

FED. RD. DIV. NO.	STATE PROJECT NO.		SHEET NO.
6	BR 2023 (135)		1
STATE	STATE DIST.	COUNTY	
TEXAS	BRY	FREESTONE	
CONT.	SECT.	JOB	HIGHWAY NO.
0917	20	046	CR 481

# STATE OF TEXAS DEPARTMENT OF TRANSPORTATION

## PLANS OF PROPOSED STATE HIGHWAY IMPROVEMENT

PROJECT NO. BR 2023(135)

### CR 481 FREESTONE COUNTY

NET LENGTH OF PROJECT: 335.00 FT. = 0.063 MI.

FOR THE CONSTRUCTION OF BRIDGE REPLACEMENT.  
CONSISTING OF REPLACING BRIDGE AND APPROACHES & GRADING.


#### FINAL PLANS

CONTRACTOR:  
LETTING DATE:  
DATE CONTRACTOR BEGAN WORK:  
DATE WORK WAS COMPLETED:  
DATE WORK WAS ACCEPTED:  
FINAL CONTRACT COST: \$

SEE SHEET 2  
PROJECT LOCATION MAP  
AND SHEET 3 FOR  
INDEX OF SHEETS

LOCATION NO.	CSJ	HIGHWAY	LIMITS	ADT	DESIGN SPEED (MPH)	STATION		ROADWAY LENGTH (FT)	BRIDGE LENGTH (FT)	PROJECT LENGTH (FT)
						FROM	TO			
1	0917-20-046	CR 481	CR 481 AT UPPER KEECHI CREEK STR: 17-082-0-AA04-81-102	2017: 91 2040: 127	MEETS OR EXCEEDS EXISTING	50+40.00	53+75.00	270.00	65.00	335.00

THESE DOCUMENTS WERE PREPARED BY OR UNDER THE SUPERVISION OF:

  
JENNA I. ALCHEVSKY, P.E.

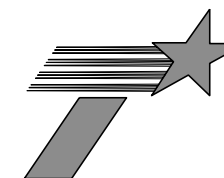
5/14/2023  
DATE

# Jacobs

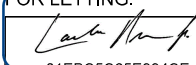
JACOBS ENGINEERING GROUP INC. FIRM #2966  
2705 BEE CAVE ROAD, SUITE 300  
AUSTIN, TEXAS 78746  
(512) 314-3100 FAX (512) 314-3135

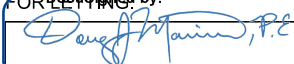
SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS INCLUDED IN THE CONTRACT, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, JUL 05, 2022)

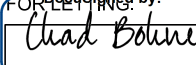
NO EXCEPTIONS  
NO EQUATIONS  
NO RAILROAD CROSSINGS



TEXAS DEPARTMENT OF TRANSPORTATION®

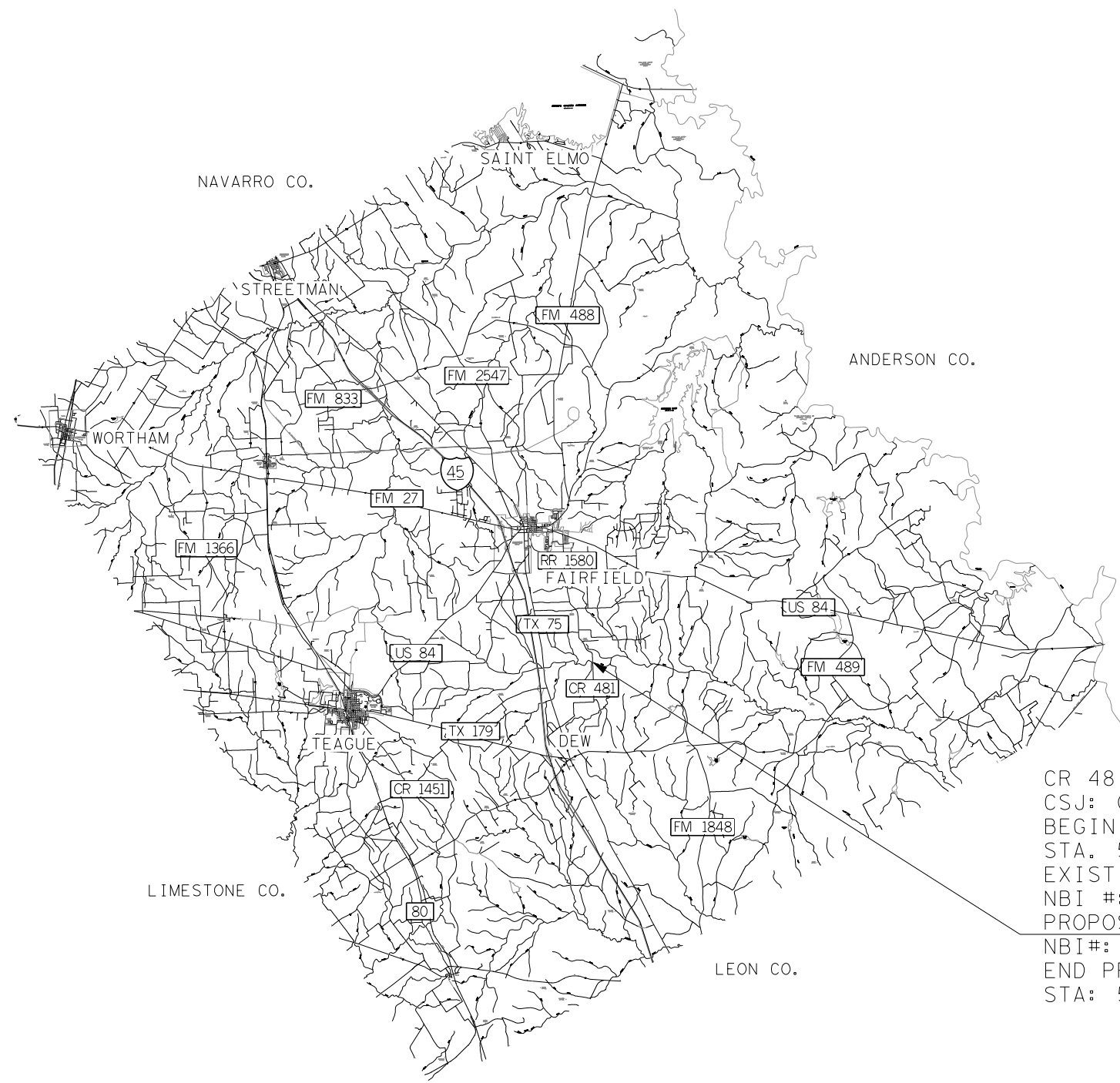
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Designed by:  
  
01EBC5C65E334CE  
BRIDGE ENGINEER

RECOMMENDED FOR LETTING: 6/2/2023  
Designed by:  
  
DAA3B0624EE3419  
DIRECTOR OF TRANSPORTATION PLANNING AND DEVELOPMENT

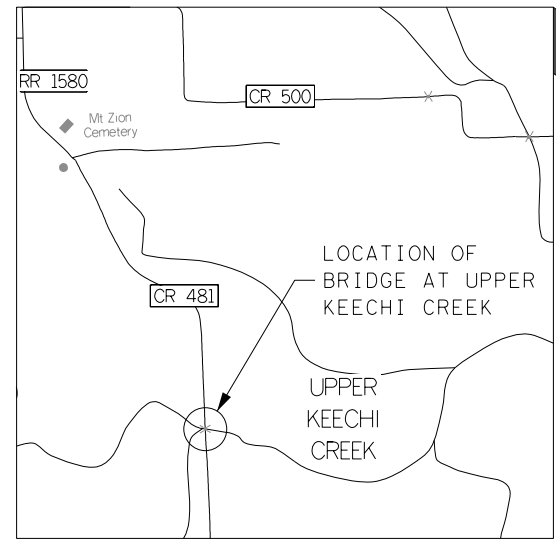
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DISTRICT ENGINEER

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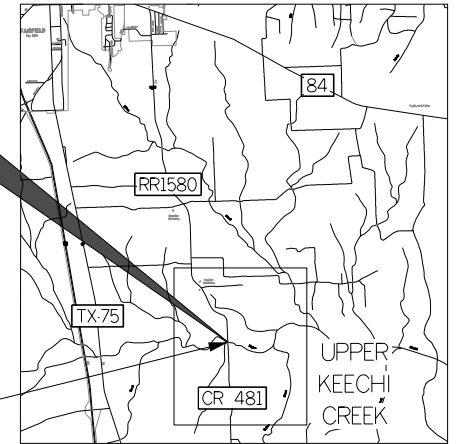
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FREESTONE COUNTY  
 SCALE N. T. S.



CR 481 AT UPPER KEECHI CREEK  
 LOCATION DETAIL  
 SCALE N. T. S.



FREESTONE COUNTY PROJECT  
 CR 481 AT UPPER KEECHI CREEK LOCATION  
 SCALE N. T. S.

CR 481 AT UPPER KEECHI CREEK  
 CSJ: 0917-20-046  
 BEGIN PROJECT  
 STA. 50+40.00  
 EXISTING STRUCTURE  
 NBI #: 17-082-0-AA01-34-002  
 PROPOSED STRUCTURE  
 NBI #: 17-082-0-AA04-81-102  
 END PROJECT  
 STA: 53+75.00



*J. Alchevsky*  
 5/14/2023

PRINT DATE	REVISION DATE
5/14/2023	

**Jacobs** 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966



PROJECT LOCATION MAP

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	2



REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
 FILENAME: \_pw\Project\Wise\AMER\jacobs.com\jacobs\_US\_B\_L\_SSA\Documents\WJXN4000\_BRY\_Bridge\_Program\WJXN4000\1720046\_CR481\700\_CADD\SH\T\GENR\CR481\_INDEX\_01.dgn

SHEET	DESCRIPTION
<u>GENERAL</u>	
1	TITLE SHEET
2	PROJECT LOCATION MAP
3	INDEX OF SHEETS
4	EXISTING TYPICAL SECTIONS
5	PROPOSED TYPICAL SECTIONS
6, 6A - 6C	GENERAL NOTES
7, 7A	ESTIMATE & QUANTITY
<u>QUANTITY SUMMARY SHEETS</u>	
8	ROADWAY & TCP SUMMARY
9	SUMMARY OF SW3P QUANTITIES
10	SUMMARY OF SMALL SIGNS
<u>TRAFFIC CONTROL PLAN</u>	
11	ADVANCED WARNING SIGNS LAYOUT
12	TRAFFIC CONTROL PLAN & SEQUENCE OF CONSTRUCTION
<u>TRAFFIC CONTROL PLAN STANDARDS</u>	
13 - 24	BC (1) - 21 TO BC (12) - 21*
25	WZ (RCD) - 13*
<u>ROADWAY</u>	
25A - 25B	SURVEY CONTROL
26	HORIZONTAL ALIGNMENT DATA
27	PLAN AND PROFILE
28	SIGNING AND OBJECT MARKERS
<u>ROADWAY STANDARDS</u>	
29	CRR*
30	GF (31) - 19*
31	GF (31) TRTL2 - 19*
32	BED - 14*
33	WF (1) - 10*
34	SGT (10S) 31 - 16*
35	SGT (11S) 31 - 18*
36	SGT (12S) 31 - 18*
37	SGT (15) 31 - 20*
38 - 40	D&OM (1) - 20 TO D&OM (3) - 20*
41	D&OM (5) - 20*
42	D&OM (VIA) - 20*
<u>BRIDGE</u>	
43	DRAINAGE AREA MAP
44	HYDRAULIC DATA SHEET
45	SCOUR DATA SHEET
46	BRIDGE LAYOUT
47	TEST HOLE DATA
48	ESTIMATED QUANTITIES
49	TOP OF CAP ELEVATIONS
<u>BRIDGE STANDARDS</u>	
50	NBI NUMBER LABELS
51 - 52	SBBS - B20 - 24 (MOD)
53 - 54	ABB - 24**
55 - 57	BB - B20**
58	BBEB**
59	BBRAS**
60	BBSDS - B20 - 24**
61 - 62	CSAB**
63 - 64	FD**
65 - 66	SRR**
67 - 68	T631**
<u>SW3P</u>	
69 - 70	STORM WATER POLLUTION PREVENTION PLAN (SWP3)
71	EPIC
72	SWP3 LAYOUT
<u>SW3P STANDARDS</u>	
73	EC (1) - 16*
74	EC (2) - 16*
75	EC (3) - 16*

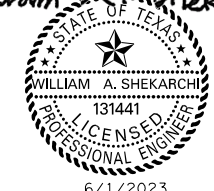
\*THE STANDARDS SPECIFICALLY IDENTIFIED HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.



*J. Alchevsky*

\*\*THE STANDARDS SPECIFICALLY IDENTIFIED HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

*William A. Shekarchi*



PRINT DATE	REVISION DATE
6/1/2023	

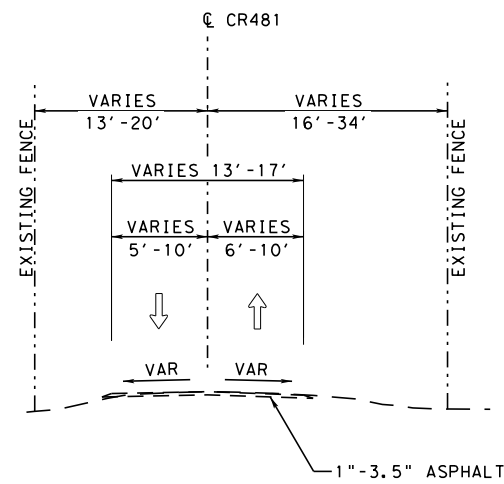
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 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966



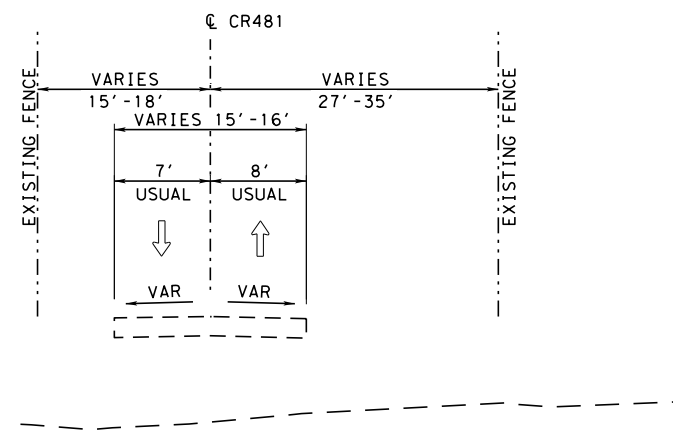
**INDEX OF SHEETS**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	3

REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
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**EXISTING CR 481 TYPICAL**  
 N. T. S.



**EXISTING CR 481 (BRIDGE) TYPICAL**  
 STA 51+92.88 TO STA 52+21.83  
 N. T. S.



*J. Alchevsky*  
 5/14/2023

PRINT DATE	REVISION DATE
5/14/2023	

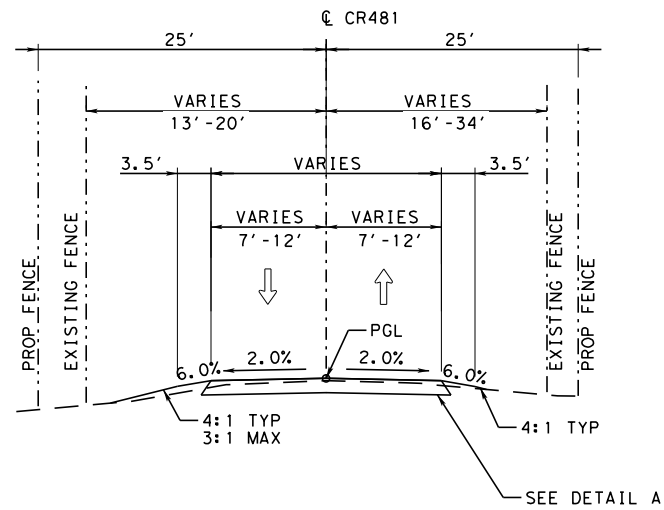
**Jacobs** 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966



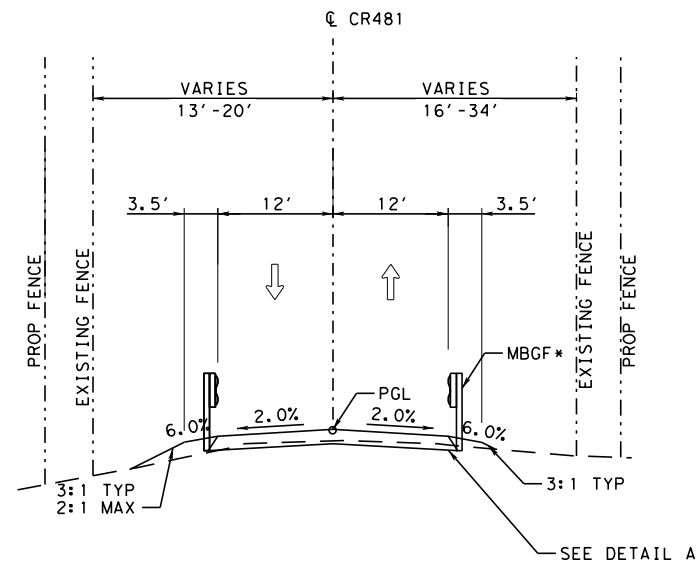
**EXISTING TYPICAL SECTIONS  
 CR 481**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	4

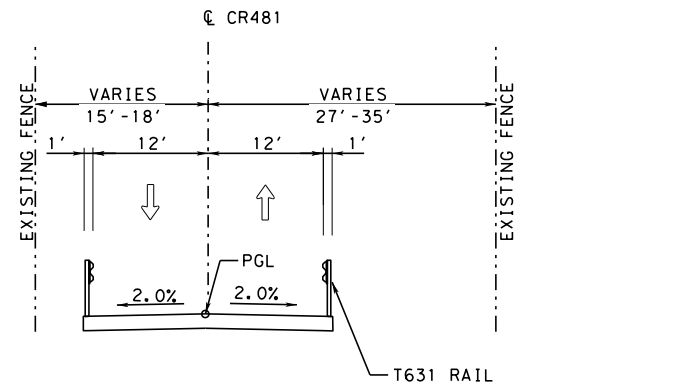
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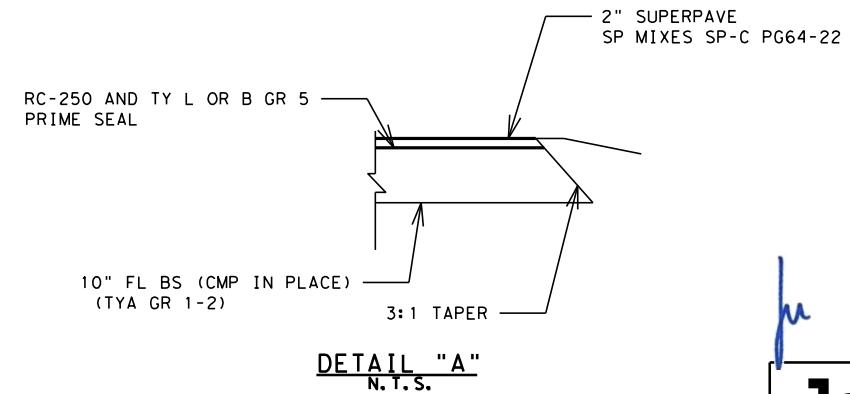
**PROPOSED CR 481 TYPICAL**  
 STA 50+40.00 TO 51+15.00  
 STA 53+00.00 TO 53+75.00  
 N. T. S.



**PROPOSED CR 481 TYPICAL**  
 STA 51+15.00 TO 51+75.00  
 STA 52+40.00 TO 53+00.00  
 \*SEE PLAN AND PROFILE SHEET FOR MBGF LIMITS  
 N. T. S.



**PROPOSED CR 481 (BRIDGE) TYPICAL**  
 STA 51+75.00 TO 52+40.00  
 N. T. S.



*J. Alchevsky*  
 5/14/2023

PRINT DATE	REVISION DATE
5/14/2023	

**Jacobs** 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966



**PROPOSED TYPICAL SECTIONS  
 CR 481**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	5

Project Number: See Title Sheet  
 Highway: CR 481  
 County: Freestone

Sheet: 6  
 Control: 0917-20-046

BASIS OF ESTIMATE					
ITEM	DESCRIPTION	COURSE	RATE	AMOUNT	QUANTITY
168	Vegetative Watering		10 GAL/SY	756 SY	7.6 MG
316	ASPH (RC-250)	PRIME SEAL	0.25 GAL/SY	689 SY	172 GAL
316	AGGR (TY-B GR-5 OR TY-L GR-5)	PRIME SEAL	1 CY/135 SY	689 SY	5 CY
3077	SP MIXES SP-C PG64-22	HOT MIX	330 LB/SY	672 SY	111 TON

BASIS OF ESTIMATE					
* for contractor's information only					
ITEM	DESCRIPTION	COURSE	RATE	AMOUNT	QUANTITY
166*	FERTILIZER **		60 LBS/AC	1,378 SY	0.009 TON

Note: Rates are for estimating purposes only. Actual Rates will be determined in the field.

\*\* Tonnage represents Nitrogen content only.

**GENERAL:**

Contractor questions on this project are to be addressed to the following individuals:  
 Delmy Reyes, P.E., A.E., [Delmy.Reyes@txdot.gov](mailto:Delmy.Reyes@txdot.gov)  
 Matt Hensarling, P.E., A.A.E., [Matt.Hensarling@txdot.gov](mailto:Matt.Hensarling@txdot.gov)

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

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

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

For non-bridge items, send eligible shop plan submittals with PDF attachments directly to the reviewing office. Submit bridge, retaining wall, and structural item shop drawings following the directions described at  
<http://www.txdot.gov/business/resources/specifications/shop-drawings.html>

Project Number: See Title Sheet  
 Highway: CR 481  
 County: Freestone

Sheet: 6  
 Control: 0917-20-046

**ITEM 5 “CONTROL OF THE WORK”**

Prior to letting, earthwork construction cross-section data is available at the Area Engineer’s office in *Huntsville* for inspection by prospective bidders. In addition, bidders may request electronic earthwork construction cross-section data by sending an email to: [Delmy.Reyes@txdot.gov](mailto:Delmy.Reyes@txdot.gov) or [Matt.Hensarling@txdot.gov](mailto:Matt.Hensarling@txdot.gov)

Earthwork files will be provided by email or by using TxDOT’s Dropbox FTP Service. These cross-sections are for non-construction purposes only, and it is the responsibility of the prospective bidder to validate the data for this project.

After letting, the Engineer will provide final earthwork construction cross-section data necessary for the contractor to establish and control the work.

When a precast or cast-in-place concrete element is included in the plans, a precast concrete alternate may be submitted in accordance with “Standard Operating Procedure for Alternate Precast Proposal Submission” found online at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#design>. Acceptance or denial of an alternate is at the sole discretion of the Engineer. Impacts to the project schedule and any additional costs resulting from the use of alternates are the sole responsibility of the Contractor.

**ITEM 6 “CONTROL OF MATERIALS”**

To comply with the latest provisions of Build America, Buy America Act (BABA Act) of the Bipartisan Infrastructure Law, the contractor must submit a notarized original of the TxDOT Construction Material Buy America Certification Form for all items classified as construction materials. This form is not required for materials classified as a manufactured product.

Refer to the Buy America Material Classification Sheet for clarification on material categorization.

The Buy America Material Classification Sheet is located at the below link.

<https://www.txdot.gov/business/resources/materials/buy-america-material-classification-sheet.html> for clarification on material categorization.

**ITEM 7 “LEGAL RELATIONS AND RESPONSIBILITIES”**

In the event of the declaration of a hurricane watch, warning, other severe weather warning or national or state emergency that requires the roadways in the vicinity be used as evacuation routes, cease all work that requires the Contractor’s, sub-contractors’ or material suppliers’ vehicles to enter the stream of traffic on these primary or secondary evacuation routes. This work includes material hauling and delivery, and mobilization or demobilization of equipment.



**Project Number:** See Title Sheet

**Sheet:** 6A

**Highway:** CR 481

**Control:** 0917-20-046

**County:** Freestone

The following roadways are recognized evacuation routes in the Bryan District:

Primary Evacuation Routes: IH 45, US 290, SH 6, SH 36.

Secondary Evacuation Routes: US 79, US 84, SH 7, SH 30, SH 21, SH 105.

Other routes may be designated.

- No significant traffic generator events identified.

#### **ITEM 8 “PROSECUTION AND PROGRESS”**

The following standard detail sheet(s) has(have) been modified.  
SBBS-B20-24

By noon of each Wednesday, provide the Engineer a written outline of the daily work schedule for the following week. Include in the outline the times and places for proposed traffic control changes, lane and shoulder closures, and moving operations or other operations that affect traffic on the roadway. Unless otherwise authorized by the Engineer, prosecute the work on this project in accordance with the following sequence of work:

- 1) Place advanced signing and barricades. Set up detour and place SW3P devices.
- 2) Close roadway then demolish existing bridge and remove stabilized base. Construct new bridge and full depth reconstruct proposed roadway. Return right of way to previous conditions.
- 3) Construct metal beam guard fence, grade channel, and construct riprap. Place permanent signs, and object markers. Remove temporary SW3P devices and install permanent SW3P components. Stabilize disturbed soil (permanent).
- 4) Final cleanup.

Some of these operations may be performed simultaneously.

Prepare Progress Schedule Bar Chart.

Equipment and material may be pre-staged at approved locations.

The 90-day delayed start allowed after authorization under SP008-003 is for Contractor time for material acquisition.

#### **ITEM 100 “PREPARING RIGHT OF WAY”**

During burn bans obtain written approval from the Commissioners Court prior to burning brush.

**Project Number:** See Title Sheet

**Sheet:** 6A

**Highway:** CR 481

**Control:** 0917-20-046

**County:** Freestone

Prevent ashes from burned vegetation to be transported into any stream.

If burning is not allowed, all trees and brush will be disposed of by shredding, logging or other methods approved by the Engineer. Create a windrow, stockpile, or topdress biomass on disturbed areas along the project at locations approved by necessary permits and the Engineer.

#### **ITEM 132 “EMBANKMENT”**

Provide Embankment material for areas within the limits of the Pavement Structure that meet one of the following requirements:

- Sources outside the ROW provide material with a plasticity index between 10 and 25 and with less than 10% silt.
- Sources within the ROW provide material with a plasticity index between 10 and 25 and with less than 10% silt.

Provide Embankment material for areas outside the limits of the Pavement Structure with a plasticity index between 10 and 35.

#### **ITEM 160 “TOPSOIL”**

All slopes requiring topsoil will be tracked immediately upon final grading to prevent erosion per standard sheet EC(1)-16. Tracking slopes to prevent erosion will not be measured or paid for directly, but will be subsidiary to pertinent Items.

Topsoil may be obtained from the right of way at sites of proposed excavation and embankment.

#### **ITEM 166 “FERTILIZER”**

Fertilize all areas of project that are being seeded or sodded.

#### **ITEM 168 “VEGETATIVE WATERING”**

Vegetative watering is required for all areas of the project that are being seeded or sodded.

#### **ITEM 247 “FLEXIBLE BASE”**

Place flexible base in equal lifts of 4 to 8 in. in depth unless otherwise approved by the Engineer.

**Project Number:** See Title Sheet

**Sheet:** 6B

**Highway:** CR 481

**Control:** 0917-20-046

**County:** Freestone

#### **ITEM 316 “SEAL COAT”**

When placing surface treatment on base material, prepare surface by sweeping or other approved methods. Before applying bituminous material, lightly sprinkle the surface with water. When directed, sweep the surface after sprinkling with water. Do not apply bituminous material when water is puddling on the surface.

Sweep excess aggregate no sooner than 2 hours after rolling or as directed.

Vehicles used to haul aggregate from the stockpile to the chip spreader will not be overloaded. Any damage to the roadway caused by the vehicles will be repaired by the Contractor at his expense and subsequent loads will be reduced so as not to cause further damage.

Transverse variance rates shall be used as directed. The nozzles outside the wheel paths will output up to 20% more asphalt by volume than the nozzles over the wheel paths.

The Contractor may be required to furnish and set string line to insure straight and uniform alignment as directed by the Engineer. The Contractor may use other methods subject to approval of the Engineer.

Air and surface temperature for asphalt material application will be in accordance with the specification and the manufacturer’s recommendation. However, the engineer may limit the use of an asphalt material due to the time of year.

#### **ITEM 416 “DRILLED SHAFT FOUNDATIONS”**

Stake foundation locations and have them approved by the Engineer before installation.

#### **ITEM 454 “BRIDGE EXPANSION JOINTS”**

The list of approved Header Type Expansion Joints can be found at:

<http://www.txdot.gov/inside-txdot/division/bridge/approved-systems/expansion-joints.html>

#### **ITEM 496 “REMOVING STRUCTURES”**

Notify the Engineer of the exact date of bridge removal at least twenty (20) working days prior to the removal of the existing structure to allow for compliance with the Texas Department of State Health Services requirements for structural demolition. Bridge removal will not be allowed to take place until this notice is given.

**Project Number:** See Title Sheet

**Sheet:** 6B

**Highway:** CR 481

**Control:** 0917-20-046

**County:** Freestone

Store the following items to be salvaged at a location designated by the Engineer: TBD after conversation with County.

#### **ITEM 502 “BARRICADES, SIGNS AND TRAFFIC HANDLING”**

Removal of ground mounted temporary signs and supports as specified on standard sheet BC(5), shall include the immediate backfilling of support holes with Type B embankment material and the compaction of the backfill material.

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

#### **ITEM 540 “METAL BEAM GUARD FENCE”**

Furnish and Install only one type of timber post.

#### **ITEM 544 “GUARDRAIL END TREATMENTS”**

Furnish and install only MASH compliant guardrail end treatments.

#### **ITEM 644 “SMALL ROADSIDE SIGN ASSEMBLIES”**

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

Project Number: See Title Sheet

Sheet: 6C

Highway: CR 481

Control: 0917-20-046

County: Freestone

**ITEM 3077 “SUPERPAVE MIXTURES”**

<b>Hamburg Wheel Test Requirements</b>			
<b>High-Temperature Binder Grade</b>	<b>Test Method</b>	<b>Laboratory Mixture Design or Trial Batch</b>	<b>Production and Placement Test<sup>1</sup></b>
		<b>Minimum # of Passes @ 0.5" Rut Depth, Tested @122°F</b>	<b>Minimum # of Passes @ 0.5" Rut Depth, Tested @122°F</b>
PG 64 or lower	Tex-242-F	7,000	7,000

<sup>1</sup>. The Engineer may accept if no more than 1 of the 5 most recent Hamburg Wheel tests is below the specified number of passes and the failing test is no more than 2,000 passes below the specified number of passes.

Add one (1.0) percent hydrated lime, commercial lime slurry, or an equivalent anti-stripping agent, based on the total aggregate weight, as mix enhancer for all mixture types unless otherwise approved by the Engineer. Provide hydrated lime or commercial lime slurry in accordance with DMS-6350, “Lime and Lime Slurry”. Add hydrated lime, commercial lime slurry, or an equivalent anti-stripping agent in accordance with Section 301.4.2.

Apply tack coat through a distributor spray bar in accordance with Section 316.3.1. Distributor. If residual from emulsion tack is not tacky, then the Engineer can require the use of PG binder.

RAS is not permitted in thin level-up courses.

**ITEM 6001 “PORTABLE CHANGEABLE MESSAGE SIGN”**

Furnish, install, and operate up to two (2) Portable Changeable Message Signs (PCMS) for this project. The signs can be used both on the project and within a ten (10) mile radius of the project. Locations, messages, and durations of use will be specified by the Engineer. The primary uses will be to inform the public of special events, lane and road closures, and changes in traffic control. Signs will be paid for only when used as directed by the Engineer.



CONTROLLING PROJECT ID 0917-20-046

DISTRICT Bryan  
HIGHWAY CR 481

COUNTY Freestone

# Estimate & Quantity Sheet

CONTROL SECTION JOB				0917-20-046		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00124550			
COUNTY				Freestone			
HIGHWAY				CR 481			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	100-6002	PREPARING ROW	STA	3.400		3.400	
	110-6001	EXCAVATION (ROADWAY)	CY	128.000		128.000	
	110-6002	EXCAVATION (CHANNEL)	CY	271.000		271.000	
	132-6006	EMBANKMENT (FINAL)(DENS CONT)(TY C)	CY	198.000		198.000	
	160-6003	FURNISHING AND PLACING TOPSOIL (4")	SY	756.000		756.000	
	164-6021	CELL FBR MLCH SEED(PERM)(RURAL)(SANDY)	SY	756.000		756.000	
	164-6029	CELL FBR MLCH SEED(TEMP)(WARM)	SY	378.000		378.000	
	164-6031	CELL FBR MLCH SEED(TEMP)(COOL)	SY	378.000		378.000	
	168-6001	VEGETATIVE WATERING	MG	7.600		7.600	
	247-6231	FL BS (CMP IN PLACE)(TY A GR 1-2)(10")	SY	762.000		762.000	
	316-6029	ASPH (RC-250)	GAL	172.000		172.000	
	316-6403	AGGR (TY-B GR-5 OR TY-L GR-5)	CY	5.000		5.000	
	400-6005	CEM STABIL BKFL	CY	43.000		43.000	
	416-6003	DRILL SHAFT (30 IN)	LF	210.000		210.000	
	420-6013	CL C CONC (ABUT)	CY	27.200		27.200	
	422-6005	REINF CONC SLAB (BOX BEAM)	SF	1,701.000		1,701.000	
	422-6023	SHEAR KEY	CY	8.600		8.600	
	425-6001	PRESTR CONC BOX BEAM (4B20)	LF	258.000		258.000	
	425-6002	PRESTR CONC BOX BEAM (5B20)	LF	129.000		129.000	
	432-6001	RIPRAP (CONC)(4 IN)	CY	15.000		15.000	
	432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY	303.000		303.000	
	450-6018	RAIL (TY T631)	LF	162.000		162.000	
	454-6021	TYPE A JOINT	LF	53.000		53.000	
	496-6009	REMOV STR (BRIDGE 0 - 99 FT LENGTH)	EA	1.000		1.000	
	496-6043	REMOV STR (SMALL FENCE)	LF	421.000		421.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	5.000		5.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	58.000		58.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	58.000		58.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	778.000		778.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	778.000		778.000	
	540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	150.000		150.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	4.000		4.000	
	552-6001	WIRE FENCE (TY A)	LF	363.000		363.000	
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	2.000		2.000	
	658-6014	INSL DEL ASSM (D-SW)SZ (BRF)CTB (BI)	EA	4.000		4.000	
	658-6062	INSL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	4.000		4.000	

DISTRICT	COUNTY	CCSJ	SHEET
Bryan	Freestone	0917-20-046	7





CONTROLLING PROJECT ID 0917-20-046

DISTRICT Bryan  
HIGHWAY CR 481

COUNTY Freestone

# Estimate & Quantity Sheet

CONTROL SECTION JOB		0917-20-046		TOTAL EST.	TOTAL FINAL
PROJECT ID		A00124550			
COUNTY		Freestone			
HIGHWAY		CR 481			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL
	3077-6011	SP MIXESSP-CPG64-22	TON	111.000	
	4171-6001	INSTALL BRIDGE IDENTIFICATION NUMBERS	EA	2.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	14.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000	

REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
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SUMMARY OF ROADWAY ITEMS																	
LOCATION	100	110	110	132	247	PRIME SEAL		432	496	496	540	544	552	644	658	658	3077
	6002	6001	6002	6006	6231	316	316	6001	6009	6043	6001	6001	6001	6004	6014	6062	6011*
	PREPARING ROW	EXCAVATION (ROADWAY)	EXCAVATION (CHANNEL)	EMBANKMENT (FINAL) (DENS CONT) (TY C)	FL BS (CMP IN PLACE) (TY A GR 1-2) (10")	ASPH (RC-250)	AGGR (TY-B GR-5 OR TY-L GR-5)	RIPRAP (CONC) (4 IN)	REMOV STR (BRIDGE 0 - 99 FT LENGTH)	REMOVE STR (SMALL FENCE)	MTL W-BEAM GD FEN (TIM POST)	GUARDRAIL END TREATMENT (INSTALL)	WIRE FENCE (TY A)	IN SM RD SN SUP&AM TY10BWG (1) SA (T)	IN STL DEL ASSM (D-SW) SZ (BRF) CTB (BI)	IN STL DEL ASSM (D-SW) SZ (BRF) GF2 (BI)	SP MIXES SP-C PG64-22
	STA	CY	CY	CY	SY	AREA (SY)	AREA (SY)	CY	EA	LF	LF	EA	LF	EA	EA	EA	SY
0917-20-046	3.4	128	271	198	762	689	689	15.0	1	421	150	4	363	2	4	4	672
PROJECT TOTALS	3.4	128	271	198	762	689	689	15.0	1	421	150	4	363	2	4	4	672

\*CONTRACTOR INFO ONLY. SEE BASIS OF ESTIMATE FOR RATES.

SUMMARY OF TRAFFIC CONTROL ITEMS	
LOCATION	
	6001
	6001
	PORTABLE CHANGEABLE MESSAGE SIGN
	DAY
0917-20-046	14
PROJECT TOTALS	14

PRINT DATE	REVISION DATE
5/30/2023	

**Jacobs**  
 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966



### ROADWAY & TCP SUMMARY

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	8

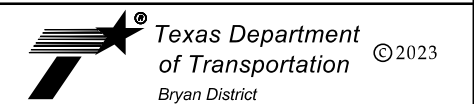
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LOCATION	160	164	164	164	* 168	506	506	506	506
	6003	6021	6029	6031	6001	6002	6011	6038	6039
	FURNISHING AND PLACING TOPSOIL (4")	CELL FBR MLCH SEED (PERM) (RURAL) (SANDY)	CELL FBR MLCH SEED (TEMP) (WARM)	CELL FBR MLCH SEED (TEMP) (COOL)	VEGETATIVE WATERING	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)
	SY	SY	SY	SY	SY	LF	LF	LF	LF
0917-20-046	756	756	378	378	756	58	58	778	778
PROJECT TOTALS	756	756	378	378	756	58	58	778	778

\* FOR CONTRACTOR USE ONLY, SEE BASIS OF ESTIMATE FOR RATE

PRINT DATE	REVISION DATE
5/12/2023	

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**CR481  
 SW3P SUMMARY**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	9

# SUMMARY OF SMALL SIGNS

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PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX)				BRIDGE MOUNT CLEARANCE SIGNS (See Note 2)	
							POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION		
										PREFABRICATED		1EXT or 2EXT = # of Ext
28	1	W8-13aT	 	36"x36"			10BWG	1	SA	T		
28	2	W8-13aT	 	36"x36"			10BWG	1	SA	T		

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

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

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



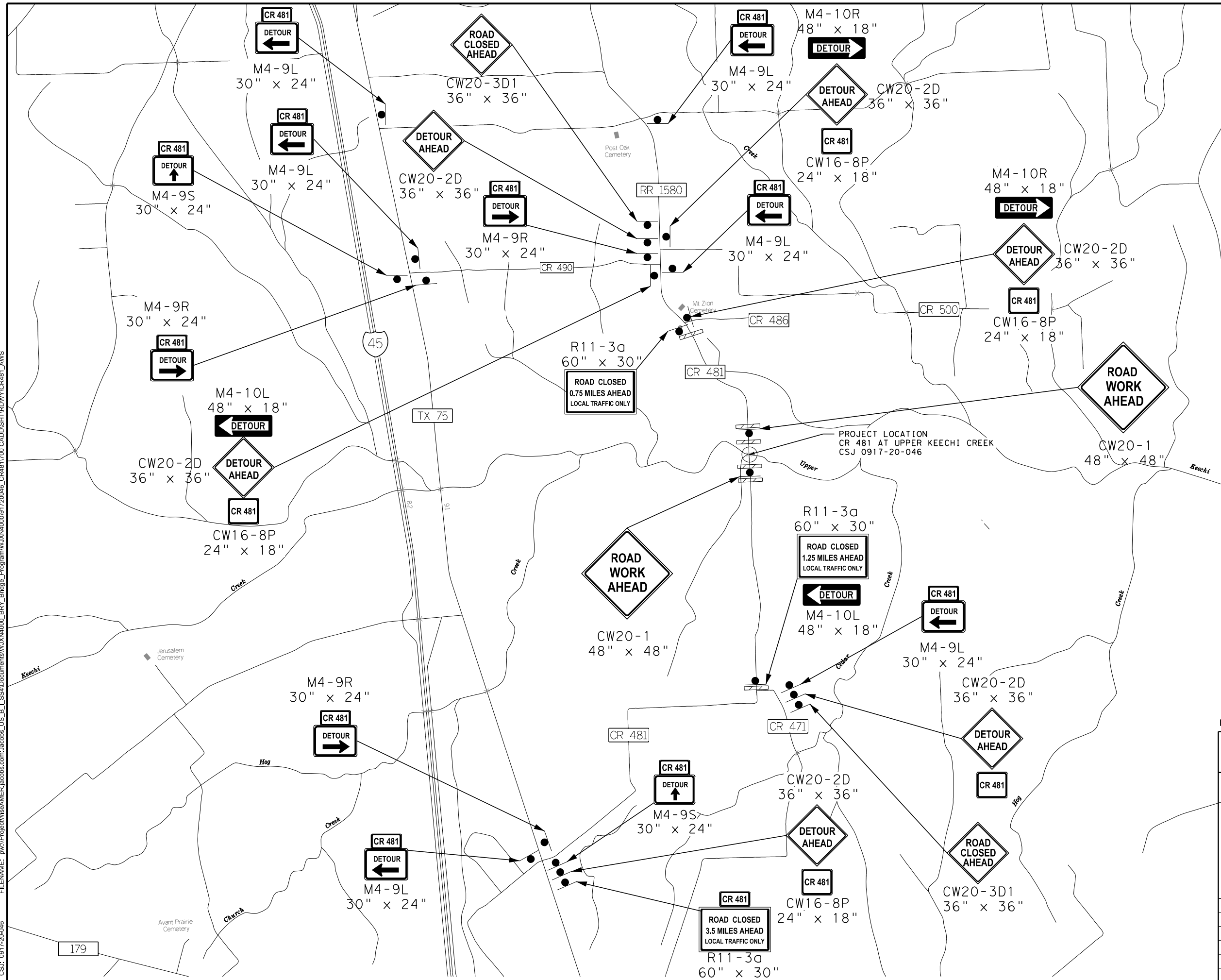
## SUMMARY OF SMALL SIGNS

### SOSS

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© TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
4-16	DIST	COUNTY	SHEET NO.	
8-16	BRY	FREESTONE	10	





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- NOTES:
1. PLACE SIGNS IN ACCORDANCE WITH TXDOT STANDARDS BC(1)-BC(12)-21, WZ(RCD) AND TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
  2. ADJUST SIGNING AS NECESSARY TO FIT FIELD CONDITIONS.
  3. SEE TRAFFIC CONTROL PLAN FOR PLACEMENT OF ADDITIONAL SIGNS.

LEGEND

 TYPE III BARRICADE

 DETOUR SIGN



*Jenna I. Alchevsky*  
 5/30/2023

Drawings Not To Scale

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**ADVANCED WARNING SIGNS  
 CR 481**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	11

SEQUENCE OF CONSTRUCTION

MAINTAIN TEMPORARY DRAINAGE AT ALL TIMES. TEMPORARY DRAINAGE SHALL BE CONSIDERED SUBSIDIARY TO THE OTHER BID ITEMS. EXISTING SIGNS THAT CONFLICT WITH THE TEMPORARY TRAFFIC CONTROL PLAN SHALL BE REMOVED OR COVERED AS DIRECTED.

PHASE 1:  
ONE WEEK PRIOR TO CONSTRUCTION, SET UP ONE PORTABLE CHANGEABLE MESSAGE SIGN (PCMS) AT THE INTERSECTION OF CR 481 & TX 75 AND CR 481 & CR 486 TO ALERT PUBLIC TO UPCOMING CONSTRUCTION. INSTALL ADVANCED WARNING SIGNS IN ACCORDANCE WITH STANDARD BC(2)-21 AND ROAD CLOSURE SIGNS IN ACCORDANCE WITH STANDARD WZ(RCD)-13.

PHASE 2:  
CLOSE CR 481 TO THRU TRAFFIC, SET UP DETOUR, AND INSTALL TEMPORARY SW3P DEVICES.




PHASE 3:  
DEMOLISH EXISTING BRIDGE, CONSTRUCT NEW ROADWAY, GRADING, AND BRIDGE, TIE TO EXISTING PAVEMENT.

PHASE 4:  
INSTALL METAL BEAM GUARD FENCE AND DELINEATORS/OBJECT MARKERS. COMPLETE PERMANENT SEEDING AND PLACE SIGNING. REMOVE ADVANCED WARNING SIGNS AND BARRICADES AND OPEN ROADWAY.

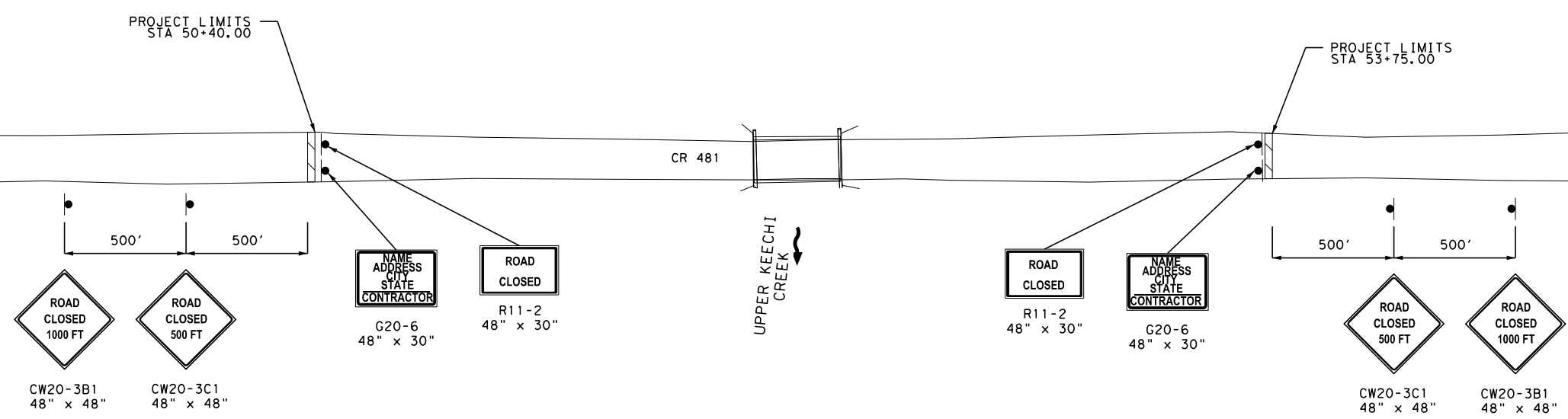
PHASE 5:  
RESTORE ROW BACK TO PRE-CONSTRUCTION CONDITIONS AND COMPLETE FINAL SITE CLEAN UP.



LEGEND

-  TRAFFIC SIGN
-  TY III BARRICADE
-  DIRECTION OF CREEK FLOW

- NOTES:
- LOCAL ACCESS SHALL BE MAINTAINED FOR THE EXISTING COUNTY ROADS, CROSS STREETS, AND DRIVEWAYS.
  - CONTRACTOR SHALL BE RESPONSIBLE FOR TEMPORARY DRAINAGE AT ALL TIMES, TO BE SUBSIDIARY TO OTHER BID ITEMS.
  - INSTALL ADVANCED WARNING SIGNS IN ACCORDANCE WITH TXDOT STANDARD BC(2)-21.
  - UTILIZE CHANNELING DEVICES TO CLOSE DRIVEWAYS UNDER CONSTRUCTION, WHEN AN ALTERNATE ACCESS IS PROVIDED.
  - SPACE CHANNELIZING DEVICES IN ACCORDANCE WITH TXDOT STANDARD BC(9)-21.



*J. Alchevsky*  
5/14/2023  
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TRAFFIC CONTROL PLAN & SEQUENCE OF CONSTRUCTION

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	12

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

- 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).
- The development and design of the Traffic Control Plan (TCP) is the responsibility of the Engineer.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Traffic control devices should be in place only while work is actually in progress or a definite need exists.
- The Engineer has the final decision on the location of all traffic control devices.
- 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:**

- 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.
- Except in emergency situations, flagger stations shall be illuminated when flagging is used at night.

**COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES**

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

<b>THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT</b> <a href="http://www.txdot.gov">http://www.txdot.gov</a>
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

SHEET 1 OF 12



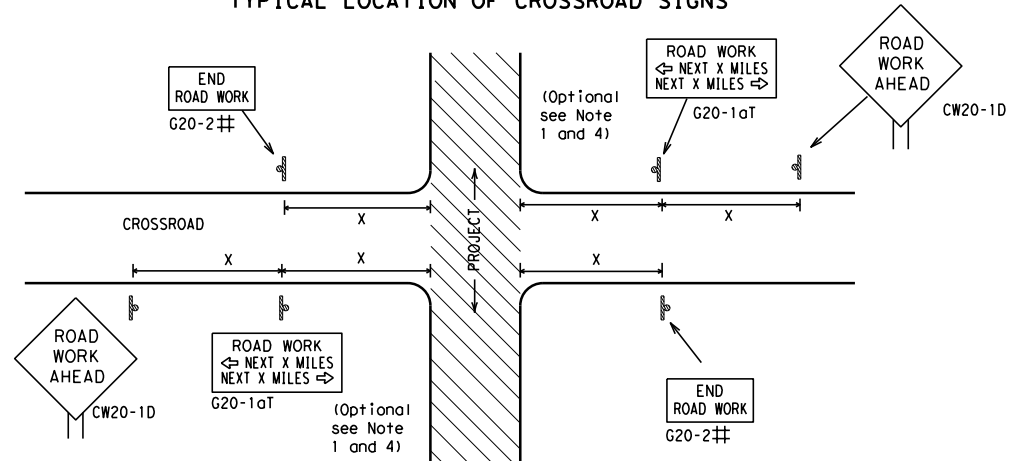
**BARRICADE AND CONSTRUCTION  
GENERAL NOTES  
AND REQUIREMENTS**

**BC (1) - 21**

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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
4-03	7-13	0917	20	046	CR 481				
9-07	8-14	DIST	COUNTY	SHEET NO.					
5-10	5-21	BRY	FREESTONE	13					

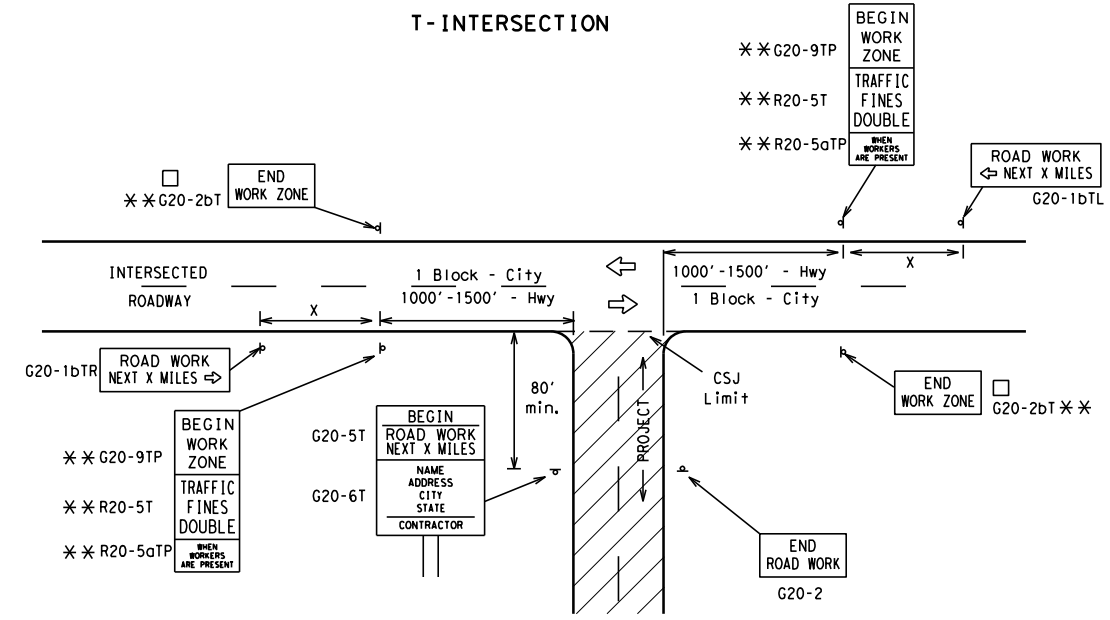
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**TYPICAL LOCATION OF CROSSROAD SIGNS**



- ## 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<sup>1,5,6</sup>**

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Δ Spacing "x" Feet (Apprx.)
CW20 <sup>4</sup>	48" x 48"	48" x 48"	30	120
CW21			35	160
CW22			40	240
CW23			45	320
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	50	400
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	60	600 <sup>2</sup>
			65	700 <sup>2</sup>
			70	800 <sup>2</sup>
			80	1000 <sup>2</sup>
*			*	* <sup>3</sup>

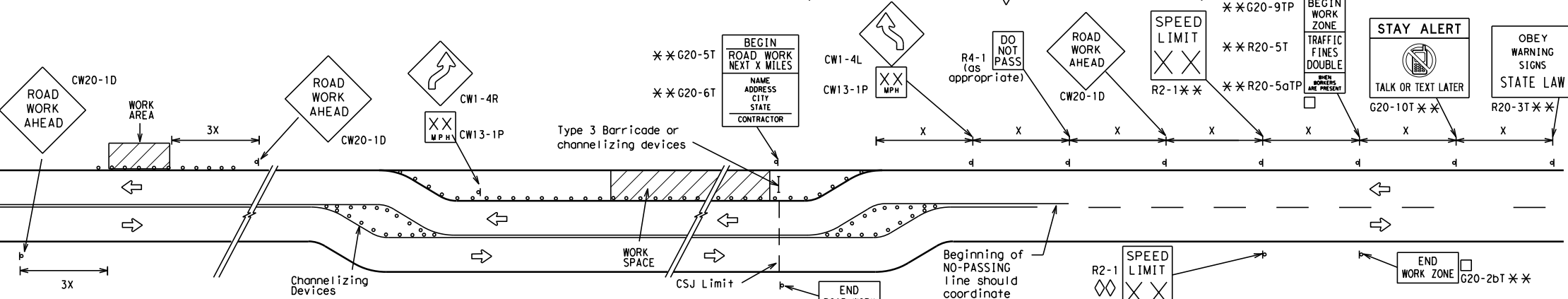
\* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

**GENERAL NOTES**

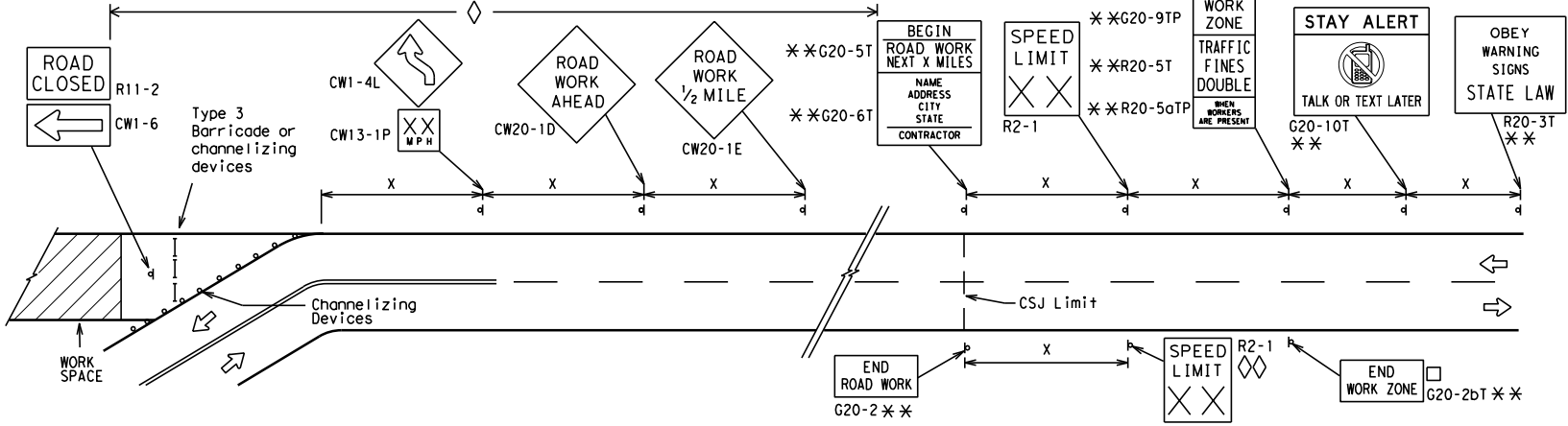
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be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

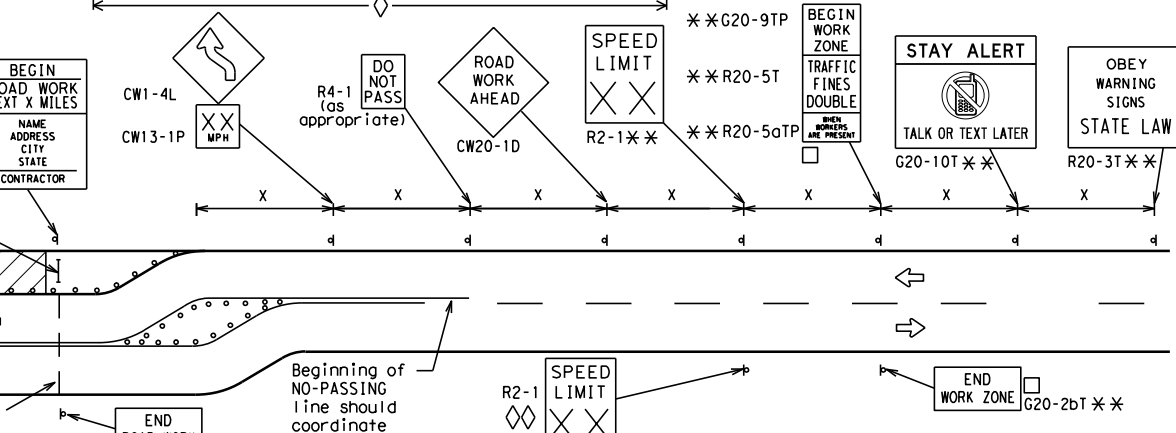


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

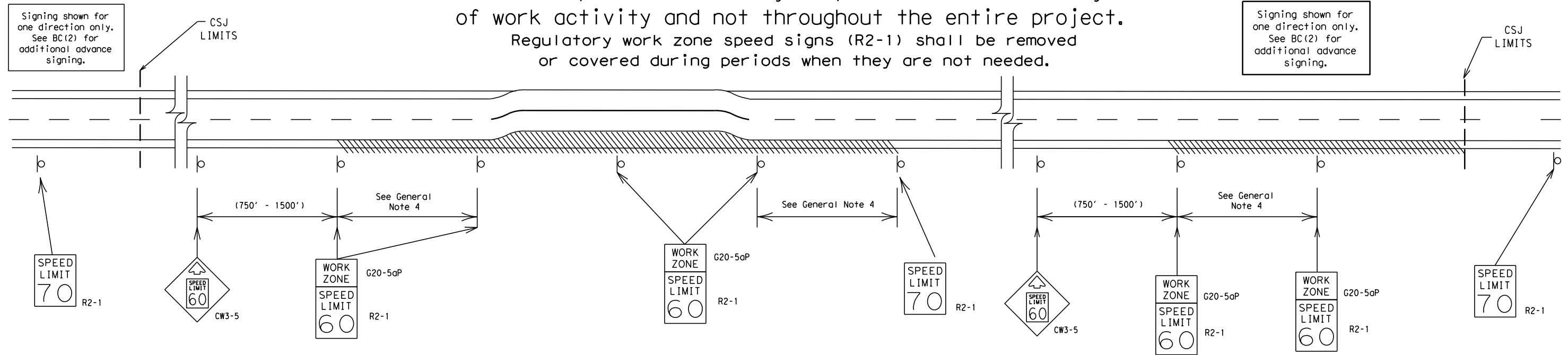
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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	BRY	FREESTONE	14	



# 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:
  - Law 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.

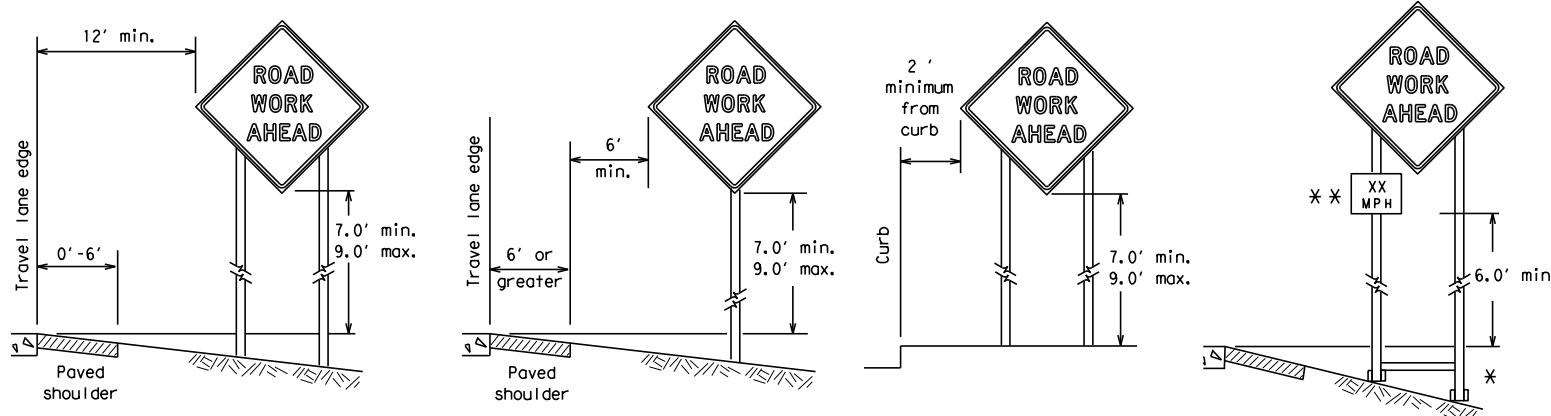
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or the use of this standard in any project. DATE: 5/14/2023 4:46:48 PM FILE: \\Project\wise\amer\_jacobs.com\Jacobs\_US\_B\_I\_SS4\Documents\WJXN4000\_BRY\BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT.dgn

SHEET 3 OF 12

<b>BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT</b>			
<b>BC (3) - 21</b>			
FILE:	bc-21.dgn	DN: TxDOT	ck: TxDOT
© TxDOT	November 2002	CON: 0917	SECT: 20
REVISIONS 9-07 8-14 7-13 5-21		JOB: 046	HIGHWAY: CR 481
DIST:	BRY	COUNTY:	FREESTONE
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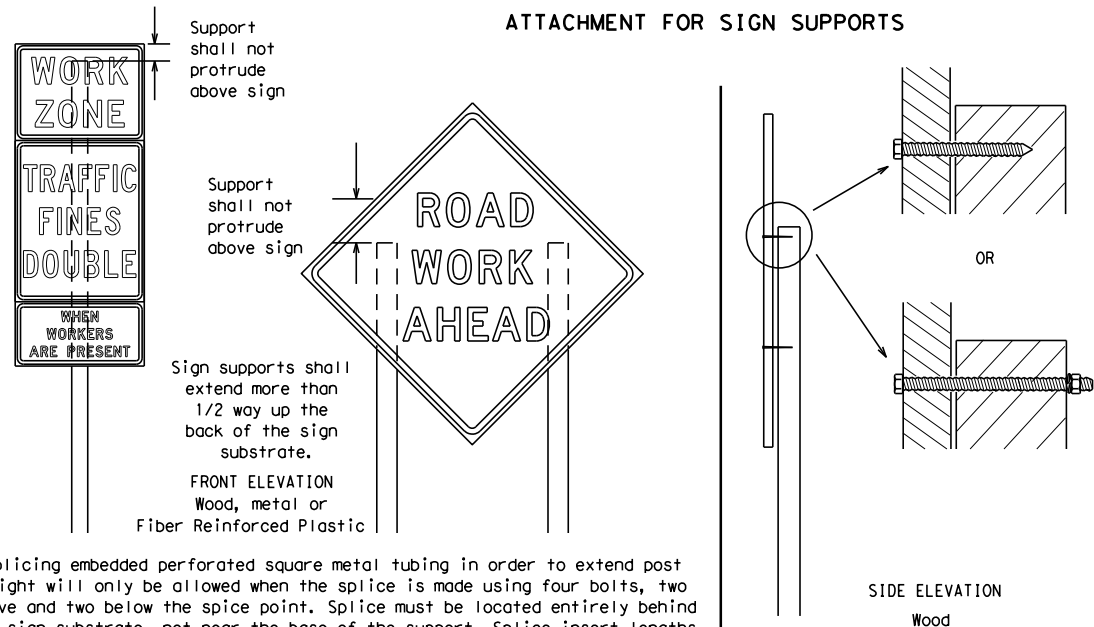
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



\* 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.

**GENERAL NOTES FOR WORK ZONE SIGNS**

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

**DURATION OF WORK (as defined by the "Texas Manual 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 sign height.
- Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

**SIZE OF SIGNS**

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

**SIGN SUBSTRATES**

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

**REFLECTIVE SHEETING**

- All signs shall be 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).
- White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
- Orange sheeting, meeting the requirements of DMS-8300 Type B<sub>FL</sub> or Type C<sub>FL</sub>, shall be used for rigid signs with orange backgrounds.

**SIGN LETTERS**

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

- 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 headlights at night, without damaging the sign sheeting.
- Burlap shall NOT be used to cover signs.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

**SIGN SUPPORT WEIGHTS**

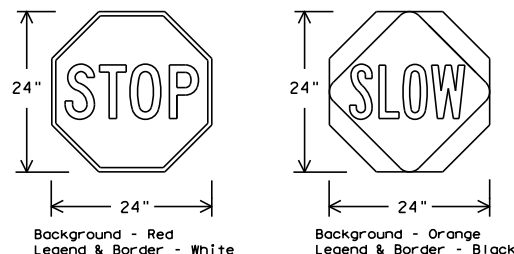
- Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects shall not 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.

**STOP/SLOW PADDLES**

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



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

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

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



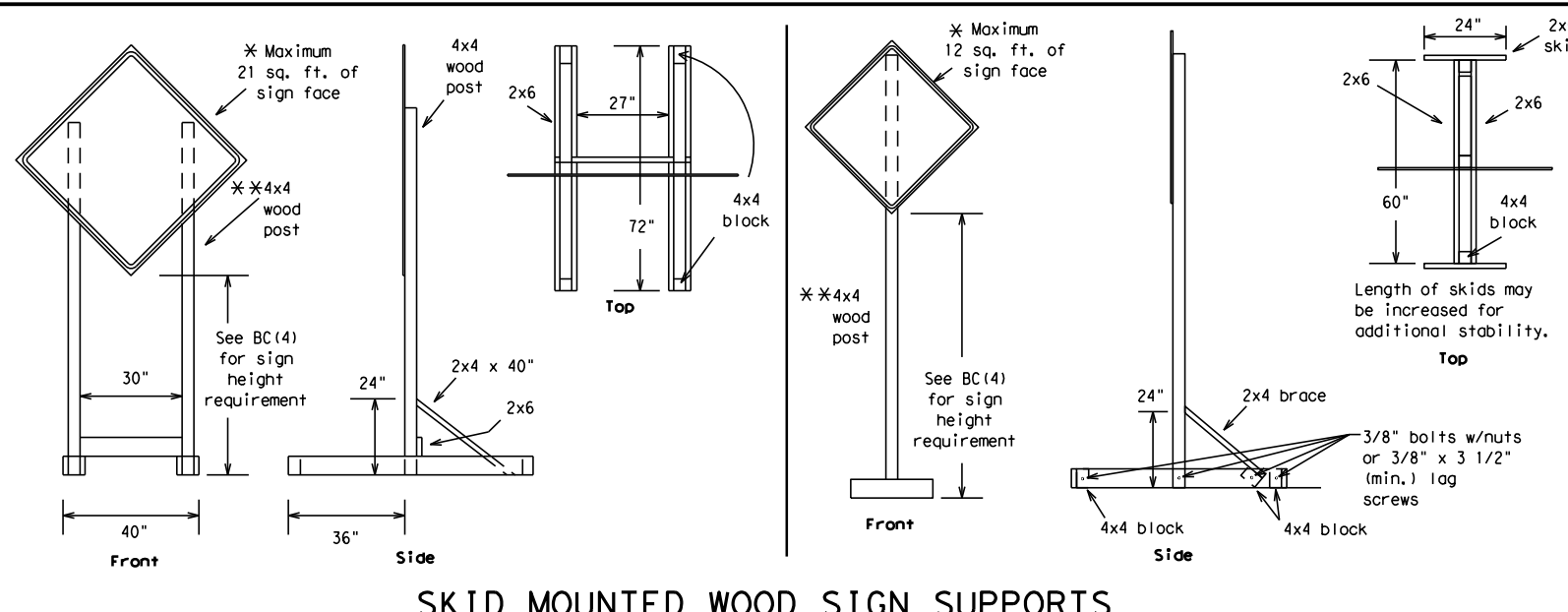
**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

**BC (4) - 21**

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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0917	20	046	CR 481				
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7-13	5-21	BRY	FREESTONE	16					

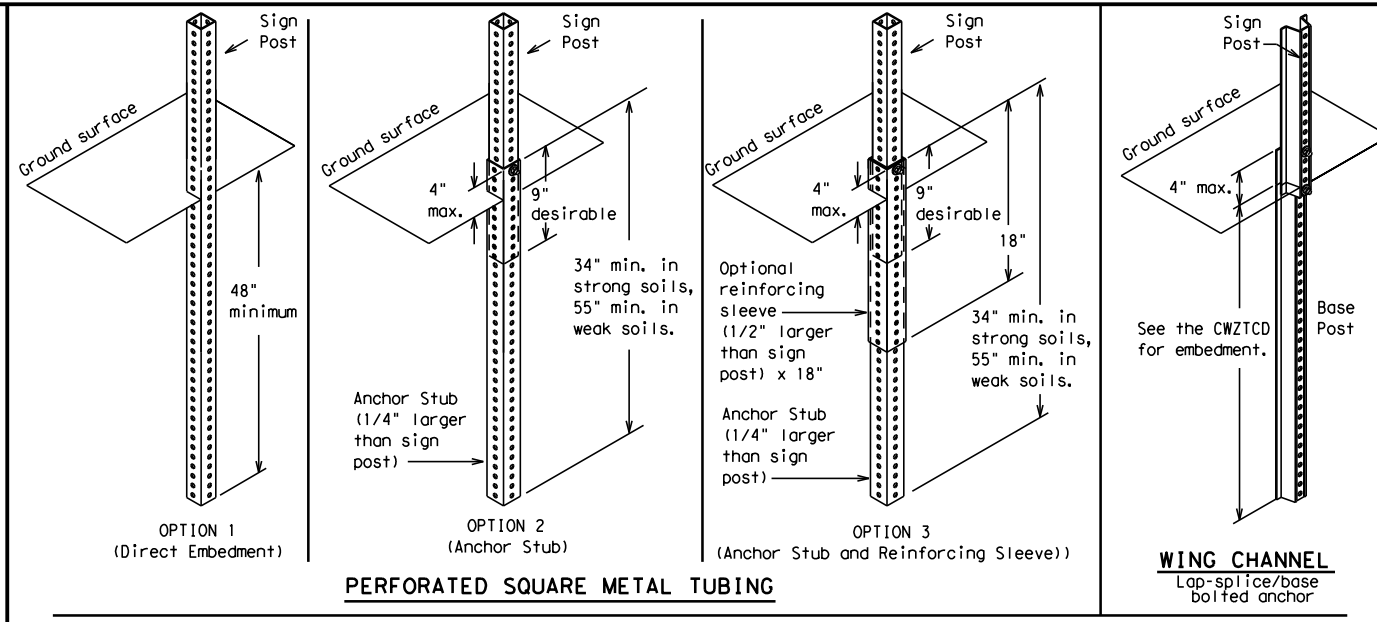
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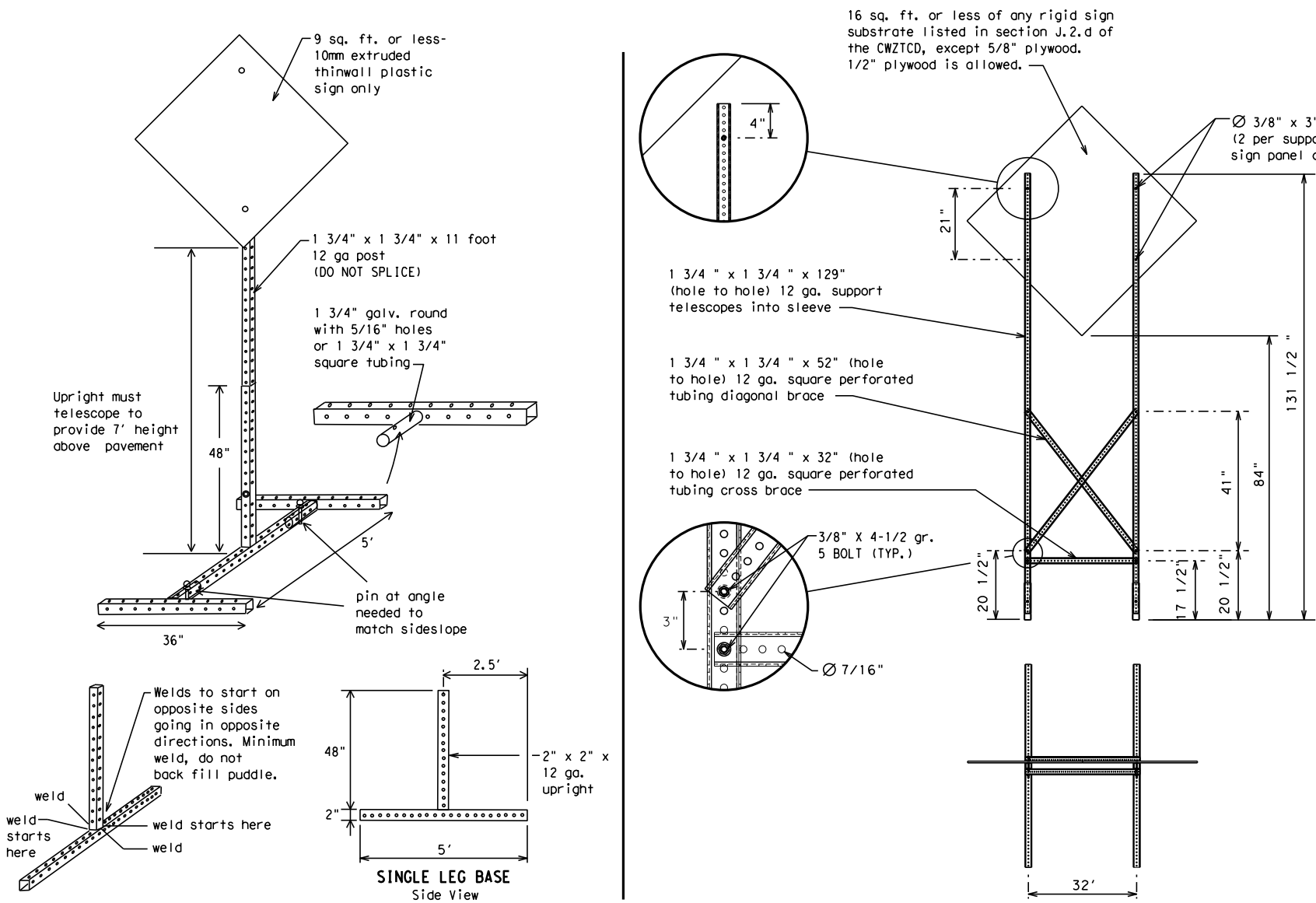
**SKID MOUNTED WOOD SIGN SUPPORTS**

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



**GROUND MOUNTED SIGN SUPPORTS**

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



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

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

**WEDGE ANCHORS**

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

**OTHER DESIGNS**

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

**GENERAL NOTES**

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

SHEET 5 OF 12



**BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT**

BC(5) - 21

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7-13 5-21	BRY	FREESTONE	17	

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

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

## 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.

## Phase 1: Condition Lists

### Road/Lane/Ramp Closure List

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

### Other Condition List

FRONTAGE ROAD CLOSED
SHOULDER CLOSED XXX FT
RIGHT LN CLOSED XXX FT
RIGHT X LANES OPEN
DAYTIME LANE CLOSURES
I-XX SOUTH EXIT CLOSED
EXIT XXX CLOSED X MILE
RIGHT LN TO BE CLOSED
X LANES CLOSED TUE - FRI
ROADWORK XXX FT
FLAGGER XXXX FT
RIGHT LN NARROWS XXXX FT
MERGING TRAFFIC XXXX FT
LOOSE GRAVEL XXXX FT
DETOUR X MILE
ROADWORK PAST SH XXXX
BUMP XXXX FT
TRAFFIC SIGNAL XXXX FT
ROAD REPAIRS XXXX FT
LANE NARROWS XXXX FT
TWO-WAY TRAFFIC XX MILE
CONST TRAFFIC XXX FT
UNEVEN LANES XXXX FT
ROUGH ROAD XXXX FT
ROADWORK NEXT FRI-SUN
US XXX EXIT X MILES
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
DETOUR NEXT X EXITS
USE EXIT XXX
STAY ON US XXX SOUTH
TRUCKS USE US XXX N
WATCH FOR TRUCKS
EXPECT DELAYS
REDUCE SPEED XXX FT
USE OTHER ROUTES
STAY IN LANE *
FORM X LINES RIGHT
USE XXXXX RD EXIT
USE EXIT I-XX NORTH
USE I-XX E TO I-XX N
WATCH FOR TRUCKS
EXPECT DELAYS
END SHOULDER USE
WATCH FOR WORKERS

### Location List

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

### \*\* 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

\*\* 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.

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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
Canal	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



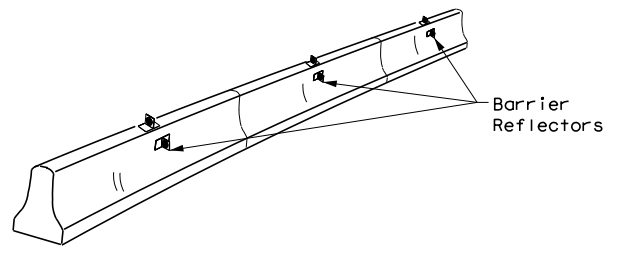
## BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC (6) - 21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	BRY	FREESTONE	18	

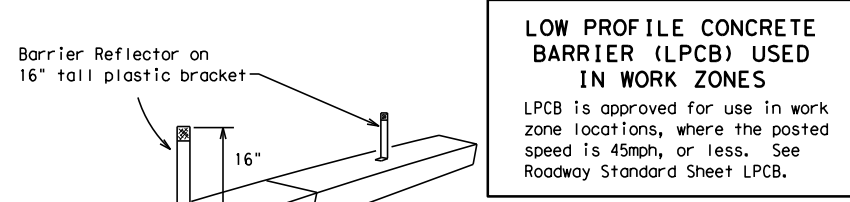
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors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



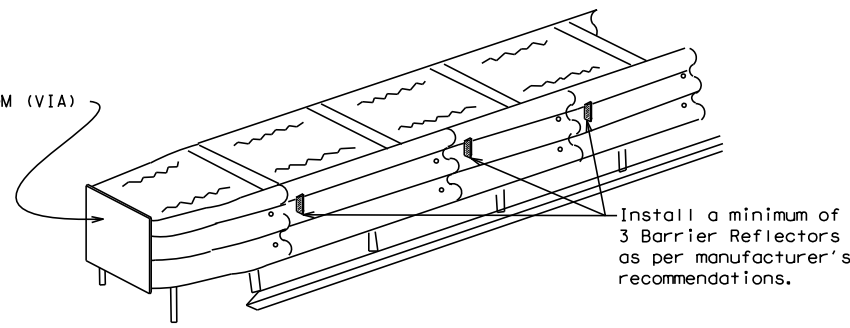
**CONCRETE TRAFFIC BARRIER (CTB)**

- 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.

**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**

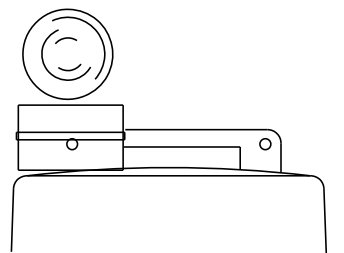
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet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

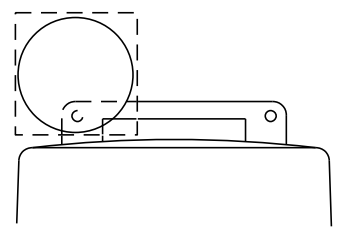
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing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



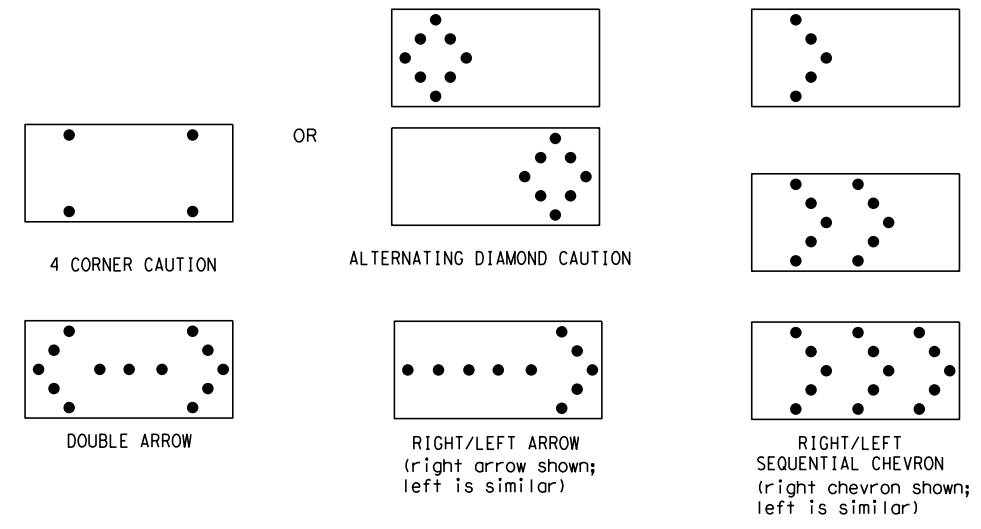
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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.

Traffic Safety Division Standard

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

**BC (7) - 21**

FILE:	bc-21.dgn	DN:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
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**GENERAL NOTES**

- For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
- For intermediate term stationary work zones on freeways, drums should be used as the primary channelizing device but may be replaced in tangent sections by vertical panels, 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.
- For short term stationary work zones on freeways, drums are the preferred channelizing device but may be replaced in tapers, transitions and tangent sections by vertical panels, two-piece cones or one-piece cones as approved by the Engineer.
- Drums and 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).
- Drums, bases, and related materials shall exhibit good workmanship and shall be free from objectionable marks or defects that would adversely affect their appearance or serviceability.
- The Contractor shall have a maximum of 24 hours to replace any plastic drums identified for replacement by the Engineer/Inspector. The replacement device must be an approved device.

**GENERAL DESIGN REQUIREMENTS**

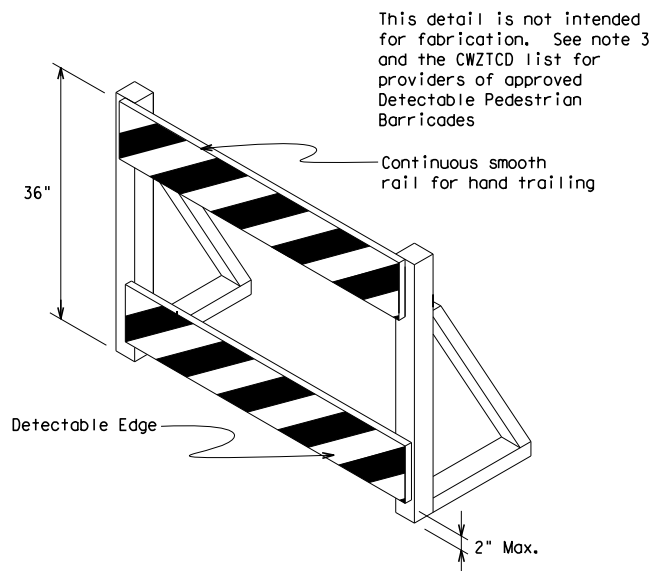
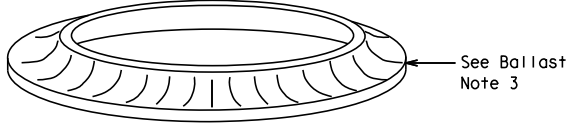
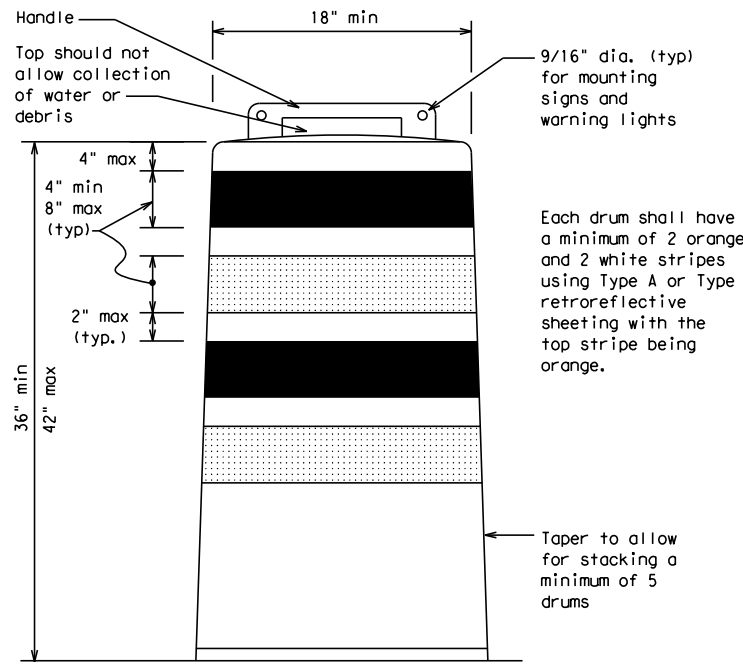
- Pre-qualified plastic drums shall meet the following requirements:
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
  - The body and base shall lock together in such a manner that the body separates from the base when impacted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

**RETROREFLECTIVE SHEETING**

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

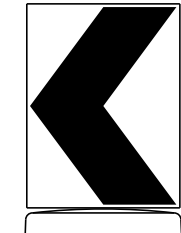
**BALLAST**

- 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.
- Bases with built-in ballast shall weigh between 40 lbs. and 50 lbs. Built-in ballast can be constructed of an integral crumb rubber base or a solid rubber base.
- Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
- The ballast shall not be heavy objects, water, or any material that would become hazardous to motorists, pedestrians, or workers when the drum is struck by a vehicle.
- When used in regions susceptible to freezing, drums shall have drainage holes in the bottoms so that water will not collect and freeze becoming a hazard when struck by a vehicle.
- Ballast shall not be placed on top of drums.
- Adhesives may be used to secure base of drums to pavement.

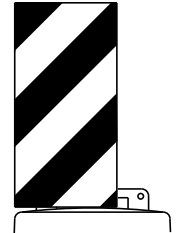


**DETECTABLE PEDESTRIAN BARRICADES**

- When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Refer to WZ(BTS-2) for Pedestrian Control requirements for Sidewalk Diversions, Sidewalk Detours and Crosswalk Closures.
- Where pedestrians with visual disabilities normally use the closed sidewalk, a Detectable Pedestrian Barricade shall be placed across the full width of the closed sidewalk instead of a Type 3 Barricade.
- Detectable pedestrian barricades similar to the one pictured above, longitudinal channelizing devices, some concrete barriers, and wood or chain link fencing with a continuous detectable edging can satisfactorily delineate a pedestrian path.
- Tape, rope, or plastic chain strung between devices are not detectable, do not comply with the design standards in the "Americans with Disabilities Act Accessibility Guidelines (ADAAG)" and should not be used as a control for pedestrian movements.
- Warning lights shall not be attached to detectable pedestrian barricades.
- Detectable pedestrian barricades should use 8" nominal barricade 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**

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

SHEET 8 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

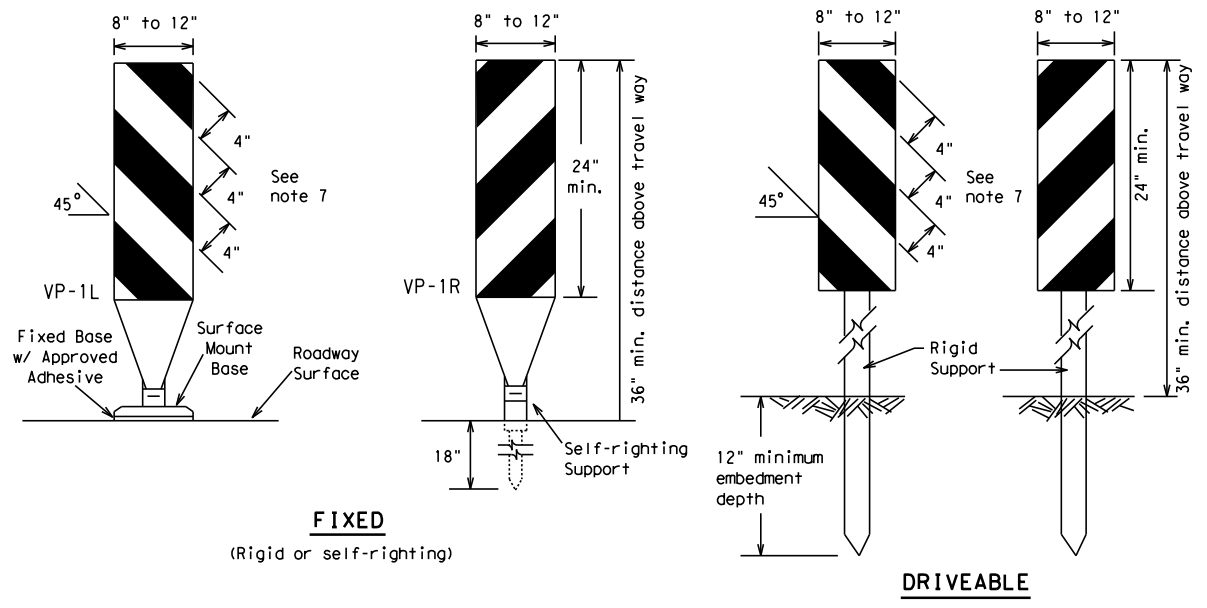
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9-07	5-21	BRY	FREESTONE	20					
7-13									



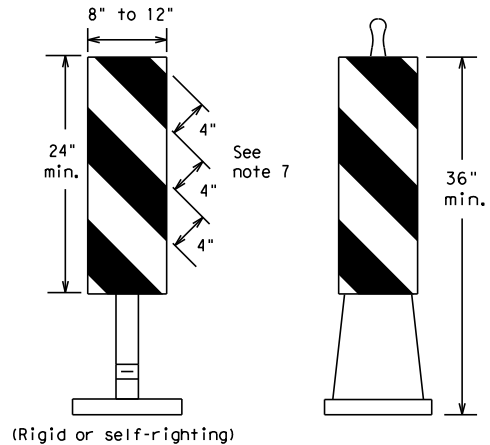
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**FIXED**  
(Rigid or self-righting)

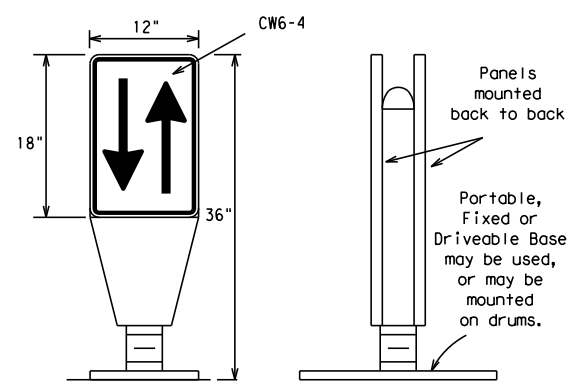
**DRIVEABLE**



**PORTABLE**

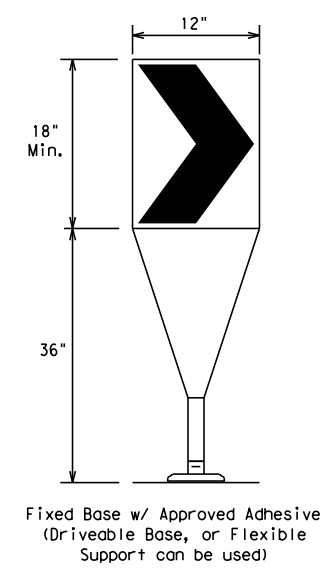
**VERTICAL PANELS (VPs)**

- 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.



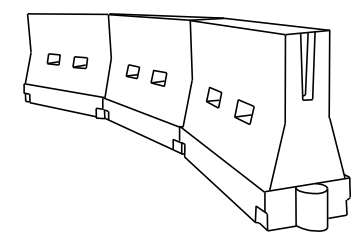
**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**

- 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 VPs.
- Spacing between the OTLD shall not exceed 500 feet. 42" cones or VPs 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<sub>FL</sub> or Type C<sub>FL</sub> conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



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

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

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

SHEET 9 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (9) - 21**

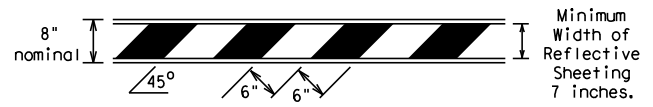
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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0917	20	046	CR 481				
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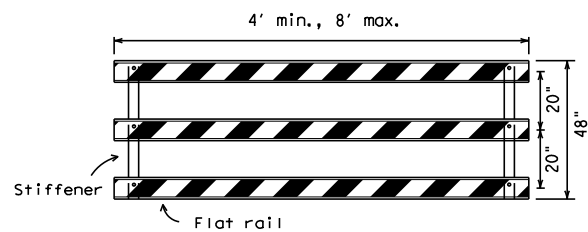
**TYPE 3 BARRICADES**

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

Barricades shall NOT be used as a sign support.



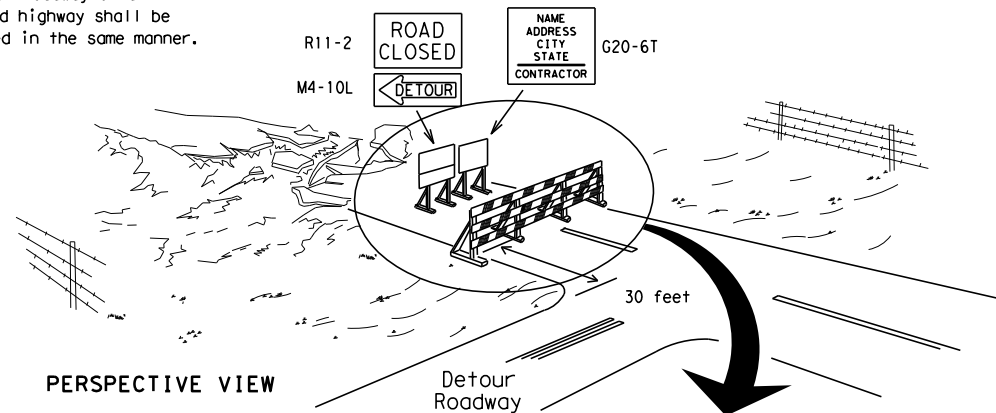
**TYPICAL STRIPING DETAIL FOR BARRICADE RAIL**



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

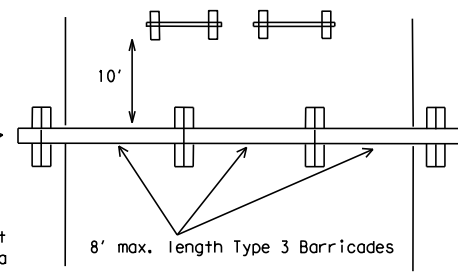
**TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES**

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



PERSPECTIVE VIEW

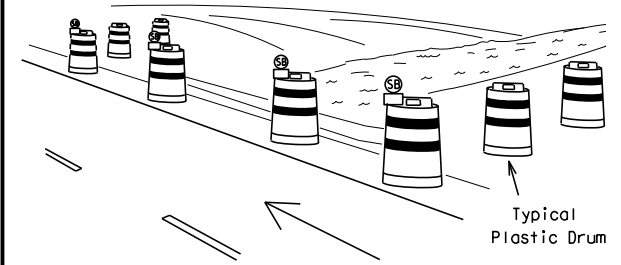
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



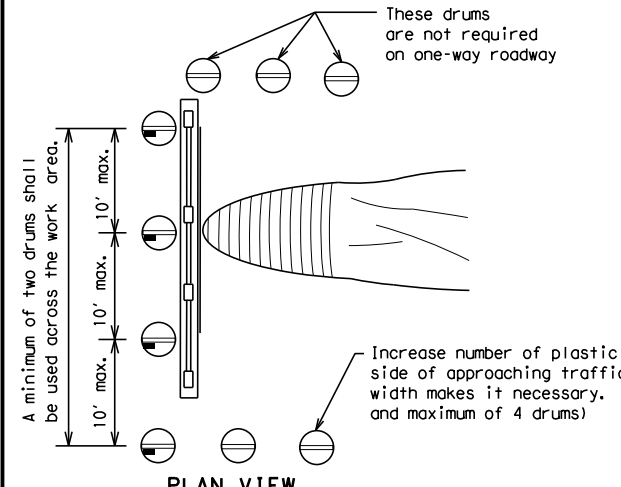
PLAN VIEW

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

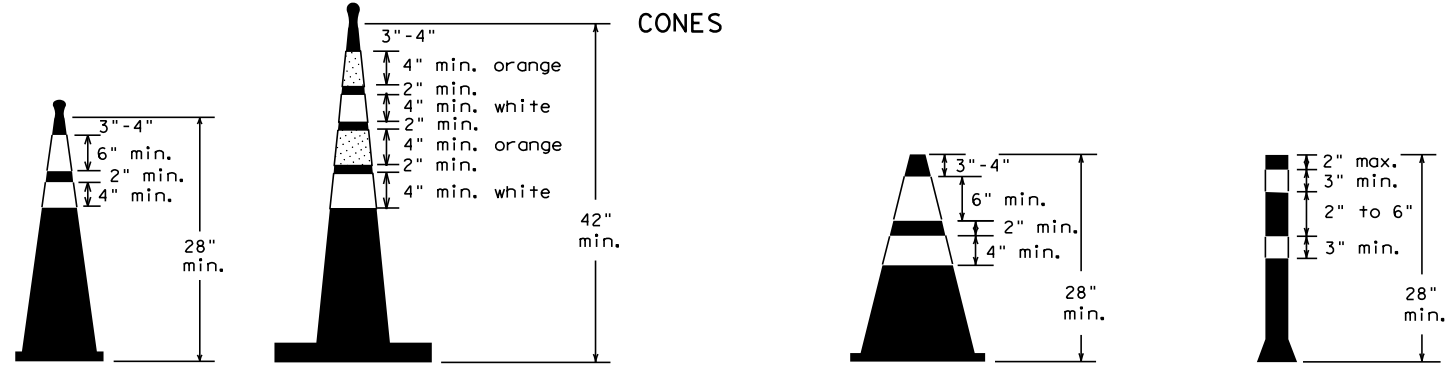


PLAN VIEW

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**



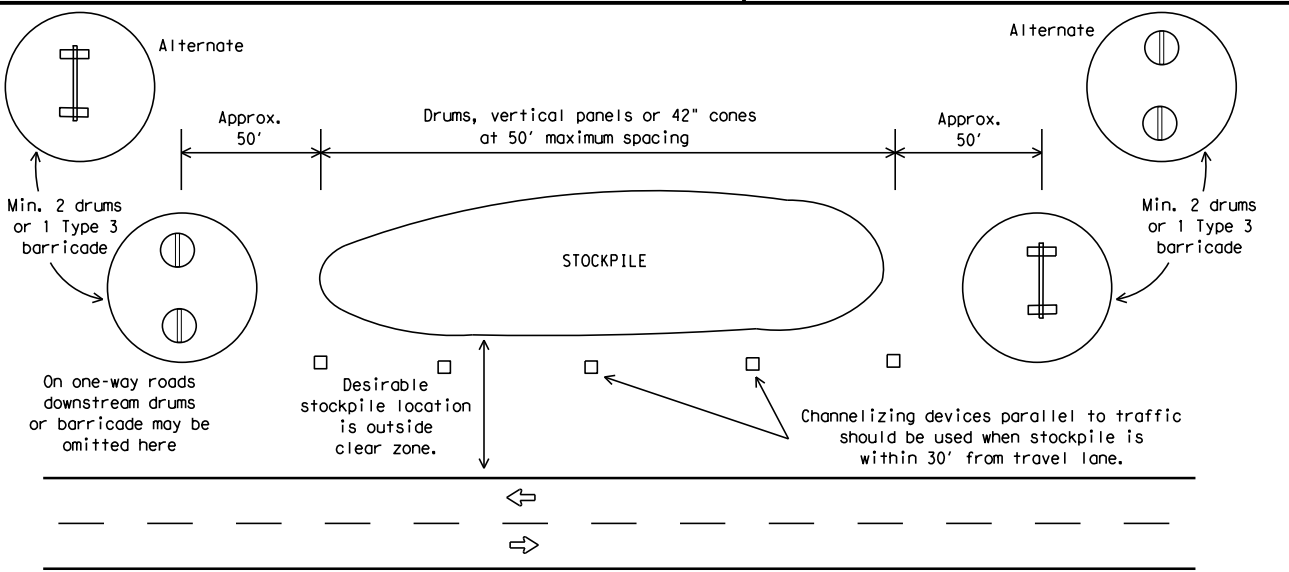
Two-Piece cones

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.



**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (10) - 21**

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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.

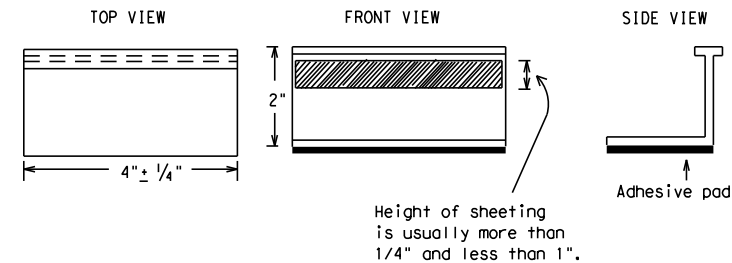
### MAINTAINING WORK ZONE PAVEMENT MARKINGS

- 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.
- Black-out marking tape may be used to cover conflicting existing markings for periods less than two weeks when approved by the Engineer.

## Temporary Flexible-Reflective Roadway Marker Tabs



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

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

### RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

SHEET 11 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

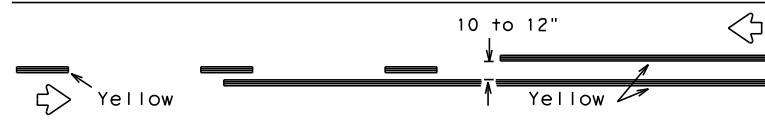
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11-02 8-14				

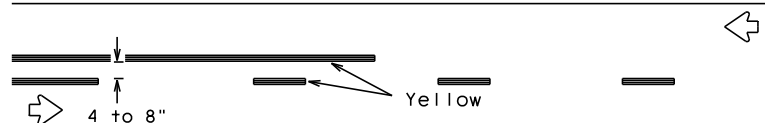
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## PAVEMENT MARKING PATTERNS

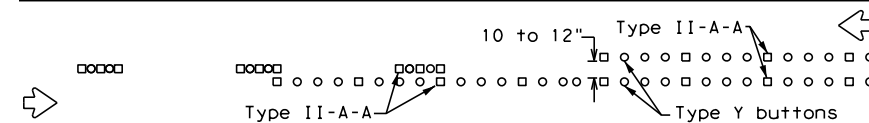


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

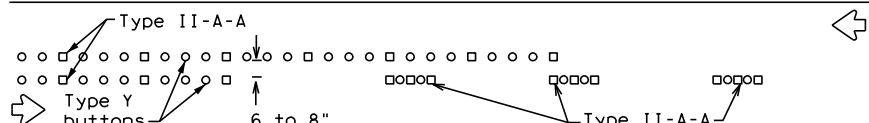


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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

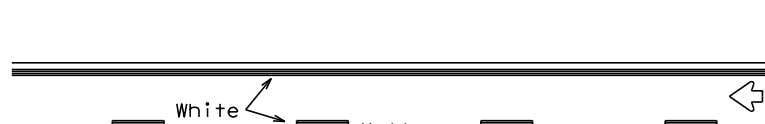


RAISED PAVEMENT MARKERS - PATTERN A



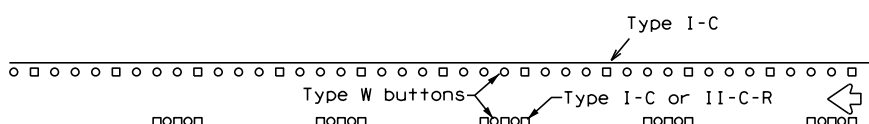
RAISED PAVEMENT MARKERS - PATTERN B

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



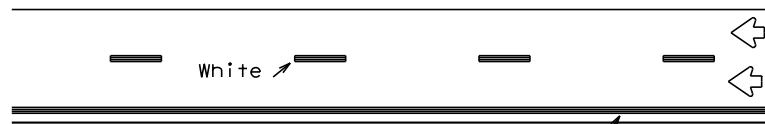
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



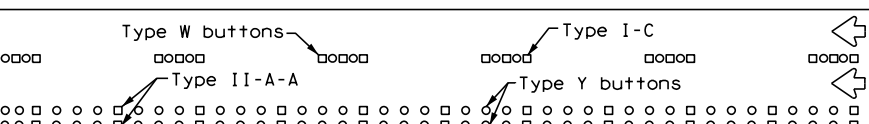
RAISED PAVEMENT MARKERS

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



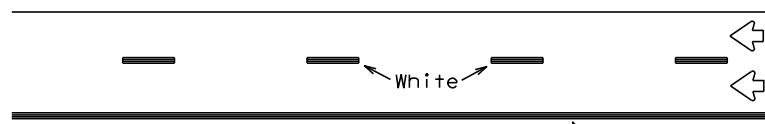
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



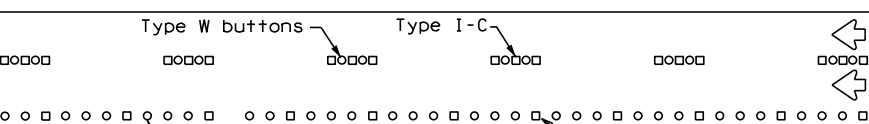
RAISED PAVEMENT MARKERS

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

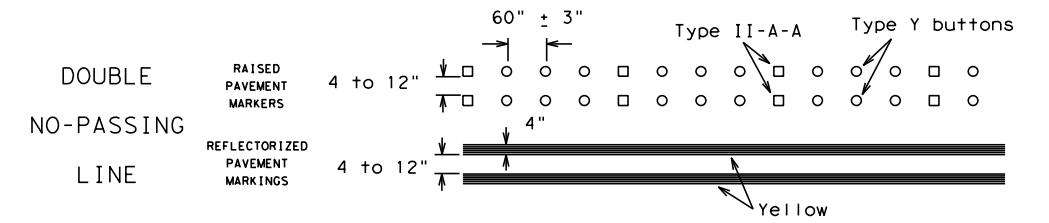
Prefabricated markings may be substituted for reflectorized pavement markings.



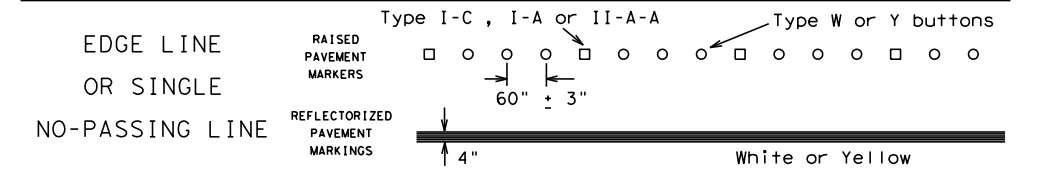
RAISED PAVEMENT MARKERS

## TWO-WAY LEFT TURN LANE

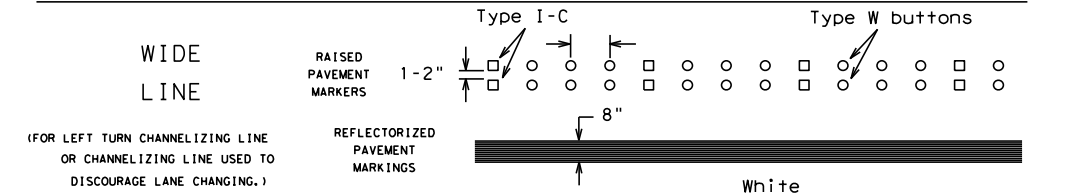
## STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



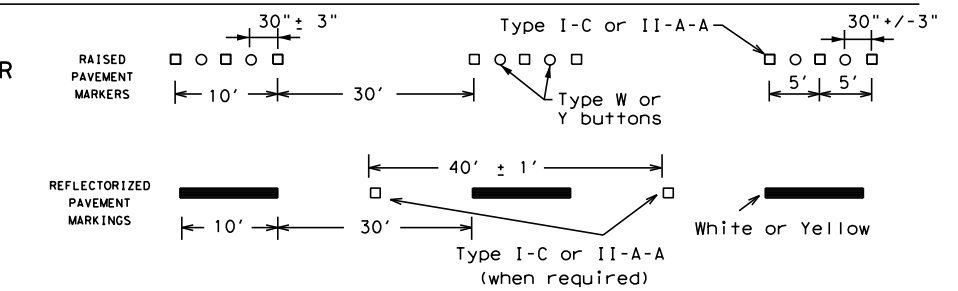
### SOLID LINES



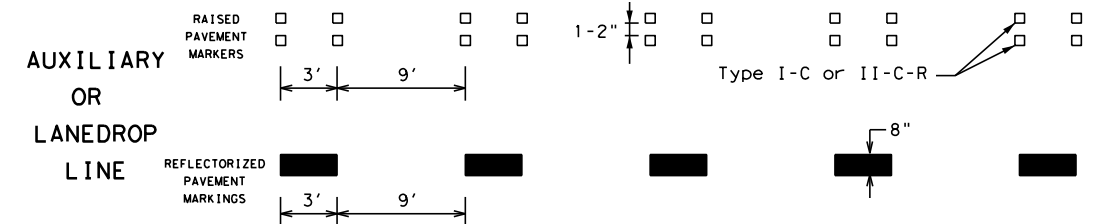
### WIDE LINE



### CENTER LINE OR LANE LINE

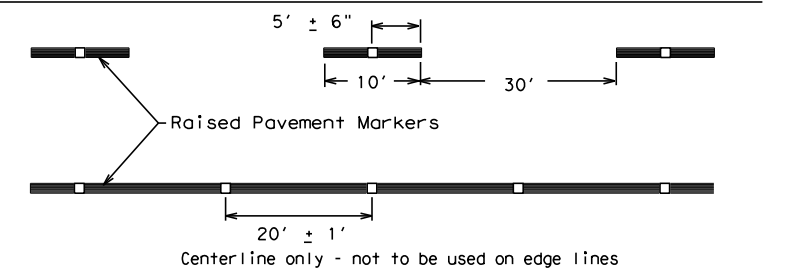


### BROKEN LINES



### REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



SHEET 12 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
1-97 9-07 5-21	DIST	COUNTY	SHEET NO.	
2-98 7-13	BRY	FREESTONE	24	
11-02 8-14				

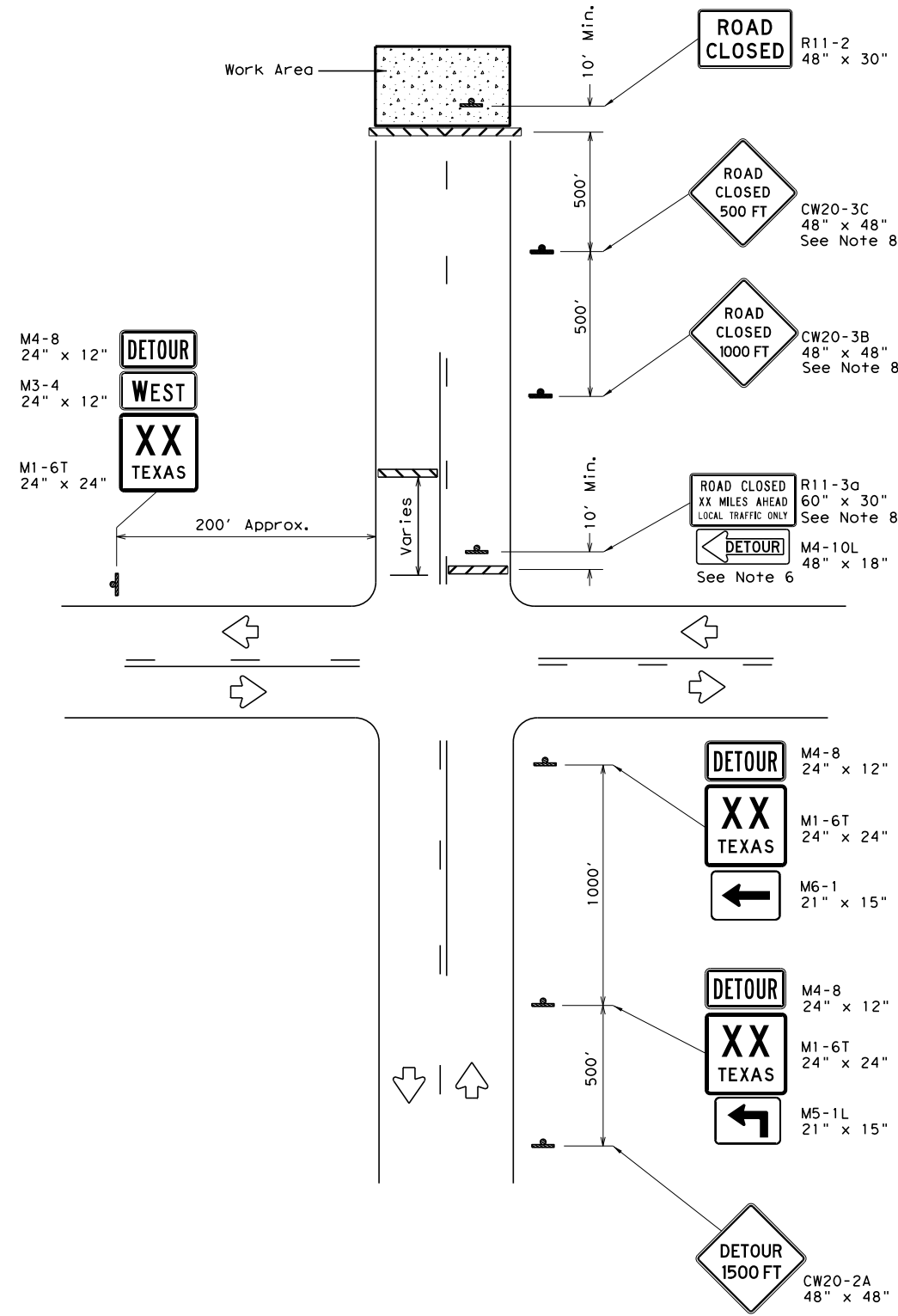
Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

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

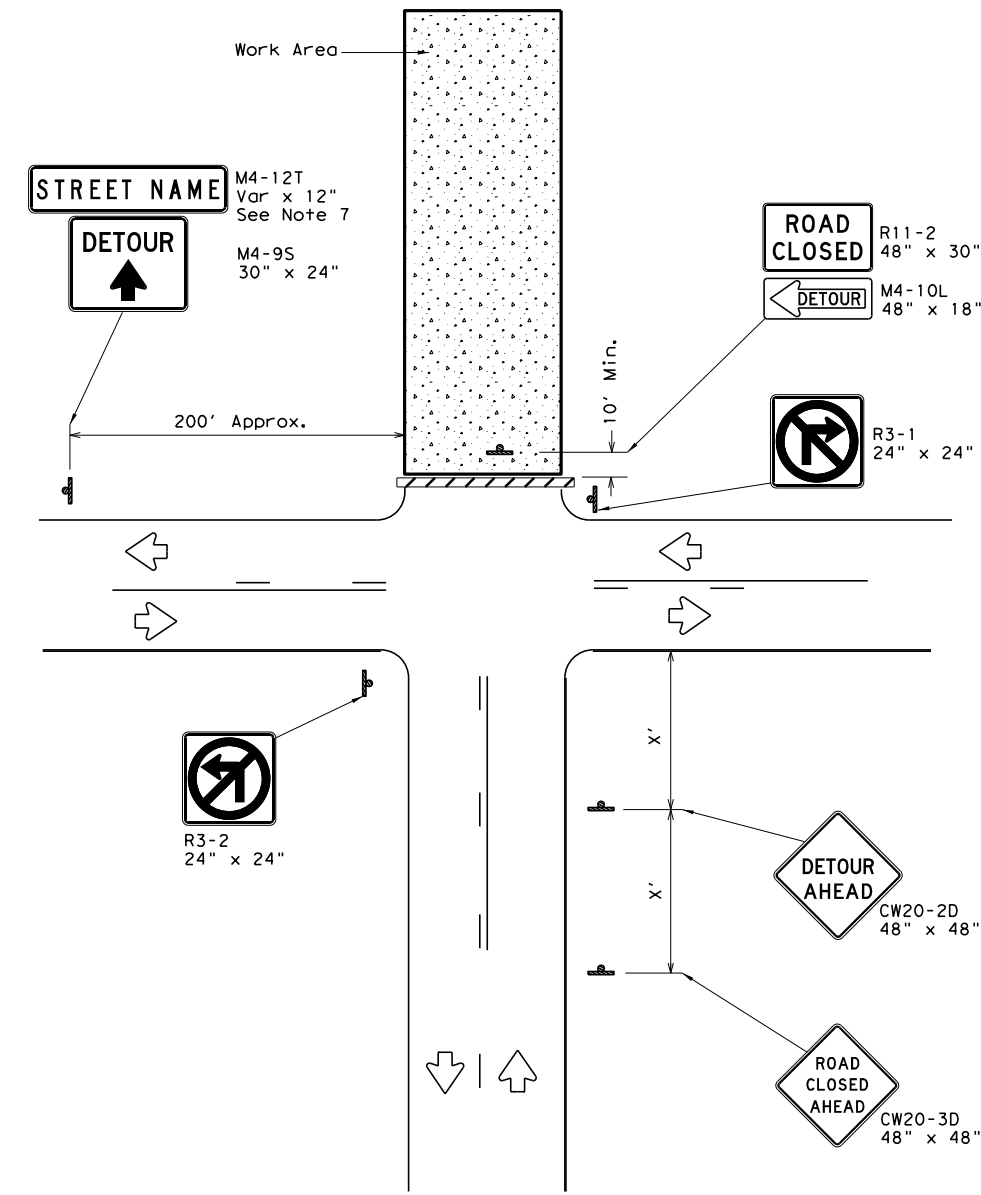
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**ROAD CLOSURE BEYOND THE INTERSECTION**  
 Signing for a Numbered Route with an Off-Site Detour



**ROAD CLOSURE AT THE INTERSECTION**  
 Signing for an Un-numbered Route with an Off-Site Detour

LEGEND	
	Type 3 Barricade
	Sign

Posted Speed *	Minimum Sign Spacing "X" Distance
30	120'
35	160'
40	240'
45	320'
50	400'
55	500'
60	600'
65	700'
70	800'
75	900'

\* Conventional Roads Only

**GENERAL NOTES**

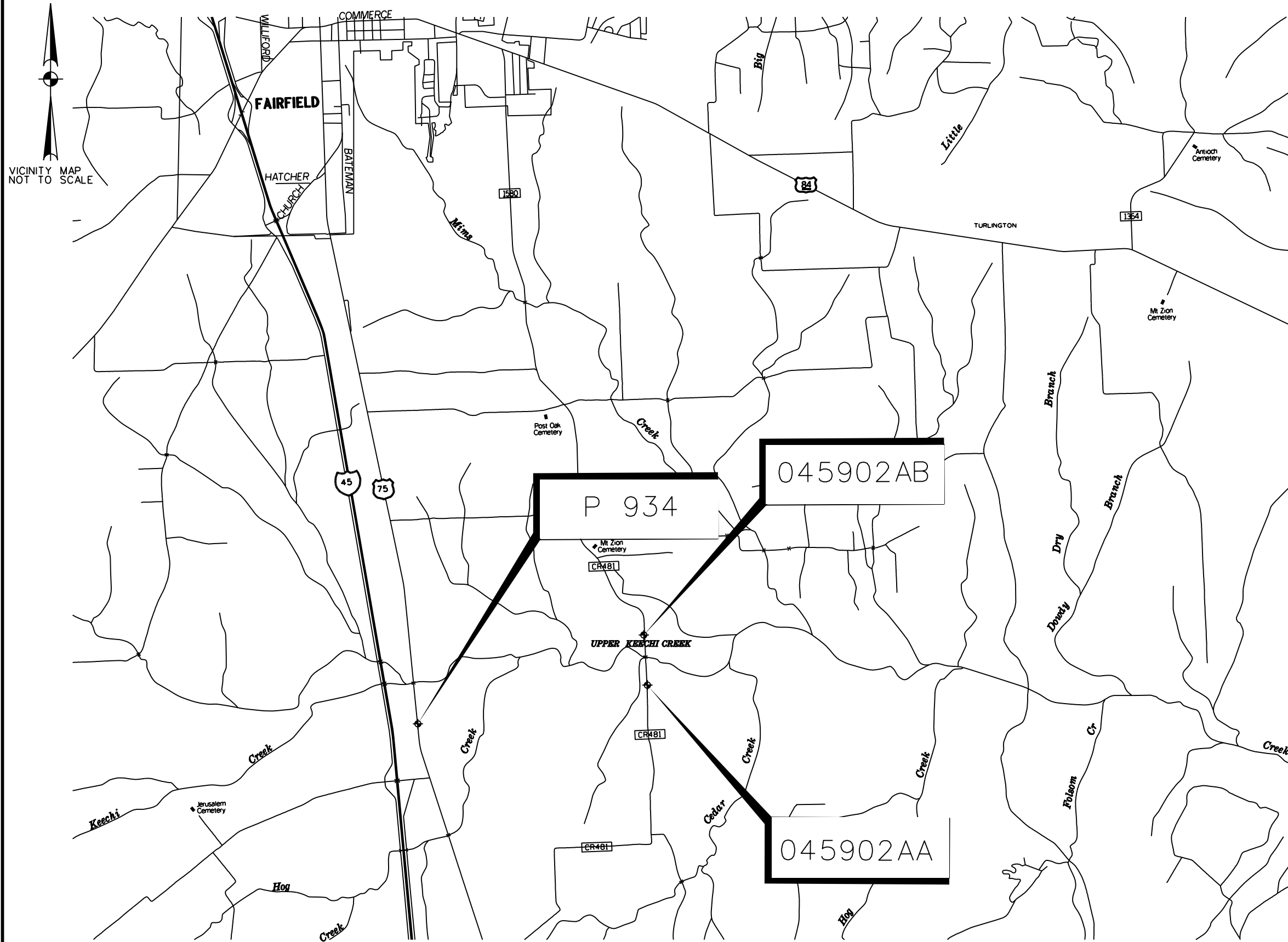
- This sheet is intended to provide details for temporary work zone road closures. For permanent road closure details see the D&OM standards.
- Barricades used shall meet the requirements shown on Barricade and Construction Standard BC(10) and listed on the Compliant Work Zone Traffic Control Devices List (CWZTCD).
- Stockpiled materials shall not be placed on the traffic side of barricades.
- Barricades at the road closure should extend from pavement edge to pavement edge.
- Detour signing shown is intended to illustrate the type of signing that is appropriate for numbered routes or un-numbered routes as labeled. It does not indicate the full extent of detour signing required. Detour routes should be signed as shown elsewhere in the plans.
- If the road is open for a significant distance beyond the intersection or there are significant origin/destination points beyond the intersection, the signs and barricades at this location should be located at the edge of the traveled way.
- The Street Name (M4-12T) sign is to be placed above the DETOUR (M4-9S) sign.
- For urban areas where there is a shorter distance between the intersection and the actual closure location, the ROAD CLOSED XX MILES AHEAD (R11-3a) sign may be replaced with a ROAD CLOSED TO THRU TRAFFIC (R11-4) sign. If adequate space does not exist between the intersection and the closure a single ROAD CLOSED AHEAD (CW20-3D) sign spaced as per the table above may replace the ROAD CLOSED 1000 FT (CW20-3B) and ROAD CLOSED 500 FT (CW20-3C) signs.
- Signs and barricades shown shall be subsidiary to Item 502. Locations where these details will be required shall be as shown elsewhere in the plans.



**WORK ZONE ROAD CLOSURE DETAILS**

**WZ (RCD) - 13**

FILE: wzrcd-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
1-97 4-98 7-13	DIST	COUNTY	SHEET NO.	
2-98 3-03	BRY	FREESTONE	25	



VICINITY MAP  
NOT TO SCALE

NOTES:

ALL COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, TEXAS CENTRAL ZONE 4203, NAD83 (2011 ADJ) EPOCH 2010.00 GEOD 12A DETERMINED BY GPS OBSERVATIONS CALCULATED FROM TXDOT VRS NETWORK (CORS PIDS "TXMX D08873", "TXPI DN5858", "TXNA DF8992") ALL DISTANCES AND COORDINATES ARE SURFACE WITH A GRID TO GROUND SCALE FACTOR OF 1.000030000

PROJECT BENCHMARK: USCGS P 934 (BZ0166)

A STANDARD DISK STAMPED "P 934 1948" IN THE CITY OF FAIRFIELD, TX, SET IN A CONCRETE MONUMENT, 5.1 MILES WEST ALONG FARM HIGHWAY NO. 27 FROM THE JUNCTION WITH U.S. HIGHWAY NO. 84 AT FAIRFIELD, 0.1 MILE EAST OF THE MOST EASTERLY OF TWO BRIDGES OVER CANEY CREEK, 49.3 FEET SOUTH AND ABOUT 2.0 FEET ABOVE THE CENTER OF THE HIGHWAY, 10.3 FEET EAST OF A FENCE CORNER POST, 1.8 FEET WEST OF A WITNESS POST, 1.0 FOOT NORTH OF A BARB WIRE FENCE AND SET IN THE TOP OF A CONCRETE POST WHICH PROJECTS 0.4 FOOT ABOVE GROUND.

	SURFACE		
NORTHING	10,585,813.318	(MEASURED)	
EASTING	3,596,677.851	(MEASURED)	
ELEV:	428.610	(PUBLISHED)	
	GRID		
NORTHING	10,585,495.753	(CALCULATED)	
EASTING	3,596,569.954	(CALCULATED)	
ELEV:	428.610	(PUBLISHED)	



*Mark E. Keeton* 6/03/2021  
 MARK E. KEETON DATE  
 PLS NO. 6790

NO.	REVISIONS	BY	DATE



SURVEY CONTROL

SHEET 1 OF 2

Point ID	Latitude (Global)	Longitude (Global)	Northing (Grid)	Easting (Grid)	Northing (Surface)	Easting (Surface)	Elevation	Ellipsoid Height (Global)	Feature Code
045902AA	31d38'45.23674"	-96d07'23.62673"	10,587,148.663	3,606,390.057	10,587,466.277	3,606,498.249	347.080'	262.943'	3-1/2 INCH ALUM DISK STAMPED TEXAS DEPT OF TRANSPORTATION
045902AB	31d39'06.54495"	-96d07'24.47523"	10,589,297.429	3,606,235.303	10,589,615.108	3,606,343.490	354.099'	269.980'	3-1/2 INCH ALUM DISK STAMPED TEXAS DEPT OF TRANSPORTATION

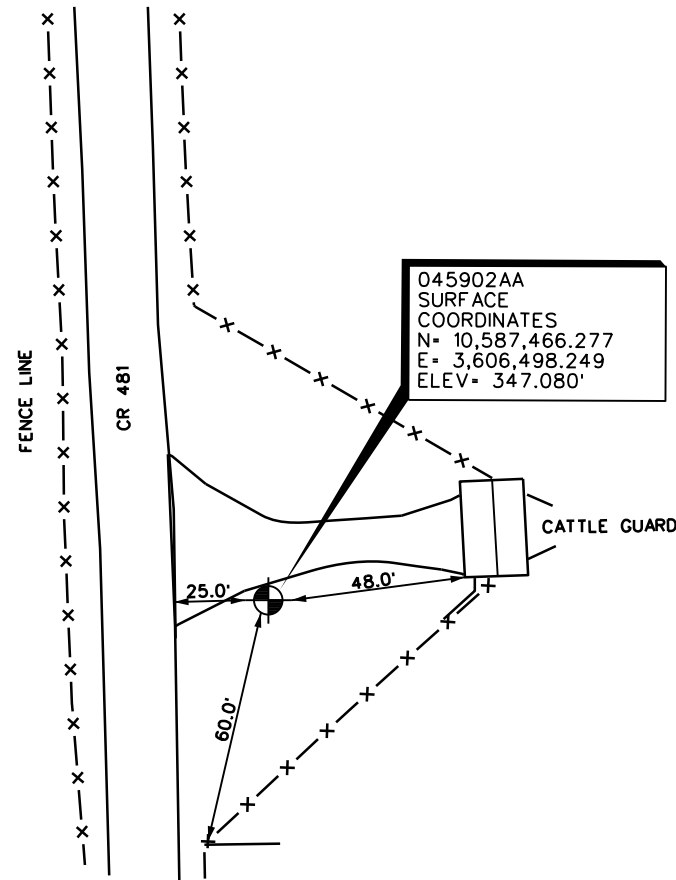
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		25A	
STATE	DISTRICT	COUNTY	
TEXAS	17	FREESTONE	
CONTROL	SECTION	JOB	HIGHWAY NO.
0917	20	046	CR 481



CONTROL MONUMENT DESCRIPTION:

A 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "045902AA".

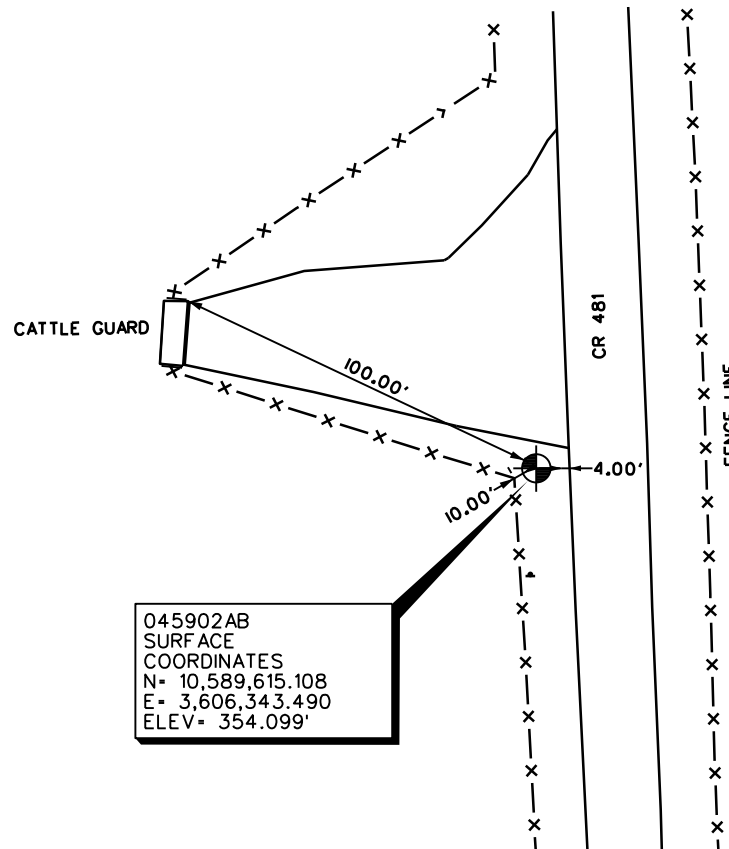
SKETCH (NOT TO SCALE)



CONTROL MONUMENT DESCRIPTION:

A 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "045902AB".

SKETCH (NOT TO SCALE)



NOTES:

ALL COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, TEXAS CENTRAL ZONE 4203, NAD83 (2011 ADJ) EPOCH 2010.00 GEOID 12A DETERMINED BY GPS OBSERVATIONS CALCULATED FROM TXDOT VRS NETWORK (CORS PIDs "TXMX D08873", "TXPI DN5858", "TXNA DF8992") ALL DISTANCES AND COORDINATES ARE SURFACE WITH A GRID TO GROUND SCALE FACTOR OF 1.000030000

PROJECT BENCHMARK: USCGS P 934 (BZ0166)

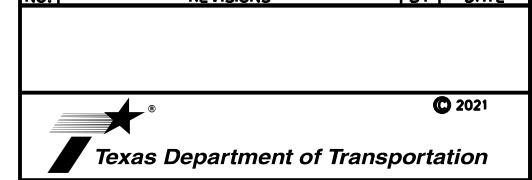
A STANDARD DISK STAMPED "P 934 1948" IN THE CITY OF FARFIELD, TX, SET IN A CONCRETE MONUMENT, 5.1 MILES WEST ALONG FARM HIGHWAY NO. 27 FROM THE JUNCTION WITH U.S. HIGHWAY NO. 84 AT FAIRFIELD, 0.1 MILE EAST OF THE MOST EASTERLY OF TWO BRIDGES OVER CANEY CREEK, 49.3 FEET SOUTH AND ABOUT 2.0 FEET ABOVE THE CENTER OF THE HIGHWAY, 10.3 FEET EAST OF A FENCE CORNER POST, 1.8 FEET WEST OF A WITNESS POST, 1.0 FOOT NORTH OF A BARB WIRE FENCE AND SET IN THE TOP OF A CONCRETE POST WHICH PROJECTS 0.4 FOOT ABOVE GROUND.

	SURFACE	
NORTHING	10,585,813.318	(MEASURED)
EASTING	3,596,677.851	(MEASURED)
ELEV:	428.610	(PUBLISHED)
	GRID	
NORTHING	10,585,495.753	(CALCULATED)
EASTING	3,596,569.954	(CALCULATED)
ELEV:	428.610	(PUBLISHED)



*Mark E. Keeton* 6/03/2021  
MARK E. KEETON DATE  
PLS NO. 6790

NO.	REVISIONS	BY	DATE



SURVEY CONTROL

FED. RD. DIV. NO.			FEDERAL AID PROJECT NO.	SHEET NO.
STATE			DISTRICT	COUNTY
TEXAS			17	FREESTONE
CONTROL			SECTION	JOB
0917			20	046
				HIGHWAY NO.
				CR 481

6/3/2021 1:45:19 PM KeetonME I:\SUR\WJXN4001-Bryon Bridges PS&E\700 CADD\713 Survey\713.4 Control\Surveys\WJXN4001 91720046 CONTROL.dgn

045902AA

APPROXIMATE LOCATION:

A 3-1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "045902AA" LOCATED ON CR 481 APPROXIMATELY 1260 FEET SOUTH OF UPPER KEECHICREEK CROSSING, APPROXIMATELY 5.5 MILES SOUTH OF THE INTERSECTION AT US HIGHWAY 84 AND POST OAK ROAD, SOUTH OF AN EASTBOUND PRIVATE GRAVEL ROAD, APPROXIMATELY 25 FEET EAST OF THE EAST EDGE OF PAVEMENT, APPROXIMATELY 48 FEET SOUTHWEST OF THE SOUTHWEST CORNER OF A STEEL CATTLE GUARD, AND APPROXIMATELY 60 FEET NORTHEAST OF A 1-INCH METAL CORNER POST.

US SURVEY FEET  
TEXAS CENTRAL ZONE 4203  
NORTH AMERICAN DATUM OF 1983 (NAD83)  
GEOID 12A MODEL  
DATE SET: APRIL 22, 2021  
TXDOT SURFACE ADJUSTMENT FACTOR: 1.000030000

GRID NORTHING:	10,587,148.663
GRID EASTING:	3,606,390.057
SURFACE NORTHING:	10,587,466.277
SURFACE EASTING:	3,606,498.249
NAVD88 ELEVATION:	347.080'

045902AB

APPROXIMATE LOCATION:

A 3-1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "045902AB" LOCATED ON CR 481 APPROXIMATELY 900 FEET NORTH OF UPPER KEECHICREEK CROSSING, APPROXIMATELY 5.1 MILES SOUTH OF THE INTERSECTION AT US HIGHWAY 84 AND POST OAK ROAD, SOUTH OF A WESTBOUND PRIVATE GRAVEL ROAD, APPROXIMATELY 4 FEET WEST OF THE WEST EDGE OF PAVEMENT, APPROXIMATELY 100 FEET SOUTHEAST OF THE NORTHEAST CORNER OF A STEEL CATTLE GUARD, AND APPROXIMATELY 10 FEET EAST OF A 5-INCH WOOD CORNER POST.

US SURVEY FEET  
TEXAS CENTRAL ZONE 4203  
NORTH AMERICAN DATUM OF 1983 (NAD83)  
GEOID 12A MODEL  
DATE SET: APRIL 22, 2021  
TXDOT SURFACE ADJUSTMENT FACTOR: 1.000030000

GRID NORTHING:	10,589,297.429
GRID EASTING:	3,606,235.303
SURFACE NORTHING:	10,589,615.108
SURFACE EASTING:	3,606,343.490
NAVD88 ELEVATION:	354.099'

Beginning chain CR481 description

Point CR4811 X 3,606,404.3890 Y 10,588,511.0987 Sta 50+00.00

Course from CR4811 to PC CR481\_3 N 1° 04' 55.20" W Dist 25.2374

Curve Data  
\*-----\*

Curve CR481\_3

P.I. Station 50+44.74 X 3,606,403.5441 Y 10,588,555.8327  
 Delta = 1° 29' 23.84" (LT)  
 Degree = 3° 49' 10.99"  
 Tangent = 19.5046  
 Length = 39.0070  
 Radius = 1,500.0000  
 External = 0.1268  
 Long Chord = 39.0059  
 Mid. Ord. = 0.1268  
 P.C. Station 50+25.24 X 3,606,403.9124 Y 10,588,536.3316  
 P.T. Station 50+64.24 X 3,606,402.6688 Y 10,588,575.3176  
 C.C. X 3,604,904.1799 Y 10,588,508.0065  
 Back = N 1° 04' 55.20" W  
 Ahead = N 2° 34' 19.04" W  
 Chord Bear = N 1° 49' 37.12" W

Course from PT CR481\_3 to CR4815 N 2° 34' 19.04" W Dist 400.0489

Point CR4815 X 3,606,384.7170 Y 10,588,974.9635 Sta 54+64.29

Ending chain CR481 description

REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
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*J. Alchevsky*

PRINT DATE	REVISION DATE
5/14/2023	

**Jacobs** 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966

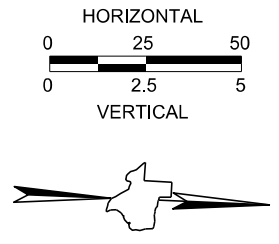
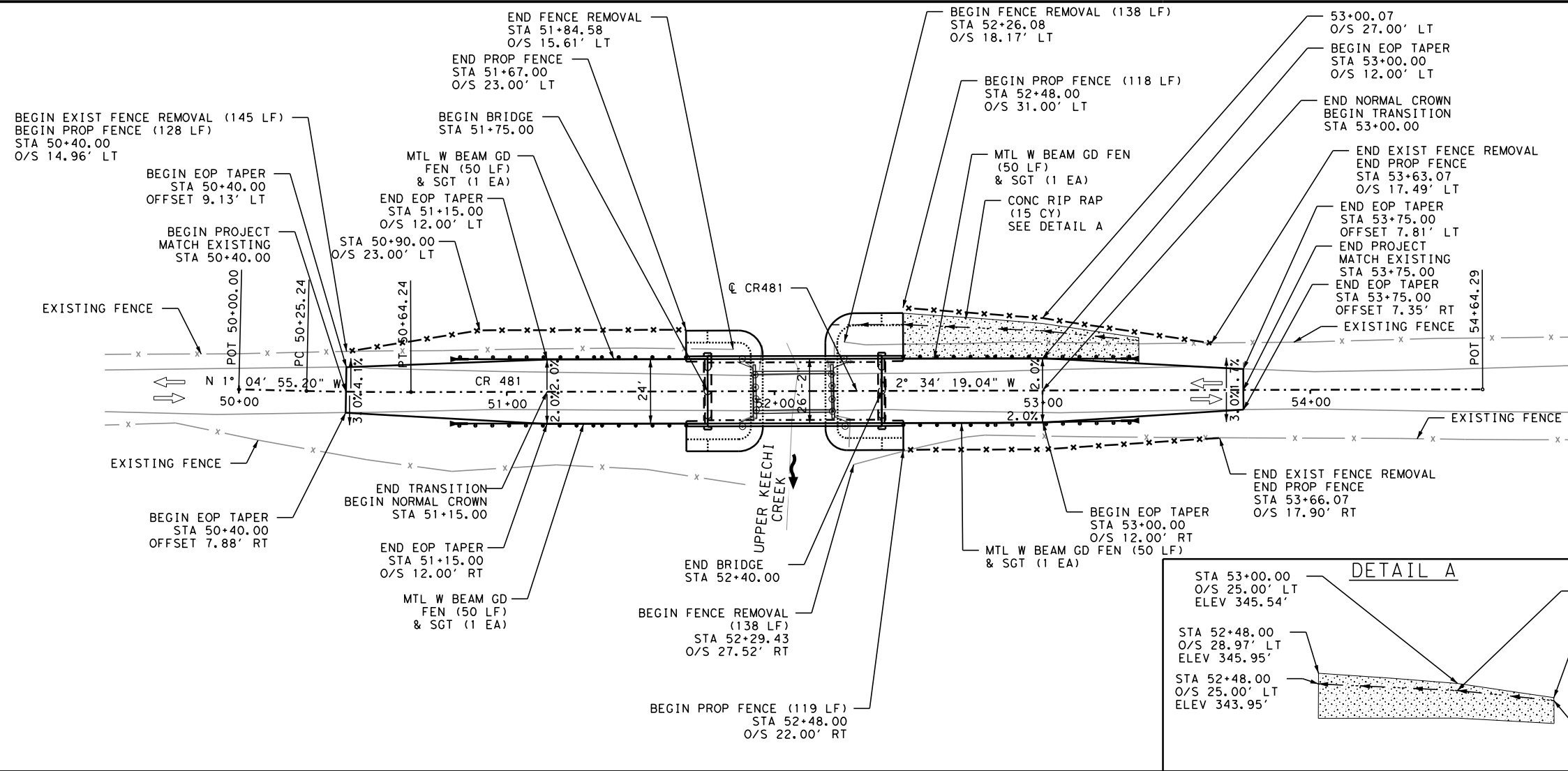


**HORIZONTAL ALIGNMENT DATA  
 CR 481**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	26

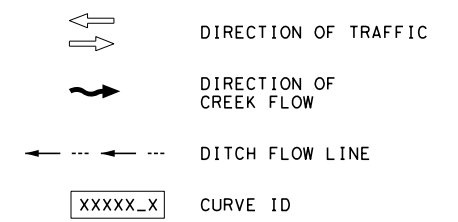


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- NOTES:
1. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES IN THE FIELD PRIOR TO BEGINNING ANY TYPE OF WORK.
  2. EXISTING ROW IS ASSUMED BASED ON VISIBLE FEATURES SUCH AS FENCE LINES AND/OR FREESTONE COUNTY APPRAISAL DISTRICT MAPS.
  3. REMOVAL OF TREES LESS THAN 12" DIAMETER WILL BE SUBSIDIARY TO PREP ROW BID ITEM 0100-6002.

LEGEND



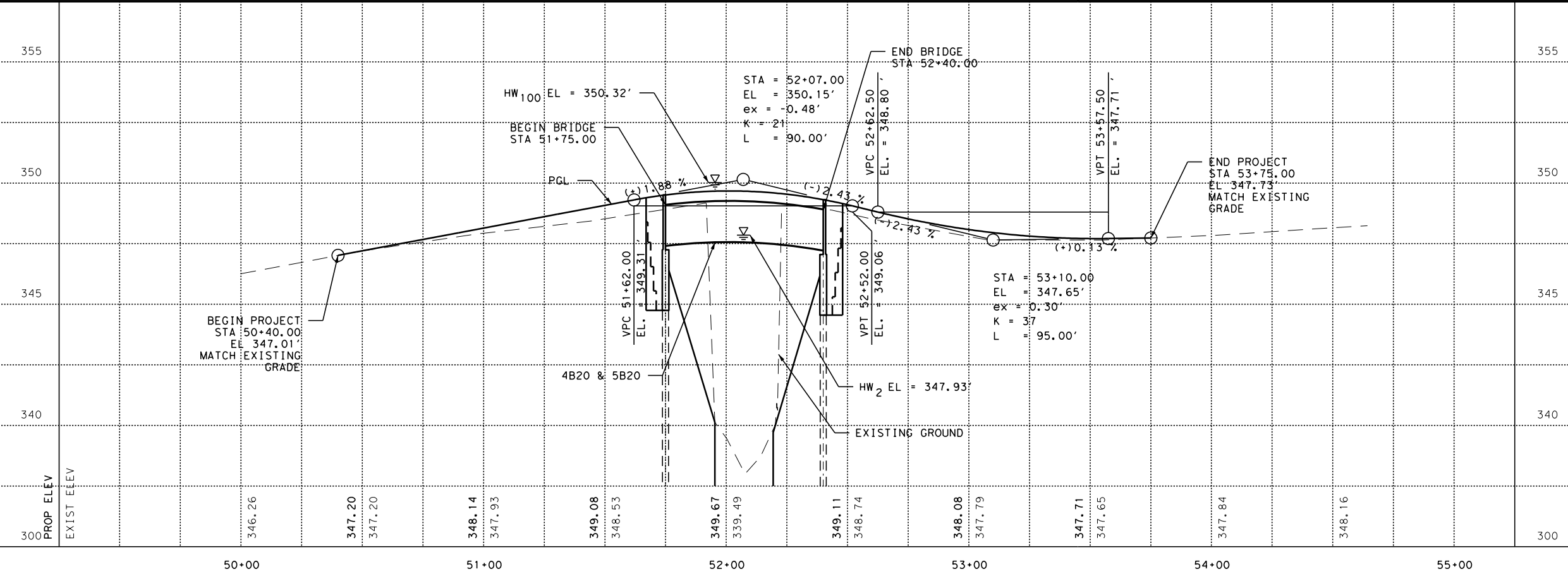
*J. Alchewsky*

PRINT DATE	REVISION DATE
5/15/2023	

**Jacobs** 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966

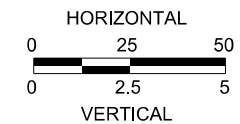


PLAN AND PROFILE



FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	27



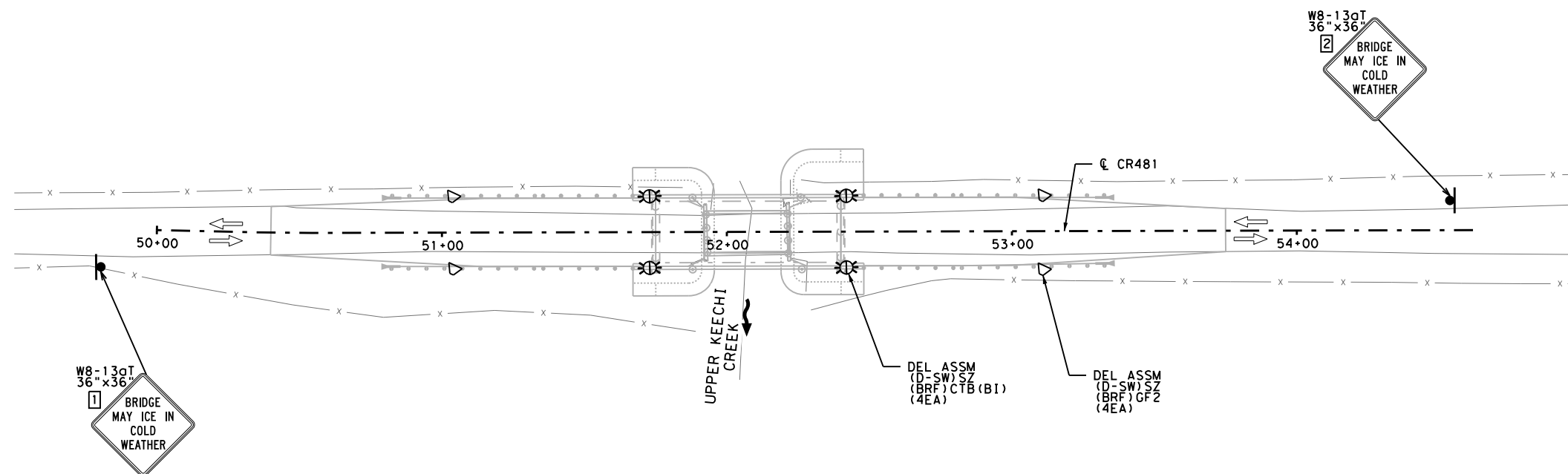


NOTES:

- CONTRACTOR TO REFER TO D&OM(5)-20 FOR OBJECT MARKER PLACEMENT AND SPACING.

LEGEND

- DIRECTION OF TRAFFIC
- DIRECTION OF CREEK FLOW
- TYPE CTB DELINEATOR
- TYPE GF2 DELINEATOR
- SMALL SIGN
- SOSS IDENTIFIER



*Emily Weigand*



5/12/2023

PRINT DATE	REVISION DATE
5/12/2023	

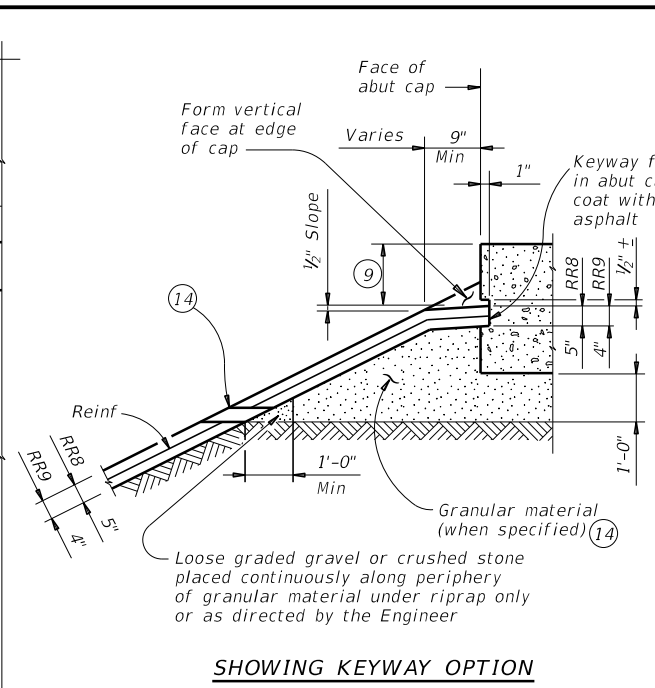
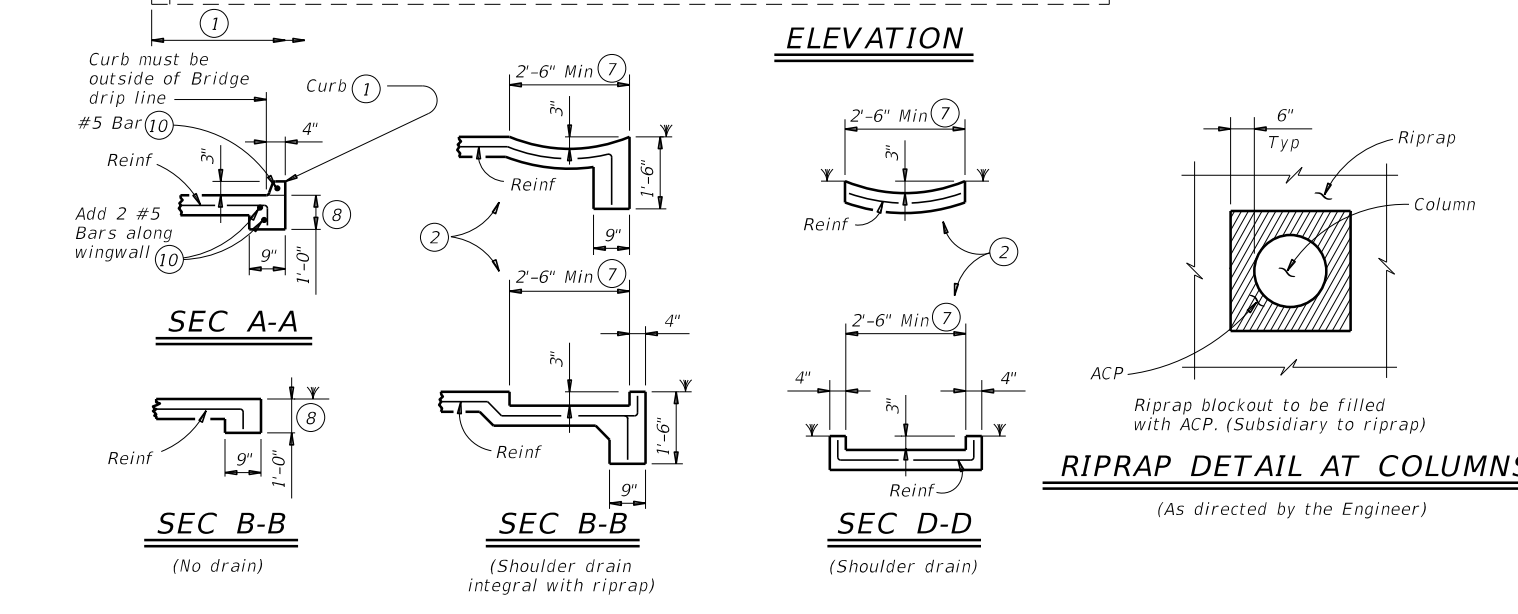
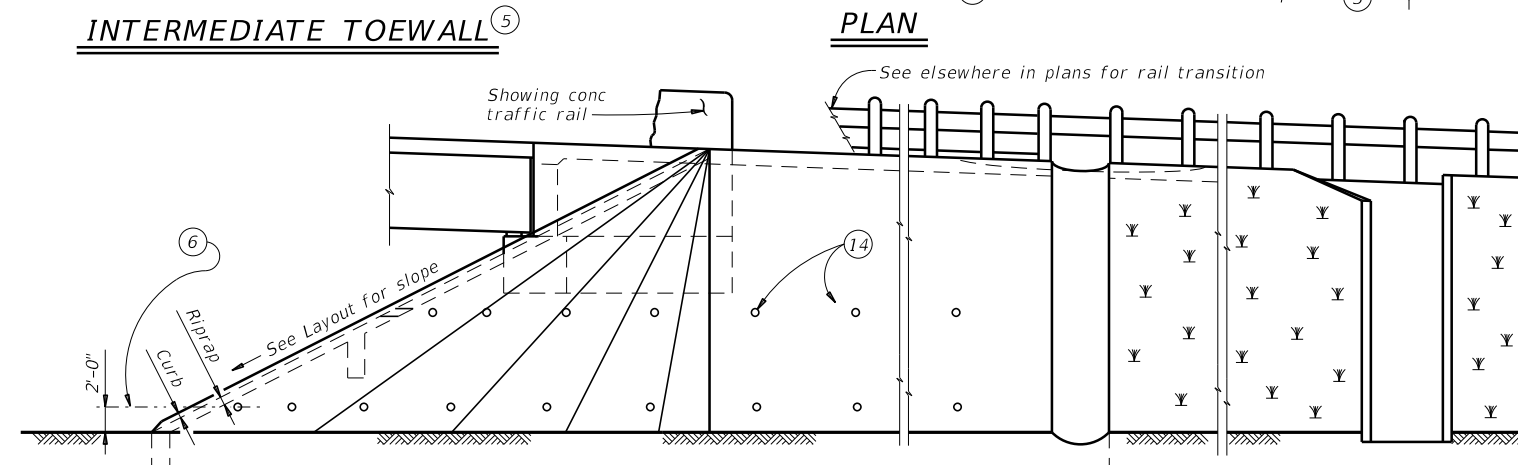
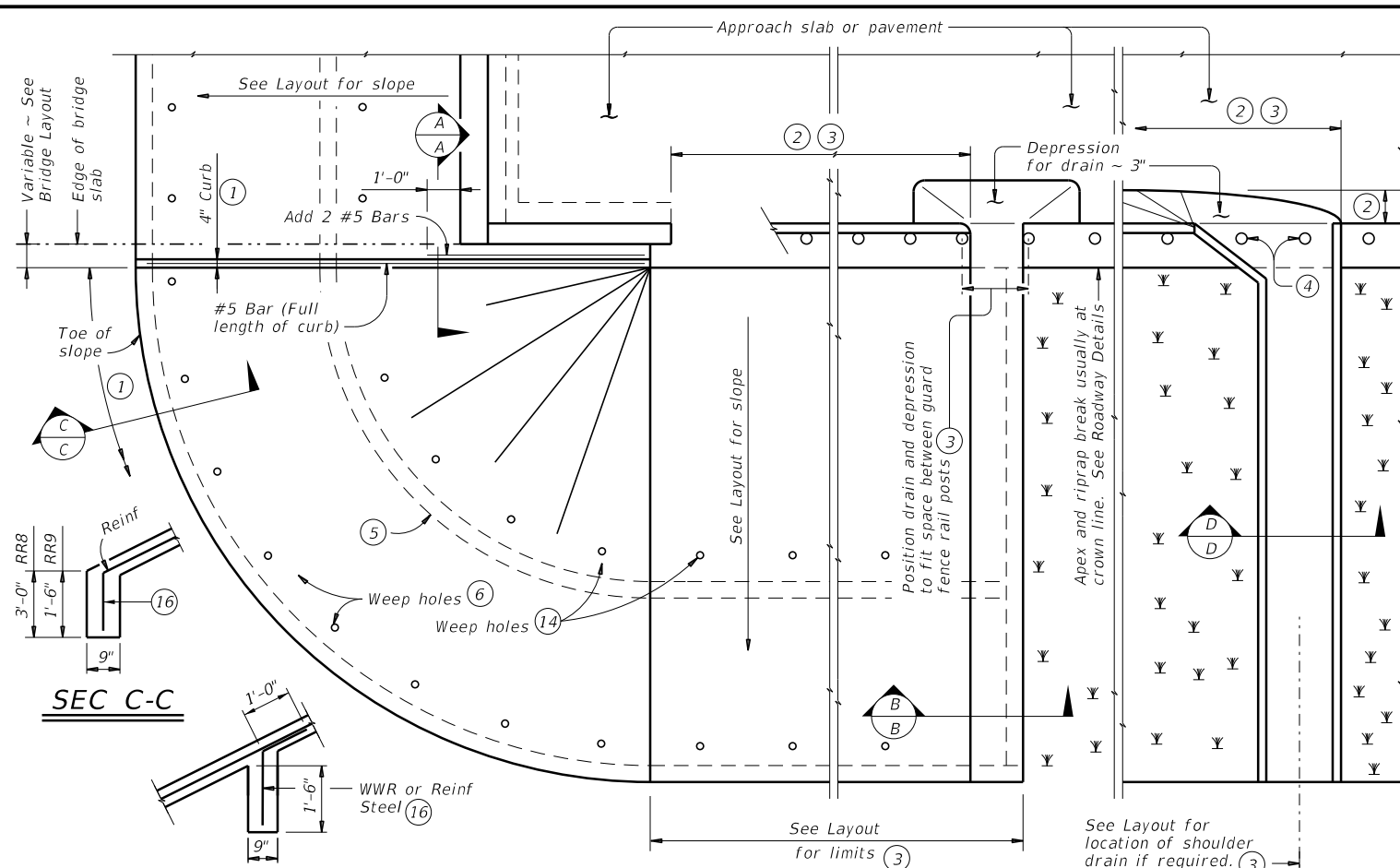
**Jacobs** 2705 BEE CAVE RD, SUITE 300  
AUSTIN TX 78746  
FIRM REGISTRATION F-2966



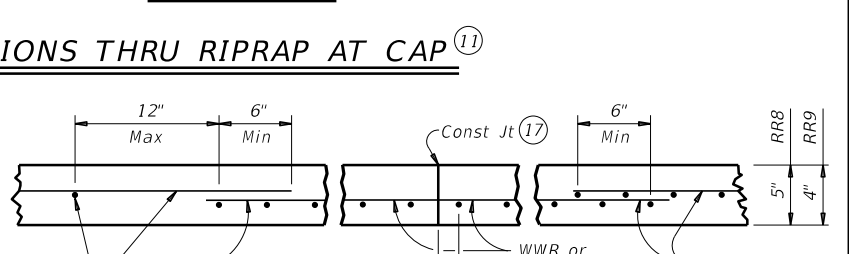
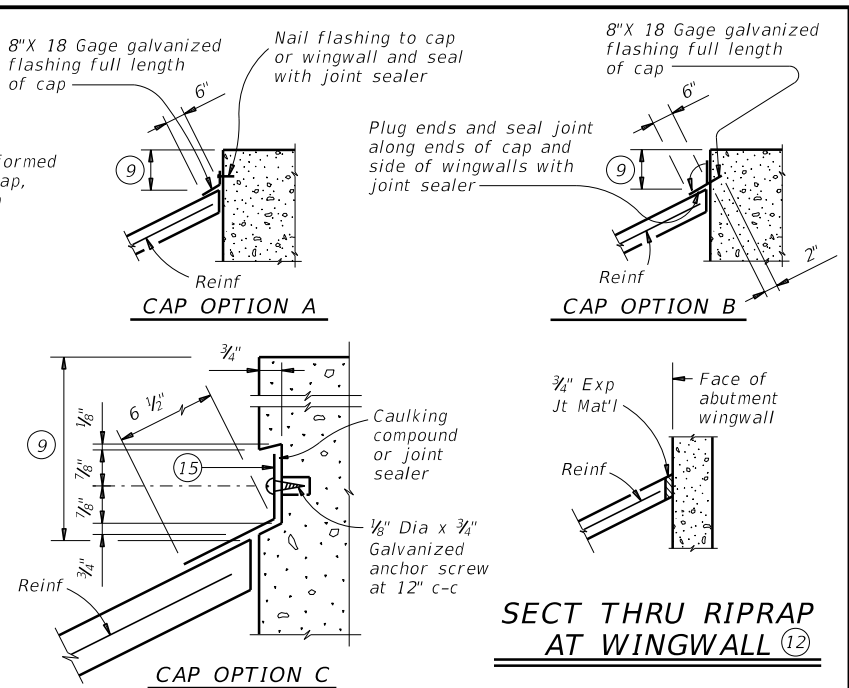
SIGNS AND OBJECT MARKERS  
CR 481

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	28

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



- SHOWING KEYWAY OPTION**
- When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.
  - Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.
  - Location of shoulder drain must consider limitations imposed by rail transition. Do not locate shoulder drains at expansion joints between approach slab and concrete pavement.
  - See details elsewhere in plans for installation of guard fence posts through concrete riprap.
  - Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.
  - Provide lower level of 2" Dia weep holes at 10' c-c backed by 1 CF packet of gravel and galvanized hardware cloth at all locations unless directed by the Engineer to eliminate.
  - Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.
  - Wall extension may be reduced or modified if approved by the Engineer. Increase wall extension to 1'-6" whenever the optional intermediate toewall is called for in the plans.
  - Top of cap to top of riprap dimension varies as directed by the Engineer. Should be 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.
  - #5 bars shown are required even when synthetic fiber reinforcing option is selected.
  - Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.
  - Flashing (shown in Cap Option A) may be used at wingwall in addition to Exp Jt Mat'l if shown on plans or directed by the Engineer.
  - Provide #3 reinforcing bars at 18" Spa c-c. Provide Welded Wire Reinforcement (WWR) as 6x6-D2.9xD2.9 or D3xD3. Combinations of WWR and reinforcing bars may be used if both are permitted. Use lap splices of a minimum 6 inches, measured from the transverse wire of WWR, and the ends of reinforcing bars.
  - If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.
  - 8" x 18 Gage Galv Sheet Metal
  - Provide WWR or #3 bars, with 1'-0" extension into slope.
  - WWR or reinforcing steel is continuous through riprap construction joints. Provide WWR or reinforcing steel that extends 1'-1" minimum into adjacent riprap on each side of construction joint even if synthetic reinforcing fiber is utilized.



- REINFORCEMENT DETAILS**
- See General Notes for optional synthetic fiber reinforcement.

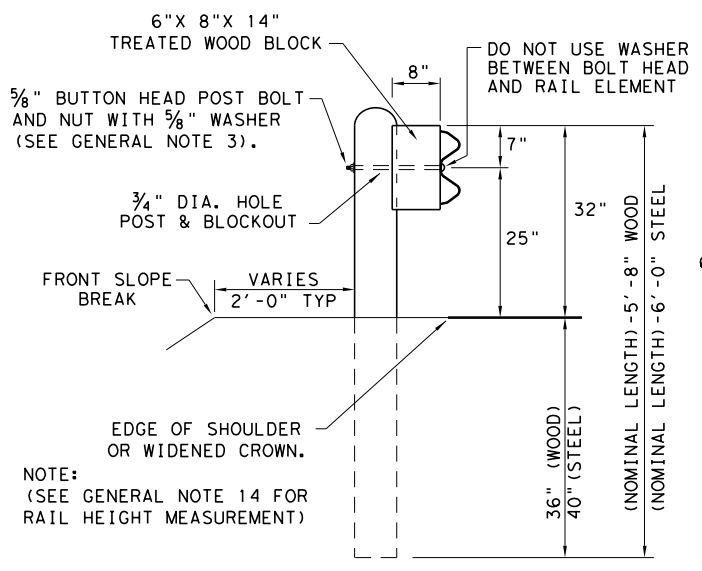
**GENERAL NOTES:**  
 Provide Class "B" concrete (f'c = 2,000 psi) unless noted elsewhere in plans.  
 Provide Grade 60 reinforcing steel.  
 Provide deformed welded wire reinforcement (WWR) meeting ASTM A1064, unless otherwise shown.  
 Provide reinforcing bars, deformed WWR, or any suitable combination of both types for riprap reinforcing, unless specified elsewhere in the plans.  
 Optionally synthetic fibers may be used if approved by the Engineer. Provide synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) in lieu of steel reinforcing in riprap concrete.  
 Install construction joints or grooved joints extending the full slant slope height at intervals of approximately 20 feet unless otherwise directed by the Engineer.  
 Hardware cloth, loose grade stone behind weep holes, flashing, or other sealing material are subsidiary to the bid item "Riprap".  
 See Layout for limits of riprap.  
 RR8 is to be used on stream crossings.  
 RR9 is to be used on other embankments.

		<b>Bridge Division Standard</b>	
<b>CONCRETE RIPRAP AND SHOULDER DRAINS EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 &amp; RR9)</b>			
<b>CRR</b>			
FILE: crrside1-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT April 2019	CONTRACT NO. 0917 20	SECTION NO. 046	HIGHWAY CR 481
REVISIONS	DIST. BRY	COUNTY. FREESTONE	SHEET NO. 29

**FOR CONTRACTOR'S INFORMATION ONLY:**  
 5" of RR8 = 0.015 CY/SF  
 4" of RR9 = 0.012 CY/SF  
 #3 Reinf at 18" c-c = 0.501 Lbs/SF  
 6x6-D3xD3 = 0.408 Lbs/SF

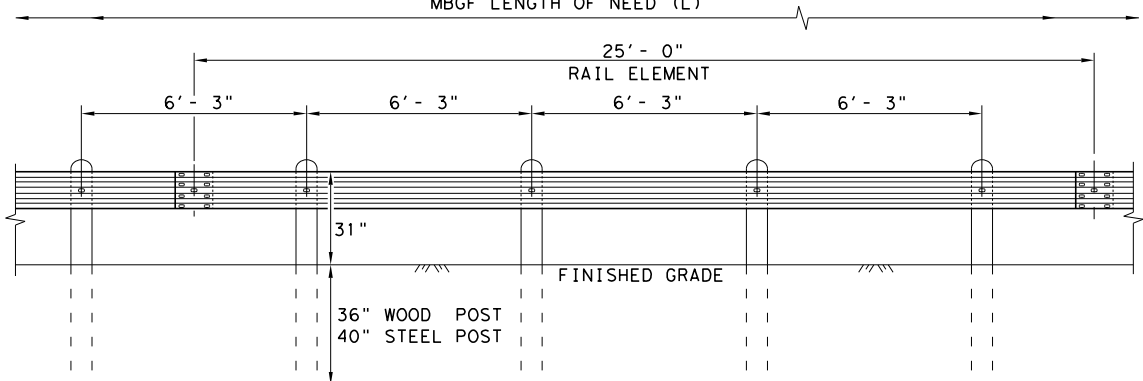
DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.

DATE: 5/14/2023  
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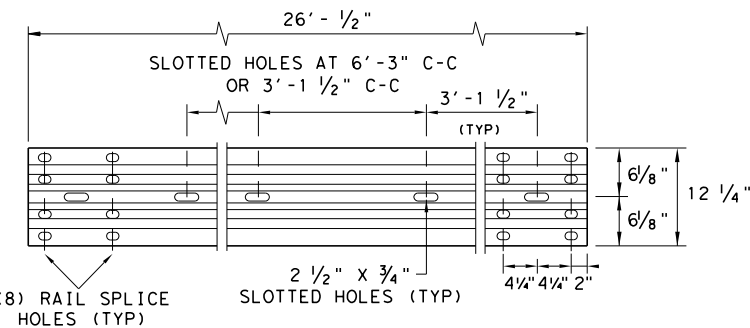
**TYPICAL POST PLACEMENT**

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



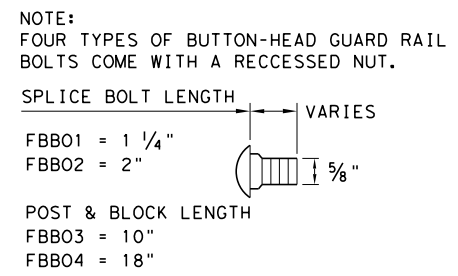
**ELEVATION MID-SPAN RAIL SPLICE**

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



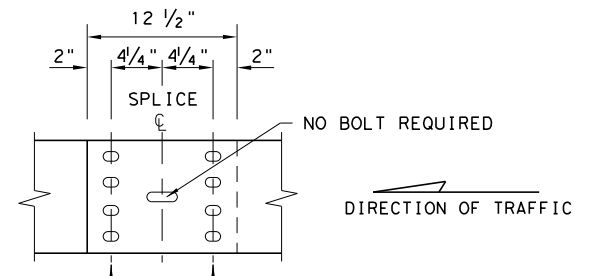
**ELEVATION 25' - 0" (NOM.) W-BEAM SECTION**

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



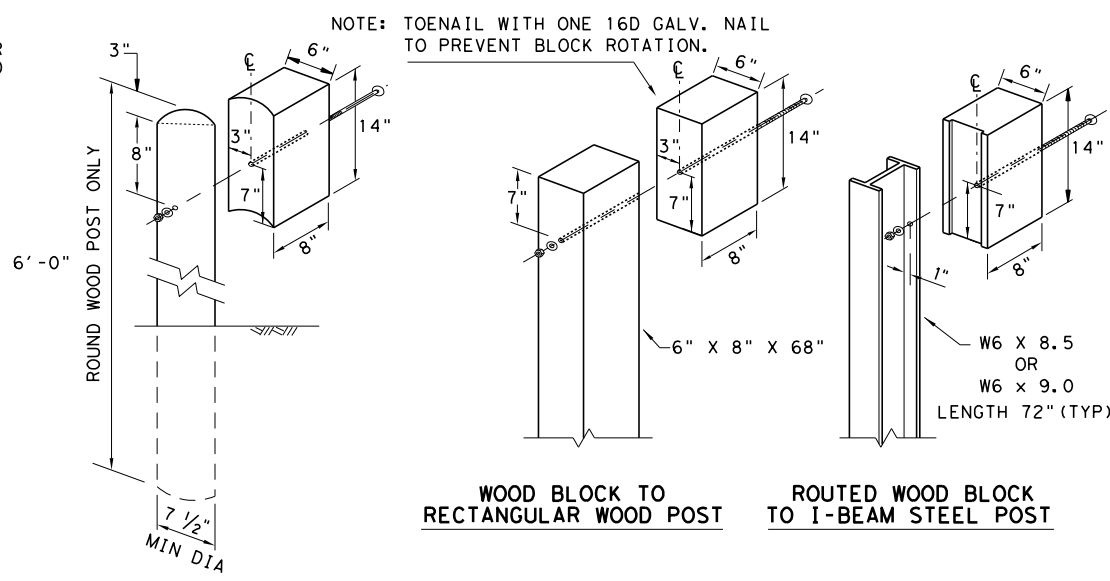
**BUTTON HEAD BOLT**

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



**MID-SPAN RAIL SPLICE DETAIL**

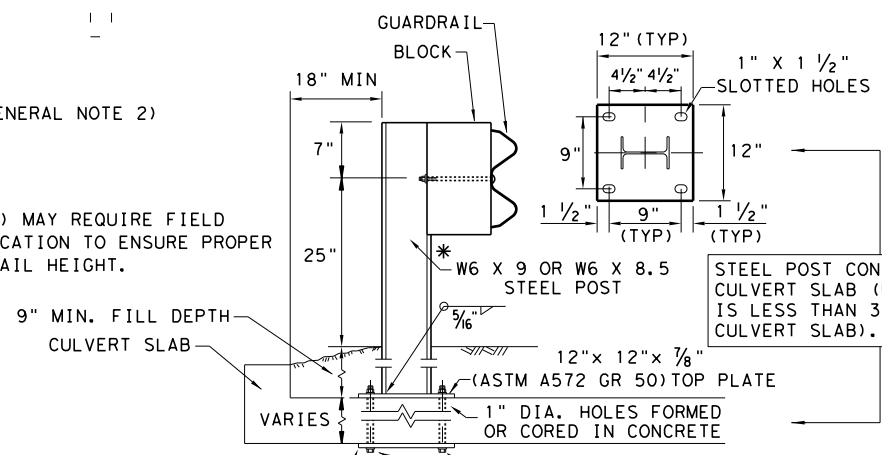
NOTE: GF(31), MID-SPAN RAIL SPLICES ARE REQUIRED WITH 6'-3" POST SPACINGS.



**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 (FWC160) 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 MAYBE 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.

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



**LOW FILL CULVERT POST**

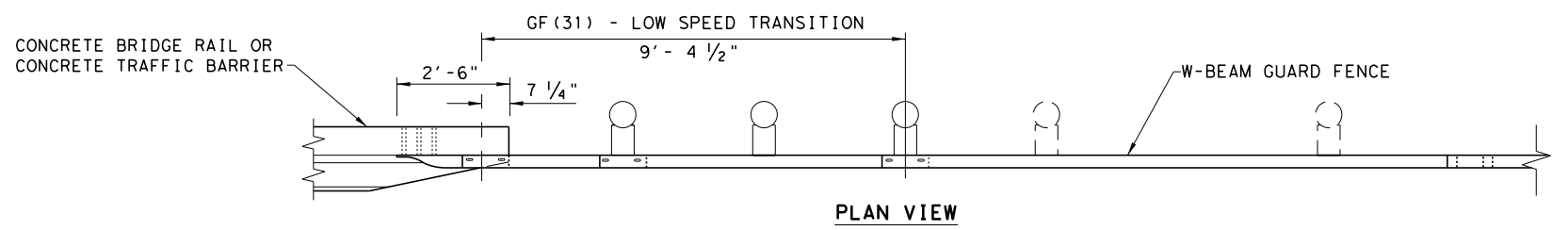
NOTE: TWO INSTALLATION OPTIONS.

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.

		<b>Design Division Standard</b>	
<b>METAL BEAM GUARD FENCE</b> <b>TL-3 MASH COMPLIANT</b> <b>GF(31)-19</b>			
FILE: gf3119.dgn	DN: TXDOT	CK: KM	DW: VP
© TXDOT: NOVEMBER 2019	CONT	SECT	JOB
REVISIONS	0917	20	046
	DIST	COUNTY	SHEET NO.
	BRY	FREESTONE	30

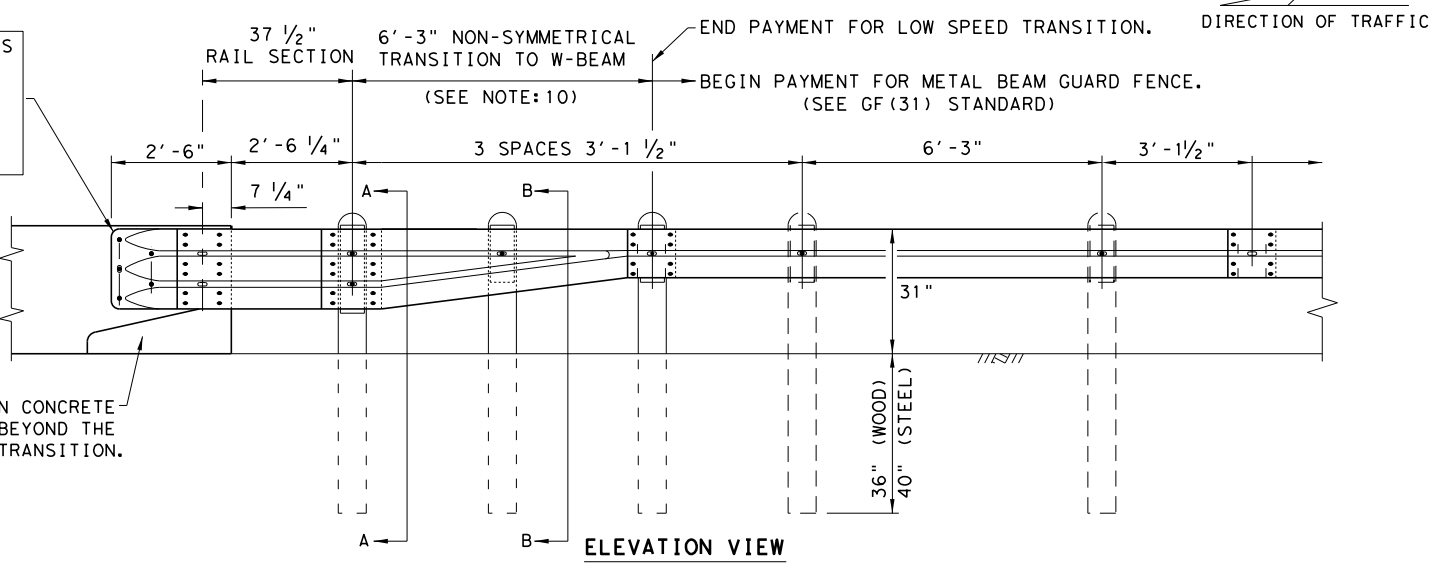
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 DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR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



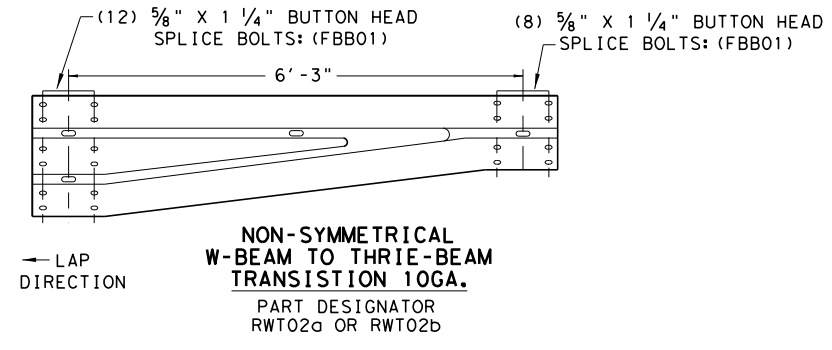
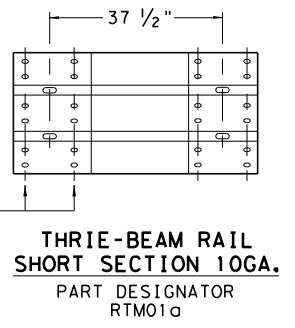
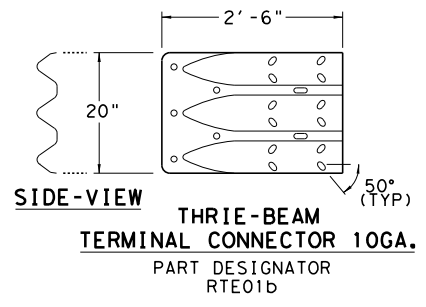
- (5) 7/8" DIA. HEAVY HEX HEAD BOLTS (ASTM A325 OR A449)
- (10) 1 3/4" O.D. WASHER UNDER EACH HEX BOLT HEAD AND NUT.
- (5) 7/8" DIA. HEAVY HEX NUTS (ASTM A194 OR A563)

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.



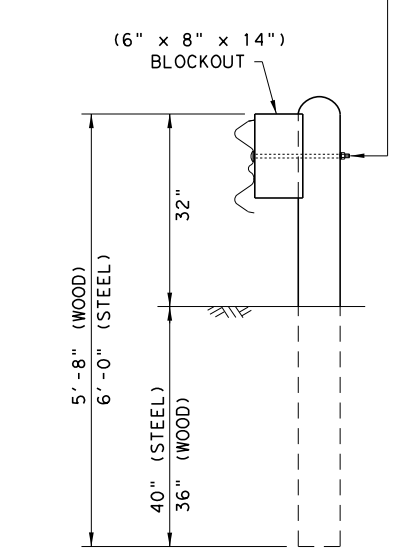
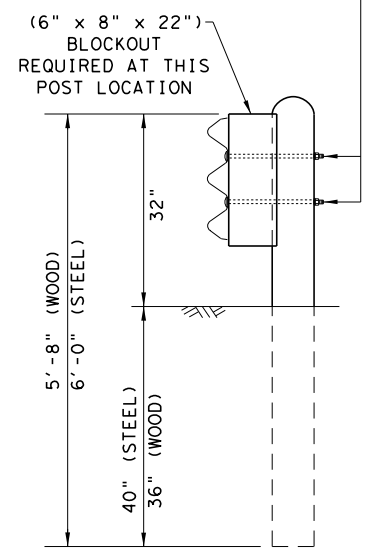
- ### GENERAL NOTES
- THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF TRANSITIONS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. REFER TO GF(31) STANDARD SHEET.
  - RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS.
  - 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.
  - 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 (FWC160) AND NOT MORE THAN 1" BEYOND IT. TRIM BOLT LENGTH TO MEET REQUIRED LENGTH.
  - POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
  - 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. 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.
  - REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
  - FOR ROUND WOOD POSTS SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 1/2" DIA. MINIMUM THROUGHOUT THE TRANSITION.



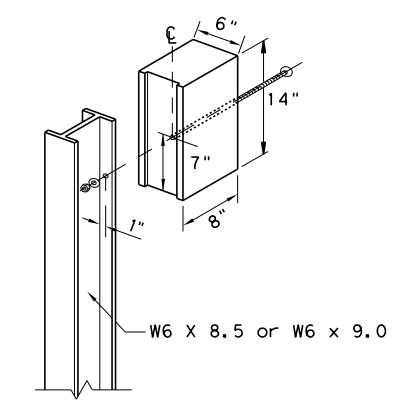
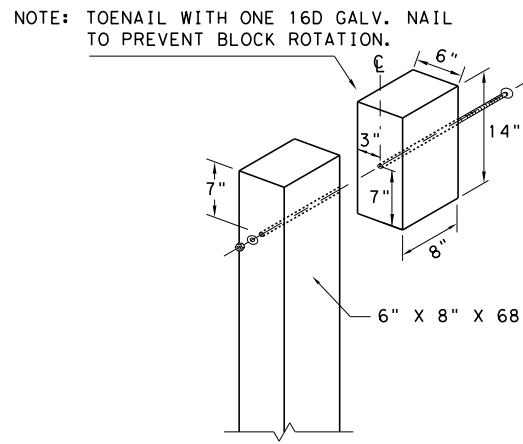
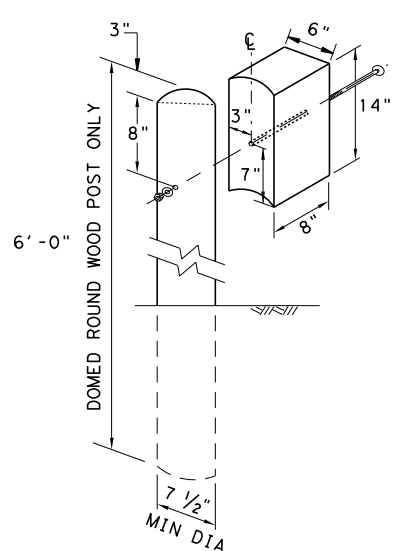
- (2) 5/8" BUTTON HEAD POST BOLTS & NUTS: (FBB04)
- (1) 5/8" FLAT WASHER: (FWC14a) UNDER EACH NUT

- (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.



NOTE: TOENAIL WITH ONE 16D GALV. NAIL TO PREVENT BLOCK ROTATION.

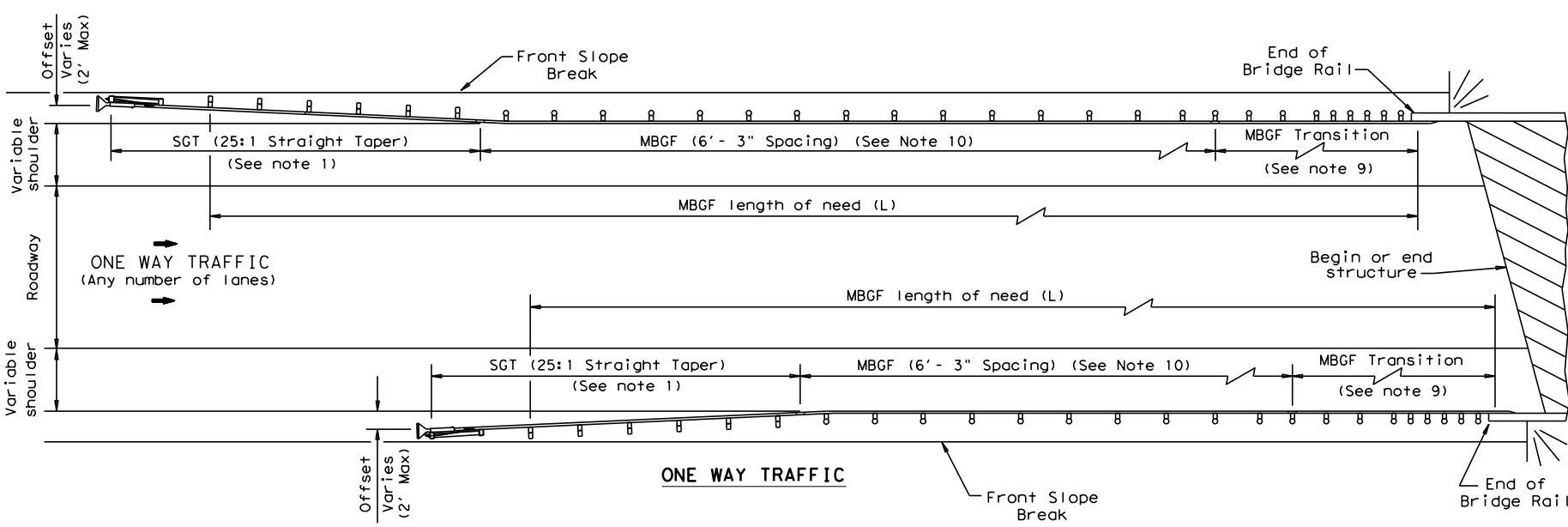
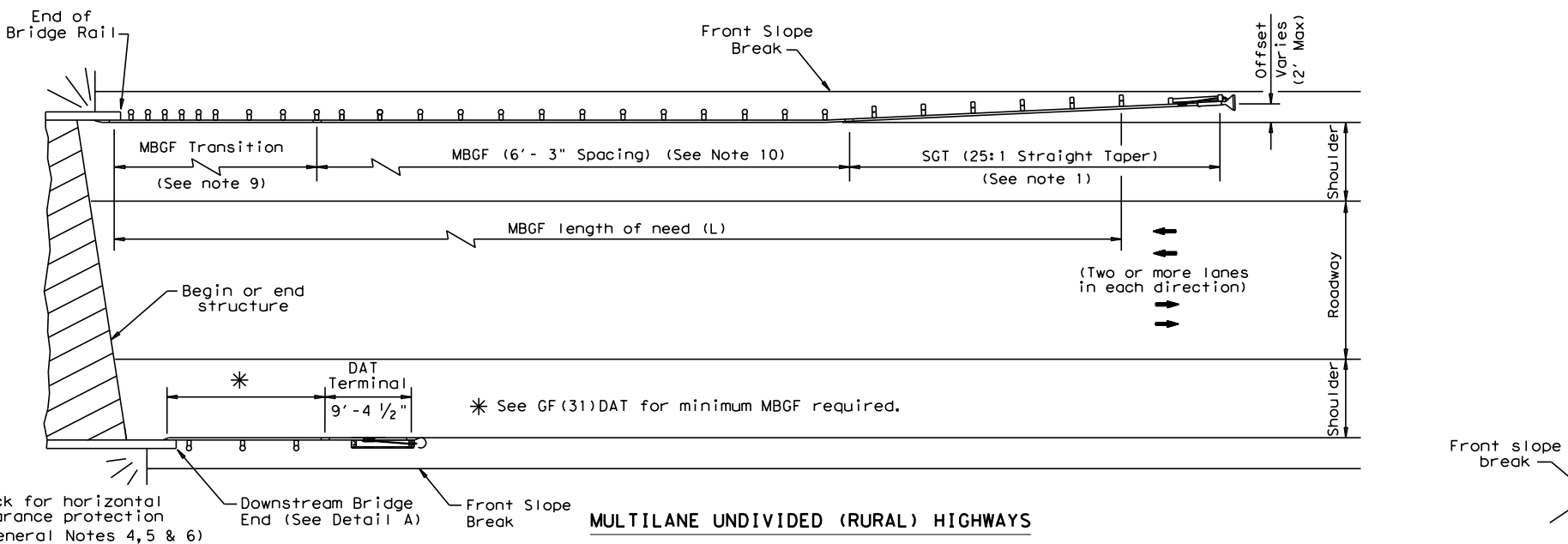
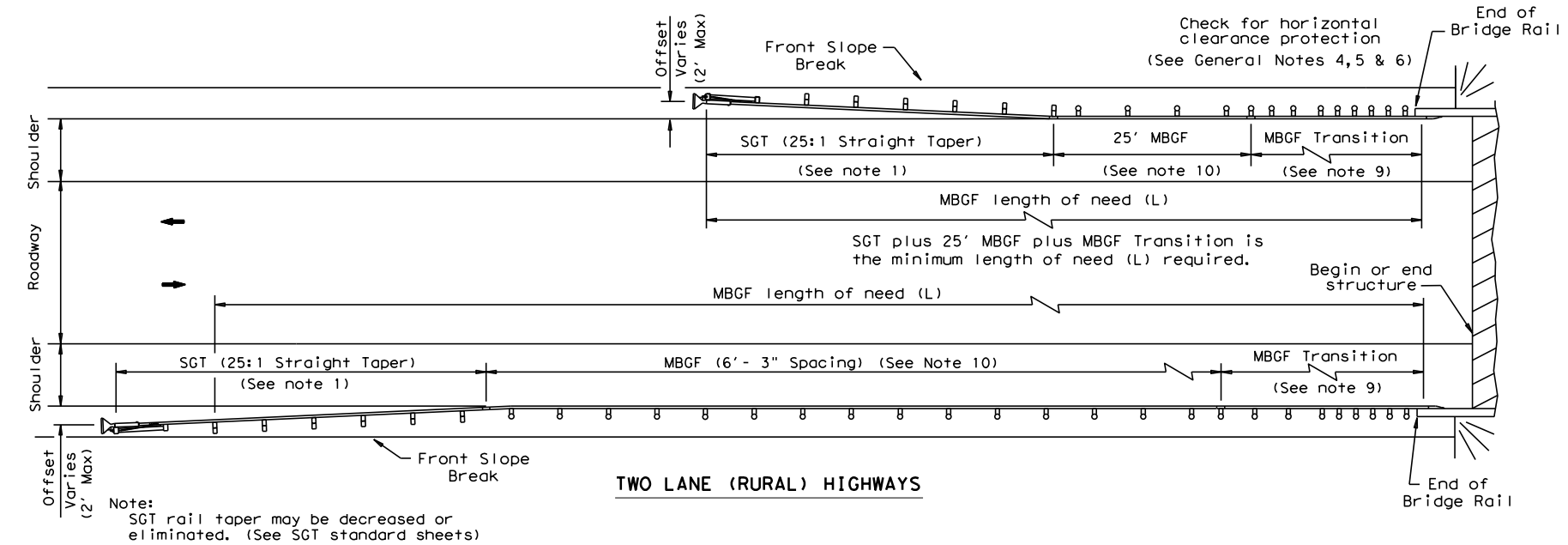
**LOW-SPEED TRANSITION**

**METAL BEAM GUARD FENCE  
THRIE-BEAM TRANSITION  
TL-2 MASH COMPLIANT  
GF(31)TR TL2-19**

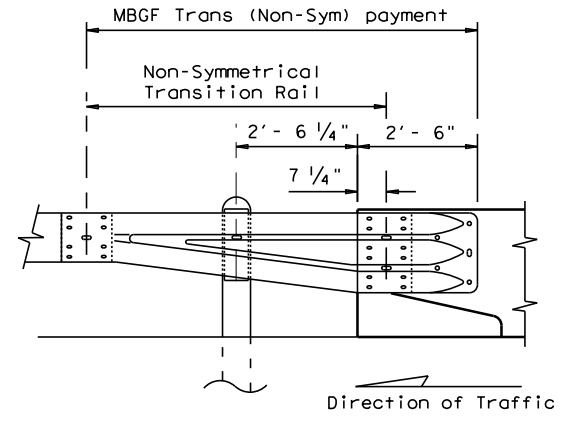
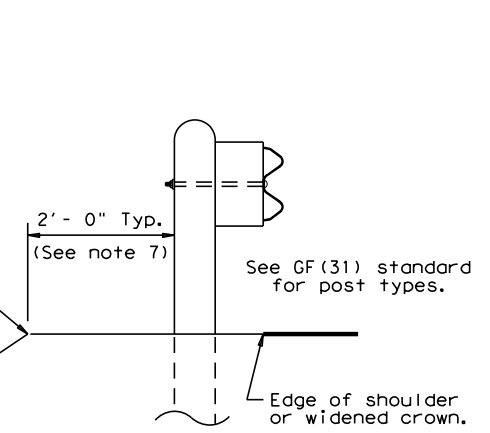
Texas Department of Transportation		Design Division Standard	
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© TXDOT: NOVEMBER 2019	CONT	SECT	JOB
REVISIONS	0917	20	046
	DIST	COUNTY	SHEET NO.
	BRY	FREESTONE	31

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- GENERAL NOTES**
- For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
  - Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the plans.
  - 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.
  - 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.
  - Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
  - 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)
  - 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).
  - 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.
  - Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.
  - A minimum 25' length of MBGF will be required.



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

**Texas Department of Transportation** Design Division Standard

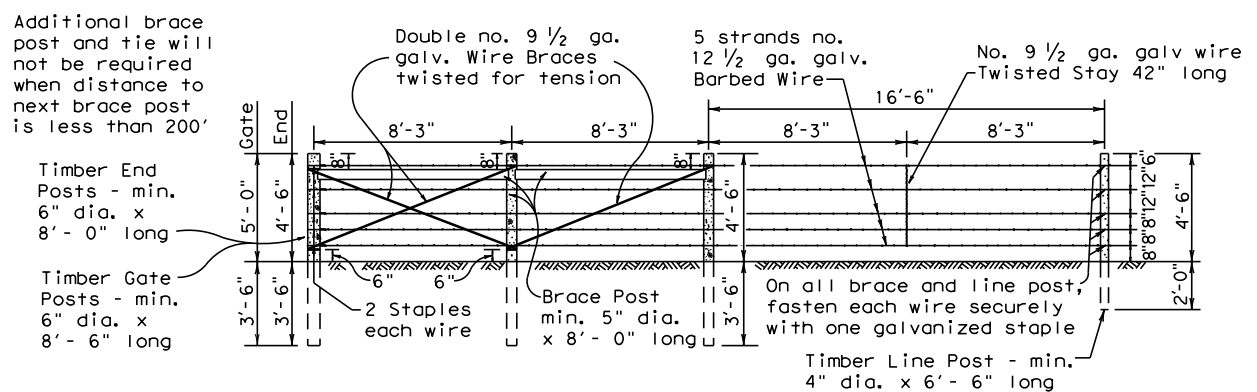
**BRIDGE END DETAILS**  
 (METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

**BED-14**

FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: CGL
© TxDOT: December 2011	CONT	SECT	JOB	HIGHWAY
REVISED APRIL 2014 SEE (MEMO 0414)	0917	20	046	CR 481
	DIST	COUNTY	SHEET NO.	
	BRY	FREESTONE	32	

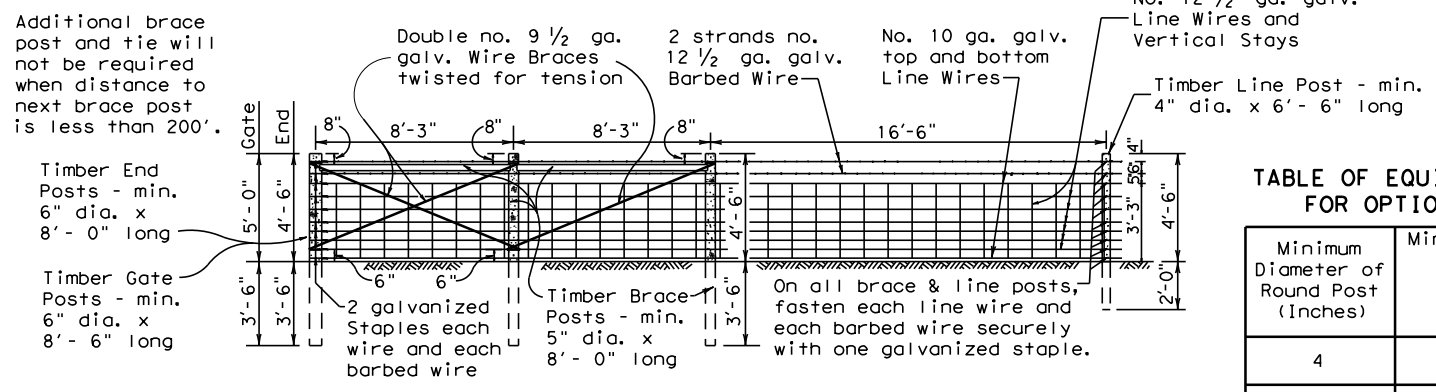
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DATE: 5/14/2023  
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**SECTION GALVANIZED BARBED WIRE FENCE WITH WOOD POSTS**  
 Bracing Detail Used at Ends and Gates

**TYPE "A" FENCE**  
 (See General Note 6)



**SECTION GALVANIZED WOVEN WIRE FENCE WITH WOOD POSTS**  
 Bracing Detail Used at Ends and Gates

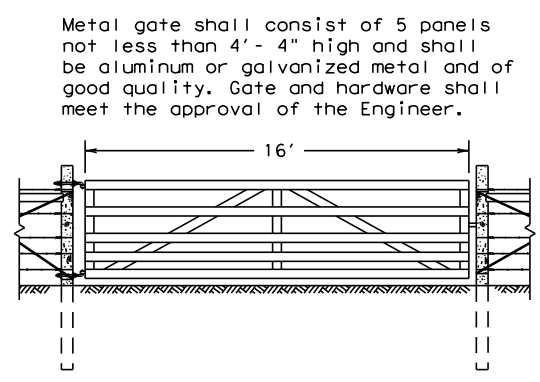
**TYPE "B" FENCE**  
 (See General Note 6)

**TABLE OF EQUIVALENT SIZES FOR OPTIONAL SHAPE**

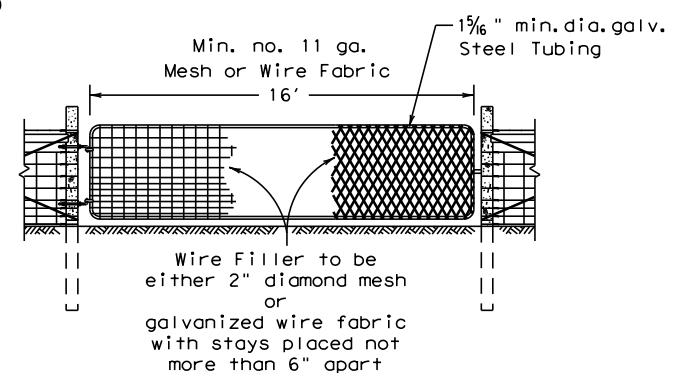
Minimum Diameter of Round Post (Inches)	Minimum Equivalent Dimension for Each Side of Square Post (Inches)
4	3 1/2
5	4 1/2
6	5 1/4

**GENERAL NOTES**

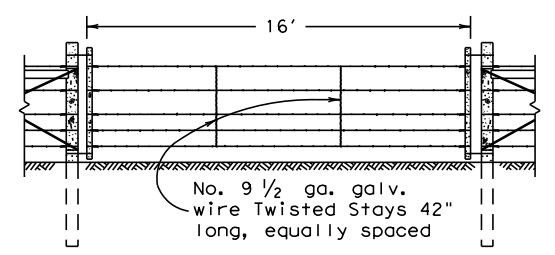
- Any high point which interferes with the placing of wire mesh shall be excavated to provide 2" clearance.
- Latches for Type 1 and Type 2 gates shall be good commercial quality and design latches of the spring, fork or chain type. All latches shall be suitable for the gate and shall be approved by the Engineer.
- Hinges for Type 2 gates shall be commercial design approved by the Engineer suitable for post and gate.
- Concrete shall be of the design and consistency approved by the Engineer and shall contain not less than 4 sacks of cement per cubic yard. Concrete footings are to be crowned at the top to shed water.
- If rock is encountered at a depth less than the embedded depth required, a 15" or larger diameter hole shall be drilled for the post and the post shall be set in concrete. If rock is encountered at a depth of 1'-6" or more below the ground surface, the hole shall be drilled to the required depth. If rock is encountered at a depth less than 1'-6" below the ground surface, the holes shall be drilled a minimum of 2'-0" into the rock or to the depth whichever is the lesser depth.
- Barbed Wire shall be in accordance with ASTM A 121 (Class 1) Design designation 12-2-4-1 4R or 12-2-5-1 4R, or as approved by the Engineer.
- Woven Wire Fence (Type B) shall be in accordance with ASTM A 116 (Class 1) No. 12-1/2 Grade 60 (See Table 1 ASTM A 116) to the height and design shown on the plans, or as approved by the Engineer.
- The location of gates and corner posts will be as indicated elsewhere on these plans.
- Square wood posts may be used in lieu of round posts provided minimum equivalent size requirements, as shown are met. All wood posts shall be in accordance with Item 552, "Wire Fence."



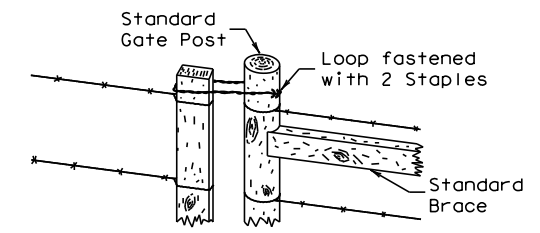
**DETAIL TYPE 1 GATE**



**DETAIL TYPE 2 GATE**

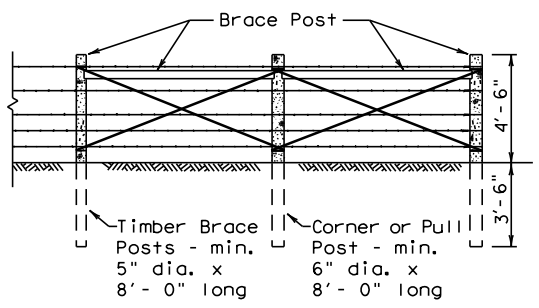


**DETAIL TYPE 3 GATE**

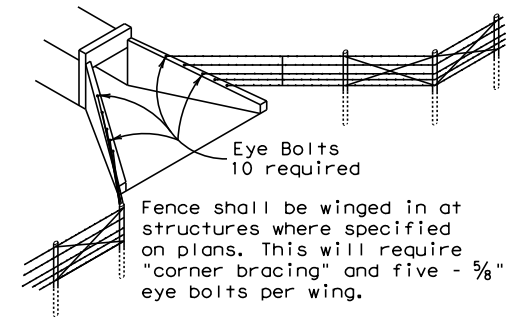


Loop to be made from two strands twisted no. 9 1/2 ga. galv. smooth wire, and to be securely fastened to gate post with two galv. staples.

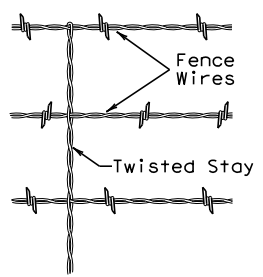
**DETAIL FASTENER TYPE 3 GATE**



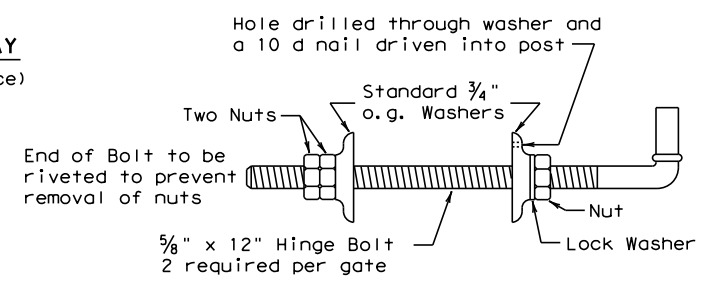
**CORNER OR PULL POST ASSEMBLY**



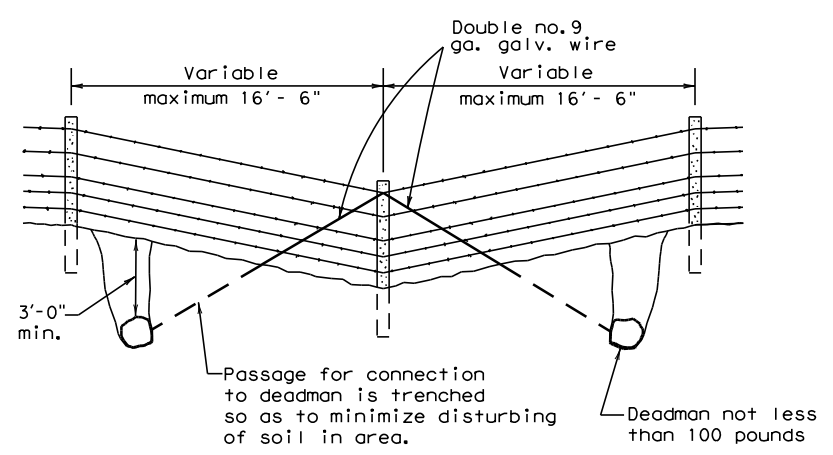
**DETAIL OF FENCE TREATMENT AT STRUCTURES**



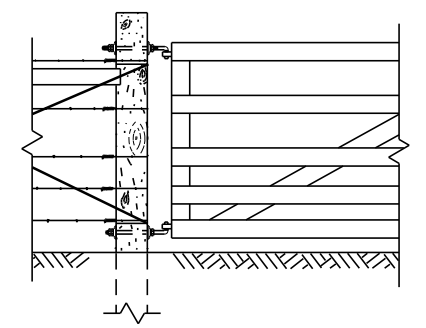
**DETAIL OF STAY**  
 (Barbed wire fence)



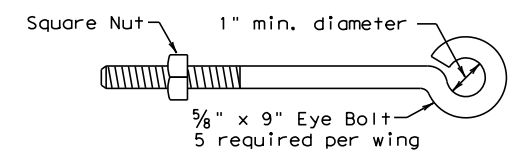
**DETAIL OF GATE HINGE BOLT ASSEMBLY**



**DETAIL OF FENCE SAG**  
 (Single Line Connection)



**DETAIL SHOWING INSTALLATION OF HINGES OF TYPE 1 & 2 GATE**



**DETAIL OF EYE BOLT**

**Texas Department of Transportation** Design Division Standard

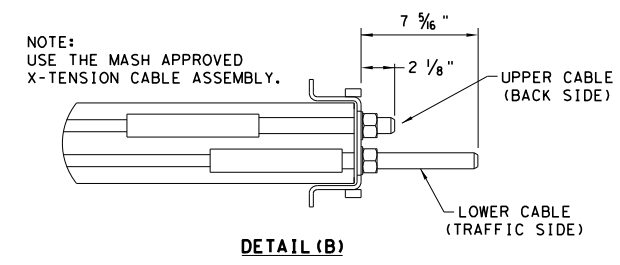
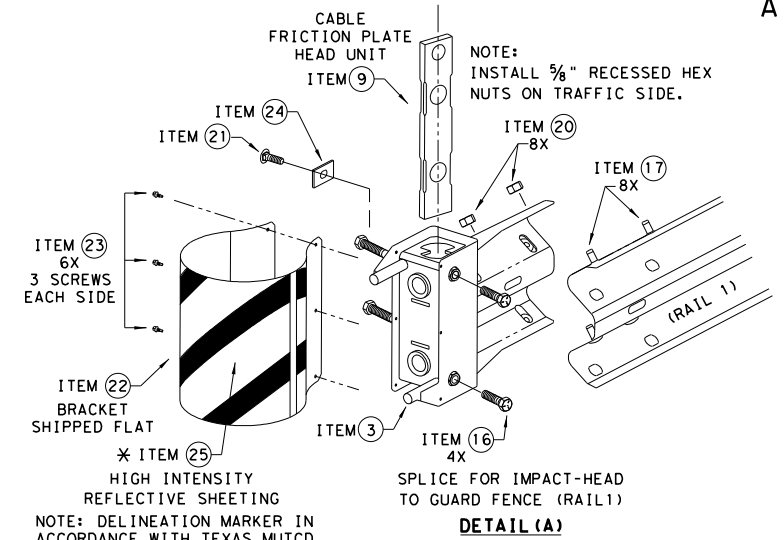
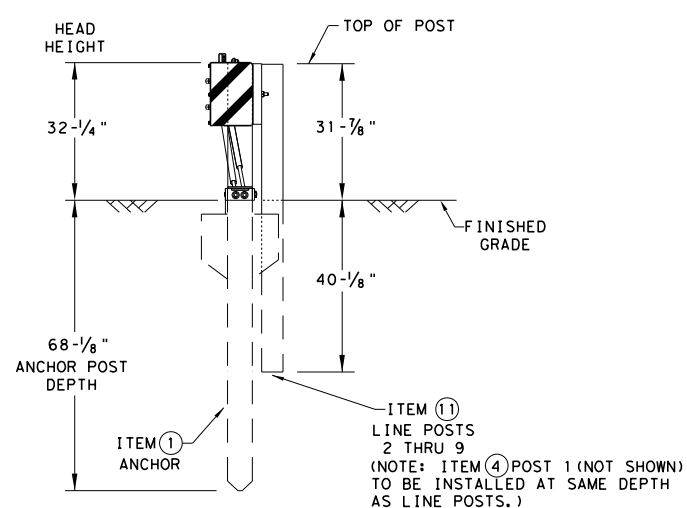
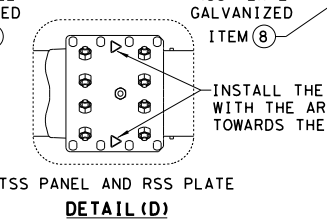
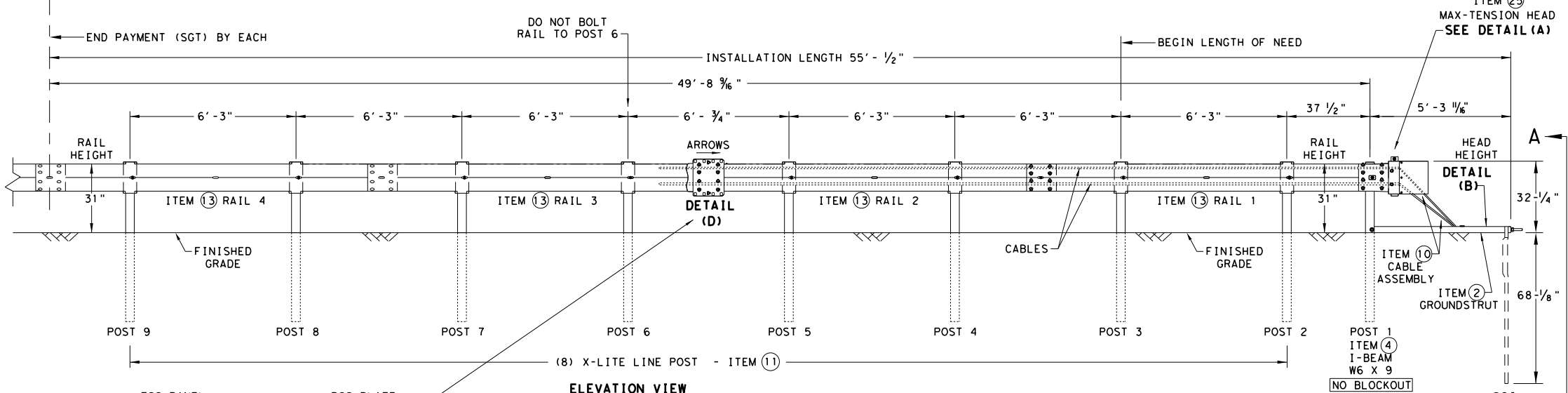
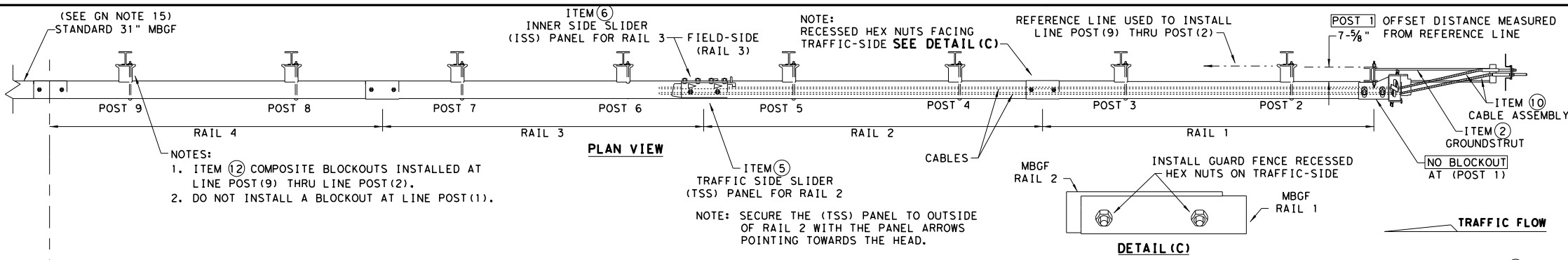
**BARBED WIRE AND WOVEN WIRE FENCE (WOOD POSTS) WF (1) - 10**

FILE: wf110.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
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REVISIONS	0917	20	046	CR 481
	DIST	COUNTY	SHEET NO.	
	BRY	FREESTONE	33	



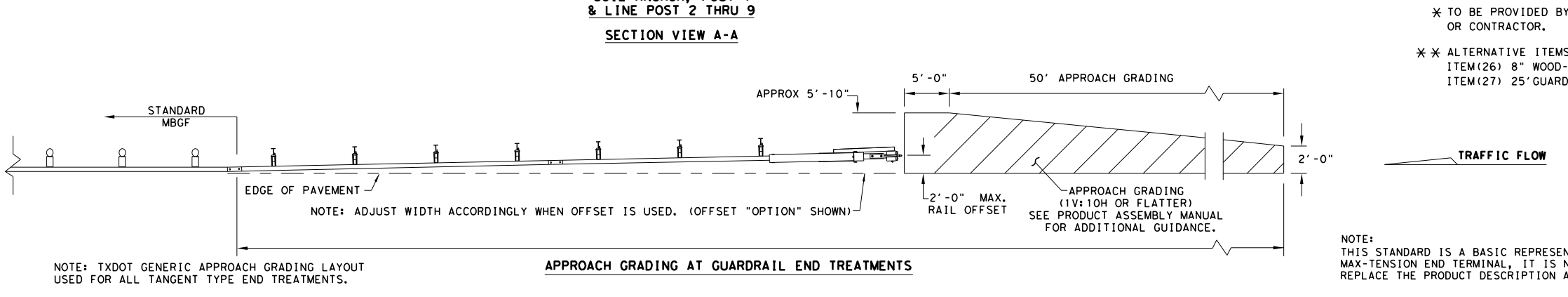


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- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800
  - FOR INSTALLATION, REPAIR, & MAINTENANCE REFER TO 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" MBGF PANELS, 25'-0" MBGF PANELS ARE ALSO ALLOWED.
  - A MINIMUM OF 12'-6" OF 12GA. MBGF IS REQUIRED IMMEDIATELY DOWNSTREAM OF THE MAX-TENSION SYSTEM.

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 FWRO3	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

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

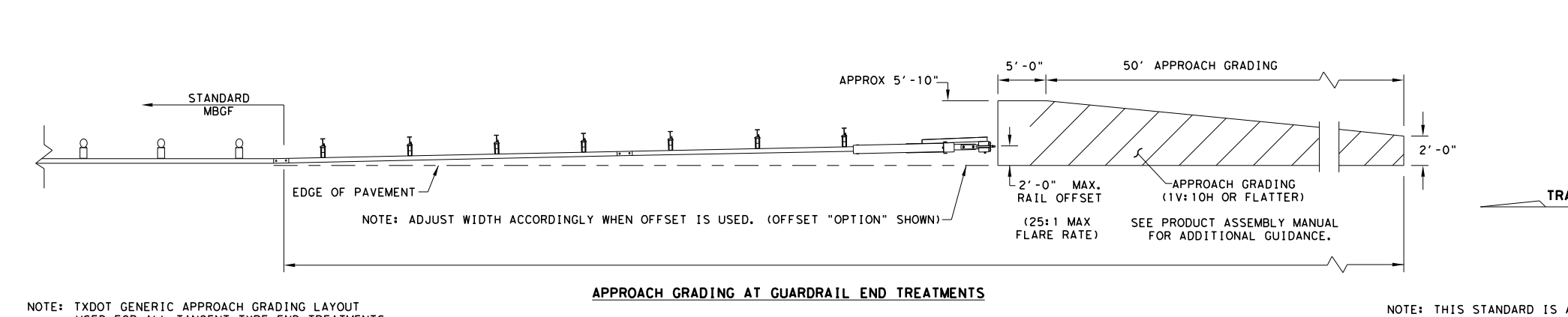
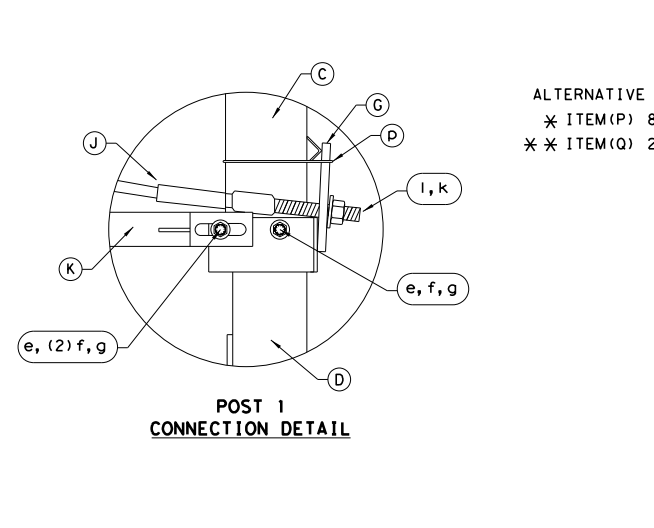
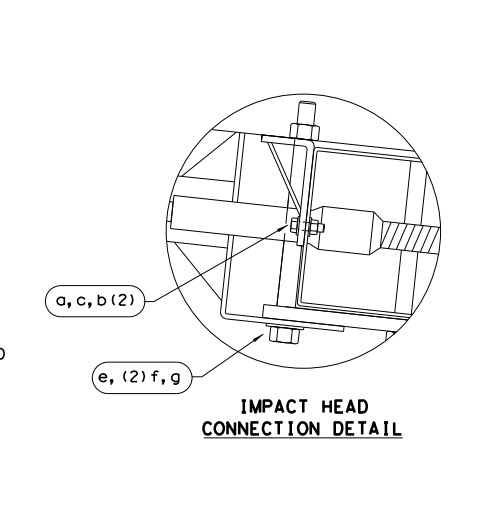
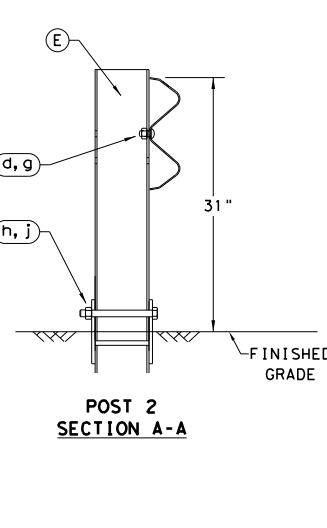
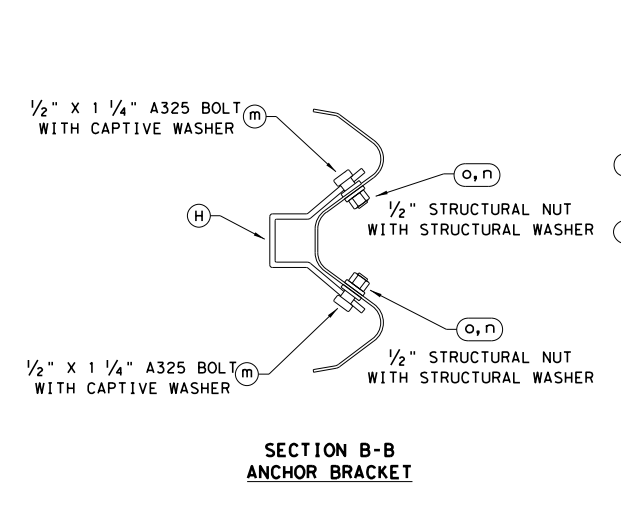
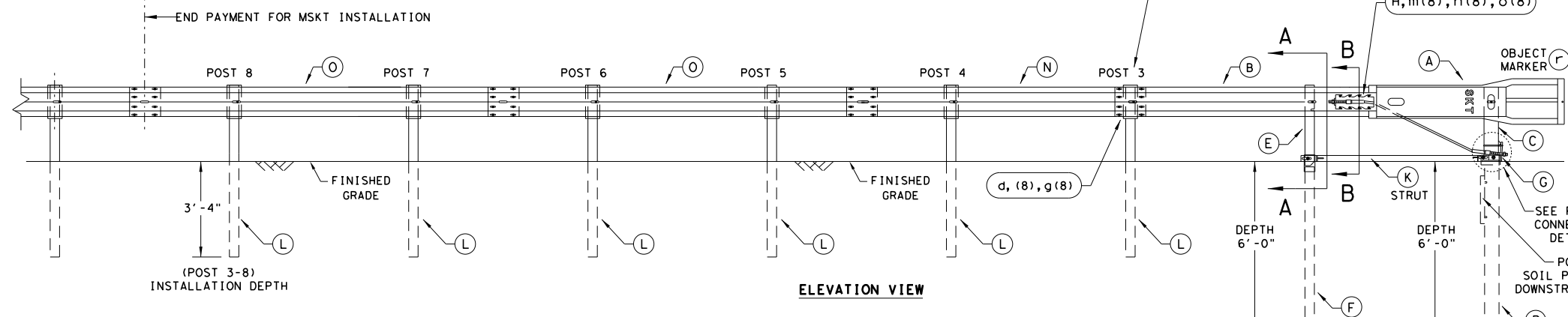
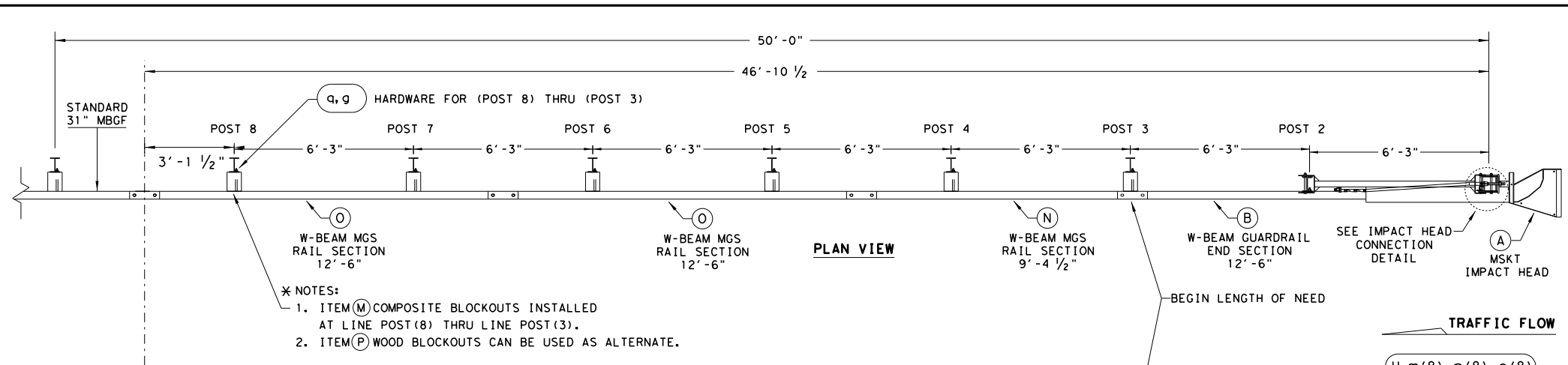
**Texas Department of Transportation**

**Design Division Standard**

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

FILE: sg11s3118.dgn	DN: TxDOT	CK: KM	DW: TxDOT	CK: CL
© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
	DIST	COUNTY	SHEET NO.	
	BRY	FREESTONE	35	

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



- 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 MBSGF STANDARD FOR INSTALLATION GUIDANCE.
  - POSTS SHALL NOT BE SET IN CONCRETE.
  - SYSTEM MUST BE ATTACHED TO STANDARD 31" MBSGF.
  - 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 ENCRUCHING 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" MBSGF PANELS, ONE 25'-0" MBSGF PANEL IS ALSO ALLOWED IN ITS 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	5/8" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	5/8" WASHER	W0516
c	2	5/8" HEX NUT	N0516
d	25	5/8" Dia. x 1 1/4" SPLICE BOLT (POST 2)	B580122
e	2	5/8" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	5/8" WASHER	W050
g	33	5/8" 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 1/8" O.D. x 3/8" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	5/8" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151

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

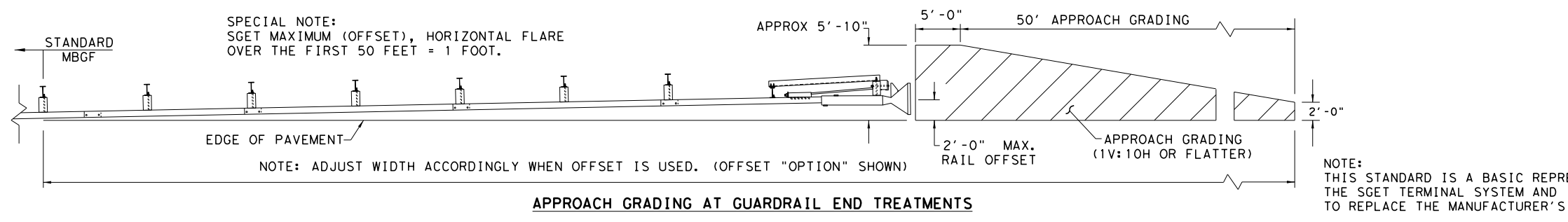
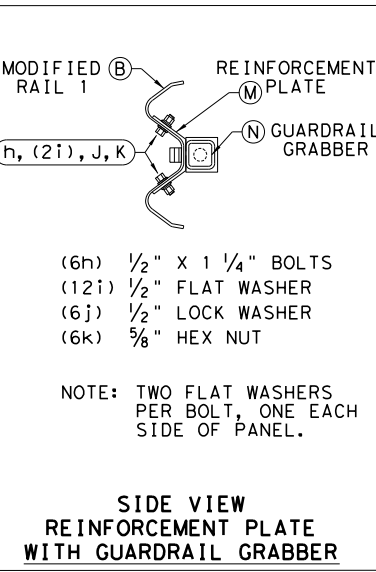
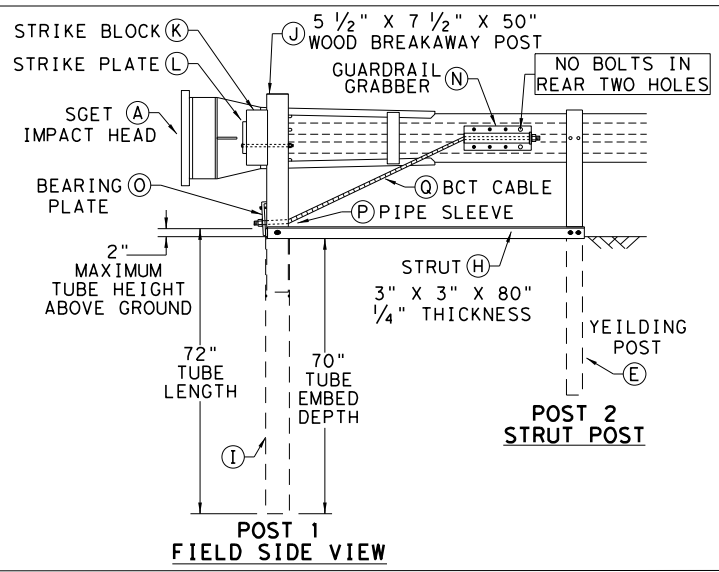
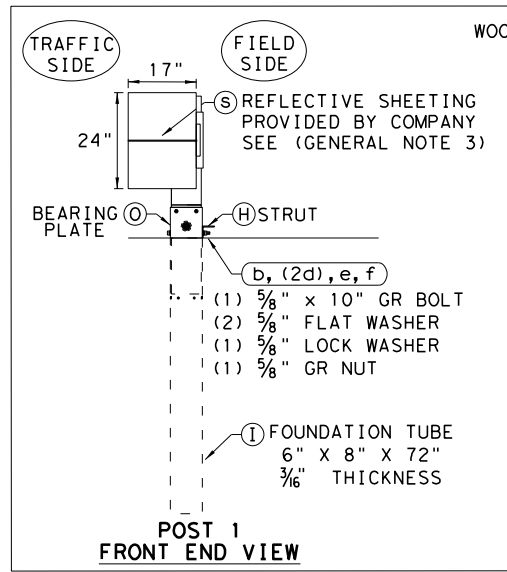
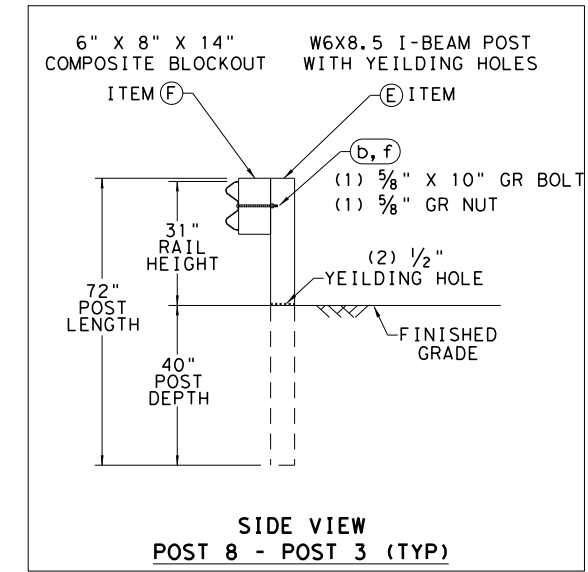
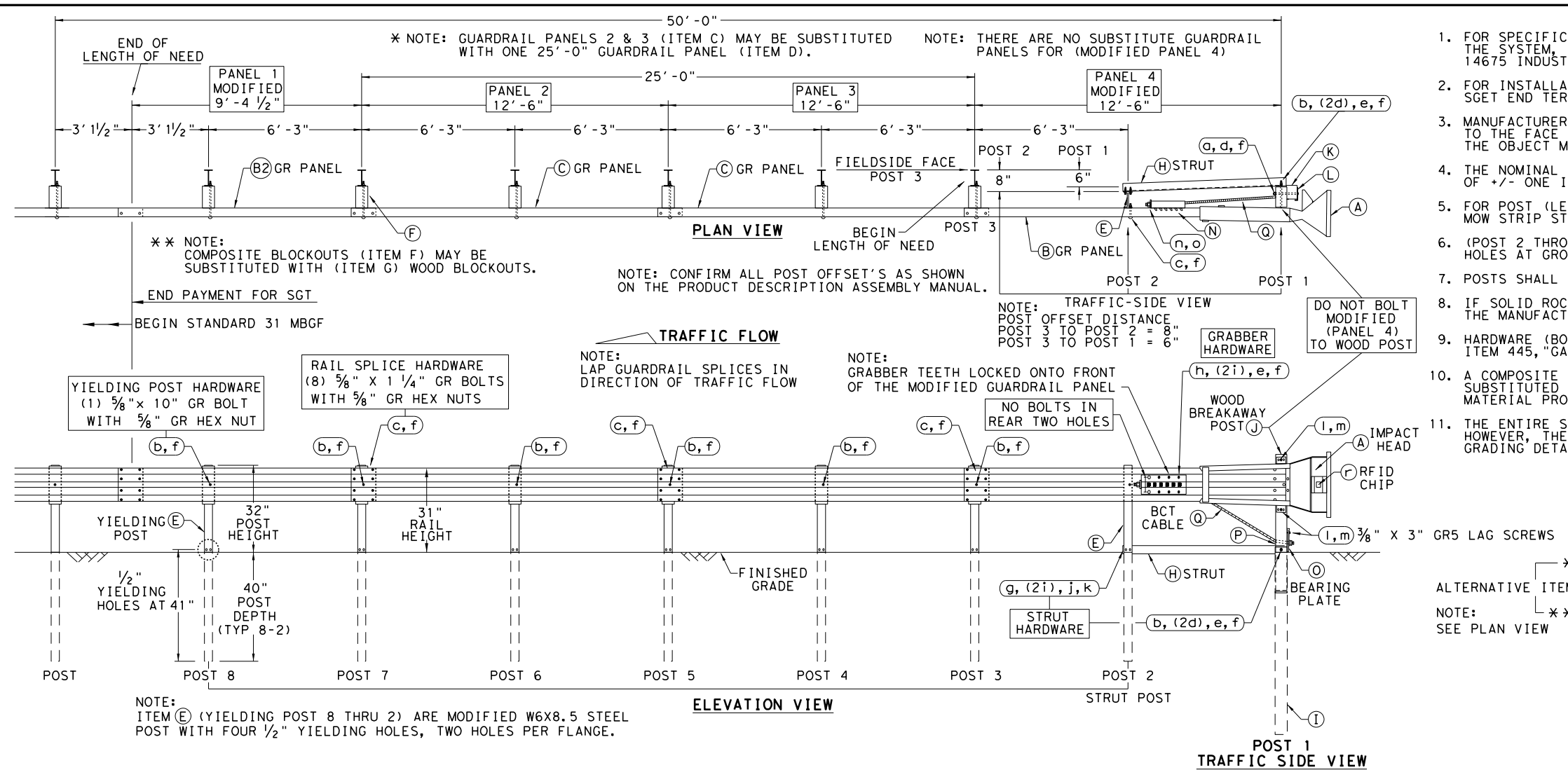
### MSKT-MASH-TL-3

### SGT (12S) 31-18

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REVISIONS	0917	20	046	CR 481
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- ### GENERAL NOTES
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
  - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL.
  - MANUFACTURER WILL APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" TO THE FACE PLATE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. THE OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
  - THE NOMINAL HEIGHT OF THE GUARDRAIL BEAM IS 31 INCHES WITH A TOLERANCE OF +/- ONE INCH.
  - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
  - (POST 2 THROUGH POST 8) ARE MODIFIED STEEL-YIELDING POSTS WITH YIELDING HOLES AT GROUND LEVEL. THERE ARE NO SUBSTITUTE POSTS.
  - POSTS SHALL NOT BE SET IN CONCRETE.
  - IF SOLID ROCK IS ENCOUNTERED FOR ANY OF THE POSTS IN THE SYSTEM, CONTACT THE MANUFACTURER FOR SPECIFIC INSTALLATION GUIDANCE.
  - 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 DMS-7210 REQUIREMENTS MAY BE SUBSTITUTED FOR AN APPROVED WOOD BLOCKOUT. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
  - THE ENTIRE SYSTEM MUST BE INSTALLED IN A STRAIGHT LINE WITHOUT ANY CURVE. HOWEVER, THE SYSTEM CAN BE OFFSET BY TWO FEET AS SHOWN ON THE APPROACH GRADING DETAIL TO HELP OFF-SET THE IMPACT HEAD FROM SHOULDER OF THE ROAD.

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM #
A	1	SGET IMPACT HEAD	SIH1A
B	1	MODIFIED GUARDRAIL PANEL 12'-6" 12GA	126SPZGP
B2	1	MODIFIED GUARDRAIL PANEL 9'-4 1/2" 12GA	GP94
C	2	STANDARD GUARDRAIL PANEL 12'-6" 12GA	GP126
D	1	STANDARD GUARDRAIL PANEL 25'-0" 12GA	GP25
E	7	MODIFIED YIELDING I-BEAM POST W6x8.5	YPMOD
F	6	COMPOSITE BLOCKOUT 6" X 8" X 14"	CBO8
G	6	WOOD BLOCKOUT 6" X 8" X 14"	WB08
H	1	STRUT 3" X 3" X 80" X 1/4" A36 ANGLE	STR80
I	1	FOUNDATION TUBE 6" X 8" X 72" X 3/16"	FNDT6
J	1	WOOD BREAKAWAY POST 5 1/2" X 7 1/2" X 50"	WBRK50
K	1	WOOD STRIKE BLOCK	WSBK14
L	1	STRIKE PLATE 1/4" A36 BENT PLATE	SPLT8
M	1	REINFORCEMENT PLATE 12 GA. GR55	REPLT17
N	1	GUARDRAIL GRABBER 2 1/2" X 2 1/2" X 16 1/2"	GGR17
O	1	BEARING PLATE 8" X 8 5/8" X 5/8" A36	BPLT8
P	1	PIPE SLEEVE 4 1/4" X 2 3/8" O.D. (2 1/8" I.D.)	PSLV4
Q	1	BCT CABLE 3/4" X 81" LENGTH	CBL81

ITEM	QTY	SMALL HARDWARE	ITEM #
a	1	5/8" X 12" GUARDRAIL BOLT 307A HDG	12GRBLT
b	7	5/8" X 10" GUARDRAIL BOLT 307A HDG	10GRBLT
c	33	5/8" X 1 1/4" GR SPlice BOLTS 307A HDG	1GRBLT
d	3	5/8" FLAT WASHER F436 A325 HDG	58FW436
e	1	5/8" LOCK WASHER HDG	58LW
f	39	5/8" GUARDRAIL HEX NUT HDG	58HN563
g	2	1/2" X 2" STRUT BOLT A325 HDG	2BLT
h	6	1/2" X 1 1/4" PLATE BOLT A325 HDG	125BLT
i	16	1/2" FLAT WASHER F436 A325 HDG	12FWF436
j	8	1/2" LOCK WASHER HDG	12LW
k	8	1/2" HEX NUT A563 HDG	12HN563
l	4	3/8" X 3" HEX LAG SCREW GR5 HDG	38LS
m	4	3/8" FLAT WASHER F436 A325 HDG	38FW844
n	2	1" FLAT WASHER F436 A325 HDG	1FWF436
o	2	1" HEX NUT A563HD HDG	1HN563
p	1	18" TO 24" LONG ZIP TIE RATED 175-200LB	ZPT18
q	1	1 1/2" X 4" SCH-40 PVC PIPE	PSPCR4
r	1	RFID CHIP RATED MIL-STD-810F	RFID810F
s	1	IMPACT HEAD REFLECTIVE SHEETING	RS30M

**Texas Department of Transportation**  
 Design Division Standard

**SPIG INDUSTRY, LLC**  
**SINGLE GUARDRAIL TERMINAL**  
**SGET - TL-3 - MASH**  
**SGT (15) 31-20**

FILE: sgt153120.dgn	DN: TXDOT	CK: KM	DW: VP	CK: VP
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REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS				DELINEATORS				D & OM DESCRIPTIVE CODES	
DEVICE	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 DIRECTION If Required BI = Bi-Directional BR = Bi-Directional with red on back
SHEETING	Yellow, White or Red Type B or C reflective sheeting				Yellow, White or Red Type B or C Reflective Sheeting				
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (fix). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.				POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
					MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

OBJECT MARKERS								D & OM DESCRIPTIVE CODES	
DEVICE	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)	INSTL OM ASSM (OM-XX) (XXXX)XXX (XX) TYPE OF OBJECT MARKER 1, 2, 3, or 4 NUMBER OF REFLECTORS OR DIRECTION X = 3-Size 2 reflector unit (Type 2 only) Y = 1-Size 3 reflector unit (Type 2 only) Z = 3-Size 1 or 1-Size 4 reflector unit (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
SHEETING	Yellow-Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroreflective yellow - Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting			Red -Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting	
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT	
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP	

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		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.	
DEVICE	GF1	GF2	CTB					W1-6		
	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.		SIZE (W x L)	18" x 24" (Conventional)	24" x 30" (Conventional Oversize)	30" x 36" (Expressway)	36" x 48" (Freeway)	SIZE (W x L)	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)
			MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only		MOUNTING HEIGHT	7'-0"	
			NOTE	1. 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). 2. 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).						
SHEETING	Yellow, White, Red									
NOTE	1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.									

Texas Department of Transportation  
 Traffic Safety Division Standard

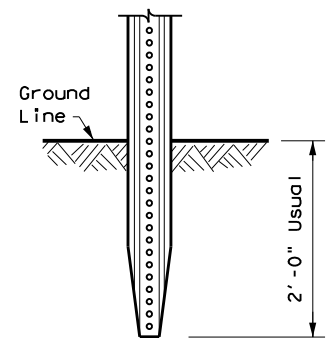
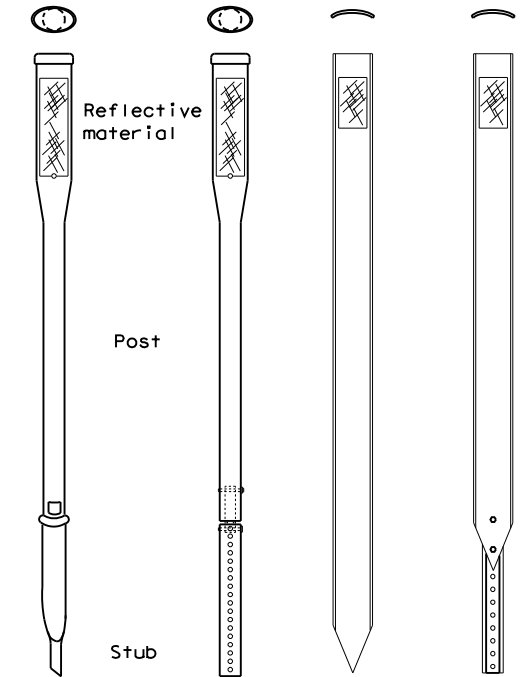
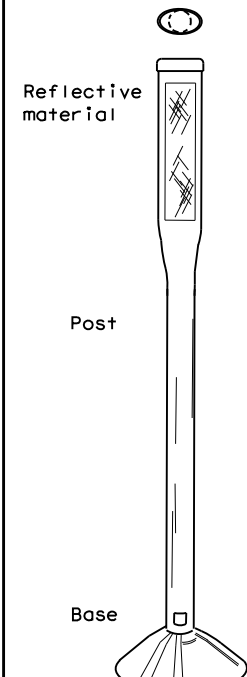
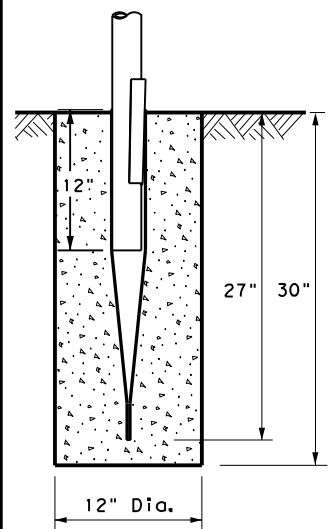
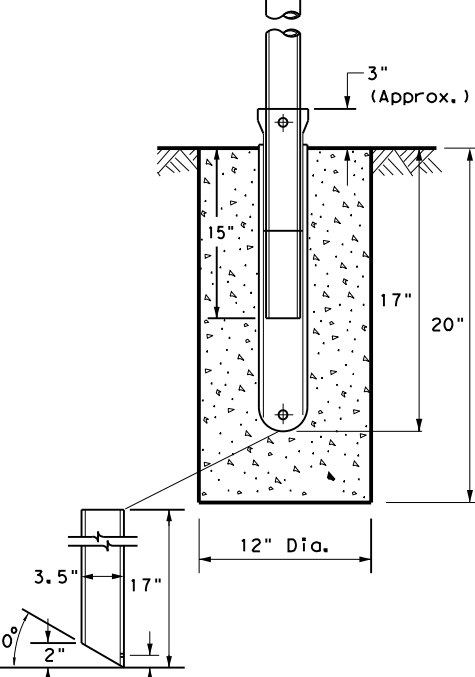
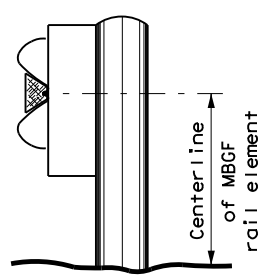
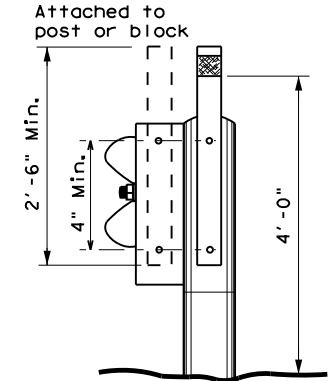
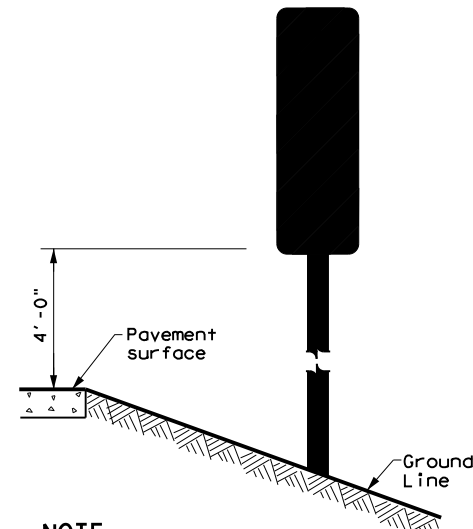
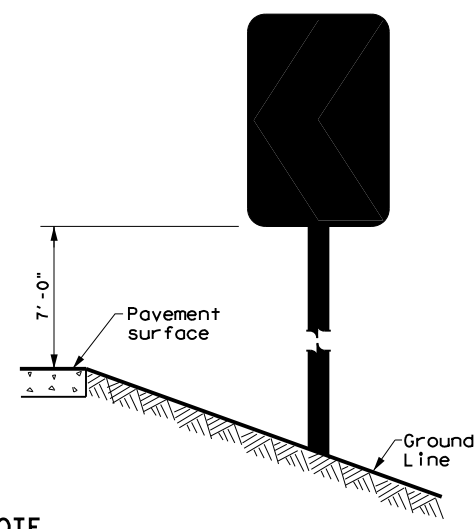
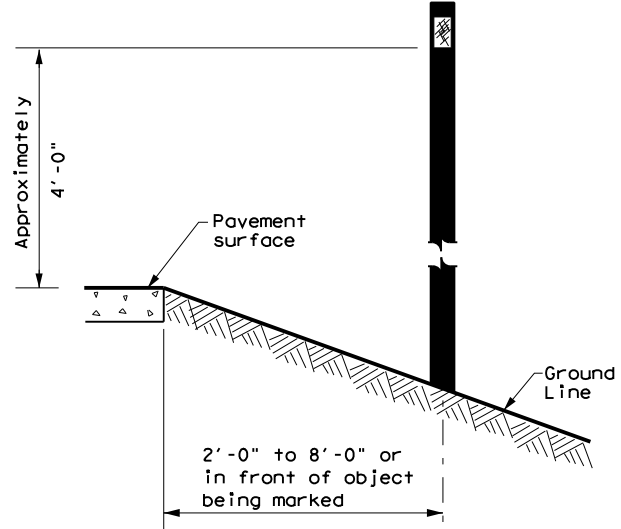
### DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION


#### D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	BRY	FREESTONE	38	

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 FILE: \\Project\wise\AMEMER\_jacobs.com\Jacobs\_US\_B\_I\_SS4\Documents\WJXN4000.dwg

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	GF 1	
						
	EMBEDDED	SURFACE MOUNT	STEEL	PLASTIC	CONCRETE TRAFFIC BARRIER (CTB)	
<b>NOTES</b> 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.			<b>NOTE</b> 1. Install per manufacturer's recommendations.		<b>GENERAL NOTES</b> 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.	
<b>NOTES</b> 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.						
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS		CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN		DELINEATORS AND TYPE 2 OBJECT MARKERS		
						
<b>NOTE</b> 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)		<b>NOTE</b> 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.		<b>NOTE</b> See general notes 1, 2 and 3.		


  
 Traffic Safety Division Standard

## DELINEATOR & OBJECT MARKER INSTALLATION

### D & OM(2)-20

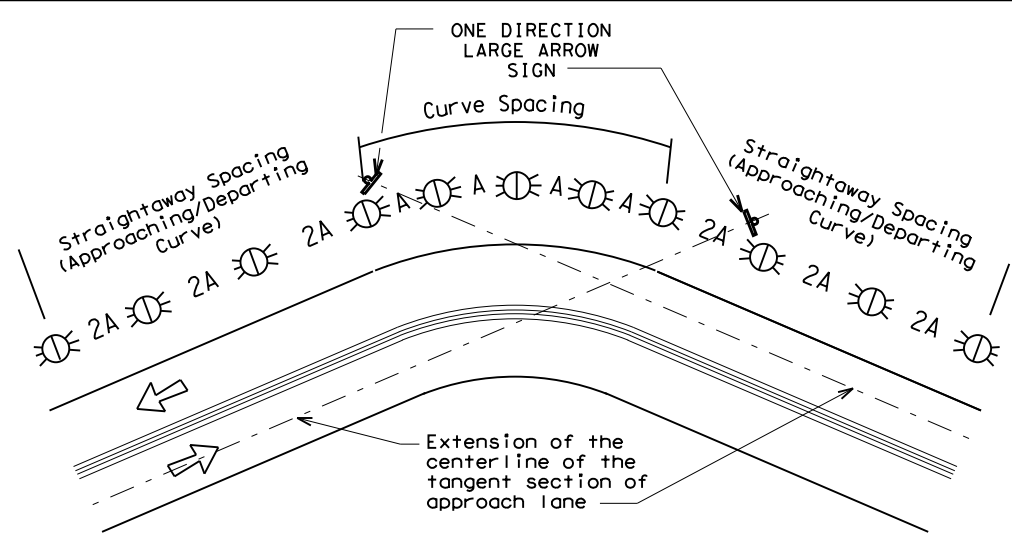
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© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	BRY	FREESTONE	39	

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### MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

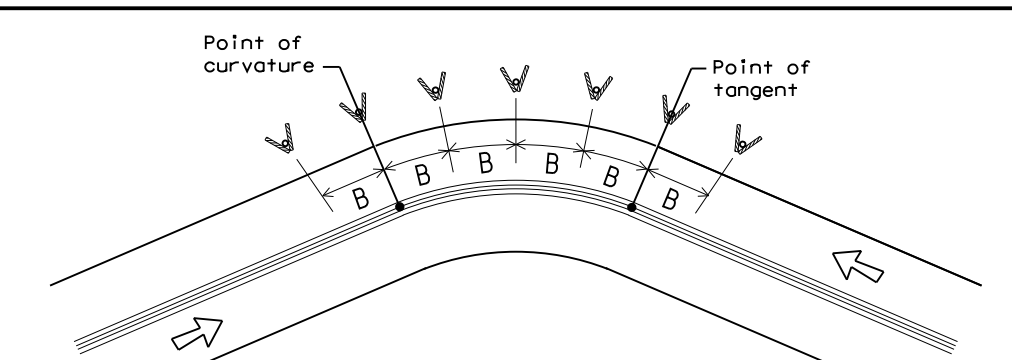
Amount by which Advisory Speed is less than Posted Speed	Curve Advisory Speed	
	Turn (30 MPH or less)	Curve (35 MPH or more)
5 MPH & 10 MPH	• RPMs	• RPMs
15 MPH & 20 MPH	• RPMs and One Direction Large Arrow sign	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions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

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN				
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

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN			
Advisory Speed (MPH)	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

- 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.
- Barrier reflectors may be used to replace required delineators.
- Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND	
	Bi-directional Delineator
	Delineator
	Sign

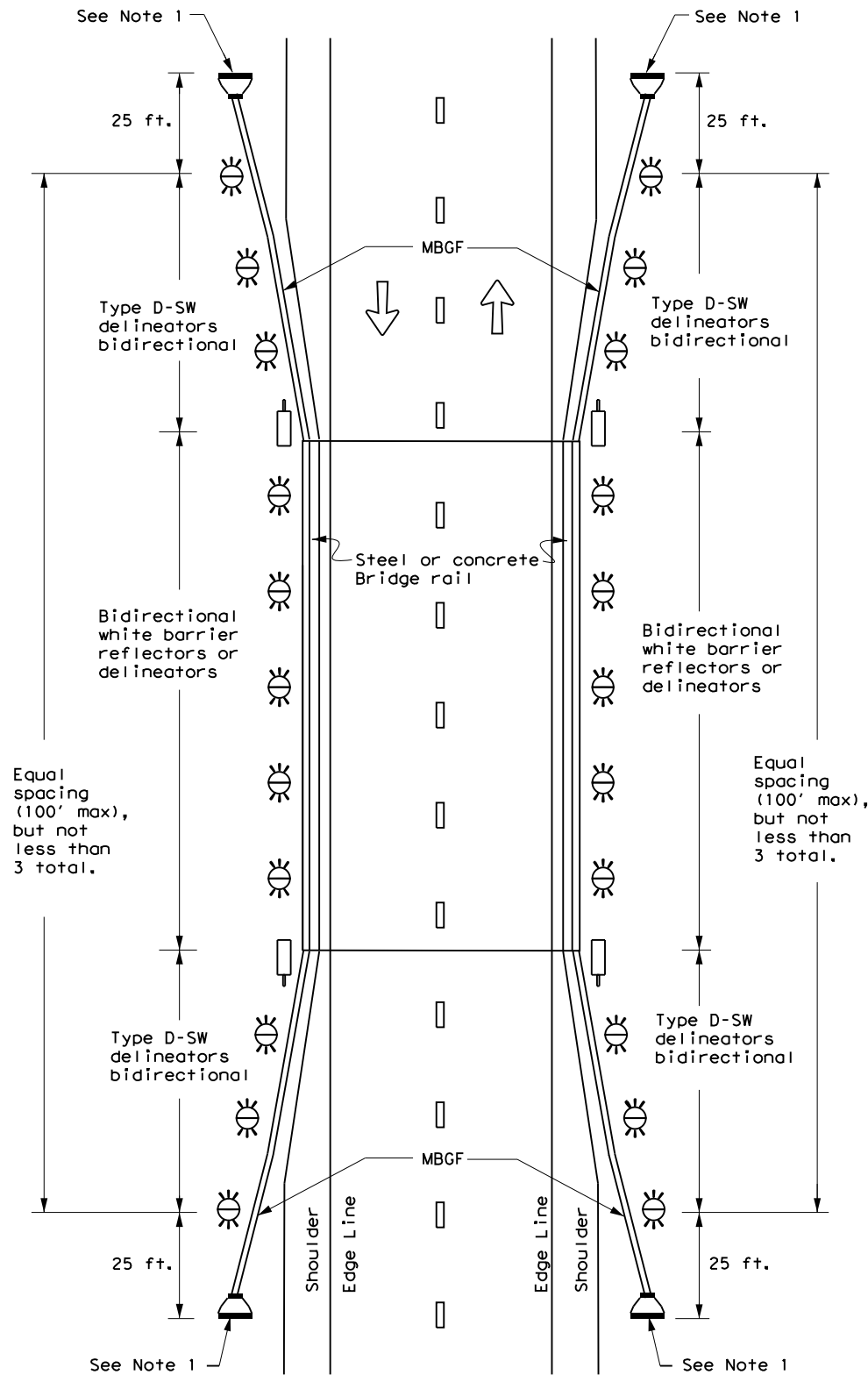
Texas Department of Transportation  
Traffic Safety Division Standard

## 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	BRY	FREESTONE	40	

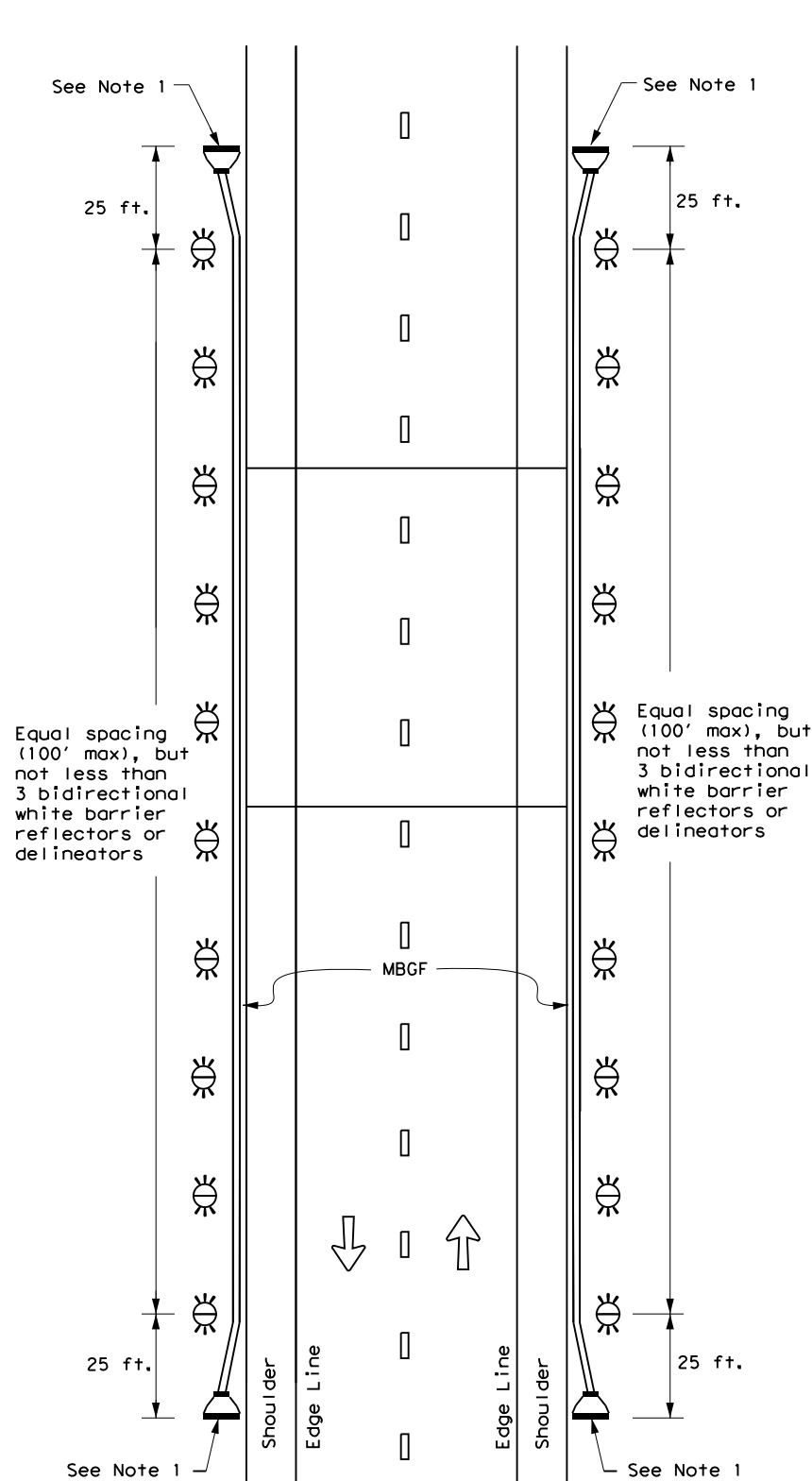
**TWO-WAY, TWO LANE ROADWAY  
WITH REDUCED WIDTH APPROACH RAIL**



**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.

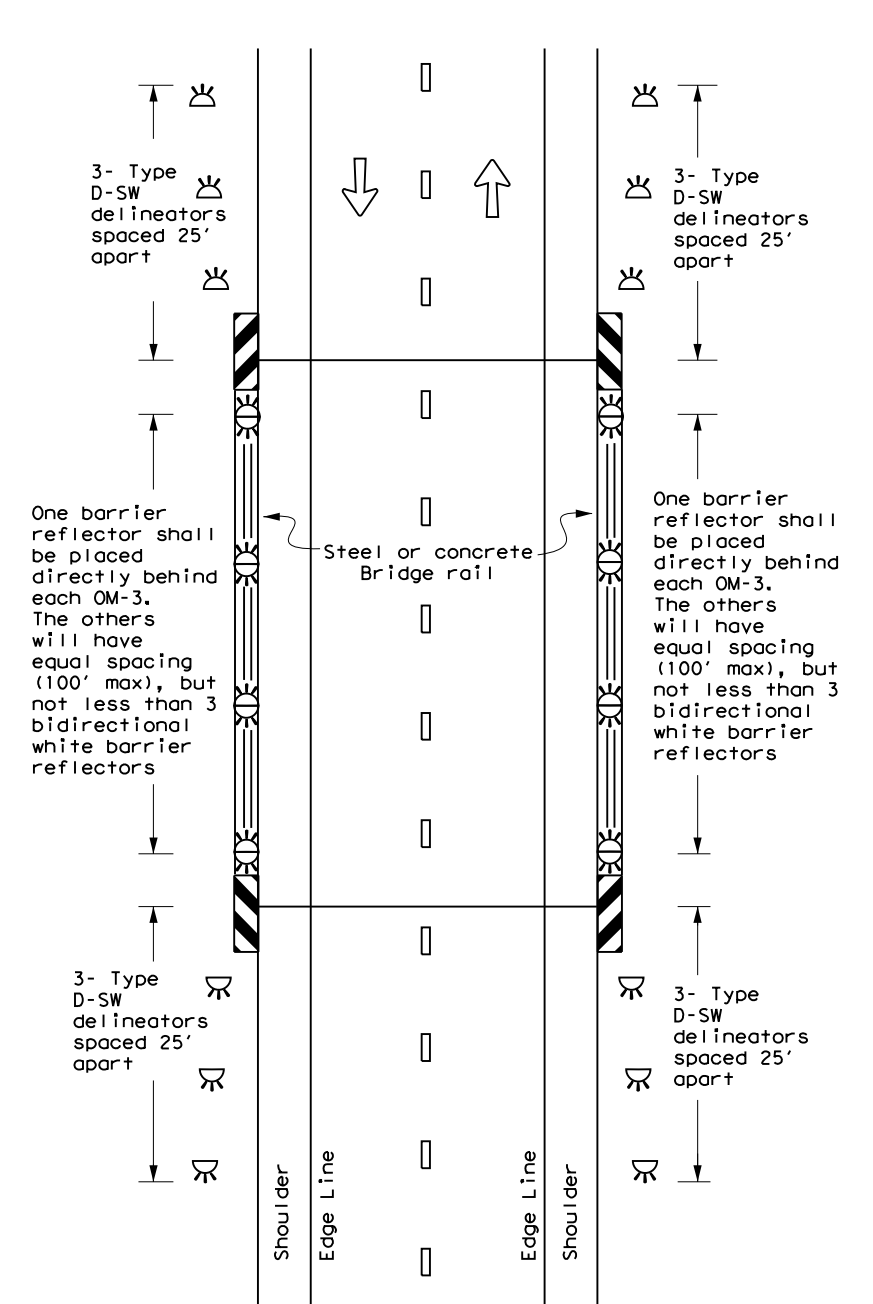
**TWO-WAY, TWO LANE ROADWAY  
WITH METAL BEAM GUARD FENCE (MBGF)**



**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

Texas Department of Transportation  
Traffic Safety Division Standard

**DELINEATOR &  
OBJECT MARKER  
PLACEMENT DETAILS**

**D & OM(5) - 20**

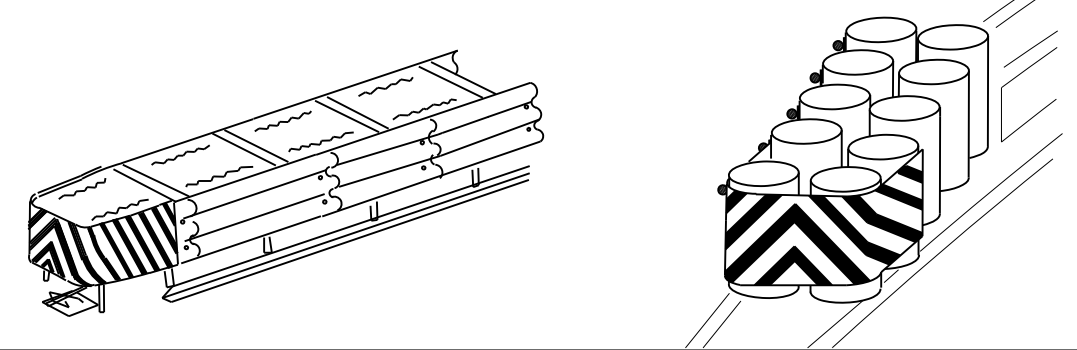
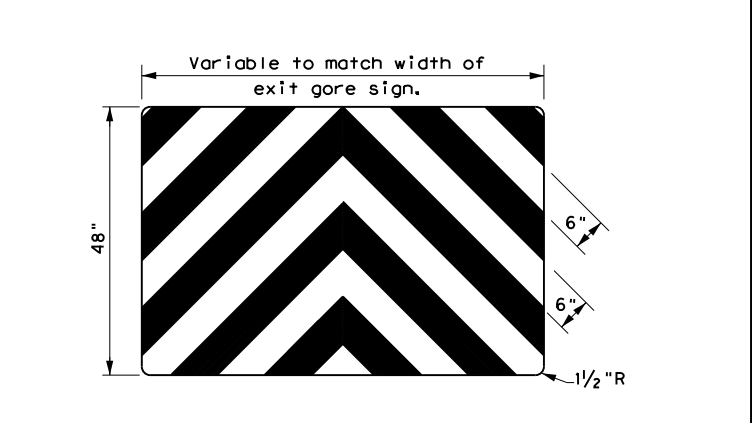
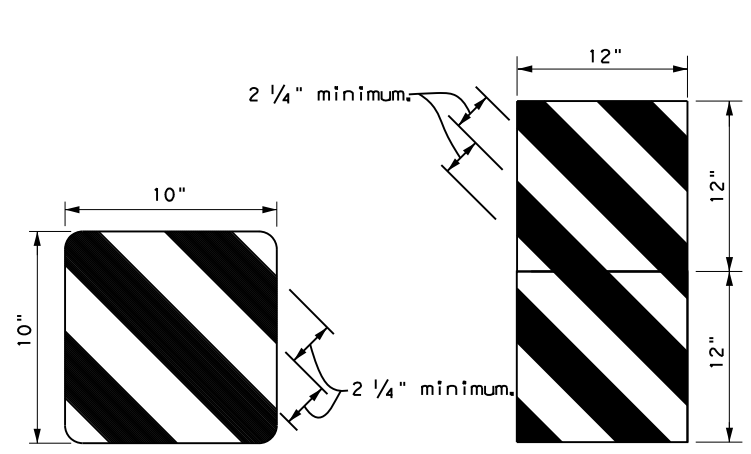
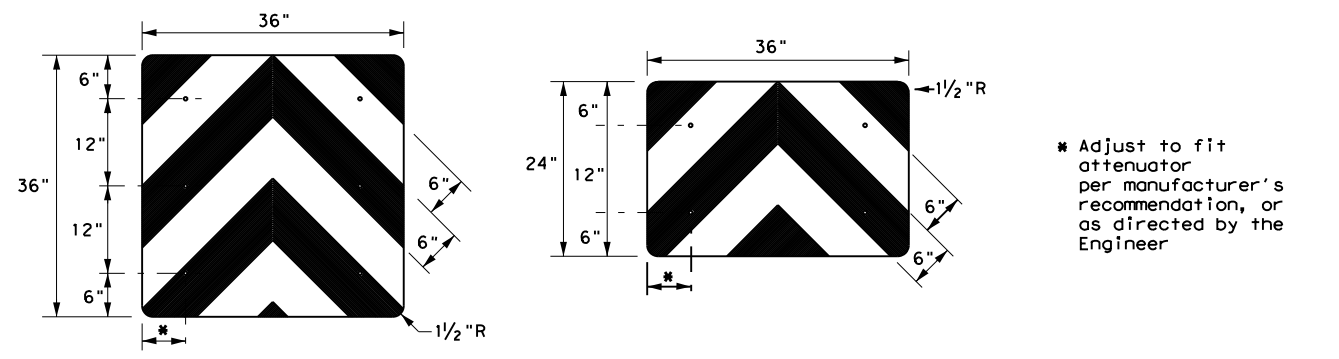
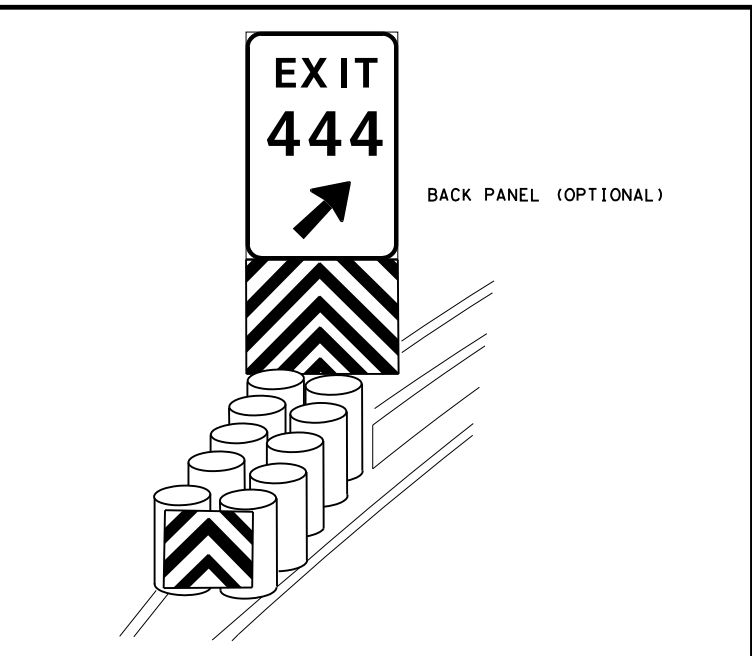
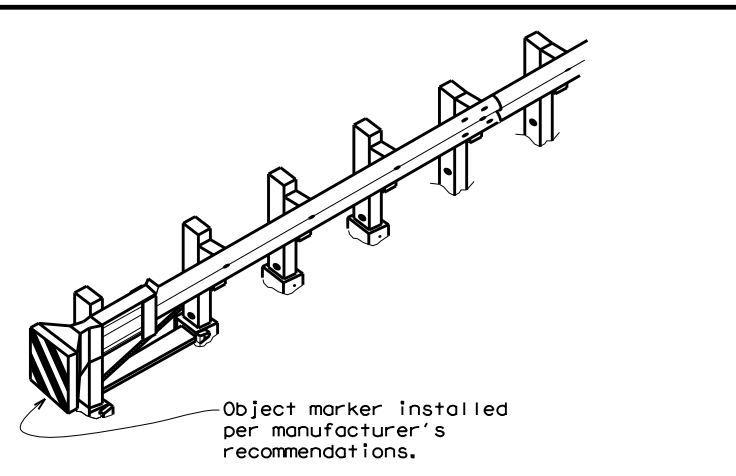
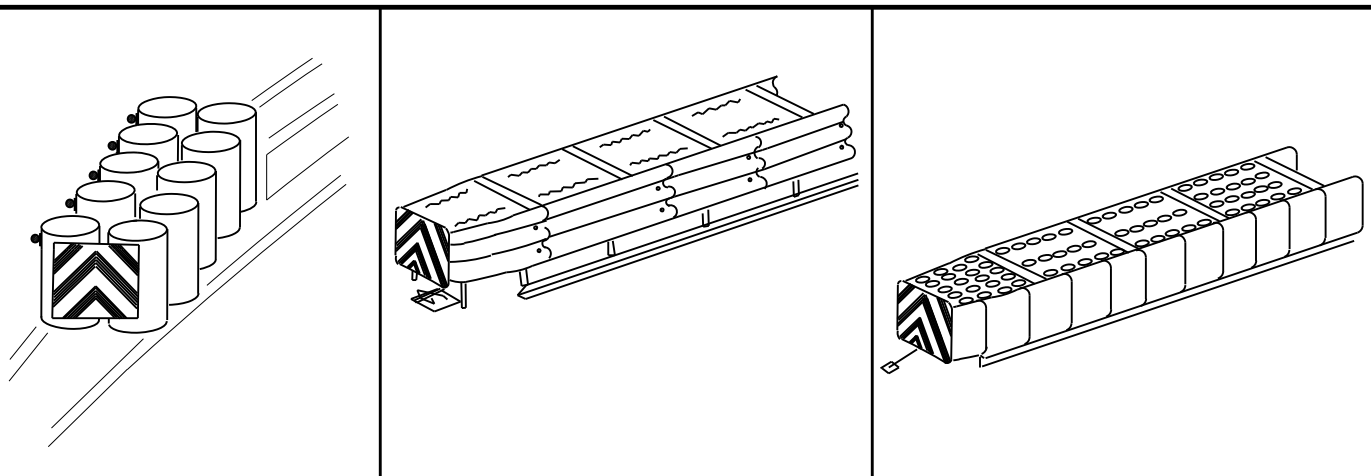
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© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
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7-20	DIST	COUNTY	SHEET NO.	
	BRY	FREESTONE	41	

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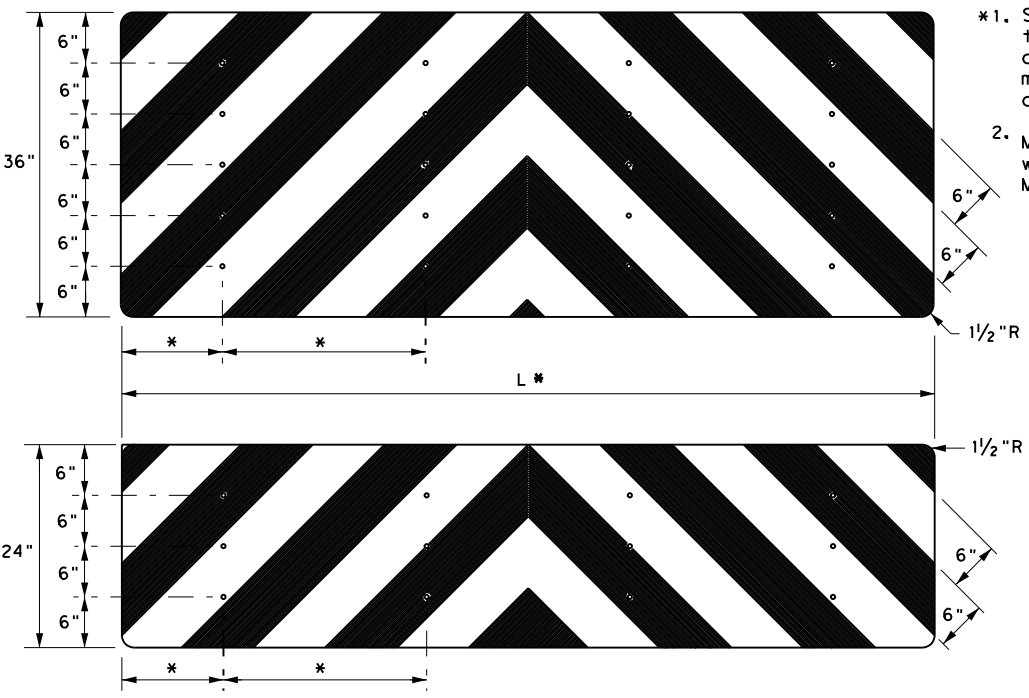


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OBJECT MARKERS SMALLER THAN 3 FT<sup>2</sup>



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

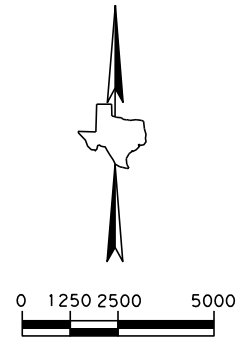
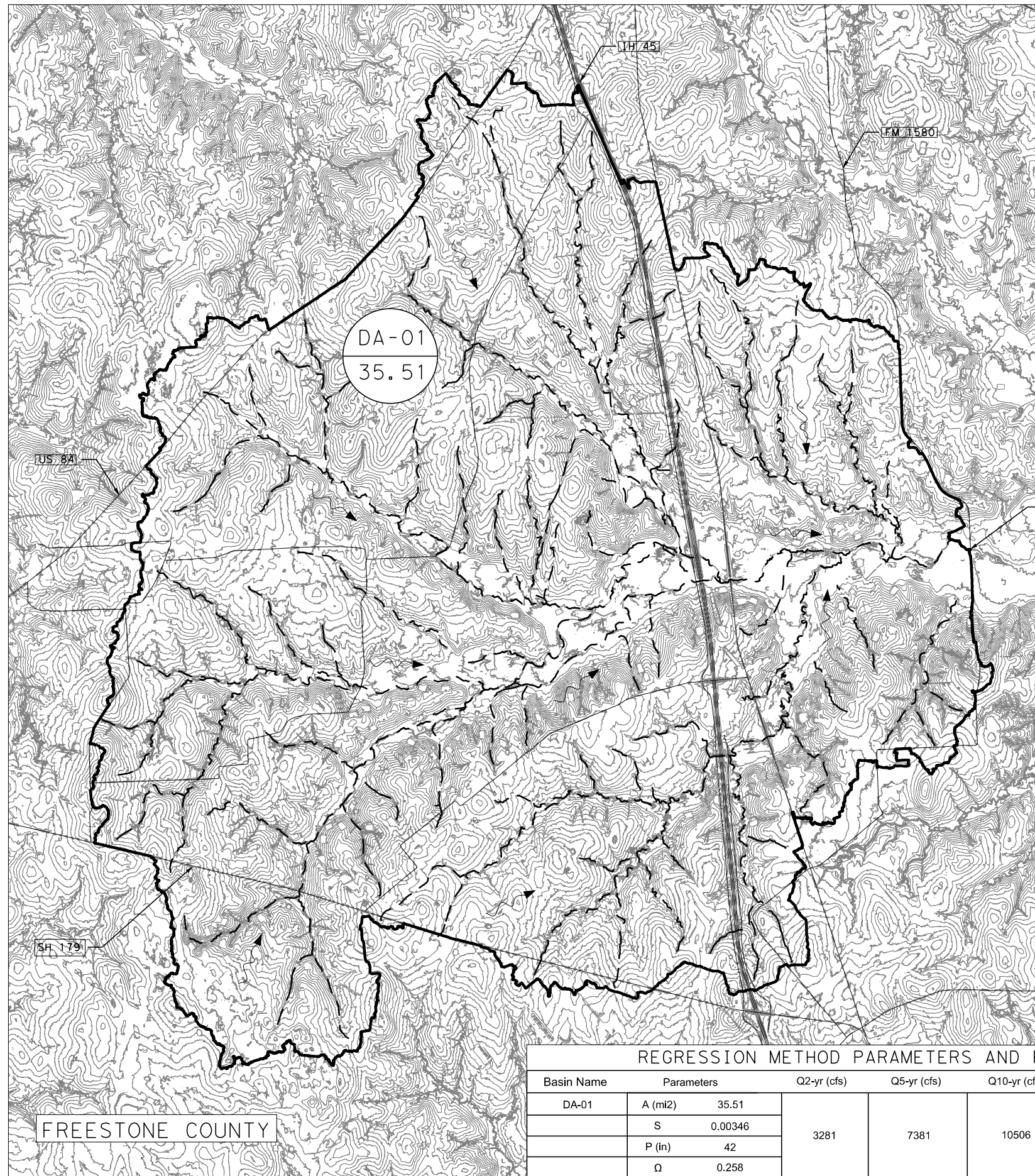
**NOTES**

1. 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.
2. 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.
3. 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".
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.
5. Object Marker at nose of attenuator is subsidiary to the attenuator.
6. See D & OM (1-4) for required barrier reflectors.

		<b>Traffic Safety Division Standard</b>	
<b>DELINEATOR &amp; OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS</b> <b>D &amp; OM(VIA) -20</b>			
FILE: domvia20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT December 1989	CONT	SECT	JOB
REVISIONS		0917 20	046 CR 481
4-92 8-04	DIST	COUNTY	SHEET NO.
8-95 3-15	BRY	FREESTONE	42
4-98 7-20			
20G			



REV DATE: 12-6-2022  
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**NOTES:**

1. DRAINAGE AREA DELINEATED BASED ON USGS TOPOGRAPHIC DATA.
2. REGRESSION METHOD WAS USED TO CALCULATE PEAK FLOWS PER TXDOT HYDRAULIC DESIGN MANUAL (SEPT 2019)
3. PROJECT IS LOCATED IN FEMA FLOOD ZONE A (MAP NO 4808220008 B, EFFECTIVE SEPTEMBER 1, 2007)

**LEGEND**

- DRAINAGE AREA I. D.
- DRAINAGE AREA
- CONTOUR
- FLOW ARROW
- STREAM



PRINT DATE	REVISION DATE
5/12/2023	

**Jacobs** 2705 BEE CAVE RD, SUITE 300  
 AUSTIN TX 78746  
 FIRM REGISTRATION F-2966



**DRAINAGE AREA MAP**  
 CR 481 AT UPPER KEECHI CREEK

REGRESSION METHOD PARAMETERS AND PEAK FLOWS (CFS)								
Basin Name	Parameters	Q2-yr (cfs)	Q5-yr (cfs)	Q10-yr (cfs)	Q25-yr (cfs)	Q50-yr (cfs)	Q100-yr (cfs)	
DA-01	A (mi <sup>2</sup> )	35.51	3281	7381	10506	15674	20287	25723
	S	0.00346						
	P (in)	42						
	Ω	0.258						

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	43



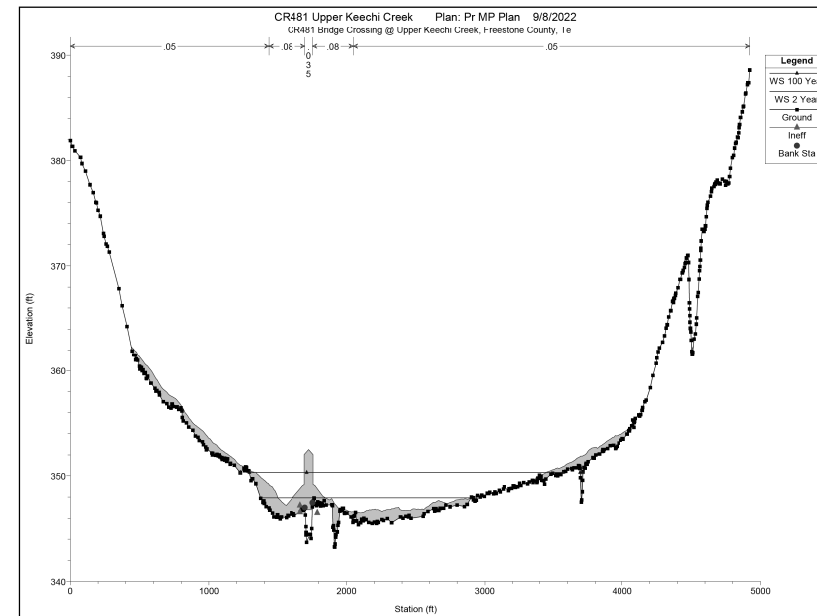
HEC-RAS 2-YEAR COMPARISON

RIVER STATION (FT)	LOCATION	PROPOSED STRUCTURE			RIVER STATION (FT)	EXISTING STRUCTURE				
		2 YR				2 YR				
		Q	V (CHAN)	WSEL		Q	V (CHAN)	WSEL		
		CFS	FPS	FT			CFS	FPS	FT	
8093		3281	3.34	349.03	8093	3281	3.29	349.04		
7043		3281	2.02	348.34	7043	3281	1.99	348.38		
6351		3281	2.52	347.98	6351	3281	2.42	348.04		
6325	BR U/S XS	3281	3.27	347.93	6325	3281	3.15	348.00		
6290	U. K. CREEK	Bridge			6290	Bridge				
6248	BR D/S XS	3281	8.46	347.16	6248	3281	8.46	347.16		
6228		3281	7.59	347.02	6228	3281	7.58	347.02		
5484		3281	1.92	345.18	5484	3281	1.92	345.18		
4611		3281	2.24	344.73	4611	3281	2.24	344.73		
2818		3281	5.05	342.99	2818	3281	5.05	342.99		

HEC-RAS 100-YEAR COMPARISON

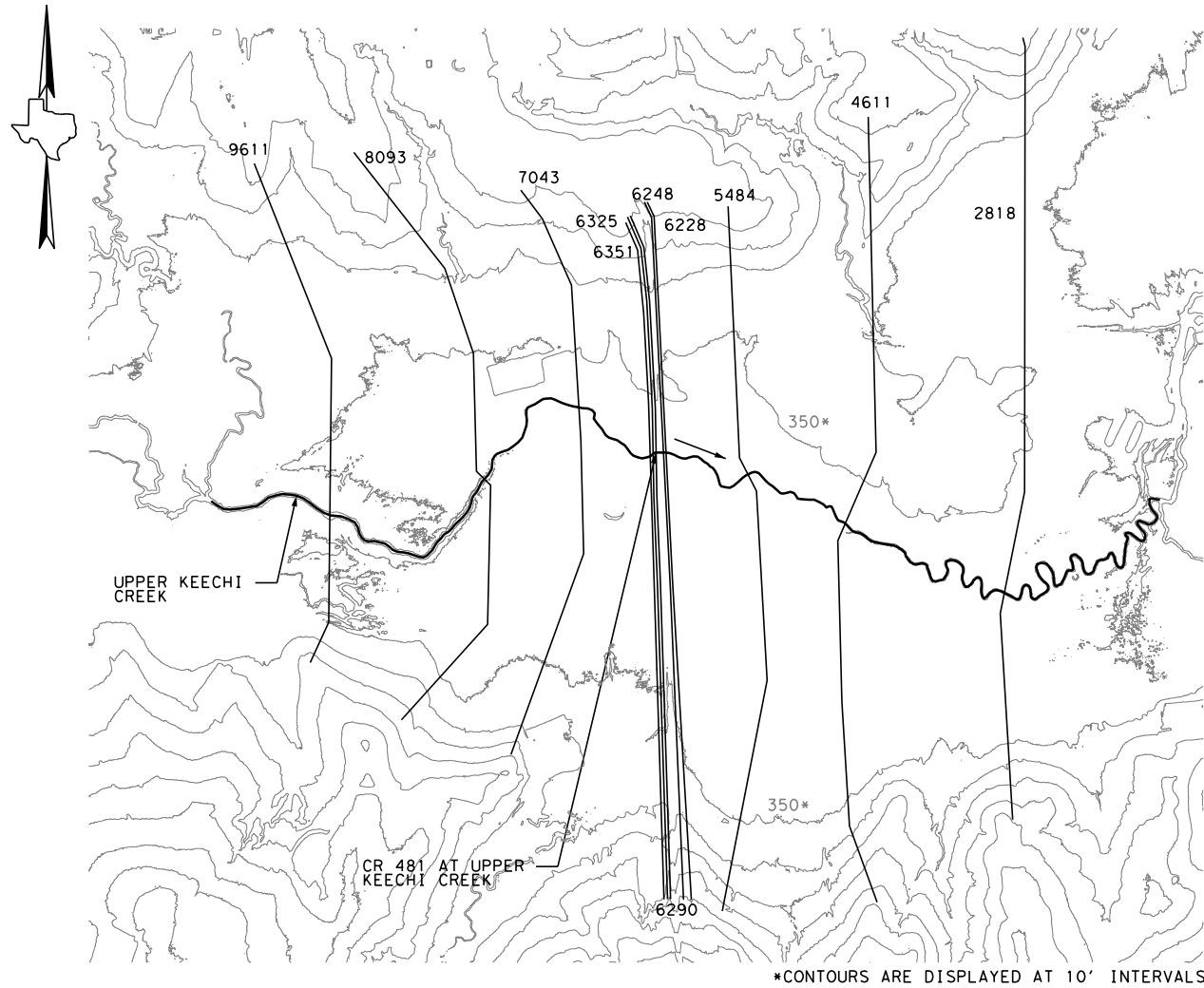
RIVER STATION (FT)	LOCATION	PROPOSED STRUCTURE			RIVER STATION (FT)	EXISTING STRUCTURE				
		100 YR				100 YR				
		Q	V (CHAN)	WSEL		Q	V (CHAN)	WSEL		
		CFS	FPS	FT			CFS	FPS	FT	
8093		25723	4.38	352.63	8093	25723	4.38	352.63		
7043		25723	4.93	351.62	7043	25723	4.93	351.62		
6351		25723	7.32	350.47	6351	25723	7.32	350.47		
6325	BR U/S XS	25723	8.43	350.32	6325	25723	8.43	350.32		
6290	U. K. CREEK	Bridge			6290	Bridge				
6248	BR D/S XS	25723	11.94	349.64	6248	25723	11.94	349.64		
6228		25723	8.84	349.59	6228	25723	8.84	349.59		
5484		25723	2.91	348.92	5484	25723	2.91	348.92		
4611		25723	4.21	348.41	4611	25723	4.21	348.41		
2818		25723	8.07	346.23	2818	25723	8.07	346.23		

CR 481 AT UPPER KEECHI CREEK HEC-RAS CROSS SECTION COMPUTATION



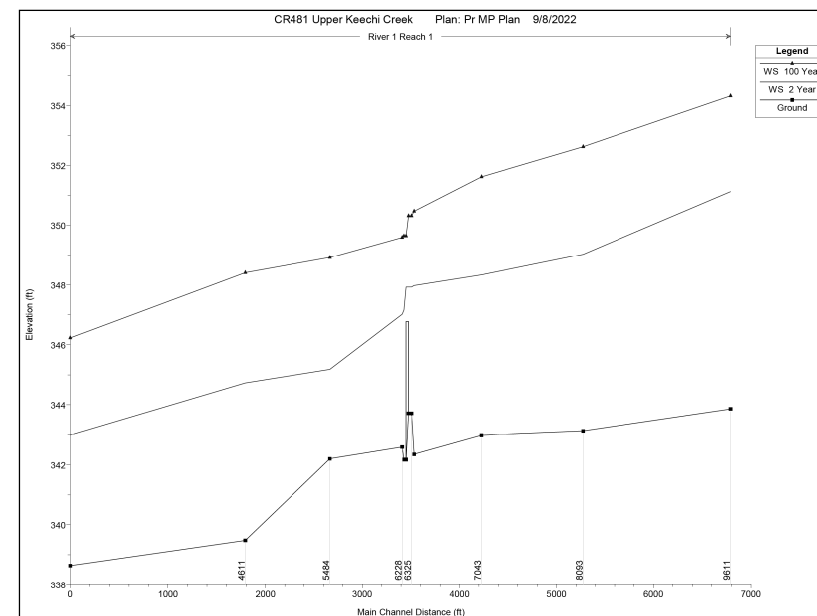
- NOTES:
- HEC-RAS VER 5.0.7 WAS USED FOR THE HYDRAULIC ANALYSIS AND DESIGN OF THE BRIDGE. NORMAL DEPTH COMPUTATION USED FOR THE DOWNSTREAM BOUNDARY CONDITION SLOPE = 0.003686 FT/FT FOR EXISTING AND PROPOSED CONDITIONS.
  - FREESTONE COUNTY FLOODPLAIN ADMINISTRATOR, LEONARD SMITH, WAS INFORMED OF THE PROPOSED PROJECT AND PROVIDED WITH A SUMMARY OF HYDRAULIC IMPACTS ON 05-15-2023.

CROSS SECTION LAYOUT MAP



\*CONTOURS ARE DISPLAYED AT 10' INTERVALS

CR 481 AT UPPER KEECHI CREEK HEC-RAS PROFILE COMPUTATION



Professional Engineer Seal for Adam N. Koransky, License No. 95988, State of Texas, dated 5/10/2023.

PRINT DATE	REVISION DATE
5/10/2023	

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FIRM REGISTRATION F-2966

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HYDRAULIC DATA SHEET  
CR 481 AT UPPER KEECHI CREEK

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	44

REV DATE: 12-6-2022  
CSJ: 0917-20-046  
FILENAME: p:\Project\Wise\AMER\jacobs.com\jacobs\_US\_B\_L\_SSA\Documents\WJXN4000\_BRY\_Bridge\_Program\WJXN4000600 DISC\602 DRNG\HDS CR 481 Upper Keechi Creek\91720046\_CR481\_HDS

CONTRACTION SCOUR CALCULATIONS 5-YEAR

PARAMETER	LOB	CHANNEL	ROB	UNIT
AVERAGE DEPTH OF FLOW IN U/S CHANNEL (Y1)		5.37		FT
APPROACH VELOCITY (V1)		4.87		FPS
DEPTH IN CONTRACTED SECTION BEFORE SCOUR (Y0)		3.28		FT
FLOW IN CONTRACTED SECTION (Q2)		711.00		CFS
BOTTOM WIDTH OF CONTRACTED SECTION (W2)		65.00		FT
GRAIN SIZE (D50)		0.20		MM
FLOW IN UPSTREAM CHANNEL (Q1)		7381.00		CFS
BOTTOM WIDTH OF MAIN CHANNEL (W1)		55.70		FT
CHANNEL SLOPE		0.001		FT/FT
SHEAR VELOCITY (V*) = (g.y.S)0.5		0.36		FPS
WATER TEMPERATURE		60.00		°F
MEDIAN BED MATERIALS FALL VELOCITY(1)		0.06		FPS
V*/T		6.15		-
K1(2)		0.69		-
AVERAGE FLOW DEPTH IN CONTRACTED SECTION (Y2)	N/A	0.65	N/A	FT
CONTRACTION SCOUR (Ys = Y2 - Y0)	N/A	0.00	N/A	FT
CRITICAL VELOCITY FOR INCEPTION MOTION (Vc)	0.00	1.30	0.00	FPS
EQUATION	N/A	LIVE	N/A	-

CONTRACTION SCOUR CALCULATIONS 100-YEAR

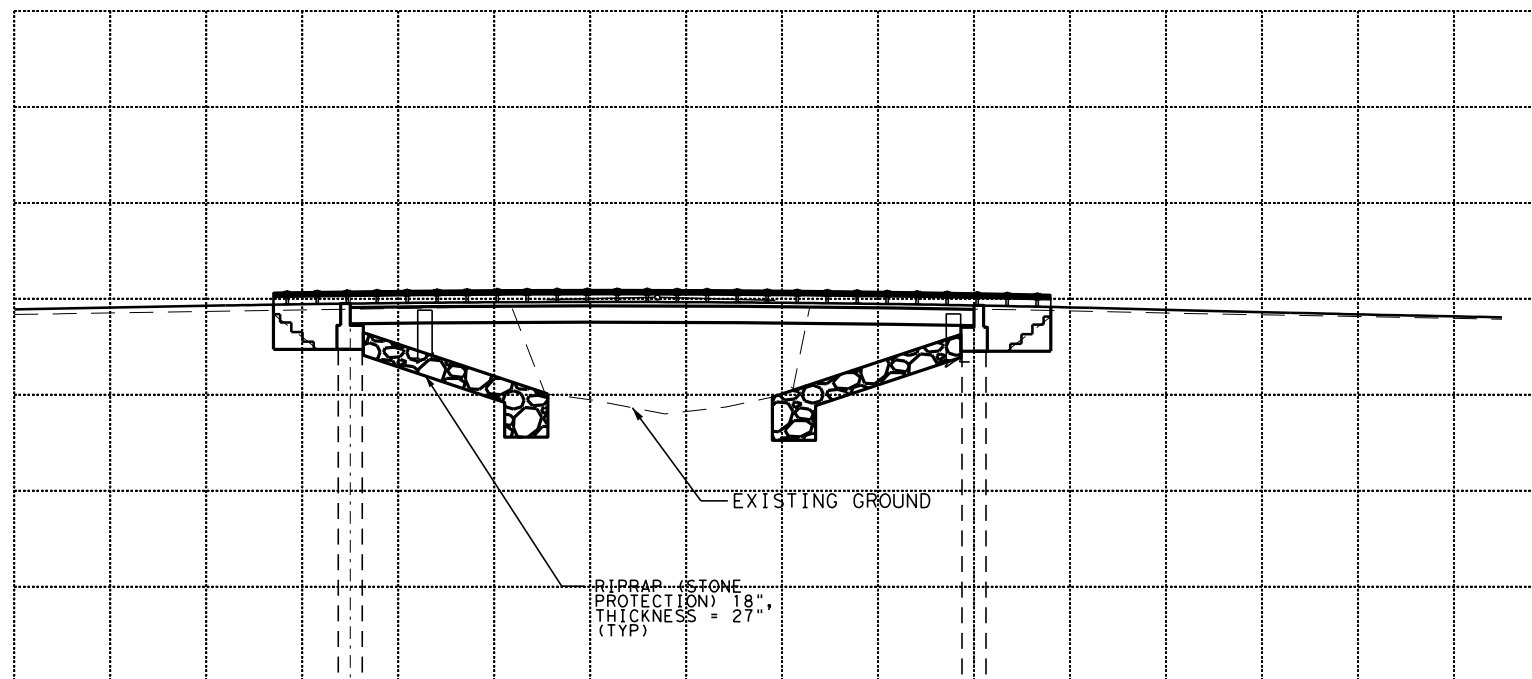
PARAMETER	LOB	CHANNEL	ROB	UNIT
AVERAGE DEPTH OF FLOW IN U/S CHANNEL (Y1)		7.06		FT
APPROACH VELOCITY (V1)		8.43		FPS
DEPTH IN CONTRACTED SECTION BEFORE SCOUR (Y0)		3.28		FT
FLOW IN CONTRACTED SECTION (Q2)		688.40		CFS
BOTTOM WIDTH OF CONTRACTED SECTION (W2)		65.00		FT
GRAIN SIZE (D50)		0.20		MM
FLOW IN UPSTREAM CHANNEL (Q1)		25723.00		CFS
BOTTOM WIDTH OF MAIN CHANNEL (W1)		55.70		FT
CHANNEL SLOPE		0.001		FT/FT
SHEAR VELOCITY (V*) = (g.y.S)0.5		0.42		FPS
WATER TEMPERATURE		60.00		°F
MEDIAN BED MATERIALS FALL VELOCITY(1)		0.06		FPS
V*/T		7.05		-
K1(2)		0.69		-
AVERAGE FLOW DEPTH IN CONTRACTED SECTION (Y2)	N/A	0.28	N/A	FT
CONTRACTION SCOUR (Ys = Y2 - Y0)	N/A	0.00	N/A	FT
CRITICAL VELOCITY FOR INCEPTION MOTION (Vc)	0.00	1.30	0.00	FPS
EQUATION	N/A	LIVE	N/A	-

NOTES:

1. UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) WEB SOIL SURVEY INDICATES NAHATCHE CLAY LOAM AS THE DOMINATE SOIL TYPE.
2. D50 VALUES: MINIMUM D50 OF 0.20 MM USED AS RECOMMENDED IN THE TXDOT GEOTECHNICAL MANUAL, CHAPTER 5, SECTION 6.
3. ABUTMENT SCOUR RESULTS NOT REPORTED AS RECOMMENDED IN THE TXDOT GEOTECHNICAL MANUAL, CHAPTER 5, SECTION 6.

TOTAL SCOUR

5-YR	100-YR
0.00	0.00



PRINT DATE	REVISION DATE
5/10/2023	

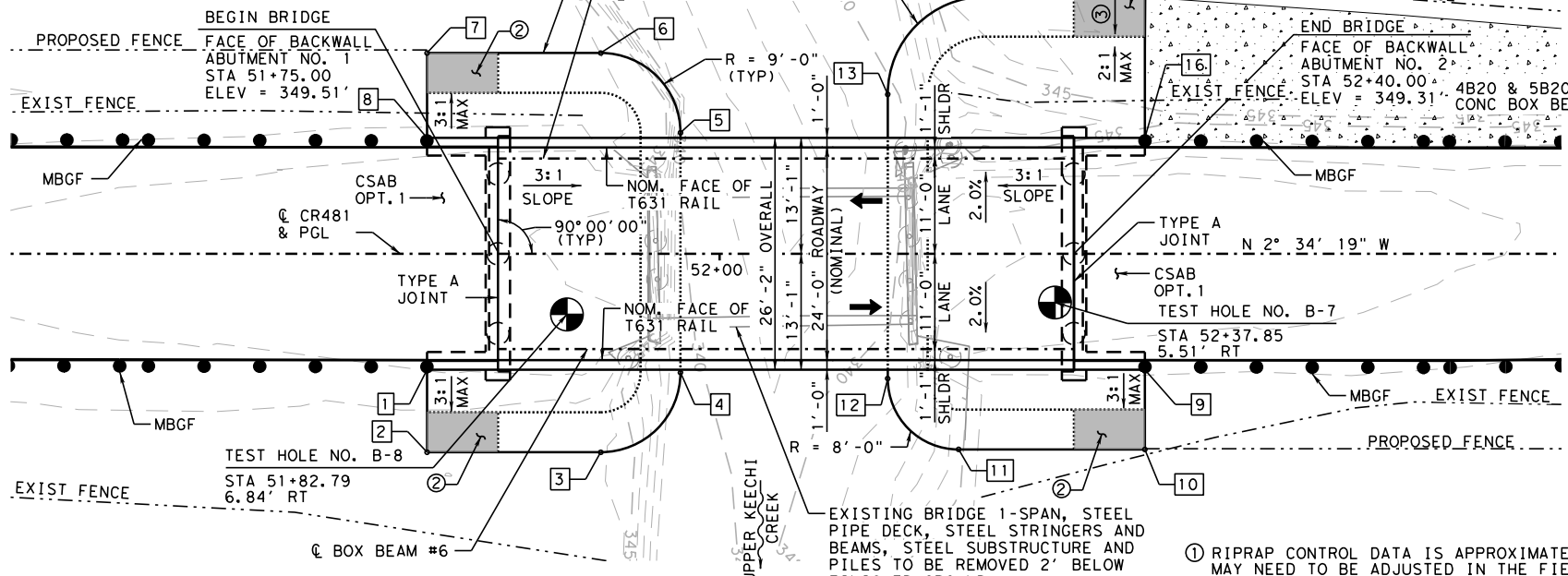
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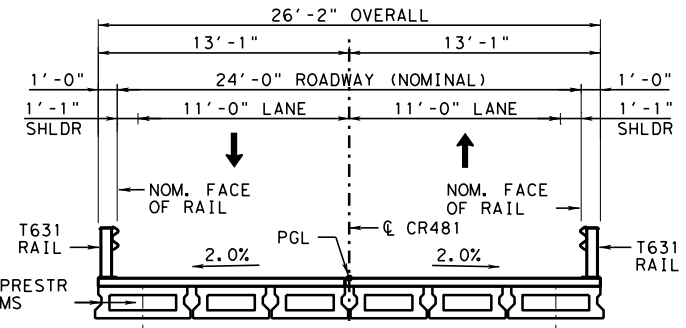
SCOUR DATA SHEET  
CR481 AT UPPER KEECHI CREEK

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	45

REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
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PLAN



TYPICAL TRANSVERSE SECTION

RIPRAP CONTROL DATA ①

POINT	STA	OFFSET (FT)
1	51+67.00	13.08 RT
2	51+67.00	22.40 RT
3	51+86.60	22.40 RT
4	51+95.60	13.40 RT
5	51+95.60	13.66 LT
6	51+86.60	22.66 LT
7	51+67.00	22.66 LT
8	51+67.00	13.08 LT
9	52+48.00	13.08 RT
10	52+48.00	22.08 RT
11	52+26.98	22.08 RT
12	52+18.98	14.08 RT
13	52+18.98	18.00 LT
14	52+29.98	29.00 LT
15	52+48.00	29.00 LT
16	52+48.00	13.08 LT

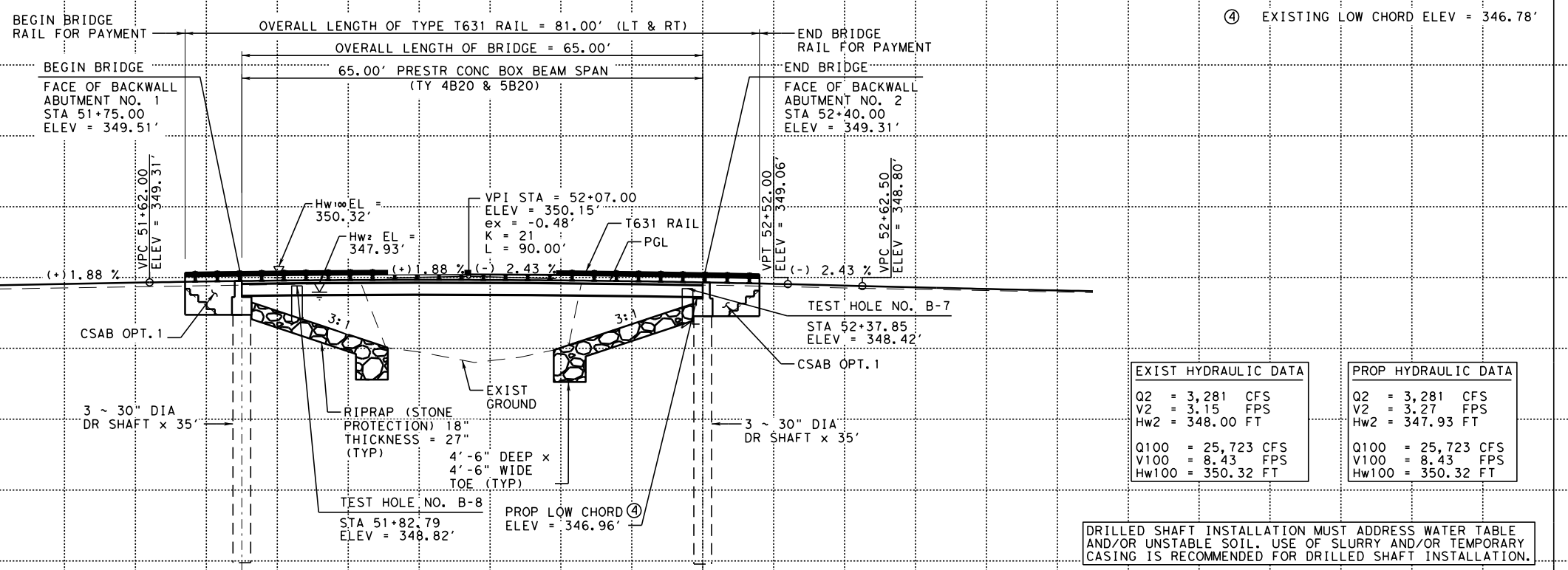
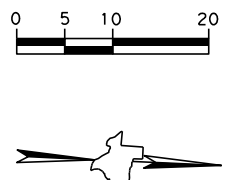
- ① RIPRAP CONTROL DATA IS APPROXIMATE AND MAY NEED TO BE ADJUSTED IN THE FIELD.
- ② PLACE GROUT IN THE TOE OF THE RIPRAP ALONG THE ABUTMENT WINGWALL, AS SHADED, IN ACCORDANCE WITH TxDOT ITEM 432.2.3. THE GROUT MUST FILL ALL VOIDS BETWEEN STONES. DO NOT PLACE GROUT IN THE RIPRAP TOE BEYOND THE ABUTMENT WINGWALL LIMITS. THE LABOR, MATERIALS, AND INCIDENTALS FOR THE GROUT PLACEMENT WILL BE SUBSIDIARY TO BID ITEM 432-6033, RIPRAP (STONE PROTECTION) (18 IN).
- ③ 2:1 MAX

ABUTMENTS AT BEARING N 87° 25' 41" E

HL93 LOADING: SUPERSTRUCTURE INV/OPR RATING = 1.00/1.30  
SUBSTRUCTURE INV/OPR RATING = SUBSTRUCTURE NOT RATED

- GENERAL NOTES:
- DESIGNED ACCORDING TO AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH EDITION (2020).
  - BRIDGE NOT DESIGNED FOR OVERLAY.
  - ALL DIMENSIONS ARE EITHER HORIZONTAL OR VERTICAL AND MUST BE CORRECTED FOR GRADE AND CROSS SLOPE.
  - CONTRACTOR TO VERIFY LOCATION AND STATUS OF ALL UTILITIES SHOWN AND THOSE NOT IDENTIFIED PRIOR TO CONSTRUCTION.
  - CONTRACTOR MUST FIELD VERIFY ALL EXISTING ABUTMENT LOCATIONS, DIMENSIONS, AND ELEVATIONS PRIOR TO FABRICATION OF BOX BEAMS.
  - SEE "TEST HOLE DATA" SHEET FOR TEST HOLE DATA.
  - SEE SBBS-B20-24 (MOD) STANDARD FOR TYPE A JOINT DETAIL.

FUNCTIONAL CLASS: RURAL LOCAL  
DESIGN SPEED: MEETS OR EXCEEDS EXISTING  
DESIGN AEP: MEETS OR EXCEEDS EXISTING  
ADT: 91 (2017); 127 (2040)  
EXIST NBI: 17-082-0-AA01-34-002  
PROP NBI: 17-082-0-AA04-81-102



ELEVATION

EXIST HYDRAULIC DATA

Q2	= 3,281 CFS
V2	= 3.15 FPS
Hw2	= 348.00 FT
Q100	= 25,723 CFS
V100	= 8.43 FPS
Hw100	= 350.32 FT

PROP HYDRAULIC DATA

Q2	= 3,281 CFS
V2	= 3.27 FPS
Hw2	= 347.93 FT
Q100	= 25,723 CFS
V100	= 8.43 FPS
Hw100	= 350.32 FT

DRILLED SHAFT INSTALLATION MUST ADDRESS WATER TABLE AND/OR UNSTABLE SOIL. USE OF SLURRY AND/OR TEMPORARY CASING IS RECOMMENDED FOR DRILLED SHAFT INSTALLATION.



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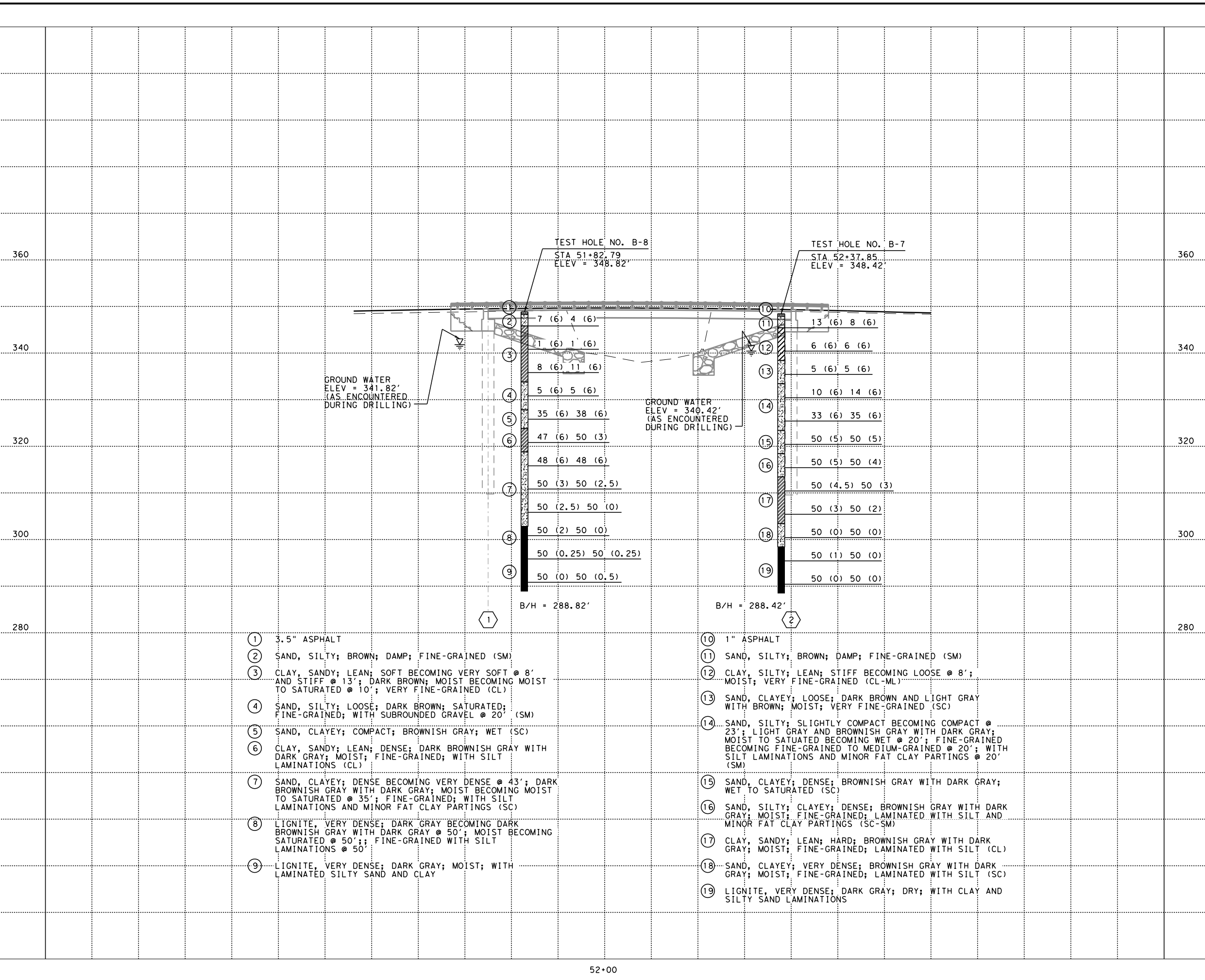
BRIDGE LAYOUT  
CR 481 AT UPPER KEECHI CREEK

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	BR 2023(135)	CR 481
STATE	DISTRICT	COUNTY
TEXAS	BRY	FREESTONE
CONTROL	SECTION	JOB SHEET NO.
0917	20	046 46

REV DATE: 12-6-2022  
CSJ: 0917-20-046  
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TEST HOLE DATA IS A REPRODUCTION OF THE DRILLING LOGS FROM A GEOTECHNICAL INVESTIGATION BY ETL ENGINEERS & CONSULTANTS INC. DATED JUNE 18, 2021 AND JUNE 21, 2021.

REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
 FILENAME: p:\Project\Wise\AMER\jacobs.com\jacobs\_US\_B\_L\_SSA\Documents\WJXN4000\_BRY\_Bridge\_Program\WJXN4000\91720046\_CR481\TH.dgn



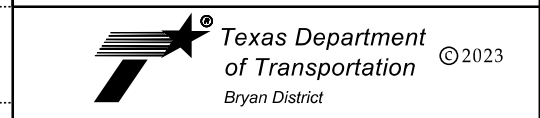
- ① 3.5" ASPHALT
- ② SAND, SILTY; BROWN; DAMP; FINE-GRAINED (SM)
- ③ CLAY, SANDY; LEAN; SOFT BECOMING VERY SOFT @ 8'; AND STIFF @ 13'; DARK BROWN; MOIST BECOMING MOIST TO SATURATED @ 10'; VERY FINE-GRAINED (CL)
- ④ SAND, SILTY; LOOSE; DARK BROWN; SATURATED; FINE-GRAINED; WITH SUBROUNDED GRAVEL @ 20' (SM)
- ⑤ SAND, CLAYEY; COMPACT; BROWNISH GRAY; WET (SC)
- ⑥ CLAY, SANDY; LEAN; DENSE; DARK BROWNISH GRAY WITH DARK GRAY; MOIST; FINE-GRAINED; WITH SILT LAMINATIONS (CL)
- ⑦ SAND, CLAYEY; DENSE BECOMING VERY DENSE @ 43'; DARK BROWNISH GRAY WITH DARK GRAY; MOIST BECOMING MOIST TO SATURATED @ 35'; FINE-GRAINED; WITH SILT LAMINATIONS AND MINOR FAT CLAY PARTINGS (SC)
- ⑧ LIGNITE, VERY DENSE; DARK GRAY BECOMING DARK BROWNISH GRAY WITH DARK GRAY @ 50'; MOIST BECOMING SATURATED @ 50'; FINE-GRAINED WITH SILT LAMINATIONS @ 50'
- ⑨ LIGNITE, VERY DENSE; DARK GRAY; MOIST; WITH LAMINATED SILTY SAND AND CLAY

- ⑩ 1" ASPHALT
- ⑪ SAND, SILTY; BROWN; DAMP; FINE-GRAINED (SM)
- ⑫ CLAY, SILTY; LEAN; STIFF BECOMING LOOSE @ 8'; MOIST; VERY FINE-GRAINED (CL-ML)
- ⑬ SAND, CLAYEY; LOOSE; DARK BROWN AND LIGHT GRAY WITH BROWN; MOIST; VERY FINE-GRAINED (SC)
- ⑭ SAND, SILTY; SLIGHTLY COMPACT BECOMING COMPACT @ 23'; LIGHT GRAY AND BROWNISH GRAY WITH DARK GRAY; MOIST TO SATURATED BECOMING WET @ 20'; FINE-GRAINED BECOMING FINE-GRAINED TO MEDIUM-GRAINED @ 20'; WITH SILT LAMINATIONS AND MINOR FAT CLAY PARTINGS @ 20' (SM)
- ⑮ SAND, CLAYEY; DENSE; BROWNISH GRAY WITH DARK GRAY; WET TO SATURATED (SC)
- ⑯ SAND, SILTY; CLAYEY; DENSE; BROWNISH GRAY WITH DARK GRAY; MOIST; FINE-GRAINED; LAMINATED WITH SILT AND MINOR FAT CLAY PARTINGS (SC-SM)
- ⑰ CLAY, SANDY; LEAN; HARD; BROWNISH GRAY WITH DARK GRAY; MOIST; FINE-GRAINED; LAMINATED WITH SILT (CL)
- ⑱ SAND, CLAYEY; VERY DENSE; BROWNISH GRAY WITH DARK GRAY; MOIST; FINE-GRAINED; LAMINATED WITH SILT (SC)
- ⑲ LIGNITE, VERY DENSE; DARK GRAY; DRY; WITH CLAY AND SILTY SAND LAMINATIONS



HL93 LOADING PRINT DATE: 5/12/2023 REVISION DATE:

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**TEST HOLE DATA**  
 CR 481 AT UPPER KEECHI CREEK

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	BR 2023(135)	CR 481
STATE	DISTRICT	COUNTY
TEXAS	BRY	FREESTONE
CONTROL	SECTION	JOB SHEET NO.
0917	20	046 47

SUMMARY OF ESTIMATED QUANTITIES

BID ITEM NUMBER	400-6005	416-6003	420-6013	422-6005	422-6023	425-6001	425-6002	432-6033	450-6018	454-6021	4171-6001
BID ITEM DESCRIPTION	CEM STABIL BKFL	DRILL SHAFT (30 IN)	CL "C" CONC (ABUT)	REINF CONC SLAB (BOX BEAM)	SHEAR KEY	PRESTR CONC BOX BEAM (4B20)	PRESTR CONC BOX BEAM (5B20)	RIPRAP (STONE PROTECTION) (18 IN)	RAIL (TY T631)	TYPE A JOINT	INSTALL BRIDGE IDENTIFICATION NUMBERS
BRIDGE ELEMENT	CY	LF	CY	SF	CY	LF	LF	CY	LF	LF	EA
2 ~ ABUTMENTS	43	210	27.2					303	32.0	53	
1 ~ 65.00' PRESTR CONC BOX BEAM SPAN				1,701	8.6	258.00	129.00		130.0		
TOTAL	43	210	27.2	1,701	8.6	258.00	129.00	303	162.0	53	2

① LENGTH SHOWN ARE BOTTOM BEAM LENGTHS WITH ADJUSTMENTS MADE FOR BEAM SLOPE.

PRINT DATE	REVISION DATE
5/12/2023	

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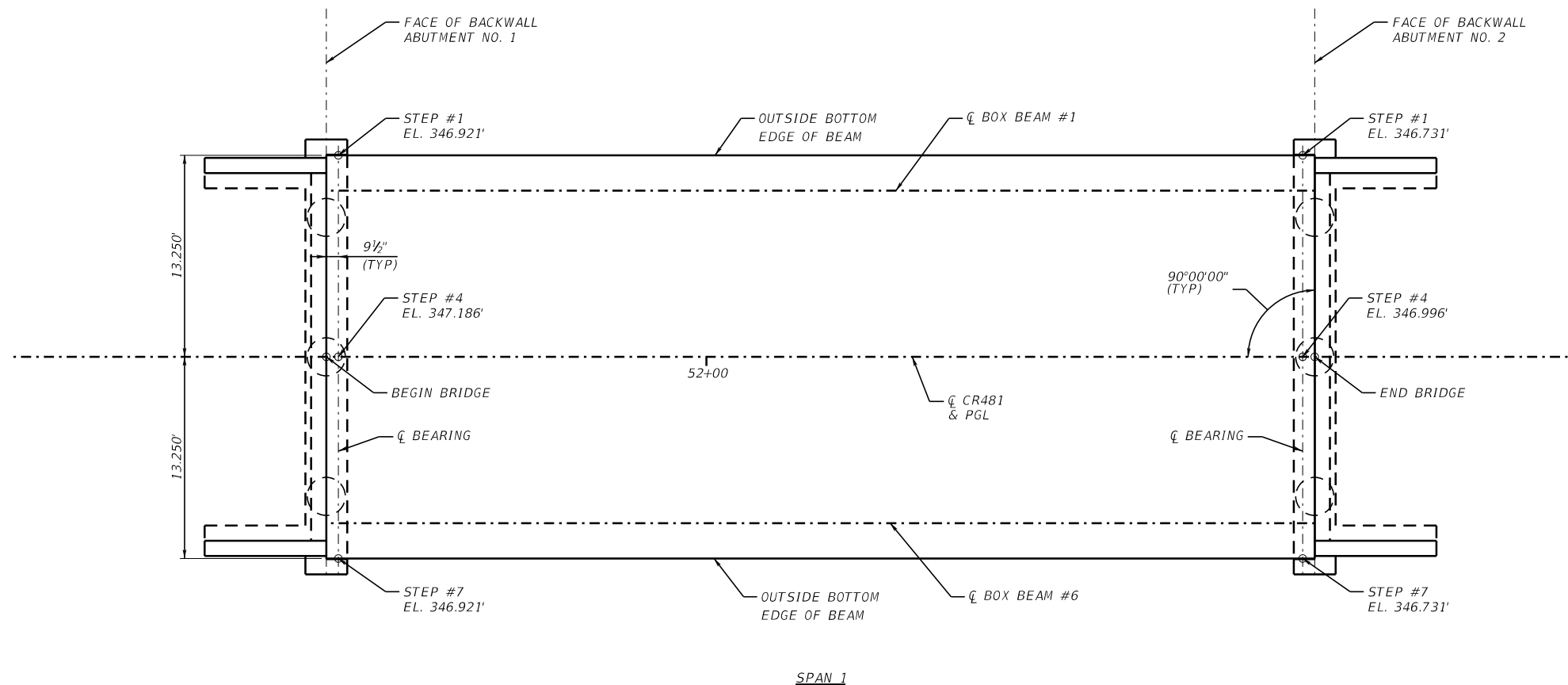
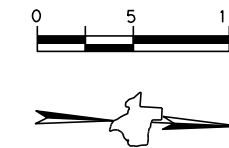


**ESTIMATED QUANTITIES**  
CR 481 AT UPPER KEECHI CREEK

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	48

REV DATE: 12-6-2022  
CSJ: 0917-20-046  
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**TOP OF CAP ELEVATIONS**  
(ELEVATIONS SHOWN ARE SAME FOR BOTH LEFT AND RIGHT SIDE OF STEP)

① LENGTHS SHOWN ARE BOTTOM BEAM LENGTHS WITH ADJUSTMENTS MADE FOR BEAM SLOPE.



**BEAM REPORT**

BEAM REPORT AT CENTER OF BEAM, SPAN 1

	HORIZONTAL DISTANCE	TRUE DISTANCE	BEAM SLOPE
	C-C BENT	C-C BRG.	BOT. BM. FLG. ①
BOX 1	65.0000	63.4167	64.5003
BOX 2	65.0000	63.4167	64.5003
BOX 3	65.0000	63.4167	64.5003
BOX 4	65.0000	63.4167	64.5003
BOX 5	65.0000	63.4167	64.5003
BOX 6	65.0000	63.4167	64.5003

**BENT REPORT**

ABUT NO. 1 (N 87 25 40.96 E)  
DISTANCE BETWEEN STATION LINE AND STEP LINE 1, 13.2500 L

	STEP SPAC.	BEAM ANGLE
	(CL ABUT)	D M S
SPAN 1 STEP 1	00.0000	90 00 00
STEP 4	13.2500	90 00 00
STEP 7	13.2500	90 00 00
TOTAL	26.5000	

ABUT NO. 2 (N 87 25 40.96 E)  
DISTANCE BETWEEN STATION LINE AND STEP LINE 1, 13.2500 L

	STEP SPAC.	BEAM ANGLE
	(CL ABUT)	D M S
SPAN 1 STEP 1	00.0000	90 00 00
STEP 4	13.2500	90 00 00
STEP 7	13.2500	90 00 00
TOTAL	26.5000	

PRINT DATE	REVISION DATE
5/12/2023	

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AUSTIN TX 78746  
FIRM REGISTRATION F-2966

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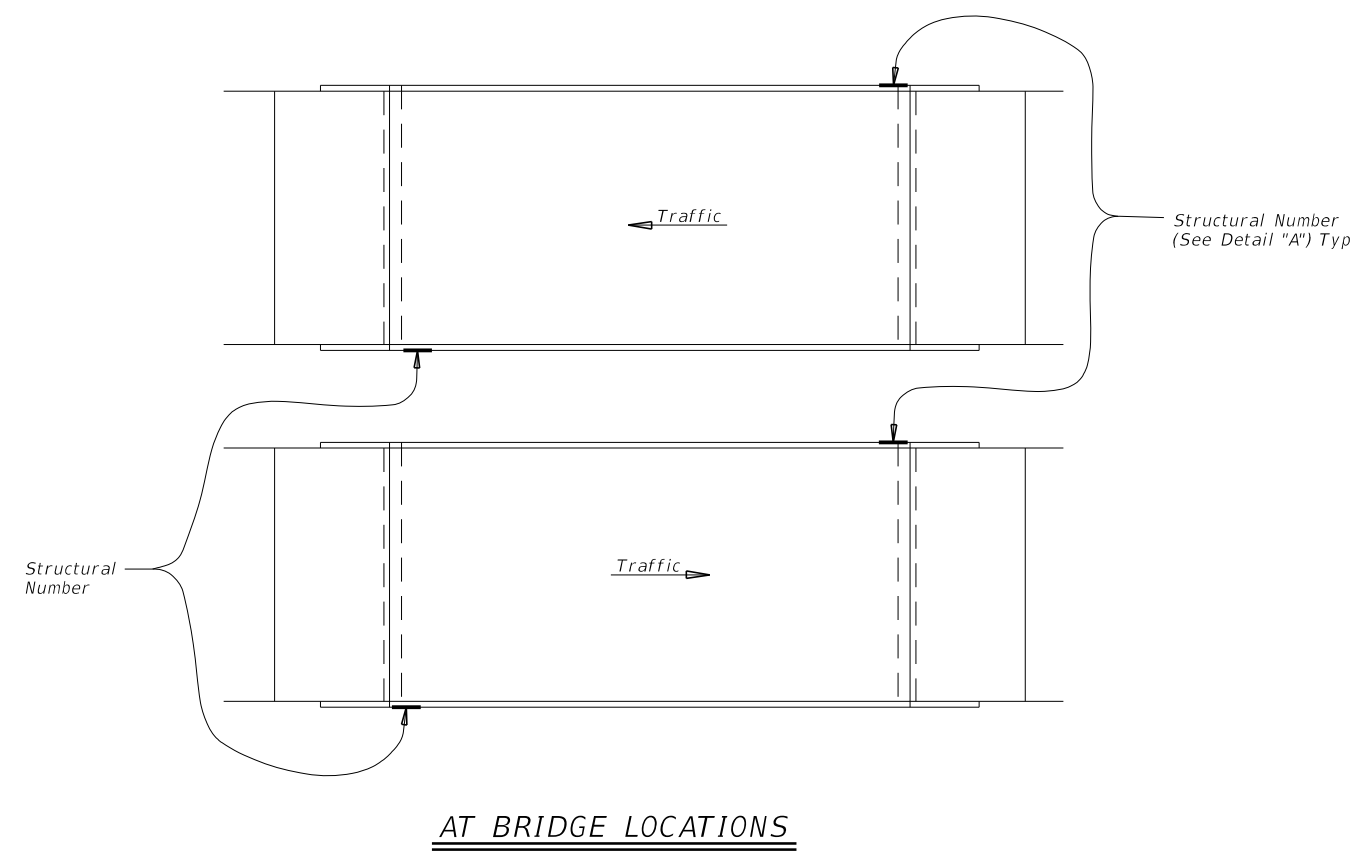
**TOP OF CAP ELEVATIONS**

CR 481 AT UPPER KEECHI CREEK

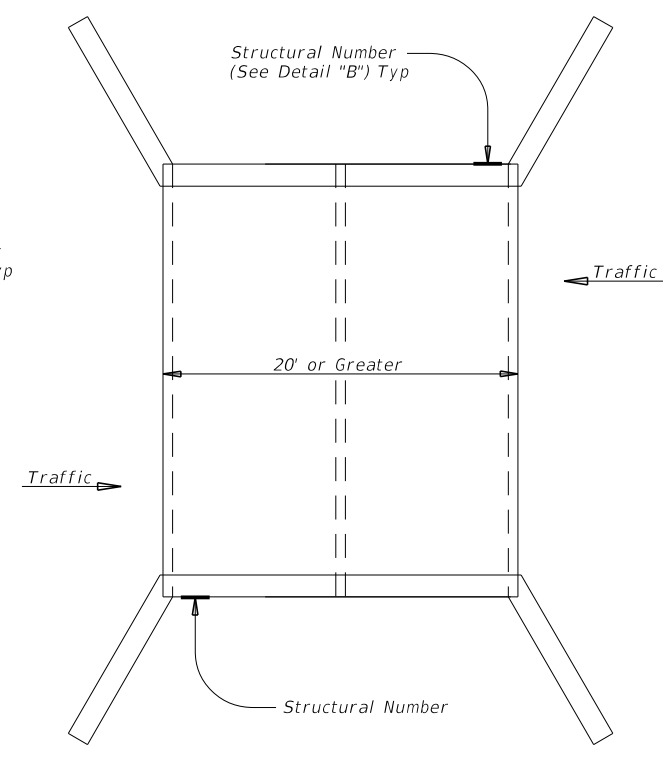
FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	BR 2023(135)	CR 481
STATE	DISTRICT	COUNTY
TEXAS	BRY	FREESTONE
CONTROL	SECTION	JOB SHEET NO.
0917	20	046 49

REV DATE: 12-6-2022  
CSJ: 0917-20-046  
FILENAME: p:\Project\Wise\AMER\jacobs.com\jacobs\_US\_B\_I\_SSA\Documents\WJXN4000\_BRY\_Bridge\_Program\WJXN4000\91720046\_CR481\_Tc-ELEV.dgn

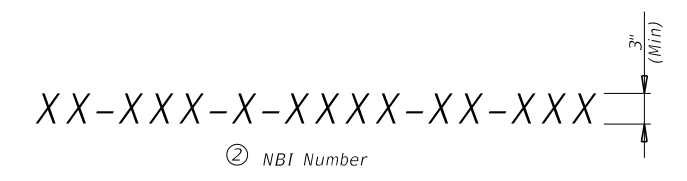
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AT BRIDGE LOCATIONS



AT CULVERT LOCATIONS



DETAIL FOR NBI NUMBERS

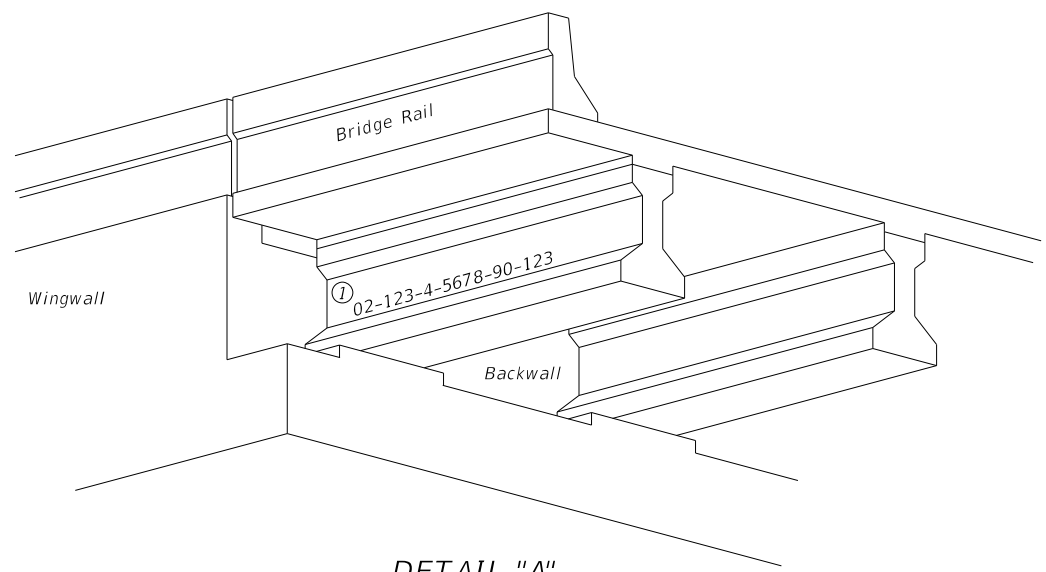
**GENERAL NOTES:**

Cost of furnishing and applying NBI numbers, including ink and stencil plates shall be paid at the unit bid price for "Install Bridge Identification Numbers" under SS 4171.

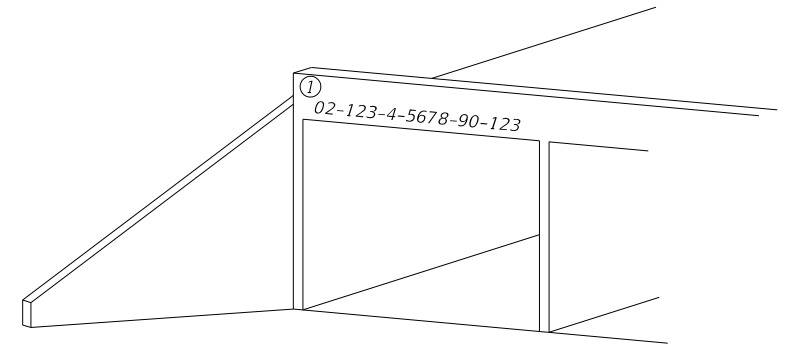
Each structure shall have 2 (two) NBI numbers applied per structure.



PRINT DATE	REVISION DATE
5/12/2023	



DETAIL "A"



DETAIL "B"

① Apply NBI number on both sides of structure (once each side). Apply to outside beam close to abutment on the upstream traffic side at bridge locations. Apply to headwall adjacent to wingwall at culvert locations.

② Use brass stencil, 3 inch, numbers and letters, adjustable interlocking stencil set or equal of legend height 3 inches, symbol height 3 inches.

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 FIRM REGISTRATION F-2966

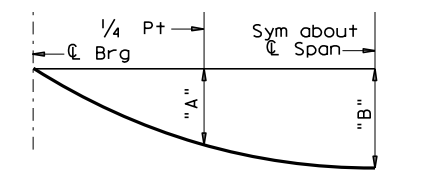
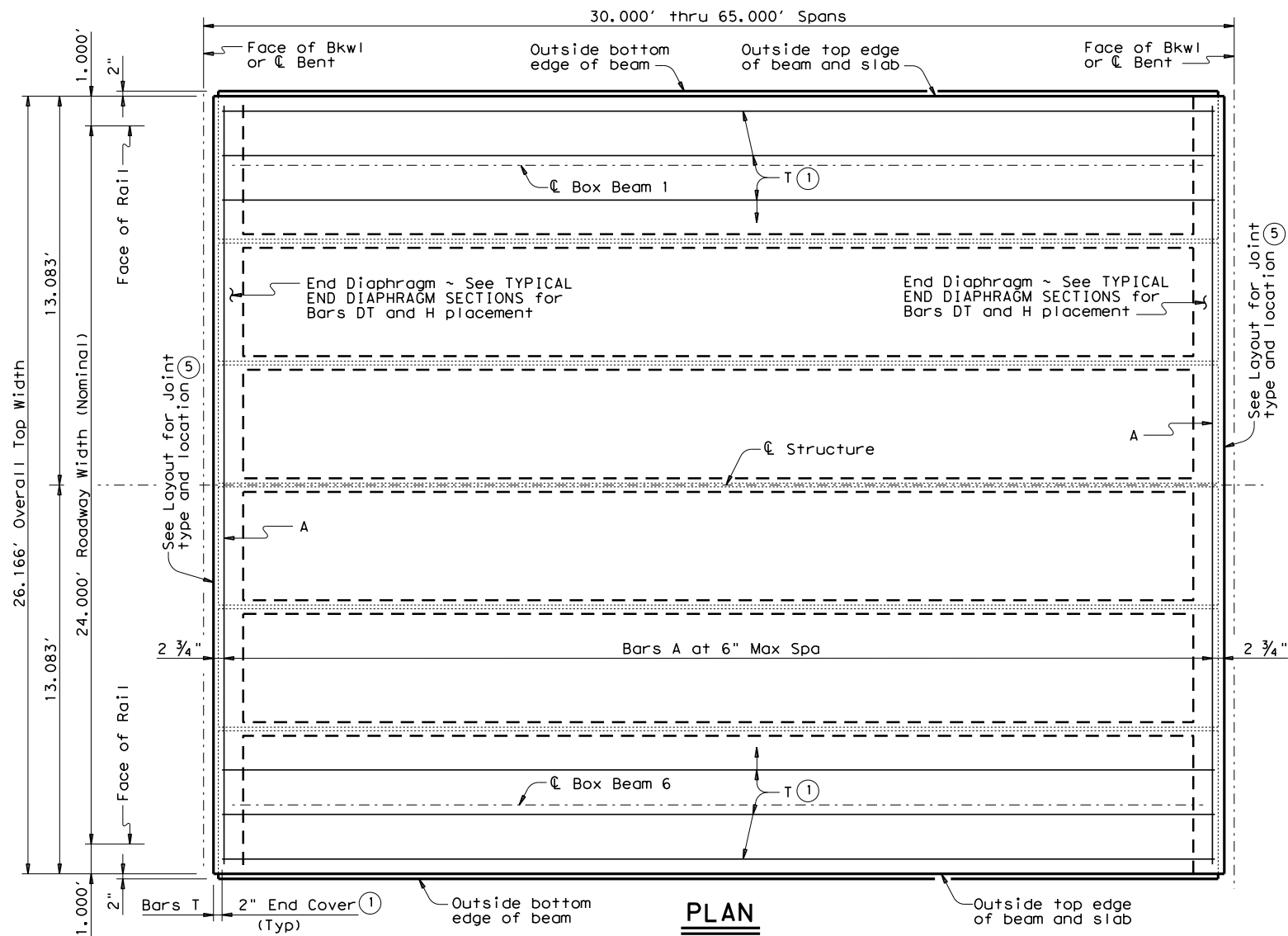


**NBI NUMBER LABELS**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	50

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Note: Deflections shown are due to shear key and concrete slab only, ( $E_c = 5 \times 10^3$  ksi). Calculated deflections shown are theoretical and actual dimension may be less. Deflections may be adjusted based on field observation.

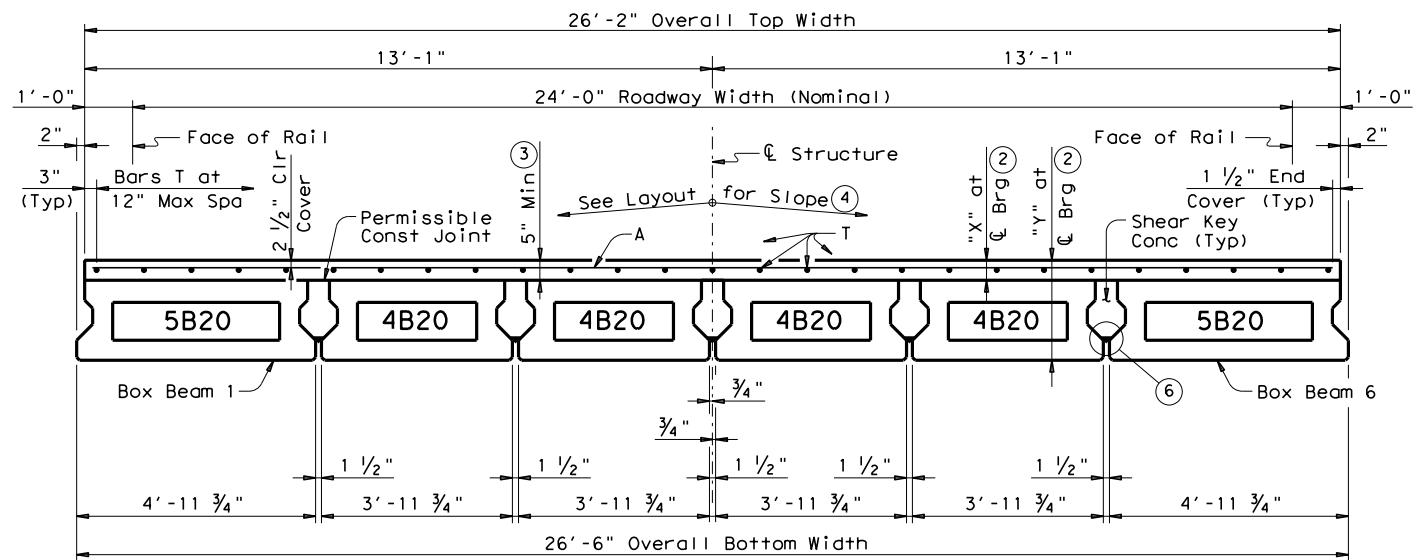
**DEAD LOAD DEFLECTION DIAGRAM**

TABLE OF DEFLECTIONS AND SECTION DEPTHS							
SPAN LENGTH (FT)	BEAM NO.	POINT	DEAD LOAD DEFLECTIONS (FT)			SECTION DEPTHS	
			SHEAR KEY	SLAB	TOTAL	"X" AT $\ell$ BRG 2	"Y" AT $\ell$ BRG 2
30	ALL	"A"	0.000	0.002	0.002	5 1/4"	2'-1 1/4"
		"B"	0.001	0.002	0.003		
35	ALL	"A"	0.001	0.003	0.004	5 1/4"	2'-1 1/4"
		"B"	0.001	0.004	0.005		
40	ALL	"A"	0.002	0.005	0.007	5 1/4"	2'-1 1/4"
		"B"	0.003	0.007	0.010		
45	ALL	"A"	0.003	0.009	0.012	5 1/2"	2'-1 1/2"
		"B"	0.004	0.012	0.016		
50	ALL	"A"	0.005	0.013	0.018	5 3/4"	2'-1 3/4"
		"B"	0.006	0.019	0.025		
55	ALL	"A"	0.007	0.019	0.026	6 1/4"	2'-2 1/4"
		"B"	0.010	0.027	0.037		
60	ALL	"A"	0.010	0.028	0.038	6 3/4"	2'-2 3/4"
		"B"	0.014	0.039	0.053		
65	ALL	"A"	0.013	0.039	0.052	5 1/4"	2'-1 1/4"
		"B"	0.019	0.054	0.073		

- 1 If multi-span units (with slab continuous over Interior Bents) are indicated on the Bridge Layout, Bars T must be continuous through joint. See Continuous Slab Detail.
- 2 Based on theoretical beam camber, dead load deflections of 5" Cast-in-place slab, shear key dead load and a constant grade. The contractor must adjust these values for any vertical curve.
- 3 Slab thickness at midspan of Beams may not exceed 7 inches.
- 4 This standard does not provide for changes in roadway cross slopes within the structure.
- 5 If using Type A expansion joints, the maximum distance between joints is 100 feet.
- 6 Form bottom of shear keys with foam backer rod or other material acceptable to the Engineer.

BAR TABLE	
BAR	SIZE
A	#4
DT	#4
H	#5
T	#4

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Specifications.  
 Provide Class S concrete ( $f'c = 4,000$  psi) for slab and shear key.  
 Provide Class S (HPC) concrete if shown elsewhere in the plans.  
 All reinforcing must be Grade 60.  
 Two-span or three-span units, with the slab continuous over Interior Bents, may be formed with the details on this standard. Unit Length cannot exceed 3.5 times length of the shortest end span.  
 Bar laps, where required, will be as follows:  
 Uncoated ~ #4 = 1'-5"  
 Epoxy coated ~ #4 = 2'-1"  
 It is recommended, with crown cross-slope, to erect beams adjacent to crown point first. For structures without a crown point, it is recommended to erect beams on the high side of cross-slope first and progress to the low side.  
 This sheet does not support the use of Transition Bents.  
 See railing details and standard BBRAS for rail anchorage.



**TYPICAL TRANSVERSE SECTION**



REV: MODIFIED SECTION DEPTHS FOR 65 FT SPAN

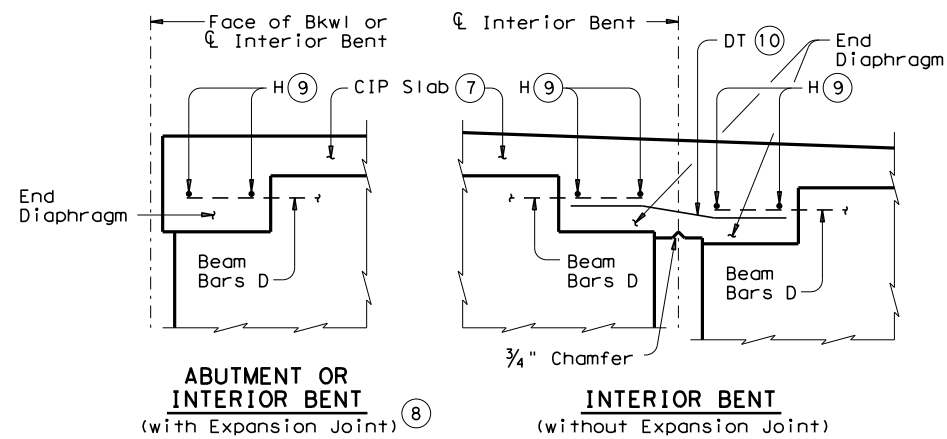
HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation  
 Bridge Division Standard

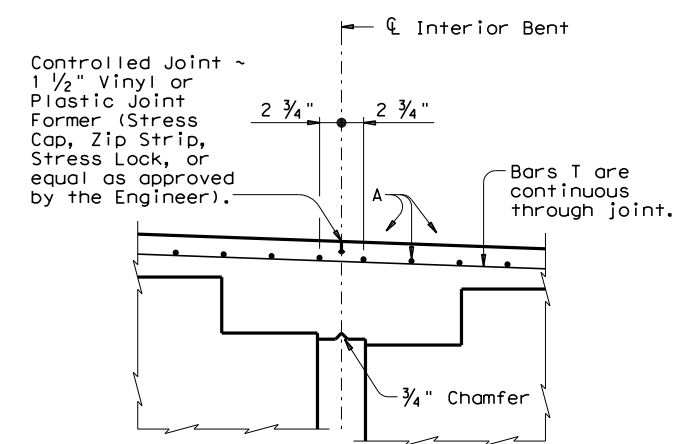
**PRESTRESSED CONCRETE BOX BEAM SPANS**  
 TYPE B20 24' RDWY (WITH SLAB)

**SBBS-B20-24 (MOD)**

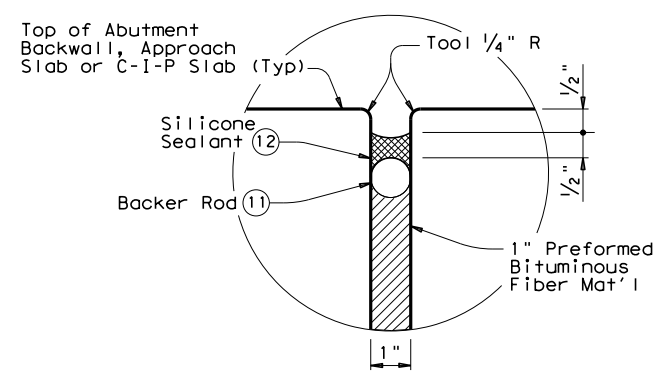
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0917	December, 2006	CONTRACT	SECTION	JOB
0917	20	046	CR 481	
01-12: Cover		DIST	COUNTY	SHEET NO.
10-15: Table of Est Quantities, Notes.		BRY	FREESTONE	51



**TYPICAL END DIAPHRAGM SECTIONS**  
(along centerline of Box Beam)



**CONTINUOUS SLAB DETAIL**  
(Diaphragm reinforcing not shown for clarity)



**TYPE A JOINT DETAIL 5**

TABLE OF ESTIMATED QUANTITIES					
SPAN LENGTH	SHEAR KEY	REINF CONC SLAB (BOX BEAM)	PRESTR CONCRETE BOX BEAMS (TY 4B20) (13)	PRESTR CONCRETE BOX BEAMS (TY 5B20) (13)	TOTAL REINF STEEL (14)
FT	CY	SF	LF	LF	Lb
30	4.0	785	118.00	59.00	1,570
35	4.6	916	138.00	69.00	1,832
40	5.3	1,047	158.00	79.00	2,094
45	6.0	1,177	178.00	89.00	2,354
50	6.6	1,308	198.00	99.00	2,616
55	7.3	1,439	218.00	109.00	2,878
60	8.0	1,570	238.00	119.00	3,140
65	8.6	1,701	258.00	129.00	3,402

- 5 If using Type A expansion joints, the maximum distance between joints is 100 ft.
- 7 Slab reinforcing omitted for clarity.
- 8 See Bridge Layout for Joint type.
- 9 Provide 1 1/2" end cover to Bars H. After all beams have been placed, weld one Bar H to two Bars D at each end of all beams.
- 10 Lap Bars DT 9" Min with each Beam Bar D at Interior Bents without Expansion Joints. Bars DT shown bent for clarity only.
- 11 Backer rod must be 25% larger than joint opening and must be compatible with the sealant.
- 12 Use Class 7 silicone sealant. Prepare joint and seal in accordance with Item 438 "Cleaning and Sealing Joints".
- 13 Fabricator must adjust beam lengths for beam slopes as required.
- 14 Reinforcing steel weight is based on an approximate factor of 2.0 lbs per square foot of slab.



REV: MODIFIED SECTION DEPTHS FOR 65 FT SPAN

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 FILE: \\Project\wisemer\_jacobs.com\Jacobs\_US\_B\_I\_SS4\Documents\WJN4000\_BRY\SBBS-B20-24.dgn  
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HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation  
 Bridge Division Standard

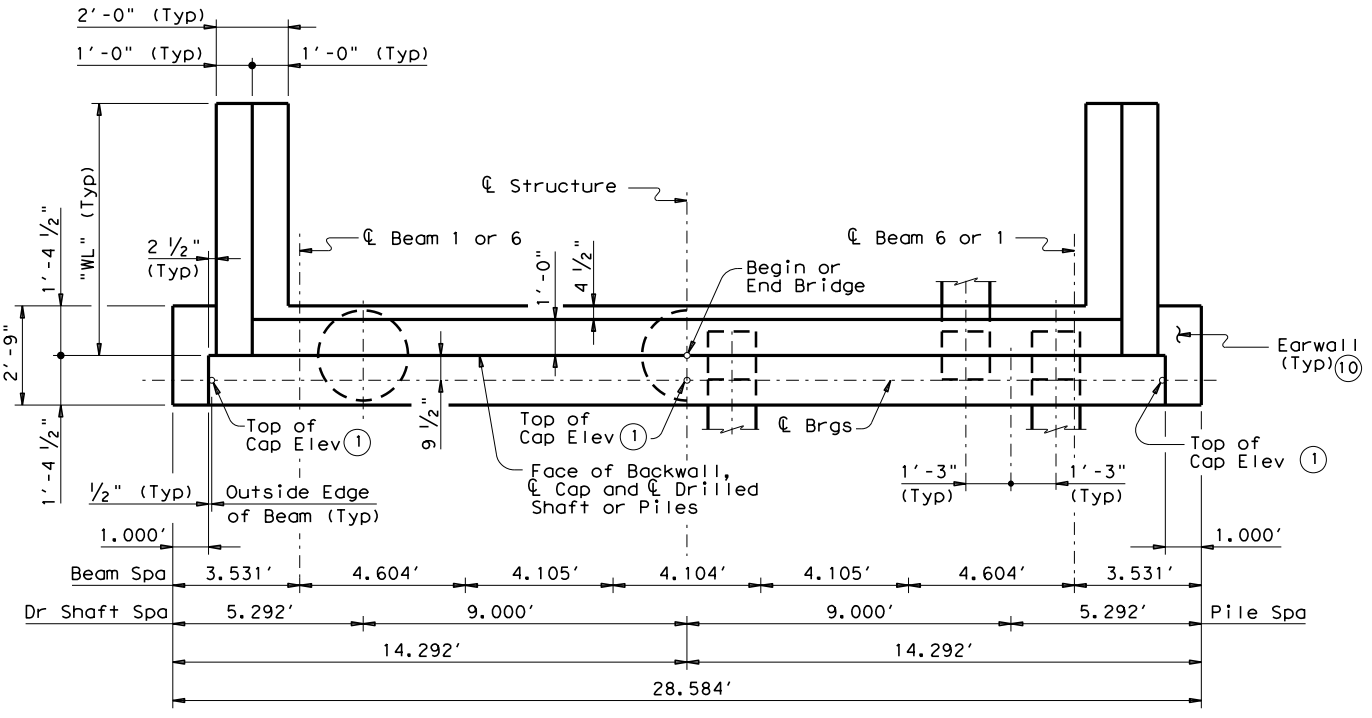
**PRESTRESSED CONCRETE BOX BEAM SPANS**  
 TYPE B20 24' RDWY  
 (WITH SLAB)

**SBBS-B20-24 (MOD)**

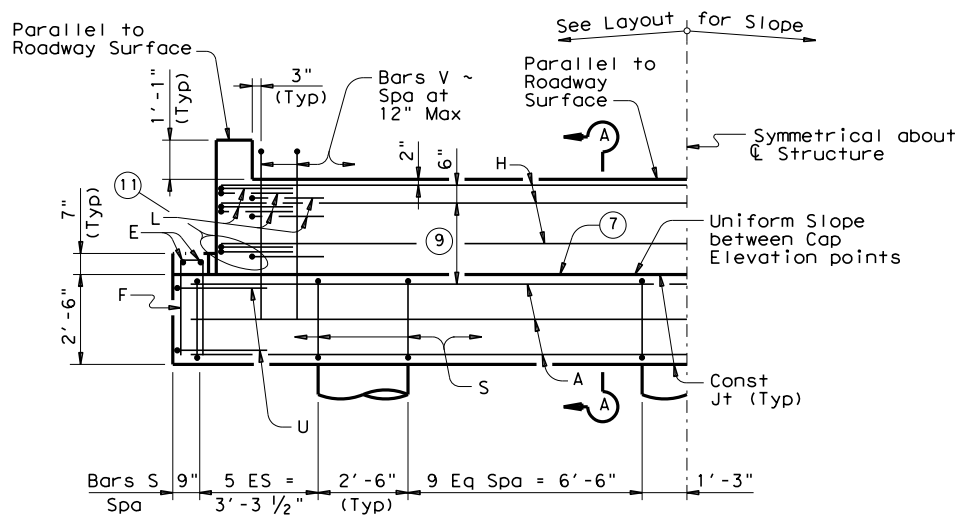
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0917	20	046	CR	481
01-12: Cover, 10-15: Table of Est Quantities, Notes.	BRY	FREESTONE		52

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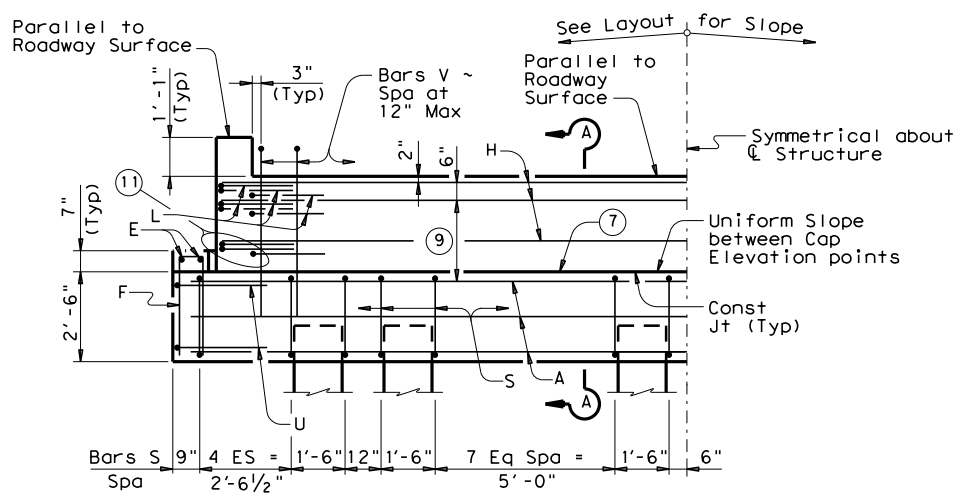
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SHOWING DRILLED SHAFTS **PLAN** SHOWING BATTERED PILES

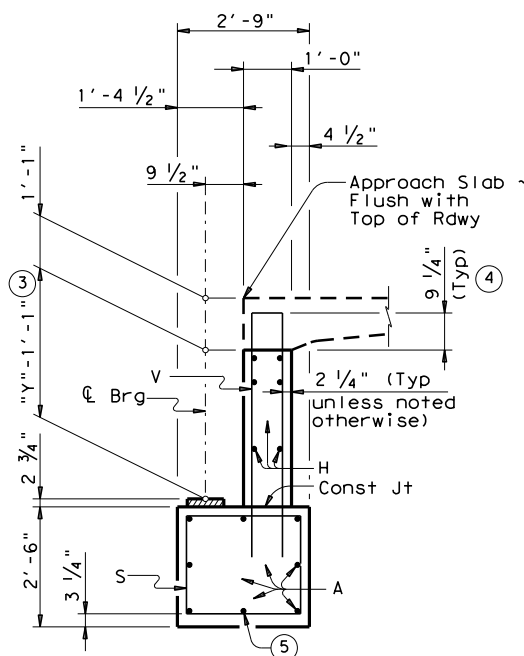


**HALF ELEVATION ~ DRILLED SHAFT ABUTMENT**

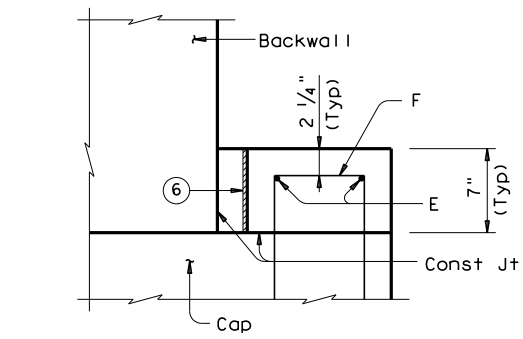


**HALF ELEVATION ~ PILE ABUTMENT**

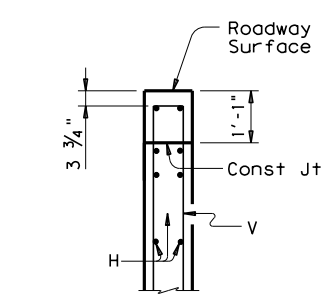
(Showing 16" Piles ~ for Piles larger than 16", adjust Bars S spacing as required to avoid Piling)



**SECTION A-A**  
(Showing Approach Slab) 2



**EARWALL ELEVATION DETAIL 10**  
(Slope top of earwall away from beams)



**BACKWALL DETAIL**  
(Without Approach Slab) 2

TABLE OF WINGWALL LENGTHS "WL"	
Beam Type	"WL"
B20	8.000'
B28	10.000'
B34	11.000'

TABLE OF FOUNDATION LOADS 8		
Span Length	Drilled Shaft Load	Battered Pile Load
Ft	Tons/DS	Tons/Pile
30	50	38
35	55	41
40	60	43
45	64	45
50	68	47
55	73	50
60	77	52
65	81	54
70	85	56
75	89	58
80	93	60
85	97	62
90	101	64
95	105	66

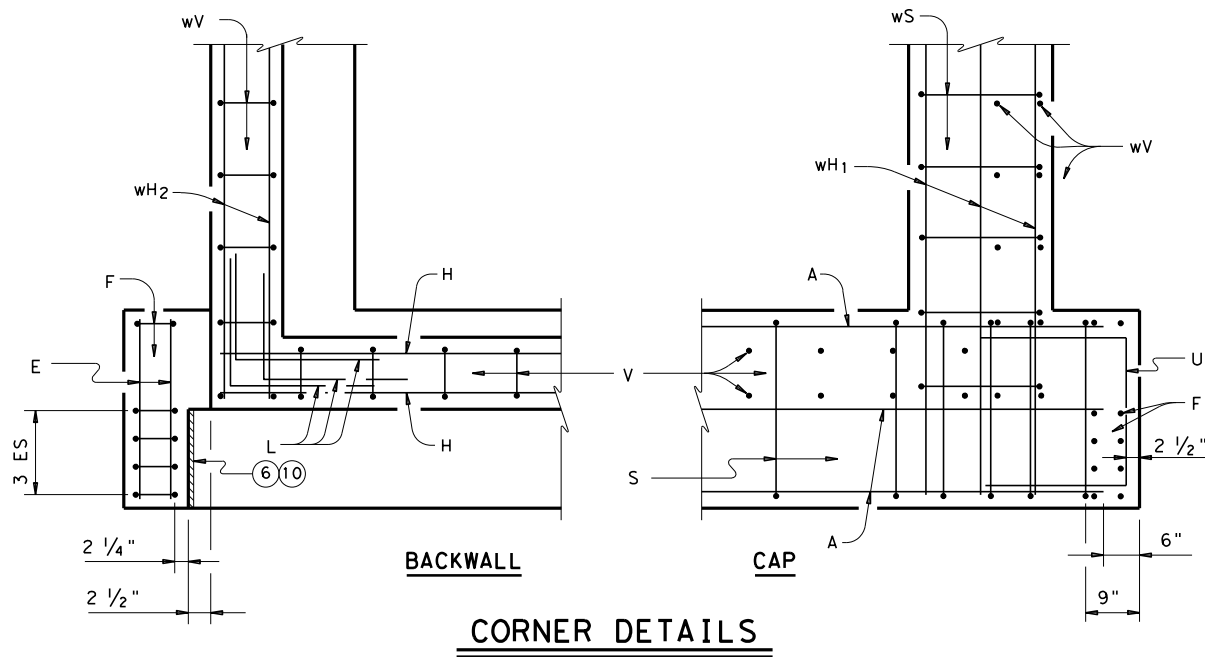
- 1 Top of Cap Elevations are based on section depths shown on Span Details.
- 2 See Bridge Layout for Joint type and to determine if Approach Slab is present.
- 3 See Span details for "Y" value.
- 4 Increase as required to maintain 3 3/4" from Finished Grade.
- 5 With pile foundations, replace Bar A, located at bottom centerline of cap with 2 ~ #11 x 5'-0" bars placed between pile groups. Deduct 93 Lbs from reinforcing steel total.
- 6 1/2" Preformed Bituminous Fiber material between beam and earwall. Bond to beam with an approved adhesive. Inside face of earwall to be cast with vertical side of beam.
- 7 Surface finish for the top of Cap will be a textured wood float finish. The surface must be level in the direction of the centerline of Beams.
- 8 Foundation loads are based on B34 beams.
- 9 Use 2 Eq Spa for B28 and B34 beams. Use 1 space for B20 beams.
- 10 Do not cast earwalls until beams are erected in their final position.
- 11 This set of Bars L only required for B28 and B34 beams.

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Specifications.  
 Concrete strength f'c = 3,600 psi.  
 All reinforcing must be Grade 60.  
 Designed for normal embankment header slope of 3:1 or 2:1.  
 See Bridge Layout for beam type and foundation type, size and length.  
 See standard FD for all foundation details and notes.  
 See applicable rail details for rail anchorage cast in wingwalls.  
 See standard CRR for riprap attachment details, if applicable.  
 These abutment details may be used only with the following standards:  
 SBBS-B20-24 or SBBO-B20-24  
 SBBS-B28-24 or SBBO-B28-24  
 SBBS-B34-24 or SBBO-B34-24

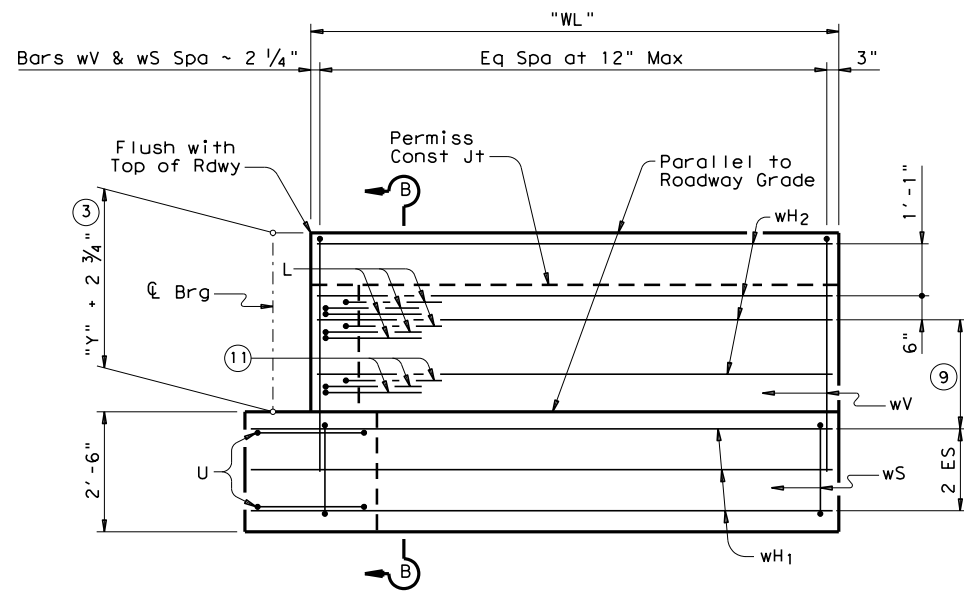
HL93 LOADING SHEET 1 OF 2

<b>ABUTMENTS</b> <b>PRESTR CONC BOX BEAMS</b> <b>24' RDWY</b>			
<b>ABB-24</b>			
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©TxDOT December, 2006	CONT	SECT	JOB
REVISIONS	0917	20	046
04-11: Span length.	DIST	COUNTY	SHEET NO.
	BRY	FREESTONE	53

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**CORNER DETAILS**



**WINGWALL ELEVATION**  
(Earwall omitted for clarity)

**TABLE OF ESTIMATED QUANTITIES (TYPE B20 BEAMS)<sup>(12)</sup>**

BAR	NO.	SIZE	LENGTH	WEIGHT
A (5)	8	#11	27' - 7"	1,172
E	4	#5	2' - 5"	10
F	10	#5	6' - 1"	63
H	4	#6	25' - 10"	155
L	12	#6	4' - 0"	72
S	32	#4	9' - 8"	207
U	4	#6	7' - 3"	44
V	25	#5	7' - 6"	191
wH1	14	#6	9' - 0"	189
wH2	12	#6	7' - 8"	138
wS	18	#4	7' - 9"	93
wV	18	#5	7' - 9"	145
Reinforcing Steel				Lb 2,479
Class "C" Concrete (w/Slab)				CY 12.6
Class "C" Concrete (w/ACP)				CY 12.3

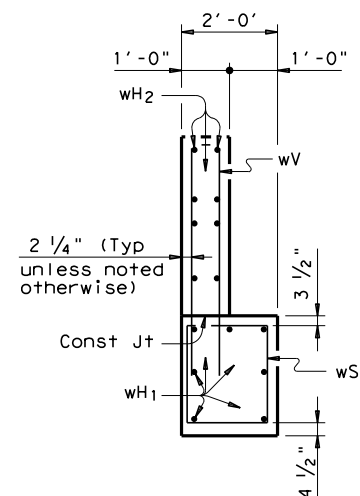
**TABLE OF ESTIMATED QUANTITIES (TYPE B28 BEAMS)<sup>(12)</sup>**

BAR	NO.	SIZE	LENGTH	WEIGHT
A (5)	8	#11	27' - 7"	1,172
E	4	#5	2' - 5"	10
F	10	#5	6' - 1"	63
H	6	#6	25' - 10"	233
L	18	#6	4' - 0"	108
S	32	#4	9' - 8"	207
U	4	#6	7' - 3"	44
V	25	#5	8' - 9"	226
wH1	14	#6	11' - 0"	231
wH2	16	#6	9' - 8"	232
wS	22	#4	7' - 9"	114
wV	22	#5	9' - 0"	207
Reinforcing Steel				Lb 2,847
Class "C" Concrete (w/Slab)				CY 14.7
Class "C" Concrete (w/ACP)				CY 14.4

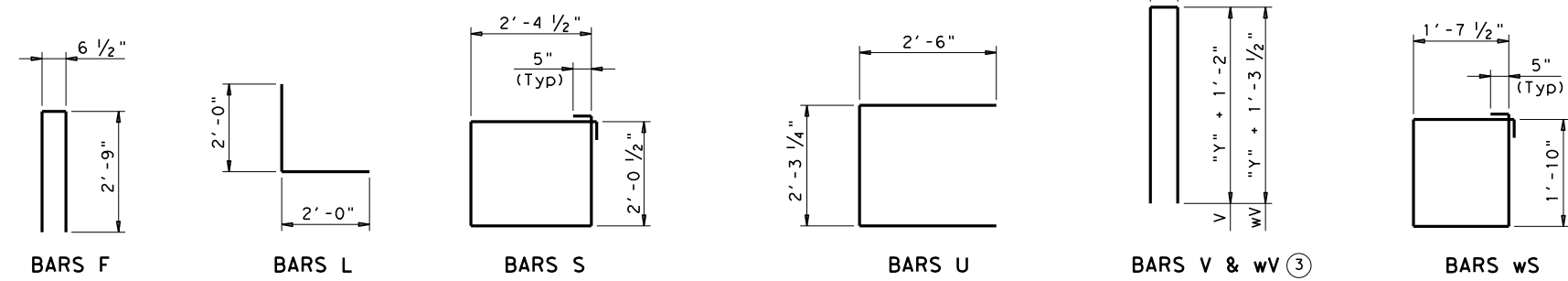
**TABLE OF ESTIMATED QUANTITIES (TYPE B34 BEAMS)<sup>(12)</sup>**

BAR	NO.	SIZE	LENGTH	WEIGHT
A (5)	8	#11	27' - 7"	1,172
E	4	#5	2' - 5"	10
F	10	#5	6' - 1"	63
H	6	#6	25' - 10"	233
L	18	#6	4' - 0"	108
S	32	#4	9' - 8"	207
U	4	#6	7' - 3"	44
V	25	#5	9' - 10"	254
wH1	14	#6	12' - 0"	252
wH2	16	#6	10' - 8"	256
wS	24	#4	7' - 9"	124
wV	24	#5	10' - 1"	252
Reinforcing Steel				Lb 2,975
Class "C" Concrete (w/Slab)				CY 16.2
Class "C" Concrete (w/ACP)				CY 15.9

- (3) See Span details for "Y" value.
- (5) With pile foundations, replace Bar A, located at bottom centerline of cap, with 2 - #11 x 5'-0" bars placed between pile groups. Deduct 93 Lbs from reinforcing steel total.
- (6) 1/2" Preformed Bituminous Fiber material between beam and earwall. Bond to beam with an approved adhesive. Inside face of earwall to be cast with vertical side of beam.
- (9) Use 2 Eq Spa for B28 and B34 beams and 1 space for B20 beams.
- (10) Do not cast earwalls until beams are erected in their final position.
- (11) This set of Bars L only required for B28 and B34 beams.
- (12) Quantities shown are for one Abutment only (with Approach Slab). With no Approach Slab, add 1.0 CY Class "C" concrete and 78 Lb reinforcing steel for 2 additional Bars H.



**SECTION B-B**



HL93 LOADING SHEET 2 OF 2

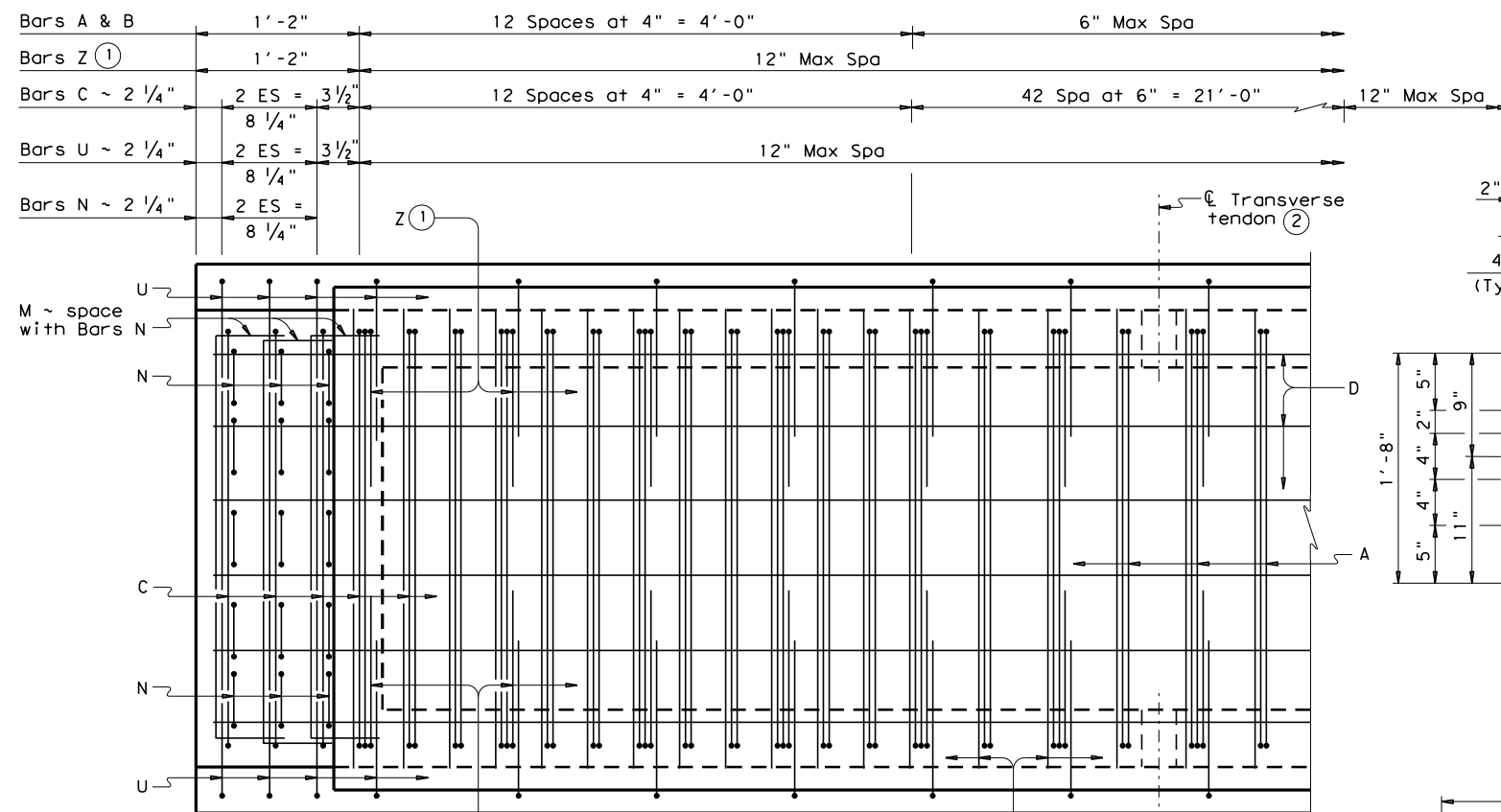
Texas Department of Transportation  
 Bridge Division Standard

**ABUTMENTS**  
 PRESTR CONC BOX BEAMS  
 24' RDWY

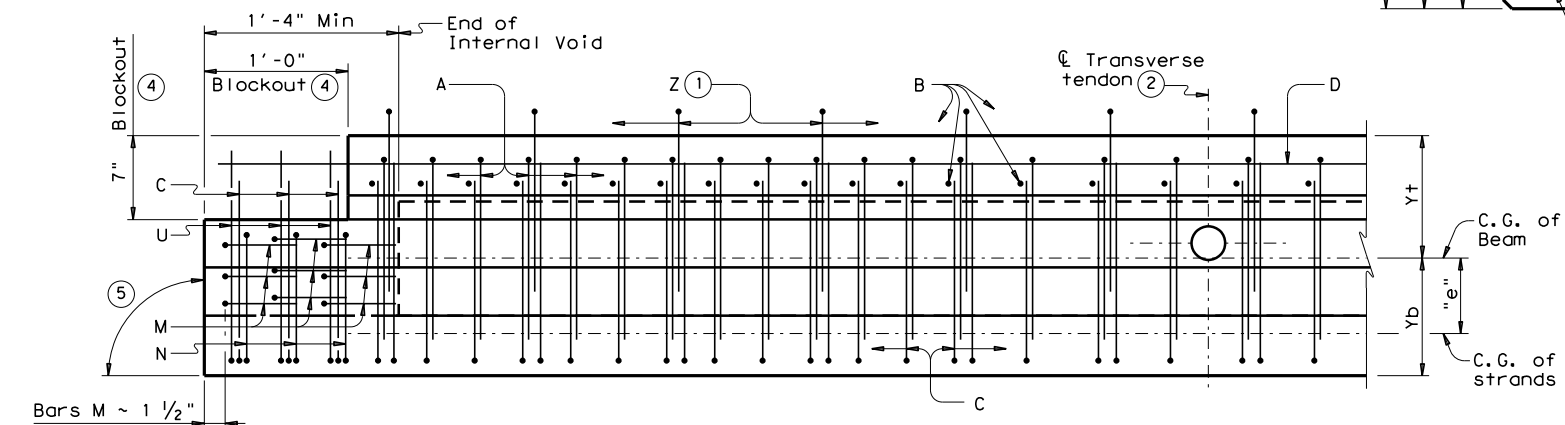
**ABB-24**

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04-11: Span length.	DIST	COUNTY	SHEET NO.	
BRY	FREESTONE		54	

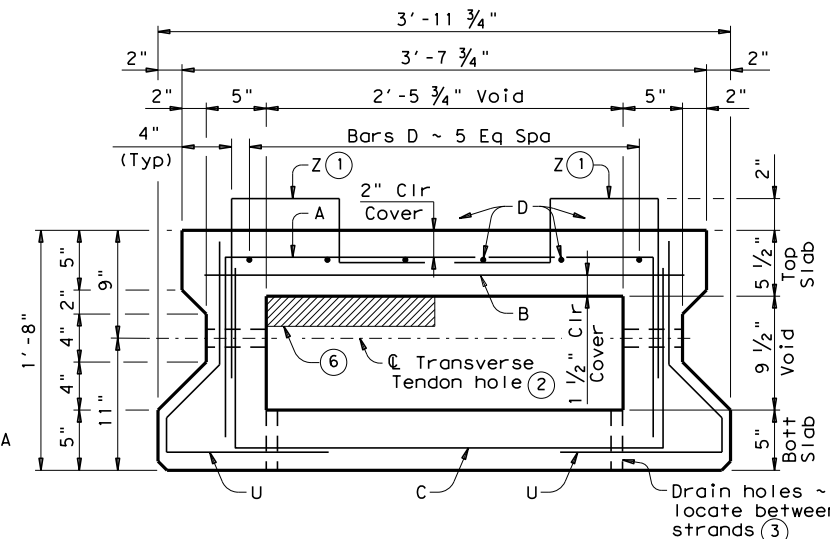
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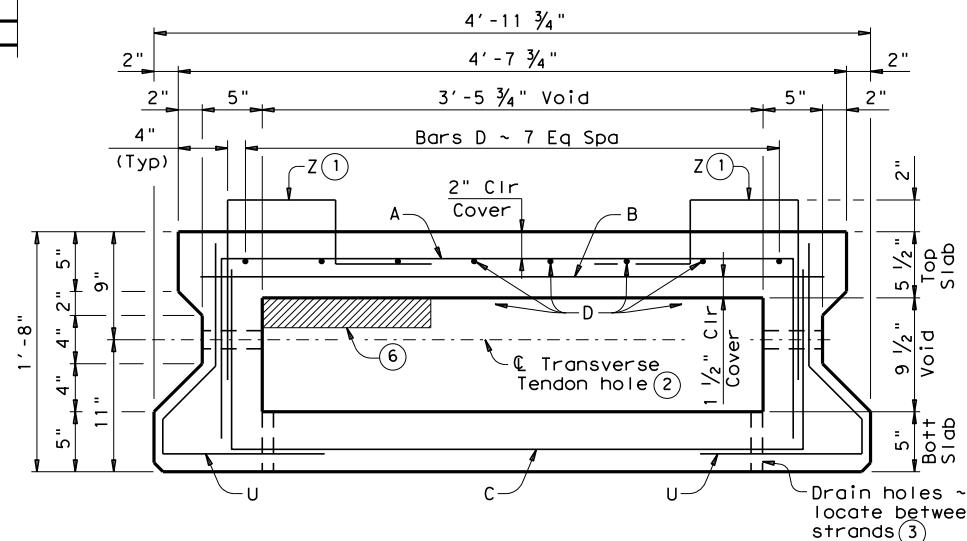
**PARTIAL PLAN**  
(Showing Type 4B20)



**ELEVATION**



**TYPICAL SECTION ~ TYPE 4B20**



**TYPICAL SECTION ~ TYPE 5B20**

BEAM PROPERTIES			
		Type 4B20	Type 5B20
Area	in <sup>2</sup>	591.8	717.8
Y top	in	10.19	10.12
Y bott	in	9.81	9.88
I	in <sup>4</sup>	28,086	35,234
Weight	lb/ft	616	748

- Bars Z are required for beams topped with a cast-in-place concrete slab only.
- Post-tensioning tendons are required for beams not topped with a Min 5" cast-in-place concrete slab. See span details for number and spacing of transverse tendons. Cast interior diaphragms in exterior beams and beams that serve temporarily as exterior beams in staged constructed bridges. See "Blockout, Interior Diaphragm, and Drain Details". Form 3" Dia holes in interior beams. See standard BBPT for details.
- Place drain holes (1" Dia PVC Sch 40 Pipe) as shown in all beam void corners including each side of interior diaphragms. See "Blockout, Interior Diaphragm, and Drain Details".
- Blockouts required at ends of all beams. Extend beam reinforcement into blockouts.
- 90° at conventional Interior Bents. Ends of beams shall be vertical at Abutment backwall and Inverted Tee Bent Stems.
- Showing void modification required in exterior beams not topped with a Min 5" cast-in-place concrete slab. See standard BBRAO for void modification dimensions.
- Based on 150 pcf weight density of concrete. Weight of end blocks and interior diaphragms is not included.

**GENERAL NOTES:**

Designed according to AASHTO LRFD Specifications. Use Class H concrete. Use Class H (HPC) if required elsewhere in plans. All reinforcing steel must be Grade 60. Two-stage monolithic casting is required. The concrete in the first stage cast (bottom beam flange) must remain plastic until the second stage cast (webs and top beam flange) is placed. Vibrate as required to ensure consolidation between the two casts. 1 1/4" clear cover to reinforcement is required unless noted otherwise. See standard BBRAS or BBRAO for railing anchorage at bridge edges to be cast in beams. An equal area of welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be substituted for Bars A, B, C, and D. These details are applicable for skews up to 30 degrees only. Chamfer bottom beam corners 3/4" or round to a 3/4" radius.

HL93 LOADING SHEET 1 OF 3

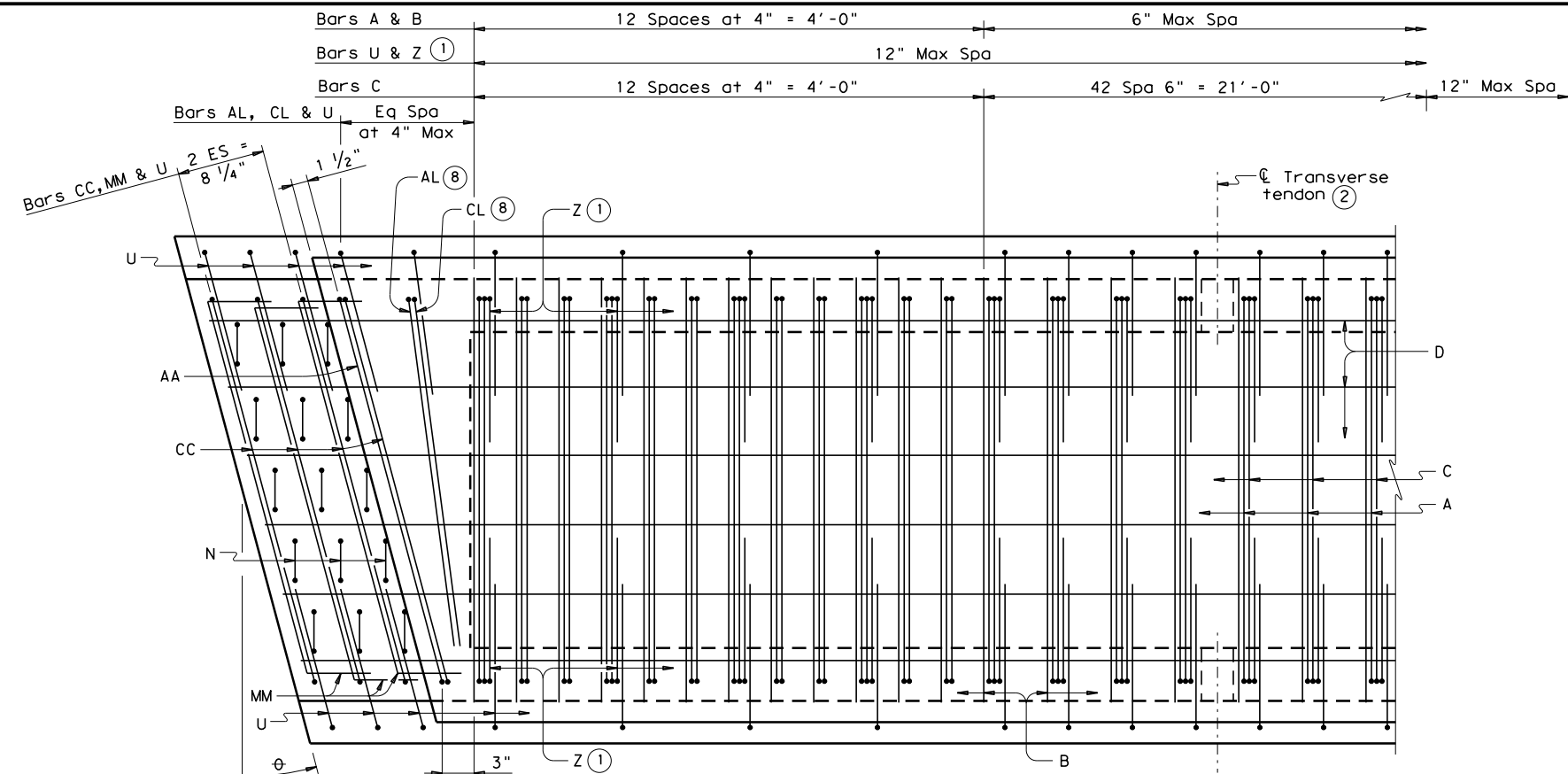
Texas Department of Transportation  
 PRESTRESSED CONCRETE BOX BEAM DETAILS (TYPE B20)  
 BB-B20

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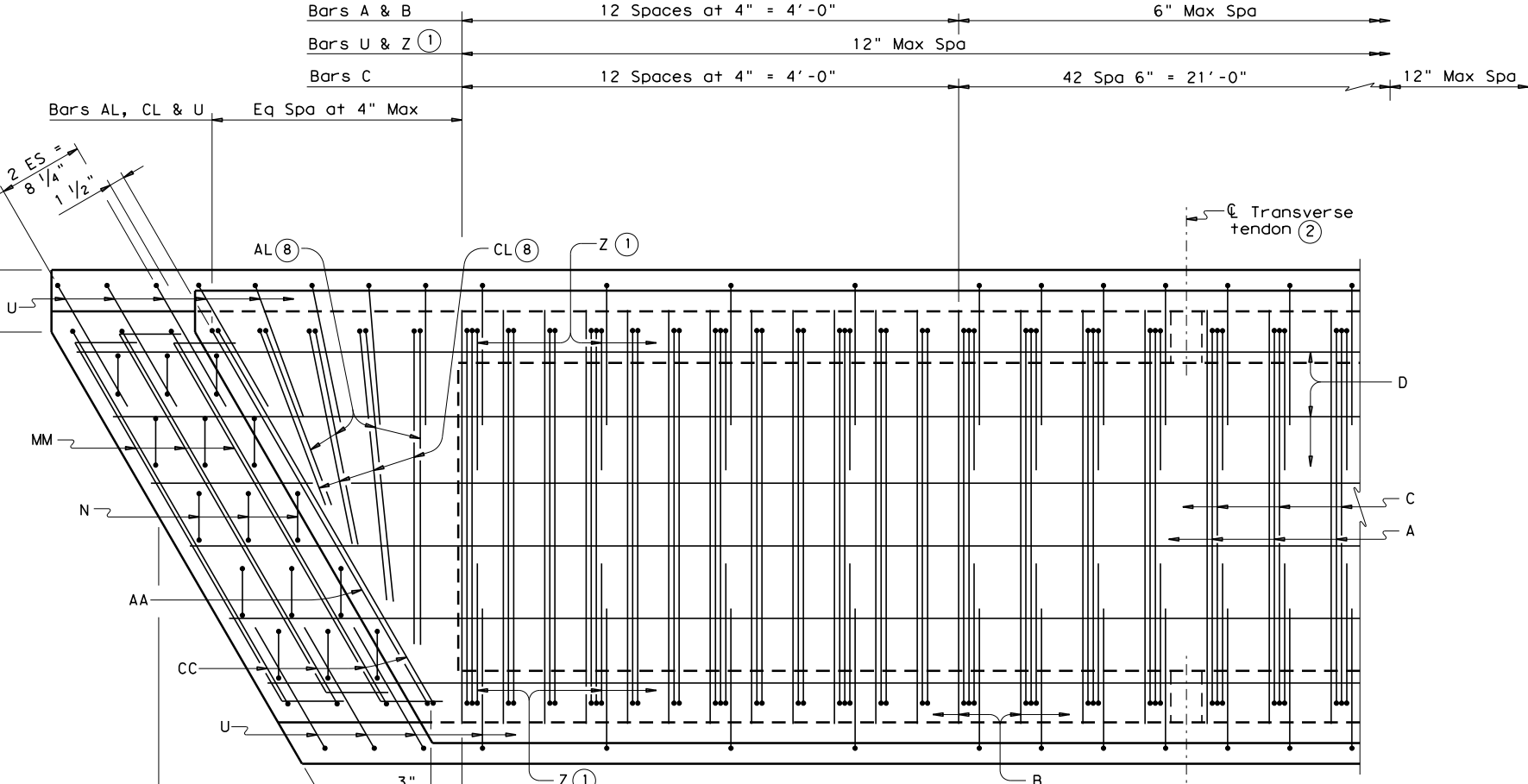
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 TITLE: PRESTRESSED CONCRETE BOX BEAM DETAILS (TYPE B20)

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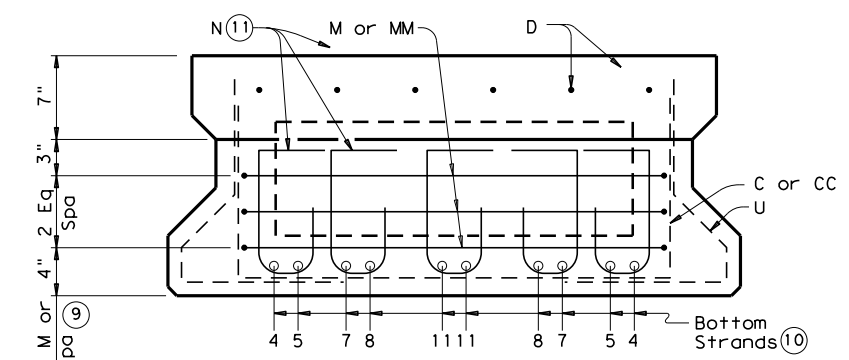
**PARTIAL PLAN ~ 15° SKEW**

(Showing Type 4B20)  
 (use for skew angles of 15° or less)



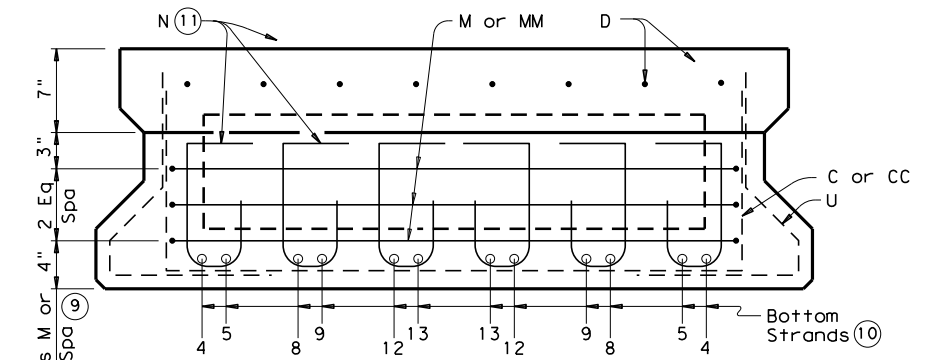
**PARTIAL PLAN ~ 30° SKEW**

(Showing Type 4B20)  
 (use for skew angles greater than 15° and less than or equal to 30°)



**SECTION THRU BLOCKOUT ~ TYPE 4B20**

(Showing End Mat Reinforcing)



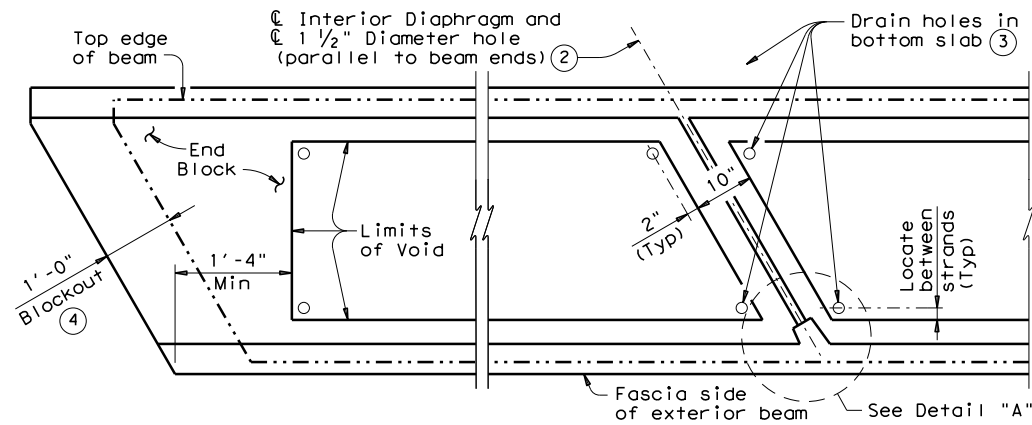
**SECTION THRU BLOCKOUT ~ TYPE 5B20**

(Showing End Mat Reinforcing)

- ① Bars Z are required for beams topped with a cast-in-place concrete slab only.
- ② Post-tensioning tendons are required for beams not topped with a Min 5" cast-in-place concrete slab. See span details for number and spacing of transverse tendons. Cast interior diaphragms in exterior beams and beams that serve temporarily as exterior beams in staged constructed bridges. See "Blockout, Interior Diaphragm, and Drain Details". Form 3" Dia hole in interior beams. See standard BBPT for details.
- ③ Cut as required to maintain one inch clear between bars.
- ④ Bars M may be adjusted vertically as required to avoid pretensioning strands in web.
- ⑤ See standard BBND or appropriate Prestressed Concrete Box Beam Standard Designs sheet for locations of pretensioning strands.
- ⑥ For Type 4B20 Box Beams: Bars N may be reduced to 4 bars per row when beam design contains fewer than 22 strands. In this case, place Bars N at the 5-6 and 8-9 strand locations.
- ⑦ For Type 5B20 Box Beams: Bars N may be reduced to 5 bars per row when beam design contains fewer than 28 strands. In this case, place Bars N at the 4-5, 9-10 and 14-14 strand locations.

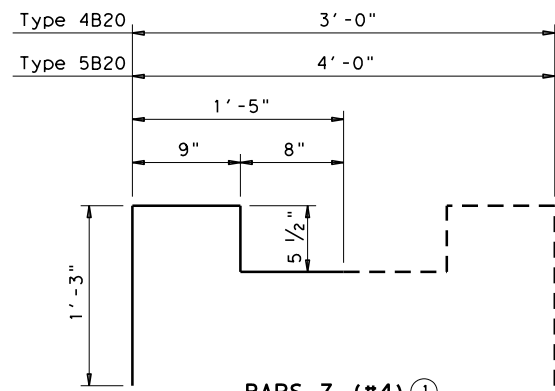
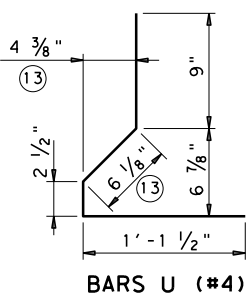
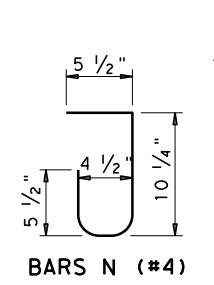
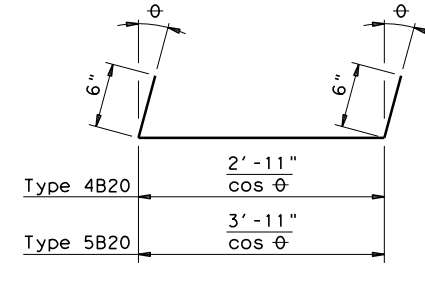
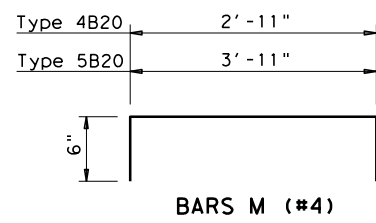
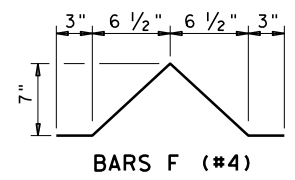
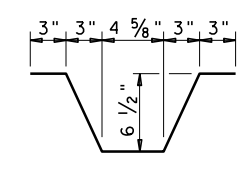
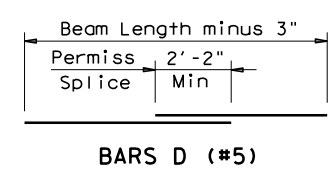
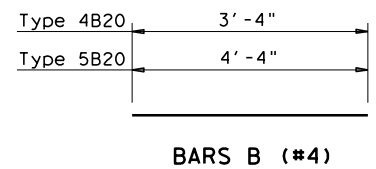
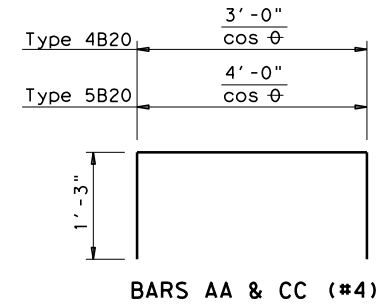
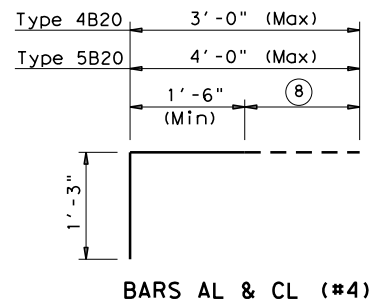
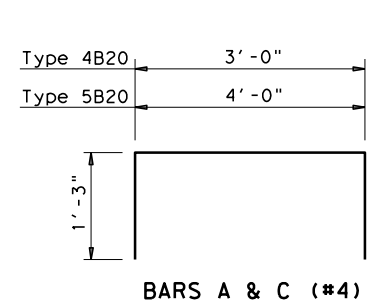
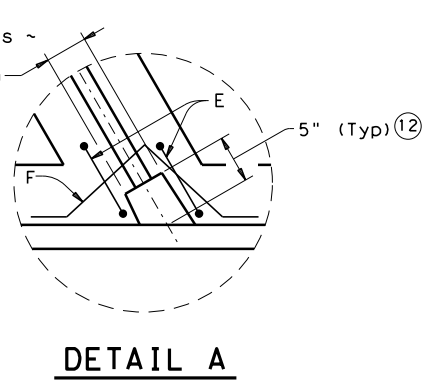
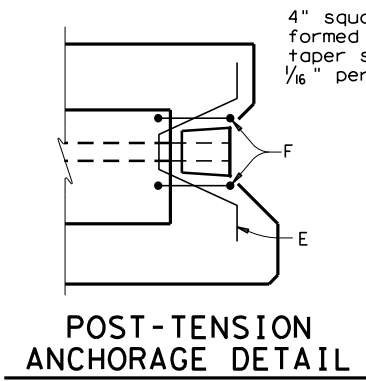
		Bridge Division Standard	
<b>PRESTRESSED CONCRETE BOX BEAM DETAILS (TYPE B20)</b>			
<b>BB-B20</b>			
FILE: bbstds01.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT December, 2006	CONTRACT: 0917	SECTION: 20	JOB: 046
REVISIONS	HIGHWAY		CR 481
01-12: Bars Z.	DIST: BRY	COUNTY: FREESTONE	SHEET NO: 56

DATE: 5/12/2023 11:34:34 AM  
 FILE: \\Project\wise\AMEER\_jacobs.com\Jacobs\_US\_B\_I\_SS4\Documents\WJXN4000\_BRY\B20.dgn  
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**BLOCKOUT, INTERIOR DIAPHRAGM AND DRAIN DETAILS**

(Showing 30° skew)

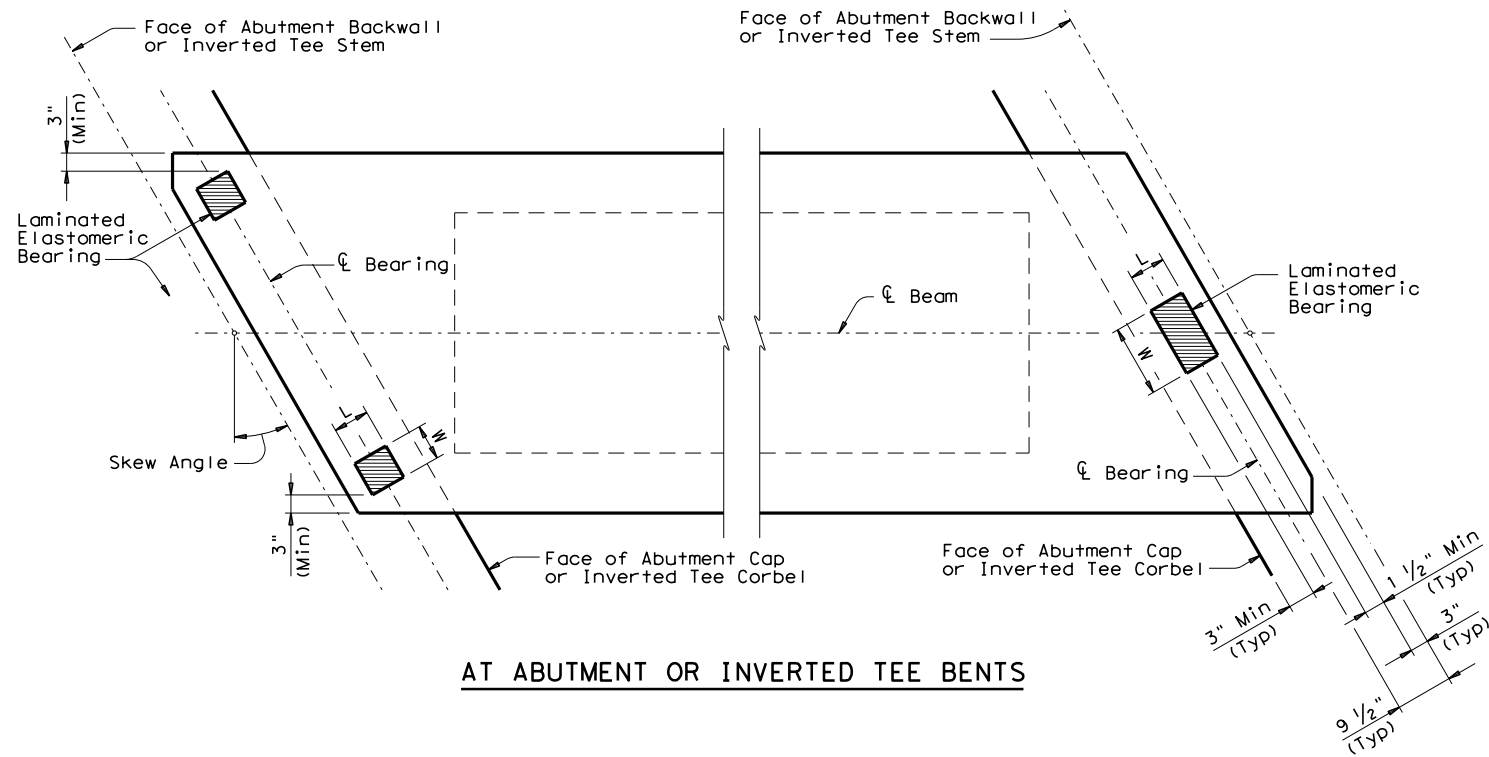


- ① Bars Z are required for beams topped with a cast-in-place concrete slab only.
- ② Post-tensioning tendons are required for beams not topped with a Min 5" cast-in-place concrete slab. See span details for number and spacing of transverse tendons. Cast interior diaphragms in exterior beams and beams that serve temporarily as exterior beams in staged constructed bridges. Form 3" Dia holes in interior beams. See "Blockout, Interior Diaphragm, and Drain Details". See standard BBPT for details.
- ③ Place drain holes (1" Dia PVC Sch 40 Pipe) as shown in all beam void corners including each side of interior diaphragms. See "Blockout, Interior Diaphragm, and Drain Details".
- ④ Blockouts required at ends of all beams. Extend beam reinforcement into blockouts.
- ⑧ Cut as required to maintain one inch clear between bars.
- ⑫ 5" (Typ) or sufficient depth to provide 1" Cover on cut-off tendon. See BBPT for details.
- ⑬ Dimension will vary slightly with skew. Adjust as necessary.

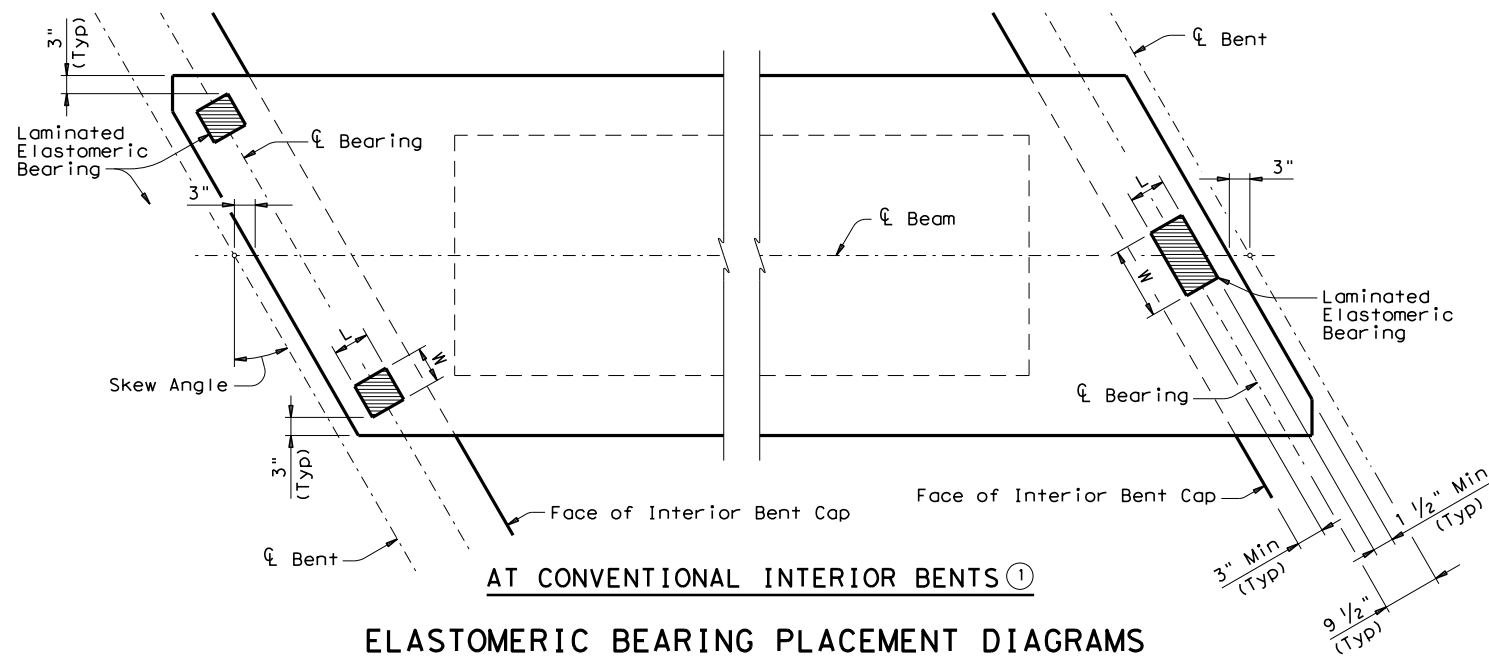
At fabricator's option, Bars Z pairs may be fabricated using one continuous bar. If this option is used, Bars B at Bar Z locations (only) may be omitted.

		Bridge Division Standard	
<b>PRESTRESSED CONCRETE BOX BEAM DETAILS (TYPE B20)</b>			
<b>BB-B20</b>			
FILE: bbstds01.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT December, 2006	CONT	SECT	JOB
REVISIONS	0917	20	046
01-12: Bars Z.	DIST	COUNTY	SHEET NO.
BRY	FREESTONE		57

DATE: 5/12/2023 11:34:44 AM  
 FILE: \\Project\wisem\jacobs.com\Jacobs\_US\_B\_I\_SS4\Documents\WJXN4000\BRY\BRY.dgn  
 PROJECT: 09172046  
 DRAWING: BBS1de08 (BBEB).dgn  
 DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units.



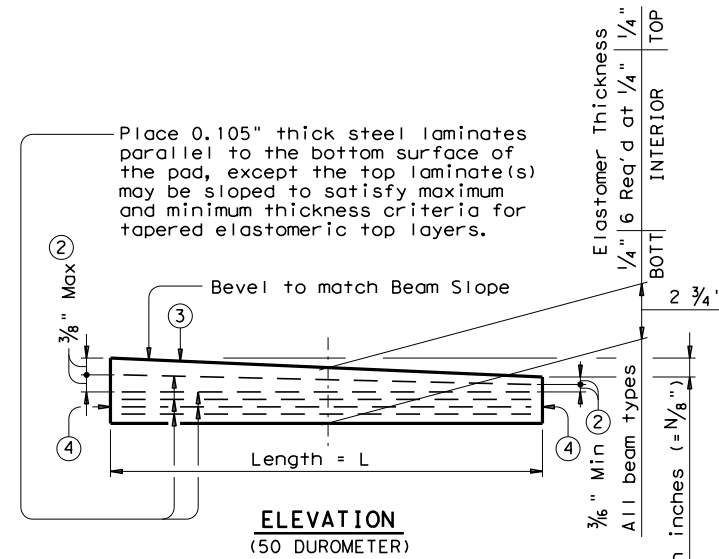
**AT ABUTMENT OR INVERTED TEE BENTS**



**AT CONVENTIONAL INTERIOR BENTS ①**

**ELASTOMERIC BEARING PLACEMENT DIAGRAMS**

The Forward Station Beam End will have one bearing and the Back Station Beam End will have two bearings.



**ELASTOMERIC BEARING SECTION**

(50 DUROMETER)

The use of Polyisoprene (natural rubber), for the manufacture of bearing pads, is not permitted.

- ① For Transition Bents with backwall, beams and elastomeric bearings will receive the same treatment as shown for Abutment Bents.
- ② Maximum and minimum layer thicknesses shown are for elastomer only, on tapered layers.
- ③ Indicate BEARING TYPE on all pads. For tapered pads, BEARING TYPE will be located on the high side. The Fabricator will include the value of "N" (amount of taper in 1/8" increments) in this mark. Examples: N=0, (for 0" taper)  
 N=1, (for 1/8" taper)  
 N=2, (for 1/4" taper)  
 (etc.)  
 Fabricated pad top surface slope must not vary from plan beam slope by more than  $(\frac{0.0625"}{\text{Length}})$  IN/IN.
- ④ Locate Permanent Mark here.

ELASTOMERIC BEARING DIMENSIONS					
BEARING TYPE	BEAM TYPE	ONE BEARING		TWO BEARINGS	
		L	W	L	W
B20-"N"	4B20	6"	12"	6"	6"
	5B20	6"	12"	6"	6"
B28-"N"	4B28	6"	14"	6"	7"
	5B28	6"	14"	6"	7"
B34-"N"	4B34	6"	16"	6"	8"
	5B34	6"	16"	6"	8"
B40-"N"	4B40	6"	20"	6"	10"
	5B40	6"	20"	6"	10"

**GENERAL NOTES:**

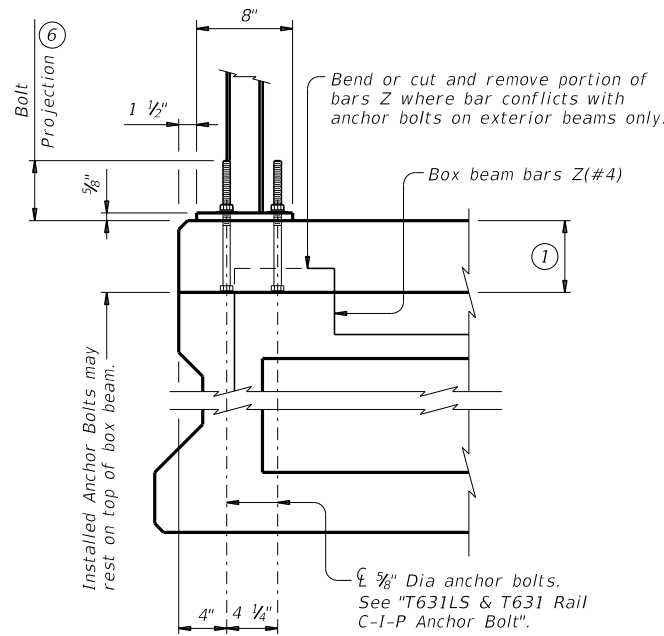
Set beams on elastomeric bearings of the dimensions shown. Center bearings as near nominal  $\bar{\epsilon}$  bearing as possible within limits shown.  
 Constant thickness bearings may be used for moderate beam slopes up to 0.0113 ft/ft.  
 For skewed supports, Bearings beveled for beam slope may not provide uniform contact. However, predicted contact is considered within allowable tolerances.  
 Shop drawings for approval are required. A bearing layout which identifies location and orientation of all bearings will be developed by the bearing fabricator. Permanently mark each bearing in accordance with the bearing layout. A copy of the bearing layout is to be provided to the Engineer.  
 Cost of furnishing and installing elastomeric bearings is to be included in unit price bid for "Prestressed Concrete Box Beams".  
 Details are drawn showing right forward skew. See Bridge Layout for actual direction.  
 These details are applicable for skews up to 30 degrees only.

HL93 LOADING

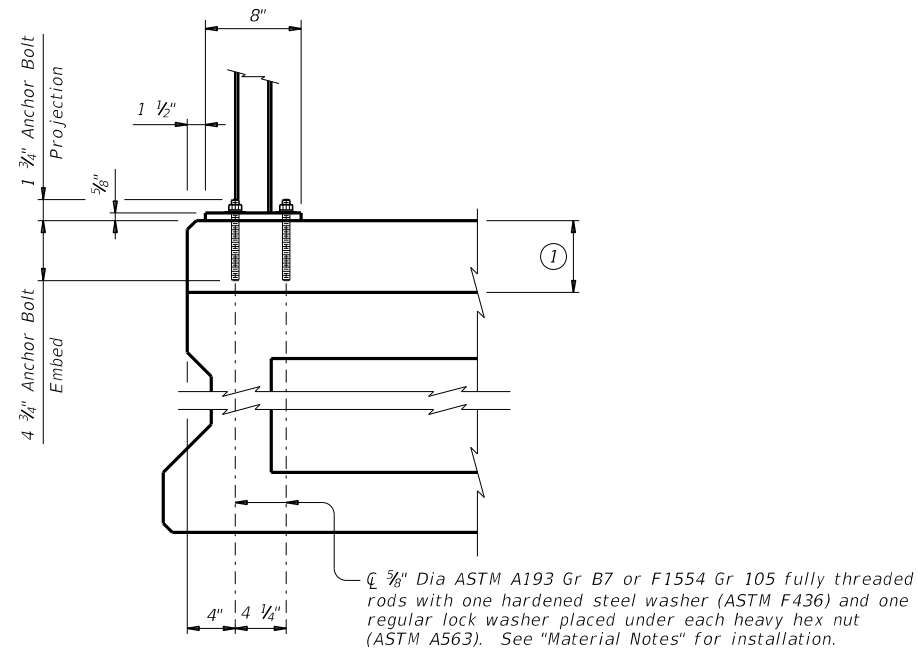
			<b>Bridge Division Standard</b>	
<b>ELASTOMERIC BEARING DETAILS</b> <b>PRESTR CONC BOX BEAMS</b>				
<b>BBEB</b>				
FILE: bbstde08.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT December, 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
	DIST	COUNTY	SHEET NO.	
	BRY	FREESTONE	58	

DATE: 5/12/2023 11:34:54 AM  
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 DRAWING: WJXN4000\BR1\BR1.dgn  
 TITLE: T631LS & T631 RAIL ANCHORAGE PLACEMENT (2)7  
 (BBRAS).dgn

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**CAST-IN-PLACE ANCHORAGE OPTION**



**ADHESIVE ANCHORAGE OPTION**

**T631LS & T631 RAIL ANCHORAGE PLACEMENT (2)7**

- ① Cast-in-place slab thickness varies due to beam camber (5" minimum).
- ② Replace cast-in-place anchor bolts shown on T631LS or T631 Rail standard with an adhesive anchor system or cast-in-place anchor bolts shown on this sheet.
- ③ Bar length shown on rail standard, minus 1 1/4". Adjust bar length for a raised sidewalk.
- ④ See Rail standard for projection from finished grade or top of sidewalk.
- ⑤ Place additional (#5) longitudinal bar.
- ⑥ Excess bolt length has been provided to accommodate a variable slab thickness due to beam camber. If slab thickness on span details exceed 10", bolt length must be increased accordingly. After posts have been set and bolts tightened, bolt projection above nuts of more than 1/2" must be cut off and painted with two coats of zinc-rich paint conforming to the Item 445 "Galvanizing".
- ⑦ Distance from end of top outside edge of slab to center of first bolt group can not be less than 9", except: 15° Skew: 1'-0" (acute corner only)  
30° Skew: 1'-3" (acute corner only)
- ⑧ Location of Rail Expansion Joint must be at the intersection of Slab Expansion Joint, Rail Footprint and perpendicular to slab outside edge.
- ⑨ Cross-hatched area must have 1/2" Preformed Bituminous Fiber Material under concrete rail, as shown.

**CONSTRUCTION NOTES:**

Rail anchorage bars may be field bent as required to clear rail reinforcing or provide minimum cover shown on standard rail detail sheets. Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

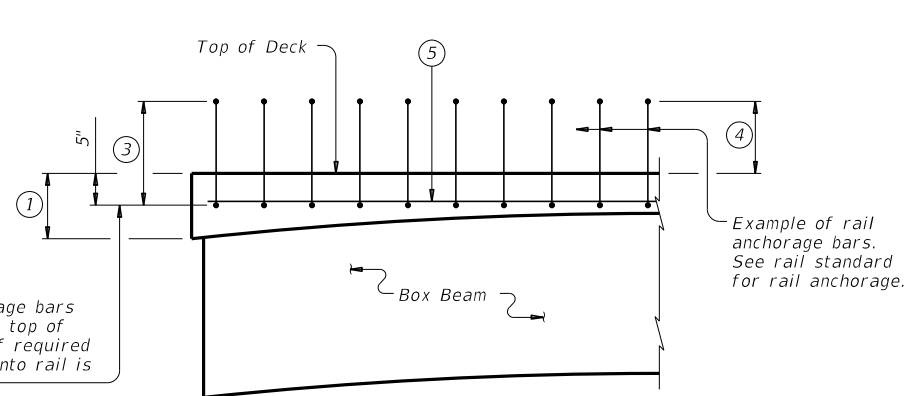
**MATERIAL NOTES:**

Galvanize all steel components of steel rail system. Provide Grade 60 reinforcing steel. Cast-in-place anchorage system for T631LS and T631 Rail must be 5/8" Dia heavy hex head anchor bolts (ASTM F3125 Gr 325 or A449) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed anchor bolts 4 1/2" minimum. Adhesive anchors for T631LS and T631 Rail must be 5/8" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 3/4". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." Epoxy coat or galvanize reinforcing steel shown on this standard if rail reinforcement is epoxy coated or galvanized.

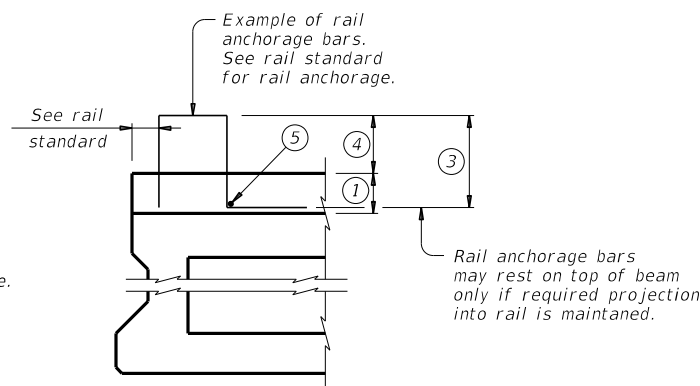
**GENERAL NOTES:**

Designed in accordance with AASHTO LRFD Bridge Design Specifications. This standard is for use with structures with a 5" minimum cast-in-place concrete slab. This standard may require modification for interior rails. This standard does not apply to median barriers. This standard does not provide details for Type T221P, T224, T80HT, T80SS, C412, PR11, PR22 and PR3 rails on box beam bridges. See rail standards for approved speed restrictions, notes and details not shown.

Cover dimensions are clear dimensions, unless noted otherwise.



**PART SPAN ELEVATION**

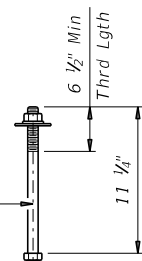


**SECTION**

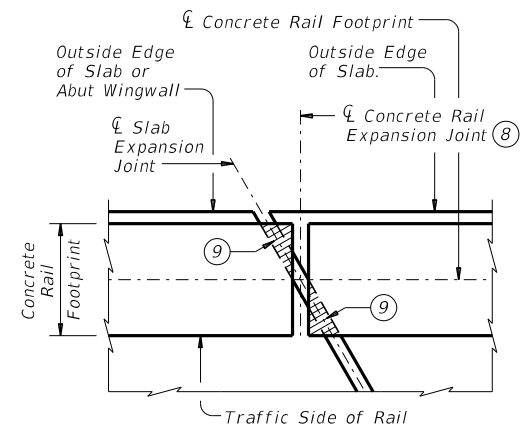
**TYPICAL CONCRETE RAIL ANCHORAGE**

(Showing typical concrete rail anchorage)

5/8" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563).



**T631LS & T631 RAIL C-I-P ANCHOR BOLT**



**PLAN OF CONCRETE RAILS AT EXPANSION JOINTS**

				<b>Bridge Division Standard</b>	
<b>RAIL ANCHORAGE DETAILS</b> <b>PRESTR CONC BOX BEAMS (WITH SLAB)</b> <b>BBRAS</b>					
FILE: bbstoe09-18.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH	
©TxDOT December 2006	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0917	20	046	CR 481	
04-90: Updated for new rails.					
01-12: rails anchor bars.					
07-14: Removed T101 & T16. Added T631.					
03-16: Class D, E, or F epoxy in material notes. T221P & T224 in general notes.					
03-18: Updated adhesive anchor notes.					
DIST	COUNTY		SHEET NO.		
BRY	FREESTONE		59		

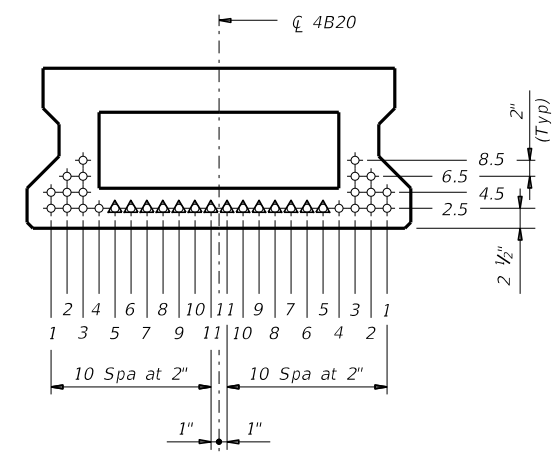
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DATE: 5/12/2023 11:35:04 AM  
 FILE: \\Project\wisemmer\jacobs.com\Jacobs\_US\_B\_I\_SS4\Documents\WJXN4000\BRY\BRY.dgn

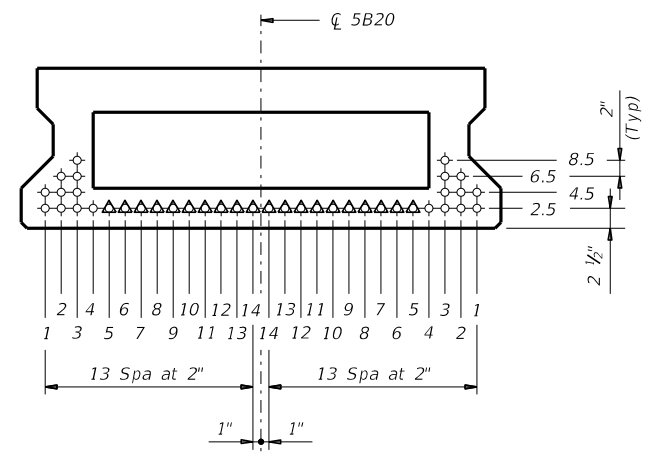
STANDARD SBBS-B20-24	DESIGNED BEAMS (STRAIGHT STRANDS)																	OPTIONAL DESIGN							
	SPAN LENGTH (ft)	BEAM NO.	BEAM TYPE	PRESTRESSING STRANDS							DEBONDED STRAND PATTERN PER ROW					CONCRETE		DESIGN LOAD COMP STRESS (TOP $\epsilon$ ) (SERVICE I)	DESIGN LOAD TENSILE STRESS (BOTT $\epsilon$ ) (SERVICE III)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I)	LIVE LOAD DISTRIBUTION FACTOR				
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH (ksi)	"e" $\bar{c}$ (in)	"e" END (in)	TOT NO. DEB	DIST FROM BOTTOM (in)	NO. OF STRANDS		NUMBER OF STRANDS DEBONDED TO (ft from end)							RELEASE STRGTH $f'_{ci}$ (ksi)	MINIMUM 28 DAY COMP STRGTH $f'_c$ (ksi)	②		
												TOTAL	DE-BONDED	3	6	9	12						15	Moment	Shear
24' Roadway 5" Slab	30	1&6	5B20		8	0.6	270	7.38	7.38	0	2.50	8	0	0	0	0	0	0	4.000	5.000	0.640	-0.808	704	0.454	0.691
	30	2-5	4B20		6	0.6	270	7.31	7.31	0	2.50	6	0	0	0	0	0	0	4.000	5.000	0.693	-0.860	601	0.379	0.511
	35	1&6	5B20		8	0.6	270	7.38	7.38	0	2.50	8	0	0	0	0	0	0	4.000	5.000	0.838	-1.041	795	0.440	0.680
	35	2-5	4B20		6	0.6	270	7.31	7.31	0	2.50	6	0	0	0	0	0	0	4.000	5.000	0.911	-1.111	615	0.367	0.498
	40	1&6	5B20		10	0.6	270	7.38	7.38	0	2.50	10	0	0	0	0	0	0	4.000	5.000	1.061	-1.297	889	0.427	0.671
	40	2-5	4B20		8	0.6	270	7.31	7.31	0	2.50	8	0	0	0	0	0	0	4.000	5.000	1.156	-1.388	712	0.356	0.488
	45	1&6	5B20		10	0.6	270	7.38	7.38	0	2.50	10	0	0	0	0	0	0	4.000	5.000	1.316	-1.590	960	0.417	0.663
	45	2-5	4B20		10	0.6	270	7.31	7.31	0	2.50	10	0	0	0	0	0	0	4.000	5.000	1.437	-1.706	824	0.348	0.481
	50	1&6	5B20		12	0.6	270	7.38	7.38	0	2.50	12	0	0	0	0	0	0	4.000	5.000	1.606	-1.927	1147	0.408	0.655
	50	2-5	4B20		12	0.6	270	7.31	7.31	0	2.50	12	0	0	0	0	0	0	4.000	5.000	1.755	-2.070	985	0.340	0.476
	55	1&6	5B20		16	0.6	270	7.38	7.38	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.921	-2.289	1344	0.400	0.649
	55	2-5	4B20		14	0.6	270	7.31	7.31	0	2.50	14	0	0	0	0	0	0	4.000	5.000	2.104	-2.464	1157	0.334	0.471
	60	1&6	5B20		18	0.6	270	7.38	7.38	0	2.50	18	0	0	0	0	0	0	4.000	5.000	2.262	-2.677	1551	0.393	0.643
	60	2-5	4B20		18	0.6	270	7.31	7.31	2	2.50	18	2	0	2	0	0	0	4.000	5.000	2.487	-2.899	1347	0.333	0.467
	65	1&6	5B20		24	0.6	270	7.38	7.38	6	2.50	24	6	2	2	0	2	0	4.000	5.000	2.627	-3.091	1769	0.387	0.638
	65	2-5	4B20		20	0.6	270	7.31	7.31	4	2.50	20	4	0	2	0	2	0	4.000	5.800	2.903	-3.368	1551	0.333	0.463

**DESIGN NOTES:**  
 Designed in accordance with AASHTO LRFD Bridge Design Specifications.  
 Prestress losses for the designed beams have been calculated for a relative humidity of 60 percent. Optional designs must likewise conform.  
 Beam designs are applicable for 5" concrete slabs without overlay and 0 degree skew.

**FABRICATION NOTES:**  
 Provide Class H concrete.  
 Provide Grade 60 reinforcing steel bars.  
 Use low relaxation strands, each pretensioned to 75 percent of fpu.  
 When shown on this sheet, the Fabricator has the option of furnishing either the designed beam or an approved optional beam design. All optional design submittals and shop drawings must be signed, sealed and dated by a Professional Engineer registered in the State of Texas.  
 Locate strands for the designed beam as low as possible on the 2" grid system unless a non-standard stand pattern is indicated. Fill row "2.5", then row "4.5", then row "6.5", etc. Place strands within a row as follows:  
 1) Locate a strand in each "1" position.  
 2) Place strand symmetrically about vertical centerline of box.  
 3) Space strands as equally as possible across the entire width.  
 Strand debonding must comply with Item 424.4.2.2.4.  
 Do not debond strands in position "1". Distribute debonded strands equally about the vertical centerline. Decrease debonded lengths working inward, with debonding staggered in each row.  
 Full-length debonded strands are only permitted in positions marked  $\Delta$ .



**TxDOT 4B20 BOX BEAM**



**TxDOT 5B20 BOX BEAM**

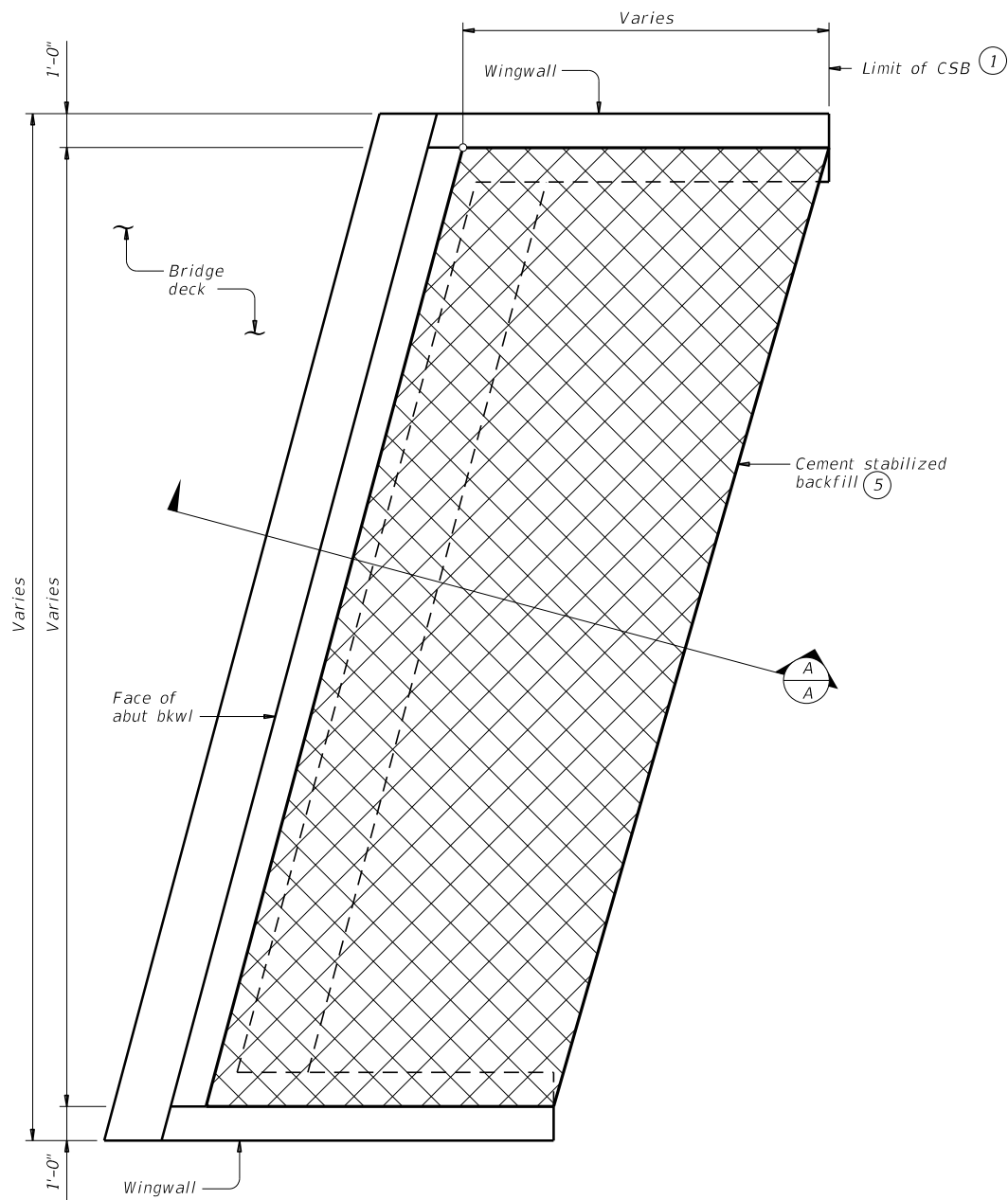
- ① Based on the following allowable stresses (ksi):  
 Compression =  $0.65 f'_{ci}$   
 Tension =  $0.24 \sqrt{f'_{ci}}$   
 Optional designs must likewise conform.
- ② Portion of full HL93.

HL93 LOADING

		<b>Bridge Division Standard</b>	
<b>PRESTR CONC BOX BEAM STANDARD DESIGNS TYPE B20 24' RDWY (WITH SLAB)</b>			
<b>BBSDS-B20-24</b>			
FILE: bbstds11.dgn	DN: SRW	CK: BMP	DW: SFS
©TxDOT December 2006	CONT	SECT	JOB
REVISIONS	0917	20	046
04-1: f'ci and LLDF. 01-16: Notes, 0.6" strand designs.	DIST	COUNTY	SHEET NO.
	BRY	FREESTONE	60

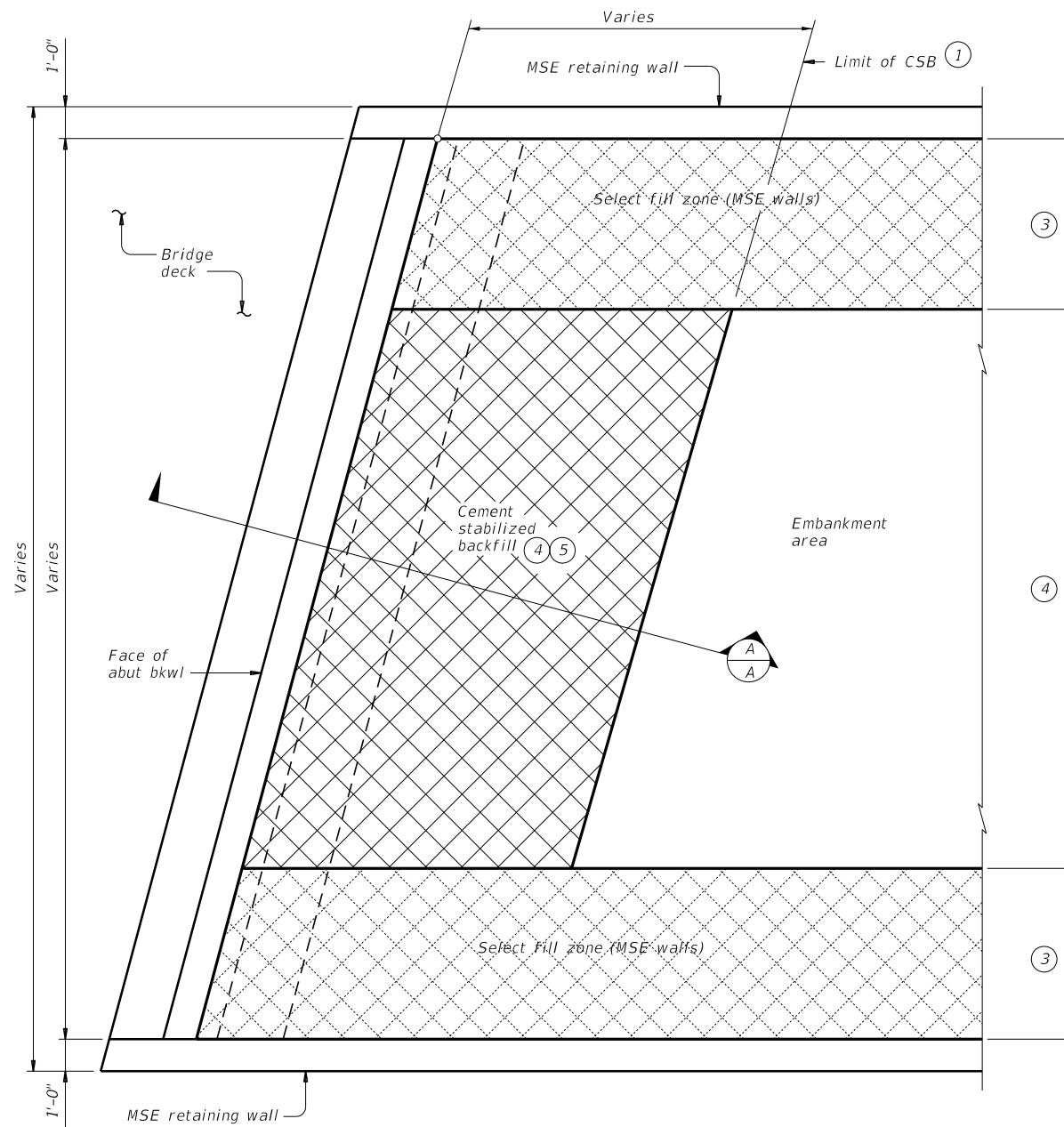
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**OPTION 1 ~ PLAN WITH WINGWALLS**

Cast-in-place retaining walls similar.

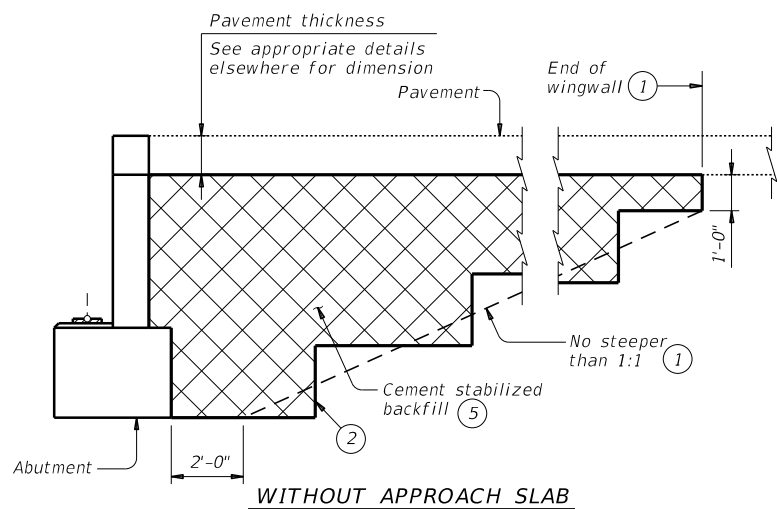


**OPTION 1 ~ PLAN WITH MSE RETAINING WALLS**

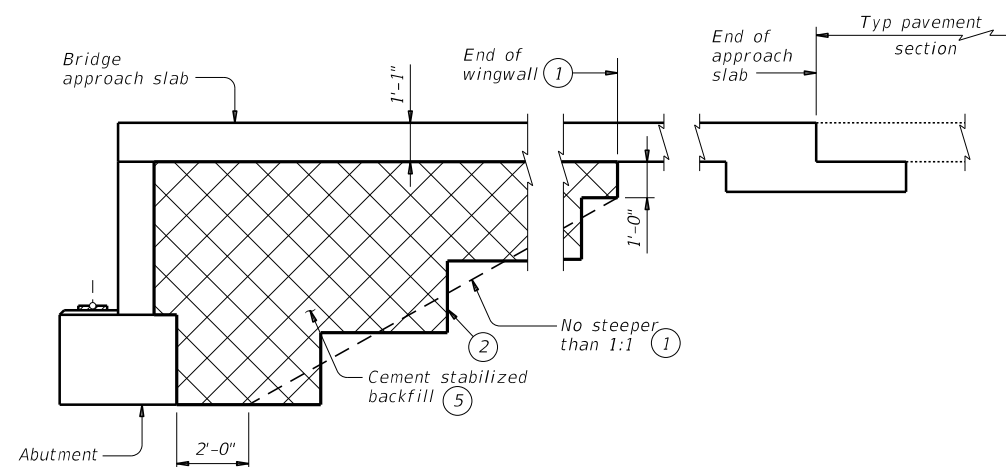
- ① Usual limit of Cement Stabilized Backfill is at end of wingwall. Extend CSB limits as required to maintain a slope no steeper than 1:1 at bottom of backfill.
- ② Bench backfill as shown with 12" (approximate) bench depths.
- ③ Where MSE retaining walls are present, adjust CSB limits to accommodate the select fill zone. See retaining wall details for additional information.
- ④ When distance between select fill zones is less than 5'-0", MSE select fill may be substituted for cement stabilized backfill with approval from the Engineer.
- ⑤ If shown in the plans flowable backfill can be used as a substitute for cement stabilized backfill with the following constraints:
  - a) If flowable backfill is to be placed over MSE backfill then a filter fabric will be placed over the MSE backfill prior to placement of the flowable fill; and
  - b) Place flowable fill in lifts not exceeding 2 feet in height, place each successive lift when the previous lift has stiffened/hardened (i.e. has lost its flowability).

**GENERAL NOTES:**

See the Bridge Layout for selected Option. Option 2 is intended for new construction requiring high plasticity embankment fill with a plasticity index (PI) greater than 30 or pavement built in poor native soil. Poor soils are defined as high plasticity clays or expansive clays. Option 1 is intended for construction only requiring PI controlled embankment fill or excavation in competent soils/rocks in order to construct the abutment.  
 Provide Cement Stabilized Backfill (CSB) meeting the requirements of Item 400, "Excavation and Backfill for Structures", to the limits shown at bridge abutments.  
 If required elsewhere in the plans, provide Flowable Backfill meeting the requirements of Item 401, "Flowable Backfill", to the limits shown at bridge abutments.  
 Details are drawn showing left forward skew. See Bridge Layout for actual skew direction.  
 These details do not apply when Concrete Block retaining walls are used in lieu of wingwalls.



**WITHOUT APPROACH SLAB**



**WITH APPROACH SLAB**  
 (Showing BAS-C, BAS-A similar.)

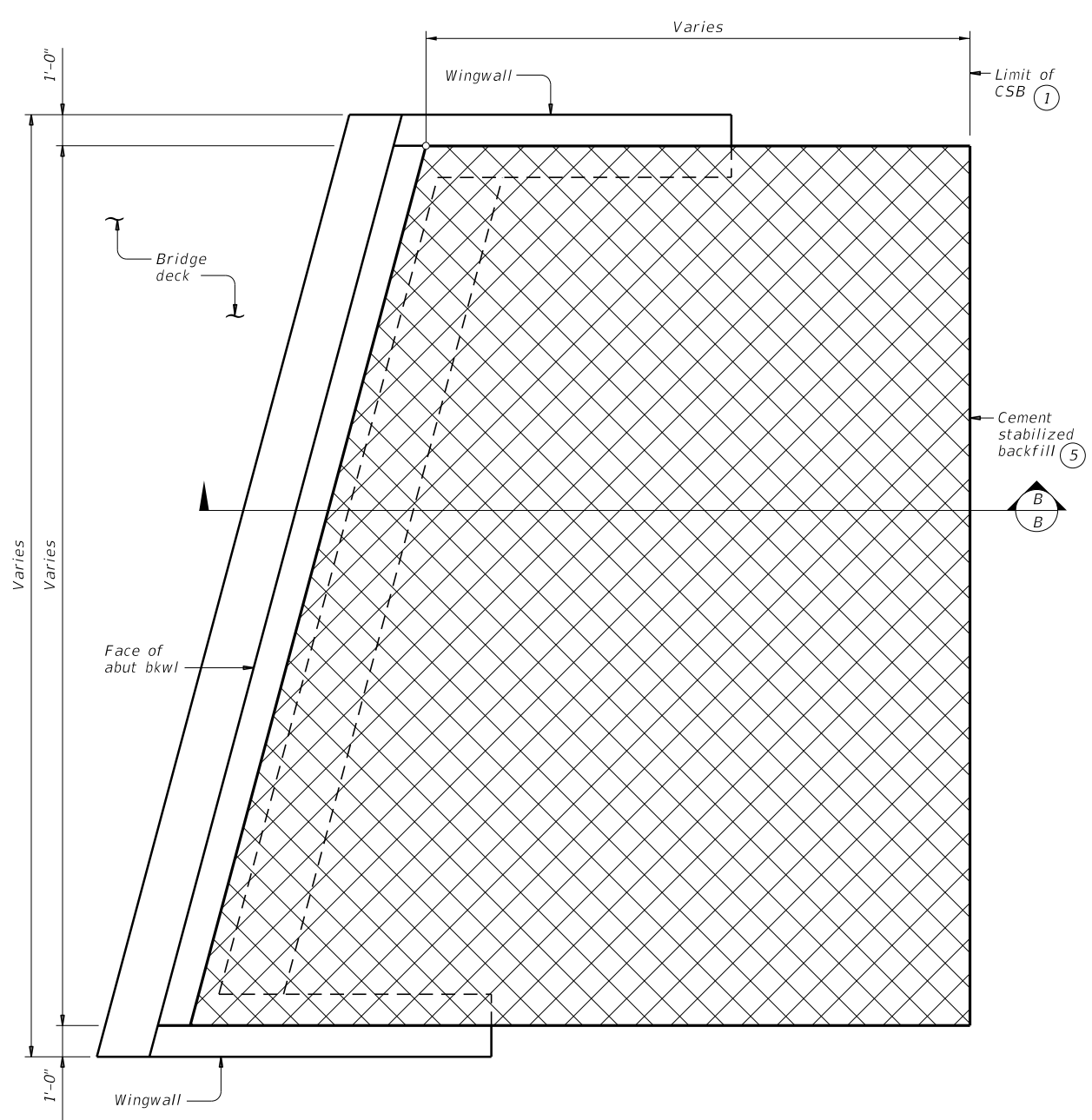
**SECTION A-A**

SHEET 1 OF 2

		<b>Bridge Division Standard</b>	
<b>CEMENT STABILIZED ABUTMENT BACKFILL BRIDGE ABUTMENT</b>			
<b>CSAB</b>			
FILE: csabste1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT	April 2019	CONTRACT	SECT
0917	20	046	CR 481
02-20: Added Option 2.	DIST	COUNTY	SHEET NO.
BRY	FREESTONE		61

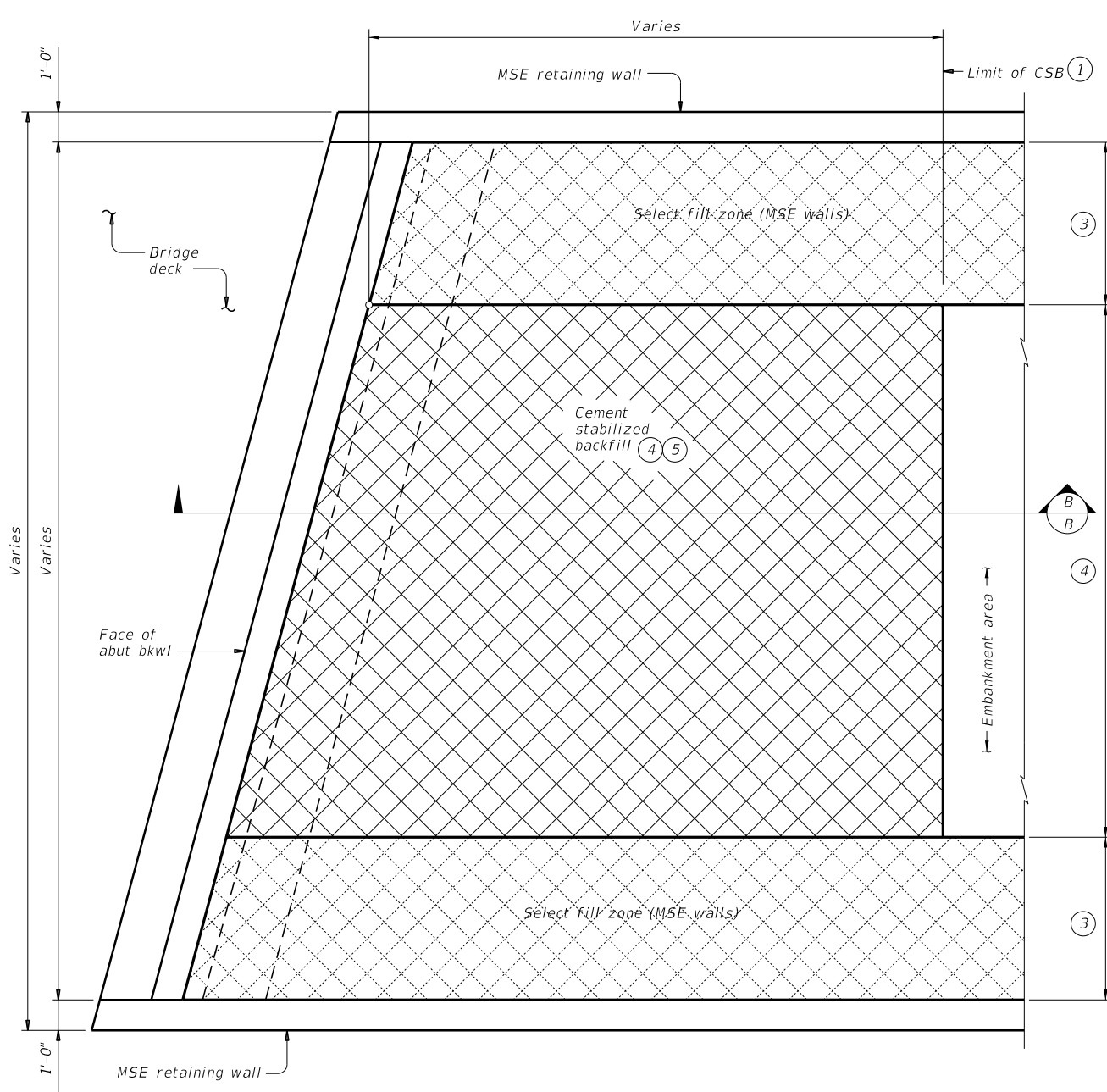
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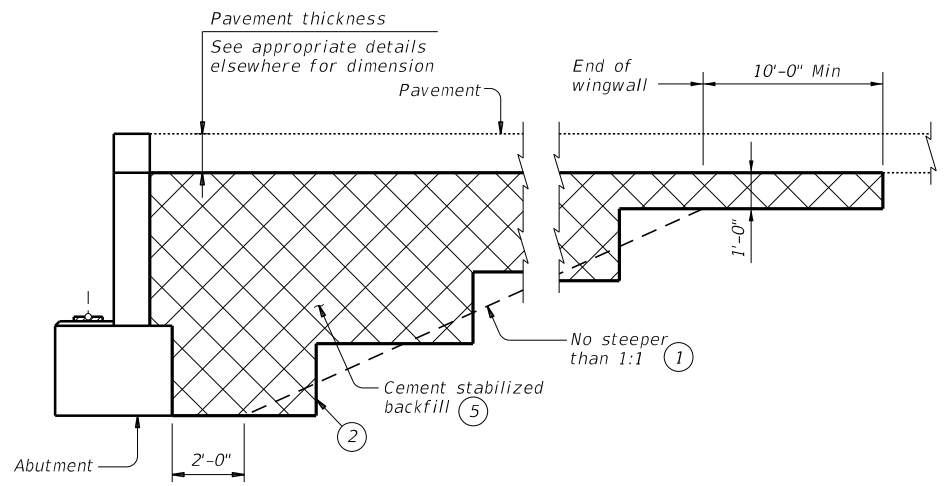
**OPTION 2 ~ PLAN WITH WINGWALLS**

Cast-in-place retaining walls similar.

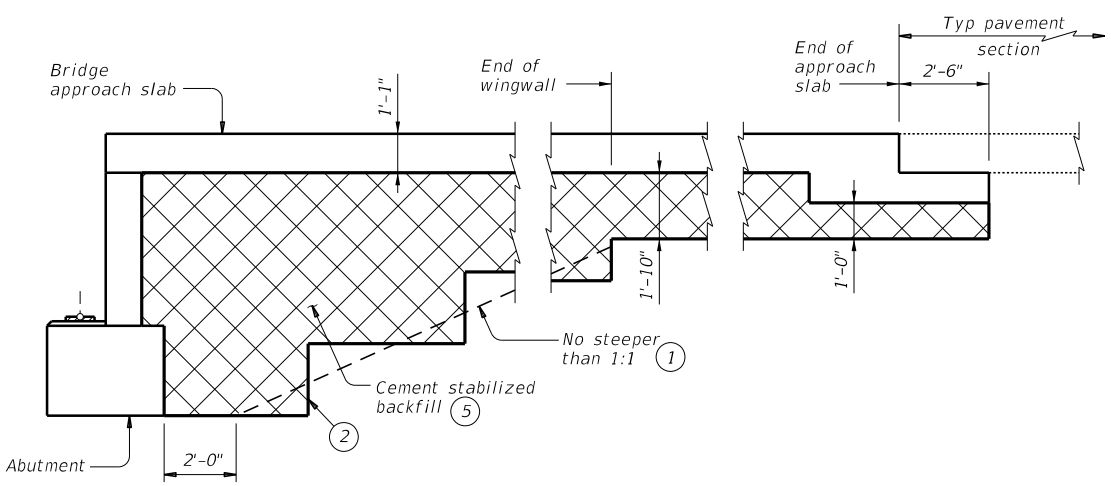


**OPTION 2 ~ PLAN WITH MSE RETAINING WALLS**

- ① Usual limit of Cement Stabilized Backfill is at end of wingwall. Extend CSB limits as required to maintain a slope no steeper than 1:1 at bottom of backfill.
- ② Bench backfill as shown with 12" (approximate) bench depths.
- ③ Where MSE retaining walls are present, adjust CSB limits to accommodate the select fill zone. See retaining wall details for additional information.
- ④ When distance between select fill zones is less than 5'-0", MSE select fill may be substituted for cement stabilized backfill with approval from the Engineer.
- ⑤ If shown in the plans flowable backfill can be used as a substitute for cement stabilized backfill with the following constraints:
  - a). If flowable backfill is to be placed over MSE backfill then a filter fabric will be placed over the MSE backfill prior to placement of the flowable fill; and
  - b). Place flowable fill in lifts not exceeding 2 feet in height, place each successive lift when the previous lift has stiffened/hardened (i.e. has lost its flowability).



**WITHOUT APPROACH SLAB**



**SECTION B-B**

**WITH APPROACH SLAB**

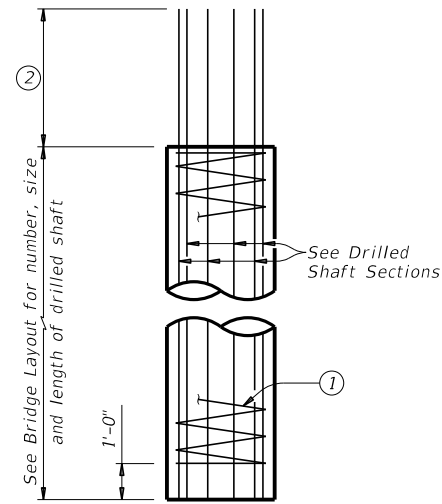
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SHEET 2 OF 2

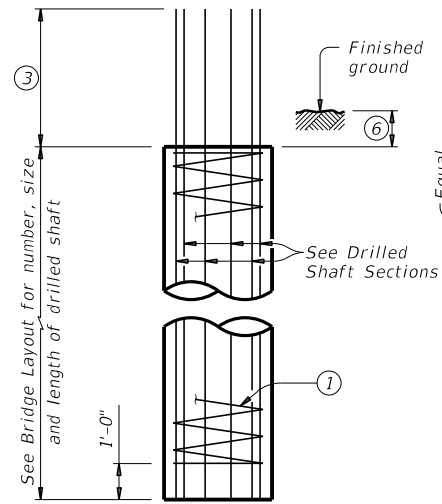
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<b>CEMENT STABILIZED ABUTMENT BACKFILL BRIDGE ABUTMENT</b>			
<b>CSAB</b>			
FILE: csabste1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT	APRIL 2019	CONTRACT	SECTION
0917	20	046	CR 481
REVISIONS 02-20: Added Option 2.		DIST	COUNTY
		BRY	FREESTONE
		SHEET NO.	62



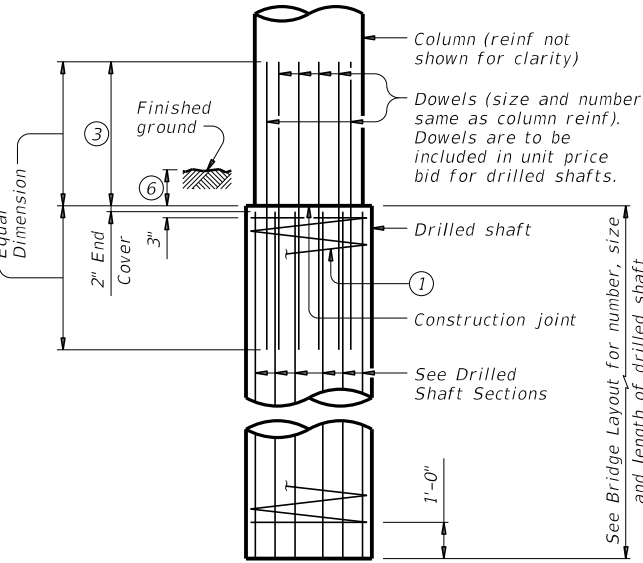
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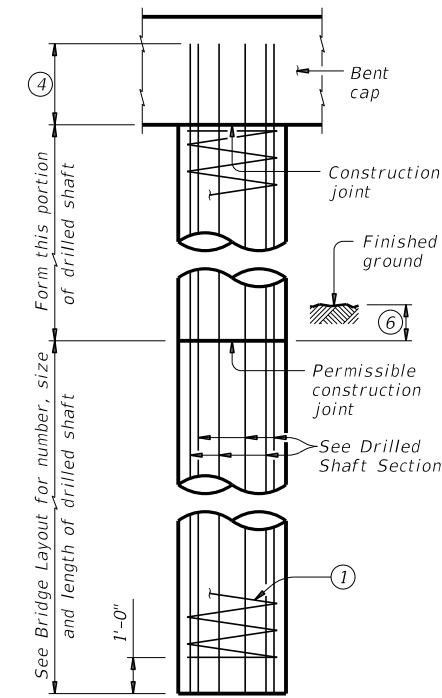
ABUTMENTS, WINGWALLS AND MULTI-DRILLED SHAFT FOOTINGS



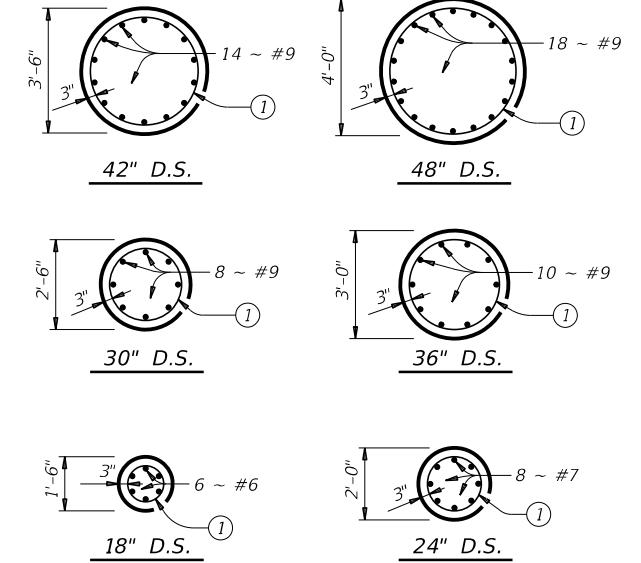
INTERIOR BENTS DRILLED SHAFT DIA EQUAL TO COLUMN DIA



INTERIOR BENTS DRILLED SHAFT DIA GREATER THAN COLUMN DIA



OPTIONAL INTERIOR BENT DRILLED SHAFT DETAIL



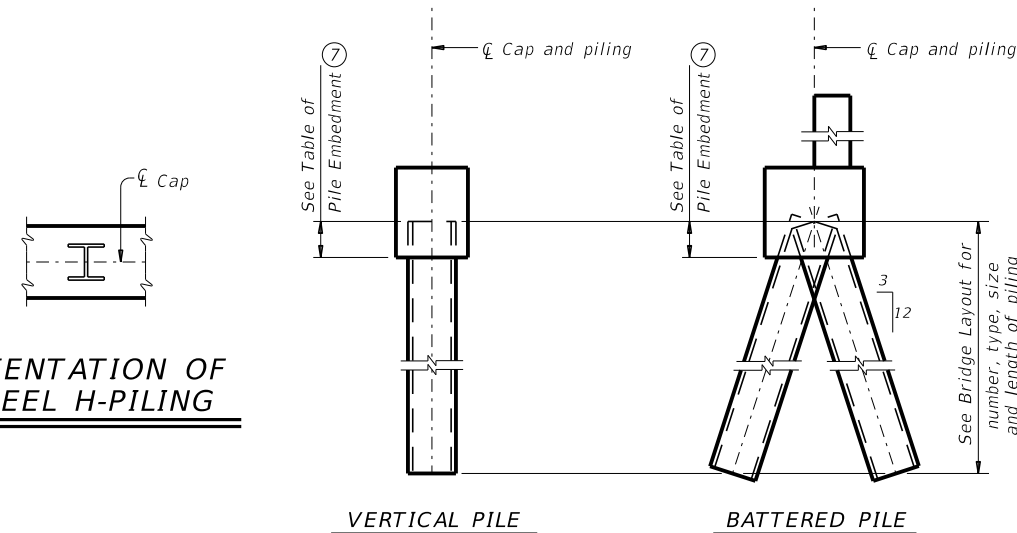
DRILLED SHAFT SECTIONS

**DRILLED SHAFT DETAILS**

TABLE OF PILE EMBEDMENT	
Pile Type	Embedment Depth (Ft)
16" Sq Concrete 18" Sq Concrete HP14 Steel HP16 Steel	1'-0"
20" Sq Concrete 24" Sq Concrete HP18 Steel	1'-6"

See Prestressed Concrete Piling (CP) standard for additional details on concrete pile embedment.

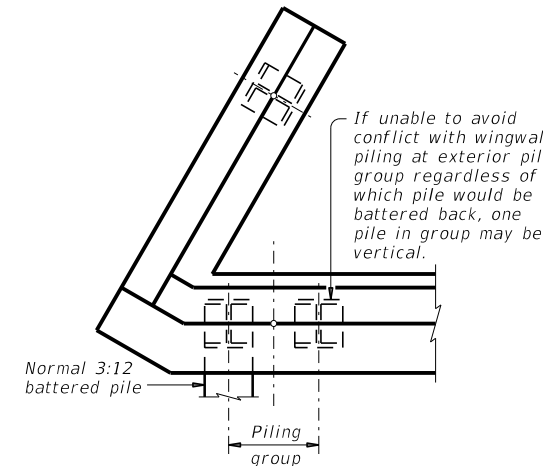
**ORIENTATION OF STEEL H-PILING**



VERTICAL PILE

BATTERED PILE

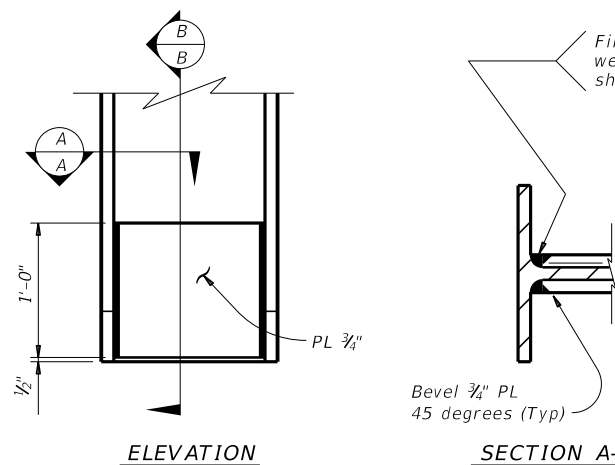
**PILING DETAILS**  
(Concrete or steel H)



**DETAIL "A"**

(Showing plan view of a 30° skewed abutment)

- ① #3 spiral at 6" pitch (one and a half flat turns top and bottom).
- ② Min extension into supported element:  
#6 Bars = 1'-11"  
#7 Bars = 2'-0"  
#9 Bars = 2'-3"
- ③ Min lap with column reinf:  
#7 Bars = 2'-11"  
#9 Bars = 3'-9"  
#11 Bars = 4'-8"
- ④ Min extension into supported element:  
#6 Bars = 1'-11"  
#7 Bars = 2'-3"  
#9 Bars = 2'-9"
- ⑤ Drilled shafts may extend to the bottom of bent caps for "H" heights of 6 ft and less (as shown on the Bridge Layout), if approved. This option can only be used when the drilled shaft diameter equals the column diameter. Obtain approval of the forming method above the ground line prior to construction. No adjustments in payment will be made if this option is used.
- ⑥ 1'-0" Min, unless shown otherwise on plans.
- ⑦ Or as shown on plans.

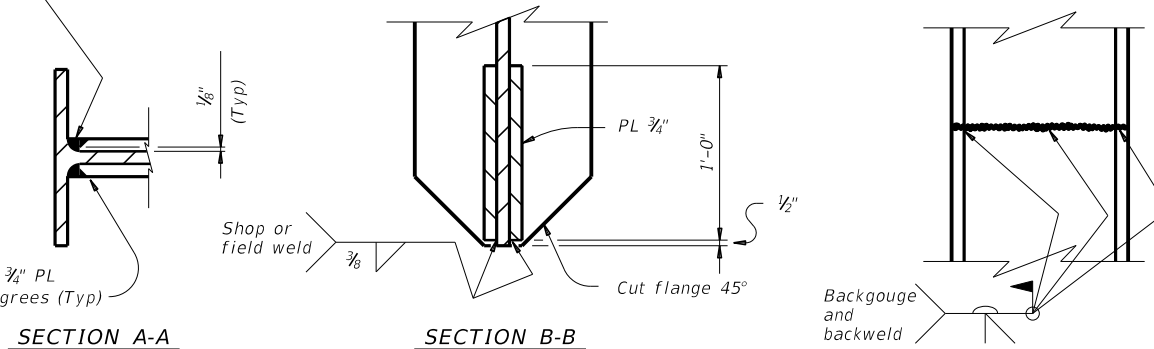


ELEVATION

SECTION A-A

**STEEL H-PILE TIP REINFORCEMENT**

See Item 407 "Steel Piling" to determine when tip reinforcement is required and for options to the details shown.



SECTION B-B

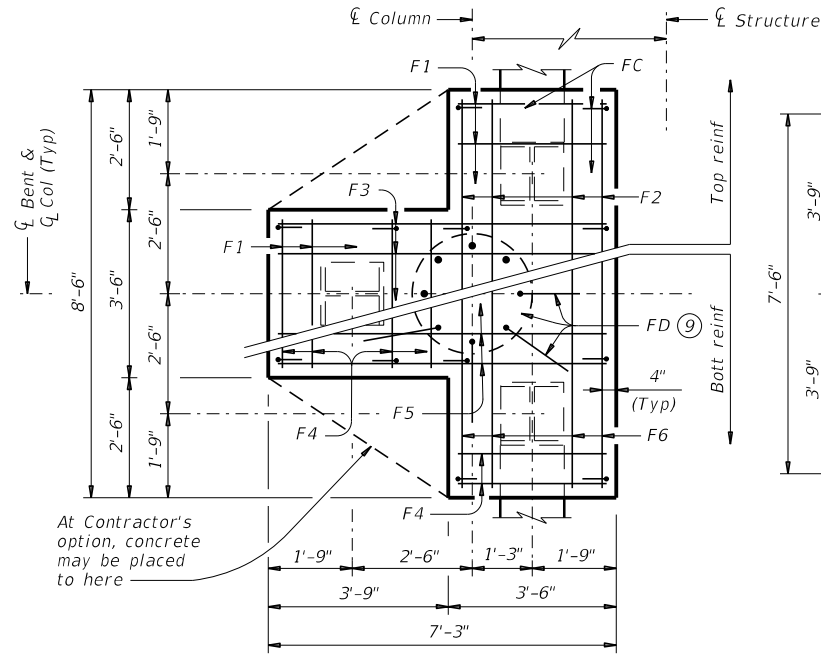
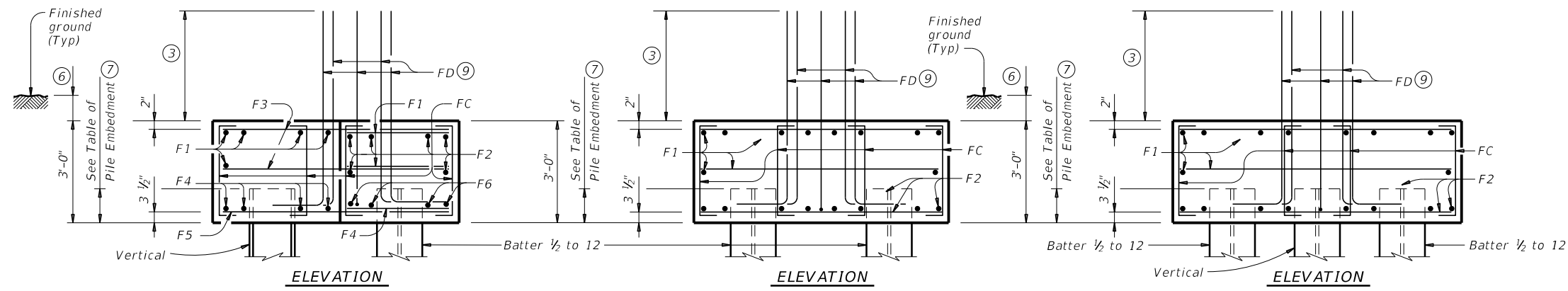
SECTION THRU FLANGE OR WEB

**STEEL H-PILE SPLICE DETAIL**

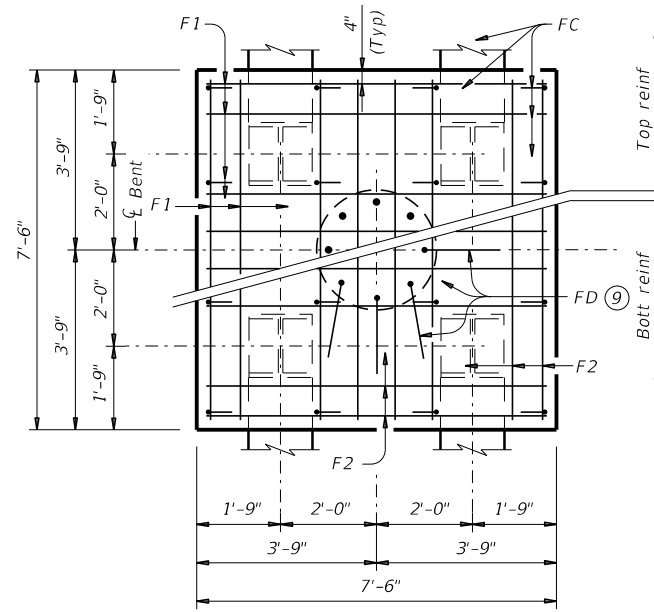
Use when required.

		<b>Bridge Division Standard</b>	
<b>COMMON FOUNDATION DETAILS</b>			
<b>FD</b>			
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©TxDOT April 2019	CONTRACT: 0917	SECTION: 20	JOB: 046
REVISIONS	COUNTY: FREESTONE		HIGHWAY: CR 481
01-20: Added #11 bars to the FD bars.	DIST:	COUNTY:	SHEET NO. 63

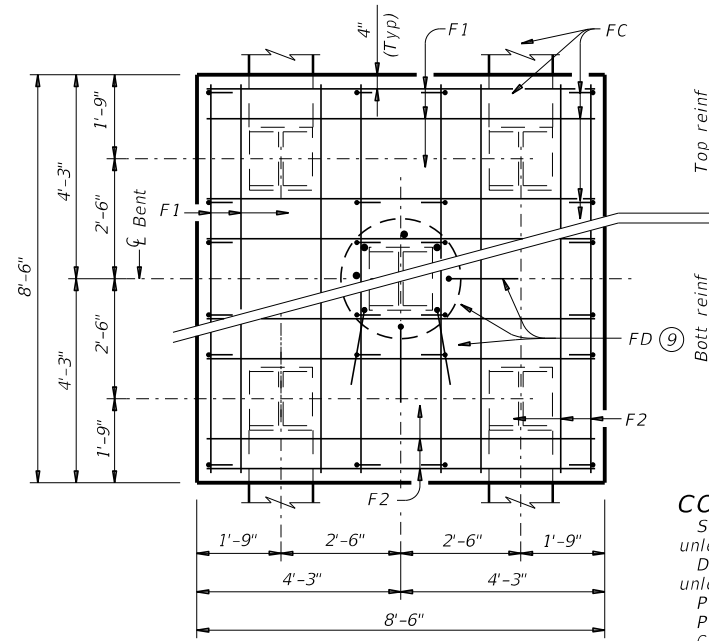
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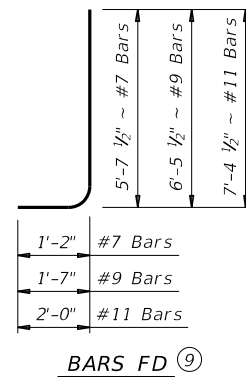
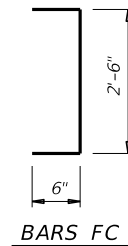
**THREE PILE FOOTING**<sup>8</sup>  
For 36" Dia and smaller columns.



**FOUR PILE FOOTING**<sup>8</sup>  
For 42" Dia and smaller columns.



**FIVE PILE FOOTING**<sup>8</sup>  
For 42" Dia and smaller columns.



- ③ Min lap with column reinforcing:  
#7 Bars = 2'-11"  
#9 Bars = 3'-9"  
#11 Bars = 4'-8"
- ⑥ 1'-0" Min, unless shown otherwise on plans.
- ⑦ Or as shown on plans.
- ⑧ See Bridge Layout for type, size and length of piling.
- ⑨ Number and size of FD bars must match column reinforcing. Tie FD bars to the top of the bottom reinforcing mat.
- ⑩ Adjust FD quantity, size and weight as needed to match column reinforcing.

**TABLE OF FOOTING QUANTITIES FOR 30" COLUMNS**

ONE 3 PILE FOOTING					
Bar	No.	Size	Length	Weight	
F1	11	#4	3'- 2"	23	
F2	6	#4	8'- 2"	33	
F3	6	#4	6'- 11"	28	
F4	8	#9	3'- 2"	86	
F5	4	#9	6'- 11"	94	
F6	4	#9	8'- 2"	111	
FC	12	#4	3'- 6"	28	
FD ⑩	8	#9	8'- 1"	220	
Reinforcing Steel				Lb	623
Class "C" Concrete				CY	4.8

ONE 4 PILE FOOTING					
Bar	No.	Size	Length	Weight	
F1	20	#4	7'- 2"	96	
F2	16	#8	7'- 2"	306	
FC	16	#4	3'- 6"	37	
FD ⑩	8	#9	8'- 1"	220	
Reinforcing Steel				Lb	659
Class "C" Concrete				CY	6.3

ONE 5 PILE FOOTING					
Bar	No.	Size	Length	Weight	
F1	20	#4	8'- 2"	109	
F2	16	#9	8'- 2"	444	
FC	24	#4	3'- 6"	56	
FD ⑩	8	#9	8'- 1"	220	
Reinforcing Steel				Lb	829
Class "C" Concrete				CY	8.0

**CONSTRUCTION NOTES:**

See Bridge Layout for foundation type required. Use these foundation details unless shown otherwise.  
 Drive piling under abutment wingwalls to a minimum resistance of 10 Tons/Pile unless shown otherwise.  
 Provide Class C Concrete ( $f'c = 3,600$  psi), unless shown otherwise.  
 Provide Grade 60 reinforcing steel.  
 Galvanize reinforcing if shown elsewhere in the plans.  
 Provide bar laps for drilled shaft reinforcing, where required, as follows:  
 Uncoated or galvanized (#6) ~ 2'-6"  
 Uncoated or galvanized (#7) ~ 2'-11"  
 Uncoated or galvanized (#9) ~ 3'-9"

**GENERAL NOTES:**

Designed according to AASHTO LRFD Bridge Design Specifications.

Cover dimensions are clear dimensions, unless noted otherwise.  
 Reinforcing bar dimensions shown are out-to-out of bar.

**DESIGNER NOTES:**

Do not use the drilled shaft details shown on this standard for retaining wall, noise wall, barrier, or sign foundations without structural evaluation.  
 Do not use the footings shown on this standard in direct contact with salt water or exposed to salt water spray.  
 Maximum allowable pile loads for the footings shown are:

- 72 Tons/Pile with 24" Dia Columns
- 80 Tons/Pile with 30" Dia Columns
- 100 Tons/Pile with 36" Dia Columns
- 120 Tons/Pile with 42" Dia Columns



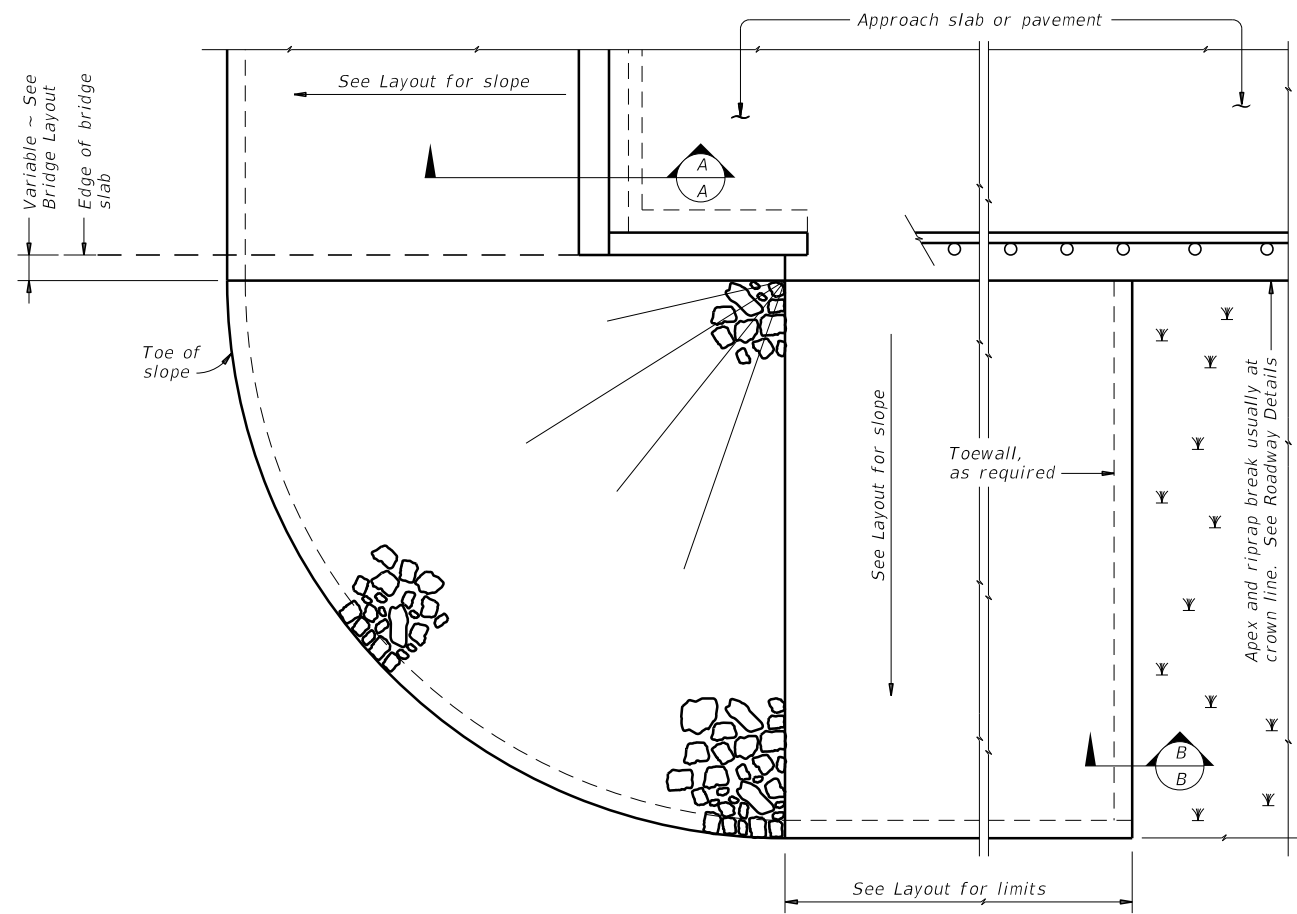
**COMMON FOUNDATION DETAILS**

FD

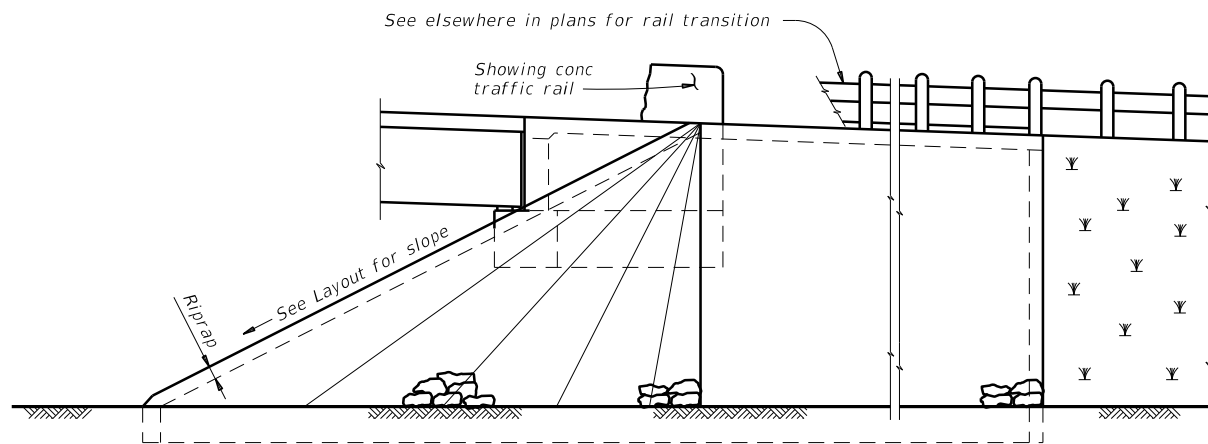
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©TxDOT	April 2019	CONTRACT	SECTION	JOB
	REVISIONS	0917	20	046
01-20: Added #11 bars to the FD bars.		DIST	COUNTY	SHEET NO.
		BRY	FREESTONE	64

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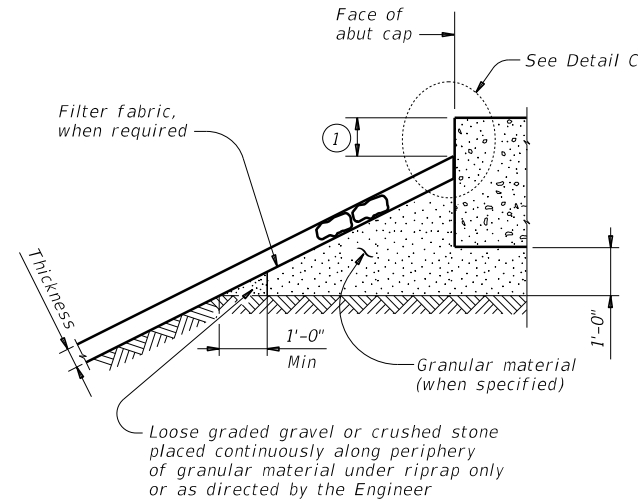
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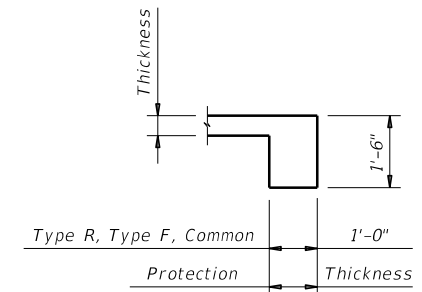
**PLAN**



**ELEVATION**

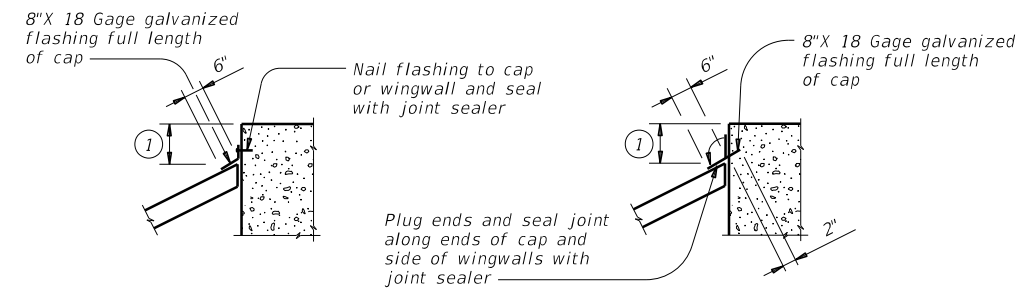


**SECTION A-A AT CAP**



**SECTION B-B**

Provide toewall when shoulder drain is located adjacent to limits of stone riprap. Omit toewall when thickness of protection riprap is greater than 18".



**CAP OPTION A**

**CAP OPTION B**

**DETAIL C**

① Top of cap to top of riprap dimension varies as directed by the Engineer. Provide 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.

**GENERAL NOTES:**

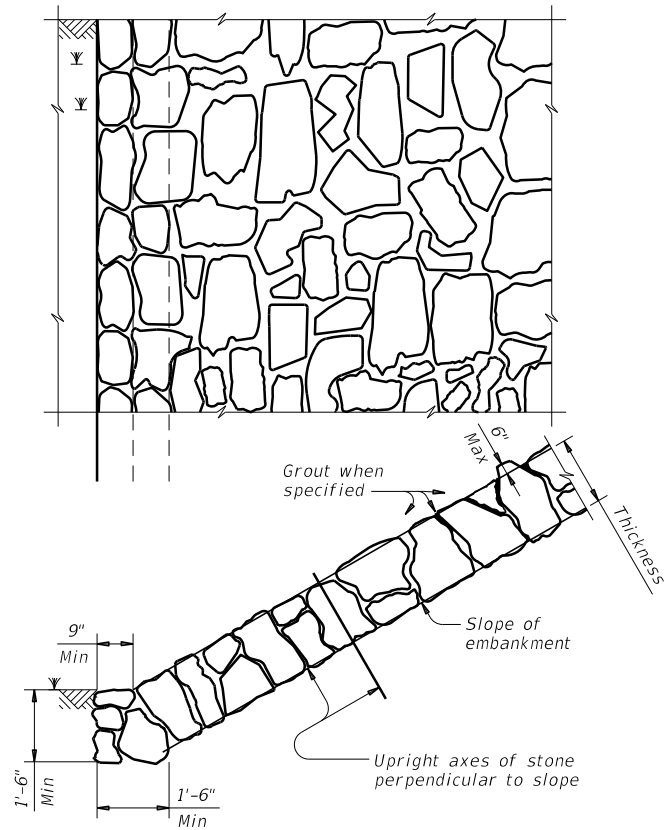
Refer to Item 432, "Riprap" for stone size and gradation, and construction details. See Layout for limits and thickness of riprap specified.  
 See elsewhere in plans for locations and details of shoulder drains.

SHEET 1 OF 2

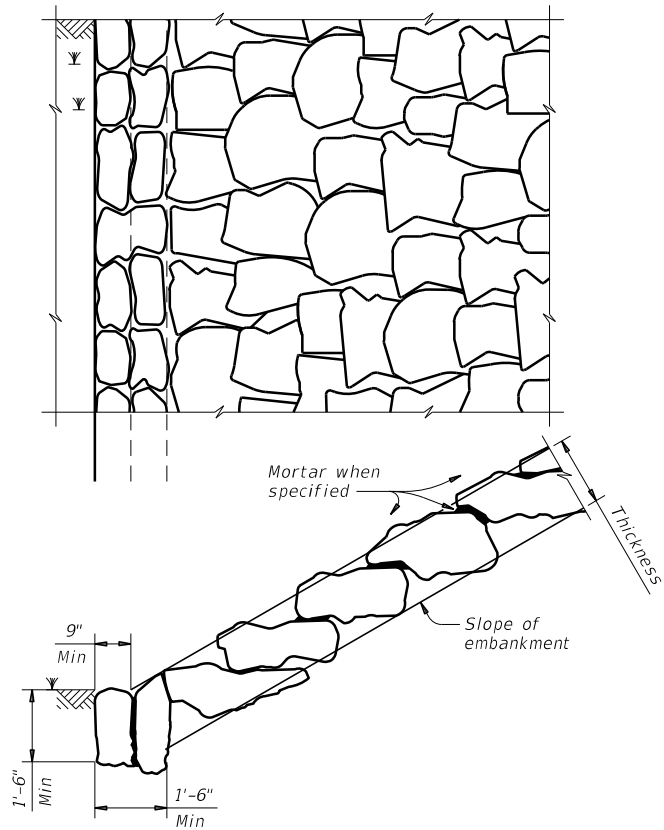
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<h2>SRR</h2>			
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©TxDOT April 2019	CONT	SECT	JOB
REVISIONS	0917	20	046
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	BRY	FREESTONE	65

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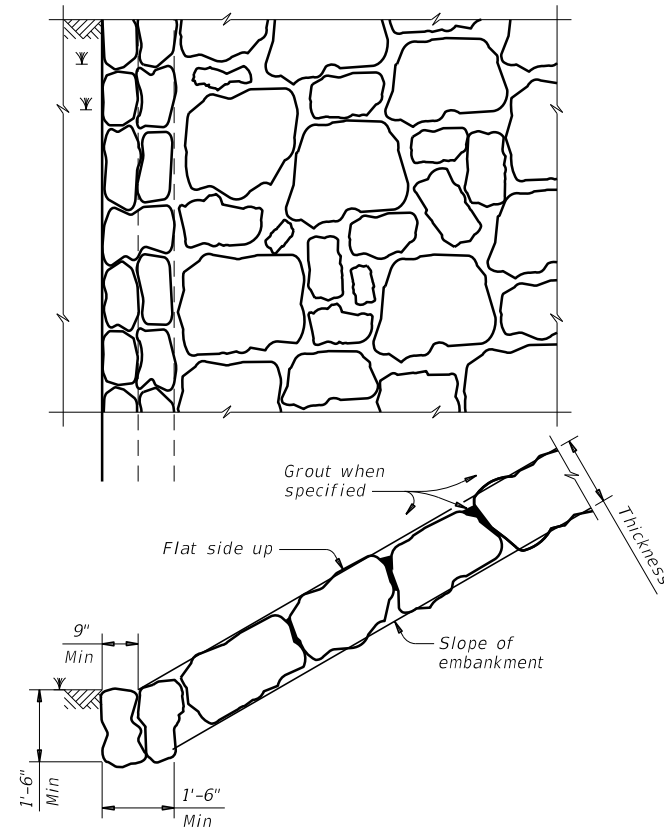
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 DRAWING: SRR-481  
 SHEET: 2 OF 2



**FIGURE 1 ~ TYPE R STONE RIPRAP**  
dry or grouted

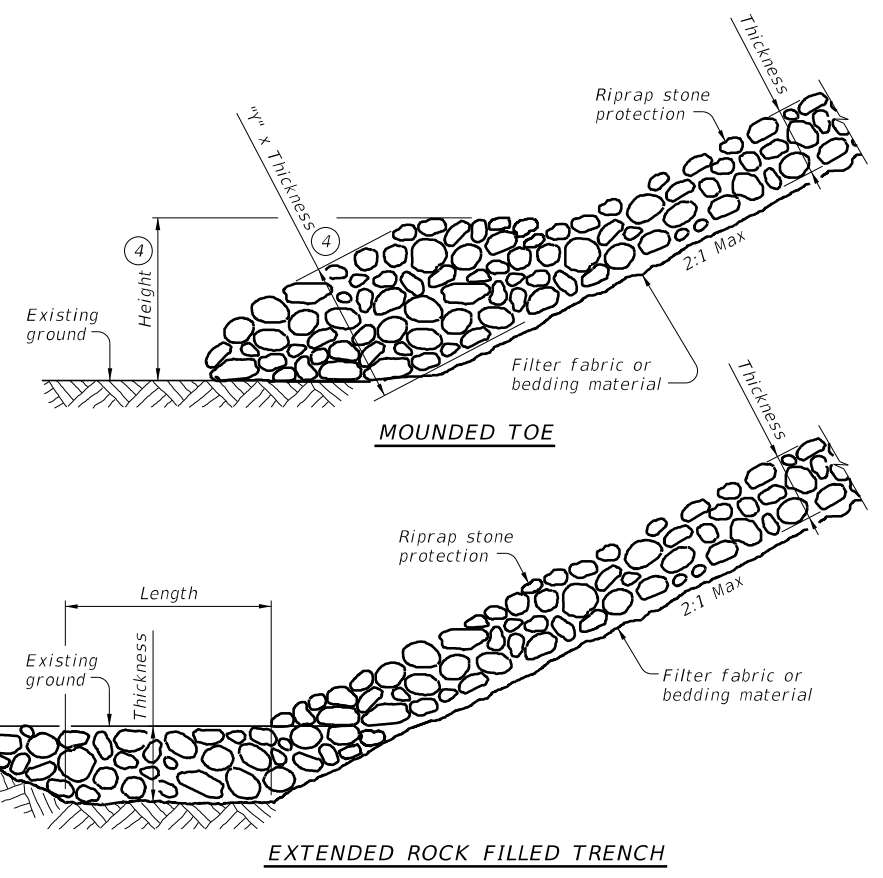


**FIGURE 2 ~ TYPE F STONE RIPRAP**  
dry or mortared

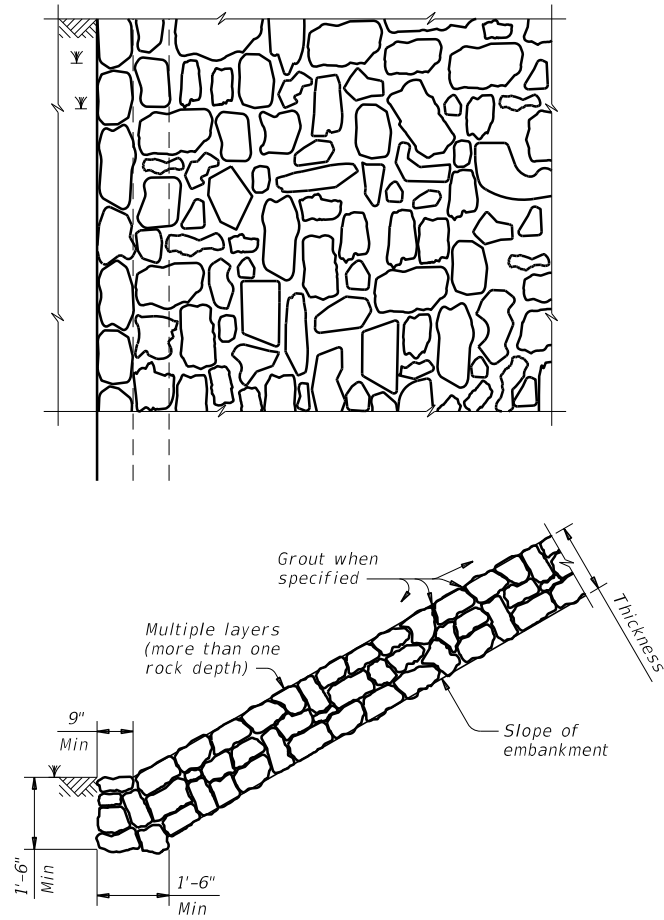


**FIGURE 3 ~ TYPE F STONE RIPRAP**  
grouted

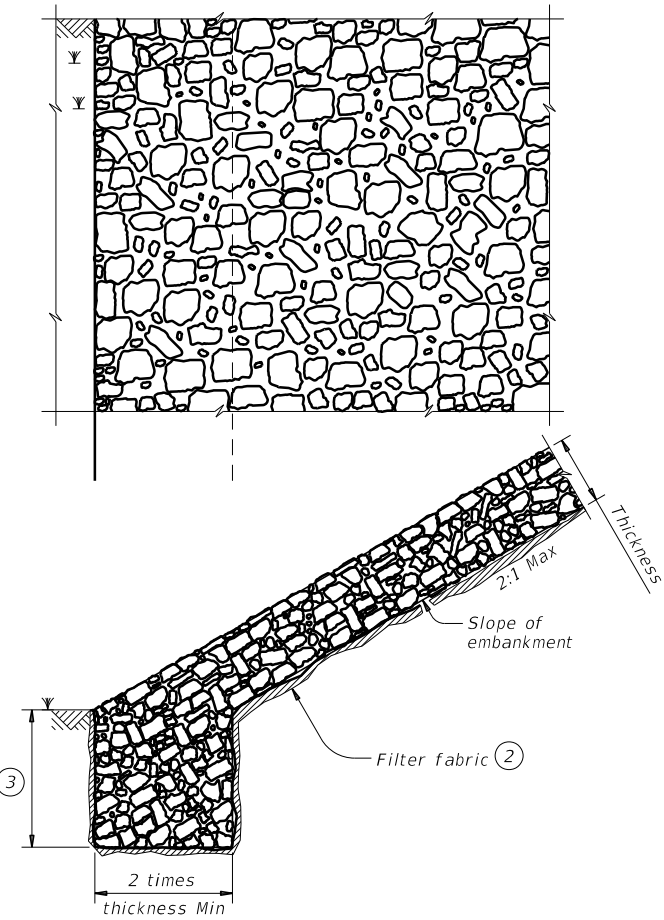
- ② Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.
- ③ Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.
- ④ "Y" and Height need to be defined. See layout or detail sheet for values if this option is used.
- ⑤ List Stone Protection as size (XX inch) and thickness (YY inch) on the layout.  
Example: Riprap (Stone Protection) XX inch, Thickness = YY inch.



**PROTECTION STONE RIPRAP TOE OPTIONS** ④ ⑤



**FIGURE 4 ~ COMMON STONE RIPRAP**  
dry or grouted

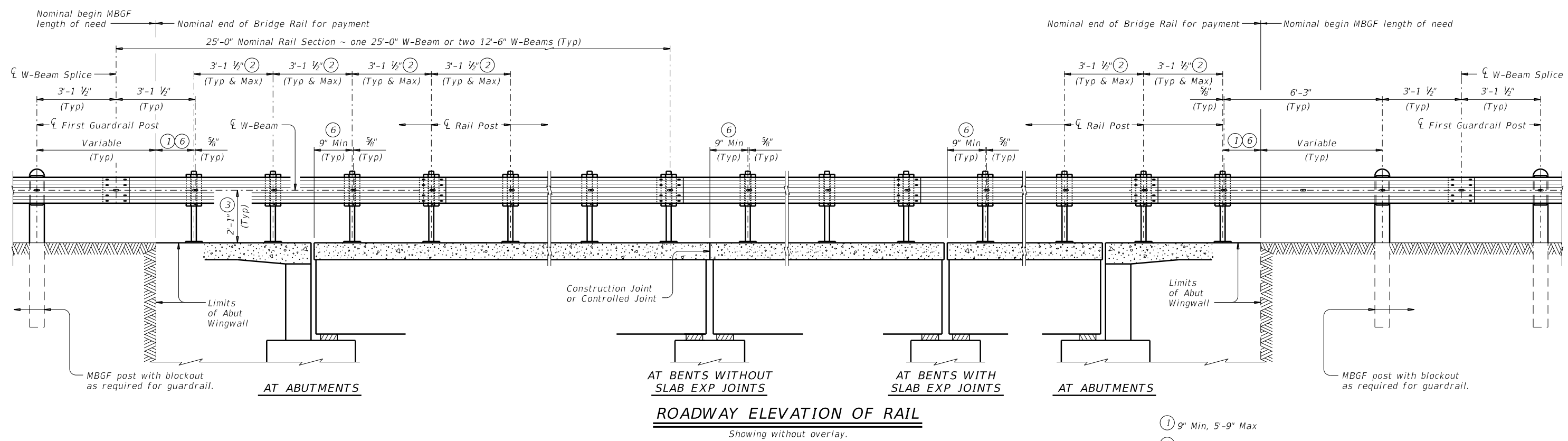


**FIGURE 5 ~ PROTECTION STONE RIPRAP** ⑤

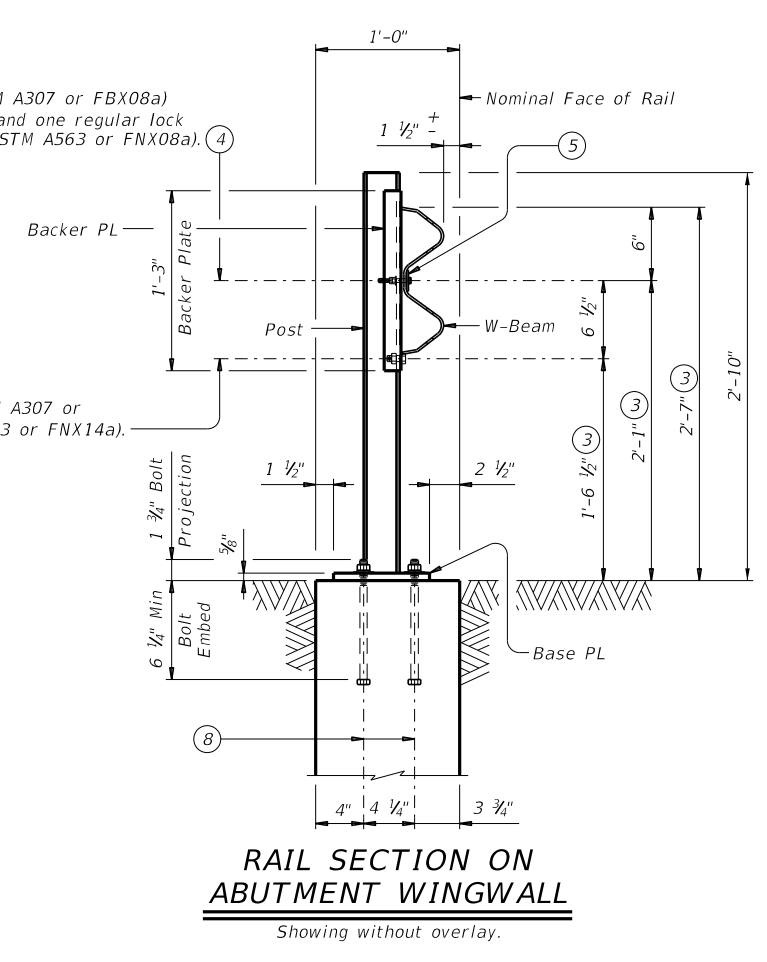
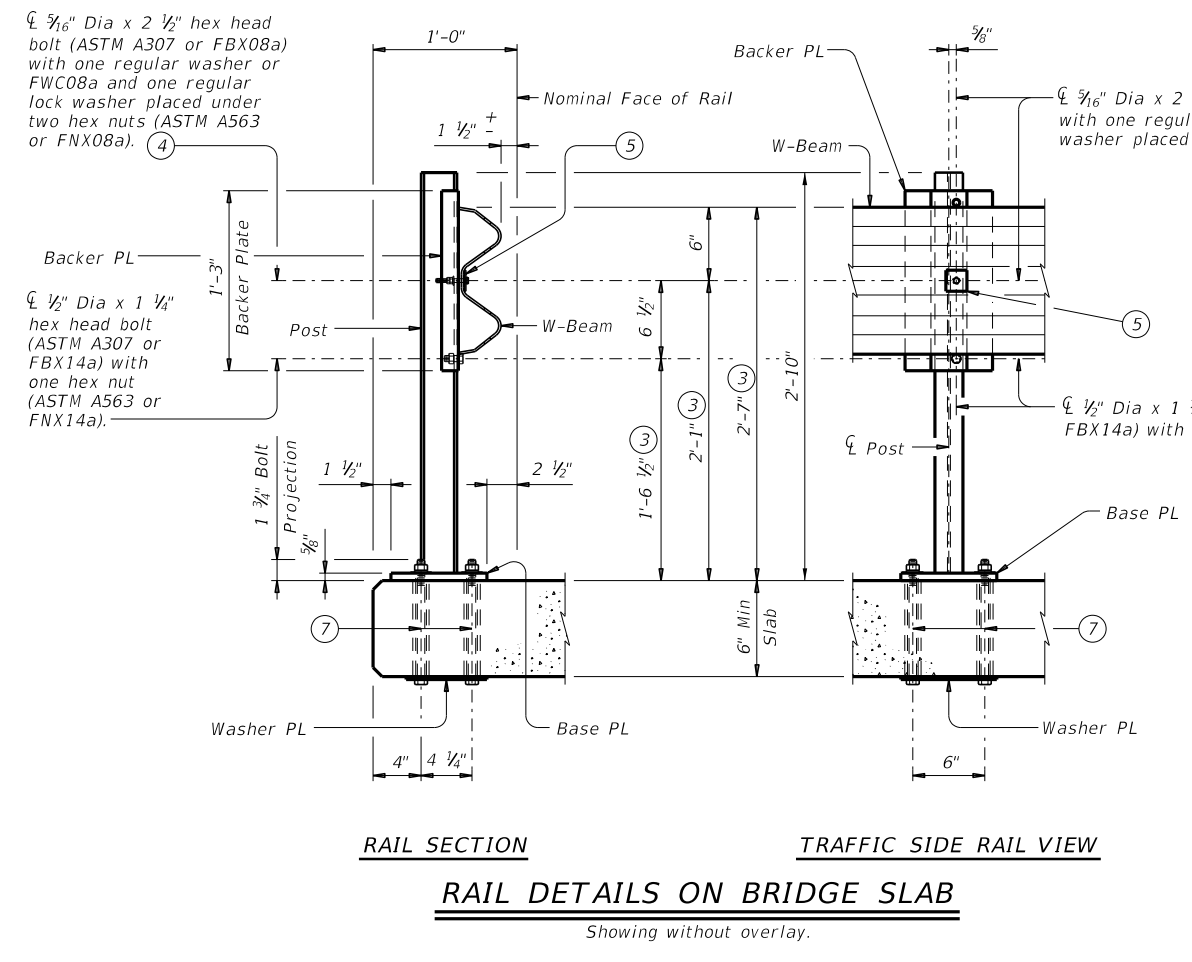
SHEET 2 OF 2

		<b>Bridge Division Standard</b>	
<b>STONE RIPRAP</b>			
<b>SRR</b>			
FILE: srrside1-19.dgn	DN: AES	CK: JGD	DW: BWH
©TxDOT April 2019	CONT SECT	JOB	HIGHWAY
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	DIST	COUNTY	SHEET NO.
	BRY	FREESTONE	66

DATE: 5/12/2023 11:35:47 AM  
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- ① 9" Min, 5'-9" Max
- ② Maintain 3'-1 1/2" Rail Post spacing wherever possible for use with nominal 25'-0" or 12'-6" W-Beam sections. Symmetry of post spacing on both sides and along the structure is not necessary.
- ③ Increase 2" for structures with overlay.
- ④ Tighten the first hex nut by hand until the top and bottom edges of the W-Beam engage the Backer Plate (Backer Plate should be snug against the post). Then tighten hex nut one revolution with wrench and secure with the second hex nut.
- ⑤ PL 1/8 x 1 3/4 x 1 3/4 with 5/8 Dia Hole centered in PL (ASTM A36). Square Guardrail Washer (FWR01).
- ⑥ The post nearest to a slab joint or end of structure may be shifted up to 9" in order to satisfy the minimum offset dimension. Drill a new 3/4" Dia hole in the centerline of W-beam for shifted post. Paint hole with two coats of zinc-rich paint conforming to the Item "Galvanizing". All other posts must remain on the typical spacing.
- ⑦ 5/8 Dia formed holes for 5/8 Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod. See "Cast-In-Place & Formed Hole Anchor Bolt Options".
- ⑧ 5/8 Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod. See "Cast-In-Place & Formed Hole Anchor Bolt Options".



SHEET 1 OF 2

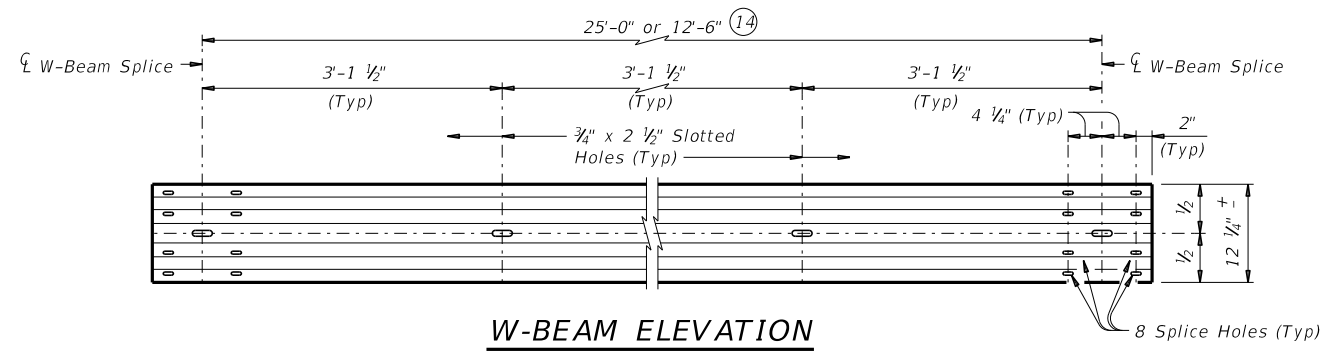
Bridge Division Standard

## TRAFFIC RAIL

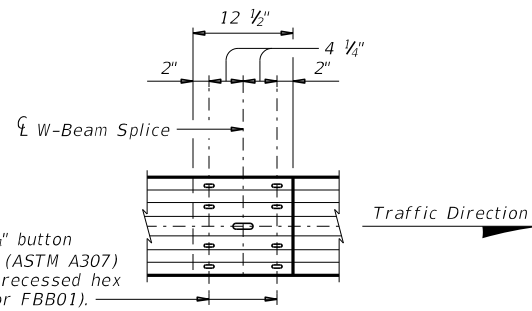
### TYPE T631

FILE: r1std038-20.dgn	DN: TxDOT	CK: AES	DW: JTR	CK: AES
©TxDOT September 2019	CONTRACT	SECTION	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
07-20: Allowing 9'-4 1/2" or 6'-3" W-Beam sections.	DISTRICT	COUNTY	SHEET NO.	
	BRY	FREESTONE	67	

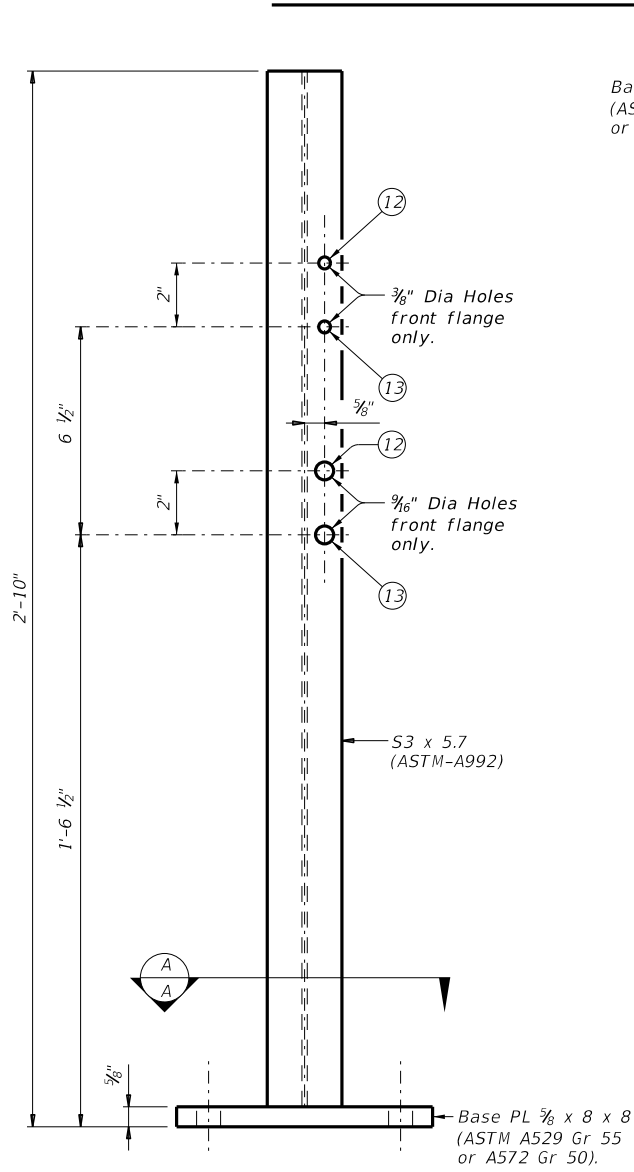
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 DISCLAIMER: This standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of metric units.



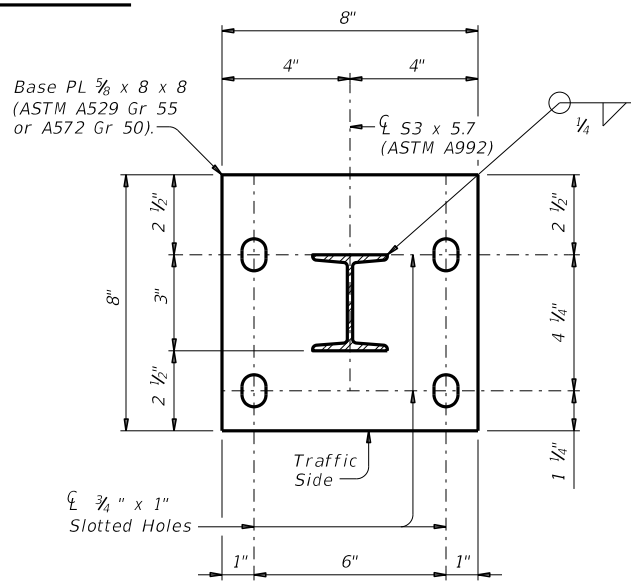
W-BEAM ELEVATION



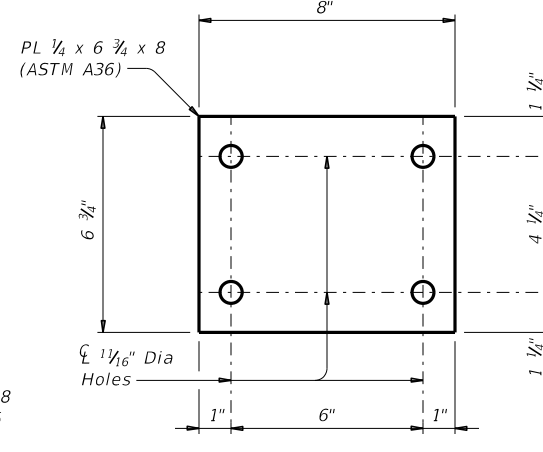
W-BEAM SPLICE ELEVATION



POST ELEVATION

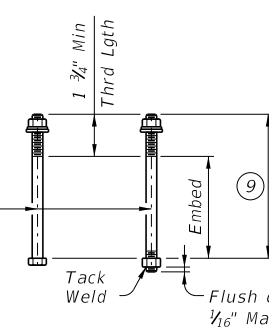


SECTION A-A



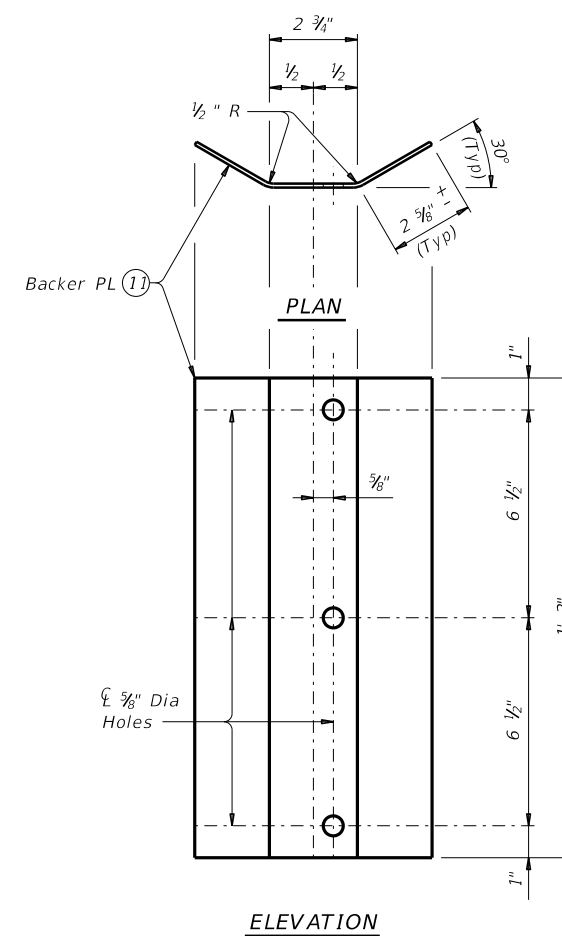
WASHER PLATE DETAIL

3/8" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ASTM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod.



CAST-IN-PLACE & FORMED HOLE ANCHOR BOLT OPTIONS (10)

- (9) See "Rail Details On Bridge Slab" and/or "Rail Section On Abutment Wingwall".
- (10) See "Material Notes" for anchor bolt information.
- (11) Backer PL 1/2 x 8 x 1'-3" (ASTM A1011 CS or SS Gr 33, or A1008 CS or SS Gr 33 (11 Gage acceptable)).
- (12) Used for structures with overlay.
- (13) Used for structures without overlay.
- (14) At the nominal end of the bridge rail for payment, one 9'-4 1/2" or 6'-3" W-beam section is permitted in order to achieve the required W-Beam splice location on the MBGF.



BACKER PLATE

**MBGF AND END TREATMENT NOTES:**  
 This traffic railing must be anchored by metal beam guard fence (MBGF) and guard fence end treatments. Determine MBGF length of need in accordance with the Roadway Design Manual, unless otherwise specified. The minimum MBGF length of need required for anchoring the railing is 25' of MBGF plus the appropriate end treatment.

**CONSTRUCTION NOTES:**  
 Face of rail post must be plumb unless otherwise approved by the Engineer. Post must be perpendicular to adjacent roadway grade. Use epoxy mortar under post base plates if gaps larger than 1/16" exist.  
 Fully anchored guardrail must be attached to each end of rail. A metal beam guard fence transition is not used with this rail.

At the Contractor's option anchor bolts may be an adhesive anchor system. See "Material Notes".  
 Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

It is recommended to show a Rail Layout with rail posts and W-beam splices. Fabricator must submit erection drawings to the Engineer for approval.  
 Round or chamfer exposed edges of rail post and backer plate to approximately 1/16" by grinding.  
 Shop drawings are not required for this rail.

**MATERIAL NOTES:**  
 Galvanize all steel components.  
 Anchor bolts for base plate must be 3/8" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Optional adhesive anchorage system must be 3/8" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 3/4". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing."

W-beam must 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" (Nominal) lengths and a single rail element of 9'-4 1/2" or 6'-3" (Nominal) length. W-Beam must have slotted holes at 3'-1 1/2".  
 Some part numbers from the "Task Force 13" Guide to Standardized Highway Barrier Hardware have been furnished for quick reference.

**GENERAL NOTES:**  
 This railing has been successfully evaluated by full-scale crash test to meet MASH TL-3 criteria. This railing can be used for speeds of 50 mph and greater.  
 This rail is designed to deflect approximately 4' to 6" as it contains and redirects the errant vehicle. This rail may not be installed on top of or behind curbs that project above finished grade, on bridges with expansion joints providing more than 5" movement, on retaining walls, or on grade separations and interchanges.  
 Repairs to impact-damaged post and base plate unit are not permitted. Replace all impact-damaged posts with a new post and base plate unit.  
 Average weight of railing with no overlay: 20 plf total.

SHEET 2 OF 2

		<b>Bridge Division Standard</b>		
				<h1>TRAFFIC RAIL</h1> <h2>TYPE T631</h2>
FILE: r1std038-20.dgn	DN: TxDOT	CK: AES	DW: JTR	CK: AES
©TxDOT September 2019	CONTRACT	SECTION	JOB	HIGHWAY
REVISIONS	0917	20	046	CR 481
07-20: Allowing 9'-4 1/2" or 6'-3" W-Beam sections.	DIST	COUNTY	SHEET NO.	
	BRY	FREESTONE	68	

**STORMWATER POLLUTION PREVENTION PLAN (SWP3):**

This SWP3 has been developed in accordance with TxDOT policy for projects disturbing less than 1 acre of soil, and not part of a larger common plan of development.

For all projects with any soil disturbing activities, TxDOT will maintain a SWP3 with all pertinent records, correspondence, environmental documents, etc. at the project field office. If no field office is available, then this SWP3 shall be kept at the appropriate TxDOT Area Office.

This SWP3 is consistent with requirements specified in applicable stormwater plans, and the project's environmental permits, issues, and commitments (EPICs).

**1.0 SITE/PROJECT DESCRIPTION**

**1.1 PROJECT CONTROL SECTION JOB (CSJ):**  
0917-20-046

**1.2 PROJECT LIMITS:**

From: CR 481 AT UPPER KEECHI CREEK

To: STR # 17-082-0-AA04-81-102

**1.3 PROJECT COORDINATES:**

BEGIN: (Lat) +31.649368, (Long) -96.123418

END: (Lat) \_\_\_\_\_, (Long) \_\_\_\_\_

**1.4 TOTAL PROJECT AREA (Acres):** 0.41 AC

**1.5 TOTAL AREA TO BE DISTURBED (Acres):** 0.37 AC (100%)

**1.6 NATURE OF CONSTRUCTION ACTIVITY:**

FOR THE CONSTRUCTION OF BRIDGE REPLACEMENT CONSISTING OF REPLACING BRIDGE AND APPROACHES, GRADING, ACP BASE AND SURFACE, MBGF

**1.7 MAJOR SOIL TYPES:**

Soil Type	Description
Edge Fine Sandy Loam, 1 to 5% slopes	90% Edge and similar soils, well drained, high rate of runoff
Edge Fine Sandy Loam, 5 to 12% slopes	85% Edge and similar soils, well drained, very high rate of runoff

**1.8 PROJECT SPECIFIC LOCATIONS (PSLs):**

PSLs must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. PSLs may be identified during preconstruction meetings or during the construction process. Please choose from the options below:

- PSLs determined during preconstruction meeting
- PSLs determined during construction
- No PSLs planned for construction

Type	Sheet #s

All off-ROW PSLs required by the Contractor are the Contractor's responsibility. The Contractor shall secure all permits required by local, state, federal laws for off-ROW PSLs. The contractor shall provide diagrams, areas of disturbance, acreage, and BMPs for all off-ROW PSLs within one mile of the project.

**1.9 CONSTRUCTION ACTIVITIES:**

(Use the following list as a starting point when developing the Construction Activity Schedule and Ceasing Record in Attachment 2.3.)

- Mobilization
- Install sediment and erosion controls
- Blade existing topsoil into windrows, prep ROW, clear and grub
- Remove existing pavement
- Grading operations, excavation, and embankment
- Excavate and prepare subgrade for proposed pavement widening
- Remove existing culverts, safety end treatments (SETs)
- Remove existing metal beam guard fence (MBGF), bridge rail
- Install proposed pavement per plans
- Install culverts, culvert extensions, SETs
- Install mow strip, MBGF, bridge rail
- Place flex base
- Rework slopes, grade ditches
- Blade windrowed material back across slopes
- Revegetation of unpaved areas
- Achieve site stabilization and remove sediment and erosion control measures

Other: \_\_\_\_\_  
 Other: \_\_\_\_\_  
 Other: \_\_\_\_\_

**1.10 POTENTIAL POLLUTANTS AND SOURCES:**

- Sediment laden stormwater from stormwater conveyance over disturbed area
- Fuels, oils, and lubricants from construction vehicles, equipment, and storage
- Solvents, paints, adhesives, etc. from various construction activities
- Transported soils from offsite vehicle tracking
- Construction debris and waste from various construction activities
- Contaminated water from excavation or dewatering pump-out water
- Sanitary waste from onsite restroom facilities
- Trash from various construction activities/receptacles
- Long-term stockpiles of material and waste
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_

**1.11 RECEIVING WATERS:**

Receiving waters must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. Include Segment # for receiving waters.

Tributaries	Classified Waterbody
UPPER KEECHI CREEK	CREEK
TRINITY RIVER	RIVER

\* Add (\*) for impaired waterbodies with pollutant in ( ).

**1.12 ROLES AND RESPONSIBILITIES: TxDOT**

- Development of plans and specifications
- Perform SWP3 inspections
- Maintain SWP3 records and update to reflect daily operations
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_

**1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR**

- Day To Day Operational Control
- Maintain schedule of major construction activities
- Install, maintain and modify BMPs
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_



**STORMWATER POLLUTION PREVENTION PLAN (SWP3) (Less Than 1 Acre)**

FED. RD. DIV. NO.	PROJECT NO.			SHEET NO.
6	BR 2023(135)			69
STATE	STATE DIST.	COUNTY		
TEXAS	BRY	FREESTONE		
CONT.	SECT.	JOB	HIGHWAY NO.	
0917	20	046	CR 481	



**STORMWATER POLLUTION PREVENTION PLAN (SWP3):**

**2.0 BEST MANAGEMENT PRACTICES (BMPs) AND CONTROLS, INSPECTION, AND MAINTENANCE**

The Contractor shall be the responsible party for implementing the BMPs described herein and for complying with the SWP3 for control of erosion and sedimentation during day-to-day operations. The Contractor shall implement changes to this SWP3 approved by TxDOT within the times specified in this SWP3 or the CGP.

**2.1 EROSION CONTROL AND SOIL STABILIZATION BMPs:**

**T / P**

- Protection of Existing Vegetation
- Vegetated Buffer Zones
- Soil Retention Blankets
- Geotextiles
- Mulching/ Hydromulching
- Soil Surface Treatments
- Temporary Seeding
- Permanent Planting, Sodding or Seeding
- Biodegradable Erosion Control Logs
- Rock Filter Dams/ Rock Check Dams
- Vertical Tracking
- Interceptor Swale
- Riprap
- Diversion Dike
- Temporary Pipe Slope Drain
- Embankment for Erosion Control
- Paved Flumes
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_

**2.2 SEDIMENT CONTROL BMPs:**

**T / P**

- Biodegradable Erosion Control Logs
- Dewatering Controls
- Inlet Protection
- Rock Filter Dams/ Rock Check Dams
- Sandbag Berms
- Sediment Control Fence
- Stabilized Construction Exit
- Floating Turbidity Barrier
- Vegetated Buffer Zones
- Vegetated Filter Strips
- Other: STONE PROTECTION RIPRAP
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

**2.3 PERMANENT CONTROLS:**

(Coordinate post-construction BMPs with appropriate TxDOT maintenance sections.)

BMPs To Be Left In Place Post Construction:

Type	Stationing	
	From	To

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

**2.4 OFFSITE VEHICLE TRACKING CONTROLS:**

- Excess dirt/mud on road removed daily
- Haul roads dampened for dust control
- Loaded haul trucks to be covered with tarpaulin
- Stabilized construction exit
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_

**2.5 POLLUTION PREVENTION MEASURES:**

- Chemical Management
- Concrete and Materials Waste Management
- Debris and Trash Management
- Dust Control
- Sanitary Facilities
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_
- Other: \_\_\_\_\_

**2.6 VEGETATED BUFFER ZONES:**

Natural vegetated buffers shall be maintained as feasible to protect adjacent surface waters. If vegetated natural buffer zones are not feasible due to site geometry, the appropriate additional sediment control measures have been incorporated into this SWP3.

Type	Stationing	
	From	To

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

**2.7 ALLOWABLE NON-STORMWATER DISCHARGES:**

- Fire hydrant flushings
- Irrigation drainage
- Pavement washwater (where spills or leaks have not occurred, and detergents are not used)
- Potable water sources
- Springs
- Uncontaminated groundwater
- Water used to wash vehicles or control dust
- Other allowable non-stormwater discharges as allowed by TPDES GP TXR150000.

**2.8 INSPECTIONS:**

All disturbed areas and erosion and sediment control devices shall be inspected at least once every seven (7) days. Inspections shall be performed by TxDOT as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.3 of this SWP3 .

**2.9 MAINTENANCE:**

Control measures shall be properly installed according to specifications. If it is determined that a BMP or control measure is not operating effectively, maintenance must be accomplished as soon as possible and before the next anticipated rain event, but in no case later than 7 calendar days after being able to access the site. Maintenance shall be performed by the Contractor as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.3 of this SWP3.



**STORMWATER POLLUTION PREVENTION PLAN (SWP3) (Less Than 1 Acre)**

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	BR 2023(135)		70
STATE	STATE DIST.	COUNTY	
TEXAS	BRY	FREESTONE	
CONT.	SECT.	JOB	HIGHWAY NO.
0917	20	046	CR 481

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FILENAME: p:\Project\Wise\AMER\jacobs.com\jacobs\_US\_B\_L\_SSA\Documents\WJ\XN4000\_BRY\_Bridge\_Program\WJ\XN4000\_91720046\_CR481\700\_CADD\SH\TRD\WV\091720046\_CR481\_Upper\_Keechi\_Creek\EPIC\_11102022.dgn

REV DATE: 12-6-2022  
 CSJ: 0917-20-046

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

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

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

1.  
2.
- No Action Required       Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

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

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

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

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

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

1. Upper Keechi Creek - Sta. 52+10
- 2.
- 3.
- 4.

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

Best Management Practices:

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

**III. CULTURAL RESOURCES**

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

- No Action Required       Required Action

Action No.

- 1.
- 2.
- 3.

**IV. VEGETATION RESOURCES**

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

- No Action Required       Required Action

Action No.

1. Limit the clearing of vegetation and topsoil to only the areas needed to accomplish the project or activity.
2. Re-vegetation of disturbed areas in compliance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping. Re-vegetation efforts would provide appropriate and sustainable cover to prevent erosion and siltation.

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

- No Action Required       Required Action

Action No.

- 1.
- 2.

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

**LIST OF ABBREVIATIONS**

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

**VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES**

General (applies to all projects):

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

Contact the Engineer if any of the following are detected:

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

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

- Yes       No

If "No", then no further action is required. If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

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

- Yes       No

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

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

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

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

- No Action Required       Required Action

Action No.

- 1.
- 2.
- 3.

**VII. OTHER ENVIRONMENTAL ISSUES**

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

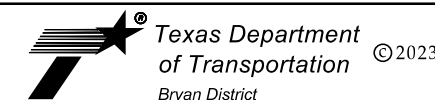
- No Action Required       Required Action

Action No.

- 1.
- 2.
- 3.

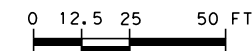
PRINT DATE	REVISION DATE
5/17/2023	

**Jacobs** 2705 BEE CAVE RD, SUITE 300  
AUSTIN TX 78746  
FIRM REGISTRATION F-2966



**ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS (EPIC) CR 481**

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	71



**LEGEND**

- DIRECTION OF FLOW
- TYPE 2 ROCK FILTER DAM
- SEDIMENT CONTROL FENCE
- SEEDING/TOPSOIL AREA
- EXIST CONTOUR

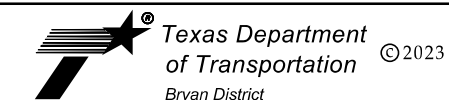
**NOTES:**

1. EROSION CONTROL DEVICE INSTALLATION, MAINTENANCE AND REMOVAL SHALL BE IN ACCORDANCE WITH TXDOT STANDARDS FOR EROSION CONTROL.
2. EROSION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO THE START OF ANY CONSTRUCTION ACTIVITY AND SHALL REMAIN IN PLACE UNTIL CONSTRUCTION IS COMPLETE.
3. LOCATIONS OF EROSION CONTROL DEVICES ARE APPROXIMATIONS. ACTUAL LOCATIONS TO BE DETERMINED IN THE FIELD BY THE ENGINEER.
4. OVERALL SW3P INSTALLATION SHALL FOLLOW TCP PHASING AND CONSTRUCTION SEQUENCE.



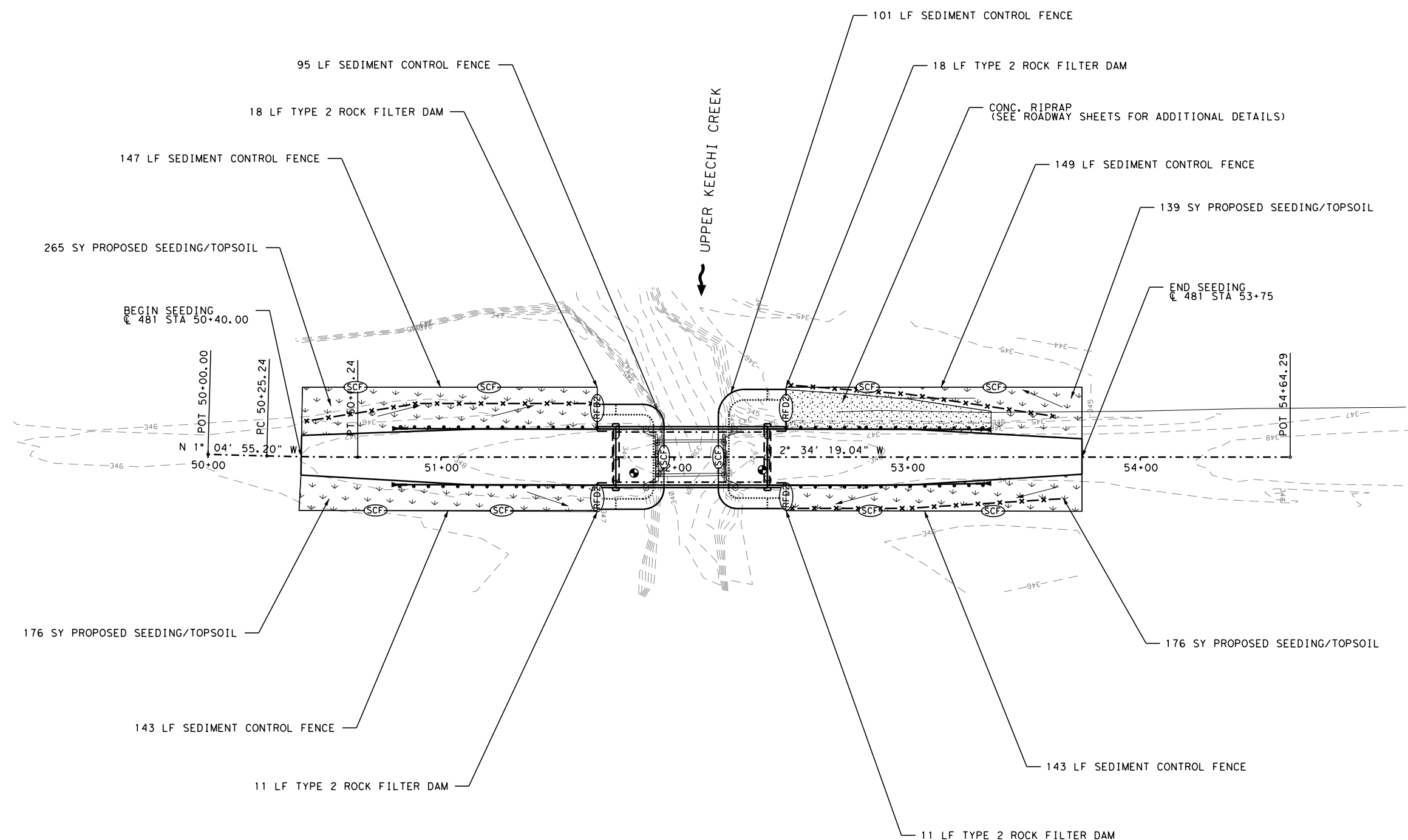
PRINT DATE	REVISION DATE
5/11/2023	

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AUSTIN TX 78746  
FIRM REGISTRATION F-2966



**SW3P LAYOUT**  
CR 481

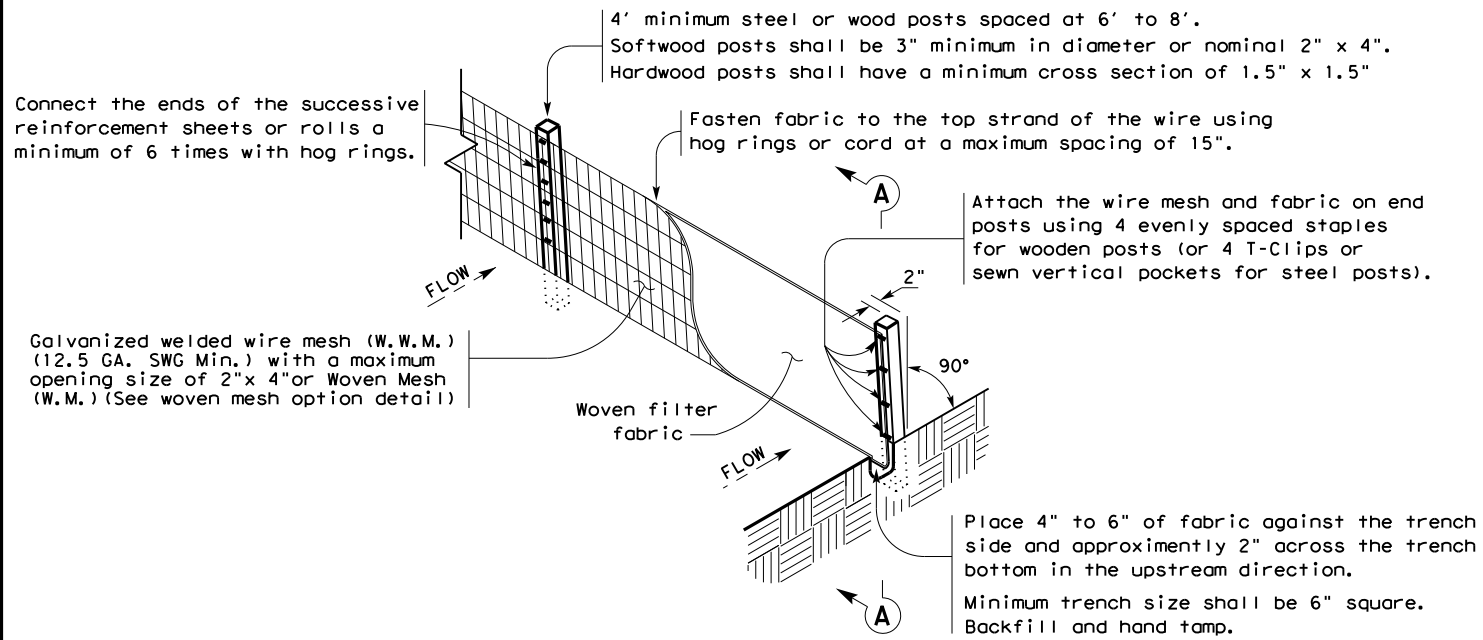
FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER	
6	BR 2023(135)	CR 481	
STATE	DISTRICT	COUNTY	
TEXAS	BRY	FREESTONE	
CONTROL	SECTION	JOB	SHEET NO.
0917	20	046	72



REV DATE: 12-6-2022  
 CSJ: 0917-20-046  
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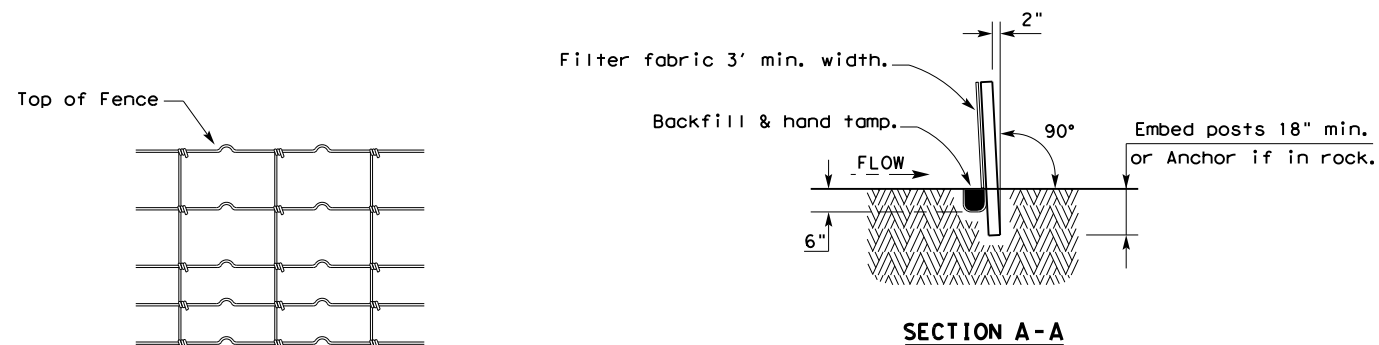
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DATE  
FILE



**TEMPORARY SEDIMENT CONTROL FENCE**

SCF



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

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

**SEDIMENT CONTROL FENCE USAGE GUIDELINES**

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

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

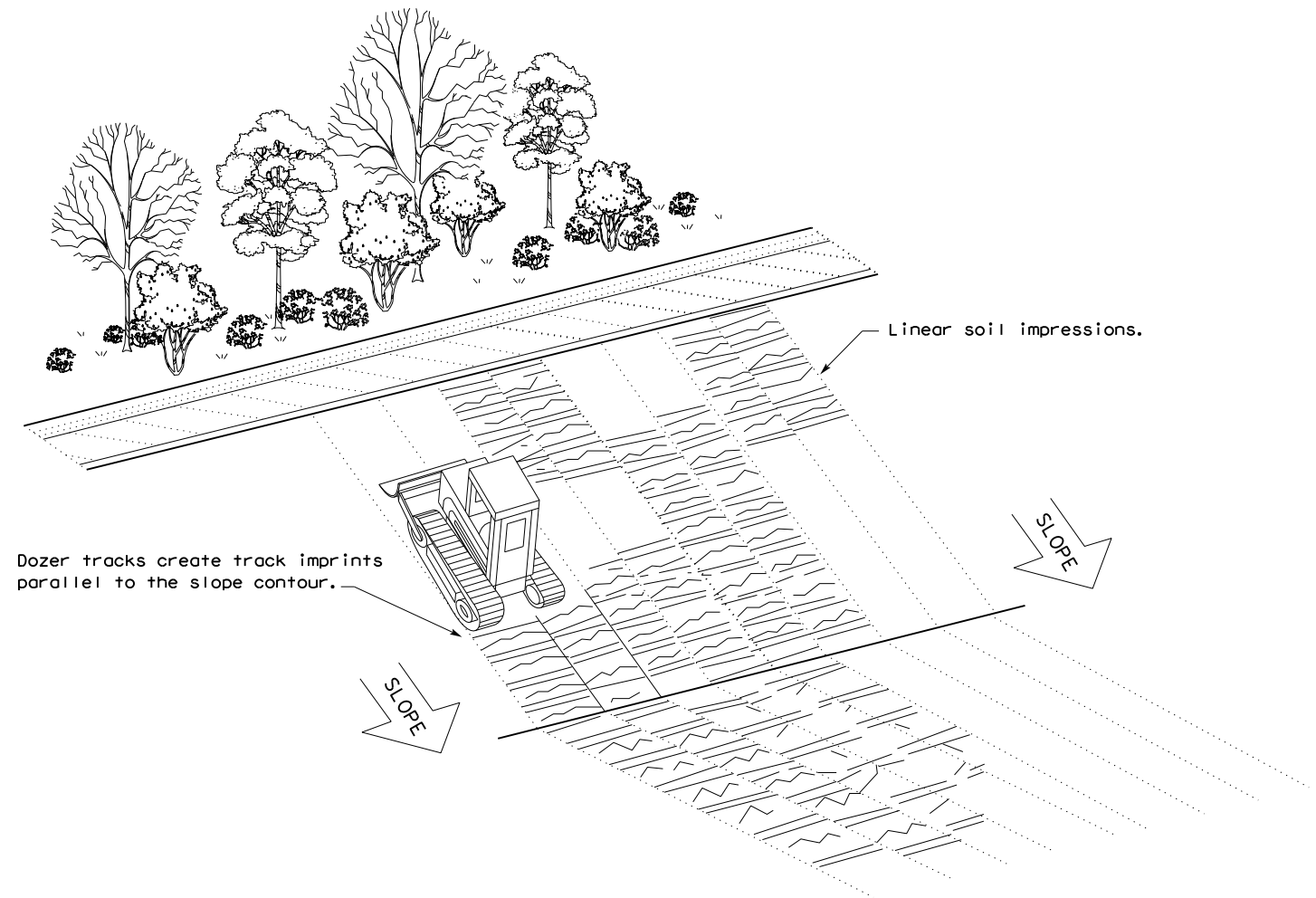
**LEGEND**

Sediment Control Fence

SCF

**GENERAL NOTES**

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

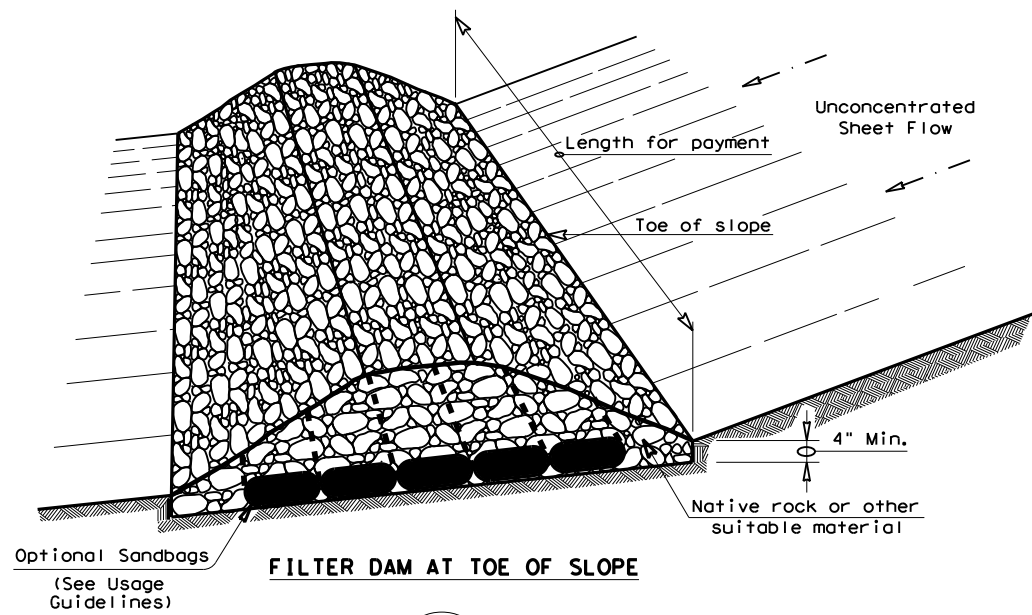


**VERTICAL TRACKING**

		Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE &amp; VERTICAL TRACKING EC(1)-16</b>			
FILE: ec116	DN: TxDOT	CK: KM	DW: VP
© TxDOT: JULY 2016	CONT	SECT	JOB
REVISIONS		HIGHWAY	
DIST		COUNTY	
			SHEET NO.
			73

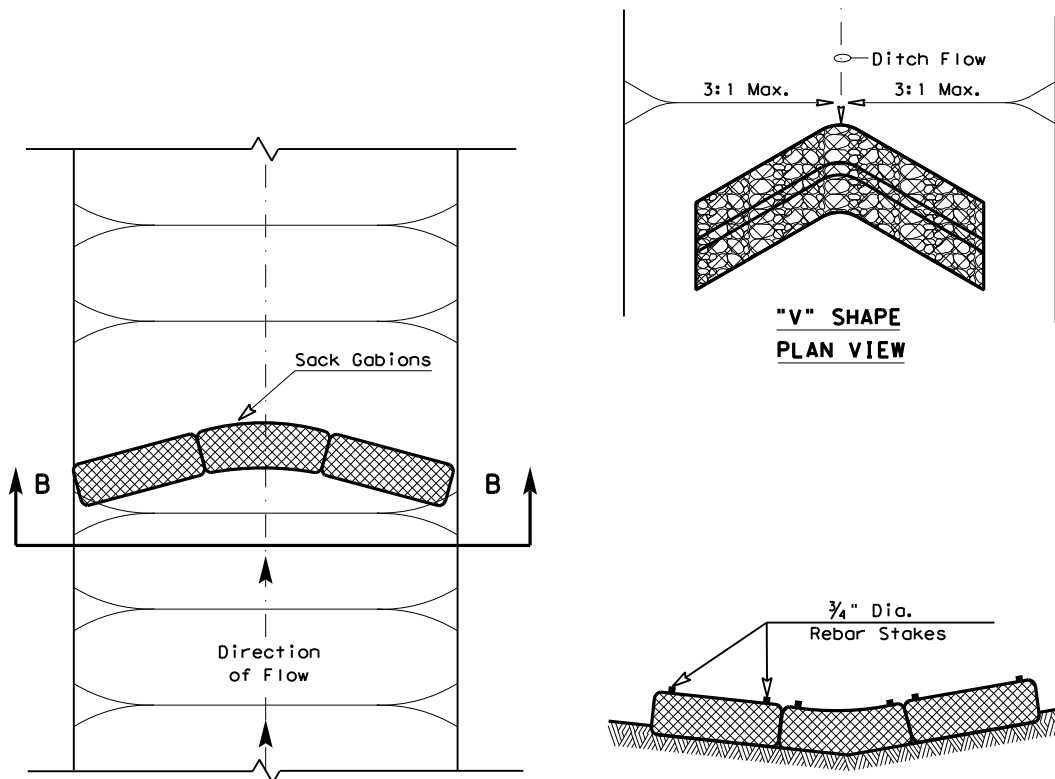
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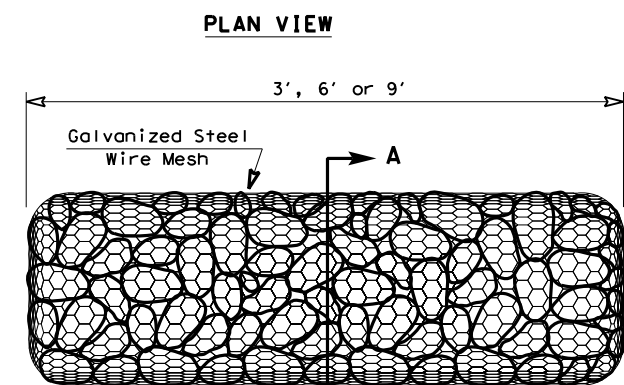


**FILTER DAM AT TOE OF SLOPE**

(RFD1)

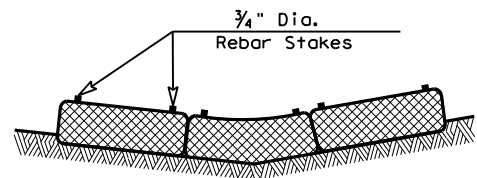


**"V" SHAPE PLAN VIEW**

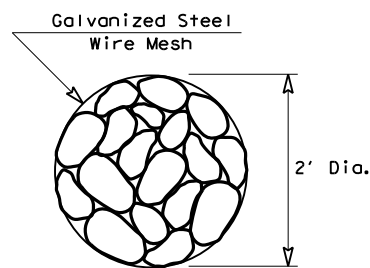


**TYPE 4 (SACK GABIONS)**

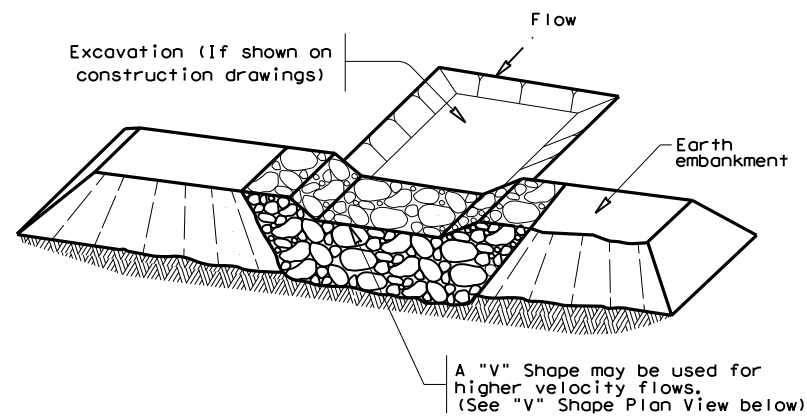
(RFD4)



**SECTION B-B**

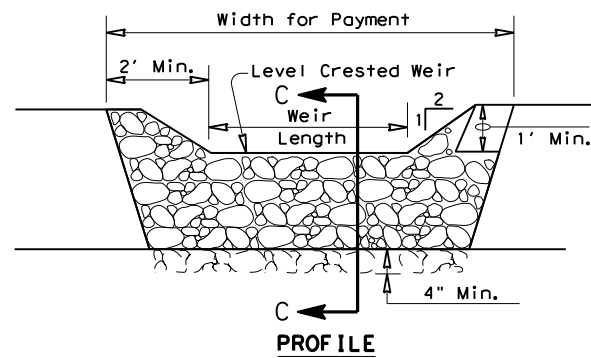


**SECTION A-A**

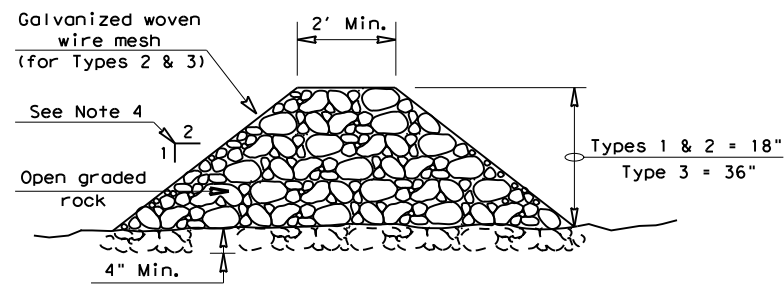


**FILTER DAM AT SEDIMENT TRAP**

(RFD2) OR (RFD1)



**PROFILE**



**SECTION C-C**

**ROCK FILTER DAM USAGE GUIDELINES**

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT<sup>2</sup> of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

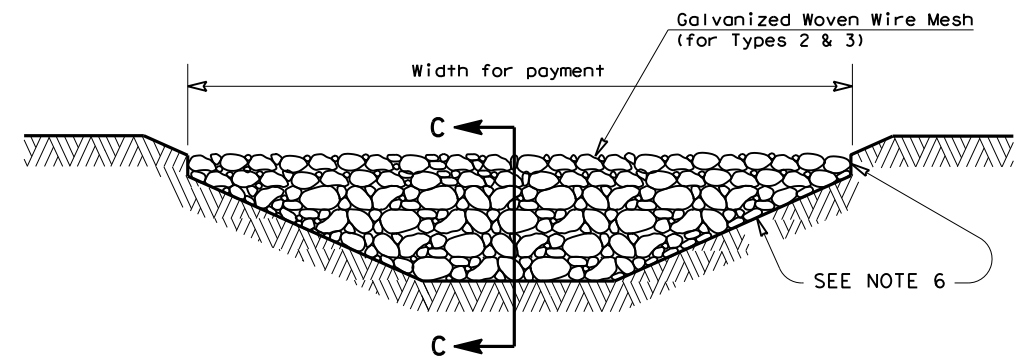
**Type 1 (18" high with no wire mesh) (3" to 6" aggregate):** Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximately 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

**Type 2 (18" high with wire mesh) (3" to 6" aggregate):** Type 2 may be used in ditches and at dike or swale outlets.

**Type 3 (36" high with wire mesh) (4" to 8" aggregate):** Type 3 may be used in stream flow and should be secured to the stream bed.

**Type 4 (Sack gabions) (3" to 6" aggregate):** Type 4 May be used in ditches and smaller channels to form an erosion control dam.

**Type 5:** Provide rock filter dams as shown on plans.



**FILTER DAM AT CHANNEL SECTIONS**

(RFD3) OR (RFD2) OR (RFD1)

**GENERAL NOTES**

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with 3/4" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 1/2" x 3 1/4".
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

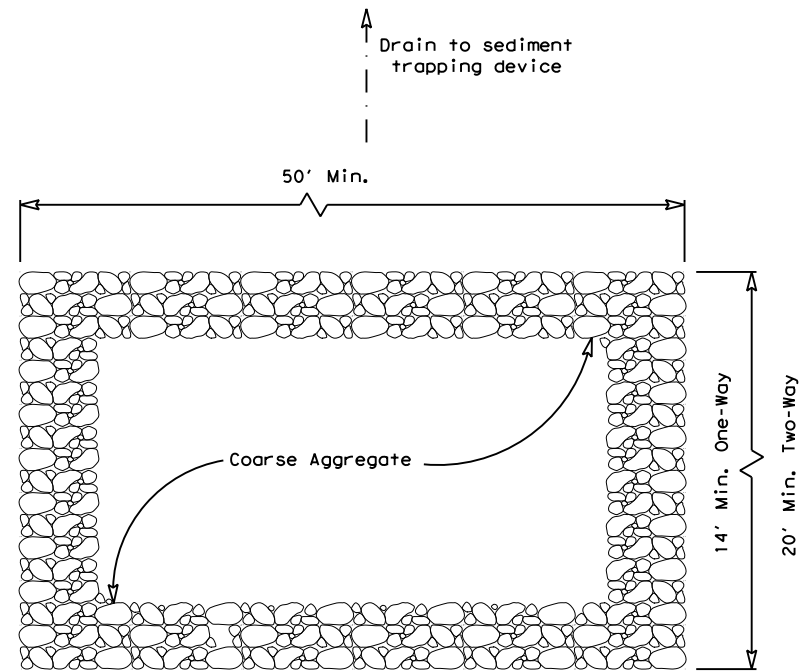
**PLAN SHEET LEGEND**

- Type 1 Rock Filter Dam (RFD1)
- Type 2 Rock Filter Dam (RFD2)
- Type 3 Rock Filter Dam (RFD3)
- Type 4 Rock Filter Dam (RFD4)

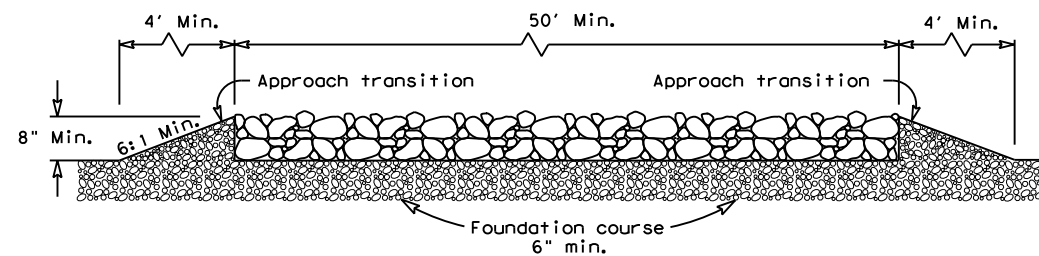
		Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES</b> <b>ROCK FILTER DAMS</b> <b>EC(2) - 16</b>			
FILE: ec216	DN: TxDOT	CK: KM	DW: VP
© TxDOT: JULY 2016	CONT	SECT	JOB
REVISIONS			HIGHWAY
	DIST	COUNTY	SHEET NO.
			74

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DATE: \$DATES  
FILE: \$FILES



PLAN VIEW

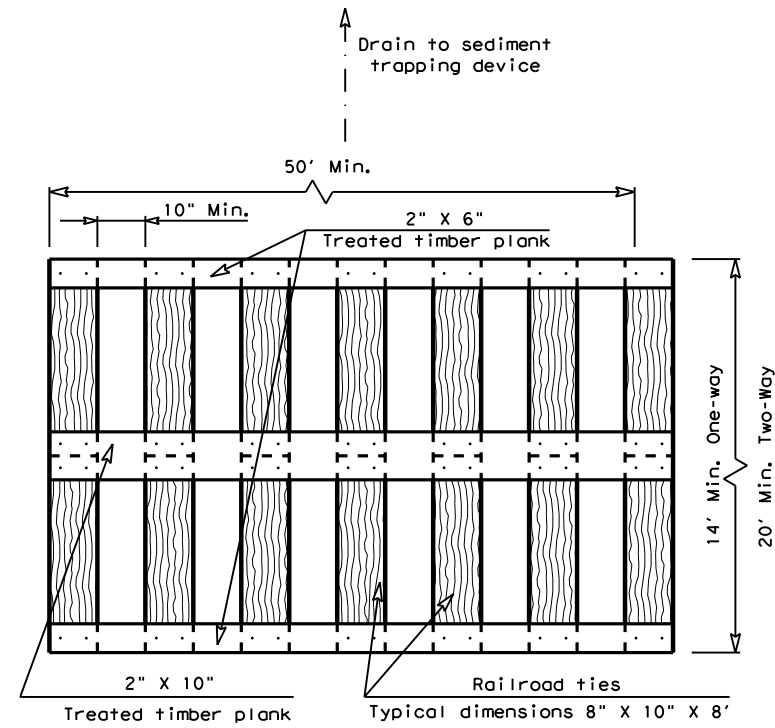


ELEVATION VIEW

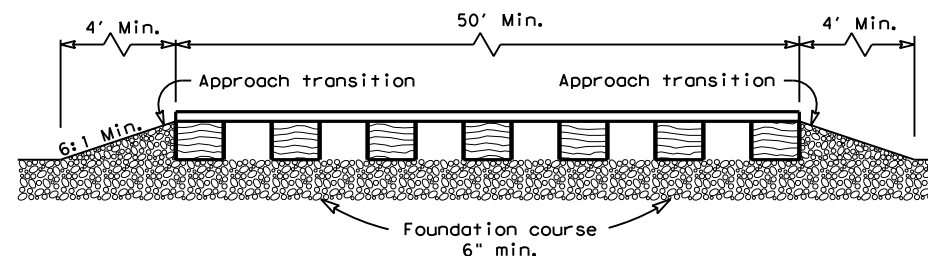
CONSTRUCTION EXIT (TYPE 1)  
ROCK CONSTRUCTION (LONG TERM)

**GENERAL NOTES (TYPE 1)**

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other materials approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
7. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.



PLAN VIEW

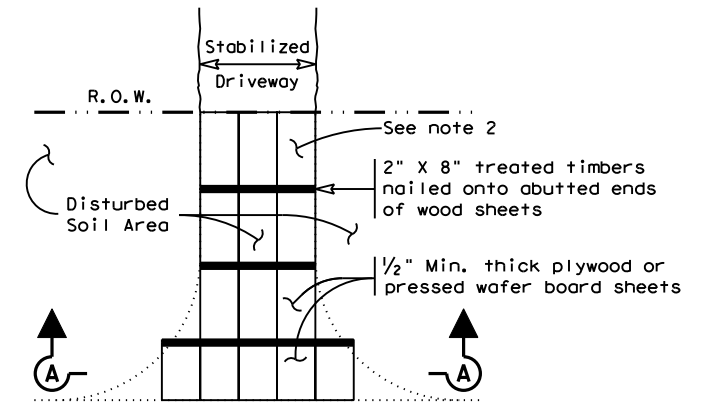


ELEVATION VIEW

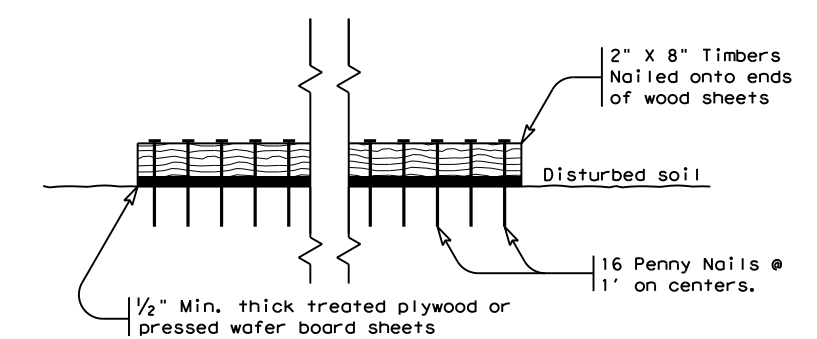
CONSTRUCTION EXIT (TYPE 2)  
TIMBER CONSTRUCTION (LONG TERM)

**GENERAL NOTES (TYPE 2)**

1. The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50'.
2. The treated timber planks shall be attached to the railroad ties with 1/2" x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
8. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.



PLAN VIEW



SECTION A-A  
CONSTRUCTION EXIT (TYPE 3)  
SHORT TERM

**GENERAL NOTES (TYPE 3)**

1. The length of the type 3 construction exit shall be as shown on the plans, or as directed by the Engineer.
2. The type 3 construction exit may be constructed from open graded crushed stone with a size of two to four inches spread a min. of 4" thick to the limits shown on the plans.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

		<i>Design Division Standard</i>	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES</b> <b>CONSTRUCTION EXITS</b> <b>EC(3)-16</b>			
FILE: ec316	DN: TxDOT	CK: KM	DW: VP
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			75