BARRICADES AND SIGNS**

**WZ(BTS-2)-13**

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© TxDOT April 1992	CONT SECT	JOB	HIGHWAY	
REVISIONS	6466	55	001	US 59, ETC.
2:98 10-99 7-15	DIST	COUNTY	SHEET NO.	
4-98 3-03	LFK	ANGELINA, ETC.	21	

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

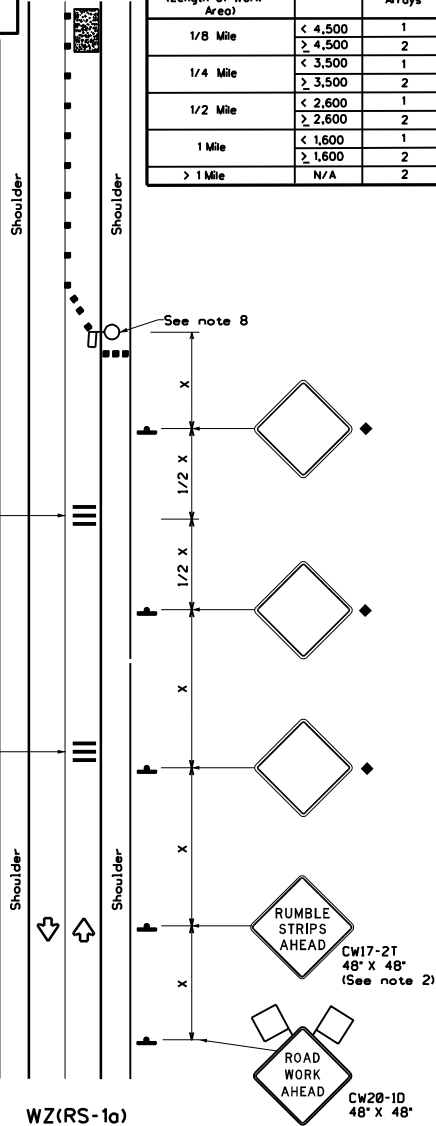
OASC 4463: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to metric units.

Rumble Strip Array (See note 1)

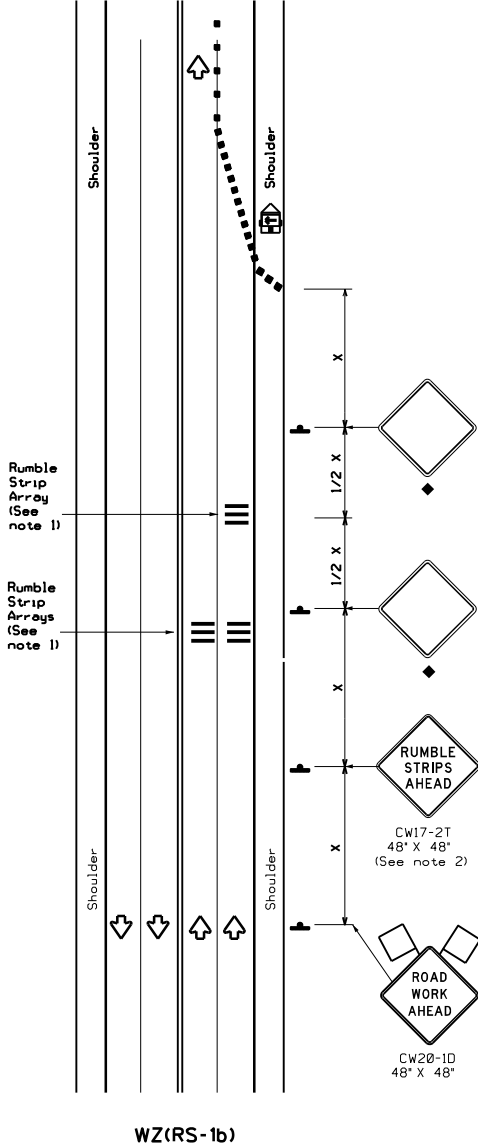
Rumble Strip Array (See note 1)

The second Rumble Strip Array is required when the ADT thresholds in Table 1 indicate the need for 2 Arrays.

Flagger to Flagger (Length of Work Area)	ADT	# of Rumble Strip Arrays
1/8 Mile	< 4,500	1
	> 4,500	2
1/4 Mile	< 3,500	1
	> 3,500	2
1/2 Mile	< 2,600	1
	> 2,600	2
1 Mile	< 1,600	1
	> 1,600	2
> 1 Mile	N/A	2



**RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION**



**RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY**

**GENERAL NOTES**

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

Speed	Approximate distance between strips in an array
≤ 40 MPH	10'
> 40 MPH & ≤ 55 MPH	15'
= 60 MPH	20'
≥ 65 MPH	• 35'+

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

Posted Speed x	Formula	Minimum Desirable Taper Lengths = x			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x"	Suggested Longitudinal Buffer Space "x"
		10' Offset	15' Offset	15' Offset	On a Taper	On a Tangent	Distance	Distance
30	L = WS <sup>2</sup> / 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	L = WS	500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60	L = WS	600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70	L = WS	700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

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

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

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

• For posted speeds in excess of 65 MPH, it is recommended that spacing is increased as speed limits increase. Increasing space between rumble strips will improve effectiveness.

Texas Department of Transportation  
 Traffic Safety Division Standard

## TEMPORARY RUMBLE STRIPS

### WZ(RS)-22

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© TxDOT November 2012	CONT: November 2012	SECT: November 2012	JOB: November 2012	HIGHWAY: November 2012
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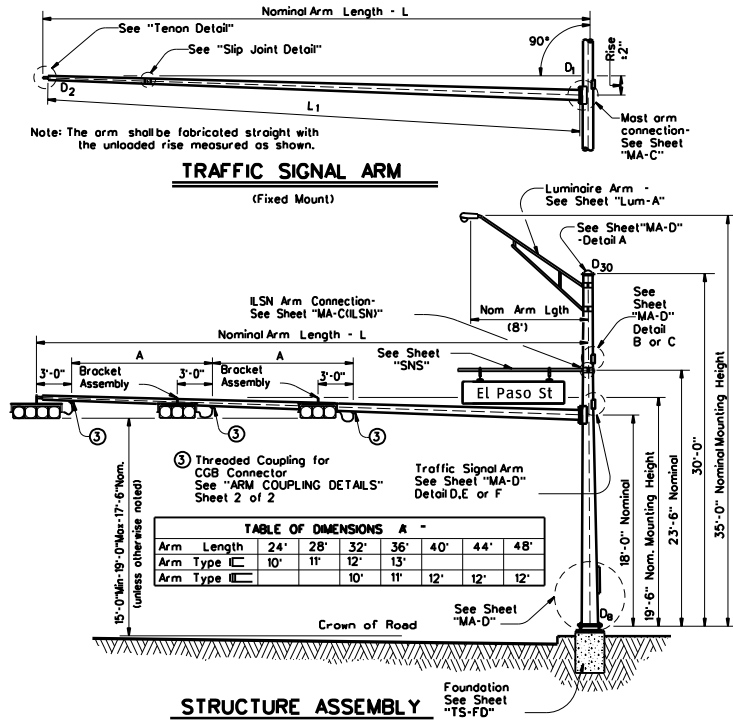
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Arm Length	ROUND POLES					POLYGONAL POLES					Foundation Type
	D <sub>8</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	D <sub>8</sub>	D <sub>19</sub>	D <sub>24</sub>	D <sub>30</sub>	① thk	
20	10.5	7.8	7.1	6.3	.179	11.5	8.5	7.7	6.8	.179	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				Rise	POLYGONAL ARMS				Rise
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	① thk		L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	① thk	
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>8</sub> = Pole Base O.D.
  - D<sub>19</sub> = Pole Top O.D. with no Luminare and no ILSN
  - D<sub>24</sub> = Pole Top O.D. with ILSN w/out Luminare
  - D<sub>30</sub> = Pole Top O.D. with Luminare
  - 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.



**STRUCTURE ASSEMBLY**  
Foundation See Sheet TS-FD

**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 Luminare		24' Poles With ILSN		19' Poles With No Luminare and No ILSN	
	Above hardware plus: One (or two if ILSN attached) small hand hole, clamp-on simplex		Above hardware plus one small hand hole		See note above	
ft	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20L-80		20S-80		20-80	
24	24L-80		24S-80		24-80	
28	28L-80		28S-80		28-80	
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)	
	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	
48					48III-80	

Luminare 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"	

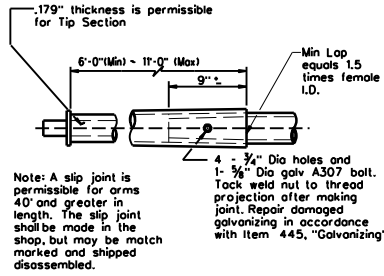
Each anchor bolt assembly consists of the following: Top and Bottom templates, 4 anchor bolts, 8 nuts, 8 flat washers, and 4 nut anchor devices (Type 2) per Standard Drawing "TS-FD".  
 Templates may be removed for shipment.

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

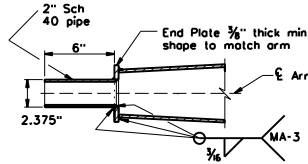
© TxDOT August 1995		DR: MS	CR: JSY	DR: MAF	CR: JSY
REVISIONS					
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5466	55	001	US 59, ETC.		
DIST	COUNTY	SHEET NO.			
LFK	ANGELINA, ETC.	23			

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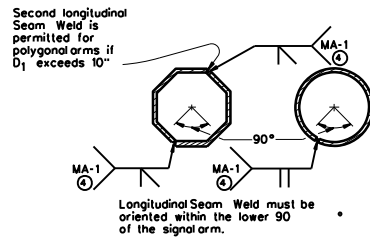
**SLIP JOINT DETAIL**



**TENON DETAIL**

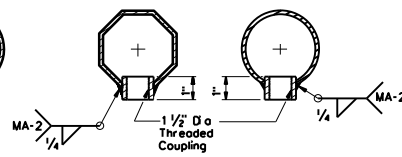
Stainless steelbands (or Cables) and cast bracket as in "Astro-Brac", "Sky Bracket" or "Easy Bracket" with 1 1/2" Dia Threaded Coupling.

**BRACKET ASSEMBLY**



**ARM WELD DETAIL**

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



**ARM COUPLING DETAILS**

**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 signalheads 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 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.

**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.

**Texas Department of Transportation**  
 Traffic Operations Division

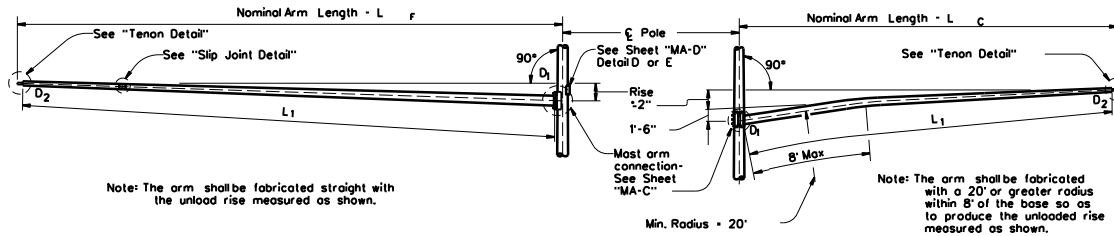
TRAFFIC SIGNAL  
 SUPPORT STRUCTURES  
 SINGLE MAST ARM ASSEMBLY  
 (80 MPH WIND ZONE)  
 SMA-80(2)-12

© TxDOT August 1995		DN: MS	CK: JSY	DR: MAF	CK: JSY
REVISIONS		CONT	SECT	JOB	HIGHWAY
59	10	6466	55	001	US 59, ETC.
		DIST	COUNTY		SHEET NO.
		LFK	ANGELINA, ETC.		24

1228

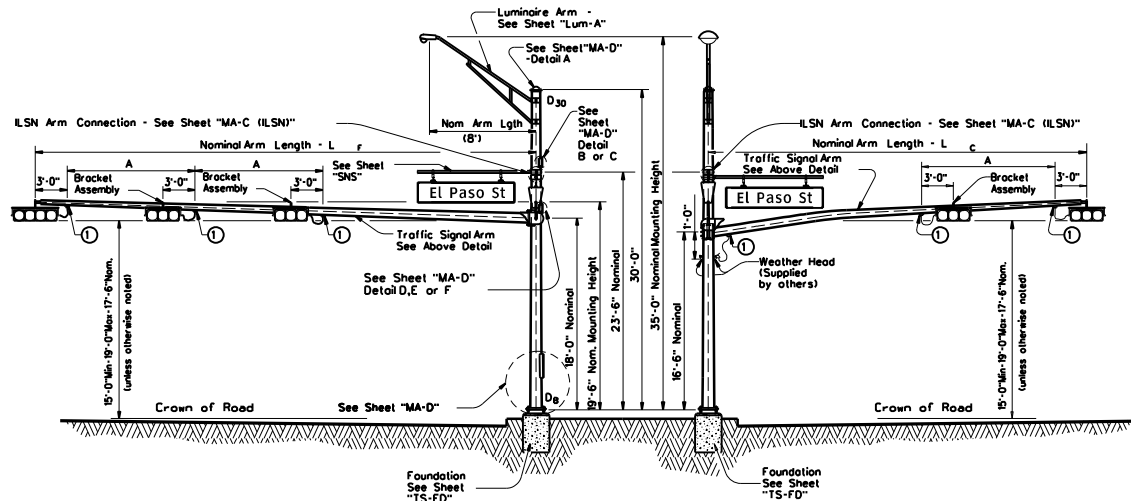
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**FIXED MOUNT TRAFFIC SIGNAL ARM**

**CLAMP-ON TRAFFIC SIGNAL ARM**



**ELEVATION**  
(Showing fixed mount arm)

**STRUCTURE ASSEMBLY**

**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'

**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 (octal 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)".

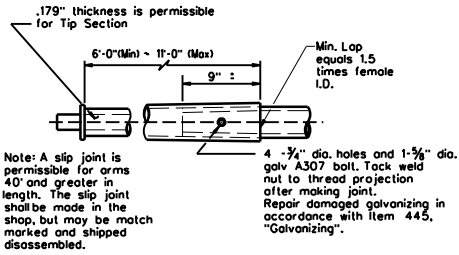
Unless otherwise noted, all parts shall be galvanized in accordance with Item 445, "Galvanizing", after fabrication.

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.

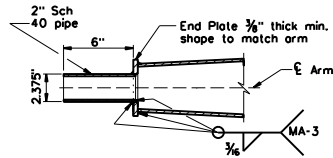
Texas Department of Transportation  
 Traffic Operations Division  
**TRAFFIC SIGNAL**  
**SUPPORT STRUCTURES**  
**DUAL MAST ARM ASSEMBLY**  
**(80 MPH WIND ZONE)**  
**DMA-80 (1)-12**

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1-2	CONT	SECT	JOB	HIGHWAY	
5466	55	001	US 59, ETC.		
DIST	COUNTY		SHEET NO.		
LFK	ANGELINA, ETC.		25		

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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**

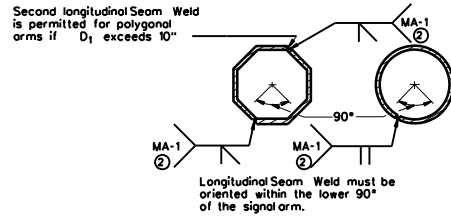
Most Arms of SMA and DMA structures and clamp-on Arms of LMA structures of approximately 40 ft or longer are subject to harmonic vertical vibrations in light wind conditions due to the aerelastic characteristics of a few of the myriads of possible combinations of the following: signal numbers, weights 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.

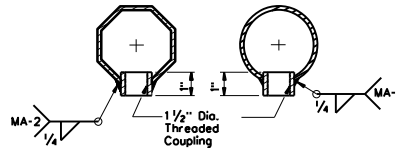
The traffic signal mast arms shall be visually inspected in 5 to 20 mph wind conditions after installation of signalheads and any attachments, including any required backplates. If vertical movements with a total excursion (maximum upward excursion to maximum downward excursion) of more than approximately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

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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5/21/2024	12	CONT	SECT	JOB	HIGHWAY
5466	55	001	US 59, ETC.		
DIST		COUNTY		SHEET NO.	
LFK		ANGELINA, ETC.		26	

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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	
	ft.	Designation	Designation	Designation	Designation	Designation
20	20	2020L-80	2020S-80	2020-80	2020-80	
24	24	2420L-80	2420S-80	2420-80	2420-80	
28	28	2820L-80	2820S-80	2820-80	2820-80	
32	32	3220L-80	3220S-80	3220-80	3220-80	
36	36	3620L-80	3620S-80	3620-80	3620-80	
40	40	4020L-80	4020S-80	4020-80	4020-80	
44	44	4420L-80	4420S-80	4420-80	4420-80	

Nominal Arm Length	Type 1 Arm (1 Signal)		Type 2 Arm (2 Signals)		Type 3 Arm (3 Signals)	
	ft.	Designation	Designation	Designation	Designation	Designation
20	20	20I-80	20IE-80	20IIE-80	20III-80	20IIIE-80
24	24	24I-80	24IE-80	24IIE-80	24III-80	24IIIE-80
28	28	28I-80	28IE-80	28IIE-80	28III-80	28IIIE-80
32	32	32I-80	32IE-80	32IIE-80	32III-80	32IIIE-80
36	36	36I-80	36IE-80	36IIE-80	36III-80	36IIIE-80
40	40	40I-80	40IE-80	40IIE-80	40III-80	40IIIE-80
44	44	44I-80	44IE-80	44IIE-80	44III-80	44IIIE-80

Nominal Arm Length	Type 1 Arm (1 Signal)		Type 2 Arm (2 Signals)		Type 3 Arm (3 Signals)	
	ft.	Designation	Designation	Designation	Designation	Designation
20	20	20I-80	20IE-80	20IIE-80	20III-80	20IIIE-80
24	24	24I-80	24IE-80	24IIE-80	24III-80	24IIIE-80
28	28	28I-80	28IE-80	28IIE-80	28III-80	28IIIE-80
32	32	32I-80	32IE-80	32IIE-80	32III-80	32IIIE-80
36	36	36I-80	36IE-80	36IIE-80	36III-80	36IIIE-80


Luminaire Arms (1 per 30' pole)		ILSN Arm (1 or 2 per pole) ship with clamps, bolts and washers	
Nominal Arm Length	Quantity	Nominal Arm Length	Quantity
8' Arm		7' Arm	
		9' Arm	

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

LF	Lc	ROUND POLES					POLYGONAL POLES					Foundation Type
		D <sub>B</sub>	D <sub>9</sub>	D <sub>24</sub>	D <sub>30</sub>	(3)thk	D <sub>8</sub>	D <sub>9</sub>	D <sub>24</sub>	D <sub>30</sub>	(3)thk	
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
28	24	12.5	9.8	9.1	8.3	.179	12.0	9.0	8.2	7.3	.239	30-A
32	28	13.0	10.3	9.6	8.8	.179	12.5	9.5	8.7	7.8	.239	30-A
36	20	13.0	10.3	9.6	8.8	.179	12.5	9.5	8.7	7.8	.239	30-A
40	24	13.0	10.3	9.6	8.8	.179	12.5	9.5	8.7	7.8	.239	30-A
44	28	12.0	9.3	8.6	7.8	.239	13.0	10.0	9.2	8.3	.239	30-A
	32	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
	20	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
	24	12.0	9.3	8.6	7.8	.239	13.5	10.5	9.7	8.8	.239	36-A
	28	12.5	9.8	9.1	8.3	.239	13.5	10.5	9.7	8.8	.239	36-A
	32	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
	36	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
	20	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
	24	12.5	9.8	9.1	8.3	.239	14.0	11.0	10.2	9.3	.239	36-A
	28	13.0	10.3	9.6	8.8	.239	14.0	11.0	10.2	9.3	.239	36-A
	32	13.0	10.3	9.6	8.8	.239	15.0	12.0	11.2	10.3	.239	36-A
	36	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
	20	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
	24	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
	28	13.5	10.8	10.1	9.3	.239	15.0	12.0	11.2	10.3	.239	36-A
	32	14.0	11.3	10.6	9.8	.239	15.5	12.5	11.7	10.8	.239	36-B
	36	14.0	11.3	10.6	9.8	.239	15.5	12.5	11.7	10.8	.239	36-B

Arm Length	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
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>9</sub> = Pole Top O.D.
- D<sub>24</sub> = Pole Top O.D. with no Luminaire and no ILSN
- D<sub>30</sub> = Pole Top O.D. with ILSN w/out Luminaire
- (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.
- D<sub>1</sub> = Arm Base O.D.
- D<sub>2</sub> = Arm End O.D.
- L<sub>1</sub> = Shaft Length
- L<sub>c</sub> = Fixed Arm Length w/out Luminaire
- L<sub>c</sub> = Clamp-on Arm Length (36' Max)



**Texas Department of Transportation**  
Traffic Operations Division

**TRAFFIC SIGNAL SUPPORT STRUCTURES**

**DUAL MAST ARM ASSEMBLY**

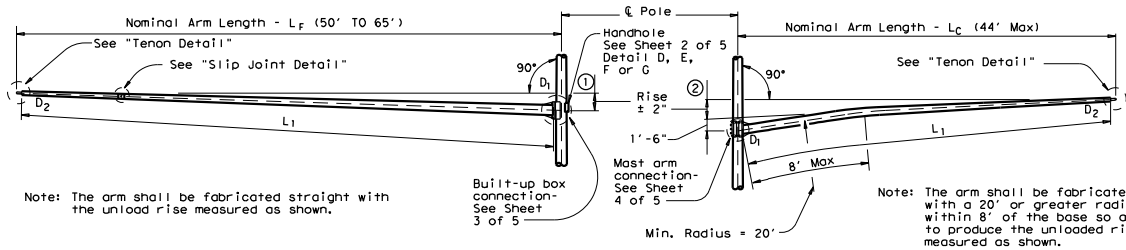
**(80 MPH WIND ZONE)**

**DMA-80 (3)-12**

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5466		55	001	US 59, ETC.	
DIST		COUNTY		SHEET NO.	
LFK		ANGELINA, ETC.		27	

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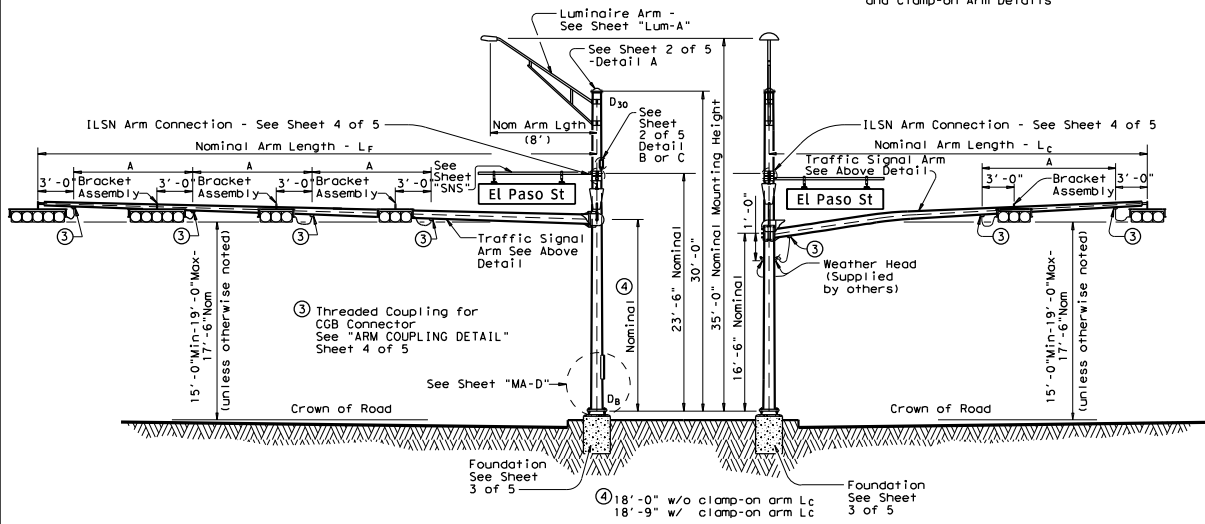


**FIXED MOUNT TRAFFIC SIGNAL ARM**

① See Sheet 3 of 5 for Arm Rise

**CLAMP-ON TRAFFIC SIGNAL ARM (IF REQUIRED)**

② See Sheet 4 of 5 for Arm Rise and Clamp-on Arm Details



**ELEVATION**

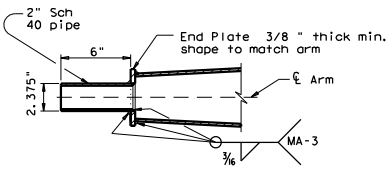
(Showing fixed mount arm)

**STRUCTURE ASSEMBLY**

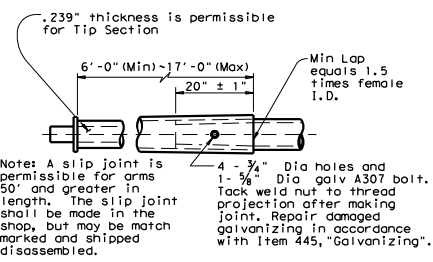
**ELEVATION**

(Showing clamp-on arm)

Arm Length	24'	28'	32'	36'	40'	44'	50'	55'	60'	65'
Arm Type II	10'	11'	12'	13'						
Arm Type III			10'	11'	12'	12'				
Arm Type IV							12'	12'	12'	12'



**TENON DETAIL**



**SLIP JOINT DETAIL (FIXED MOUNT 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 can be either 100 mph or 80 mph plus a 1.3 gust factor. If clamp-on traffic signal is required, 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 (ILSN) signs and two traffic signal arms with limited length combinations.

Each arm with its related attachment is shown below

Arm	Equivalent DL ⑤	WL EPA ⑤⑥
8' Luminaire Arm	Luminaire 60 lbs	1.6 sq ft
9' ILSN Arm	Sign 85 lbs	11.5 sq ft
50' to 65' Fixed Mount Arm	Signal Loads 310 lbs	52 sq ft
Up to 44' Clamp-on Arm	Signal Loads 180 lbs	32.4 sq ft

⑤ Equivalent dead load plus horizontal wind load applied at the end of arm except ILSN arm, which applied 4.5' from the centerline of the pole.

⑥ Effective projected area (actual area times drag coefficient) for the application of horizontal wind load.

Except as noted in Sheet 1 thru 5 of 5, other details not covered shall refer to Standard Sheet "MA-D" for pole 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.

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. Material, fabrication tolerances, and shipping practices shall also 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.

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

Installation of damping plate for the long mast arm is not recommended.

Provision of the bracket assembly used to support the traffic signal heads shall be under the direction of the Engineer for approval.

Design also conforms to NCHRP Report 412 for fatigue resistance except that there are no stiffeners at the base plate. TxDOT is conducting tests to determine if stiffeners at the base plate will or will not result in optimal performance; depending upon the results of the tests, poles may need a retrofit to ensure optimal fatigue performance.

**Texas Department of Transportation**  
 Traffic Operations Division  
**TRAFFIC SIGNAL**  
**STRUCTURES**  
**LONG MAST ARM ASSEMBLY**  
**(50 TO 65 FT)**  
**(80 AND 100 MPH WIND ZONE)**  
**LMA (1) - 12**  
 Sheet 1 of 5

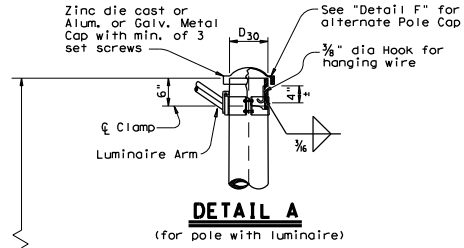
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6466	55	001	US 59, ETC.		
	DIST	COUNTY	SHEET NO.		
		LFK	ANGELINA, ETC.	28	



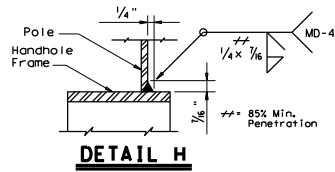
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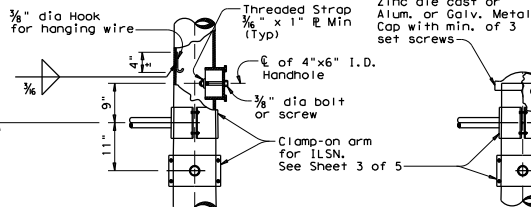
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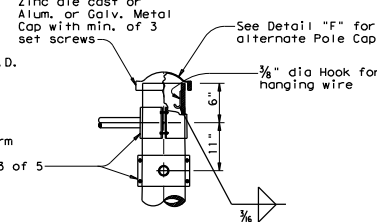
**DETAIL A**  
(for pole with luminaire)



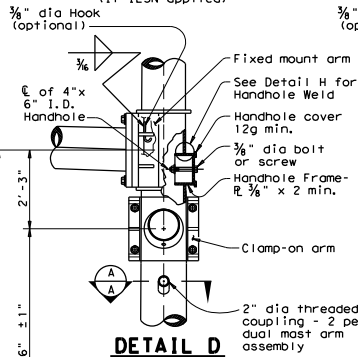
**DETAIL H**



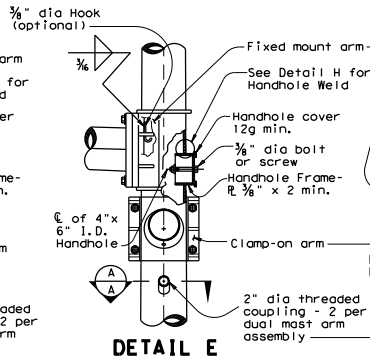
**DETAIL B**  
(if ILSN applied)



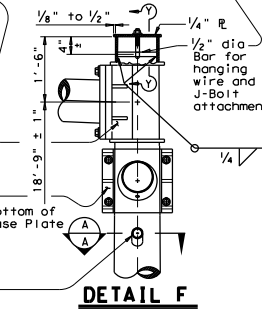
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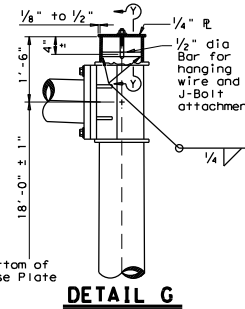
**DETAIL D**  
(for 30' pole with luminaire and ILSN sign)



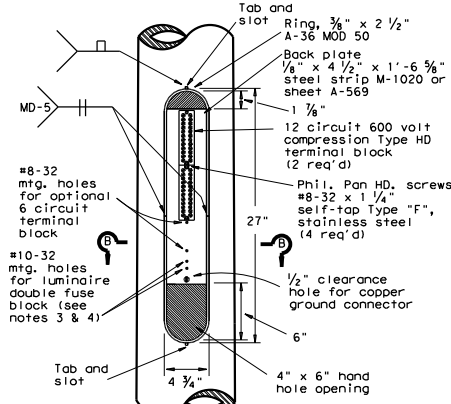
**DETAIL E**  
(for 24' pole with ILSN sign and no luminaire, single or dual mast arm)



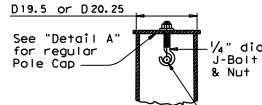
**DETAIL F**  
(for 20.25' pole with no ILSN sign and no luminaire, dual mast arm)



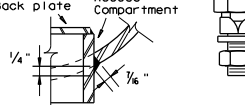
**DETAIL G**  
(for 19.5' pole with no ILSN sign and no luminaire, single mast arm)



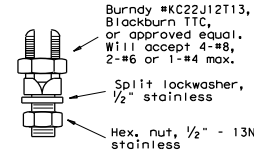
**ACCESS COMPARTMENT**



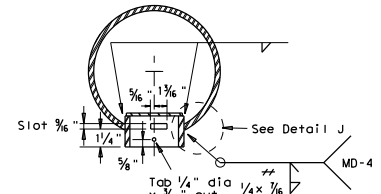
**SECTION Y-Y**



**DETAIL J**



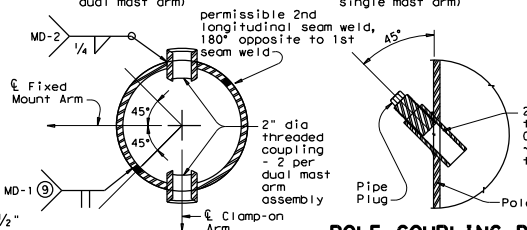
**COPPER GROUND CONNECTOR**



**SECTION B-B**

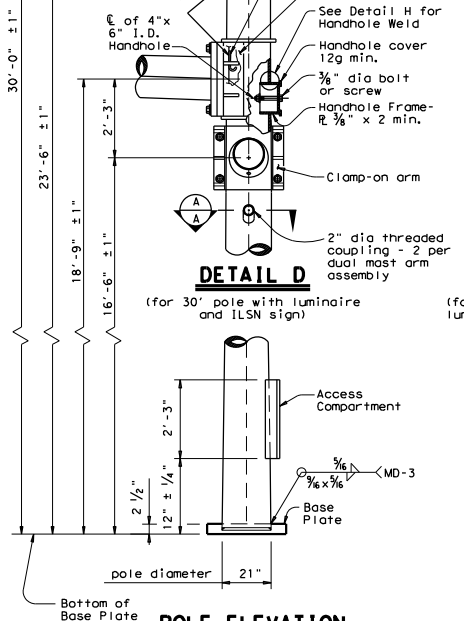
**ACCESS COMPARTMENT NOTES:**

- 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 1/4" self tapping type "F" stainless steel pan head screws, and one ground connector (Blackburn TTC, Burndy KC22J12T13, or Ilisco 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.

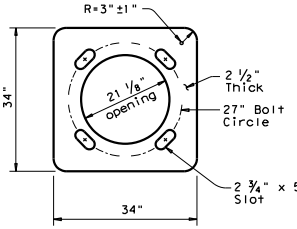


**SECTION A-A**

**POLE COUPLING DETAIL**



**POLE ELEVATION**



**BASE PLATE**

③ Longitudinal seam weld must be oriented within 90° (45° rotation each side) along the fixed mount arm. 60% min penetration required, 100% penetration within 6" of circumferential base weld.

MATERIALS	
Round Shafts or Polygonal Shafts ⑦	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 ⑧
Plates ⑦	ASTM A36, A588, or A572 Gr. 50
Connection Bolts	ASTM A325, or A449 except where noted
Pin Bolts	ASTM A325
Pipe ⑦	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

⑦ 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.

⑧ ASTM A1011 SS Gr. 50 shall also have a minimum elongation of 18 percent in 2 inches or 23 percent in 4 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.

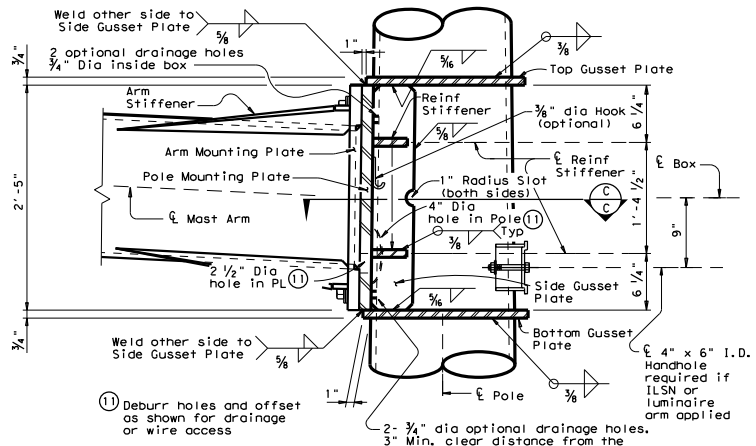
Texas Department of Transportation  
 Traffic Operations Division  
**TRAFFIC SIGNAL**  
**SUPPORT STRUCTURES**  
**LONG MAST ARM ASSEMBLY**  
**(50 TO 65 FT)**  
**(80 AND 100 MPH WIND ZONE)**  
**LMA (2) - 12**  
 Sheet 2 of 5

REVISIONS		DATE	BY	CHKD	APP'D	REASON
6466	55	001	US 59	ETC.		
DIST	COUNTY	SHEET NO.				
LFK	ANGELINA, ETC.	29				

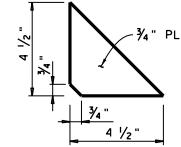
131B

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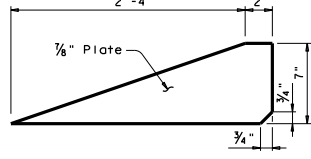
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**BUILT-UP BOX CONNECTION**



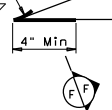
**REINFORCING STIFFENER**



**ARM STIFFENER**

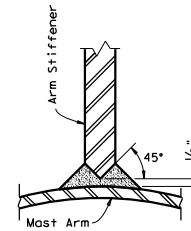
(Cut to match arm inclination and taper)

Provide Detail shown in SECTION F-F or equivalent 100% complete joint penetration weld from both sides.

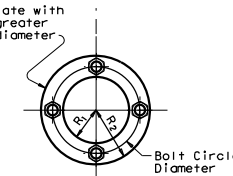


**DETAIL "K"**

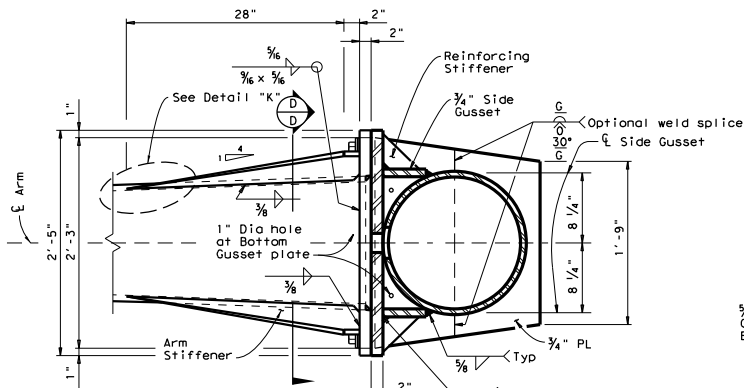
Only 4" length at tip of Arm Stiffener requires a complete joint penetration weld. Smooth weld radius to connect Stiffener. Only a fillet weld is required for the remaining weld length.



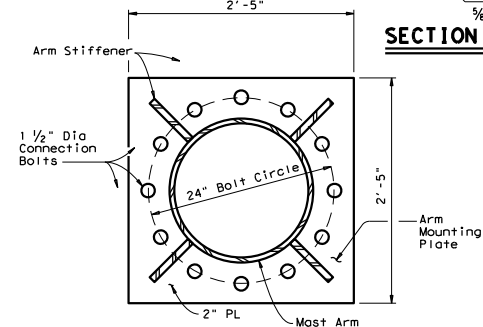
**SECTION F-F**



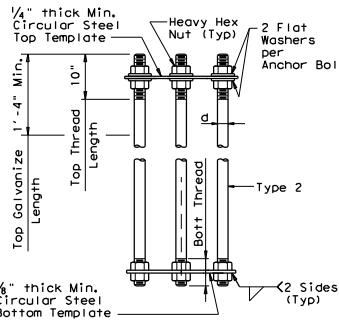
**TEMPLATE DETAIL**



**SECTION C-C**



**SECTION D-D**



**NUT ANCHOR (TYPE 2)**

**ANCHOR BOLT ASSEMBLY**

FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL			DRILLED SHAFT LENGTH-FT (6), (7), (8)			ANCHOR BOLT DESIGN (4)			FOUNDATION DESIGN LOAD (5)		TYPICAL APPLICATION
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER N Blows/ft	ANCHOR BOLT DIA	F <sub>y</sub> (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips			
48-A	48"	20 #9	#4 at 6"	21.9	19.5	14.7	2 1/2"	55	27"	2	490	10	50' to 65' Mast arm assembly.

SEE SHEET "TS-FD" FOR ADDITIONAL DETAILS.

- (14) Anchor bolt design develops the foundation capacity given under Foundation Design Loads.
- (15) Foundation Design Loads are the allowable moments and shears at the base of the structure.
- (16) Field Penetrometer readings at a depth of approximately 3 to 5 feet may be used to adjust shaft lengths.
- (17) If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.
- (18) Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

Fixed Mount Arm L <sub>f</sub>	ROUND POLES (13)					Foundation Type
	D <sub>8</sub>	D <sub>19.5</sub>	D <sub>20.25</sub>	D <sub>24</sub>	D <sub>30</sub>	
ft.	in.	in.	in.	in.	(2)thk in.	
50', 55', 60', 65'	21.0	18.2	17.6	16.8	.3125	48-A

Fixed Mount Arm L <sub>f</sub>	ROUND ARMS (13)				Rise
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	(2)thk	
ft.	ft.	in.	in.	in.	
50	49	18.5	11.7	.3125	3' - 3"
55	54	18.5	11.0	.3125	3' - 7"
60	59	18.5	10.3	.3125	3' - 11"
65	64	18.5	9.6	.3125	4' - 4"

- D<sub>8</sub> = Pole Base O.D.
- D<sub>19.5</sub> = Pole Top O.D. with no Luminaire and no ILSN (single mast arm)
- D<sub>20.25</sub> = Pole Top O.D. with no Luminaire and no ILSN (dual mast arm)
- 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

- (12) Thickness shown is minimum, thicker materials may be used.
- (13) Shaft profile 16-sided or 18-sided is considered to be equivalent to round section.

**GENERAL NOTES:**  
 Built-up Box Connection: For the welded arm-to-pole connection as a built-up box configuration illustrated here is an example only, fabricators are required to submit a shop drawing of box connection for approval. The drawing shall specify the details of each box element, welds of arm-to-pole connection, arm-to-plate socket connection, and arm rise creation. Specify the proper location of drain holes along the pole. 2 1/2" dia hole in the pole mounting plate and 4" dia hole in the pole need to be aligned for wiring access or drainage. Arm stiffeners cut to match arm inclination and taper shall also be included.

The deviation from flat for either arm or pole mounting plate shall not exceed 1/2 in., which is measured along the center of mounting plate to a radial distance of 13.5 in. The deformed-from-flat connection between arm and pole mounting plates shall not be allowed if the center of both mounting plates cannot contact directly.

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

ANCHOR BOLT & TEMPLATE SIZE						
Bolt Dia in.	Length †	Top Thread	Bottom Thread	Bolt Circle	R <sub>2</sub>	R <sub>1</sub>
2 1/2"	5'-2"	10"	6 1/2"	27"	16"	11"

† Min dimension given, longer bolts are acceptable.

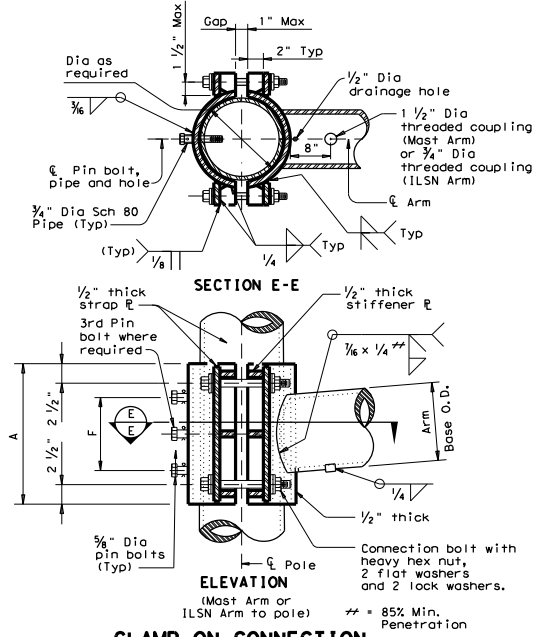
Texas Department of Transportation  
 Traffic Operations Division  
**TRAFFIC SIGNAL SUPPORT STRUCTURES**  
**LONG MAST ARM ASSEMBLY (50 TO 65 FT)**  
**(80 AND 100 MPH WIND ZONE)**  
 Sheet 3 of 5 LMA (3) - 12

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4-20-01 1-12	REVISIONS	CONT	SECT	JOB	HIGHWAY
	6466	55	001	US 59, ETC.	
	DIST	COUNTY	SHEET NO.		
	LFK	ANGELINA, ETC.	30		

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DISCLAIMER

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**CLAMP-ON CONNECTION**

80 MPH WIND												
Clamp-on Arm Lc	ROUND ARMS					Rise	POLYGONAL ARMS					Rise
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	thk (12)	thk (12)		L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	thk (12)	thk (12)	
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"		

100 MPH WIND												
Clamp-on Arm Lc	ROUND ARMS					Rise	POLYGONAL ARMS					Rise
	L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	thk (12)	thk (12)		L <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	thk (12)	thk (12)	
20	19.1	8.0	5.3	.179	1'-8"	19.1	8.0	3.5	.179	1'-7"		
24	23.1	9.0	5.8	.179	1'-9"	23.1	9.0	3.5	.179	1'-8"		
28	27.1	9.5	5.7	.179	1'-10"	27.1	10.0	3.5	.179	1'-9"		
32	31.0	9.5	5.2	.239	1'-11"	31.0	9.5	3.5	.239	1'-10"		
36	35.0	10.0	5.1	.239	2'-0"	35.0	10.0	3.5	.239	1'-11"		
40	39.0	10.5	5.1	.239	2'-3"	39.0	11.0	3.5	.239	2'-1"		
44	43.0	11.0	5.1	.239	2'-8"	43.0	11.5	4.0	.239	2'-3"		

D<sub>1</sub> = Arm Base O.D.  
 D<sub>2</sub> = Arm End O.D.  
 L<sub>1</sub> = Shaft Length  
 Lc = Clamp-on Arm Length

(12) Thickness shown is minimum, thicker materials may be used.

CLAMP-ON ARM CONNECTION							
ILSN Arm Size		A		F		4 Conn. Bolts	5/8" Dia. Pin Bolts
Sch 40 pipe Dia	Thick	in.	in.	in.	in.	in.	ea
3	.216	10	4			3/4	2

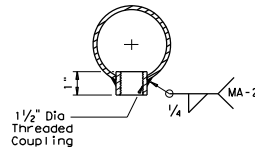
Mast Arm Size		A		F		4 Conn. Bolts	5/8" Dia. Pin Bolts
Base Dia	Thick	in.	in.	in.	in.	in.	ea
6.5	.179	12	6			1	2
7.5	.179	14	8			1	2
8.0	.179	14	8			1	2
9.0	.179	16	10			1	2
9.5	.179	18	12			1 1/4	3
9.5	.239	18	12			1 1/4	3
10.0	.239	18	12			1 1/4	3
10.5	.239	18	12			1 1/4	3
11.0	.239	18	12			1 1/4	3
11.5	.239	18	12			1 1/4	3

**GENERAL NOTES:**

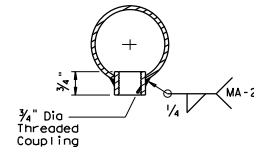
Clamp-on details are used for the second arm on dual mast arm assemblies or ILSN arm support. For a clamp-on mast arm, a maximum 1/2" wide vertical slotted hole may be cut in the front clamp plate to facilitate drainage during galvanizing. The slot shall be centered behind the arm and shall be no longer than the arm diameter minus 1". For an ILSN arm, a 1 1/2" diameter hole shall be cut in the front clamp plate for wire 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 part shall apply to all similar parts on the detail.

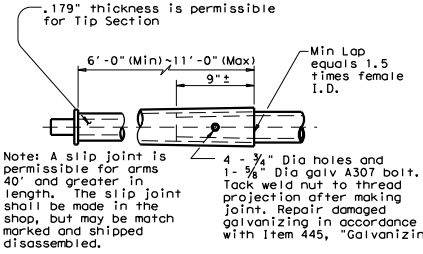
Pin bolts are required to prevent rotation of clamp-on arms under design wind forces. Pin bolts shall be ASTM A325 with threads excluded from the shear plane. Pin bolt and 3/4" diameter pipe shall have 3/8" diameter holes for a 1/4" diameter galvanized cotter pin. Back clamp plate shall be furnished with a 3/4" diameter hole for each pin bolt. An 1/8" diameter hole for each pin bolt shall be field drilled through the pole after arm orientations have been approved by the Engineer.



**ARM COUPLING DETAIL**



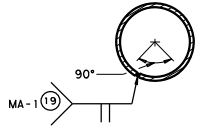
**ILSN ARM COUPLING DETAIL**



**SLIP JOINT DETAIL (CLAMP-ON ARM)**

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

**BRACKET ASSEMBLY**



**ARM WELD DETAIL**

(19) Longitudinal Seam Weld must be oriented within the lower 90° of the signal arm.  
 60% Min penetration  
 100% penetration within 6" of circumferential base welds.

Texas Department of Transportation  
 Traffic Operations Division  
**TRAFFIC SIGNAL SUPPORT STRUCTURES**  
**LONG MAST ARM ASSEMBLY**  
**(50 TO 65 FT)**  
**(80 AND 100 MPH WIND ZONE)**  
 Sheet 4 of 5 LMA (4) -12

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4-28-01	1-12	6466	55	001	US 59, ETC.
		DIST	COUNTY	SHEET NO.	
		LFK	ANGELINA, ETC.	31	

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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	19.50' (Single Mast Arm)	20.25' (Dual Mast Arm)	Poles with no Luminaire and no ILSN	
	See note above plus one for two if ILSN attached) small hand hole, clamp-on simplex	See note above plus one small hand hole	See note above			
Single Mast Arm						
Lf ft.	Designation	Quantity	Designation	Quantity	Designation	Quantity
50	50L		50S		50	
55	55L		55S		55	
60	60L		60S		60	
65	65L		65S		65	
Dual Mast Arm						
Lf ft.	Lc ft.	Designation	Quantity	Designation	Quantity	Designation
50	20	5020L		5020S		5020
	24	5024L		5024S		5024
	28	5028L		5028S		5028
	32	5032L		5032S		5032
	36	5036L		5036S		5036
	40	5040L		5040S		5040
55	20	5520L		5520S		5520
	24	5524L		5524S		5524
	28	5528L		5528S		5528
	32	5532L		5532S		5532
	36	5536L		5536S		5536
	40	5540L		5540S		5540
60	20	6020L		6020S		6020
	24	6024L		6024S		6024
	28	6028L		6028S		6028
	32	6032L		6032S		6032
	36	6036L		6036S		6036
	40	6040L		6040S		6040
65	20	6520L		6520S		6520
	24	6524L		6524S		6524
	28	6528L		6528S		6528
	32	6532L		6532S		6532
	36	6536L		6536S		6536
	40	6540L		6540S		6540
	44	6544L		6544S		6544

Foundation Summary Table \*\*

Location Ident.	Avg. N Blow/ft.	No. Each	Drill Shaft *** Length (feet)
			48-A
Total Drill Shaft Length			

Notes

- \*\* Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the Contractor's information only.
- \*\*\* Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

Abbreviations  
 Lf= Fixed Arm Length  
 Lc= Clamp-on Arm Length (44' Max.)

Shipping Parts List						
Traffic Signal Arms (Fixed Mount) (1 per pole)						
Ship each arm with listed equipment attached						
Nominal Arm Length	Type IV Arm (4 Signals)	Luminaire Arms (1 per 30' pole)				
	3 Bracket Assembly and 4 CGB Connectors	Nominal Arm Length		Quantity		
ft.	Designation	Quantity	8' Arm			
50	50IV					
55	55IV					
60	60IV					
65	65IV					
Traffic Signal Arms (80 MPH Clamp-On Mount) (1 per pole) Ship each arm with 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 and 3 CGB connectors, and 1 clamp w/bolts and washers	2 Bracket Assembly and 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	
40					40III-80	
44					44III-80	
Traffic Signal Arms (100 MPH Clamp-On Mount) (1 per pole) Ship each arm with 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 and 3 CGB connectors, and 1 clamp	2 Bracket Assembly and 4 CGB connectors, and 1 clamp			
ft.	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20I-100					
24	24I-100		24II-100			
28	28I-100		28II-100			
32			32II-100		32III-100	
36			36II-100		36III-100	
40					40III-100	
44					44III-100	
Anchor Bolt Assemblies (1 per pole)						
Anchor Bolt Diameter	Anchor Bolt Length	Quantity	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".			
2 1/2 "	5' - 3"		Templates may be removed for shipment.			

**Texas Department of Transportation**  
 Traffic Operations Division

## LONG MAST ARM ASSEMBLY PARTS LIST

LMA (5) - 12

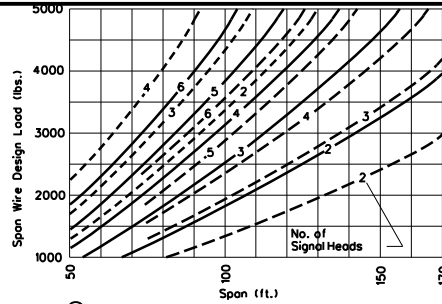
Sheet 5 of 5

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4-20-01	1-12	CONT SECT	JOB	HIGHWAY	
		6466	55	001	US 59, ETC.
		DIST	COUNTY	SHEET NO.	
		LFK	ANGELINA, ETC.	32	

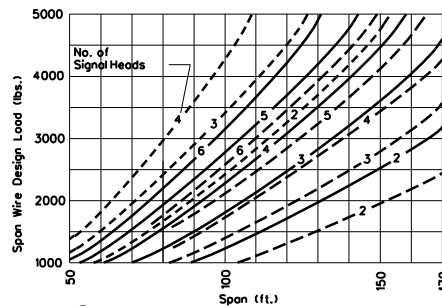
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STRAIN POLE DESCRIPTION	Pole Type	Found-ation Type	Maximum Permissible Span Wire Load (lbs.)
26' Pole	A	36-A	5200
30' Pole	B	36-A	4600
30' Pole with Lum.	B	36-A	4400
30' Pole with 20' Mast Arm	C	36-B	5600
30' Pole with 24' Mast Arm	C	36-B	5500
30' 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

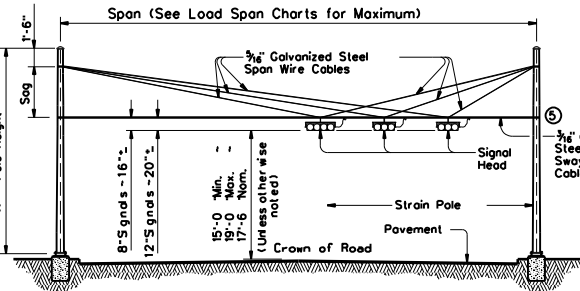


② SIGNALS WITH 8-INCH LENS

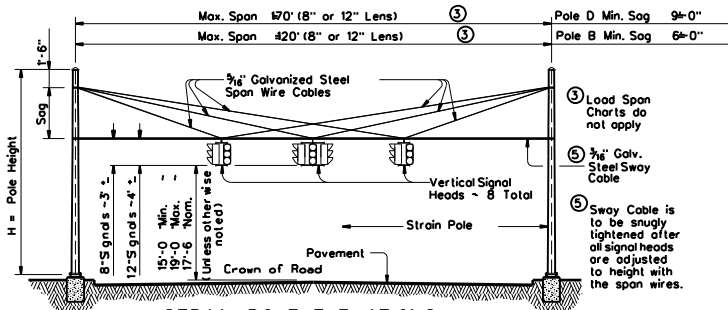
Signal Head Type	Wt. Per Head	Wind Area
5-Section, 12" Lens	125 lbs	9.6 sq. ft.
5-Section, 8" Lens	70 lbs	4.8 sq. ft.
3-Section, 12" Lens	75 lbs	5.64 sq. ft.
3-Section, 8" Lens	45 lbs	3.0 sq. ft.

◆ 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)



STRAIN POLE ELEVATIONS  
HORIZONTAL SIGNALS



STRAIN POLE ELEVATIONS  
VERTICAL SIGNALS

(Most arms are not used with vertical signals)

SHIPPING PARTS LIST						
<b>Poles (Without Traffic Signal Arm)</b>						
Pole Type	Strain poles with Luminaire			Strain poles without Luminaire		
	Description	Designation	Quantity	Description	Quantity	
A	Ship each pole with the following hardware attached: handhole at base, pole cap, 2 clamp-on simplex and 1 pipe plug.			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	
<b>Poles (With Traffic Signal Arm)</b>						
Pole Type	Strain poles with Luminaire			Strain poles without Luminaire		
	Description	Designation	Quantity	Description	Quantity	
C	30' SPw/TS Arm	SPL 30 C-80		30' SPw/TS Arm	SP 30 C-80	
<b>Traffic Signal Arms (For Type C poles)</b>						
Nominal Arm Length	Type I Arm (1 Signal)		Type II Arm (2 Signals)		Type III Arm (3 Signals)	
	Ship each Type I Arm with the following hardware attached: 2 CGB Connectors, 1 clamp with bolts and washers		Ship each Type II Arm with the following hardware attached: 1 Bracket Assembly, 3 CGB Connectors and 1 clamp with bolts and washers		Ship each Type III Arm with the following hardware attached: 2 Bracket Assemblies, 4 CGB Connectors and 1 clamp with bolts and washers	
ft.	Designation	Quantity	Designation	Quantity	Designation	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	
<b>Anchor Bolt Assemblies (1 per pole)</b>						
Anchor Bolt Diameter	Anchor Bolt Length	Templates may be removed for shipment.		Luminaire Arms		
		Quantity		Nominal Arm Length	Quantity	
1 3/4"	3'-10"			8' Arm		
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".						

① See Sheet "DMA-80"

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

Pole Type	ROUND POLES				POLYGONAL POLES			
	D <sub>B</sub> in.	D <sub>T</sub> in.	(4)thk in.	H ft.	D <sub>B</sub> in.	D <sub>T</sub> in.	(4)thk in.	H ft.
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

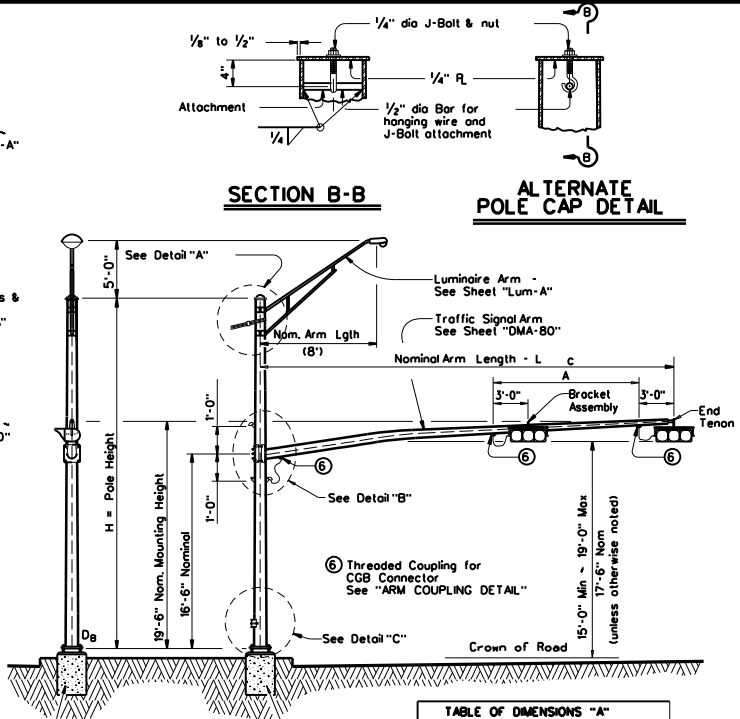
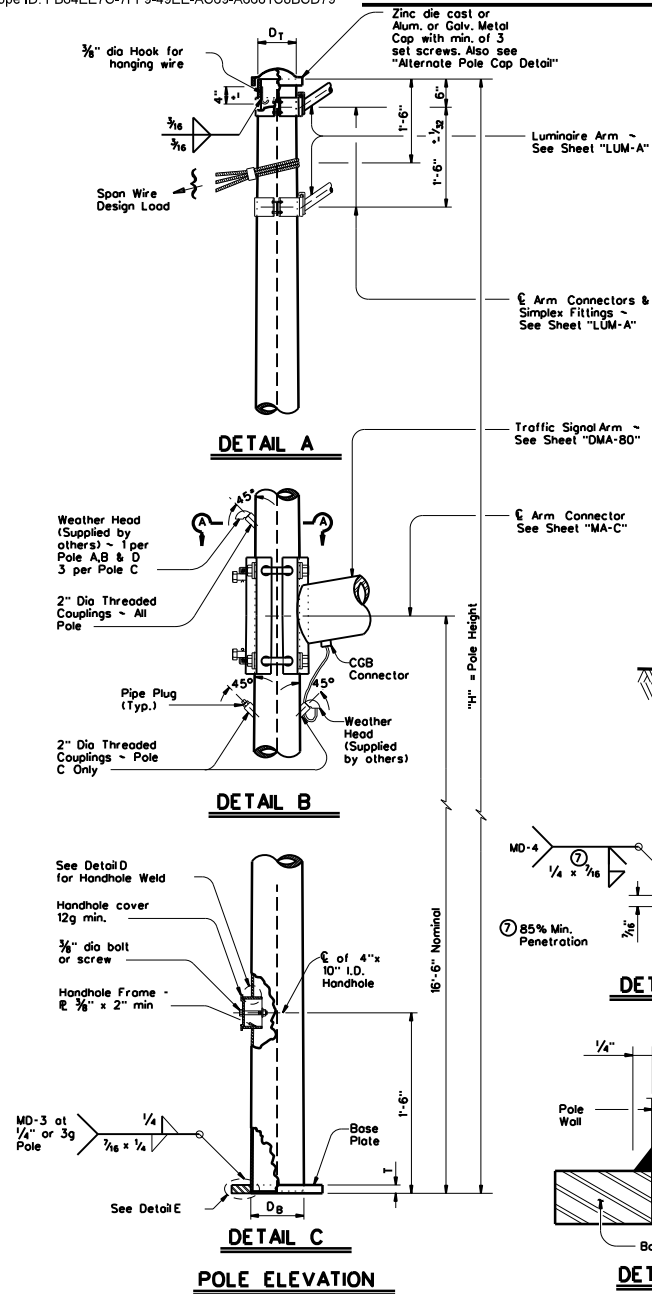
D<sub>B</sub> = Pole Base O.D.      D<sub>T</sub> = Pole Top O.D.      H = Pole Height

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

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5466	55	001	US 59, ETC.		
DIST	COUNTY	SHEET NO.			
LFK	ANGELINA, ETC.	33			

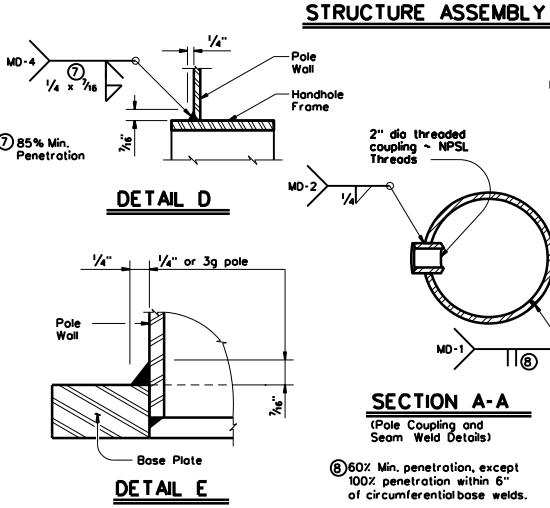
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**TABLE OF DIMENSIONS "A"**

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



**SECTION B-B**

**ALTERNATE POLE CAP DETAIL**

**MATERIALS**

Round Shafts or Polygonal Shafts	⑤ 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
Plates	⑥ ASTM A36, A588, or A572 Gr.50
Connection Bolts	ASTM A325 except where noted
Pin Bolts	ASTM A325
Pipe	⑦ 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

⑤ 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.

⑥ 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.

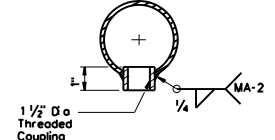
Fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. Materials, fabrication tolerances,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

**BASE PLATE PLAN**



**SECTION A-A**

(Pole Coupling and Seam Weld Details)

⑧ 60% Min. penetration, except 100% penetration within 6" of circumferential base welds.

**ARM COUPLING DETAIL**

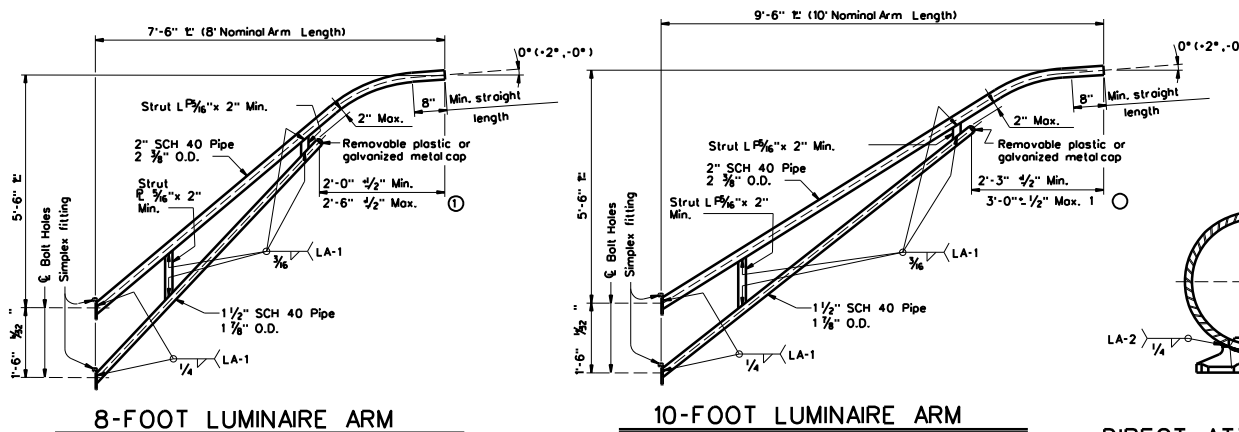


Texas Department of Transportation  
 Traffic Operations Division  
**TRAFFIC SIGNAL**  
**SUPPORT STRUCTURES**  
**STRAIN POLE ASSEMBLIES**  
 (80 MPH WIND ZONE)  
**SP-80(2)-12**

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	5466	55	001	US 59, ETC.	
	DIST	COUNTY		SHEET NO.	
	LFK	ANGELINA, ETC.		34	

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

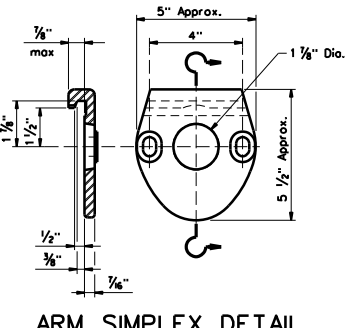
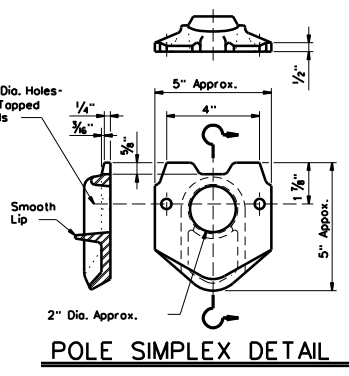
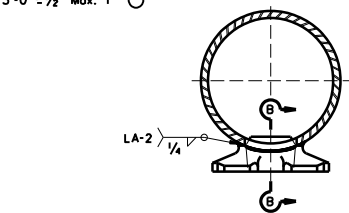
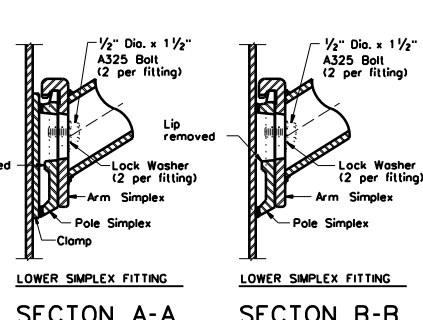
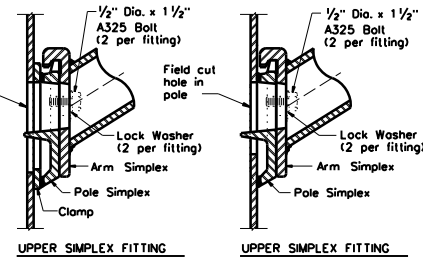
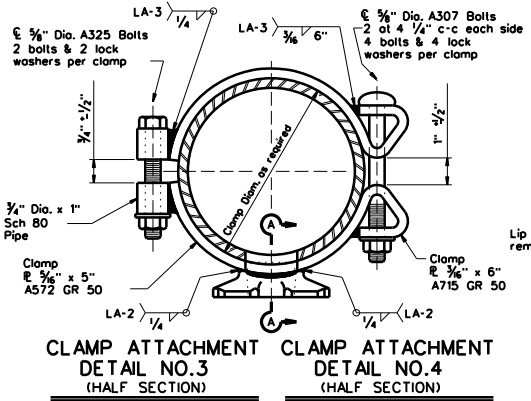
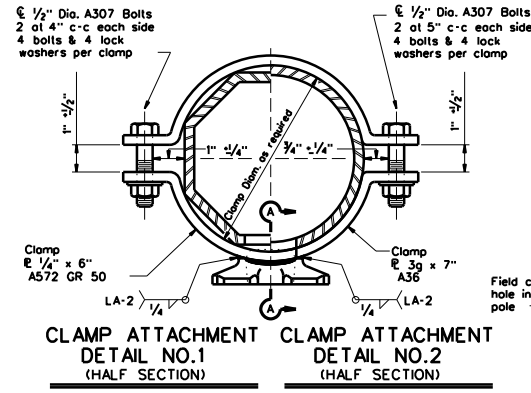
Materials and fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the fabricator must obtain prior to fabrication. In the absence of specified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

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

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

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

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



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

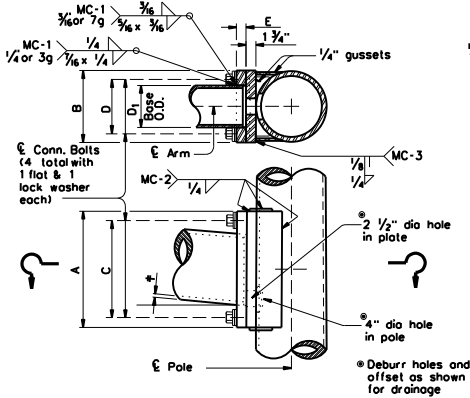
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		DIST	COUNTY		SHEET NO.
		LFK	ANGELINA, ETC.		35

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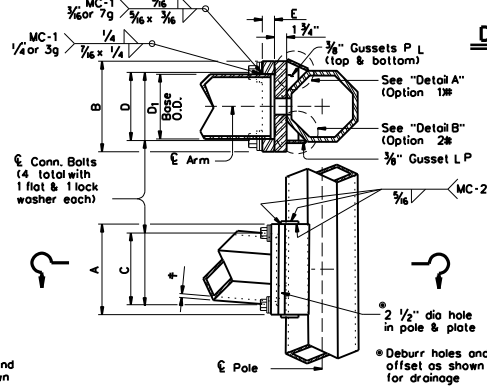
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ARM SIZE		A	B	C	D	E	CONN. BOLT DIA
D <sub>1</sub>	#	in.	in.	in.	in.	in.	in.
6.5	.179	12	9	9	6	1 1/4	1
7.5	.179	13	9	10	6	1 1/4	1
8.0	.179	14	10	11	7	2	1 1/2
9.0	.179	16	11	13	8	2	1 1/2
9.5	.179	17	12	14	9	2	1 1/2
9.5	.239	18	12	15	9	2	1 1/2
10.0	.179	18	12	15	9	2	1 1/2
10.0	.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>	#	in.	in.	in.	in.	in.	in.
7.0	.179	11	11	8	8	1 1/4	1 1/4
7.5	.179	11	11	8	8	1 1/4	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



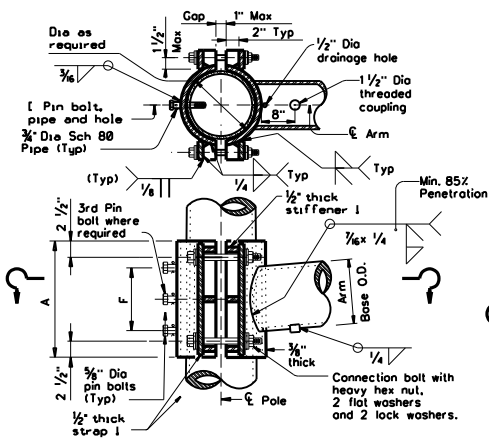
**FIXED MOUNT DETAIL 1**



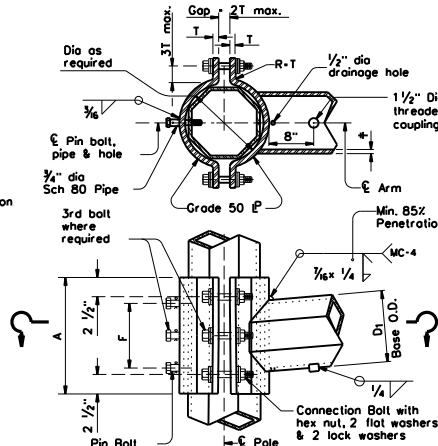
**FIXED MOUNT DETAIL 2**

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

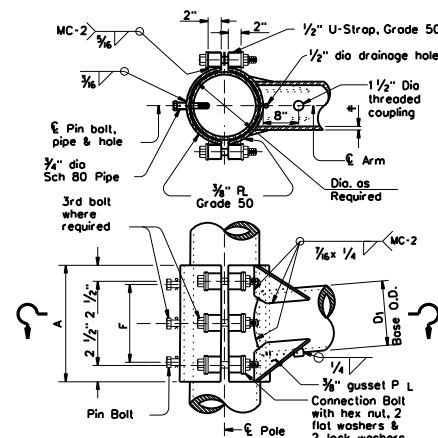
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7.5	.179	14	8	3/4	4	3/4	2	3/8
8.0	.179	14	8	3/4	4	3/4	2	3/8
9.0	.179	16	10	3/4	4	1	2	3/8
9.5	.179	18	12	3/4	4	1	2	3/8
9.5	.239	18	10	1	6	1	3	3/8
10.0	.239	18	10	1	6	1	3	3/8



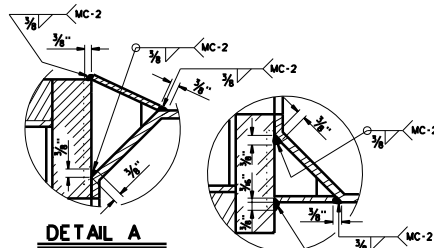
**CLAMP-ON DETAIL 1**



**CLAMP-ON DETAIL 2**



**CLAMP-ON DETAIL 3**



**ARM BASE WELD DETAILS**

MATERIALS	
Round Shafts or Polygonal Shafts	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
Plates	ASTM A36, A588, or A572 Gr. 50
Connection Bolts	ASTM A325 or A449, except where noted
Pin Bolts	ASTM A325
Pipe	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

- 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.
- 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 in dual arm assemblies. A Maximum 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 in 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 3/8" dia holes for a 1/8" dia galvanized cotter pin. Back clamp plate shall be furnished with a 3/4" dia hole for each pin bolt. An 1/16" dia hole for each pin bolt shall be field drilled through the pole after arm orientations have been approved by the Engineer.

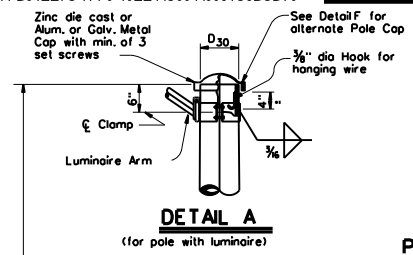
Texas Department of Transportation  
 Traffic Operations Division  
**STANDARD ASSEMBLY**  
**FOR TRAFFIC SIGNAL**  
**SUPPORT STRUCTURES**  
**MAST ARM CONNECTIONS**  
**MA-C-12**

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DIST	COUNTY			SHEET NO.	
LFK	ANGELINA, ETC.			36	

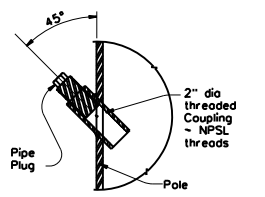


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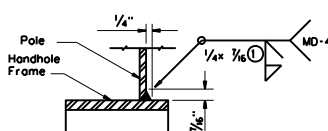
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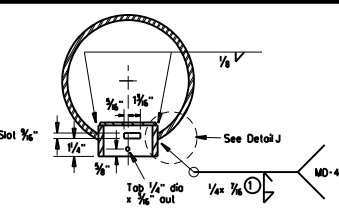
**DETAIL A**  
(for pole with luminaire)



**POLE COUPLING DETAIL**

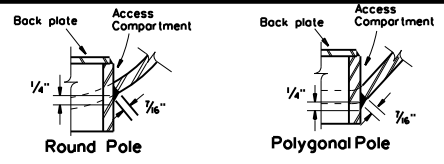


**DETAIL G**

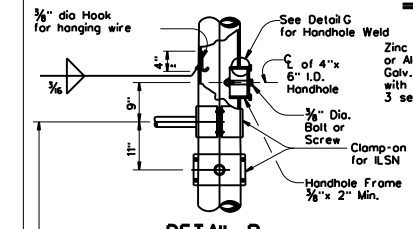


**SECTION X-X**

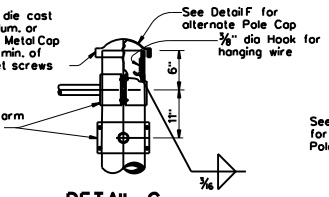
Opening for access compartment shall be no more than 1/8 inch wider than the access compartment itself.



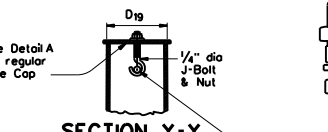
**DETAIL J**



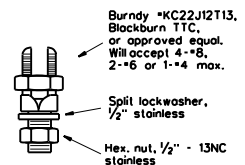
**DETAIL B**  
(if ILSN applied)



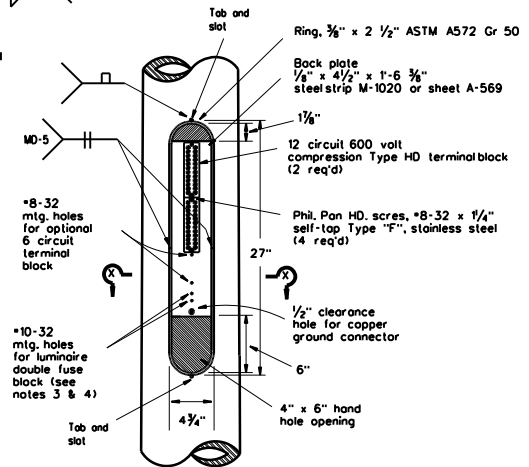
**DETAIL C**



**SECTION Y-Y**



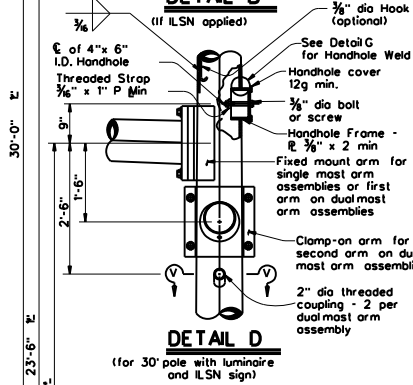
**COPPER GROUND CONNECTOR**



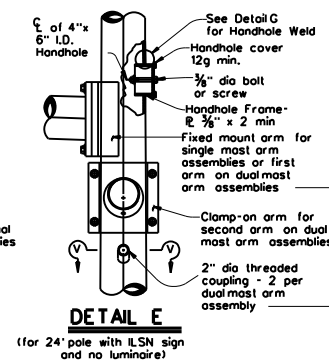
**ACCESS COMPARTMENT**

**NOTES:**

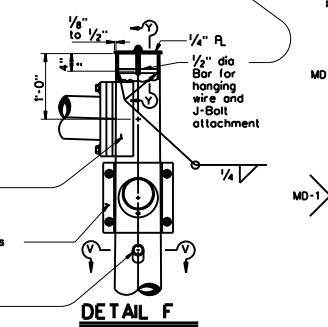
- The cover shall be one piece formed from ABS plastic, shall be a pearlgrey color, and shall be suitable for exposure to harsh sunlight and extreme weather. Cover shall latch with two screw latches and shall fit tightly to the enclosure ring to create a rainproof seal. Latch screws shall be 1/4-20 stainless 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 #985GP12C 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 KC22J1213, or Isco SSS-51). 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 Ferroz-Shawmut #30352 fuse block for poles where luminaires are to be installed.



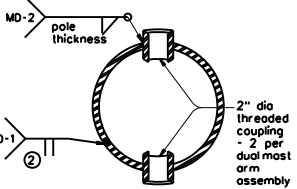
**DETAIL D**  
(for 30" pole with luminaire and ILSN sign)



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

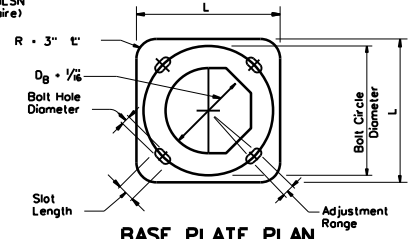


**DETAIL F**  
(for 19" pole with no ILSN sign and no luminaire)



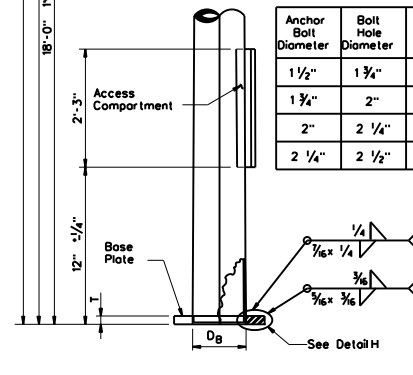
**SECTION V-V**

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"

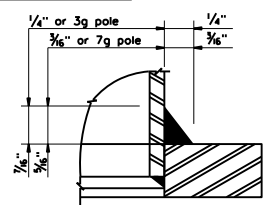


**BASE PLATE PLAN**

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



**POLE ELEVATION**



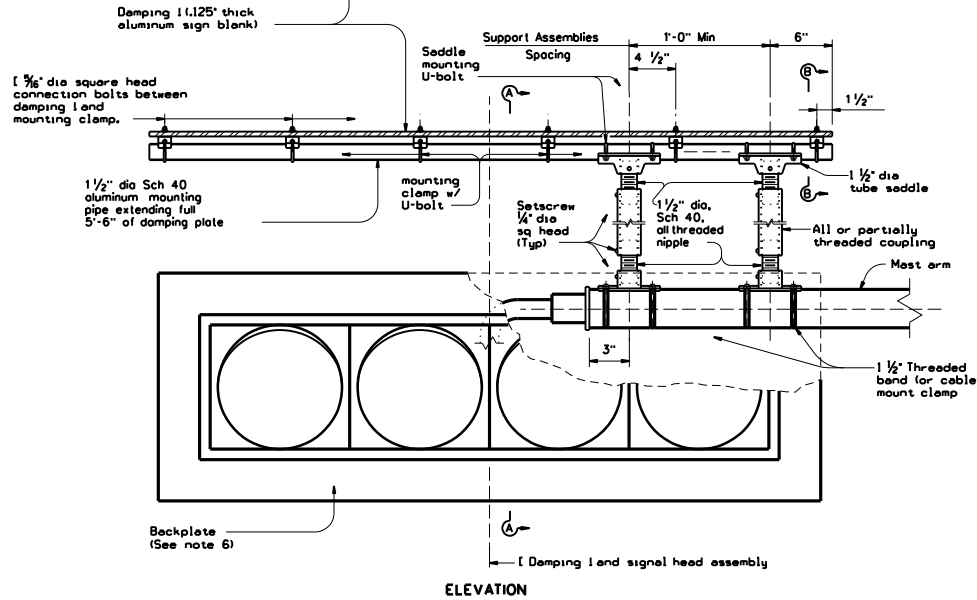
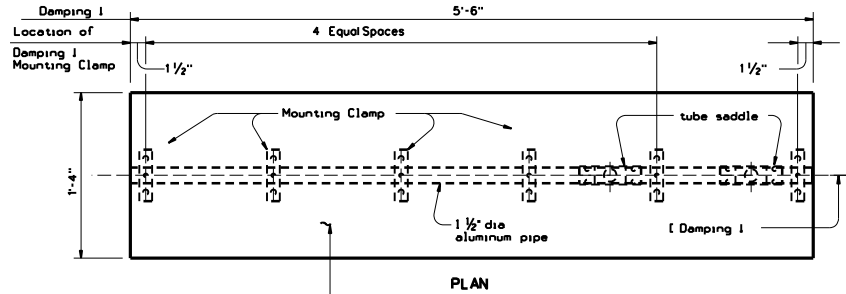
**DETAIL H**

**TRAFFIC SIGNAL SUPPORT STRUCTURES MAST ARM POLE DETAILS**  
**MA-D-12**

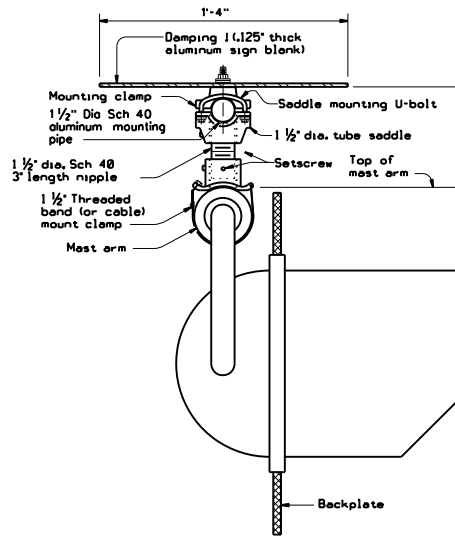
© TxDOT August 1995		DN: MS	CK: JSY	DR: FON	CK: CAL
REVISIONS					
CONT	SECT	JOB	HIGHWAY		
5466	55	001	US 59, ETC.		
DIST	COUNTY		SHEET NO.		
LFK	ANGELINA, ETC.		37		

DSC# 4465: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for any damage resulting from its use.

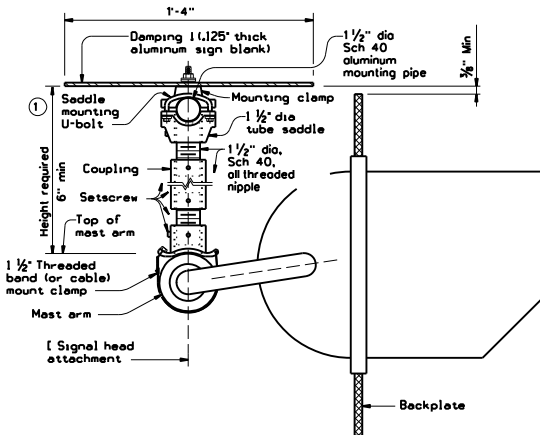
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**DAMPING PLATE MOUNTING DETAILS**  
(Showing alternate placement of signal head)



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



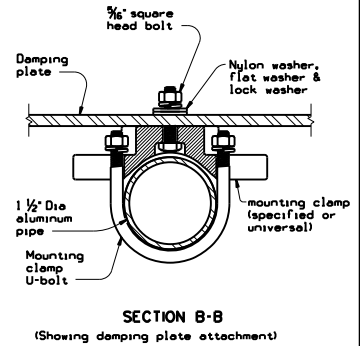
**SECTION A-A**  
(Showing alternate placement of signal head)  
(Mounting clamp U-bolt is not shown for clarity)

① Recommended supporting assemblies to achieve required height for horizontal section heads

Height required	One nipple each length	Two nipples each length	plus One coupling each length
6'-6 3/4"	3'	-	-
7'-8 1/2"	4'	-	-
9'-10 1/2"	6'	-	-
11'-15 1/2"	-	4'	5'
16'-24"	-	6'	10'

**GENERAL NOTES:**

- 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-balls 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 <sup>or</sup> C PL retroreflective border conforming to TxDOT DMS-8300 "Sign Face Materials." See Sheet 15-8P-20 for backplate details.



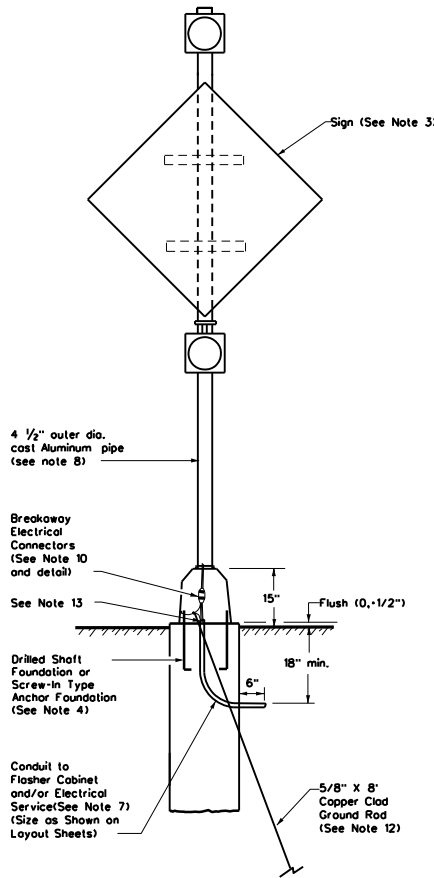
**MAST ARM DAMPING PLATE DETAILS**

**MA-DPD-20**

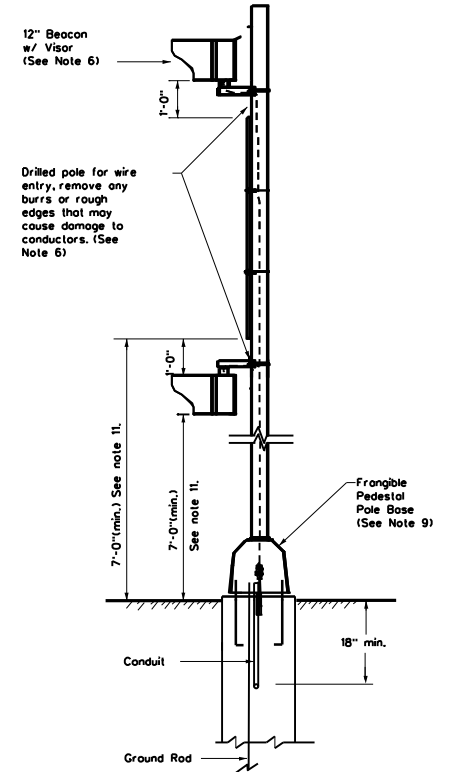
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① TxDOT January 2012	COM: SECT	JOB: 001	US 59, ETC.	
6-20 REVISIONS	DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO: 38	

**GENERAL NOTES:**

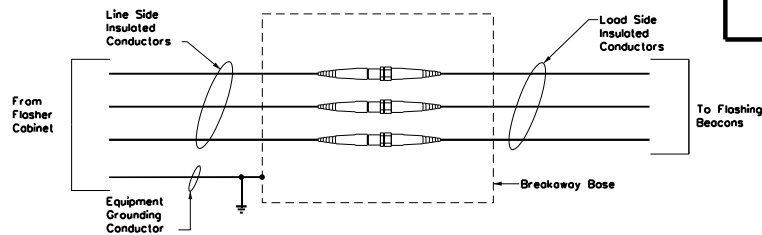
1. Details show a typical warning sign with two flashing beacon heads, other arrangements are possible. When only one beacon is required, install the upper beacon.
2. See Item 685, "Roadside Flashing Beacon Assemblies" for further requirements.
3. See SMD standard sheets for lateral and vertical clearances 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 Signs".
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.



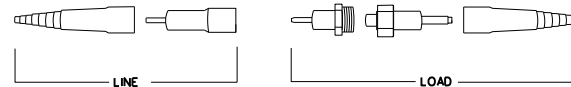
**FRONT**



**SIDE**



**NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS**



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

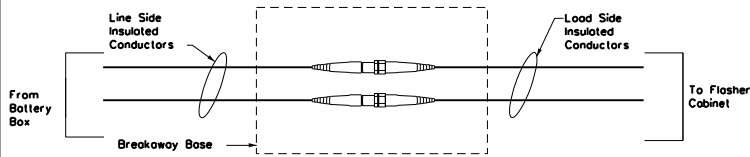
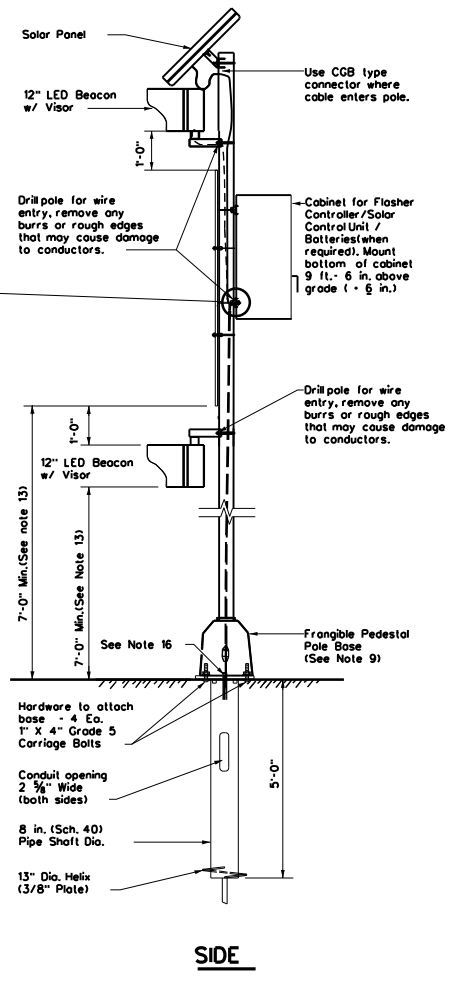
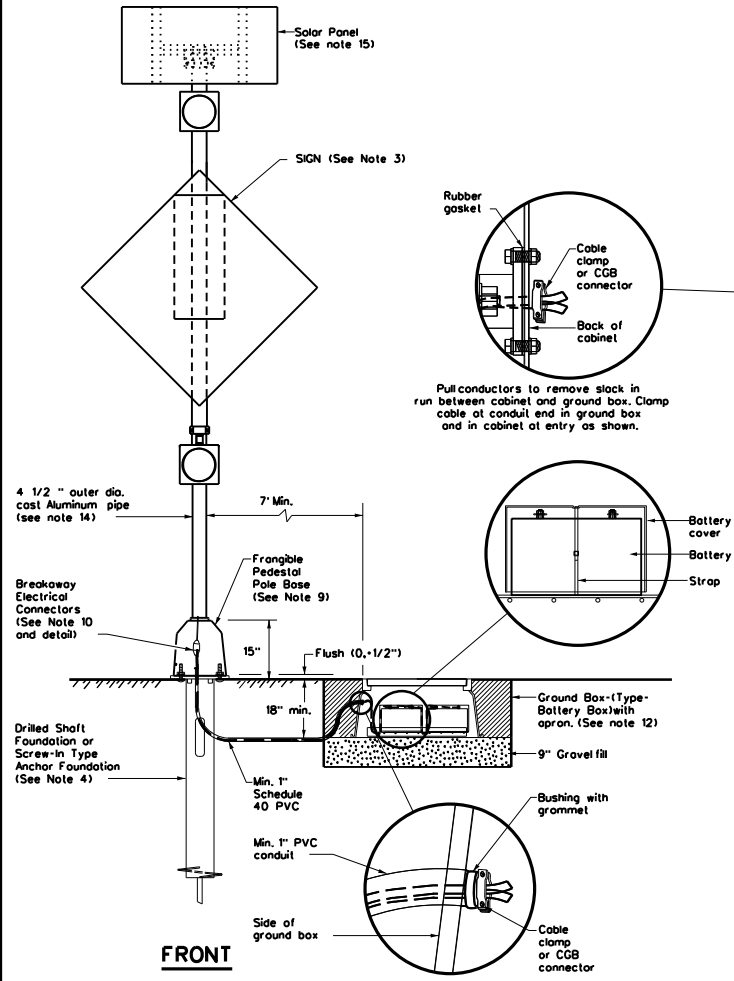
DSC: MKS. The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for any errors or omissions that may appear hereon.

DATE: 5/21/2024 10:26:05 AM  
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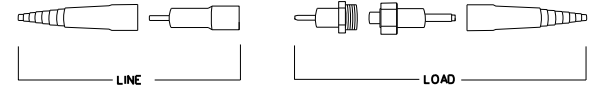
		Traffic Operations Division Standard	
<h2>ROADSIDE FLASHING BEACON ASSEMBLY</h2>			
<h3>RFBA-13</h3>			
FILE: rfa-13.dgn	DATE: TxDOT	DATE: TxDOT	DATE: TxDOT
© TxDOT January 1992	CONT: 6466	SECT: 55	JOB: 001
5-93 12-04 REVISIONS	US 59, ETC.		HIGHWAY
10-93 3-13	DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO.: 39
4-98			

**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 of 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. Use materials specifically designed for attaching cabinets, beacon heads, solar panels, etc., to poles.
7. 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.
8. Conduit in foundation and within 6 in. of foundation is subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies."
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 on 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. Install the batteries in a battery box. Place the batteries on a 3/16" thick plastic sheet and connect together. Place a plastic cover (battery bell jar) over the top of each battery and secure the battery bell jar to the battery with a strap. The batteries, bell jars, straps and 3/16" plastic sheet are subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies." When required, install batteries in the flasher cabinet. Wire batteries according to manufacturer's recommendations. Provide the number of batteries as required by the manufacturer.
12. See standard sheet Electrical Details (ED) for additional requirements regarding the installation of ground boxes/battery boxes, conduit, and cabinets.
13. Provide clearance as shown above the sidewalk or pavement grade at the edge of the road. When a bottom grade 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.
14. 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.
15. Orient solar panel for optimum exposure to sunlight (face to the south). Prior to installation, check the location to ensure there is no overhead obstruction that would block the solar panel from receiving full sunlight. Unless specified elsewhere, mount a minimum of 14' above grade.
16. Ensure height of conduit is below top of anchor bolts.



**NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS**



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

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		Traffic Operations Division Standard	
<b>SOLAR POWERED ROADSIDE FLASHING BEACON ASSEMBLY DETAILS</b>			
<b>SPRFBA(1)-13</b>			
FILE: spb1-13.dgn	CHK: TxDOT	CHK: TxDOT	CHK: TxDOT
REV: TxDOT May 2003	CONT: 6466	SECT: 55	JOB: 001
12-04 3-13	DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO.: 40

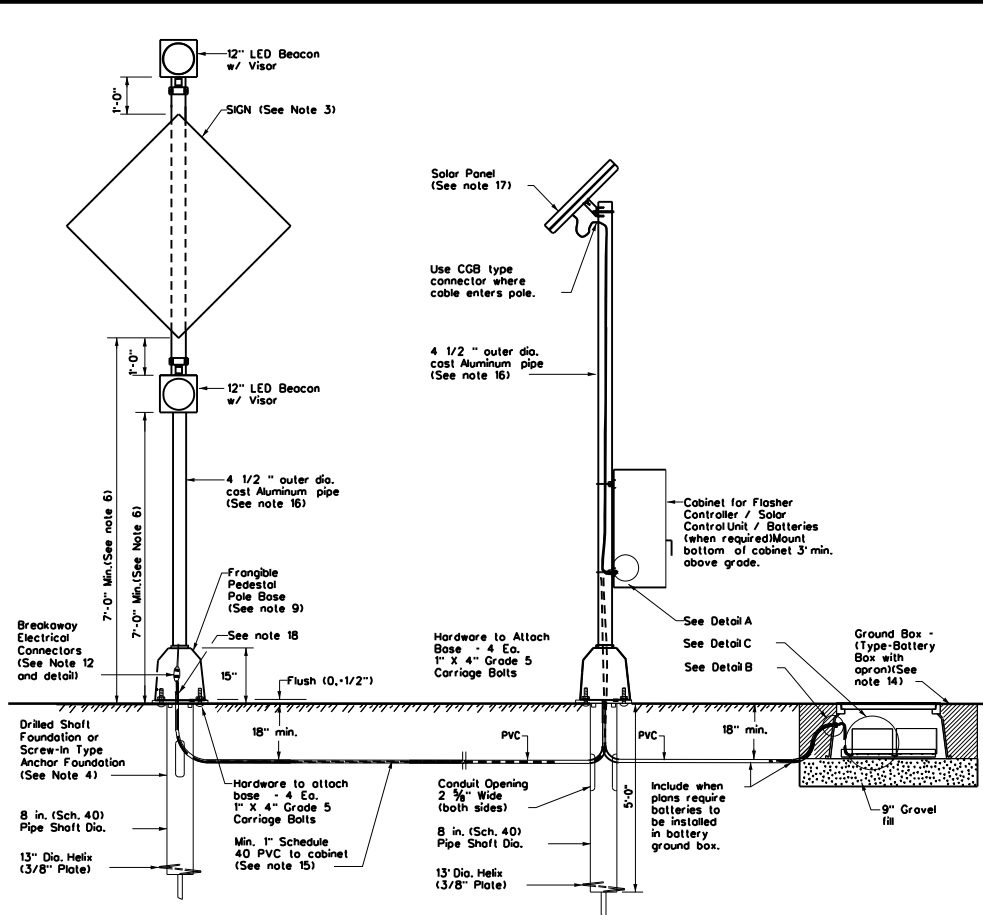
75A

**GENERAL NOTES:**

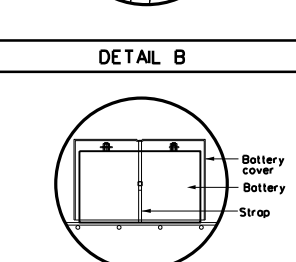
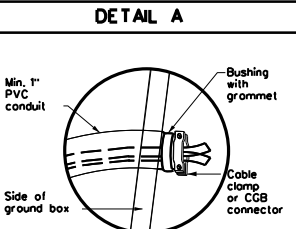
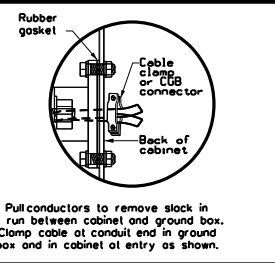
- Details show a typical warning sign with two flashing beacon heads, other arrangements are possible. When only one beacon is required, install the upper beacon.
- See Item 685, "Roadside Flashing Beacon Assemblies" for further requirements.
- See SMD standard sheets for lateral and vertical clearances and sign mounting details. Install signs as shown on the sign layout sheets.
- 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.
- When used, provide Screw-In Type Anchor Foundations as shown on TxDOT's Material Producer List (MPL) in the file "Highway Traffic Signs".
- 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.
- Use materials specifically designed for attaching cabinets, beacon heads, solar panels, etc., to poles.
- Conduit in foundation and within 6 in. of foundation is subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies."
- 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 on connection.
- 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.
- Install the cable clamp in the bottom third of the back of the cabinet. See Detail A.
- 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).
- Install the batteries in a battery box. Place the batteries on a 3/16" thick plastic sheet and connect together. Place a plastic cover (battery bell jar) over the top of each battery and secure the battery bell jar to the battery with a strap. The batteries bell jars, straps and 3/16" plastic sheet are subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies." When required, install batteries in the flasher cabinet. Wire batteries according to manufacturer's recommendations. Provide the number of batteries as required by the manufacturer.
- See standard sheet Electrical Details (ED) for additional requirements regarding the installation of ground boxes/battery boxes, conduit, and cabinets.
- Unless otherwise shown on the plans or recommended by the manufacturer, use the following table to determine the wire size from cabinet to beacons.

Distance from Cabinet to Beacons (ft.)	Minimum Required Wire Size (AWG)
0 - 35	#14
35 - 60	#12
60 - 100	#10
> 100	#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.
- Orient solar panel for optimum exposure to sunlight (face to the south). Prior to installation, check the location to ensure there is no overhead obstruction that would block the solar panel from receiving full sunlight. Unless specified elsewhere, mount a minimum of 14" above grade.
- Ensure height of conduit is below top of anchor bolts.



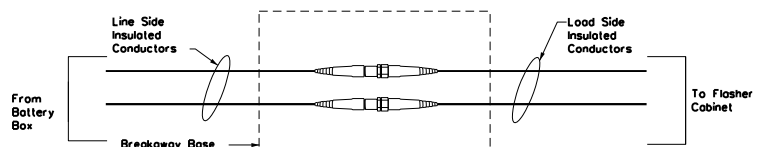
**DETAIL FOR SOLAR PANEL, CABINET, AND BATTERIES LOCATED OUT OF CLEAR ZONE ON SEPARATE ALUMINUM POLE ASSEMBLY**



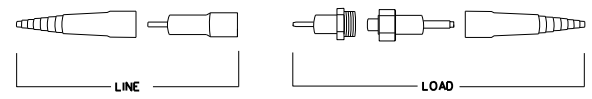
**DETAIL A**

**DETAIL B**

**DETAIL C**



**NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS**



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

Texas Department of Transportation  
Traffic Operations Division Standard

**SOLAR POWERED ROADSIDE FLASHING BEACON ASSEMBLY DETAILS (ALUMINUM)**

**SPRFBA(3)-13**

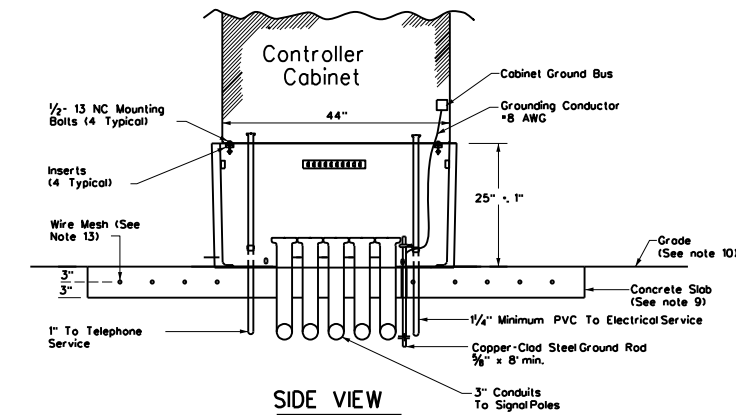
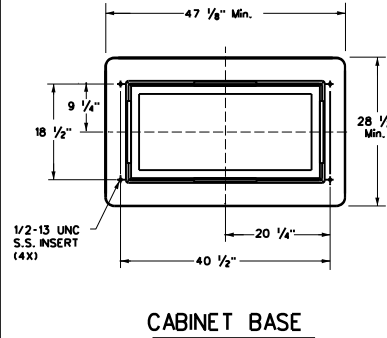
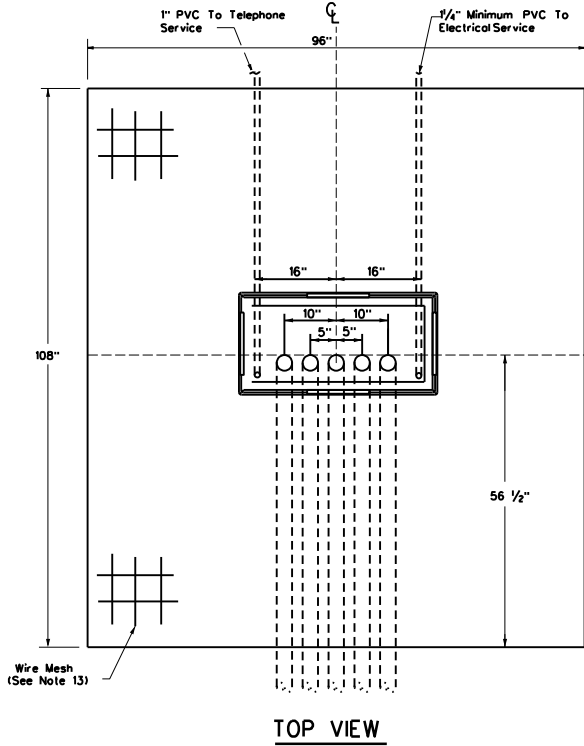
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REV: 01 May 2003	CONT: 6466	SECT: 55	JOB: 001	HIGHWAY: US 59, ETC.
12-04 3-13	DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO.:	41

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DATE: 5/21/2024 10:26:09 AM  
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O&C# 4469. The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for any damage resulting from its use.

DATE: 5/21/2024 10:26:09 AM  
 FILE: T:\LFK\TRPS\maintenance\contracts\PLANS\2024\Jobs\RMC-6466-55-001\T-017.dgn



**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*, *Quozite 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 base-mount 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 AWC 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.

		Traffic Safety Division Standard	
<b>TRAFFIC SIGNAL CONTROLLER CABINET BASE AND PAD</b> <b>TS-CF-21</b>			
FILE: ts-cf-21.dgn	DATE: October 2000	CONT SECT: 6466 55	JOB: 001
REVISIONS 12-04 2-21		DIST: LFK	COUNTY: ANGELINA, ETC.
		SHEET NO. 42	



**GENERAL NOTES FOR ALL ELECTRICAL WORK**

- The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.
- 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.
- 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.
- 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.
- 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.
- 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**

- Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.
- Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.
- 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 conductors 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"

- 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.
- 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.
- 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.
- Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

- 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.
- 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.
- 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**

- 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.
- 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.
- Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.
- Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or other 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.
- 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."
- Provide and place warning tape approximately 10 in. above all trench conduit as per Item 618.
- 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.
- 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.
- 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.
- 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.
- At all electrical services, install a 6 AWG solid copper grounding electrode conductor.
- 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).
- 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.
- 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.

DMS: M&P: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for the accuracy of the information contained herein. For more information, contact the Texas Department of Transportation, 1701 North Loop West, Austin, Texas 78701.

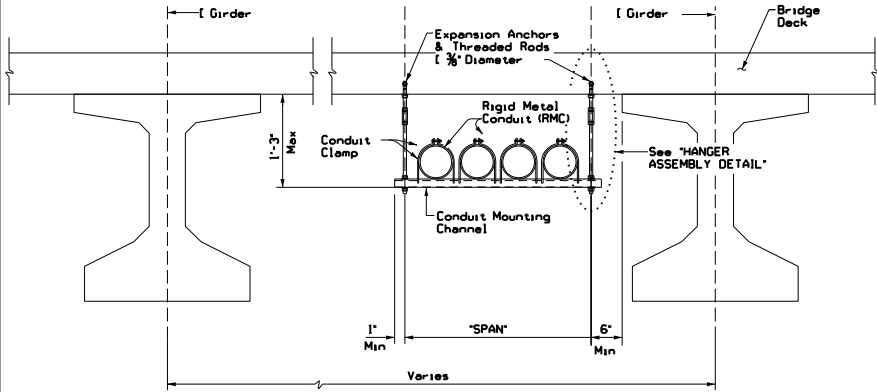
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		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS CONDUITS &amp; NOTES</h2>			
<h3>ED(1)-14</h3>			
FILE:	ed1-14.dgn	DATE:	05/21/2024
DESIGNED BY:	6466	CONTRACT NO.:	55
REVISIONS:		JOB NO.:	001
		COUNTY:	US 59, ETC.
		DIST:	ANGELINA, ETC.
		SHEET NO.:	44



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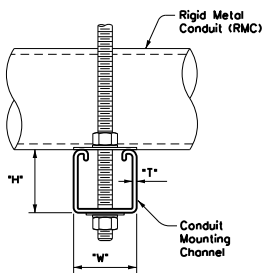
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CONDUIT HANGING DETAIL

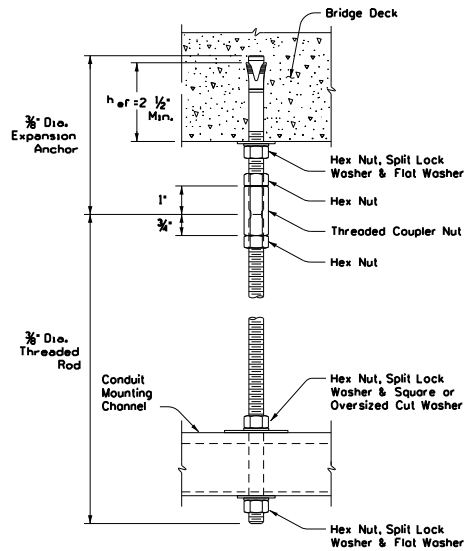
CONDUIT MOUNTING CHANNEL		
"SPAN"	"H" x "H"	"T"
less than 2'	1 3/8" x 1 3/8"	12 Ga.
2'-0" to 2'-6"	1 3/8" x 1 3/8"	12 Ga.
>2'-6" to 3'-0"	1 3/8" x 2 3/8"	12 Ga.

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

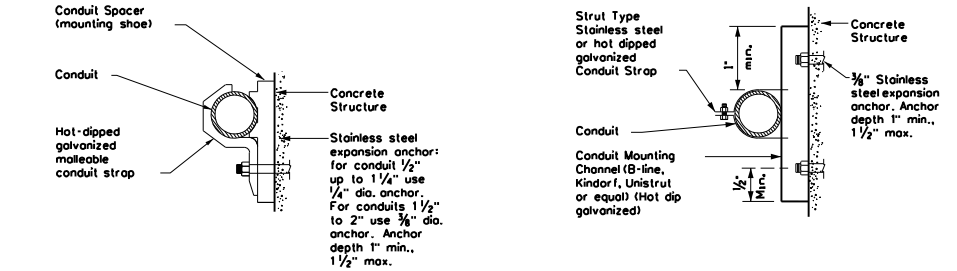


HANGER ASSEMBLY DETAIL

ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT



TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL



CONDUIT MOUNTING OPTIONS

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

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, (e<sub>f</sub>) as shown. Increase (e<sub>f</sub>) as needed to ensure sufficient thread length for proper torquing 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 (e<sub>f</sub>). No lateral loads shall be introduced after conduit installation.

		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS</h2> <h2>CONDUIT SUPPORTS</h2> <h3>ED(2)-14</h3>			
FILE: e42-14.dgn	DATE: TxDOT	CHK: TxDOT	DATE: TxDOT
REV: TxDOT October 2014	CONT: 6466	SECT: 55	JOB: 001
DIST: LFK		COUNTY: ANGELINA, ETC.	SHEET NO.: 45

**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 accordance 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. on 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 waterproof boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.
- C. TEMPORARY WIRING**
1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.
  2. Provide a ground fault circuit interrupter (GFCI) for power outlets for service equipment, 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.

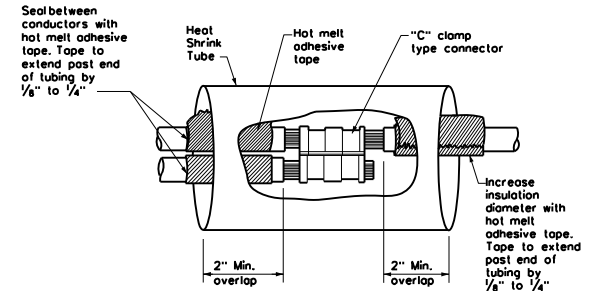
**GROUND RODS & GROUNDING ELECTRODES**

**A. MATERIAL INFORMATION**

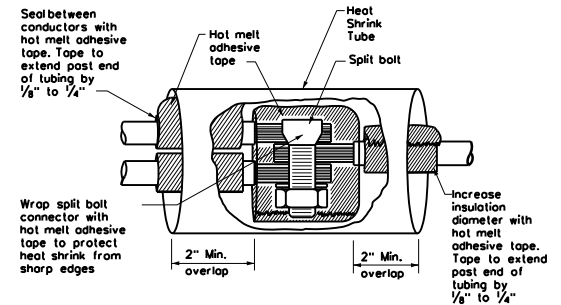
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in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

**B. CONSTRUCTION METHODS**

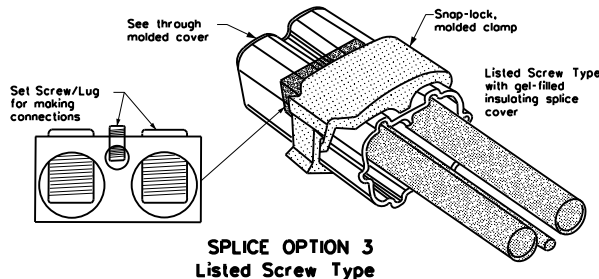
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil,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



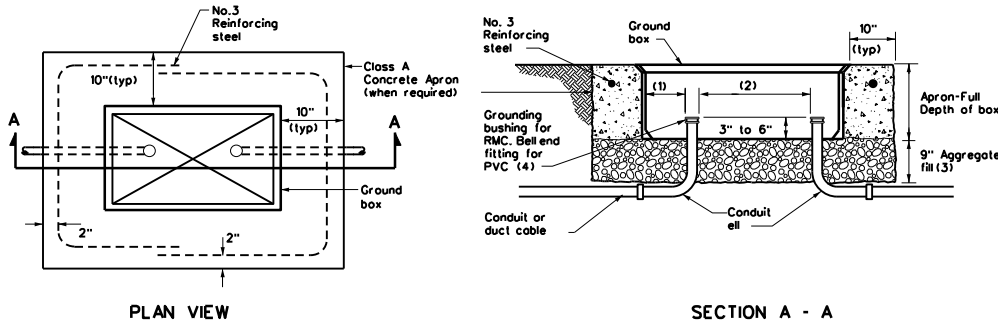
**SPLICE OPTION 3  
Listed Screw Type**

DMS 11040. The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or the accuracy of the information contained herein.

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		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS CONDUCTORS</h2> <h3>ED(3)-14</h3>			
FILE: ed3-14.dgn	DATE: TxDOT	DATE: TxDOT	DATE: TxDOT
REVISIONS: October 2014	COM: 6466	SECT: 55	JOB: 001
	DIST: LFK	COUNTY: ANGELINA, ETC.	HIGHWAY: US 59, ETC.
			SHEET NO.: 46

DMS 11070. The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion or damage resulting from its use.

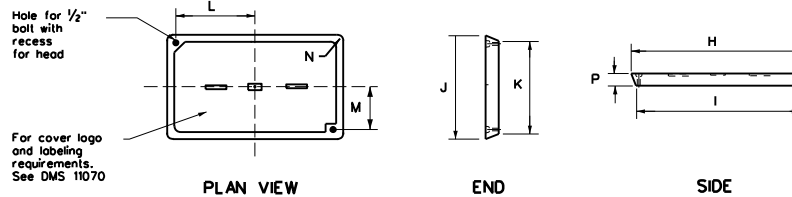


**APRON FOR GROUND BOX**

- (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.

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		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS</h2> <h3>GROUND BOXES</h3>			
<h3>ED(4)-14</h3>			
FILE: e44-14.dgn	DATE: TxDOT	DATE: TxDOT	DATE: TxDOT
October 2014	COM: 6466	SECT: 55	JOB: 001
REVISIONS	US 59, ETC.	COUNTY	SHEET NO.
LFK	ANGELINA, ETC.		47

**ELECTRICAL SERVICES NOTES**

- 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.
- 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.
- Provide all work, materials, services, and any incidents needed to install complete electrical service as specified in the plans.
- 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.
- 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 keys and 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.
- 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.
- When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.
- 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.
- 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.
- 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.
- 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.
- Ensure all mounting hardware and installation details of services conform to utility company specifications.
- 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 reline plan sheets before laminating.
- 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.
- 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**

- Provide threaded hub for all conduit entries into the top of enclosure.
- 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.
- 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 point stainless steel.
- 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 on AL enclosure.

**MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS**

- Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.
- 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**

- Provide photocells 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.

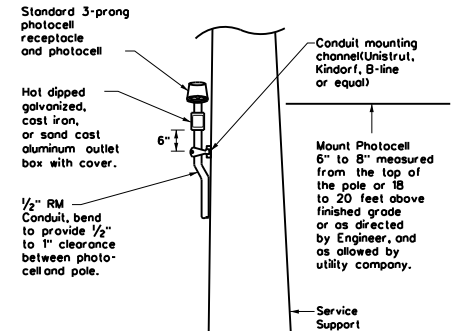
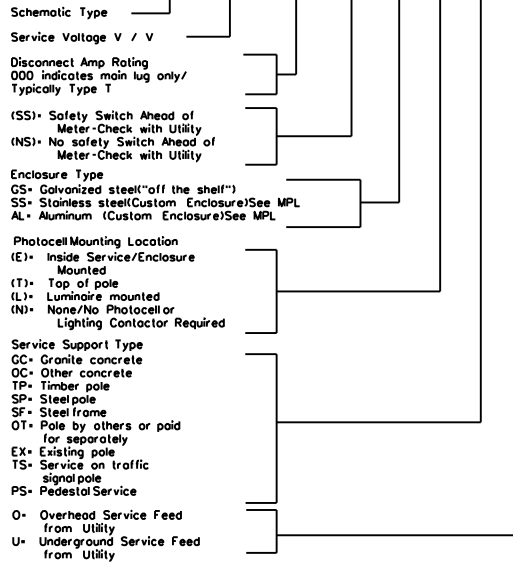
**\* ELECTRICAL SERVICE DATA**

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(IN)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.

Texas Department of Transportation  
 Traffic Operations Division Standard

**ELECTRICAL DETAILS  
 SERVICE NOTES & DATA**

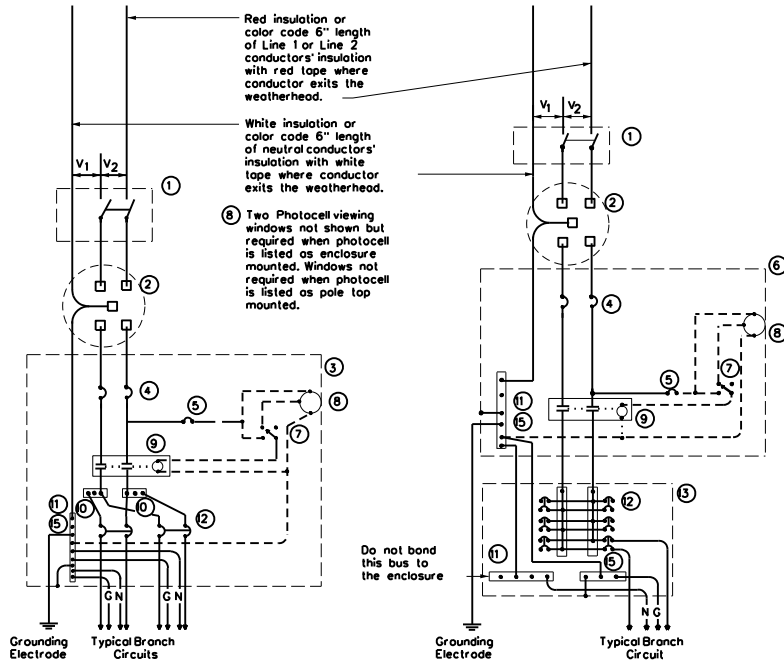
**ED(5)-14**

FILE: ed5-14.dgn    ON: TxDOT    ON: TxDOT    ON: TxDOT    ON: TxDOT  
 © TxDOT October 2014    COM: SECT    JOB: HIGHWAY  
 REVISIONS:    6466 55    001    US 59, ETC.  
 DIST: COUNTY SHEET NO.  
 LFK ANGELINA, ETC. 48

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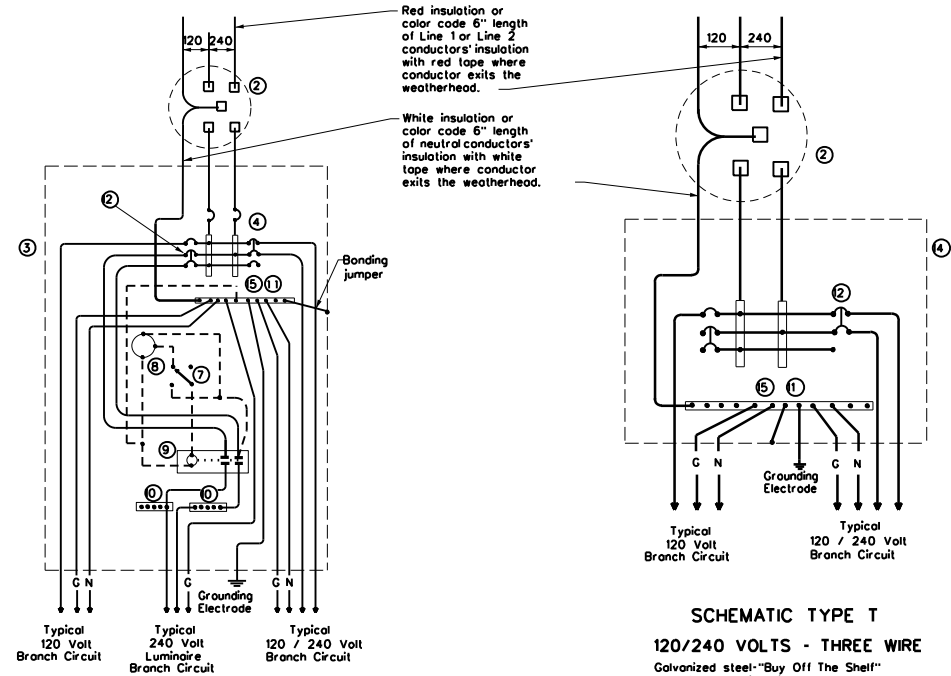
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**SCHEMATIC TYPE A  
THREE WIRE**

**SCHEMATIC TYPE C  
THREE WIRE**

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



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

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

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

		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES</b>			
<b>ED(6)-14</b>			
FILE: e96-14.dgn	DN: TxDOT	DN: TxDOT	DN: TxDOT
REV: TxDOT October 2014	CONT SECT	JOB	HIGHWAY
REVISIONS	6466	55	001 US 59, ETC.
DIST	LFK	COUNTY	ANGELINA, ETC.
		SHEET NO.	49

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

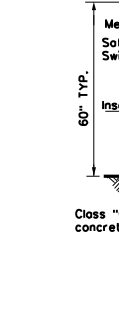
1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (DMS) 11080 "Electrical Services." Mount all equipment and conduit on 12 gauge galvanized steel or stainless steel channel strut, 1 1/2 in. or 1 3/4 in. wide by 1 in. up to 3 3/4 in. deep Unistrut, Kindorf, 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 3/4 in. to 3 7/8 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 elts 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 steels Grade 60 with 3" of unobstructed concrete cover.
7. Drill and tap 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.

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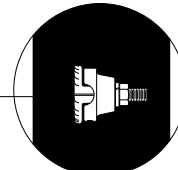
White insulation or color code 6" of neutral conductor's insulation with white tape where conductor exits weatherhead.

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.

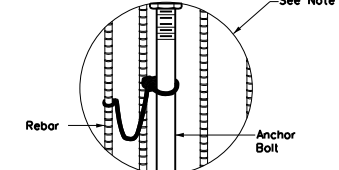


WITH SAFETY SWITCH  
WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE**

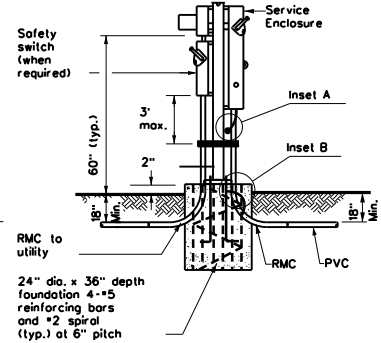
Drill, tap, and thread 1/2" x 13 UNC. Install tank ground fitting, connect electrical service grounding electrode conductor. See Note 7.



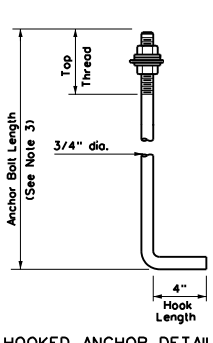
FRONT VIEW  
**INSET A**



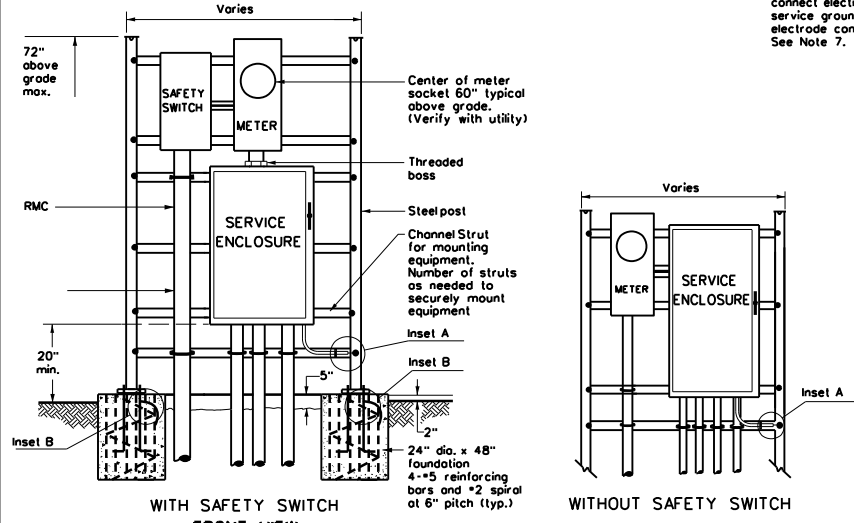
**INSET B**



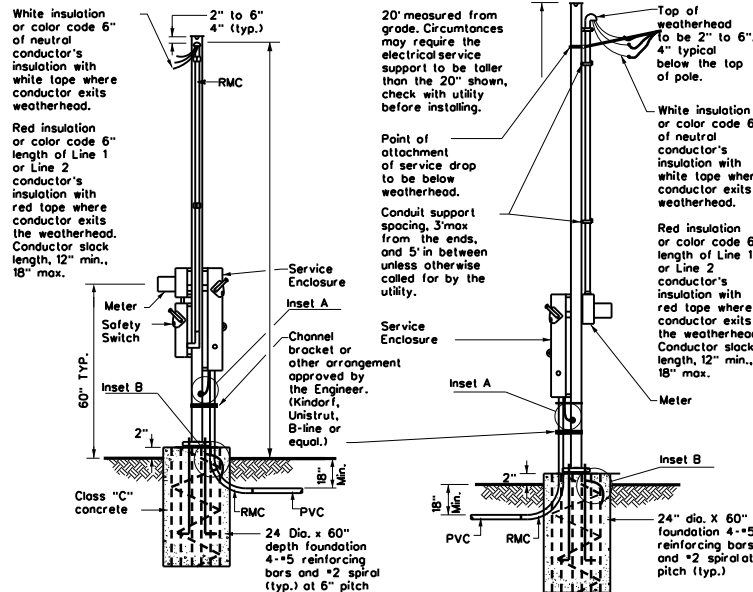
WITH SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP(U) - UNDERGROUND SERVICE**



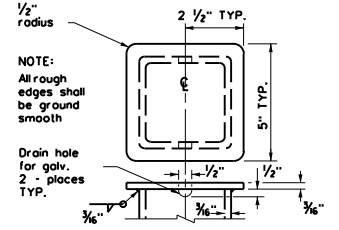
**HOOKED ANCHOR DETAIL**



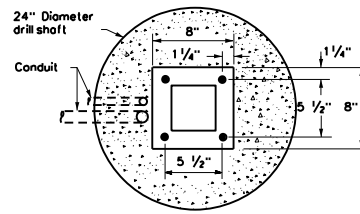
WITH SAFETY SWITCH  
WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SF(U) - UNDERGROUND SERVICE**



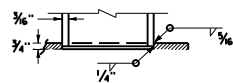
WITH SAFETY SWITCH  
WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE**



**POLE TOP PLATE**

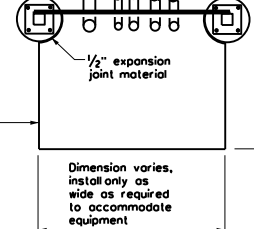


**BASE PLATE DETAIL**



**BOTTOM OF POLE**

**SERVICE SUPPORT TYPE SF & SP**



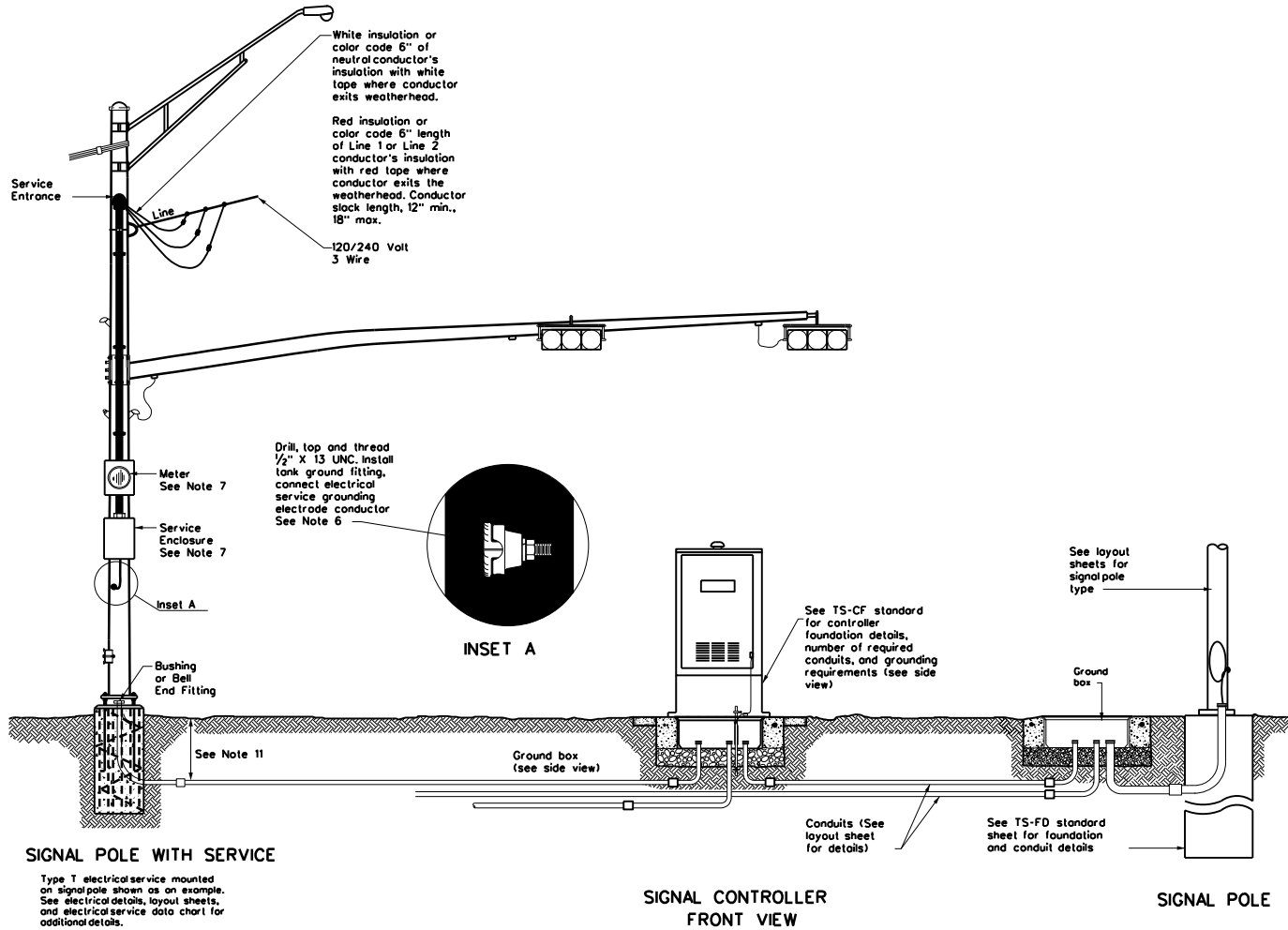
**TOP VIEW**

**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: e07-14.dgn	DATE: TxDOT	CHK: TxDOT	APP: TxDOT
REV: TxDOT October 2014	COM: SECT	JOB: HIGHWAY	
6466	55	001	US 59, ETC.
DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO: 50	

**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 lock 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. Band 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".



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**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.

**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**

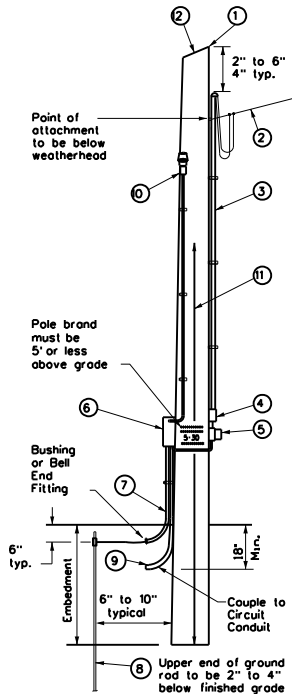
**SIGNAL POLE**

		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS TYPICAL TRAFFIC SIGNAL SYSTEM DETAILS</b>			
<b>ED(8)-14</b>			
FILE: e08-14.dgn	CON: TxDOT	DES: TxDOT	DWG: TxDOT
REV: TxDOT October 2014	CONT: 6466	SECT: 55	JOB: 001
DIST: LFK		COUNTY: ANGELINA, ETC.	SHEET NO.: 51

**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 3/8 in. max. depth and 1 7/8 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 channel sized 1 in. to 3 3/4 in. maximum depth, and 1/2 in. to 1 7/8 in. maximum width. File smooth the cut ends of galvanized channel and paint with zinc rich paint 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.

- 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 3/8 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.
- 2 When required by utility, cut top of pole at an angle to enhance rain run off.

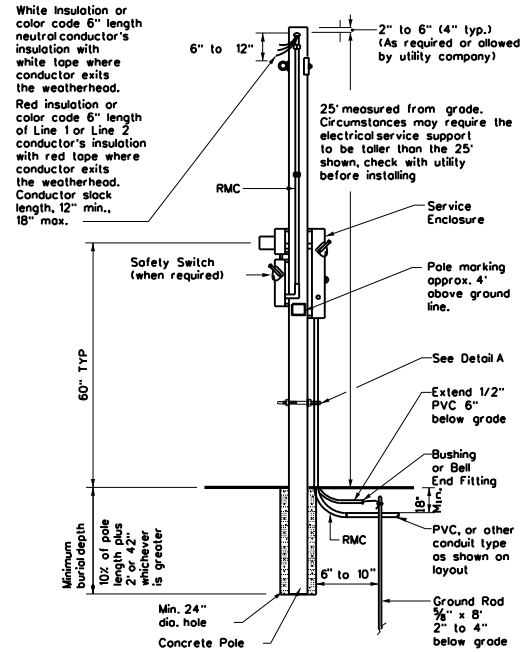


**SERVICE SUPPORT TYPE TP (O)**

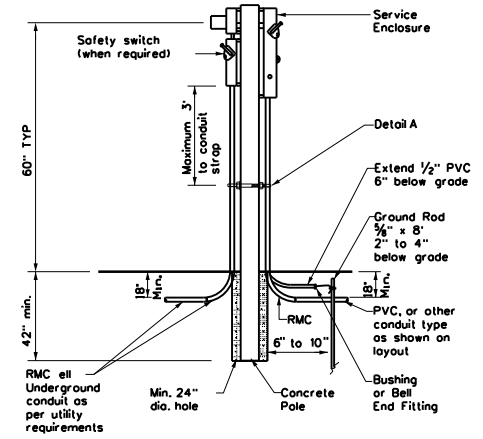
**GRANITE CONCRETE (GC) & OTHER CONCRETE (OC) NOTES**

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

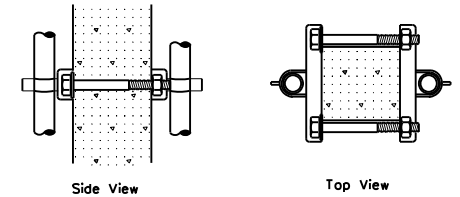
1. Provide GC and OC poles that meet the requirements of DMS 11080 "Electrical Services."
2. Provide prestressed concrete poles suitable for direct embedment into the ground without special foundations.
3. Verify poles are marked as required on DMS 11080. Location of marking should be approximately 4' 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 3/8 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 paint. Ensure there is no point splatter on the pole.

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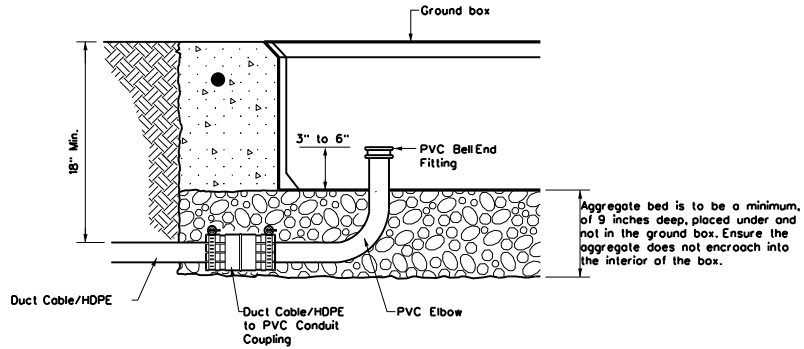
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		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE SUPPORT TYPES GC, OC, &amp; TP</b>			
<b>ED(10)-14</b>			
FILE: ed10-14.dgn	DATE: TxDOT	CHK: TxDOT	DATE: TxDOT
REV: TxDOT October 2014	CONT: SECT	JOB: HIGHWAY	
6466	55	001	US 59, ETC.
DIST: LFK	COUNTY: ANGELINA, ETC.	SHEET NO.:	52



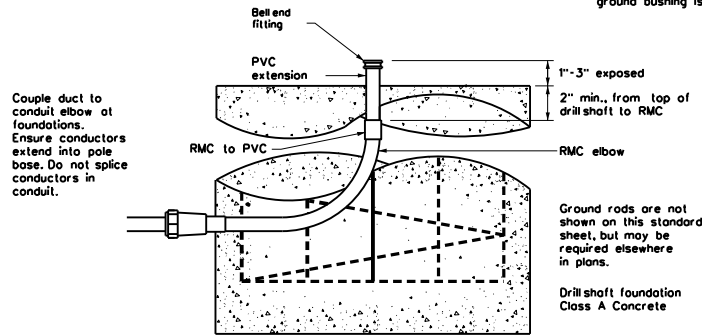
**DUCT CABLE & HDPE CONDUIT NOTES**

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 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.

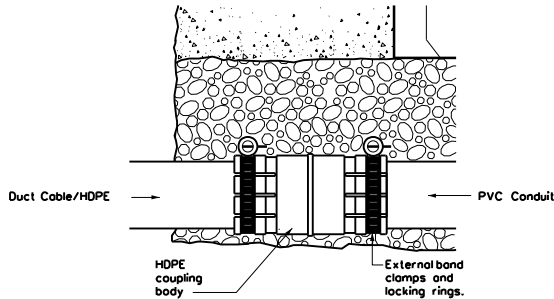


**DUCT CABLE/HDPE AT GROUND BOX**

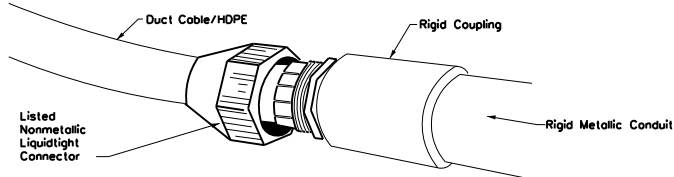
When the upper end of an RMC Elbow does not enter the ground box, it may be extended with a SCH-40 PVC conduit nipple and bell end, provided there is a minimum of 18" of cover over all parts of the elbow. If not, a rigid extension and ground bushing is required.



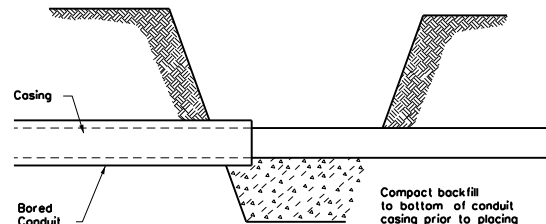
**DUCT CABLE / HDPE AT FOUNDATION**



**DUCT CABLE/HDPE TO PVC**



**DUCT CABLE/HDPE TO RMC**



**BORE PIT DETAIL**

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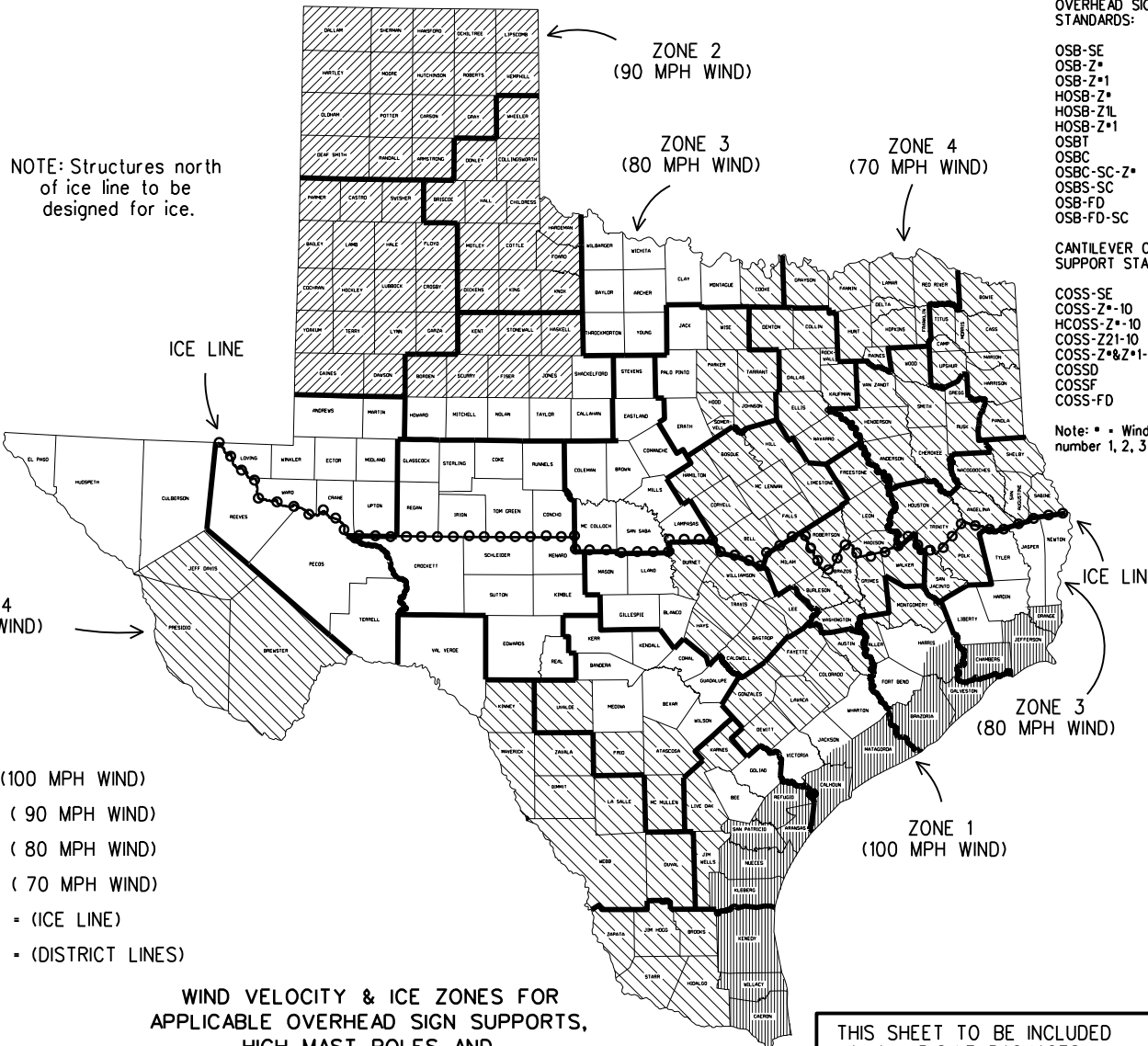
		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS DUCT CABLE/ HDPE CONDUIT</b>			
<b>ED(11)-14</b>			
FILE: ed11-14.dgn	CHK: TxDOT	CHK: TxDOT	CHK: TxDOT
REV: 01 TxDOT October 2014	CONT SECT	JOB	HIGHWAY
REVISIONS	6466	55	001 US 59, ETC.
	DIST	COUNTY	SHEET NO.
	LFK	ANGELINA, ETC.	53

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**APPLICABLE STANDARDS SHEETS**

- |  |   |
|--|---|
| <b>OVERHEAD SIGN BRIDGE STANDARDS:</b>             | <b>HIGH MAST ILLUMINATION POLE STANDARDS:</b> |
| OSB-SE   | HMP-98  |
| OSB-Z*   | HMF-98  |
| OSB-Z*1  |   |
| HOSB-Z*  | <b>WALKWAYS AND BRACKETS STANDARDS:</b>       |
| HOSB-Z1L   | SWW   |
| HOSB-Z*1   | SB(SWL-1)                                     |
| OSBT   |   |
| OSBC   | <b>TRAFFIC SIGNAL POLE STANDARDS:</b>         |
| OSBC-SC-Z*   | SP-80   |
| OSBS-SC  | SP-100  |
| OSB-FD   | SMA-80  |
| OSB-FD-SC  | SMA-100                                       |
|  | DMA-80  |
|  | DMA-100                                       |
| <b>CANTILEVER OVERHEAD SIGN SUPPORT STANDARDS:</b> | MA-C  |
| COSS-SE  | MAC(ILSN)                                     |
| COSS-Z*10  | MAD-D   |
| HCOSS-Z*10   | TS-FD   |
| COSS-Z21-10  | LUM-A   |
| COSS-Z*Z*1-10                                      | CFA   |
| COSSD  | LMA   |
| COSSF  | TS-C  |
| COSS-FD  | MA-DPD  |
- Note: \* = Wind Zone number 1, 2, 3 or 4



NOTE: Structures north of ice line to be designed for ice.

**LEGEND**

- ZONE 1 - [diagonal lines] (100 MPH WIND)
- ZONE 2 - [diagonal lines] (90 MPH WIND)
- ZONE 3 - [diagonal lines] (80 MPH WIND)
- ZONE 4 - [diagonal lines] (70 MPH WIND)
- [circles and line] = (ICE LINE)
- [thick line] = (DISTRICT LINES)

**WIND VELOCITY & ICE ZONES FOR APPLICABLE OVERHEAD SIGN SUPPORTS, HIGH MAST POLES, AND TRAFFIC SIGNAL POLES**

Based on 50 Year Mean Recurrence Interval of Fastest Mile Wind Velocity at 33 feet height.

THIS SHEET TO BE INCLUDED IN ALL P.S.&E. PACKAGES CONTAINING ONE OR MORE OF THE APPLICABLE STANDARD SHEETS LISTED HEREON

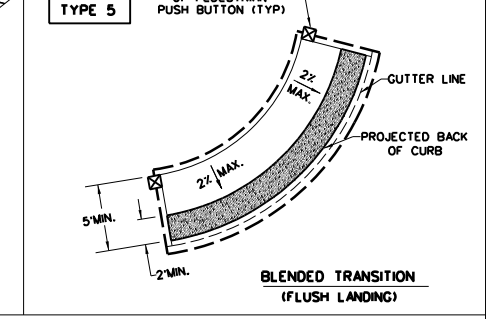
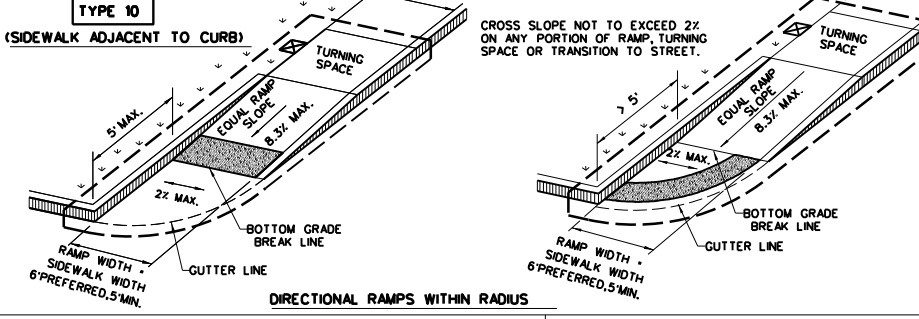
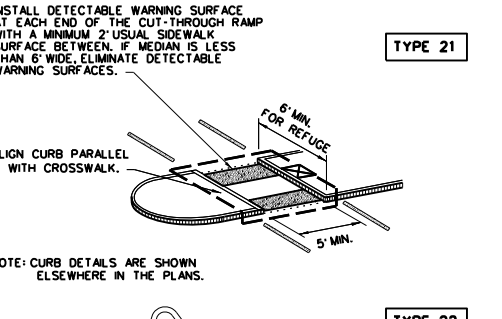
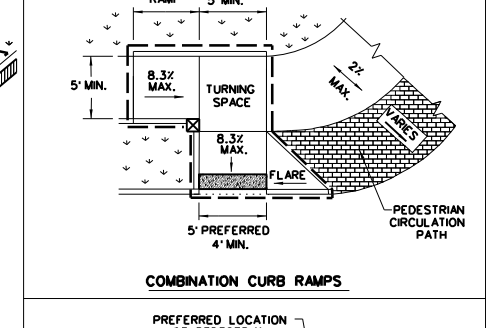
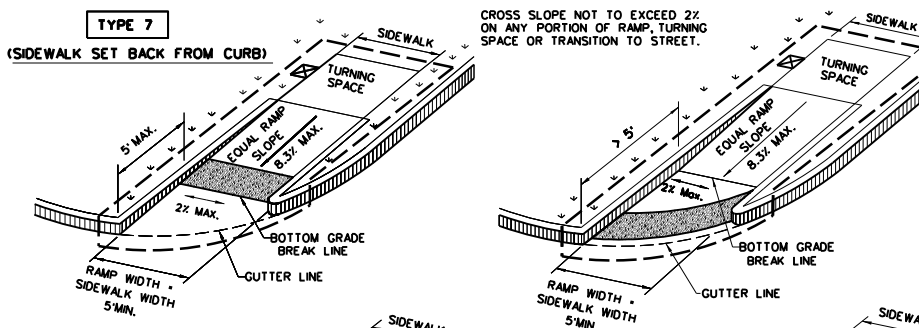
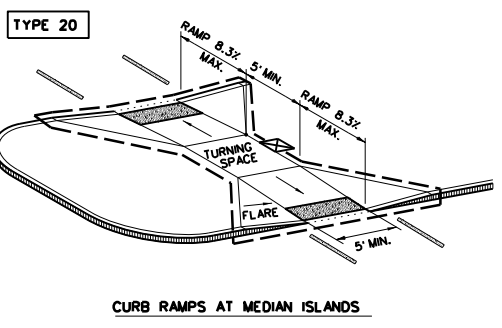
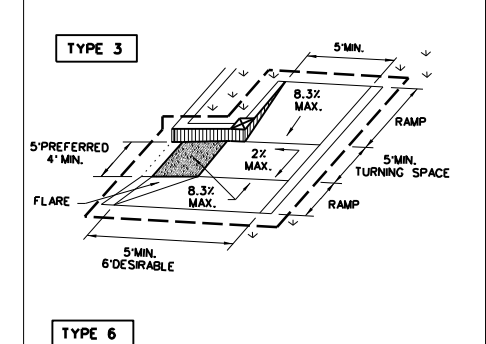
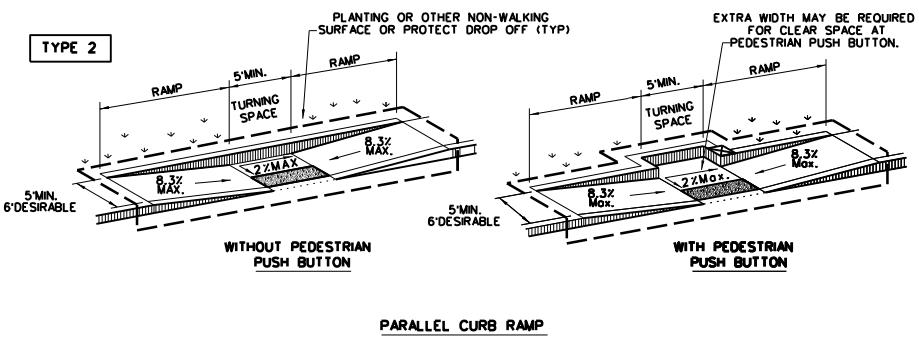
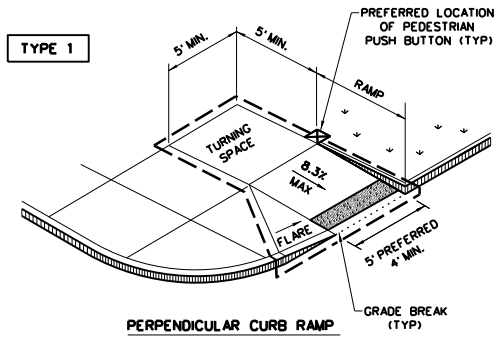
**FOR HARRIS CO. ONLY**  
 Zone line is just North of US 90, around on the North, West and South sides of IH 610 and down the West side of SH 288.

**FOR JACKSON CO. ONLY**  
 Zone line is just North of SH 616.

		Traffic Operations Division Standard	
<b>WIND VELOCITY AND ICE ZONES</b>			
<b>WV &amp; IZ-14</b>			
FILE: windice.dgn	DATE: TxDOT	CHK: TxDOT	DATE: TxDOT
© TxDOT April 1996	COM: 6466	SECT: 55	JOB: US 59, ETC.
REVISIONS		SHEET NO.	
DIST: LFK		COUNTY: ANGELINA, ETC.	
SHEET NO. 54		SHEET NO. 54	

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DATE: 5/21/2024  
 FILE: T:\LFPK\TROPs\maintenance\contracts\PLANS\2024\Jobs\NMC-6466-55-001 (T-r)Trig\_Signal Maintenance\2\_Signals-rds-VPED-1B.dgn



**NOTES / LEGEND:**

SEE GENERAL NOTES ON SHEET 2 OF 4 FOR MORE INFORMATION.

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH.

DETECTABLE WARNING SURFACE

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON IF APPLICABLE.

GUTTER LINE

GRADE BREAK

RAMP LIMITS OF PAYMENT

SHEET 1 OF 4

Texas Department of Transportation  
 Design Division Standard

## PEDESTRIAN FACILITIES CURB RAMPS

### PED-18

FILE: ped18	DN: TxDOT	DW: V/P	CK: K/M	DK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY
REVISED 08/2009 REVISIONS	6466	55	001	US 59, ETC.
REVISED 08/2007	DIST	COUNTY	SHEET NO.	
REVISED 01/2008	LFK	ANGELINA, ETC.	55	

**GENERAL NOTES**

**CURB RAMPS**

1. Install a curb ramp or blended transition at each pedestrian street crossing.
2. All slopes shown are maximum allowable. Cross slopes of 1.5% and lesser running should be used. Adjust curb ramp length or grade of approach sidewalks as directed.
3. Maximum allowable cross slope on sidewalk and curb ramp surfaces is 2%.
4. The minimum sidewalk width is 5'. Where the sidewalk is adjacent to the back of curb, a 6' sidewalk width is desirable. Where a 5' sidewalk cannot be provided due to site constraints, sidewalk width may be reduced to 4' for short distances. 5' x 5' passing areas at intervals not to exceed 200' are required.
5. Turning Spaces shall be 5' x 5' minimum. Cross slope shall be maximum 2%.
6. Clear space at the bottom of curb ramps shall be a minimum of 4' x 4' wholly contained within the crosswalk and wholly outside the parallel vehicular travel path.
7. Provide flared sides where the pedestrian circulation path crosses the curb ramp. Flared sides shall be sloped at 10% maximum, measured parallel to the curb. Returned curbs may be used only where pedestrians would not normally walk across the ramp, either because the adjacent surface is planted, substantially obstructed, or otherwise protected.
8. Additional information on curb ramp location, design, light reflective value and texture may be found in the latest draft of the Proposed Guidelines for Pedestrian Facilities in the Public Right of Way (PROWAG) as published by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board).
9. To serve as a pedestrian refuge area, the median should be a minimum of 6' wide, measured from back of curbs. Medians should be designed to provide accessible passage over or through them.
10. Small channelization islands, which do not provide a minimum 5' x 5' landing at the top of curb ramps, shall be cut through level with the surface of the street.
11. Crosswalk dimensions, crosswalk markings and stop bar locations shall be as shown elsewhere in the plans. At intersections where crosswalk markings are not required, curb ramps shall align with theoretical crosswalks unless otherwise directed.
12. Provide curb ramps to connect the pedestrian access route at each pedestrian street crossing. Handrails are not required on curb ramps.
13. Curb ramps and landings shall be constructed and paid for in accordance with Item 531 "Sidewalks".
14. Place concrete at a minimum depth of 5" for ramps, flares and landings, unless otherwise directed.
15. Furnish and install No. 3 reinforcing steel bars at 18" o.c. both ways, unless otherwise directed.
16. Provide a smooth transition where the curb ramps connect to the street.
17. Curbs shown on sheet 1 within the limits of payment are considered part of the curb ramp for payment, whether it is concrete curb, gutter, or combined curb and gutter.
18. Existing features that comply with applicable standards may remain in place unless otherwise shown on the plans.

**DETECTABLE WARNING MATERIAL**

19. Curb ramps must contain a detectable warning surface that consists of raised truncated domes complying with PROWAG. The surface must contrast visually with adjoining surfaces, including side flares. Furnish and install an approved cast-in-place dark brown or dark red detectable warning surface material adjacent to uncolored concrete, unless specified elsewhere in the plans.
20. Detectable Warning Materials must meet TxDOT Departmental Materials Specification DMS 4350 and be listed on the Material Producer List. Install products in accordance with manufacturer's specifications.
21. Detectable warning surfaces must be firm, stable and slip resistant.
22. Detectable warning surfaces shall be a minimum of 24 inches in depth in the direction of pedestrian travel, and extend the full width of the curb ramp or landing where the pedestrian access route enters the street.
23. Detectable warning surfaces shall be located so that the edge nearest the curb line is at the back of curb and neither end of that edge is greater than 5 feet from the back of curb. Detectable warning surfaces may be curved along the corner radius.
24. Shaded areas on Sheet 1 of 4 indicate the approximate location for the detectable warning surface for each curb ramp type.

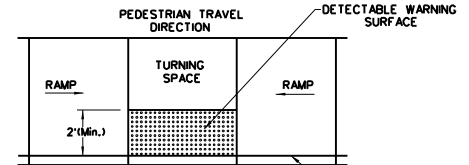
**DETECTABLE WARNING PAVERS (IF USED)**

25. Furnish detectable warning paver units meeting all requirements of ASTM C-936, C-33. Lay in a two by two unit basket weave pattern or as directed.
26. Lay full-size units first followed by closure units consisting of at least 25 percent (25%) of a full unit. Cut detectable warning paver units using a power saw.

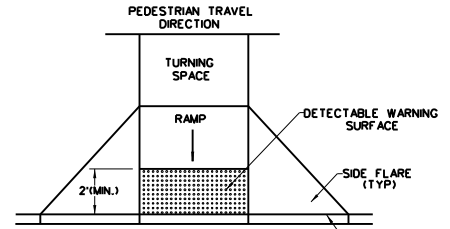
**SIDEWALKS**

27. Provide clear ground space at operable parts, including pedestrian push buttons. Operable parts shall be placed within unobstructed reach range specified in PROWAG section R406.
28. Place traffic signal or illumination poles, ground boxes, controller boxes, signs, drainage facilities and other items so as not to obstruct the pedestrian access route or clear ground space.
29. Street grades and cross slopes shall be as shown elsewhere in the plans.
30. Changes in level greater than 1/4 inch are not permitted.
31. The least possible grade should be used to maximize accessibility. The running slope of sidewalks and crosswalks within the public right of way may follow the grade of the parallel roadway. Where a continuous grade greater than five percent (5%) must be provided, handrails may be desirable to improve accessibility. Handrails may also be needed to protect pedestrians from potentially hazardous conditions. If provided, handrails shall comply with PROWAG R409.
32. Handrail extensions shall not protrude into the usable landing area or into intersecting pedestrian routes.
33. Driveways and turnouts shall be constructed and paid for in accordance with Item "Intersections, Driveways and Turnouts". Sidewalks shall be constructed and paid for in accordance with Item, "Sidewalks".
34. Sidewalk details are shown elsewhere in the plans.

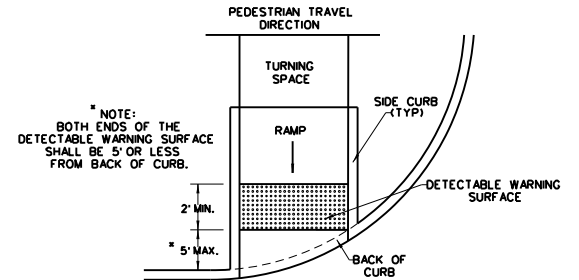
**DETECTABLE WARNING SURFACE DETAILS**



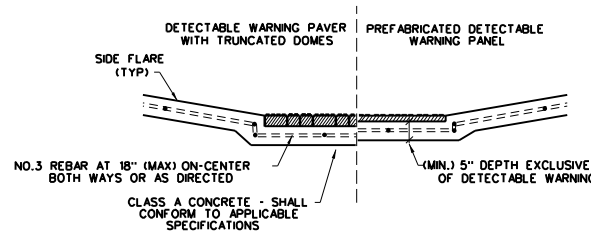
**PARALLEL CURB RAMP**  
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON LANDING AT STREET EDGE.



**PERPENDICULAR CURB RAMP**  
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.



**DIRECTIONAL CURB RAMP**  
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.



**SECTION VIEW DETAIL**  
**CURB RAMP AT DETECTABLE WARNINGS**

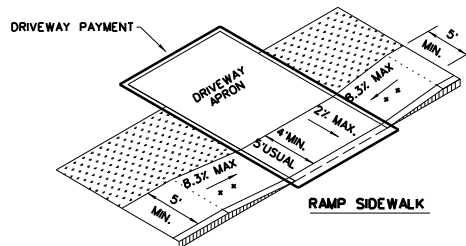
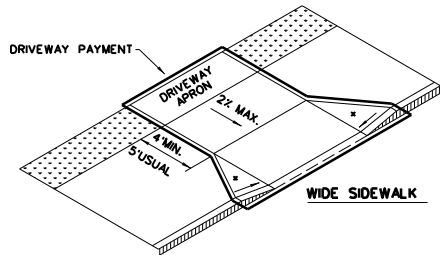
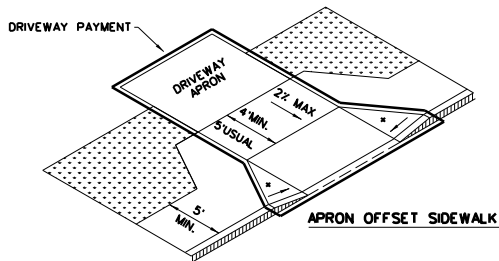
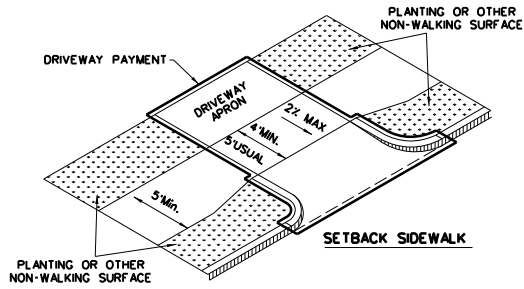


**PEDESTRIAN FACILITIES**  
**CURB RAMPS**  
**PED-18**

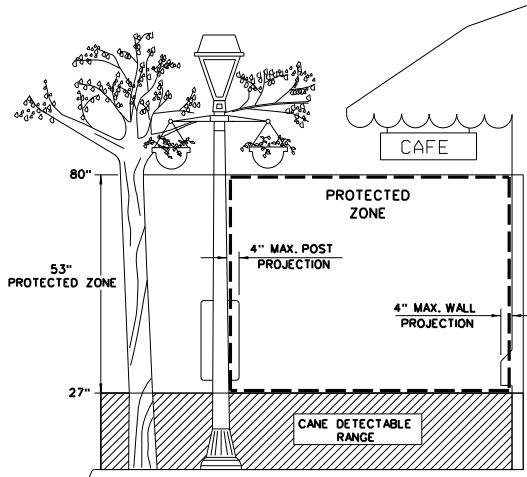
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REVISOR: 08/2008	DIST	COUNTY	SHEET NO.	
REVISOR: 08/2012	LFK	ANGELINA, ETC.	56	
REVISOR: 03/2016				

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 DATE: 5/21/2024  
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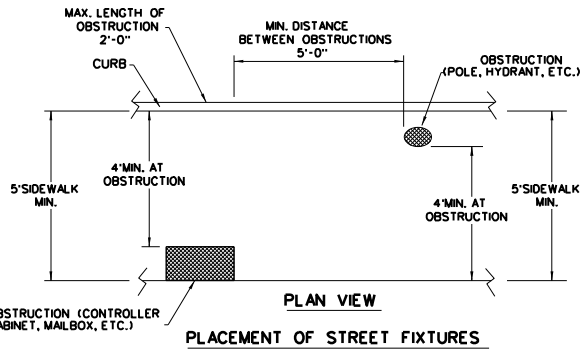
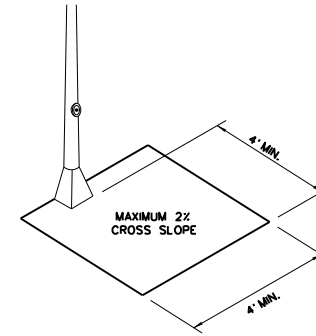
**SIDEWALK TREATMENT AT DRIVEWAYS**



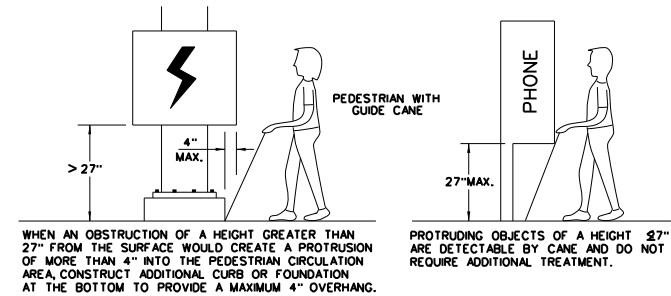
- NOTES:**
- \* WHERE DRIVEWAYS CROSS THE PEDESTRIAN ROUTE, SIDES SHALL BE FLARED AT 10% MAX SLOPE.
  - \*\* IF CURB HEIGHT IS GREATER THAN 6 INCHES, USE GRADE LESS THAN OR EQUAL TO 5% HANDRAIL AND DETECTABLE WARNING ARE NOT REQUIRED.



NOTE: IN PEDESTRIAN CIRCULATION AREA, MAXIMUM 4" PROJECTION FOR POST OR WALL MOUNTED OBJECTS BETWEEN 27" AND 80" ABOVE THE SURFACE.



NOTE: ITEMS NOT INTENDED FOR PUBLIC USE. MINIMUM 4' X 4' CLEAR GROUND SPACE REQUIRED AT PUBLIC USE FIXTURES.



WHEN AN OBSTRUCTION OF A HEIGHT GREATER THAN 27" FROM THE SURFACE WOULD CREATE A PROTRUSION OF MORE THAN 4" INTO THE PEDESTRIAN CIRCULATION AREA, CONSTRUCT ADDITIONAL CURB OR FOUNDATION AT THE BOTTOM TO PROVIDE A MAXIMUM 4" OVERHANG.

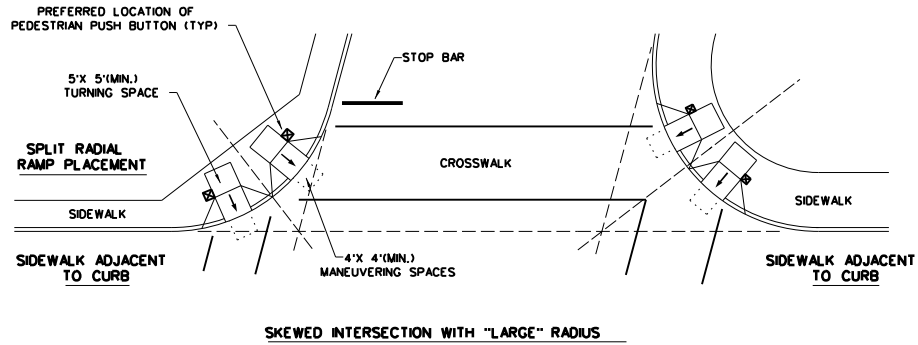
PROTRUDING OBJECTS OF A HEIGHT 27" ARE DETECTABLE BY CANE AND DO NOT REQUIRE ADDITIONAL TREATMENT.

SHEET 3 OF 4

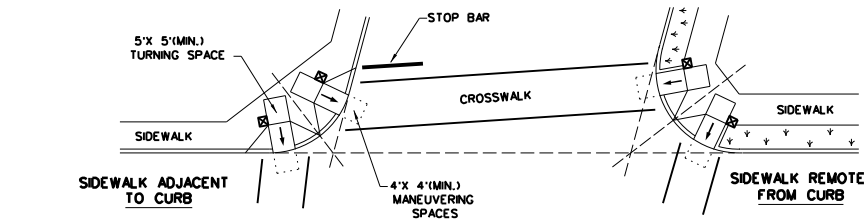
		Design Division Standard	
<b>PEDESTRIAN FACILITIES</b> <b>CURB RAMPS</b> <b>PED-18</b>			
FILE: ped18	DN: TxDOT	DW: V/P	CK: KM
© TxDOT: MARCH, 2002	CONT: SECT	JOB	HIGHWAY
REVISED 08.2009	6466	55	001
REVISED 08.2007	DIST	COUNTY	US 59, ETC.
REVISED 03.2006	LFK	ANGELINA, ETC.	SHEET NO. 57

DISCLAIMER: This standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any persons whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.  
 DATE: 5/21/2024  
 FILE: T:\LFK\TROPs\maintenance\contracts\PI\ANS\2024\Jobs\NMC-6466-55-001\TxdOT\Signal Maintenance\2\_Standards\PED-18.dgn

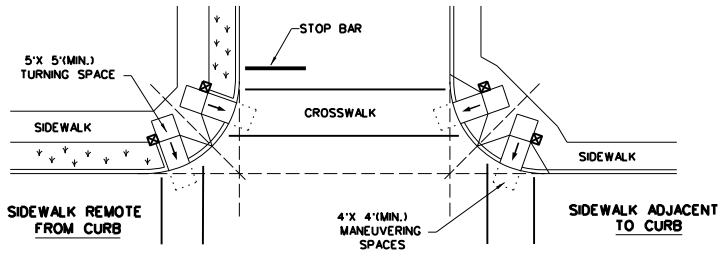
TYPICAL CROSSING LAYOUTS  
SEE SHEET 1 OF 4 FOR DETAILS AND DIMENSIONS



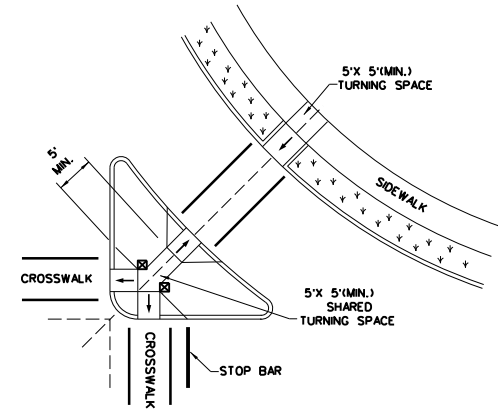
SKewed INTERSECTION WITH "LARGE" RADIUS



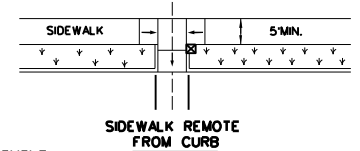
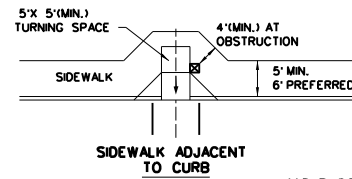
SKewed INTERSECTION WITH "SMALL" RADIUS



NORMAL INTERSECTION WITH "SMALL" RADIUS



AT INTERSECTION  
W/FREE RIGHT TURN & ISLAND



LEGEND:

SHOWS DOWNWARD SLOPE. →

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON (IF APPLICABLE). ☒

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH. {X's}

SHEET 4 OF 4



PEDESTRIAN FACILITIES  
CURB RAMPS  
PED-18

FILE: ped18	DW: TxDOT	DW: V.P.	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY
REVISED 08/2009	6466	55	001	US 59, ETC.
REVISED 08/2012	DIST	COUNTY	SHEET NO.	
REVISED 01/2016	LFK	ANGELINA, ETC.	58	

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 DATE: 5/21/2024  
 FILE: T:\LFK\TROPs\maintenance\contracts\PLANS\2024\Trafic\Signal Maintenance\2. Standards\PED-18.dgn

### 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))
- IOBWC - 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
- SBD - 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 - SIpbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
- SB - SIpbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

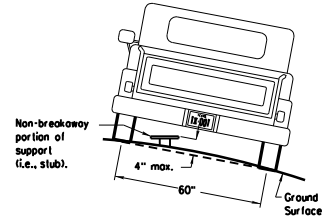
**Sign Mounting Designation**

- 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**

- EXT or 2EXT - Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
- EM - Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
- WC - 1/2" x 1/1" Wing Channel (see SMD(SLIP-1) to (SLIP-3))
- EXAL - Extruded Aluminum Sign Panels (see SMD(SLIP-3))

### REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT

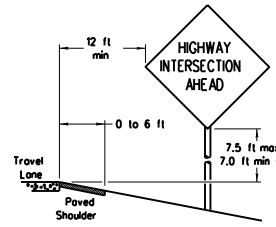


Non-breakaway portion of support (i.e., stub).

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).

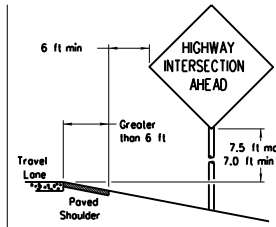
### SIGN LOCATION

**PAVED SHOULDERS**



**LESS THAN 6 FT. WIDE**

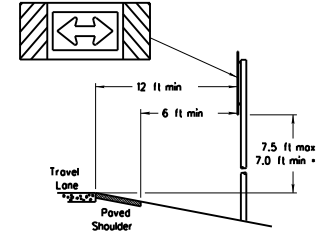
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



**GREATER THAN 6 FT. WIDE**

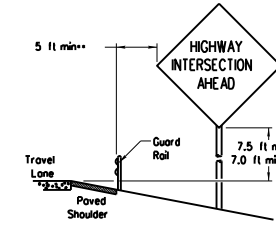
When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

**T-INTERSECTION**



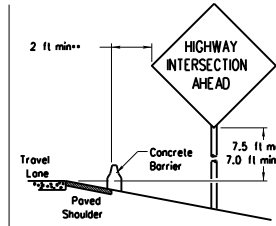
When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.

**BEHIND BARRIER**



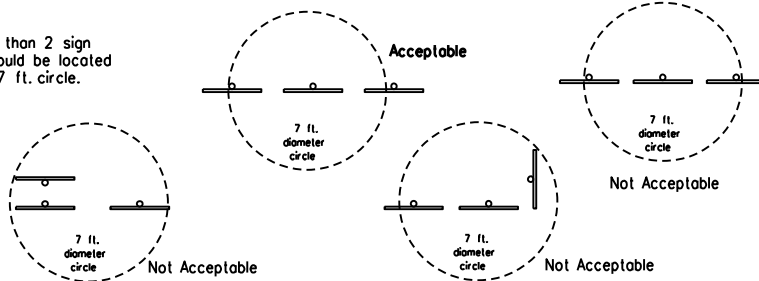
**BEHIND GUARDRAIL**

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

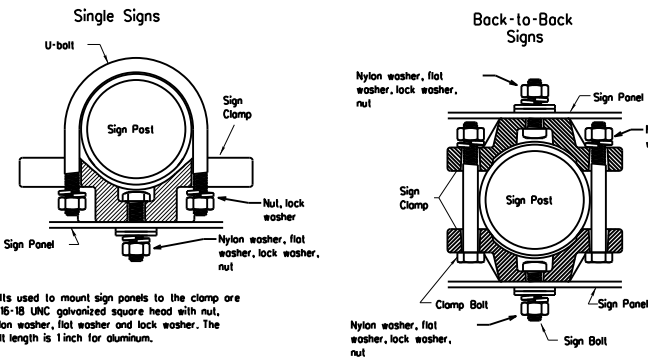


**BEHIND CONCRETE BARRIER**

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



### TYPICAL SIGN ATTACHMENT DETAIL



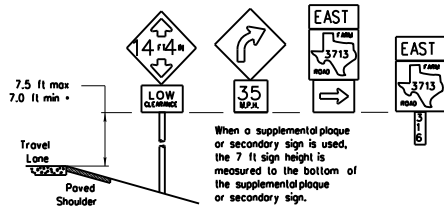
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

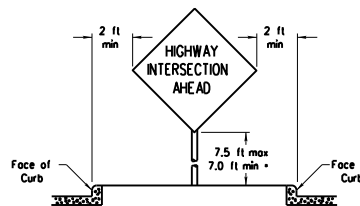
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

**SIGNS WITH PLAQUES**

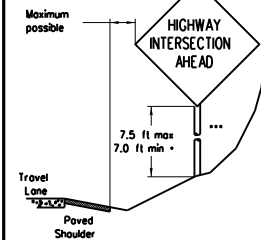


When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

**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 SIpbase 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	DN: TxDOT	CK: TxDOT
9-08 REVISIONS	CONT SECT	JOB	HIGHWAY	
	5466	55	001	US 59, ETC.
	DIST	COUNTY	SHEET NO.	
	LFK	ANGELINA, ETC.	59	

DISCLAIMER: The use of this standard is governed by the "Traffic Engineering Practice Act" to the extent of any conflict with the "Traffic Engineering Practice Act" or any other applicable law. TxDOT assumes no responsibility for the use of this standard or for incorrect results or damages resulting from its use.

DATE: 5/21/2024 10:26:16 AM  
FILE: T:\LFK\TROPs\maintenance\contracts\PLANS\2024\_Jobs\RMV-6466-55-001\Traffic\_Signals\Maintenance\2\_Signals\Maintenance\2\_Signals\Maintenance\08.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. N/A

No Action Required  Required Action

Action No.

1. The proposed work of this project is to perform traffic signal maintenance at various locations throughout the Lufkin District. This activity maintains the original line and grade, hydraulic capacity and original purpose of the site. Therefore, this project meets the definition of a routine maintenance activity as defined in the TPDES General Permit No. TXR150000 issued March 5, 2023 and TCEQ's TPDES CGP does not apply.

**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 (1/10th to < 1/2 acre, 1/3 in tidal waters)
- Individual 404 Permit Required
- Other Nationwide Permit Required: NWP # \_\_\_\_\_

1. N/A

**Best Management Practices:**

- |  |  |   |
|--|--|---|
| <b>Erosion</b>   | <b>Sedimentation</b>                                   | <b>Post-Construction TSS</b>                          |
| <input type="checkbox"/> Temporary Vegetation          | <input 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 Compst       |
| <input type="checkbox"/> Erosion Control Compst        | <input type="checkbox"/> Erosion Control Compst        | <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"/> Compst Filter Berm and Socks |
| <input type="checkbox"/> Compost Filter Berm and Socks | <input type="checkbox"/> Compost Filter Berm and Socks | <input 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. Contractor to repair or replace in kind, at their own expense, any historic materials damaged (buildings, historical markers, etc.) in the course of executing work. Contractor is responsible for locating replacement source for historical materials damaged in the course of the work. TxDOT-Environmental Affairs Division is to be informed of proposed repairs to facilitate consultation with Texas Historical Commission prior to the execution of repairs.

**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

1. N/A

**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. N/A

**LIST OF ABBREVIATIONS**

- |   |   |
|---|---|
| BMP: Best Management Practice                   | SPCC: Spill Prevention Control and Countermeasure   |
| CGP: Construction General Permit                | SWP3: 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 Treat 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.

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


1. N/A

**VII. OTHER ENVIRONMENTAL ISSUES**

No Action Required  Required Action

1. N/A

DATE: 5/21/2024 10:26:17 AM FILE: \\NFKTR\GIS\maintenance\contracts\PIANS\2024\05\18\MC-24565-56011\Traffic Signal Maintenance\EPIC Sheet.dgn

			
<p><b>EPIC</b></p> <p>(ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS)</p>			
CONT	SHEET	JOB	WORKDAY
6466	55	001	US 59, ETC.
CITY	COUNTY	SHEET NO.	
LFK	ANGELINA, ETC.	60	



**Certificate Of Completion**

Envelope Id: FB64EE7C7FF949EEAC69A6681C8BCD79	Status: Completed
Subject: Complete with Docusign: RMC 6466-55-001 Traffic Signal Maintenance Plan Set.pdf	
Source Envelope:	
Document Pages: 64	Signatures: 3
Certificate Pages: 5	Initials: 0
AutoNav: Enabled	Envelope Originator:
Envelopeld Stamping: Enabled	Tamara Gibson
Time Zone: (UTC-06:00) Central Time (US & Canada)	125 E. 11th Street
	Austin, TX 78701
	Tamara.Gibson@txdot.gov
	IP Address: 204.64.21.234

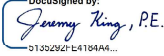
**Record Tracking**

Status: Original	Holder: Tamara Gibson	Location: DocuSign
5/31/2024 10:38:41 AM	Tamara.Gibson@txdot.gov	
Security Appliance Status: Connected	Pool: StateLocal	
Storage Appliance Status: Connected	Pool: Texas Department of Transportation	Location: DocuSign

**Signer Events**

Jeremy King  
 Jeremy.King@txdot.gov  
 Lufkin District Maintenance Engineer  
 Texas Department of Transportation  
 Security Level: Email, Account Authentication (Optional)

**Signature**

DocuSigned by:  
  
 Signature Adoption: Uploaded Signature Image  
 Using IP Address: 204.64.21.247

**Timestamp**

Sent: 5/31/2024 10:42:44 AM  
 Resent: 6/3/2024 8:40:20 AM  
 Viewed: 6/3/2024 9:28:09 AM  
 Signed: 6/3/2024 9:28:50 AM

**Electronic Record and Signature Disclosure:**  
 Not Offered via DocuSign

Kevin Buranakitipinyo  
 Kevin.Buranakitipinyo@txdot.gov  
 Director of Operations  
 TxDOT - Lufkin  
 Security Level: Email, Account Authentication (Optional)

DocuSigned by:  
  
 Signature Adoption: Pre-selected Style  
 Using IP Address: 204.64.21.250

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 Signed: 6/3/2024 9:37:43 AM

**Electronic Record and Signature Disclosure:**  
 Accepted: 7/25/2016 9:02:34 AM  
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In Person Signer Events	Signature	Timestamp
Editor Delivery Events	Status	Timestamp
Agent Delivery Events	Status	Timestamp
Intermediary Delivery Events	Status	Timestamp
Certified Delivery Events	Status	Timestamp
Carbon Copy Events	Status	Timestamp

Guadalupe Sandoval  
 Guadalupe.Sandoval@txdot.gov  
 Texas Department of Transportation  
 Security Level: Email, Account Authentication (Optional)

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**Electronic Record and Signature Disclosure:**  
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Carbon Copy Events	Status	Timestamp
Donald Maddux Donald.Maddux@txdot.gov Traffic Systems Admin TxDOT Security Level: Email, Account Authentication (Optional) <b>Electronic Record and Signature Disclosure:</b> Not Offered via DocuSign	<div style="border: 2px solid blue; padding: 5px; display: inline-block;"><b>COPIED</b></div>	Sent: 6/3/2024 9:37:51 AM

Witness Events	Signature	Timestamp
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Notary Events	Signature	Timestamp
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Envelope Summary Events	Status	Timestamps
Envelope Sent	Hashed/Encrypted	5/31/2024 10:42:44 AM
Certified Delivered	Security Checked	6/3/2024 9:37:40 AM
Signing Complete	Security Checked	6/3/2024 9:37:43 AM
Completed	Security Checked	6/3/2024 9:37:51 AM

Payment Events	Status	Timestamps
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Electronic Record and Signature Disclosure
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- i. decline to sign a document from within your DocuSign account, and on the subsequent page, select the check-box indicating you wish to withdraw your consent, or you may;
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**Required hardware and software**

Operating Systems:	Windows2000? or WindowsXP?
Browsers (for SENDERS):	Internet Explorer 6.0? or above
Browsers (for SIGNERS):	Internet Explorer 6.0?, Mozilla FireFox 1.0, NetScape 7.2 (or above)
Email:	Access to a valid email account
Screen Resolution:	800 x 600 minimum
Enabled Security Settings:	<ul style="list-style-type: none"><li>• Allow per session cookies</li></ul>

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|--|---|
|  | <ul style="list-style-type: none"><li>• Users accessing the internet behind a Proxy Server must enable HTTP 1.1 settings via proxy connection</li></ul> |
|--|---|

\*\* These minimum requirements are subject to change. If these requirements change, we will provide you with an email message at the email address we have on file for you at that time providing you with the revised hardware and software requirements, at which time you will have the right to withdraw your consent.

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To confirm to us that you can access this information electronically, which will be similar to other electronic notices and disclosures that we will provide to you, please verify that you were able to read this electronic disclosure and that you also were able to print on paper or electronically save this page for your future reference and access or that you were able to e-mail this disclosure and consent to an address where you will be able to print on paper or save it for your future reference and access. Further, if you consent to receiving notices and disclosures exclusively in electronic format on the terms and conditions described above, please let us know by clicking the 'I agree' button below.

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