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INDEX OF SHEETS	
SHEET No.	DESCRIPTION
1	TITLE SHEET
2	INDEX OF SHEETS

STATE OF TEXAS

DEPARTMENT OF TRANSPORTATION

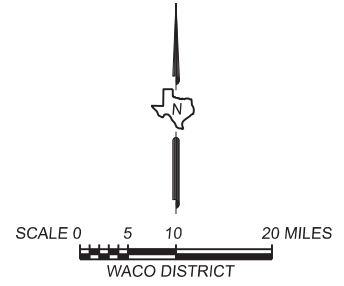
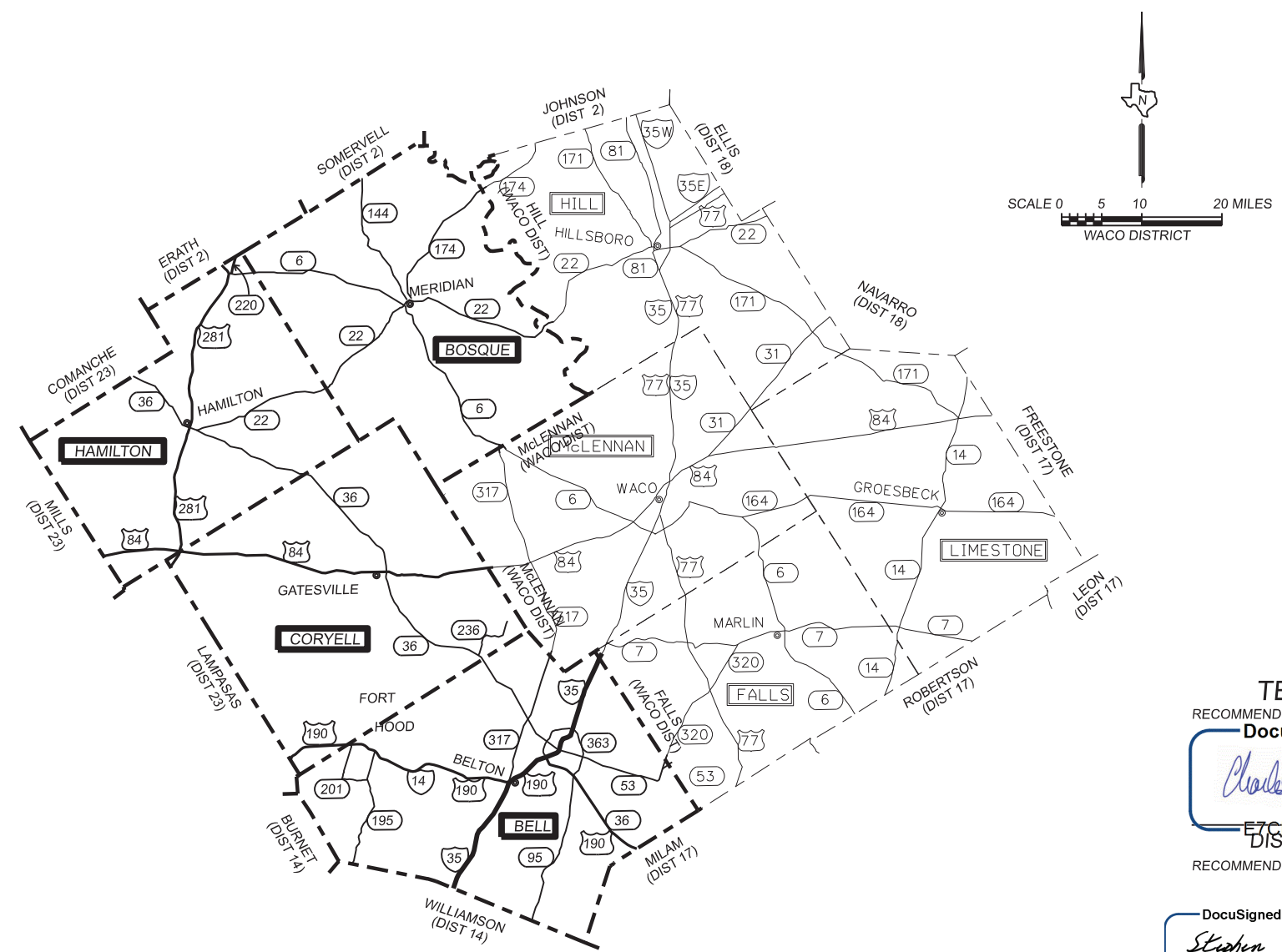
PLANS OF PROPOSED HIGHWAY ROUTINE MAINTENANCE CONTRACT

TYPE OF WORK:

METAL BEAM GUARD FENCE, CABLE BARRIER AND BRIDGE RAIL REPAIR/INSTALL

PROJECT No.: RMC 646789001
 HIGHWAY No.: US 190,ETC
 LIMITS OF WORK: VARIOUS LOCATIONS IN BELL, BOSQUE,
 CORYELL AND HAMILTON COUNTIES

MAINTENANCE PROJECT No.				SHEET No.
RMC 646789001				1
DRAFT	STATE	DISTRICT	COUNTY	
MS	TEXAS	WACO	BELL,ETC	
CHECK	CONT	SECT	JOB	HIGHWAY No.
CS	6467	89	001	US 190,ETC



EXCEPTIONS: NONE
 EQUATIONS: NONE
 RAILROAD: NONE

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND PROVISIONAL ITEMS INCLUDED HEREIN, SHALL GOVERN ON THIS CONTRACT.



TEXAS DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR LETTING:
DocuSigned by:
Charles W. Smith, PE
 7/30/2024
 E7CE02001F6C45F
 DISTRICT MAINTENANCE ENGINEER

RECOMMENDED FOR LETTING:
DocuSigned by:
Stephen Michael Kasberg P.E.
 7/30/2024
 6597DE65B49C452
 DIRECTOR OF MAINTENANCE

SUBMITTED FOR LETTING:
DocuSigned by:
Stanley Swiatek
 7/30/2024
 B69BD796D554C9
 DISTRICT ENGINEER

7/29/2024 p:\w\tdot\project\wiseonline.com:\TxDOT3\Documents\09 - WAC\Offices\Maintenance\Design\...RMC_Contracts\MBGF\2024\BELL+WEST\CADD\SHEETS\TITLE-DIS-WEST.dgn

SHEET	DESCRIPTION	SHEET	DESCRIPTION	SHEET	DESCRIPTION
	<u>I. GENERAL</u>		<u>III. ROADWAY DETAILS (CONTINUED)</u>		<u>IV. RETAINING WALL DETAILS</u>
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4 - 4A	ESTIMATE & QUANTITY SHEET	52	#GF (31) LS - 19		
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		54 - 55	#GF (31) TRTL3 - 19		
	<u>II. TRAFFIC CONTROL PLAN</u>	56	#GF (31) T101 - 19		
		57	#GF (31) T6 - 19		
	<u>STANDARDS</u>	58	#GF (31) MS - 19		
7 - 18	#BC (1) THRU (12) - 21	59	#BED - 14		
19 - 24	#TCP (1-1) THRU (1-6) - 18	60	#RAIL - ADJ (A) - 19		
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33	#WZ (RS) - 22	62	#SGT (10S) 31 - 16		
34 - 35	#MAINTENANCE WORK ZONE SPEED LIMIT SIGNS	63	#SGT (11S) 31 - 18		
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36	<u>STANDARDS</u>	66	#MBGF - 19	87	
	#CCCG - 12	67	#MBGF (SR) - 19		
	<u>CRASH CUSHION STANDARDS</u>	68	#MBGF (TR) - 19		
	-LOW MAINTENANCE (REDIRECTIVE, NON-GATING)	69	#MBGF (TL2) - 19		
37	#QGELITE (M10) (N) - 20	70	#MBGF (T101) - 19		
38	#QGELITE (M10) (W) - 20	71	#MBGF (MS) - 19		
39	#REACT (M) - 21	72	#BED (28) - 19		
40	#SMTC (N) - 16		<u>CABLE BARRIER STANDARDS</u>		
41	#SMTC (W) - 16	73 - 75	#BRIFEN (TL4) - 14		
	-REUSABLE (REDIRECTIVE, NON-GATING)	76	#CASS (TL4) - 14		
42	#QGUARD (M) (W) - 21	77	#GBRLTR (TL4) - 14		
43	#QGUARD (M10) (N) - 20	78 - 79	#NU-CABLE (TL4) - 14		
44	#QUAD (W) - 17	80	#PCF - 05		
45	#TAU (M) (N) - 19			88 - 90	
	-SACRIFICIAL (NON-REDIRECTIVE)				
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VI. UTILITIES

VII. BRIDGES

VIII. TRAFFIC ITEMS

STANDARDS
#D&OM (1) & (2) - 15; (3) - 15B; (4) THRU (6) - 15
#D&OM (VIA) - 15

IX. RAILROAD ITEMS

NONE

X. ENVIRONMENTAL ISSUES

NONE

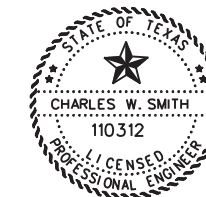
XI. MISCELLANEOUS ITEMS

STANDARDS

#PRD - 13

WACO DISTRICT STANDARDS

#HANDRAIL DETAILS



STANDARD SHEETS SPECIFICALLY IDENTIFIED WITH (*)
HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE
SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

Charles W. Smith, PE 7/30/2024
DATE

Texas Department of Transportation
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**MBGF, CABLE BARRIER
AND BRIDGE RAIL
INDEX OF SHEETS**

DESIGN MS	FED RD DIV No.	PROJECT No.		HIGHWAY No.
CHECK CS	6	RMC 646789001		US 190, ETC
GRAPHICS MS	STATE	DISTRICT	COUNTY	SHEET No.
CHECK CS	6467	89	001	2
	TEXAS	WACO	BELL, ETC	
	CONTROL	SECTION	JOB	

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Project Number: RMC 646789001

County: BELL, ETC

Highway: US 190, ETC

Control: 6467-89-001

GENERAL

This is a maintenance contract for installing, repairing, and/or upgrading metal beam guard fence and bridge rails within the highway right of way of various roadways in Bell, Coryell, Hamilton and Bosque Counties, according to the standard specifications or as modified in the general specifications listed below. Work may also include locations on IH 35 and IH 14.

PRE-BID QUESTIONS

Contractor questions on this project are to be emailed to the Waco District at the following address:

Stephen Kasberg - Wacoprebid@txdot.gov, 254-867-2780, 100 S. Loop Dr., Waco, TX
 Carmen Chau - Wacoprebid@txdot.gov, 254-867-2794, 100 S. Loop Dr., Waco, TX

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

GENERAL NOTES

This contract will consist of multiple work orders.

Work orders for emergency work (with emergency mobilization bid item) will require a 48-hour response time from the Contractor.

This contract shall commence upon issuance of a Work Order. The Engineer shall notify the Contractor in writing to begin the initial work.

Project Number: RMC 646789001

Sheet No. 3

County: BELL, ETC

Highway: US 190, ETC

Control: 6467-89-001

ITEM 1: ABBREVIATIONS AND DEFINITIONS

This is a Non-Site-Specific Contract as defined in Item 1.3.95

ITEM 2: INSTRUCTIONS TO BIDDERS

This proposed Contract will not include federal funds. Bid tabulations will include stipulations in accordance with 2.11.5.4 "Rubber Additives" and 2.11.5.5 "Home State Bidding Preference".

ITEM 5: CONTROL OF THE WORK

Provide the Engineer with a weekly work schedule of planned activities including anticipated quantities of materials to be placed daily. Schedules will be provided for the following week as part of each week's project meetings or by 5PM on Thursday as approved by the Engineer. Failure to provide notifications are required here may be deemed as insufficient notice per item 5.10.

All work on this contract will be scheduled and directed by the following person(s). Payments will be made on a monthly basis for work completed and accepted according to specifications. All payment requests will be directed to the same:

Maintenance Supervisor	Telephone Number	Maintenance Office Location
Jerrod Swift (Bell County)	(254) 939-3691	410 W. Loop 121 BELTON, TX 76513
Waylon Holden (Coryell County)	(254) 865-5716	3502 E. Main GATESVILLE, TX 76528
Shad Parum (Hamilton County)	(254) 386-5512	1301 East Main HAMILTON, TX 76531
Chris Niedorf (Bosque County)	(254) 435-2258	9167 SH 6 CLIFTON, TX 76634

Submit all fabrication and shop drawings per TxDOT's online shop drawing submittal system and copy the Area Engineer on the email submittal, unless otherwise directed.

Underground utilities owned by the Texas Department of Transportation may be present within the Right-Of-Way on this project. For signal, illumination, surveillance, and communications & control maintained by TxDOT, call the TxDOT Traffic Signal Office (254) 867-2808 for locates a minimum of 48 hours in advance of excavation. For irrigation systems, call TxDOT Landscape Office (254) 867-2726 for locates a minimum of 48 hours in advance of excavation. If city or town owned irrigation facilities are present, call the appropriate department of the local city or town a minimum of 48 hours in advance of excavation. The Contractor is liable for all damages when utilities are

Project Number: RMC 646789001**County:** BELL, ETC**Highway:** US 190, ETC**Control:** 6467-89-001

damaged due to Contractor's negligence including, but not limited to, repair or replacement at the Contractor's expense.

ITEM 6: CONTROL OF MATERIALS

This proposed Contract will not include federal funds. Buy Texas stipulations apply in accordance with 6.1.2 "Buy Texas".

References to manufacturer's trade name or catalog numbers are for the purpose of identification only and the Contractor will be permitted to furnish like materials of other manufacturers provided they are of equal quality and comply with specifications for this project.

ITEM 7: LEGAL RELATIONS AND RESPONSIBILITIES

No significant traffic generator events identified.

Protect all adjoining pavement sections during all phases of construction. Any damages incurred due to Contractor's operation shall be repaired and/or replaced at the Contractor's expense.

The Contractor shall restrict movement of equipment and trucks to all paved surfaces and will be prohibited from crossing the median unless specifically authorized by the Engineer. Ingress and egress to the freeway main-lanes shall be through the use of entrance and exit ramps.

If utilizing private property for waste disposal sites, field office sites, equipment storage sites or for any other purpose involved with this project, provide to the Engineer written proof of the property owner's approval of the use of this property. This proof may be in the form of a letter or agreement signed by the property owner or other documents acceptable to the Engineer. Provide such proof prior to occupying the site.

Personal vehicles of the Contractor's employees will not be parked within the right of way at any time including any section closed to public traffic, unless the vehicle is being utilized for construction procedures. However, the Contractor's employees may park on the right of way at the sites where the Contractor has his office, equipment and materials storage yard.

The Contractor is alerted to the possible presence of swallows under the existing bridges or culverts. Because the migratory bird treaty act prohibits harm to swallows, their eggs or their nestlings, the Contractor will not begin potentially disturbing activities on or near the bridge until the birds have abandoned any occupied nests (approximately September 1). Active nests may not be removed regardless of the date.

Project Number: RMC 646789001**Sheet No. 3A****County:** BELL, ETC**Highway:** US 190, ETC**Control:** 6467-89-001**Law Enforcement Personnel**

As approved by the Engineer, provide uniformed off duty police officers and squad cars during the following activities:

- Lane closures on controlled access facilities or 4 lane divided facilities with speed limits above 55mph,
- ramp closures,
- Roadway Closures,
- Support of phase construction traffic switches,
- nighttime work, or
- other situations that indicate a need for additional traffic control to protect the traveling public or the construction workforce.

Law Enforcement Personnel will be paid when use is approved by the Engineer. The Contractor retains the right to have law enforcement personnel on sight at their own cost and discretion when not approved by the Engineer.

Submit charge summary and invoices using the Department form 318. Provide documentation such as payroll, log sheets with signatures and badge number, or invoices from the government entity providing the officers for reimbursement.

Patrol vehicles must be clearly marked to correspond with the officer's agency and equipped with appropriate lights to identify them as law enforcement. For patrol vehicles not owned by a law enforcement agency, markings will be retroreflective and legible from 100 ft. from both sides and the rear of the vehicle. Lights will be high intensity and visible from all angles. Windows / Windshields may not be blocked.

No payment will be made for law enforcement personnel needed for moving equipment or payment for drive time to/from the event site. A minimum number of hours is not guaranteed. Payment is for work performed.

Cancel law enforcement personnel when the event is canceled. Cancellation, minimums or "show up" fees will not be paid when cancellation is made 12 hours prior to beginning of the event. Failure to cancel within 12 hours will not be cause for payment for cancellation, minimums, or "show up" time. Payment of actual "show up" time to the event site due to cancellation will be on a case by case basis at a maximum of 2 hours per officer.

ITEM 8: PROSECUTION AND PROGRESS

This Project will be Calendar Day in accordance with Article 8.3.1.5.

Project Number: RMC 646789001**County:** BELL, ETC**Highway:** US 190, ETC**Control:** 6467-89-001

Work may be performed under multiple work orders. The contractor shall begin work within seven (7) calendar days after the authorization date shown on the work order. The work order will include the date when work and time charges will begin, the allowable number of working days, and details specific to the item of work. Unless directed by the Engineer, a preconstruction meeting will not be required when each work order is issued. The work order will consist of any combination of bid items listed in the contracts and will include multiple locations within the included counties as identified in the plans.

The Engineer will have the right to remove items and quantities of work on work orders after the work order is issued to the contractor.

Meet weekly or at intervals as agreed upon with the Engineer to notify him or her of planned work for the upcoming 3-week period.

For this project, provide a Bar Chart progress schedule.

In accordance with SP000-1243, liquidated damages will be assessed on each work order for every day work continues beyond the number of days allowed in the work order.

ITEM 132: EMBANKMENT

Excavated material from the project site has not been determined to be suitable for embankment. The bidder assumes all risk for the use of excavated materials for embankment and is expected to meet all material requirements for embankment regardless of the source.

Use Type B or Type C material free from rock and debris. The material must be capable of forming a stable embankment and sustaining vegetation.

ITEM 429: CONCRETE STRUCTURE REPAIR

Rail shall be repaired to match existing rail. Repair railing removed for repair during the same workday unless otherwise approved by the Engineer.

ITEM 432: RIPRAP

Weep holes and granular material are required and locations will be determined prior to placement of concrete riprap at bridge abutments.

ITEM 500: MOBILIZATION**Project Number:** RMC 646789001**Sheet No. 3B****County:** BELL, ETC**Highway:** US 190, ETC**Control:** 6467-89-001

Each work order may include multiple locations, but only one mobilization (call out) will be paid per work order.

ITEM 502: BARRICADES, SIGNS AND TRAFFIC HANDLING

On this project Barricades, signs and traffic handling will not be paid for directly, but considered subsidiary to the various bid items.

Place barricades and signs in locations that do not obstruct the sight distance of drivers entering the highway from driveways or side streets.

The Contractor Responsible Person(s) (CRP) will be certified by TEEEX, ATSSA, the National Safety Council or other approved organization. Certifications will be submitted to the Engineer at the pre-construction meeting.

The Contractor Responsible Person(s) (CRP) for Work Zone Traffic Controls will inspect and insure any deficiencies are corrected each and every day throughout the duration of this contract. Any misaligned or damaged traffic control devices will be repaired as soon as practical after deficiency is discovered.

In addition to providing a Contractor's Responsible Person and a phone number for emergency contact, have an employee(s) available to respond on the project for emergencies and for taking corrective measures within thirty (30) minutes.

The **shadow vehicle** with truck mounted attenuator (TMA) will not be optional but will be required as shown on the appropriate traffic control plan sheets. Truck mounted attenuators must meet the requirements of the Compliant Work Zone Traffic Control Device List.

Open the pavement to traffic each night. Remove all material stockpiles, equipment left overnight or any obstruction within thirty (30) feet of a travel way or clearly mark by warning lights and barricades.

Arrange construction operations to prevent the hauling of materials through the completed pavement sections unless otherwise approved.

Unless otherwise shown on plans, where there is excavation adjacent to the pavement edge, provide adequate warning signs, vertical panels, drums and reflectors at the pavement edge. Treat pavement drop-offs created by ACP operations in a similar manner and in accordance with the details shown on the plans.

Provide a pilot vehicle for this contract.

Project Number: RMC 646789001

County: BELL, ETC

Highway: US 190, ETC

Control: 6467-89-001

Prior to beginning work, the Contractor and Engineer will agree on the allowable length of lane closure.

When operations require a sidewalk closure, use traffic control devices controlling pedestrian flows as necessary to route pedestrians around the closed sidewalk.

Equip all construction equipment involved in roadway work with a permanently mounted warning light with amber lens as approved.

For nighttime flagging operations, each flagger station must be lighted with portable light plants using balloon-type fixtures approved. The flagger must wear Class 3 reflective garments. Lights will be positioned as to not blind motorists.

ITEM 540: METAL BEAM GUARD FENCE, ITEM 542: REMOVING METAL BEAM GUARD FENCE, and ITEM 544: GUARDRAIL END TREATMENTS

Pay items for 540, 542, and 544 shall be used for locations with new rail. These pay items will not be used for repair work.

Furnish steel posts throughout the project except as specifically noted in the plans.

Wooden block out will not be allowed.

Measurement for Downstream Anchor Terminal shall be by each section, complete in place, consisting of a terminal anchor post and one 25 ft. section of rail.

Metal Beam Guard Fence Transition (Thrie) Steel Posts shall be measured as each consisting of the Thrie-Beam Transition to W-Beam, Thrie Beam section, Thrie Beam Terminal Connector, and the Type II Concrete Curb (see plan sheet GF (31) TR-14 (current standard)

In the event a guard post falls on top of an inlet, cut the post to the proper length and bolt it to the inlet top as shown on the plans.

Steel posts may be driven with approval from the Engineer.

The block-outs used on the Metal Beam Guard Fence will be made of a composite material from a source on the Department approved list of suppliers. The use of wooden block-outs will not be allowed.

ITEMS 542 & 544: REMOVING METAL BEAM GUARD FENCE & GUARDRAIL END TREATMENTS

Project Number: RMC 646789001

Sheet No. 3C

County: BELL, ETC

Highway: US 190, ETC

Control: 6467-89-001

W-Beam elements, steel posts, and composite material block-outs deemed salvageable will remain the property of the State and will be dismantled and returned to the TxDOT Maintenance yard within fifty (50) miles of project as directed. All other guard fence, and SGT's deemed non-salvageable will become the property of the Contractor.

ITEM 545: CRASH CUSHION ATTENUATORS

Do not purchase new crash cushion attenuators until being notified of approval in writing.

Crash cushion attenuators that are not re-usable will become property of Contractor for disposal. The Engineer will make the determination of what is re-usable or not re-usable. Replace, at the Contractor's expense, units or hardware that are damaged by the Contractor's operations.

Stockpile re-usable crash cushion attenuators at a TxDOT facility approved by the Engineer.

ITEM 658: DELINEATOR AND OBJECT MARKER ASSEMBLIES

All flexible and GF2 delineators will have a tubular body.

Installation of new delineator and object marker assemblies should be the same as existing delineator and object marker assemblies in that location unless otherwise approved by the Engineer.

ITEM 770: GUARD FENCE REPAIR

The Department will determine if new or salvaged material will be used for repair work. Department furnished material is located at the nearest TxDOT Maintenance Yard. The Contractor shall pickup and deliver salvaged material to the work location. Material shall be picked up during TxDOT normal business hours.

ITEM 771: REPAIR CABLE BARRIER SYSTEM

Contractor should identify manufacturer of existing cable barrier system to be repaired and use only parts and materials that meet the company standards for all repairs and replacements.

ITEM 772: POST AND CABLE FENCE

Post and Cable Fence (Removal) shall include removal of the anchor.

Project Number: RMC 646789001

County: BELL, ETC

Highway: US 190, ETC

Control: 6467-89-001

Installation of reflectors shall not be paid for directly but considered subsidiary to various bid items.

ITEM 776: METAL RAIL REPAIR

The Contractor shall field measure curb heights, curb widths, slab thickness, overlays, and bridge joints prior to fabricating rail. The Contractor shall furnish a copy of field measurements to the Engineer.

ITEM 6185: TRUCK MOUNTED ATTENUATORS

The total number of truck mounted attenuators (TMA) required when utilizing the traffic control standards are shown in the tables below.

TCP 1 Series	Scenario	Required TMA
(1-1)-18 / (1-2)-18		1
(1-3)-18	A B	1 2
(1-4)-18 / (1-5)-18 / (1-6)-18		1

TCP 6 Series	Scenario	Required TMA
(6-1)-12	A B	1 2
(6-2)-12 / (6-3)-12	All	1
(6-4)-12	A B	1 2
(6-5)-12	A B	1 2
(6-6)-12 / (6-7)-12	All	1 Per Lane
(6-8)-14 / (6-9)-14	All	1
WZ (BTS) Series	Scenario	Required TMA
(BTS-1)-13	Near Side Lane Closure	1

The shadow vehicle with truck mounted attenuator (TMA) will not be optional but will be required as shown on the appropriate traffic control plan sheets. Truck mounted attenuators must meet the requirements of the Compliant Work Zone Traffic Control Device List.

Project Number: RMC 646789001

Sheet No. 3D

County: BELL, ETC

Highway: US 190, ETC

Control: 6467-89-001

All TMAs required for this project will be Level 3 Compliant.

Mobile operations will be paid for by the hour, per specifications. For mobile operations, payment will be made only while the TMA is in use.

A total of two (2) shadow vehicles with TMA will be required for work with the exception of Pavement Marking Operations. The contractor will be responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMA needed for the project for those times per plan requirements. Additional TMAs used that are not specified in the plans in which the contractor expects compensation will require prior approval from the Engineer.

ITEM 7329: MAINTENANCE SPEED LIMIT SIGNING

All maintenance activity work sites will require Maintenance Work Zone Speed Limit Signs to temporarily lower regulatory speed limits. Form 1204M will be completed for each work site and this form will determine the temporary reduced speed based on the type of work and relevant work zone factors. Refer to the Maintenance Work Zone Speed Limit Standard Sheets for the listing of signs required and additional information on placement and covering of signs. At the conclusion of work, all signs related to the temporary speed limit must immediately be removed and permanent speed limit signs uncovered.



CONTROLLING PROJECT ID 6467-89-001

DISTRICT Waco
HIGHWAY US0190

COUNTY Bell

Estimate & Quantity Sheet

CONTROL SECTION JOB				6467-89-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00209955			
COUNTY				Bell			
HIGHWAY				US0190			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	132-7015	EMBANK (VEH)(OC)(TY B)	CY	75.000		75.000	
	429-7007	CONC STR REPAIR (VERTICAL & OVERHEAD)	SF	25.000		25.000	
	432-7013	RIPRAP (MOW STRIP)(4 IN)	CY	50.000		50.000	
	500-7002	MOBILIZATION (CALLOUT)	EA	12.000		12.000	
	500-7033	MOBILIZATION (EMERGENCY)	EA	60.000		60.000	
	503-7001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	120.000		120.000	
	505-7001	TMA (STATIONARY)	DAY	300.000		300.000	
	529-7002	CONC CURB (TY II)	LF	100.000		100.000	
	540-7001	MTL W-BEAM GD FEN (TIM POST)	LF	25.000		25.000	
	540-7002	MTL W-BEAM GD FEN (STEEL POST)	LF	5,000.000		5,000.000	
	540-7005	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	3.000		3.000	
	540-7015	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	3.000		3.000	
	540-7016	MTL BM GD FEN TRANS (NON - SYM)	EA	20.000		20.000	
	540-7027	MTL BM GD FEN (LONG SPAN SYSTEM)	EA	100.000		100.000	
	542-7001	REMOVE METAL BEAM GUARD FENCE	LF	1,500.000		1,500.000	
	542-7002	REMOVE TERMINAL ANCHOR SECTION	EA	10.000		10.000	
	544-7003	GUARDRAIL END TREATMENT (REMOVE)	EA	2.000		2.000	
	544-7007	GDRAIL END TRT(INSTALL)(HBA POST)	EA	50.000		50.000	
	545-7001	CRASH CUSH ATTEN (DES SOURCE)	EA	2.000		2.000	
	545-7004	CRASH CUSH ATTEN (REMOVE)	EA	2.000		2.000	
	545-7009	CRASH CUSH ATTEN (INSTL)(R)(N)(TL2)	EA	2.000		2.000	
	545-7010	CRASH CUSH ATTEN (INSTL)(R)(N)(TL3)	EA	2.000		2.000	
	545-7012	CRASH CUSH ATTEN (INSTL)(R)(W)(TL3)	EA	2.000		2.000	
	658-7018	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2	EA	20.000		20.000	
	658-7019	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	20.000		20.000	
	658-7055	INSTL OM ASSM (OM-2X)(WC)GND	EA	5.000		5.000	
	770-7001	REPLACE RAIL ELEMENT (W-BEAM)	LF	3,500.000		3,500.000	
	770-7002	REPLACE RAIL ELEMENT (THRIE-BEAM)	LF	25.000		25.000	
	770-7003	REPL RAIL ELMNT(THRIE-BM TRANS TO W-BM)	EA	25.000		25.000	
	770-7006	REPLACE TIMBER POST W/O CONC FND	EA	75.000		75.000	
	770-7007	REPLACE STEEL POST W/O CONC FND	EA	75.000		75.000	
	770-7008	REPLACE TIMBER POST W/ CONC FND	EA	25.000		25.000	
	770-7009	REPLACE STEEL POST W/ CONC FND	EA	25.000		25.000	
	770-7010	REALIGN POSTS	EA	200.000		200.000	
	770-7013	REM OBSOLETE GET & REPL W/ SGT	EA	35.000		35.000	
	770-7015	REPL SINGLE GDRAIL TERM IMPACT HEAD	EA	10.000		10.000	
	770-7016	REPLACE SINGLE GDRAIL TERMINAL RAIL	LF	400.000		400.000	



DISTRICT	COUNTY	CCSJ	SHEET
Waco	Bell	6467-89-001	4



CONTROLLING PROJECT ID 6467-89-001

DISTRICT Waco
HIGHWAY US0190

COUNTY Bell

Estimate & Quantity Sheet

CONTROL SECTION JOB				6467-89-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00209955			
COUNTY				Bell			
HIGHWAY				US0190			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	770-7017	REPLACE SINGLE GDRAIL TERMINAL POST	EA	10.000		10.000	
	770-7018	REPLACE BLOCKOUT	EA	100.000		100.000	
	770-7020	RESET SGT IMPACT HEAD	EA	10.000		10.000	
	770-7021	REPLACE SGT OBJECT MARKER	EA	1.000		1.000	
	770-7022	REPLACE SGT CABLE ANCHOR	EA	10.000		10.000	
	770-7023	REPLACE SGT CABLE ASSEMBLY	EA	10.000		10.000	
	770-7024	REPLACE SGT STRUT	EA	2.000		2.000	
	770-7025	RAISE RAIL	LF	150.000		150.000	
	771-7005	REPLACE POSTS (TL-4)(GIBRALTAR)	EA	310.000		310.000	
	771-7006	REPLACE POSTS (TL-4)(NU-CABLE)	EA	310.000		310.000	
	771-7007	REPLACE POSTS (TL-4)(TRINITY)	EA	310.000		310.000	
	771-7008	REPLACE POSTS (TL-4)(BRIFEN)	EA	310.000		310.000	
	771-7010	CABLE SPLICE / TURNBUCKLE (TL-4)	EA	2.000		2.000	
	771-7012	REPAIR CONCRETE FOUNDATION (TL-4)	EA	1.000		1.000	
	771-7014	REPR OR REPLC CABLE BARR TERM SEC(TL-4)	EA	5.000		5.000	
	771-7016	REPLACE CABLE (TL-4)	LF	500.000		500.000	
	771-7018	CHECK / RE-TENSION CABLE (TL-4)	EA	20.000		20.000	
	772-7001	POST AND CABLE FENCE (REMOVAL)	LF	100.000		100.000	
	772-7003	POST AND CABLE FENCE (NEW INSTALLATION)	LF	400.000		400.000	
	772-7004	POST AND CABLE FENCE (NEW CONC ANCHOR)	EA	5.000		5.000	
	772-7005	POST AND CABLE FENCE(REMV / REPL POSTS)	EA	10.000		10.000	
	772-7007	POST AND CABLE FENCE (REMV/ REPL CABLE)	LF	250.000		250.000	
	774-7052	REPAIR (WIDE TRACC)	LF	50.000		50.000	
	774-7054	REPAIR (WIDE TRACC BAY)	EA	10.000		10.000	
	774-7056	REPLACE (FASTRACC)	EA	2.000		2.000	
	776-7001	REPAIR (STEEL RAIL)	LF	50.000		50.000	
	776-7006	REPAIR (T101)	LF	42.000		42.000	
	776-7007	REPAIR (STEEL POST W/ BASE PLATE)(T101)	EA	4.000		4.000	
	776-7008	REPAIR (T101RC)	LF	20.000		20.000	
	776-7013	REPAIR (ALUM POST W/ BASE PLATE)(T4(A))	EA	20.000		20.000	
	776-7014	REPAIR (T6)	LF	20.000		20.000	
	776-7015	REPAIR STEEL POST W/ BASE PLATE (T6)	EA	4.000		4.000	
	7010-7002	MAINTENANCE SPEED LIMIT SIGNING	DAY	120.000		120.000	

DISTRICT	COUNTY	CCSJ	SHEET
Waco	Bell	6467-89-001	4A

PROJECT SUMMARY

DISTRICT-WEST MBGF(FY-2024)

DISTRICT - WEST	MISC			MOBILIZATION		NEWRAIL LOCATIONS											
	0132 7015	0429 7007	0432 7013	0500 7002	0500 7033	0529 7002	0540 7001	0540 7002	0540 7005	0540 7015	0540 7027	0540 7016	0542 7001	0542 7002	0544 7003	0544 7007	0545 7001
	EMBANKMENT (VEHICLE)(ORD COMP)(TYB) (TY B)	CONCSTR REPAIR (VERTICAL & OVERHEAD)	RIPRAP (MOWSTRIP) (4 IN)	MOBIL- IZATION (CALLOUT)	MOBIL- IZATION (EMERGENCY)	CONC CURB (TY II)	MTL W-BEAM GDFEN (TIM POST)	MTL W-BEAM GDFEN (STEEL POST)	MTL BEAM GD FEN TRANS (THRIE-BEAM)	DOWNSTREAM ANCHOR TERMINAL SECTION	MTL BM GDFEN (LONGSPAN SYSTEM)	MTL BM GD FEN TRANS (NON-SYM)	REMOVE METAL BEAM GUARD FENCE	REMOVE TERMINAL ANCHOR SECTION	GDRAIL ENDTRT (REMOVE)	GDRAIL ENDTRT (INSTALL) (HBAPOST)	CRASHCUSH ATTEN (DESSOURCE)
CY	SF	CY	EA	EA	LF	LF	LF	EA	EA	LF	EA	LF	EA	EA	EA	EA	EA
BELL	75	25	50	12	60	100	25	5000	3	3	100	20	1500	10	2	50	2
CORYELL																	
HAMILTON																	
BOSQUE																	
TOTAL	75	25	50	12	60	100	25	5000	3	3	100	20	1500	10	2	50	2

NOTE- QUANTITIES SHOWN ARE ESTIMATED ONLY, ACTUAL QUANTITIES WILL VARY.

CRASH CUSHIONS							MAINTAINING EXISTING MBGF										
0545 7004	0545 7009	0545 7010	0545 7012	0658 7055	0658 7018	0658 7019	0770 7001	0770 7002	0770 7003	0770 7025	0770 7006	0770 7007	0770 7008	0770 7009	0770 7010	0770 7018	0770 7016
CRASHCUSH ATTEN (REMOVE)	CRASHCUSH ATTEN (INSTL) (R)(N) (TL2)	CRASHCUSH ATTEN (INSTL) (R)(N) (TL3)	CRASHCUSH ATTEN (INSTL) (R)(W) (TL3)	INSTL OM ASSM (OM-2X) (WC)GND	INSTL DEL ASSM (D-SW) SZ 1 (BRF) GF2	INSTL DEL ASSM (D-SW) SZ 1 (BRF) GF2 (BI)	REPLACE RAIL ELEMENT (W-BEAM)	REPLACE RAIL ELEMENT (THRIE-BEAM)	REPL RAIL ELMNT (THRIE-BM TRANS TOW-BM)	RAISE RAIL	REPLACE TIMBER POSTW/O CONCFND	REPLACE STEEL POSTW/O CONCFND	REPLACE TIMBER POSTW/ CONCFND	REPLACE STEEL POSTW/ CONCFND	REALIGN POSTS	REPLACE BLOCKOUT	REPLACE SINGLE GDRAIL TERMINAL RAIL
EA	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	LF
2	2	2	2	5	20	20	3500	25	25	150	75	75	25	25	200	100	400
2	2	2	2	5	20	20	3500	25	25	150	75	75	25	25	200	100	400



MBGF, CABLE BARRIER AND BRIDGE RAIL SUMMARY SHEET PROJECT TOTALS

Sheet 1 of 2

DESIGN MS	FED RD DIV No.	PROJECT No.		HIGHWAY No.
CHECK CS	6	RMC 646789001		US 190,ETC
GRAPHICS MS	STATE	DISTRICT	COUNTY	SHEET No.
CHECK CS	TEXAS	WACO	BELL,ETC	5
	CONTROL	SECTION	JOB	
	6467	89	001	

PROJECT SUMMARY

DISTRICT-WEST MBGF(FY-2024)

MAINTAINING EXISTING MBGF CONT'D								REPAIR OF CABLE BARRIER SYSTEMS								WOOD POST		
0770 7017	0770 7013	0770 7015	0770 7020	0770 7023	0770 7022	0770 7024	0770 7021	0771 7005	0771 7006	0771 7007	0771 7008	0771 7010	0771 7012	0771 7014	0771 7016	0771 7018	0772 7001	0772 7003
REPLACE SINGLE GDRAIL TERMINAL POST	REMOVE OBSOLETE GET & REPL W/SGT	REPL SINGLE GDRAIL TERM IMPACT HEAD	RESET SGTIMPACT HEAD	REPLACE SGT CABLE ASSEMBLY	REPLACE SGT CABLE ANCHOR	REPLACE SGT STRUT	REPLACE SGT OBJECT MARKER	REPLACE POSTS (TL-4) (GIBRALTAR)	REPLACE POSTS (TL-4) (NUCABLE)	REPLACE POSTS (TL-4) (TRINITY)	REPLACE POSTS (TL-4) (BRIFEN)	CABLE SPLICE/ TURNBUCKLE (TL-4)	REPAIR CONCRETE FOUNDATION (TL-4)	REPR OR REPLC CABLE BARR TERMSEC (TL-4)	REPLACE CABLE (TL-4)	CHECK/ RE-TENSION CABLE (TL-4)	POSTAND CABLE FENCE (REMOVAL)	POSTAND CABLE FENCE (NEW INSTALLATION)
EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	EA	LF	LF
10	35	10	10	10	10	2	1	310	310	310	310	2	1	5	500	20	100	400
10	35	10	10	10	10	2	1	310	310	310	310	2	1	5	500	20	100	400

NOTE- QUANTITIES SHOWN ARE ESTIMATED ONLY, ACTUAL QUANTITIES WILL VARY.

AND CABLE FENCE			CRASH CUSHION REPAIR			BRIDGE RAIL						PCMS, TMA & WZ SIGNS			
0772 7004	0772 7005	0772 7007	0774 7056	0774 7052	0774 7054	0776 7014	0776 7013	0776 7015	0776 7008	0776 7006	0776 7007	0776 7001	0503 7001	0505 7001	7010 7002
POSTAND CABLE FENCE (NEWCONC ANCHOR)	POSTAND CABLE FENCE (REMV/REPL POSTS)	POSTAND CABLE FENCE (REMV/REPL CABLE)	REPLACE (FASTRACC)	REPAIR (WIDETRACC)	REPAIR (WIDETRACC) (BAY)	REPAIR (T6)	REPALUM POSTW/ BASE PLATE (T4(A))	REPSTEEL POSTW/ BASE PLATE (T6)	REPAIR (T101RC)	REPAIR (T101)	REPSTEEL PSTW/ BASE PLATE (T101)	REPAIR (STEEL RAIL)	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)	MAINTENANCE SPEED LIMIT SIGNING
EA	EA	LF	EA	LF	EA	LF	EA	EA	LF	LF	EA	LF	DAY	DAY	DAY
5	10	250	2	50	10	20	20	4	20	42	4	50	120	300	120
5	10	250	2	50	10	20	20	4	20	42	4	50	120	300	120



**MBGF, CABLE BARRIER
AND BRIDGE RAIL
SUMMARY SHEET
PROJECT TOTALS**

Sheet 2 of 2

DESIGN MS	FED RD DIV No.	PROJECT No.		HIGHWAY No.
CHECK CS	6	RMC 646789001		US 190,ETC
GRAPHICS MS	STATE	DISTRICT	COUNTY	SHEET No.
CHECK CS	TEXAS	WACO	BELL,ETC	6
	CONTROL	SECTION	JOB	
	6467	89	001	

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

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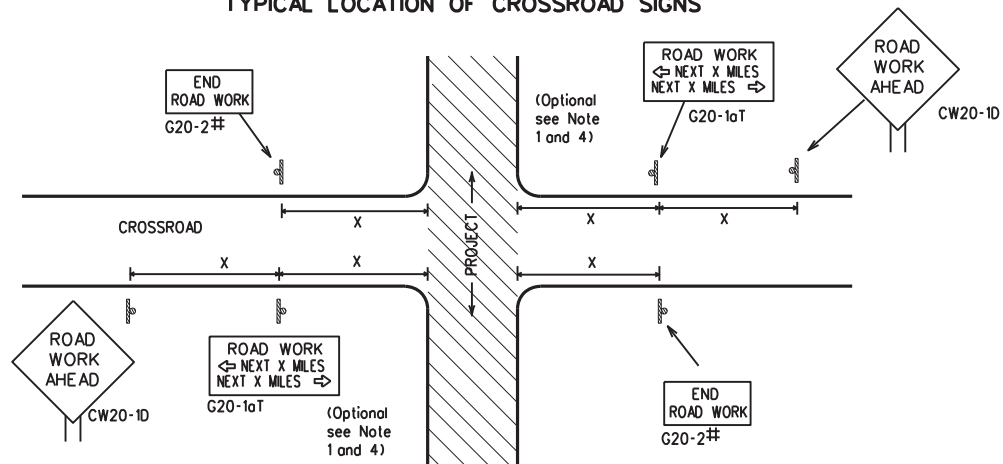


**BARRICADE AND CONSTRUCTION
GENERAL NOTES
AND REQUIREMENTS**

BC(1)-21

FILE:	bc-21.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		6467	89	001	US 190, ETC				
4-03	7-13								
9-07	8-14								
5-10	5-21	DIST	COUNTY		SHEET NO.				
		WACO	BELL, ETC		7				

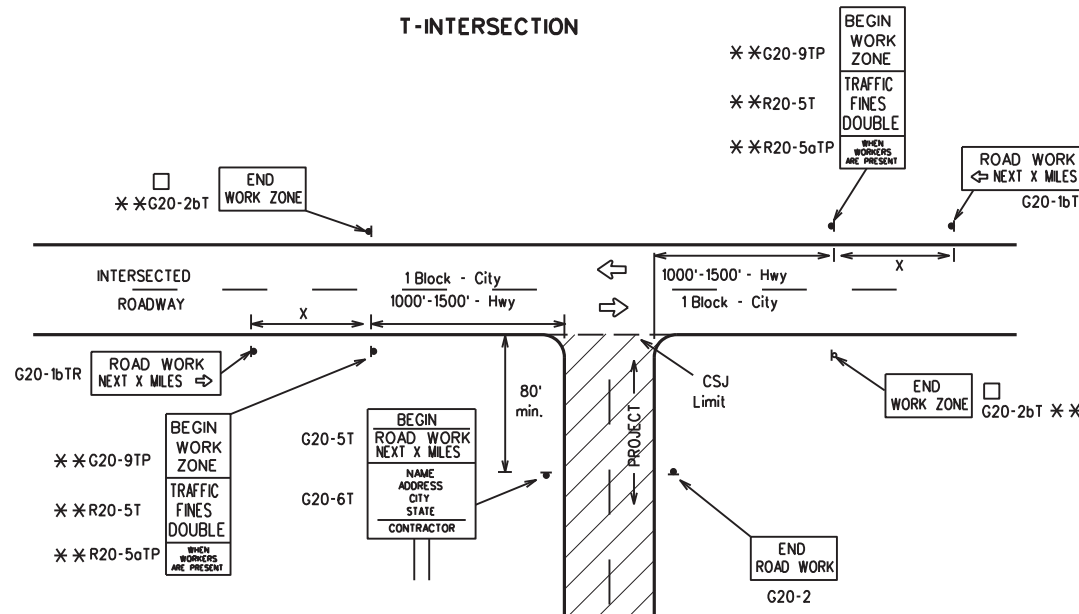
TYPICAL LOCATION OF CROSSROAD SIGNS



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

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

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

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

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING

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

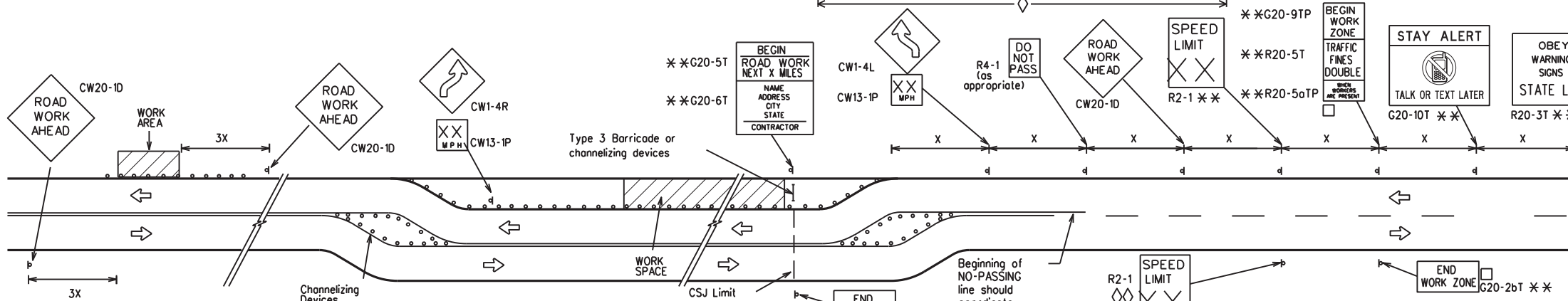
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

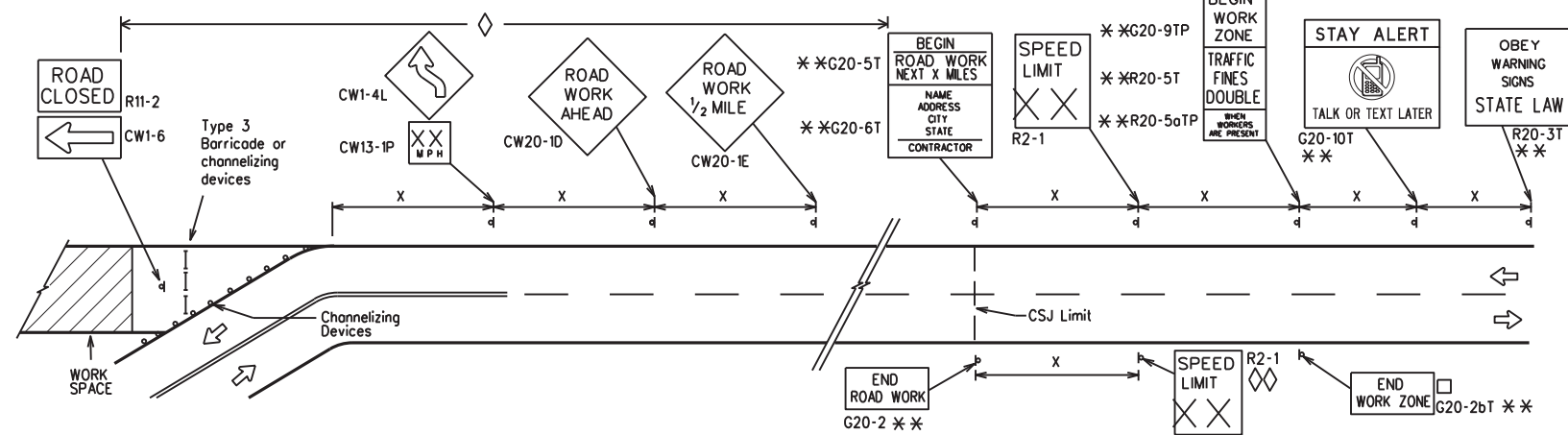
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be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

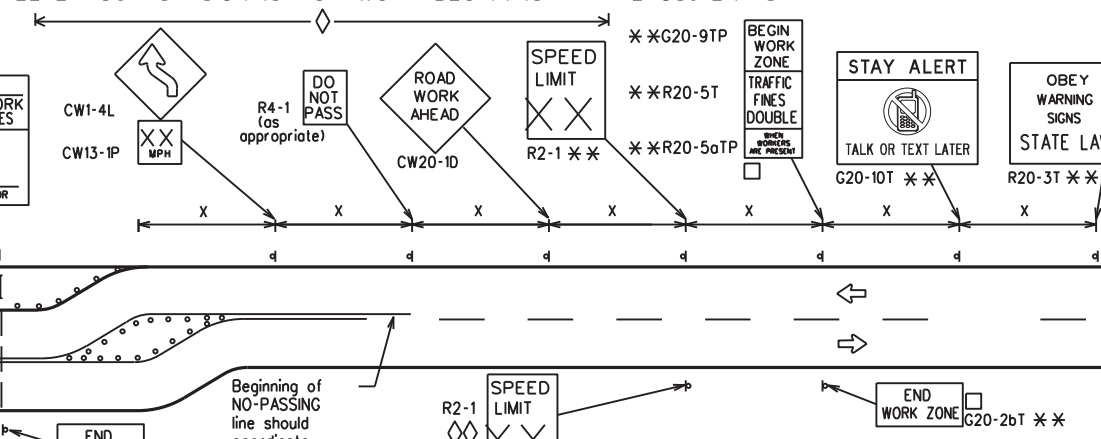


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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



NOTES

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

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

LEGEND

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

SHEET 2 OF 12



BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
REVISIONS:	7-13	8-14	5-21	
DIST: WACO	COUNTY: BELL, ETC	SHEET NO.: 8		

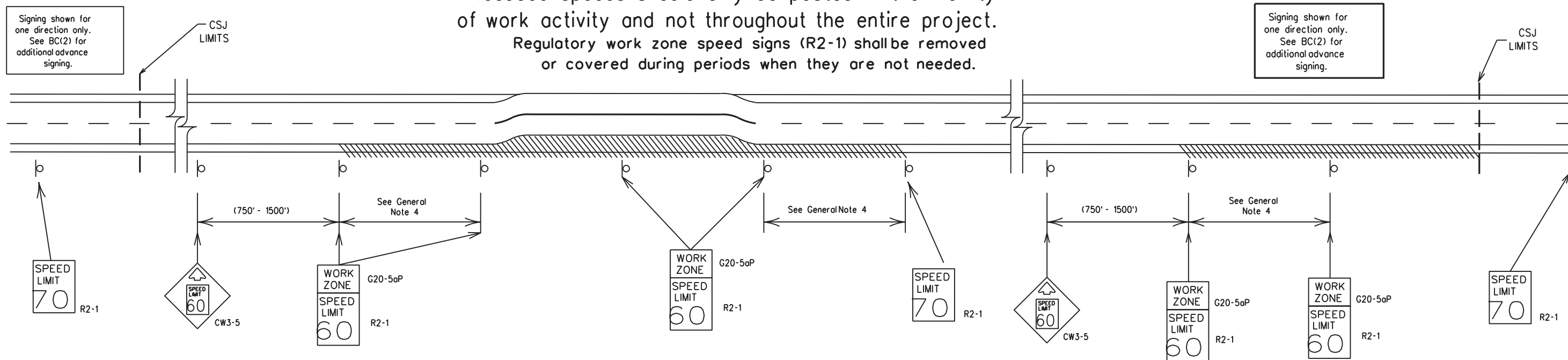
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TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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:

- rough road or damaged pavement surface
- substantial alteration of roadway geometrics (diversions)
- construction detours
- grade
- width
- 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

- Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
- Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
- Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
- 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
- Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
- 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.
- Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
- Techniques that may help reduce traffic speeds include but are not limited to:
 - Low enforcement.
 - Flagger stationed next to sign.
 - Portable changeable message sign (PCMS).
 - Low-power (drone) radar transmitter.
 - Speed monitor trailers or signs.
- Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
- 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.

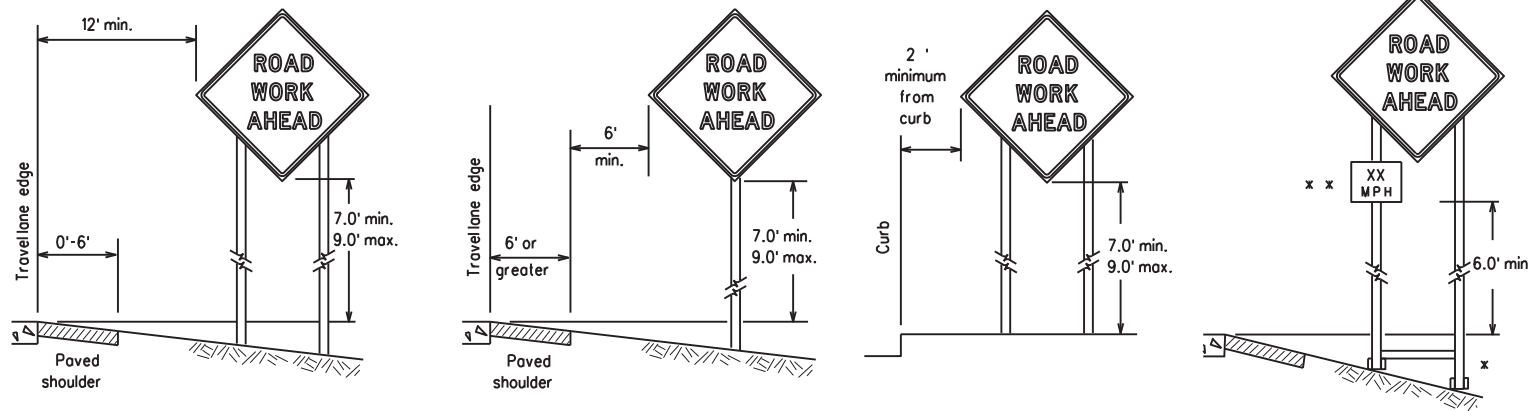
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SHEET 3 OF 12

Texas Department of Transportation		Traffic Safety Division Standard
<h2 style="margin: 0;">BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT</h2>		
<h3 style="margin: 0;">BC(3)-21</h3>		
FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT
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REVISIONS	JOB: 001	HIGHWAY: US 190, ETC
9-07 8-14	DIST: WACO	COUNTY: BELL, ETC
7-13 5-21	SHEET NO.:	9

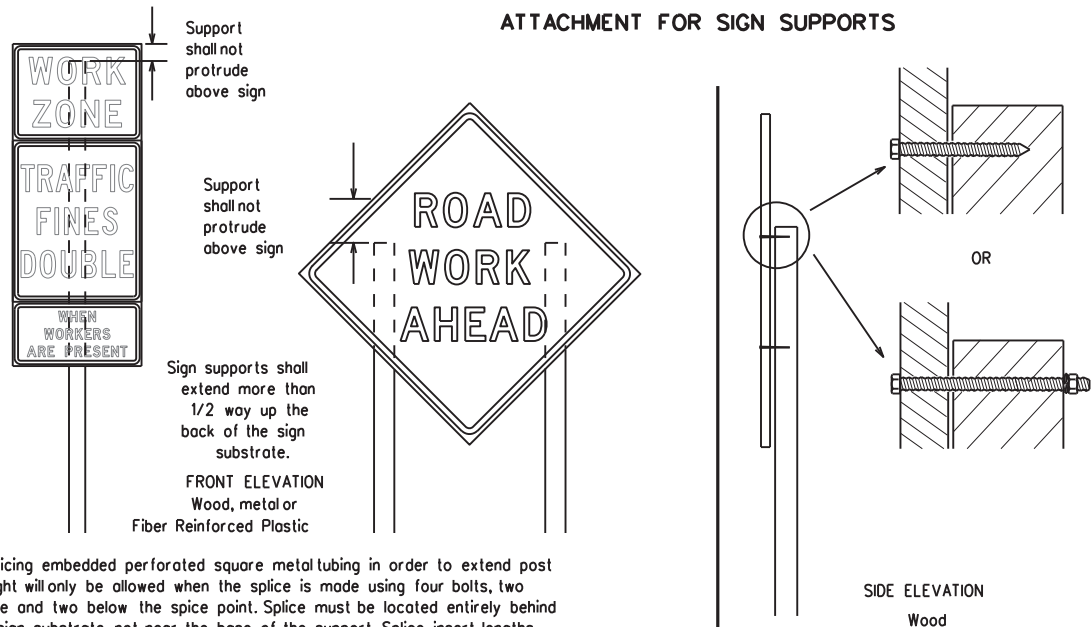
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



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

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

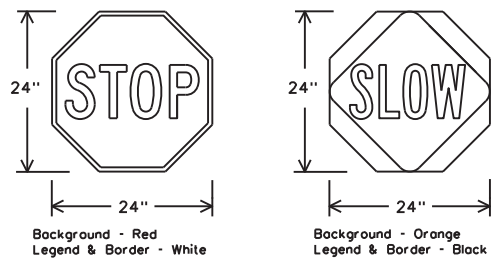
ATTACHMENT FOR SIGN SUPPORTS



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

STOP/SLOW PADDLES

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



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

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
2. Long-term stationary or intermediate stationary signs installed on square metal tubing may be turned away from traffic 90 degrees when the sign message is not applicable. This technique may not be used for signs installed in the median of divided highways or near any intersections where the sign may be seen from approaching traffic.
3. Signs installed on wooden skids shall not be turned at 90 degree angles to the roadway. These signs should be removed or completely covered when not required.
4. When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night, without damaging the sign sheeting.
5. Burlap shall NOT be used to cover signs.
6. Duct tape or other adhesive material shall NOT be affixed to a sign face.
7. Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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



BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

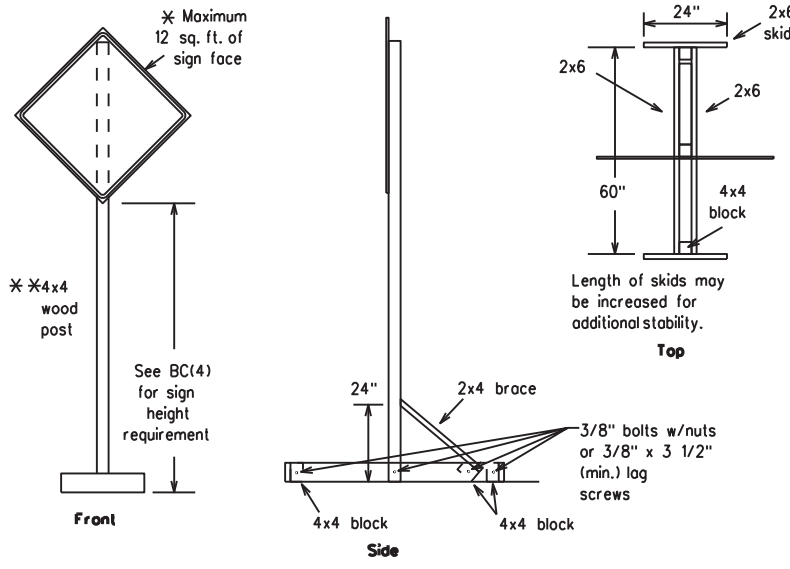
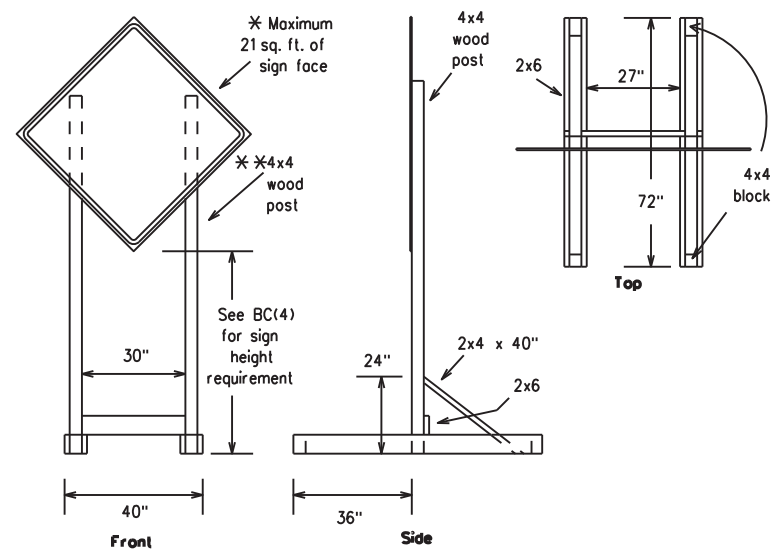
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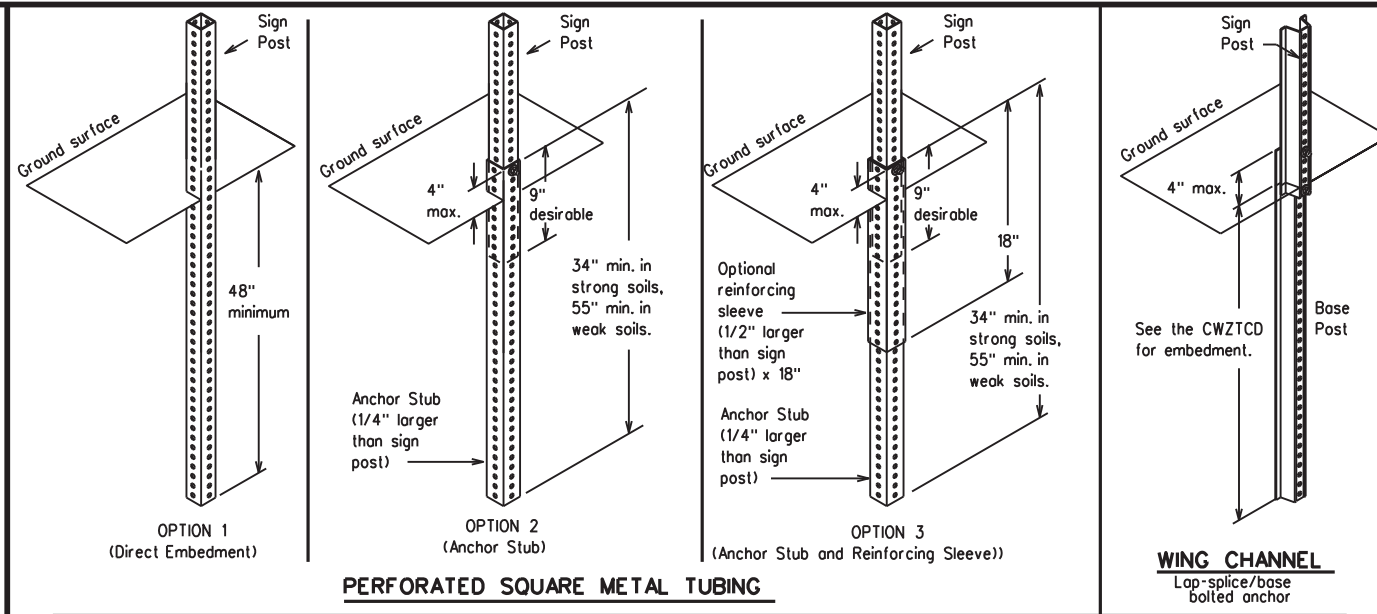
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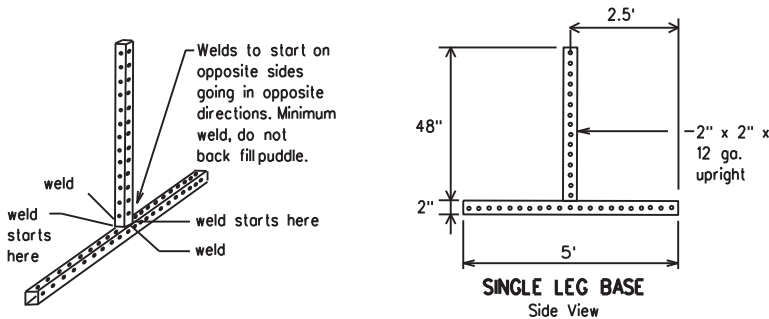
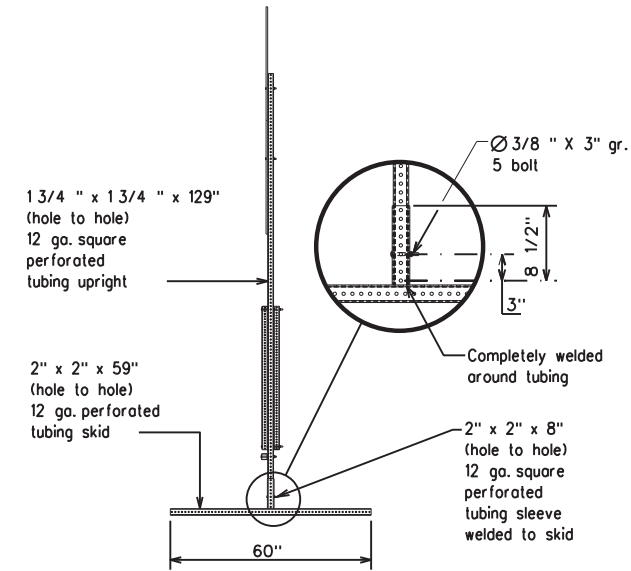
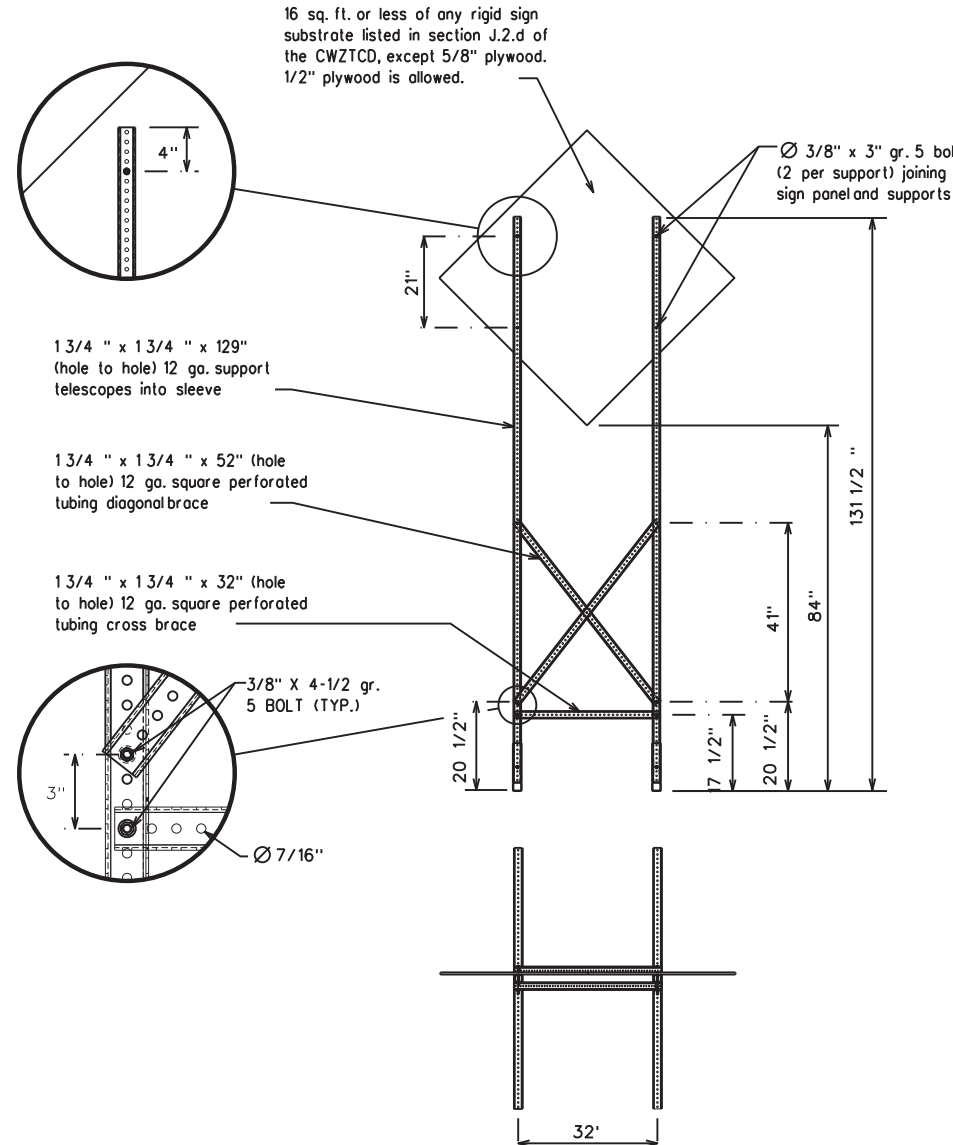
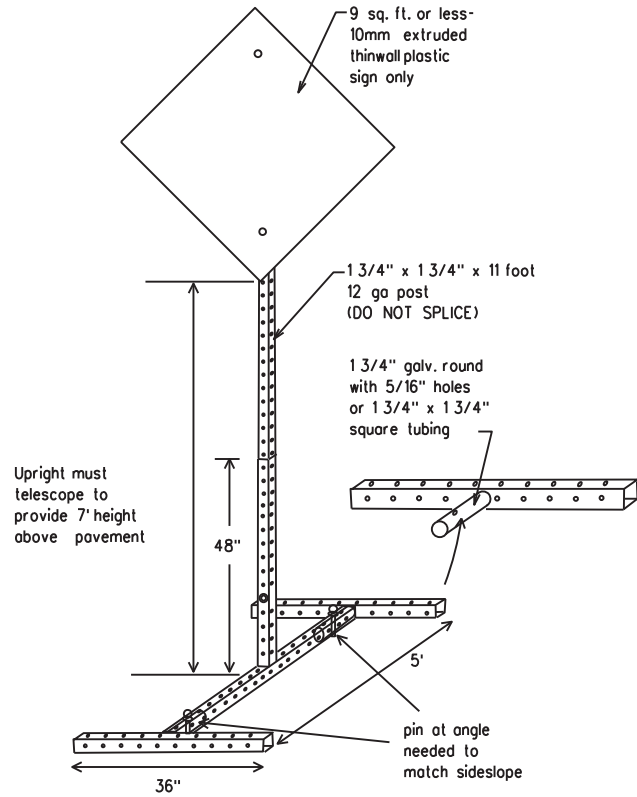
SKID MOUNTED WOOD SIGN SUPPORTS

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



GROUND MOUNTED SIGN SUPPORTS

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



SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

1. 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.
2. No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
3. When project is completed, all sign supports and foundations shall be removed from the project site. This will be considered subsidiary to Item 502.

- * See BC(4) for definition of "Work Duration."
- ** Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.
- See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

SHEET 5 OF 12



BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

FRONTAGE ROAD CLOSED	ROADWORK XXX FT	ROAD REPAIRS XXXX FT
SHOULDER CLOSED XXX FT	FLAGGER XXXX FT	LANE NARROWS XXXX FT
RIGHT LN CLOSED XXX FT	RIGHT LN NARROWS XXXX FT	TWO-WAY TRAFFIC XX MILE
RIGHT X LANES OPEN	MERGING TRAFFIC XXXX FT	CONST TRAFFIC XXX FT
DAYTIME LANE CLOSURES	LOOSE GRAVEL XXXX FT	UNEVEN LANES XXXX FT
I-XX SOUTH EXIT CLOSED	DETOUR X MILE	ROUGH ROAD XXXX FT
EXIT XXX CLOSED X MILE	ROADWORK PAST SH XXXX	ROADWORK NEXT FRI-SUN
RIGHT LN TO BE CLOSED	BUMP XXXX FT	US XXX EXIT X MILES
X LANES CLOSED TUE - FRI	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 LINES RIGHT
DETOUR NEXT X EXITS	USE XXXX 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 XXXXXXXX
US XXX TO FM XXXX

Warning List

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

x x Advance Notice List

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

x x See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

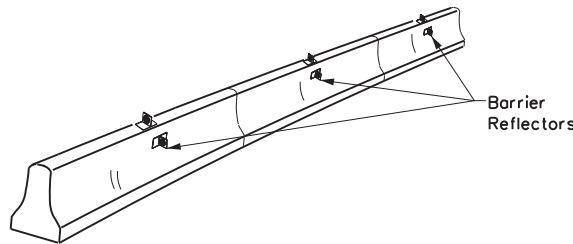
- When Full Matrix PCMS signs are used, the character height and legibility/visibility requirements shall be maintained as listed in Note 15 under "PORTABLE CHANGEABLE MESSAGE SIGNS" above.
- When symbol signs, such as the "Flagger Symbol"(CW20-7) are represented graphically on the Full Matrix PCMS sign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

<p>BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)</p> <p>BC(6)-21</p>			
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7-13 5-21	SHEET NO. 12		

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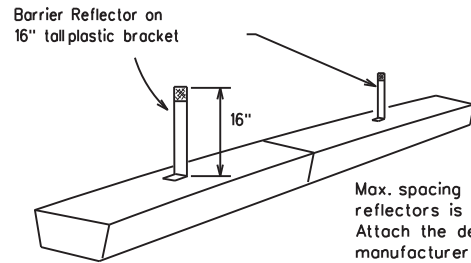
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



CONCRETE TRAFFIC BARRIER (CTB)

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

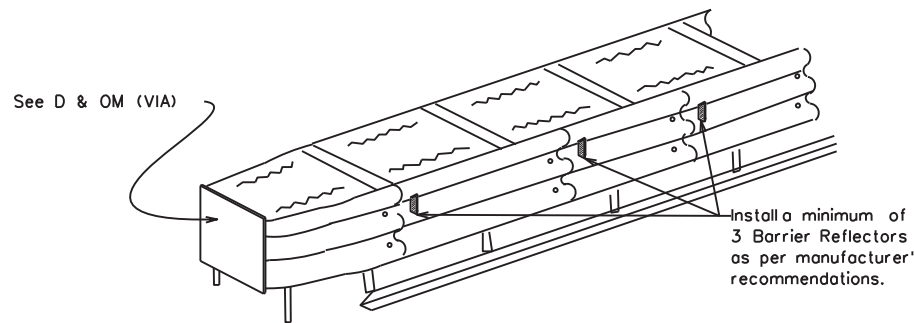


LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

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

LOW PROFILE CONCRETE BARRIER (LPCB)



DELINEATION OF END TREATMENTS

END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS

WARNING LIGHTS

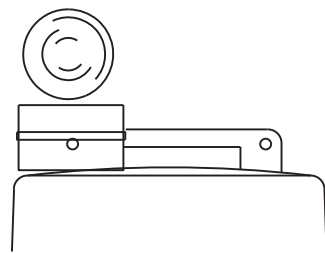
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

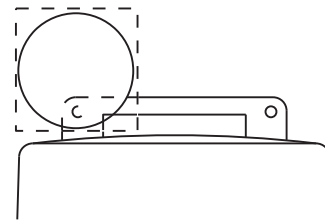
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing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

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

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



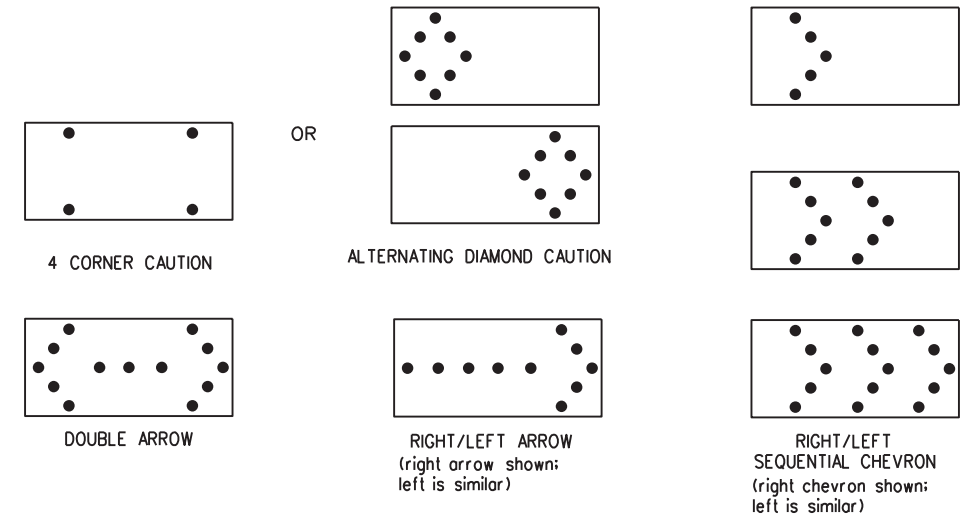
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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

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

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



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

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

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

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

FLASHING ARROW BOARDS

SHEET 7 OF 12

TRUCK-MOUNTED ATTENUATORS

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



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

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GENERAL NOTES

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

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

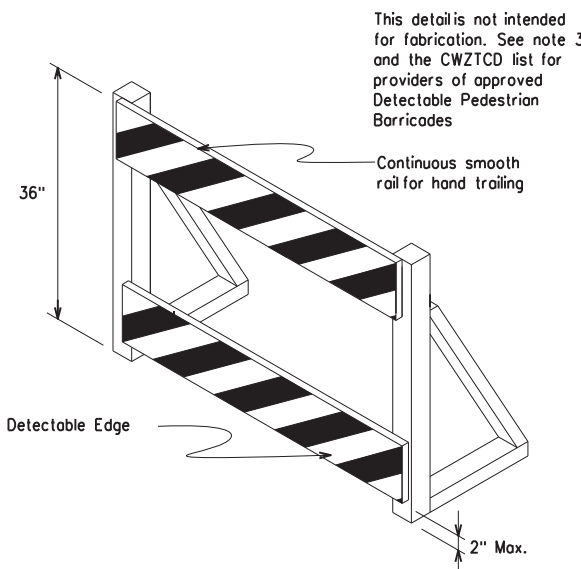
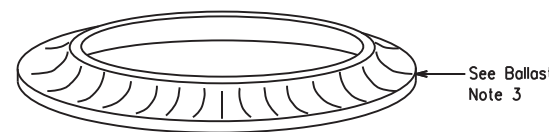
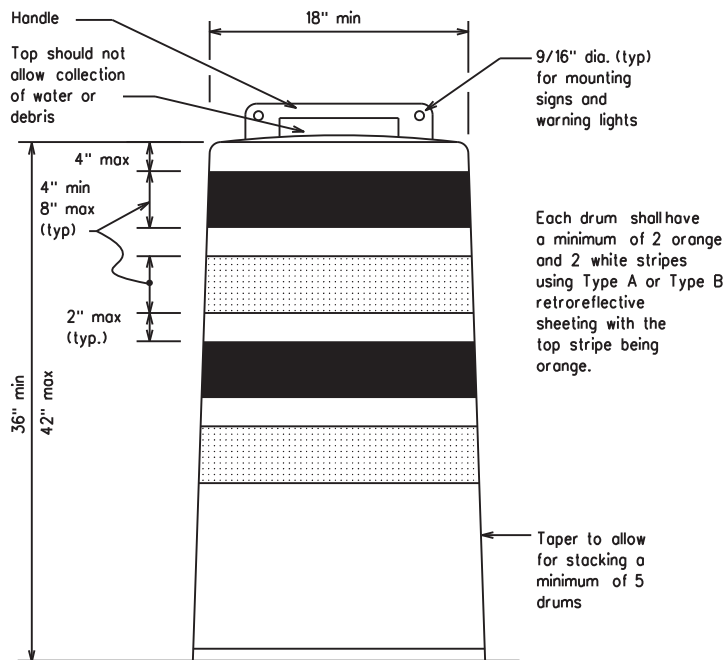
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

RETROREFLECTIVE SHEETING

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

BALLAST

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



This detail is not intended for fabrication. See note 3 and the CWZTCD list for providers of approved Detectable Pedestrian Barricades

DETECTABLE PEDESTRIAN BARRICADES

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



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



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

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

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

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

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

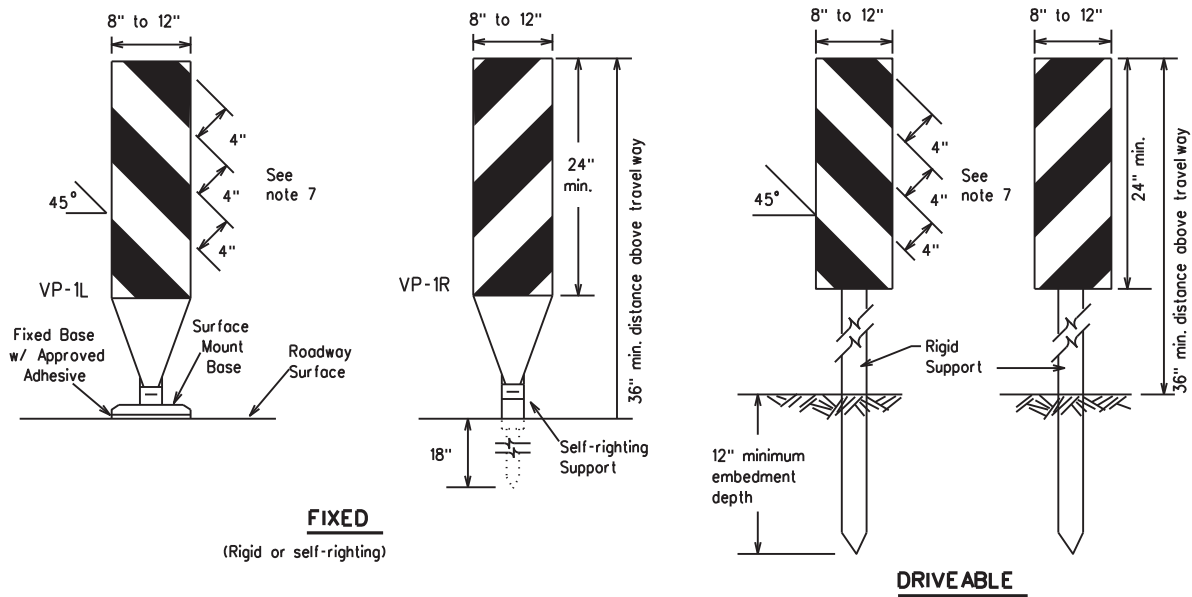
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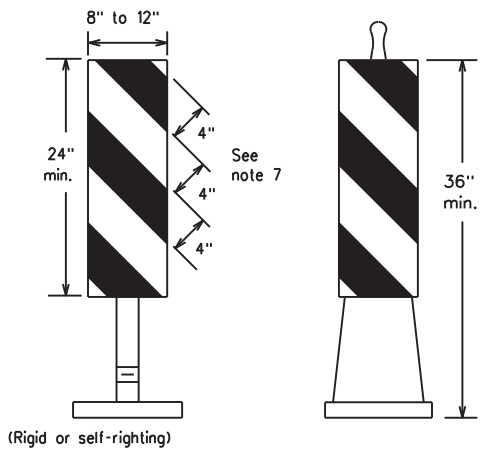
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FIXED
(Rigid or self-righting)

DRIVEABLE

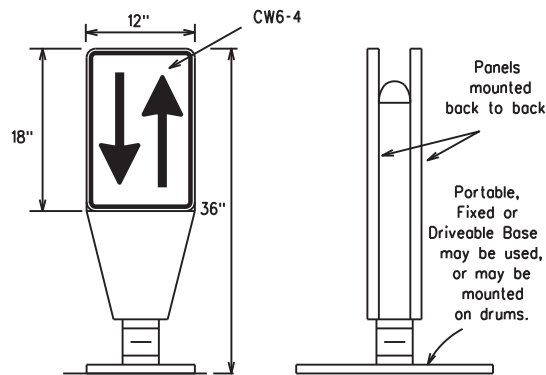


PORTABLE

VERTICAL PANELS (VPs)

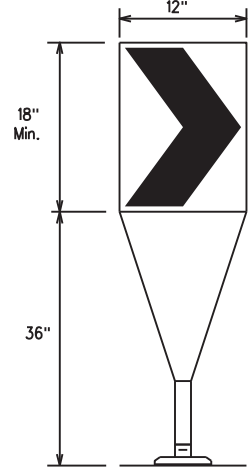
- Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
- VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual for additional requirements on the use VP's for drop-offs.
- VP's should be mounted back to back if used at the edge of cuts adjacent to two-way two lane roadways. Stripes are to be reflective orange and reflective white and should always slope downward toward the travel lane.
- VP's 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 base. 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 panel is 36 inches or greater, a panel stripe of 6 inches shall be used.

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OPPOSING TRAFFIC LANE DIVIDERS (OTLD)

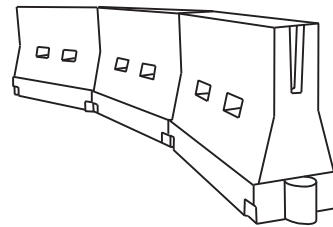
- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base 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" cones or VP's.
- Spacing between the OTLD shall not exceed 500 feet. 42" cones or VP's placed between the OTLD's should not exceed 100 foot spacing.
- The OTLD shall be orange with a black non-reflective legend. Sheeting for the OTLD shall be retroreflective Type B or Type C conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

- 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 tapers or transitions on freeways and divided highways, self-righting chevrons may be used to supplement plastic drums but not to replace plastic drums.

CHEVRONS



LONGITUDINAL CHANNELIZING DEVICES (LCD)

- 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 rails as shown on BC(10). Place reflective sheeting near the top of the LCD along the full length of the device.

WATER BALLASTED SYSTEMS USED AS BARRIERS

- 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 flared to a point outside the clear zone.

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

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

GENERAL NOTES

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12



BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

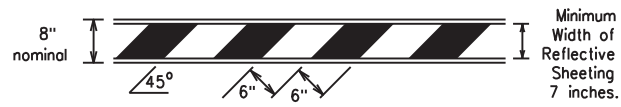
BC(9)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190, ETC
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	WACO	BELL, ETC	15	

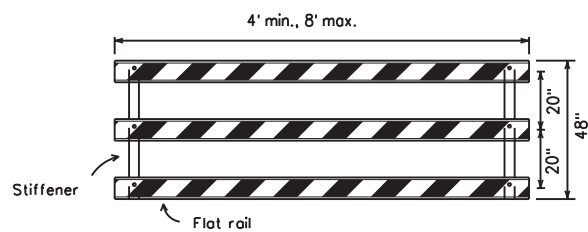
TYPE 3 BARRICADES

1. Refer to the Compliant Work Zone Traffic Control Devices List (CWZTCD) for details of the Type 3 Barricades and a list of all materials used in the construction of Type 3 Barricades.
2. Type 3 Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending across a roadway should have stripes that slope downward in the direction toward which traffic must turn in detouring. When both right and left turns are provided, the chevron striping may slope downward in both directions from the center of the barricade. Where no turns are provided at a closed road, striping should slope downward in both directions toward the center of roadway.
4. Striping of rails, for the right side of the roadway, should slope downward to the left. For the left side of the roadway, striping should slope downward to the right.
5. Identification markings may be shown only on the back of the barricade rails. The maximum height of letters and/or company logos used for identification shall be 1".
6. Barricades shall not be placed parallel to traffic unless an adequate clear zone is provided.
7. Warning lights shall NOT be installed on barricades.
8. Where barricades require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight. Sand bags shall not be stacked in a manner that covers any portion of a barricade rails reflective sheeting. Rock, concrete, iron, steel or other solid objects will NOT be permitted. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall not be used for sandbags. Sandbags shall only be placed along or upon the base supports of the device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners.
9. Sheeting for barricades shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.

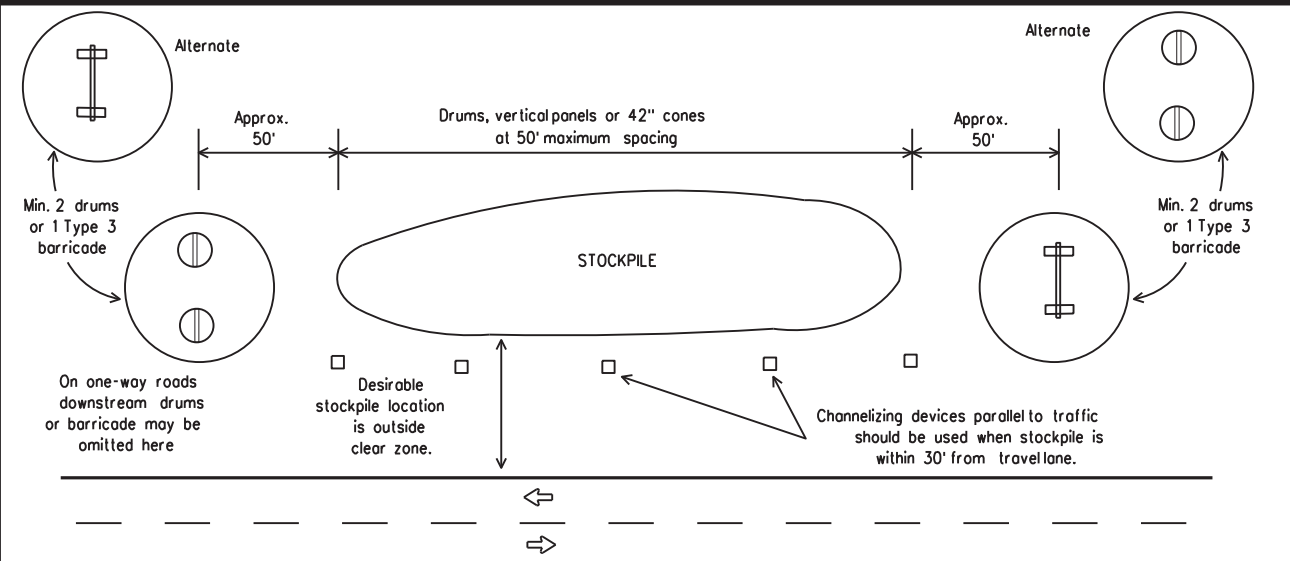


TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



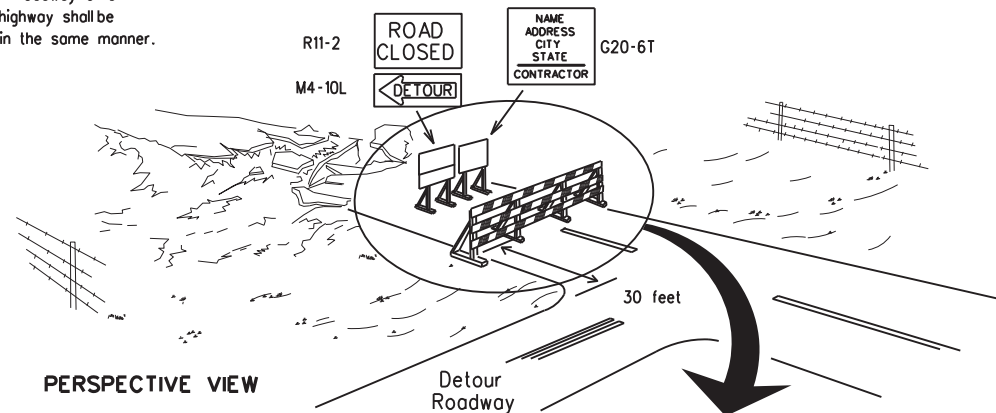
Stiffener may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES



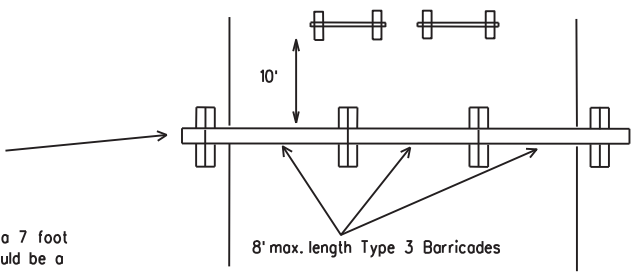
TRAFFIC CONTROL FOR MATERIAL STOCKPILES

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



PERSPECTIVE VIEW

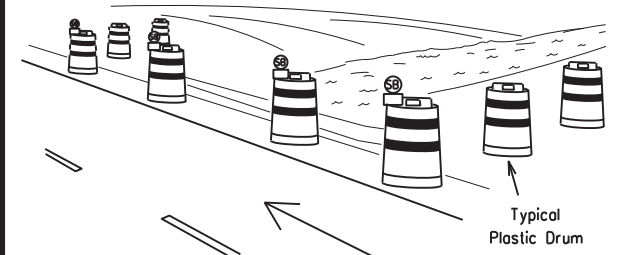
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



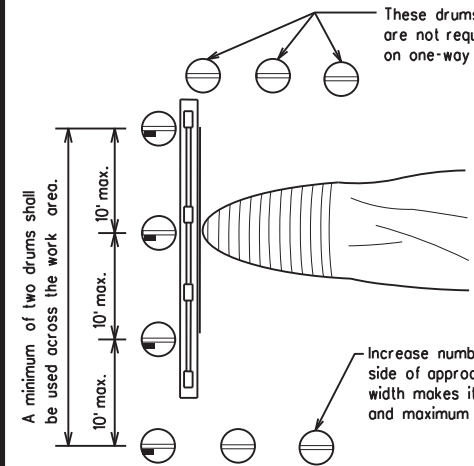
PLAN VIEW

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

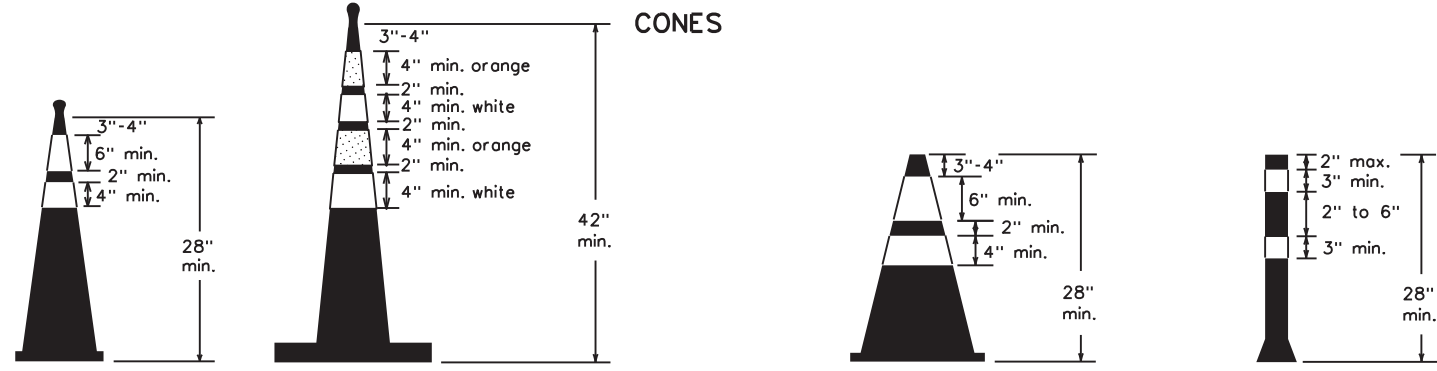


PLAN VIEW

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

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

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones

One-Piece cones

Tubular Marker

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

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



BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

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9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	WACO	BELL, ETC	16	

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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 on Uniform Traffic Control Devices" (TMUTCD).
- Additional supplemental pavement marking details may be found in the plans or specifications.
- Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
- When short term markings are required on the plans, short term markings shall conform with the TMUTCD, the plans and details as shown on the Standard Plan Sheet WZ(STPM).
- When standard pavement markings are not in place and the roadway is opened to traffic, DO NOT PASS signs shall be erected to mark the beginning of the sections where passing is prohibited and PASS WITH CARE signs at the beginning of sections where passing is permitted.
- All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

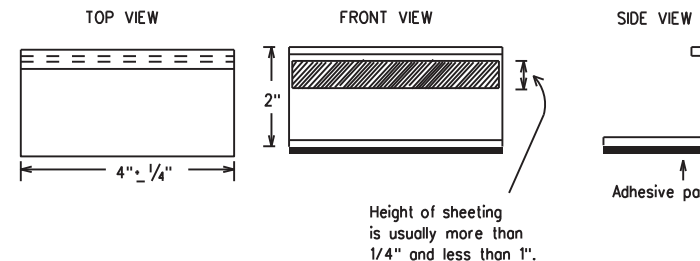
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

- Pavement markings that are no longer applicable, could create confusion or direct a motorist toward or into the closed portion of the roadway shall be removed or obliterated before the roadway is opened to traffic.
- The above shall not apply to detours in place for less than three days, where 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.
- Blast cleaning may be used but will not be required unless specifically shown in the plans.
- Over-painting of the markings SHALL NOT BE permitted.
- Removal of raised pavement markers shall be as directed by the Engineer.
- Removal of existing pavement markings and markers will be paid for directly in accordance with Item 677, "ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS," unless otherwise stated in the plans.
- 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.
- Tabs detailed on this sheet are to be inspected and accepted by the Engineer or designated representative. Sampling and testing is not normally required, however at the option of the Engineer, either "A" or "B" below may be imposed to assure quality before placement on the roadway.
 - Select five (5) or more tabs at random from each lot or shipment and submit to the Construction Division, Materials and Pavement Section to determine specification compliance.
 - Select five (5) tabs and perform the following test. Affix five (5) tabs at 24 inch intervals on an asphaltic pavement in a straight line. Using a medium size passenger vehicle or pickup, run over the markers with the front and rear tires at a speed of 35 to 40 miles per hour, four (4) times in each direction. No more than one (1) out of the five (5) reflective surfaces shall be lost or displaced as a result of this test.
- Small design variances may be noted between tab manufacturers.
- See Standard Sheet WZ(STPM) for tab placement on new pavements. See Standard Sheet TCP(7-1) for tab placement on seal coat work.

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

SHEET 11 OF 12



BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

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1-02	7-13			
11-02	8-14			
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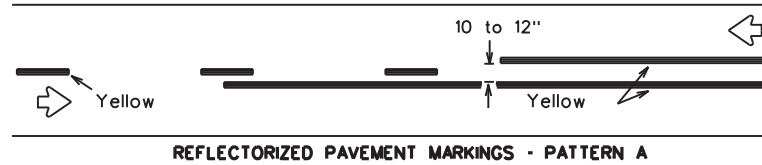
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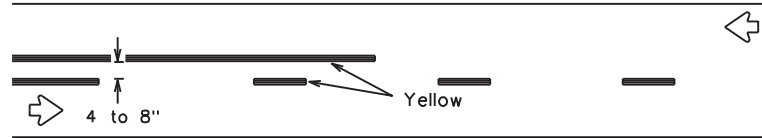
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PAVEMENT MARKING PATTERNS

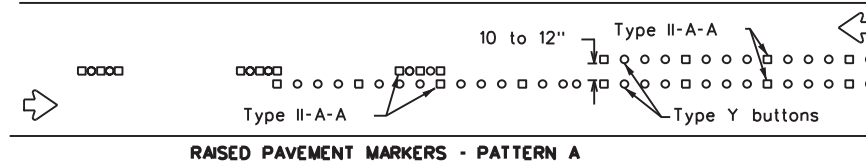


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

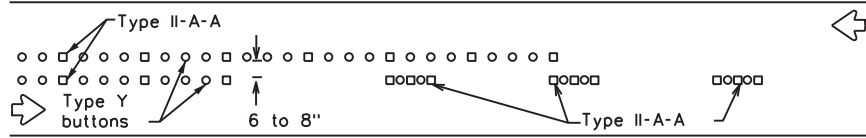


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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

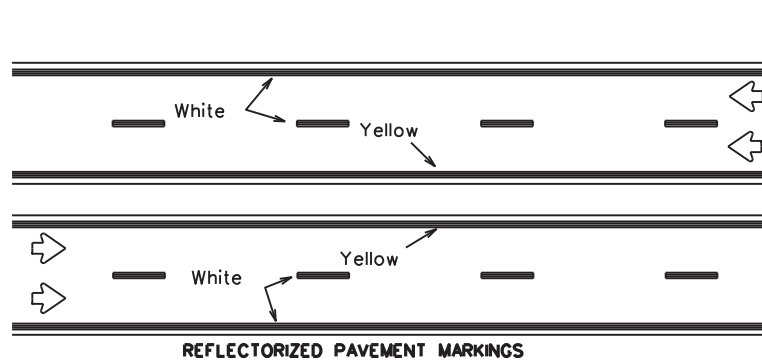


RAISED PAVEMENT MARKERS - PATTERN A



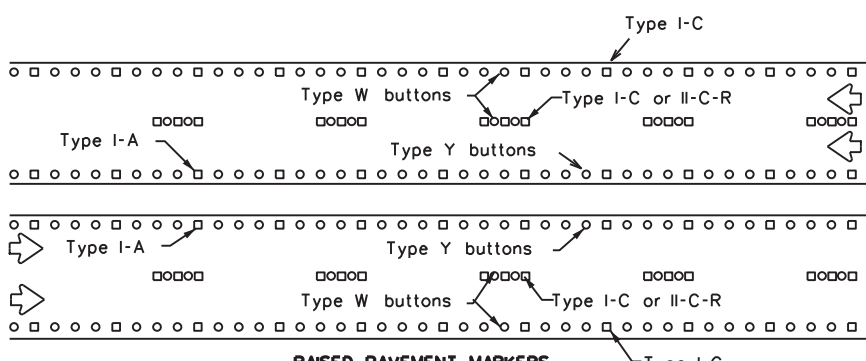
RAISED PAVEMENT MARKERS - PATTERN B

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



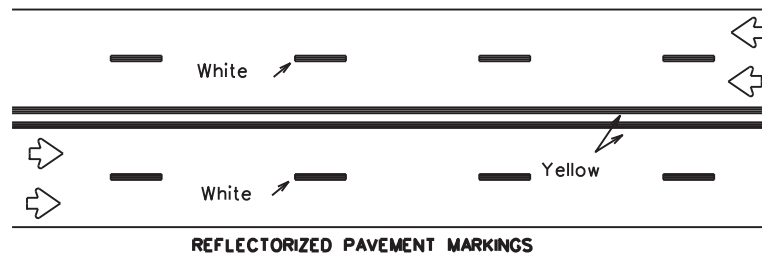
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



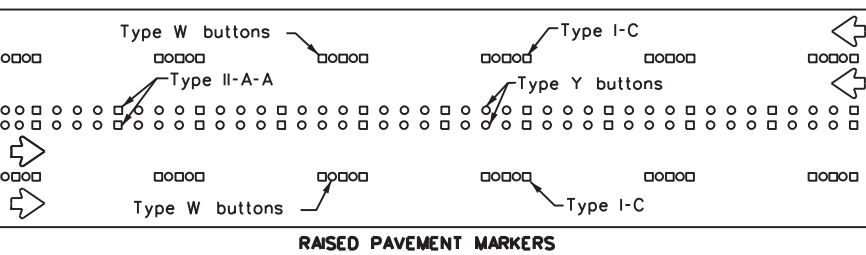
RAISED PAVEMENT MARKERS

EDGE & LANE LINES FOR DIVIDED HIGHWAY



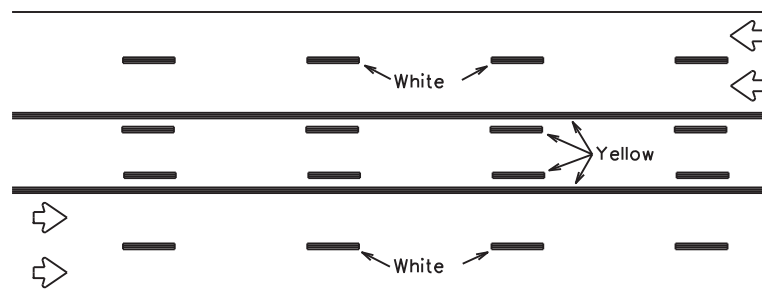
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



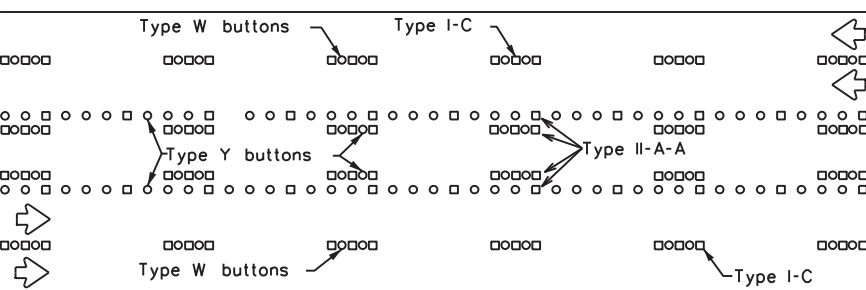
RAISED PAVEMENT MARKERS

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

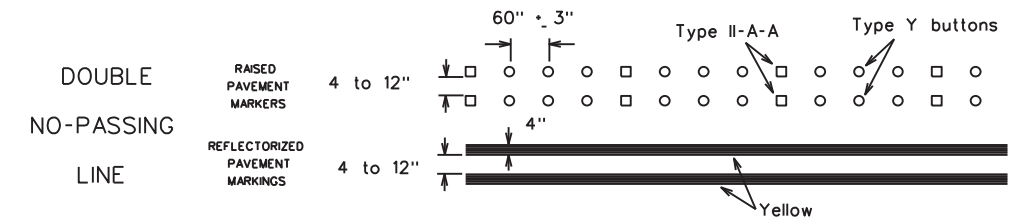
Prefabricated markings may be substituted for reflectorized pavement markings.



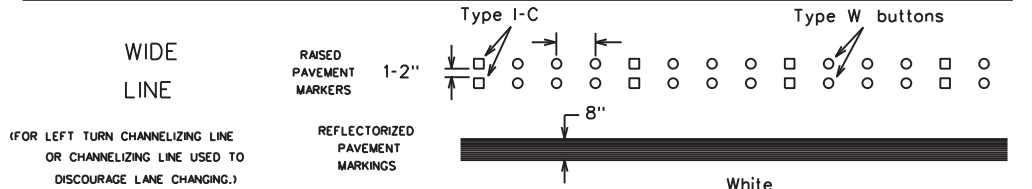
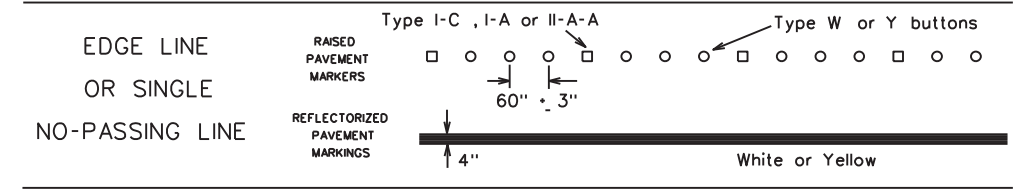
RAISED PAVEMENT MARKERS

TWO-WAY LEFT TURN LANE

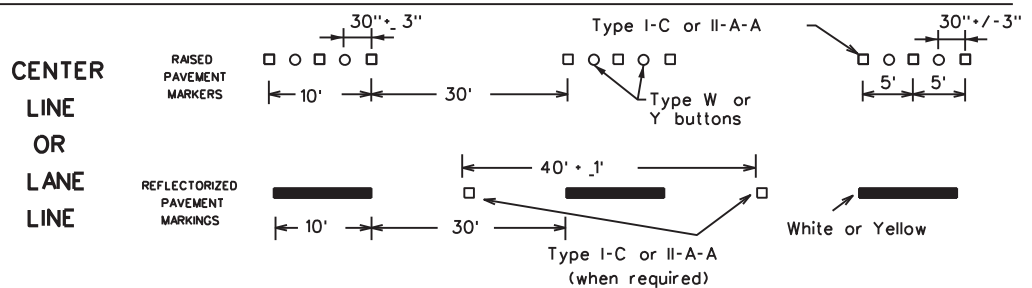
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



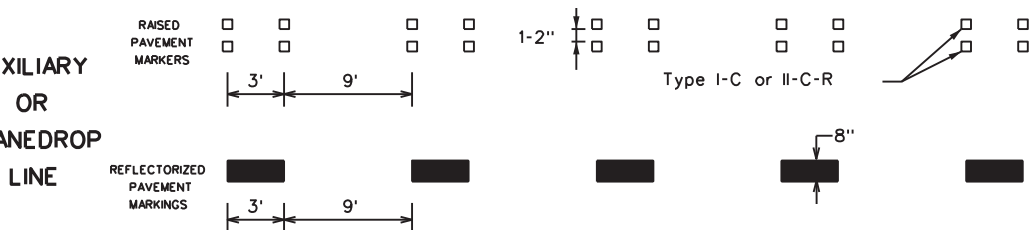
SOLID LINES



BROKEN LINES

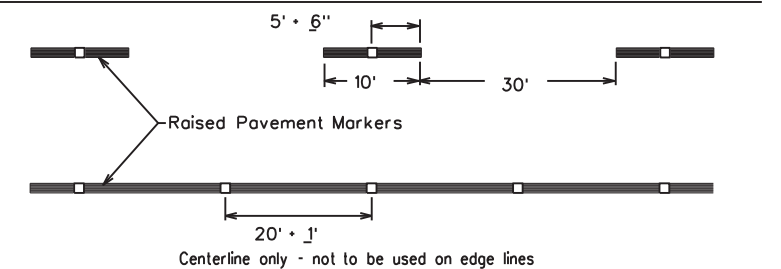


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



SHEET 12 OF 12



BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

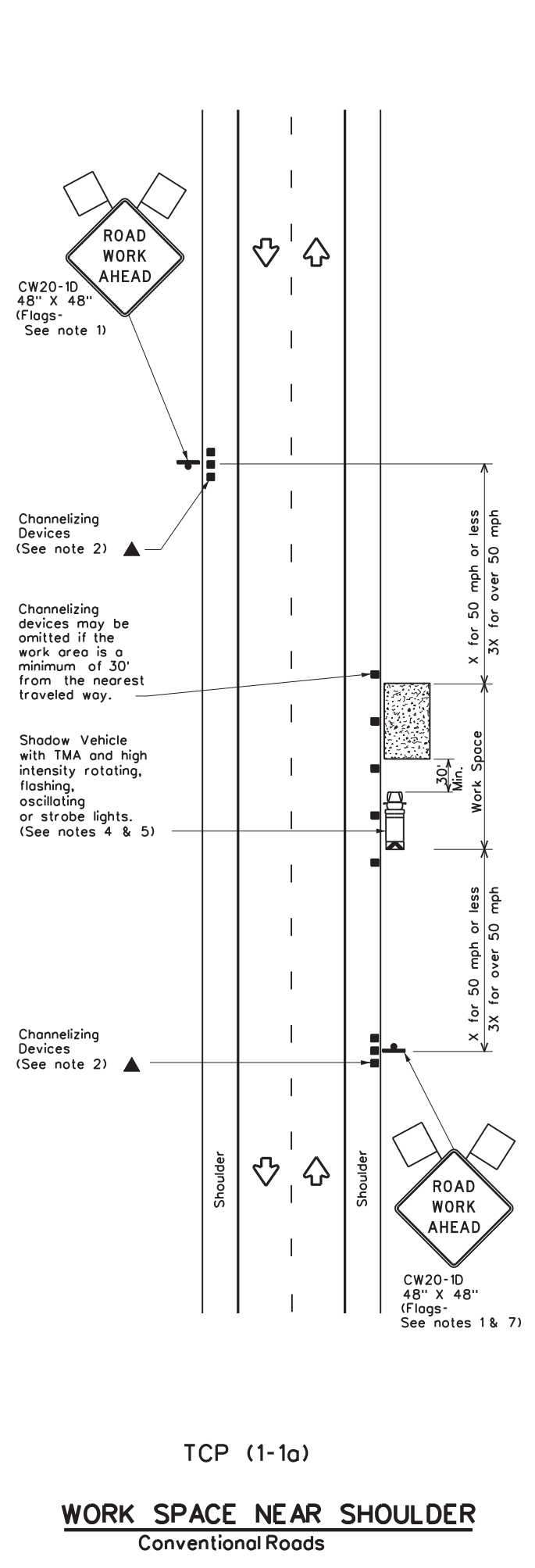
BC(12)-21

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

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2-98 7-13				
11-02 8-14	WACO	BELL, ETC		SHEET NO. 18

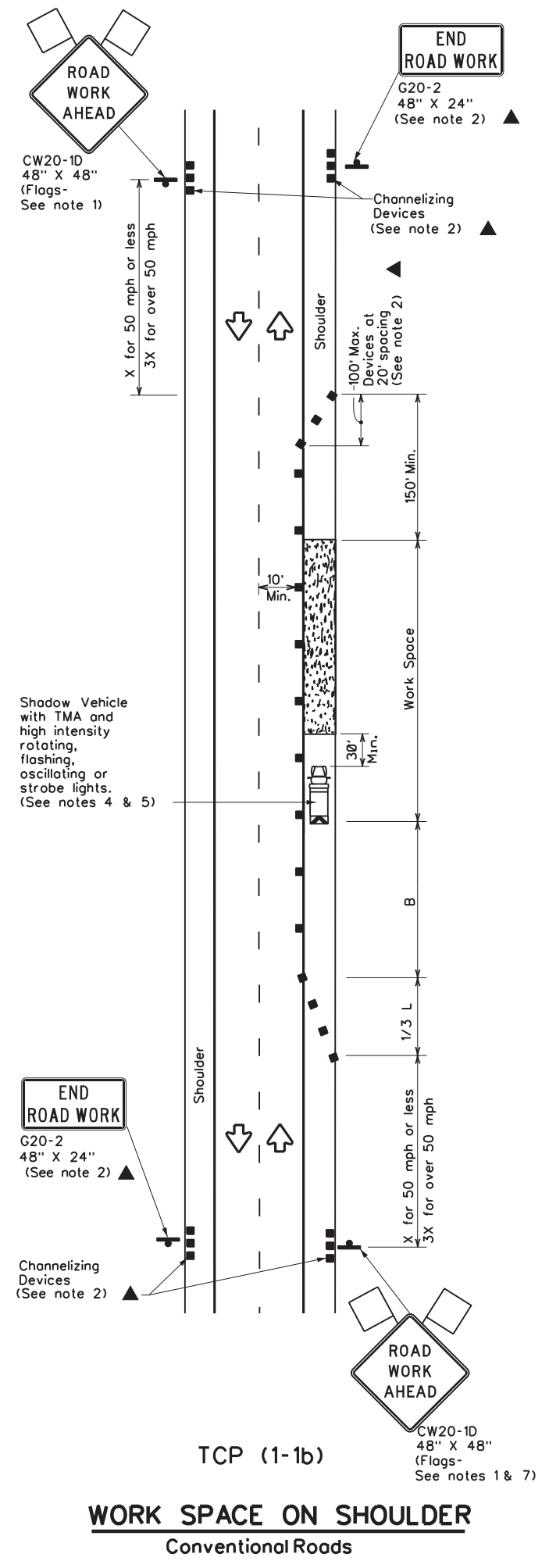
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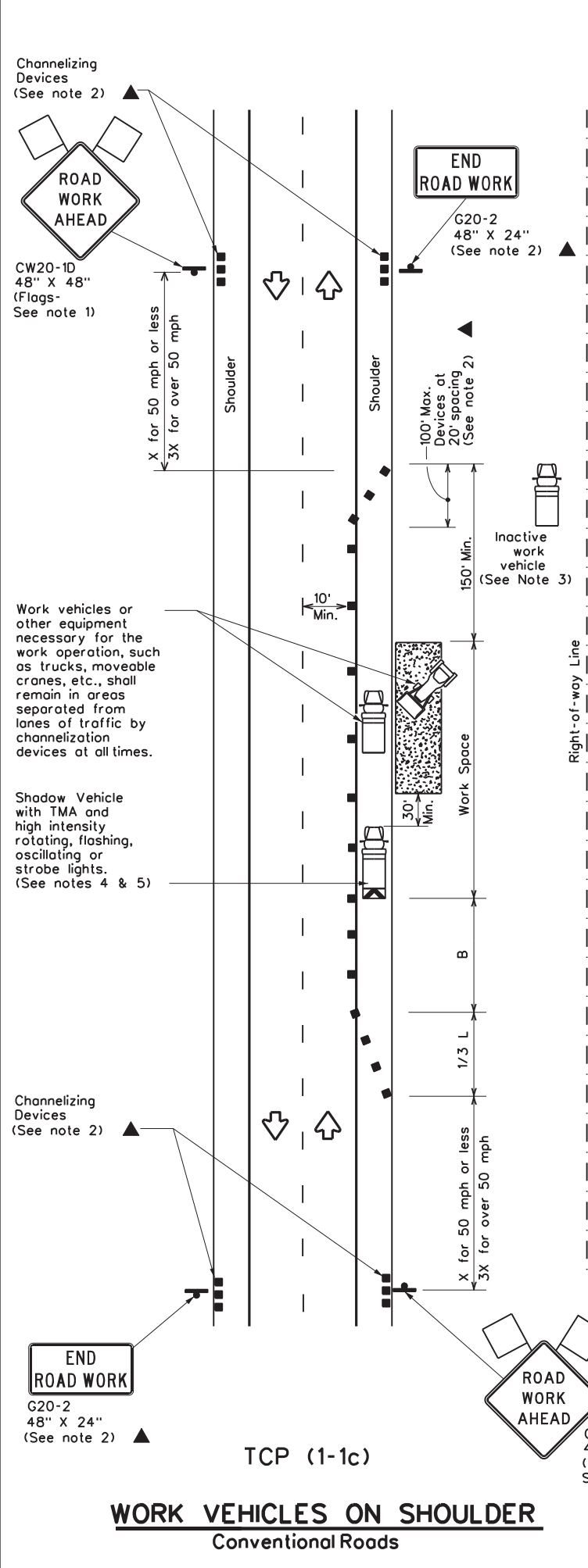
TCP (1-1a)

WORK SPACE NEAR SHOULDER
 Conventional Roads



TCP (1-1b)

WORK SPACE ON SHOULDER
 Conventional Roads



TCP (1-1c)

WORK VEHICLES ON SHOULDER
 Conventional Roads

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

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

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

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

- GENERAL NOTES**
- 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 TCP(5-1) 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.



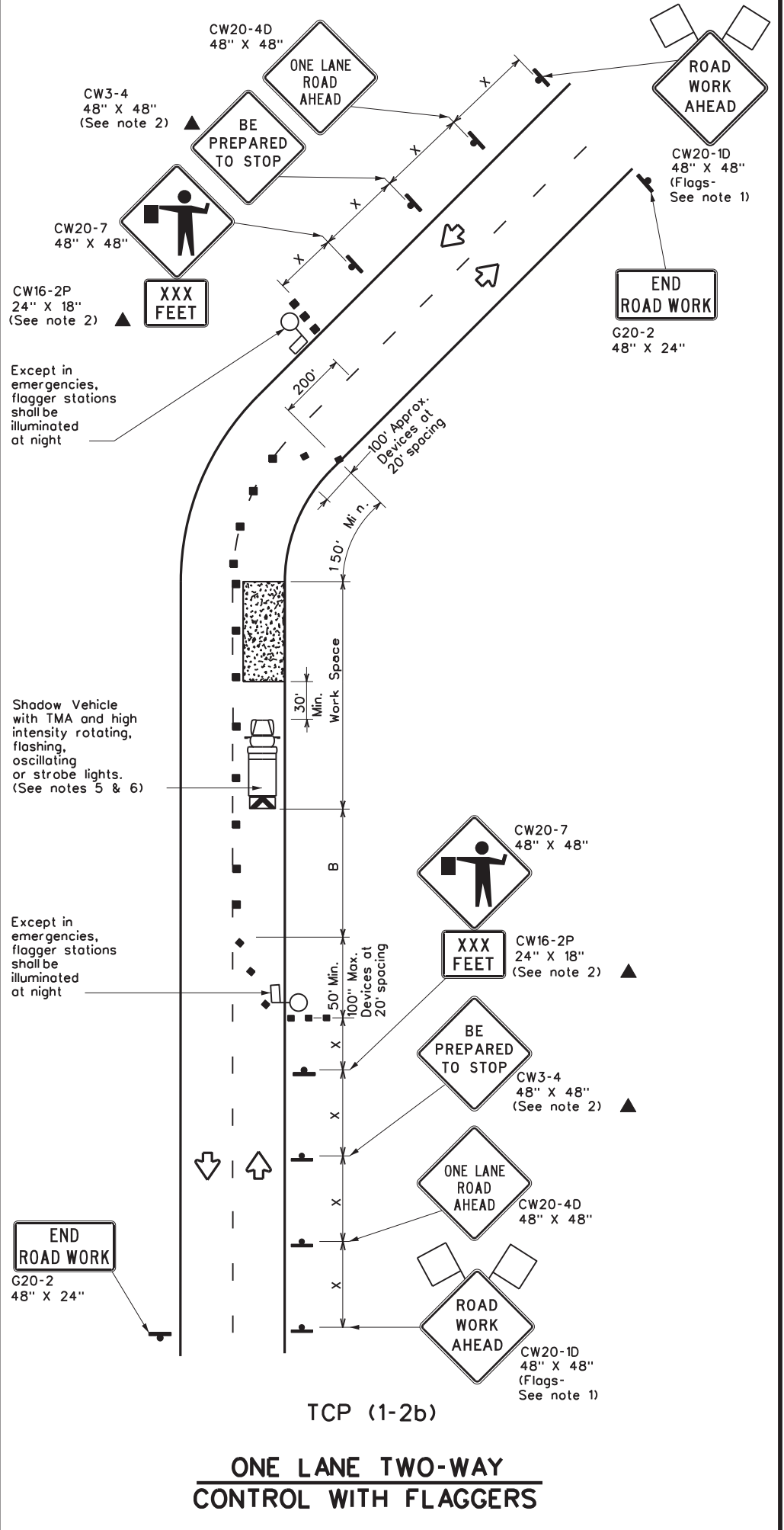
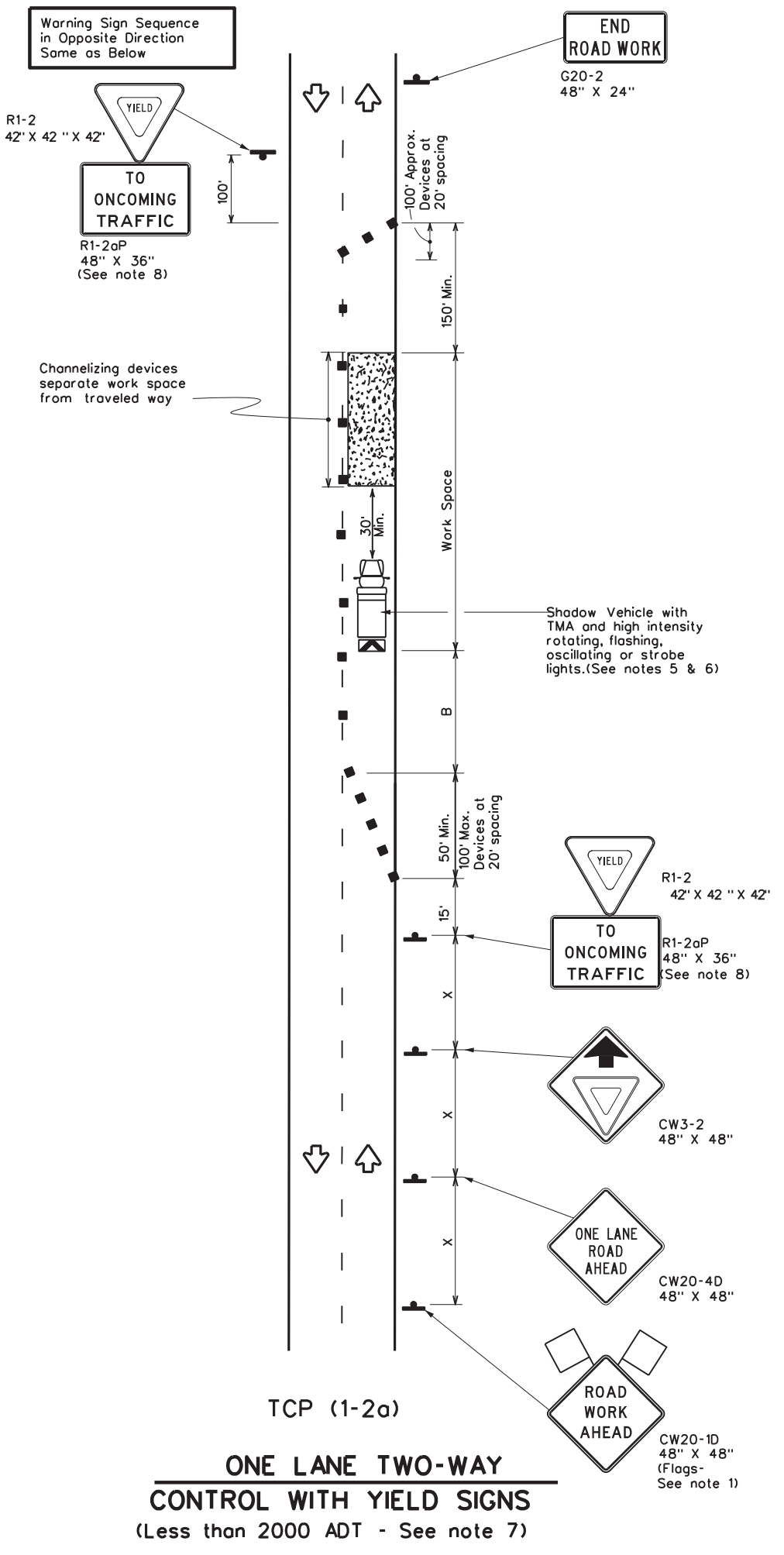
TRAFFIC CONTROL PLAN
CONVENTIONAL ROAD
SHOULDER WORK

TCP(1-1)-18

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8-95 2-12	DIST	COUNTY		SHEET NO.
1-97 2-18	WACO	BELL,ETC		19

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

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

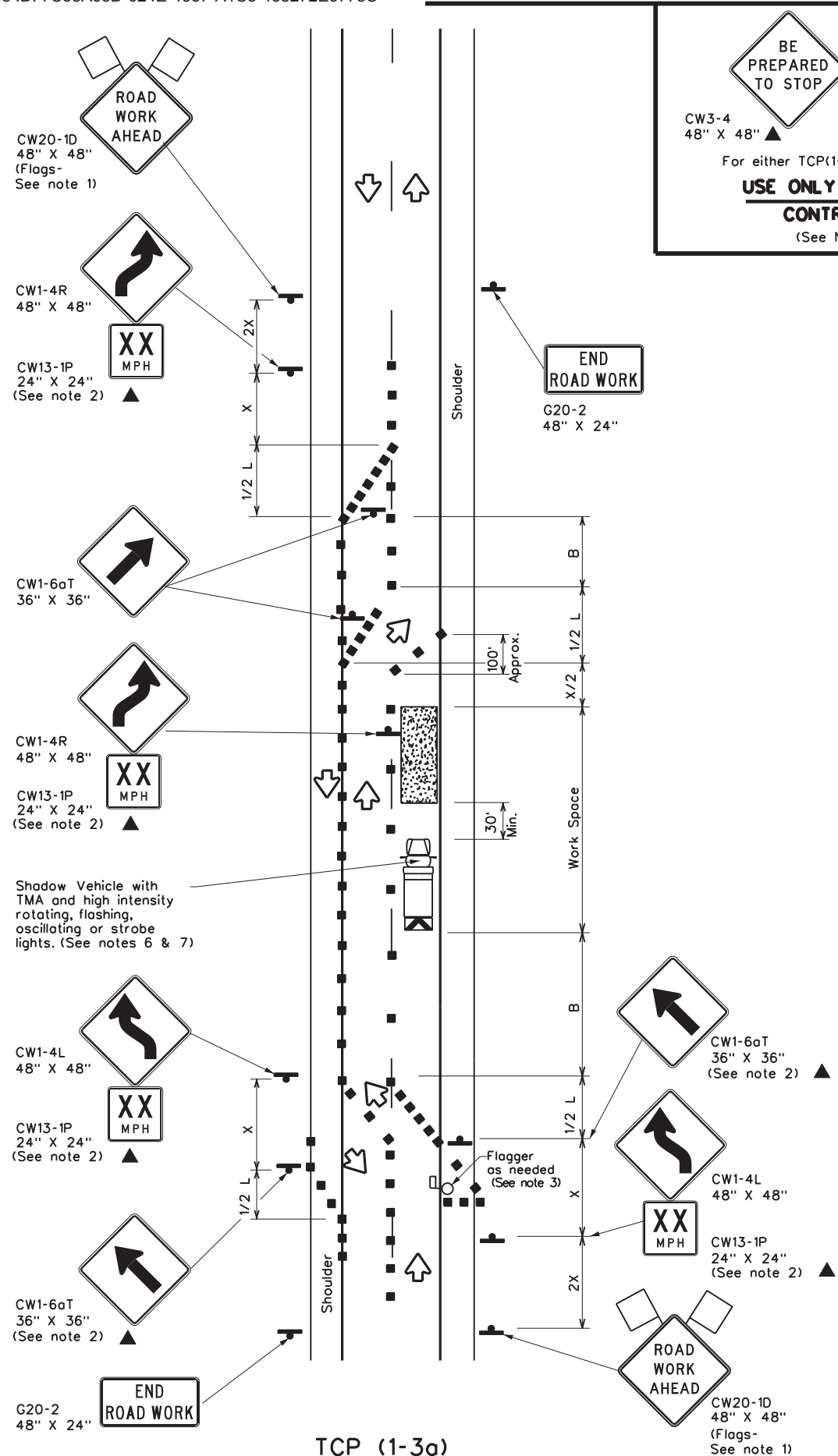
GENERAL NOTES

- 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.
 - 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 flagger 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)**
- R1-2 "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 flagger 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.

		Traffic Operations Division Standard	
TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL			
TCP(1-2)-18			
FILE:	tcp1-2-18.dgn	DN:	CK:
© TxDOT	December 1985	CONT:	SECT:
REVISIONS:		6467	89
4-90	4-98	JOB:	HIGHWAY:
2-94	2-12	001	US 190, ETC
1-97	2-18	DIST:	COUNTY:
		WACO	BELL, ETC
			SHEET NO.
			20

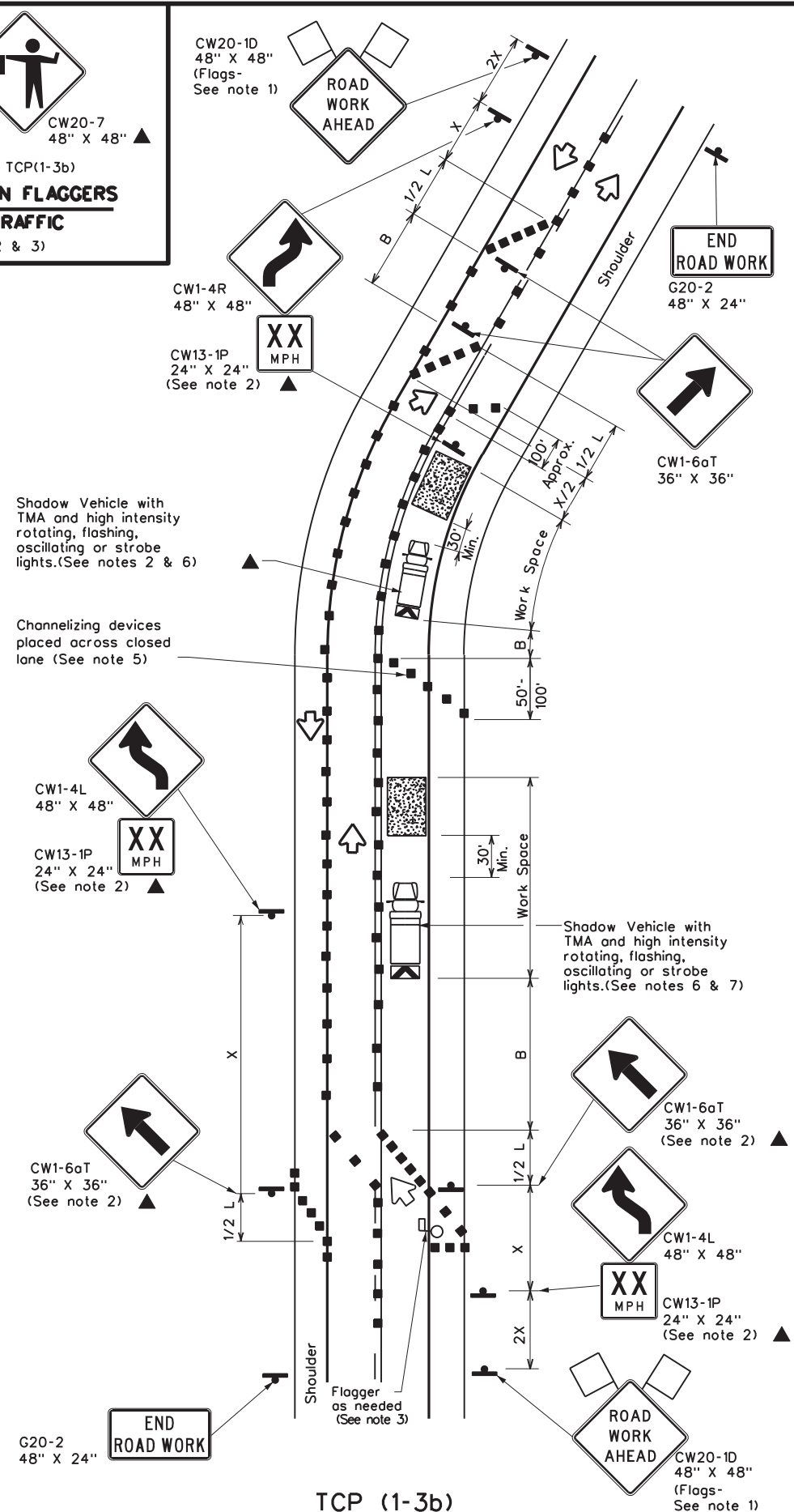
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DATE: 7/29/2024
 FILE: c:\txdot\pw_online\txdot3\me\lendy.sm\th\d0754862\tcp1-3-18.dgn



TCP (1-3a)
 2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
 ADEQUATE FIELD OF VIEW

BE PREPARED TO STOP
 CW3-4 48" X 48" ▲ CW20-7 48" X 48" ▲
 For either TCP(1-3a) or TCP(1-3b)
USE ONLY WHEN FLAGGERS CONTROL TRAFFIC
 (See Notes 2 & 3)



TCP (1-3b)
 2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
 INADEQUATE FIELD OF VIEW

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

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

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

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

- GENERAL NOTES**
- Flags attached to signs where shown are REQUIRED.
 - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
 - Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Additional flaggers may be positioned in advance of traffic queues to alert traffic to reduce speed.
 - DO NOT PASS, PASS WITH CARE and construction regulatory speed zone signs may be installed downstream of the ROAD WORK AHEAD signs.
 - When the work zone is made up of several work spaces, channelizing devices should be placed laterally across the closed lane to re-emphasize closure. Laterally placed channelizing devices should be repeated every 500 to 1000 feet in urban areas and every 1/4 to 1/2 mile in rural areas.
 - 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.
 - 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 speed are 35 mph or slower, and for tangent sections, at 1/2S where S is the speed in mph. This tighter device spacing is intended for the area of conflicting markings not the entire work zone.

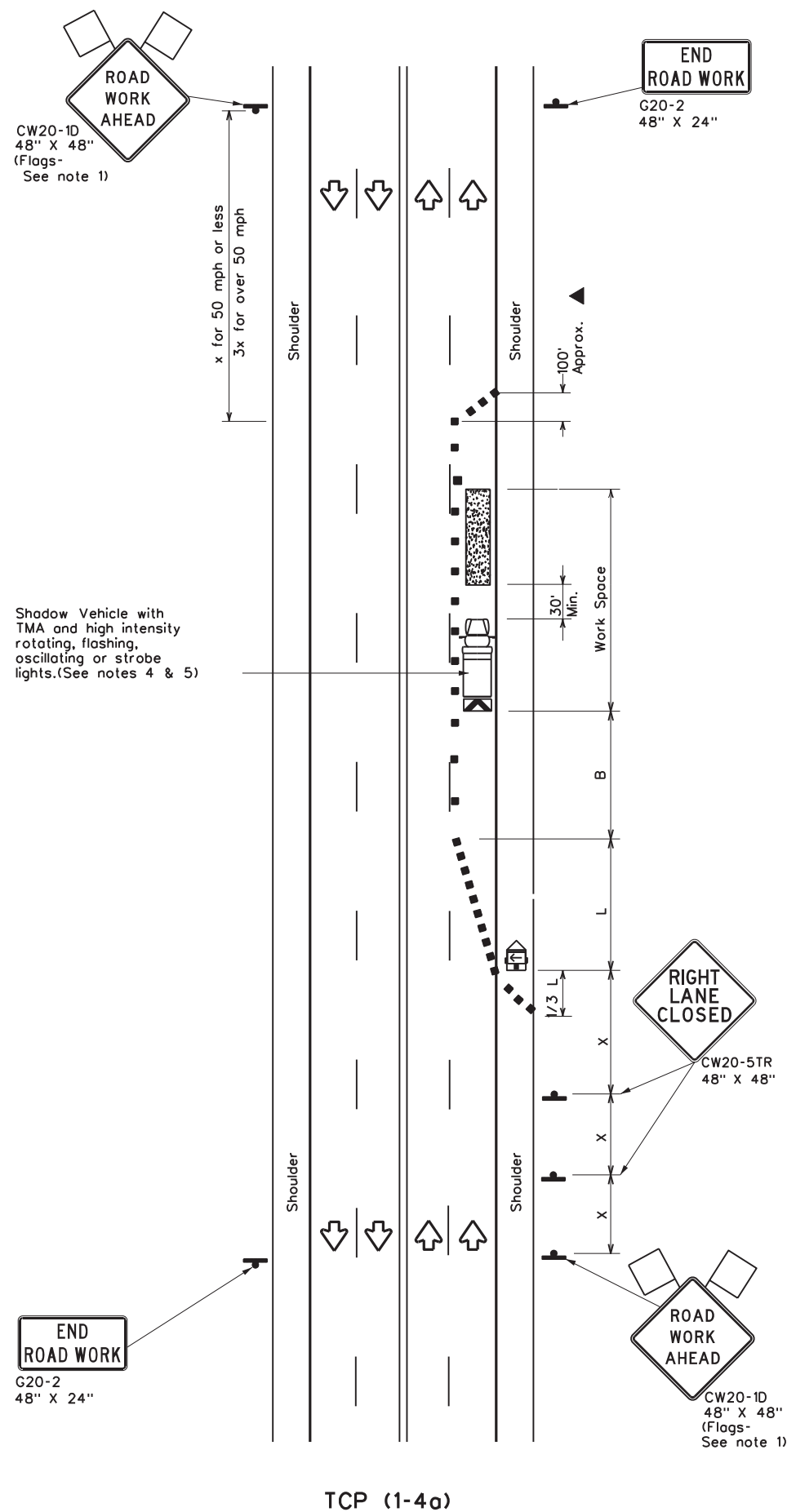
Texas Department of Transportation Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO LANE ROADS
TCP(1-3)-18

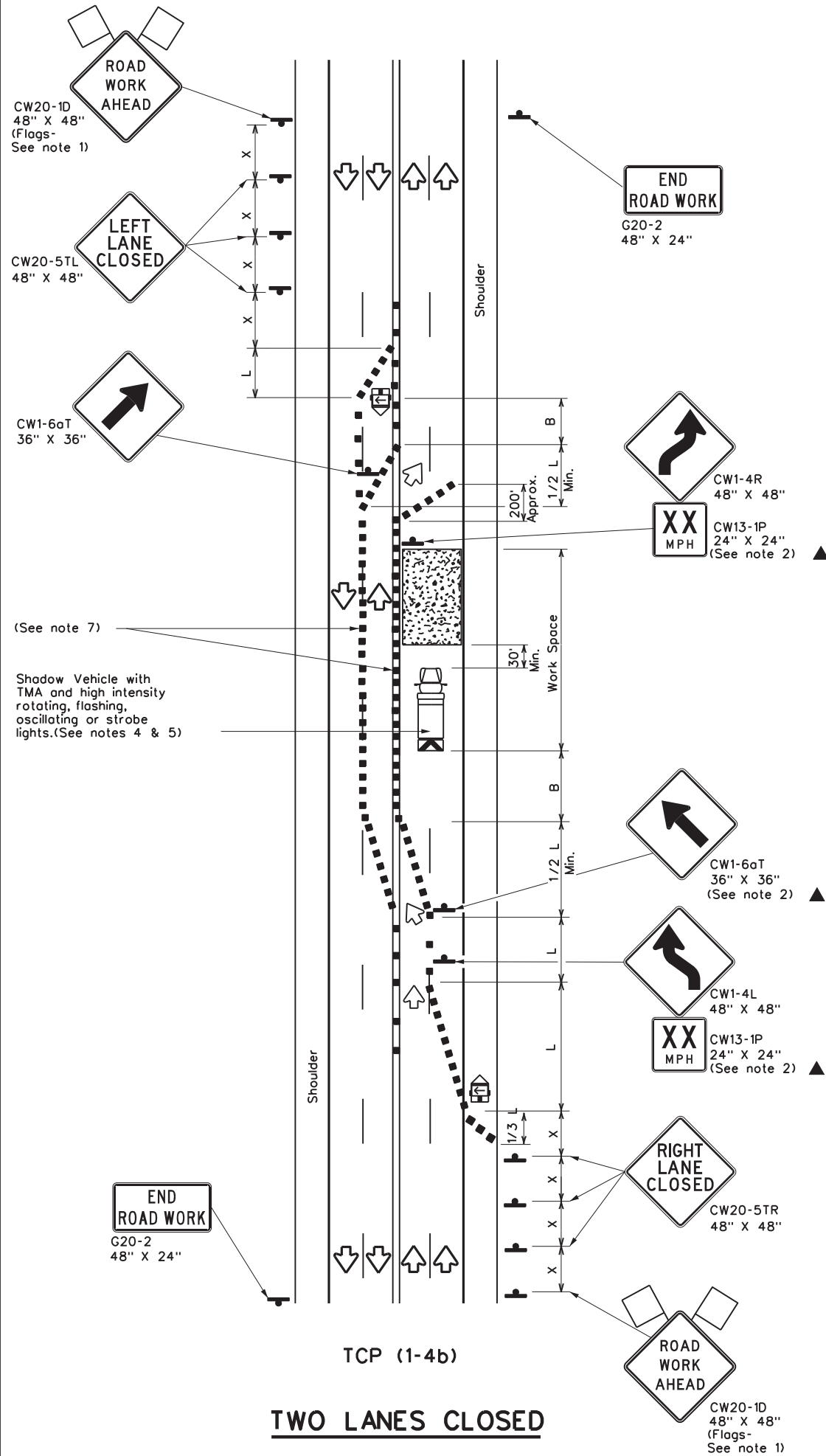
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© TxDOT December 1985	CONT:	SECT:	JOB:	HIGHWAY:
REVISIONS	6467	89	001	US 190, ETC
2-94 4-98	DIST:	COUNTY:	SHEET NO.:	
8-95 2-12	WACO	BELL, ETC	21	
1-97 2-18				

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 FILE: c:\txdot\pw_online\txdot3\me\lendy.sm\th\d0754862\tcp1-4-18.dgn



TCP (1-4a)
ONE LANE CLOSED



TCP (1-4b)
TWO LANES CLOSED

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

Posted Speed *	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 ² / 60	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

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

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

- GENERAL NOTES**
- Flags attached to signs where shown are REQUIRED.
 - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
 - 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 (1-4a)

6. If this TCP is used for a left lane closure, CW20-5TL "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline 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.

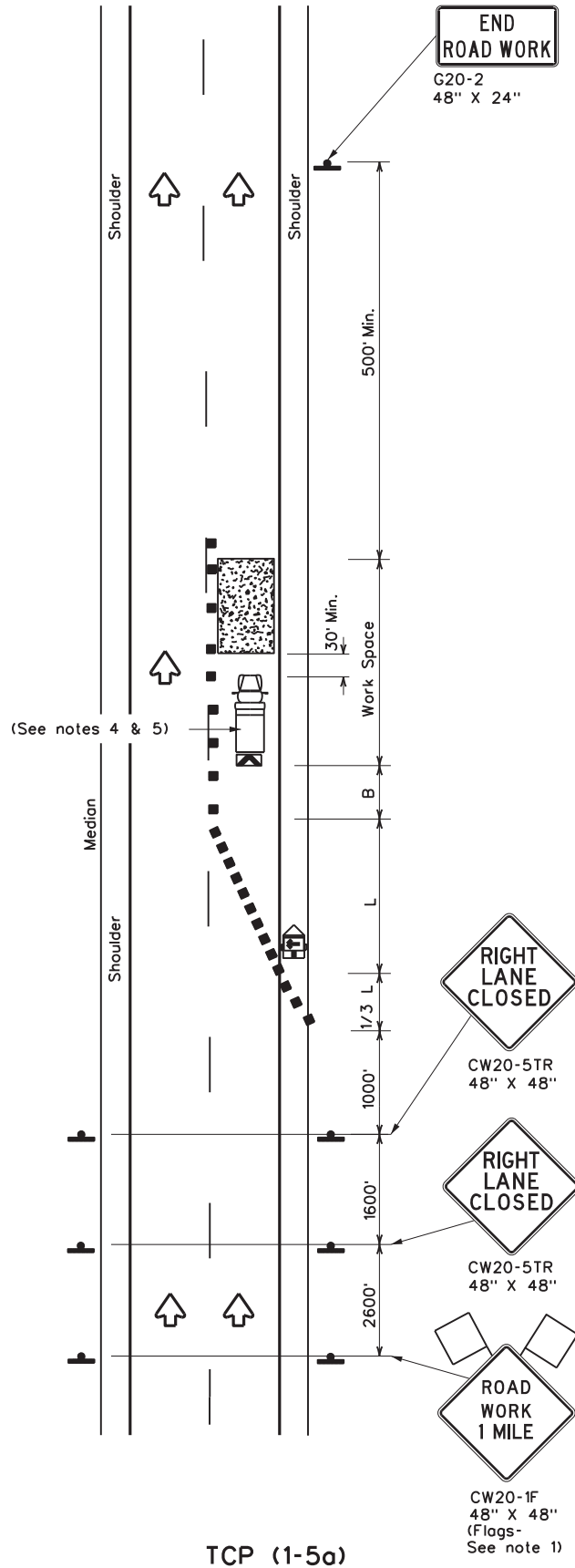
TCP (1-4b)

7. 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 1/2S where S is the speed in mph. This tighter device spacing is intended for the areas of conflicting markings, not the entire work zone.

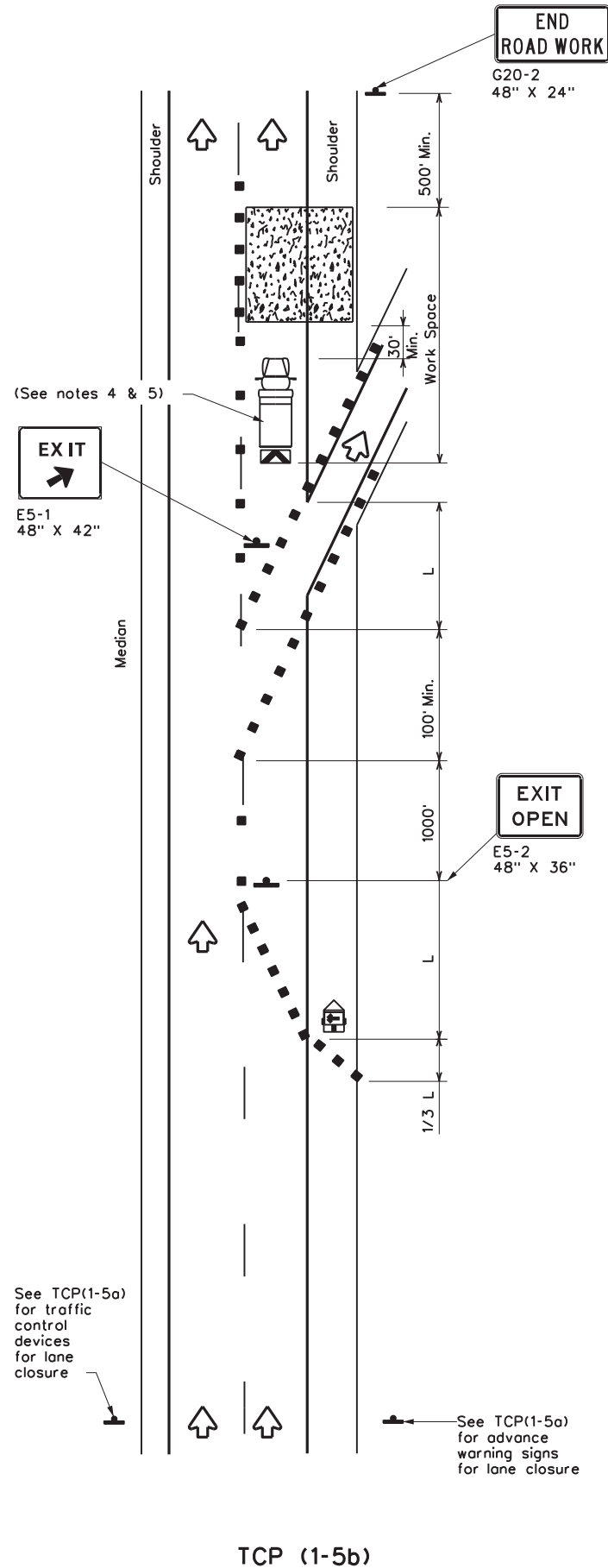
Texas Department of Transportation		Traffic Operations Division Standard	
TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS			
TCP(1-4)-18			
FILE:	tcp1-4-18.dgn	DN:	CK:
© TxDOT	December 1985	CON:	SECT:
REVISIONS	6467	89	JOB
2-94 4-98			001
8-95 2-12			US 190,ETC
1-97 2-18			
	WACO	COUNTY	SHEET NO.
	BELL,ETC		22

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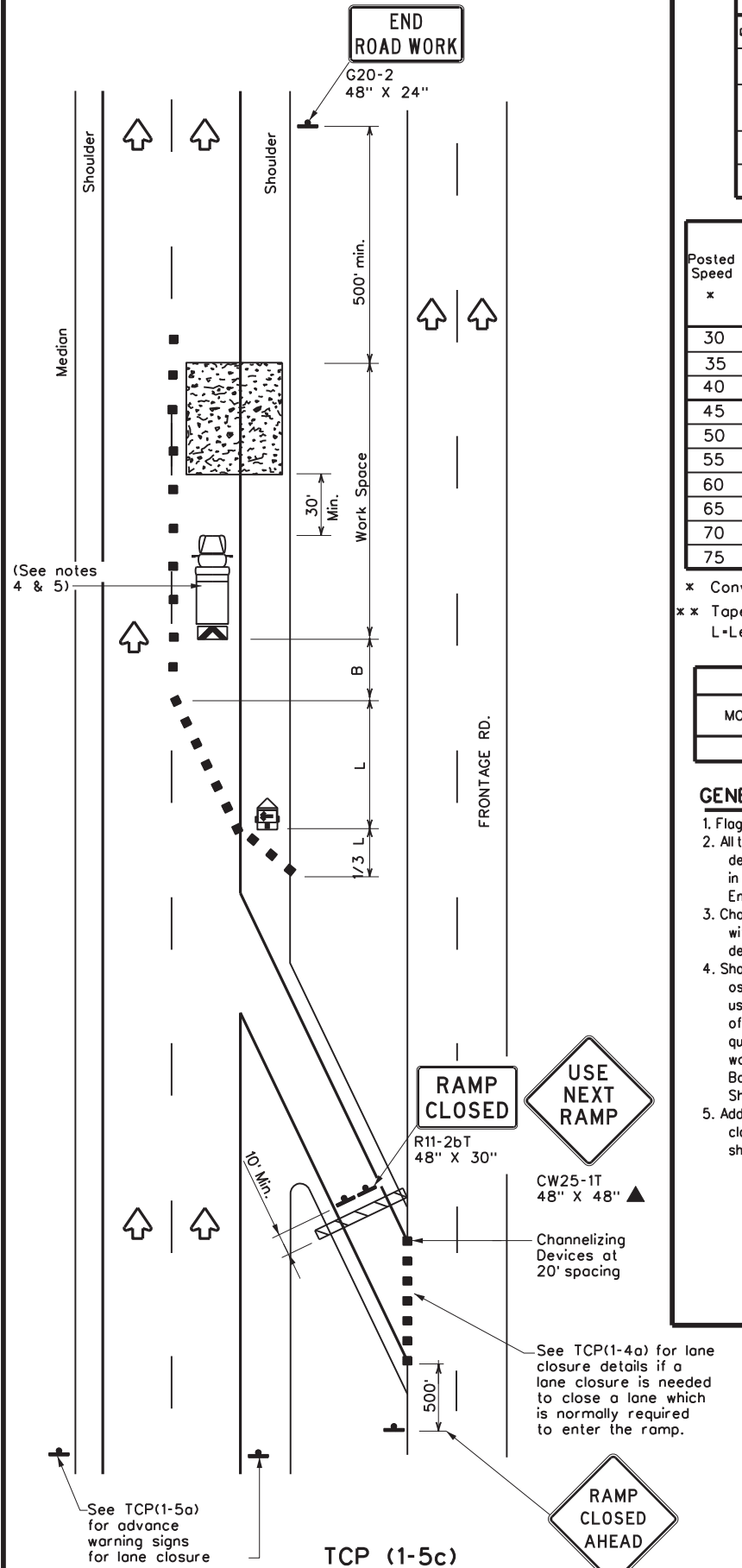
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ONE LANE CLOSURE



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 *	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	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

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

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

GENERAL NOTES

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

Texas Department of Transportation
 Traffic Operations Division Standard

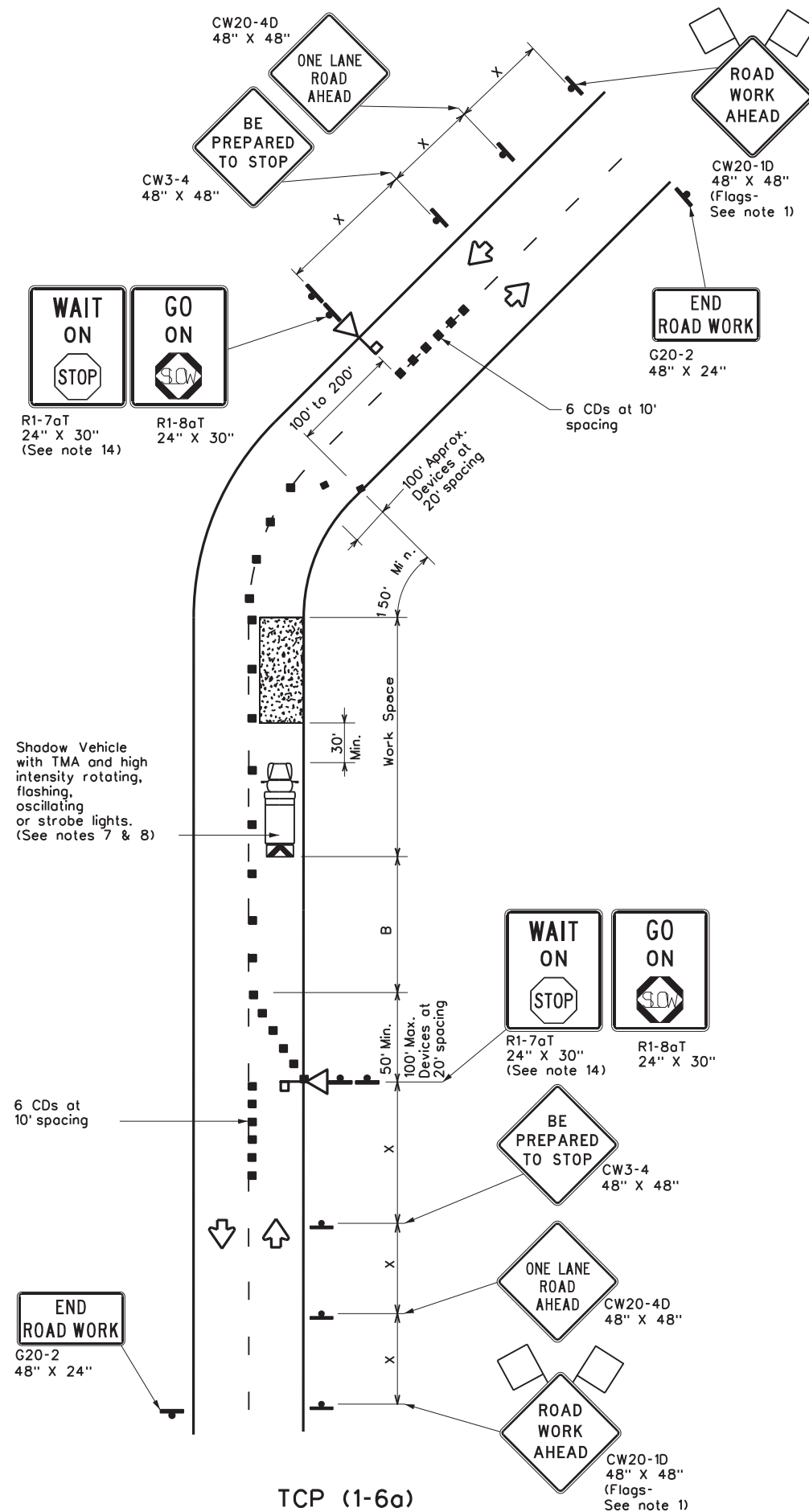
TRAFFIC CONTROL PLAN LANE CLOSURES FOR DIVIDED HIGHWAYS

TCP(1-5)-18

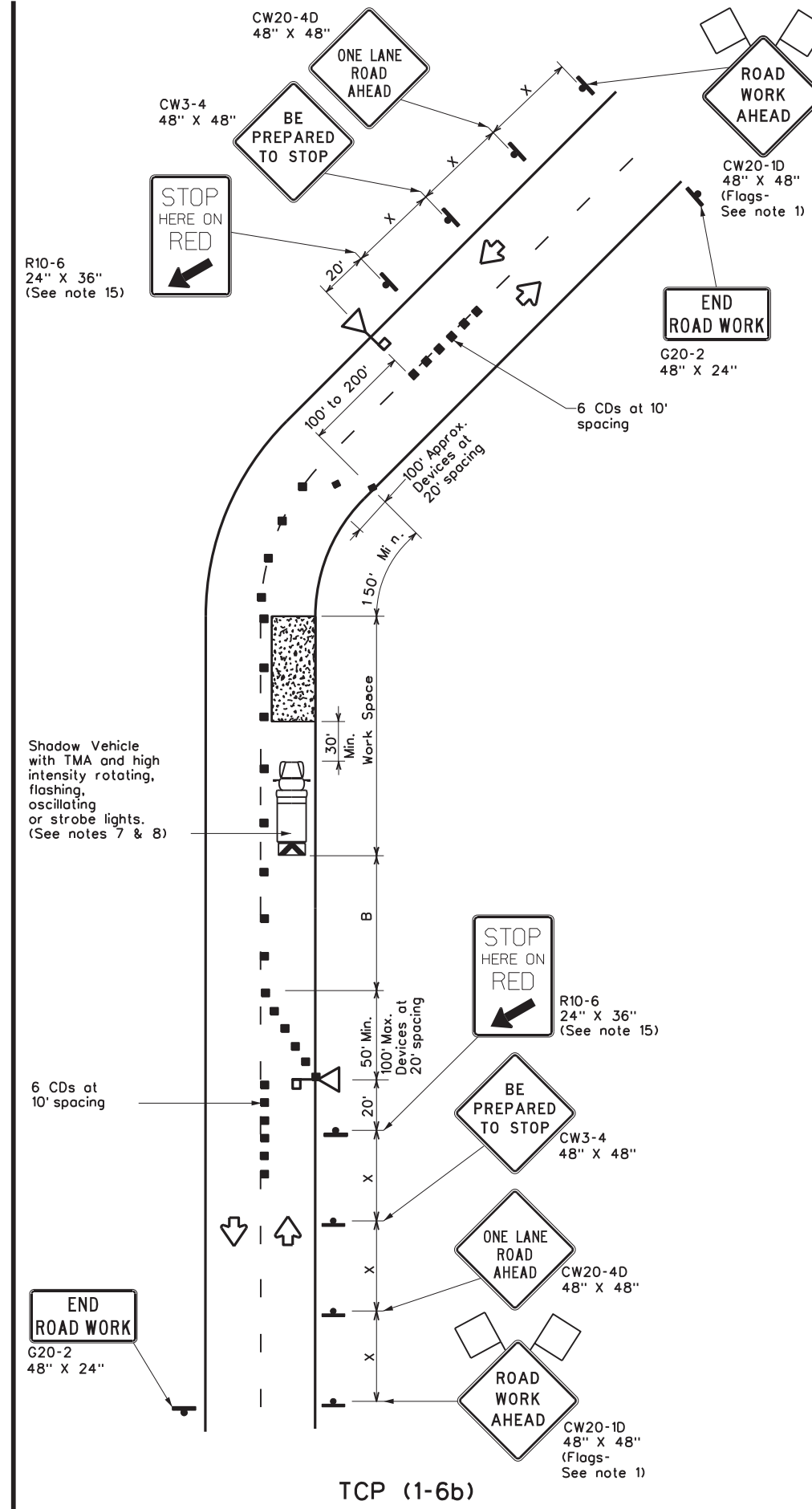
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© TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
2-18	REVISIONS	6467	89	001
	DIST	COUNTY		SHEET NO.
	WACO	BELL, ETC		23

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 FILE: c:\txdot\pw_online\txdot3\me\lendy\sm\th\d0754862\tcp1-6-18.dgn



TCP (1-6a)
ONE LANE TWO-WAY CONTROL WITH STOP/SLOW AFADs



TCP (1-6b)
ONE LANE TWO-WAY CONTROL WITH RED/YELLOW LENS AFADs

LEGEND			
	Type 3 Barricade		Channelizing Devices (CDs)
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Automated Flagger Assistance Device (AFAD)		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"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'	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'

* 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
	✓	✓		

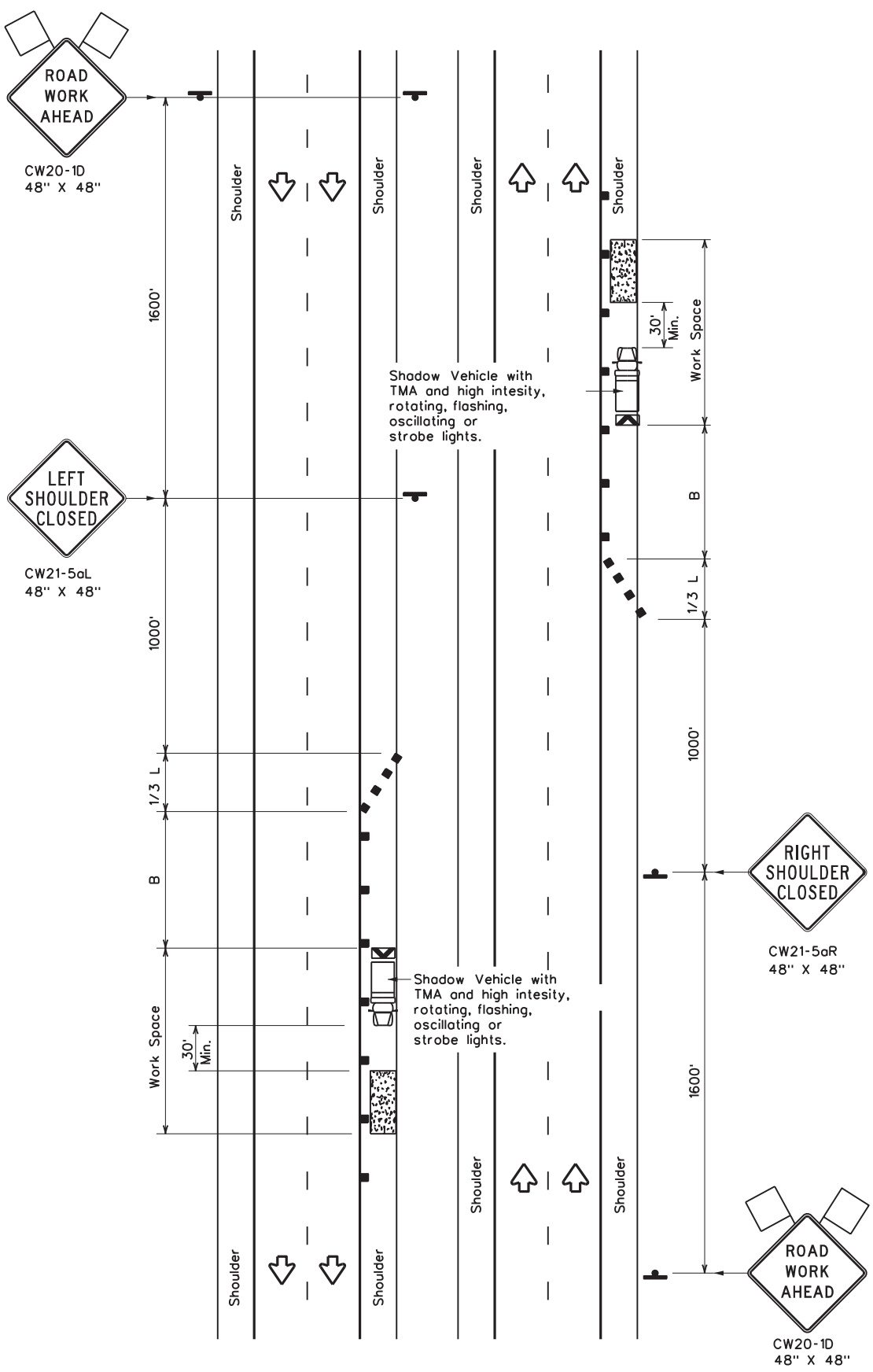
GENERAL NOTES

- Flags attached to signs where shown are REQUIRED.
- AFADs shall only be used in situations where there is one lane of approaching traffic in the direction to be controlled.
- Adequate stopping sight distance must be provided to each AFAD location for approaching traffic. (See table above).
- Each AFAD shall be operated by a qualified/certified flagger. Flaggers operating AFADs shall not leave them unattended while they are in use.
- One flagger may operate two AFADs only when the flagger has an unobstructed view of both AFADs and of the approaching traffic in both directions.
- When pilot cars are used, a flagger controlling traffic shall be located on each approach. AFADs shall not be operated by the pilot car operator.
- All AFADs shall be equipped with gate arms with an orange or fluorescent red-orange flag attached to the end of the gate arm. The flag shall be a minimum of 16" square.
- 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.
- 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 stopping sight distance to the AFAD.
- Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
- The R1-7aT "WAIT ON STOP" sign and the R1-8aT "GO ON SLOW" sign shall be installed at the AFAD location on separate supports or they may be fabricated as one 48" x 30" sign. They shall not obscure the face of the STOP/SLOW AFAD.
- The R10-6 "STOP HERE ON RED" arrow sign shall be offset so as not to obscure the lenses of the AFAD.

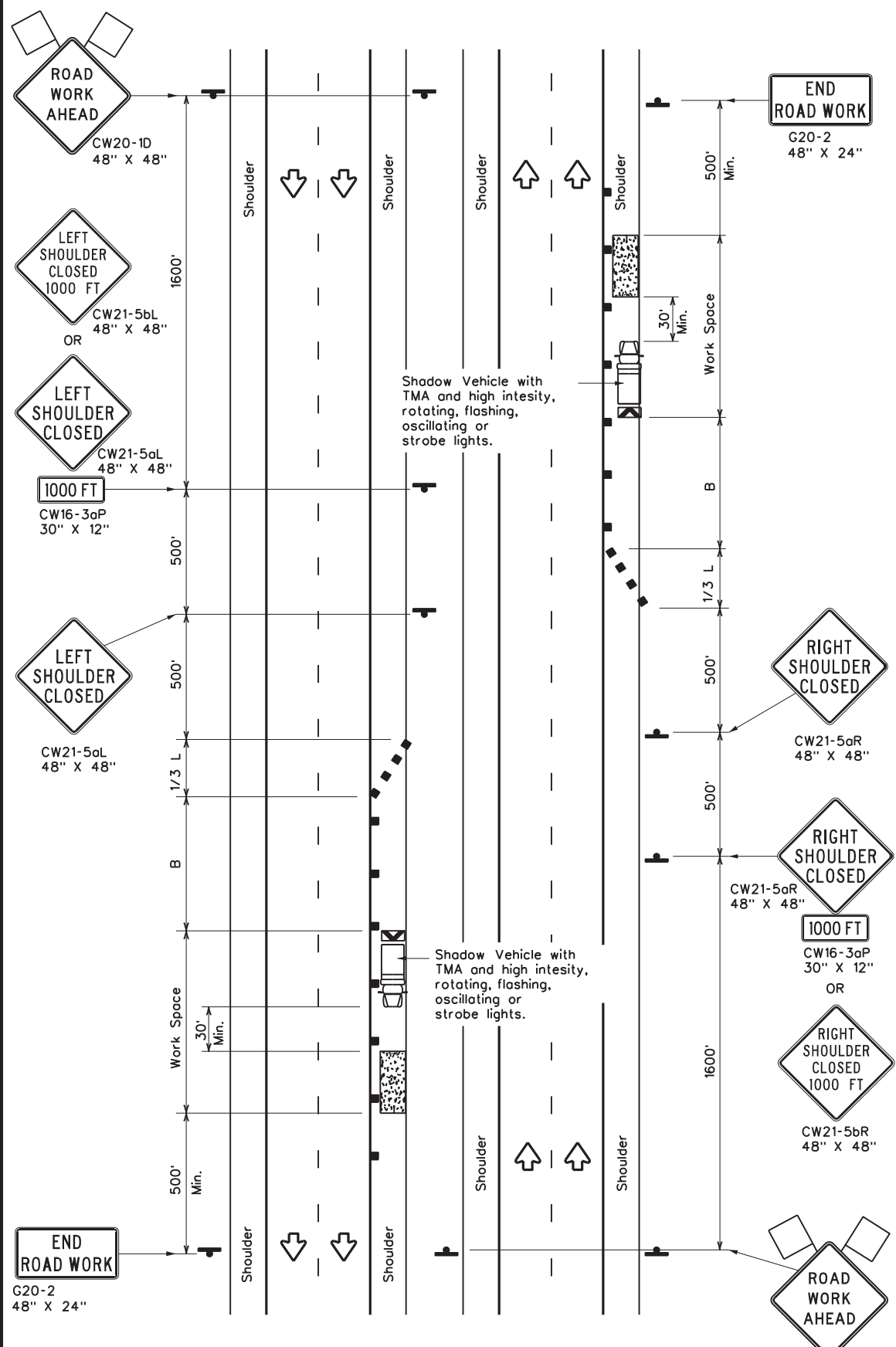
		Traffic Operations Division Standard	
TRAFFIC CONTROL PLAN AUTOMATED FLAGGER ASSISTANCE DEVICES (AFADs) TCP(1-6)-18			
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© TxDOT	February 2012	CONT:	SECT:
REVISIONS:	6467	89	001
2-18		DIST:	COUNTY:
		WACO	BELL, ETC
			SHEET NO. 24

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DATE: 7/29/2024
 FILE: c:\txdot\pw_online\txdot3\me\lendy.sm\th\d0754862\tcp5-1-18.dgn



TCP (5-1a)
WORK AREA ON SHOULDER



TCP (5-1b)
WORK AREA ON SHOULDER

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

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

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	TCP(5-1a)	TCP(5-1b)	TCP(5-1b)	

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



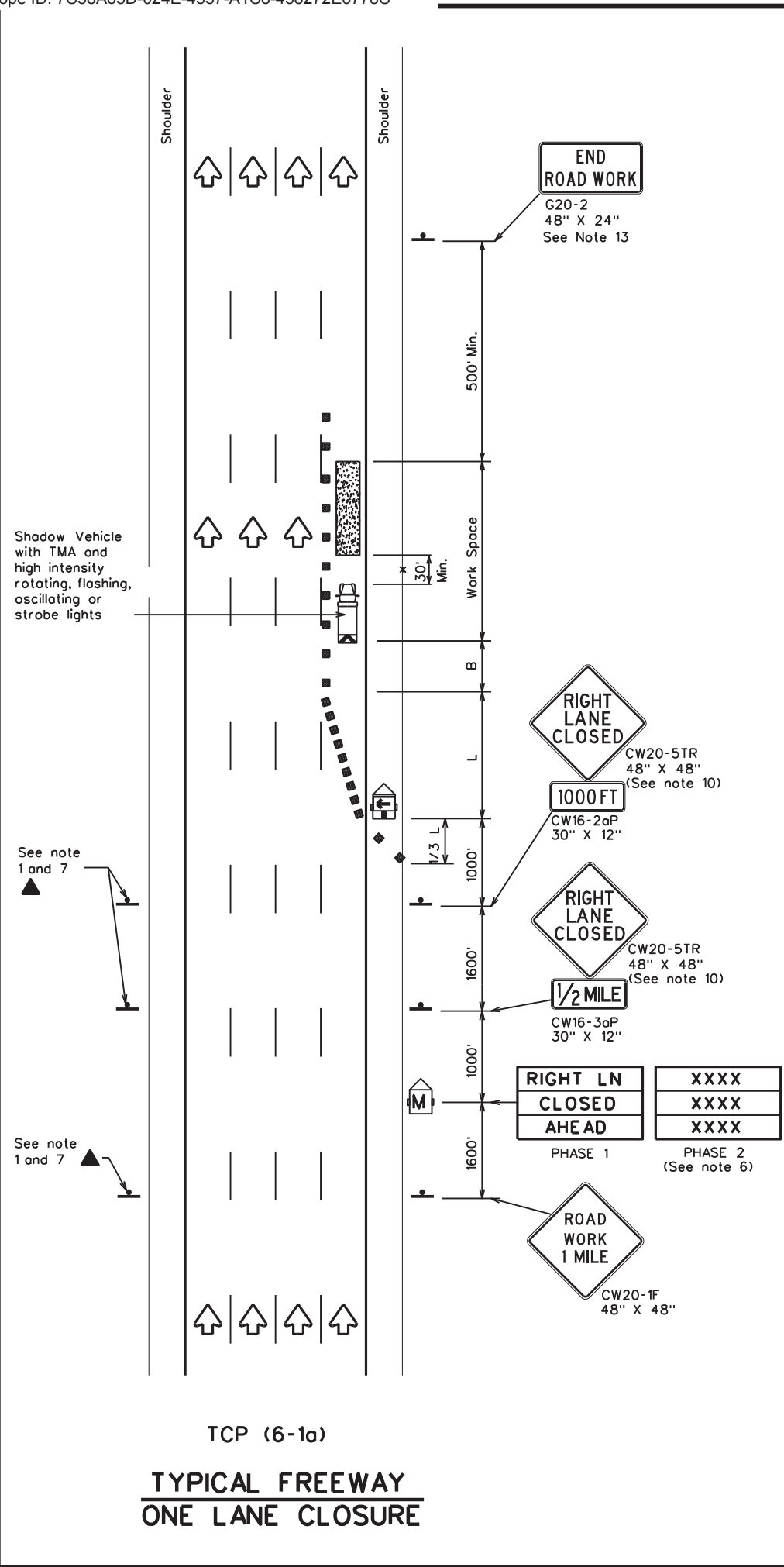
**TRAFFIC CONTROL PLAN
 SHOULDER WORK FOR
 FREEWAYS / EXPRESSWAYS**

TCP(5-1)-18

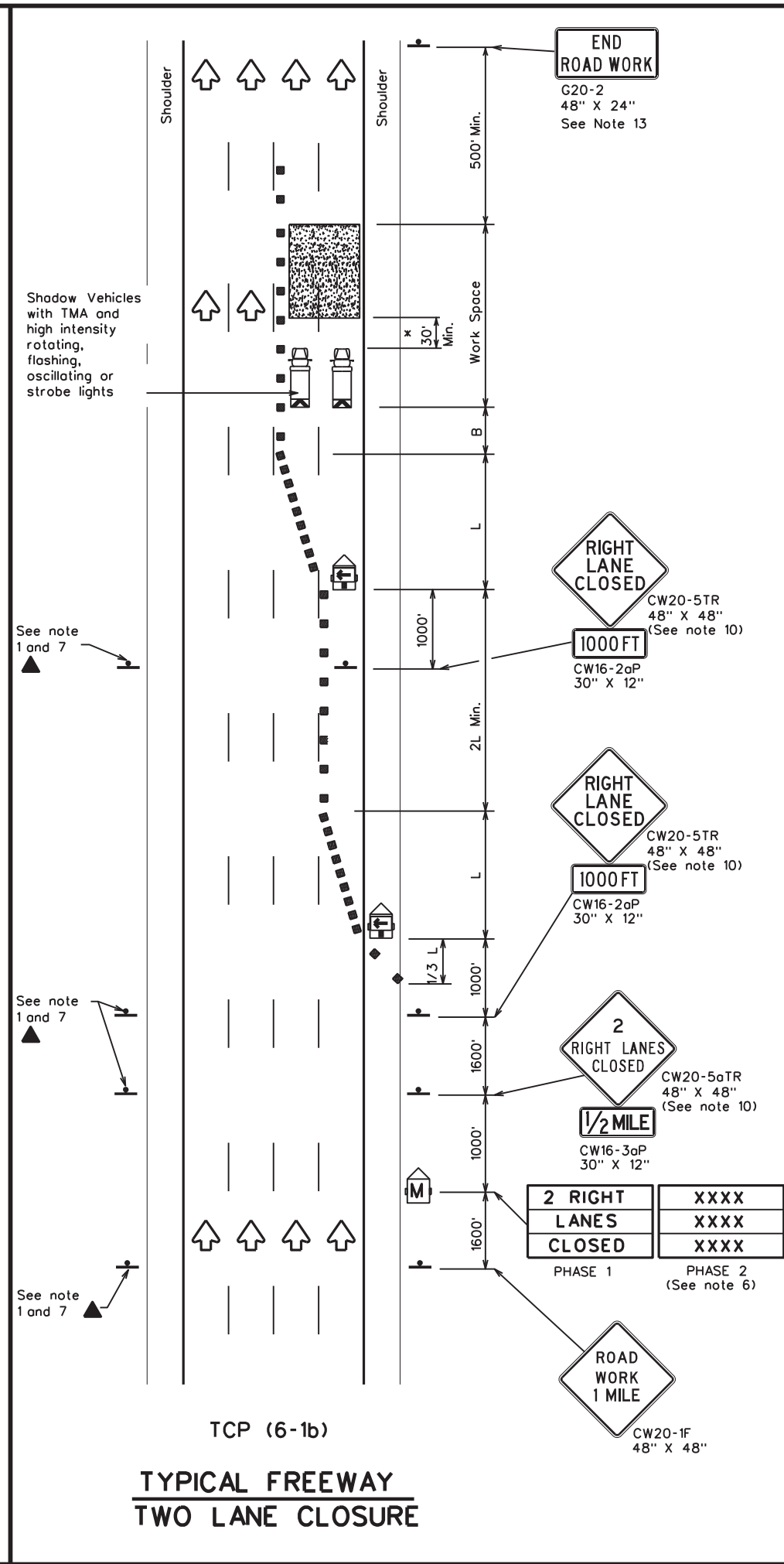
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© TxDOT	February 2012	CONT:	6467	SECT:	89	JOB:	001	HIGHWAY:	US 190,ETC
2-18	REVISIONS	DIST:	WACO	COUNTY:	BELL,ETC	SHEET NO.:	25		

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DATE: 7/29/2024 10:41:34 AM
 FILE: c:\txdot\pw_online\me\lendy.sm\th\d0754862\tcp6-1.dgn



TCP (6-1a)
TYPICAL FREEWAY ONE LANE CLOSURE



TCP (6-1b)
TYPICAL FREEWAY TWO LANE CLOSURE

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L" x x			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

** 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

- All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
- Drums or 42" cones are the typical channelizing devices. For Intermediate Term Stationary work, drums shall be used on tapers with drums or 42" cones used on tangent sections. Other channelizing devices may be used as directed by the Engineer.
- All construction signs and barricades placed during any phase of work shall remain in place until removal is approved by the Engineer.
- The Engineer may direct the Contractor to furnish additional signs and barricades as required to maintain traffic flow, detours and motorist safety during construction.
- Static message boards or changeable message signs stating the date and duration of ramp or freeway lane closures shall be placed a minimum of seven (7) calendar days in advance of the actual closure.
- Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE LEFT," recommended advisory speed, delay information, or other specific warnings.
- Duplicate construction warning signs should be erected on the medians side of freeways where median width will permit and traffic volume justifies the signing.
- The number of closed lanes may be increased provided the spacing of traffic control devices, taper lengths and tangent lengths meet the requirements of the TMUTCD.
- Warning signs for intermediate term stationary work should be mounted at 7' to the bottom of the sign.
- Warning signs shown shall be appropriately altered for left lane closures. When signs are mounted at 7' height for short term stationary or short duration work, sign versions shown in the SHSD for Texas with distances on the sign face rather than mounted on a plaque below the sign may be used.
- When possible, PCMS units should be located in advance of the last available exit ramp prior to the lane closure to allow motorists an alternate route. They may also be relocated to improve advance warning in case of unanticipated queuing or congestion.
- For Intermediate Term Stationary work at night, floodlights should be used to illuminate the work area and equipment crossings. Floodlights shall not produce a disabling glare condition for road users or workers.
- The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

* A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Texas Department of Transportation
 Traffic Operations Division Standard

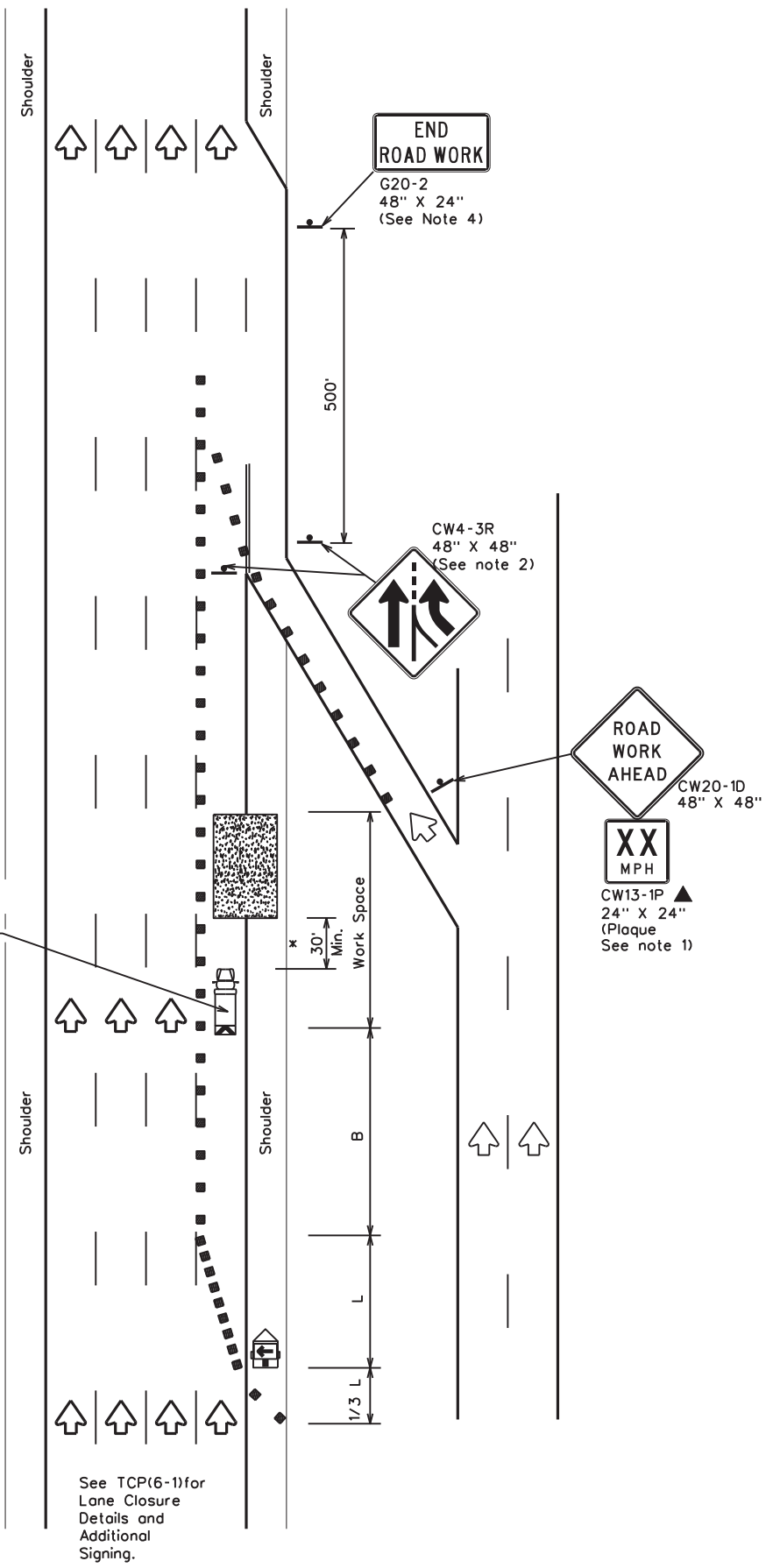
TRAFFIC CONTROL PLAN
FREEWAY LANE CLOSURES

TCP(6-1)-12

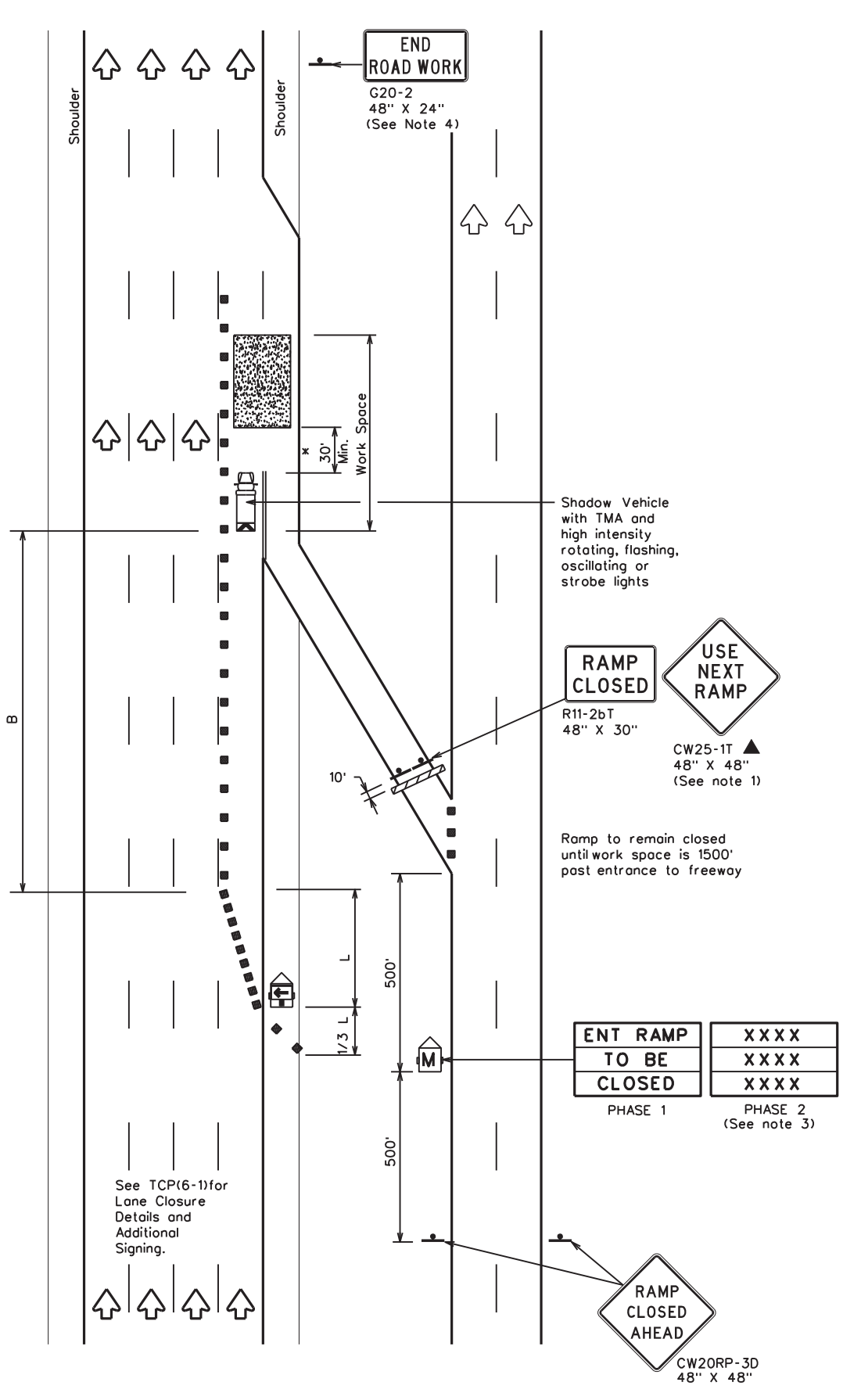
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© TxDOT February 1998	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
8-12	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 26	

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DATE: 7/29/2024 10:41:36 AM
 FILE: c:\txdot\pw_online\me\lendy.sm\th\d0754862\tcp6-2.dgn



TCP (6-2a)
ENTRANCE RAMP OPEN
WORK WITHIN 500' OF RAMP



TCP (6-2b)
ENTRANCE RAMP CLOSED

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L"			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

x 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

- All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
- ADDED LANE Symbol (CW4-3) sign may be omitted when sign between ramp and mainline can be seen from both roadways.
- See "Advance Notice List" on BC(6) for recommended date and time formatting options for PCMS Phase 2 message.
- The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

x A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.



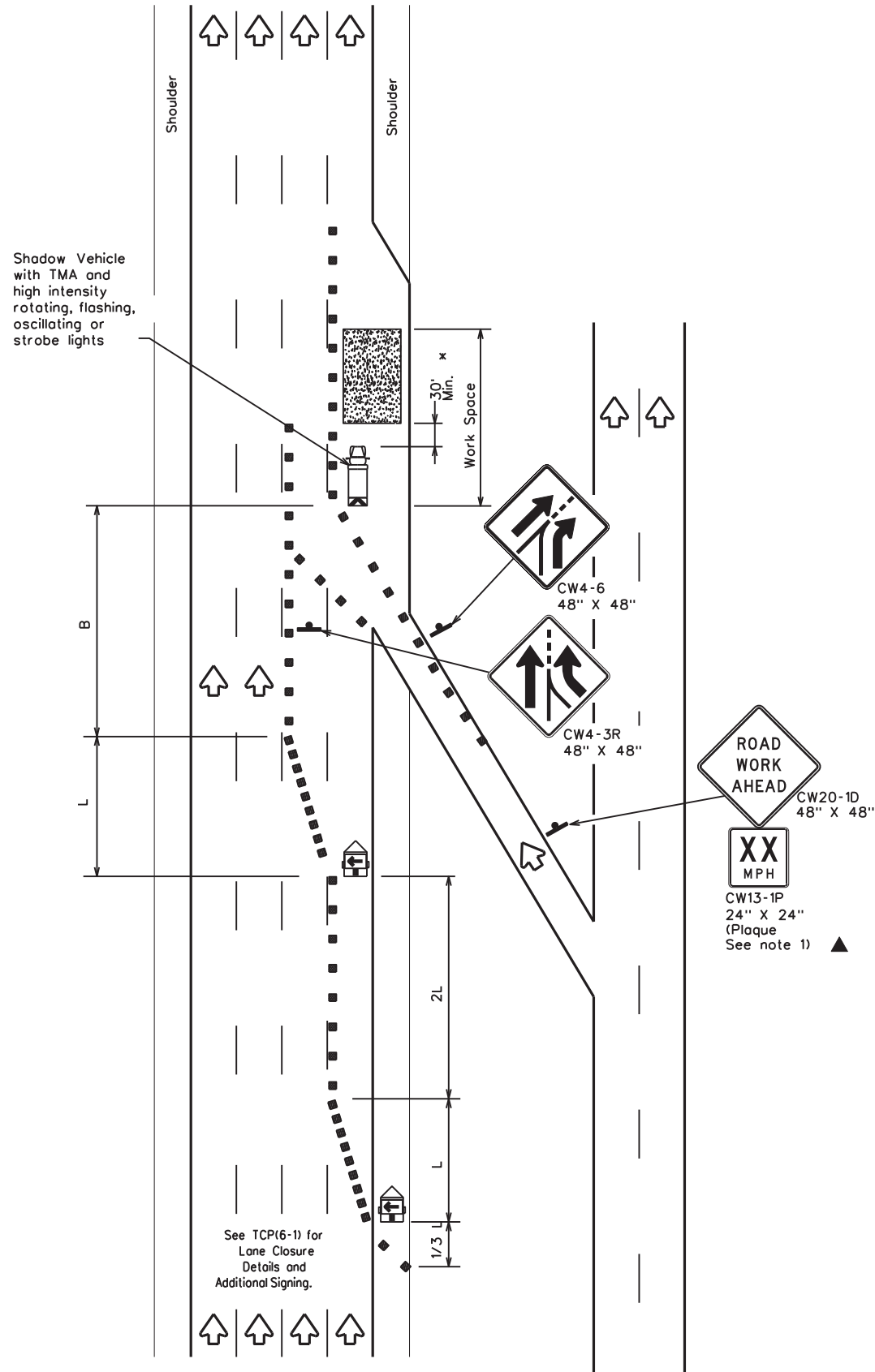
TRAFFIC CONTROL PLAN
WORK AREA NEAR RAMP

TCP(6-2)-12

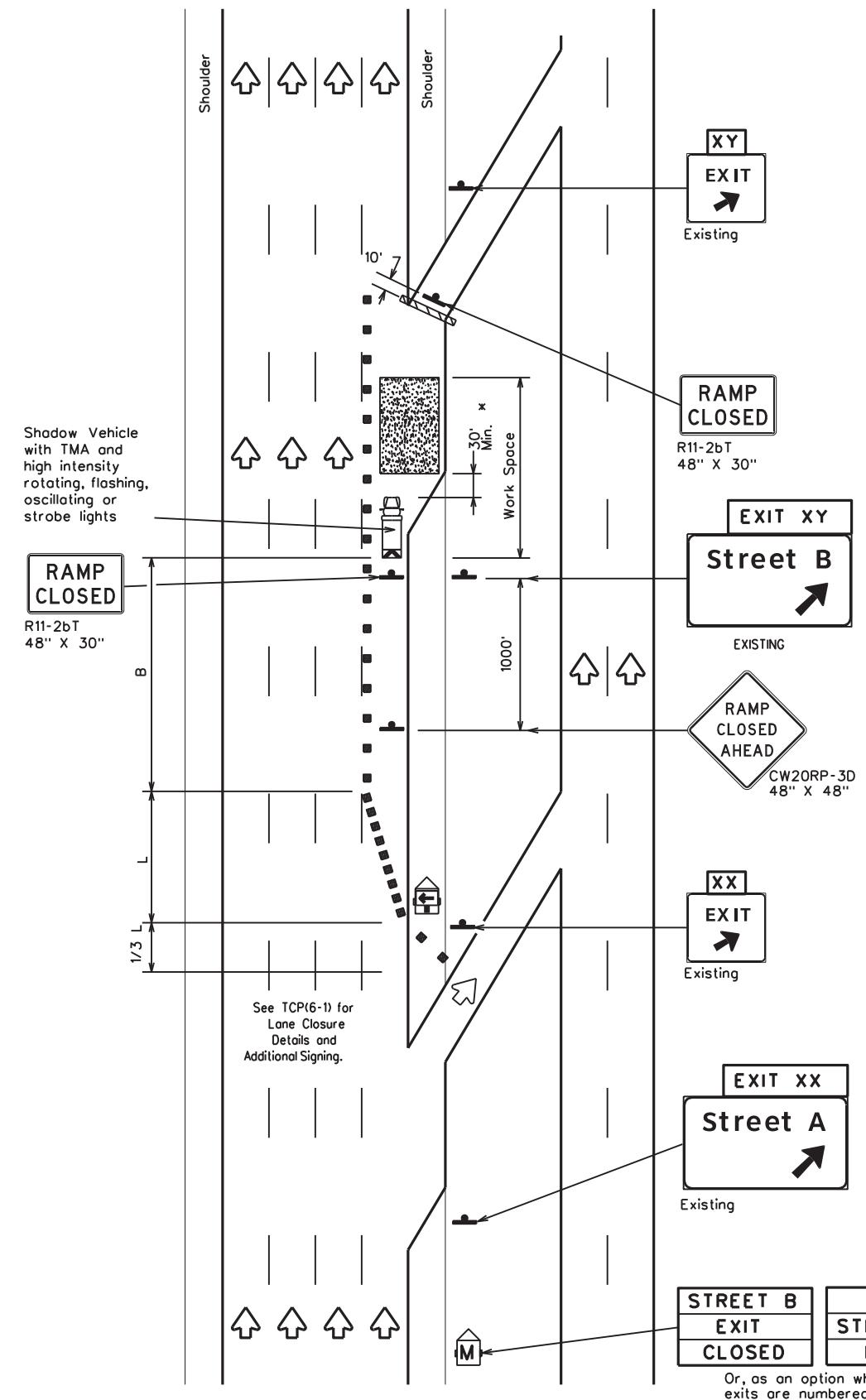
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©TxDOT	February 1994	CONT	SECT	JOB	HIGHWAY				
REVISIONS	6467	89	001	US	190,ETC				
1-97	8-98	DIST	COUNTY	SHEET NO.					
4-98	8-12	WACO	BELL,ETC	27					

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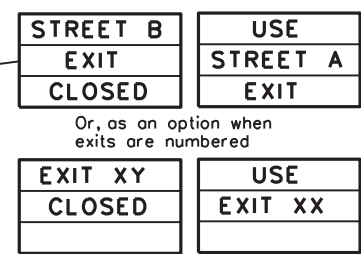
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TCP (6-3a)
ENTRANCE RAMP OPEN



TCP (6-3b)
EXIT RAMP CLOSED
TRAFFIC EXITS PRIOR TO CLOSED 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	Formula	Minimum Desirable Taper Lengths "L"			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

** 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:
 1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.

* A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.



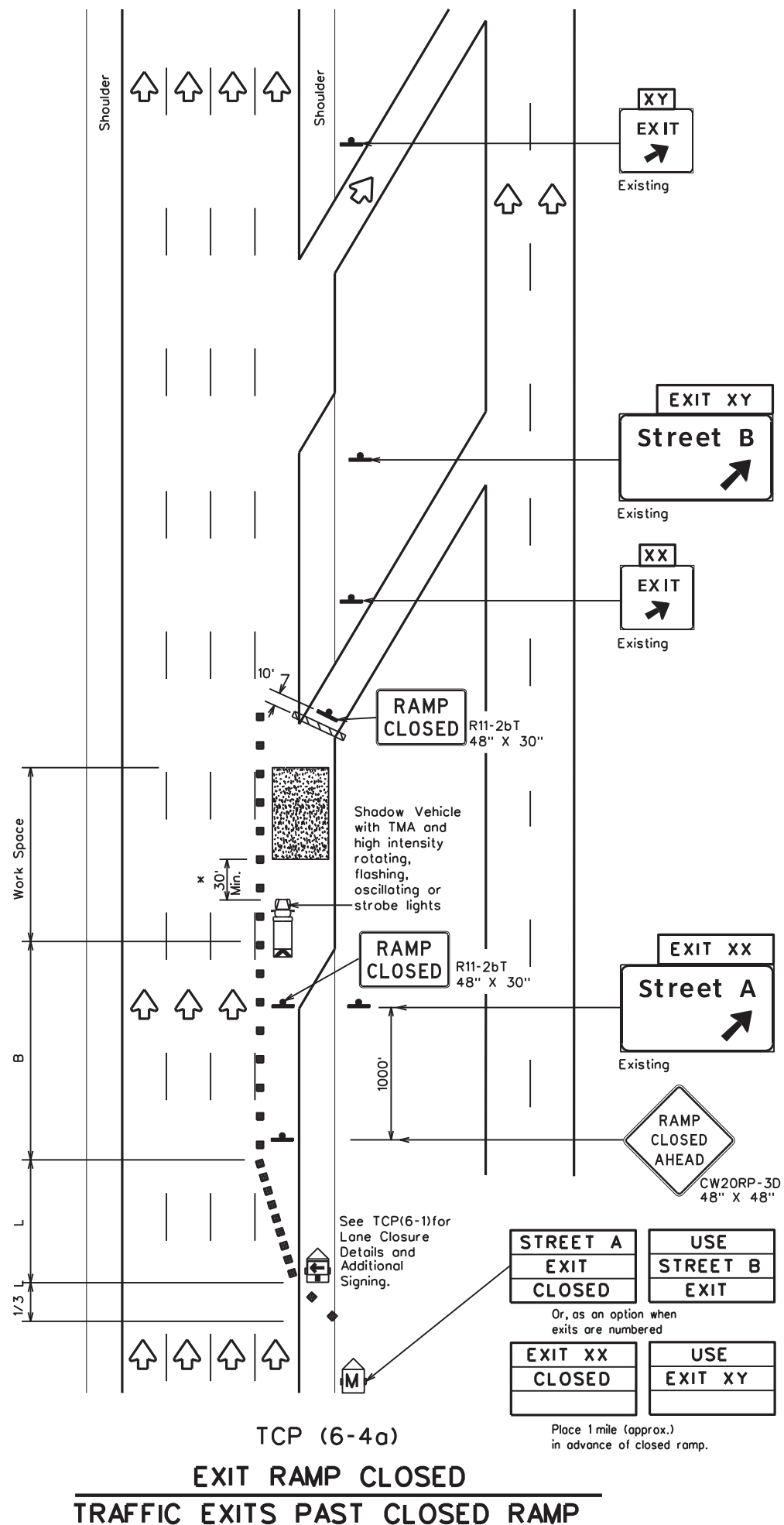
**TRAFFIC CONTROL PLAN
 WORK AREA BEYOND RAMP**

TCP(6-3)-12

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© TxDOT February 1994	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190,ETC
REVISIONS: 1-97 8-98 4-98 8-12	DIST: WACO	COUNTY: BELL,ETC	SHEET NO. 28	

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DATE: 7/29/2024 10:41:39 AM
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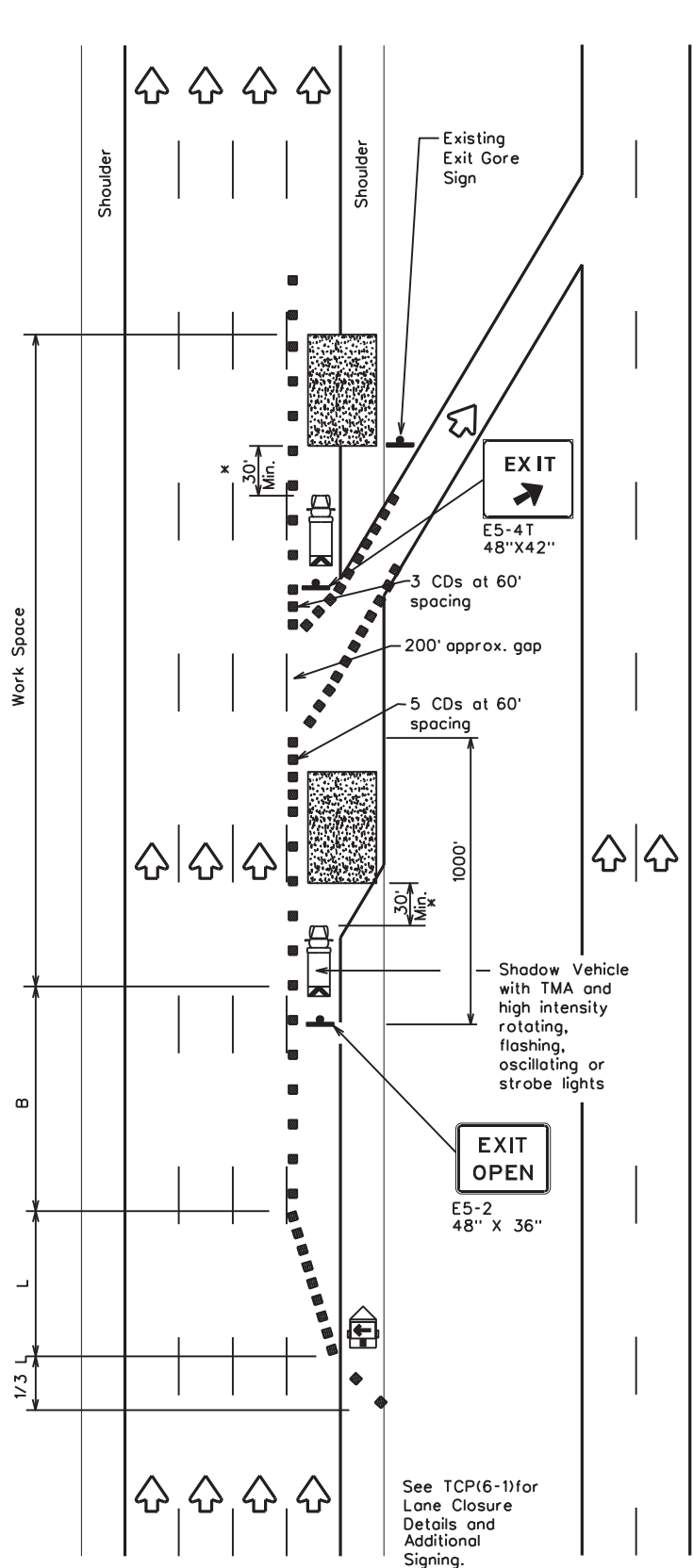


TCP (6-4a)
EXIT RAMP CLOSED
TRAFFIC EXITS PAST CLOSED RAMP

STREET A EXIT CLOSED	USE STREET B EXIT
EXIT XX CLOSED	USE EXIT XY

Or, as an option when exits are numbered

Place 1 mile (approx.) in advance of closed ramp.



TCP (6-4b)
EXIT RAMP OPEN

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L"			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

x 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

- All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
- See BC Standards for sign details.

x A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.



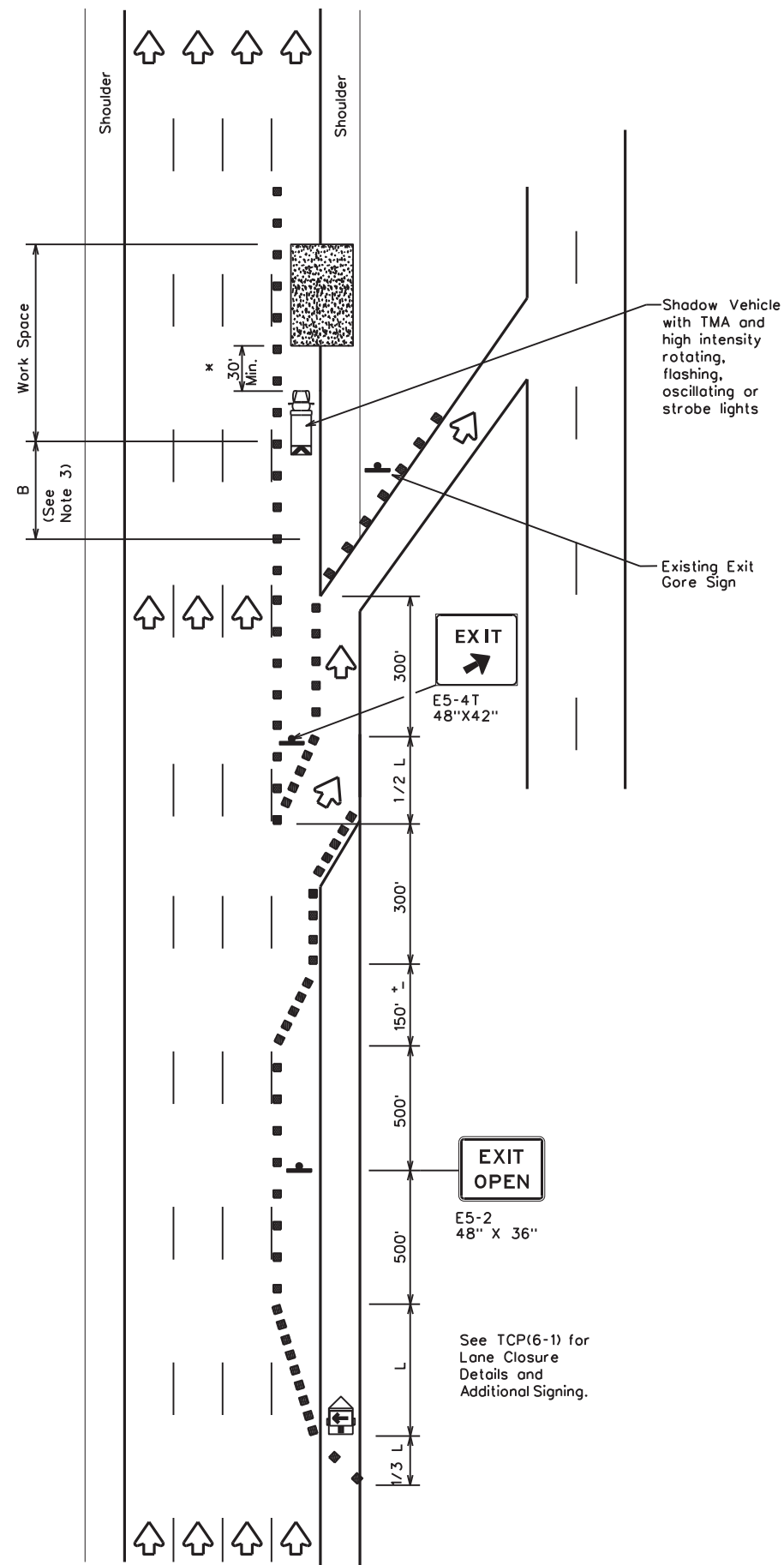
TRAFFIC CONTROL PLAN
WORK AREA AT EXIT RAMP

TCP(6-4)-12

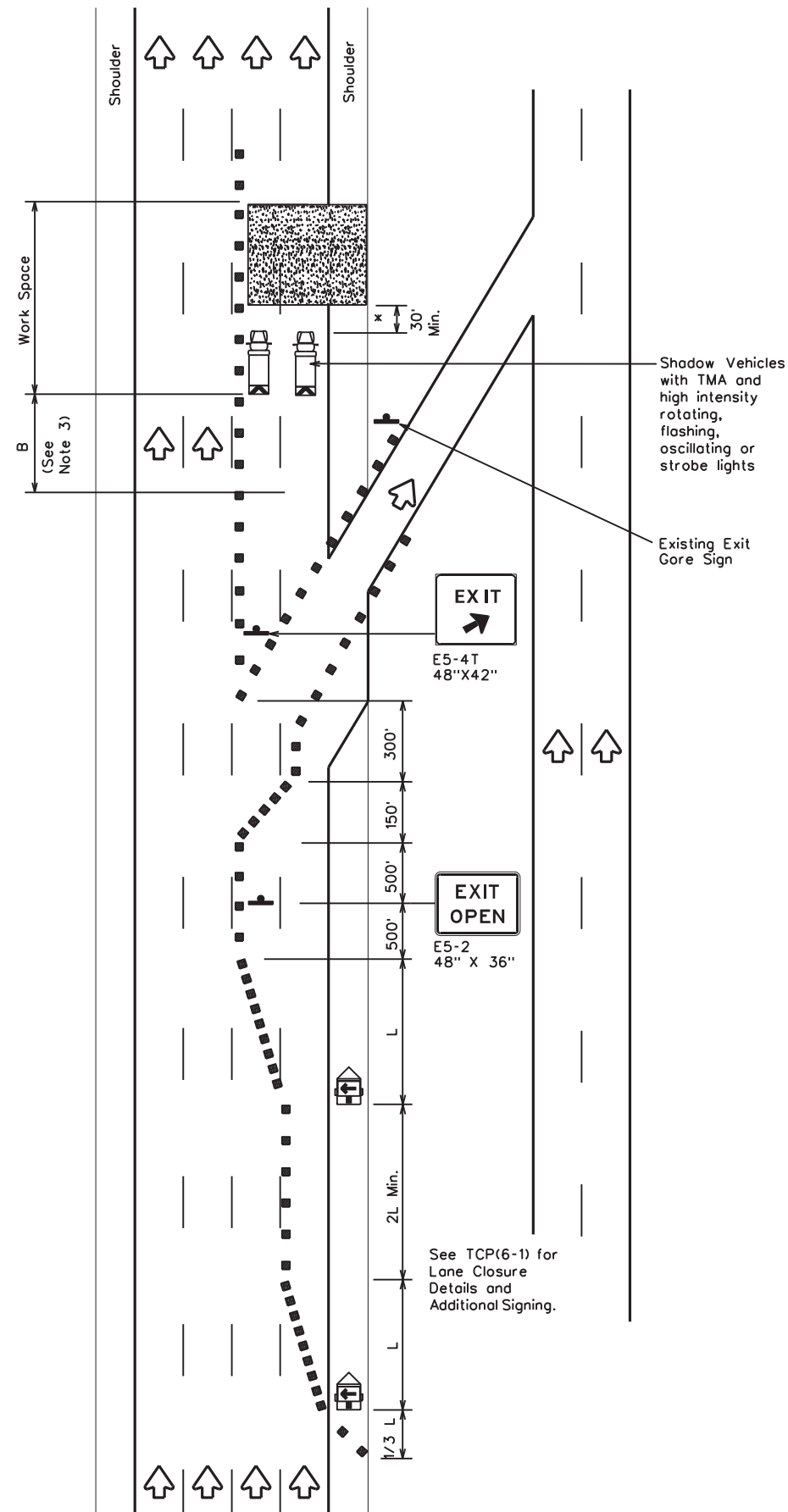
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©TxDOT February 1994	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190,ETC
REVISIONS: 1-97 8-98 4-98 8-12	DIST: WACO	COUNTY: BELL,ETC	SHEET NO. 29	

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DATE: 7/29/2024 10:41:41 AM
 FILE: c:\txdot\pw_online\txdot3\me\lendy.smth\d0754862\tcp6-5.dgn



TCP (6-5a)
EXIT RAMP OPEN



TCP (6-5b)
**EXIT RAMP OPEN
 TWO LANE CLOSURE WITHIN
 1500' PAST EXIT 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	Formula	Minimum Desirable Taper Lengths "L"			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

x 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

- All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
- See BC standards for sign details.
- If adequate longitudinal buffer length "B" does not exist between the work space and the exit ramp, consideration should be given to closing the ramp.

x A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.



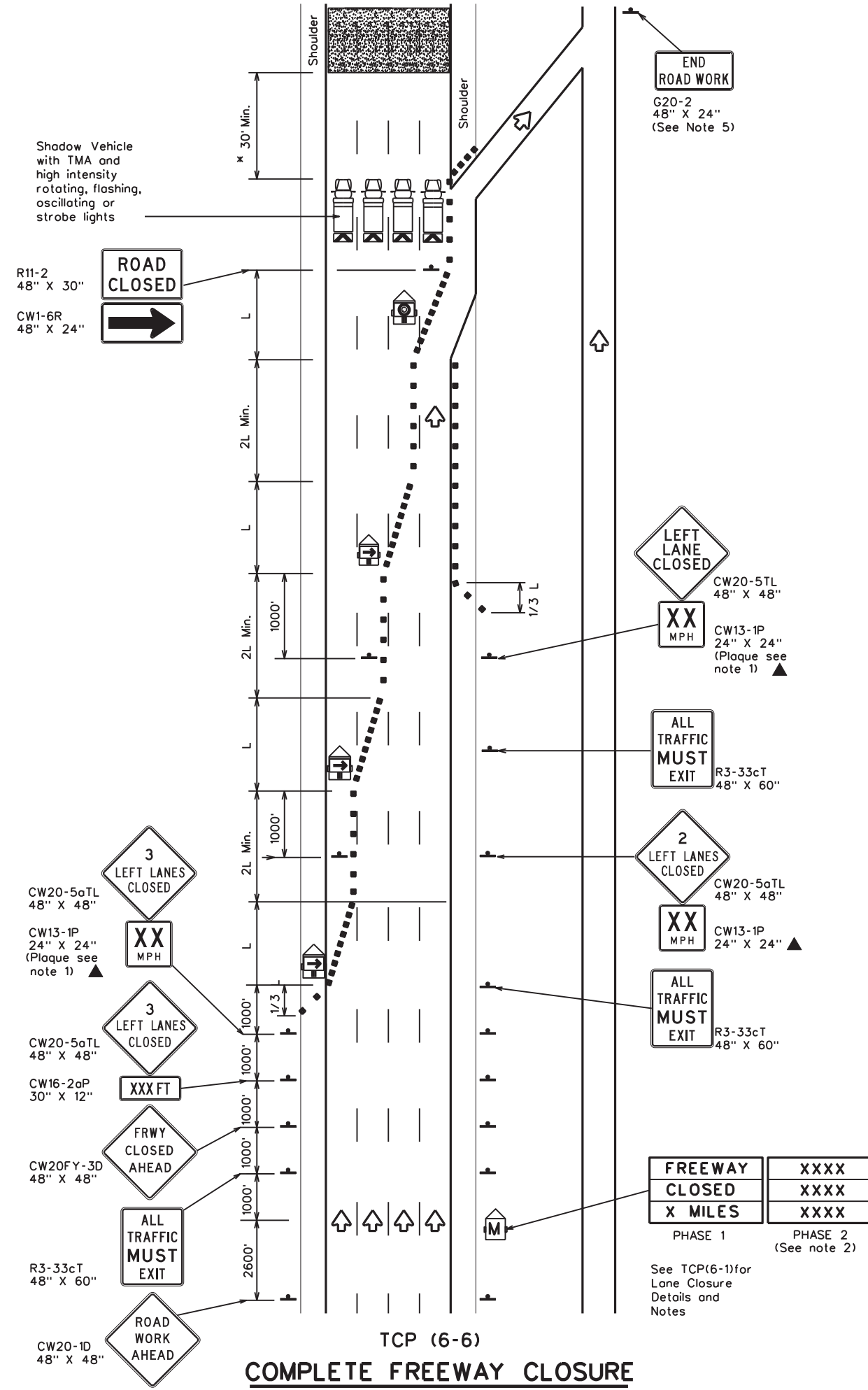
**TRAFFIC CONTROL PLAN
 WORK AREA BEYOND EXIT RAMP**

TCP(6-5)-12

FILE: tcp6-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190,ETC
REVISIONS: 1-97 8-98	DIST: WACO	COUNTY: BELL,ETC	SHEET NO. 30	
4-98 8-12				

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DATE: 7/29/2024 10:41:43 AM
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LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Portable Changeable Message Sign (PCMS)
	Flashing Arrow Board in Caution Mode		Traffic Flow
	Sign		

Posted Speed	Formula	Minimum Desirable Taper Lengths "L"			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L = WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

** 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**
- All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
 - Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE RIGHT," recommended speed, delay, exit information, or other specific warnings.
 - Where queuing is anticipated beyond signing shown, additional PCMS signs, other warning signs, devices or Law Enforcement Officers should be available to warn approaching high speed traffic of the end of the queue, as directed by the Engineer.
 - Entrance ramps located from the advance warning area to the exit ramp should be closed whenever possible.
 - The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

* A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
 Traffic Operations Division Standard

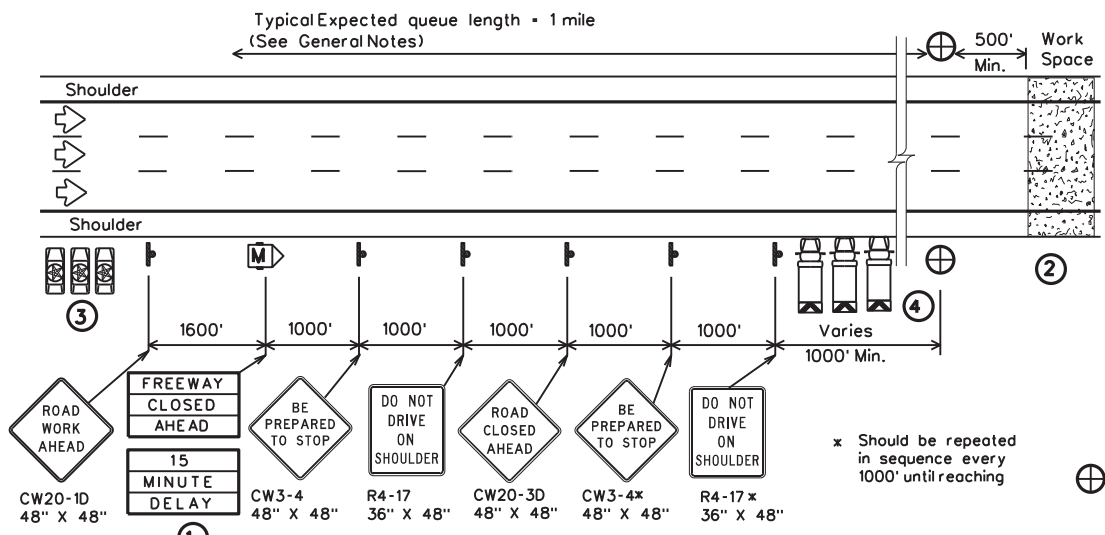
TRAFFIC CONTROL PLAN FREEWAY CLOSURE

TCP(6-6)-12

FILE: tcp6-6.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
1-97 8-98	DIST	COUNTY	SHEET NO.	
4-98 8-12	WACO	BELL,ETC	31	

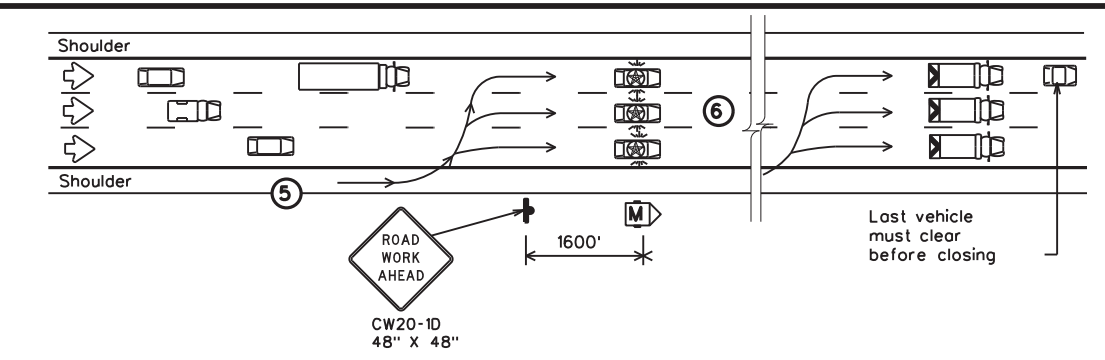
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DATE: 7/29/2024 10:41:44 AM
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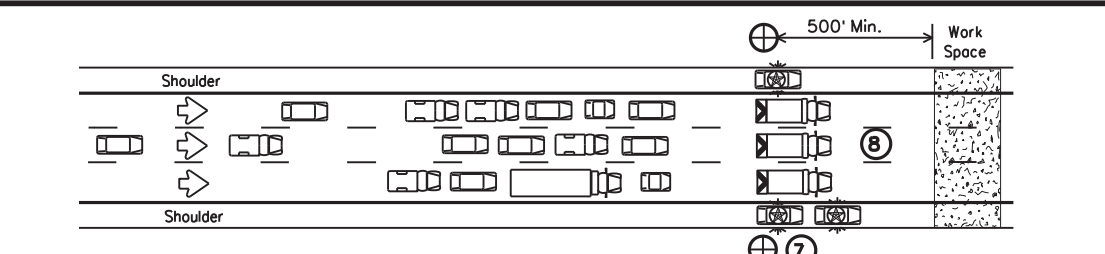
1 STARTING POSITION

- 1 Traffic control devices should be installed or located near their intended position prior to beginning temporary roadway closure sequence. Duplicate signs should be erected on the median side of the roadway when median width permits. Warning signs should not be placed on the paved shoulders that will be used by the WARNING LEOV, or where movement of the LEOVs or barrier vehicles will be impeded.
- 2 Prior to beginning the roadway closure sequence, all equipment, materials, personnel, and other items necessary to complete the work should be gathered near the work area. Entrance ramps located in the area where a queue is expected to build should be closed.
- 3 There should be one LEOV for every lane to be controlled, plus a minimum of one to warn traffic approaching a queue. An additional lead law enforcement officer is desirable to remain with the Engineer's or Contractor's point of contact (POC) during the operation in order to improve communication with all LEOVs involved.
- 4 One barrier vehicle with a Truck Mounted Attenuator and amber or blue and amber high intensity flashing/oscillating/strobe lighting shall be used for each lane to be closed.



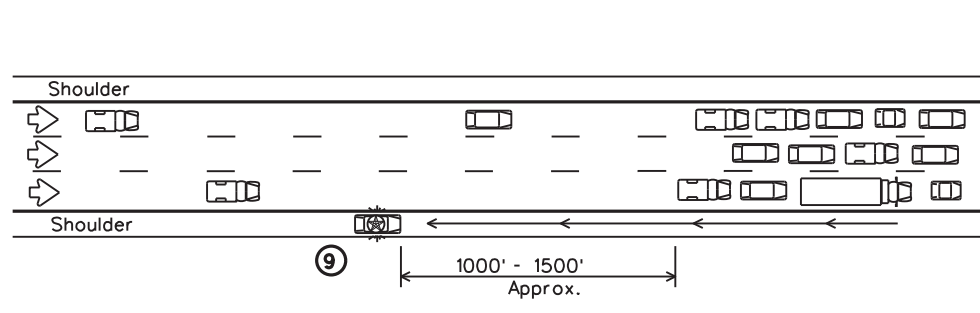
2 REDUCING SPEED OPERATION

- 5 Starting position of the LEOVs should be in advance of the most distant warning signs.
- 6 Once the LEOVs have achieved an abreast blocking formation while traveling toward the CP, emergency lights and headlights should be turned "ON". The LEOVs should maintain formation, not allow traffic to pass, and begin to decelerate. The LEOVs should continue to decelerate, giving the barrier vehicles opportunity to be staged upstream of the work space after traffic has cleared. The LEOVs should then continue to decelerate slowly until bringing traffic to a stop near the barrier vehicles.



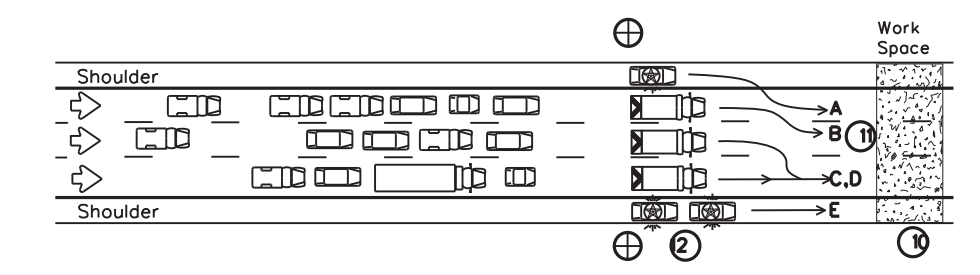
3 ALL TRAFFIC STOPPED AT CP

- 7 Once traffic is stopped the LEOVs should park on the shoulders with emergency lighting "ON" in order to provide law enforcement presence at the closure and keep shoulders blocked ahead of the work space. They should stay in radio contact with the WARNING LEOV.
- 8 The barrier vehicles should be parked, one in each lane, the parking brake set, with the high visibility flashing/oscillating/strobe lighting "ON," and the transmission in gear.



4 WARNING THE TRAFFIC QUEUE

- 9 The WARNING LEOV should proceed to the right shoulder of the roadway, with emergency lights on approximately 1000' in advance of the traffic queue (stopped traffic) as the queue develops. When determined that limited sight distance situations (crest of hills, sharp roadway curvature, etc.) may occur to motorists approaching the queue, the WARNING LEOV may proceed 1/4 mile or more in advance of the queue.



5 RELEASING STOPPED TRAFFIC

- 10 All equipment, materials, personnel, and other items should be removed from the roadway and maintain an adequate clear zone.
- 11 When the roadway is clear for traffic, the LEOV should proceed forward from the left shoulder followed by the barrier vehicles, from left to right, as shown alphabetically in the plan view.
- 12 The LEOV or LEOVs on the right shoulder may remain on the shoulder until satisfied that traffic is moving satisfactorily before merging or proceeding.
- 13 LEOVs and barrier vehicles should re-group at their respective starting positions if necessary.

LEGEND			
■	Channelizing Devices	⊕	Control Position (CP)
M	Portable Changeable Message Sign (PCMS)	⊠	Barrier Vehicle with Truck Mounted Attenuator
Ⓜ	Law Enforcement Officer's Vehicle (LEOV)	←	Traffic Flow

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

GENERAL NOTES

1. All traffic control devices shall conform with the latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Additional guidelines for traffic control devices may be found in the TMUTCD. Signs conflicting with the roadway closure sequence should be completely removed or covered. Additional traffic control devices may be required for closure of access roads, cross streets, exit and entrance ramps as directed by the Engineer.
2. Law enforcement officers and all workers involved should review and understand all procedures before the roadway closure sequence begins. Pre-work meetings may be held for this purpose. Local emergency services and media should have advance notification of roadway closure, expected dates and approximate times of closures.
3. Law enforcement officers shall be in uniform and have jurisdiction in the locale of the work area. An additional WARNING Law Enforcement Officer's Vehicle (LEOV) may be used on the median side of the roadway where median shoulder width permits (See sequence *9).
4. The roadway closure should be during off-peak hours, as shown in the plans, or as directed by the Engineer.
5. Work should be limited to approximately 15 minutes maximum duration unless otherwise directed by the Engineer based on existing roadway conditions. If the work is not complete within 15 minutes, or if the end of the traffic queue extends past the most distant advance warning signs, the work area should be cleared of all equipment, materials, personnel, and other items, and the roadway reopened. When the queue has dissipated and the traffic flow appears normal the roadway closure sequence may be repeated.
6. For traffic volumes greater than 1000 Passenger Cars Per Hour Per Lane (PCPHPL), or for roadway closures that exceed 15 minutes, see details elsewhere in the plan.
7. If traffic queues beyond the advance warning signs during one road closure sequence, the advance warning should be extended prior to repeating the road closure sequence. When possible, PCMS signs should be located in advance of the last available exit prior to the closure to allow motorists the choice of an alternate route.

THIS PLAN IS INTENDED TO BE USED AT LOCATIONS/TIMES WHEN TRAFFIC VOLUMES ARE LESS THAN 1000 PASSENGER CARS PER HOUR PER LANE.

Texas Department of Transportation

 Traffic Operations Division Standard

TRAFFIC CONTROL PLAN SHORT DURATION FREEWAY CLOSURE SEQUENCE

TCP(6-7)-12

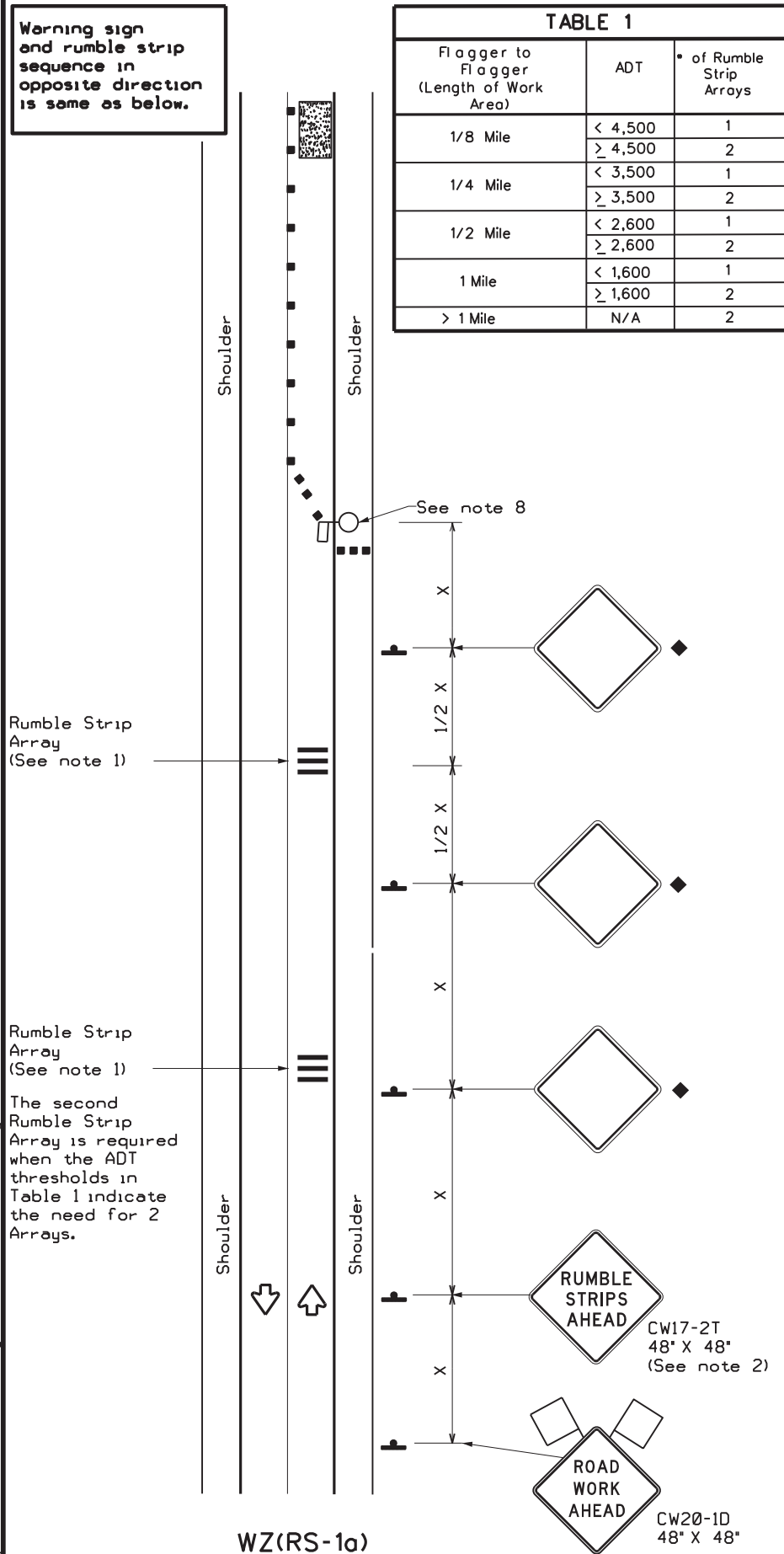
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© TxDOT February 1998	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
REVISIONS: 1-97 8-12 4-98	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 32	

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

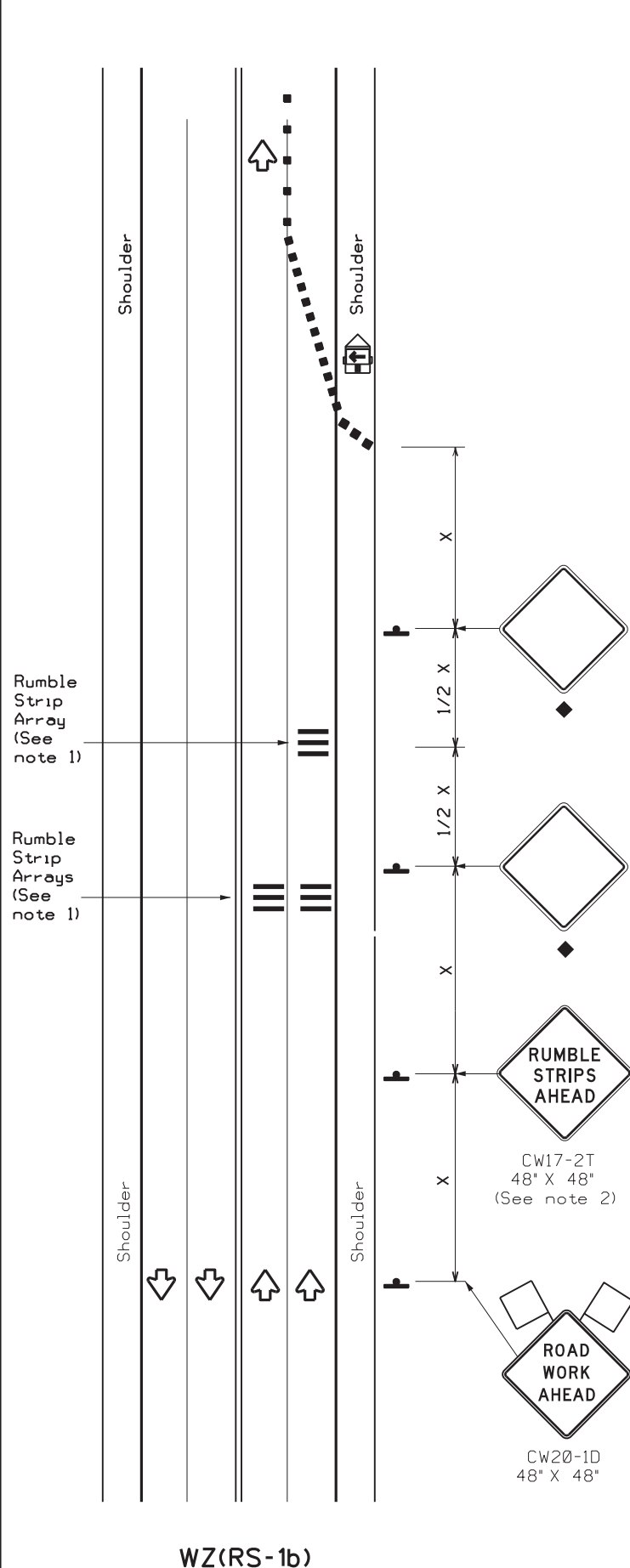
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Flagger to Flagger (Length of Work Area)	ADT	• of Rumble Strip Arrays
1/8 Mile	< 4,500	1
	≥ 4,500	2
1/4 Mile	< 3,500	1
	≥ 3,500	2
1/2 Mile	< 2,600	1
	≥ 2,600	2
1 Mile	< 1,600	1
	≥ 1,600	2
> 1 Mile	N/A	2



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 at the spacing shown in Table 2, placed transverse across the lane at locations shown.
- The CW17-2T "RUMBLE STRIPS AHEAD" sign should be located after the CW20-1D "ROAD WORK AHEAD" sign and spaced as shown. If traffic is observed to be queuing, or is expected to queue beyond the Rumble Strips, the CW17-2T sign and the first Rumble Strip Array may be located upstream of the CW20-1D sign as necessary to provide needed warning.
- Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
- 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 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 ² / 60	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40	L = WS	265'	295'	320'	40'	80'	240'	155'
45		450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75	750'	825'	900'	75'	150'	900'	540'	

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

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

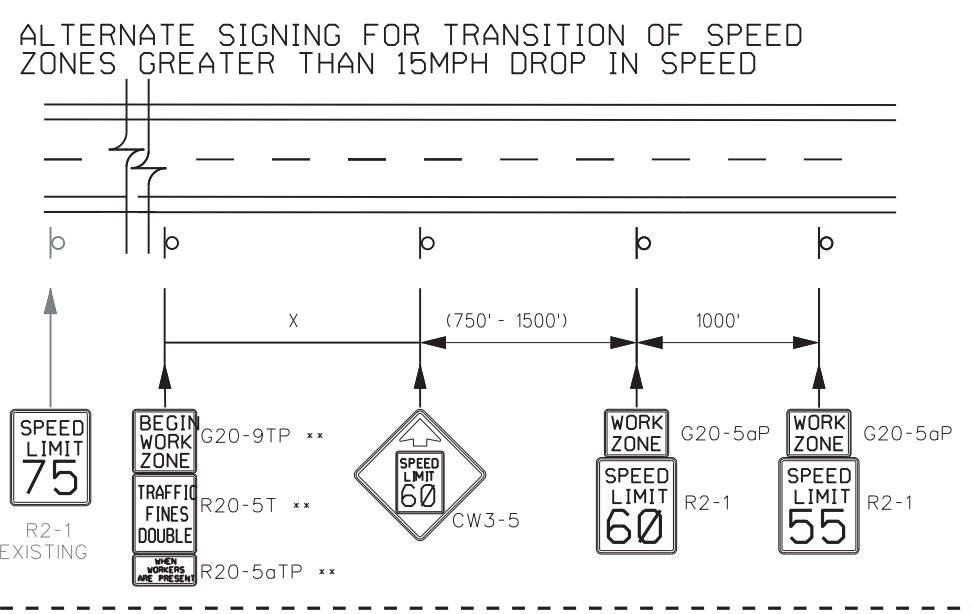
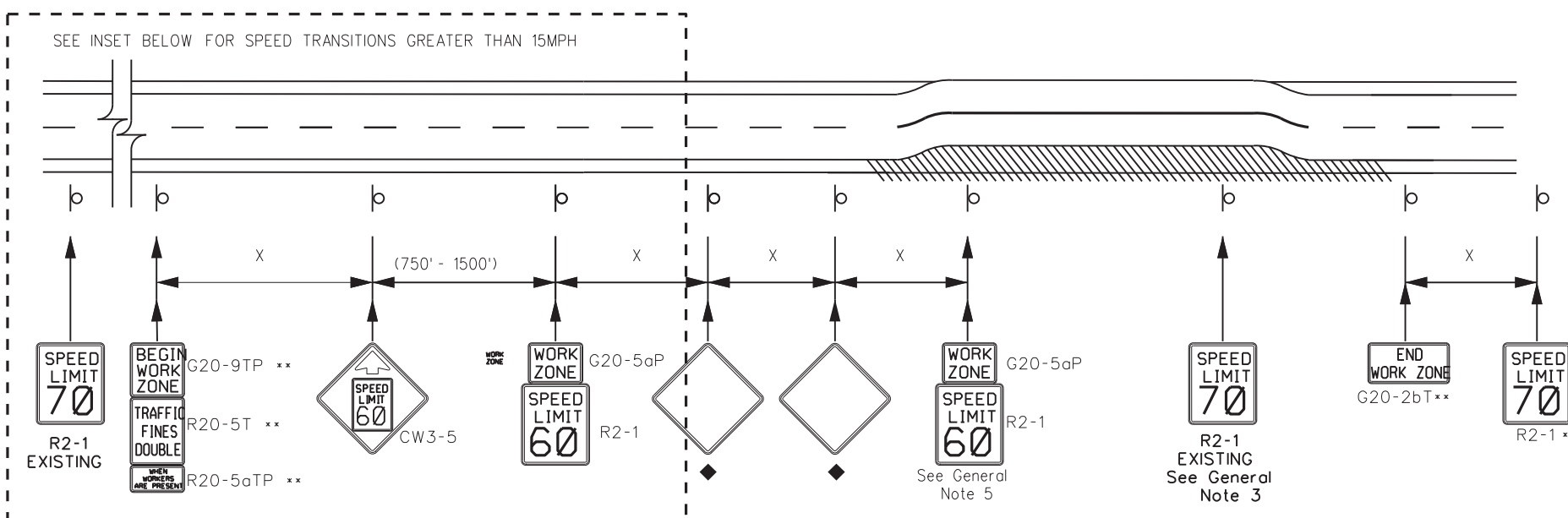
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© TxDOT November 2012	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
REVISIONS: 2-14 1-22 4-16	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 33	

TYPICAL APPLICATION OF MAINTENANCE WORK ZONE SPEED LIMIT SIGNS

Signing shown for one direction only.

Remove all temporary speed limit signs and concealments of permanent speed limit signs when the maintenance activity has been completed and equipment has been removed from the activity site.



GENERAL NOTES

- Signs may be skid mounted for long term or intermediate term work durations. Roll up signs may be used for short term, short duration or mobile operations.
- Reduced speeds shall only be posted in the vicinity of work activity and not throughout the entire maintenance work area.
- Cover all permanent speed limit signs within the work area that conflict with the temporary reduced speed limit. Advisory speed plaques on warning signs within the work area are not required by law to be covered.
- Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
- Frequency of maintenance 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
- Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
- Turning signs from view or laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
- Speeds shown on details above are for illustration only. Maintenance work zone speed limits shall only be posted as approved for each highway maintenance activity work zone.
- For more specific guidance concerning the type of work, work zone conditions and factors impacting allowable regulatory maintenance speed zone reduction see TxDOT form #1204M available from TRF.

DURATION OF WORK

- As defined by the "Texas Manual on 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 daylight 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 daylight 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-term 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.

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 mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlight 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 stubs 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 dry, cohesionless sand should 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 should weigh a minimum of 35 lbs and a maximum of 50 lbs.
- Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall NOT be used.
- Rubber ballasts designed for channelizing devices should not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber bases may be used when shown on the CWZTCD list.
- Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
- Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

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.

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- At the end of the maintenance work zone place a sign indicating the speed limit after the temporary zone ends.
- Signs should not be installed for mobile operations.

Signs are for illustrative purposes only. Signs and sign spacing requirements may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.

Posted Speed *	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 ² /60	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

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

SIGN DETAILS

Sign Number	Conventional Road	Expressway/Freeway
G20-2bT	36"x18"	48"x24"
G20-5aP	24"x18"	36"x24"
G20-9TP	24"x24"	36"x30"
R20-5T	24"x30"	36"x36"
R20-5aTP	24"x12"	36"x18"
CW3-5	36"x36"	48"x48"
R2-1	24"x30"	36"x48"

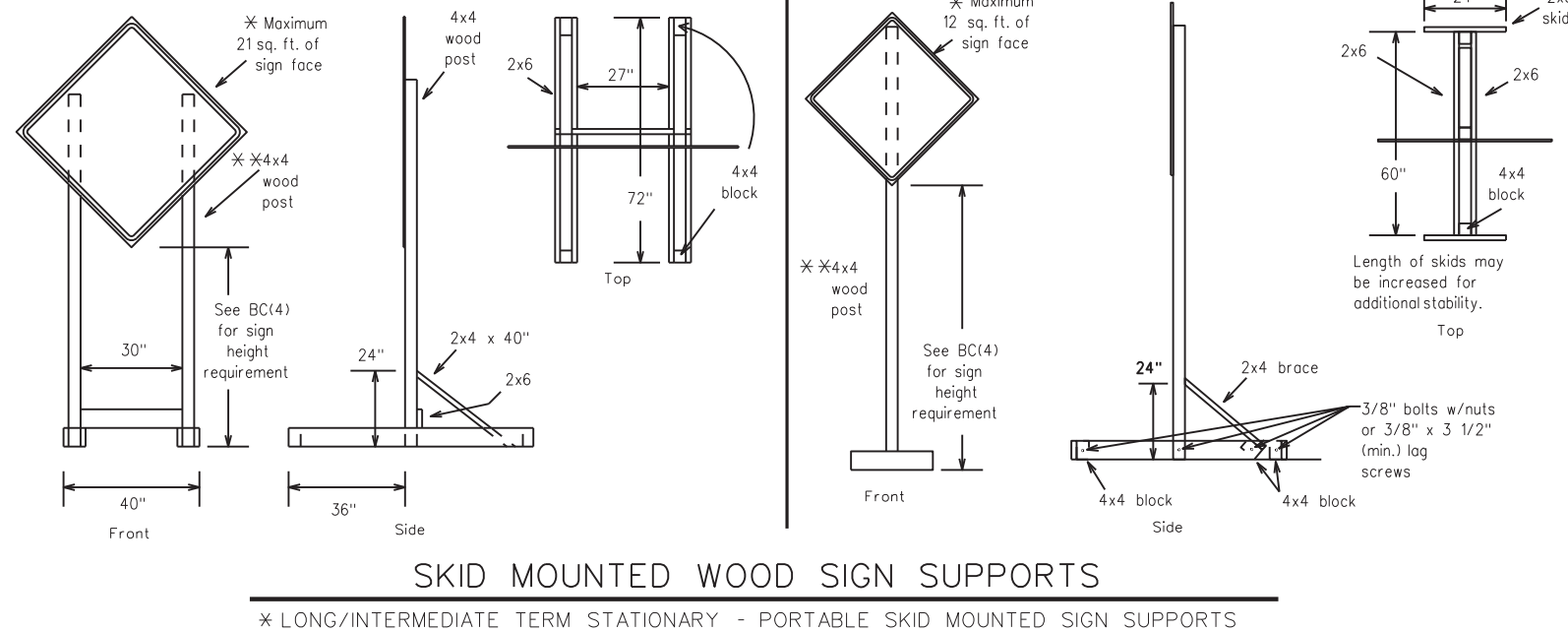
SHEET 1 OF 2



MAINTENANCE WORK ZONE SPEED LIMIT SIGNS

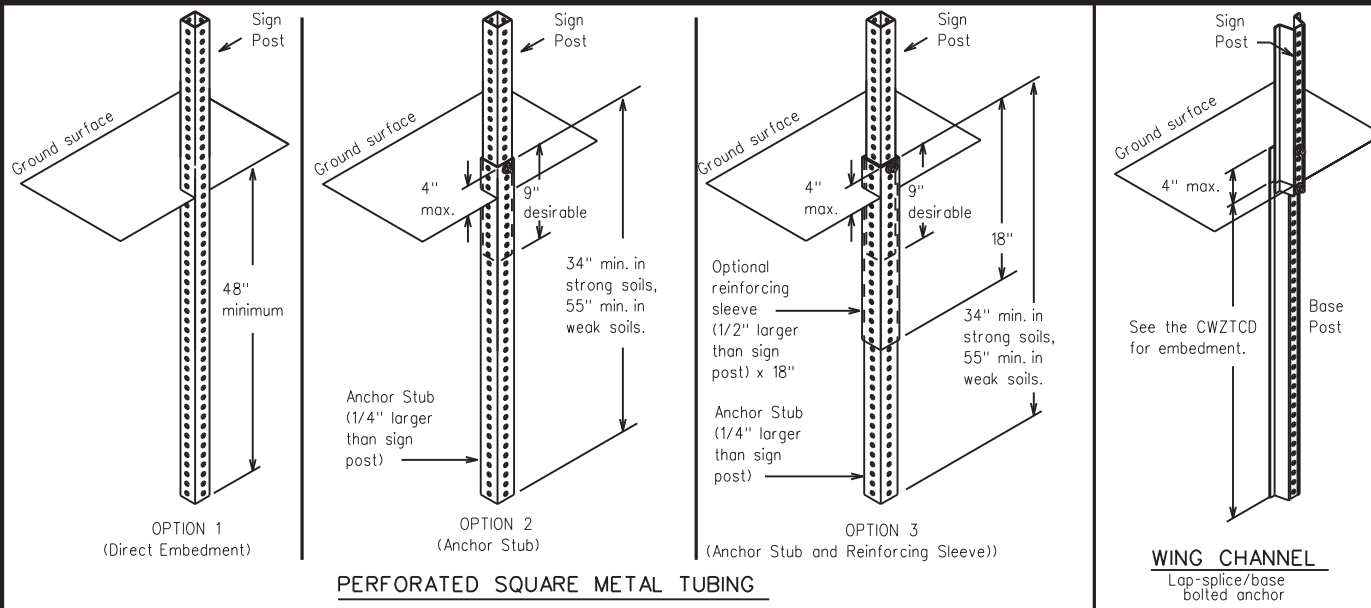
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	DIST	COUNTY	SHEET NO.	
	WACO	BELL, ETC	34	

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SKID MOUNTED WOOD SIGN SUPPORTS

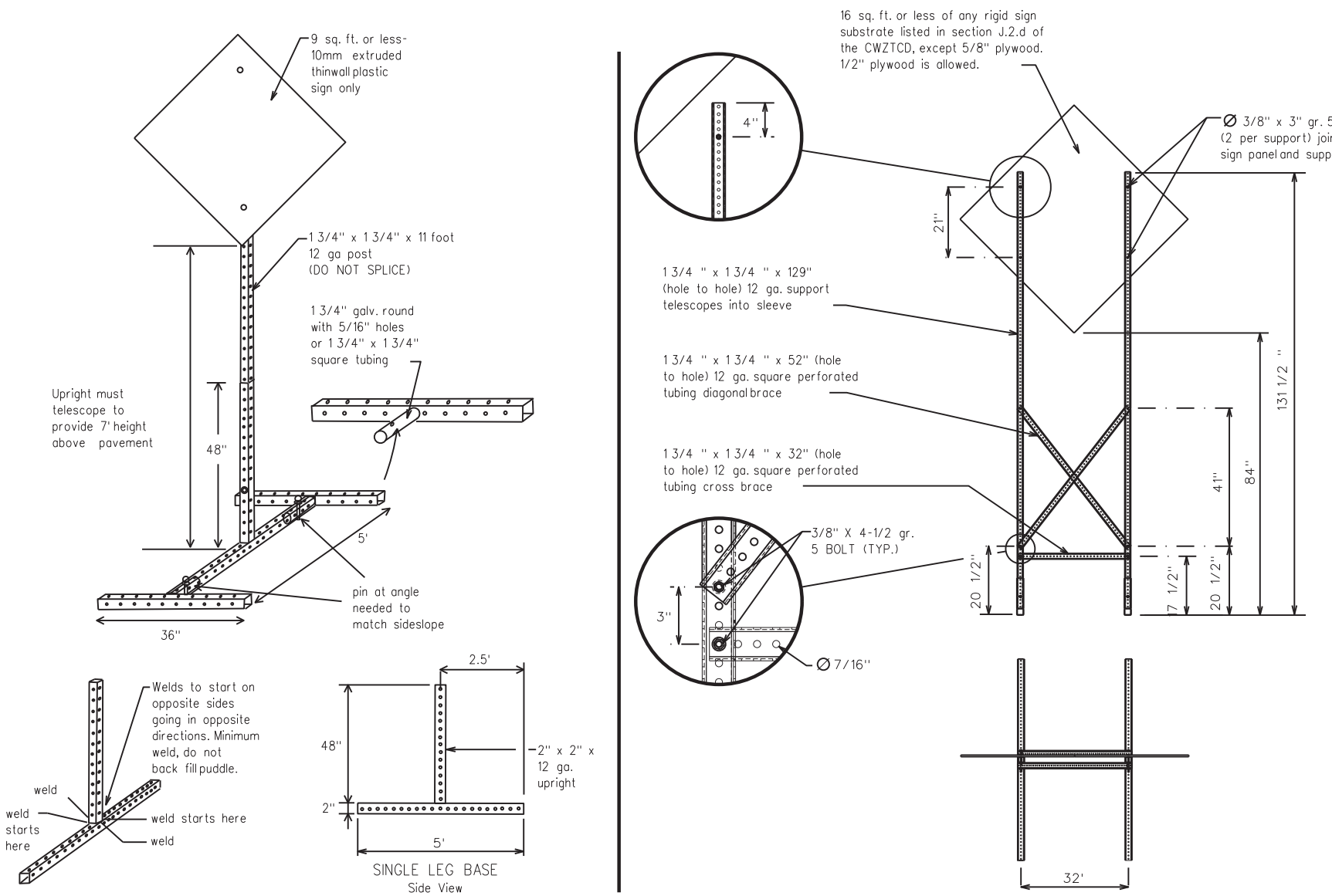
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS



GROUND MOUNTED SIGN SUPPORTS

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

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SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

- Nails may be used in the assembly of wooden sign supports, but 3/8" bolts with nuts or 3/8" x 3 1/2" lag screws must be used on every joint for final connection.
- No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
- When project is completed, all sign supports and foundations shall be removed from the project site. This will be considered subsidiary to Item 502.

- * See sheet 1 for definition of "Work Duration."
- ** Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.
- See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

SHEET 2 OF 2

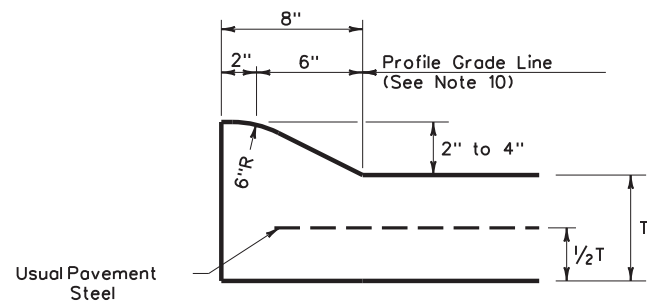


**MAINTENANCE WORK ZONE
SPEED LIMIT SIGNS**

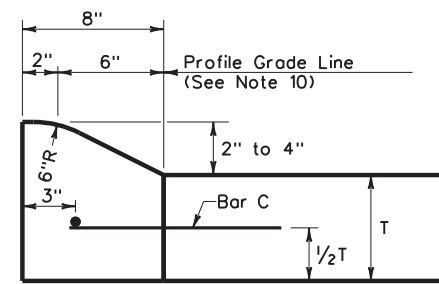
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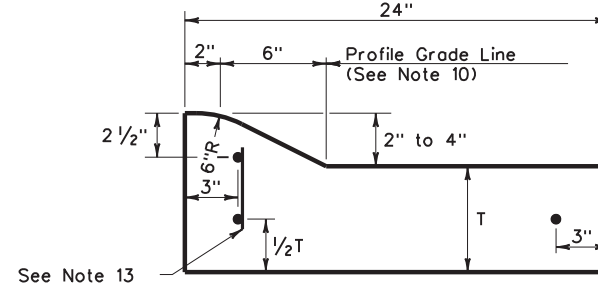
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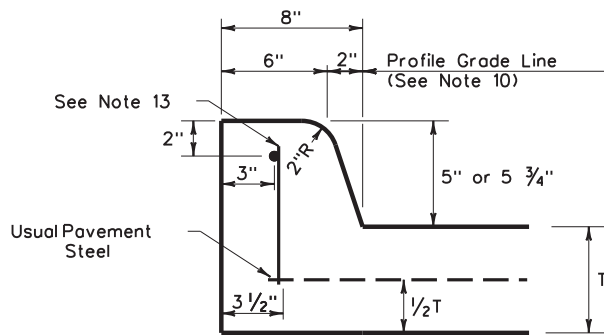
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2" - 4" HEIGHT**



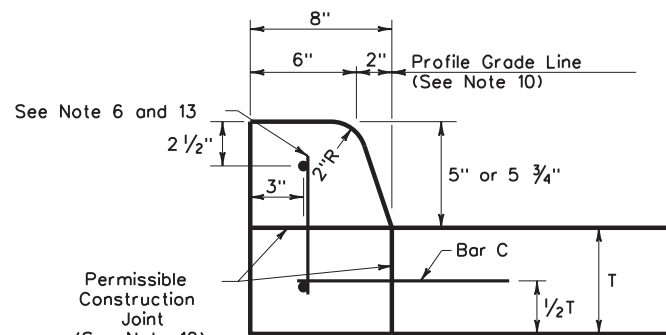
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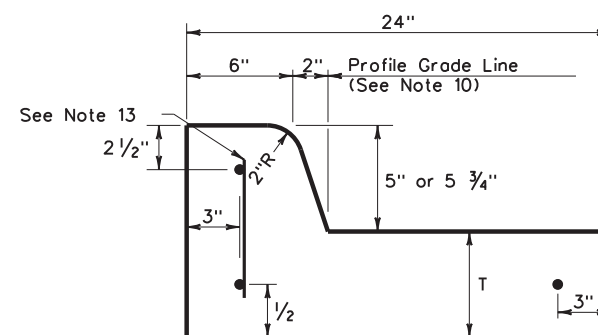
**TYPE I CURB AND GUTTER
2" - 4" HEIGHT**



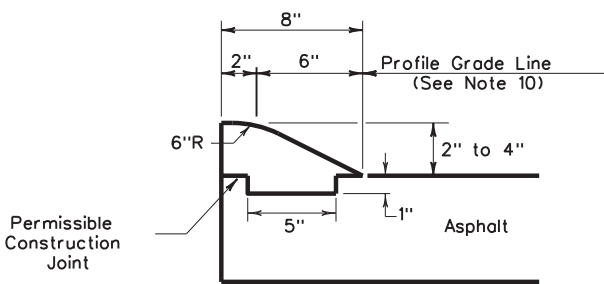
**TYPE II CURB (MONOLITHIC)
5" - 5 3/4" HEIGHT**



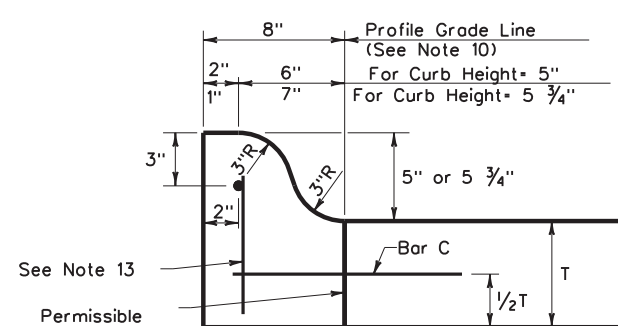
**TYPE II CURB
5" - 5 3/4" HEIGHT**



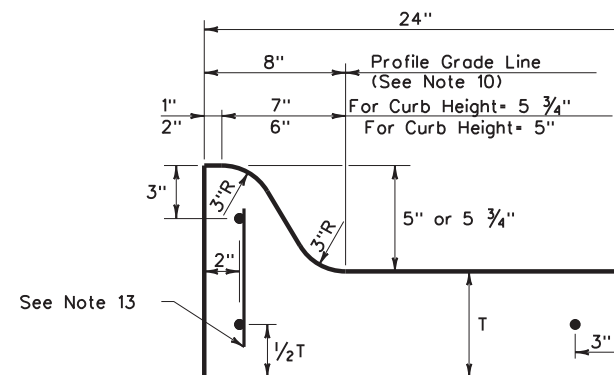
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5" - 5 3/4" HEIGHT**



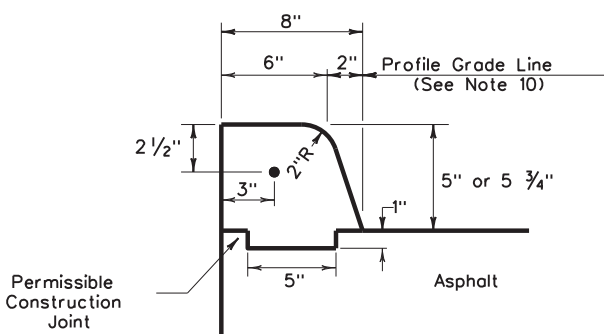
**TYPE III CURB (KEYED)
2" - 4" HEIGHT**



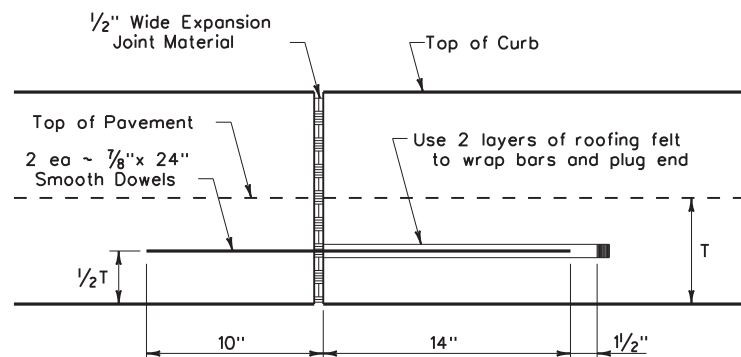
**TYPE IIa CURB
5" - 5 3/4" HEIGHT**



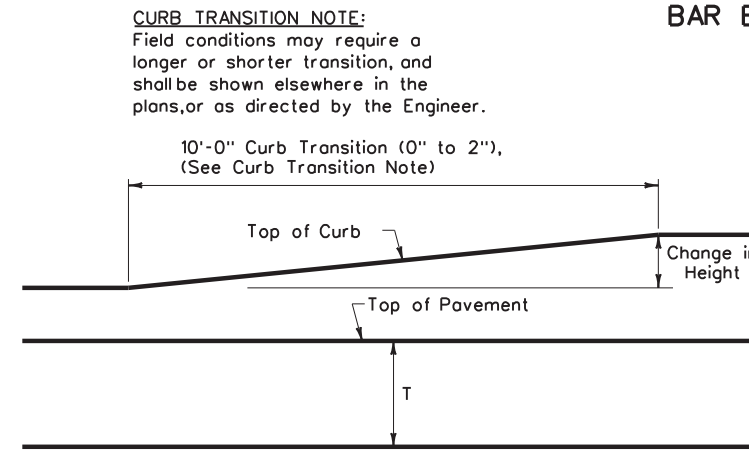
**TYPE IIa CURB AND GUTTER
5" - 5 3/4" HEIGHT**



**TYPE IV CURB (KEYED)
5" - 5 3/4" HEIGHT**



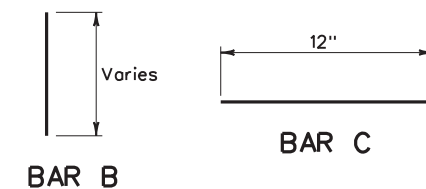
EXPANSION JOINT DETAIL



CURB TRANSITION
Note: To be paid for as Highest Curb

GENERAL NOTES

- All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
- Concrete shall be Class A.
- When reinforcing bars are used, they shall be No.4 unless otherwise shown. The use of fiber reinforced concrete in lieu of reinforcing steel is acceptable. Use fibers meeting the requirements of DMS 4550, "Fibers for Concrete," and dose fibers in accordance with Material Producers List (MPL) "Fibers for Class A and B Concrete Applications."
- Round exposed sharp edges with a rounding tool, to a minimum radius of 1/4 inch.
- All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
- Where concrete curb is to be placed on existing concrete pavement, Bar B may be drilled and grouted in place, or may be inserted into fresh concrete.
- Expansion and contraction joints shall be constructed to match pavement joints in all curbs and curb and gutter adjacent to jointed concrete pavement. Where placement of curb or curb and gutter is not adjacent to concrete pavement, expansion joints shall be provided at structures, curb returns at streets, and at locations directed by The Engineer.
- Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C-C.
- Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
- Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
- One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
- When horizontal permissible construction joints are used, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans. Reinforcing steel for curb section shall then conform to that required for concrete curb.
- Bar B placement as needed (typically at four ft. C-C) to support curb reinforcing steel during concrete placement.



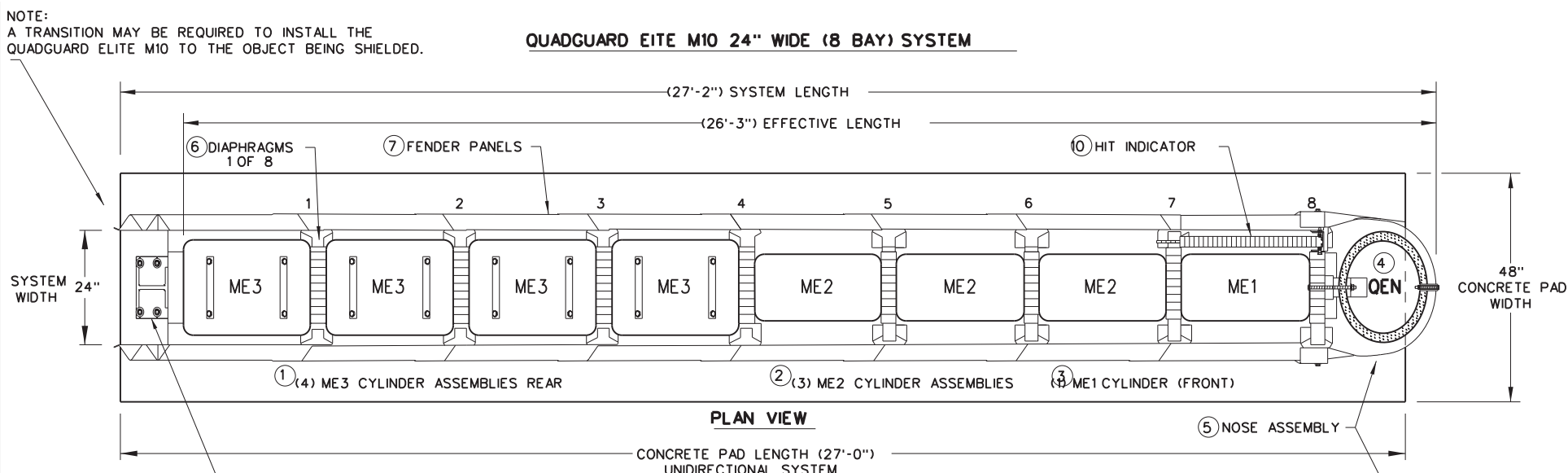
CURB TRANSITION NOTE:
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.

		Design Division Standard	
<h2>CONCRETE CURB AND GUTTER</h2>			
<h3>CCCG-22</h3>			
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QUADGUARD ELITE M10 24" WIDE (8 BAY) SYSTEM



KEY	KEY	KEY
① ME3 CYLINDER ASSEMBLIES	⑥ DIAPHRAGMS	⑩ HIT INDICATOR
② ME2 CYLINDER ASSEMBLIES	⑦ FENDER PANELS	
③ ME1 CYLINDER ASSEMBLY	⑧ MONORAILS	
④ QEN CYLINDER	⑨ TYPE OF BACKUP	
⑤ NOSE BELT ASSEMBLY		

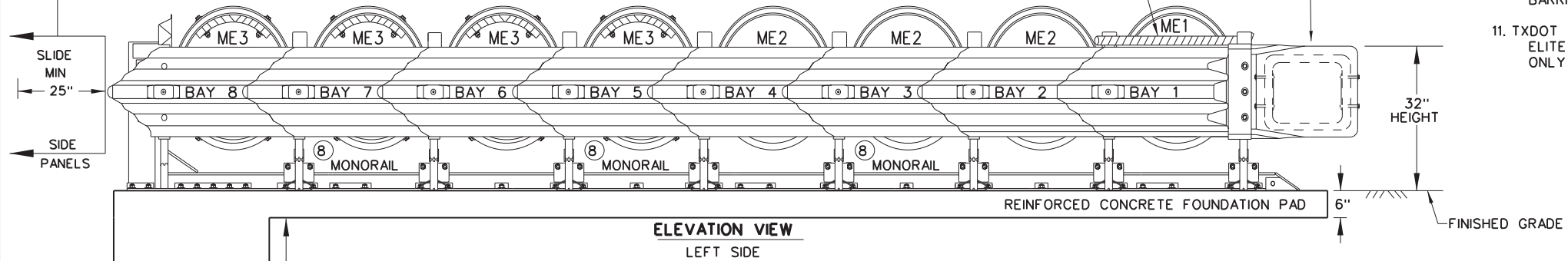
NOTE: A TRANSITION MAY BE REQUIRED TO INSTALL THE QUADGUARD ELITE M10 TO THE OBJECT BEING SHIELDED.

⑨ SHOWN WITH TENSION STRUT BACKUP ASSEMBLY

NOTE: PROVISION SHALL BE MADE FOR REAR FENDER SIDE PANELS TO SLIDE REARWARD UPON IMPACT, 25" MIN.

NOTE: HIT INDICATOR WILL RAISE UPON IMPACT.

④ QEN CYLINDER INSTALLED INSIDE OF NOSE BELT ASSEMBLY ⑤



BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS

SEE GENERAL NOTE 10 FOR CLEARANCE LIMITATIONS

⑨ TENSION STRUT BACKUP

⑨ CONCRETE BACKUP

SYSTEM TRANSITIONS TYPES	
1	QUAD-BEAM TO CONCRETE SAFETY BARRIER
2	QUAD-BEAM TO CONCRETE BRIDGE RAIL
3	QUAD-BEAM TO CONCRETE END SHOE
4	QUAD-BEAM TO THRIE-BEAM RAIL
5	QUAD-BEAM TO W-BEAM RAIL

NOTE: TRANSITION ASSEMBLIES FOR THE QUADGUARD ELITE M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:
 10 (W6X9) I-BEAM POSTS.
 POST 1 THRU 4 (84" LONG)
 POST 5 THRU 10 (72" LONG)

NOTE: CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS: AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

NOTES:
 CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR CONCRETE PAD AND ANCHOR BLOCK INSTALLATION REQUIREMENTS.

A MANUFACTURER'S DRAWING PACKAGE UNIQUE AND SPECIFIC FOR THE QUADGUARD ELITE M10 FIELD INSTALLATION AND INFORMATION REGARDING THE TYPE OF BACKUP ASSEMBLY REQUIRED FOR THE TRANSITION WILL BE PROVIDED BY THE MANUFACTURER TO THE ENGINEER AND INSTALLER.

6" REINFORCED CONCRETE PAD REQUIRES THE INSTALLATION OF AN ANCHOR BLOCK AS SHOWN ON THE MANUFACTURER'S DRAWING PACKAGE.

8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.

CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

NOTE:
 THE QUADGUARD ELITE M10 8-BAY, 24" WIDE - NARROW SYSTEM TESTED TO MASH TEST LEVEL 3.

TL-3 MODEL #	QM10024E	CYLINDER TYPES IN BAYS			
BAYS	8	TYPE-ME3	TYPE-ME2	TYPE-ME1	TYPE-QEN
DIAPHRAGMS	8	4	3	1	1
WIDTH	24"	REAR	FRONT		NOSE

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT 1(888)323-6374.
- SEE THE RECENT QUADGUARD ELITE M10 PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE NARROW 24" SYSTEM BEFORE INSTALLING THE QUADGUARD ELITE M10 AT ANY GIVEN LOCATION.
- FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD ELITE M10 IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD ELITE M10, THE QUADGUARD ELITE M10 SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD ELITE M10 AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
- SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD ELITE M10 SYSTEM IS SHIELDING. SEE THE QUADGUARD ELITE M10 PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- COMPONENTS FOR THE QUADGUARD ELITE (M10) BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD ELITE M10 PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
- CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE QUADGUARD ELITE M10 SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
- FOR THE TENSION STRUT BACKUP THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
- TXDOT HAS ONLY APPROVED THE 24" WIDE QUADGUARD ELITE M10 SYSTEM. THE QUADGUARD ELITE M10 PRODUCT DESCRIPTION AND ASSEMBLY MANUAL INCLUDES SYSTEM WIDTH OF 24". ONLY THE 24" SYSTEM IS ALLOWED TO BE INSTALLED ON TEXAS ROADWAYS.

FOUNDATION & ANCHORING REQUIREMENTS	
FOUNDATION TYPES: A, B, C, & D	
FOUNDATION TYPE:A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2"
FOUNDATION TYPE:C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE

KEY:
 ASPHALT CONCRETE (A.C.)
 COMPACTED SUBBASE (C.S.)
 PORTLAND CEMENT CONCRETE (P.C.C.)

NOTE: SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR THE APPROVED ADHESIVE.

IF THE UNIT IS ANCHORED TO ASPHALTIC CONCRETE, IT SHOULD BE RELOCATED TO FRESH, UNDISTURBED ASPHALT AND RE-ANCHORED AFTER EACH IMPACT TO ENSURE ADEQUATE FUTURE PERFORMANCE.

TENSION STRUT BACKUP MAY BE USED IN CONSTRUCTION ZONES ON ASPHALT CONCRETE (A.C.) FOR TEMPORARY USE ONLY.

Texas Department of Transportation

TRINITY HIGHWAY
ENERGY ABSORPTION
QUADGUARD ELITE M10
(MASH TL-3)
QGELE(M10)(N)-20

FILE: qgelitem10n20.dgn	DN: TxDOT	CK: KM	DW:VP	CK: AG
© TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
	DIST	COUNTY	SHEET NO.	
	WACO	BELL,ETC	37	

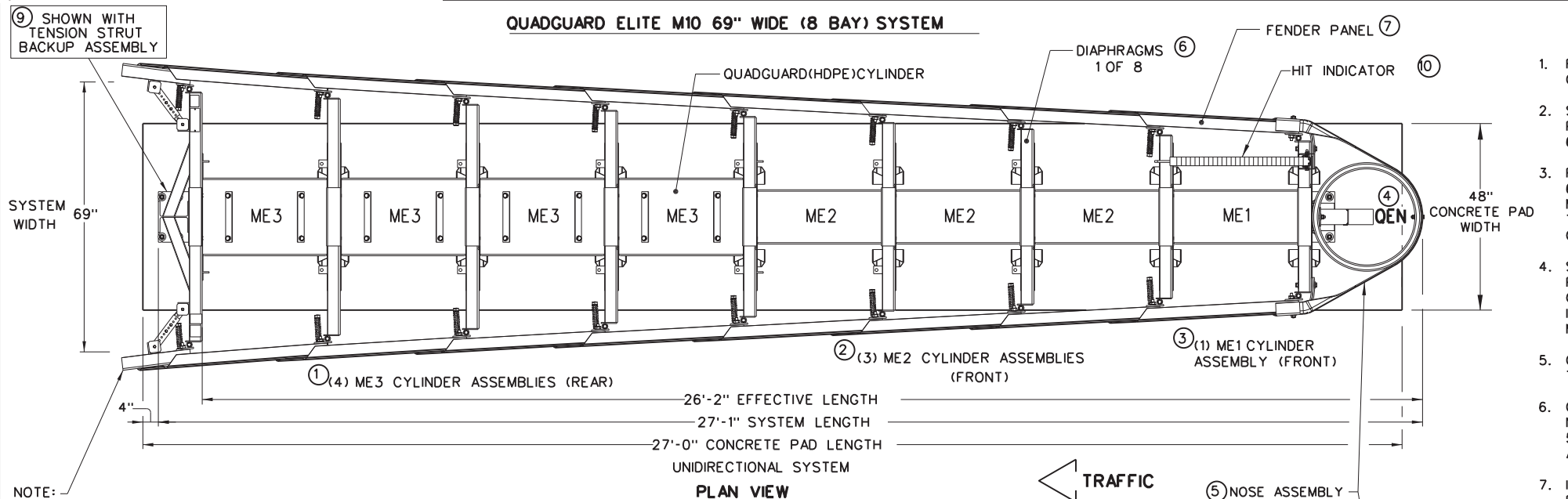
NOTE:
 THIS STANDARD IS A BASIC REPRESENTATION OF THE QUADGUARD ELITE M10 SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

LOW MAINTENANCE

DISCLAIMER: THE USE OF THIS STANDARD IS COVERED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TxDOT FOR ANY PURPOSE WHATSOEVER. TxDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.

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QUADGUARD ELITE M10 69" WIDE (8 BAY) SYSTEM

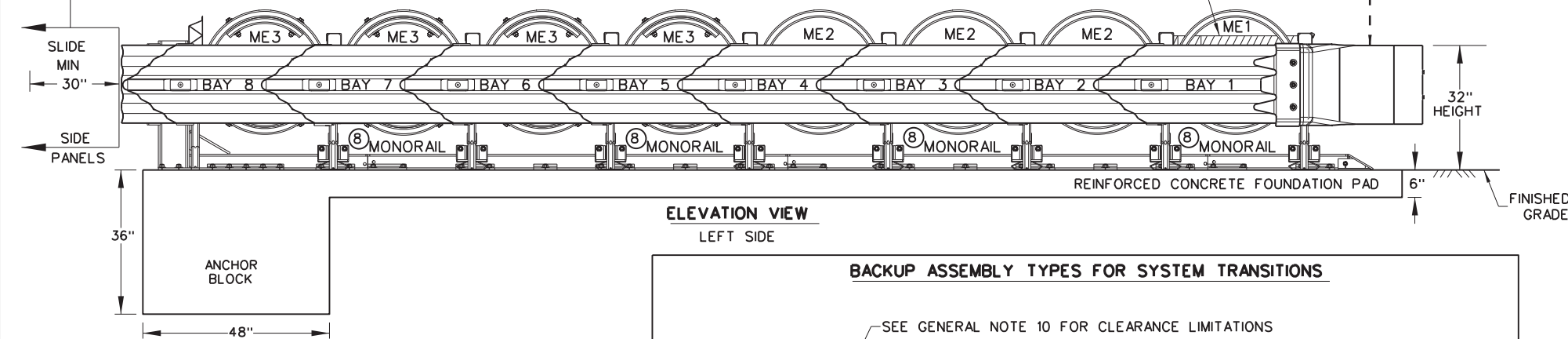


NOTE:
A TRANSITION MAY BE REQUIRED TO INSTALL THE QUADGUARD ELITE M10 TO THE OBJECT BEING SHIELDED.

KEY	KEY
① ME3 CYLINDER ASSEMBLIES	⑥ DIAPHRAGMS
② ME2 CYLINDER ASSEMBLIES	⑦ FENDER PANELS
③ ME1 CYLINDER ASSEMBLY	⑧ MONORAILS
④ QEN CYLINDER	⑨ TYPE OF BACKUP
⑤ NOSE BELT ASSEMBLY	⑩ HIT INDICATOR

NOTE:
HIT INDICATOR WILL RAISE UPON IMPACT.

NOTE:
PROVISION SHALL BE MADE FOR REAR FENDER SIDE PANELS TO SLIDE REARWARD UPON IMPACT, 30" MIN.



NOTES:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR CONCRETE PAD AND ANCHOR BLOCK INSTALLATION REQUIREMENTS.

A MANUFACTURER'S DRAWING PACKAGE UNIQUE AND SPECIFIC FOR THE QUADGUARD ELITE WIDE M10 FIELD INSTALLATION AND INFORMATION REGARDING THE TYPE OF BACKUP ASSEMBLY REQUIRED FOR THE TRANSITION WILL BE PROVIDED BY THE MANUFACTURER TO THE ENGINEER AND INSTALLER.

6" REINFORCED CONCRETE PAD REQUIRES THE INSTALLATION OF AN ANCHOR BLOCK AS SHOWN ON THE MANUFACTURER'S DRAWING PACKAGE.

8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.

CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

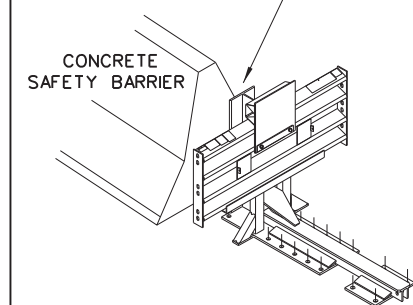
NOTE:
THE QUADGUARD ELITE M10 WIDE 8-BAY SYSTEM TESTED TO MASH TEST LEVEL 3.

TL-3 MODEL *	QM10069E	CYLINDER TYPES IN BAYS			
BAYS	8	TYPE-ME3	TYPE-ME2	TYPE-ME1	TYPE-QEN
DIAPHRAGMS	8	4	3	1	1
WIDTH	69"	REAR	FRONT		NOSE

ELEVATION VIEW
LEFT SIDE

BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS

SEE GENERAL NOTE 10 FOR CLEARANCE LIMITATIONS



⑨ TENSION STRUT BACKUP

NOTES:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS:
AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

SYSTEM TRANSITIONS TYPES	
1	QUAD-BEAM TO CONCRETE SAFETY BARRIER
2	QUAD-BEAM TO CONCRETE BRIDGE RAIL
3	QUAD-BEAM TO SINGLE SLOPE OFFSET
4	QUAD-BEAM TO CONCRETE END SHOE
5	QUAD-BEAM TO THRIE-BEAM RAIL
6	QUAD-BEAM TO W-BEAM RAIL

NOTE:
TRANSITION ASSEMBLIES FOR THE QUADGUARD ELITE M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:

ALL POSTS W6X8.5/9 I-BEAMS (78" LONG).

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE QUADGUARD ELITE M10 WIDE SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT (888)323-6374.
- SEE THE RECENT QUADGUARD ELITE M10 WIDE PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE WIDE 69" SYSTEM BEFORE INSTALLING THE QUADGUARD ELITE M10 AT ANY GIVEN LOCATION.
- FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD ELITE M10 WIDE 69" IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD ELITE M10 WIDE 69", THE QUADGUARD ELITE M10 SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD ELITE M10 AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
- SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD ELITE M10 SYSTEM IS SHIELDING. SEE THE QUADGUARD ELITE M10 WIDE [69"] PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- COMPONENTS FOR THE QUADGUARD ELITE (M10) BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD ELITE M10 WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
- CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE QUADGUARD ELITE M10 SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
- FOR THE TENSION STRUT BACKUP, THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
- THE WIDE QUADGUARD ELITE M10 SYSTEM IS ONLY AVAILABLE IN A 69" WIDTH.

FOUNDATION & ANCHORING REQUIREMENTS
FOUNDATION TYPES: A, B, C, & D

FOUNDATION TYPE:A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE

KEY:
ASPHALT CONCRETE (A.C.)
COMPACTED SUBBASE (C.S.)
PORTLAND CEMENT CONCRETE (P.C.C.)

NOTE: SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR THE APPROVED ADHESIVE.

IF THE UNIT IS ANCHORED TO ASPHALTIC CONCRETE, IT SHOULD BE RELOCATED TO FRESH, UNDISTURBED ASPHALT AND RE-ANCHORED AFTER EACH IMPACT TO ENSURE ADEQUATE FUTURE PERFORMANCE.

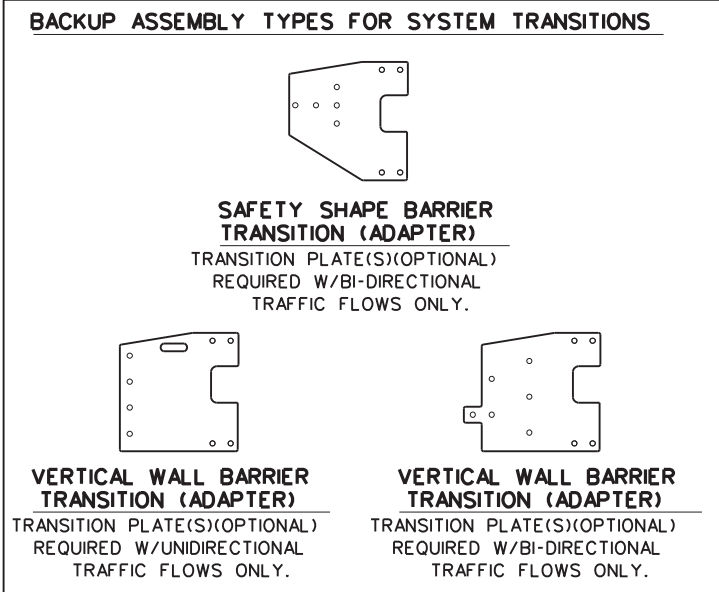
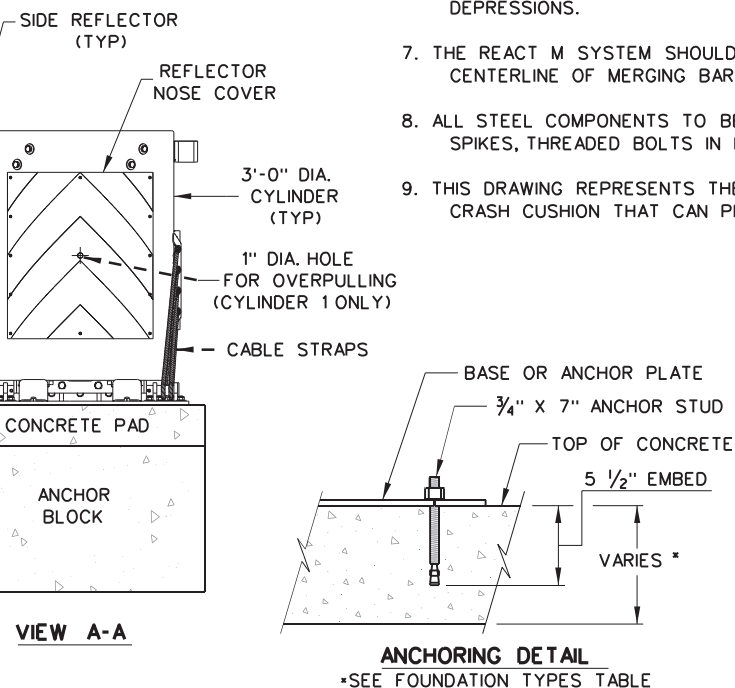
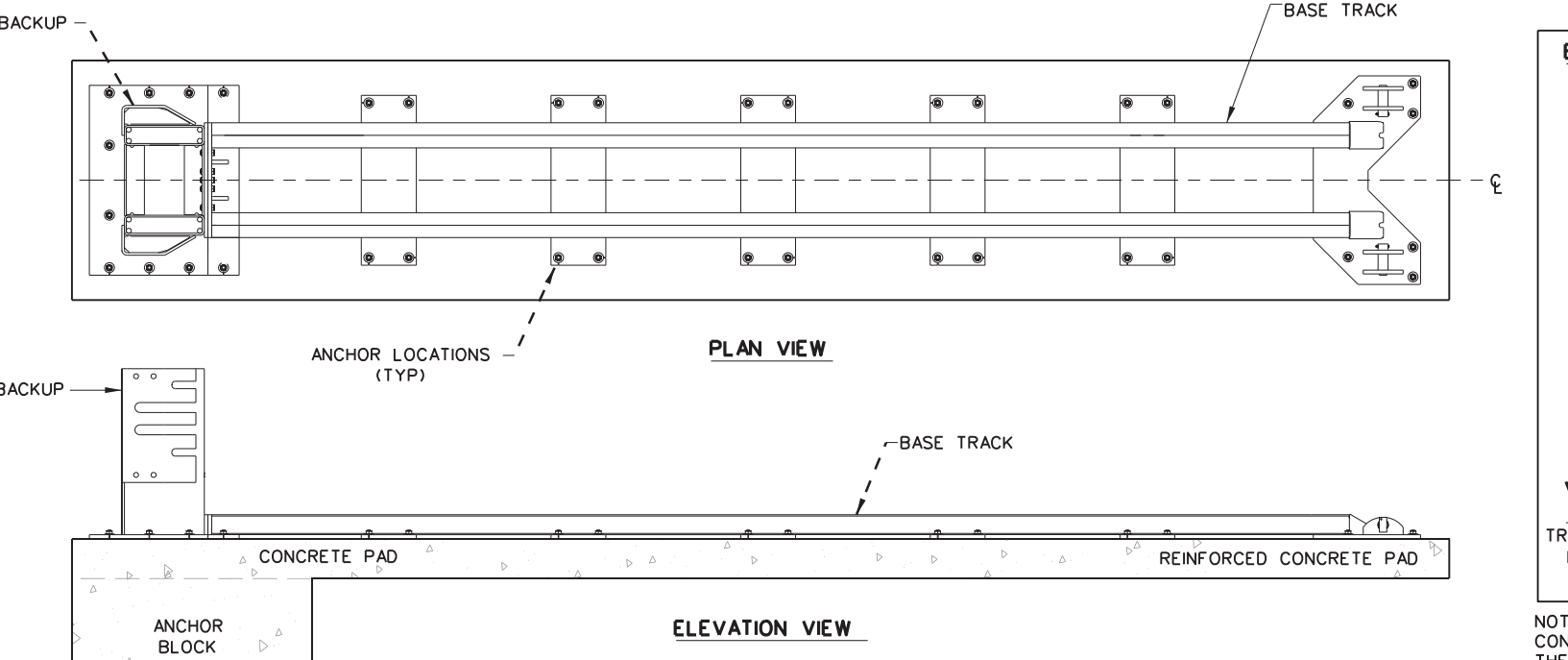
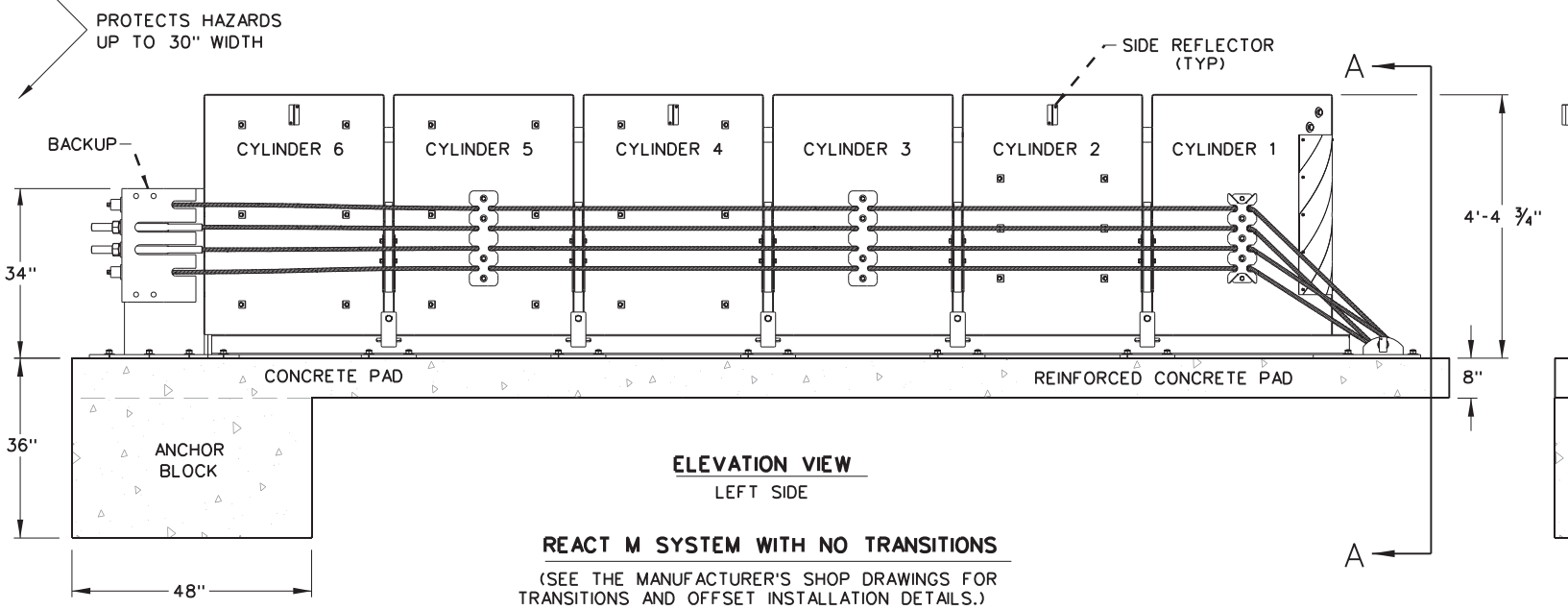
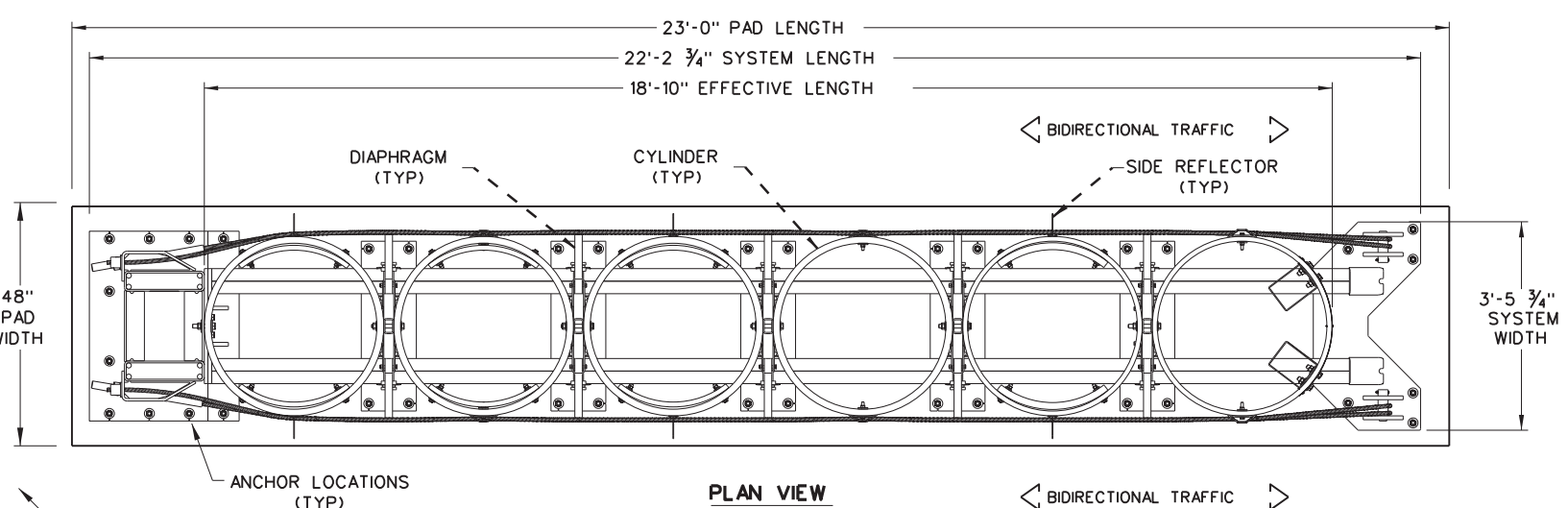
TENSION STRUT BACKUP MAY BE USED IN CONSTRUCTION ZONES ON ASPHALT CONCRETE (A.C.) FOR TEMPORARY USE ONLY.

		Design Division Standard		
TRINITY HIGHWAY ENERGY ABSORPTION QUADGUARD ELITE M10 WIDE (MASH TL-3) QGELE(M10)(W)-20				
FILE: qgelitem10w20.dgn	DN: TxDOT	CK: KM	DW: SS	CK: AG
© TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190, ETC
	DIST	COUNTY	SHEET NO.	
	WACO	BELL, ETC	38	

LOW MAINTENANCE

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NOTES:
 CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS: AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION AT 1(888)323-6374 OR WEBSITE: www.trinityhighway.com.
- THE NOSE OF THE REACT M SHALL BE CLAD WITH A PLASTIC WRAP WITH STANDARD DELINEATION ADHERED TO THE WRAP AND SHALL HAVE A SERIES OF SIDE MARKER REFLECTORS ON BOTH SIDES OF THE UNIT. SEE SITE PLAN VIEWS FOR MARKER AND PLASTIC WRAP COLOR ORIENTATION.
- FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION DETAILS WILL BE AS SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS.
- DETAILS OF COMPONENTS FOR THE REACT M, BACKUPS AND REINFORCING DETAILS WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE REACT M SYSTEM SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTERLINE OF MERGING BARRIERS.
- ALL STEEL COMPONENTS TO BE HOT DIPPED GALVANIZED EXCEPT STAKES, DRIVE SPIKES, THREADED BOLTS IN BACKUP UNIT, AND WEDGE FITTINGS ON CABLES.
- THIS DRAWING REPRESENTS THE REACT M TL-3 SYSTEM, RE-DIRECTIVE, NON-GATING CRASH CUSHION THAT CAN PROTECT HAZARDS UP TO 30-INCHES IN WIDTH.

TEST NUMBER	TEST LEVEL	OVERALL LENGTH	TRANSITION LENGTH	SYSTEM WIDTH
3-30 TO 3-36	TL-3	22'-2 3/4"	-	3'-5 3/4"
3-37A	TL-3	22'-2 3/4"	9'-10 3/4"	3'-5 3/4"
3-38	TL-3	22'-2 3/4"	-	3'-5 3/4"

ANCHOR SYSTEM TYPE	
APPROVED ADHESIVE, 7" STUDS, 5.5" EMBEDMENT	
FOUNDATION TYPES	
MINIMUM 8" REINFORCED PORTLAND CEMENT CONCRETE PAD (REQUIRED REINFORCING STEEL FOR CONCRETE PAD SHALL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS.)	
MINIMUM 8" NON-REINFORCED PORTLAND CEMENT CONCRETE ROADWAY MEASURING AT LEAST 12' WIDE BY 50' LONG	
MINIMUM 7" CONCRETE DECK STRUCTURE, OR MINIMUM 6" REINFORCED CONCRETE ROADWAY	

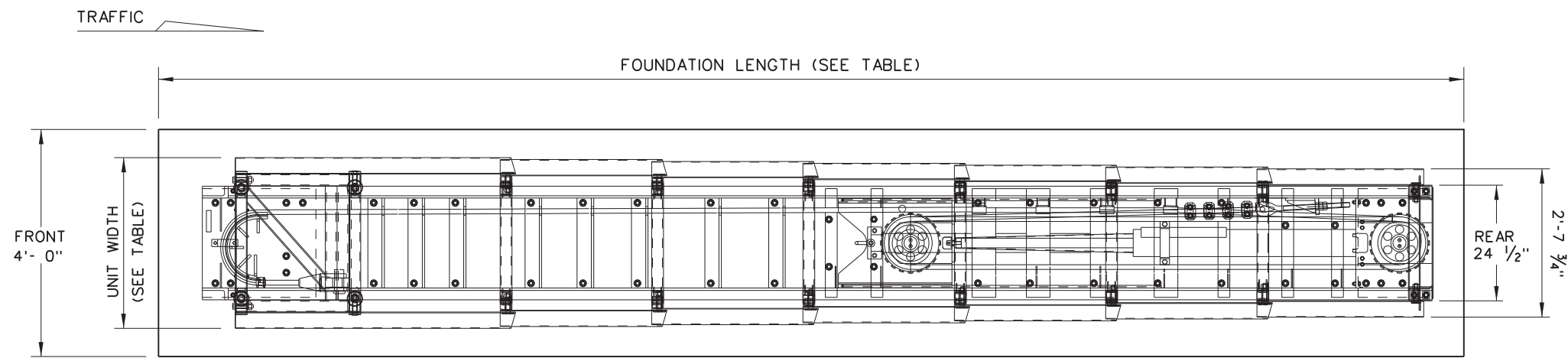
NOTE:
 THIS STANDARD IS A BASIC REPRESENTATION OF THE REACT M SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

Texas Department of Transportation Design Division Standard				
TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION REACT M (NARROW) (MASH TL-3) REACT(M)-21				
FILE: reactm21.dgn	DN: TXDOT	CK: KM	DW: SS	CK: CL
© TXDOT: JULY 2021	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
REVISIONS:	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 39	

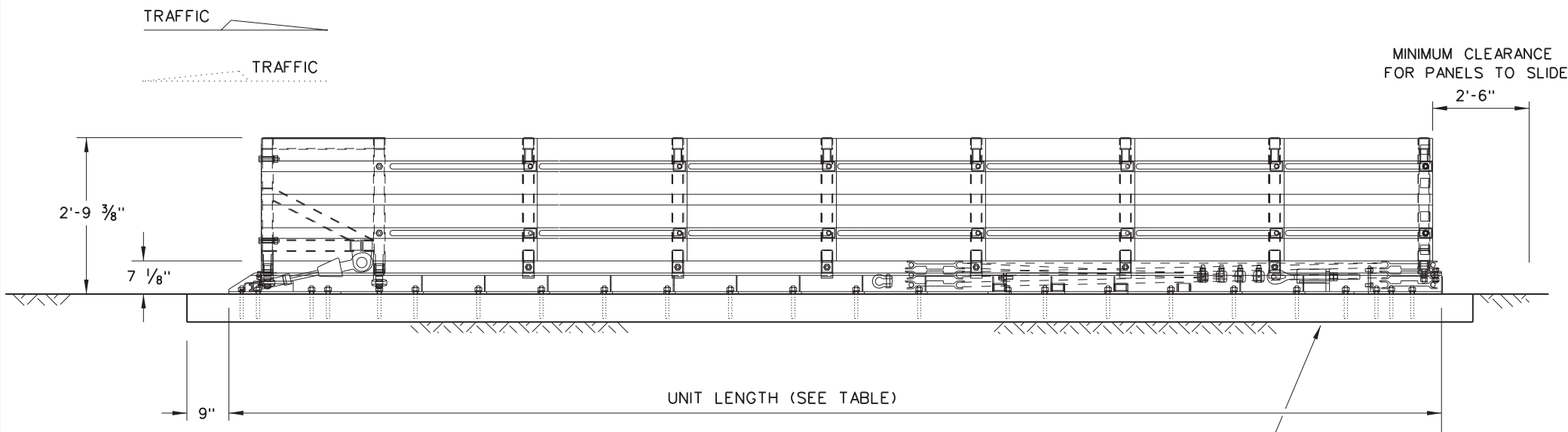
LOW MAINTENANCE

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PLAN VIEW



ELEVATION VIEW

- GENERAL NOTES**
1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: WORK AREA PROTECTION, CORP. AT (800) 327-4417, OR (630) 377-9100.
 2. FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION PANELS WILL BE REQUIRED.
 3. ADDITIONAL DETAILS FOR THE TRANSITION OPTION AND FOUNDATION OPTION WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
 4. CONCRETE SHALL BE CLASS "S" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
 5. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
 6. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
 7. THE SCI100GM & SCI70GM SYSTEMS SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTERLINE OF MERGING BARRIERS.

NOTE:
 FOR ATTACHMENT AND TRANSITIONS TO OTHER SHAPES, BARRIERS, RAILINGS AND BI-DIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE. (SEE MANUFACTURER'S PRODUCT MANUAL)

NOTE:
 SIDE PANELS CAN TRAVEL 30" BEYOND THE LAST TERMINAL BRACE AT THE REAR OF THE CUSHION. ALL OBJECTS THAT MAY INTERFERE WITH THIS MOTION CAN AFFECT PERFORMANCE OF AND MAY CAUSE UNDUE DAMAGE TO THE CRASH CUSHION.

MODEL	TEST LEVEL	UNIT LENGTH (approx.)	UNIT WIDTH	FOUNDATION LENGTH	OBSTACLE WIDTH
SCI70GM	TL-2	13'-6"	2'-10 5/8"	15'- 6 1/4"	24"to 36"
SCI100GM	TL-3	21'-6"	3'-1 1/2"	23'- 0"	24"to 36"

SYSTEM AND PAD LENGTHS VARY DEPENDING ON BACKUP TYPE.

FOUNDATION OPTIONS
6" REINFORCED CONCRETE (5 1/2" ANCHOR EMBEDMENT)
8" UNREINFORCED CONCRETE (5 1/2" ANCHOR EMBEDMENT)
3" MIN. ASPHALT OVER 3" MIN. CONCRETE (16 1/2" ANCHOR EMBED.)
6" ASPHALT OVER 6" COMPACT SUBBASE (16 1/2" ANCHOR EMBED.)
8" MINIMUM ASPHALT (16 1/2" ANCHOR EMBEDMENT)

FOR STEEL PLACEMENT IN CONCRETE FOUNDATIONS, SEE MANUFACTURER'S PRODUCT MANUAL.

TRANSITION OPTIONS
CONCRETE VERTICAL WALL
CONCRETE TRAFFIC BARRIERS
GUARDRAIL (W-BEAM)
GUARDRAIL (THRIE-BEAM)

TRANSITION TYPES ARE SHOWN ELSEWHERE ON THE PLANS (I.E. ATTENUATOR LOCATION DETAILS OR IN THE GENERAL NOTES).

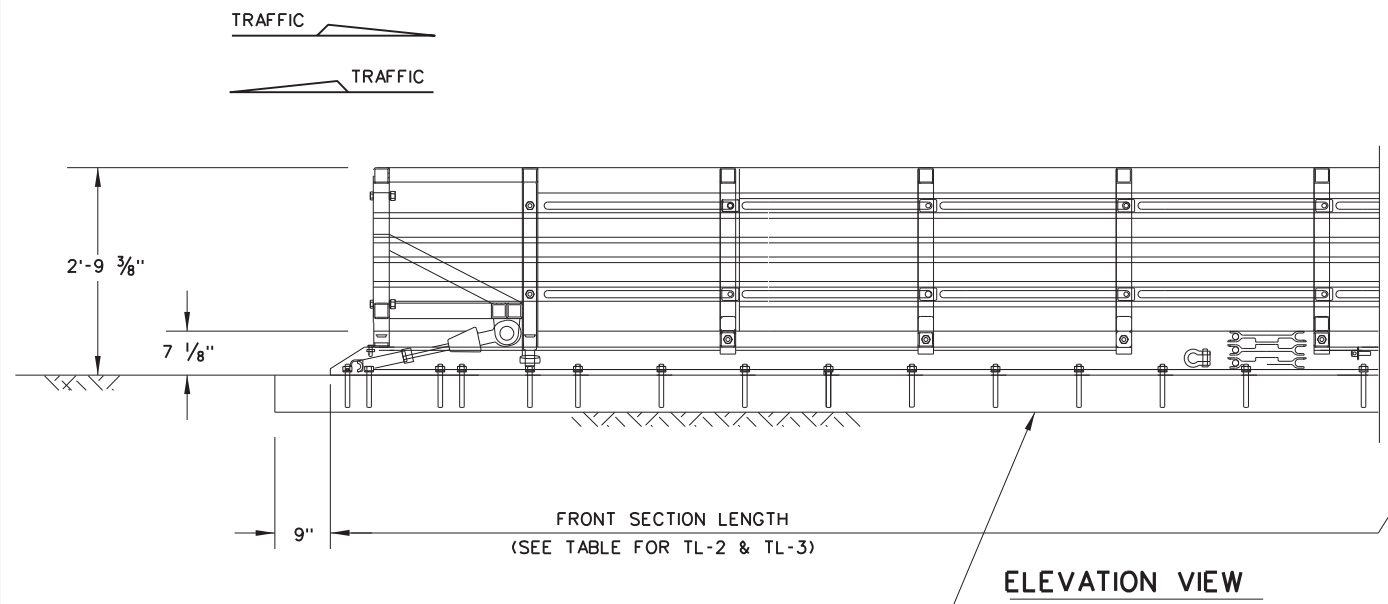
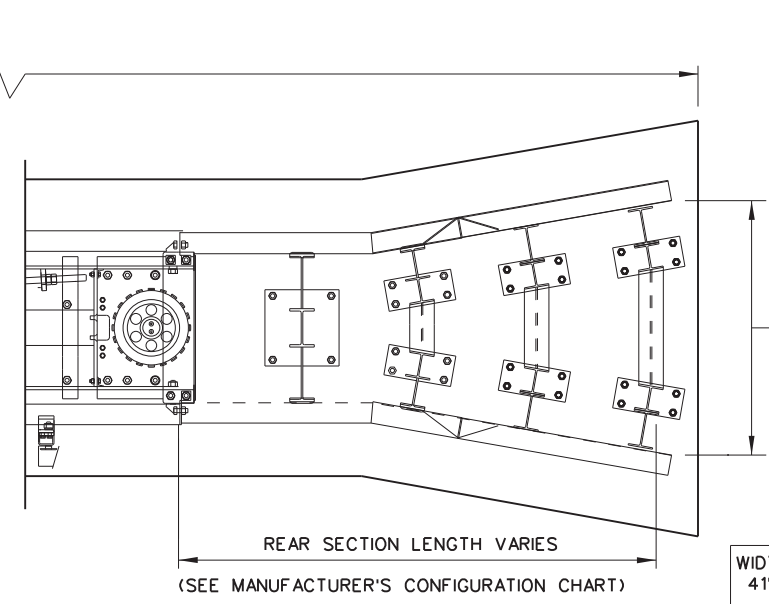
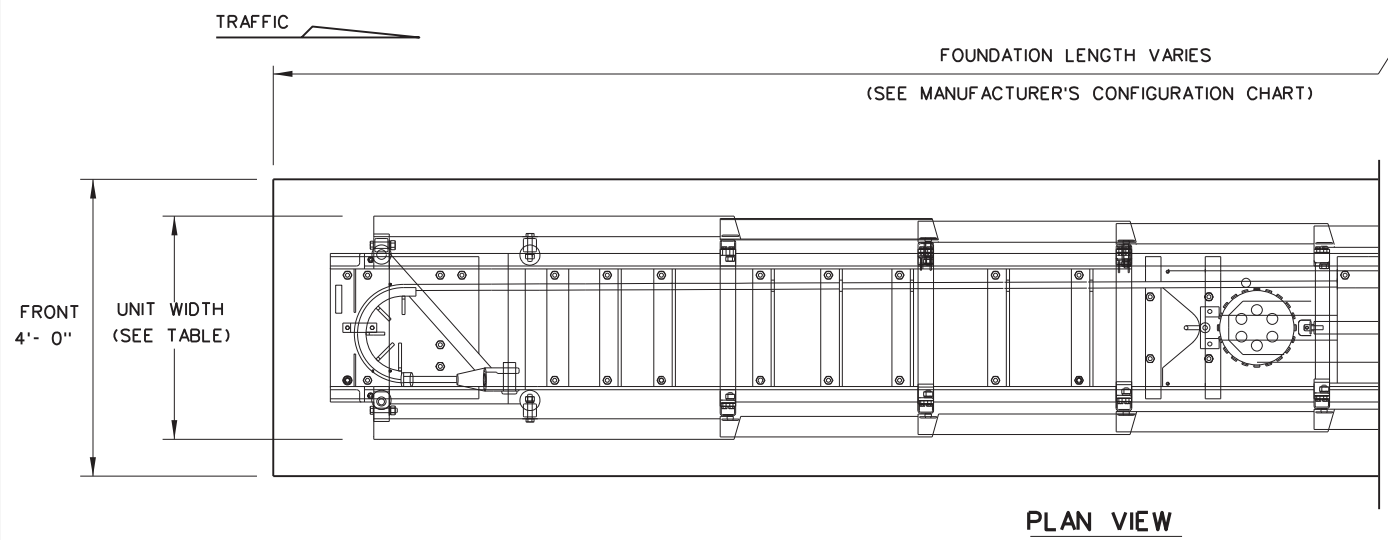
FOR BI-DIRECTIONAL TRANSITION PANEL AND END SHOE DETAILS, SEE MANUFACTURER'S PRODUCT MANUAL.

LOW MAINTENANCE

				Design Division Standard	
WORK AREA PROTECTION CORP (SMART-NARROW)					
SMTC(N)-16					
FILE: smtn16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: VP	
©TxDOT: February 2006	CONT	SECT	JOB	HIGHWAY	
REVISIONS	6467	89	001	US 190,ETC	
REVISED 06, 2013 (VP)	DIST	COUNTY	SHEET NO.		
REVISED 03, 2016 (VP)	WACO	BELL,ETC			40

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DATE: 7/29/2024
 FILE: c:\txdot\pw_online\txdot3\me\lendy.smth\d0754862\smtcw16.dgn



WIDE TRANSITION LENGTHS		
GORE WIDTH	TL-2 OVERALL SYSTEM LENGTH	TL-3 OVERALL SYSTEM LENGTH
41"	20'-1"	28'-1"
48"	21'-10"	29'-10"
55"	23'-5"	31'-5"
60"	24'-7"	32'-7"
68"	26'-6"	34'-6"
69"	26'-8"	34'-8"
81"	29'-7"	37'-7"
88"	31'-2"	39'-2"
94"	32'-7"	40'-7"
100"	34'-1"	42'-1"
107"	35'-8"	43'-8"
112"	36'-11"	44'-11"
120"	38'-10"	46'-10"
126"	40'-2"	48'-2"
133"	41'-11"	49'-11"

FOUNDATION OPTIONS
6" Reinforced Concrete (5 1/2" Anchor Embedment)
8" Unreinforced Concrete (5 1/2" Anchor Embedment)
3" Min. Asphalt over 3" Min. Concrete (16 1/2" Anchor Embed.)
6" Asphalt over 6" Compact Subbase (16 1/2" Anchor Embed.)
8" Minimum Asphalt (16 1/2" Anchor Embedment)

FOR STEEL PLACEMENT IN CONCRETE FOUNDATIONS, SEE MANUFACTURER'S PRODUCT MANUAL.

TRANSITION OPTIONS
Concrete Vertical Wall
Concrete Traffic Barriers
Guardrail (W-Beam)
Guardrail (Thrie-Beam)

TRANSITION TYPES ARE SHOWN ELSEWHERE ON THE PLANS (I.E. ATTENUATOR LOCATION DETAILS OR IN THE GENERAL NOTES).

FOR BI-DIRECTIONAL TRANSITION PANEL AND END SHOE DETAILS, SEE MANUFACTURER'S PRODUCT MANUAL.

MODEL (WIDE)	TEST LEVEL	FRONT SECTION LENGTH	UNIT WIDTH	FOUNDATION LENGTH	GORE WIDTH
SCI70GM	TL-2	13'-6"	2'-10 5/8"	OVERALL LENGTH PLUS 1'-6"	41" TO 133"
SCI100GM	TL-3	21'-6"	3'-1 1/2"	OVERALL LENGTH PLUS 1'-6"	41" TO 133"

SYSTEM AND PAD LENGTHS VARY DEPENDING ON BACKUP TYPE.

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: WORK AREA PROTECTION, CORP. AT (800) 327-4417, OR (630) 377-9100.
- FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION PANELS WILL BE REQUIRED.
- ADDITIONAL DETAILS FOR THE TRANSITION OPTIONS AND FOUNDATION OPTIONS WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
- CONCRETE SHALL BE CLASS "S" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
- MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE SCI100GM & SCI70GM SYSTEMS SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR C OF MERGING BARRIERS.

NOTE: FOR ATTACHMENT AND TRANSITIONS TO OTHER SHAPES, BARRIERS RAILINGS AND BI-DIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE. (SEE MANUFACTURER'S PRODUCT MANUAL)

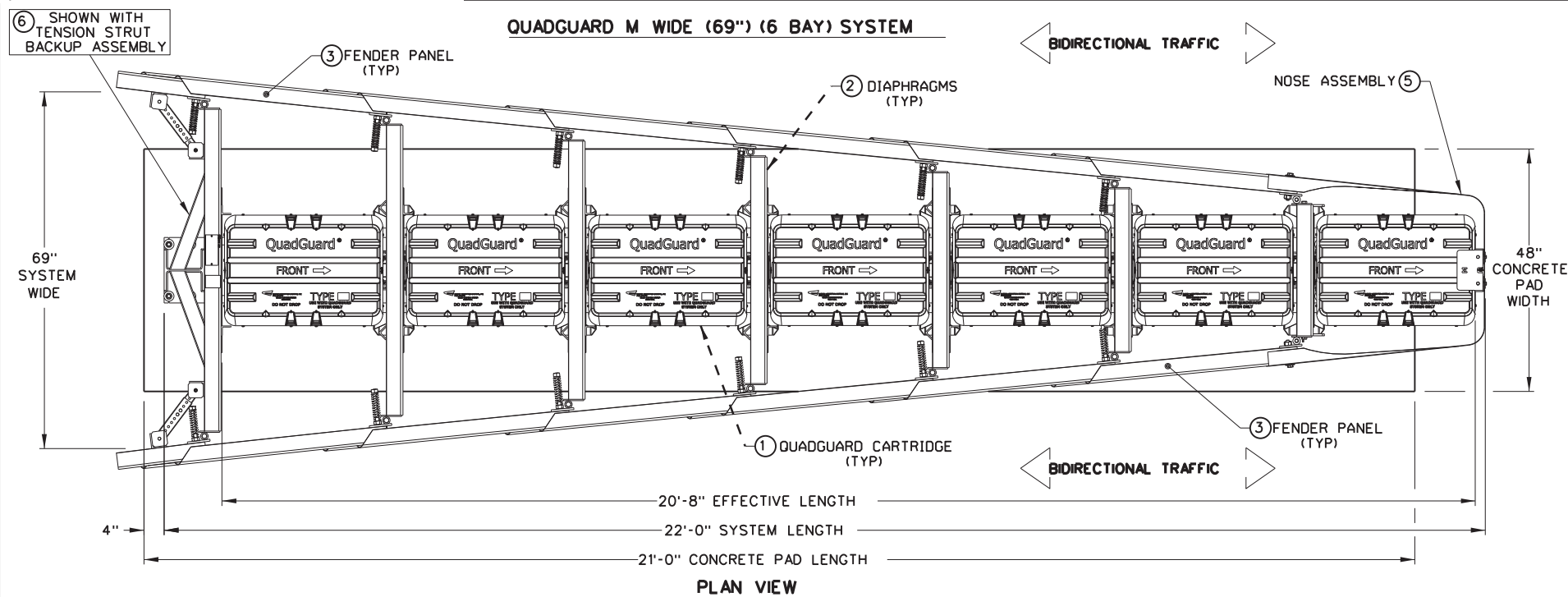
NOTE: SIDE PANELS CAN TRAVEL 30" BEYOND THE LAST TERMINAL BRACE AT THE REAR OF THE CUSHION. ALL OBJECTS THAT MAY INTERFERE WITH THIS MOTION CAN AFFECT PERFORMANCE OF AND MAY CAUSE UNDUE DAMAGE TO THE CRASH CUSHION.

LOW MAINTENANCE

				Design Division Standard	
WORK AREA PROTECTION CORP (SMART-WIDE)					
SMTC(W)-16					
FILE: smtcw16.dgn	DN: TxDOT	CK: KM	DW: BD/VP	CK: VP	
© TxDOT: FEBRUARY 2006		CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
REVISIONS					
REVISED 06, 2013 VP		DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 41	
REVISED 03, 2018 VP					
REVISED 04, 2018 VP					

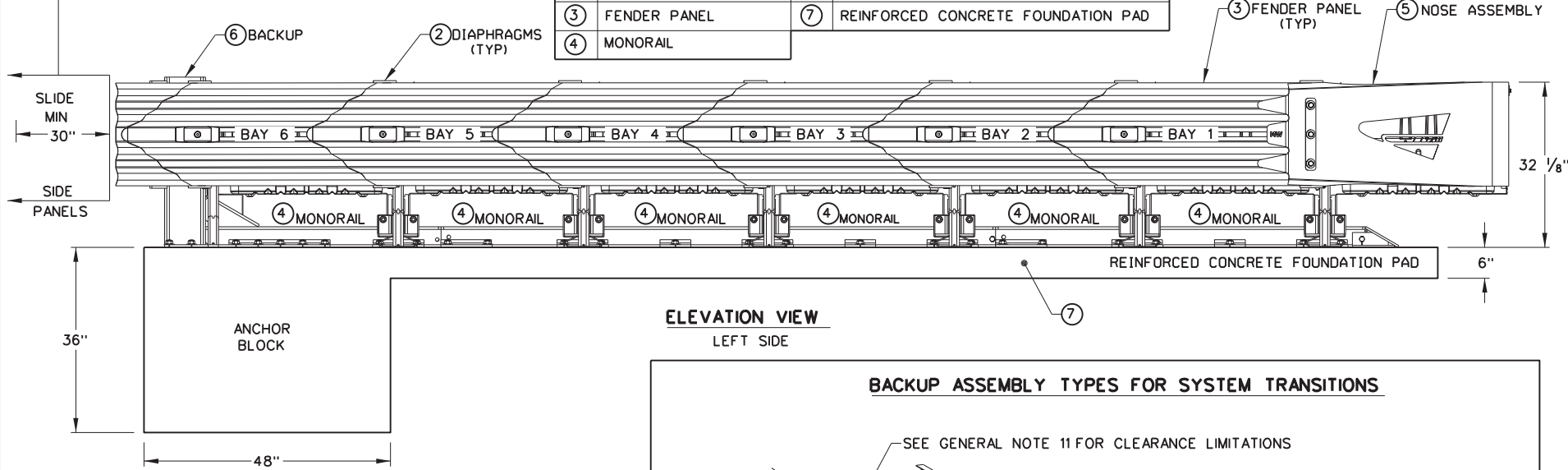
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DATE: 7/29/2024
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KEY	DESCRIPTION	KEY	DESCRIPTION
1	QUADGUARD CARTRIDGE	5	NOSE ASSEMBLY
2	DIAPHRAGM	6	TYPE OF BACKUP
3	FENDER PANEL	7	REINFORCED CONCRETE FOUNDATION PAD
4	MONORAIL		

NOTE: PROVISION SHALL BE MADE FOR REAR FENDER SIDE PANELS TO SLIDE REARWARD UPON IMPACT, 30" MIN.



NOTES:
 CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR CONCRETE PAD AND ANCHOR BLOCK INSTALLATION REQUIREMENTS.
 A MANUFACTURER'S DRAWING PACKAGE UNIQUE AND SPECIFIC FOR THE QUADGUARD M WIDE FIELD INSTALLATION AND INFORMATION REGARDING THE TYPE OF BACKUP ASSEMBLY REQUIRED FOR THE TRANSITION WILL BE PROVIDED BY THE MANUFACTURER TO THE ENGINEER AND INSTALLER.
 6" REINFORCED CONCRETE PAD REQUIRES THE INSTALLATION OF AN ANCHOR BLOCK AS SHOWN ON THE MANUFACTURER'S DRAWING PACKAGE.
 8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.
 CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS

SEE GENERAL NOTE 11 FOR CLEARANCE LIMITATIONS

6 TENSION STRUT BACKUP

SYSTEM TRANSITIONS TYPES	
1	QUAD-BEAM TO W-BEAM RAIL
2	QUAD-BEAM TO THRIE-BEAM RAIL
3	QUAD-BEAM TO CONCRETE SAFETY BARRIER
4	QUAD-BEAM TO SINGLE SLOPE BARRIER
5	QUAD-BEAM TO CONCRETE END SHOE
6	QUAD-BEAM TO CONCRETE BRIDGE RAIL

NOTE:
 TRANSITION ASSEMBLIES FOR THE QUADGUARD M WIDE TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:
 ALL POSTS W6X8.5/9 I-BEAMS (78" LONG).

NOTES:
 CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS:
 AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

NOTE:
 THE QUADGUARD M WIDE 6-BAY SYSTEM TESTED TO MASH TL-3.

TL-3 MODEL *	QM10069 (627515)	CARTRIDGE TYPES IN BAYS	
BAYS	6	TYPE I	TYPE II
DIAPHRAGMS	6	4	3
WIDTH	69"	REAR	FRONT

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT (1888)323-6374 OR WEBSITE www.trinityhighway.com.
- SEE THE RECENT QUADGUARD M WIDE PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE SIX (6) BAY WIDE [69"] SYSTEM BEFORE INSTALLING THE QUADGUARD M WIDE AT ANY GIVEN LOCATION.
- COMPONENTS FOR THE QUADGUARD M WIDE BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD M WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
- THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- FOR PERMANENT APPLICATIONS, QUADGUARD M WIDE SHOULD BE ASSEMBLED ON AN EXISTING OR FRESHLY PLACED AND CURED CONCRETE BASE 28MPa [4,000 PSI] MINIMUM. QUADGUARD M WIDE SYSTEM MAY ALSO BE ASSEMBLED ON REINFORCED OR NON-REINFORCED CONCRETE ROADWAY (MINIMUM 8" THICK).
- CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD M WIDE IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD M WIDE, THE QUADGUARD M WIDE SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD M WIDE AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
- SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD M WIDE SYSTEM IS SHIELDING. SEE THE QUADGUARD M WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- THE QUADGUARD M WIDE SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
- FOR THE TENSION STRUT BACKUP, THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
- THE WIDE QUADGUARD M WIDE SYSTEM IS ONLY AVAILABLE IN A 69" WIDTH AND HAS A 6-BAY SYSTEM THAT HAS BEEN TESTED TO MASH TEST LEVEL 3.
- IF THE OUTSIDE WIDTH OF OBSTACLE(S) BEING SHIELDED IS 53" OR GREATER, THE OUTSIDE OF OBSTACLE(S) MUST BE CHAMFERED. SEE THE QUADGUARD M WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- SEE THE "QUADGUARD M WIDE SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.

FOUNDATION & ANCHORING REQUIREMENTS
FOUNDATION TYPES: A & B

FOUNDATION TYPE:A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH WITH ANCHOR BLOCK (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:B	REINFORCED OR NON-REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	8" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE

KEY:
 COMPACTED SUBBASE (C.S.)
 PORTLAND CEMENT CONCRETE (P.C.C.)

NOTE: SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR THE APPROVED ADHESIVE.

TENSION STRUT BACKUP MAY NOT BE USED IN ASPHALT CONCRETE (A.C.). SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR MORE INFORMATION.

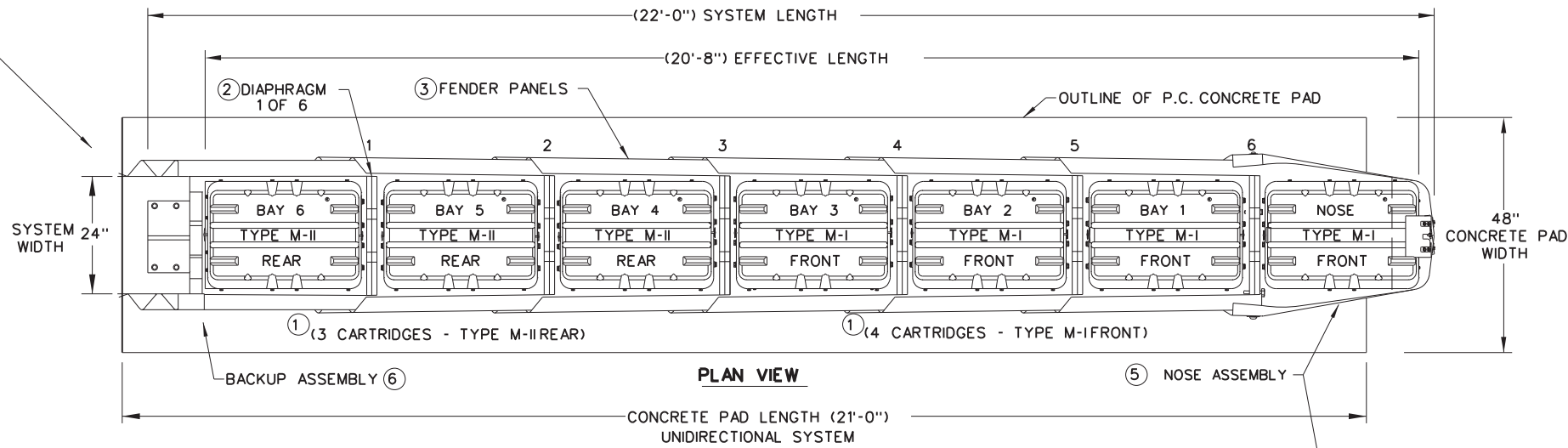
NOTE:
 THIS STANDARD IS A BASIC REPRESENTATION OF THE QUADGUARD M WIDE SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

REUSABLE

		Design Division Standard	
TRINITY HIGHWAY ENERGY ABSORPTION QUADGUARD M WIDE (MASH TL-3)			
QG(M)(W)-21			
FILE:	qgmw21.dgn	DN: TXDOT	CK: KM
© TXDOT:	JULY 2021	CONT: 89	SECT: 001
REVISIONS:		JOB: 001	US 190,ETC
DIST:	WACO	COUNTY:	BELL,ETC
		SHEET NO.:	42

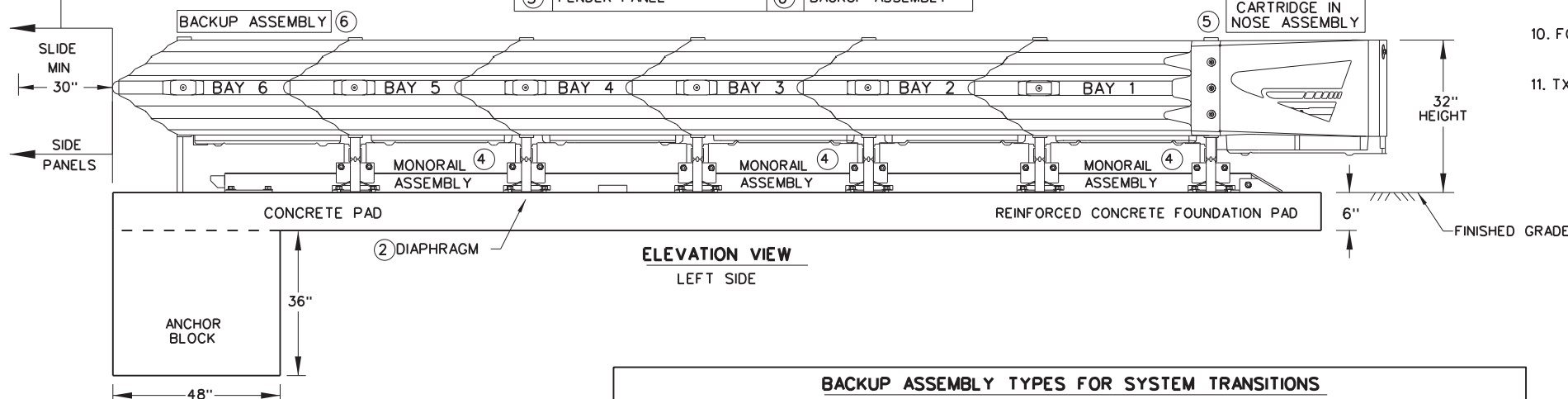
NOTE:
A TRANSITION MAY BE REQUIRED TO INSTALL THE QUADGUARD M10 TO THE OBJECT BEING SHIELDED.

QUADGUARD M10 24" WIDE 6-BAY SYSTEM

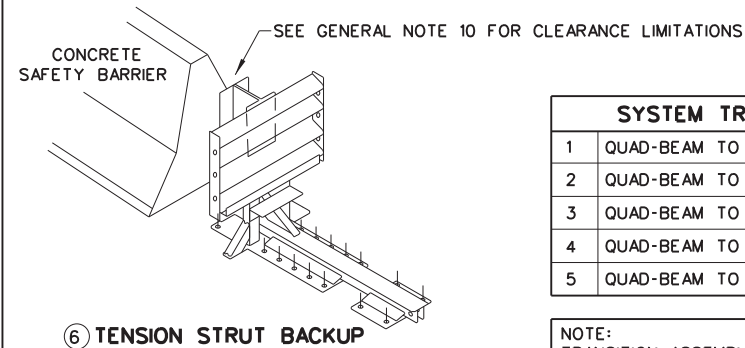


KEY		KEY	
①	QUADGUARD CARTRIDGE	④	MONORAILS
②	DIAPHRAGM	⑤	NOSE ASSEMBLY
③	FENDER PANEL	⑥	BACKUP ASSEMBLY

NOTE:
PROVISION SHALL BE MADE FOR REAR FENDER SIDE PANELS TO SLIDE REARWARD UPON IMPACT, 30" MIN.

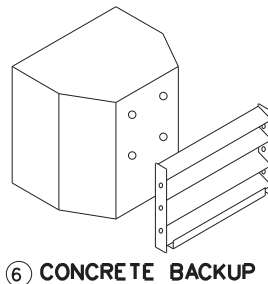


BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS



SYSTEM TRANSITIONS TYPES	
1	QUAD-BEAM TO CONCRETE SAFETY BARRIER
2	QUAD-BEAM TO CONCRETE BRIDGE RAIL
3	QUAD-BEAM TO CONCRETE END SHOE
4	QUAD-BEAM TO THRIE-BEAM RAIL
5	QUAD-BEAM TO W-BEAM RAIL

NOTE:
TRANSITION ASSEMBLIES FOR THE QUADGUARD M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:
10 (W6X9) I-BEAM POSTS.
POST 1 THRU 4 (84" LONG)
POST 5 THRU 10 (72" LONG)



NOTE:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS: AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT (1888)323-6374.
- SEE THE RECENT QUADGUARD M10 PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE NARROW 24" SYSTEM BEFORE INSTALLING THE QUADGUARD M10 SYSTEM AT ANY GIVEN LOCATION.
- FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD M10 IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD M10, THE QUADGUARD M10 SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
- SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD M10 SYSTEM IS SHIELDING. SEE THE QUADGUARD M10 PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- COMPONENTS FOR THE QUADGUARD M10 BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD M10 PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
- CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE QUADGUARD M10 SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
- FOR THE TENSION STRUT BACKUP THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
- TXDOT HAS ONLY APPROVED THE 24" WIDE QUADGUARD M10 SYSTEM. THE QUADGUARD M10 PRODUCT DESCRIPTION AND ASSEMBLY MANUAL INCLUDES SYSTEM WIDTH OF 24". ONLY THE 24" SYSTEM IS ALLOWED TO BE INSTALLED ON TEXAS ROADWAYS.

**FOUNDATION & ANCHORING REQUIREMENTS
FOUNDATION TYPES: A, B, C, & D**

FOUNDATION TYPE:A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2"
FOUNDATION TYPE:C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE

KEY:
ASPHALT CONCRETE (A.C.)
COMPACTED SUBBASE (C.S.)
PORTLAND CEMENT CONCRETE (P.C.C.)

NOTE: SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR THE APPROVED ADHESIVE.

IF THE UNIT IS ANCHORED TO ASPHALTIC CONCRETE, IT SHOULD BE RELOCATED TO FRESH, UNDISTURBED ASPHALT AND RE-ANCHORED AFTER EACH IMPACT TO ENSURE ADEQUATE FUTURE PERFORMANCE.

TENSION STRUT BACKUP MAY BE USED IN CONSTRUCTION ZONES ON ASPHALT CONCRETE (A.C.) FOR TEMPORARY USE ONLY.

NOTES:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR CONCRETE PAD AND ANCHOR BLOCK INSTALLATION REQUIREMENTS.

A MANUFACTURER'S DRAWING PACKAGE UNIQUE AND SPECIFIC FOR THE QUADGUARD M10 (N) INSTALLATION AND DETAILED INFORMATION REGARDING THE TYPE OF BACKUP ASSEMBLY FOR THE REQUIRED TRANSITION WILL BE PROVIDED TO THE ENGINEER AND INSTALLER.

6" REINFORCED CONCRETE PAD REQUIRES THE INSTALLATION OF AN ANCHOR BLOCK AS SHOWN ON THE MANUFACTURER'S DRAWING PACKAGE.

8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.

CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

NOTE:
THE QUADGUARD M10 24" WIDE 6-BAY - NARROW SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.

TL-3 MODEL #	QM10024	CYLINDER TYPES IN BAYS		
BAYS	6	TYPE-MII	TYPE-MI	TYPE-MI
DIAPHRAGMS	6	3	3	1
WIDTH	24"	REAR	FRONT	NOSE

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE QUADGUARD M10 SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

REUSABLE

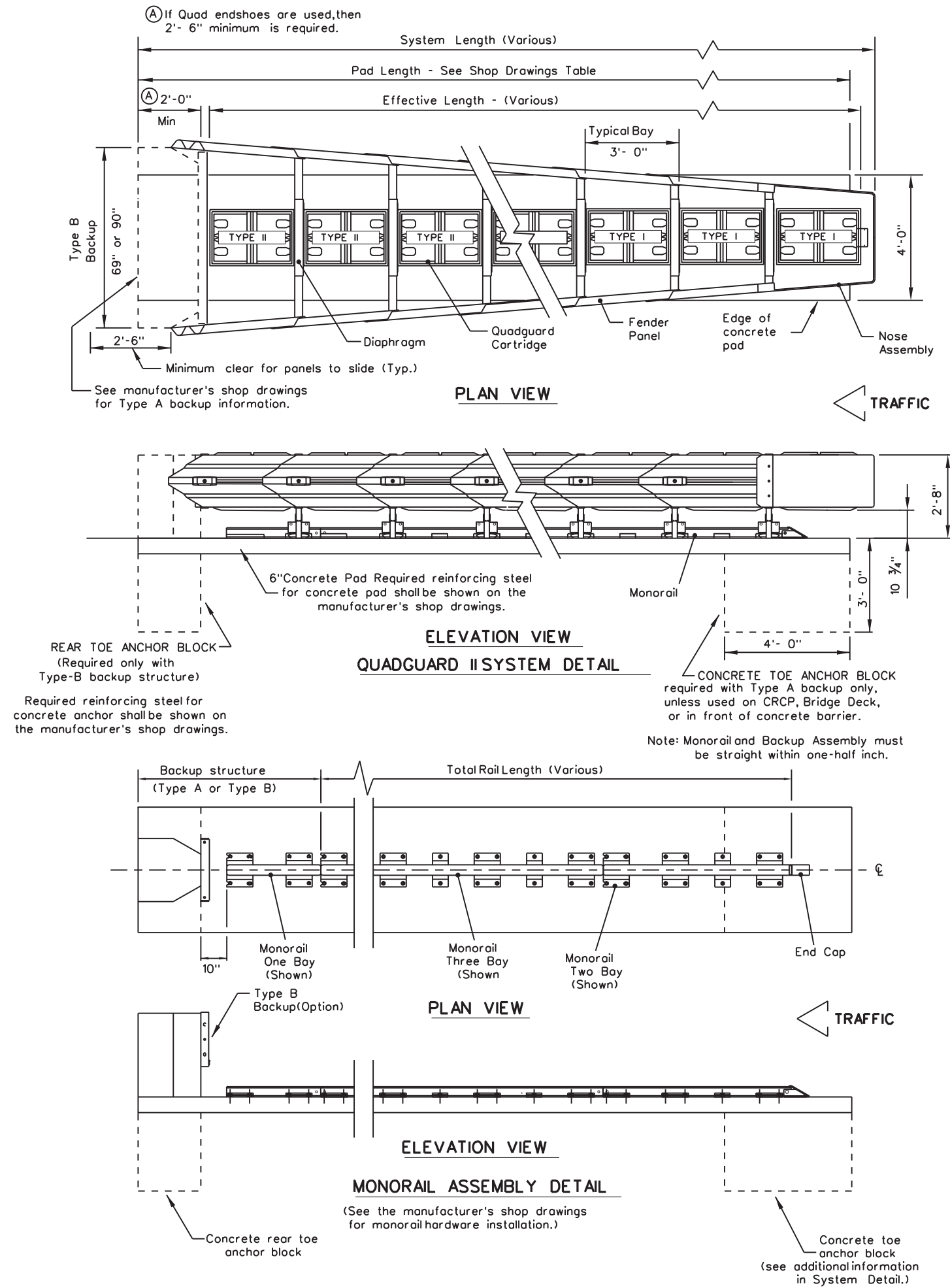
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TRINITY HIGHWAY ENERGY ABSORPTION QUADGUARD M10 (MASH TL-3 NARROW-24" ONLY) QUADGUARD(M10)(N)-20			
FILE: aguardm10n20.dgn	DN: TxDOT	CK: KM	DW:VP
© TxDOT: APRIL 2020	CONT SECT	JOB	HIGHWAY
REVISIONS	6467 89	001	US 190,ETC
	DIST	COUNTY	SHEET NO.
	WACO	BELL,ETC	43

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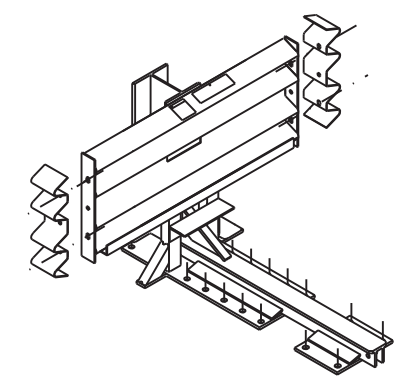
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QUADGUARD II (WIDE) SYSTEM				
Test Level	NO. OF BAYS	UNIT EFFECTIVE LENGTH	PAD LENGTH TYPE A	PAD LENGTH TYPE B
TL-2	3	11'- 8"	12'- 0"	11'- 6"
TL-3	5	17'- 8"	18'- 0"	17'- 6"

Additional bays may be added if special considerations warrant and site conditions will accommodate additional length.

QUAD II (W) units are available in 69" and 90" widths from 3 to 8 bays.
 Unit width, number of bays, and backup type shall be specified elsewhere in the plans.



TYPE A TENSION STRUT BACKUP

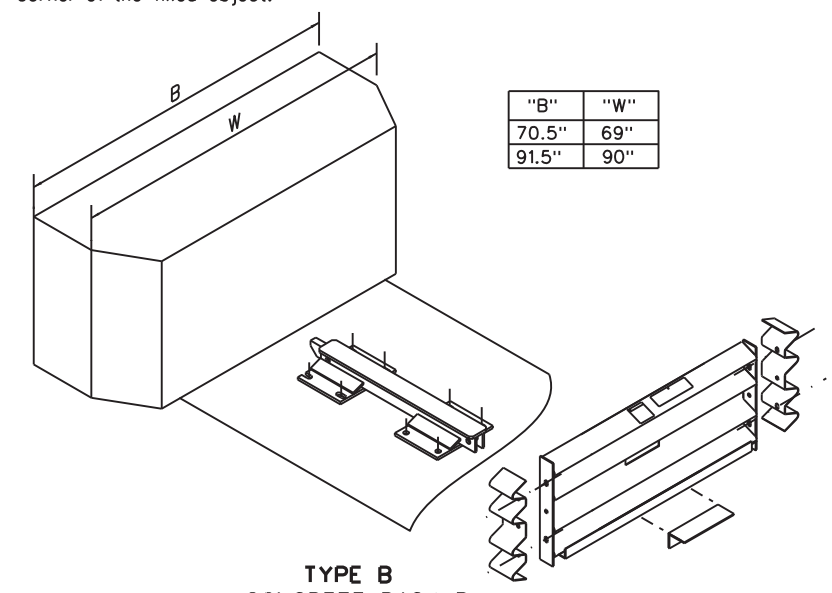
TENSION STRUT: Consists of diagonal struts, connections, and accessories, as detailed by the Manufacturer, located at the rear of the QUAD unit. Typical application is for QUAD units attached to double-face quadrail. When used, a 4'-0" x 4'-0" x 3'-0" concrete toe anchor block shall be provided beneath the front portion of the concrete pad, except where the QUAD unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 p.s.i.) or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.)

Anchorage requirements are as follows:

WITH FOUNDATION TYPE:	ANCHOR WITH:
Minimum six inch portland cement concrete pad	Epoxy anchoring system with 7" studs, 5.5" embedment

GENERAL NOTES

- For specific information regarding installation and technical guidance of the system, contact: Trinity Highway - Energy Absorption at (888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
- For bi-directional traffic, appropriate transition panels will be required.
- Details of components for the QUAD and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
- Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
- If the cross-slope varies more than 2% over the length of the system, the concrete pad will require levelling. Maximum permissible cross-slope is 8%.
- The installation area should be free from curbs, elevated objects, or depressions.
- The QUAD system should be approximately parallel with the barrier or C_L of merging barriers.
- Unit width selected should be adequate to protect an errant vehicle travelling at 15 degrees to the roadway from the face or corner of the fixed object.



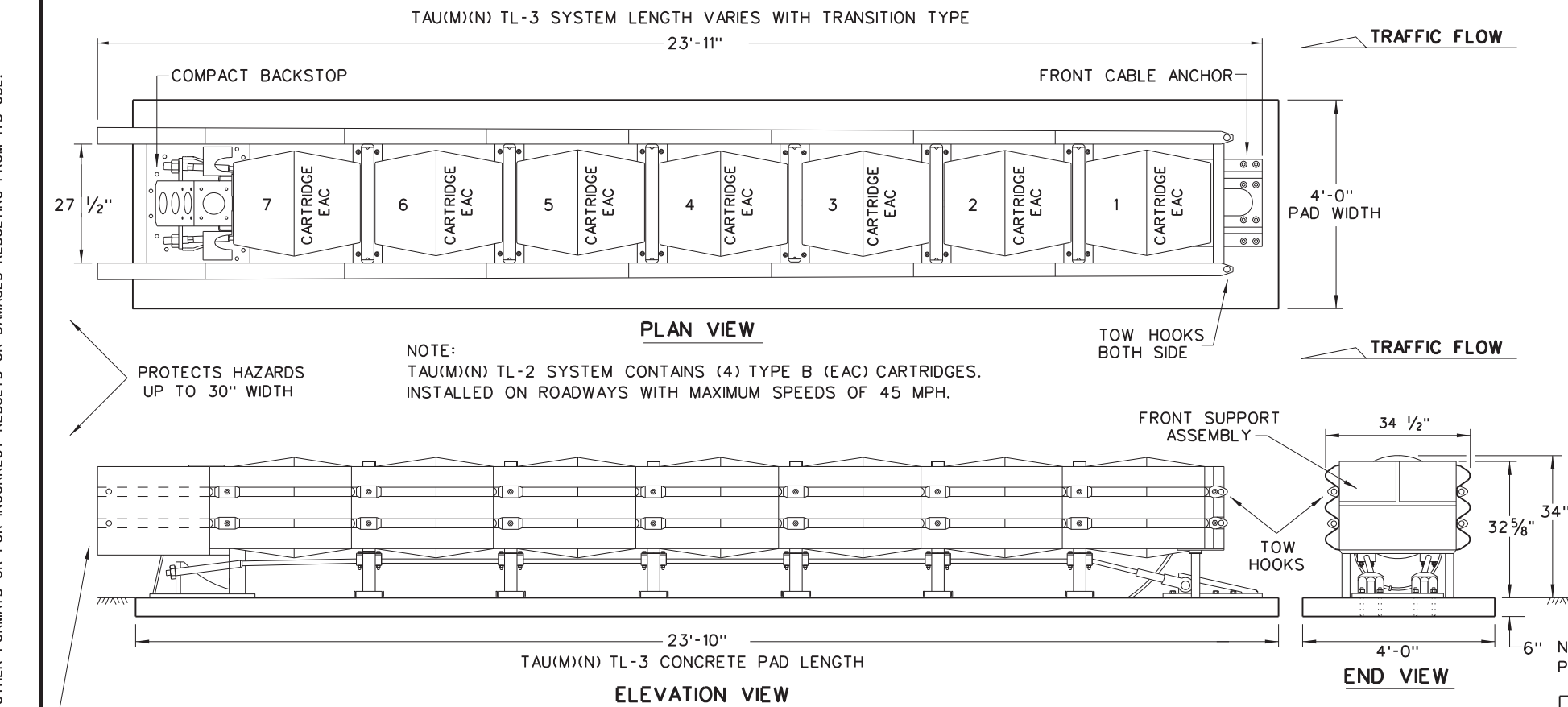
TYPE B CONCRETE BACKUP

CAST-IN-PLACE CONCRETE WALL BACKUP: If cast-in-place structures such as bridge parapets, columns, or special walls are used as backup structures, then intermediate walls shall be provided between the structures and the QUAD unit. Intermediate walls shall be equal in height and width to the QUAD unit and reinforced with a steel cage. A cast-in-place transition section from concrete barrier may be used. Reinforcing steel should transition from the standard barrier section to the standard backup section. Details for the intermediate walls, cast-in-place transition sections, or other modifications will be shown elsewhere in the plans. Concrete wall backups may be used on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 p.s.i.) or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.) In those cases, all vertical steel will be doweled (5 inch minimum) into existing decks or located and placed prior to pouring proposed decks as approved by the Engineer.

REUSABLE

Texas Department of Transportation		Design Division Standard	
TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD II) (WIDE) QUAD(W)-17			
FILE: quadw17.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: FEBRUARY 1998	CONT	SECT	JOB
REVISIONS	6467	89	001
REVISED 06,2013 VP	DIST	COUNTY	SHEET NO.
REVISED 03,2016 VP	WACO	BELL, ETC	44
REVISED 03,2017 KM			

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GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING THE INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800. 180 RIVER ROAD, RIO VISTA, CA 94571
2. REFER TO THE LATEST (LTS) INSTALLATION INSTRUCTION MANUAL FOR IMPORTANT SAFETY MESSAGES, COMPLETE SYSTEM ASSEMBLY, AND ANCHOR INSTALLATION REQUIREMENTS FOR THE NINE (9) DIFFERENT SITE TRANSITIONS.
3. INSTALLATION DETAILS FOR THE COMPACT BACKSTOP, FRONT CABLE ANCHOR AND FOUNDATION OPTIONS ARE SHOWN ON THE INSTALLATION INSTRUCTION MANUAL FURNISHED TO THE ENGINEER.
4. CONCRETE SHALL BE CLASS "S" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 P.S.I.
5. IF THE CROSS-SLOPES VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
6. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
7. THE TAU(M)(N) SYSTEM SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTER LINE OF MERGING BARRIERS.
8. THIS DRAWING REPRESENTS THE UNIVERSAL TAU(M)(N) TL-3 SYSTEM, A RE-DIRECTIVE NON-GATING CRASH CUSHION THAT CAN PROTECT HAZARDS UP TO 30-INCHES IN WIDTH. ALSO AVAILABLE IN TL-2 CONFIGURATION.

NOTE:
TAU(M)(N) TL-2 SYSTEM CONTAINS (4) TYPE B (EAC) CARTRIDGES.
INSTALLED ON ROADWAYS WITH MAXIMUM SPEEDS OF 45 MPH.

PROTECTS HAZARDS
UP TO 30" WIDTH

NOTE:
PAD THICKNESS VARIES - SEE FOUNDATION OPTIONS

NOTES:
TRANSITIONS AND ATTACHMENTS TO VARIOUS BARRIER SHAPES,
RAILINGS AND BI-DIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE.
SEE MANUFACTURER'S INSTALLATION INSTRUCTIONS MANUAL FOR
ADDITIONAL TRANSITION DETAILS.

NOTE:
CONCRETE FOUNDATION PAD LENGTH VARIES WITH TL-3 AND
TL-2 SYSTEMS, SEE SYSTEM & FOUNDATION LENGTH TABLE.

BILL OF MATERIALS FOR TAU(M)(N) TL-3 & TL-2 SYSTEMS		QUANTITIES	
PART NUMBER	PART DESCRIPTION	TL-3 SYSTEM	TL-2 SYSTEM
BSI-1708019-00	SLIDING PANEL GALVANIZED TAU(M)(N)	14	8
BSI-1708030-00	END PANEL, THRIE BEAM, GALV, TAU(M)(N)	2	2
BSI-1706001-00	CABLE ASSEMBLY, 7 BAY, TAU(M)(N)	2	-
BSI-1805036-00	CABLE ASSEMBLY, 4 BAY, TAU(M)(N)	-	2
BSI-1708018-00	FRONT CABLE ANCHOR	1	1
BSI-1707034-00	COMPACT BACKSTOP	1	1
B030703	MIDDLE SUPPORT ASSEMBLY	6	3
B030704	FRONT SUPPORT	1	1
B010722	ENERGY ABSORBING CARTRIDGE, TYPE B	7	4
K001005	TAU-II FRONT SUPPORT LEG KIT	1	1
BSI-1709083-KT	TETHER KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1809041-KT	SLIDER KIT (INCLUDES ALL HARDWARE)	7	4
BSI-1808033-KT	CABLE GUIDE KIT (INCLUDES ALL HARDWARE)	6	3
BSI-1809040-KT	TOW HOOK KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1808034-KT	DELINEATION BRACKET KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1808035-KT	END PANEL MOUNT KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1808036-KT	CONCRETE ANCHORING KIT	1	1
SEE NOTE	HIGH REFLECTIVE DECAL	1	1
ECN 3883	INSTALLATION AND INSTRUCTIONS MANUAL	1	1

FOUNDATION OPTIONS
6" REINFORCED CONCRETE
8" UNREINFORCED CONCRETE
ASPHALT OVER CONCRETE WITH MINIMUM 6" EMBEDMENT IN CONCRETE
6" ASPHALT OVER 6" COMPACT SUBBASE
8" MINIMUM ASPHALT

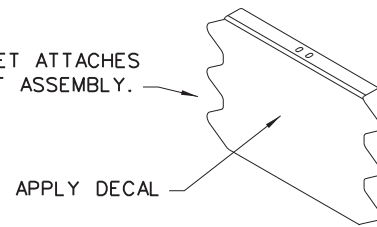
SYSTEM & FOUNDATION LENGTH TABLE	
SYSTEM LENGTH	FOUNDATION LENGTH
TL-2 = 15'-5"	TL-2 = 15'-4"
TL-3 = 23'-11"	TL-3 = 23'-10"

* NOTE:
REQUIRES AN ASPHALT ANCHORAGE PACKAGE: INCLUDES ADDITIONAL BRACES
FOR THE FRONT CABLE ANCHOR AND THE COMPACT BACKSTOP, AND ASPHALT
HARDWARE KIT. THE TL-3 ASPHALT CONFIGURATION ALSO REQUIRES NESTED
SLIDER PANELS AND SHIMS AT THE LAST TWO BAYS. SEE MANUFACTURER'S
INSTALLATION INSTRUCTION MANUAL FOR DETAILS.

NOTE:
SEE MANUFACTURER'S INSTALLATION INSTRUCTION MANUAL FOR FOUNDATION
SPECIFICATIONS THAT INCLUDE, STONE AGGREGATE MIX, COMPRESSION
STRENGTH, STEEL SIZE, ANCHOR SIZE, AND EMBEDMENT DEPTH.

* * NOTE:
ENGINEER OR CONTRACTOR SHALL COORDINATE WITH
THE MANUFACTURER FOR THE CORRECT DECAL PER
TRAFFIC FLOW, LEFT, RIGHT OR BOTH-SIDES.

NOTE:
DELINEATION BRACKET ATTACHES
TO FRONT SUPPORT ASSEMBLY.



DELINEATION BRACKET

NOTE:
APPLY A HIGH REFLECTIVE DECAL TO THE DELINEATION BRACKET.
DELINEATION DECAL ORIENTATION IS SHOWN ON THE CONSTRUCTION
PLAN SET AND SHALL BE IN ACCORDANCE WITH THE TEXAS MUTCD
FOR (TRAFFIC CONTROL DEVICES). DECALS ARE AVAILABLE FOR
TRAFFIC FLOW ON THE LEFT-SIDE, BOTH -SIDES AND RIGHT-SIDE.

NOTES:
UPGRADE KITS ARE AVAILABLE TO RETROFIT EXISTING
NCHRP 350 TAU-II SYSTEMS TO MASH COMPLIANT SYSTEMS.
SEE MANUFACTURER'S PRODUCT INFORMATION.

THE TAU(M)(N) UNIDIRECTIONAL SYSTEM IS FREE STANDING
AND IS NOT REQUIRED TO BE CONNECTED TO THE HAZARD.

TRANSITIONS TO GUARD FENCE, BRIDGE RAILS AND ROADSIDE
BARRIERS SHALL BE IN ACCORDANCE WITH TxDOT'S POLICY.

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE
UNIVERSAL TAU(M)(N) SYSTEM, IT IS NOT INTENDED TO
REPLACE THE INSTALLATION INSTRUCTION MANUAL.

TRANSITION OPTIONS	
USE THE COMPACT BACKSTOP	VERTICAL WALL
	CONCRETE TRAFFIC BARRIERS
	W-BEAM GUARDRAIL
	THRIE BEAM GUARDRAIL

NOTE:
FOR BI-DIRECTIONAL TRANSITION PANELS AND BRIDGE RAIL END SHOE
DETAILS. SEE MANUFACTURER'S INSTALLATION INSTRUCTIONS MANUAL.

REUSABLE

Texas Department of Transportation

Design Division Standard

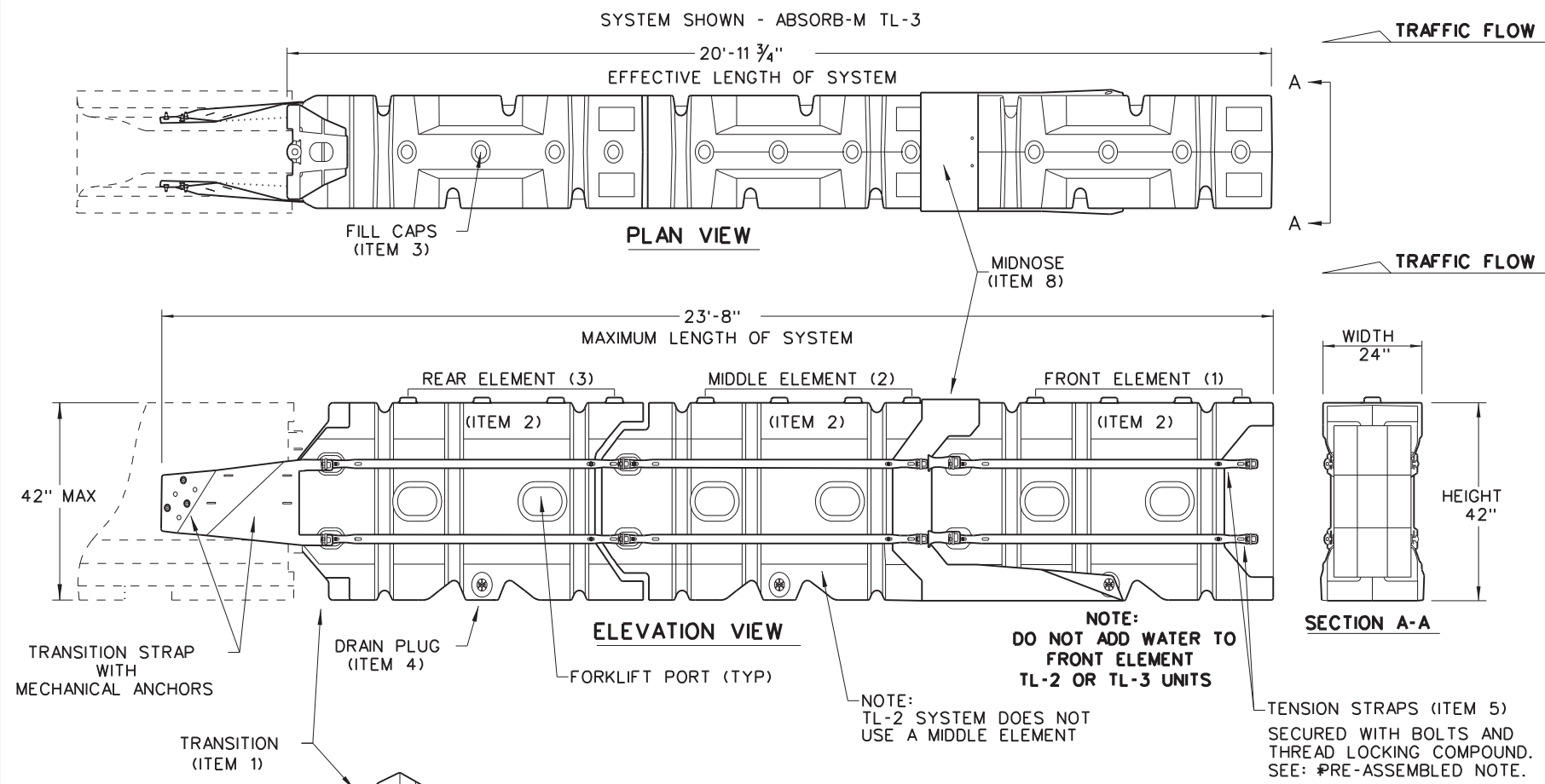
LINDSAY TRANSPORTATION SOLUTIONS

**UNIVERSAL
CRASH CUSHION
(MASH TL-3 & TL-2)
TAU(M)(N)-19**

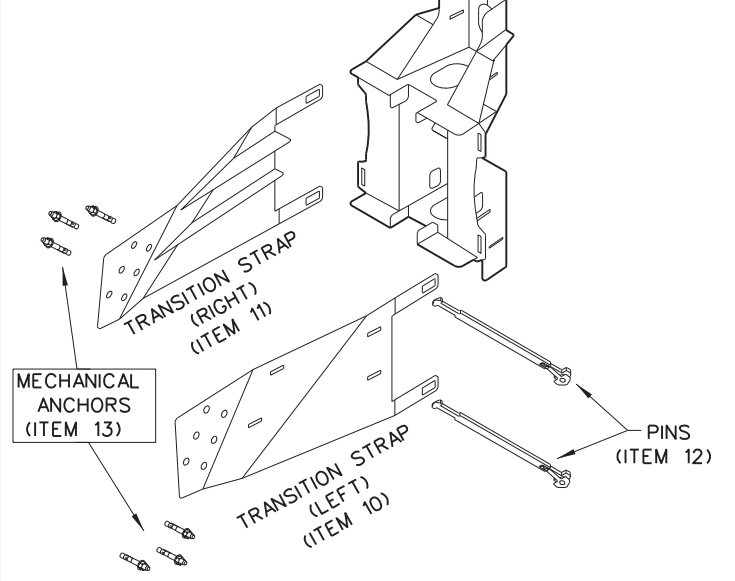
FILE: taumn19.dgn	DN: TxDOT	CK: KM	DW: VP	CK:
© TxDOT: APRIL 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190, ETC
DIST	COUNTY		SHEET NO.	
WACO	BELL, ETC		45	

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DATE: 7/29/2024
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- ### GENERAL NOTES
- FOR SPECIFIC INFORMATION REGARDING THE INSTALLATION AND TECHNICAL GUIDANCE, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800. 180 RIVER ROAD, RIO VISTA, CA 94571
 - THE ABSORB-M SYSTEM IS ONLY APPROVED FOR USE IN (TEMPORARY WORK ZONE) LOCATIONS.
 - THE ABSORB-M IS A WATER FILLED NON-REDIRECTIVE, GATING CRASH CUSHION THAT DOES NOT NEED TO BE ATTACHED TO A FOUNDATION AND CAN BE INSTALLED ON TOP OF CONCRETE, ASPHALT, OR ANY SURFACE CAPABLE OF BEARING THE WEIGHT OF THE SYSTEM.
 - MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
 - THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
 - THE ABSORB-M SHOULD BE LOCATED APPROXIMATELY PARALLEL WITH THE BARRIER.
 - THE USE OF THE ABSORB-M IS RESTRICTED TO A BARRIER HEIGHT OF UP TO 42 INCHES.
 - DO NOT ADD WATER TO FRONT ELEMENT (TL-2 OR TL-3 UNIT).



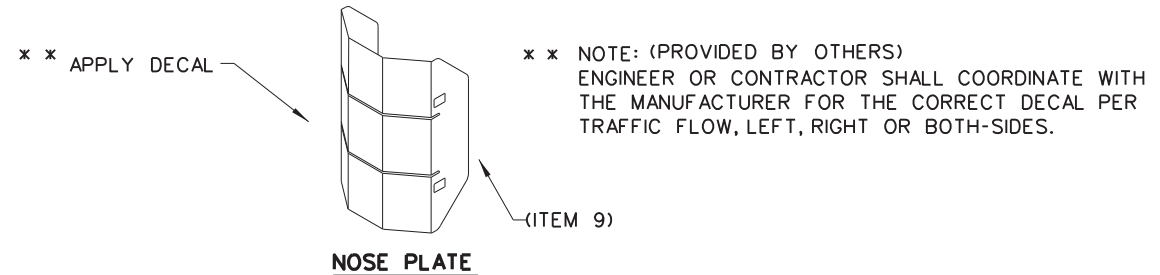
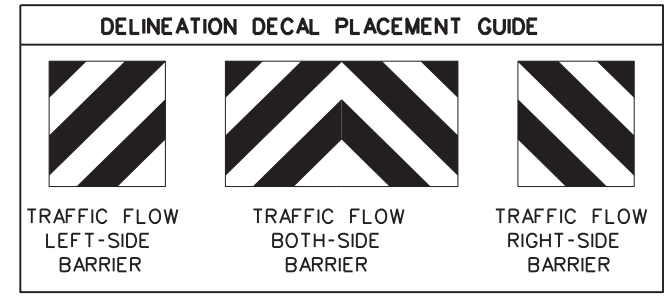
THE ABSORB-M IS A NON-REDIRECTIVE, GATING, CRASH CUSHION DESIGNED TO MEET THE LATEST TL-3 & TL-2 MASH REQUIREMENTS.
 THE SYSTEM IS DESIGNED TO ACCOMMODATE A VARIETY OF F-SHAPE AND SINGLE SLOPE CONCRETE BARRIERS. CONTACT THE MANUFACTURER FOR GUIDANCE REGARDING OTHER ALLOWABLE SHAPES.

TEST LEVEL	NUMBER OF ELEMENTS	EFFECTIVE LENGTH	MAXIMUM LENGTH
TL-2	2	14'- 7 3/4"	17'- 4"
TL-3	3	20'- 11 3/4"	23'- 8"

NOTE: CROSS SLOPES OF UP TO 8% (OR 1:12 SLOPE) CAN BE ACCOMMODATED WITH STANDARD HARDWARE SHOWN WITHIN THE INSTRUCTIONS MANUAL. FOR SLOPES WITH EXCESS OF 8% (OR 1:12) CONTACT, LINDSAY TRANSPORTATION SOLUTIONS.

BILL OF MATERIALS (BOM) ABSORB-M TL-3 & TL-2 SYSTEMS			QTY	QTY
ITEM #	PART NUMBER	PART DESCRIPTION	TL-2 SYSTEM	TL-3 SYSTEM
1	BSI-1809036-00	TRANSITION-(GALV)	1	1
2	BSI-1808002-00	PRE-ASSEMBLED ABSORBING (ELEMENTS)	2	3
3	BSI-4004598	FILL CAPS	8	12
4	BSI-4004599	DRAIN PLUGS	2	3
5	BSI-1809053-00	TENSION STRAP-(GALV)	8	12
6	BSI-2001998	C-SCR FH 3/8-16 X 1 1/2 GR5 PLT	8	12
7	BSI-2001999	C-SCR FH 3/8-16 X 1 GR5 PLT	8	12
8	BSI-1809035-00	MIDNOSE -(GALV)	1	1
9	BSI-1808014-00	NOSE PLATE	1	1
10	BSI-1809037-00	TRANSITION STRAP (LEFT-HAND)-(GALV)	1	1
11	BSI-1809038-00	TRANSITION STRAP (RIGHT-HAND)-(GALV)	1	1
12	BSI-1808005-00	PIN ASSEMBLY	8	10
13	BSI-2002001	ANC MECH 5/8-11X5 (GALV)	6	6
14	ABSORB-M	INSTALLATION AND INSTRUCTIONS MANUAL	1	1

* COMPONENTS PRE-ASSEMBLED WITH ELEMENT ASSEMBLY



NOTE: APPLY A HIGH REFLECTIVE DECAL TO THE NOSE PLATE. DELINEATION DECAL ORIENTATION IS SHOWN ON THE CONSTRUCTION PLAN SET AND SHALL BE IN ACCORDANCE WITH THE TEXAS MUTCD FOR (TRAFFIC CONTROL DEVICES). DECALS ARE AVAILABLE FOR TRAFFIC FLOW ON THE LEFT-SIDE, BOTH -SIDES AND RIGHT-SIDE.

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE ABSORB-M, IT IS NOT INTENDED TO REPLACE THE INSTALLATION INSTRUCTIONS MANUAL.

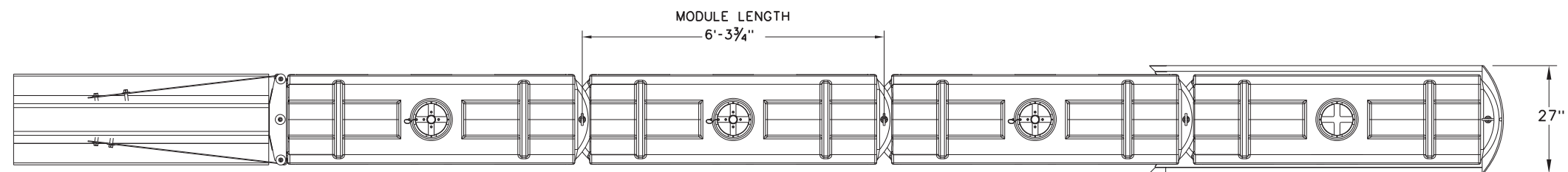
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Design Division Standard

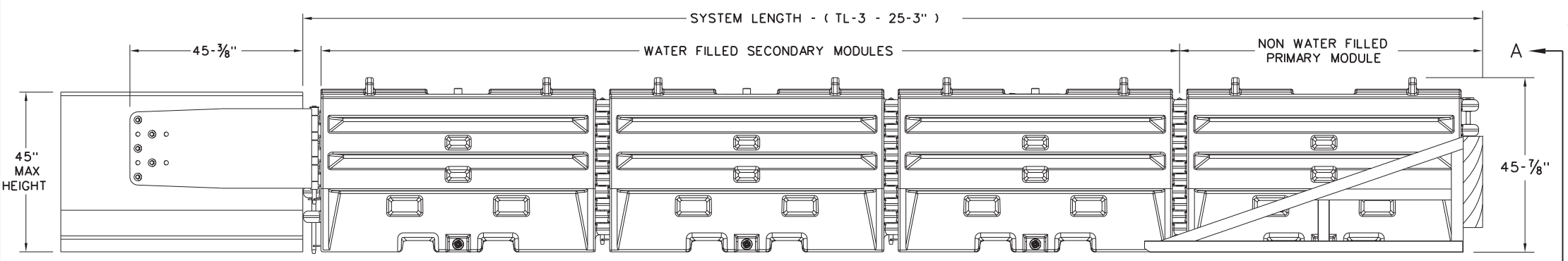
LINDSAY TRANSPORTATION SOLUTIONS CRASH CUSHION (MASH TL-3 & TL-2) TEMPORARY - WORK ZONE ABSORB(M)-19

FILE: absorbm19	DN: TxDOT	CK: KM	DW: VP	CK:
© TxDOT: JULY 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
DIST	COUNTY		SHEET NO.	
WACO	BELL,ETC		46	

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PLAN VIEW

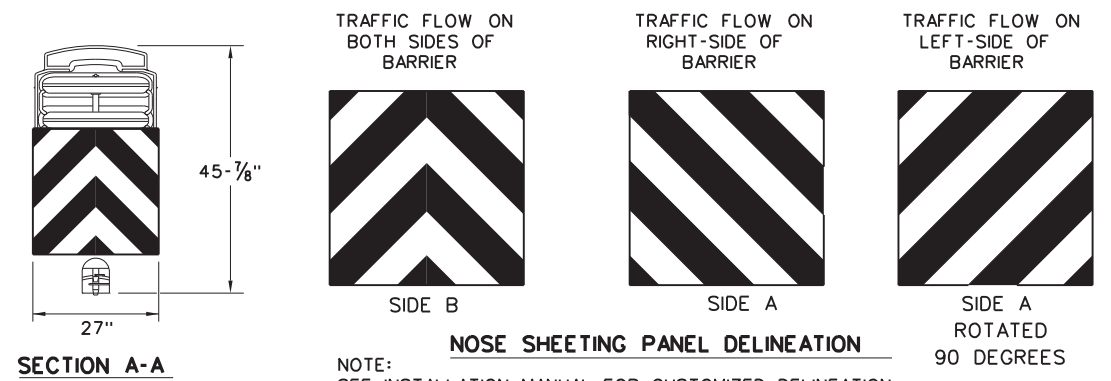


ELEVATION VIEW

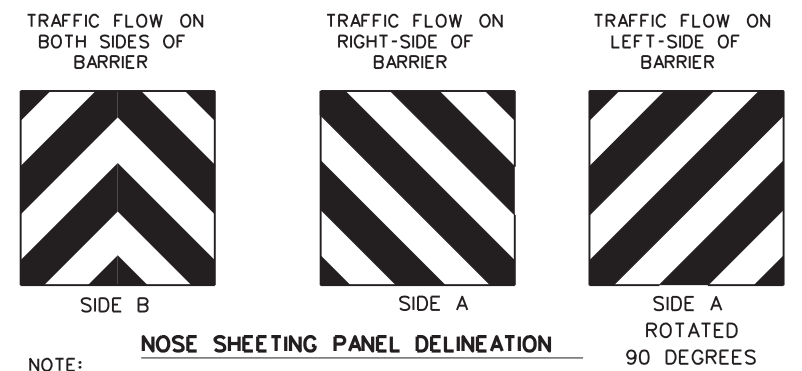
GENERAL NOTES

1. REFER TO THE INSTALLATION MANUAL FOR SPECIFIC SYSTEM ASSEMBLY AND MODULE ORIENTATION. FOR ADDITIONAL INFORMATION, CONTACT TRAFFIX, INC. AT (949) 361-5663.
2. THE SLED SYSTEM IS A MASH APPROVED TEST LEVEL 3 (TL-3) CRASH CUSHION APPROVED FOR USE IN TEMPORARY WORK ZONES. THE SLED SYSTEM IS A NON-REDIRECTIVE, GATING CRASH CUSHION THAT DOES NOT NEED TO BE ATTACHED TO THE GROUND AND CAN BE INSTALLED ON CONCRETE, ASPHALT, GRAVEL OR COMPACTED SOIL.
3. MAXIMUM PERMISSIBLE CROSS SLOPE IS 8° (DEGREES)(14%).
4. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
5. THE SLED SYSTEM CAN BE ATTACHED TO:

- CONCRETE BARRIER, TEMPORARY OR PERMANENT, 45" MAXIMUM HEIGHT
- STEEL BARRIER
- PLASTIC BARRIER
- CONCRETE BRIDGE ABUTMENTS
- W-BEAM GUARD RAIL
- THRIE BEAM GUARD RAIL



SECTION A-A

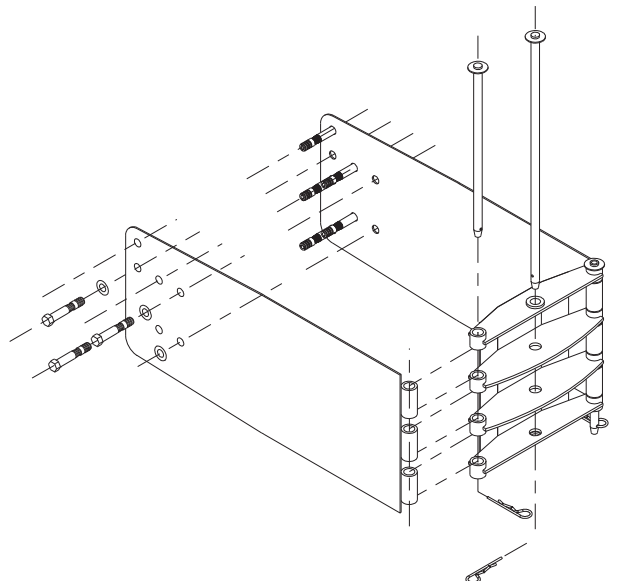


NOSE SHEETING PANEL DELINEATION

NOTE: SEE INSTALLATION MANUAL FOR CUSTOMIZED DELINEATION NOSE SHEETING FOR DECAL PLACEMENT.

TEST LEVEL	NUMBER OF SECONDARY MODULES	SYSTEM LENGTH
TL-3	3	25' 3"

BILL OF MATERIAL		
PART NUMBER	DESCRIPTION	QTY:TL-3
45131	TRANSITION FRAME,GALVANIZED	1
45150	TRANSITION PANEL,GALVANIZED	2
45147-CP	TRANSITION SHORT DROP PIN W/ KEEPER PIN, GALVANIZED	2
45148-CP	TRANSITION LONG DROP PIN W/ KEEPER PIN, GALVANIZED	1
45050	ANCHOR BOLTS	9
12060	WASHER, 3/4" ID X 2" OD	9
45044-Y	SLED YELLOW WATER FILLED MODULE	3
45044-YH	SLED YELLOW "NO FILL" MODULE	1
45044-S	CIS (CONTAINMENT IMPACT SLED), GALVANIZED	1
45043-CP	T-PIN W/ KEEPER PIN	4
18009-B-1	FILL CAP W/ "DRIVE BY" FLOAT INDICATOR	3
45033-RC-B	DRAIN PLUG	3
45032-DPT	DRAIN PLUG REMOVAL TOOL	1



SLED TRANSITION COMPONENTS FOR ATTACHMENT TO CMB

NOTE: SEE MANUFACTURER'S INSTALLATION MANUAL FOR FURTHER DETAILS.

TRANSITION OPTIONS
SLED TRANSITION TO CONCRETE TRAFFIC BARRIER (TEMPORARY OR PERMANENT)
SLED TRANSITION TO STEEL TRAFFIC BARRIER (CONTACT MFGR FOR PROPER TRANSITION)
SLED TRANSITION TO PLASTIC TRAFFIC BARRIER (CONTACT MFGR FOR PROPER TRANSITION)
SLED TRANSITION TO W-BEAM OR THRIE BEAM GUARD RAIL (CONTACT MFGR FOR PROPER TRANSITION)
SLED TRANSITION TO CONCRETE BRIDGE ABUTMENT

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE SLED, IT IS NOT INTENDED TO REPLACE THE INSTALLATION INSTRUCTIONS MANUAL.

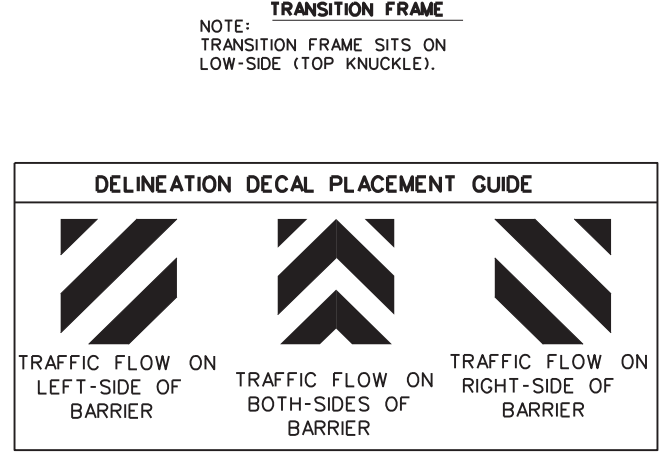
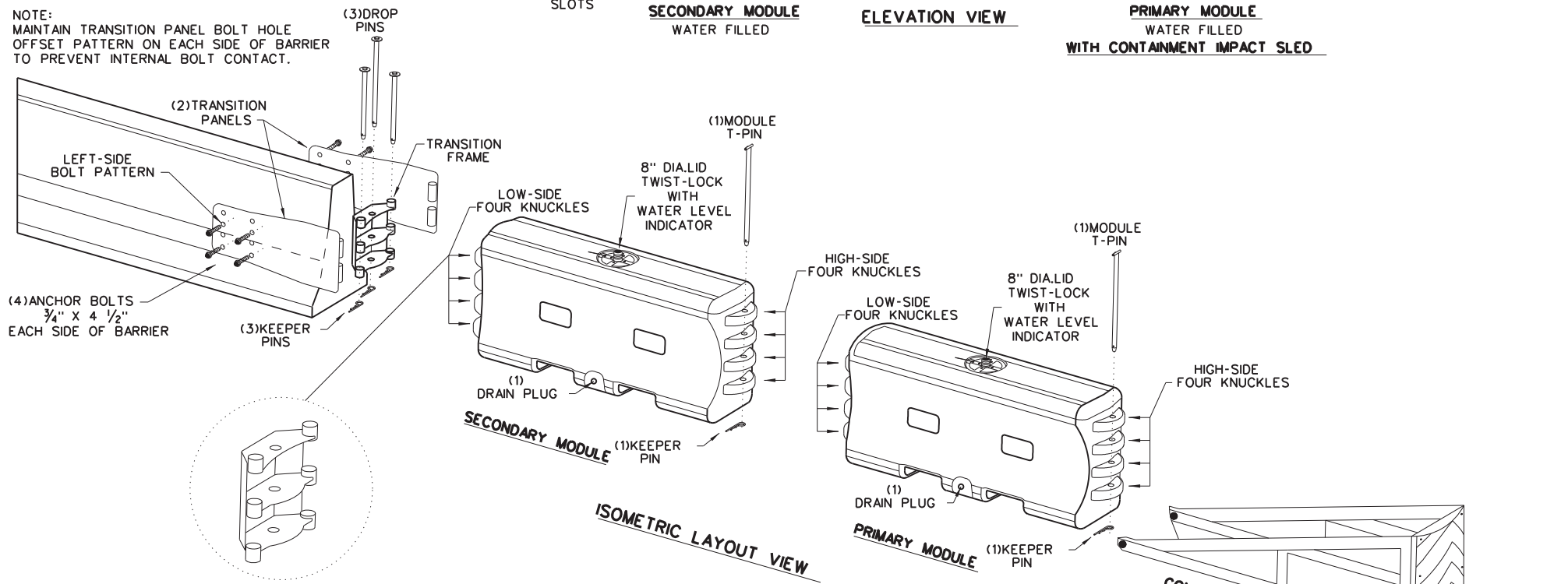
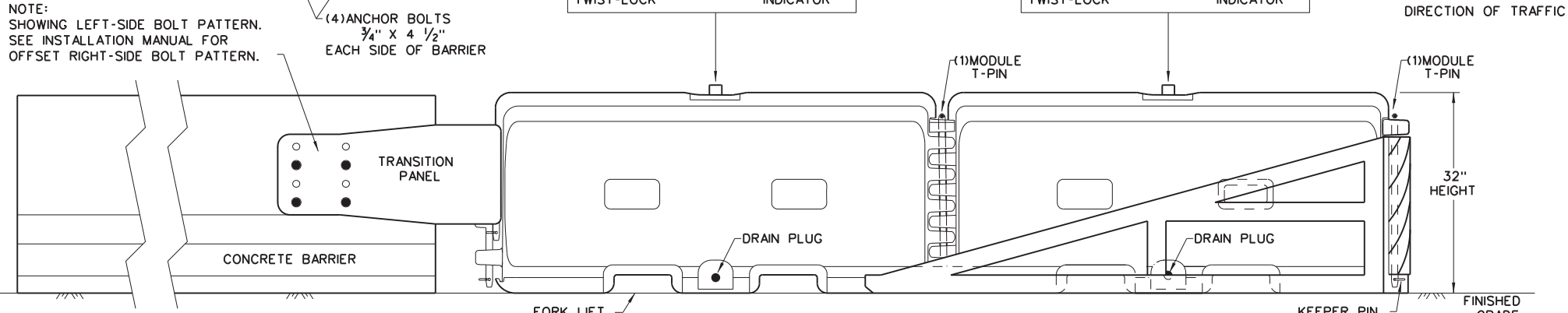
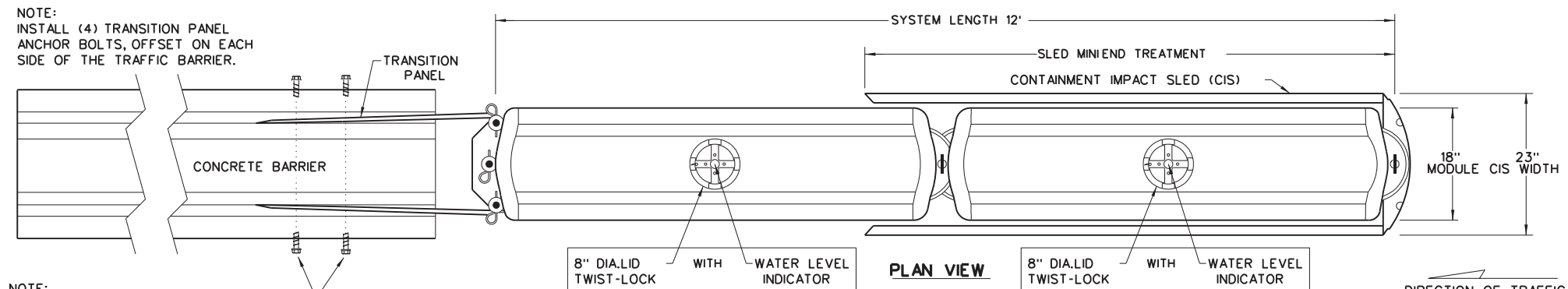
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Design Division Standard

SLED CRASH CUSHION TL-3 MASH COMPLIANT (TEMPORARY, WORK ZONE) SLED-19

FILE: sled19.dgn	DN: TxDOT	CK: KM	DW: VP	CK:
© TxDOT: DECEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
DIST	COUNTY		SHEET NO.	
WACO	BELL,ETC		47	

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* NOTE: ENGINEER OR CONTRACTOR SHALL COORDINATE WITH THE MANUFACTURER FOR THE CORRECT DECAL PER TRAFFIC FLOW, LEFT, RIGHT OR BOTH-SIDES.

NOTE: APPLY A HIGH REFLECTIVE DECAL TO THE NOSE PLATE. DELINEATION DECAL ORIENTATION IS SHOWN ON THE CONSTRUCTION PLAN SET AND SHALL BE IN ACCORDANCE WITH THE TEXAS MUTCD FOR TRAFFIC CONTROL DEVICES. DECALS ARE AVAILABLE FOR TRAFFIC FLOW ON THE LEFT-SIDE, BOTH -SIDES AND RIGHT-SIDE. THE ORIENTATION BETWEEN THE LEFT-SIDE AND RIGHT-SIDE TRAFFIC IS CHANGED BY ROTATING THE DECAL 90 DEGREES AND REINSTALLING.

GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT TrofFix Devices, Inc. AT (949)361-5663
- THE SLED MINI IS A MASH APPROVED TEST LEVEL 2 (TL-2) CRASH CUSHION APPROVED FOR USE WITHIN TEMPORARY WORK ZONE LOCATIONS. TL-2 IS APPROVED FOR SPEEDS OF 45 MPH OR LESS.
- THE SLED MINI IS A GATING, NON-REDIRECTIVE CRASH CUSHION THAT DOES NOT NEED TO BE BOLTED TO THE GROUND AND CAN BE INSTALLED ON CONCRETE, ASPHALT, GRAVEL OR COMPACTED SOIL.
- THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, AND DEPRESSIONS.
- THE SLED MINI CAN BE ATTACHED TO CONCRETE BRIDGE ABUTMENTS, CONCRETE BARRIER, STEEL BARRIER AND PLASTIC BARRIER.

SLED MINI TL-2 - BILL OF MATERIALS		
QTY:	PART #	PART DESCRIPTIONS
2	45332-MY	WATER FILLED MODULE
2	45032-CPGAL	T-PINS - LENGTH 26" WITH KEEPER PINS - FOR MODULES
2	18009-B-I	WATER LEVEL INDICATOR FLOAT LID
1	45032-S	CONTAINMENT IMPACT SLED (CIS)
2	45151	UNIVERSAL TRANSITION PANELS
1	45132	TRANSITION FRAME
1	45141	DROP PIN - LENGTH 26.50" WITH KEEPER PIN
2	45142	DROP PINS - LENGTH 18.50" WITH KEEPER PINS
8	45050	TRANSITION PANEL ANCHOR BOLTS 3/4" X 4 1/2" (4 EA. SIDE)

MODULE SPECIFICATIONS	(CIS) SPECIFICATIONS
LENGTH: 73" (PIN TO PIN)	LENGTH: 87 1/8"
HEIGHT: 32"	HEIGHT: 32"
WIDTH: 18"	WIDTH: 23"
EMPTY WEIGHT: 110 lbs.	APPROX. WEIGHT: 1250 lbs.
FILLED WEIGHT: 1100 lbs.	
FILL CAPACITY: 118.5 Gal	

Design Division Standard

**SLED MINI
END TREATMENT
TL-2 MASH COMPLIANT
(TEMPORARY, WORK ZONE)
SLEDMINI-19**

FILE: sledmini19	DN: TxDOT	CK: KM	DN: VP	CK:
© TxDOT: DECEMBER 2019	CONT SECT	JOB	HIGHWAY	
REVISIONS	6467 89	001	US 190,ETC	
	DIST	COUNTY	SHEET NO.	
	WACO	BELL,ETC	48	

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE SLED MINI. IT IS NOT INTENDED TO REPLACE THE INSTALLATION INSTRUCTIONS MANUAL.

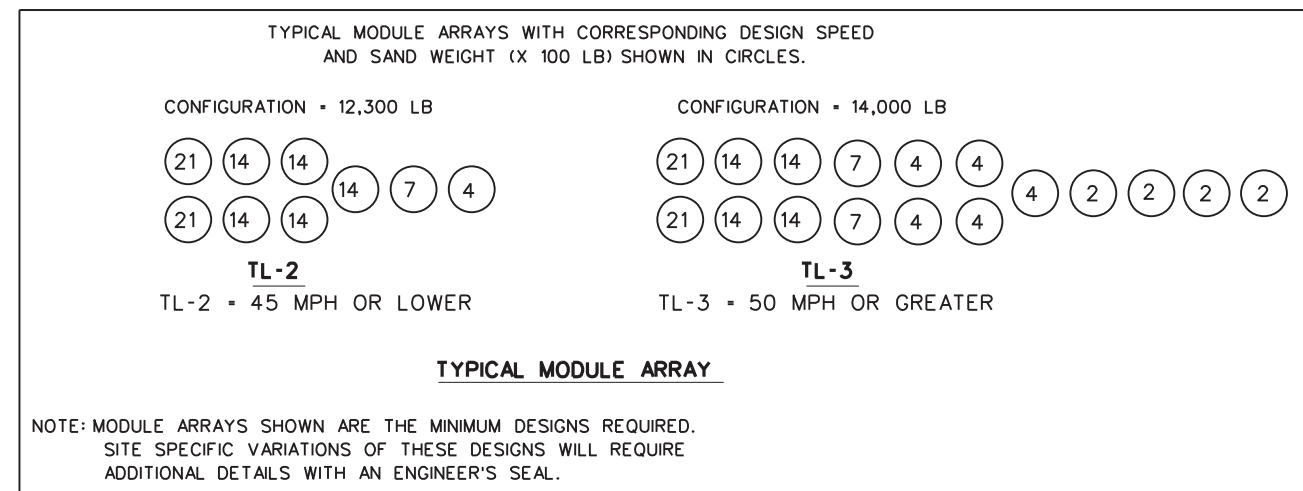
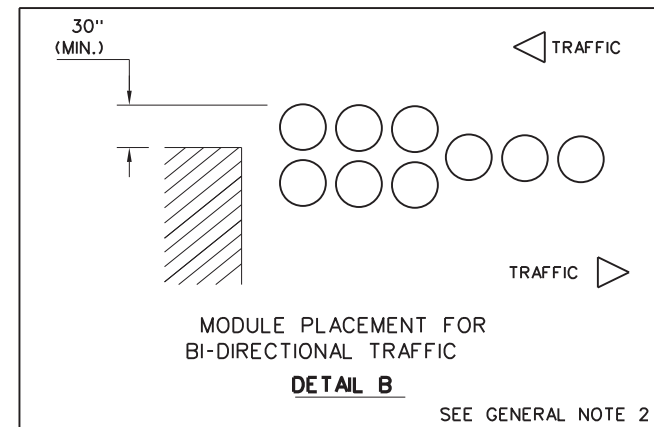
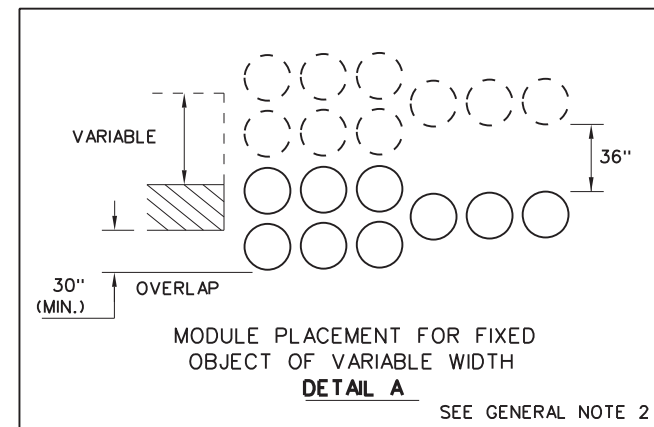
SACRIFICIAL

DATE: 7/29/2024
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DATE: 7/29/2024
FILE: c:\txdot\pw_online\txdot3\me\lendy.sm\th\d0754862\viasfpm19.dgn

SITE CONDITIONS AND PLACEMENT GUIDELINES		
CONDITION	RECOMMENDATION	ILLUSTRATION
1. ANGLE OF ARRAY IN RELATION TO CENTER LINE OF OBSTACLE	NOT RECOMMENDED FOR MORE THAN 10°	
2. MODULE SPACING: MODULE TO FIXED OBJECT MODULE TO MODULE	12" TO 24" SEE DIAGRAM	
3. BI-DIRECTIONAL TRAFFIC	OFFSET ARRAY TO AVOID REAR CORNER MODULE SNAGGING, POTENTIAL BY TRAFFIC IN THE UPSTREAM DIRECTION OF FLOW.	SEE (DETAIL B) SHOWING BI-DIRECTIONAL TRAFFIC
4. "COFFIN" CORNER	SHIELD 30" MINIMUM OUTSIDE OF FIXED OBJECT	
5. SLOPING SITES: LATERAL AND LONGITUDINAL FOR MORE INFORMATION READ GENERAL NOTE:7	1:10 MAXIMUM (V:H)	
6. CURB: RAISED ISLAND:	NO MORE THAN 4" HIGH (REMOVE IF POSSIBLE)	
7. FOUNDATION PADS:	FLAT SURFACE: CONCRETE OR ASPHALT	
8. MAINTENANCE:	KEEP SITE CLEAR OF TRASH, ROAD DEBRIS, ETC	
9. SAND DENSITIES	100 LBS / CF	
10. VANDALISM	CHECK PERIODICALLY FOR DAMAGES, GRAFFITI.	



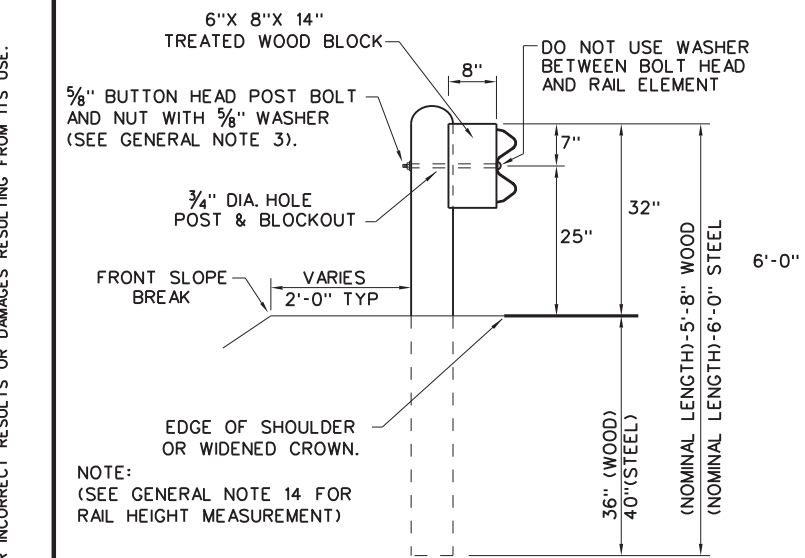
GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE AVAILABLE MASH COMPLIANT SYSTEMS, CONTACT: Traffix DEVICES, INC. AT (949) 361-5663 OR PSS INNOVATIONS, INC. AT (800) 662-6338.
- REAR MODULES SHOULD OVERLAP THE HAZARDOUS FIXED OBJECT IN WIDTH ON EACH SIDE BY A MINIMUM OF 30 INCHES. SEE DETAILS A, B.
- BARRIERS CAN BE INSTALLED AT ANY DISTANCE FROM THE SHOULDER, AT ROADSIDE AND MEDIAN LOCATIONS FROM ZERO FT UP TO 30 FT, DEPENDING UPON THE LOCATION OF THE HAZARDOUS FIXED OBJECT.
- ANGLING THE BARRIER TOWARDS ON-COMING TRAFFIC IS SUGGESTED, 3-DEGREES UP TO 10-DEGREES DEPENDING ON SPACE AVAILABLE.
- WHENEVER POSSIBLE, CURBS 4 INCHES AND HIGHER SHOULD BE REMOVED FROM THE HAZARDOUS SITES. HOWEVER, WHEN REMOVAL IS NOT POSSIBLE, MODULES CAN BE SEPARATED ALONG THE BARRIER AXIS TO FIT THE SITUATION.
- LONGITUDINAL SPACING OF MODULES MAY BE INCREASED WHERE SPACE PERMITS, E.G., 2 FT UP TO 3 FT SPACING OF SELECTED MODULES MAY PERMIT THE DESIGNER TO USE ALL THE SPACE ALLOCATED FOR AN ENERGY-ABSORBING BARRIER.
- THE ENTIRE AREA OF THE CRASH CUSHION INSTALLATION AND APPROACHES SHALL BE GRADED SO THAT THE MAXIMUM SLOPE DOES NOT EXCEED 1V:10H VERTICALLY OR HORIZONTALLY IN ANY DIRECTION.
- WHERE REQUIRED, SUPPORT PADS, CONCRETE, ASPHALT, ETC. WILL BE MEASURED AND PAID FOR IN ACCORDANCE WITH PERTINENT BID ITEMS.
- TRAFFIX DEVICES AND PSS INNOVATIONS SAND BARREL SYSTEMS HAVE BEEN ASSESSED AS MASH COMPLIANT.

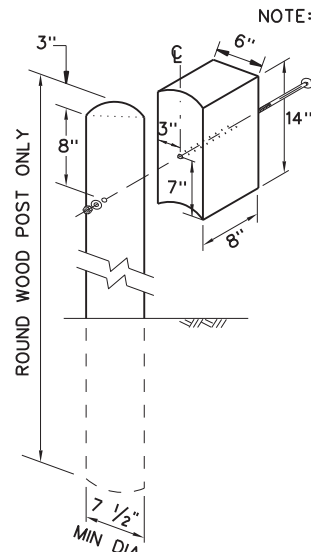
SACRIFICIAL

		Design Division Standard	
VEHICLE IMPACT ATTENUATOR SAND FILLED PLASTIC MODULES MASH TL-3 & TL-2 VIA(SFPM)-19			
FILE: viasfpm19.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: DECEMBER 2019	CONT: 6467	SECT: 89	JOB: US 190, ETC
REVISIONS:	6467	89	001
DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 49	

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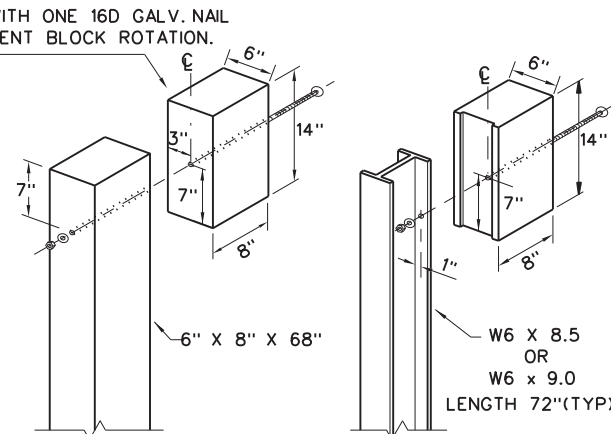
TYPICAL POST PLACEMENT



WOOD BLOCK TO ROUND WOOD POST

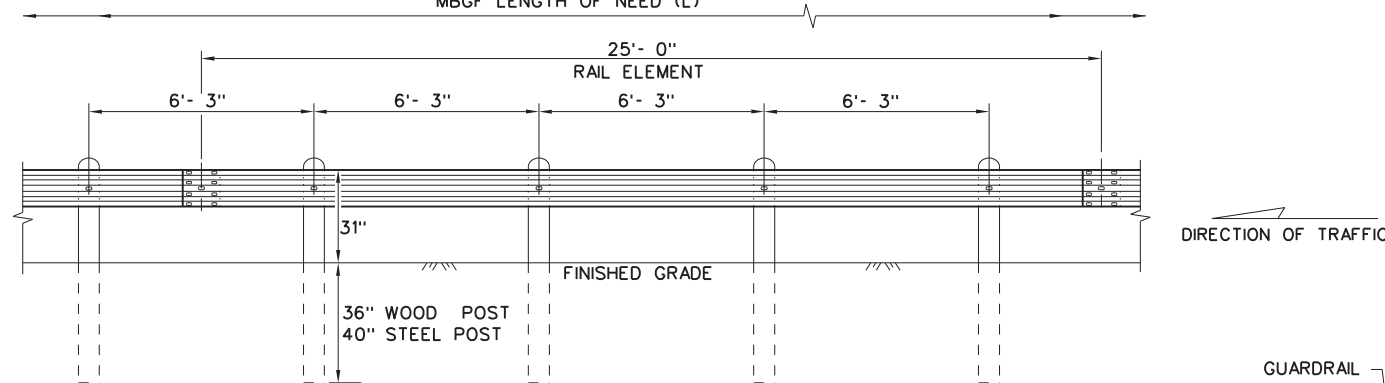
WOOD BLOCK TO RECTANGULAR WOOD POST

ROUTED WOOD BLOCK TO I-BEAM STEEL POST



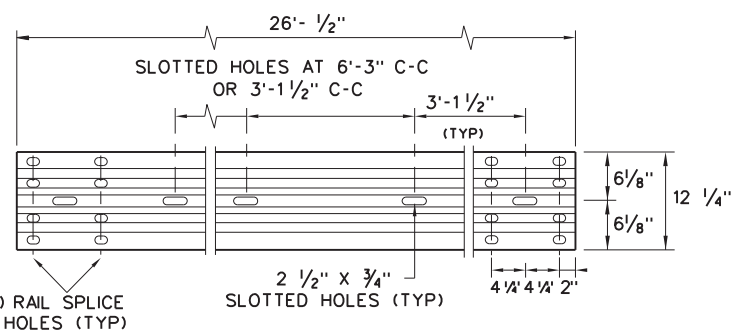
- GENERAL NOTES**
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
 2. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE DOWNSTREAM ANCHOR TERMINAL (DAT) AND THE TRANSITION SECTIONS OF GUARDRAIL.
 3. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
 4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
 6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
 7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
 8. UNLESS OTHERWISE SHOWN IN THE PLANS, GUARD FENCE PLACED IN THE VICINITY OF CURBS SHALL BE POSITIONED SO THAT THE FACE OF CURB IS LOCATED DIRECTLY BELOW OR BEHIND THE FACE OF THE RAIL. RAIL PLACED OVER CURBS SHALL BE INSTALLED SO THAT THE POST BOLT IS LOCATED APPROXIMATELY 25 INCHES ABOVE THE GUTTER PAN OR EDGE OF SHOULDER.
 9. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. IF SOLID ROCK IS ENCOUNTERED WITHIN 0 TO 18" OF THE FINISHED GRADE, DRILL A 24" DIA. HOLE, 24" INTO THE ROCK. IF SOLID ROCK IS ENCOUNTERED BELOW 18", DRILL A 12" DIA. HOLE, 12" INTO THE ROCK OR TO THE STANDARD EMBEDMENT DEPTH, WHICHEVER MAY BE LESS. ANY EXCESS POST LENGTH, AFTER MEETING THESE DEPTHS, MAY BE FIELD CUT TO ENSURE PROPER GUARDRAIL MOUNTING HEIGHT. BACKFILL WITH COARSE AGGREGATE MATERIAL.
 10. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
 11. SPECIAL FABRICATION WILL BE REQUIRED AT INSTALLATION LOCATIONS HAVING A CURVATURE OF LESS THAN 150 FT. RADIUS.
 12. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TxDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210 ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
 13. FOR THE LOW FILL CULVERT OPTION, POSTS LOCATED PARTIALLY OR WHOLLY BETWEEN PRECAST BOX CULVERT UNITS, THE USE OF A CAST-IN-PLACE CONCRETE CLOSURE BETWEEN BOXES IS REQUIRED. THE LENGTH OF THE CAST-IN-PLACE CONCRETE CLOSURE SHALL ACCOMMODATE THE PLACEMENT OF THE LOW FILL CULVERT OPTION. SEE CONCRETE CLOSURE DETAILS ON BRIDGE STANDARD SCP-MD.
 14. GUARDRAIL HEIGHT MEASUREMENT: WHEN THE GUARDRAIL IS LOCATED ABOVE PAVEMENT, MEASURE THE HEIGHT FROM THE PAVEMENT TO THE TOP OF THE W-BEAM RAIL. WHEN THE GUARDRAIL IS LOCATED UP TO 2 FT. OFF OF THE EDGE OF PAVEMENT OR FOR A PAVEMENT OVERLAY, USE A 10-FOOT STRAIGHTEDGE TO EXTEND THE PAVEMENT/SHOULDER SLOPE TO THE BACK OF RAIL, MEASURE FROM THE BOTTOM OF STRAIGHTEDGE TO THE TOP OF RAIL. FOR GUARDRAIL LOCATED DOWN A 10:1 SLOPE, MEASURE FROM THE NOMINAL TERRAIN.

NOTE: *WOOD* INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



ELEVATION MID-SPAN RAIL SPLICE

SHOWING A 25'-0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)



ELEVATION 25'-0 (NOM.) W-BEAM SECTION

NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES. SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.

NOTE: FOUR TYPES OF BUTTON-HEAD GUARD RAIL BOLTS COME WITH A RECESSED NUT.

SPLICE BOLT LENGTH VARIES

FBB01 - 1 1/4"

FBB02 - 2"

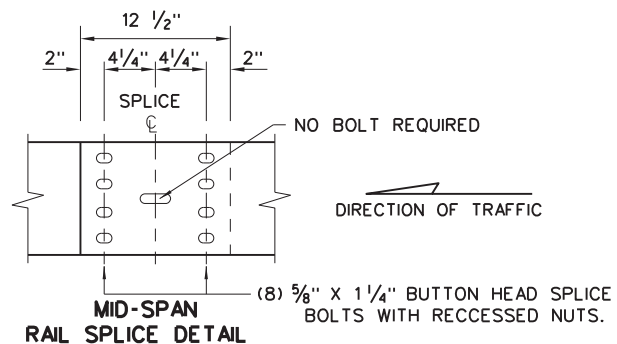
POST & BLOCK LENGTH

FBB03 - 10"

FBB04 - 18"

BUTTON HEAD BOLT

NOTE: SEE GENERAL NOTE 3 FOR SPLICE & POST BOLT DETAILS.

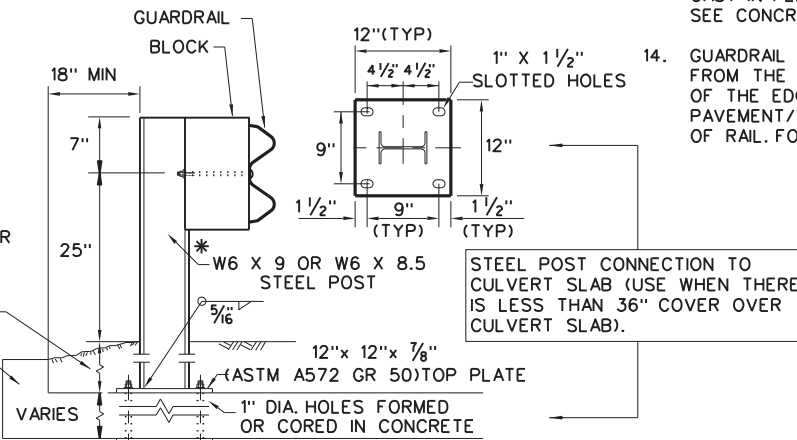


MID-SPAN RAIL SPLICE DETAIL

NOTE: GF(31), MID-SPAN RAIL SPLICES ARE REQUIRED WITH 6'-3" POST SPACINGS.

*POST(S) MAY REQUIRE FIELD MODIFICATION TO ENSURE PROPER GUARDRAIL HEIGHT.

9" MIN. FILL DEPTH CULVERT SLAB



LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

1. **BOLT-THROUGH OPTION:** REQUIRES A 6" MIN. SLAB THICKNESS. 7/8" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS. NOTE: BOLT LENGTH = SLAB PLUS 2 1/4" MIN.

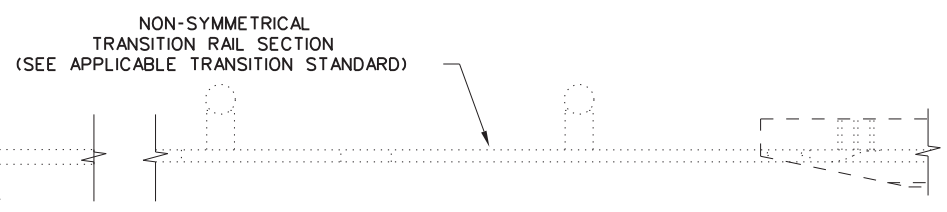
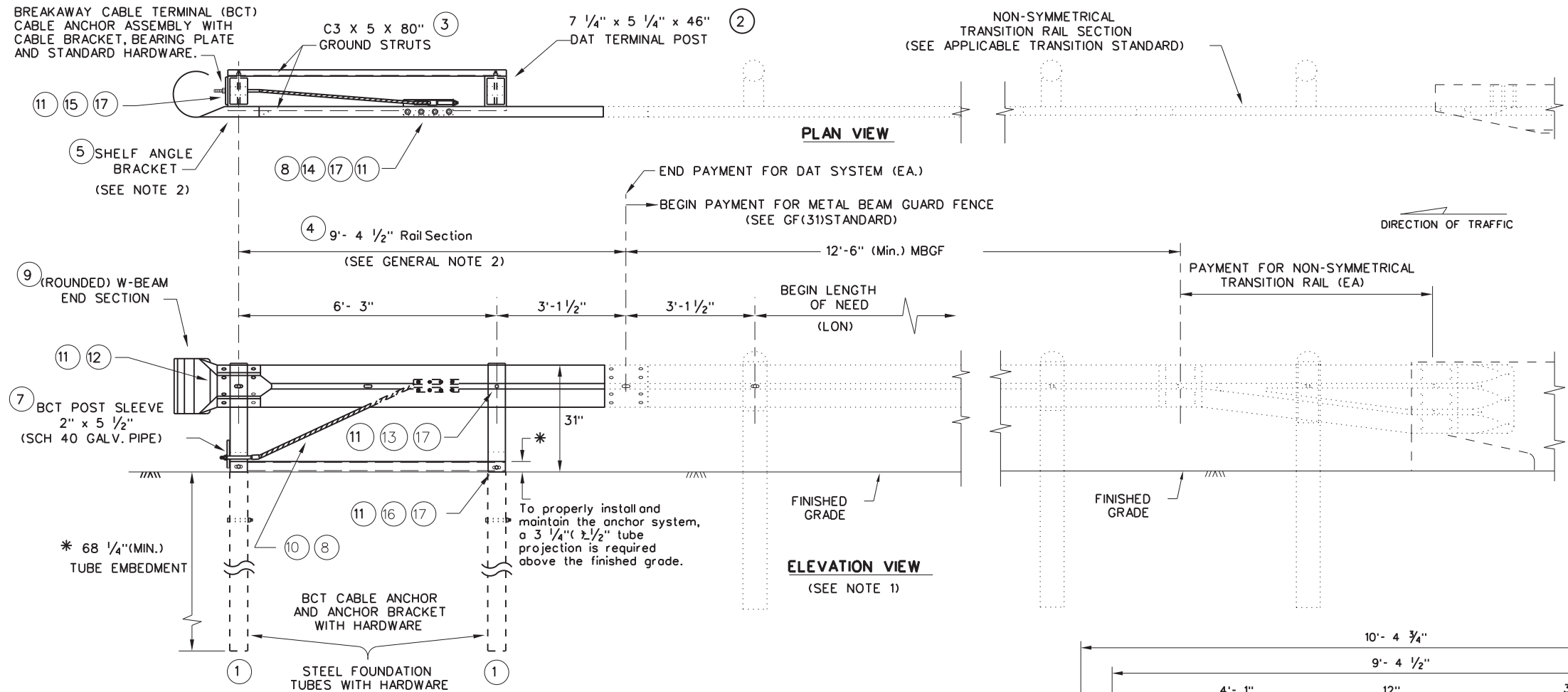
2. **EPOXY ANCHOR OPTION:** THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB IS 9" MIN. THICK. THREADED ANCHOR RODS MUST BE 7/8" DIA. ASTM A449 OR A193 GRADE B7 WITH HEAVY HEX NUT, AND ONE HARDENED WASHER EACH. EMBED ANCHOR RODS 6" WITH HILTI HIT RE 500 EPOXY ADHESIVE. OTHER TYPE III CLASS C EPOXY ADHESIVES MEETING THE REQUIREMENTS OF DMS-6100, "EPOXIES AND ADHESIVES", MAY BE USED IF IT CAN BE DEMONSTRATED THAT THEY MEET OR EXCEED THE STRENGTH OF HILTI HIT RE 500 WITH THE SAME EMBEDMENT DEPTH AND THREADED ROD DIA. FOLLOW THE MANUFACTURER'S REQUIREMENTS FOR INSTALLING EPOXIED THREADED RODS. EXTEND RODS 1/4" MIN. BEYOND NUT.

NOTE: CULVERTS OF 25 FT. OR LESS, SEE GF(31)LS STANDARD FOR "LONG SPAN" OPTION.

DATE: 7/29/2024
 FILE: c:\ttdot\pw_online\ttdot3\me\lendy.sm\th\d0754862\gf3119.dgn

		Design Division Standard	
METAL BEAM GUARD FENCE TL-3 MASH COMPLIANT GF(31)-19			
FILE: gf3119.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: NOVEMBER 2019	CONT	SECT	JOB
REVISIONS	6467	89	001
	DIST	COUNTY	SHEET NO.
	WACO	BELL, ETC	50

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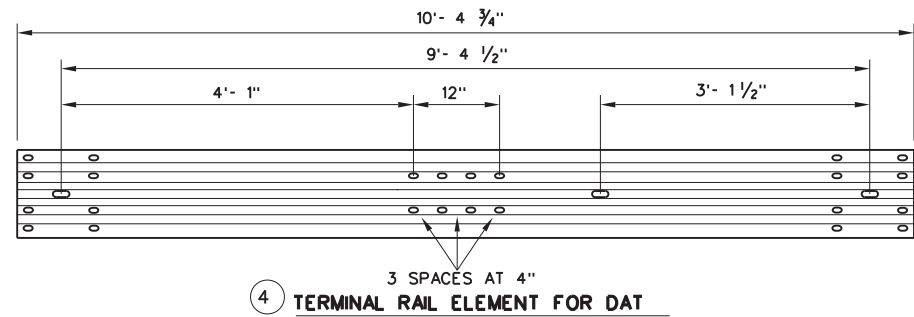
GENERAL NOTES

1. THE DETAIL SHOWN IS THE MINIMUM LENGTH OF NEED (LON) FOR A DOWNSTREAM ANCHOR TERMINAL (DAT) CONNECTED TO A CONCRETE RAIL.
2. THE RAIL SECTION AT THE END POST IS SUPPORTED BY THE SHELF ANGLE BRACKET. THE RAIL ELEMENT IS NOT ATTACHED TO THE END POST.
3. THE FOUNDATION TUBES SHALL NOT PROJECT MORE THAN 3 3/4" ABOVE THE FINISHED GRADE.
4. ALL HARDWARE FOR DAT SHALL BE ASTM A307 UNLESS OTHERWISE SHOWN.
5. REFER TO GF(31) SHEET FOR TERMINAL CONNECTION DETAILS.

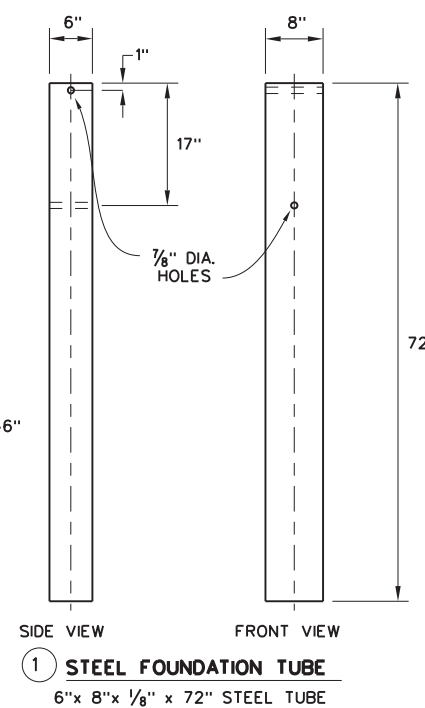
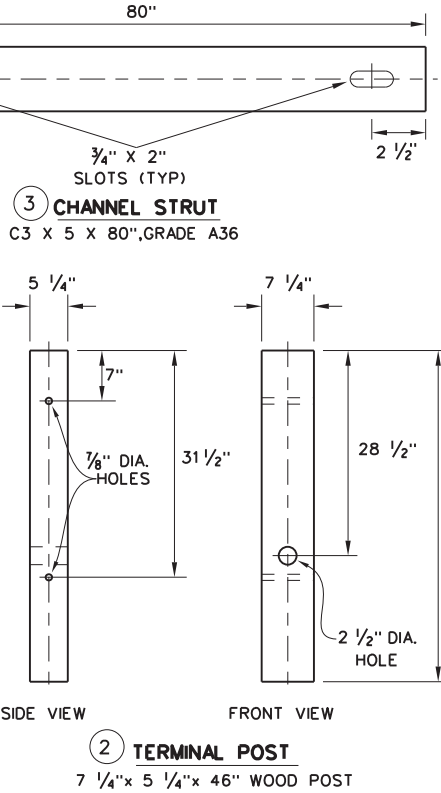
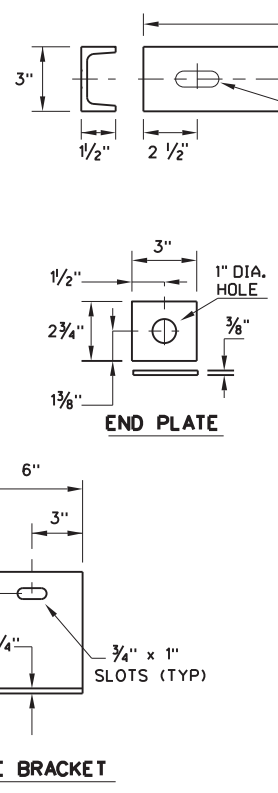
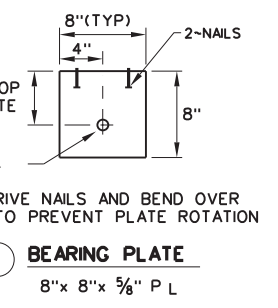
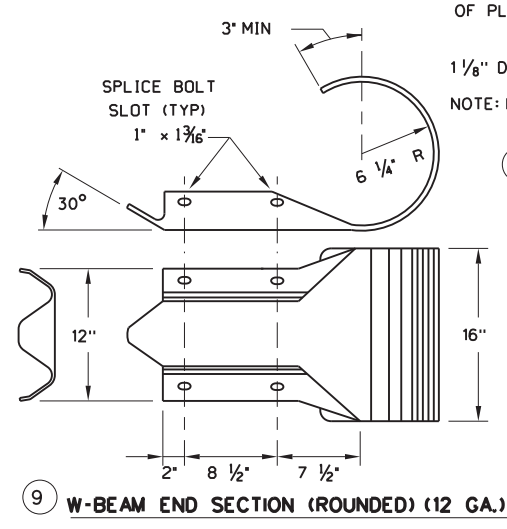
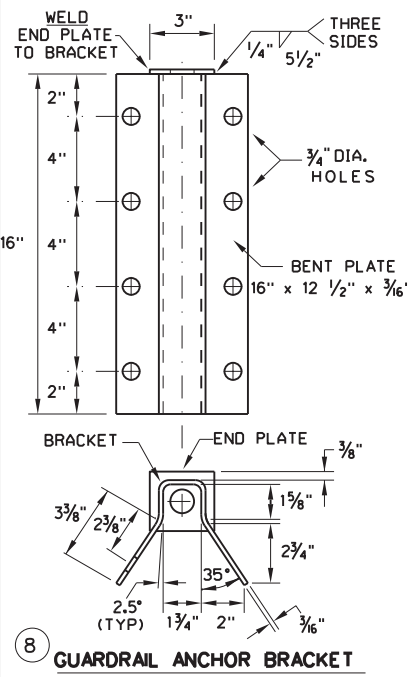
MOW STRIP INSTALLATION
 IF A MOW STRIP IS REQUIRED WITH THE DAT INSTALLATION THE LEAVE-OUT AREA AROUND THE STEEL FOUNDATION TUBES AND THE TWO CHANNEL STRUTS MAY BE OMITTED. THIS WILL REQUIRE A FULL POUR AT THE FOUNDATION TUBES.

DOWNSTREAM ANCHOR TERMINAL (DAT)

NOTE: ONLY FOR DOWNSTREAM USE, WHEN LOCATED OUTSIDE THE HORIZONTAL CLEARANCE AREA OF OPPOSING TRAFFIC.



(DAT) PARTS LIST	QTY
1 STEEL FOUNDATION TUBE	2
2 DAT TERMINAL POST	2
3 CHANNEL STRUT	2
4 TERMINAL RAIL ELEMENT	1
5 SHELF ANGLE BRACKET	1
6 BCT BEARING PLATE	1
7 BCT POST SLEEVE	1
8 GUARDRAIL ANCHOR BRACKET	1
9 (ROUNDED) W-BEAM END SECTION	1
10 BCT CABLE ANCHOR	1
11 RECESSED NUT, GUARDRAIL	20
12 1 1/4\"/>	

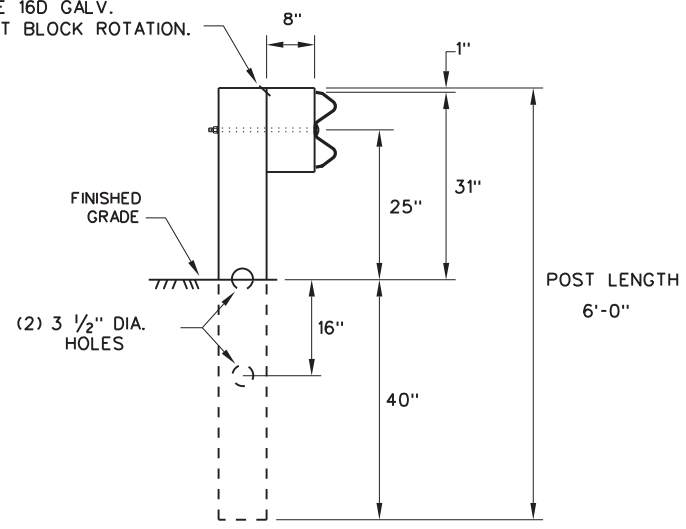


Design Division Standard
METAL BEAM GUARD FENCE (DOWNSTREAM ANCHOR TERMINAL) TL-3 MASH COMPLIANT GF(31)DAT-19
 FILE: gf31dat19.dgn DN: TxDOT CK: KM DW: VP CK: CGL / AG
 © TXDOT: NOVEMBER 2019 REVISIONS CONT SECT JOB HIGHWAY
 6467 89 001 US 190, ETC
 DIST COUNTY SHEET NO.
 WACO BELL, ETC 51

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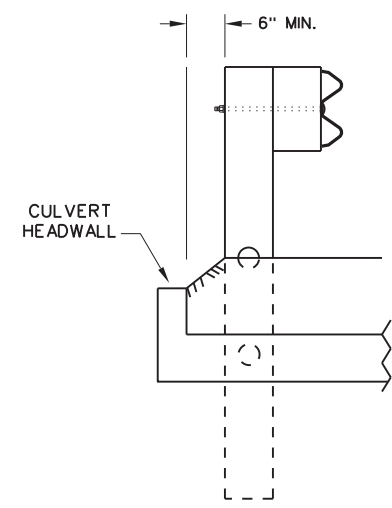
DATE: 7/29/2024
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NOTE: TOENAIL WITH ONE 16D GALV. NAIL TO PREVENT BLOCK ROTATION.



**RECTANGULAR CRT POST
(6" X 8" X 6' LONG)**

(6) CRT REQUIRED
SEE ELEVATION DETAIL FOR LOCATIONS



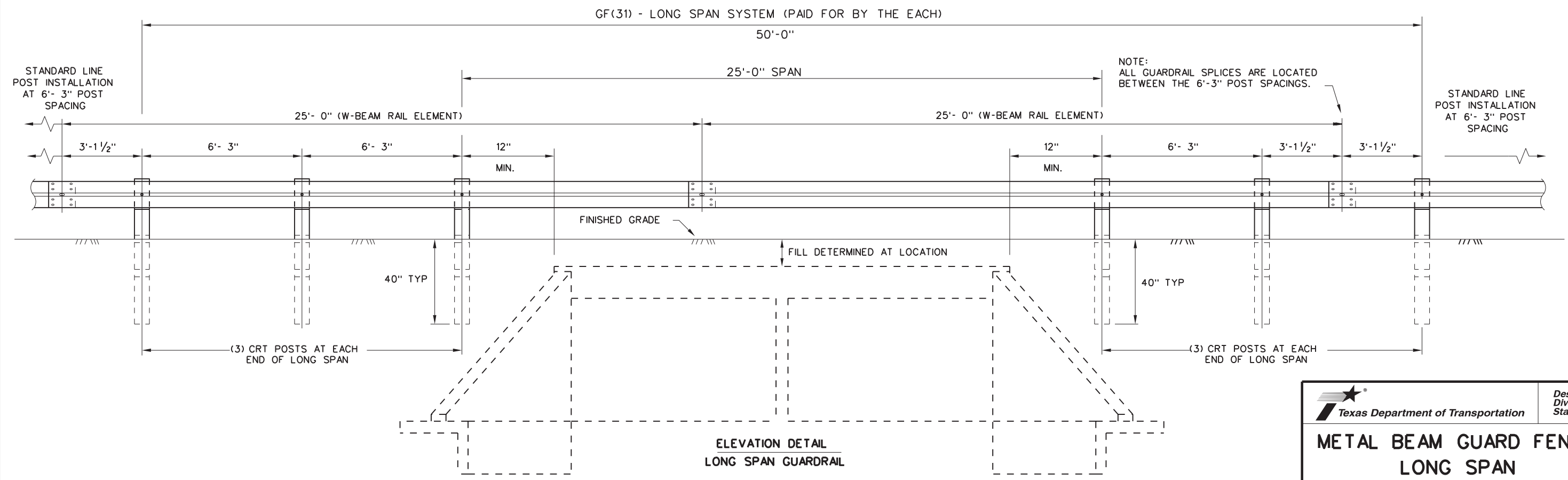
**LATERAL OFFSET BETWEEN THE
GUARDRAIL AND THE CULVERT HEADWALL**

GENERAL NOTES

1. THE TYPE OF LINE POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF THE TRANSITIONS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET ALL REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 12'- 6" OR 25'- 0" NOMINAL LENGTHS.
3. RAIL POST HOLES ARE OFFSET 3'- 1 1/2" FROM STANDARD GUARDRAIL TO ACCOMMODATE THE MIDSPAN SPlicing.
4. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16a) AND NO MORE THAN 1" BEYOND IT.
5. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
7. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
8. REFER TO GF(31) STANDARD SHEET FOR ADDITIONAL DETAILS.
9. FLAME CUTTING OF HOLES IN GUARDRAIL SHALL NOT BE PERMITTED. IF YOU ENCOUNTER MIS-ALIGNED BOLT HOLES IN GUARDRAIL CONTACT THE DESIGN DIVISION FOR ADDITIONAL INFORMATION & OPTIONS.

NOTE: SEE GF(31) STANDARD FOR STANDARD LINE POSTS.

DIRECTION OF TRAFFIC

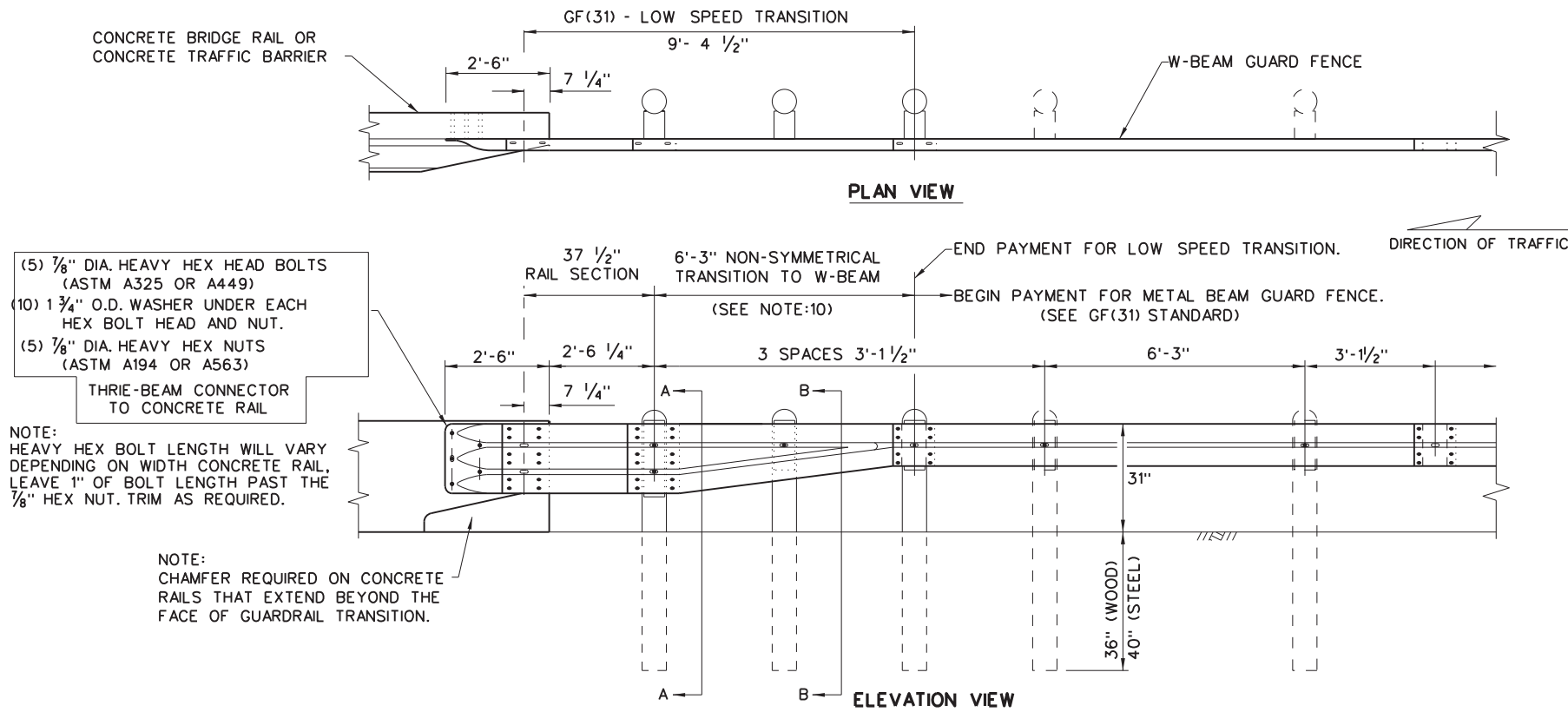


**ELEVATION DETAIL
LONG SPAN GUARDRAIL**

		Design Division Standard	
METAL BEAM GUARD FENCE LONG SPAN TL-3 MASH COMPLIANT			
GF(31)LS-19			
FILE: gf31ls19.dgn	DN: TxDOT	CK: KM	DW: VP
© TXDOT: NOVEMBER 2019	CONT	SECT	JOB
REVISIONS	6467	89	001
DIST	COUNTY		SHEET NO.
WACO	BELL, ETC		52

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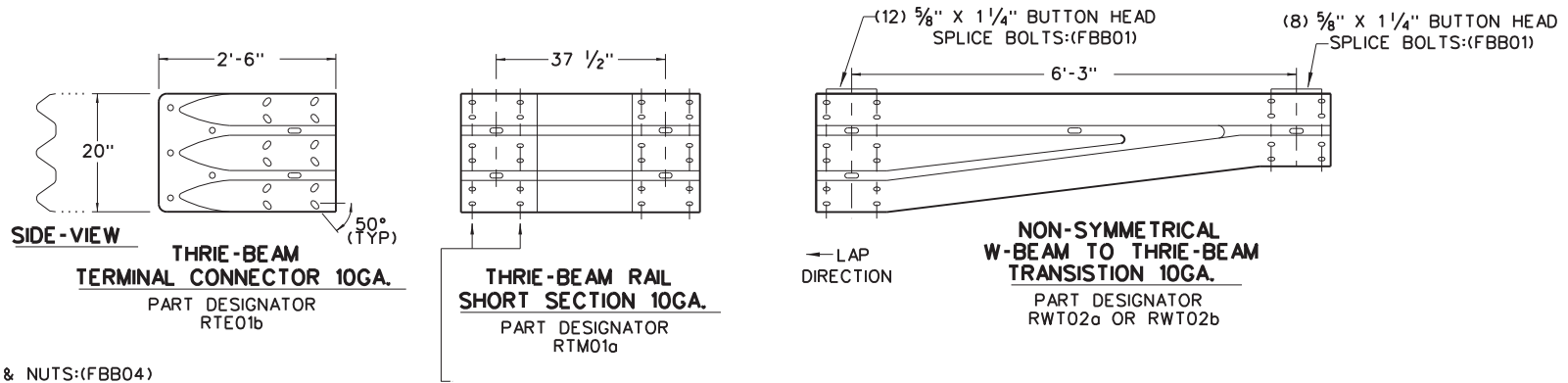
- (5) 7/8" DIA. HEAVY HEX HEAD BOLTS (ASTM A325 OR A449)
- (10) 1 3/4" O.D. WASHER UNDER EACH HEX BOLT HEAD AND NUT.
- (5) 7/8" DIA. HEAVY HEX NUTS (ASTM A194 OR A563)

NOTE:
HEAVY HEX BOLT LENGTH WILL VARY DEPENDING ON WIDTH CONCRETE RAIL, LEAVE 1" OF BOLT LENGTH PAST THE 7/8" HEX NUT. TRIM AS REQUIRED.

NOTE:
CHAMFER REQUIRED ON CONCRETE RAILS THAT EXTEND BEYOND THE FACE OF GUARDRAIL TRANSITION.

GENERAL NOTES

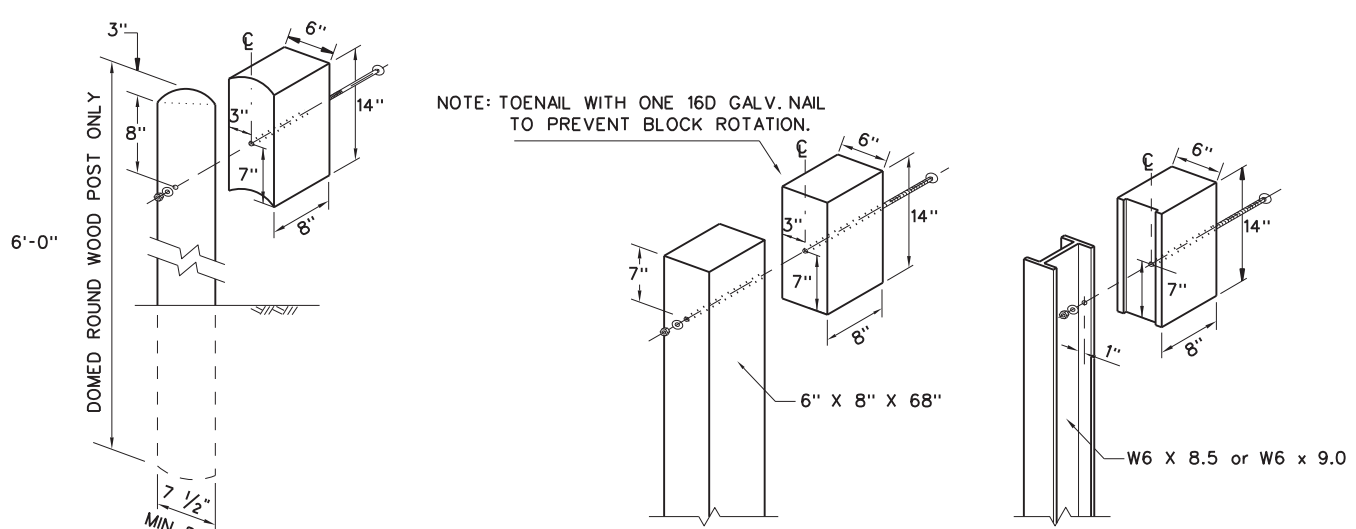
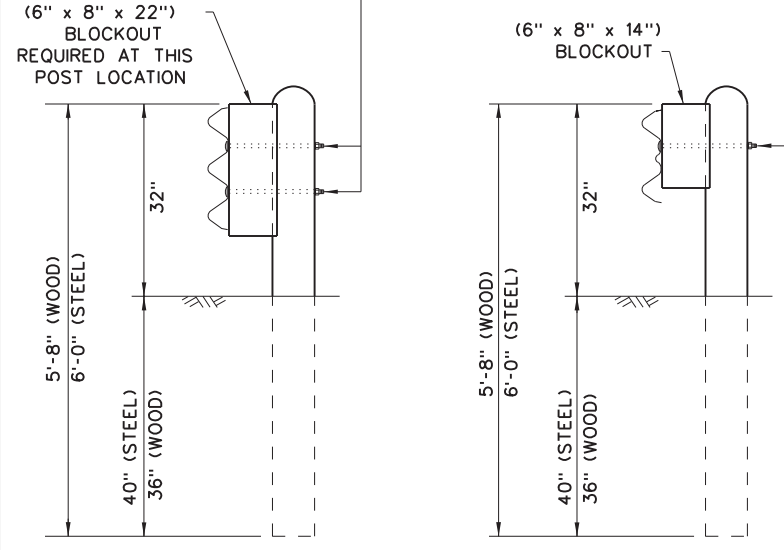
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2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS.
3. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
4. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM BOLT LENGTH TO MEET REQUIRED LENGTH.
5. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
6. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
7. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
8. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT, MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
9. REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
10. FOR ROUND WOOD POSTS SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 1/2" DIA. MINIMUM THROUGHOUT THE TRANSITION.



- (2) 5/8" BUTTON HEAD POST BOLTS & NUTS:(FBB04)
- (1) 5/8" FLAT WASHER:(FWC14a) UNDER EACH NUT

- (1) 5/8" BUTTON HEAD POST BOLT & NUT:(FBB04)
- (1) 5/8" FLAT WASHER:(FWC14a) UNDER EACH NUT

PLATE WASHER INSTRUCTIONS
 BRIDGE APPROACH - UPSTREAM: THE SHORT RAIL LAPS OVER THE TERMINAL CONNECTOR. PLATE WASHERS ARE INSTALLED UNDER THE SPLICE NUTS AGAINST INSIDE OF CONNECTOR.
 BRIDGE EXIT - DOWNSTREAM: THE TERMINAL CONNECTOR LAPS OVER THE NESTED RAIL. PLATE WASHERS ARE INSTALLED UNDER THE BOLT HEAD AGAINST OUTSIDE OF CONNECTOR.



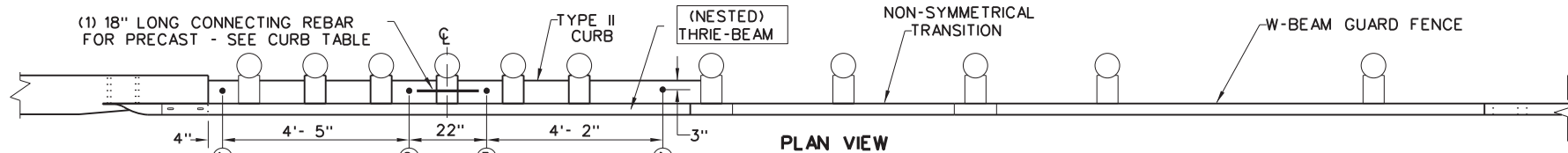
NOTE: *WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.

LOW-SPEED TRANSITION

		<i>Design Division Standard</i>	
METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-2 MASH COMPLIANT GF(31)TR TL2-19			
FILE: gf31trtl219.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: NOVEMBER 2019	CONT SECT	JOB	HIGHWAY
REVISIONS	6467 89	001	US 190, ETC
DIST	COUNTY	SHEET NO.	
WACO	BELL, ETC	53	

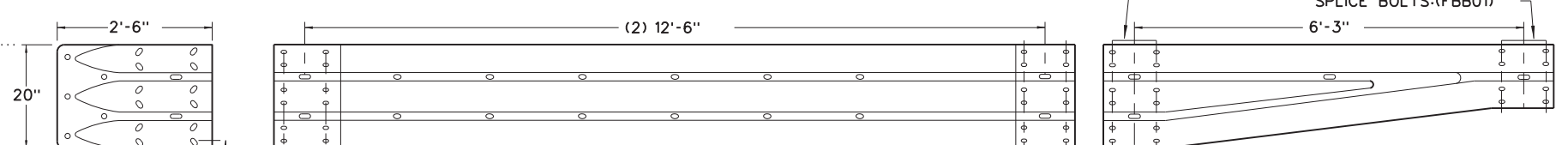
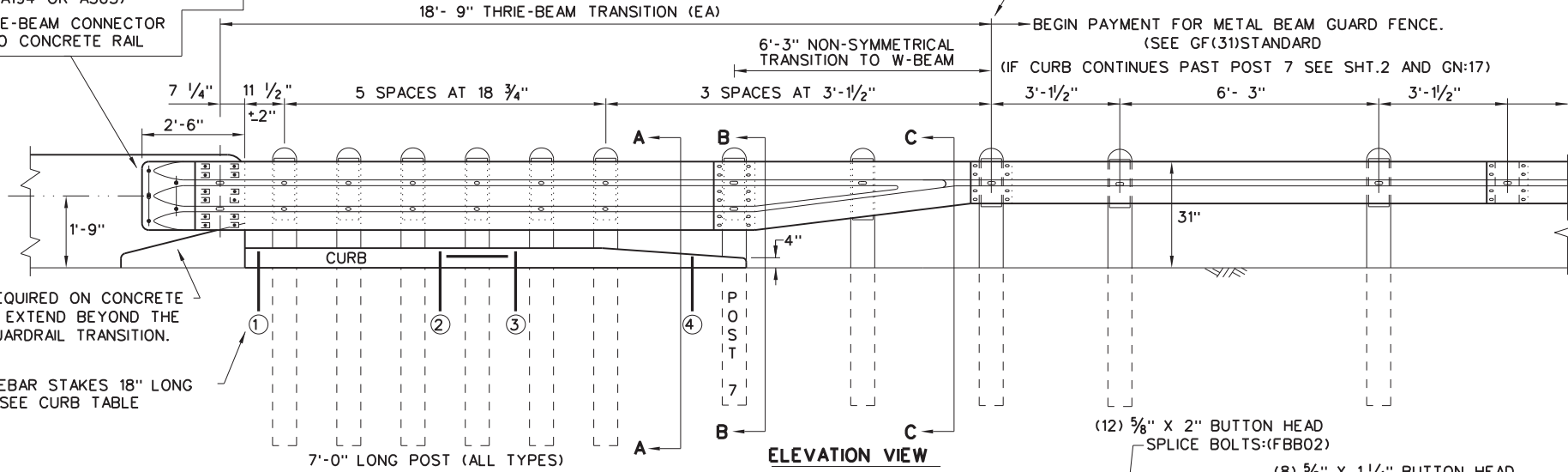
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(4) (1" DIA. HOLES) IN CURB: SEE CURB TABLE
 (5) 3/8" DIA. HEAVY HEX HEAD BOLTS (ASTM A325 OR A449)
 (10) 1 3/4" O.D. WASHER UNDER EACH HEX BOLT HEAD AND NUT.
 (5) 7/8" DIA. HEAVY HEX NUTS (ASTM A194 OR A563)
 THRIE-BEAM CONNECTOR TO CONCRETE RAIL

NOTE: HEAVY HEX BOLT LENGTH WILL VARY DEPENDING ON WIDTH CONCRETE RAIL, LEAVE 1" OF BOLT LENGTH PAST THE 7/8" HEX NUT. TRIM AS REQUIRED.
 NOTE: CURB IS A REQUIRED COMPONENT FOR THE TRANSITION TO FUNCTION PROPERLY. SEE GENERAL NOTES: 2-4 AND 16-17.

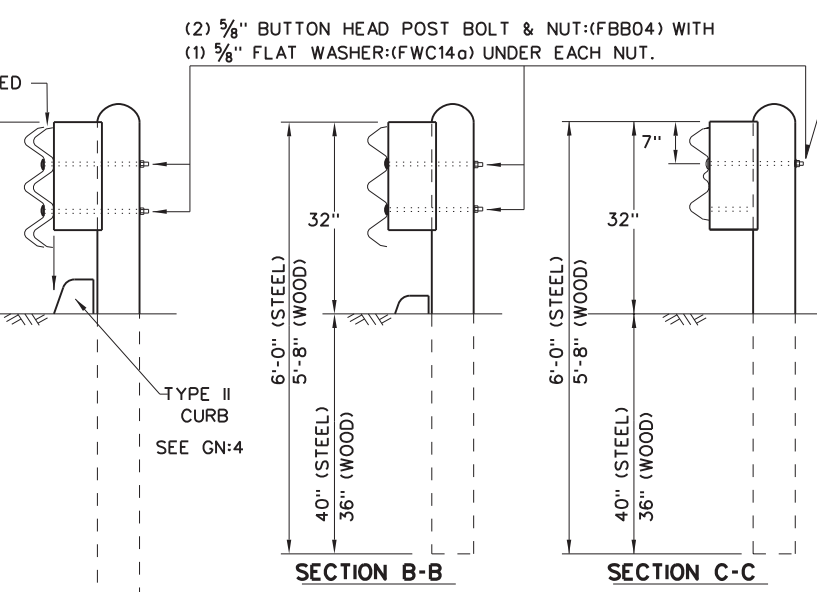


THRIE-BEAM TERMINAL CONNECTOR 10GA.
 PART DESIGNATOR RTE01b
 NOTE: SEE GENERAL NOTE:9

NESTED THRIE-BEAM RAIL
 PART DESIGNATOR RTM10a

NON-SYMMETRICAL W-BEAM TO THRIE-BEAM TRANSITION 10GA.
 PART DESIGNATOR RWT02a OR RWT02b

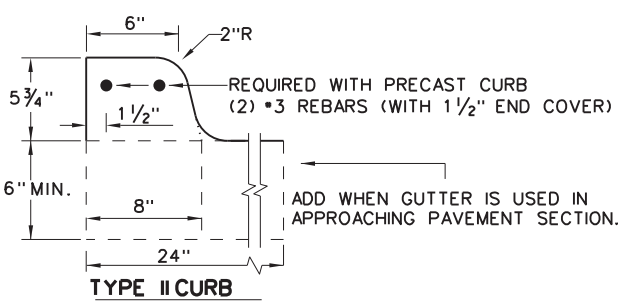
BRIDGE APPROACH - UPSTREAM: THE NESTED RAIL LAPS OVER THE TERMINAL CONNECTOR. PLATE WASHERS ARE INSTALLED UNDER THE SPLICE NUTS AGAINST INSIDE OF CONNECTOR.
 BRIDGE EXIT - DOWNSTREAM: THE TERMINAL CONNECTOR LAPS OVER THE NESTED RAIL. PLATE WASHERS ARE INSTALLED UNDER THE BOLT HEAD AGAINST OUTSIDE OF CONNECTOR.



SECTION A-A
 NOTE: ALL POST TYPES, SEE GENERAL NOTE:5 & 6
 NOTE: *WOOD INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.

THRIE-BEAM TERMINAL - CURB TABLE	
PRECAST CURB FULL LENGTH EQUALS 12'- 2"	
THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS.	
CURB (1) LENGTH 5'- 8"	
CURB (2) LENGTH 6'- 6"	
TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7	
CONNECTING PRECAST CURB SECTIONS (1) & (2):	
FORM OR CORE (1" DIA. HOLE 9" LONG) INTO EACH CURB END.	
USE (1) *5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS.	
SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE:	
FORM OR CORE FOUR (1" DIA. HOLES), SEE BOTH VIEWS FOR HOLE LOCATIONS. DRIVE (4) *5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND 1/2" BELOW TOP OF CURB. FILL HOLES WITH APPROVED GROUT MIXTURE.	

* NOTES: NOT NEEDED FOR CAST-IN-PLACE.
 SEE TYPE II CURB DETAIL FOR REBAR AND COVER REQUIREMENTS.
 PERCUSSION DRILLING IS NOT PERMITTED WITH:
 TYPE II CURB, BRIDGE RAIL OR CONCRETE TRAFFIC RAIL.



NOTE: OPTIONS FOR TYPE II CURB:
 1. PRECAST
 2. CAST-IN-PLACE

GENERAL NOTES

- CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
- CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5'- 3/4" HEIGHT; SEE CURRENT CCCG STANDARD SHEET FOR FURTHER DETAILS. IF OTHER CURB HEIGHTS ARE SHOWN IN THE PLANS IN CONJUNCTION WITH THE TRANSITION, THE CURB HEIGHT MAY BE FROM 4" TO 8" WITH A RELATIVELY VERTICAL FACE. CONCRETE CURB SHALL BE CONTINUOUS TO THE SEVENTH POST UNLESS OTHERWISE SHOWN IN THE PLANS. SEE GENERAL NOTE:17 FOR CIRCUMSTANCES WHERE CURB CONTINUES PAST POST 7.
- CONCRETE CURB TYPE II SUBSIDIARY TO "METAL BEAM GUARD FENCE TRANSITION". IF NO ADDITIONAL CURB IS INDICATED BEYOND THE TRANSITION, THEN ANY CURB HEIGHT GREATER THAN 4" WILL BE TAPERED DOWN BEGINNING AT THE LAST 7 FT. POST TO A MAXIMUM HEIGHT OF 4" AT POST 7. IF SHOWN ELSEWHERE IN THE PLANS, ADDITIONAL CURB UNDERNEATH GUARDRAIL WILL BE PAID FOR BY THE LINEAR FOOT.
- UNLESS OTHERWISE SHOWN IN THE PLANS, TRANSITIONS SHALL BE PLACED WITH THE BLOCKOUT FACE IN FRONT OF OR DIRECTLY ABOVE THE CURB FACE. SEE SECTION A-A.
- FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 1/2" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
- THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. REFER TO GF(31) STANDARD SHEET.
- THE POST LENGTH SHALL BE MARKED ON ALL 7'- 0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST 5/8" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
- POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
- RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE THRIE-BEAM TERMINAL CONNECTOR AND THE THRIE-BEAM TRANSITION TO W-BEAM SHALL BE OF THE SAME MATERIAL, BUT SHALL NOT BE LESS THAN 10 GAUGE. CONTRACTOR SHALL VERIFY THAT THE LOCATIONS OF BOLT HOLES MATCH THOSE IN THE THRIE-BEAM TERMINAL CONNECTOR PRIOR TO ORDERING MATERIALS.
- BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
- FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
- CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
- WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
- UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. TxDOT'S CONSTRUCTION DIVISION MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
- REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
- THE INSTALLATION OF THE TYPE II CURB IS CRITICAL FOR THE PERFORMANCE OF THE THRIE-BEAM TRANSITION SYSTEM. THE CURB PREVENTS (VEHICLE WHEEL SNAGGING) AT THE CONCRETE RAIL AND IS REQUIRED TO MEET MASH CRASH TEST CRITERIA.
- IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED)(TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED)(STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

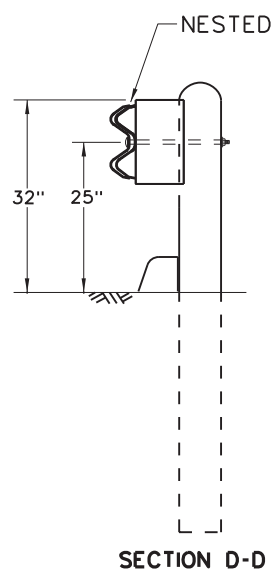
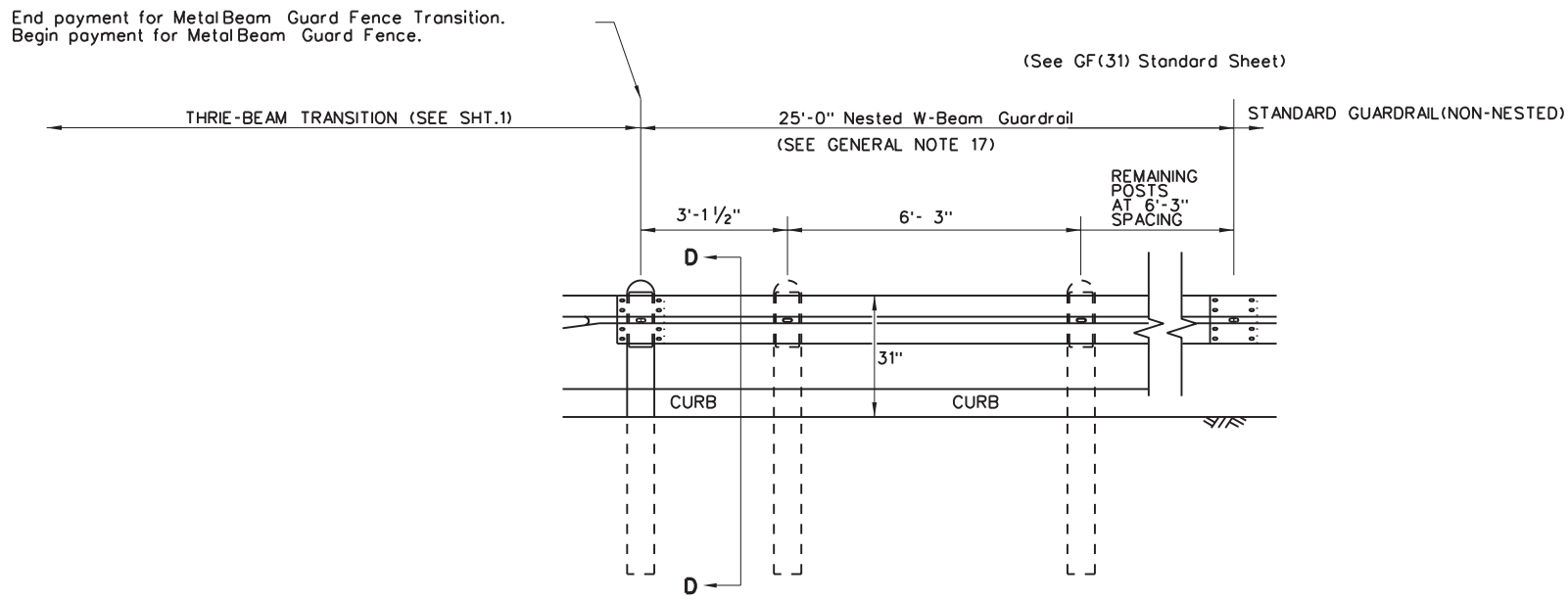
HIGH-SPEED TRANSITION
SHEET 1 OF 2

		Design Division Standard	
METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT GF(31)TR TL3-19			
FILE: gf31trtl319.dgn	DN: TxDOT	CK: KM	DW: VP
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REVISIONS	6467 89	001	US 190, ETC
	DIST	COUNTY	SHEET NO.
	WACO	BELL, ETC	54

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REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



HIGH-SPEED TRANSITION

SHEET 2 OF 2

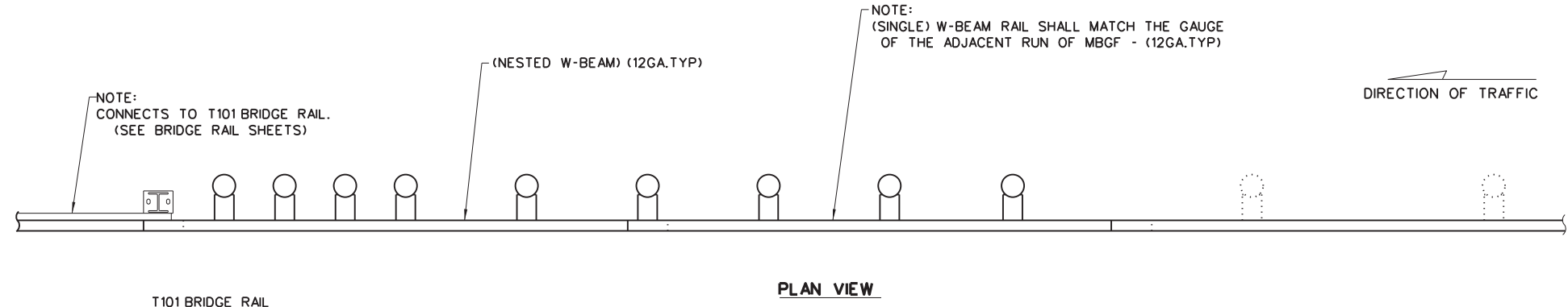


METAL BEAM GUARD FENCE
 THRIE-BEAM TRANSITION
 TL-3 MASH COMPLIANT
 GF(31)TR TL3-19

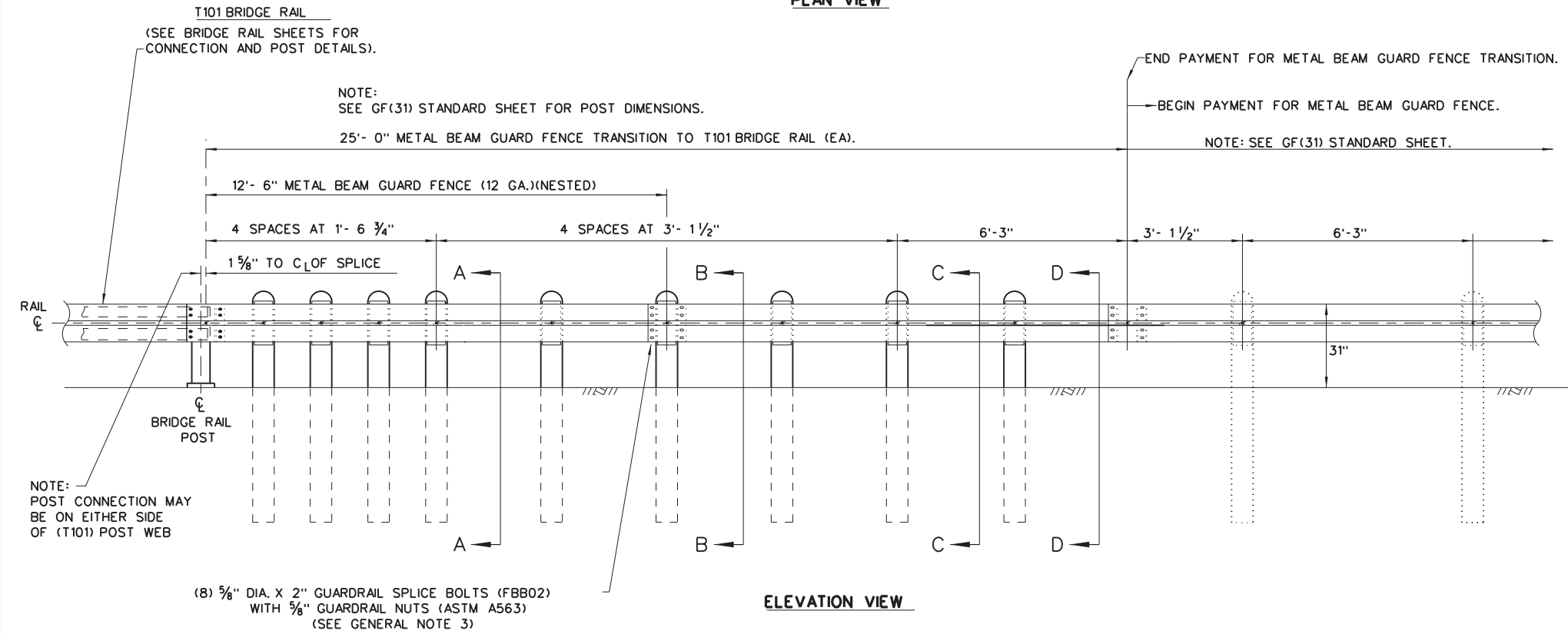
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	WACO	BELL, ETC	55	

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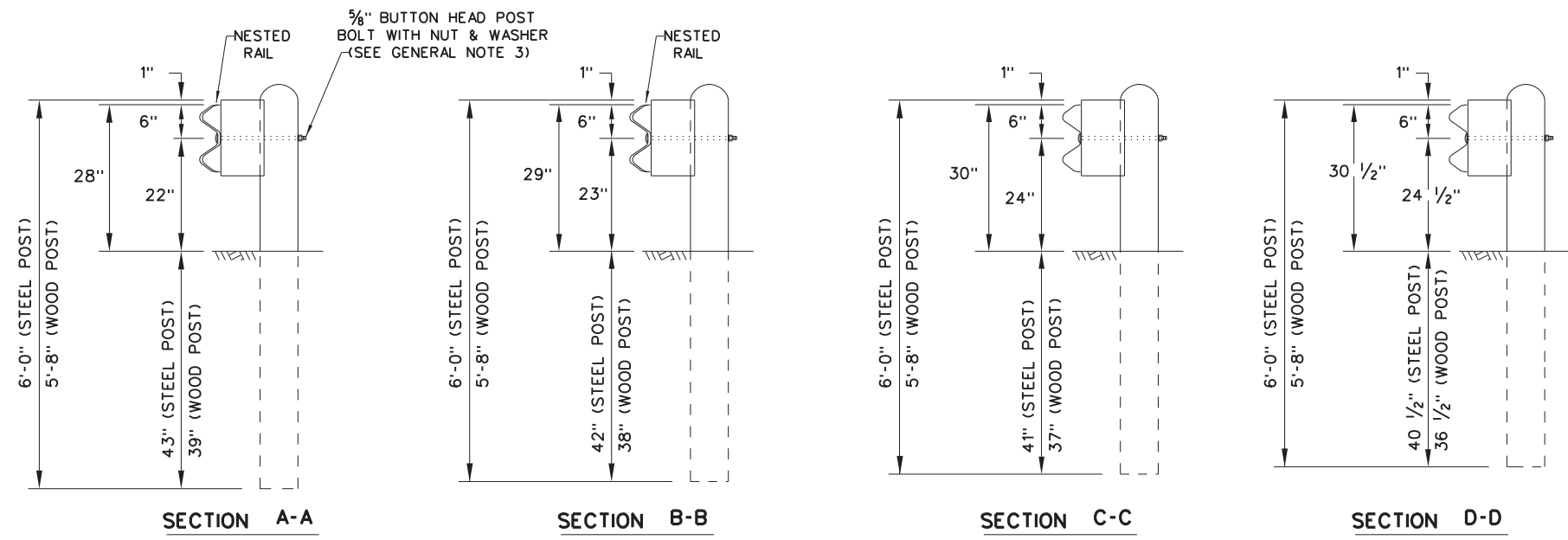


- GENERAL NOTES**
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
 2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'- 0", OR 12'- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'- 1 1/2" C-C OR 6'- 3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
 3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR.A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1- 1/4" WITH 5/8" NUTS (ASTM A563).
 4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
 5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
 6. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
 7. POSTS SHALL NOT BE SET IN CONCRETE.
 8. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
 9. REFER TO STANDARD GF(31) AND APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.



(8) 5/8" DIA. X 2" GUARDRAIL SPLICE BOLTS (FBB02) WITH 5/8" GUARDRAIL NUTS (ASTM A563) (SEE GENERAL NOTE 3)

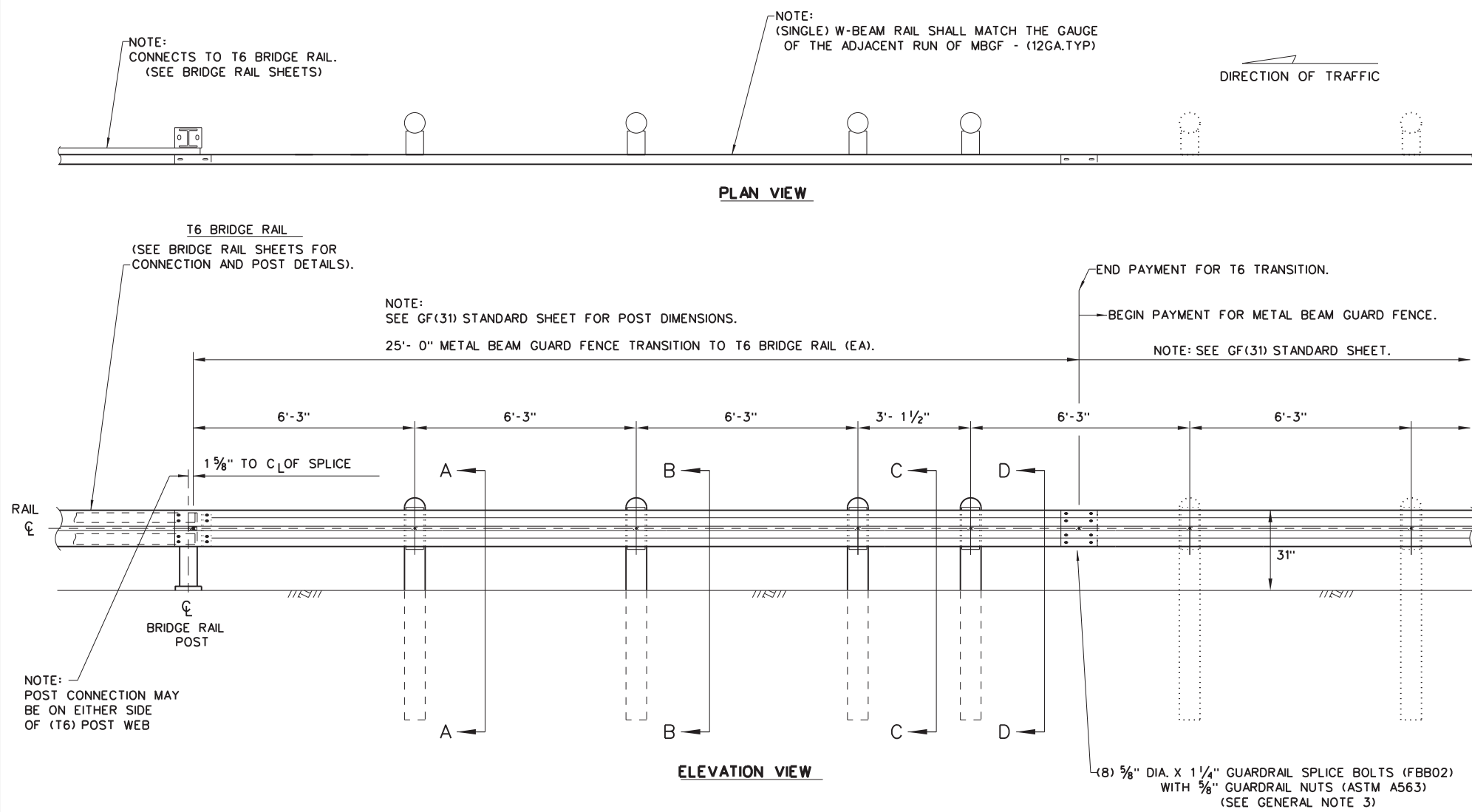
* "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



		Design Division Standard	
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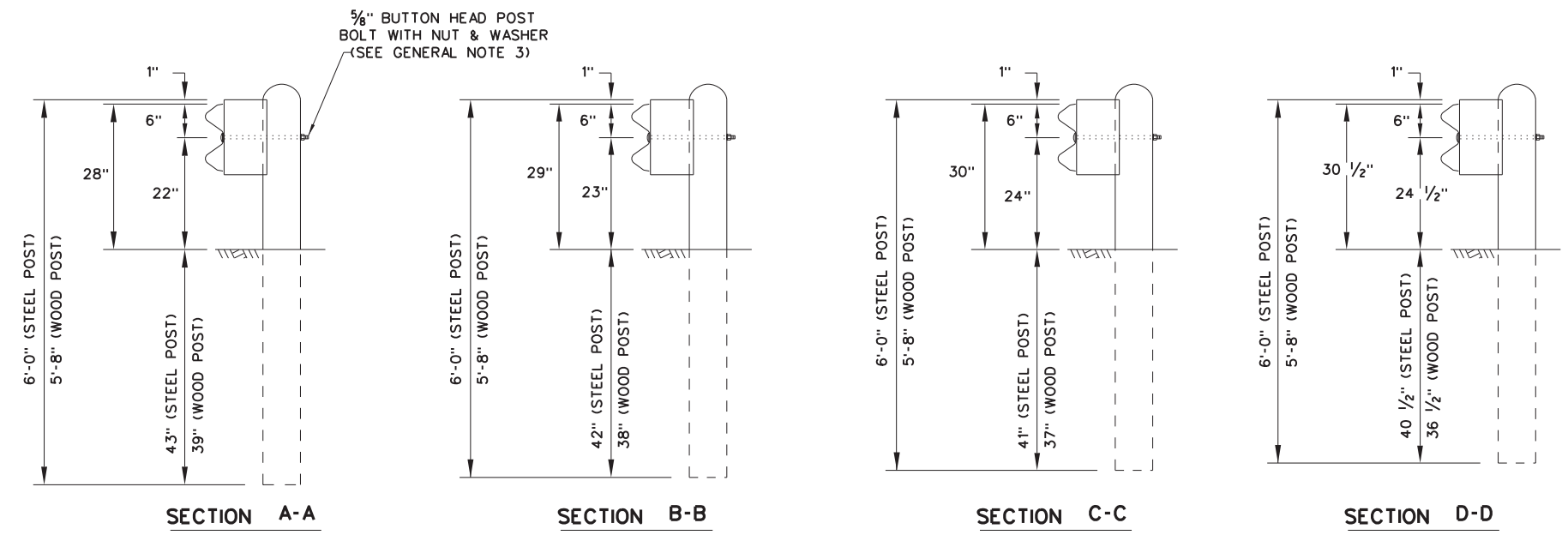
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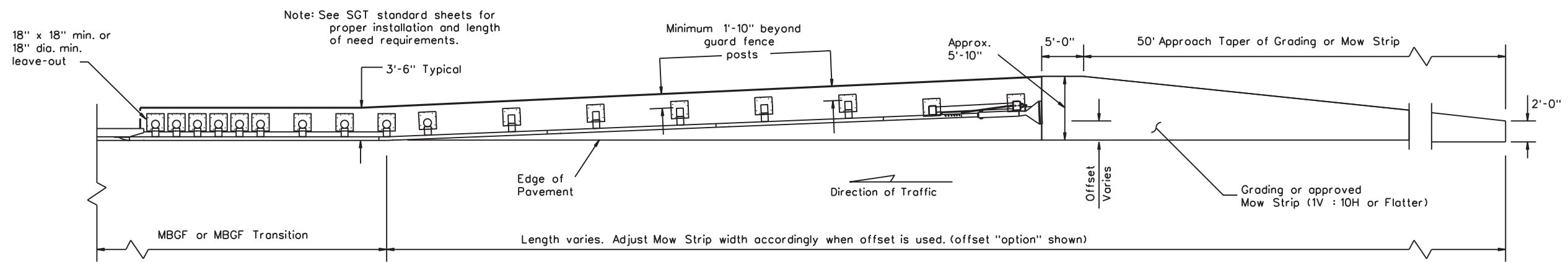
- GENERAL NOTES**
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
 2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
 3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR.A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPlice" BOLTS (ASTM A307) ARE 5/8" X 1-1/4" WITH 5/8" NUTS (ASTM A563).
 4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
 5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
 6. WHERE SOLID ROCK IS ENCOUNTERED. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
 7. POSTS SHALL NOT BE SET IN CONCRETE.
 8. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
 9. REFER TO STANDARD GF(31) & APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.

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		Design Division Standard	
METAL BEAM GUARD FENCE TRANSITION (T6)			
GF(31)T6-19			
FILE: gf31t619.dgn	DN: TxDOT	CK: KM	DW: VP
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	WACO	BELL,ETC	57

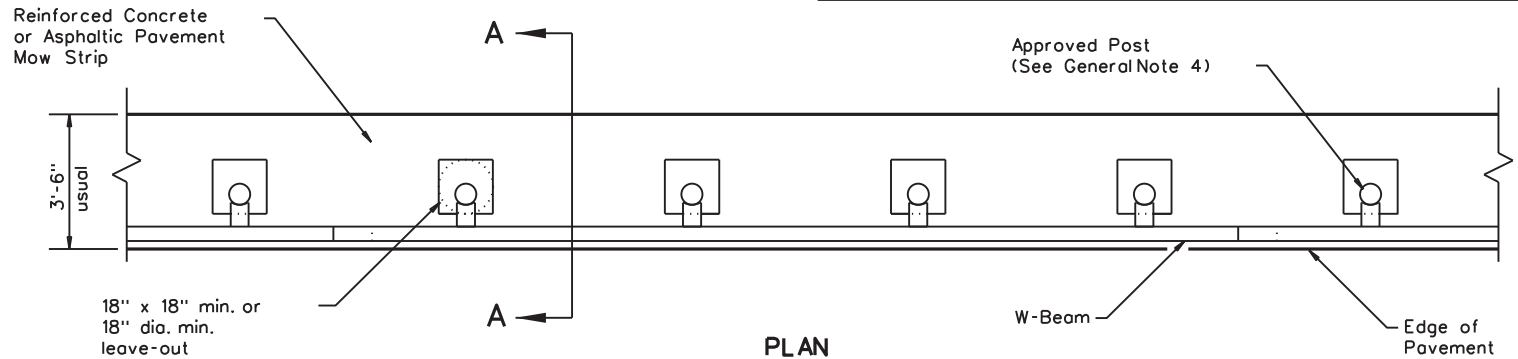
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Note: See SGT standard sheets for proper installation and length of need requirements.

GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS

Note: Site Condition(s)
 Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.
 Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

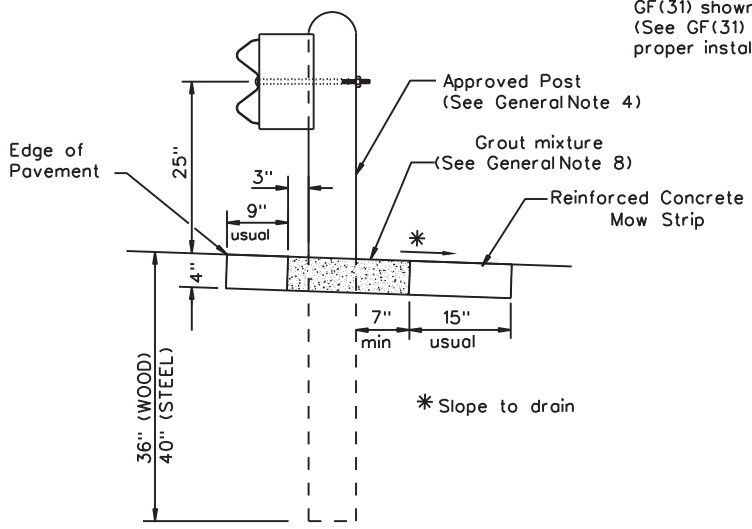


PLAN

GF(31) shown with Mow Strip (See GF(31) standard sheet for proper installation)

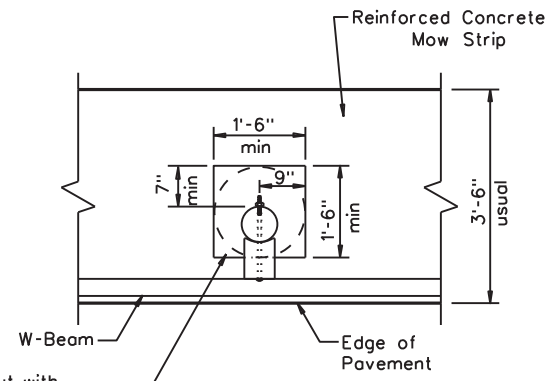
GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 1/2" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type 1 or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.



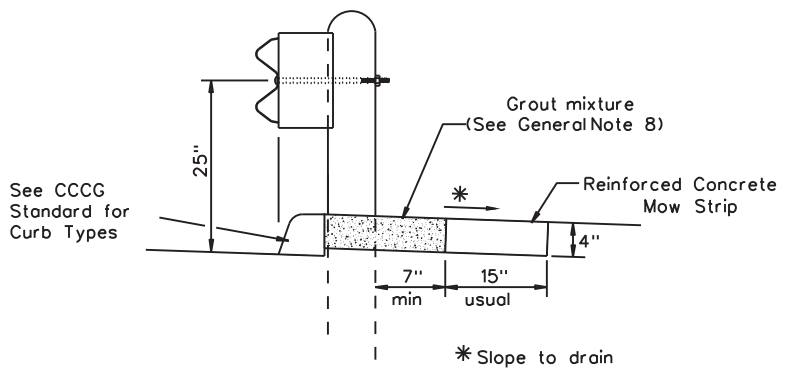
SECTION A-A

Typical



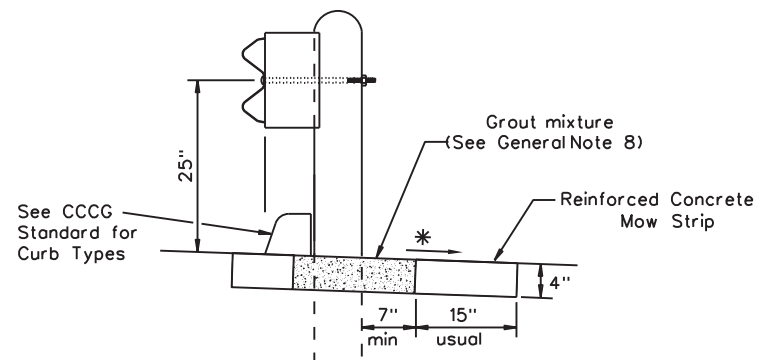
MOW STRIP DETAIL

Reinforced Concrete Mow Strip with 18" x 18" Square or 18" Dia. minimum leave-out.



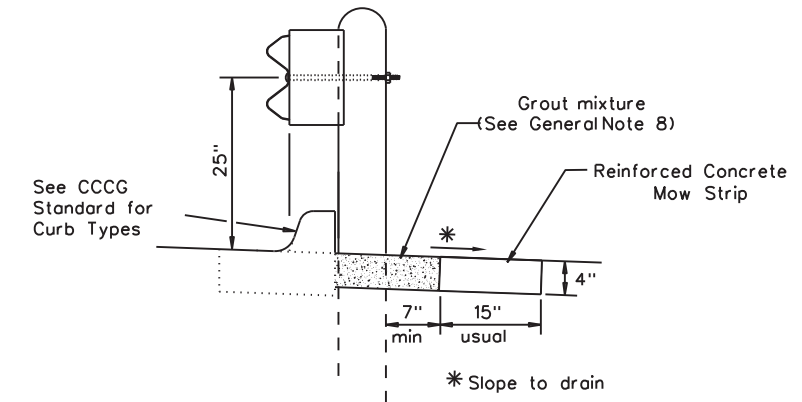
CURB OPTION (1)

This option will increase the post embedment throughout the system.



CURB OPTION (2)

Curb shown on top of mow strip

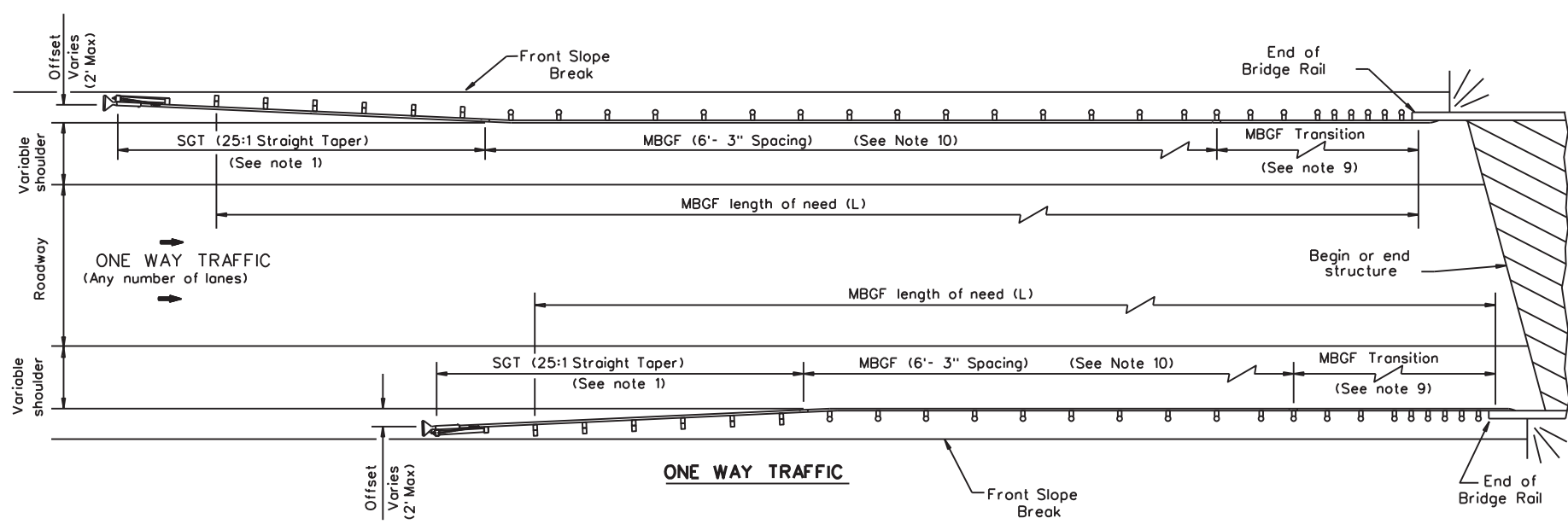
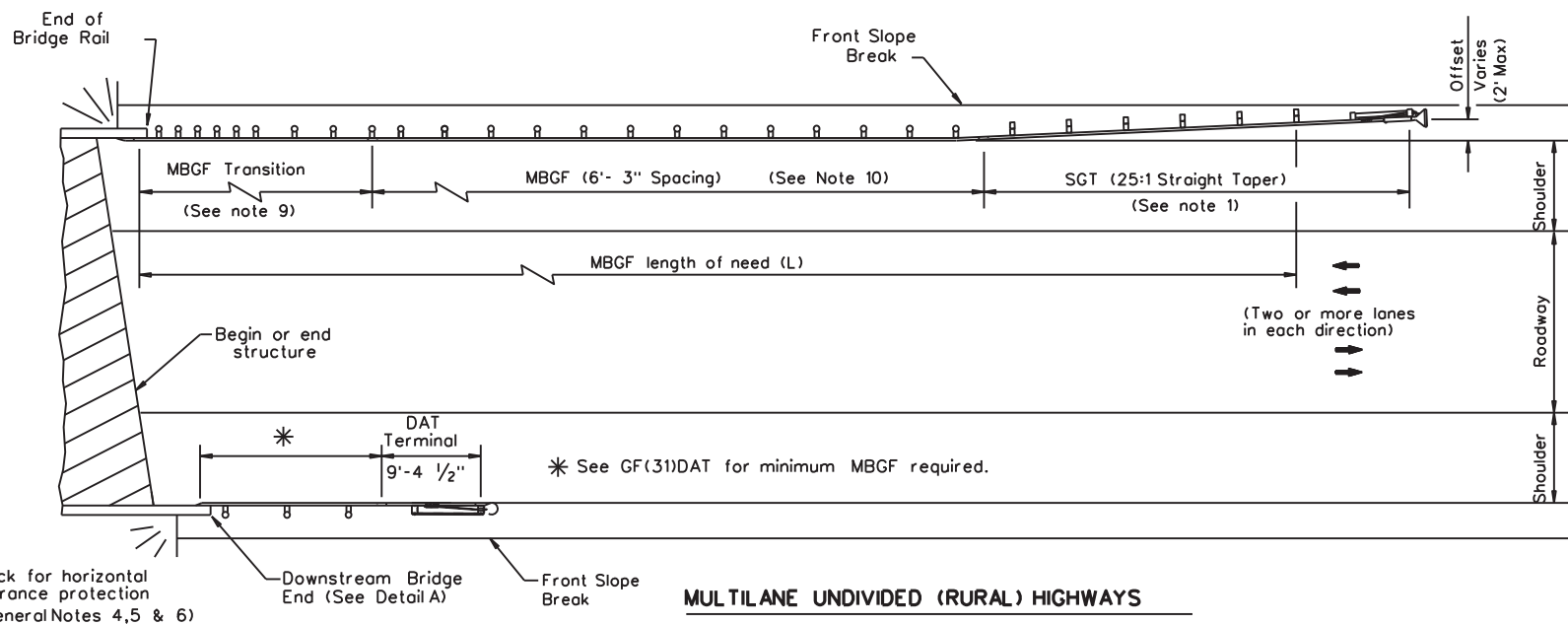
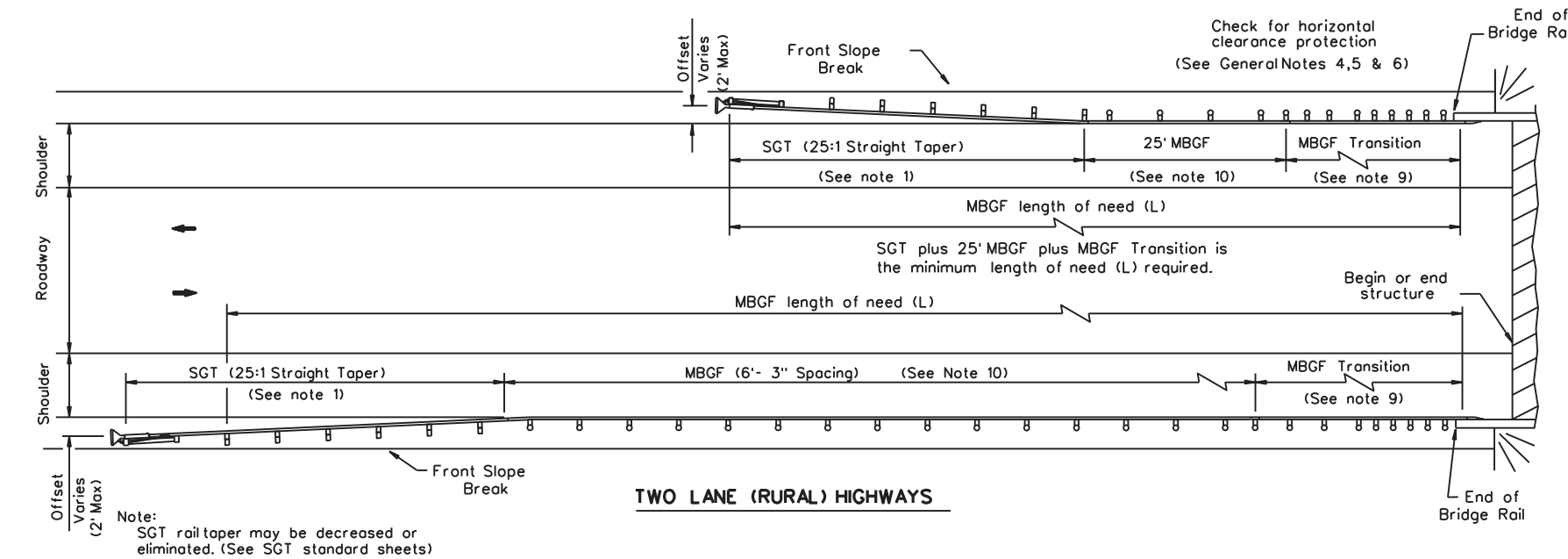


CURB OPTION (3)

		Design Division Standard	
METAL BEAM GUARD FENCE (MOW STRIP) TL-3 MASH COMPLIANT GF(31)MS-19			
FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: NOVEMBER 2019	CONT SECT	JOB	HIGHWAY
REVISIONS	6467 89	001	US 190, ETC
DIST	WACO	COUNTY	BELL, ETC
		SHEET NO.	58

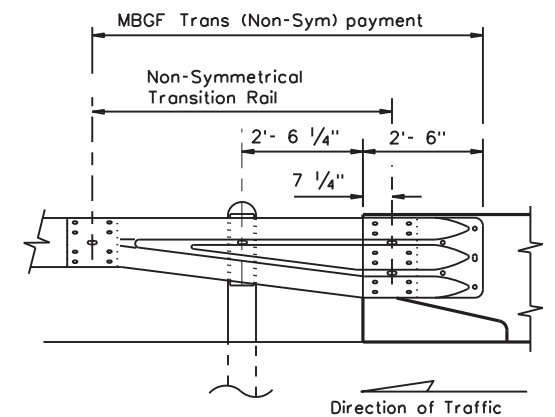
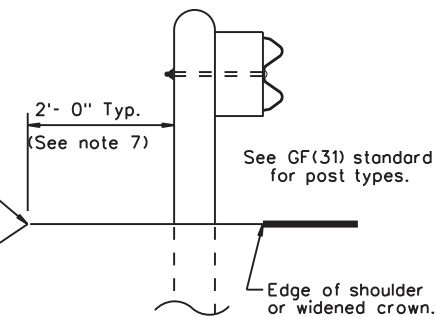
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GENERAL NOTES

1. For more detail: See GF(31), SGT (31), GF(31)TR, and GF(31)TL2 standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF to concrete rails are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (This requires a minimum of three standard line posts plus the DAT terminal, See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge in the approach direction.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.
10. A minimum 25' length of MBGF will be required.

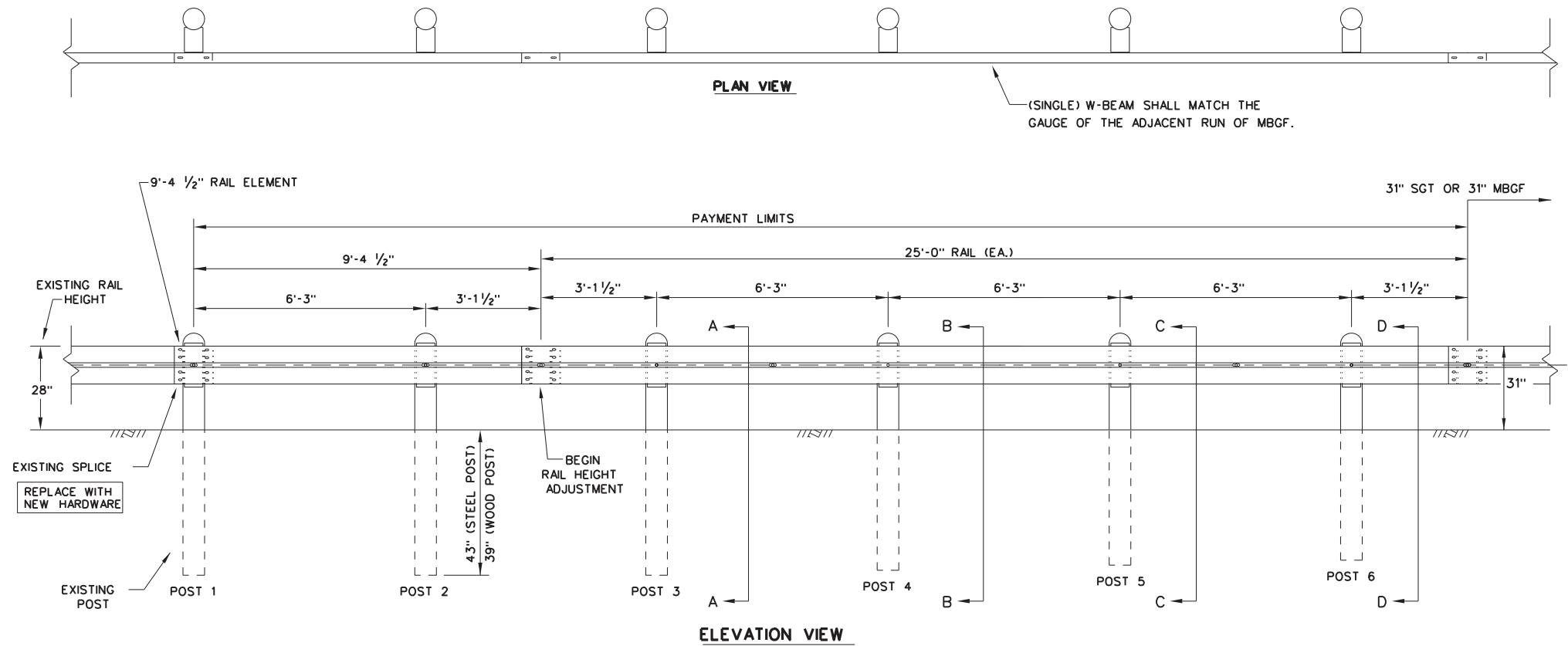


Note: All rail elements shall be lapped in the direction of adjacent traffic.

		Design Division Standard	
BRIDGE END DETAILS (METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)			
BED-14			
FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP
© TxDOT: December 2011	CONT: 6467	SECT: 89	JOB: 001
REVISIONS	DIST: WACO		COUNTY: BELL, ETC
			SHEET NO.: 59

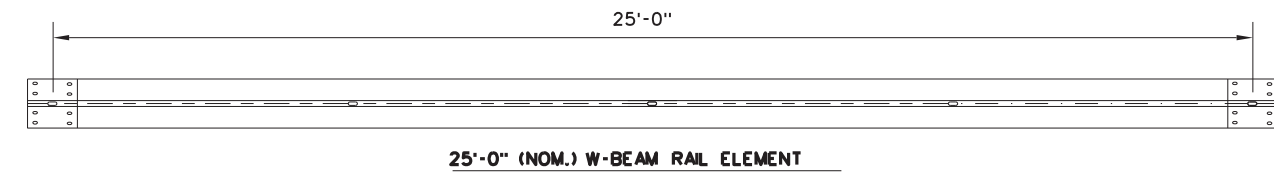
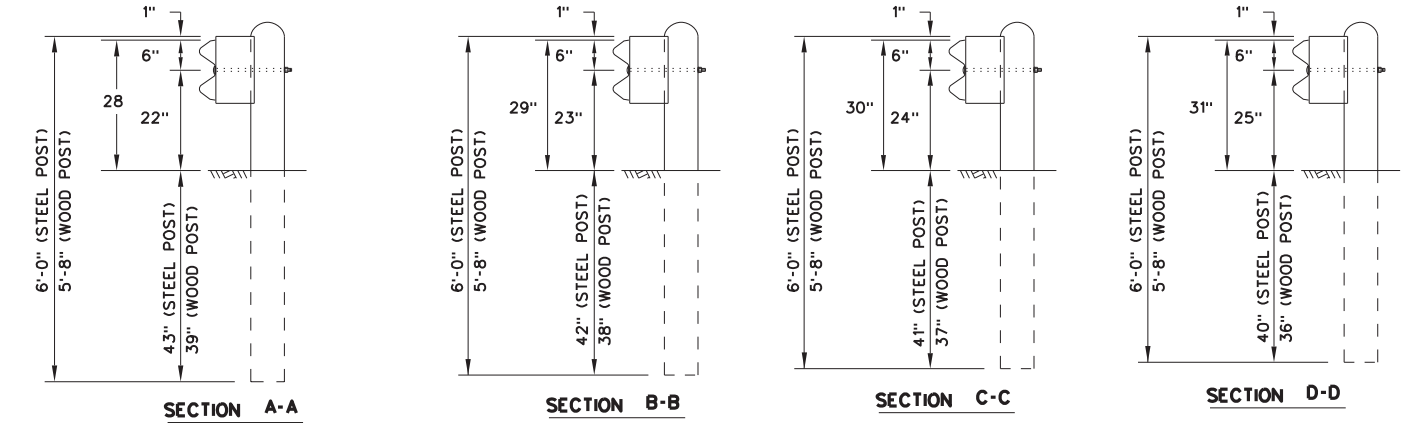
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- GENERAL NOTES**
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
 2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
 3. BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 3/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1-1/4" WITH 5/8" NUTS (ASTM A563).
 4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
 5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
 6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
 7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
 8. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. SEE GF(31) STANDARD FOR INSTALLATION GUIDANCE.
 9. POSTS SHALL NOT BE SET IN CONCRETE.
 10. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TxDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
 11. REFER TO STANDARD GF(31) FOR ADDITIONAL DETAILS.
 12. RAIL HEIGHT ADJUSTMENT IS ASSESSED AT TL-3 MASH COMPLIANT FOR STEEL POST HEIGHT TRANSITION TO 28" STEEL POST GUARDRAIL.

* "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.

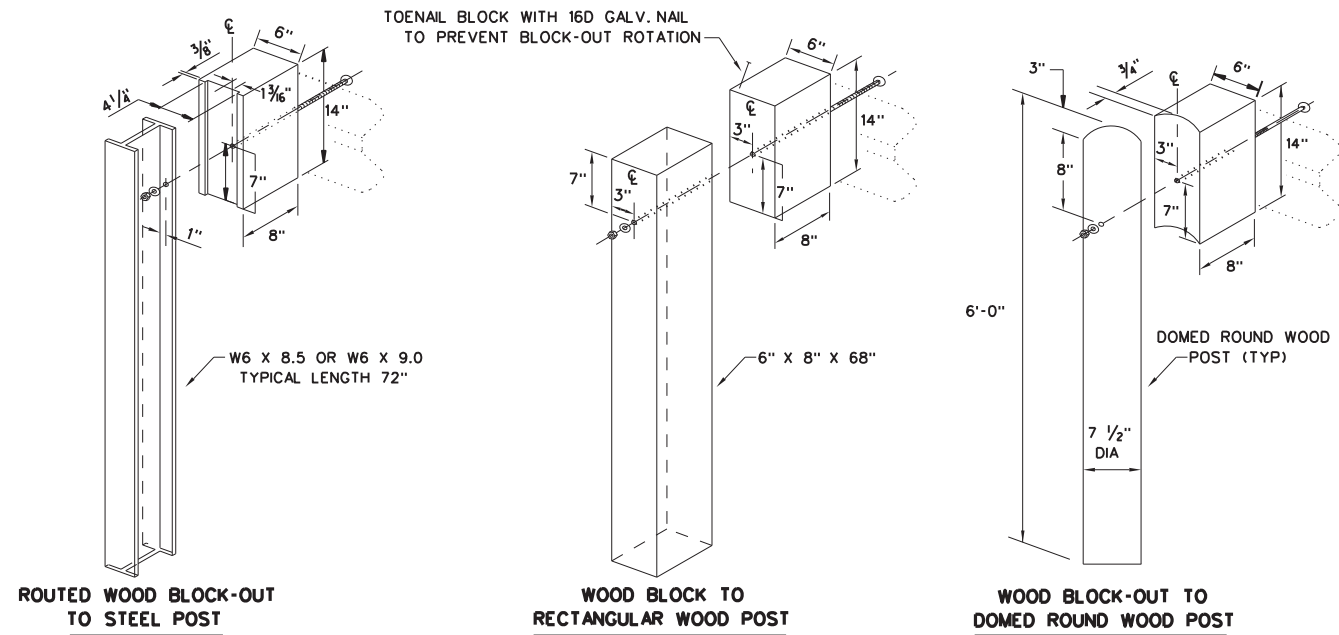


HARDWARE LIST	
QTY	DESCRIPTION
1	9'-4 1/2" W-BEAM RAIL ELEMENT 12GA.
1	25'-0" W-BEAM RAIL ELEMENT 12GA. (TYP)
6	7 1/2" DIA X 6'-0" DOMED ROUND WOOD POSTS (TYP)
6	6" X 8" X 68" RECTANGULAR WOOD POSTS (TYP)
6	W6 X 8.5 OR W6 X 9 X 72" STEEL POSTS (TYP)
6	6" X 8" X 14" WOOD BLOCKS OR COMPOSITE (TYP)
6	5/8" X 18" GUARDRAIL BOLTS WITH NUTS (FBB04)
6	5/8" ROUND WASHERS (ASTM F436)(FWC16a)
6	5/8" X 10" GUARDRAIL BOLTS WITH NUTS (FBB03)
24	5/8" X 1-1/4" GUARDRAIL SPLICE BOLTS WITH DOUBLE RECESSED NUTS (ASTM A563) (FBB01)

POST AND BLOCK-OUT TYPES AVAILABLE

FOR WOOD POST

FOR STEEL POST



NOTE: HARDWARE SHALL MEET THE FOLLOWING REQUIREMENTS.

GUARDRAIL POST BOLTS (ASTM A307 GR.A)

GUARDRAIL ROUND WASHERS (ASTM F436)

GUARDRAIL DOUBLE RECESSED NUTS (ASTM A563)

GUARDRAIL SPLICE BOLTS (ASTM A307 GR.A)

GUARDRAIL SPLICE NUTS (ASTM A563)

Texas Department of Transportation

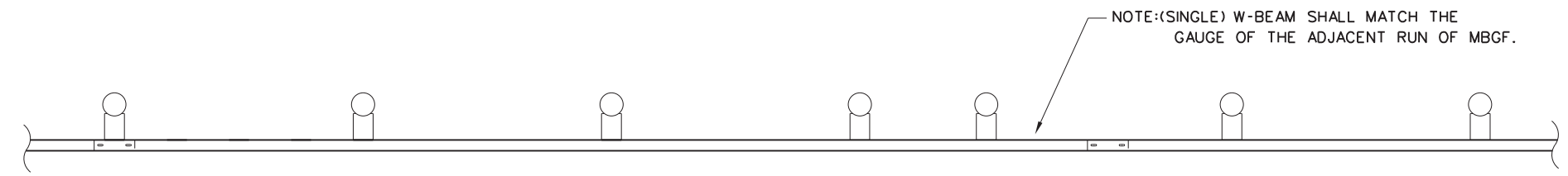
METAL BEAM GUARD FENCE RAIL HEIGHT ADJUSTMENT (28" TO 31") TL-3 MASH COMPLIANT RAIL-ADJ(A)-19

FILE: railadj19	DN: TxDOT	CK: KM	DW: VP	CK: CGL / AG
© TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190, ETC
DIST	COUNTY		SHEET NO.	
WACO	BELL, ETC		60	

Design Division Standard

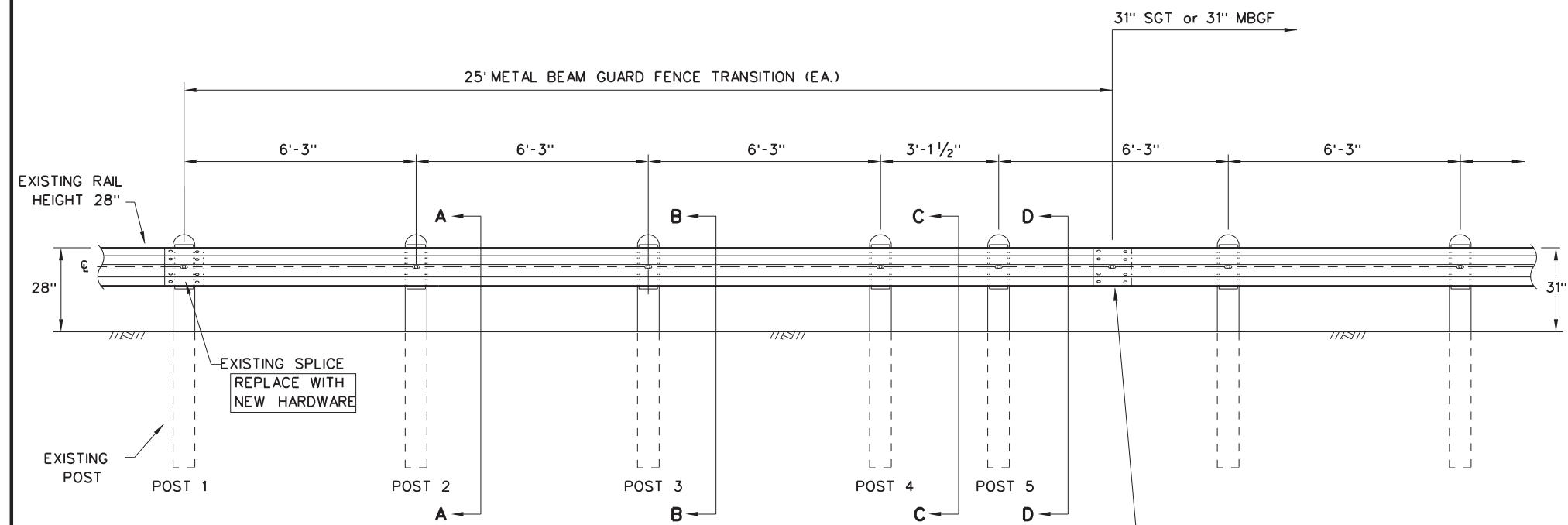
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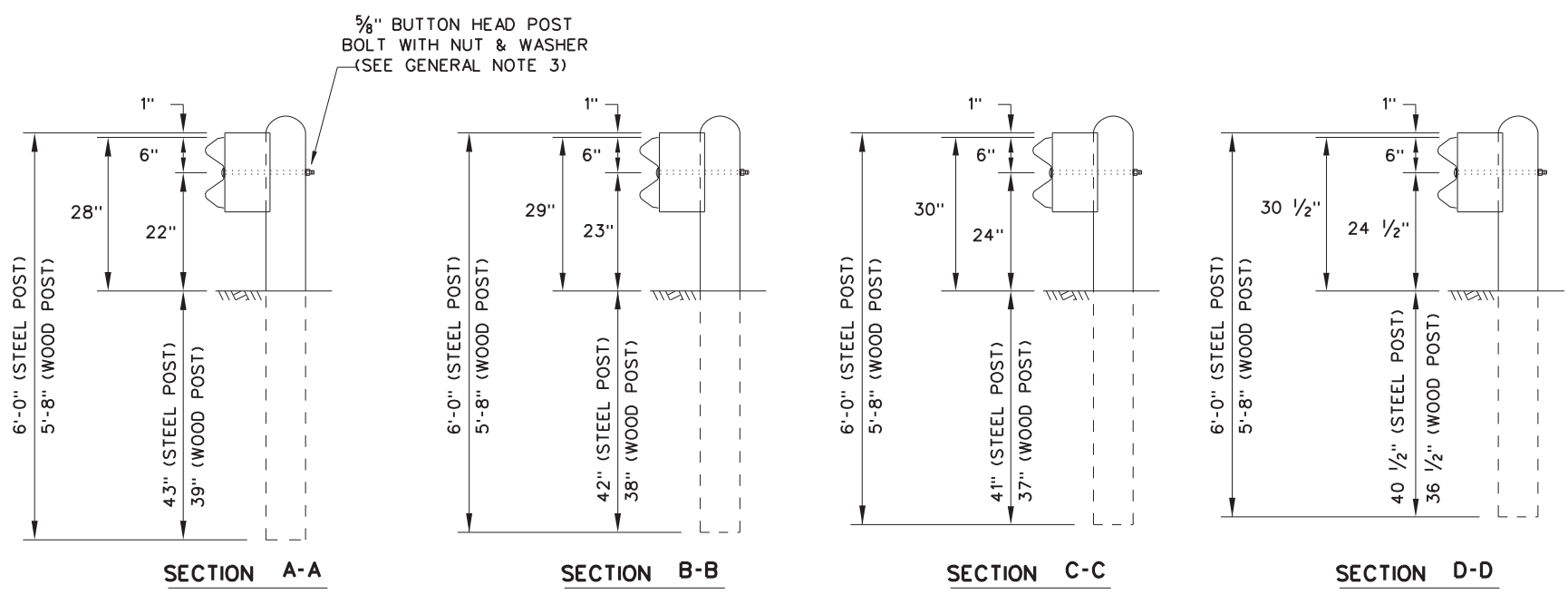
PLAN VIEW

NOTE: (SINGLE) W-BEAM SHALL MATCH THE GAUGE OF THE ADJACENT RUN OF MBGF.



ELEVATION VIEW

* "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

5/8" BUTTON HEAD POST BOLT WITH NUT & WASHER (SEE GENERAL NOTE 3)

(8) 5/8" DIA. X 1 1/4" GUARDRAIL SPLICE BOLTS WITH 5/8" NUTS (ASTM A563). (SEE GENERAL NOTE 3).

POST AND BLOCK-OUT TYPES AVAILABLE

FOR WOOD POST

FOR STEEL POST

NOTE: HARDWARE SHALL MEET THE FOLLOWING REQUIREMENTS.
 GUARDRAIL POST BOLTS (ASTM A307 GR.A)
 GUARDRAIL ROUND WASHERS (ASTM F436)
 GUARDRAIL DOUBLE RECESSED NUTS (ASTM A563)
 GUARDRAIL SPLICE BOLTS (ASTM A307 GR.A)
 GUARDRAIL SPLICE NUTS (ASTM A563)

GENERAL NOTES

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1-1/4" WITH 5/8" NUTS (ASTM A563).
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
8. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. SEE GF(31) STANDARD FOR INSTALLATION GUIDANCE.
9. POSTS SHALL NOT BE SET IN CONCRETE.
10. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
11. REFER TO STANDARD GF(31) FOR ADDITIONAL DETAILS.
12. RAIL HEIGHT ADJUSTMENT IS ASSESSED AT TL-3 MASH COMPLIANT FOR STEEL POST HEIGHT TRANSITION TO 28" STEEL POST GUARDRAIL.

HARDWARE LIST

QTY	DESCRIPTION
1	25'-0" W-BEAM RAIL ELEMENT 12GA. (TYP)
5	7 1/2" DIA X 6'-0" DOMED ROUND WOOD POSTS (TYP)
5	6" X 8" X 68" RECTANGULAR WOOD POSTS (TYP)
5	W6 X 8.5 OR W6 X 9 X 72" STEEL POSTS (TYP)
5	6" X 8" X 14" WOOD BLOCKS OR COMPOSITE (TYP)
5	5/8" X 18" GUARDRAIL BOLTS AND NUTS (FBB04)
5	5/8" ROUND WASHERS (ASTM F436)(FWC16o)
5	5/8" X 10" GUARDRAIL BOLTS AND NUTS (FBB03)
16	5/8" X 1-1/4" GUARDRAIL SPLICE BOLTS WITH DOUBLE RECESSED NUTS (ASTM A563) (FBB01)

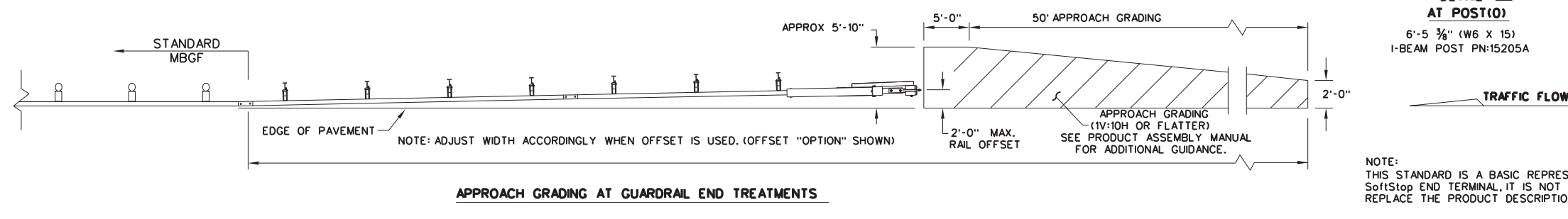
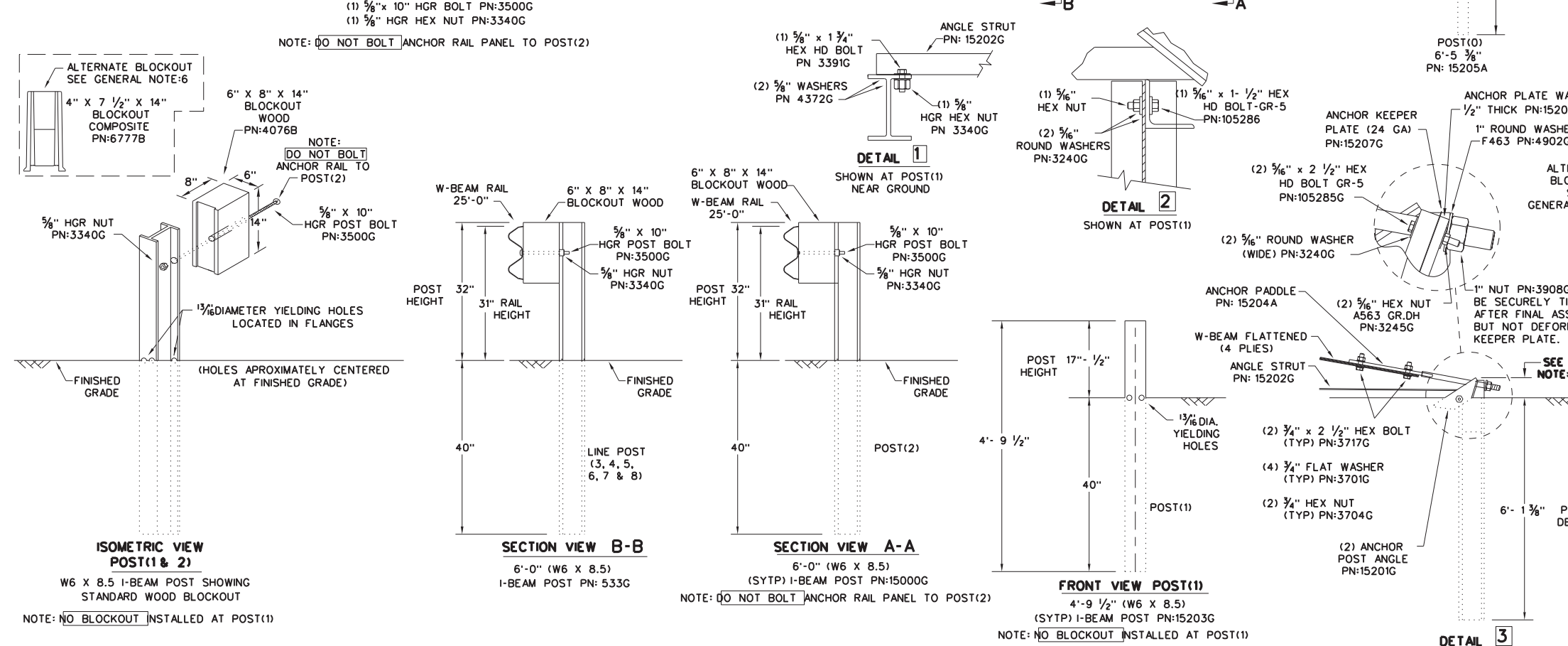
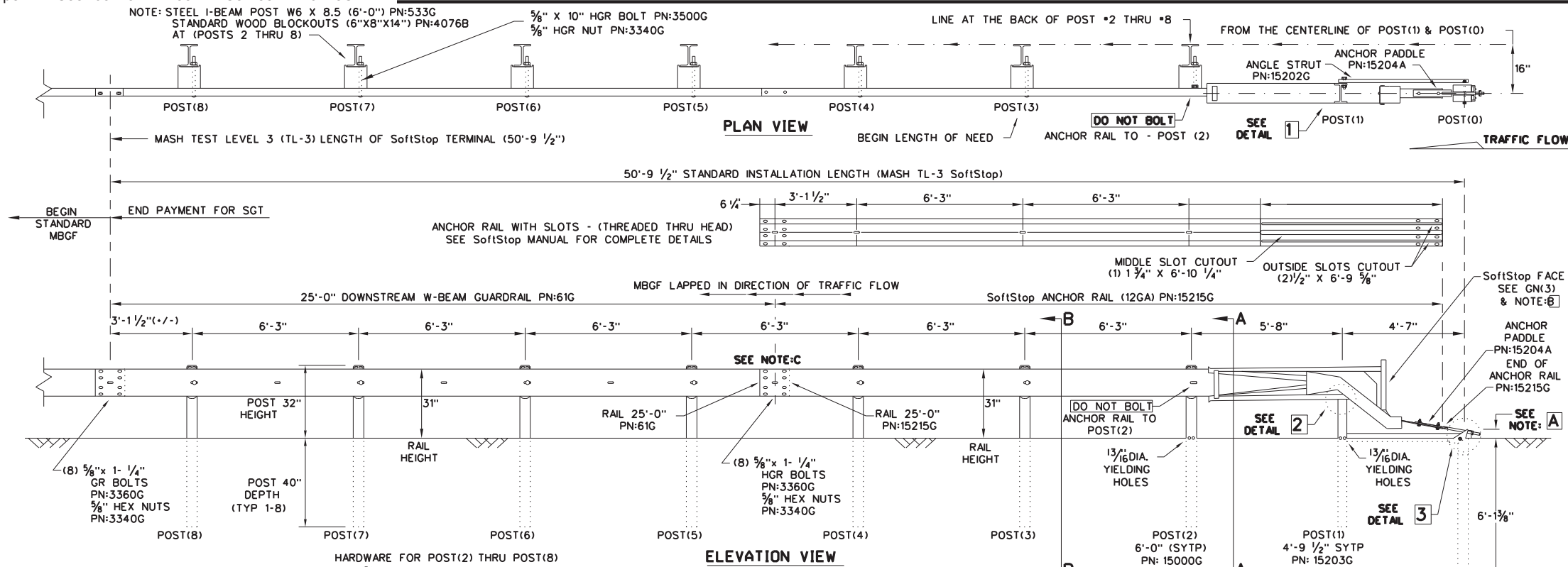


**METAL BEAM GUARD FENCE
 RAIL HEIGHT ADJUSTMENT
 (28" TO 31")
 TL-3 MASH COMPLIANT
 RAIL-ADJ(B)-19**

FILE: railadjb19	DN: TxDOT	CK: KM	DW: VP	CK: CGL / AG
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REVISIONS	6467	89	001	US 190, ETC
	DIST	COUNTY	SHEET NO.	
	WACO	BELL, ETC	61	

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- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374, 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE: SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL, PN:620237B
 - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TxDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 - A COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
 - IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MGBF STANDARD FOR INSTALLATION GUIDANCE.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
 - DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
 - UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop SYSTEM BE CURVED.
 - A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCRoaching ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.

NOTE-A	THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 3'-3/4" MIN. TO 4" MAX. ABOVE FINISHED GRADE.
NOTE-B	PART PN:5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) PART PN:5851B LEFT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING)
NOTE-C	W-BEAM SPLICE LOCATED BETWEEN LINE POST(4) AND LINE POST(5) GUARDRAIL PANEL 25'-0" PN:61G ANCHOR RAIL 25'-0" PN:15215G LAP GUARDRAIL IN DIRECTION OF TRAFFIC FLOW.

PART	QTY	MAIN SYSTEM COMPONENTS
620237B	1	PRODUCT DESCRIPTION ASSEMBLY MANUAL (LATEST REV.)
15208A	1	SoftStop HEAD (SEE MANUAL FOR RIGHT-LEFT APPROACH)
15215G	1	SoftStop ANCHOR RAIL (12GA) WITH CUTOUT SLOTS
61G	1	SoftStop DOWNSTREAM W-BEAM RAIL (12GA) (25'-0")
15205A	1	POST *0 - ANCHOR POST (6'-5 7/8")
15203G	1	POST *1 - (SYTP) (4'-9 1/2")
15000G	1	POST *2 - (SYTP) (6'-0")
533G	6	POST *3 THRU *8 - I-BEAM (W6 x 8.5) (6'-0")
4076B	7	BLOCKOUT - WOOD (ROUTED) (6" x 8" x 14")
6777B	7	BLOCKOUT - COMPOSITE (4" x 7 1/2" x 14")
15204A	1	ANCHOR PADDLE
15207G	1	ANCHOR KEEPER PLATE (24 GA)
15206G	1	ANCHOR PLATE WASHER (1/2" THICK)
15201G	2	ANCHOR POST ANGLE (10" LONG)
15202G	1	ANGLE STRUT

HARDWARE		
4902G	1	1" ROUND WASHER F436
3908G	1	1" HEAVY HEX NUT A563 GR.DH
3717G	2	3/4" x 2 1/2" HEX BOLT A325
3701G	4	3/4" ROUND WASHER F436
3704G	2	3/4" HEAVY HEX NUT A563 GR.DH
3360G	16	5/8" x 1 1/4" W-BEAM RAIL SPLICE BOLTS HGR
3340G	25	5/8" W-BEAM RAIL SPLICE NUTS HGR
3500G	7	5/8" x 10" HGR POST BOLT A307
3391G	1	5/8" x 1 3/4" HEX HD BOLT A325
4489G	1	5/8" x 9" HEX HD BOLT A325
4372G	4	5/8" WASHER F436
105285G	2	5/16" x 2 1/2" HEX HD BOLT GR-5
105286G	1	5/16" x 1 1/2" HEX HD BOLT GR-5
3240G	6	5/16" ROUND WASHER (WIDE)
3245G	3	5/16" HEX NUT A563 GR.DH
5852B	1	HIGH INTENSITY REFLECTIVE SHEETING - SEE NOTE-B

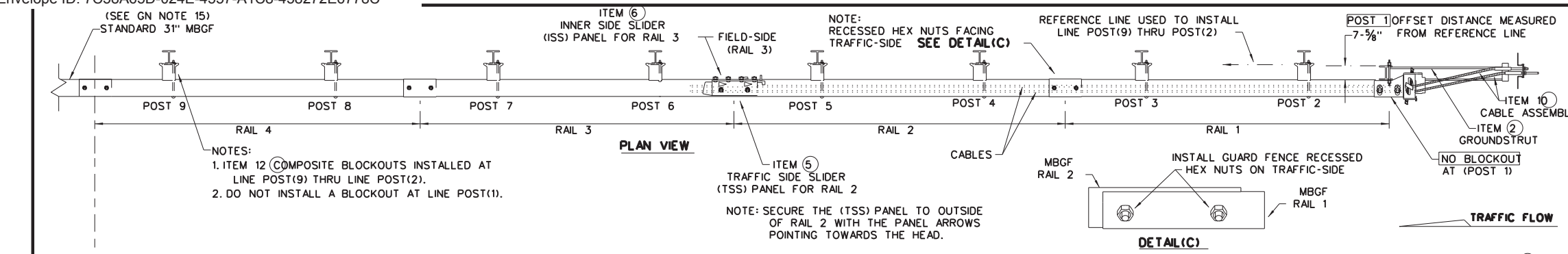
Design Division Standard

TRINITY HIGHWAY SOFTSTOP END TERMINAL MASH - TL-3 SGT(10S)31-16

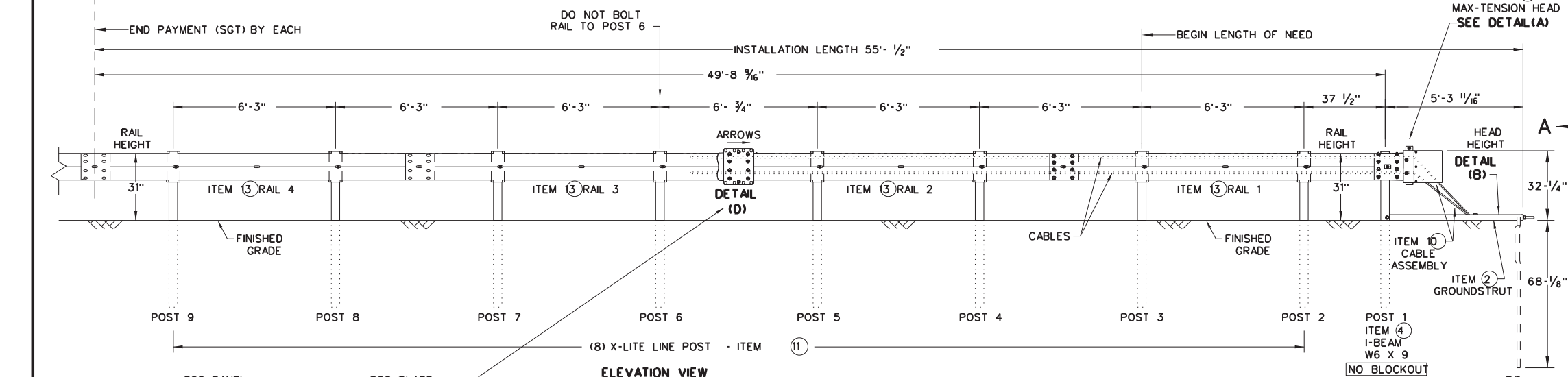
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© TxDOT: JULY 2016	CONT: 89	SECT: 001	JOB: US 190, ETC	REVISIONS
DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 62		

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE SoftStop END TERMINAL, IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

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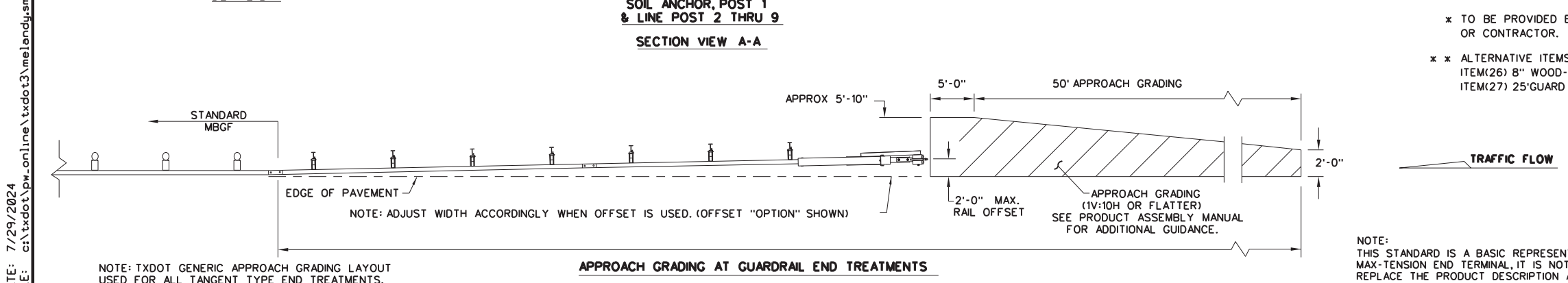
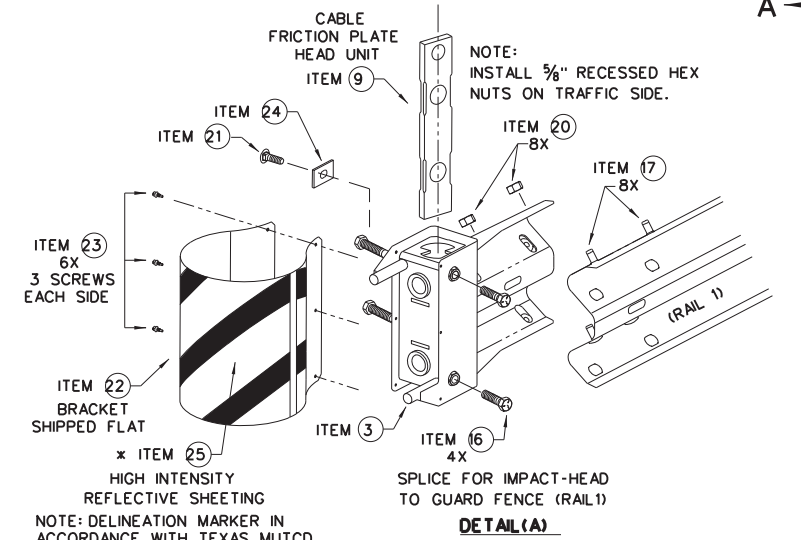
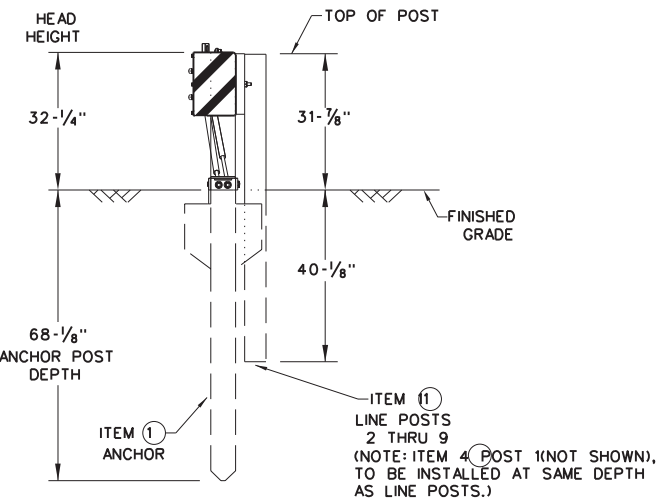
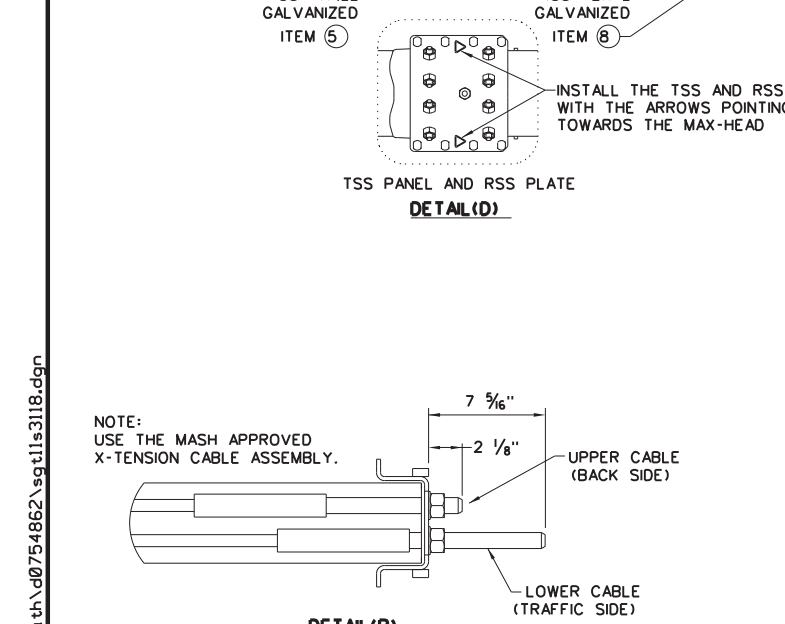


- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800
 - FOR INSTALLATION, REPAIR, & MAINTENANCE REFER TO THE: MAX-TENSION INSTALLATION INSTRUCTION MANUAL, P/N MANMAX REV D (ECN 3516).
 - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TxDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - ALL STEEL COMPONENTS ARE GALVANIZED PER ASTM A123 OR EQUIVALENT UNLESS OTHERWISE STATED.
 - SYSTEM SHOWN USING STEEL WIDE FLANGE POST WITH COMPOSITE BLOCKOUTS.
 - COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST(MPL) FOR CERTIFIED PRODUCERS.
 - REFER TO INSTALLATION MANUAL FOR SPECIFIC PANEL LAPPING GUIDANCE.
 - IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL FOR INSTALLATION GUIDANCE.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POST TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST.
 - MAX-TENSION SYSTEM SHALL NEVER BE INSTALLED WITHIN A CURVED SECTION OF GUARDRAIL.
 - IF A DELINEATION MARKER IS REQUIRED, MARKER SHALL BE IN ACCORDANCE WITH TEXAS MUTCD.
 - THE SYSTEM IS SHOWN WITH 12'-6" MBSF PANELS, 25'-0" MBSF PANELS ARE ALSO ALLOWED.
 - A MINIMUM OF 12'-6" OF 12GA. MBSF IS REQUIRED IMMEDIATELY DOWNSTREAM OF THE MAX-TENSION SYSTEM.



- ITEM 25 MAX-TENSION HEAD SEE DETAIL(A)
- ITEM 10 CABLE ASSEMBLY
- ITEM 2 GROUNDSTRUT
- NO BLOCKOUT AT (POST 1)
- ITEM 5 RAIL 4
- ITEM 3 RAIL 3
- ITEM 5 RAIL 2
- ITEM 5 RAIL 1
- ITEM 10 CABLE ASSEMBLY
- ITEM 2 GROUNDSTRUT
- ITEM 11 X-LITE LINE POST - ITEM 11
- ITEM 4 I-BEAM W6 X 9
- NO BLOCKOUT AT (POST 1)
- ITEM 25 MAX-TENSION HEAD SEE DETAIL(A)
- ITEM 10 CABLE ASSEMBLY
- ITEM 2 GROUNDSTRUT
- ITEM 1 SOIL ANCHOR POST

ITEM #	PART NUMBER	DESCRIPTION	QTY
1	BSI-1610060-00	SOIL ANCHOR - GALVANIZED	1
2	BSI-1610061-00	GROUND STRUT - GALVANIZED	1
3	BSI-1610062-00	MAX-TENSION IMPACT HEAD	1
4	BSI-1610063-00	W6x9 I-BEAM POST 6FT.-GALVANIZED	1
5	BSI-1610064-00	TSS PANEL - TRAFFIC SIDE SLIDER	1
6	BSI-1610065-00	ISS PANEL - INNER SIDE SLIDER	1
7	BSI-1610066-00	TOOTH - GEOMET	1
8	BSI-1610067-00	RSS PLATE - REAR SIDE SLIDER	1
9	B061058	CABLE FRICTION PLATE - HEAD UNIT	1
10	BSI-1610069-00	CABLE ASSEMBLY - MASH X-TENSION	2
11	BSI-1012078-00	X-LITE LINE POST-GALVANIZED	8
12	B090534	8" W-BEAM COMPOSITE-BLOCKOUT XT110	8
13	BSI-4004386	12'-6" W-BEAM GUARD FENCE PANELS 12GA.	4
14	BSI-1102027-00	X-LITE SQUARE WASHER	1
15	BSI-2001886	5/8" X 7" THREAD BOLT HH (GR.5)GEOMET	1
16	BSI-2001885	3/4" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET	4
17	4001115	5/8" X 1 1/4" GUARD FENCE BOLTS (GR.2)MGAL	48
18	2001840	5/8" X 10" GUARD FENCE BOLTS MGAL	8
19	2001636	5/8" WASHER F436 STRUCTURAL MGAL	2
20	4001116	5/8" RECESSED GUARD FENCE NUT (GR.2)MGAL	59
21	BSI-2001888	5/8" X 2" ALL THREAD BOLT (GR.5)GEOMET	1
22	BSI-1701063-00	DELINEATION MOUNTING (BRACKET)	1
23	BSI-2001887	1/4" X 3/4" SCREW SD HH 410SS	7
24	4002051	GUARDRAIL WASHER RECT AASHTO FWR03	1
25	SEE NOTE BELOW	HIGH INTENSITY REFLECTIVE SHEETING	1
26	4002337	8" W-BEAM TIMBER-BLOCKOUT, PDB01B	8
27	BSI-4004431	25' W-BEAM GUARDRAIL PANEL, 8-SPACE, 12GA.	2
28	MANMAX Rev-(D)	MAX-TENSION INSTALLATION INSTRUCTIONS	1



- * TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.
- ** ALTERNATIVE ITEMS NOT SHOWN. ITEM(26) 8" WOOD-BLOCKOUTS ITEM(27) 25' GUARD FENCE PANELS

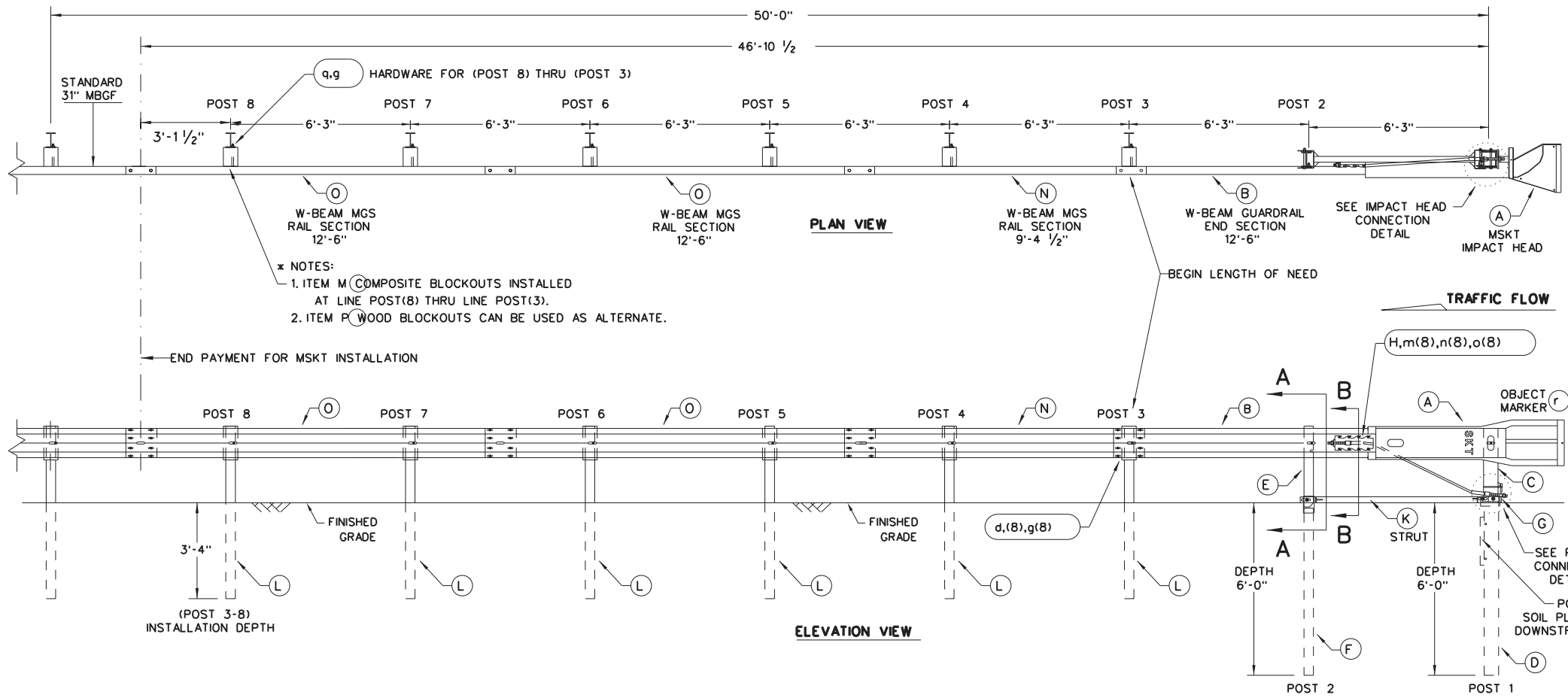
MAX-TENSION END TERMINAL
MASH - TL-3
SGT(11S)31-18

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© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
DIST	COUNTY		SHEET NO.	
WACO	BELL,ETC		63	

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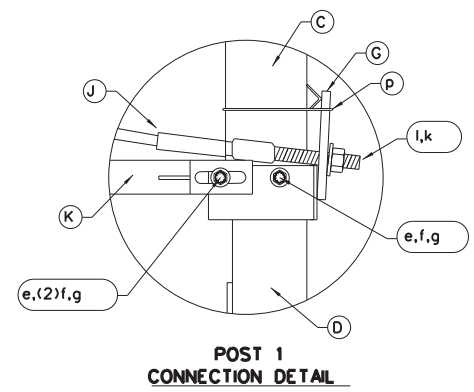
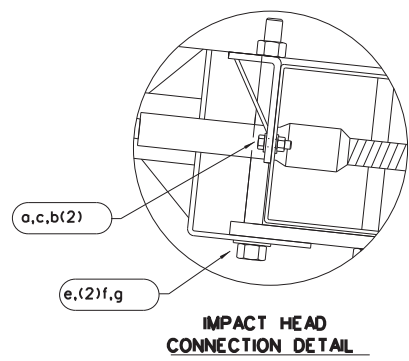
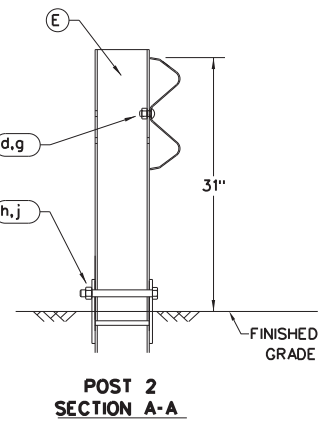
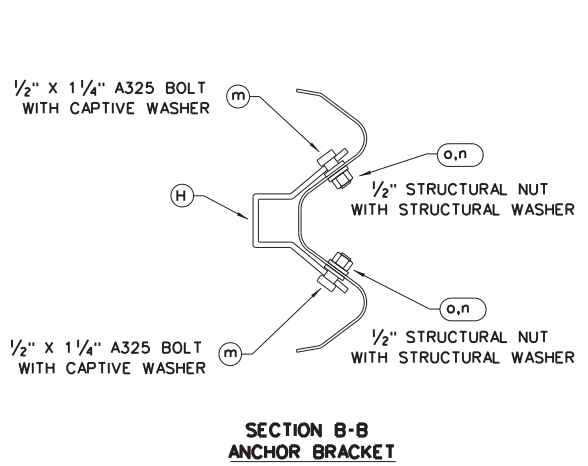
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- * NOTES:
- ITEM M (COMPOSITE BLOCKOUTS INSTALLED AT LINE POST(8) THRU LINE POST(3).
 - ITEM P (WOOD BLOCKOUTS CAN BE USED AS ALTERNATE.

- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE: MSKT END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL (PUBLICATION-062717).
 - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 - SYSTEM SHOWN USING STEEL WIDE FLANGE POSTS WITH COMPOSITE BLOCKOUTS.
 - A COMPOSITE MATERIAL BLOCKOUTS THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
 - IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, & REFER TO THE LATEST ROADWAY MGF STANDARD FOR INSTALLATION GUIDANCE.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - SYSTEM MUST BE ATTACHED TO STANDARD 31" MGBF.
 - UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
 - A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.
 - THE SYSTEM IS SHOWN WITH TWO 12'-6" MGBF PANELS, ONE 25'-0" MGBF PANEL IS ALSO ALLOWED IN THEIR PLACE.
 - A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POSTS 3-8 TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST. SPECIAL DRIVING CAP TO BE USED ON LOWER POSTS 1 & 2 TO PREVENT DAMAGE TO THE WELDED PLATES.

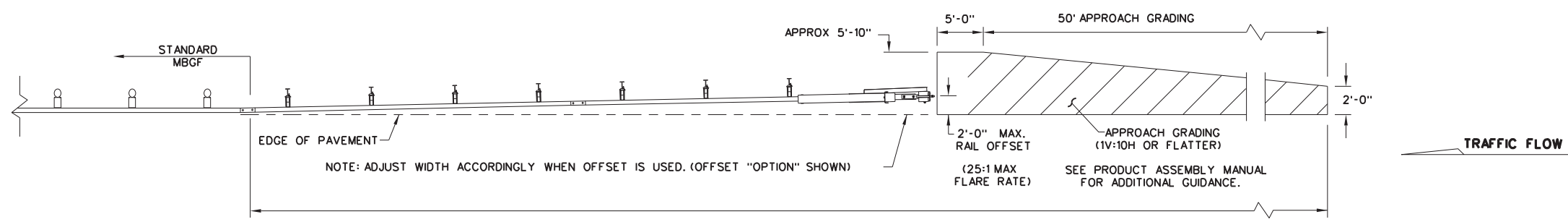
ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Go.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6" W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6" W6X9)	HP2B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770
K	1	GROUND STRUT	MS785
L	6	W6x9 OR W6x8.5 STEEL POST	P621
M	6	COMPOSITE BLOCKOUTS	CBSP-14
N	1	W-BEAM MGS RAIL SECTION (9'-4 1/2")	G12025
O	2	W-BEAM MGS RAIL SECTION (12'-6")	G1203A
P	6	WOOD BLOCKOUT 6" X 8" X 14"	P675
Q	1	W-BEAM MGS RAIL SECTION (25'-0")	G1209
SMALL HARDWARE			
a	2	3/16" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	3/16" WASHER	W0516
c	2	3/16" HEX NUT	N0516
d	25	3/8" Dia. x 1 1/4" SPLICE BOLT (POST 2)	B580122
e	2	3/8" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	3/8" WASHER	W050
g	33	3/8" Dia. H.G.R NUT	N050
h	1	3/4" Dia. x 8 1/2" HEX BOLT (GRD A449)	B340854A
j	1	3/4" Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	1/2" x 1 1/4" A325 BOLT WITH CAPTIVE WASHER	SB12A
n	8	1/2" STRUCTURAL NUTS	N012A
o	8	1 1/16" O.D. x 3/16" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	3/8" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151



ALTERNATIVE ITEMS NOT SHOWN. x x
 x ITEM(P) 8" WOOD-BLOCKOUT
 x x ITEM(Q) 25' GUARD FENCE PANEL

SEE NOTES: x

NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.



NOTE: TXDOT GENERIC APPROACH GRADING LAYOUT USED FOR ALL TANGENT TYPE END TREATMENTS.

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE MSKT END TERMINAL, IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

Design Division Standard

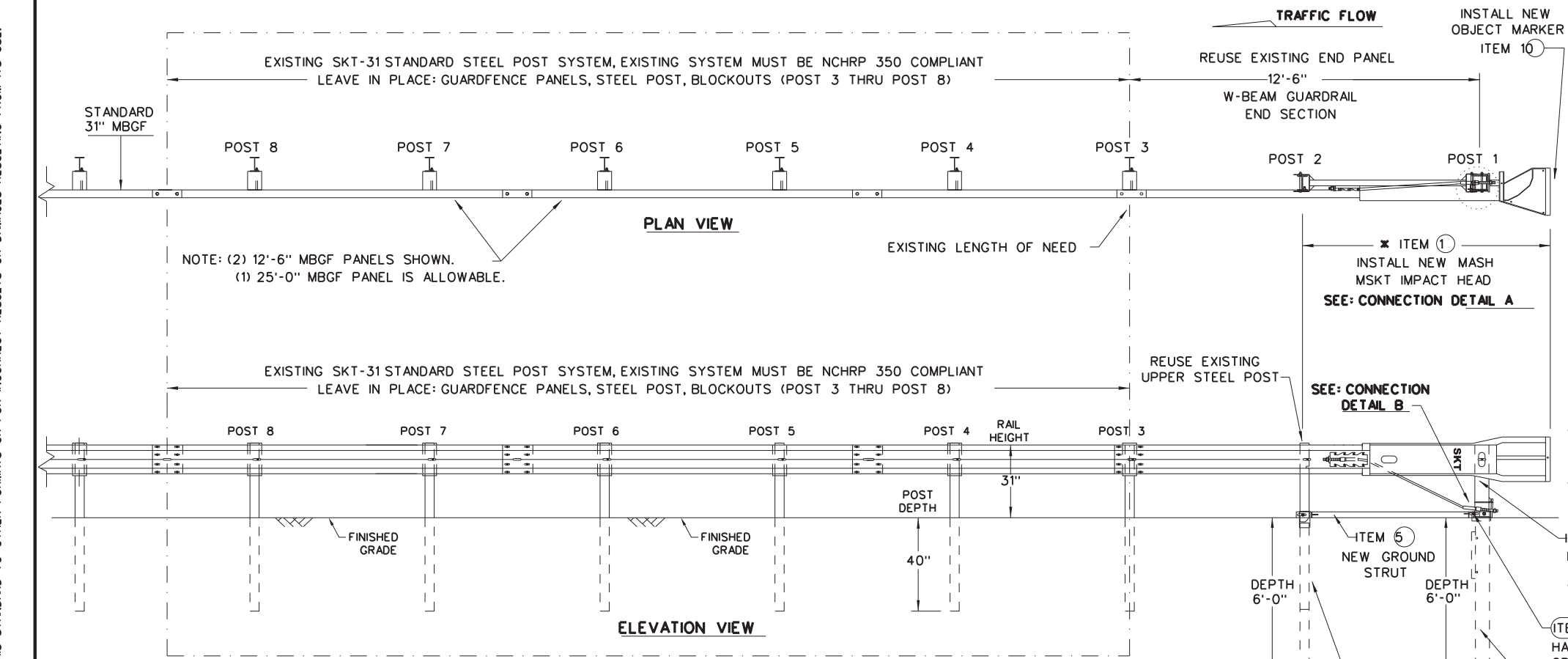
SINGLE GUARDRAIL TERMINAL

MSKT-MASH-TL-3

SGT(12S)31-18

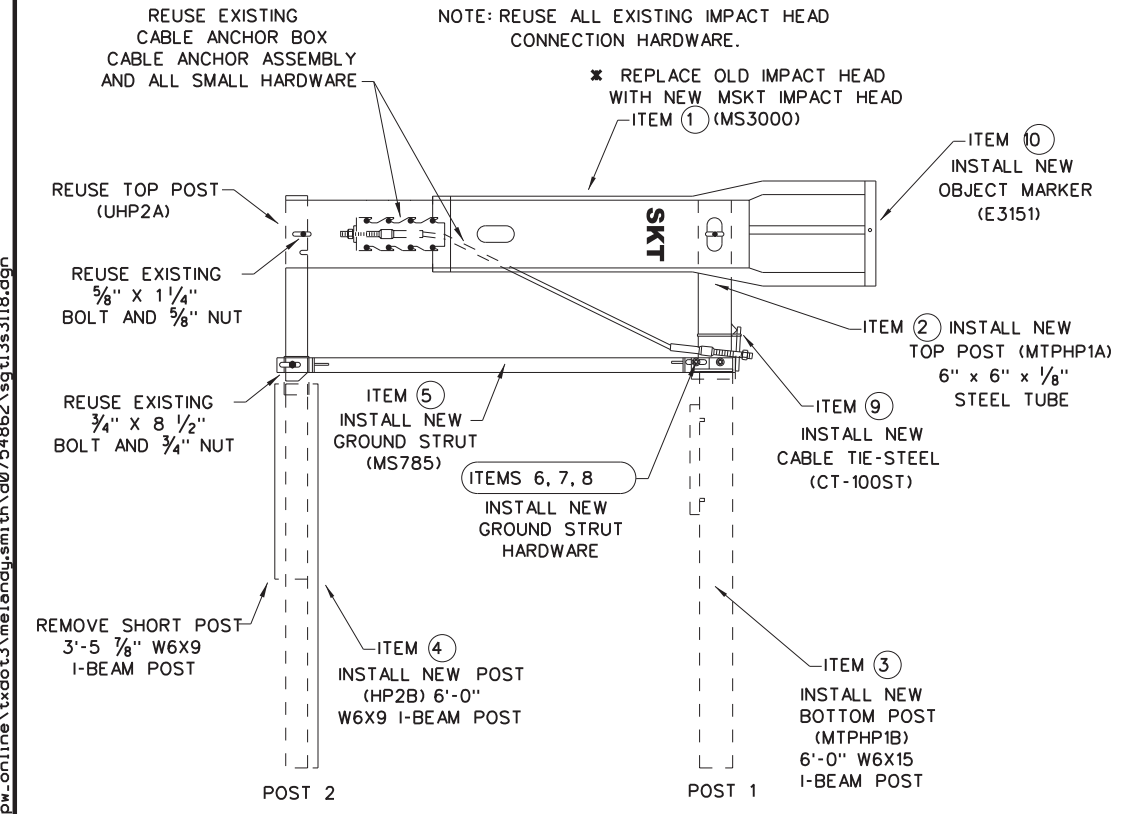
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	WACO	BELL, ETC	64	

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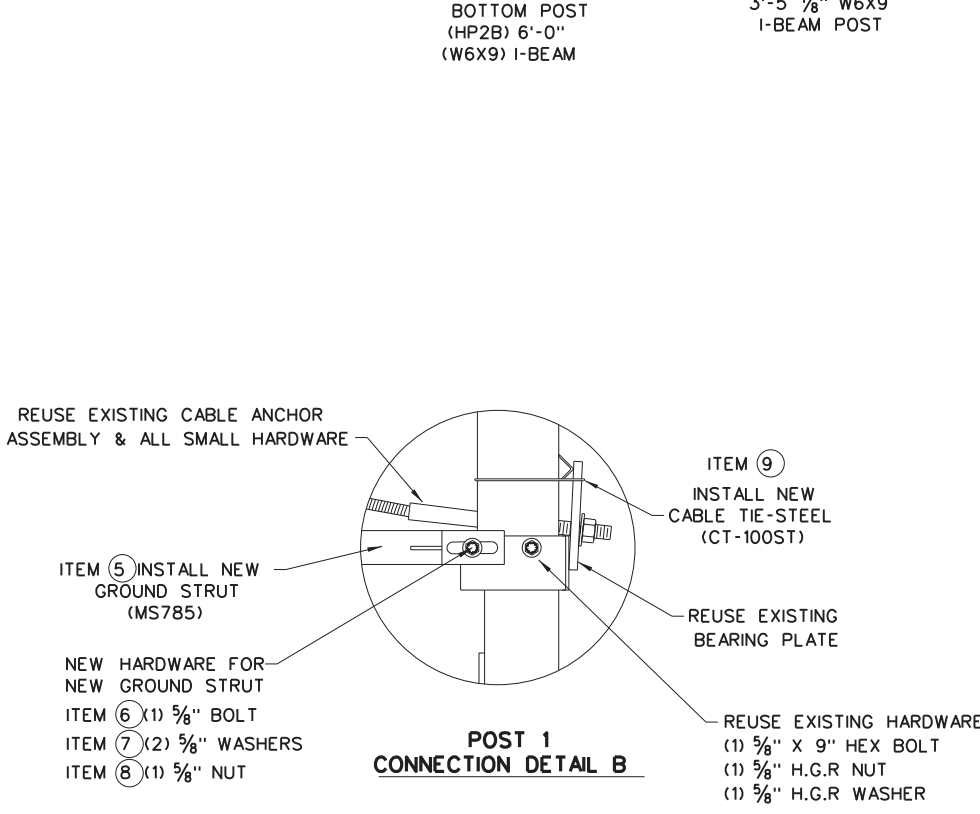


GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
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3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, AND REFER TO THE LATEST ROADWAY MOW STRIP STANDARD FOR INSTALLATION GUIDANCE.
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. THE EXISTING SKT 31" STANDARD STEEL POST SYSTEM MUST BE THOROUGHLY INSPECTED, AND DETERMINED TO BE INTACT, AND FREE OF ANY DAMAGE OR DEFECTS BEFORE RETROFITTING. THIS INSPECTION INCLUDES COMPLETING THE MSKT RETROFIT INSPECTION CHECKLIST FOR THE EXISTING SKT 31" STEEL POST NCHRP 350 SYSTEM. ALL EXISTING, AND REUSABLE PARTS MUST BE FREE OF ANY DAMAGE FOR A MASH COMPLIANT RETROFIT.
9. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
10. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCRDACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.
11. SPECIAL DRIVING CAP TO BE USED WHEN DRIVING (LOWER POSTS 1 & 2) TO PREVENT DAMAGE TO THE WELDED PLATES.



**CONNECTION DETAIL A
IMPACT HEAD (POST 1 & POST 2)**



**POST 1
CONNECTION DETAIL B**

ITEMS	QTY	MAIN SYSTEM COMPONENTS	PART NUMBERS
1	1	MSKT IMPACT HEAD	MS3000
2	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
3	1	POST 1 - BOTTOM (6" W6X15)	MTPHP1B
4	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
5	1	GROUND STRUT	MS785
6	1	5/8" X 9" HEX BOLT (GRD A449)	B580904A
7	2	5/8" WASHERS	W050
8	1	5/8" H.G.R NUT	N050
9	1	CABLE TIE-STEEL	CT-100ST
10	1	OBJECT MARKER 18" X 18"	E3151

COMPONENTS REQUIRED TO RETROFIT: EXISTING 31" STEEL POST (NCHRP 350 SKT) GUARDRAIL TERMINAL WITH THE NEW 31" (MASH COMPLIANT MSKT IMPACT HEAD).

* IF THE EXISTING NCHRP 350 (31" STEEL POST SKT) ALREADY HAS THE MSKT IMPACT HEAD THERE IS NO NEED TO REPLACE THE IMPACT HEAD OR OBJECT MARKER AS LONG AS IT IS NOT DAMAGED.

Texas Department of Transportation

RETROFIT STANDARD

SKT 31" STEEL POST SYSTEM

TO MASH MSKT

SGT(13S)31-18

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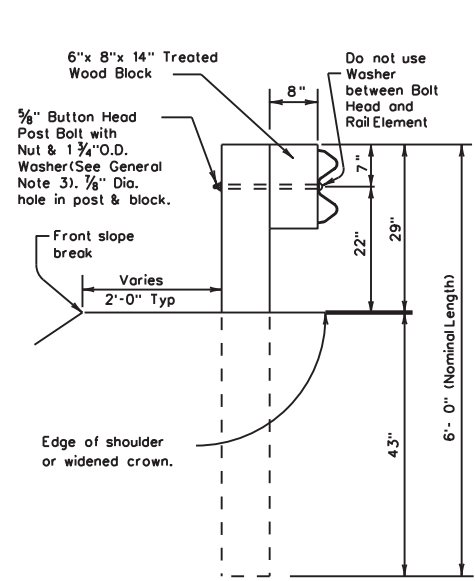
Design Division Standard

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE EXISTING; SKT END TERMINAL RETROFITED TO THE MSKT MASH COMPLIANT TERMINAL. IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

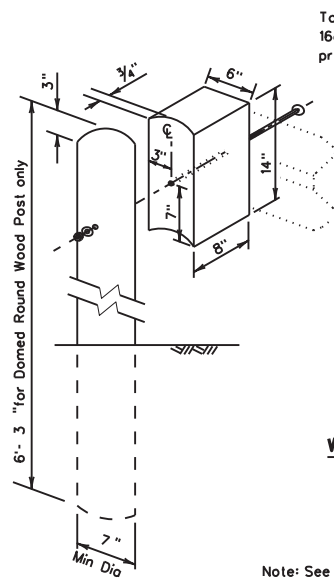
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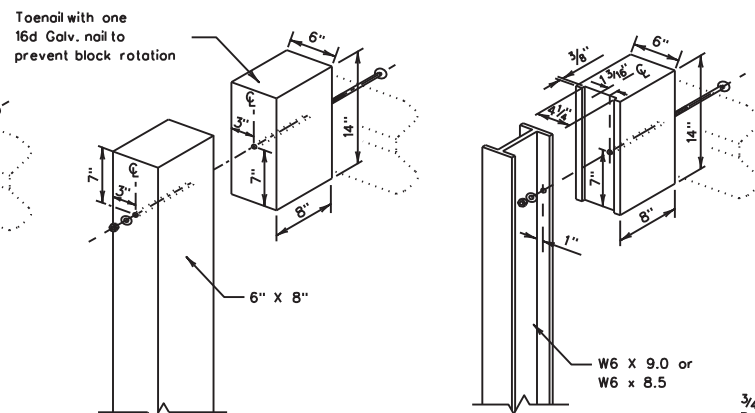
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TYPICAL POST



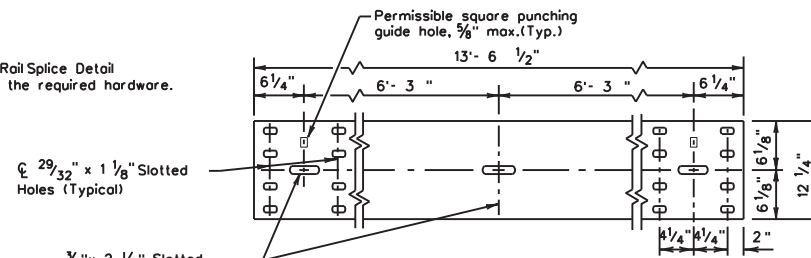
WOOD BLOCK TO ROUND WOOD POST



WOOD BLOCK TO RECTANGULAR WOOD POST

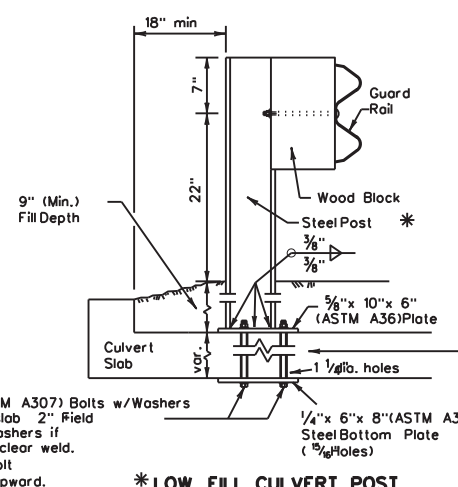
WOOD BLOCK TO STEEL POST

Note: See Rail Splice Detail for the required hardware.

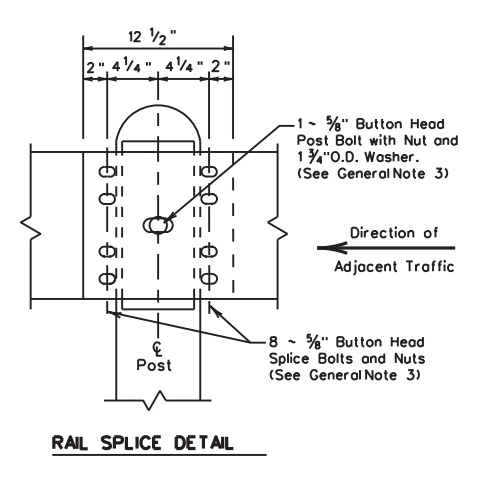
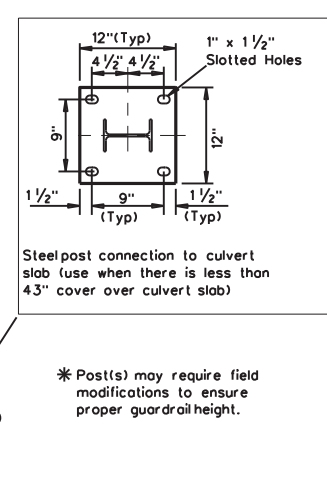


ELEVATION 12 1/2 (NOM.) W-BEAM SECTION

25 foot sections may also be supplied (See General Note 2)



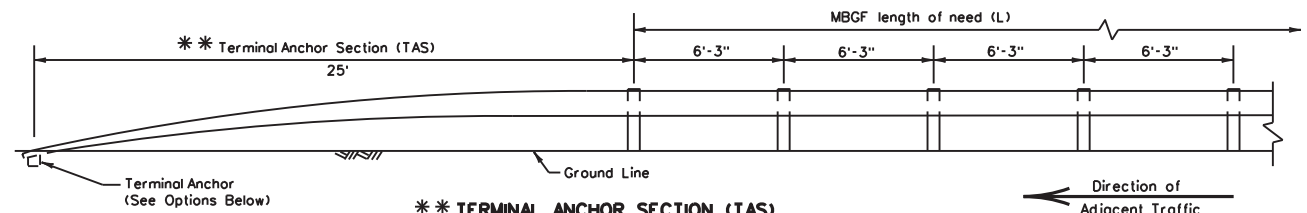
*** LOW FILL CULVERT POST**
 FOR USE ON NON-BRIDGE CLASS CULVERTS ONLY



RAIL SPLICE DETAIL

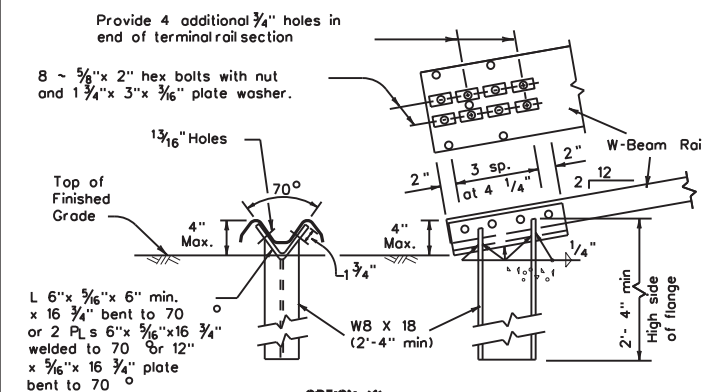
GENERAL NOTES

- The type of post (round wood post, rectangular wood post, or steel post) will be shown elsewhere in the plans. The exact position of MBGF shall be shown elsewhere in the plans or as directed by the Engineer. Steel posts to be galvanized in accordance with Item 445, "Galvanizing."
- Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans. The Contractor may furnish rail elements of 12 1/2 or 25 foot nominal lengths.
- Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the slab (ASTM A563) and Type A (1 3/4" O.D.) washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 3/8" x 1 1/4" (or 2" long at triple rail splices) with a 5/8" double recessed nut (ASTM A563).
- Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item.
- Crown shall be widened to accommodate the Metal Beam Guard Fence.
- The lateral approach to the guard fence, shall have a slope rate of not more than 1V:10H.
- Unless otherwise shown in the plans, guard fence placed in the vicinity of curbs shall be positioned so that the face of curb is located directly below or behind the face of the block. Rail placed over curbs shall be installed so that the post bolt is located approximately 21 inches above the gutter pan or roadway surface.
- If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 24" into the rock, or drill two 12" dia. front to back overlapping holes, 24" into the rock. If solid rock is encountered below 18", drill a 12" dia. hole, 12" into the rock or to the standard embedment depth, whichever is less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
- Posts shall not be set in concrete, of any depth.
- Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
- The terminal anchor section (TAS) post shall be set in Class A concrete (unless otherwise shown in the plans) in accordance with Item 421, "Hydraulic Cement Concrete." Concrete shall be subsidiary to the bid item requiring construction of the terminal anchor section (TAS). Terminal anchor post to be galvanized in accordance with Item 445, "Galvanizing."
- Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.



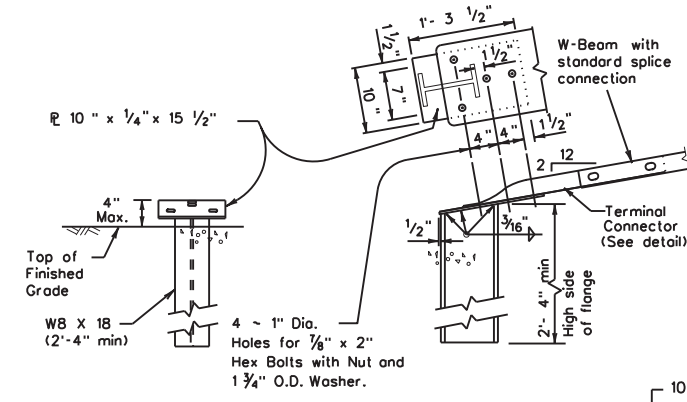
*** * TERMINAL ANCHOR SECTION (TAS)**

Terminal anchor sections are only for downstream use, when located outside the horizontal clearance area of opposing traffic.



OPTION (1)

Note: This anchor post requires four additional 3/4 inch holes (shop or field) in the rail member with eight 5/8 inch hex bolts with nut and plate washer.



OPTION (2)

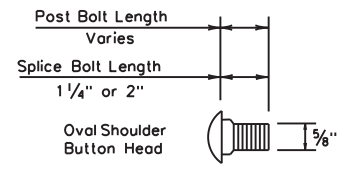
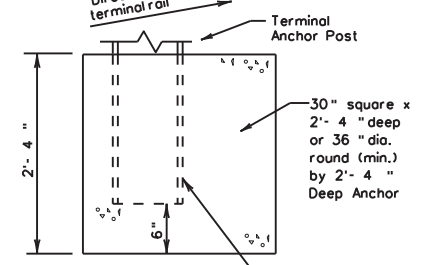
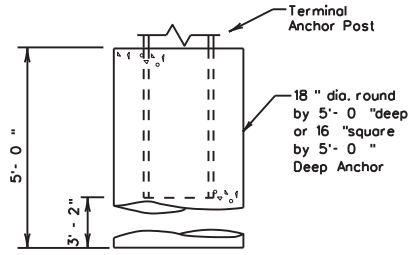
Note: This anchor post requires the use of the 10 ga. terminal connector with four 7/8 inch hex bolts with nut and washer.

TERMINAL ANCHOR POST OPTIONS
 (See General Note 11)

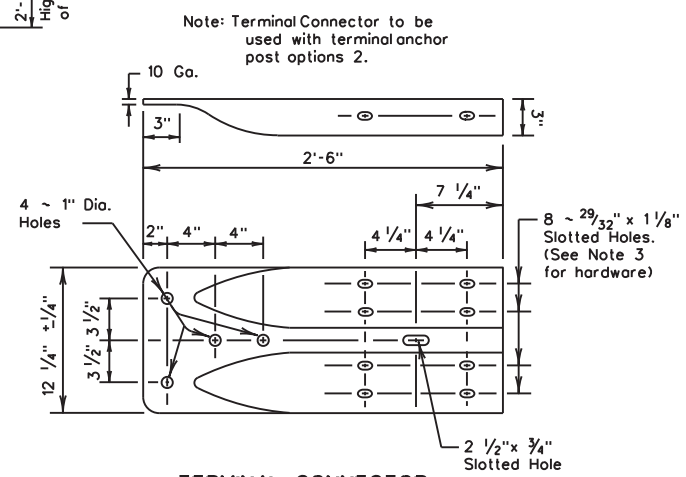
Notes:

- Either concrete anchor may be used with either post option above.
- No construction joint is allowed in the concrete anchor.
- Terminal rail may be bolted to post and in twist position prior to placing concrete anchor.
- If concrete anchor is precast, the area should be compacted as directed by the Engineer, when placed in the field.

TERMINAL CONCRETE ANCHOR OPTIONS
 (See General Note 11)



BUTTON HEAD BOLT
 Post and Splice Bolts
 (See General Note 3)



TERMINAL CONNECTOR

For connection hardware to concrete rails, see the MBGF transition standards.

ONLY FOR USE IN MAINTENANCE REPAIRS OR HIGHLY CONSTRAINED SITE CONDITIONS.



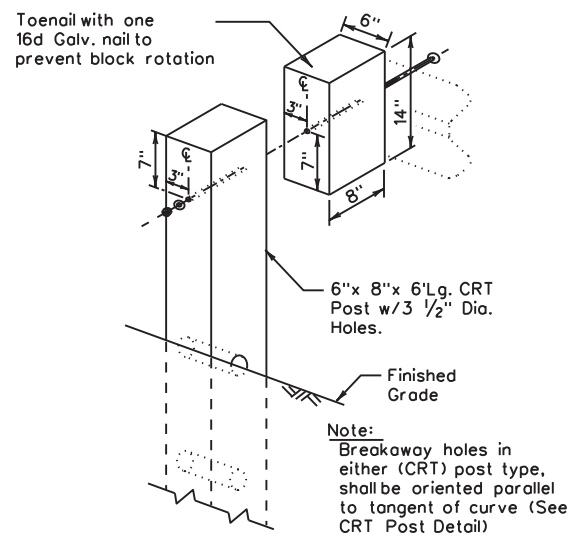
METAL BEAM GUARD FENCE

MBGF - 19

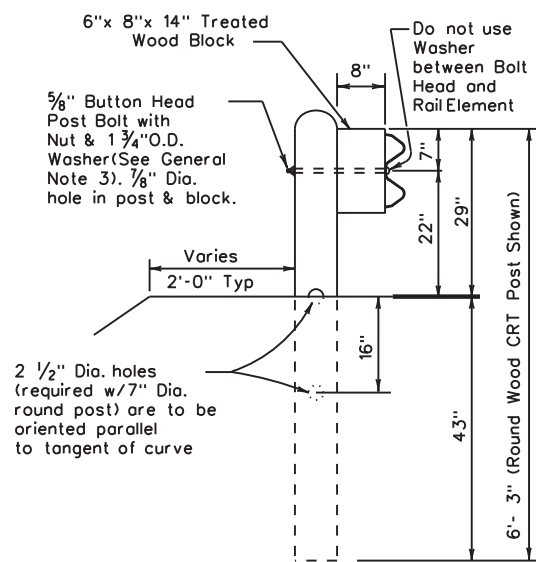
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© TxDOT NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190, ETC
DIST	COUNTY	SHEET NO.		
WACO	BELL, ETC	66		

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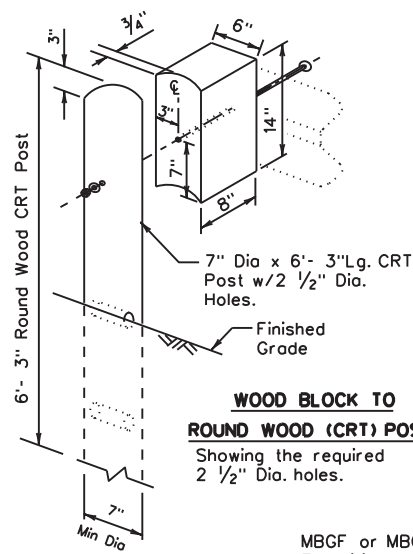


WOOD BLOCK TO RECTANGULAR WOOD (CRT) POST
Showing the required 3 1/2" Dia. holes.

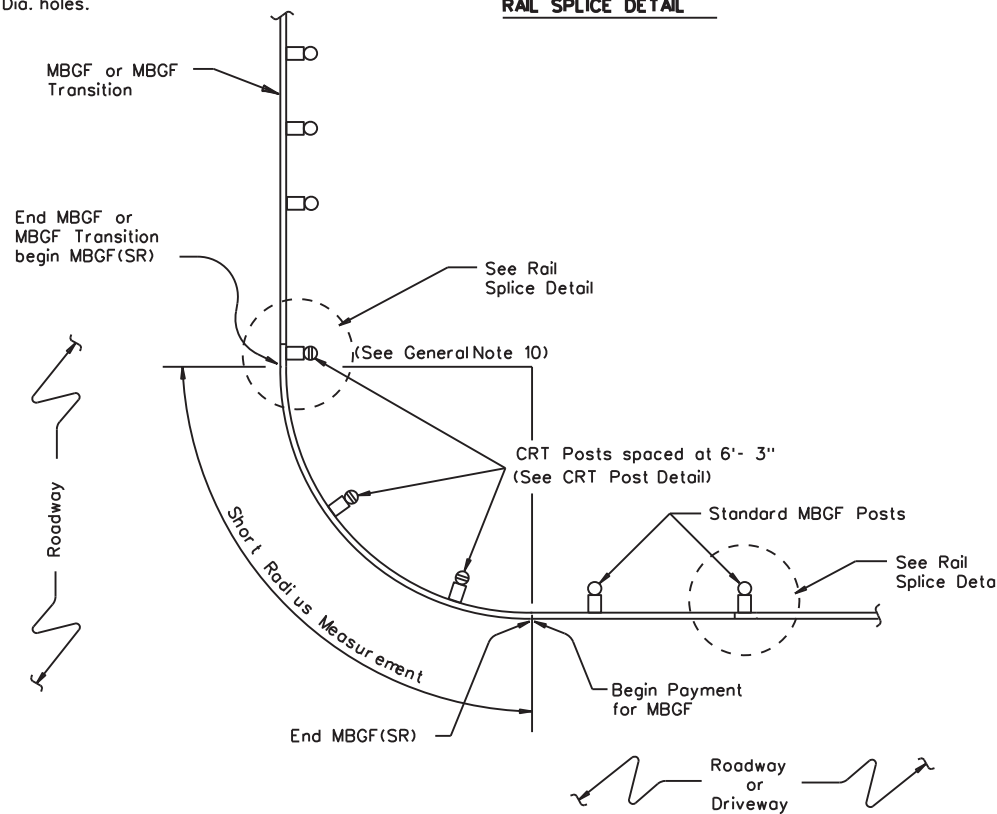
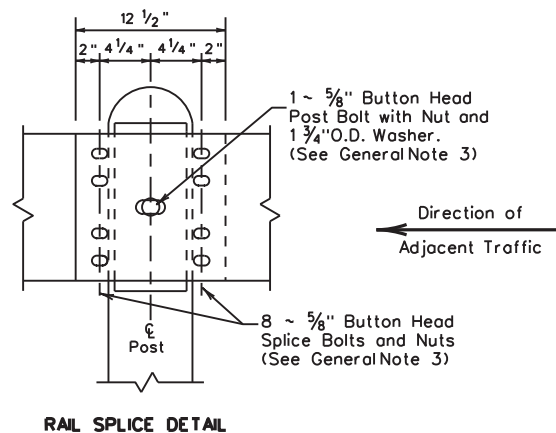


(CRT) POST DETAIL
CONTROLLED RELEASE TERMINAL POST

Two or more wood CRT post(s) are required at any radius installation located at intersecting roadways or driveways.

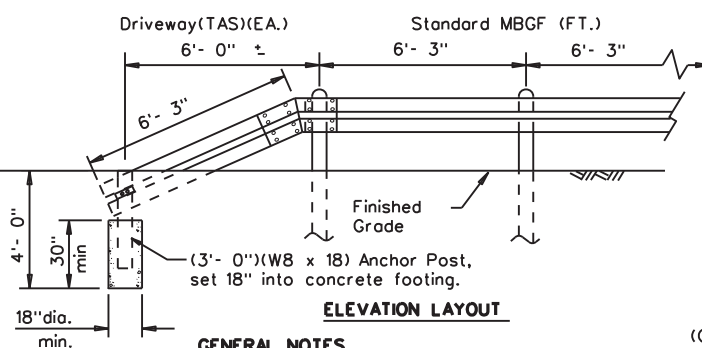


WOOD BLOCK TO ROUND WOOD (CRT) POST
Showing the required 2 1/2" Dia. holes.



PLAN VIEW SHOWING TYPICAL RADIUS

The required radius is shown elsewhere on the plans.

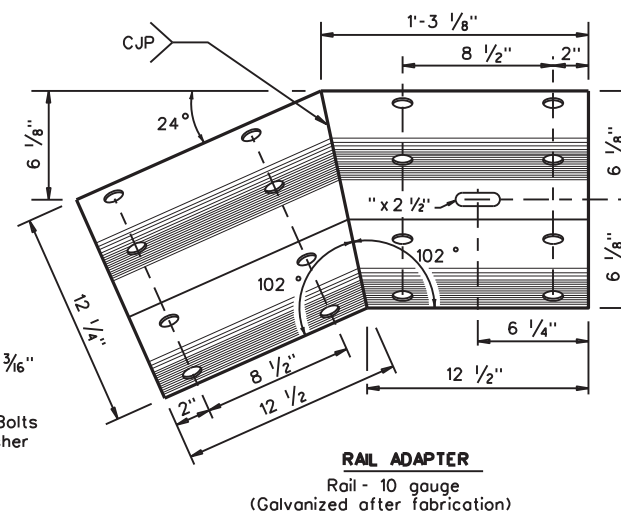
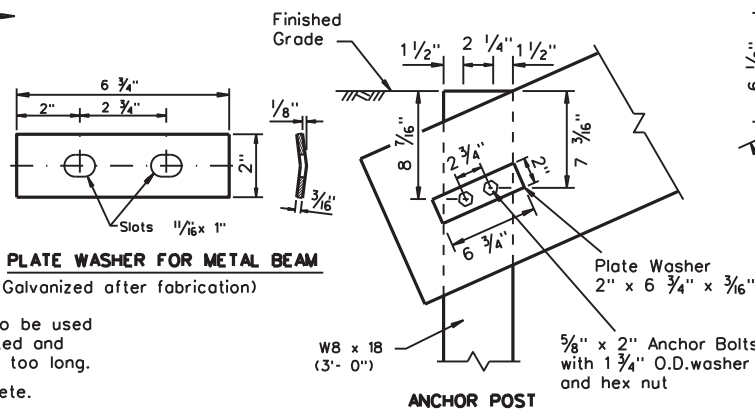


GENERAL NOTES

- The "Driveway" Terminal Anchor Section is ONLY to be used within driveway locations, where the ROW is limited and a standard 25 ft. (TAS) Terminal Anchor Section, is too long.
- Terminal anchor post shall be set in Class A concrete.
- All steel shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."

"DRIVEWAY" TERMINAL ANCHOR SECTION

Only for use within driveway locations, where a standard (TAS) Terminal Anchor Section can not be installed.



GENERAL NOTES

- The type of (CRT) post (round wood post, or rectangular wood post) will be shown elsewhere in the plans. The exact position of MGBF shall be shown elsewhere in the plans or as directed by the Engineer.
- Steel posts are not permitted at CRT post positions.
- Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans. The Contractor may furnish rail elements of 12 1/2 or 25 foot nominal lengths.
- Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 3/4" O.D.) washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 5/8" x 1 1/4" (or 2") long at triple rail splices) with a 5/8" double recessed nut (ASTM A563).
- Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item.
- Crown shall be widened to accommodate the Metal Beam Guard Fence.
- The lateral approach to the guard fence, shall have a slope rate of not more than 1V:10H.
- Unless otherwise shown in the plans, guard fence placed in the vicinity of curbs shall be positioned so that the face of curb is located directly below or behind the face of the block. Rail placed over curbs shall be installed so that the post bolt is located approximately 21 inches above the gutter pan or roadway surface.
- If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 24" into the rock, or drill two 12" dia. front to back overlapping holes, 24" into the rock. If solid rock is encountered below 18", drill a 12" dia. hole, 12" into the rock or to the standard embedment depth, whichever is less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
- Guardrail posts shall not be set in concrete, of any depth.
- Special rail fabrication will be required at installations having a curvature of less than 150 ft. radius. The required radius shall be shown on the plans.
- The terminal anchor section (TAS) post shall be set in Class A concrete (unless otherwise shown in the plans) in accordance with Item 421, "Hydraulic Cement Concrete." Concrete shall be subsidiary to the bid item requiring construction of the terminal anchor section (TAS). Terminal anchor post to be galvanized in accordance with Item 445, "Galvanizing."
- Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.

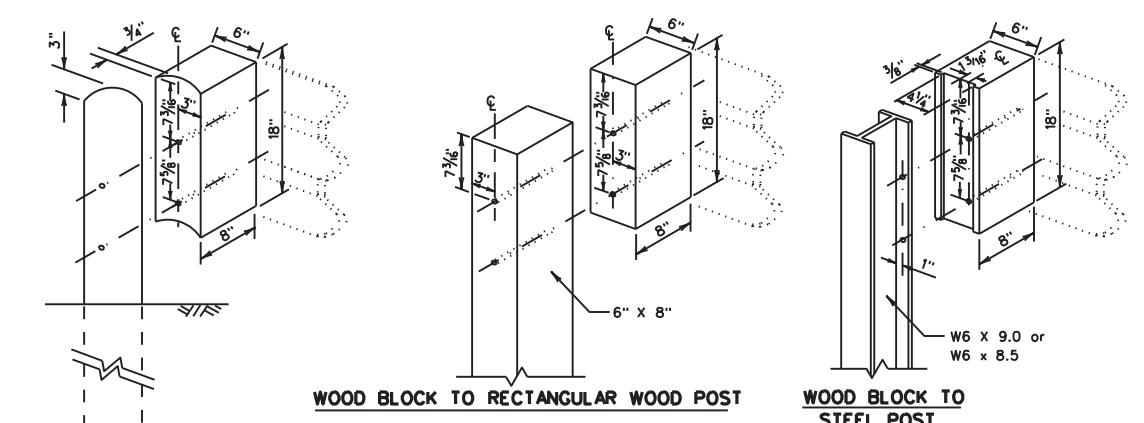
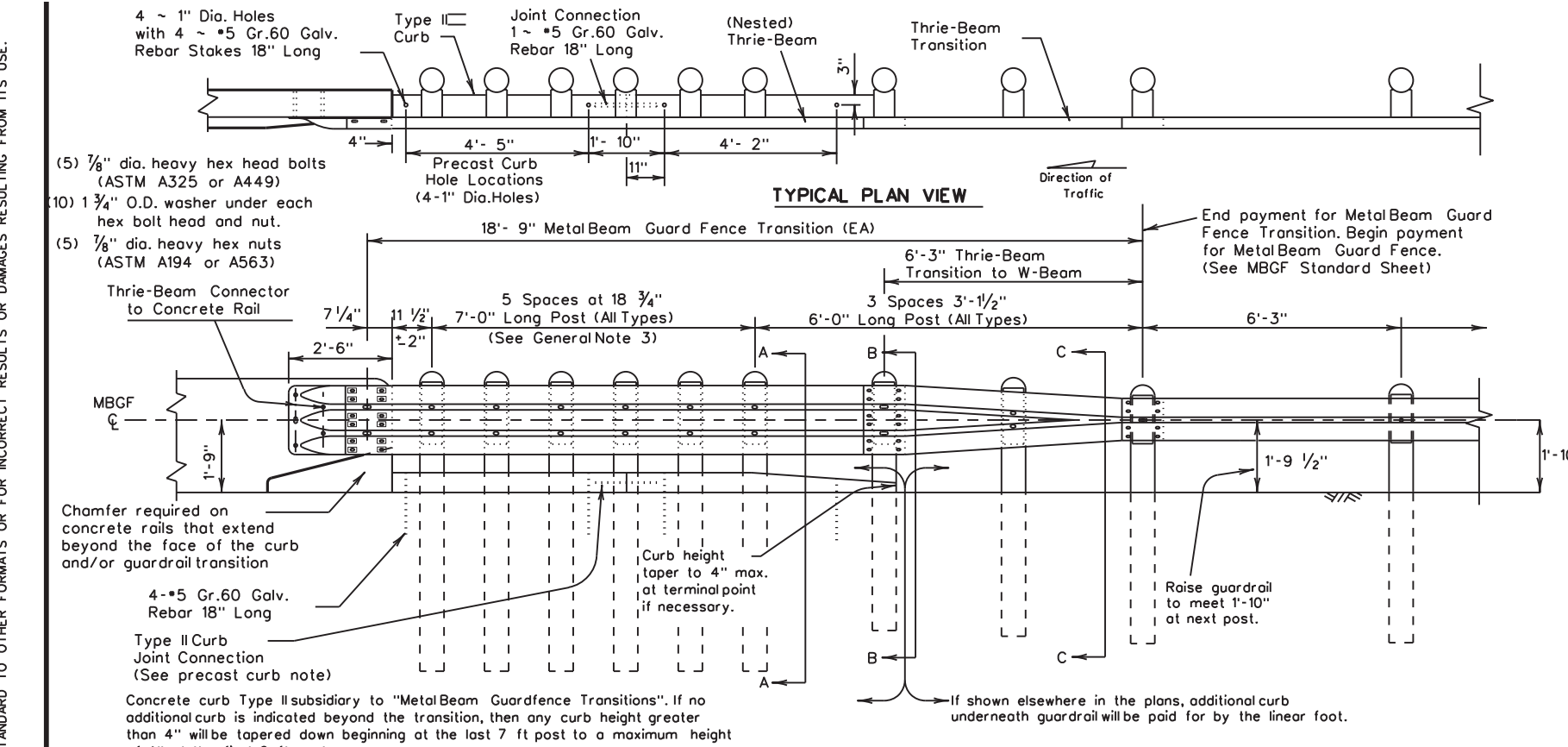
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METAL BEAM GUARD FENCE (SHORT RADIUS) MGBF (SR)-19

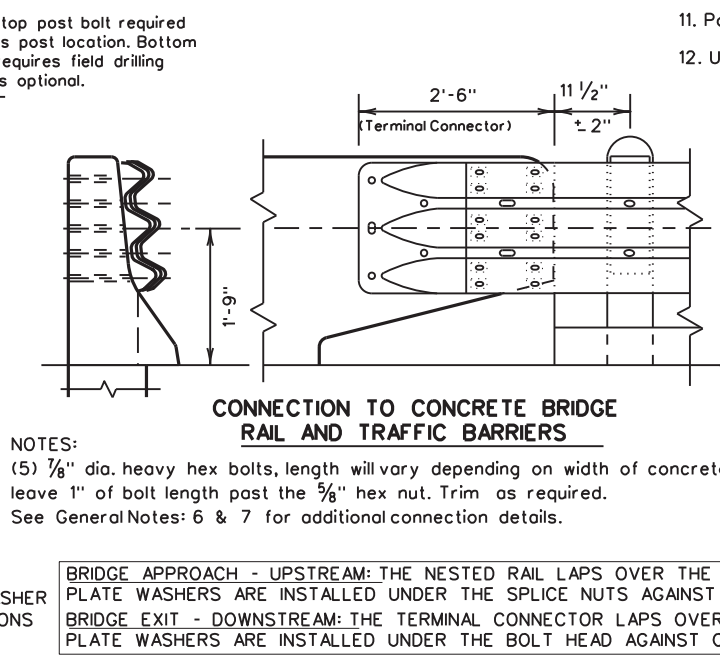
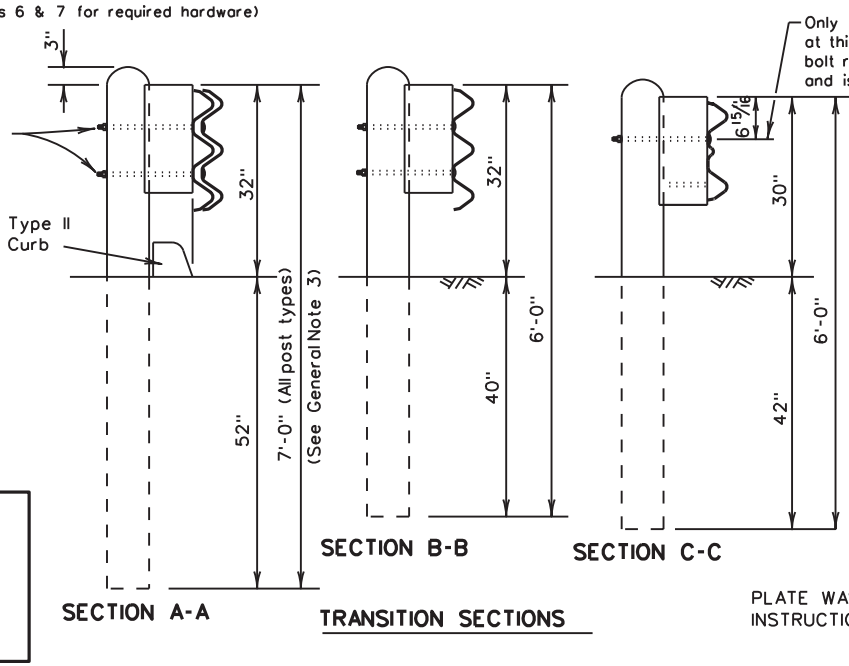
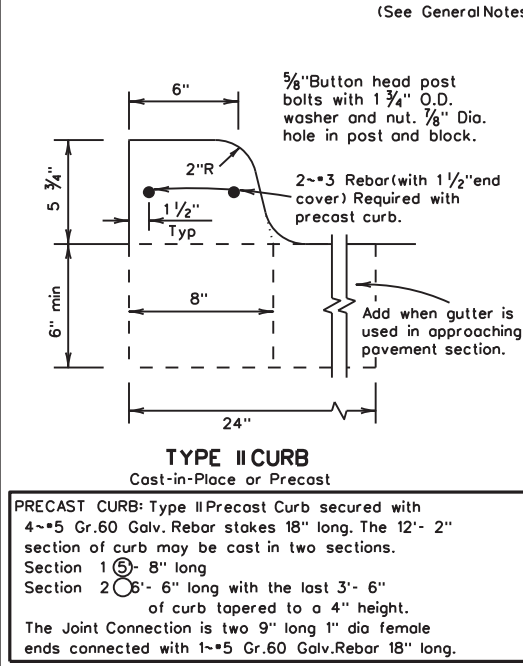
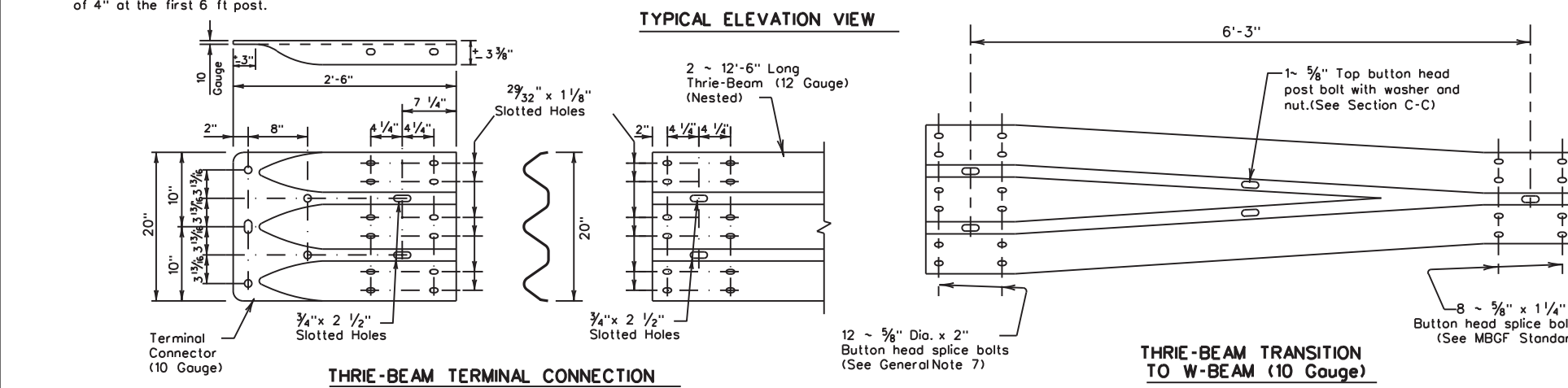
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WACO	BELL, ETC	67		

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GENERAL NOTES

- Concrete curb may be cast-in-place or precast as shown on this sheet. When used in conjunction with thrie-beam guard fence transitions, curb shall be Type II (Typically 5 3/4" height above surface; See CCCG standard sheet) unless otherwise shown in the plans. If other curb heights are shown in the plans in conjunction with the transition, the curb height may be from 4" to 8" with a relatively vertical face. Concrete curb shall be continuous to the seventh post.
- Contact the Design Division for drainage cut options needed within the curb section of the transition.
- The type of post (round wood, rectangular wood or steel) will be shown elsewhere in the plans.
- The post length shall be marked on all 7'-0" long posts by the Manufacturer. The mark shall be located within the top 1 ft. region of the post, at least 5/8" in height, and visible after installation. Wooden posts shall be marked with a brand, and steel posts with a stencil before galvanizing.
- Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans. The thrie-beam terminal connector and the thrie-beam transition to w-beam shall be of the same material, but shall not be less than 10 gauge.
- Contractor shall verify that the locations of bolt holes match those in the thrie-beam terminal connector prior to ordering materials.
- Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.
- Install terminal connector with (12) rectangular guardrail plate washers: (FWR03) and (12) 5/8" x 2" button head splice bolts with recessed nuts.
- Button head "post bolts & nuts" shall meet the requirements of (ASTM A307), and shall be of sufficient length to extend through the full thickness of the nut and 5/8" washer (FWC16a) and not more than 1" beyond it. Trim remaining bolt length to meet required length.
- Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.
- Crown shall be widened to accommodate transitions.
- If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.
- Posts shall not be set in concrete.
- Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.



NOTES:
 (5) 7/8" dia. heavy hex bolts, length will vary depending on width of concrete rail, leave 1" of bolt length past the 5/8" hex nut. Trim as required.
 See General Notes: 6 & 7 for additional connection details.

BRIDGE APPROACH - UPSTREAM: THE NESTED RAIL LAPS OVER THE TERMINAL CONNECTOR. PLATE WASHERS ARE INSTALLED UNDER THE SPLICE NUTS AGAINST INSIDE OF CONNECTOR.
BRIDGE EXIT - DOWNSTREAM: THE TERMINAL CONNECTOR LAPS OVER THE NESTED RAIL. PLATE WASHERS ARE INSTALLED UNDER THE BOLT HEAD AGAINST OUTSIDE OF CONNECTOR.

ONLY FOR USE IN MAINTENANCE REPAIRS.

METAL BEAM GUARD FENCE TRANSITION (THRIE-BEAM TRANSITION) MBGF (TR)-19

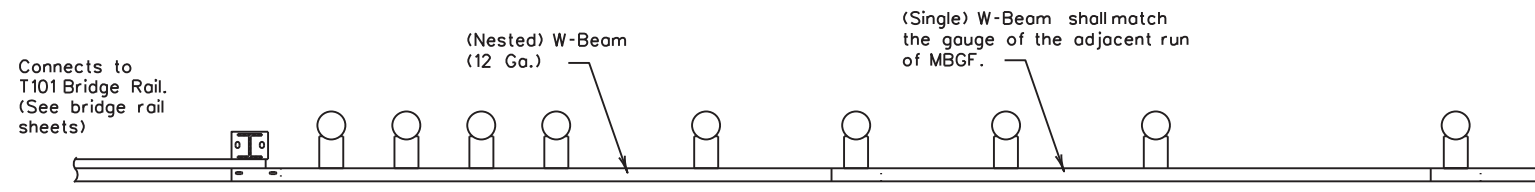
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Texas Department of Transportation Design Division Standard

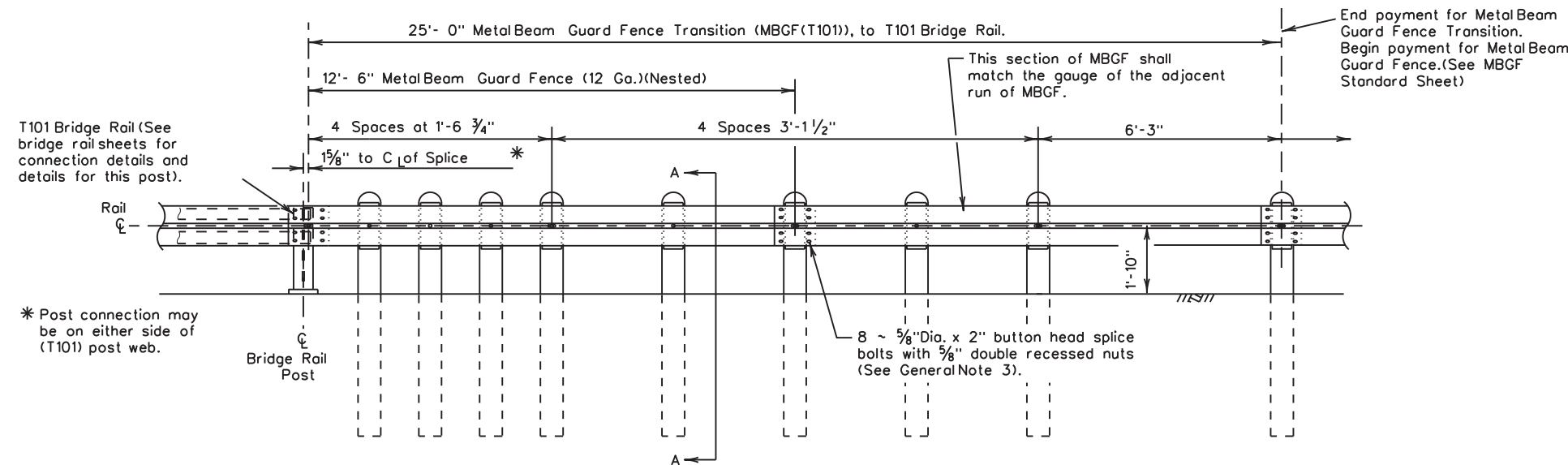
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TYPICAL PLAN VIEW

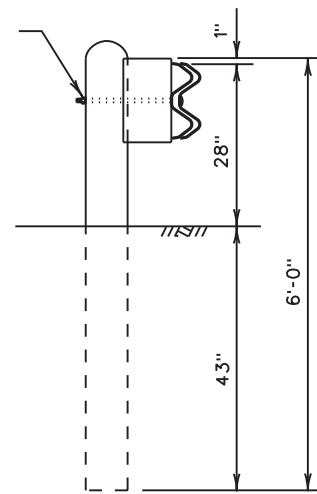


TYPICAL ELEVATION VIEW

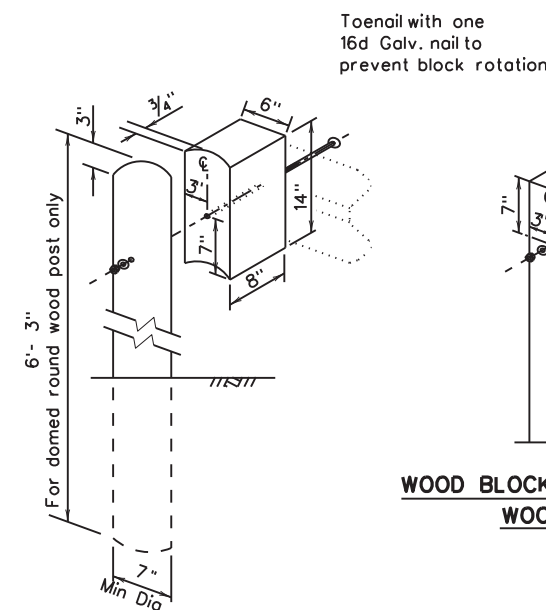
GENERAL NOTES

1. The type of post (round wood post, rectangular wood post, or steel post) will be shown elsewhere in the plans. The exact position of transitions shall be shown elsewhere in the plans or as directed by the Engineer.
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and the Type A 1 3/4" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 5/8" x 2" (at triple rail splices) with a 5/8" double recessed nuts (ASTM A563).
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item requiring construction of the transition.
5. Crown will be widened to accommodate transitions.
6. If solid rock is encountered. See the MBGF standard sheet for proper installation guidance.
7. Posts shall not be set in concrete.
8. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.
8. Refer to MBGF Standard Sheet for additional details.

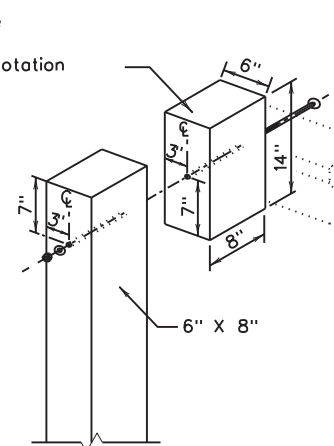
5/8" Button head post bolt with nut & washer (See General Note 3)



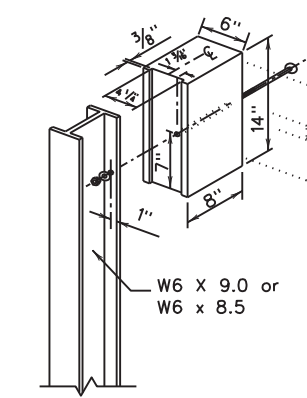
SECTION A-A



WOOD BLOCK TO ROUND WOOD POST



WOOD BLOCK TO RECTANGULAR WOOD POST

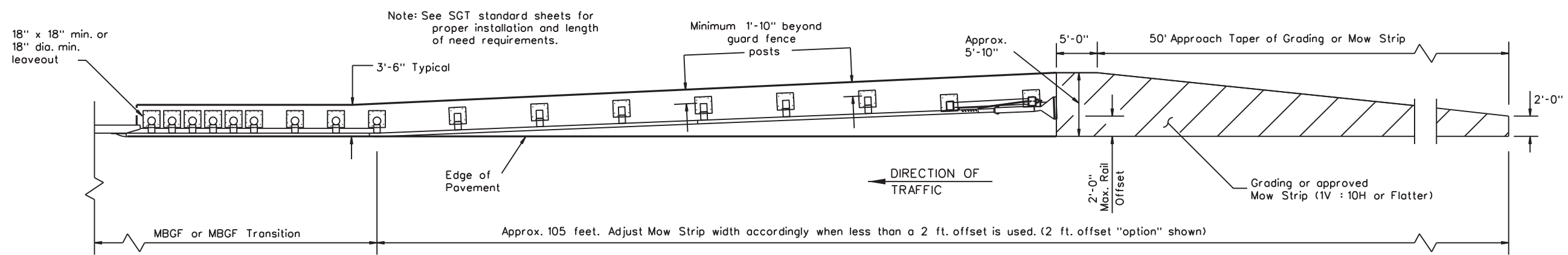


WOOD BLOCK TO STEEL POST

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		Design Division Standard	
METAL BEAM GUARD FENCE TRANSITION (T101) (T101 BRIDGE RAIL) MBGF (T101)-19			
FILE: mbgft10119.dgn	DN: TxDOT	CK: KM	DW: BD
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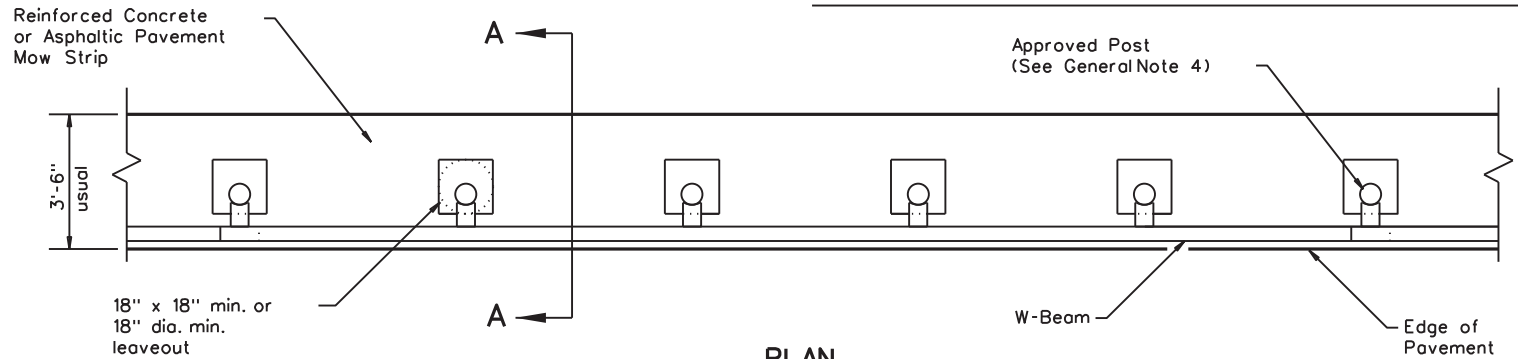


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS

Note: Site Condition(s)
 Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.
 Approach grading or mow strip may be decreased or eliminated. As directed by the Engineer.

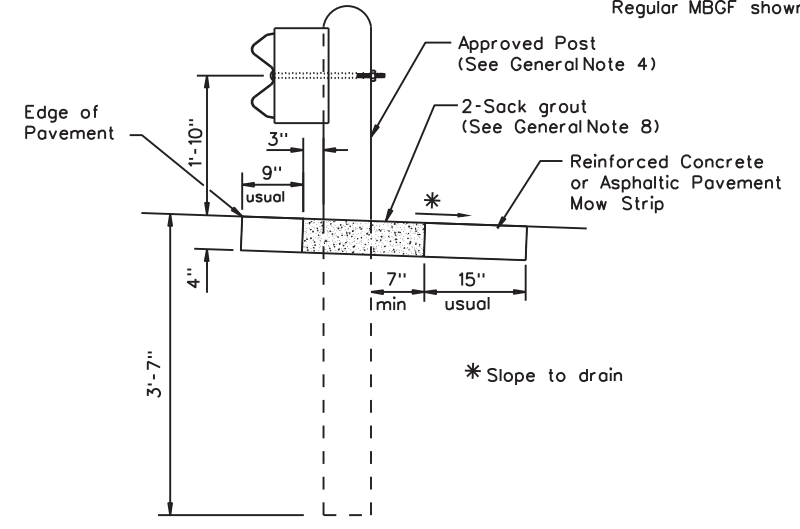
GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments (See SGT standards for proper SGT installation).
2. Mow strips shall be asphaltic pavement or reinforced concrete (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item of work. Asphaltic pavement shall meet the requirements of the item, and be placed in accordance with the pertinent bid item as shown on the plans. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leaveout behind the post shall be a minimum of 7".
4. The type of approved post will be shown elsewhere in the plans. See the applicable standard sheets for additional details and information.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Depth of mow strip will be 4".
7. The limits of payment for asphaltic pavement or reinforced concrete will include leaveouts for posts.
8. The leave-outs shall be filled with no more than a 2-sack grout mixture (1 part cement, 5 parts water, and 14 parts sand by volume) with a 28-day compressive strength of approximately 120 psi or less. Provide grout of a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of rip rap mow strip.



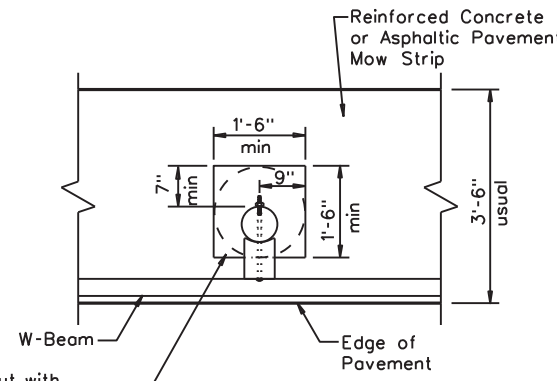
PLAN

Regular MGBF shown with Mow Strip



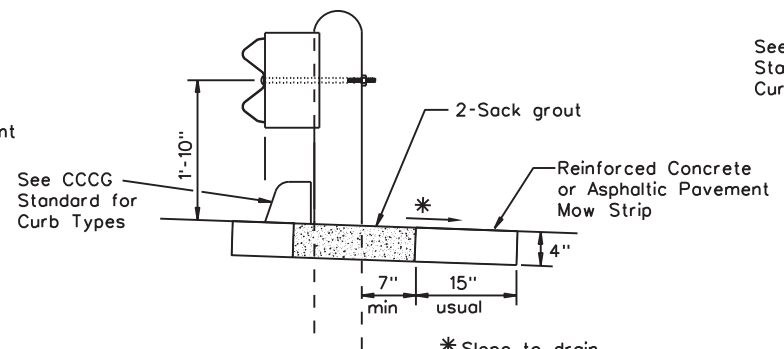
SECTION A-A

Typical



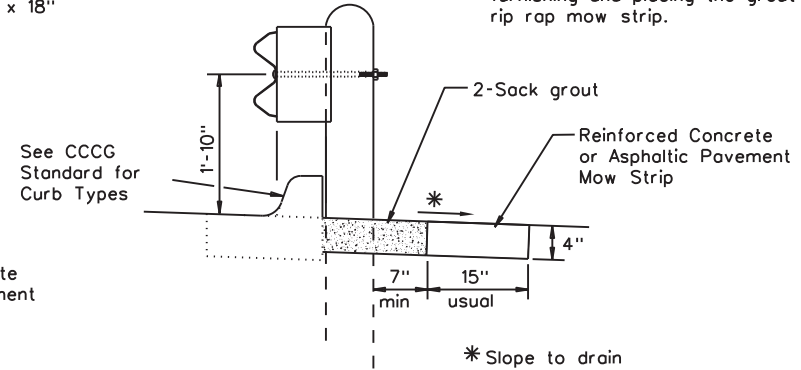
MOW STRIP DETAIL

Reinforced Concrete or Asphaltic Pavement Mow Strip with 18" x 18" or 18" dia. minimum leaveout.

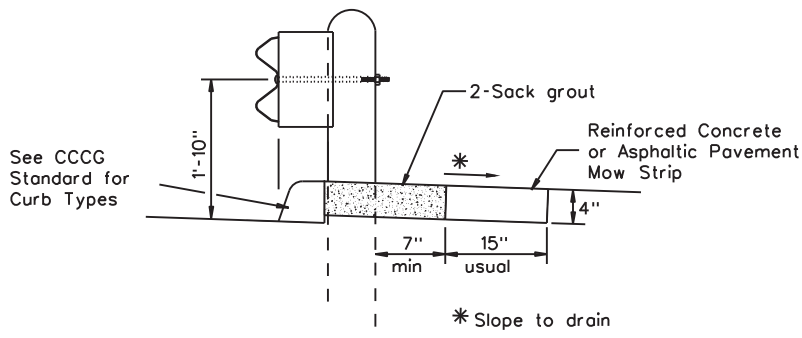


CURB OPTION (2)

Curb shown on top of mow strip



CURB OPTION (3)



CURB OPTION (1)

This option will increase the post embedment through out the system.

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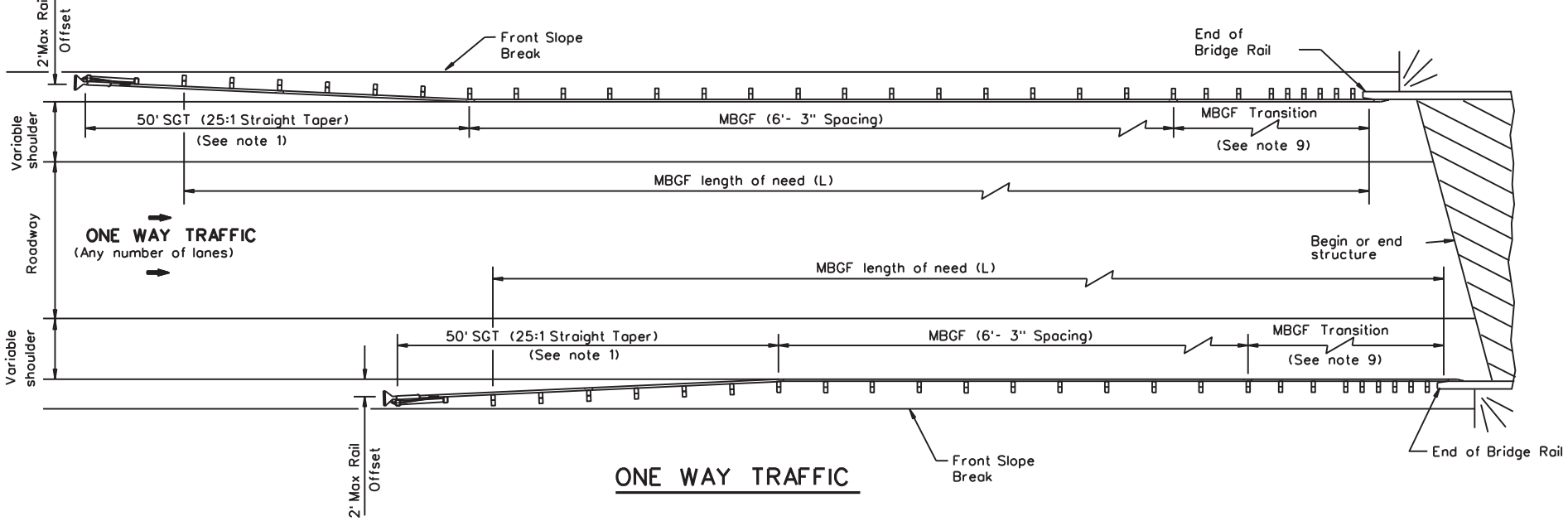
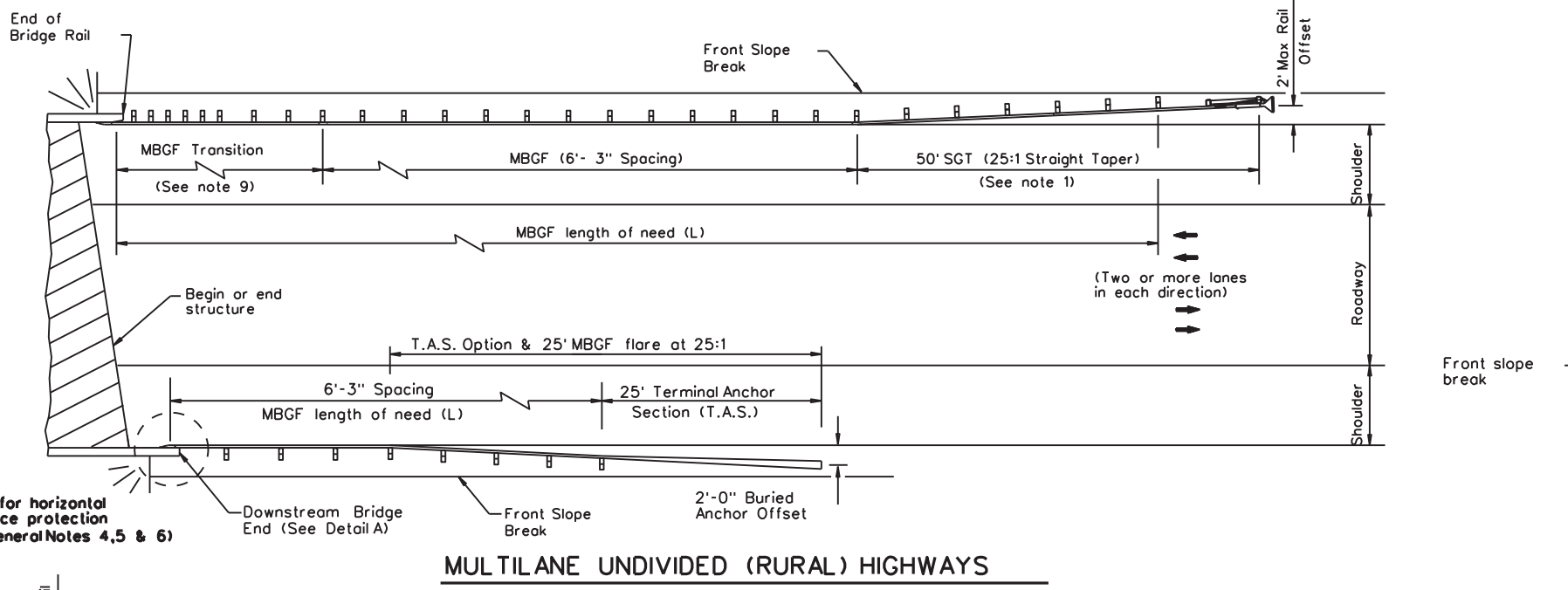
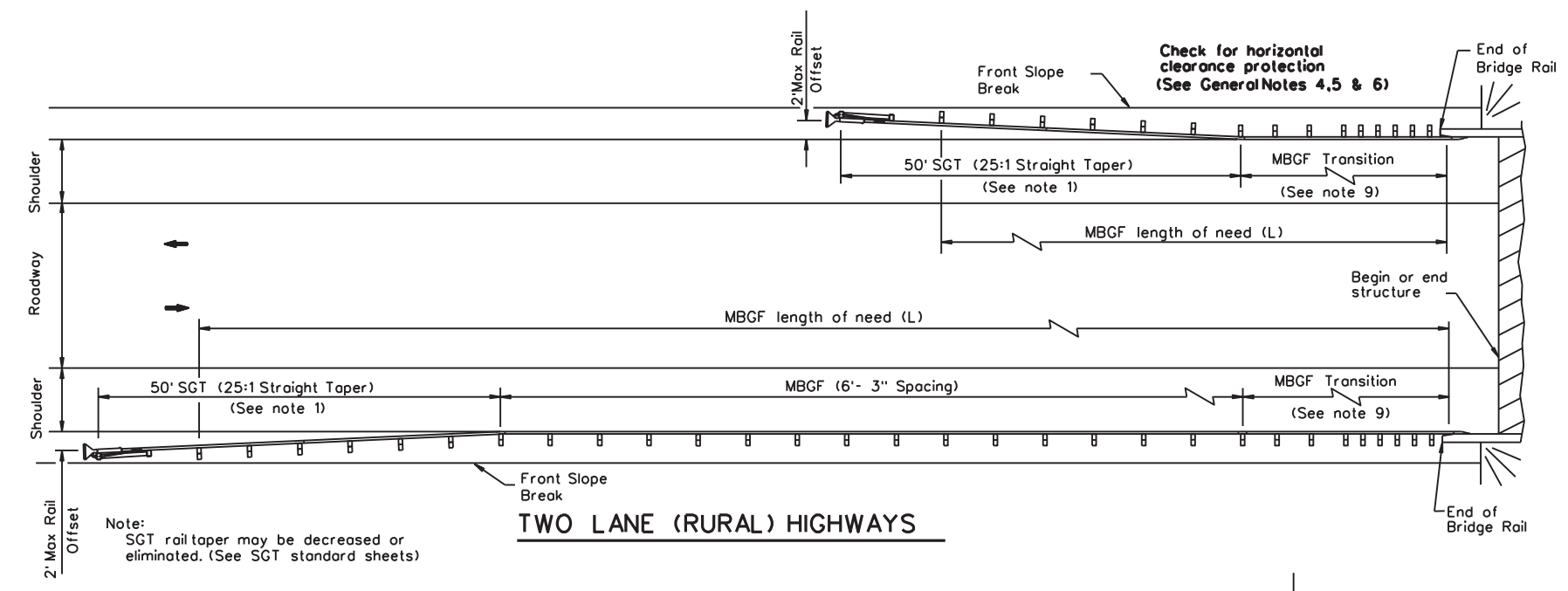


METAL BEAM GUARD FENCE (MOW STRIP) MGBF (MS) - 19

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WACO	BELL, ETC		71	

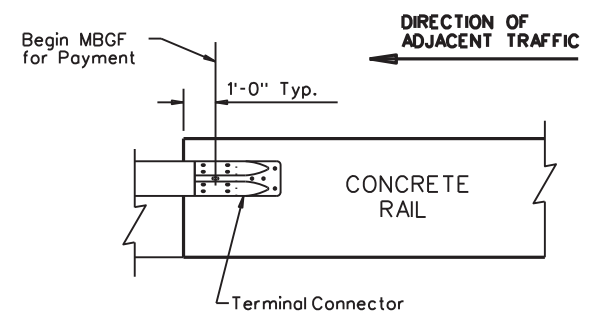
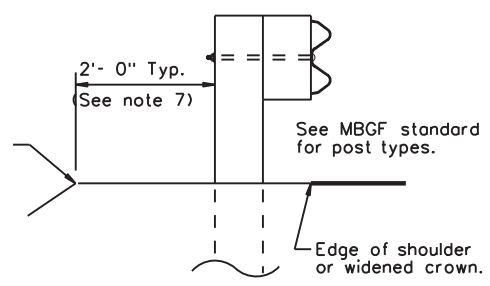
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GENERAL NOTES

1. For more detail: See MBGF, SGT, and MBGF Transition standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are shown elsewhere in plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Terminal anchor sections (TAS) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF (at 6'-3" post spacing without transition) to concrete rail are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge. (See Typical Cross Section at MBGF).
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.



TYPICAL CROSS SECTION AT MBGF

DETAIL A

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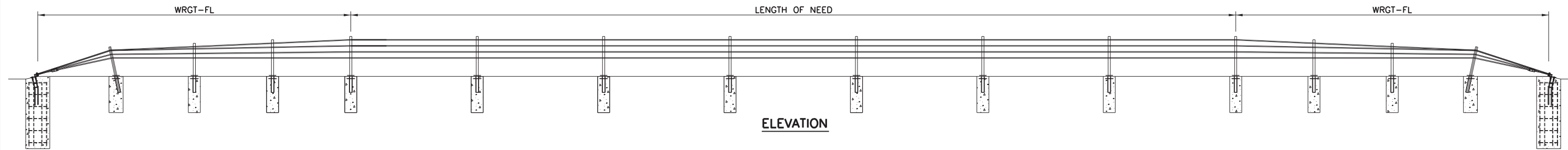


**BRIDGE END DETAILS
 (28" METAL BEAM GUARD FENCE
 APPLICATIONS TO RIGID RAILS)
 BED(28)-19**

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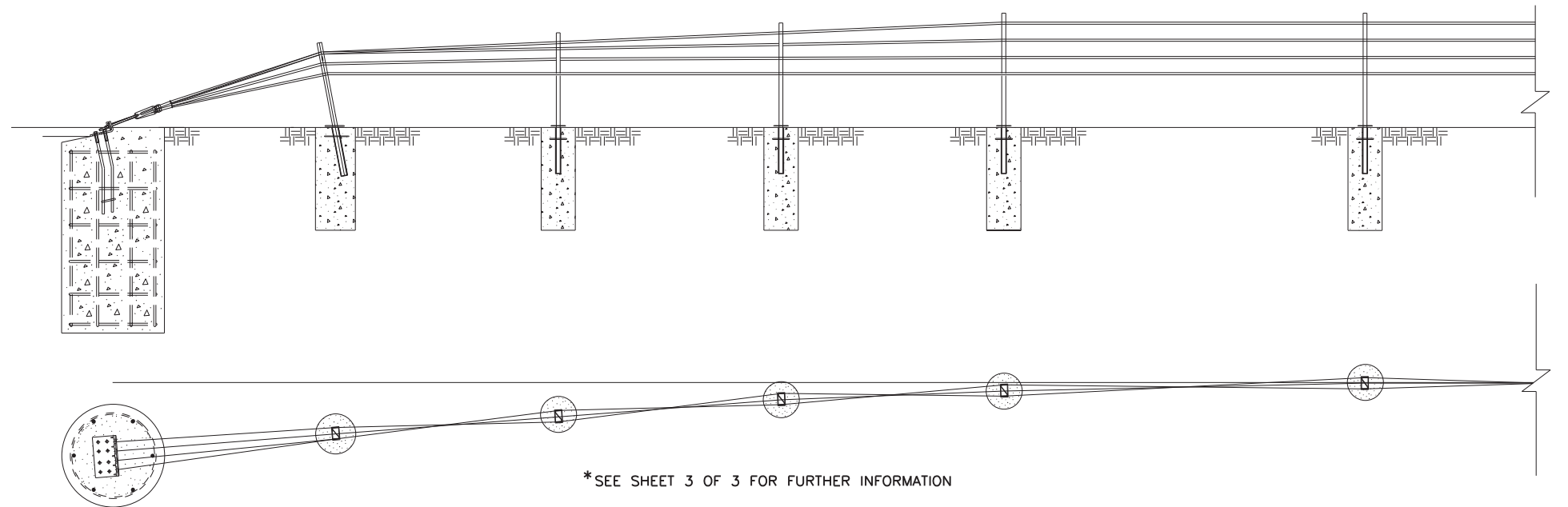


ELEVATION



PLAN

WRGT-FL END ANCHOR



ROPE TENSION TABLE		
ROPE TEMP (°F)	TENSION (LBS)	TENSION (kN)
0	5700	25.4
5	5550	24.7
10	5400	24.0
15	5250	23.4
20	5100	22.7
25	4950	22.0
30	4800	21.4
35	4650	20.74
40	4500	20.0
45	4350	19.3
50	4200	18.7
55	4050	18.0
60	3900	17.3
65	3750	16.7
70	3600	16.0
75	3450	15.3
80	3300	14.7
85	3150	14.0
90	3000	13.3
95	2850	12.7
100	2700	12.0
105	2550	11.3
110	2400	10.7
115	2250	10.0
120	2100	9.3
125	1950	8.7
130	1800	8.0
135	1650	7.3
140	1500	6.7

* ROPE TENSION: ± 20% AFTER 2-WEEK INTERVAL

GENERAL NOTES:

- BRIFEN DRAWINGS, SPECIFICATIONS, AND PRODUCT MANUAL SHOULD BE REVIEWED PRIOR TO STARTING AN INSTALLATION. FOR ADDITIONAL INFORMATION OR QUESTIONS, CONTACT BRIFEN USA, INC. AT 1-866-427-4336.
- THE BRIFEN WRSF HAS BEEN SUCCESSFULLY TESTED TO NCHRP 350 TL-4 CONDITIONS ON SLOPES 6:1 OR FLATTER AND NCHRP 350 TL-3 CONDITIONS ON SLOPES 4:1 TO 6:1.
- THE POST SPACING SHALL BE DETERMINED BY THE SPECIFYING AGENCY. POST SPACING MAY BE DECREASED TO AVOID OBSTRUCTIONS OR UTILITIES. IN NO EVENT SHALL THE POST SPACING EXCEED 21'-0".
- BRIFEN WRSF SHALL BE PLACED ON A SMOOTH SURFACE, WITHOUT HUMPS, DROP-OFFS, HOLES, ETC THAT WOULD INTERFERE WITH THE STABILITY OF THE ERRANT VEHICLE. GRADING, FILL AND COMPACT MAY BE REQUIRED TO ASSURE THAT ROPES ARE INSTALLED AT THE DESIGN HEIGHT.
- THE WRGT-FL END ANCHOR HAS BEEN SUCCESSFULLY TESTED TO NCHRP 350 TL-3 CONDITIONS. THE LENGTH OF NEED BEGINS 31'-0" FROM THE END ANCHOR. POSTS A THROUGH POST B3, SPACED 6'-6" APART, HAVE WEAKENED CUTS AT THE GROUND THAT SHALL FACE THE ANCHOR.
- ANCHOR AND LINE POST DIMENSIONS AND STEEL REINFORCEMENT WILL BE DETERMINED ON PROJECT SPECIFIC SOIL CLASSIFICATION, PROPERTIES AND TEMPERATURE EXTREMES. CONTACT BRIFEN USA, INC. FOR ADDITIONAL INFORMATION.
- ALL REINFORCEMENT AND CONCRETE FOR THE ANCHORS AND LINE POSTS PROVIDED BY OTHERS.
- REINFORCEMENT AND CONCRETE PROPERTIES SHALL MEET AGENCY SPECIFICATIONS.
- FOR PLACEMENT NEAR GUARDRAIL OR OTHER OBSTACLES CONTACT BRIFEN USA, INC. FOR ADDITIONAL DRAWINGS AND SUPPORT.
- TAPER RATES FOR THE BRIFEN WRSF ARE AS FOLLOWS:
 HORIZONTAL: 25:1 MAXIMUM, 50:1 PREFERABLE
 VERTICAL: 25:1 MAXIMUM, 50:1 PREFERABLE

*SEE SHEET 3 OF 3 FOR FURTHER INFORMATION



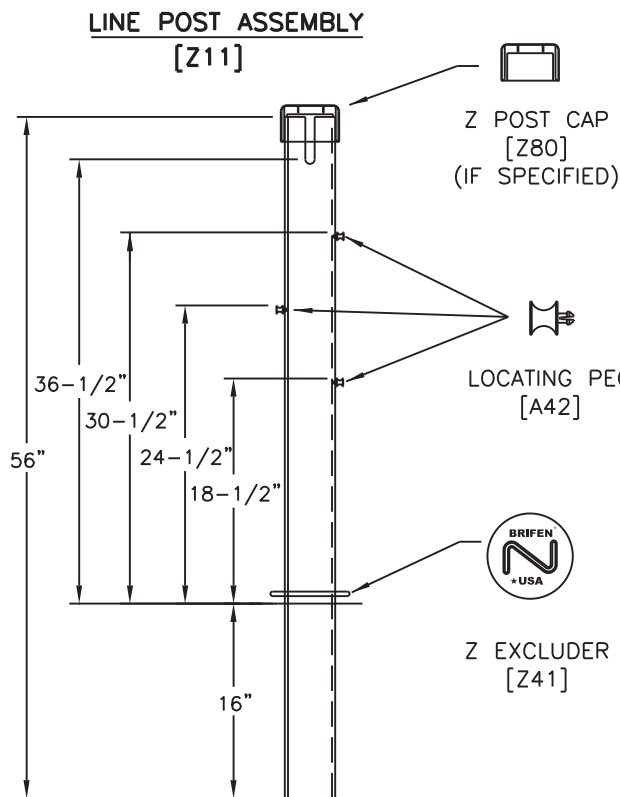
**BRIFEN
 WIRE ROPE SAFETY FENCE
 (TL-4)**

BRIFEN(TL4)-14

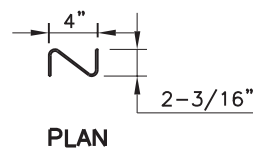
FILE: brifent1414.dgn	DN: TxDOT	CK: RM	DW: VP	CK:
© TxDOT: MARCH 2014	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190,ETC
REVISIONS	DIST: WACO	COUNTY: BELL,ETC	SHEET NO. 73	

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ELEVATION

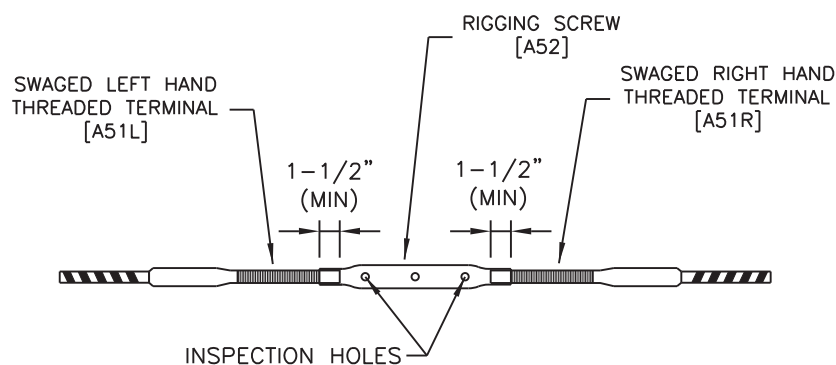


PLAN

NOTES SPECIFIC TO LINE POST ASSEMBLY

1. ROPE HEIGHTS SHALL BE $\pm 1"$ TO GROUND LINE.
2. POST SHALL BE $\pm 4"$ FROM VERTICAL PLUMB.
3. POST CAPS SHALL BE USED IF SPECIFIED.
4. REFLECTORS SHALL BE SPACED ACCORDING TO AGENCY SPECIFICATIONS.
5. REFLECTORS CAN BE PLACED ON THE POST CAP OR POST.

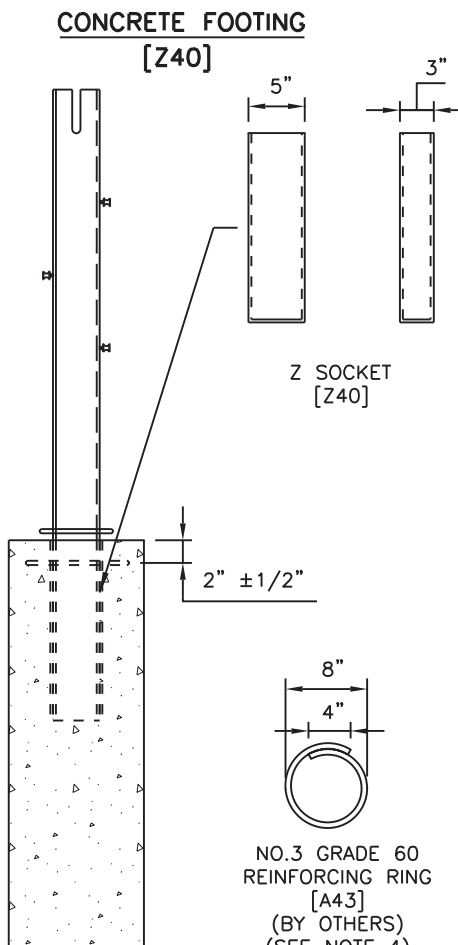
ROPE CONNECTION DETAIL



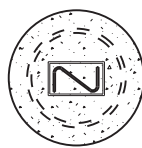
NOTES SPECIFIC TO ROPE CONNECTION DETAIL

1. THE WIRE ROPE TERMINALS SHALL BE THREADED A MINIMUM OF 1-1/2" INTO RIGGING SCREW.
2. AFTER FINAL TENSIONING, THE TERMINALS SHALL BE VISIBLE IN THE INSPECTION HOLES.

SOCKET ASSEMBLY



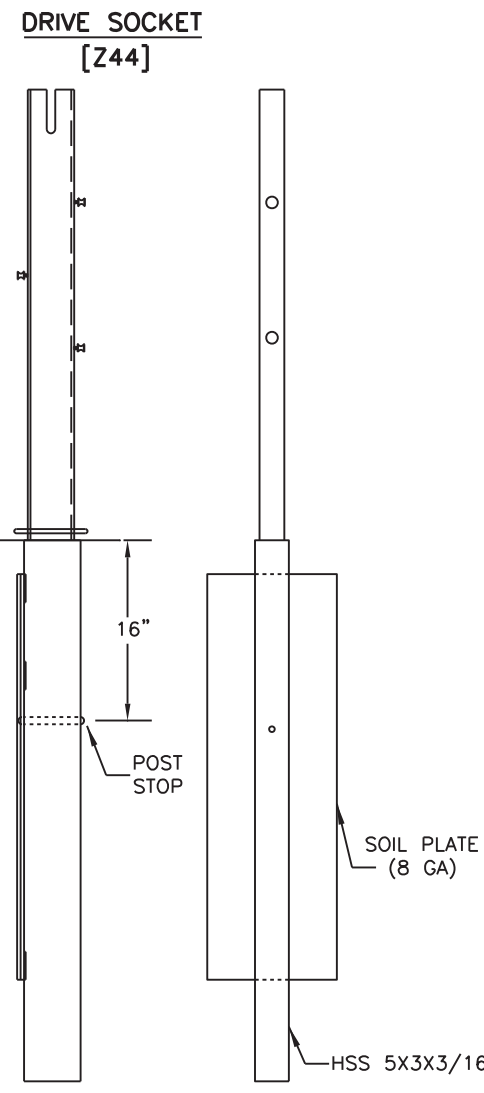
ELEVATION



PLAN

NOTES SPECIFIC TO CONCRETE FOOTING

1. SIZE OF FOOTING WILL BE DETERMINED BY SOIL CONDITIONS, FOUNDATION TYPE AND PROJECT CONDITIONS.
2. CONCRETE BASED ON AGENCY SPECIFICATIONS.
3. CONCRETE BY OTHERS.
4. REINFORCING RING (BY OTHERS) WILL BE USED ACCORDING TO FOUNDATION SIZE AND TYPE. THE REINFORCING RING MAY BE OMITTED IF THE FOOTING IS PLACED IN A CONTINUOUS CONCRETE MOW STRIP.
5. FOOTING SHALL BE FLUSH WITH THE GROUND LINE, TO A MAXIMUM OF 1 INCH BELOW OR ABOVE GROUND LINE.
6. SOCKET SHALL BE $\pm 2^\circ$ OF VERTICAL PLUMB.



ELEVATION

SIDE



PLAN

NOTES SPECIFIC TO DRIVE SOCKETS

1. SIZE OF SOIL PLATE WILL BE DETERMINED BY SOIL CONDITIONS AND PROJECT CONDITIONS.
2. THE SOIL PLATE SHALL BE PARALLEL TO ROADWAY AND CAN FACE TOWARD OR AWAY FROM THE TRAVEL LANE.
3. FOOTING SHALL BE FLUSH WITH THE GROUND LINE, TO A MAXIMUM OF 1 INCH BELOW OR ABOVE GROUND LINE.
4. SOCKET SHALL BE $\pm 2^\circ$ OF VERTICAL PLUMB.
5. SOCKETS SHALL BE DRIVEN IN A MANNER TO NOT DISTORT OR DESTROY THE TOP OF SOCKET TO A DEGREE THAT PLACES THE SOCKET OR LINE POST OUT OF CONSTRUCTION TOLERANCES.

GENERAL NOTES:

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2. THE BRIFEN WRSF HAS BEEN SUCCESSFULLY TESTED TO NCHRP 350 TL-4 CONDITIONS ON SLOPES 6:1 OR FLATTER AND NCHRP 350 TL-3 CONDITIONS ON SLOPES 4:1 TO 6:1.
3. THE POST SPACING SHALL BE DETERMINED BY THE SPECIFYING AGENCY. POST SPACING MAY BE DECREASED TO AVOID OBSTRUCTIONS OR UTILITIES. IN NO EVENT SHALL THE POST SPACING EXCEED 21'-0".
4. BRIFEN WRSF SHALL BE PLACED ON A SMOOTH SURFACE, WITHOUT HUMPS, DROP-OFFS, HOLES, ETC THAT WOULD INTERFERE WITH THE STABILITY OF THE ERRANT VEHICLE. GRADING, FILL AND COMPACTION MAY BE REQUIRED TO ASSURE THAT ROPES ARE INSTALLED AT THE DESIGN HEIGHT.

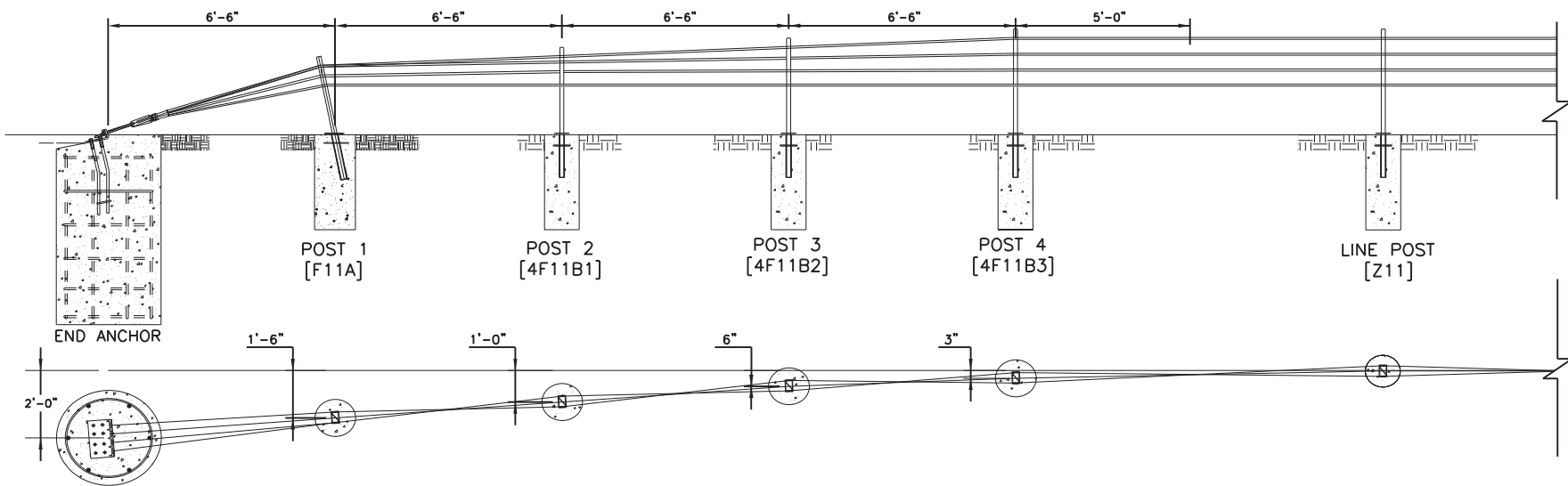
SHEET 2 OF 3

		Design Division Standard	
BRIFEN WIRE ROPE SAFETY FENCE (TL-4)			
BRIFEN(TL4)-14			
FILE: brifentl414.dgn	DN: TxDOT	CK: RM	DW: VP
© TxDOT: MARCH 2014	CONT: 6467	SECT: 89	JOB: US 190, ETC
REVISIONS	DIST: WACO	COUNTY: BELL, ETC	SHEET NO.: 74

WRGT-FL END ANCHOR LAYOUT

GENERAL NOTES:

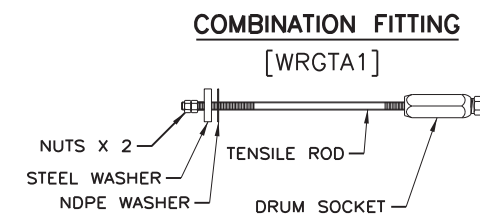
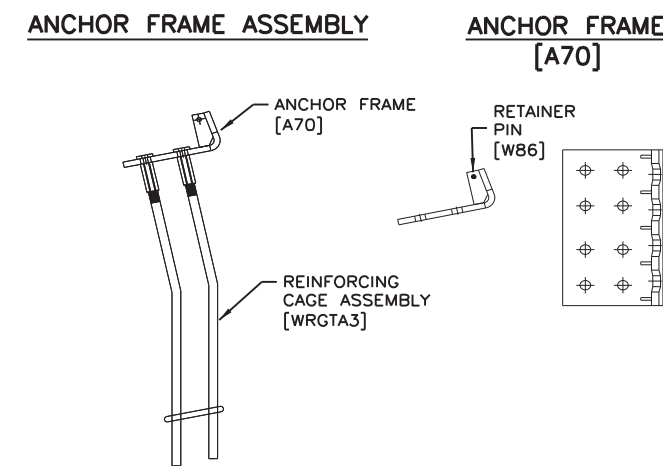
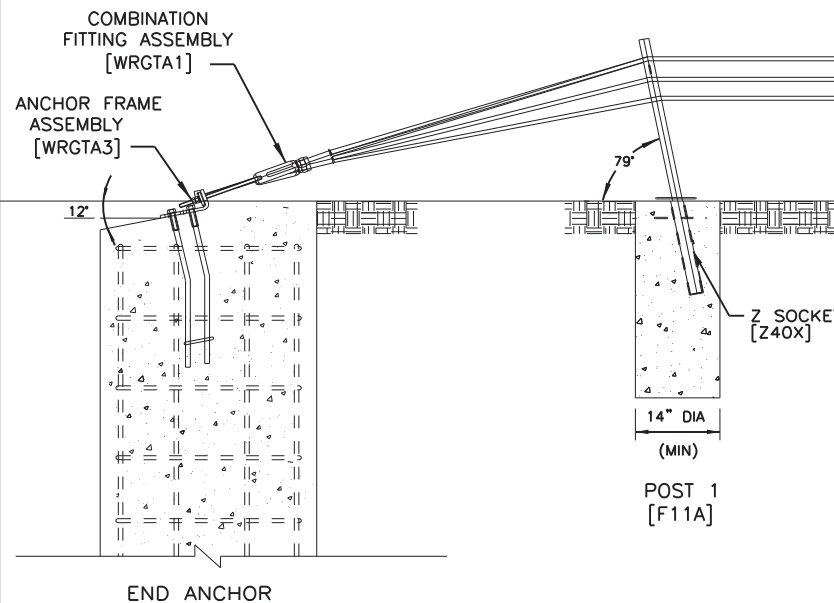
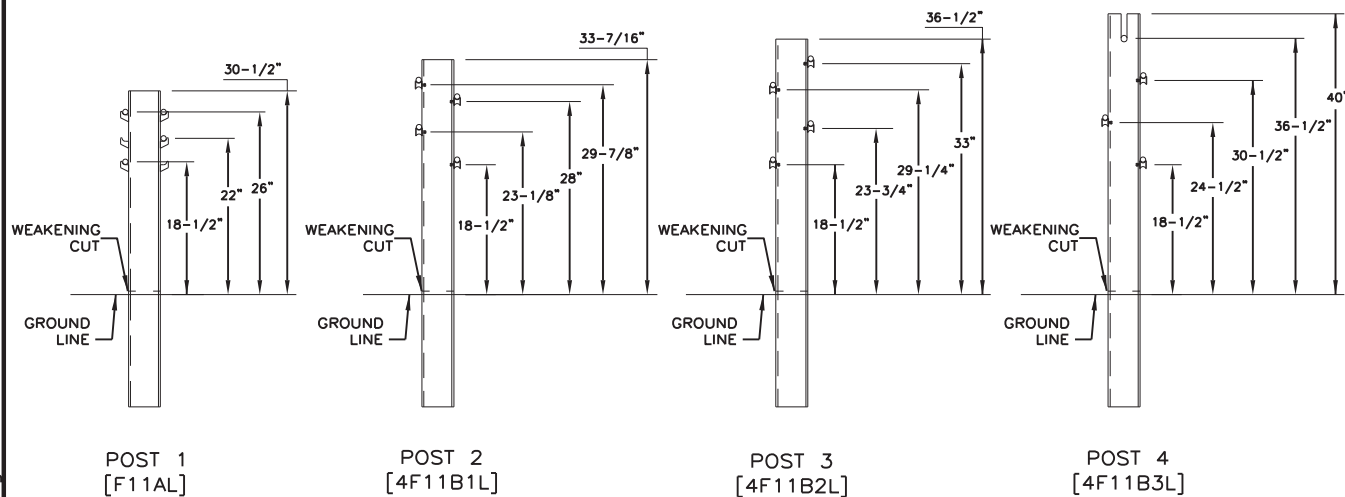
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- THE WRGT-FL END ANCHOR HAS BEEN SUCCESSFULLY TESTED TO NCHRP 350 TL-3 CONDITIONS. THE LENGTH OF NEED BEGINS 31'-0" FROM THE END ANCHOR. POSTS A THROUGH POST B3, SPACED 6'-6" APART, HAVE WEAKENED CUTS AT THE GROUND THAT SHALL FACE THE ANCHOR.
- ANCHOR AND LINE POST DIMENSIONS AND STEEL REINFORCEMENT WILL BE DETERMINED ON PROJECT SPECIFIC SOIL CLASSIFICATION, PROPERTIES AND TEMPERATURE EXTREMES. CONTACT BRIFEN USA, INC. FOR ADDITIONAL INFORMATION.
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- REINFORCEMENT AND CONCRETE PROPERTIES SHALL MEET AGENCY SPECIFICATIONS.
- FOR PLACEMENT NEAR GUARDRAIL OR OTHER OBSTACLES CONTACT BRIFEN USA, INC. FOR ADDITIONAL DRAWINGS AND SUPPORT.



WRGT-FL POST DETAILS

END ANCHOR DETAILS

END ANCHOR COMPONENTS



NOTES SPECIFIC TO WRGT-FL POST DETAIL

NOTES SPECIFIC TO END ANCHOR DETAIL

- ROPE HEIGHTS SHALL BE $\pm 1"$ TO GROUND LINE.
- POST SHALL BE $\pm 4"$ FROM VERTICAL PLUMB.
- POST CAPS SHALL BE USED IF SPECIFIED.
- REFLECTORS SHALL BE SPACED ACCORDING TO AGENCY SPECIFICATIONS.
- REFLECTORS CAN BE PLACED ON THE POST CAP OR POST.
- Z EXCLUDER (Z41) SHALL BE USED.
- POST A & SOCKET SHALL BE PLACED $79^\circ (\pm 4^\circ)$ TOWARD END ANCHOR FROM THE HORIZONTAL PLANE.
- POST A SOCKET SHALL BE PLACED IN 14" (MIN) CONCRETE FOUNDATION. DEPTH TO BE DETERMINED FROM SOIL CONDITIONS AND PROJECT CONDITIONS.
- FOUNDATIONS FOR POST 2 THRU 4 SHALL BE THE SAME AS THE LINE POST ASSEMBLY'S FOR THE PROJECT.
- WEAKENED CUTS SHALL FACE END ANCHOR.

- THE END ANCHOR ASSEMBLY SHALL BE PLACED 12" (+3", -1") BELOW HORIZONTAL PLANE.
- POST 1 & SOCKET SHALL BE PLACED $79^\circ (\pm 4^\circ)$ TOWARD END ANCHOR FROM THE HORIZONTAL PLANE.
- POST 1 SOCKET SHALL BE PLACED IN 14" (MIN) CONCRETE FOUNDATION. DEPTH TO BE DETERMINED FROM SOIL CONDITIONS AND PROJECT CONDITIONS.

SHEET 3 OF 3



**BRIFEN
WIRE ROPE SAFETY FENCE
(TL-4)**

BRIFEN(TL4)-14

FILE: brifentl4.dgn	DN: TxDOT	CK: RM	DW: VP	CK:
© TxDOT: MARCH 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
DIST	COUNTY		SHEET NO.	
WACO	BELL,ETC		75	

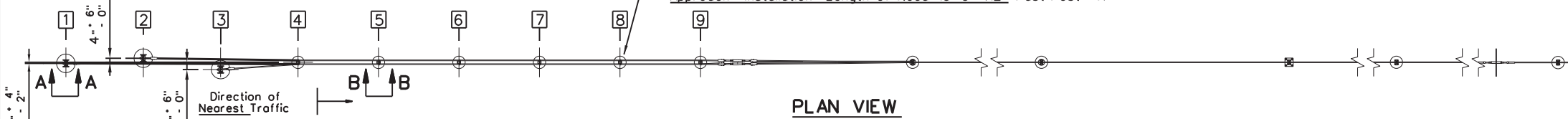
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DATE: 7/29/2024
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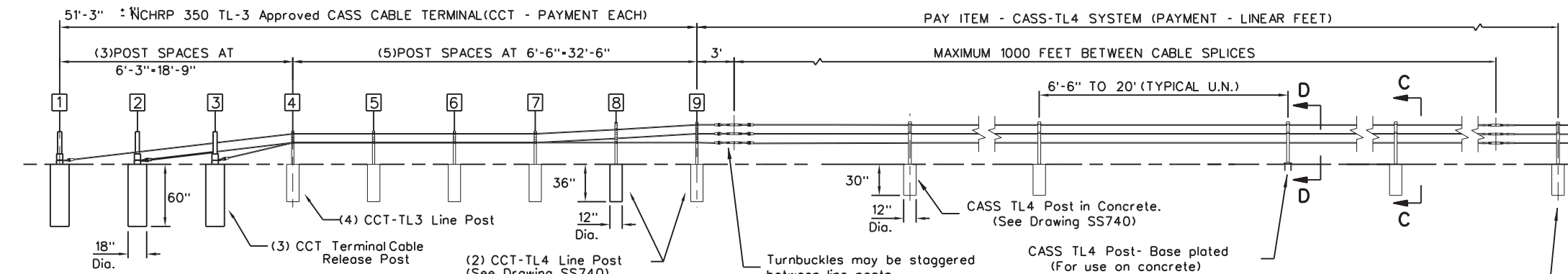
Preferred Installation: Locate post #2 away from nearest traffic.
System has been successfully tested with opposite installation.

Length-of-Need Cass Cable Terminal (CCT):

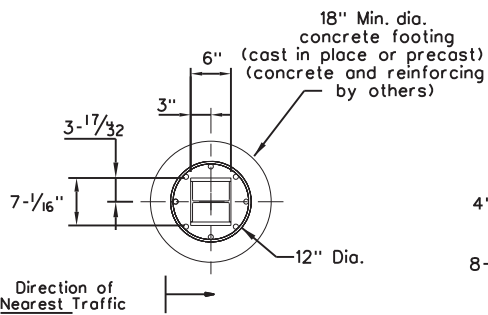
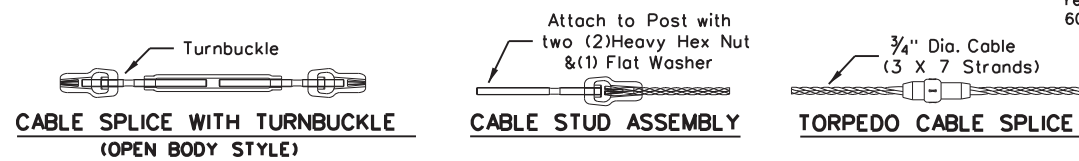
Departure Installation: Length-of-Need: 44'-9" (At Post #8)
Approach Installation: Length-of-Need: 19'-9" (12" Post Post #4)



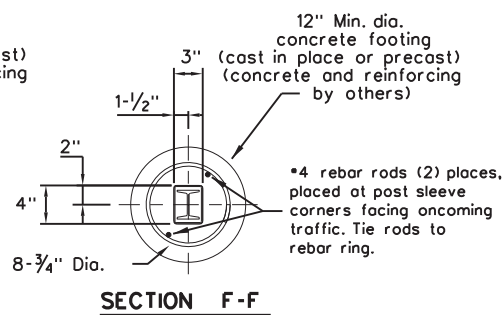
PLAN VIEW



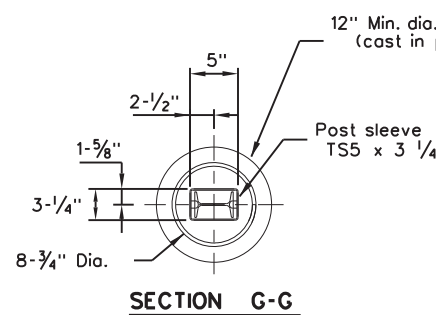
ELEVATION VIEW (TYPICAL LAY-OUT)



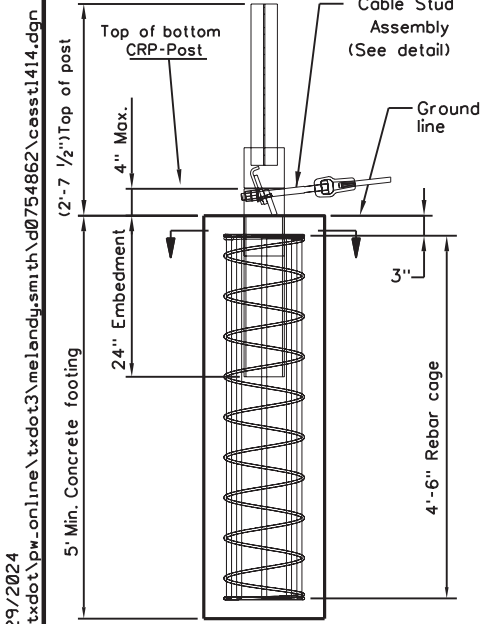
SECTION E-E



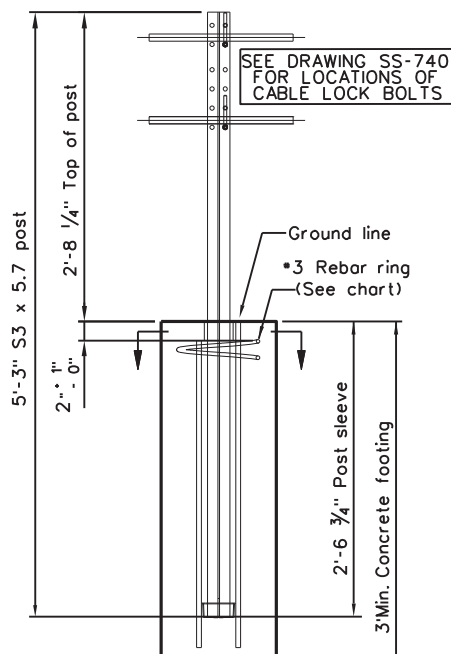
SECTION F-F



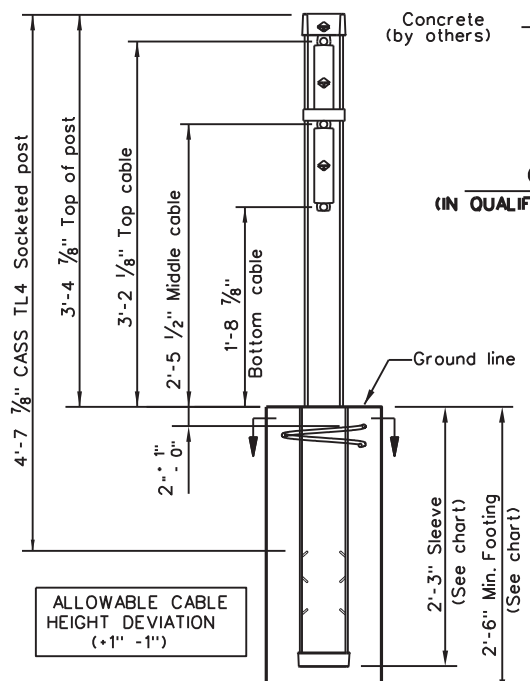
SECTION G-G



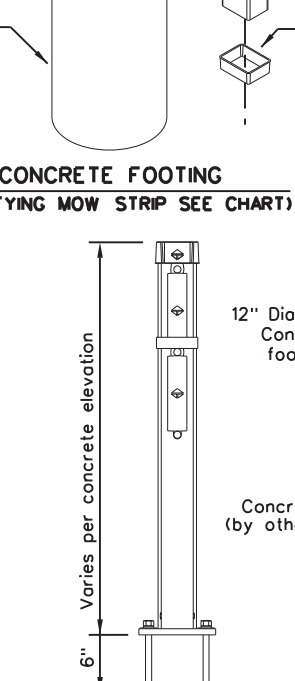
VIEW A-A (CABLE RELEASE POST 1-3)



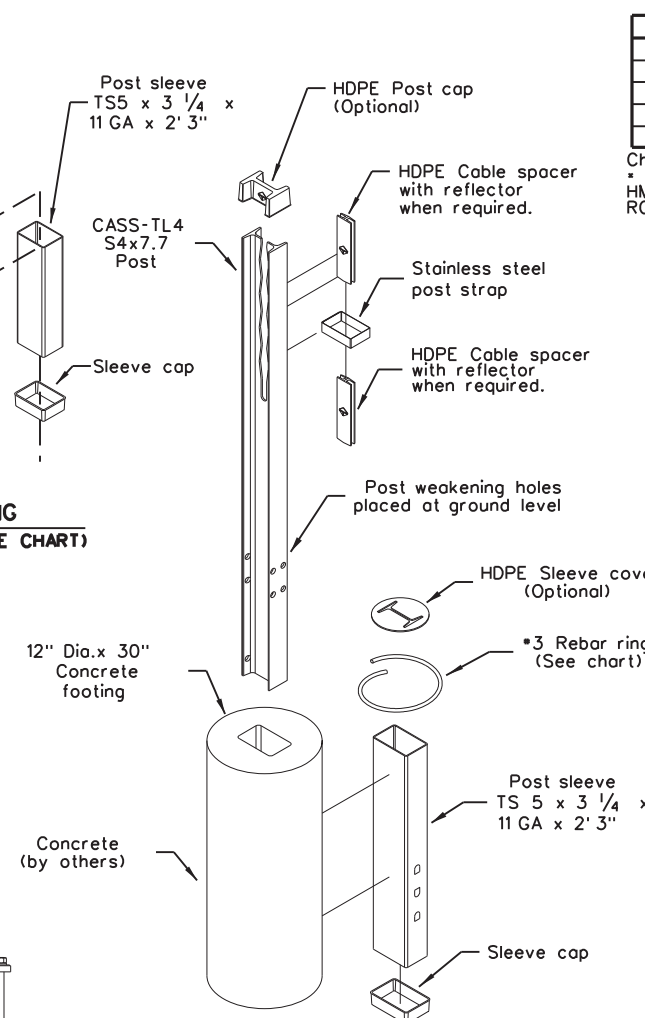
VIEW B-B (TERMINAL LINE POST 4-7)



SECTION C-C (SOCKETED POST)



SECTION D-D (BASE PLATED POST)



STANDARD POST & CONCRETE FOOTING (SOCKETED POST)

GENERAL NOTES

- This drawing is a general overview of CASS TL-4 Barrier System. See SS-740 (latest version) for specific details of CASS cable terminal (CCT) and cable safety system (CASS) requirements, proper installation, options and specification.
- CASS is designed for bi-directional traffic flows and can be installed on either side of the median. Contact Trinity (800-527-6050) or consult the design, installation, or repair manual(s) for additional information.
- All concrete for CASS footings shall be TxDOT class A. If class A or stronger concrete is utilized for the mowstrip, please see chart below for allowable footing depth and sleeve deviations.
- All posts shall be socketed unless otherwise specified. All cables shall be pre-stretched unless otherwise specified.
- For payment see Special Specification "Cable Barrier System".
- CASS-TL4 shall be installed on shoulders or medians with slopes of 6:1 or flatter without obstructions, depressions, etc. That may significantly affect the stability of an errant vehicle. Grading of site and/or appropriate fill materials may be required. The designer/installer shall "Flatten" or "Round" various topographical inconsistencies that could interfere with the ability of the installer to consistently maintain the design height (in relation to the terrain) of the cables. Please consult manual(s) and / or TxDOT Memo(s) for installations in "Ditch Sections".
- CASS TL-4 post spacing may be modified to avoid obstacles that conflict with the installation of cass-tl4 line posts or to reduce deflection on radiuses. No post space can exceed the maximum post TxDOT space limit of 20'. Reducing or increasing post spacing affects deflection. CASS TL-4 may be laterally transferred at a rate not to exceed 30:1.
- Post foundations may be drilled through existing pavement. Please see line post foundation chart for minimum footing requirements in various applications.
- For aesthetic purposes Trinity recommends all sleeves, driven posts, and lower cable release posts to be installed reasonably plumb (approximately 1/8" per foot).
- CASS TL-4 shall be installed in well-drained, compacted, NCHRP Report 350 Standard soil. If soil does not meet this classification, if solid rock/concrete is encountered below grade or if soil is susceptible to severe freeze/thaw cycles, please contact Trinity about alternate footing design(s). Trinity suggests the use of "Mow strips" for erosion prevention and ease of maintenance / installation.
- See the Texas MUTCD for proper "Barrier" Delineation.

MOW STRIP	DEPTH	WIDTH	FOOTING	TUBE SLEEVE	REBAR RING
NONE			30" Min.	27" Min.	YES
HMA	6" Min.	3' Min.	27" Min.	15" Min.	NO
HMA	8" Min.	3' Min.	24" Min.	15" Min.	NO
RC	3" Min.	3' Min.	24" Min.	15" Min.	NO

Chart does not apply to Terminal Posts 1 thru 9.
* Mow strip or pavement.
HMA = Hot Mix Asphalt (Not Recycled Asphalt Pavement).
RC = Reinforced Concrete (TxDOT Class A Minimum).

CABLE TENSION CHART	
FAHRENHEIT DEGREES	PRE-STRETCHED LB / FORCE
-10	7300
0	7000
10	6600
20	6300
30	6000
40	5600
50	5300
60	5000
70	4600
80	4300
90	4000
100	3600
110	3300
120	3000
130	2700
140	2500
150	2300

Trinity Highway Products, LLC.
2525 Stemmons Freeway
Dallas, TX 75207
Phone: (800) 644-7976
Product.INFO@TRIN.NET

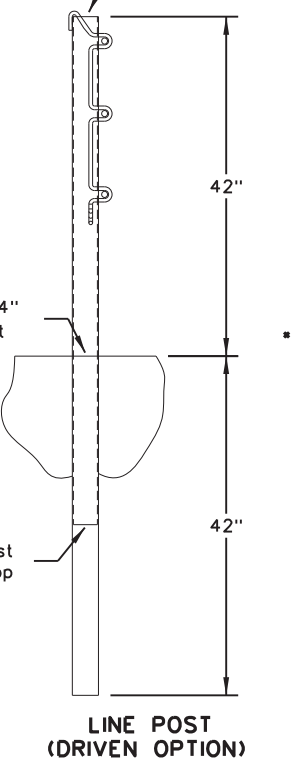
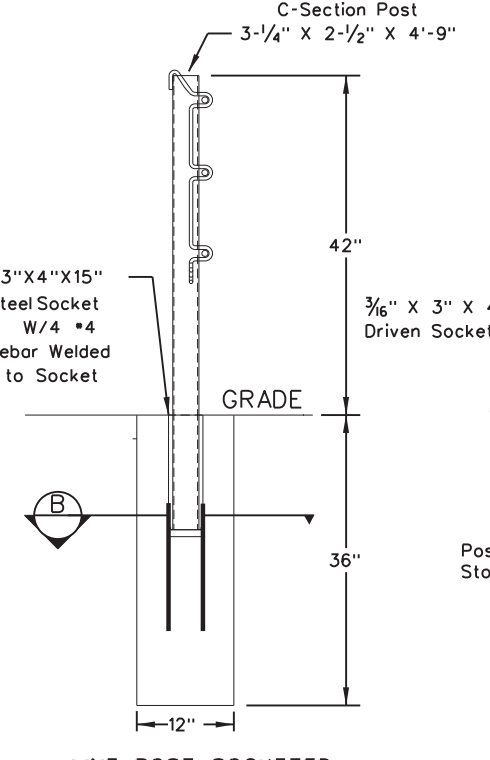
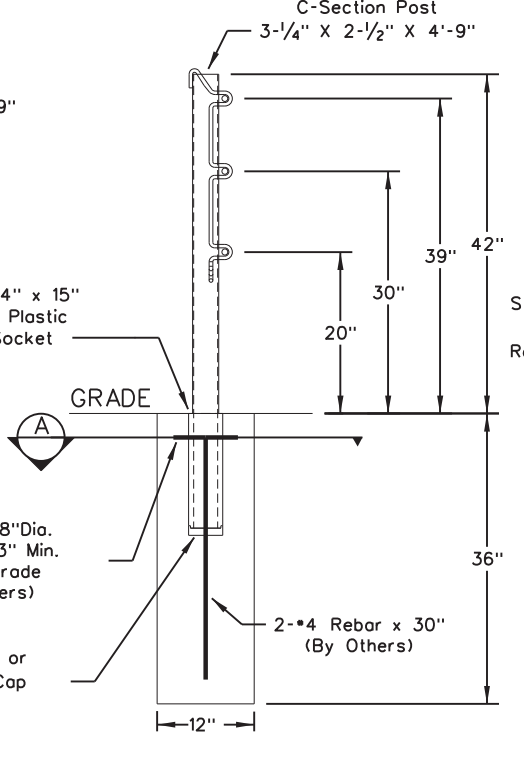
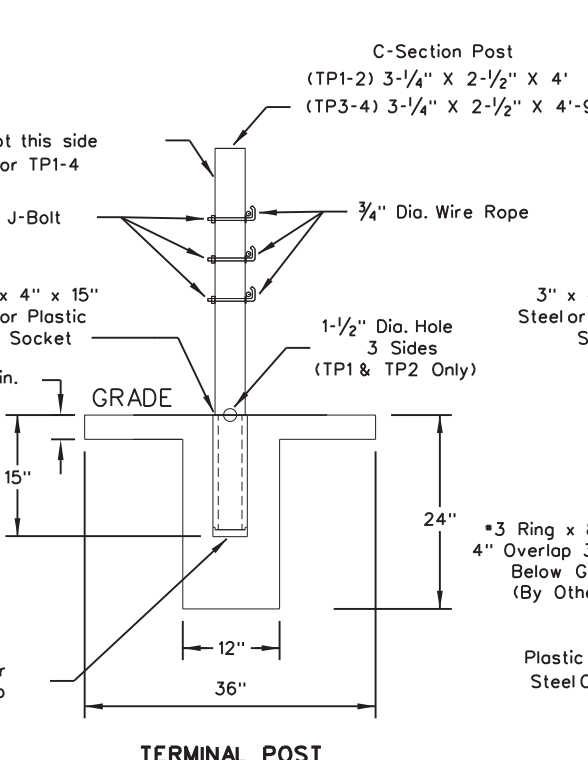
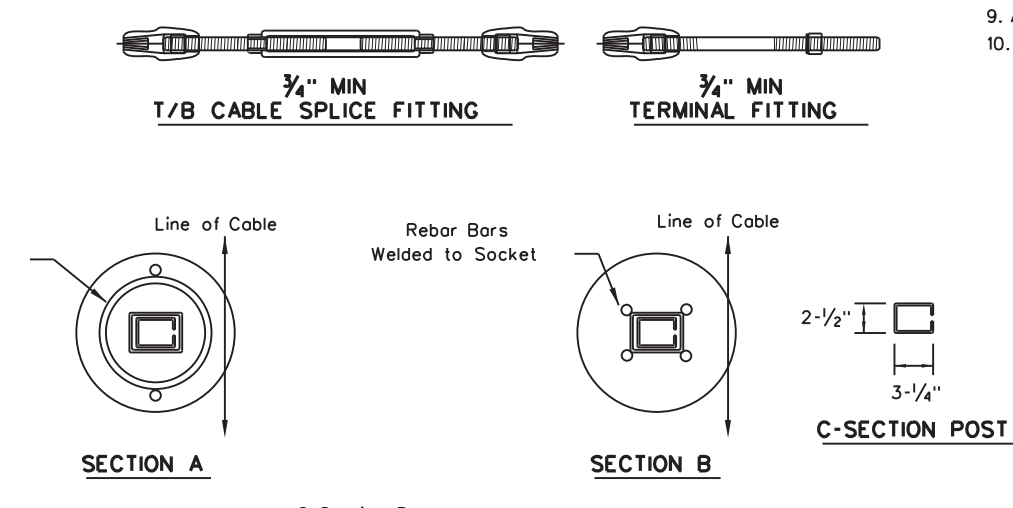
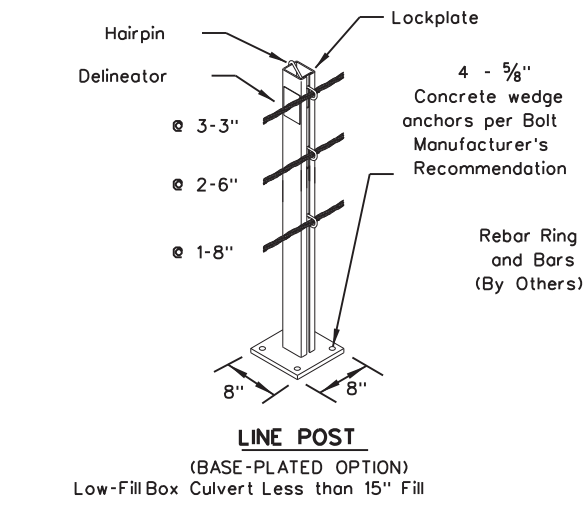
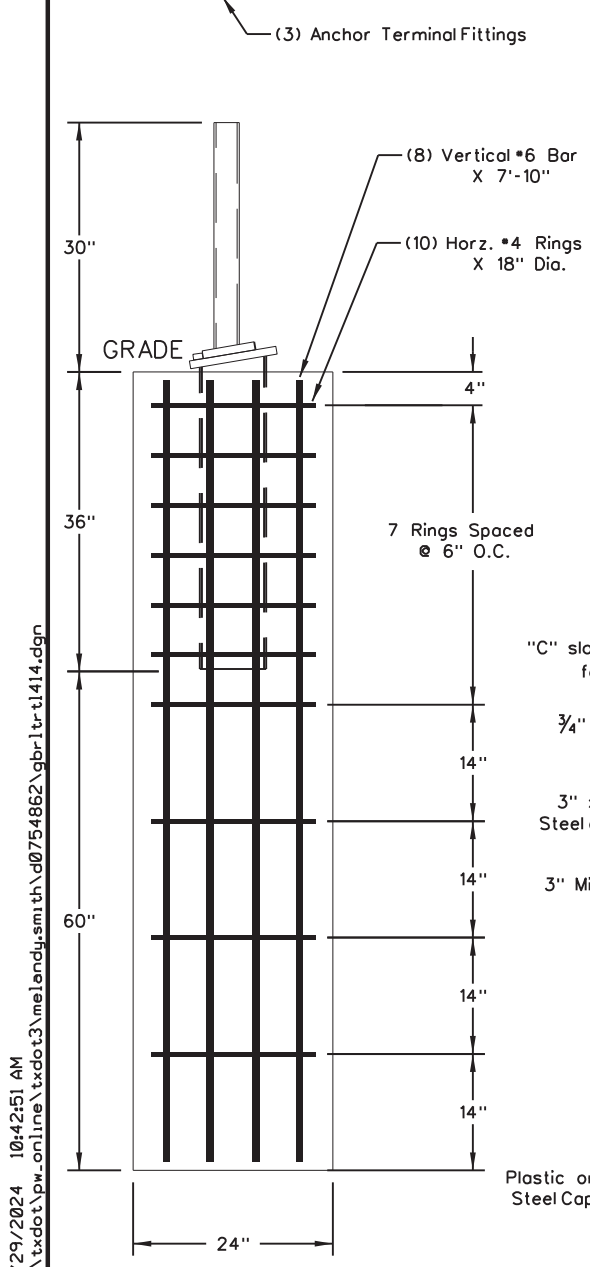
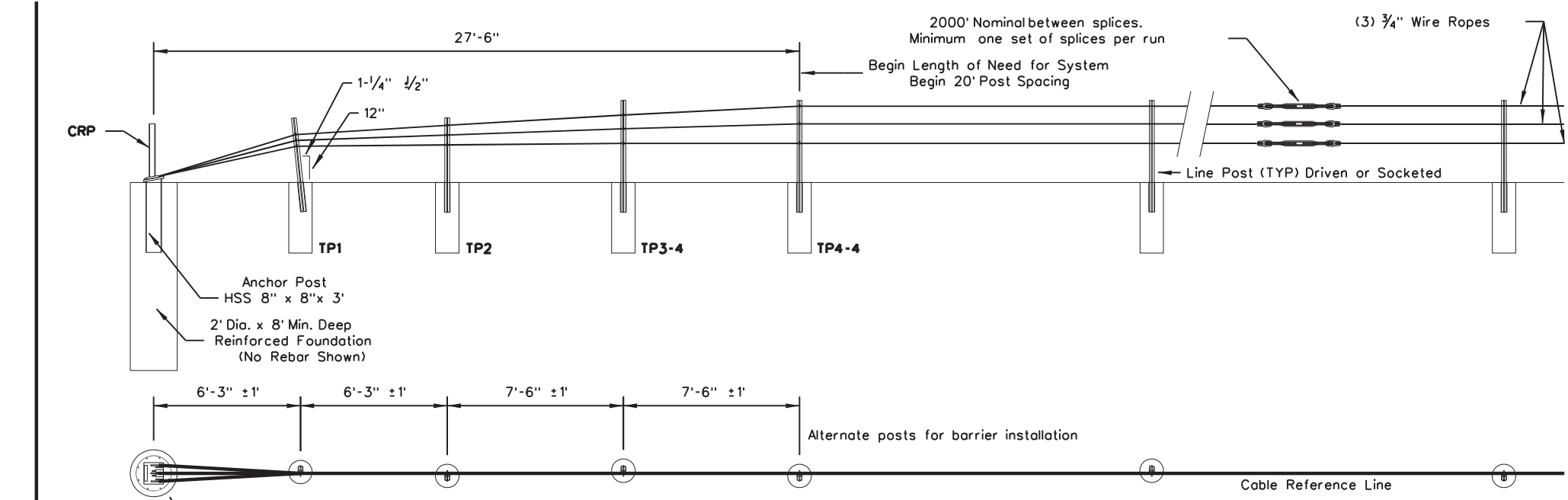
Allowable deviation from chart in tangent sections:
+800, -200 pounds/force. Cable tension readings are typically higher in curved cable sections.

		Design Division Standard	
TRINITY CABLE SAFETY SYSTEM (TL-4)			
CASS(TL4)-14			
FILE: casstl414.dgn	DN: TxDOT	CK: RM	DW: VP
©TxDOT: March 2014	CONT: 6467	SECT: 89	JOB: 001
REVISIONS			US 190, ETC
	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 76

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- ### GENERAL NOTES
- For additional information contact Gibraltar, Inc. at 1-800-495-8957, 830-798-5444, or see the manufacturer's product manual.
 - All concrete shall be CLASS A.
 - The Cable Barrier System shall be installed on shoulders or on medians with slopes of 6:1 or flatter. If installed on slopes steeper than 6:1 up to 4:1 the TL-4 system performs as a TL-3 and Gibraltar must be contacted for various guidelines related to placement.
 - The Cable Barrier System is accepted by the FHWA Test Level - 4.
 - See the Texas MUTCD for proper "Barrier" delineation.
 - Rock Clause: Where solid rock is encountered:
 - For socketed post, continue digging 12" diameter, 15" deep into rock or the required plan depth, whichever comes first.
 - For driven post, core drill a 4" diameter hole 18" deep into rock or the required plan depth, whichever comes first.
 - For Anchor post, continue digging 24" diameter, 30" deep into rock or the required plan depth, whichever comes first.
 - Tolerances:
 - LP = 3" out of plumb, at top
 - Cable height = 1"
 - Anchor Post = 5" off of Cable Reference Line
 - The Gibraltar cable barrier system shall be installed in NCHRP Report 350 standard compacted soil. Soil must be well drained.
 - All non-welded rebar by others.
 - Minimum recommended line post foundation.
 - Without mowstrip, 36" Deep x 12" diameter foundations with #3 rebar ring x 8" diameter with two #4 rebar verticalbars 30" long
 - With 4" minimum depth hot mix asphalt, 30" deep x 12" diameter foundations with #3 rebar ring x 8" diameter with two #4 rebar verticalbars 30" long.
 - With 3" minimum depth concrete mowstrip, 24" deep x 12" diameter foundations. (No rebar required)
 - Direct drive post 42" deep.

CABLE TENSION CHART

-10 °F	8000
0 °F	7600
10 °F	7200
20 °F	6800
30 °F	6400
40 °F	6000
50 °F	5600
60 °F	5200
70 °F	4800
80 °F	4400
90 °F	4000
100 °F	3600
110 °F	3200

DEFLECTION

Deflection	Post Spacing
8'-0"	20 FT
7'-0"	12 FT
6'-8"	10 FT

* Allowable Deviation from Chart +/- 10%

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Texas Department of Transportation

Design Division Standard

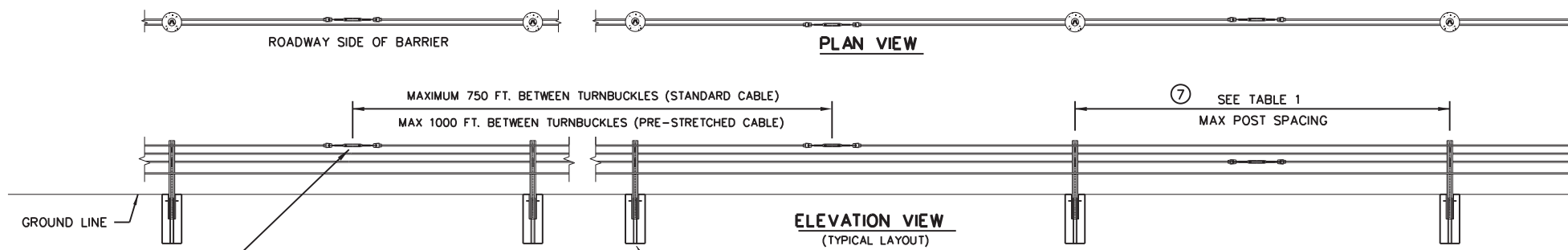
GIBRALTAR CABLE BARRIER SYSTEM (TL-4)

GBRLTR(TL4)-14

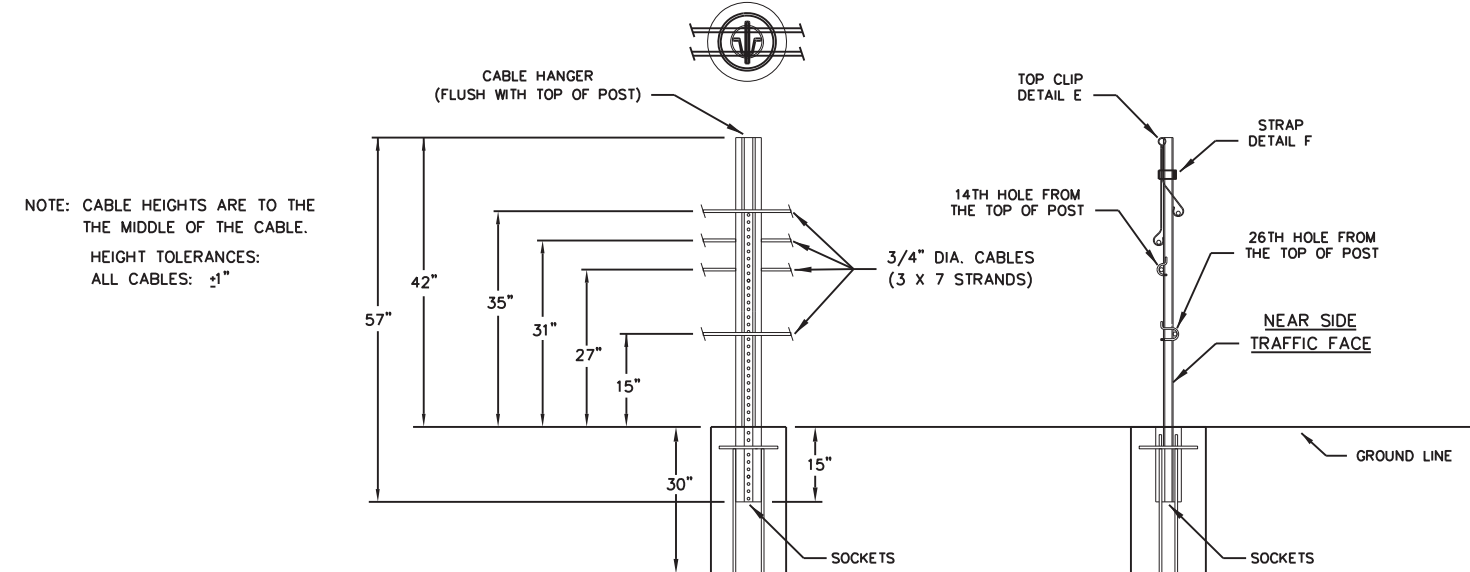
FILE: gbrltrtl414.dgn	DN: TxDOT	CK: RM	DW: VP	CK:
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REVISIONS	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 77	

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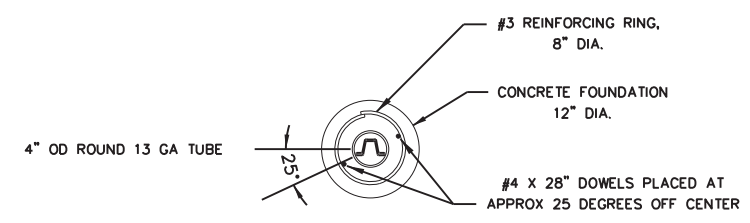
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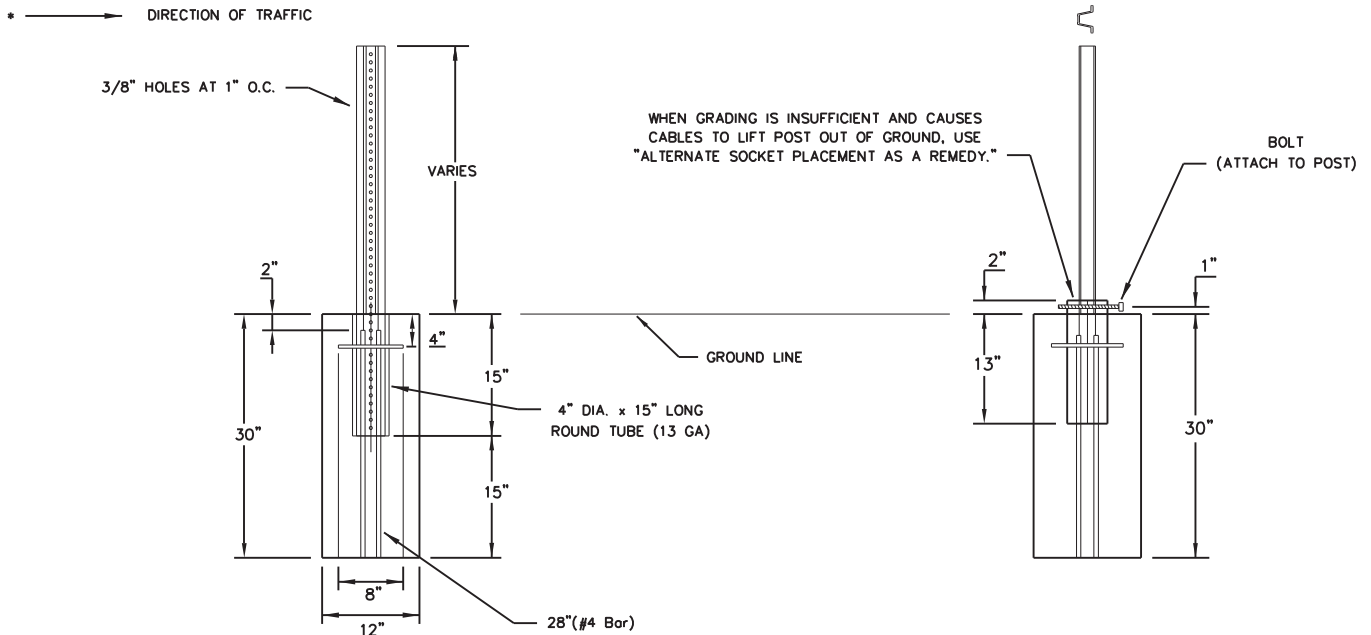
STAGGER PLACEMENT OF TURNBUCKLES LINE TO LINE BETWEEN POSTS.
 NOTE: TURNBUCKLES MAY BE SWAGED OR WEDGE FITTINGS.
 Rib-Bok™ CABLE LINE POST (SOCKET OPTION)
 30" DEEP X 12" DIA. CONCRETE FOOTING



NOTE: CABLE HEIGHTS ARE TO THE MIDDLE OF THE CABLE.
 HEIGHT TOLERANCES:
 ALL CABLES: ±1"

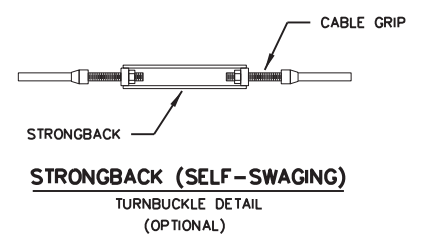
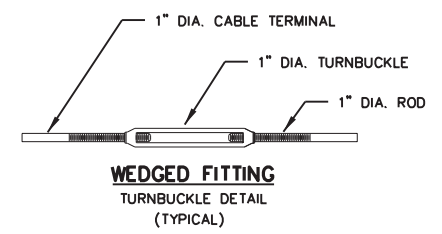
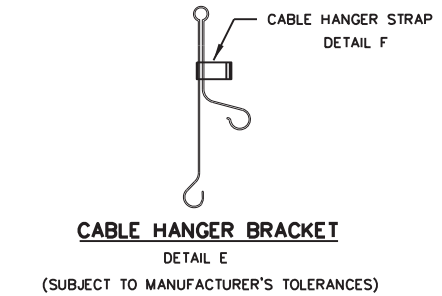


LENGTH OF NEED POSTS
 MEDIAN CONFIGURATION
INSTALLATION DETAIL
 4 CABLE 6:1



11) SOCKETED POST OPTION
 (TYPE S POST)

ALTERNATE SOCKET PLACEMENT
 (TYPE S POST)



GENERAL NOTES

- FOR ADDITIONAL INFORMATION CONTACT YOUR DISTRIBUTOR OR NUCOR STEEL MARION, INC. AT (740) 383-4011.
- FOR PAYMENT SEE SPECIAL SPECIFICATION "CABLE BARRIER SYSTEM".
- FOR ADDITIONAL INFORMATION SEE THE MANUFACTURER'S PRODUCT MANUAL.
- THE NU-CABLE SYSTEM IS DESIGNED FOR BI-DIRECTIONAL TRAFFIC FLOWS. SEE THE MANUFACTURER'S PRODUCT MANUAL FOR PLACEMENT ADJACENT TO GUARDRAIL END TREATMENTS.
- THE NU-CABLE SYSTEM SHALL BE INSTALLED ON MEDIANS WITH SLOPES OF 6:1 OR FLATTER WITHOUT OBSTRUCTIONS, DEPRESSIONS, ETC; THAT MAY SIGNIFICANTLY AFFECT THE STABILITY OF AN ERRANT VEHICLE.
- THE NU-CABLE SYSTEM MAY BE INSTALLED ON EITHER SIDE OF THE ROADWAY. Rib-Bok™ CABLE LINE POSTS MAY BE SOCKETED OR DRIVEN DESIGN.
- THE TL-4 FOR 6:1 SLOPES CAN USE 4# / LF POST. SEE TABLE #1 FOR POST SIZE PER SPACING.
- SEE (TABLE 2) FOR TENSION AMOUNT AT SPECIFIC CABLE TEMPERATURE FOR INITIAL INSTALLATION.
- SEE (TABLE 3) FOR TENSION AMOUNT AT SPECIFIC CABLE TEMPERATURE FOR MAINTENANCE.
- FOURTH (LOWEST) CABLE IS NOT OPTIONAL ON THE TL-4 SYSTEM.
- CONSULT YOUR PROJECT PLAN SHEETS AND CABLE BARRIER SPECIFICATIONS FOR DESIRED SOCKET MATERIAL.
- ALL FOUNDATION DESIGNS ARE BASED ON NCHRP 350 STRONG (S1) SOIL. CONSULT THE MANUFACTURER FOR SPECIFIC FOUNDATION DESIGN IF SOIL TYPES DIFFER.

7) TABLE 1

POST SIZE TABLE	
POST SPACING	POST SIZE
0' - 17'-6"	4# / LF X 4' OR 6' POST
17'-6" - 20'	5# / LF X 4' POST

POST SPACING IS PER 8 FOOT DEFLECTION REQUIREMENTS. CONSULT PRODUCT MANUAL IF GREATER DEFLECTION IS PERMISSIBLE.

8) TABLE 2

CABLE TENSION CHART	
INITIAL INSTALL	
F	LBF
120	4624
110	4986
100	5350
90	5713
80	6077
70	6440
60	7167
50	7894
40	8619
30	9346
20	10073
10	10800
0	11525
-10	12252
-20	12979
-30	13706

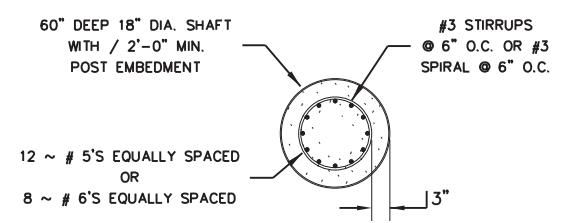
9) TABLE 3

CABLE TENSION CHART	
MAINTENANCE	
F	LBF
120	4021
110	4336
100	4652
90	4968
80	5284
70	5600
60	6232
50	6864
40	7495
30	8127
20	8759
10	9391
0	10022
-10	10654
-20	11286
-30	11918

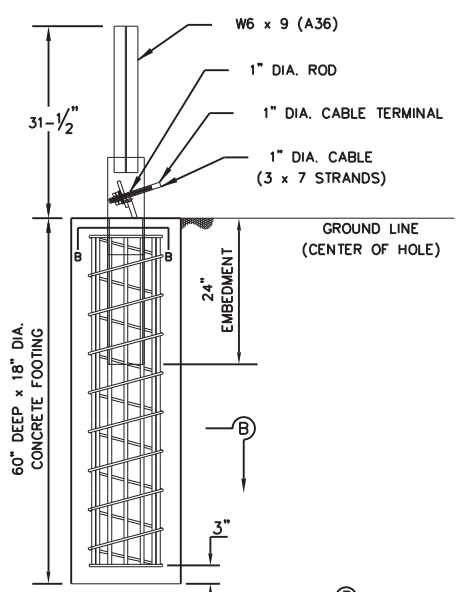
Texas Department of Transportation Design Division Standard	
NU-CABLE BARRIER SYSTEM (TL-4) (4 CABLE) NU-CABLE(TL4)-14	
FILE: nucable1414 ©TxDOT: March 2014 REVISIONS	DN: TxDOT CK: RM DW: VP CK:
CONT: 6467 SECT: 89 DIST: WACO	JOB: 001 COUNTY: BELL, ETC SHEET NO.: 78

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SECTION B-B
(CABLE RELEASE POST)



DETAIL A - CRP IN CONCRETE FOOTING
(3000 PSI MIN CONCRETE)

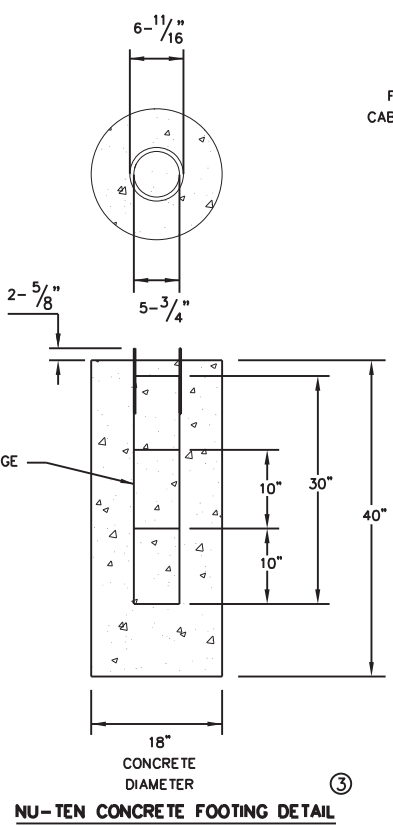
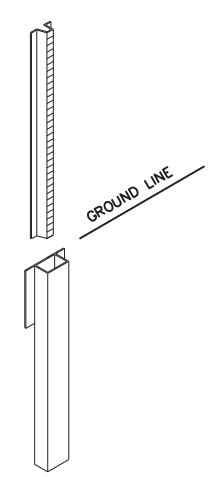
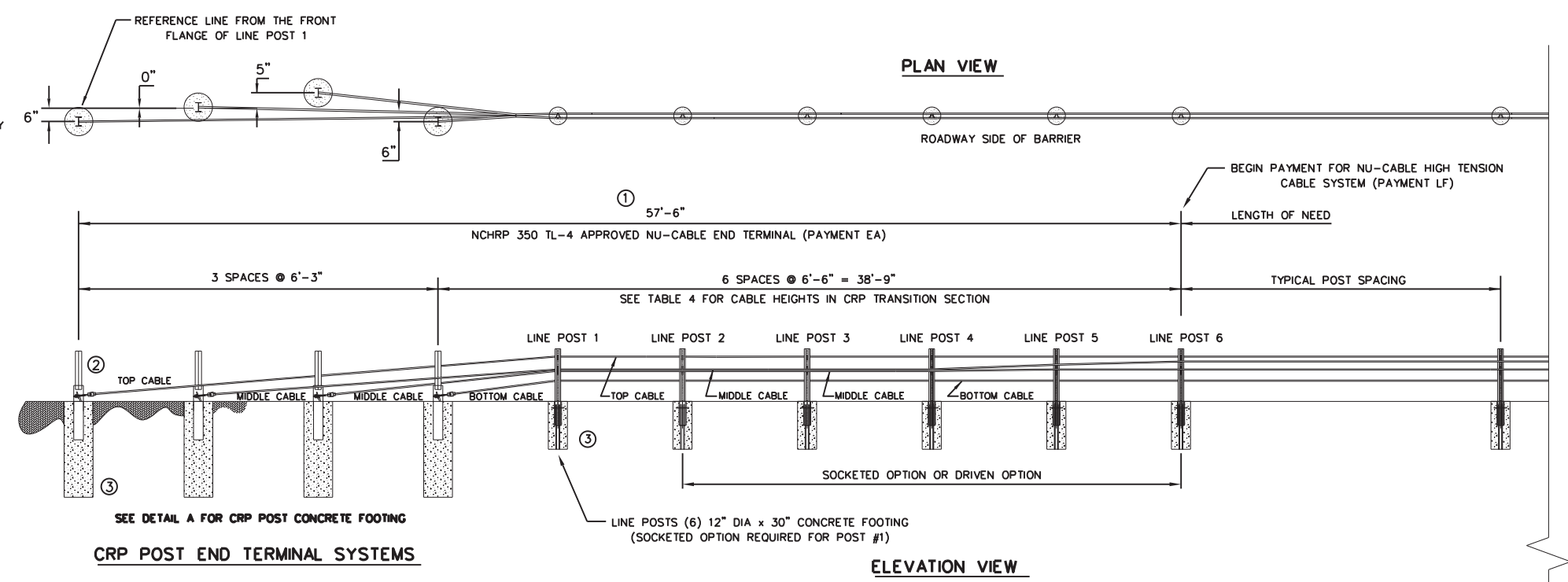
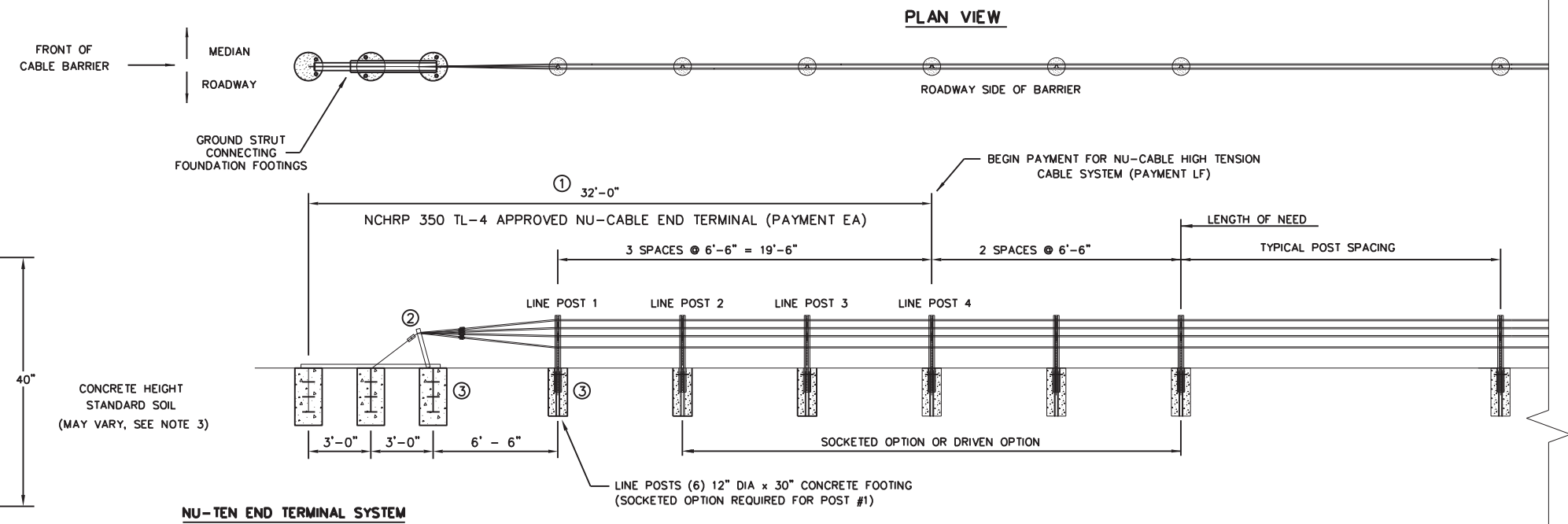


TABLE 4
CRP END TERMINAL CABLE HEIGHTS - TL-4

	LP 1	LP 2	LP 3	LP 4	LP 5	LP 6
TOP CABLE	34"	34"	34"	34"	34"	34"
UPPER-MIDDLE CABLE	27"	27"	27"	27"	28"	31"
BOTTOM-MIDDLE CABLE	24"	24"	24"	24"	24"	24"
BOTTOM CABLE	15"	15"	15"	15"	15"	15"



① THE OPPOSING END TREATMENTS ON A PARTICULAR RUN ARE MIRRORED IN THEIR LAYOUT.



NOTES

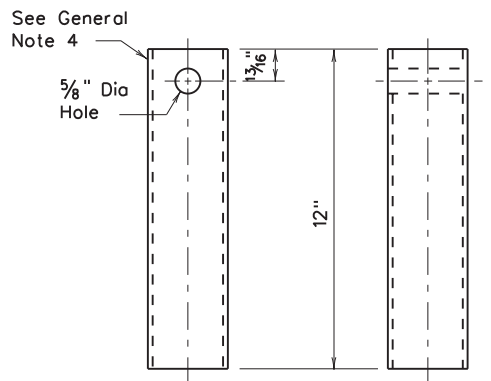
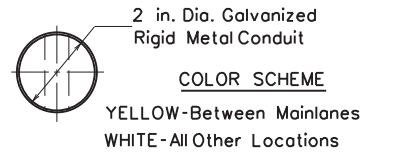
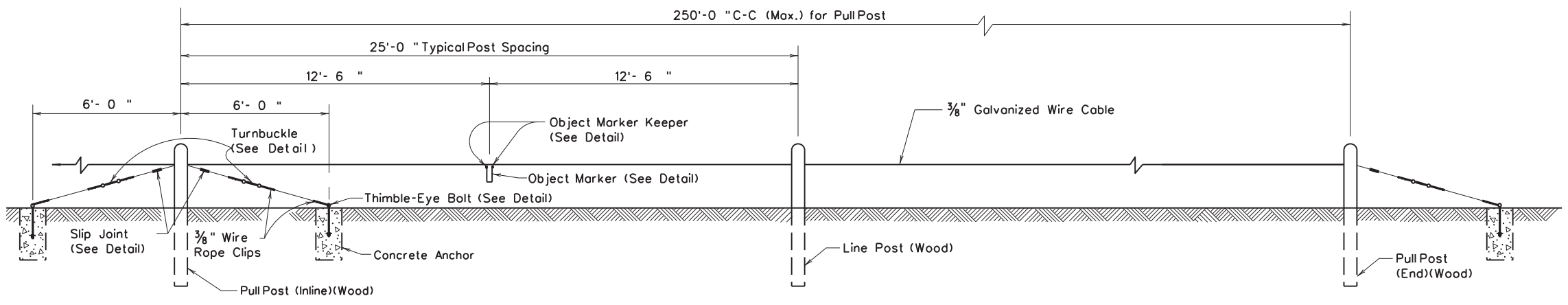
1. THE OPPOSING END TREATMENTS ON A PARTICULAR RUN ARE MIRRORED IN THEIR LAYOUT. SYSTEM PAYMENT IS PER EACH (EA). REFER TO PROJECT SPECIFICATIONS FOR ADDITIONAL PAYMENT INFORMATION
2. REFER TO INSTALLATION MANUAL FOR CABLE END ASSEMBLY DETAIL.
3. ALL FOUNDATION DESIGNS ARE BASED ON NCHRP 350 STRONG (S1) SOIL. CONSULT THE MANUFACTURER FOR SPECIFIC FOUNDATION DESIGNS IF SOIL TYPES DIFFER.
4. SEE TABLE 4 CABLE HEIGHTS IN CRP TRANSITION SECTION.

Texas Department of Transportation
 Design Division Standard

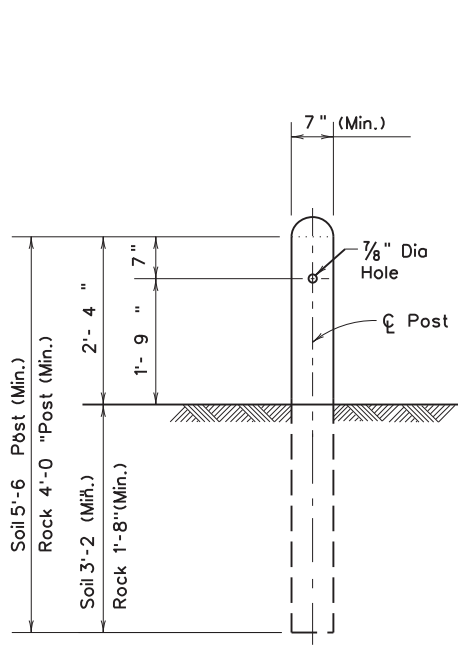
NU-CABLE BARRIER SYSTEM (TL-4) (4 CABLE)

NU-CABLE(TL4)-14

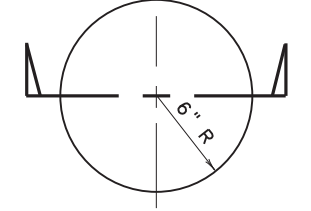
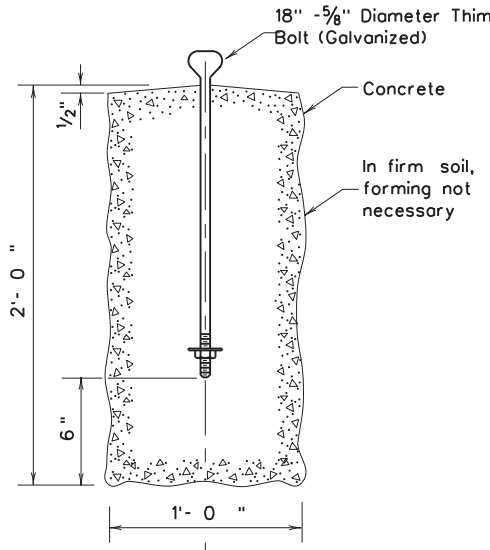
FILE: nucable1414	DN: TxDOT	CK: RM	DW: VP	CK:
© TxDOT: March 2014	CONT: 6467	SECT: 89	JOB: 001	HIGHWAY: US 190, ETC
REVISIONS:	DIST: WACO	COUNTY: BELL, ETC	SHEET NO. 79	



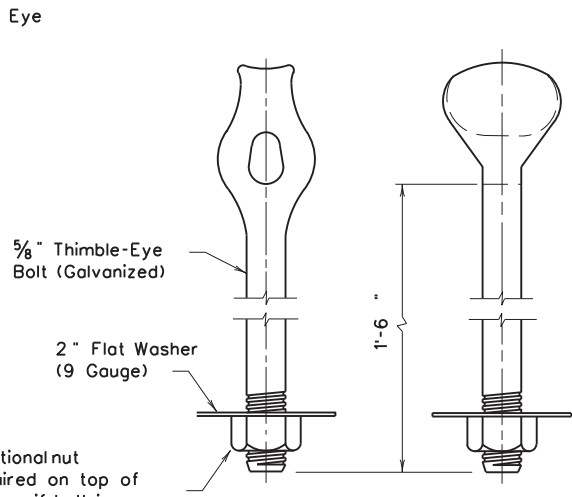
WOOD POST & CABLE UNIT



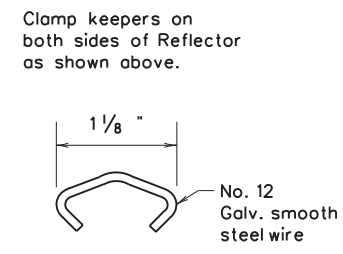
WOOD POST DETAIL



CONCRETE ANCHOR DETAILS



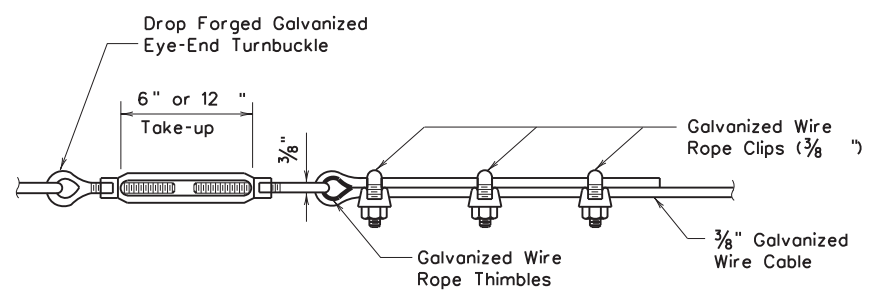
THIMBLE-EYE BOLT DETAILS



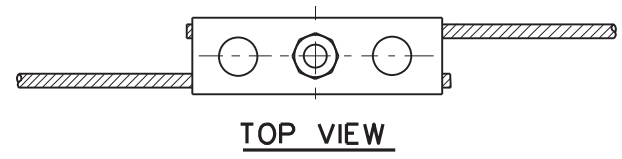
OBJECT MARKER KEEPER DETAIL

GENERAL NOTES

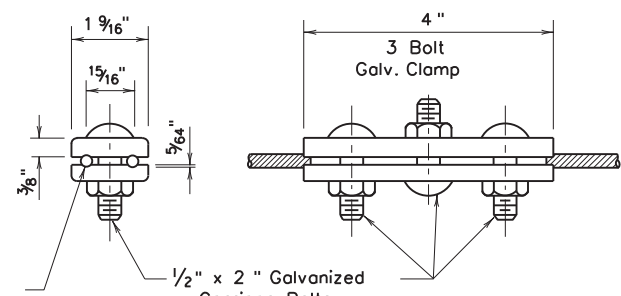
1. Furnish Class "B" or better concrete in accordance with Item 421, "Hydraulic Cement Concrete". Cure concrete anchors at least five (5) days before attaching the cable.
2. Furnish galvanized cable fittings in accordance with the Item 445, Galvanizing.
3. Furnish posts meeting the requirements of DMS 7200, "Timer Posts and Blocks for Metal Beam Guard Fence." Do not use painted timber posts.
4. Cover the entire surface of object marker (reflector) with a reflectorized sheeting material conforming to Departmental Material Specification DMS 8300, "Sign Face Materials", Type C.
5. Furnish cable conforming to ASTM designation A475.



**WIRE CABLE CONNECTION
(at turnbuckles & eyebolts)
DETAIL**



TOP VIEW



SIDE VIEW

**SLIP JOINT
DETAIL**

Texas Department of Transportation
Maintenance Division

POST & CABLE FENCE

PCF-05

FILE: pcf05.dgn	DN:	CK:	DW: LJB	CK: JG	NEG:
© TxDOT FEB. 2005					
DIST	FED REG	FEDERAL AID PROJECT		SHEET	
WACO	6	RMC 646789001		80	
COUNTY	CONTROL	SECT	JOB	HIGHWAY	
BELL,ETC	6467	89	001	US 190,ETC	

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REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

DELINEATORS

D & OM DESCRIPTIVE CODES

SIZE 1	SIZE 2	SIZE 3	SIZE 4

SINGLE	DOUBLE

INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX(XX)

NUMBER OF REFLECTORS
S = Single
D = Double

COLOR OF REFLECTORS
W = White
Y = Yellow
R = Red

REFLECTOR UNIT SIZE
1 or 2

TYPE OF POST OR DELINEATOR
WC = Wing Channel Post
YFLX = Yellow Flexible Post
WFLX = White Flexible Post
BRF = Barrier Reflector

TYPE OF MOUNT
GND = Embedded (drivable or set in concrete)
CTB = Concrete Barrier Mount
GF1 or GF2 = Guard Fence Attachment
SRF = Surface Mount

SHEETING Yellow, White or Red Type B or C reflective sheeting

NOTE

- Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx).
- Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.

SHEETING Yellow, White or Red Type B or C Reflective Sheeting

POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

DIRECTION
If Required
BI = Bi-Directional
BR = Bi-Directional with red on back

INSTL OM ASSM (OM-XX) (XXXX)XXX(XX)

OBJECT MARKERS

Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
SHEETING Yellow-Type B or C Sheeting FL	SHEETING Yellow - Type B or C Sheeting			SHEETING Alternating acrylic black and retroreflective yellow - Type B or C Sheeting			SHEETING Red -Type B or C Sheeting
POST TYPE TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

TYPE OF OBJECT MARKER
1, 2, 3, or 4

NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

TYPE OF POST
WC = Wing Channel Post
WFLX = White Flexible Post
TWT = Thin Walled Tubing

TYPE OF MOUNT
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

DIRECTION
If Required
BI = Bi-Directional

DEPARTMENTAL MATERIAL SPECIFICATIONS	
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)

CHEVRONS

ONE DIRECTION LARGE ARROW

GF1	GF2	CTB
<p>NOTE</p> <ol style="list-style-type: none"> Barrier reflectors shall meet the requirements of DMS 8600. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov. 		
SHEETING Yellow, White, Red		
<p>NOTE</p> <ol style="list-style-type: none"> Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches. 		

DEVICE	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	
NOTE	<ol style="list-style-type: none"> CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies). When there is a need to increase conspicuity, the Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTION LARGE ARROW (W1-6). 			

DEVICE	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)
SIZE (W x L)	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)
MOUNTING HEIGHT	7'-0"	

NOTE:
Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.



DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	WACO	BELL,ETC	81	

POST TYPE AND SUPPORT FOUNDATION DETAILS

TYPE OF BARRIER MOUNTS

WING CHANNEL (WC)

FLEXIBLE POSTS (YFLX, WFLX)

WEDGE ANCHOR SYSTEMS

GUARD FENCE ATTACHMENT

GND

GND

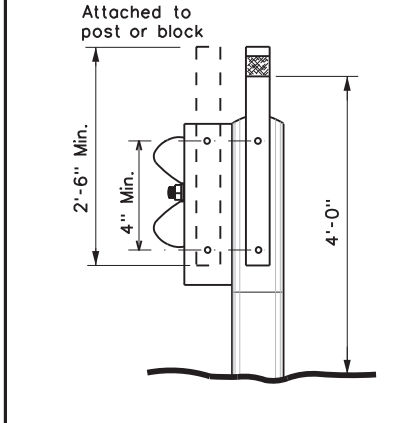
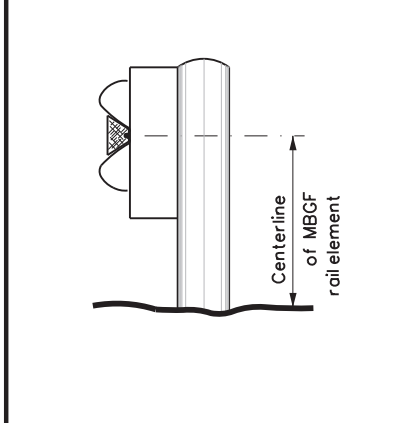
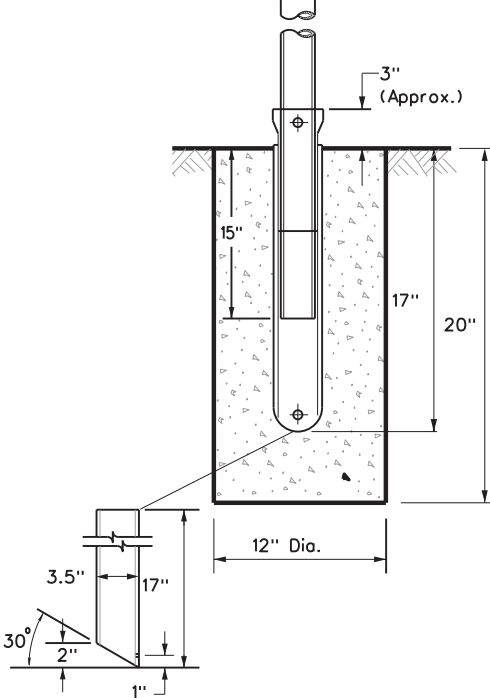
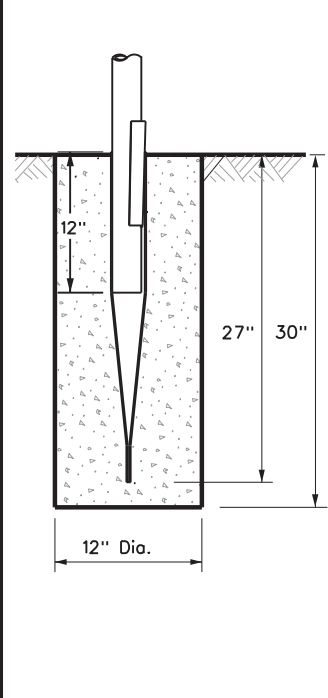
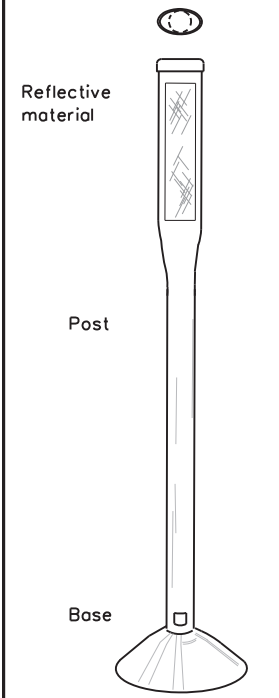
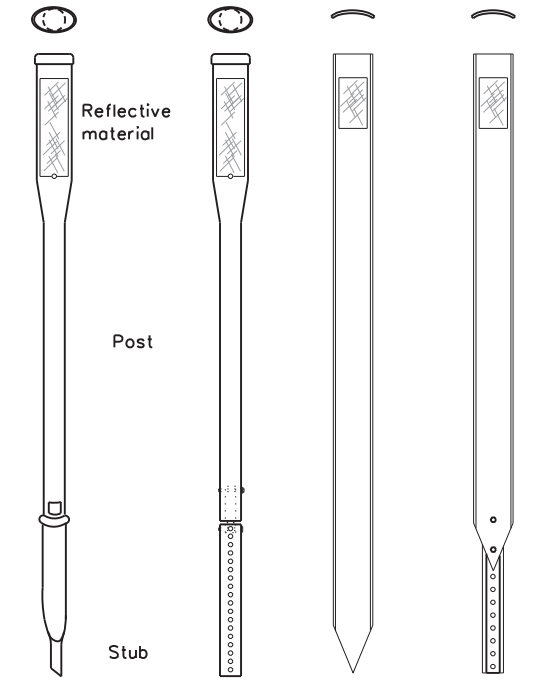
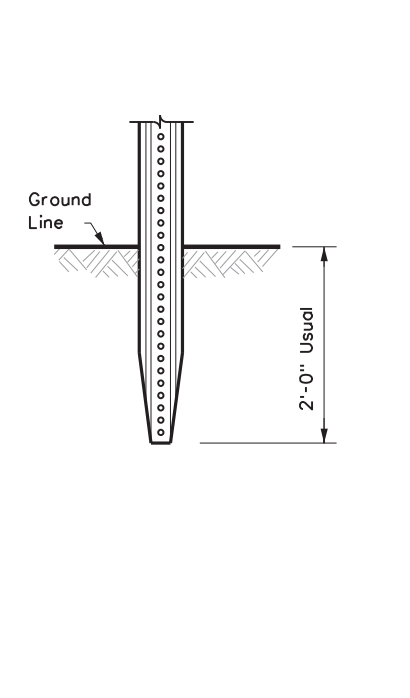
SRF

WAS

WAP

GF1

GF2



NOTES

1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only.
2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.

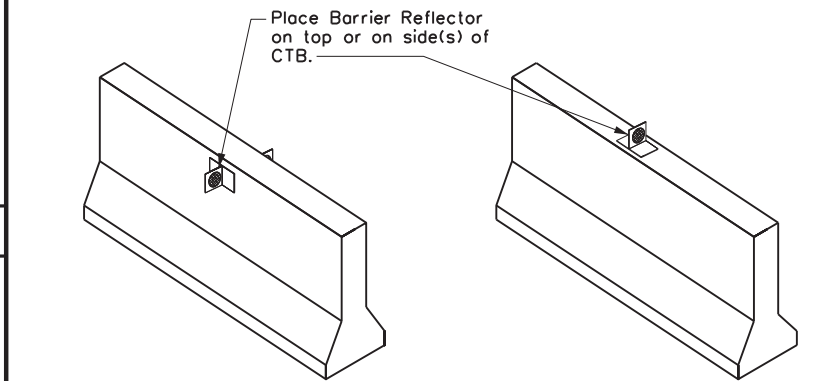
NOTES

1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.
4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.

NOTE

1. Install per manufacturer's recommendations.

CONCRETE TRAFFIC BARRIER (CTB)



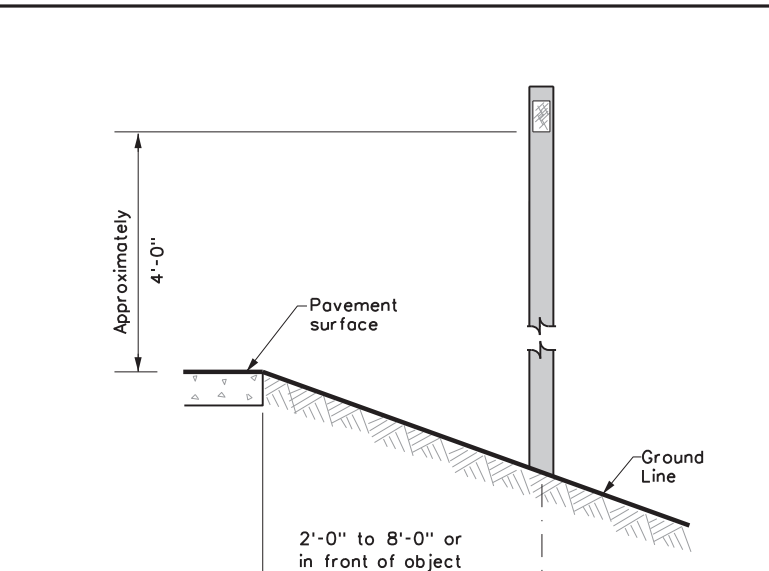
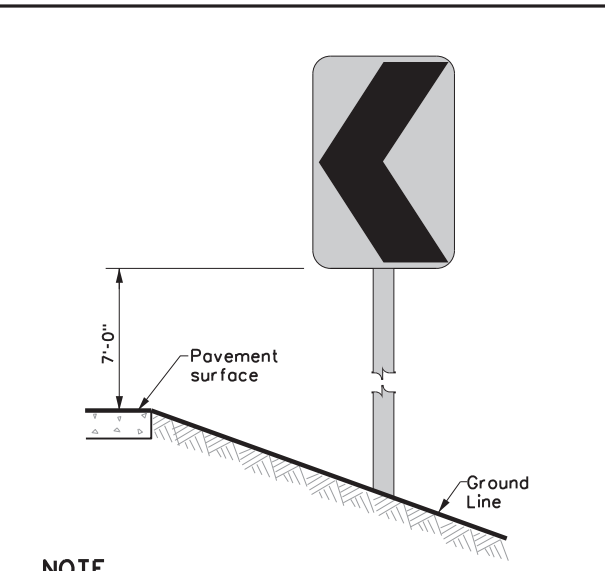
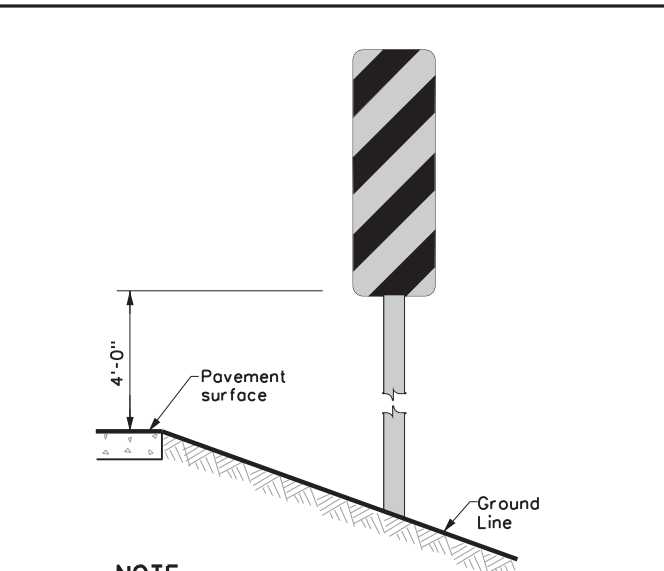
GENERAL NOTES

1. Place delineators on a section of roadway at a consistent distance from the edge of pavement.
2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction.
3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible.
4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation.
5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface.
6. Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.

TYPES 1,3, AND 4 OBJECT MARKERS AND CHEVRONS

CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN

DELINEATORS AND TYPE 2 OBJECT MARKERS



NOTE

Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

NOTE

Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

See general notes 1, 2 and 3.

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Texas Department of Transportation
Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

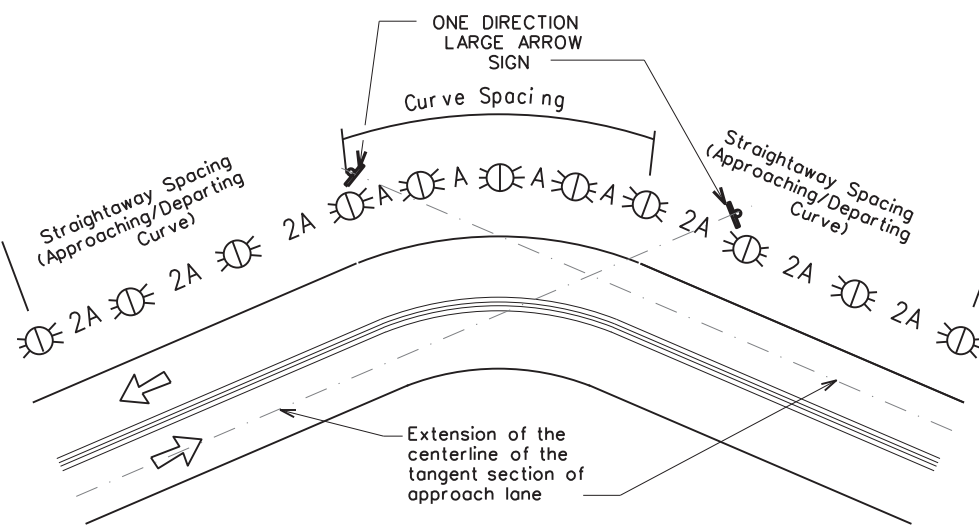
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© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	WACO	BELL,ETC	82	

20B

MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

Amount by which Advisory Speed is less than Posted Speed	Curve Advisory Speed	
	Turn (30 MPH or less)	Curve (35 MPH or more)
5 MPH & 10 MPH	• RPMs	• RPMs
15 MPH & 20 MPH	• RPMs and One Direction Large Arrow sign	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons.
25 MPH & more	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons	• RPMs and Chevrons

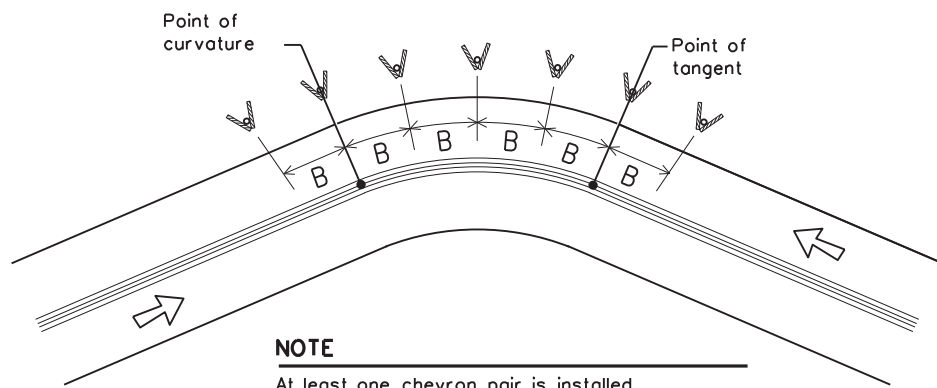
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



NOTE

ONE DIRECTION LARGE ARROW (W1-6) sign should be located at approximately and perpendicular to the extension of the centerline of the tangent section of approach lane.

SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES



NOTE

At least one chevron pair is installed beyond the point of tangent in tangent section.

DELINEATOR AND CHEVRON SPACING

Degree of Curve	FEET			
	Radius of Curve	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
		A	2A	B
1	5730	225	450	—
2	2865	160	320	—
3	1910	130	260	200
4	1433	110	220	160
5	1146	100	200	160
6	955	90	180	160
7	819	85	170	160
8	716	75	150	160
9	637	75	150	120
10	573	70	140	120
11	521	65	130	120
12	478	60	120	120
13	441	60	120	120
14	409	55	110	80
15	382	55	110	80
16	358	55	110	80
19	302	50	100	80
23	249	40	80	80
29	198	35	70	40
38	151	30	60	40
57	101	20	40	40

Curve delineator approach and departure spacing should include 3 delineators spaced at 2A. This spacing should be used during design preparation or when the degree of curve is known.

DELINEATOR AND CHEVRON SPACING

Advisory Speed (MPH)	WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN		
	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
	A	2xA	B
65	130	260	200
60	110	220	160
55	100	200	160
50	85	170	160
45	75	150	120
40	70	140	120
35	60	120	120
30	55	110	80
25	50	100	80
20	40	80	80
15	35	70	40

If the degree of curve is not known, delineator spacing may be determined based on the Advisory Speed of the curve. Use the delineator curve spacing for each Advisory Speed (MPH).

DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

CONDITION	REQUIRED TREATMENT	MINIMUM SPACING
Frwy./Exp. Tangent	RPMs	See PM-series and FPM-series standard sheets
Frwy./Exp. Curve	Single delineators on right side	See delineator spacing table
Frwy./Exp. Ramp	Single delineators on at least one side of ramp (should be on outside of curves) (see Detail 3 on D&OM(4))	100 feet on ramp tangents Use delineator spacing table for ramp curves ("straightway spacing" does not apply to ramp curves)
Acceleration/Deceleration Lane	Double delineators (see Detail 3 on D&OM(4))	100 feet (See Detail 3 on D & OM (4))
Truck Escape Ramp	Single red delineators on both sides	50 feet
Bridge Rail (steel or concrete) and Metal Beam Guard Fence	Bi-Directional Delineators when undivided with one lane each direction Single Delineators when multiple lanes each direction	Equal spacing (100' max) but not less than 3 delineators
Concrete Traffic Barrier (CTB) or Steel Traffic Barrier	Barrier reflectors matching the color of the edge line	Equal spacing 100' max
Cable Barrier	Reflectors matching the color of the edge line	Every 5th cable barrier post (up to 100' max)
Guard Rail Terminus/Impact Head	Divided highway - Object marker on approach end Undivided 2-lane highways - Object marker on approach and departure end	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5) and D & OM (6)
Bridges with no Approach Rail	Type 3 Object Marker (OM-3) at end of rail and 3 single delineators approaching rail	See D & OM(5)
Reduced Width Approaches to Bridge Rail	Type 2 and Type 3 Object Markers (OM-3) and 3 single delineators approaching bridge	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5)
Culverts without MBGF	Type 2 Object Markers	See Detail 2 on D & OM(4)
Crossovers	Double yellow delineators and RPMs	See Detail 1 on D & OM (4)
Pavement Narrowing (lane merge) on Freeways/Expressway	Single delineators adjacent to affected lane for full length of transition	100 feet

NOTES

1. Unless indicated otherwise, the delineator or barrier reflector color shall conform to the color of the pavement edge line on the side of the road where the delineators or barrier reflectors are placed.
2. Barrier reflectors may be used to replace required delineators.
3. Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND

	Bi-directional Delineator
	Delineator
	Sign



DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

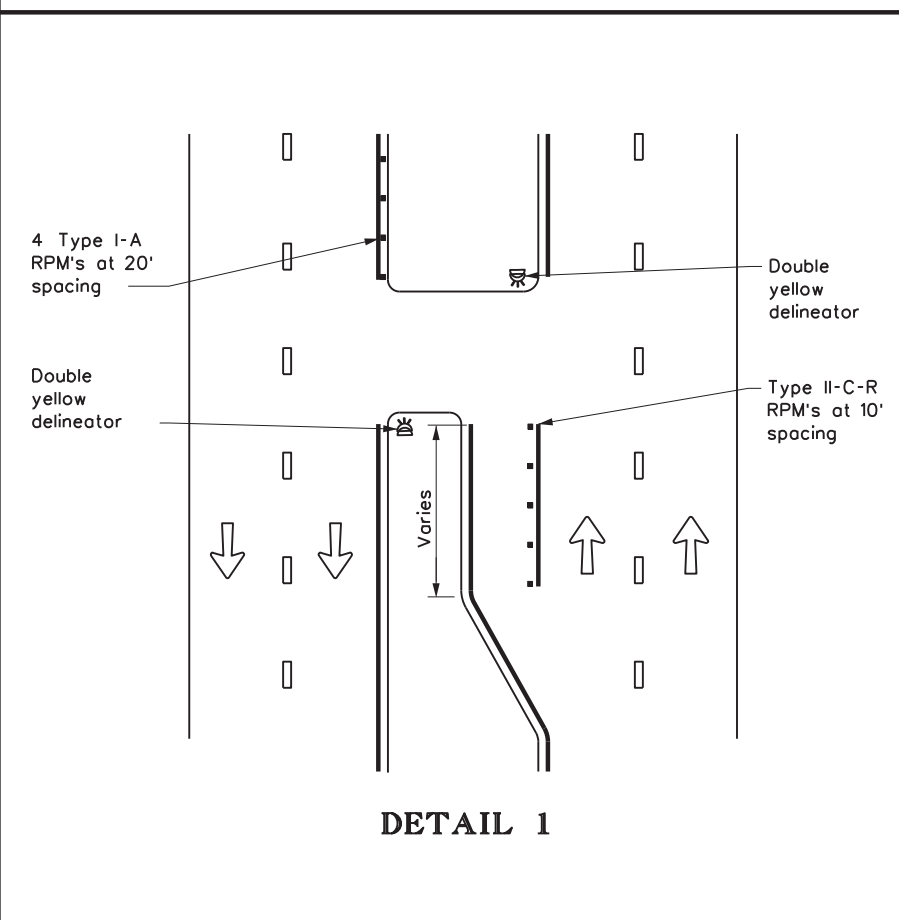
D & OM(3)-20

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© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
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3-15 8-15	DIST	COUNTY	SHEET NO.	
8-15 7-20	WACO	BELL, ETC	83	

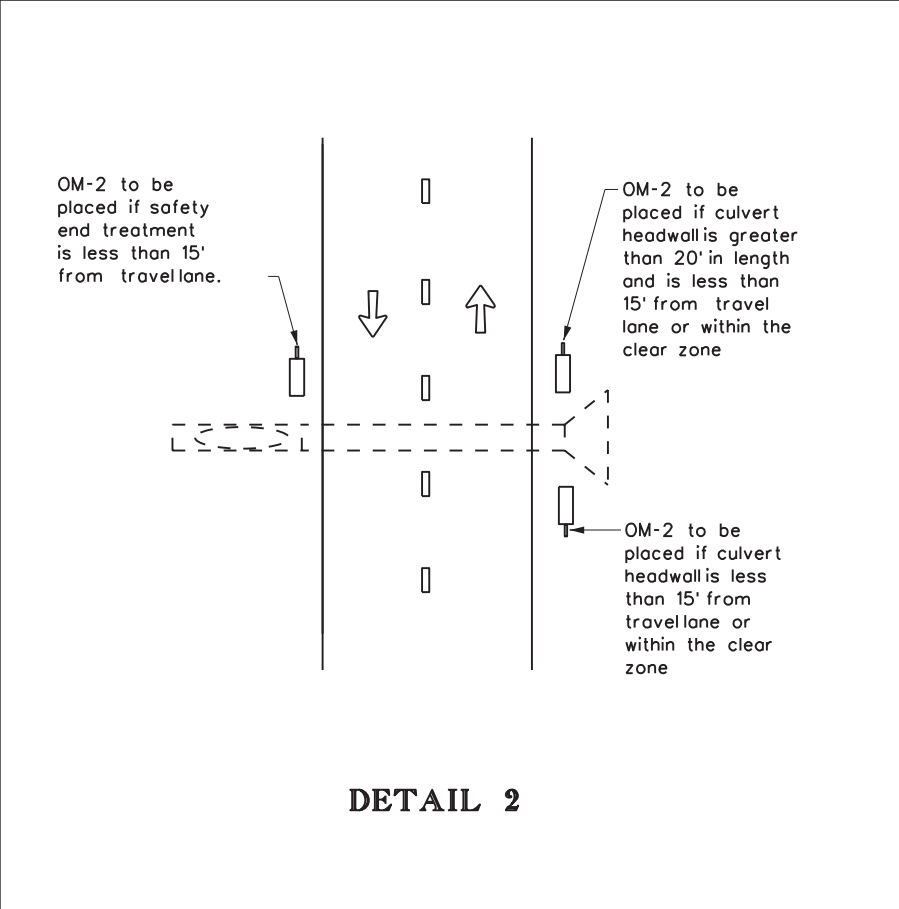
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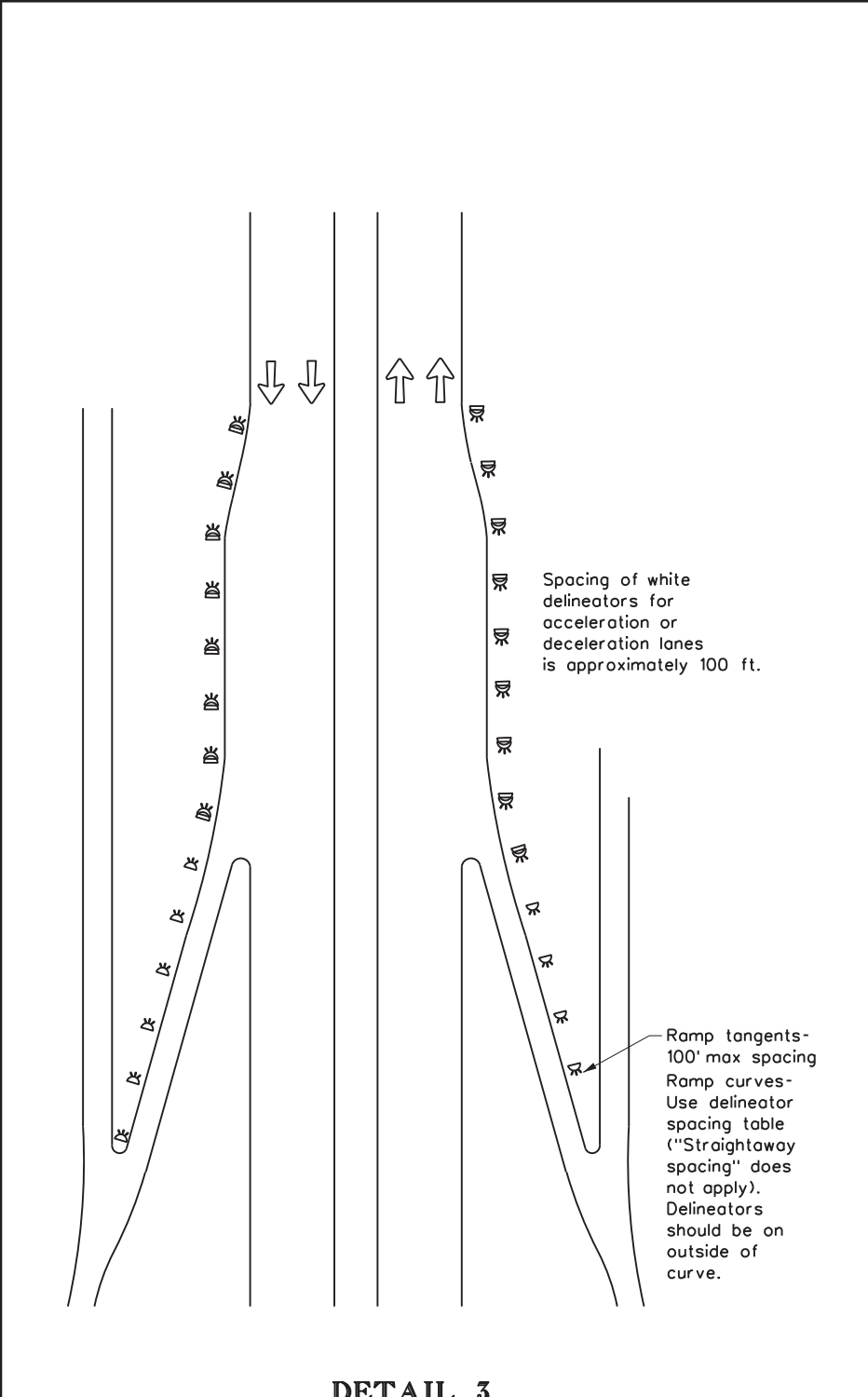
CROSSOVERS



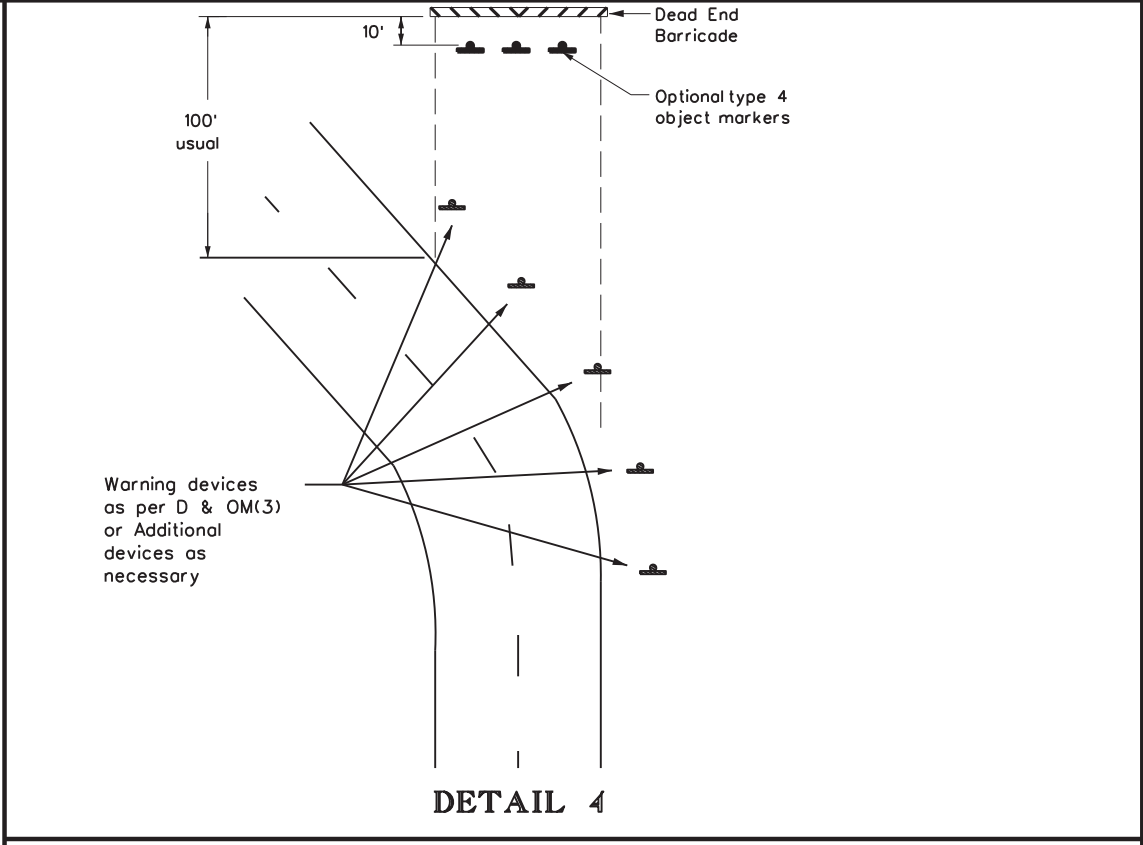
FOR CULVERTS WITHOUT MBGF



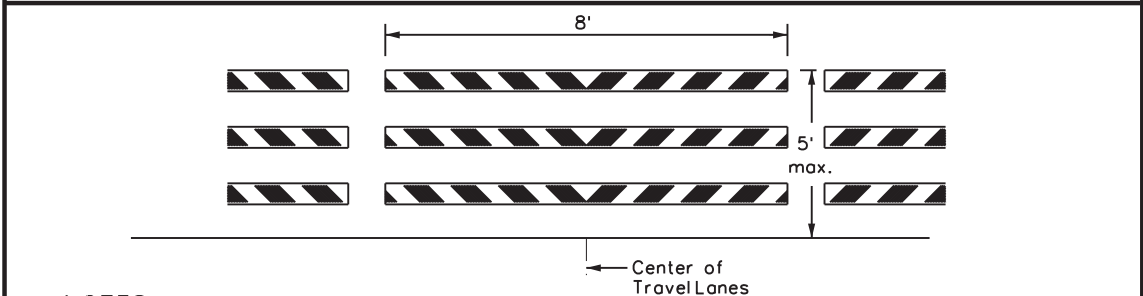
FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



TYPICAL APPLICATION OF DEAD END BARRICADE



TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

1. Barricade striping shall be red and white reflective sheeting for all permanent road closures.
2. Barricade striping is red and white sloping toward the center of the roadway.
3. Type 3 Barricade Supports should be anchored to soil or pavement as described in compliant Work Zone Traffic Control Devices List, section D.2.f and D.2.g.

DETAIL 5

LEGEND	
	Bidirectional Delineator
	Delineator
	OM-3
	Barricade
	Sign
	OM-2
	Double Delineator



DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

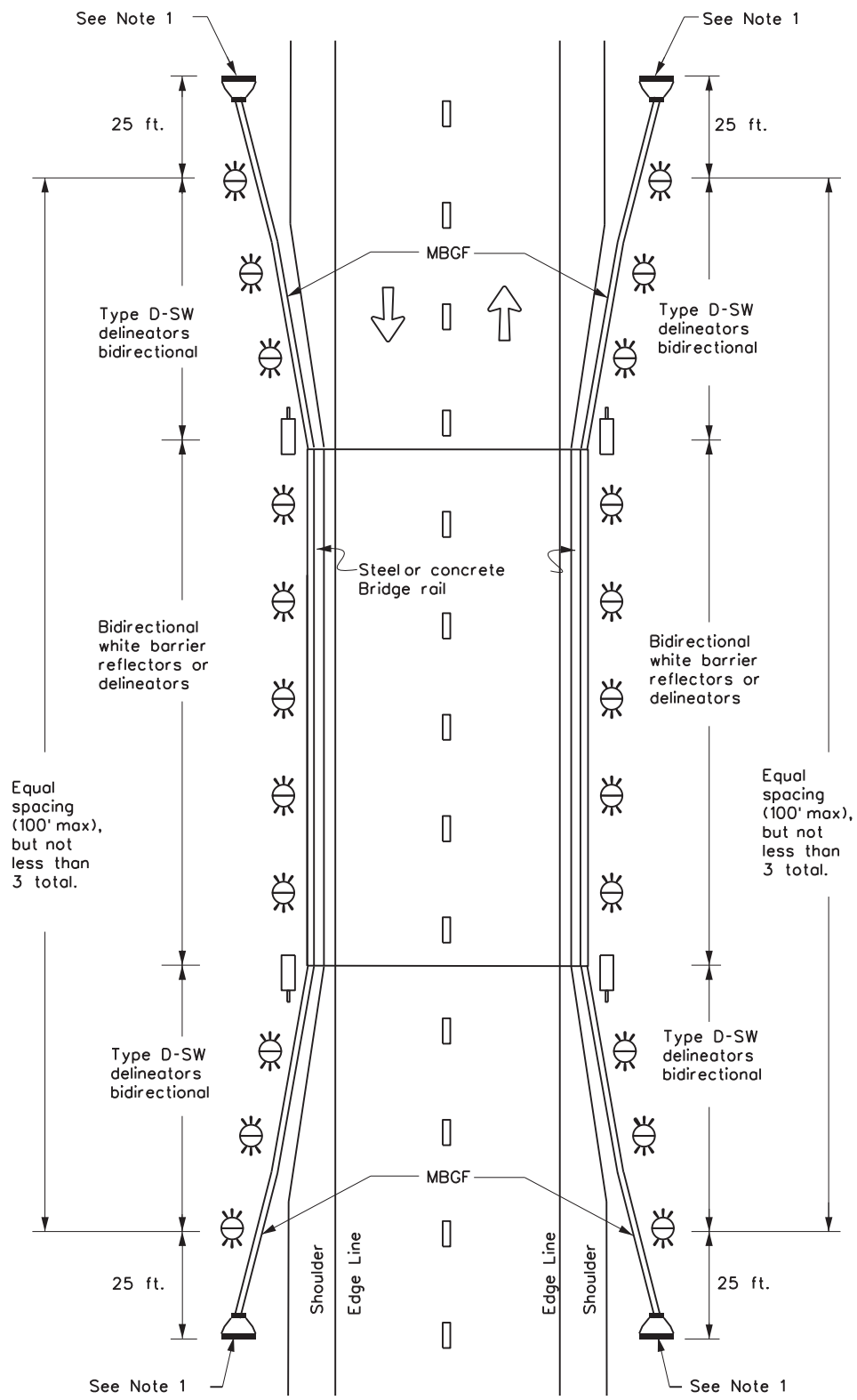
D & OM(4)-20

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© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
3-15	DIST	COUNTY	SHEET NO.	
7-20	WACO	BELL,ETC	84	

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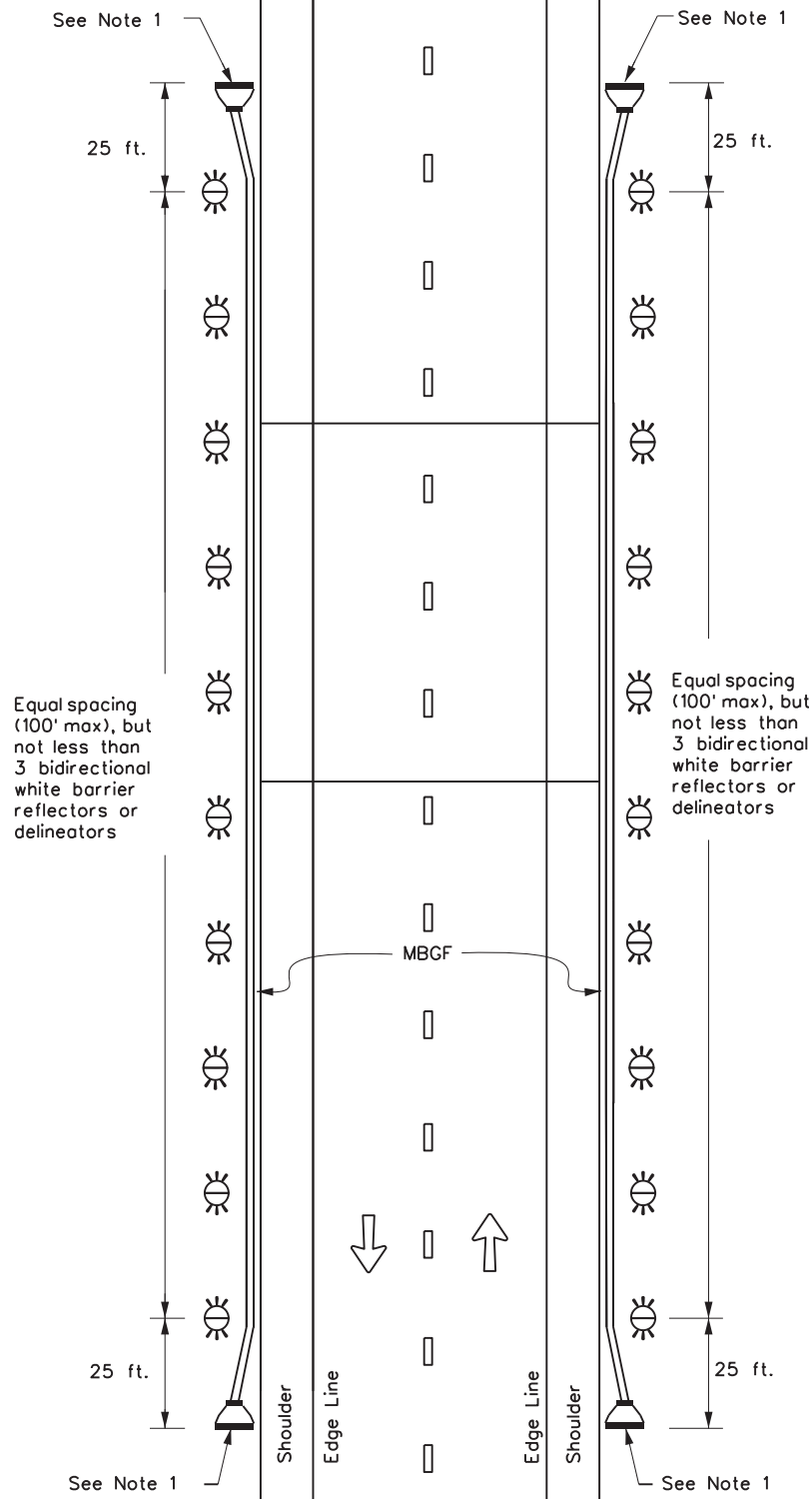
**TWO-WAY, TWO LANE ROADWAY
WITH REDUCED WIDTH APPROACH RAIL**



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

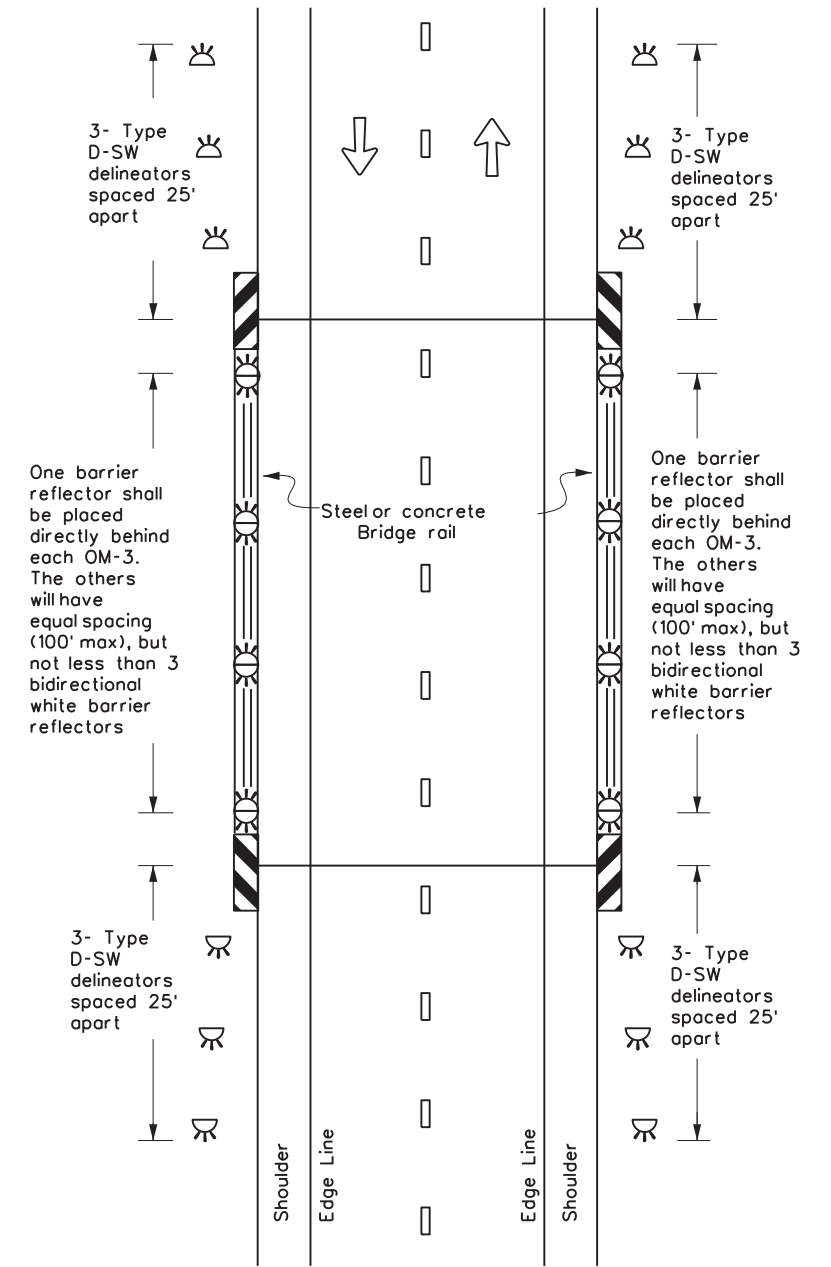
**TWO-WAY, TWO LANE ROADWAY
WITH METAL BEAM GUARD FENCE (MBGF)**



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

**TWO-WAY, TWO LANE ROADWAY
BRIDGE WITH NO APPROACH RAIL**



LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow



**DELINEATOR &
OBJECT MARKER
PLACEMENT DETAILS**

D & OM(5)-20

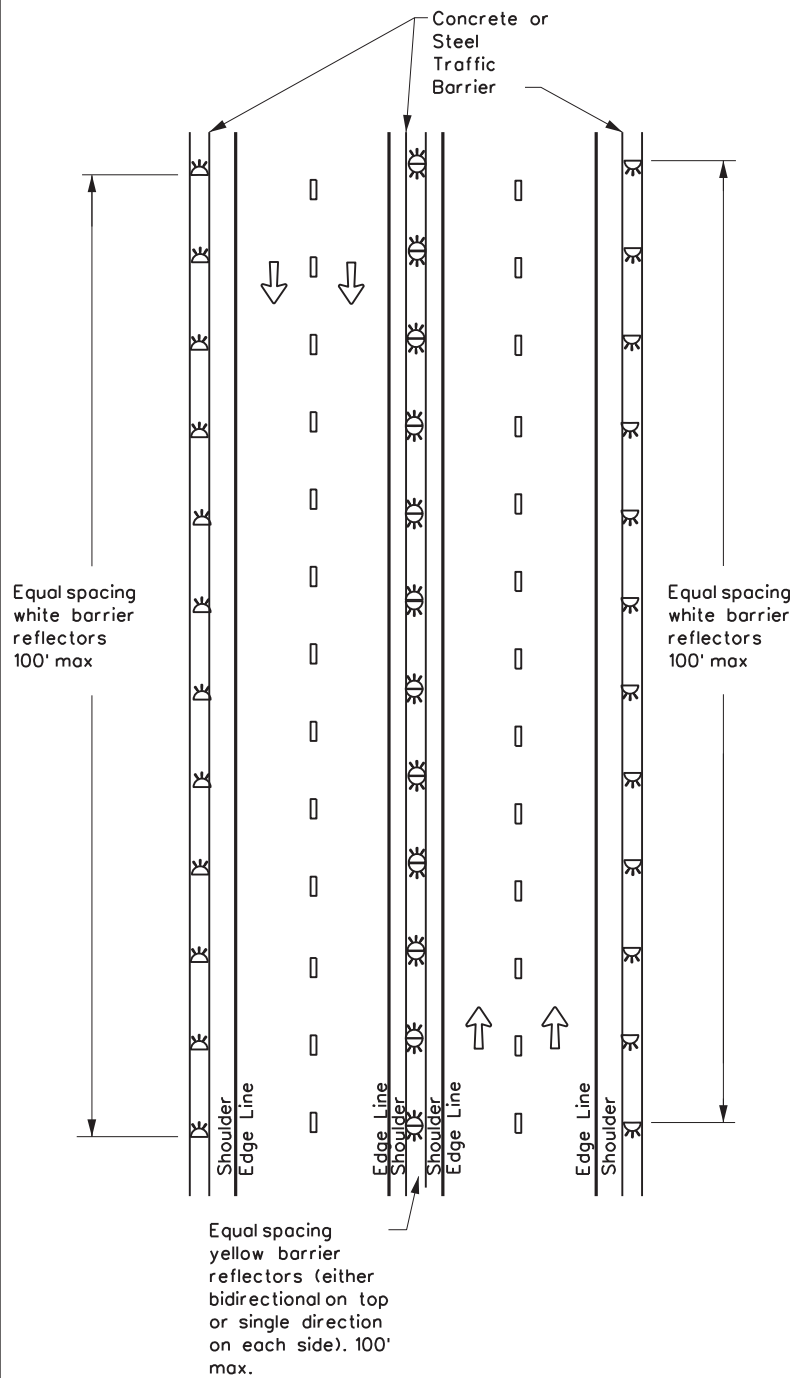
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© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190,ETC
7-20	DIST	COUNTY	SHEET NO.	
	WACO	BELL,ETC	85	

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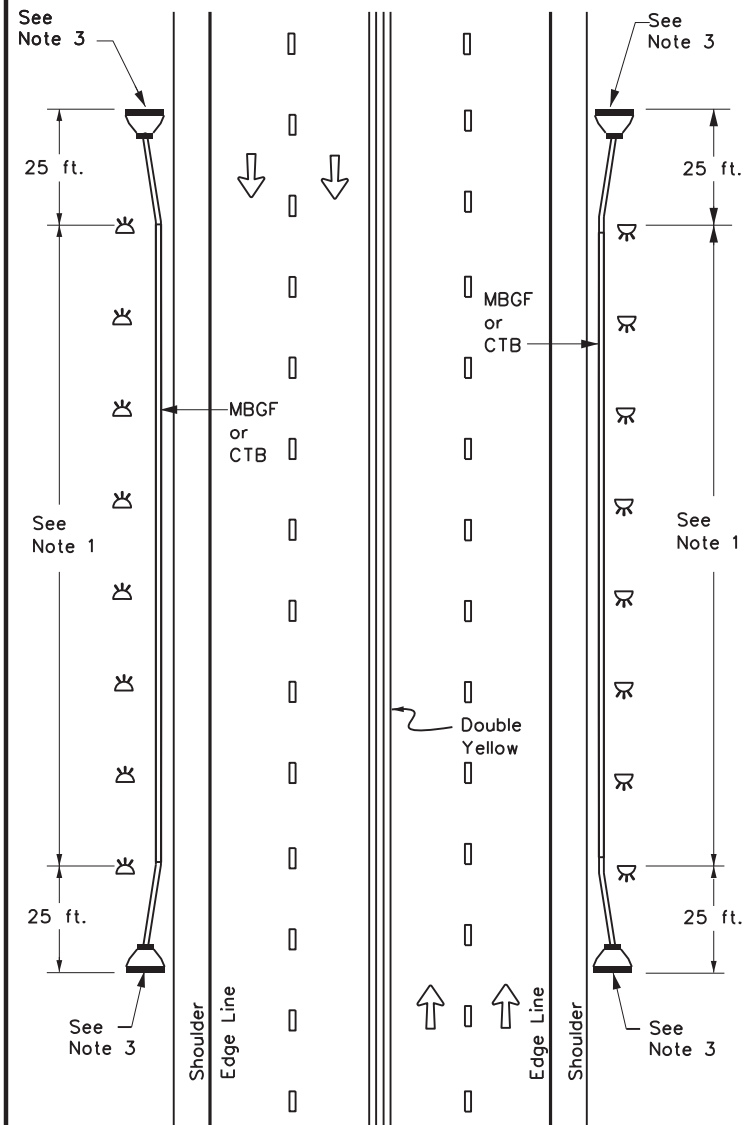
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CONTINUOUS CONCRETE OR STEEL BARRIER

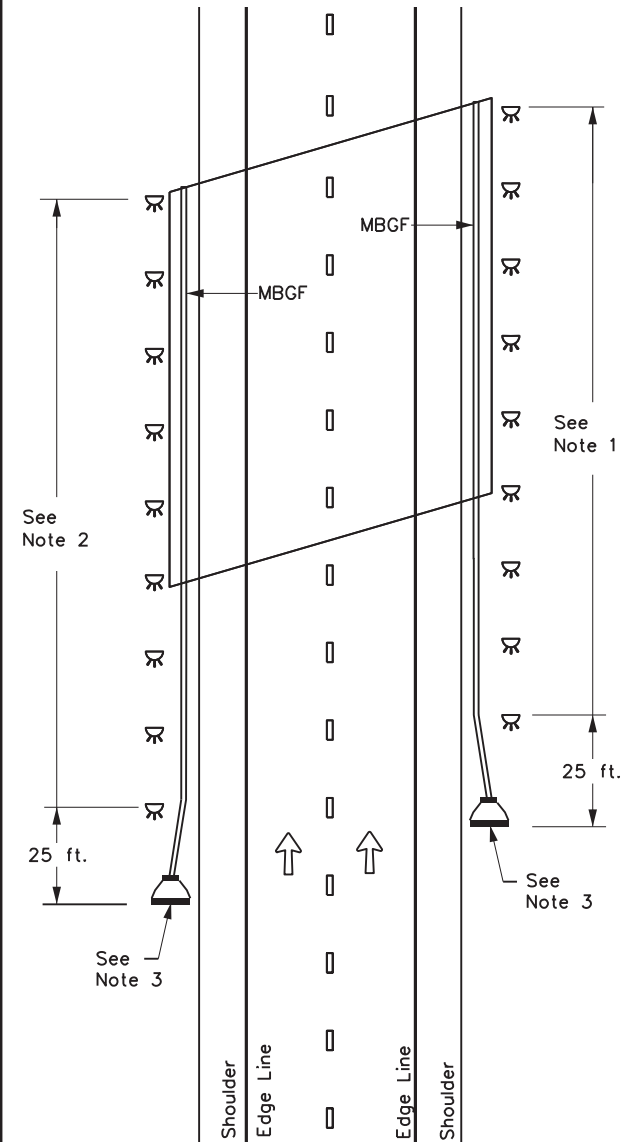
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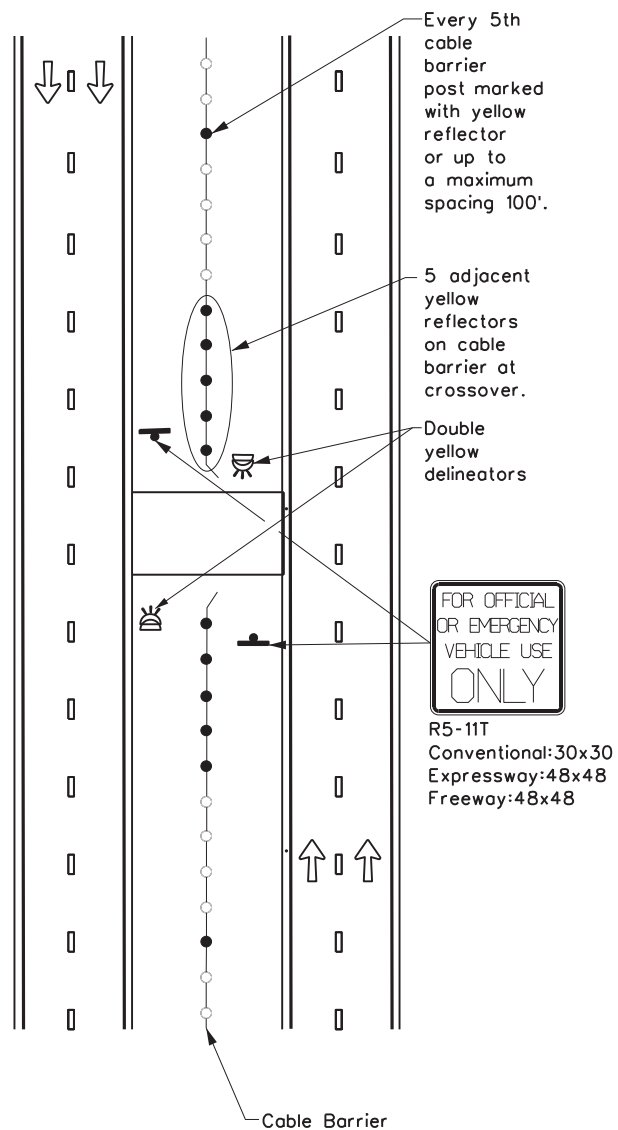
MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



DIVIDED ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



EMERGENCY CROSSOVER



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NOTES

1. Equal spacing (100' max), but not less than 3 single directional white barrier reflectors or delineators. On Continuous Barrier, equal spacing (100' max.)
2. Equal spacing (100' max), but not less than 3 single directional yellow barrier reflectors or delineators.
3. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow

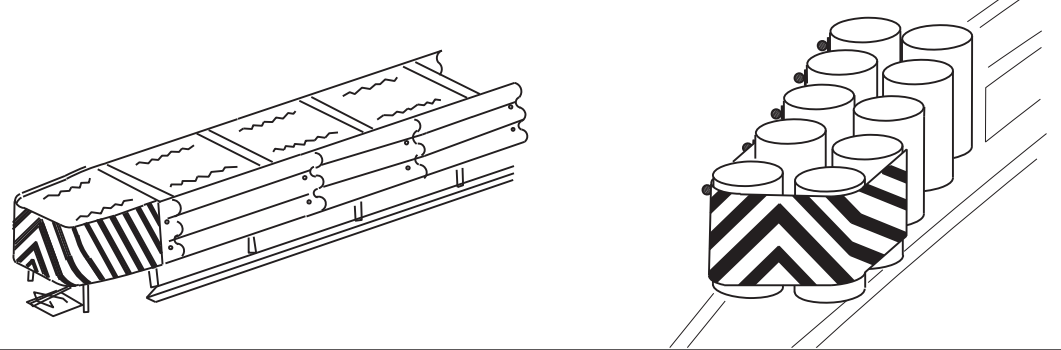
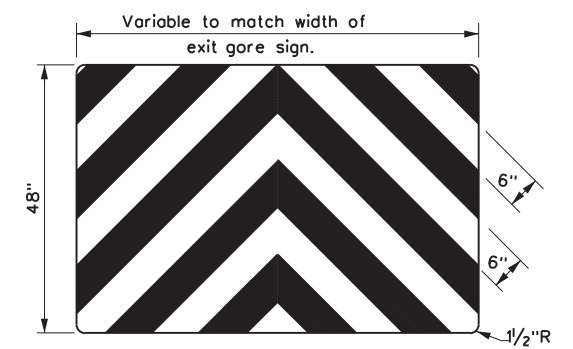
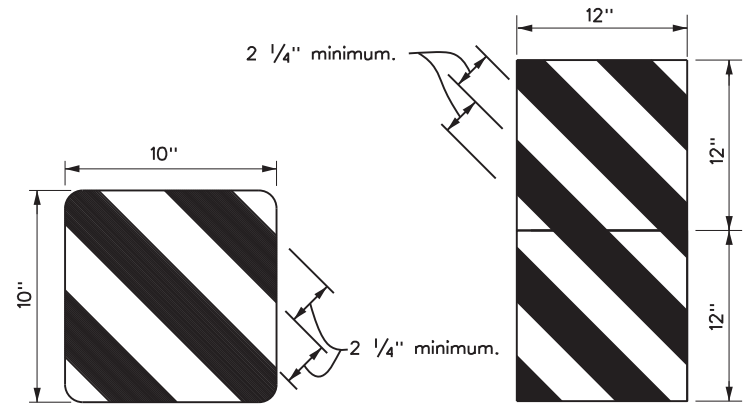
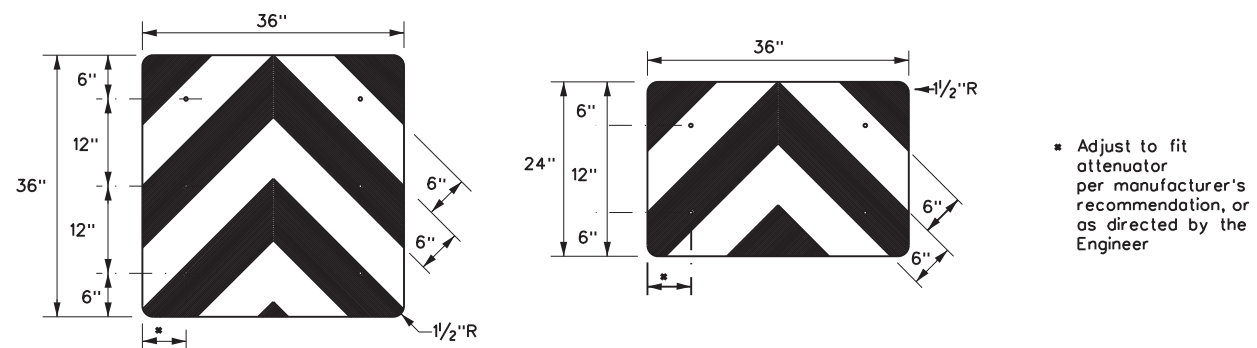
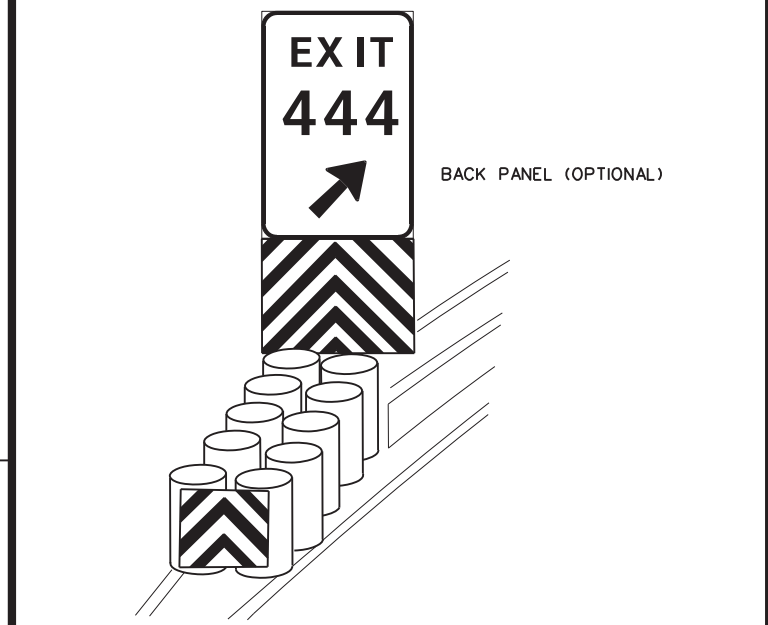
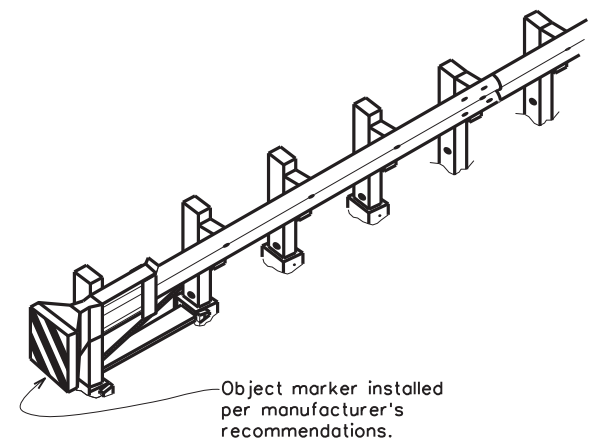
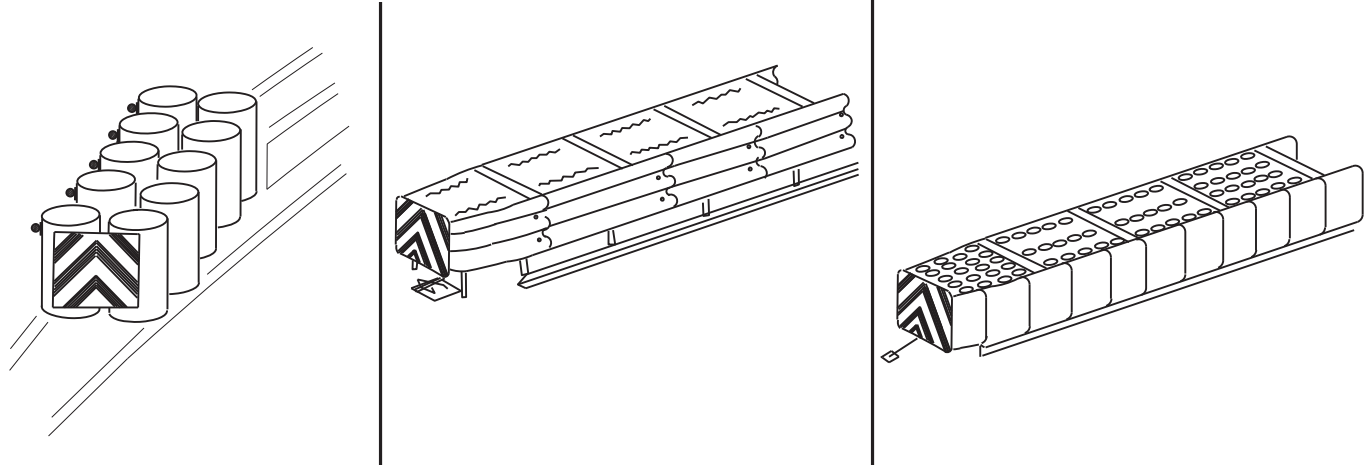


DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(6)-20

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© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	6467	89	001	US 190, ETC
7-20	DIST	COUNTY	SHEET NO.	
	WACO	BELL, ETC	86	

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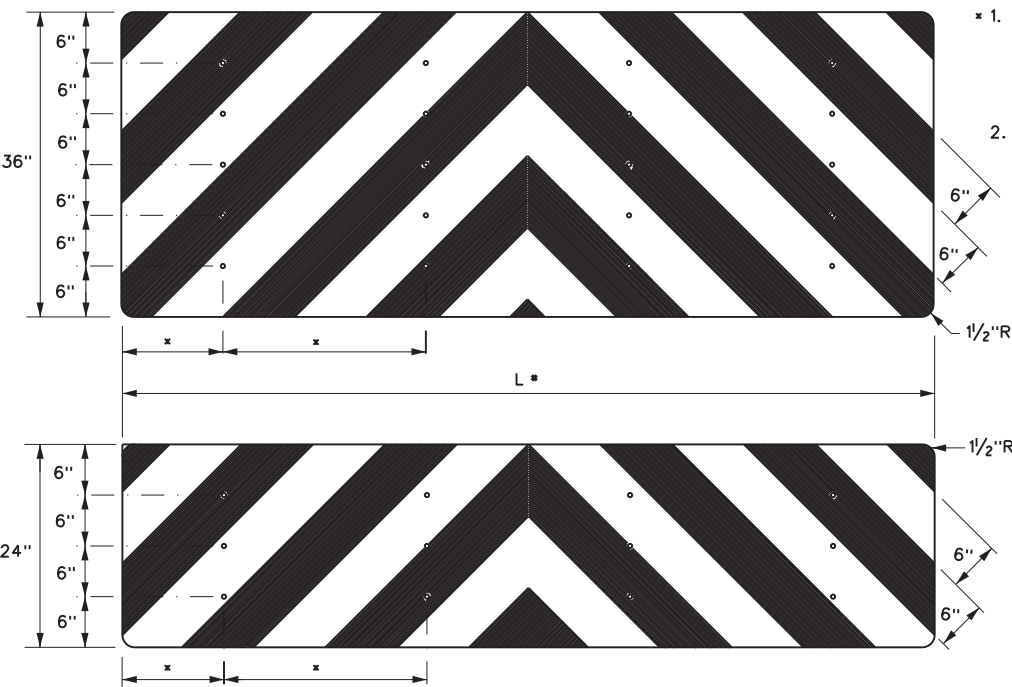
OBJECT MARKERS SMALLER THAN 3 FT²

NOTES

- Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.
- Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.
- Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 1/4".
- Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.
- Object Marker at nose of attenuator is subsidiary to the attenuator.
- See D & OM (1-4) for required barrier reflectors.

NOTES

- Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturer's recommendation, or as directed by the Engineer.
- Mounting should be flush with top of attenuator. Minimum size 96" x 24".

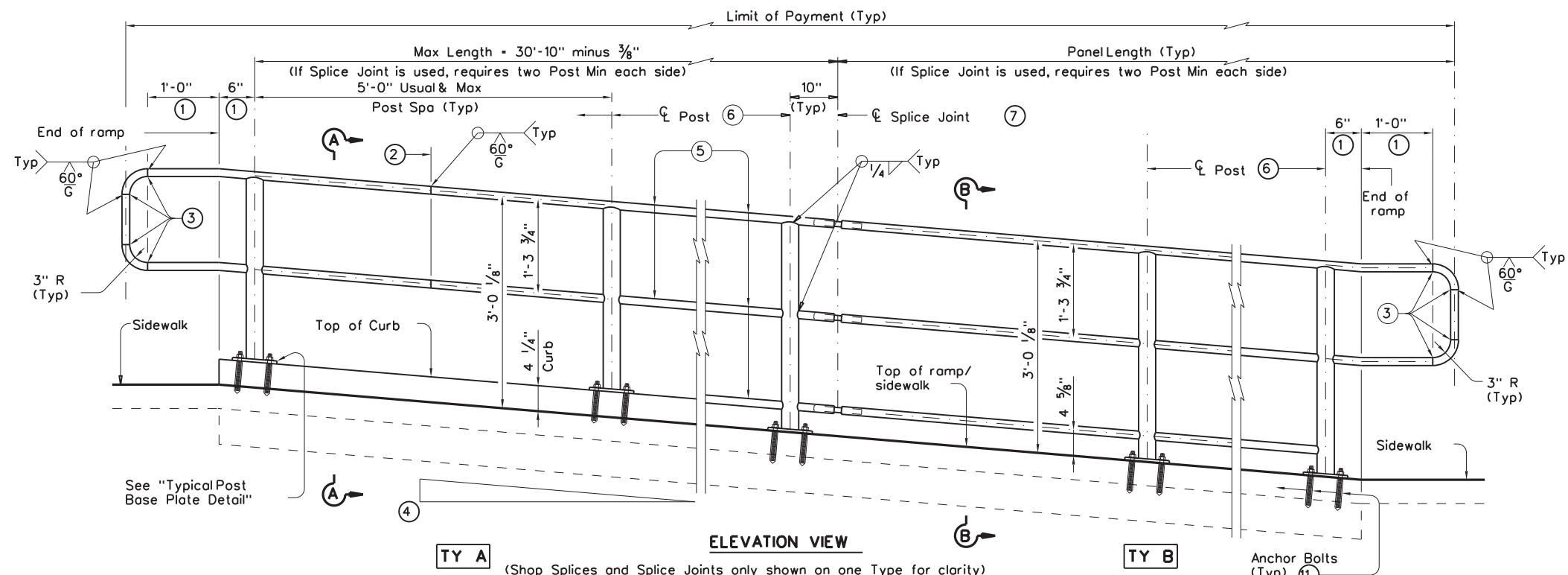


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		Traffic Safety Division Standard	
DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS D & OM(VIA)-20			
FILE: domvia20.dgn	DW: TXDOT	CK: TXDOT	DW: TXDOT
© TXDOT December 1989	CONT: 6467	SECT: 89	JOB: 001
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4-92 8-04	DIST: WACO	COUNTY: BELL, ETC	SHEET NO.: 87
8-95 3-15			
4-98 7-20			
20G			

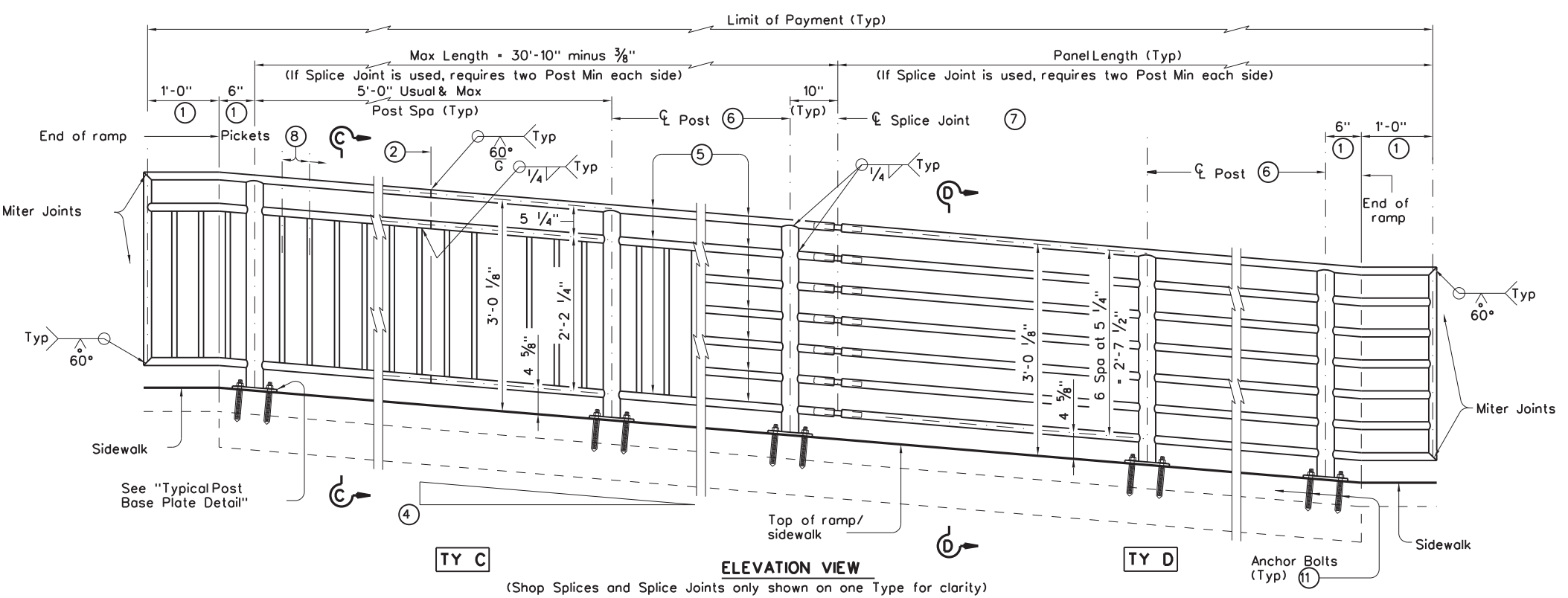
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TY A (Shop Splices and Splice Joints only shown on one Type for clarity)

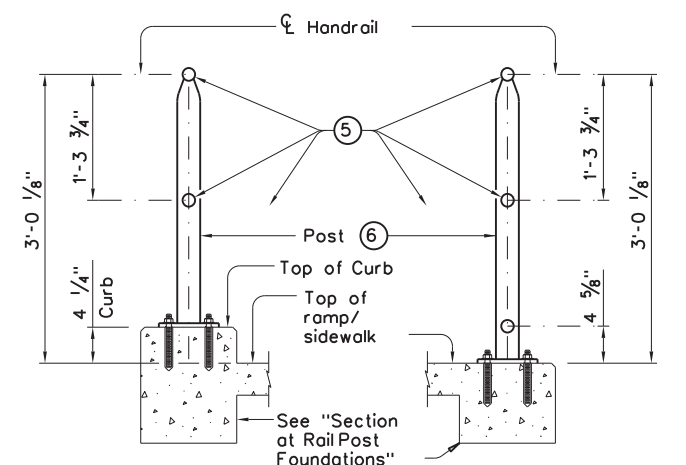
TY B (Showing Handrail)



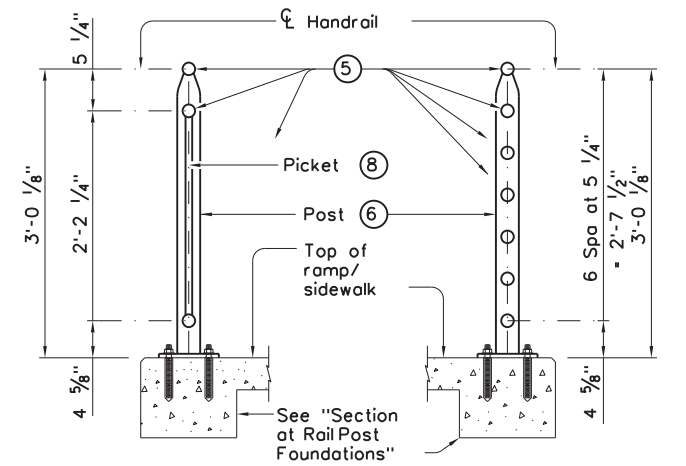
TY C (Showing Handrail)

TY D (Showing Handrail)

RECOMMENDED USAGE ⑨ ⑩	
Dropoff Height/Condition	Recommended Rail Options
<30" dropoff	TY A, TY B, TY C, or TY D
≥ 30" dropoff, or along Bike Path	TY E or TY F



SECTION A-A (Showing Handrail) **TY A** **SECTION B-B** (Showing Handrail) **TY B**



SECTION C-C (Showing Handrail) **TY C** **SECTION D-D** (Showing Handrail) **TY D**

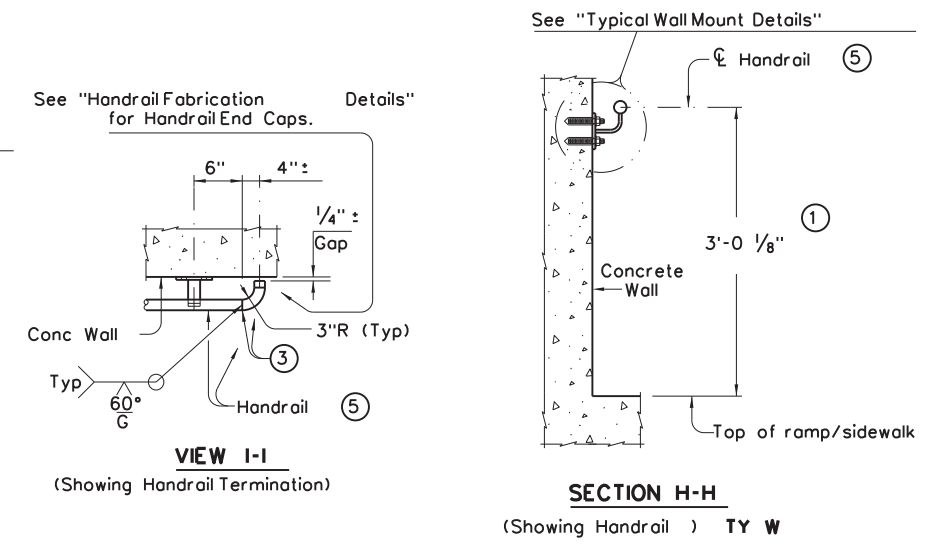
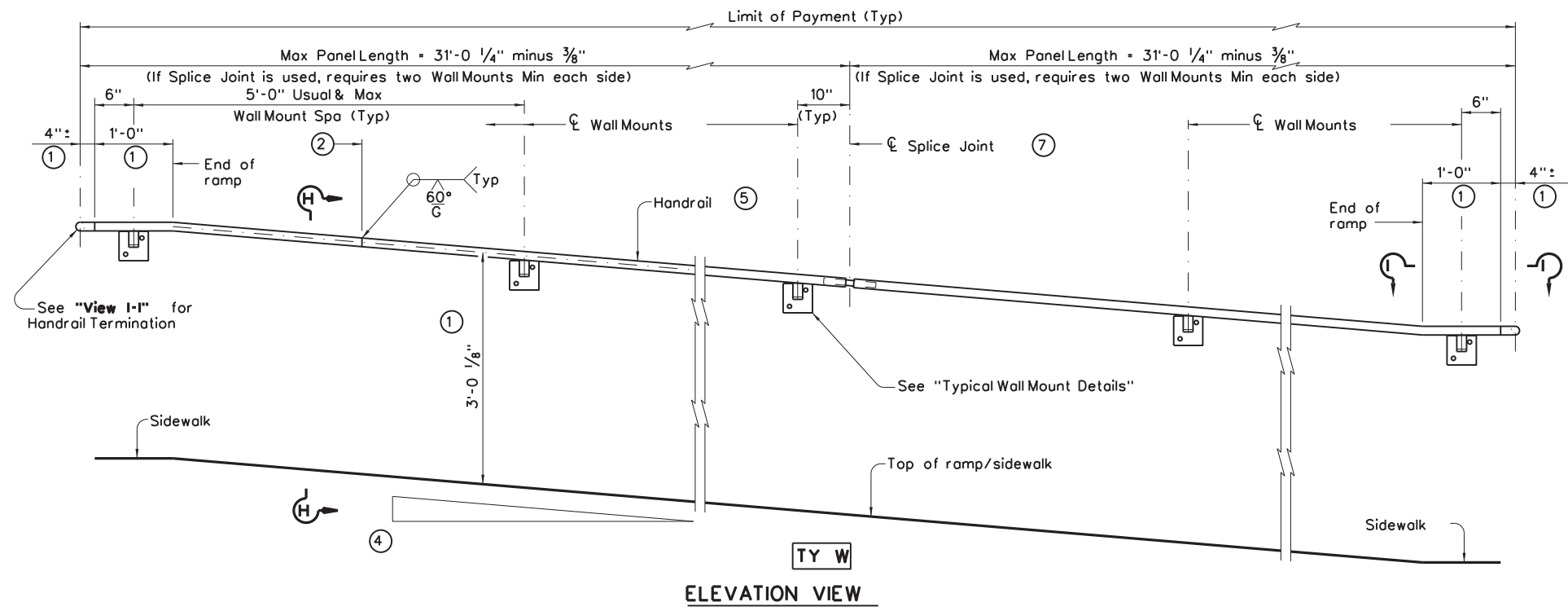
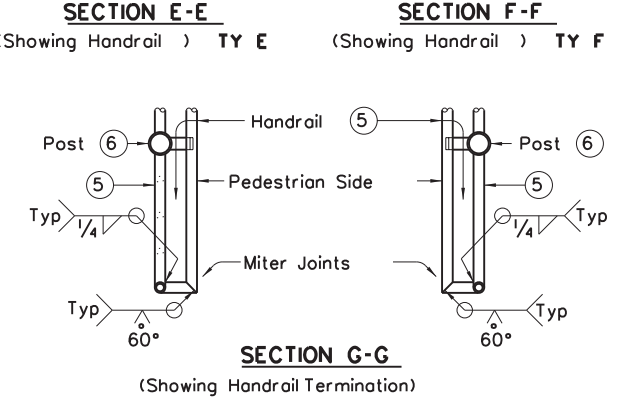
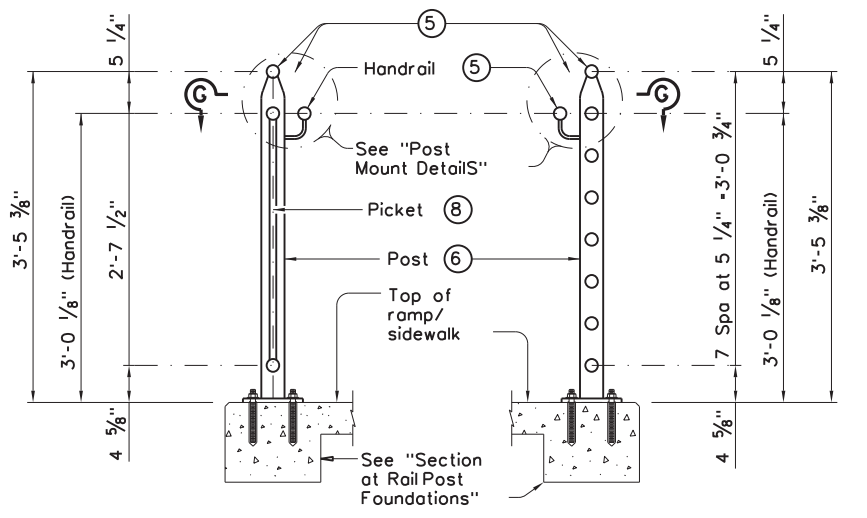
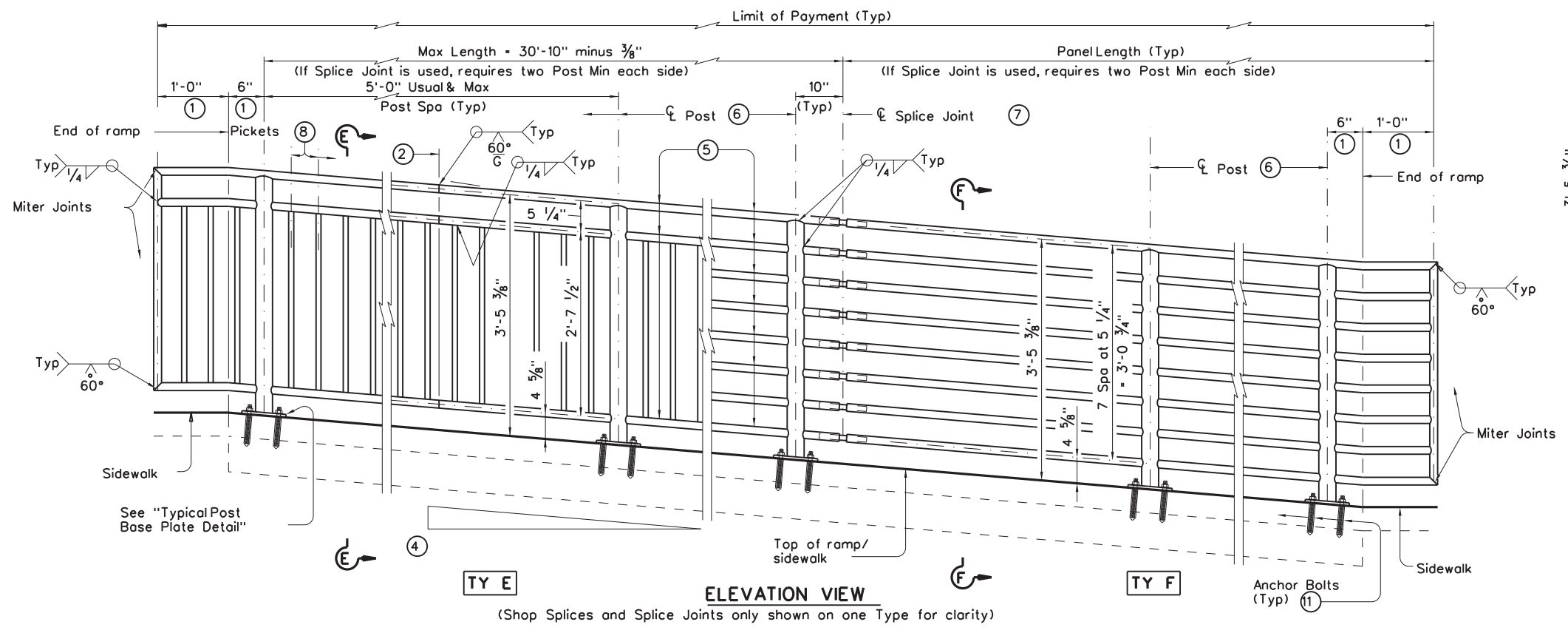
SHEET 1 OF 3

- ① Parallel to ground.
- ② One shop splice per panel is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.
- ③ Shop splice is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.
- ④ See Ramp Details located elsewhere in plans for ramp slope and dimensions. Maximum ramp slope will not exceed 8.3 percent. Level landing required for each 30" rise if grade exceeds 5 percent.
- ⑤ 1 1/2" Dia. Standard Pipe (1.900" O.D., 0.145" wall thickness). Parallel to ramp / sidewalk. Provide holes as needed in 1 1/2" Dia. pipe for galvanizing drainage and venting.
- ⑥ 2 1/2" Dia. Standard Pipe (2.875" O.D., 0.203" wall thickness). See "Post Mount Detail" for crimping and trimming post to fit Dia. of top rail. Provide holes as needed in post for galvanizing drainage and venting. Plumb all posts.
- ⑦ See "Handrail Fabrication Details" for Splice Joints.
- ⑧ 5/8" Dia. Round Bar equal spacing at 4 1/2" Max. Plumb all pickets.
- ⑨ When needed for accessibility (grade 5 percent) or as needed for pedestrian safety.
- ⑩ Not to be used on bridges.
- ⑪ See "General Notes" for anchor bolt information.

		Design Division Standard	
<h2>PEDESTRIAN HANDRAIL DETAILS</h2> <h3>PRD-13</h3>			
FILE: prd13.dgn	DN: TxDOT	CK: AM	DW: JTR
© TxDOT December 2006	CONT: 89	SECT: 001	HIGHWAY: US 190, ETC
REVISIONS	6467	89	
REVISED MAY, 2013 (VP)	DIST: WACO	COUNTY: BELL, ETC	SHEET NO.: 88

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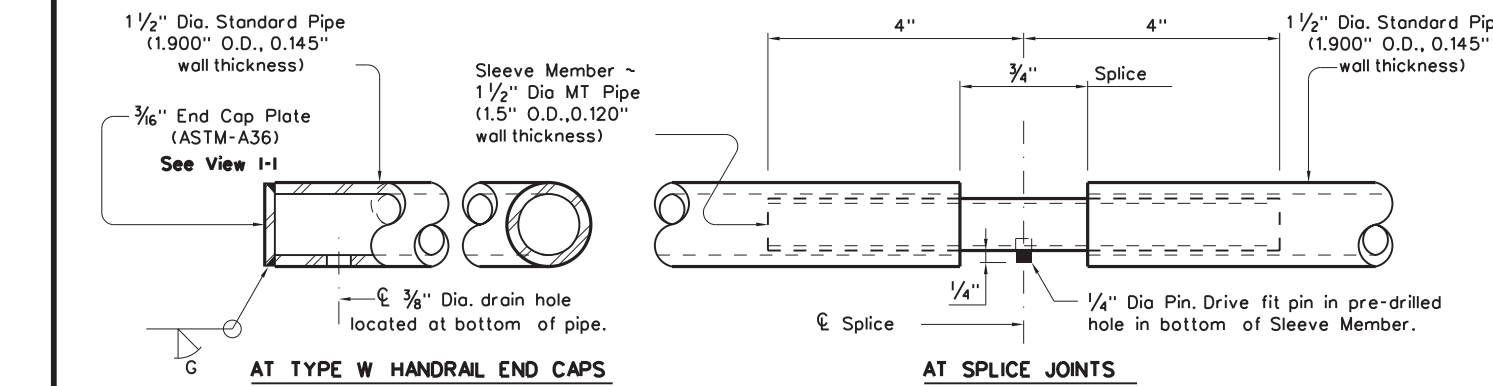
- ① Parallel to ground.
- ② One shop splice per panel is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.
- ③ Shop splice is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.
- ④ See Ramp Details located elsewhere in plans for ramp slope and dimensions. Maximum ramp slope will not exceed 8.3 percent. Leveling required for each 30" rise if grade exceeds 5 percent.
- ⑤ 1 1/2" Dia. Standard Pipe (1.900" O.D., 0.145" wall thickness). Parallel to ramp / sidewalk. Provide holes as needed in 1 1/2" Dia. pipe for galvanizing drainage and venting.
- ⑥ 2 1/2" Dia. Standard Pipe (2.875" O.D., 0.203" wall thickness). See "Post Mount Detail" for crimping and trimming post to fit Dia. of top rail. Provide holes as needed in post for galvanizing drainage and venting. Plumb all posts.
- ⑦ See "Handrail Fabrication Details" for Splice Joints.
- ⑧ 5/8" Dia. Round Bar equal spacing at 4 1/2" Max. Plumb all pickets.
- ⑪ See "General Notes" for anchor bolt information.



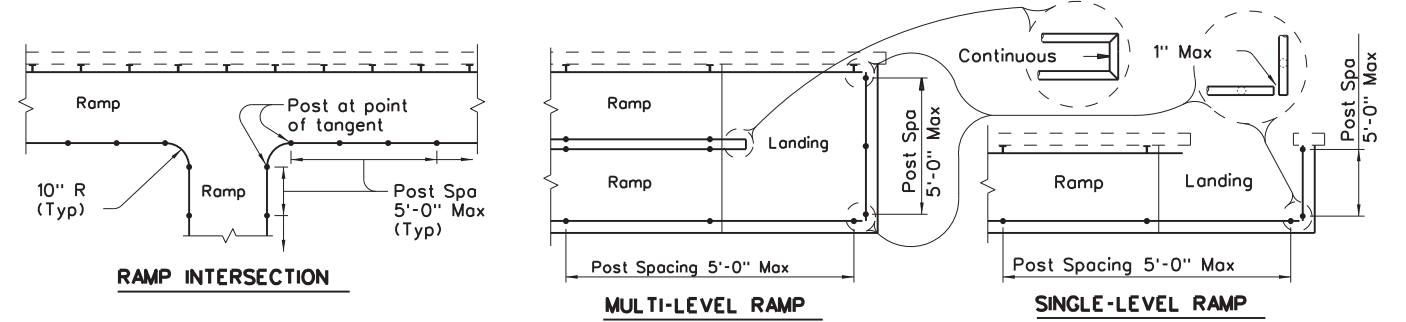
**PEDESTRIAN HANDRAIL
 DETAILS
 PRD-13**

FILE: prd13.dgn	DN: TxDOT	CK: AM	DW: JTR	CK: CGL
© TxDOT December 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS REVISED MAY, 2013 (VP)	6467	89	001	US 190, ETC
DIST	COUNTY	SHEET NO.		
WACO	BELL, ETC	89		

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HANDRAIL FABRICATION DETAILS



PLAN SHOWING RAIL AT RAMP CONDITIONS

GENERAL NOTES

Designed according to ADAAG, Texas Accessibility Standards, Uniform Building Code, and AASHTO LRFD Specifications.

Handrail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

Pipe will conform to ASTM-A53 Grade B or A500 Grade B. Steel plates and steel bars will conform to ASTM-A36. Mechanical tubing (MT) will conform to ASTM A513 Grade 1015 or higher. Galvanize all steel components except reinforcing steel unless noted otherwise.

Concrete for foundations will be in accordance with Item 531 "Sidewalks". All reinforcing steel must be Grade 60. Bar laps, where required, will be as follows: Uncoated ~ 4 - 1'-5" Epoxy coated ~ 4 - 2'-1"

When the plans require painted steel, follow the requirements for painting galvanized steel in Item 446, "Cleaning and Painting Steel". Sleeve Members will receive galvanization and only get field painted after installation unless directed otherwise by Engineer.

Epoxy Anchor bolts for wall mount and post base plate will be 5/8" Dia. ASTM A36 threaded rods with one hex nut and one hardened steel washer at each bolt. 5/8" Dia. threaded rod embedment depth for wall mounts is 3 1/2" and embedment depth for post base plate is 5".

Embed threaded rods into concrete with a Type III (Class C) epoxy meeting the requirements of DMS-6100, "Epoxy and Adhesives". Mix and dispense adhesive with the manufacturer's static mixing nozzle/dual cartridge system. Core drill holes (percussion drilling not permitted).

At the contractor's option the post base plate anchor bolts may be cast with the Ramp/Sidewalk (See Cast-in-Place Anchor Bolt Options).

Optional cast-in-place anchor bolts will be 5/8" Dia ASTM A307 Grade A bolts (or A36 threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer at each bolt. Embedment depth of cast-in-place bolt will be 8" for post base plate.

Handrails and any wall or other surface adjacent to them will be free of any sharp or abrasive elements.

Submit shop drawings to the Engineer unless otherwise noted. For curved handrail applications, fabricate the handrail to the curve if radius is less than 600 ft. Shop drawings are required when rails are fabricated to the curve.

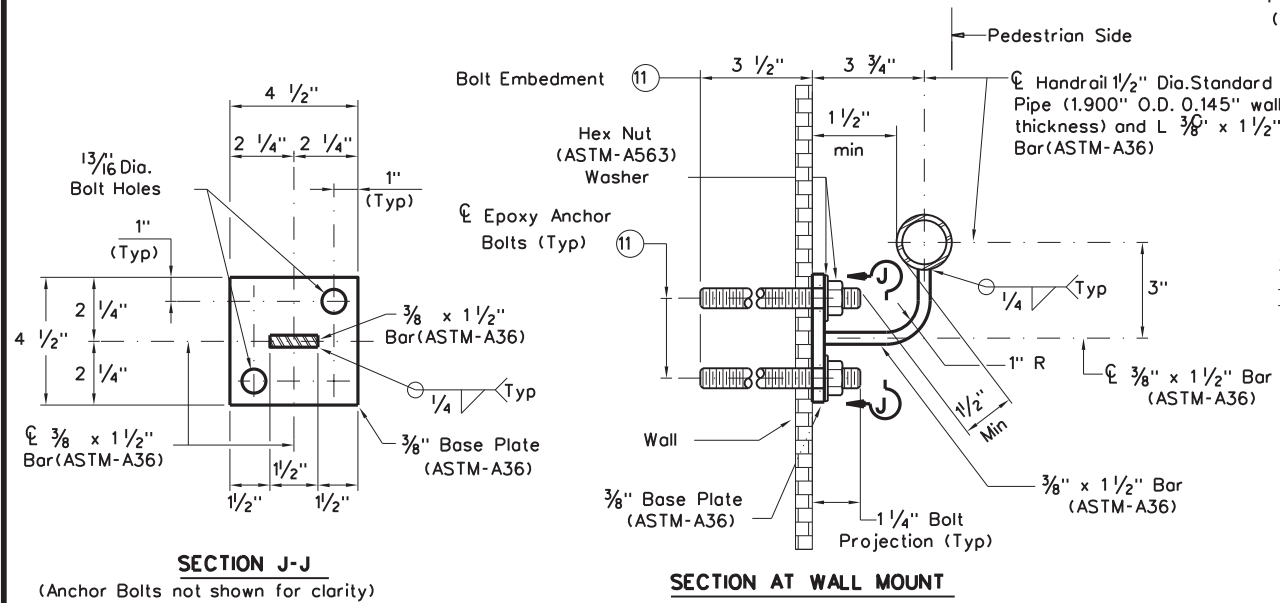
For all handrails, erection drawings will be submitted to the Engineer for approval to ensure proper installation.

Drawings will show handrail mount locations with bolts setting, spacing, ramp slope, and/or splice joint locations, and handrail lengths with identification showing where each handrail goes on the layout.

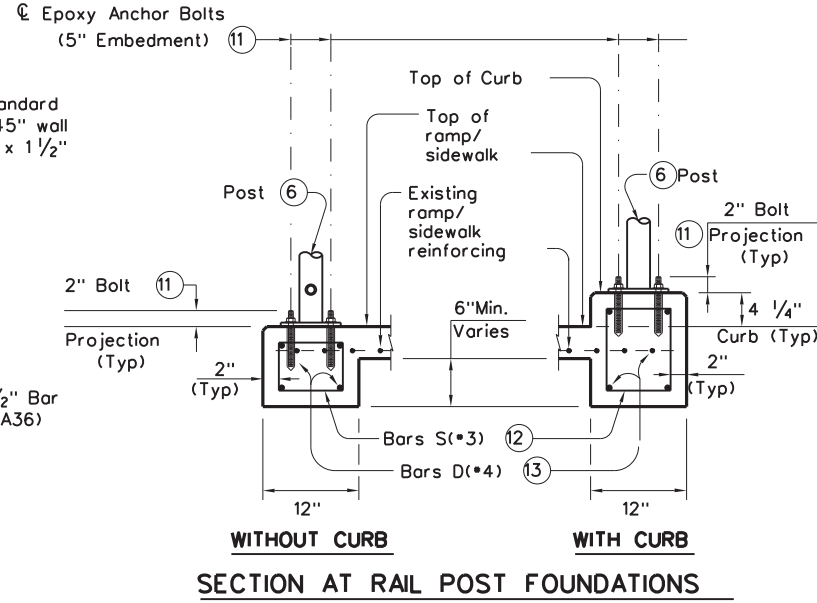
Payment for concrete sidewalks or curb ramps will be paid for in accordance with Item 531 "Sidewalks".

Payment for all items shown is to be included in unit price bid in accordance with Item 450 "Railing" of the type specified.

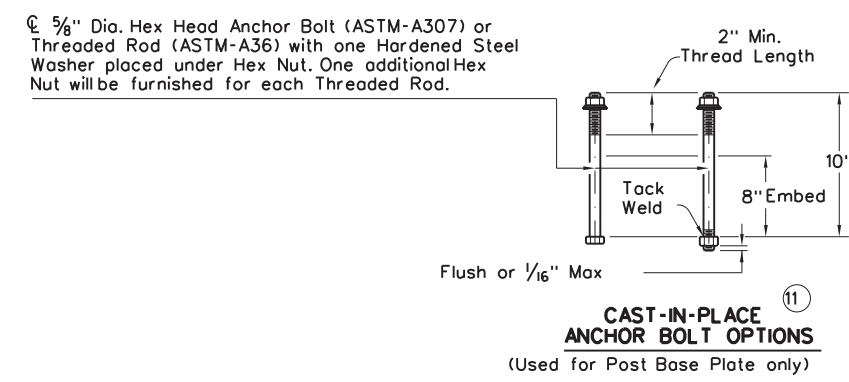
All exposed edges will be rounded or chamfered to approximately 1/8" by grinding.



TYPICAL WALL MOUNT DETAILS

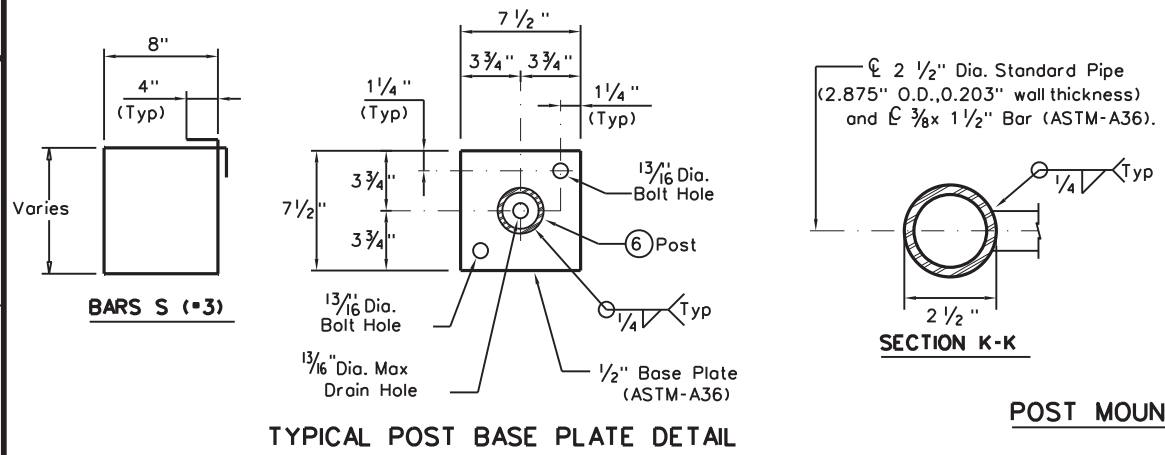


SECTION AT RAIL POST FOUNDATIONS



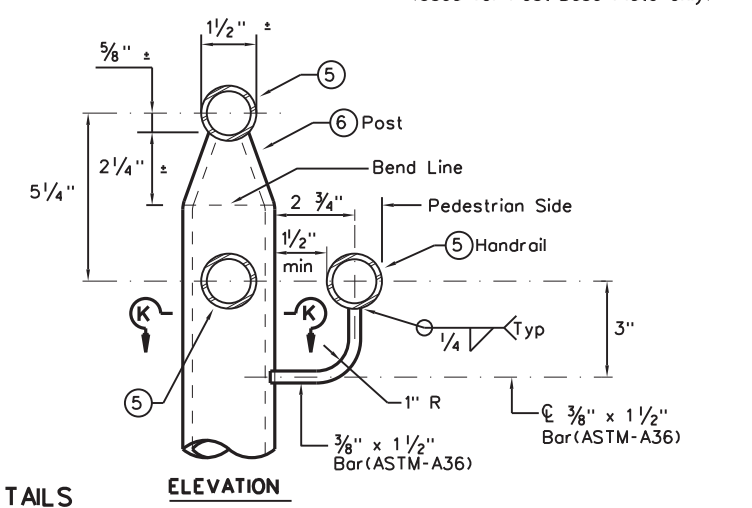
CAST-IN-PLACE ANCHOR BOLT OPTIONS
(Used for Post Base Plate only)

- ⑤ 1 1/2" Dia. Standard Pipe (1.900" O.D., 0.145" wall thickness). Parallel to ramp/sidewalk. Provide holes as needed in 1 1/2" Dia. pipe for galvanizing drainage and venting.
- ⑥ 2 1/2" Dia. Standard Pipe (2.875" O.D., 0.203" wall thickness). Plumb all posts. See "Post Mount Detail" for crimping and trimming post to fit the diameter of top rail. Provide holes as needed in post for galvanizing drainage and venting.
- ⑪ See "General Notes" for anchor bolt information.
- ⑫ Bars S(*3) spaced at 12" Max (Spaced 3" from outside edge of overall length of Ramp/Sidewalk).
- ⑬ Provide 1 1/2" end cover to Bars D(*4) from outside edge of overall length of Ramp/Sidewalk.



TYPICAL POST BASE PLATE DETAIL

POST MOUNT DETAILS



ELEVATION

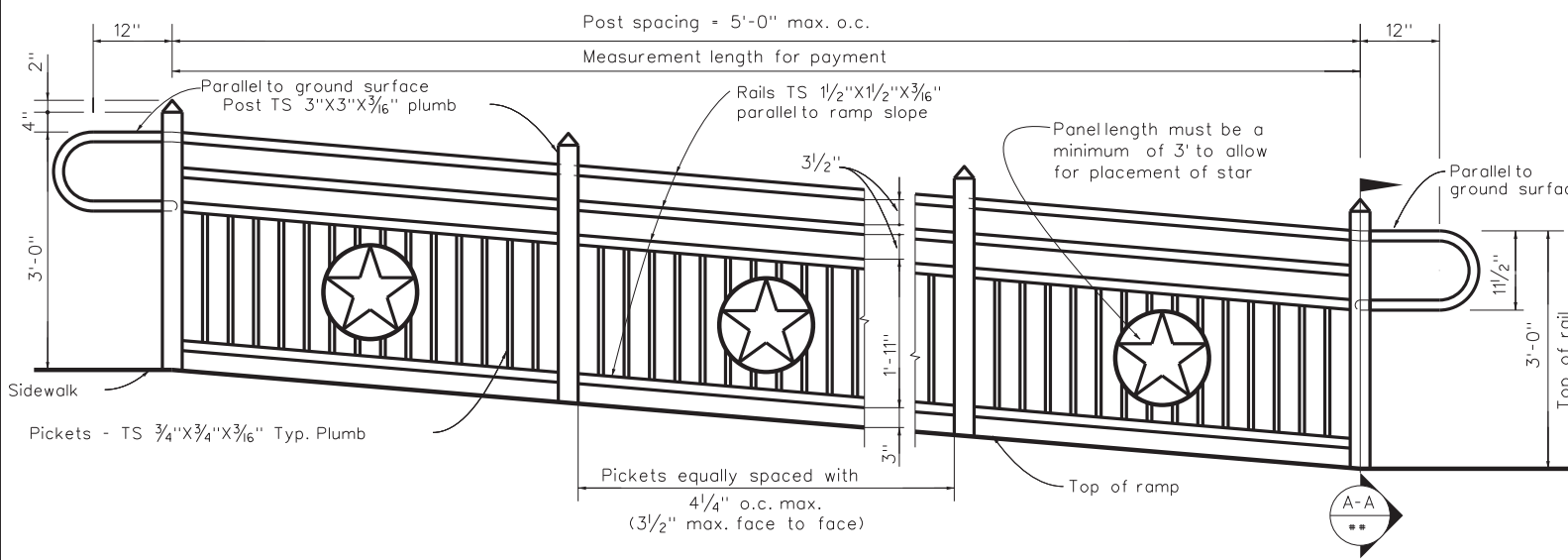


PEDESTRIAN HANDRAIL DETAILS
PRD-13

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REVISED MAY, 2013 (VP)	DIST	COUNTY	SHEET NO.	
	WACO	BELL, ETC	90	

DATE: 7/29/2024 10:43:13 AM
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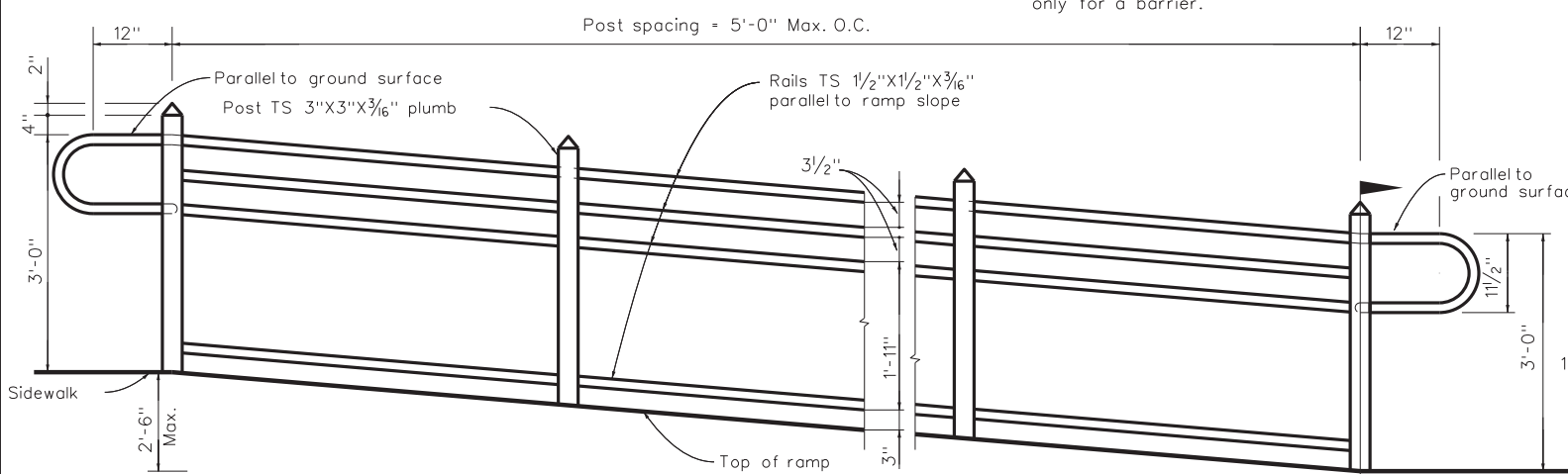
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TYPE A HANDRAIL ON RAMP

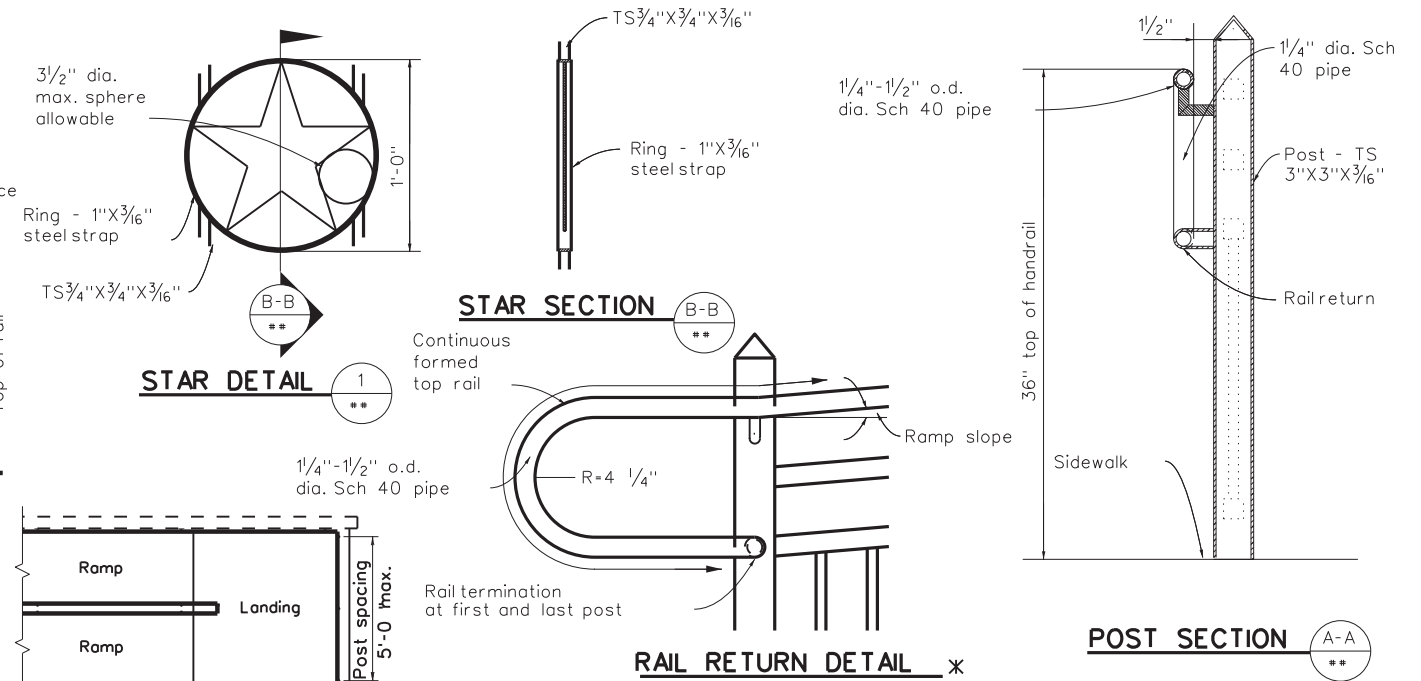
(Used in all cases unless the use will create a site obstruction)

* Type D Handrail eliminates the grasping bar and rail returns. All other elements remain the same. Type D Handrail shall be used only for a barrier.



TYPE B HANDRAIL ON RAMP

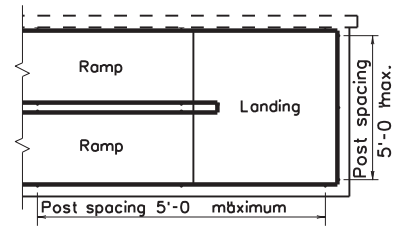
(Used where ramp or sidewalk is less than 2'-6" above adjacent surface and where Type A rail creates a sight obstruction.)



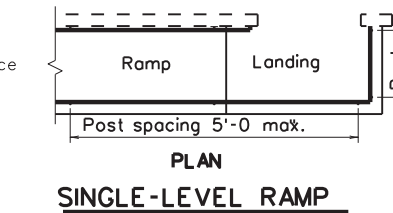
STAR DETAIL

STAR SECTION

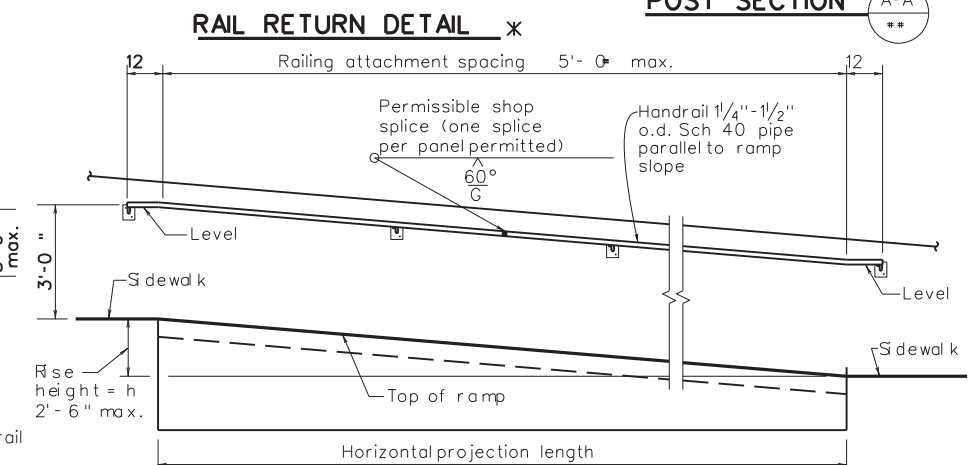
POST SECTION



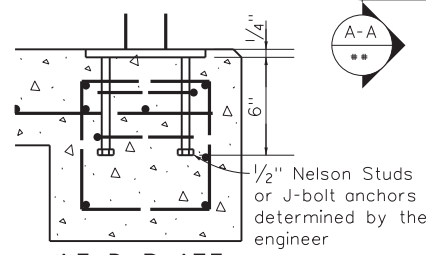
MULTI-LEVEL RAMP



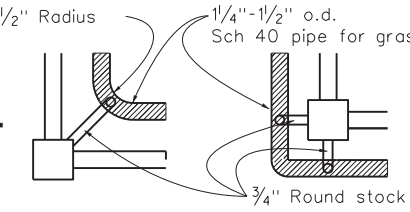
SINGLE-LEVEL RAMP



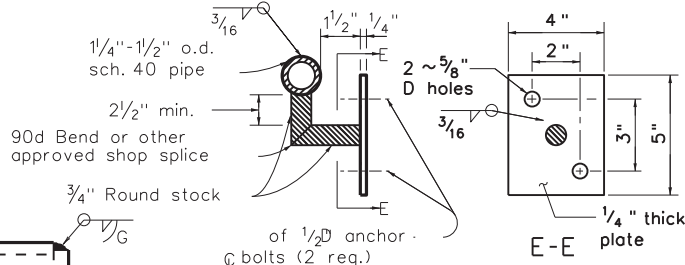
TYPE C HANDRAIL ON WALL



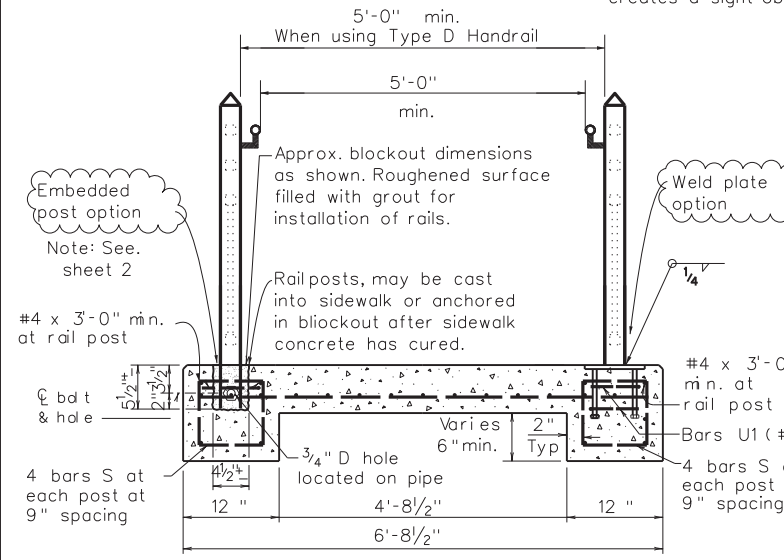
WELD PLATE ANCHOR



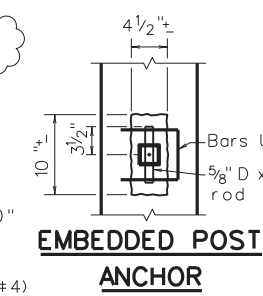
HANDRAIL ATTACHMENT DETAIL



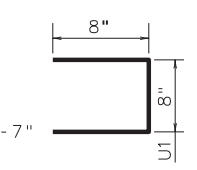
WALL MOUNT DETAILS



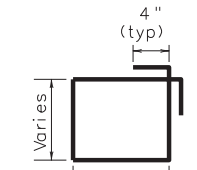
ELEVATION



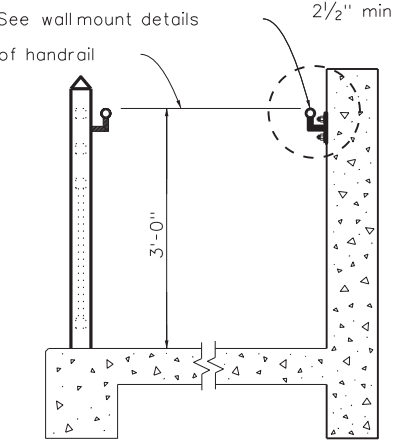
EMBEDDED POST ANCHOR



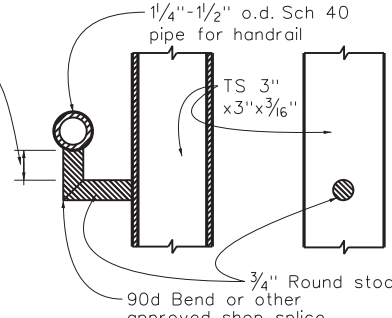
BARS U (#)



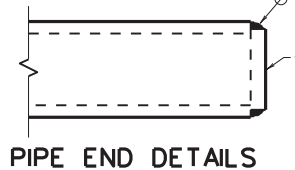
BARS S (#)



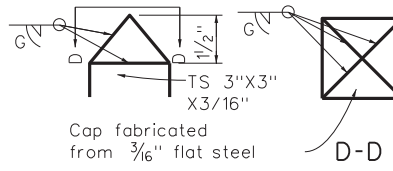
COMBINATION OF HANDRAIL ON WALL AND RAMP



HANDRAIL TO POST MOUNT DETAILS



PIPE END DETAILS



POST CAP DETAIL

R = Radius
D = Diameter

Added type D handrail 02-28-12

Texas Department of Transportation

WACO DISTRICT HANDRAIL DETAIL

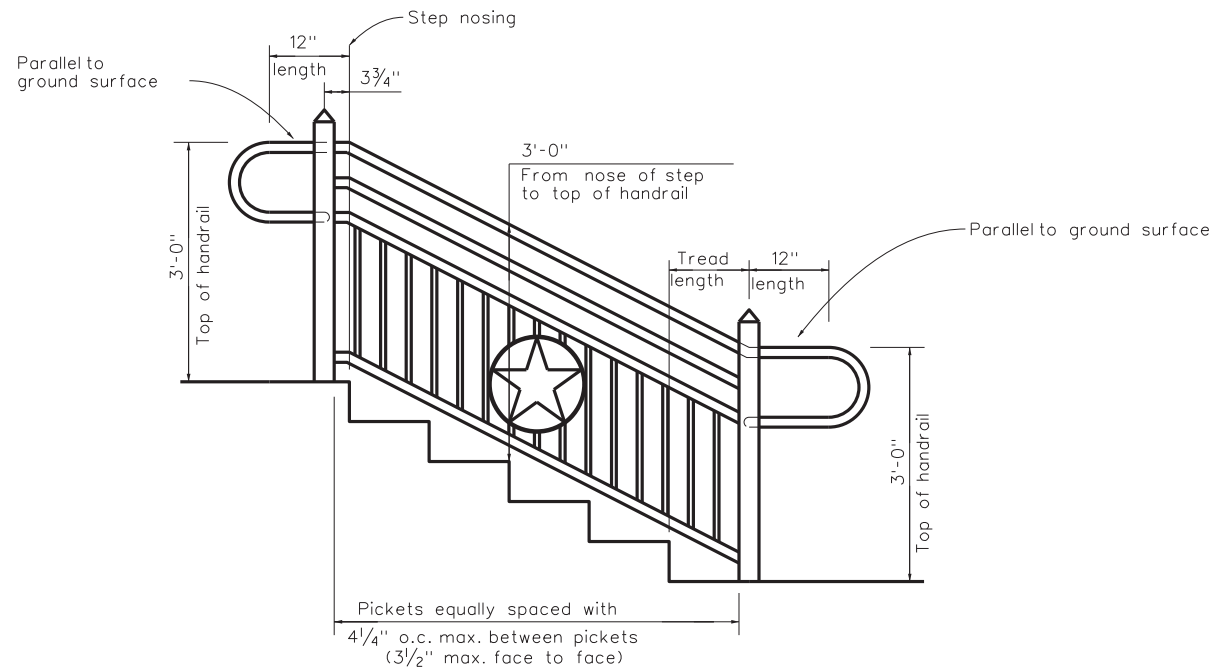
SHEET 1 OF 2

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	BELL, ETC	6467	89 001	US 190, ETC	

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GENERAL NOTES

1. The designer should carefully evaluate the site conditions to determine the necessity and extent of the warrant for handrail.
2. The designer should use careful judgment in specifying the type of handrail to be used.
3. Type 'A' handrail is to be used in all cases, unless its use will create a site obstruction, or it is adjacent to the wall of a building or a retaining wall.
4. Type 'B' handrail is to be used in cases where the Type 'A' handrail creates a site obstruction. If Type 'B' handrail is used, the ramp and/or sidewalk height above any adjacent surface shall not be more than 2'-6". Type 'B' handrail can be used adjacent to Concrete Block Retaining Walls ("Keystone" or similar type wall construction).
- △ 5. Type D handrails to be used only as a barrier.
6. Where handrail is placed adjacent to the wall of a building, Type 'B' handrail is to be used unless there is an agreement with the building owner to use Type 'A' handrail.
7. Handrail 'C' is to be used on concrete retaining walls, provided the retaining wall is TxDOT property. Otherwise, use handrail 'B', or for screening purposes, use handrail 'A'.
8. If handrail is placed on a retaining wall or the wall of a building, and the wall surface is irregular, ensure there is a minimum of 1/2" clearance between the wall surface and the handrail.
9. If handrail is used on a ramp for its intended purpose of accessibility assistance, it must be placed on both sides of the ramp. If handrail is used only as a drop off or fall barrier to pedestrian traffic, it may be used as necessary on only one side of a ramp or sidewalk.
10. Design conforms to Texas Department of Licensing and Regulation (TDLR) Texas Accessibility Standards (TAS), Americans with Disabilities Act Accessibility guidelines (ADAAG), and AASHTO Specifications. Handrail must be installed in compliance with these standards and guidelines.
11. Handrails shall not rotate within their fittings.
12. Handrails shall be at a consistent height above ramp surface.
13. See Sidewalk and Ramp details and/or plan drawings for ramp slopes, dimensions, configurations, and reinforcing steel. This standard shows additional reinforcing steel required for handrail.
14. Posts are to be attached to the concrete utilizing weld plates or embedded posts. Bolt down anchor plates are not acceptable. Weld plates are specifically to be used where there is a high possibility the handrail can be damaged by vehicles.
15. Measurement for payment will be the dimension between the centerline of the outside posts. The dimension of the rail return will not be included in the measurement for payment, but will be considered subsidiary to Item 450.
16. Material for posts and handrails shall be ASTM A53 Gr B, or A501. Weld plates shall be A36.
17. If the rail return creates a hazard or obstruction, it may be turned outward 90° to the direction of the handrail.
- △ 18. All components shall be painted in strict accordance to TxDOT specification Item 446, Cleaning and Painting Steel, System II, Class A Blast Cleaning. The paint shall be acrylic latex. Primer and paint shall be from the same manufacturer. The surface preparation shall meet the requirements of SSPC-SP 10. The paint color shall be selected by the TxDOT District Landscape Architect. A list of pre-approved structural steel paint manufacturers can be found on TxDOT's website.
18. All welds shall be 3/16" x 3/16" fillet full perimeter on all connections, unless otherwise shown on the plans.
19. Anchor bolts for handrail attached to a retaining wall shall be placed using an adhesive doweling system approved by the engineer. Anchor bolts shall have an allowable capacity of 2400 lbs in tension and 2300 lbs in shear. Installation of the anchor bolts, including hole depth and diameter, shall be in accordance with the manufacturer's recommendation. If required by the engineer, 3 of the first 10 anchors, and 5% of the remaining anchors shall be tested to 70% of the minimum yield. The contractor shall provide a suitable ram, pump, pressure gauge, and reaction system.
20. Anchor bolts for the attachment of handrail to concrete retaining wall shall conform to ASTM A36 or approved equal. Nuts for anchor bolts shall conform to ASTM A563 Gr A or better heavy hex. Threads for anchor bolts and nuts shall be rolled or cut threads of unified national coarse (UNC) thread series. Bolts and nuts shall have class 2A and 2B fit tolerances. Washers shall be included with each bolt.
21. Exposed edges of handrail and posts shall be rounded or chamfered to approximately 1/8" by grinding. Finished handrail system shall have no burrs.
22. Weld plates, other anchoring systems, rail returns, post caps, star emblem, and painting are to be including in the unit bid price for railing.
23. Erection drawings showing panel lengths, splice locations, rail post spacing, star emblem placement, and anchoring selection shall be submitted to the engineer for approval prior to installation of any handrail component. Any handrail component installation prior to approval of erection drawings will be subject to rejection.

△ - CHANGED ON 2/28/2012
 △ - CHANGED ON 4/7/2006



**WACO DISTRICT
 HANDRAIL DETAIL**

SHEET 2 OF 2

FILE:	DN:	CK:	OW:	CK:	NEG:
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REVISIONS	DIST	FED REG	PROJECT No.	SHEET	
4/7/2006 - NOTE #17 CHANGED (BRL)	WACO	6	RMC 646789001	92	
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 125 E. 11th Street
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 Charles.W.Smith@txdot.gov
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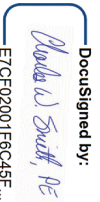
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 Charles.W.Smith@txdot.gov
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Signer Events

Charles Smith
 charles.w.smith@txdot.gov
 Asst. Dist. Design Engineer
 Texas Department of Transportation
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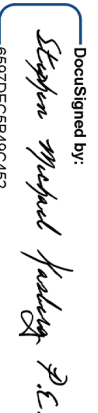
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 stephen.kasberg@txdot.gov
 Director of Maintenance
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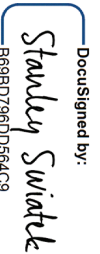
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- ii. send us an e-mail to kevin.setoda@txdot.gov and in the body of such request you must state your e-mail, full name, IS Postal Address, telephone number, and account number. We do not need any other information from you to withdraw consent. The consequences of your withdrawing consent for online documents will be that transactions may take a longer time to process..

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"> • Allow per session cookies

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

** 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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