

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	SHEET NO.
KHA	6	STP 2021 (288)	1
GRAPHICS			
KHA	STATE	STATE DIST.	COUNTY
CHECKED	TEXAS	02	PARKER
KHA	CONT.	SECT.	JOB
CHECKED	0313	07	020
KHA			FM 51

INDEX OF SHEETS

SEE SHEET 2 FOR INDEX OF SHEETS

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

CSJ: 0313-07-020

FEDERAL AID PROJECT # STP 2021 (288)
FM 51
PARKER COUNTY

LIMITS: FROM JUNCTION SH 171 SOUTH TO HOOD COUNTY LINE

ROADWAY LENGTH= 54256 FT. = 10.276 MI.
BRIDGE LENGTH= 133 FT. = 0.025 MI.
TOTAL LENGTH= 54389 FT. = 10.301 MI.

TYPE: FOR THE CONSTRUCTION OF CULVERT AND STORM DRAINAGE WORK
CONSISTING OF: MULTI LOCATION CULVERT REPLACEMENT & BRIDGE GUARDRAIL UPGRADE

FINAL PLANS

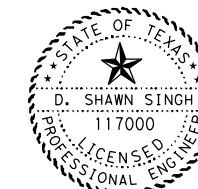
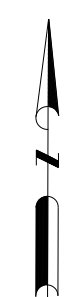
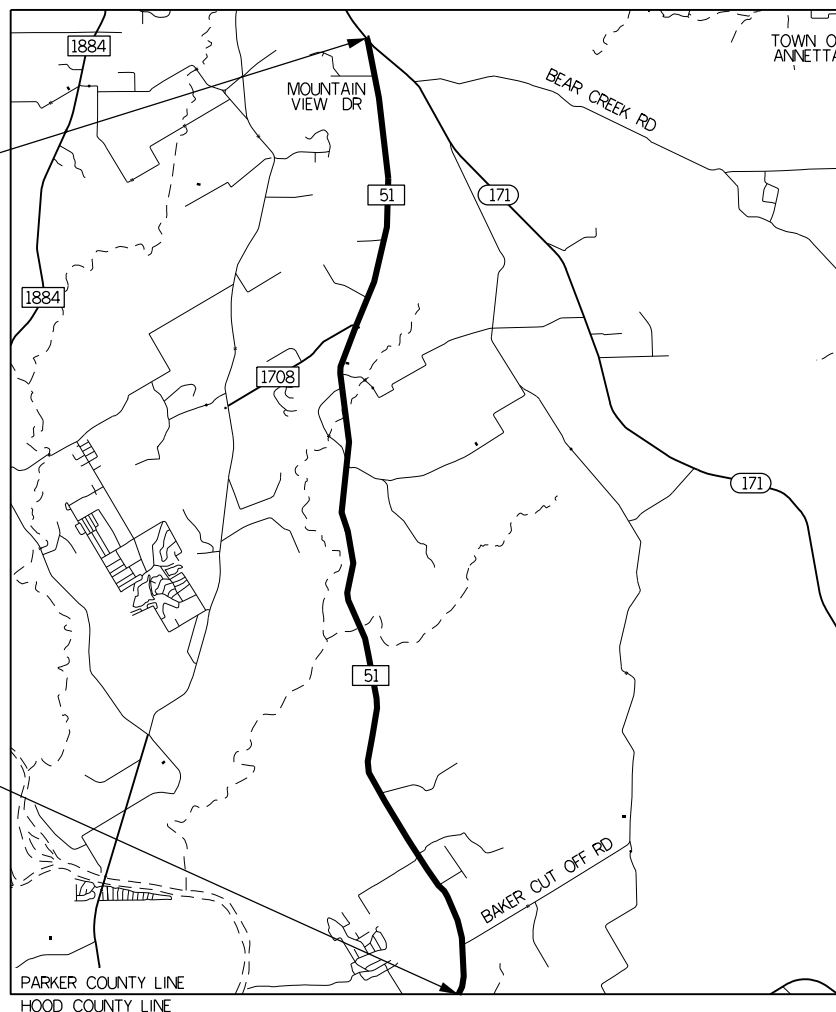
NAME OF CONTRACTOR: _____
DATE OF LETTING: _____
DATE WORK BEGAN: _____
DATE WORK COMPLETED: _____
DATE WORK ACCEPTED: _____

FM 51
DESIGN SPEED = 40 MPH
FUNCTIONAL CLASSIFICATION: RURAL ARTERIAL
ADT (2020) = 6,195
ADT (2040) = 11,190

TDLR INSPECTION NOT REQUIRED

BEGIN PROJECT
BEGIN CSJ: 0313-07-020
Q FM 51 STA 0+00.00
RM: 299+0.699

END PROJECT
END CSJ: 0313-07-020
Q FM 51 STA 543+89.00
RM: 310+0.00



SUBMITTED FOR LETTING: 10/19/2020

D. Singh
PROJECT MANAGER



DocuSigned by: 10/21/2020
D. Singh
AREA ENGINEER
2F552E37025E4A8...

RECOMMENDED FOR LETTING: 10/24/2020
Carl Johnson
DISTRICT DIRECTOR OF TRANSPORTATION
PLANNING AND DEVELOPMENT

APPROVED FOR LETTING: 10/29/2020
Carl Johnson
DISTRICT ENGINEER
2FE361390654708

EXCEPTIONS: NONE
EQUATIONS: NONE
RAILROAD CROSSINGS: NONE

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, MAY 2012).

THE CONTRACTOR SHALL PROVIDE AND ERECT BARRICADES AND WARNING SIGNS IN ACCORDANCE WITH BC(1)14 THROUGH BC(12)-14 AT POINTS INDICATED AND AT OTHER POINTS AS DIRECTED BY THE ENGINEER.

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TRAFFIC STANDARDS

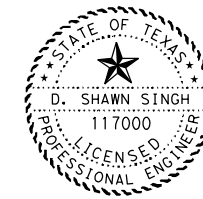
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87	*D&OM(2)-20
88	*D&OM(3)-20
89	*D&OM(4)-20
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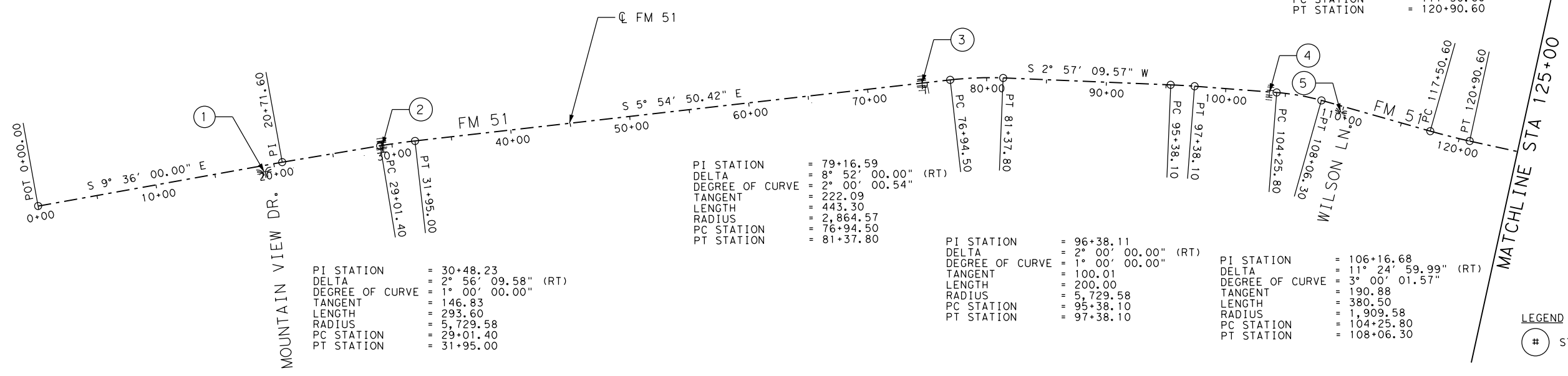
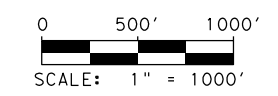
THE STANDARD SHEETS SPECIFICALLY IDENTIFIED ON THIS SHEET WITH A "*" HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

D. Shawn Singh → P. E. DATE 10/26/2020

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NO.	DATE	REVISION	APPROVED
F-928			
FM 51 INDEX OF SHEETS			
SHEET 1 OF 1			
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE TEXAS	DISTRICT FTW	COUNTY PARKER
CHECK KHA	CONTROL	SECTION	JOB
CHECK KHA	0313	07	020
			2

PI STATION = 119+20.65
 DELTA = 3° 24' 00.00" (LT)
 DEGREE OF CURVE = 1° 00' 00.00"
 TANGENT = 170.05
 LENGTH = 340.00
 RADIUS = 5,729.58
 PC STATION = 117+50.60
 PT STATION = 120+90.60



PI STATION = 30+48.23
 DELTA = 2° 56' 09.58" (RT)
 DEGREE OF CURVE = 1° 00' 00.00"
 TANGENT = 146.83
 LENGTH = 293.60
 RADIUS = 5,729.58
 PC STATION = 29+01.40
 PT STATION = 31+95.00

PI STATION = 79+16.59
 DELTA = 8° 52' 00.00" (RT)
 DEGREE OF CURVE = 2° 00' 00.54"
 TANGENT = 222.09
 LENGTH = 443.30
 RADIUS = 2,864.57
 PC STATION = 76+94.50
 PT STATION = 81+37.80

PI STATION = 96+38.11
 DELTA = 2° 00' 00.00" (RT)
 DEGREE OF CURVE = 1° 00' 00.00"
 TANGENT = 100.01
 LENGTH = 200.00
 RADIUS = 5,729.58
 PC STATION = 95+38.10
 PT STATION = 97+38.10

PI STATION = 106+16.68
 DELTA = 11° 24' 59.99" (RT)
 DEGREE OF CURVE = 3° 00' 01.57"
 TANGENT = 190.88
 LENGTH = 380.50
 RADIUS = 1,909.58
 PC STATION = 104+25.80
 PT STATION = 108+06.30

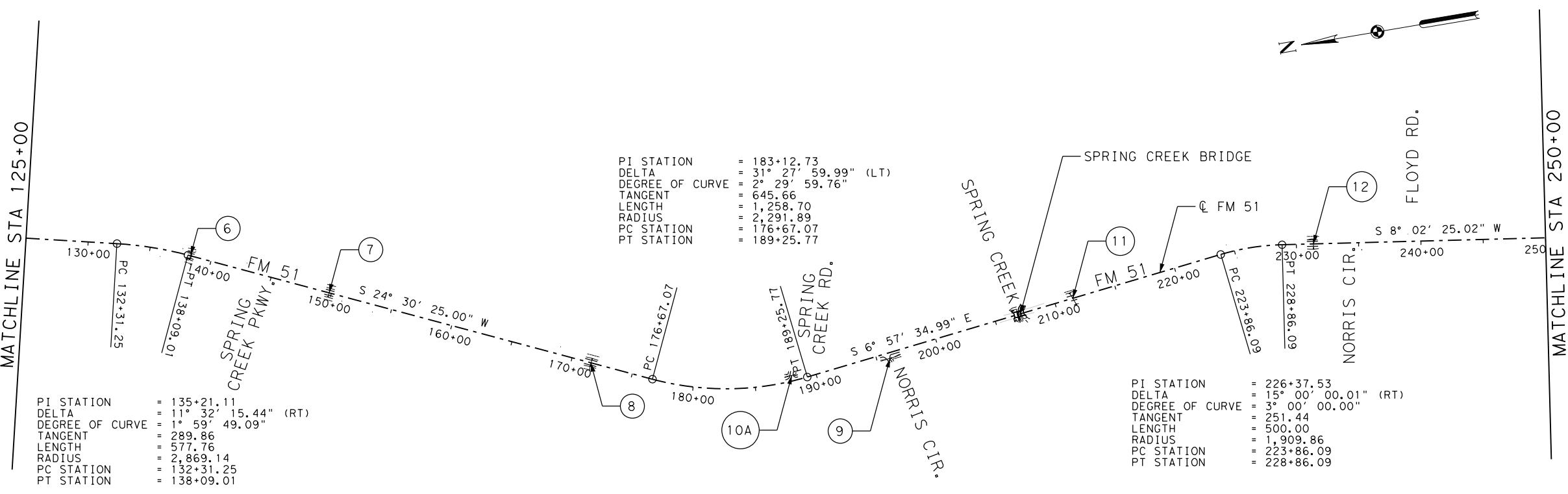
LEGEND

STRUCTURE ID

ID	STA	STRUCTURE TYPE	ACTIVITY
1	19+80	PARALLEL CULVERT	REPLACE CULVERT; ADD SETS
2	29+56	CROSS CULVERT	REPLACE CULVERT; ADD SETS
3	74+97	CROSS CULVERT	REPLACE CULVERT; ADD SETS
4	104+07	CROSS CULVERT	REPLACE CULVERT; ADD SETS
5	110+25	PARALLEL CULVERT	REPLACE CULVERT; ADD SETS

NOTES:

1. HORIZONTAL ALIGNMENT DATA IS BASED ON AS-BUILT PLANS: CSJ 0313-07-007. THIS INFORMATION IS PROVIDED TO HELP AID THE CONTRACTOR LOCATE EXISTING CULVERT STRUCTURES ONLY.

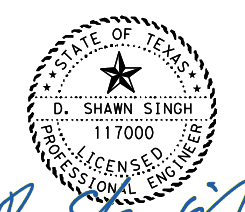


PI STATION = 135+21.11
 DELTA = 11° 32' 15.44" (RT)
 DEGREE OF CURVE = 1° 59' 49.09"
 TANGENT = 289.86
 LENGTH = 577.76
 RADIUS = 2,869.14
 PC STATION = 132+31.25
 PT STATION = 138+09.01

PI STATION = 183+12.73
 DELTA = 31° 27' 59.99" (LT)
 DEGREE OF CURVE = 2° 29' 59.76"
 TANGENT = 645.66
 LENGTH = 1,258.70
 RADIUS = 2,291.89
 PC STATION = 176+67.07
 PT STATION = 189+25.77

PI STATION = 226+37.53
 DELTA = 15° 00' 00.01" (RT)
 DEGREE OF CURVE = 3° 00' 00.00"
 TANGENT = 251.44
 LENGTH = 500.00
 RADIUS = 1,909.86
 PC STATION = 223+86.09
 PT STATION = 228+86.09

ID	STA	STRUCTURE TYPE	ACTIVITY
6	138+71	CROSS CULVERT	REPLACE CULVERT; ADD SETS
7	150+22	CROSS CULVERT	CLEAN CULVERT; ADD RIPRAP (DOWNSTREAM)
8	171+97	CROSS CULVERT	CLEAN CULVERT
10A	188+50	PARALLEL CULVERT	CLEAN CULVERT; ADD SETS
9	196+30	PARALLEL CULVERT	REPLACE CULVERT; ADD SETS
		SPRING CREEK BRIDGE	MOVE & RESET GABIONS; REPAIR CRR WING W/ STONE PROTECTION
11	211+88	CROSS CULVERT	REPLACE CULVERT AND HEADWALL; ADD MBGF; ADD RIPRAP (DOWNSTREAM)
12	231+77	CROSS CULVERT	CLEAN CULVERT



D. Singh 10/19/2020

NO.	DATE	REVISION	APPROVED

Kimley»Horn
F-928



**FM 51
PROJECT LAYOUT**

SCALE: 1"=1000' SHEET 1 OF 2

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			3

PI STATION = 266+04.00
 DELTA = 24° 52' 00.00" (LT)
 DEGREE OF CURVE = 2° 59' 59.85"
 TANGENT = 421.08
 LENGTH = 828.90
 RADIUS = 1,909.89
 PC STATION = 261+82.91
 PT STATION = 270+11.81

PI STATION = 312+52.11
 DELTA = 43° 35' 00.04" (LT)
 DEGREE OF CURVE = 3° 59' 59.78"
 TANGENT = 572.68
 LENGTH = 1,089.60
 RADIUS = 1,432.42
 PC STATION = 306+79.43
 PT STATION = 317+69.03

PI STATION = 283+66.06
 DELTA = 10° 45' 00.00" (RT)
 DEGREE OF CURVE = 2° 00' 00.00"
 TANGENT = 269.54
 LENGTH = 537.50
 RADIUS = 2,864.79
 PC STATION = 280+96.52
 PT STATION = 286+34.02

PI STATION = 297+82.99
 DELTA = 24° 44' 00.02" (RT)
 DEGREE OF CURVE = 3° 00' 00.58"
 TANGENT = 418.72
 LENGTH = 824.40
 RADIUS = 1,909.76
 PC STATION = 293+64.27
 PT STATION = 301+88.67

PI STATION = 336+92.43
 DELTA = 14° 47' 00.01" (RT)
 DEGREE OF CURVE = 2° 59' 59.52"
 TANGENT = 247.78
 LENGTH = 492.80
 RADIUS = 1,909.94
 PC STATION = 334+44.65
 PT STATION = 339+37.45

ID	STA	STRUCTURE TYPE	ACTIVITY
13	274+82	BRIDGE CLASS CULVERT	ADD MBSG; CLEAN EXIST CHANNEL; ADD RIPRAP (UPSTREAM)
14	289+12	CROSS CULVERT	CLEAN CULVERT; REGRADE DITCH
15	296+57	CROSS CULVERT	REPLACE CULVERT; ADD SETS
16	310+30	CROSS CULVERT	REPLACE CULVERT; ADD SETS; ADD RIPRAP (DOWNSTREAM)
17	323+71	CROSS CULVERT	REPLACE CULVERT; ADD SETS
18	332+32	BRIDGE CLASS CULVERT	ADD MBSG
19	348+97	CROSS CULVERT	CLEAN CULVERT

LEGEND

STRUCTURE ID

NOTES:

1. HORIZONTAL ALIGNMENT DATA IS BASED ON AS-BUILT PLANS: CSJ 0313-07-007. THIS INFORMATION IS PROVIDED TO HELP AID THE CONTRACTOR LOCATE EXISTING CULVERT STRUCTURES ONLY.

MATCHLINE STA 375+00

PI STATION = 376+01.47
 DELTA = 21° 16' 56.24" (RT)
 DEGREE OF CURVE = 2° 18' 37.13"
 TANGENT = 465.96
 LENGTH = 921.19
 RADIUS = 2,480.00
 PC STATION = 371+35.50
 PT STATION = 380+56.69

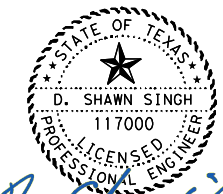
PI STATION = 411+53.39
 DELTA = 40° 55' 00.02" (LT)
 DEGREE OF CURVE = 4° 00' 00.24"
 TANGENT = 534.35
 LENGTH = 1,022.90
 RADIUS = 1,432.37
 PC STATION = 406+19.03
 PT STATION = 416+41.93

PI STATION = 441+57.87
 DELTA = 1° 08' 45.92" (LT)
 DEGREE OF CURVE = 0° 29' 53.88"
 TANGENT = 115.00
 LENGTH = 230.00
 RADIUS = 11,498.25
 PC STATION = 440+42.87
 PT STATION = 442+72.87

PI STATION = 465+08.18
 DELTA = 3° 04' 00.00" (LT)
 DEGREE OF CURVE = 0° 59' 59.61"
 TANGENT = 153.39
 LENGTH = 306.70
 RADIUS = 5,730.20
 PC STATION = 463+54.80
 PT STATION = 466+61.50

PI STATION = 493+23.61
 DELTA = 11° 48' 00.00" (RT)
 DEGREE OF CURVE = 2° 00' 00.00"
 TANGENT = 296.05
 LENGTH = 590.00
 RADIUS = 2,864.79
 PC STATION = 490+27.56
 PT STATION = 496+17.56

ID	STA	STRUCTURE TYPE	ACTIVITY
20A	381+79	PARALLEL CULVERT	CLEAN CULVERT; ADD SETS
20	387+88	CROSS CULVERT	REPLACE CULVERT; ADD SETS; ADD RIPRAP (DOWNSTREAM)
21	396+80	CROSS CULVERT	REPLACE CULVERT; ADD SETS; ADD RIPRAP (DOWNSTREAM)
22	400+73	CROSS CULVERT	ADD MBSG; REGRADE DITCH; ADD RIPRAP (DOWNSTREAM)
23	415+29	CROSS CULVERT	CLEAN CULVERT
24	435+93	CROSS CULVERT	REPLACE CULVERT; ADD SETS
25	457+83	CROSS CULVERT	REPLACE CULVERT; ADD SETS
26	468+76	CROSS CULVERT	REPLACE CULVERT; ADD SETS; ADD RIPRAP (DOWNSTREAM)
27	483+66	CROSS CULVERT	REPLACE CULVERT; ADD SETS
28	492+25	CROSS CULVERT	REPLACE CULVERT; ADD SETS



D. Singh 10/19/2020

NO.	DATE	REVISION	APPROVED

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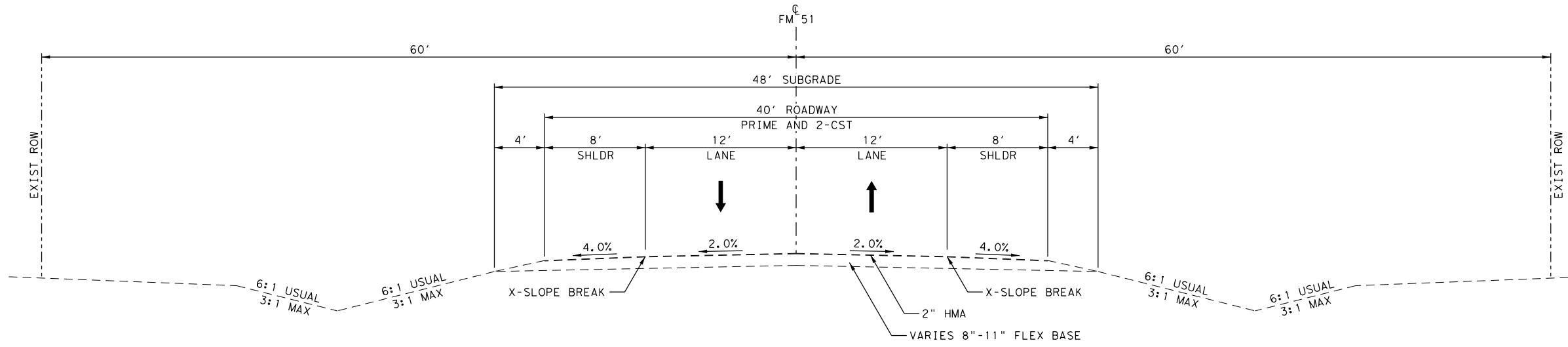


**FM 51
PROJECT LAYOUT**

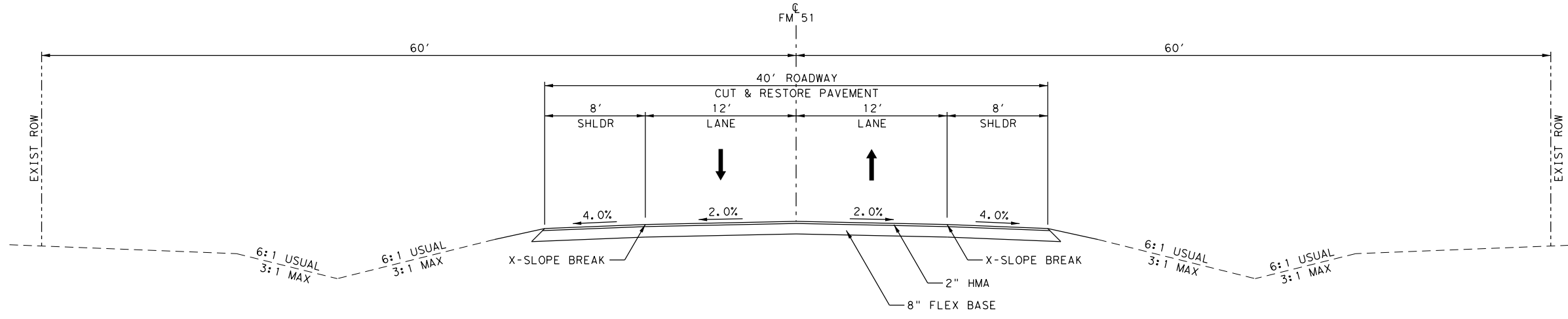
SCALE: 1"=1000' SHEET 2 OF 2

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
KHA	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
KHA	0313	07	020

4



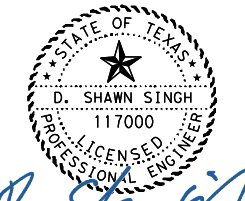
EXISTING TYPICAL SECTION
BEGIN PROJECT TO END PROJECT



PROPOSED TYPICAL SECTION
BEGIN PROJECT TO END PROJECT

NOTES:

1. REFER TO TxDOT STANDARD MDD (FTW) FOR CUT & RESTORING PAVEMENT DETAILS.



D. Singh 10/19/2020

NO.	DATE	REVISION	APPROVED

Kimley»Horn
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FM 51
TYPICAL SECTIONS

SCALE: NTS SHEET 1 OF 1

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
KHA	6	(SEE TITLE SHEET)	FM 51
DRAWN	STATE	DISTRICT	COUNTY
KHA	TEXAS	FTW	PARKER
CHECK	CONTROL	SECTION	JOB
KHA	0313	07	020

5

DATE: 10/19/2020 3:02:00 PM
FILE: FM51_GEN_TYP_01.dgn

Project Number: STP 2021(288)

County: Parker

Highway: FM 51

Control: 0313-07-020

Project Number: STP 2021(288)

County: Parker

Highway: FM 51

Control: 0313-07-020

Specification Data

Basis of Estimate

Item	Description	Rate	Unit
168	Vegetative Watering	169,400 gal./acre	1,000 gal.

Special Notes

Electronic files containing answered pre-letting questions and other project related design information will be placed in the following FTP site periodically.

Check this site for new information. Notices of new postings will not be sent out by the Engineer.

The data located in these files is for non-construction purposes only and can be found at

TxDOT's public FTP site at <https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting Responses/>

Access is read-only.

All files in the FTP site are subject to the License Agreement shown on the FTP site.

To obtain a copy of the project plans free of charge, submit a request from the following site:

<http://www.txdot.gov/business/letting-bids/plans-online.html>

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

Area Engineer's Email: david.neeley@txdot.gov

Assistant Area Engineer's Email: gary.beck@txdot.gov

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

All contractor questions will be reviewed by the Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following Address:

<https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting Responses/>

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

Existing storm sewers and utilities are shown from the best available information. Verify the location of all underground facilities prior to starting work.

For dimensions of right-of-way not shown on the plans, see right-of-way map on file at the TxDOT District Office.

Modifications to Lane Closure / Work Restrictions:

Submit a request in writing for approval by the Engineer a minimum of 10 days in advance of implementing a change to lane closure restrictions.

When deemed necessary, the Engineer will lengthen, shorten, or otherwise modify lane closure restrictions as traffic conditions warrant.

When deemed necessary, the Engineer will modify the list of major events when new events develop, existing events are rescheduled, or when warranted.

Special Events/ Special Situations will be handled on a case-by-case basis. No work restricting lane closures is allowed from 3 PM a day before to 9 AM the day after the Special Event or Special Situation.

Prevention of Migratory Bird Nesting

It is anticipated that migratory birds, a protected group of species, may try to nest on bridges, culverts, vegetation, or gravel substrate, at any time of the year. The preferred nesting season for migratory birds is from February 15 through October 1. When practicable, schedule construction operations outside of the preferred nesting season. Otherwise, avoid nests containing migratory birds and perform no work in the nesting areas until the young birds have fledged.

Structures

Do not begin bridge and culvert construction operations until swallow nesting prevention is implemented, until after October 1 if it's determined that swallow nesting is actively occurring, or until it's determined swallow nests have been abandoned. If the State installed nesting deterrent on the bridges and culverts, maintain the existing nesting deterrent to prevent swallow nesting until October 1 or completion of the bridge and culvert work, whichever occurs earlier. If new nests are built and occupied after the beginning of the work, do not perform work that can interfere with or discourage swallows from returning to their nests. Prevention of swallow nesting can be performed by one of the following methods:

1. By February 15 begin the removal of any existing mud nests and all other mud placed by swallows for the construction of nests on any portion of the bridge and culverts. The Engineer will inspect the bridges and culverts for nest building activity. If swallows begin nest building, scrape or wash down all nest sites. Perform these activities daily unless the Engineer determines the need to do this work more frequently. Remove nests and mud through October 1 or until bridge and culvert construction operations are completed.
2. By February 15 place a nesting deterrent (which prevents access to the bridge and culvert by swallows) on the entire bridge (except deck and railing) and culverts.

No extension of time or compensation payment will be granted for a delay or suspension of work

Project Number: STP 2021(288)

County: Parker

Control: 0313-07-020

Highway: FM 51

caused by nesting swallows. This work is subsidiary to the various bid items.

Remove all existing fences within the right of way and remove and replace all existing fences within easements where such fences conflict with the work. Protect the remaining fence from damage due to slacking. Erect temporary fencing in the easement areas as necessary to secure the property. Provide at least one week notice to the property owner prior to removing or relocating the fence. Restore permanent fencing to an equal or better condition.

Mail box manipulation made necessary because of construction will be in accordance with Item 560 "Mailbox Assemblies," except that this work will not be paid for directly but will be subsidiary to the pertinent bid items.

Provide all-weather surface for temporary ingress and egress to adjacent property, as directed. Materials, labor, equipment and incidentals necessary to provide temporary ingress and egress will not be paid for directly, but will be subsidiary to the various bid items.

Where necessary, the governing slopes indicated herein may be varied from the limits shown, to the extent approved.

On superelevated curves the shoulders will have the same cross-slope as the pavement, unless otherwise indicated.

On superelevated curves where the grade line is in a sag or on a flat grade, overlay the shoulders to the extent necessary to prevent trapping of water on the high side.

Locations and lengths of all private entrances are approximate only. The actual locations, lengths, lines, and grades are to be established in the field.

Remove the grass from the crown of shoulders or pavement edges by blading or other approved methods. Payment for this work will not be made directly, but will be subsidiary to the various items of the contract.

Locations shown for drainage structures refer to the control points of structures as follows:

- 1) Manholes, Inlets, and Junction Boxes—Locations are at the centroid of the structure; when two structure types are specified, location is at the centroid of the top structure. Bottom structure may be positioned as required to align with top structure, storm drain pipes and other adjacent structures.
- 2) Street Inlets—Locations are at the face of curb at a distance of L/2 from the end of the inlet.
- 3) Headwalls—Locations are to the outside face of the headwall at the centerline of the pipe or box structure. For pipe headwalls with Type "P" or "C" safety end treatment, locations are on the centerline of the pipe structure at the limit of payment for pipe.

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County: Parker

Control: 0313-07-020

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Plugging of pipes or culverts will not be paid for directly, but will be subsidiary to the various bid items, unless otherwise shown on the plans.

Provide temporary drain openings at all low points or other drainage structures, as required, at the Contractor's expense.

Remove any obstructions to existing drainage due to the contractor's operations, as required, at the Contractor's expense.

Install all required concrete riprap flumes immediately following the construction of ditches in which they are to be placed. In addition, apply all erosion control measures as shown on the plans or as directed, immediately following construction of channels to their required line, grade, and section.

Item 2. Instructions to Bidders

Proposals with a bid of more than 210 working days for the substantial completion of the project will be considered non-responsive.

Item 4 – Scope of Work

Reimbursement for project overhead will not be considered until project completion has extended beyond the original Contract Time.

Item 5. Control of the Work

When supplementary bridge plans, shop drawings, shop details, erection drawings, working drawings, forming plans, or other drawings are required, prepare and submit drawings on sheets 8-1/2 by 11 inches, 17 by 22 inches, or full size drawings reduced to half scale if completely legible. If, in the opinion of the Engineer, the drawings are not completely legible, prepare and submit on sheets 22 by 34 inches, with a 1-1/2 inch left margin, and 1/2 inch top, right, and bottom margins.

Submit all sheets with a title in the lower right hand corner. The title must include the sheet index data shown on the lower right corner of the project plans, name of the structure or element or stream, sheet numbering for the shop drawings, name of the fabricator and the name of the Contractor.

Prior to contract letting, bidders may obtain a free computer diskette or a computerized transfer of files (from the Engineer's office) that contains the earthwork information in ASCII format, plain text files. If copies of the actual cross-sections are requested, in addition to, or instead of the diskette, they will be available at the Engineers office for borrowing by copying companies for the purpose of making copies for the bidder, at the bidder's expense.

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Item 7. Legal Relations and Responsibilities

Do not initiate activities in a project specific location (PSL) associated with a U.S. Army Corps of Engineers (USACE) permit area that has not been previously evaluated by the USACE as part of the permit review of this project. Such activities include, but are not limited to haul roads, equipment staging areas, borrow and disposal sites. "Associated" as defined here means materials are delivered to or from the PSL. The permit area includes all waters of the U.S. or associated wetlands affected by activities associated with this project. Special restrictions may be required for such work. The contractor will be responsible for all consultations with the USACE regarding activities, including project specific locations (PSLs) that have not been previously evaluated by the USACE. Provide the Department with a copy of all consultations or approvals from the USACE prior to initiating activities.

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

Document and coordinate with the USACE, if required, prior to any excavation hauled from or embankment hauled into a USACE permit area by either (1) or (2) below.

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

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The total area disturbed for this project is 1.34 acres. The disturbed area in this project, all project locations in the Contract, and the Contractor project specific locations (PSLs), within 1 mile of the project limits, for the Contract will further establish the authorization requirements for storm water discharges. The Department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction activities shown on the plans. The Contractor is to obtain required authorization from the TCEQ for Contractor PSLs for construction support activities on or off the right of way. When the total area disturbed in the Contract and PSLs within 1 mile of the project limits exceeds 5 acres, provide a copy of the Contractor NOI for PSLs on the right of way to the Engineer and to the local government that operates a separate storm sewer system.

The following Holiday/Event lane closure restriction requirements apply to this project: No work that restricts or interferes with traffic shall be allowed between 3 PM on the day preceding a Holiday or Event and 9 AM on the day after the Holiday or Event.

Holiday Lane Closure Restrictions	
New Year's Eve and New Year's Day (December 31 through January 1)	3 PM December 30 through 9 AM January 2
Easter Holiday Weekend (Friday through Sunday)	3PM Thursday through 9 AM Monday
Memorial Day Weekend (Friday through Monday)	3 PM Thursday through 9 AM Tuesday
Independence Day (July 3 through July 5)	3 PM July 2 through 9 AM July 6
Labor Day Weekend (Friday through Monday)	3 PM Thursday through 9 AM Tuesday
Thanksgiving Holiday (Wednesday through Sunday)	3 PM Tuesday through 9 AM Monday
Christmas Holiday (December 23 through December 26)	3 PM December 22 through 9 AM December 27

Plan work schedules around the appropriate dates above to ensure productive work is performed without lane closures.

No significant traffic generator events identified.

Item 8. Prosecution and Progress

Working days will be computed and charged in accordance with Section 8.3.1.1, 'Five-Day Workweek.'

Work is allowed to be performed during the nighttime.

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The number of working days for final acceptance will be 150 working days after the substantial completion of the project.

Prepare the progress schedule as a bar chart, include all planned work activities and sequences and show Contract completion within the number of working days specified. Submit an updated hard copy when changes to the schedule occur or when requested.

Item 100. Preparing Right of Way

Measurement for this item will be along the centerline of the project with the limits of measurements as shown on the plans.

Item 110. Excavation

Review proposed waste sites to determine if any site is located in a “Base Floodplain” or “Floodway” as defined by the Federal Emergency Management Agency (FEMA).

If waste material from this project is placed in a base floodplain as defined by FEMA, obtain a permit from the local community responsible for enforcing National Flood Insurance Program (NFIP) regulations. Ensure that the owner of the property receiving the waste has obtained the necessary permit.

Items 110, 112, and 132. Excavation, Subgrade Widening, and Embankment

Sulfate-laden subgrade material that is to be treated with either lime or cement, including material up to one foot outside the proposed treatment limits, is susceptible to sulfate heave. It has been determined that an excessive concentration of sulfate in the soils (>3,000 PPM by dry weight of the soil) exists for given areas of excavation and/or proposed treated subgrade within the project limits. The areas of moderate to high concentrations are as follows:

Areas of subgrade to be treated (3,001–7,000 PPM—moderate concentration)

or no areas identified

Areas of excavation (>7,000 PPM—high concentration)

or no areas identified

Moderate sulfate levels are those defined from 3,001 PPM to 7,000 PPM. Treat these soils with lime at the full 150 lb./cu. yd. rate or cement at the full 125 lb./cu. yd. rate. Do not split the rates to ensure complete reaction and mitigation of sulfate heaves. Allow the mixture to mellow for 7 days to provide for complete reaction.

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High sulfate levels are not allowed within the treatment and surrounding areas as defined above.

Test soils for soluble sulfates in accordance with Test Method Tex-145 and Tex-146-E.

Treat moderate sulfate or excavate high sulfate areas identified above and other subgrade areas that may be identified during construction as having moderate to high sulfate concentrations to a depth of one foot below and laterally to one foot outside the proposed treatment limits. Treatment of the moderate level material will be paid for under Item 260, “Lime Treatment (Road Mixed)” or Item 275, “Cement Treatment (Road Mixed).” Removal of the high level material will be measured and paid for in accordance with Item 110, “Excavation” and replacement with suitable material will be measured and paid for in accordance with Item 132, “Embankment.”

Any excavated sulfate-laden material will be acceptable for use in fill areas. Do not place within previously specified section boundaries of subgrade to be treated with either lime or cement.

Off-Site Borrow Sources. In addition to meeting pertinent specification requirements, test off-site borrow sources for sulfate content. Test soils for soluble sulfates in accordance with Test Method Tex-145 and Tex-146-E and provide documentation that supports compliance with previously stated requirements. The Engineer will perform additional testing for sulfates of this material upon delivery to the project. Only material that is placed within one foot vertically or laterally of subgrade treatment will require testing for sulfates. Remove and replace failing material (sulfate concentrations >7,000 PPM by dry weight).

Item 164. Seeding for Erosion Control

Apply seeding required between December 1 and January 31 using seed types and mixtures as shown in Item 164.2.1, Table 3. If, in the opinion of the Engineer, this does not provide an effective vegetative cover, apply “straw or hay mulch” as specified in Article 164.3.2, “Straw or Hay Mulch Seeding” as soon as possible. After February 1, apply warm season seeding in order to establish a permanent protective vegetative cover.

Item 168. Vegetative Watering

Furnish and install an approved rain gauge at the project site, as directed. Furnishing and installation of the rain gauge will not be paid for directly, but will be subsidiary to Item 168.

Apply vegetative watering for an establishment period of thirteen weeks following application of seed or installation of sod, at a rate of 1/2 inch of water depth per week (approximately 13,030 gallons per acre). During the first four weeks after seeding, apply water twice per week, on non-consecutive days, each at half the weekly application rate. For the remainder of the establishment period, apply vegetative watering once per week during the months of January through June or September through December, at the weekly application rate; apply watering twice per week, on non-consecutive days during the months of July and August, each at one-half the weekly application rate.

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Average weekly rainfall rates for the District are:

January—0.39"	April—0.86"	July—0.48"	October—0.68"
February—0.46"	May—1.00"	August—0.47"	November—0.46"
March—0.48"	June—0.63"	September—0.74"	December—0.37"

Item 340. Dense-Graded Hot-Mix Asphalt (Small Quantity)

RAP aggregate must meet the requirements of Table 1.

Provide aggregate with a Surface Aggregate Classification (SAC) value of __A__ for the travel lanes and shoulders.

No blending, of the material retained on the No. 4 sieve, to meet SAC A will be allowed for surface mixes.

Provide a PG 64-22 asphalt for the base course.

Provide a PG 64-22 asphalt for the concrete underlayment course.

Grade Substitution per Table 5 is not allowed.

Warm Mix Asphalt (WMA) is not permitted in any mix type on this project.

RAP and RAS are not permitted in any surface and levelup mixes on this project.

Substitute binders are not allowed on this project.

Use only the Superpave Gyratory Compactor (SGC) to design the mixture.

Use the Boil Test, Test Procedure Tex-530-C, and provide only mixes that produce zero percent (0%) stripping for design verification and during production.

Include the approved mix design number on each delivery ticket.

Use a Material Transfer Device (MTD) unless otherwise directed.

Stop production after Lot 1. Review all test data and confirm any changes with the Engineer. Do not start production and placement on subsequent Lots until approved by the Engineer.

Shoulders, crossovers, and other areas listed on the Plan sheets or as directed are not subject to in-place air void determination for this project.

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Temporary detours are subject to in-place air void determination for this project.

Use Surface Test Type B for this project.

Ride quality is not required on this project.

Item 400. Excavation and Backfill for Structures

Class B bedding will be permitted in lieu of Class C bedding.

Recycled flex base and RAP are allowed individually or combined for use as granular material and backfill in Class B and C bedding at the discretion of the Engineer. These materials must meet the requirements of Table 1. The Engineer may require the mixing of one or both of these materials with the local soil to provide a cohesive material for compaction and stability of the backfill around the pipe or box culvert.

Item 432. Riprap

Provide weep holes as directed.

The quantities for riprap at the location indicated may be varied to the extent necessary to ensure proper functioning for the purpose intended.

All concrete riprap will be 4" (.33') in thickness, unless otherwise shown on the plans, and must be reinforced with #3 rebar.

An 8 inch (.67 ft.) by 18 inch (1.5 ft.) toe wall is required at the exposed edges of all concrete riprap, unless otherwise directed.

Locations and lengths of riprap flumes shown on the plans are approximate. Actual lengths and locations are to be determined in the field.

Welded Wire Reinforcement (WWR) may be used for construction joint and toe wall reinforcing with the approval of the Engineer.

Item 464. Reinforced Concrete Pipe

All bends and connections in pipe must be prefabricated.

Item 466. Headwalls and Wingwalls

Do not use precast headwalls/wingwalls.

Item 502. Barricades, Signs, and Traffic Handling

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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 typically 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.

Permanent signs may be installed when construction in an area is complete and they will not conflict with the traffic control plan for the remainder of the job.

Existing signs are to remain as long as they do not interfere with construction and they do not conflict with the traffic control plan.

Any sign not detailed in the plans but called for in the layout will be as shown in the current "Standard Highway Sign Designs for Texas".

When traffic is obstructed, arrange warning devices in accordance with the latest edition of the "Texas Manual on Uniform Traffic Control Devices".

Cover or remove any work zone signs when work or condition referenced is not occurring.

Do not place barricades, signs, or any other traffic control devices where they interfere with sight distance at driveways or side streets. Provide access to all driveways during all phases of construction unless otherwise noted in the plans or as directed.

Item 506. Temporary Erosion, Sedimentation, and Environmental Controls

Remove accumulated sediment or replace SW3P controls when the capacity has been reduced by 50% or when the depth of sediment at the control structure exceeds one foot.

Item 512. Portable Concrete Traffic Barrier

Traffic Barrier is in the stockpile at FM 1189 at IH-20 SFR

Use barrier from the stockpile that has been inspected and approved by the Engineer prior to using.

Provide the hardware assemblies to join barrier sections, including barrier from stockpile.

Connection hardware will remain the property of the State upon completion of the project and will not be paid for directly but will be subsidiary to Item 512,"Portable Concrete Traffic Barrier". Deliver hardware to the location specified by the Engineer.

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Delineate all barriers in accordance with Barricade and Construction (BC) Standard sheets. Barrier delineation will not be paid for directly, but will be subsidiary to Item 512,"Portable Concrete Traffic Barrier".

Remove and replace traffic barrier damaged by the traveling public and no longer serviceable as directed. Replace traffic barrier with Department-furnished barrier from designated stockpile as directed. Additional payment will be provided as compensation to remove and replace the traffic barrier damaged by the traveling public in accordance with Item 512. Return the damaged traffic barrier to the stockpile site as directed.

Item 540. Metal Beam Guard Fence

The locations and lengths of guard fence shown on the plans are approximate. Actual lengths and locations are to be determined in the field.

The tops of timber posts will be domed. Beveled tops will not be permitted for timber or steel posts.

When holes for timber posts are drilled below bottom of proposed grade, backfill the excessive depth with an acceptable sand. The furnishing and installation of the sand backfill will not be paid for directly but will be subsidiary to this Item.

When guardrail posts are placed in a finished surface, backfill the top 4 inches with an asphaltic material, domed to carry water away from the posts or as shown on the plans. The furnishing and installation of the asphaltic material backfill will not be paid for directly but will be subsidiary to this Item.

Item 542. Removing Metal Beam Guard Fence

Remove existing metal beam guard fence only when authorized.

Item 662. Work Zone Pavement Markings

When buttons are used for Removable Markings on finished pavement surfaces, hot applied thermo adhesive must be used on concrete and bituminous adhesive on asphalt. Buttons may not be used for stop bar markings.

Item 666. Reflectorized Pavement Markings with Retroreflective Requirements

Collection of retroreflectivity readings using a mobile retroreflectometer is the preferred method. If retroreflectivity readings are collected using a portable or handheld unit, then measurement is defined as a collective average of at least 20 readings taken along a 200-foot test section. A minimum of three measurements will be required per mile of roadway. Measurements collected on a centerline stripe will be averaged separately for stripe in each direction of travel. A TxDOT inspector must witness the calibration and collection of all retro-reflectivity data.

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Item 6001. Portable Changeable Message Signs

Provide all portable changeable message signs and arrow panels with a photoelectric device to allow for automatic dimming of operations to approximately 50% of their normal brightness when ambient light drops to approximately five footcandles, and then increase back again for daytime operations.

Two electronic portable changeable message sign unit(s) will be required. Individual or collective use of signs will be required by the Engineer when deemed necessary to supplement the traffic control plan.

Each sign must have programmed in its permanent memory the following 15 messages:

1. Exit Closed Ahead
2. Use Other Routes
3. Right Lane
4. Left Lane
5. Closed Ahead
6. Two Lane
7. Detour Ahead
8. Thru Traffic
9. Prepare To Stop
10. Merging Traffic
11. Expect 15 Minute Delay
12. Max Speed ** MPH
13. Merge Right
14. Merge Left
15. No Exit Next ** Miles

Item 6185. Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)

In addition to the shadow vehicles with truck mounted attenuator (TMA) that are specified as being required on the traffic control plan for this project, provide 0 additional shadow vehicle(s).

Therefore, 1 total shadow vehicles with TMA will be required for this type of work. Determine if one or more of these operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

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QUANTITY SHEET

COUNTY Parker

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PROJECT ID				A00066151			
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ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	100-6002	PREPARING ROW	STA	1.000		1.000	
	104-6009	REMOVING CONC (RIPRAP)	SY	68.000		68.000	
	110-6001	EXCAVATION (ROADWAY)	CY	20.000		20.000	
	162-6002	BLOCK SODDING	SY	1,500.000		1,500.000	
	164-6005	BROADCAST SEED (PERM) (URBAN) (SANDY)	SY	6,472.000		6,472.000	
	164-6009	BROADCAST SEED (TEMP) (WARM)	SY	3,236.000		3,236.000	
	164-6011	BROADCAST SEED (TEMP) (COOL)	SY	3,236.000		3,236.000	
	168-6001	VEGETATIVE WATERING	MG	236.000		236.000	
	400-6006	CUT & RESTORING PAV	SY	801.000		801.000	
	401-6001	FLOWABLE BACKFILL	CY	20.000		20.000	
	402-6001	TRENCH EXCAVATION PROTECTION	LF	531.000		531.000	
	403-6001	TEMPORARY SPL SHORING	SF	1,228.000		1,228.000	
	432-6001	RIPRAP (CONC)(4 IN)	CY	74.000		74.000	
	432-6007	RIPRAP (CONC)(CL C)	CY	2.000		2.000	
	432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	110.000		110.000	
	432-6035	RIPRAP (STONE PROTECTION)(24 IN)	CY	344.000		344.000	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	209.000		209.000	
	438-6001	CLEANING AND SEALING EXISTING JOINTS	LF	15.000		15.000	
	459-6002	GABION MATTRESSES (GALV)	CY	36.000		36.000	
	462-6005	CONC BOX CULV (4 FT X 4 FT)	LF	225.000		225.000	
	462-6008	CONC BOX CULV (5 FT X 4 FT)	LF	402.000		402.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF	966.000		966.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF	126.000		126.000	
	464-6008	RC PIPE (CL III)(36 IN)	LF	190.000		190.000	
	464-6017	RC PIPE (CL IV)(18 IN)	LF	159.000		159.000	
	464-6021	RC PIPE (CL IV)(42 IN)	LF	39.000		39.000	
	465-6009	JCTBOX(COMPL)(PJB)(5FTX5FT)	EA	1.000		1.000	
	466-6025	HEADWALL (CH - FW - 15) (DIA= 42 IN)	EA	1.000		1.000	
	466-6135	HEADWALL (CH - PW - 5) (DIA= 42 IN)	EA	1.000		1.000	
	467-6148	SET (TY I)(S= 4 FT)(HW= 5 FT)(3:1) (C)	EA	3.000		3.000	
	467-6150	SET (TY I)(S= 4 FT)(HW= 5 FT)(4:1) (C)	EA	3.000		3.000	
	467-6181	SET (TY I)(S= 5 FT)(HW= 5 FT)(3:1) (C)	EA	9.000		9.000	
	467-6182	SET (TY I)(S= 5 FT)(HW= 5 FT)(4:1) (C)	EA	3.000		3.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	10.000		10.000	
	467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	2.000		2.000	
	467-6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	29.000		29.000	
	467-6394	SET (TY II) (24 IN) (RCP) (6: 1) (C)	EA	3.000		3.000	

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ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	2.000		2.000	
	467-6408	SET (TY II) (30 IN) (CMP) (4: 1) (C)	EA	2.000		2.000	
	467-6419	SET (TY II) (30 IN) (RCP) (4: 1) (C)	EA	4.000		4.000	
	467-6450	SET (TY II) (36 IN) (RCP) (4: 1) (C)	EA	6.000		6.000	
	476-6030	JACK BOR OR TUN PIPE(42 IN)(RC)(CL IV)	LF	52.000		52.000	
	496-6006	REMOV STR (HEADWALL)	EA	30.000		30.000	
	496-6007	REMOV STR (PIPE)	LF	1,723.000		1,723.000	
	496-6100	REMOVE STR (GABION)	LF	119.000		119.000	
	500-6001	MOBILIZATION	LS	100.00%		100.00%	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	7.000		7.000	
	506-6001	ROCK FILTER DAMS (INSTALL) (TY 1)	LF	800.000		800.000	
	506-6003	ROCK FILTER DAMS (INSTALL) (TY 3)	LF	50.000		50.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	850.000		850.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	570.000		570.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	570.000		570.000	
	506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")	LF	1,000.000		1,000.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	1,000.000		1,000.000	
	510-6004	ONE-WAY TRAFFIC CONTROL (PORT TRAF SIG)	DAY	1.000		1.000	
	512-6017	PORT CTB (DES SOURCE)(F-SHAPE)(TY 1)	LF	120.000		120.000	
	512-6029	PORT CTB (MOVE)(F-SHAPE)(TY 1)	LF	120.000		120.000	
	512-6041	PORT CTB (STKPL)(F-SHAPE)(TY 1)	LF	120.000		120.000	
	540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	2,350.000		2,350.000	
	540-6008	MTL BEAM GD FEN TRANS (T101)	EA	4.000		4.000	
	540-6014	SHORT RADIUS	LF	175.000		175.000	
	540-6015	DRIVEWAY TERMINAL ANCHOR SECTION	EA	7.000		7.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	415.000		415.000	
	542-6003	REMOVE DOWNSTREAM ANCHOR TERMINAL	EA	4.000		4.000	
	542-6005	RM MTL BM GD FEN TRANS (T101)	EA	4.000		4.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	15.000		15.000	
	545-6003	CRASH CUSH ATTEN (MOVE & RESET)	EA	2.000		2.000	
	545-6005	CRASH CUSH ATTEN (REMOVE)	EA	2.000		2.000	
	545-6019	CRASH CUSH ATTEN (INSTL)(S)(N)(TL3)	EA	2.000		2.000	
	644-6068	RELOCATE SM RD SN SUP&AM TY 10BWG	EA	4.000		4.000	
	658-6048	INSTL OM ASSM (OM-2Z)(FLX)GND	EA	58.000		58.000	
	666-6048	REFL PAV MRK TY I (W)24*(SLD)(100MIL)	LF	42.000		42.000	
	666-6303	RE PM W/RET REQ TY I (W)4*(SLD)(100MIL)	LF	348.000		348.000	
	666-6312	RE PM W/RET REQ TY I (Y)4*(BRK)(100MIL)	LF	30.000		30.000	



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COUNTY Parker

QUANTITY SHEET

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COUNTY				Parker			
HIGHWAY				FM 51			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	666-6315	RE PM W/RET REQ TY I (Y)4*(SLD)(100MIL)	LF	250.000		250.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	14.000		14.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	150.000		150.000	
	6185-6002	TMA (STATIONARY)	DAY	150.000		150.000	
	01	CLEAN EXIST CULVERTS: STATE FORCE ACCOUNT WORK (NON-PARTICIPATING)	LS	1.000		1.000	
	18	LAW ENFORCEMENT: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000	



SUMMARY OF DRAINAGE ITEMS

LOCATION	110	400	401	402	403	432	432	432	462	462	464	464	464	464	464	465	466	466	467
	6001	6006	6001	6001	6001	6001	6031	6035	6005	6008	6005	6007	6008	6017	6021	6009	6025	6135	6148
	EXCAVATION (ROADWAY)	CUT & RESTORING PAV	FLOWABLE BACKFILL	TRENCH EXCAVATION PROTECTION	TEMPORARY SPL SHORING	RIPRAP (CONC) (4 IN)	RIPRAP (STONE PROTECTION) (12 IN)	RIPRAP (STONE PROTECTION) (24 IN)	CONC BOX CULV (4 FT X 4 FT)	CONC BOX CULV (5 FT X 4 FT)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	RC PIPE (CL IV) (18 IN)	RC PIPE (CL IV) (42 IN)	JCTBOX (COMPL) (PJB) (5FTX5 FT)	HEADWALL (CH - FW - 15) (DIA= 42 IN)	HEADWALL (CH - PW - S) (DIA= 42 IN)	SET (TY I) (S= 4 FT) (HW= 5 FT) (3:1) (C)
	CY	SY	CY	LF	SF	CY	CY	CY	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA
CULVERT 1 (STA 19+80)		11													45				
CULVERT 2 (STA 29+56)		83																	
CULVERT 3 (STA 74+97)		52																	
CULVERT 4 (STA 104+07)		20		55															
CULVERT 5 (STA 110+25)		13												45					
CULVERT 6 (STA 138+71)		37		13															
CULVERT 7 (STA 150+22)							25												
CULVERT 8 (STA 171+97)																			
CULVERT 10A (STA 188+50)																			
CULVERT 9 (STA 196+30)		12												69					
CULVERT 11 (STA 211+88)		20	20		1228	70		35							39	1	1	1	
CULVERT 12 (STA 231+77)																			
CULVERT 13 (STA 274+82)								116											
CULVERT 14 (STA 289+12)	10																		
CULVERT 15 (STA 296+57)		21		58															
CULVERT 16 (STA 310+30)		21		37				9											
CULVERT 17 (STA 323+71)		83																	
CULVERT 18 (STA 332+32)																			
CULVERT 19 (STA 348+97)																			
CULVERT 20A (STA 381+79)																			
CULVERT 20 (STA 387+88)		103		73				17	225										3
CULVERT 21 (STA 396+80)						4													
CULVERT 22 (STA 400+73)	10							26											
CULVERT 23 (STA 415+29)																			
CULVERT 24 (STA 435+93)		26		48									60						
CULVERT 25 (STA 457+83)		107		71						189									
CULVERT 26 (STA 468+76)		105		72				33		213									
CULVERT 27 (STA 483+66)		41		47									126						
CULVERT 28 (STA 492+25)		46		57									130						
PROJECT TOTALS	20	801	20	531	1228	74	110	151	225	402	966	126	190	159	39	1	1	1	3

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	502	510	512	512	512	545	545	545	6001	6185
	6001	6004	6017	6029	6041	6019	6003	6005	6001	6002
	BARRICADES, SIGNS AND TRAFFIC HANDLING	ONE-WAY TRAFFIC CONTROL (PORT TRAF SIG)	PORT CTB (DES SOURCE) (F-S HAPE) (TY 1)	PORT CTB (MOVE) (F-S APE) (TY 1)	PORT CTB (STKPL) (F-S HAPE) (TY 1)	CRASH CUSH ATTN (INSL) (S) (N) (TL3)	CRASH CUSH ATTN (MOVE & RESET)	CRASH CUSH ATTN (REMOVE)	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)
	MO	DAY	LF	LF	LF	EA	EA	EA	DAY	DAY
PHASES I AND II	7	1	120	120	120	2	2	2	150	150
PROJECT TOTALS	7	1	120	120	120	2	2	2	150	150

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NO.	DATE	REVISION	APPROVED
 F-928			
 FM 51 QUANTITY SUMMARY			
SHEET 1 OF 3			
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE TEXAS	DISTRICT FTW	COUNTY PARKER
CHECK KHA	CONTROL 0313	SECTION 07	JOB 020
CHECK KHA			8

SUMMARY OF DRAINAGE ITEMS (CONTINUED)

LOCATION	467	467	467	467	467	467	467	467	467	467	467	476	480	496	496	658	
	6150	6181	6182	6363	6388	6390	6394	6395	6408	6419	6450	6030	6001	6006	6007	6048	
	SET (TY I) (S= 4 FT) (HW= 5 FT) (4:1) (C)	SET (TY I) (S= 5 FT) (HW= 5 FT) (3:1) (C)	SET (TY I) (S= 5 FT) (HW= 5 FT) (4:1) (C)	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (3: 1) (C)	SET (TY II) (24 IN) (RCP) (4: 1) (C)	SET (TY II) (24 IN) (RCP) (6: 1) (C)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	SET (TY II) (30 IN) (CMP) (4: 1) (C)	SET (TY II) (30 IN) (RCP) (4: 1) (C)	SET (TY II) (36 IN) (RCP) (4: 1) (C)	JACK BOR OR TUN PIPE (42 IN) (RC) (CL IV)	CLEAN EXIST CULVERTS	REMOV STR (HEADWALL)	REMOV STR (PIPE)	IN STL OM ASSM (OM-2Z) (FL X) GND	
	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	EA	EA	LF	EA	
CULVERT 1 (STA 19+80)				2												41	2
CULVERT 2 (STA 29+56)						8								2	168	2	
CULVERT 3 (STA 74+97)						3	3							2	57	2	
CULVERT 4 (STA 104+07)						2								2	76	2	
CULVERT 5 (STA 110+25)				2											41	2	
CULVERT 6 (STA 138+71)						4								2	57	2	
CULVERT 7 (STA 150+22)												1				2	
CULVERT 8 (STA 171+97)												1				2	
CULVERT 10A (STA 188+50)								2				1				2	
CULVERT 9 (STA 196+30)				2											66	2	
CULVERT 11 (STA 211+88)												52		2	50	2	
CULVERT 12 (STA 231+77)												1				2	
CULVERT 13 (STA 274+82)																2	
CULVERT 14 (STA 289+12)												1				2	
CULVERT 15 (STA 296+57)					2									2	70	2	
CULVERT 16 (STA 310+30)						2								2	64	2	
CULVERT 17 (STA 323+71)						10								2	120	2	
CULVERT 18 (STA 332+32)																2	
CULVERT 19 (STA 348+97)												1				2	
CULVERT 20A (STA 381+79)				4								1				2	
CULVERT 20 (STA 387+88)	3													2	216	2	
CULVERT 21 (STA 396+80)									2			1		2		2	
CULVERT 22 (STA 400+73)																2	
CULVERT 23 (STA 415+29)												1				2	
CULVERT 24 (STA 435+93)											2			2	63	2	
CULVERT 25 (STA 457+83)		3	3											2	213	2	
CULVERT 26 (STA 468+76)		6												2	222	2	
CULVERT 27 (STA 483+66)									4					2	63	2	
CULVERT 28 (STA 492+25)										4				2	136	2	
PROJECT TOTALS	3	9	3	10	2	29	3	2	2	4	6	52	9	30	1723	58	

*

* FOR REFERENCE ONLY



SUMMARY OF ROADWAY ITEMS

LOCATION	432	540	540	540	540	542	542	542	544
	6045	6001	6008	6014	6015	6001	6003	6005	6001
	RIPRAP (MOW STRIP) (4 IN)	MTL W-BEAM GD FEN (TIM POST)	MTL BEAM GD FEN TRANS (T101)	SHORT RADIUS	DRIVEWAY TERMINAL ANCHOR SECTION	REMOVE METAL BEAM GUARD FENCE	REMOVE DOWNSTREAM ANCHOR TERMINAL	RM MTL BM GD FEN TRANS (T101)	GUARDRAIL END TREATMENT (INSTALL)
	CY	LF	EA	LF	EA	LF	EA	EA	EA
SPRING CREEK BRIDGE	38	325	4	50	2	415	4	4	2
CULVERT 11 (STA 211+88)	40	550		50	2				2
CULVERT 13 (STA 274+82)	43	450		50	2				4
CULVERT 18 (STA 332+32)	48	550							4
CULVERT 22 (STA 400+73)	40	475		25	1				3
PROJECT TOTALS	209	2350	4	175	7	415	4	4	15

SUMMARY OF BRIDGE ITEMS NBI# 021840031307028

LOCATION	100	104	432	432	438	459	496
	6002	6009	6007	6035	6001	6002	6100
	PREPARING ROW	REMOVING CONC (RIPRAP)	RIPRAP (CONC) (CL C)	RIPRAP (STONE PROTECTION) (24 IN)	CLEANING AND SEALING EXISTING JOINTS	GABION MATTRESSES (GALV)	REMOVE STR (GABION)
	STA	SY	CY	CY	LF	CY	LF
SPRING CREEK BRIDGE	1	68	2	193	15	36	119
PROJECT TOTALS	1	68	2	193	15	36	119

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NO.	DATE	REVISION	APPROVED
 F-928			
 FM 51 QUANTITY SUMMARY			
SHEET 2 OF 3			
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE TEXAS	DISTRICT FTW	COUNTY PARKER
CHECK KHA	CONTROL 0313	SECTION 07	JOB 020
CHECK KHA			9



SUMMARY OF EROSION CONTROL ITEMS

LOCATION	162	164	164	164	168	506	506	506	506	506	506	506
	6002	6005	6009	6011	6001	6001	6003	6011	6038	6039	6041	6043
	BLOCK SODDING	BROADCAST SEED (PERM) (URBAN) (SANDY)	BROADCAST SEED (TEMP) (WARM)	BROADCAST SEED (TEMP) (COOL)	VEGETATIVE WATERING	ROCK FILTER DAMS (INSTALL) (TY 1)	ROCK FILTER DAMS (INSTALL) (TY 3)	ROCK FILTER DAMS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)
	SY	SY	SY	SY	MG	LF	LF	LF	LF	LF	LF	LF
CULVERT 1 (STA 19+80)		284	142	142	10	40		40	30	30		
CULVERT 2 (STA 29+56)		338	169	169	12	40		40	30	30		
CULVERT 3 (STA 74+97)		320	160	160	12	40		40	30	30		
CULVERT 4 (STA 104+07)		284	142	142	10	40		40	30	30		
CULVERT 5 (STA 110+25)		284	142	142	10	40		40	30	30		
CULVERT 6 (STA 138+71)		302	151	151	11	40		40	30	30		
CULVERT 7 (STA 150+22)		50	25	25	2							
CULVERT 8 (STA 171+97)												
CULVERT 10A (STA 188+50)		302	151	151	11	40		40	30	30		
CULVERT 9 (STA 196+30)		302	151	151	11	40		40	30	30		
CULVERT 11 (STA 211+88)		302	151	151	11	40		40	30	30		
CULVERT 12 (STA 231+77)												
CULVERT 13 (STA 274+82)		50	25	25	2							
CULVERT 14 (STA 289+12)												
CULVERT 15 (STA 296+57)		284	142	142	10	40		40	30	30		
CULVERT 16 (STA 310+30)		284	142	142	10	40		40	30	30		
CULVERT 17 (STA 323+71)		356	178	178	13	40		40	30	30		
CULVERT 18 (STA 332+32)												
CULVERT 19 (STA 348+97)												
CULVERT 20A (STA 381+79)		294	147	147	11	40		40	30	30		
CULVERT 20 (STA 387+88)		374	187	187	14	40		40	30	30		
CULVERT 21 (STA 396+80)		294	147	147	11	40		40	30	30		
CULVERT 22 (STA 400+73)		50	25	25	2							
CULVERT 23 (STA 415+29)												
CULVERT 24 (STA 435+93)		294	147	147	11	40		40				
CULVERT 25 (STA 457+83)		400	200	200	15	40		40	30	30		
CULVERT 26 (STA 468+76)		400	200	200	15	40		40	30	30		
CULVERT 27 (STA 483+66)		312	156	156	11	40		40	30	30		
CULVERT 28 (STA 492+25)		312	156	156	11	40		40	30	30		
PROJECT TOTALS	1500	6472	3236	3236	236	800	50	850	570	570	1000	1000

SUMMARY OF SIGNING AND PAVEMENT MARKING ITEMS

LOCATION	644	666	666	666	666	672
	6068	6048	6303	6312	6315	6009
	RELOCATE SM RD SN SUP&AM TY 10BWG	REFL PAV MRK TY I (W) 24" (SLD) (100MIL)	RE PM W/RET REQ TY I (W) 4" (SLD) (100MIL)	RE PM W/RET REQ TY I (Y) 4" (BRK) (100MIL)	RE PM W/RET REQ TY I (Y) 4" (SLD) (100MIL)	REFL PAV MRKR TY II-A-A
	EA	LF	LF	LF	LF	EA
CULVERT 1 (STA 19+80)	1	14				
CULVERT 2 (STA 29+56)			38		38	1
CULVERT 3 (STA 74+97)			24		24	1
CULVERT 4 (STA 104+07)			10		10	1
CULVERT 5 (STA 110+25)	1	14				
CULVERT 6 (STA 138+71)			16	10		1
CULVERT 10A (STA 188+50)	1					
CULVERT 9 (STA 196+30)	1	14				
CULVERT 11 (STA 211+88)			14		14	1
CULVERT 15 (STA 296+57)			10		10	1
CULVERT 16 (STA 310+30)			10		10	1
CULVERT 17 (STA 323+71)			38	10		1
CULVERT 20 (STA 387+88)			44	10		1
CULVERT 24 (STA 435+93)			10		10	1
CULVERT 25 (STA 457+83)			46		46	1
CULVERT 26 (STA 468+76)			46		46	1
CULVERT 27 (STA 483+66)			20		20	1
CULVERT 28 (STA 492+25)			22		22	1
PROJECT TOTALS	4	42	348	30	250	14

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 F-928			
 FM 51 QUANTITY SUMMARY			
SHEET 3 OF 3			
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE	DISTRICT FTW	COUNTY PARKER
CHECK KHA	TEXAS	SECTION	PARKER
CHECK KHA	CONTROL 0313	SECTION 07	JOB 020
			10

THE FOLLOWING SEQUENCE OF WORK IS THE SUGGESTED METHOD OF CONSTRUCTION ACTIVITIES FOR THIS PROJECT. THIS SEQUENCE OF WORK MAY BE REVISED WITH THE APPROVAL OF THE ENGINEER.

GENERAL

1. TRAFFIC CONTROL AND LANE CLOSURES WILL BE IN ACCORDANCE WITH THE PLANS, BC, TCP, AND WZ STANDARDS AND AS DIRECTED BY THE ENGINEER.
2. CONTRACTOR IS REQUIRED TO WORK CONTINUOUS HOURS WHEN EXCAVATION STARTS TO COMPLETE CULVERT REMOVAL AND INSTALLATION. MAINTAIN ONE OPEN TRAVEL LANE WITH MANAGED TWO-WAY TRAVEL DURING CONSTRUCTION UNTIL ENTIRE CULVERT INSTALLATION IS COMPLETE.
3. CONTRACTOR SHALL VERIFY WITH ENGINEER THE USE OF PCTB, AUTOMATED FLAGGER ASSISTANCE DEVICES, AND TEMPORARY TRAFFIC SIGNALS FOR EACH CULVERT. CONTRACTOR SHALL ONLY USE TEMPORARY TRAFFIC SIGNALS WHEN DIRECTED BY THE ENGINEER.
4. VERIFY THE LOCATION AND SPACING OF SIGNS, BARRICADES, AND CHANNELIZING DEVICES PRIOR TO THEIR PLACEMENT ALONG VERTICAL CURVES, HORIZONTAL CURVES, AND OTHER GEOMETRIC CONSTRAINTS TO ASSURE PROPER VISIBILITY TO ALL MOTORISTS AT ALL TIMES.
5. THE CONTRACTOR SHALL COVER OR REMOVE EXISTING SIGNS AND PAVEMENT MARKINGS THAT CONFLICT WITH THE TCP TO AVOID CONFUSION FOR THE TRAVELING PUBLIC. PAYMENT FOR THIS WORK SHALL BE CONSIDERED SUBSIDIARY TO ITEM 502.
6. MAINTAIN POSITIVE DRAINAGE DURING CONSTRUCTION.
7. MAINTAIN ALL EXISTING DRAINAGE CONDITIONS DURING ALL CONSTRUCTION PHASES UNTIL THE PERMANENT DRAINAGE FACILITIES ARE READY FOR USE. HANDLE EXCAVATED AND STOCKPILED MATERIAL IN SUCH A WAY THAT IT WILL NOT BLOCK DRAINAGE OR DRIVER SIGHT DISTANCE.
8. INITIAL STORM WATER POLLUTION PREVENTION PLAN (SW3P) DEVICES MUST BE PLACED PRIOR TO THE START OF CONSTRUCTION IN AREAS WHERE SOIL DISTURBANCE IS EXPECTED. SW3P DEVICES SHALL BE REMOVED IN EACH AREA ONCE VEGETATION HAS BEEN ESTABLISHED OR AS APPROVED BY THE ENGINEER.
9. CONTRACTOR TO REFERENCE PAVEMENT MARKINGS PRIOR TO REMOVAL FOR PROPER REPLACEMENT.
10. CONTRACTOR TO MAINTAIN ACCESS TO ALL PROPERTIES AT ALL TIMES.

PHASE I

1. PLACE ADVANCE WARNING SIGNS IN ACCORDANCE WITH TXDOT BC AND TCP STANDARDS, THE LATEST EDITION OF THE TEXAS MUTCD, AND AS DIRECTED BY THE ENGINEER. SIGNS MAY REQUIRE ADJUSTMENT IN THE FIELD BUT ONLY WITH THE APPROVAL OF THE ENGINEER. REFERENCE ALL PAVEMENT MARKINGS PRIOR TO REMOVAL TO LATER REESTABLISH.
2. INSTALL AND MAINTAIN SW3P DEVICES AS SHOWN IN THE DETAILS AND STANDARDS AND AS DIRECTED BY THE ENGINEER.
3. SHIFT TRAFFIC IN ACCORDANCE WITH TXDOT STANDARD TCP(2-1)-18 AND TCP(2-2)-18.
4. CUT & RESTORE PAVEMENT TO CONSTRUCT CULVERTS, SAFETY END TREATMENTS, AND RELATED DRAINAGE ITEMS, AS SHOWN ON THE TRAFFIC CONTROL PLAN TYPICAL SECTIONS AND CULVERT LAYOUTS. AFTER DAILY CONSTRUCTION ACTIVITIES, ANY OPEN TRENCH MUST BE RESTORED OR COVERED TO BE OPENED BACK TO ORIGINAL TWO LANES OF TRAFFIC OVERNIGHT. ANY OVERNIGHT LANE CLOSURES WILL NEED TO BE APPROVED BY THE ENGINEER.
5. REPEAT 3 AND 4 TO CONSTRUCT REMAINING HALF OF CULVERT.



PHASE II

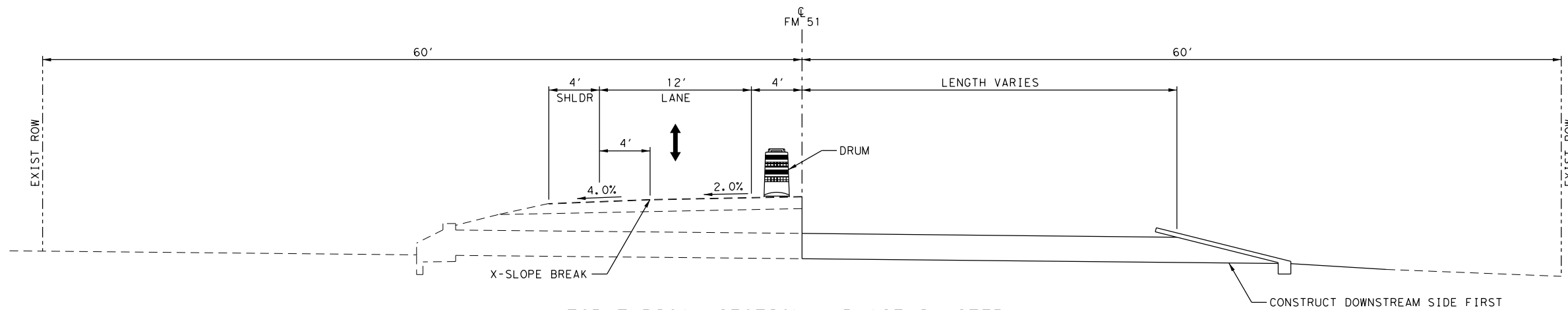
1. REGRADE FRONT SLOPES, BACK SLOPES, AND DITCHES AS NECESSARY.
2. PLACE PERMANENT PAVEMENT MARKINGS WHERE EXISTING PAVEMENT WAS PREVIOUSLY DISTURBED.
3. ESTABLISH PERMANENT VEGETATIVE COVER AS DIRECTED BY THE ENGINEER.
4. REMOVE SW3P DEVICES UPON FINAL ESTABLISHMENT OF VEGETATIVE COVER.
5. PERFORM FINAL SITE CLEAN UP AND REMOVE ADVANCE WARNING SIGNS AS DIRECTED BY THE ENGINEER.



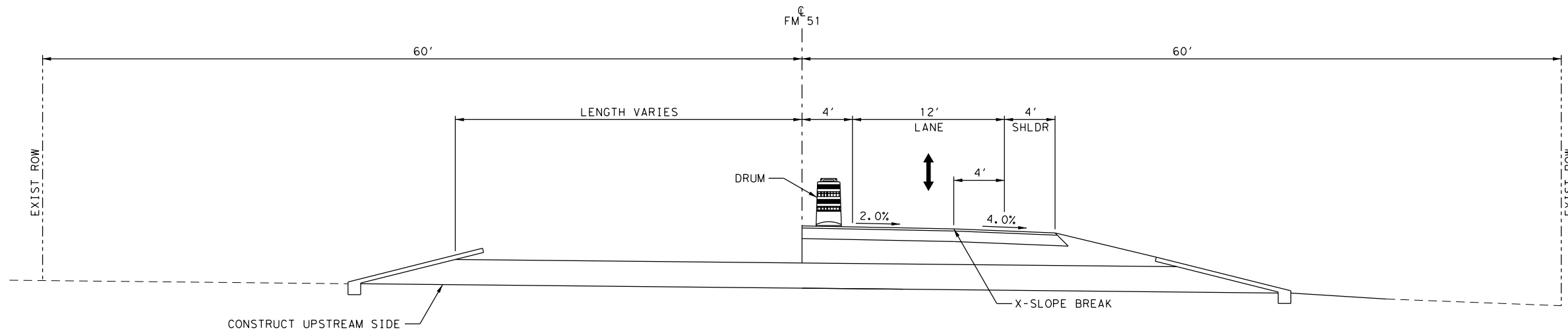
D. Singh 10/19/2020

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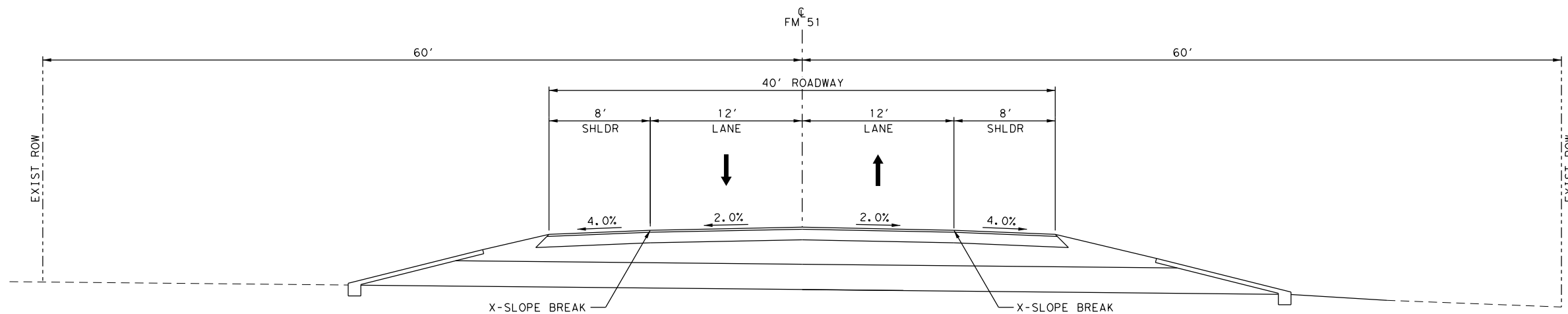
NO.	DATE	REVISION	APPROVED
 F-928			
 FM 51 TRAFFIC CONTROL PLAN NARRATIVE			
SHEET 1 OF 1			
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE	DISTRICT FTW	COUNTY PARKER
CHECK KHA	TEXAS	SECTION	JOB 020
CHECK KHA	CONTROL 0313	07	11



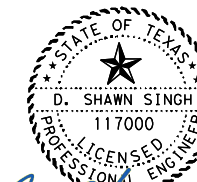
TCP TYPICAL SECTION - PHASE I (STEP 1)
CULVERT REPLACEMENT



TCP TYPICAL SECTION - PHASE I (STEP 2)
CULVERT REPLACEMENT



TCP TYPICAL SECTION - PHASE II
CULVERT REPLACEMENT



D. Singh 10/19/2020

NO.	DATE	REVISION	APPROVED

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F-928



FM 51

**TRAFFIC CONTROL PLAN
TYPICAL SECTIONS**

SCALE: NTS SHEET 1 OF 1

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
KHA	6	(SEE TITLE SHEET)	FM 51
DRAWN	STATE	DISTRICT	COUNTY
KHA	TEXAS	FTW	PARKER
CHECK	CONTROL	SECTION	JOB
KHA	0313	07	020

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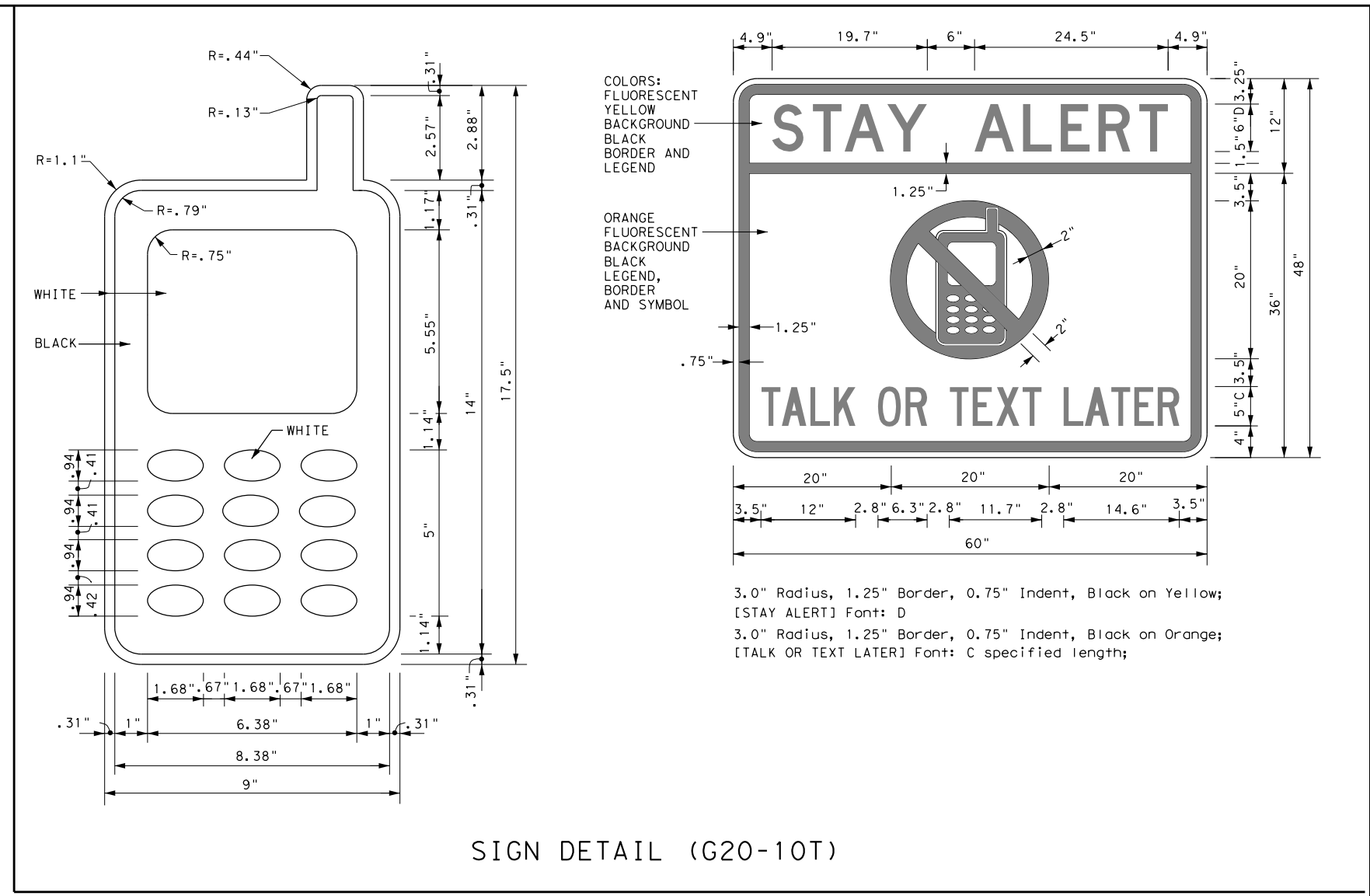
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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

- 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.
- As shown on BC(2), the OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER (see Sign Detail G20-10T) and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. However, the TRAFFIC FINES DOUBLE sign will not be required on projects consisting solely of mobile operation work, such as striping or milling edgeline rumble strips. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits.
- Except for devices required by Note 10, 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 APPAREL 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.



Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found on-line at the web address given below or by contacting:

Texas Department of Transportation
 Traffic Operations Division - TE
 Phone (512) 416-3118

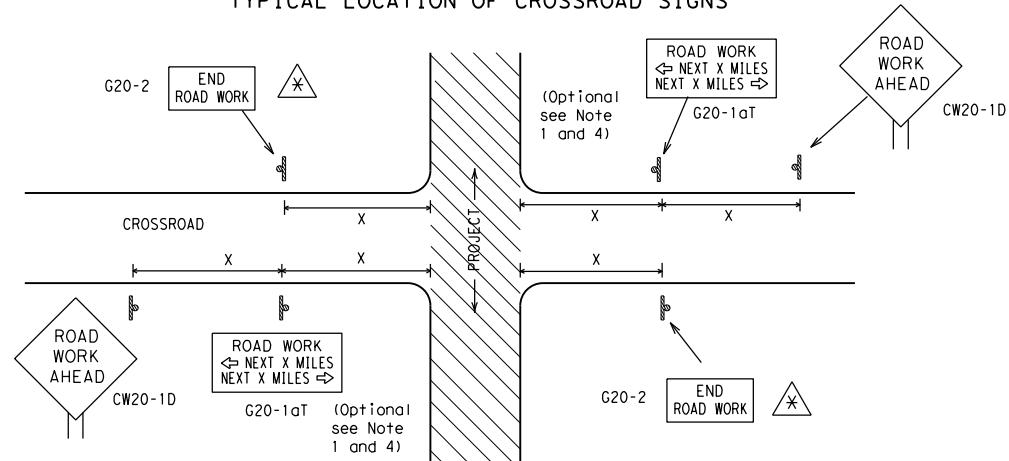
THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT http://www.txdot.gov	
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)	
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)	
MATERIAL PRODUCER LIST (MPL)	
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"	
STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS (SHSD)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

SHEET 1 OF 12

		Traffic Operations Division Standard	
BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS			
BC (1) - 14			
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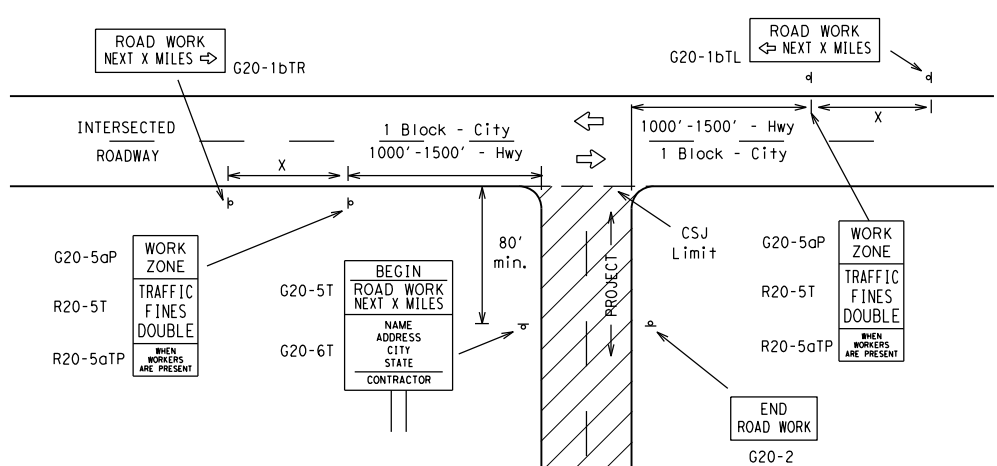
TYPICAL LOCATION OF CROSSROAD SIGNS



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

1. 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.
2. 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. This information shall be shown in the plans.
3. 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.
4. 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.
5. Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
6. 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

1. 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.
2. If construction closes the road at a T-intersection the Contractor shall place the "CONTRACTOR NAME" (G20-6T) sign behind the Type 3 Barricades for the road closure (see BC(10) also). The "ROAD WORK NEXT X MILES" left arrow (G20-1bTL) and "ROAD WORK NEXT X MILES" right arrow (G20-1bTR) signs shall be replaced by the detour signing called for in the plans.

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING^{1,5,6}

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Spacing "X" Feet (Apprx.)
CW20 ⁴	48" x 48"	48" x 48"	30	120
CW21			35	160
CW22			40	240
CW23			45	320
CW25			50	400
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	55	500 ²
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	60	600 ²
			65	700 ²
			70	800 ²
			75	900 ²
			80	1000 ²
			*	* ³

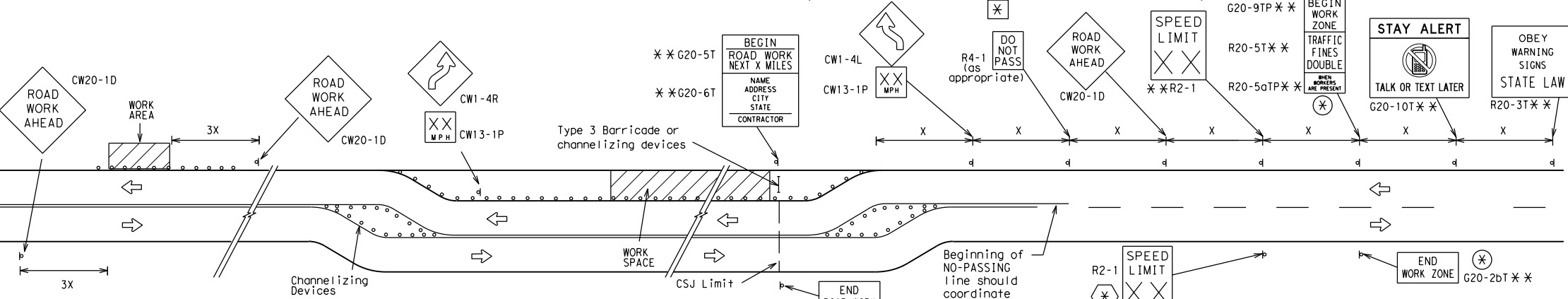
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

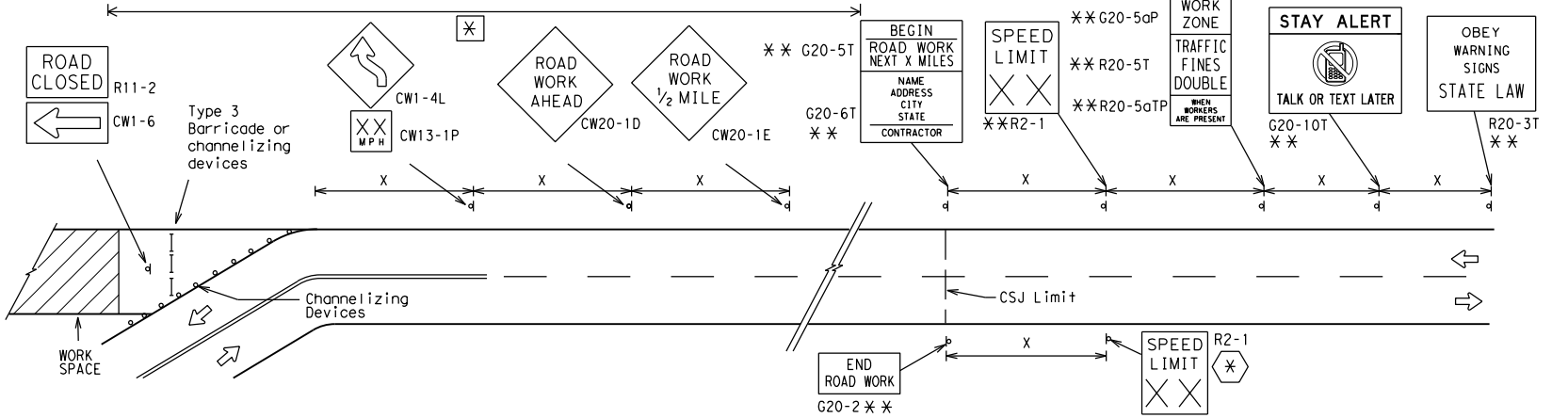
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be used on low volume crossroads at the discretion of the Engineer. See Note 2 under "Typical Location of Crossroad Signs".
5. Only diamond shaped warning sign sizes are indicated.
6. 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

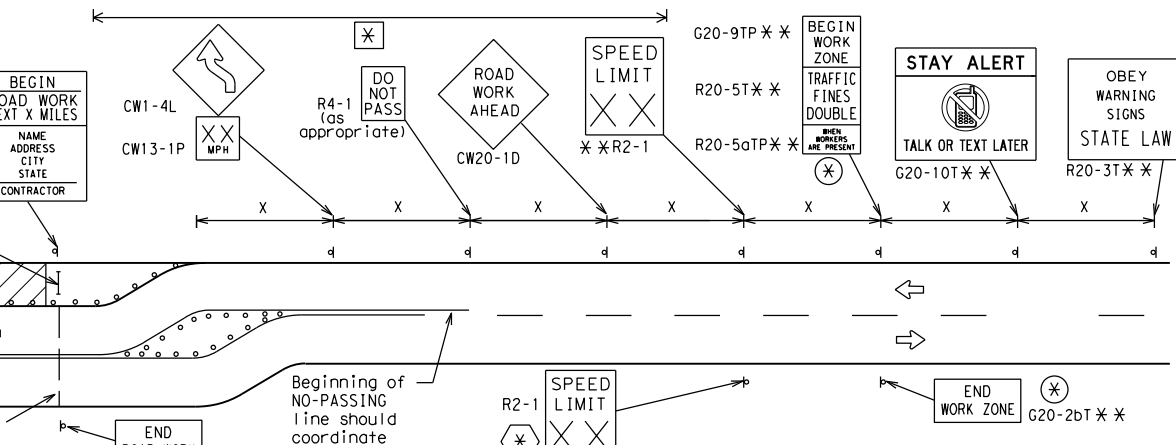


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing 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.
- ** Required CSJ Limit signing. See Note 10 on BC(1). TRAFFIC FINES DOUBLE signs will not be required on projects consisting solely of mobile operations work.
- ⊛ 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

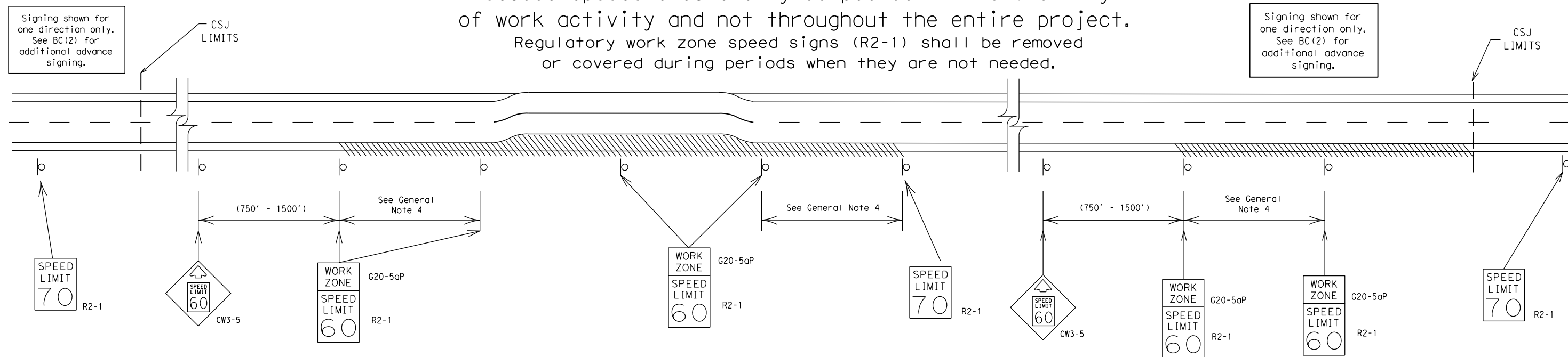
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TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

Long/Intermediate Term Work Zone Speed Limit signs, when approved as described above, should be posted and visible to the motorist when work activity is present. Work activity may also be defined as a change in the roadway that requires a reduced speed for motorists to safely negotiate the work area, including:

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

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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SHEET 3 OF 12

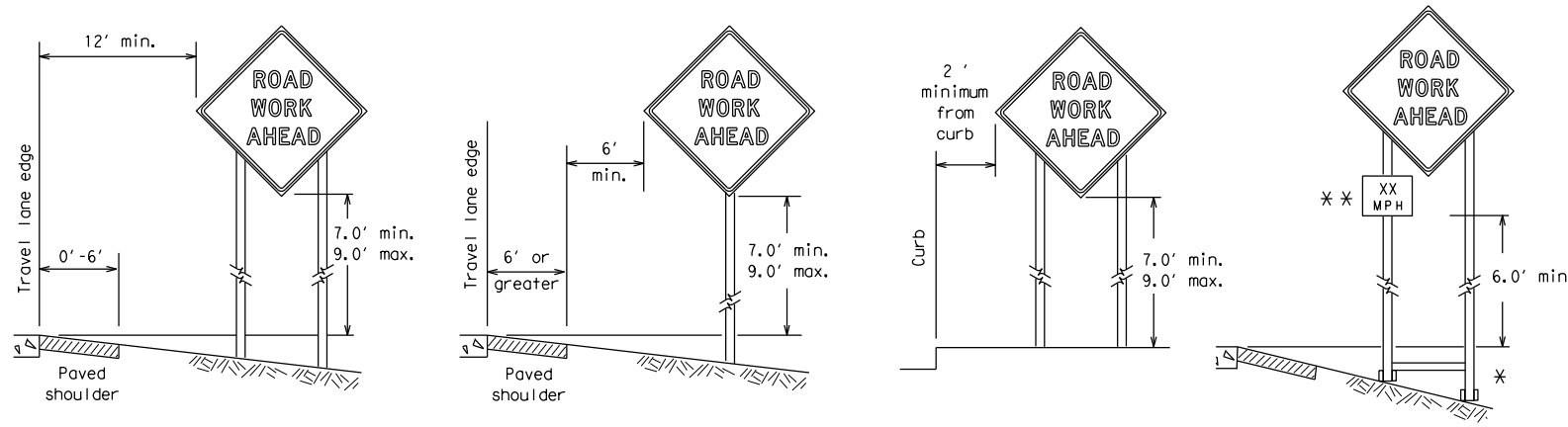


BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC (3) - 14

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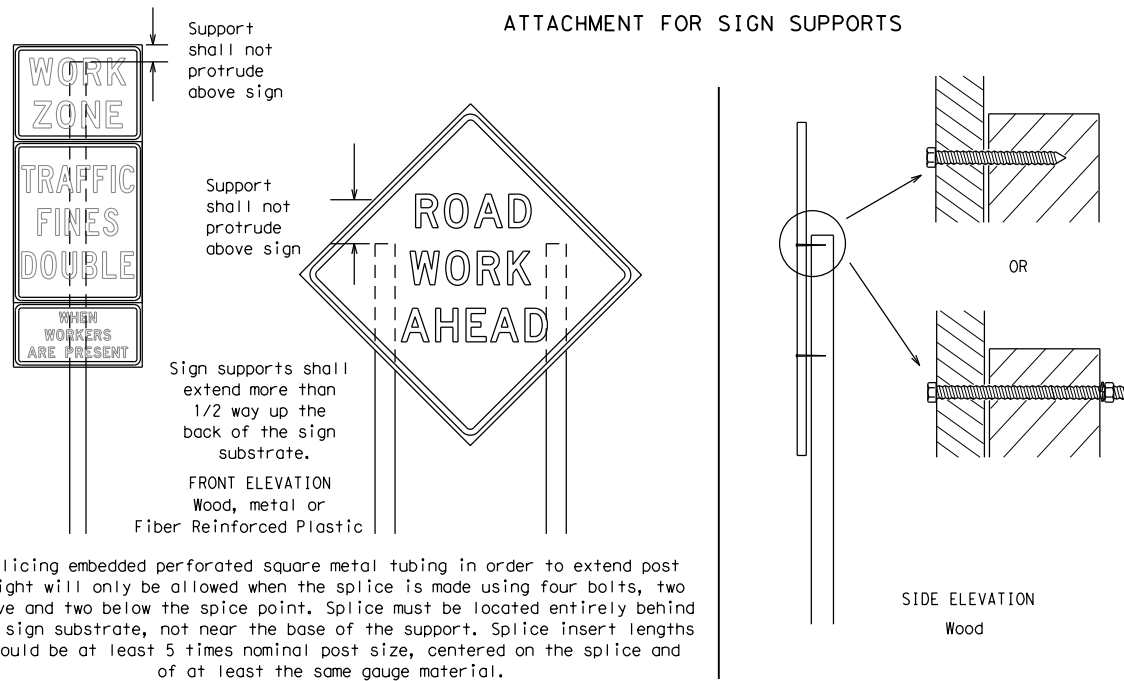
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



✱ 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



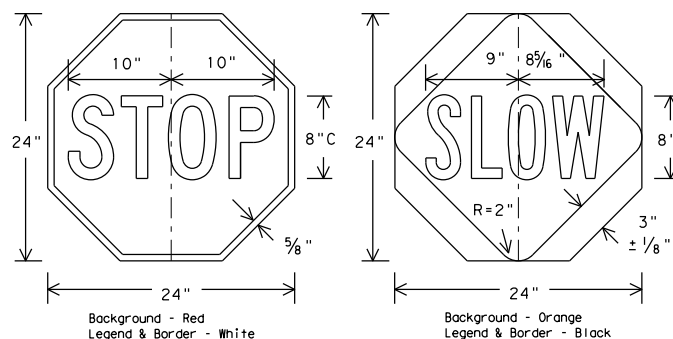
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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

STOP/SLOW PADDLES

- STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24" as detailed below.
- When used at night, the STOP/SLOW paddle shall be retroreflectORIZED.
- 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.



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, 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.
- 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 sheets or the CWZTCD. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards 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.

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). 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_{FL} or Type C_{FL}, 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.

SHEET 4 OF 12



BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC (4) - 14

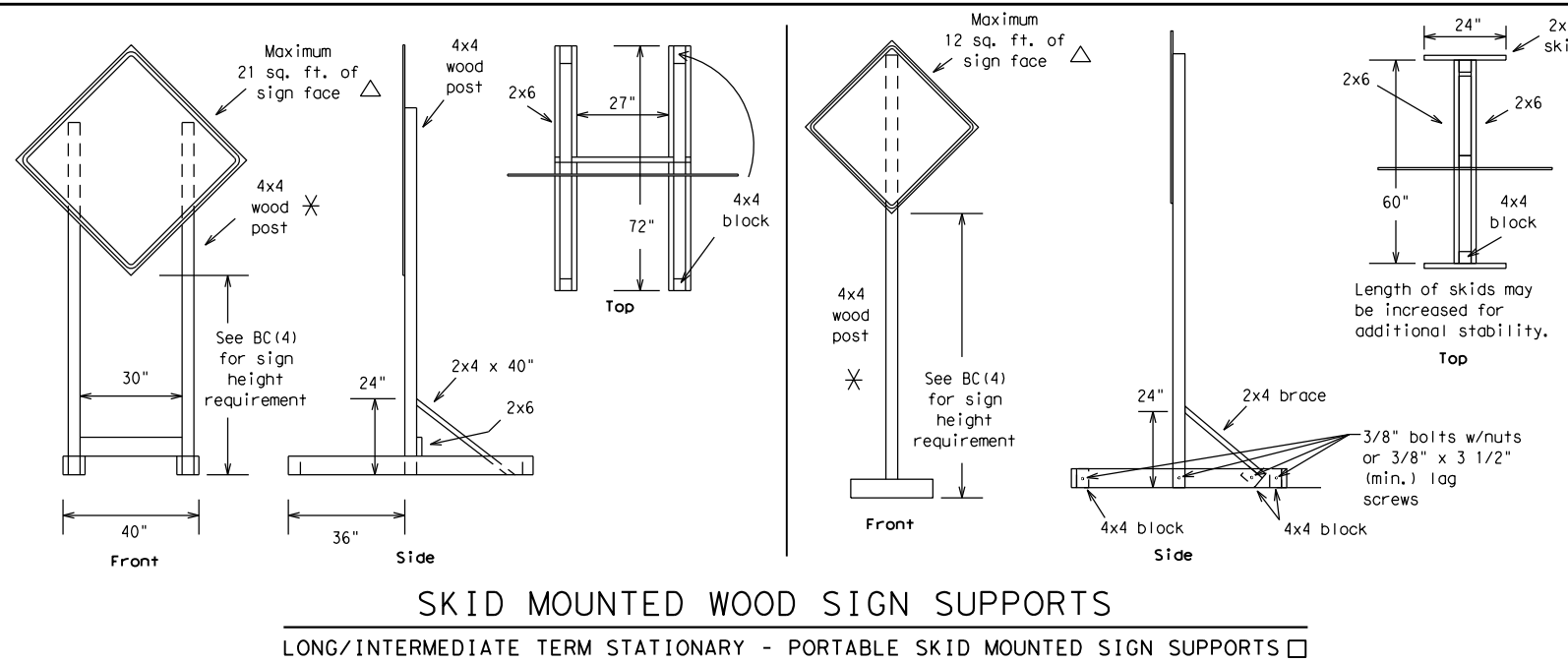
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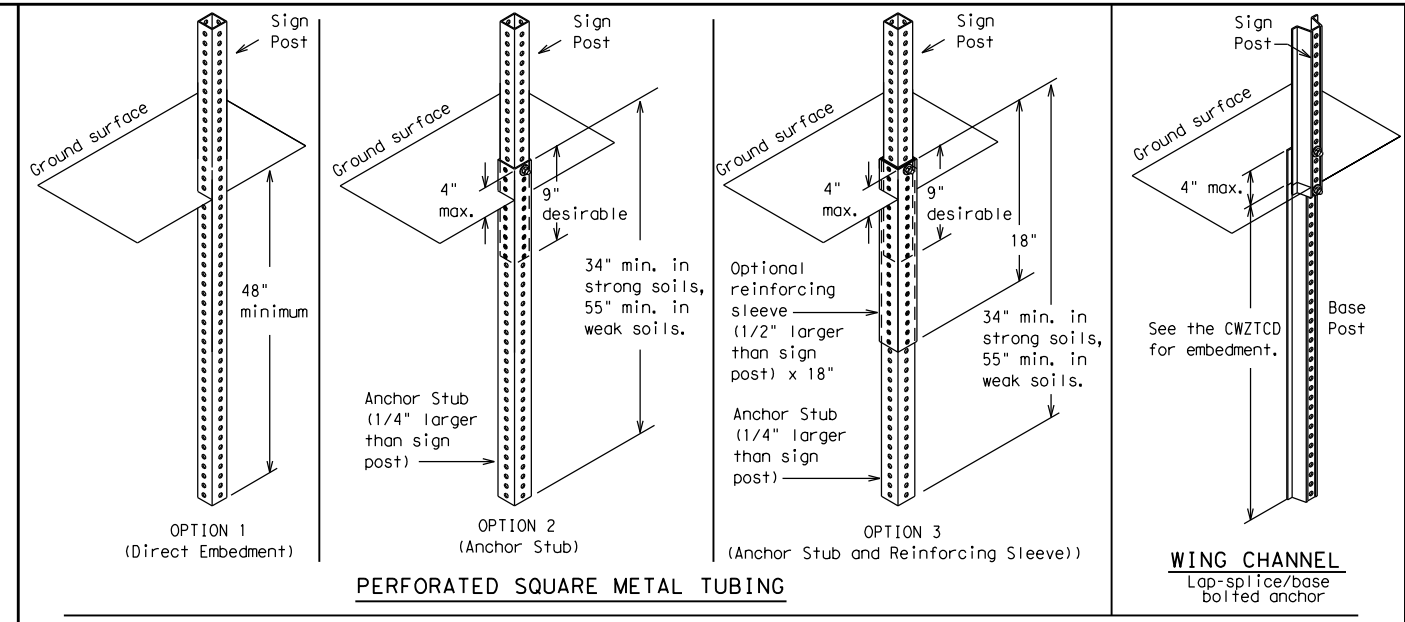
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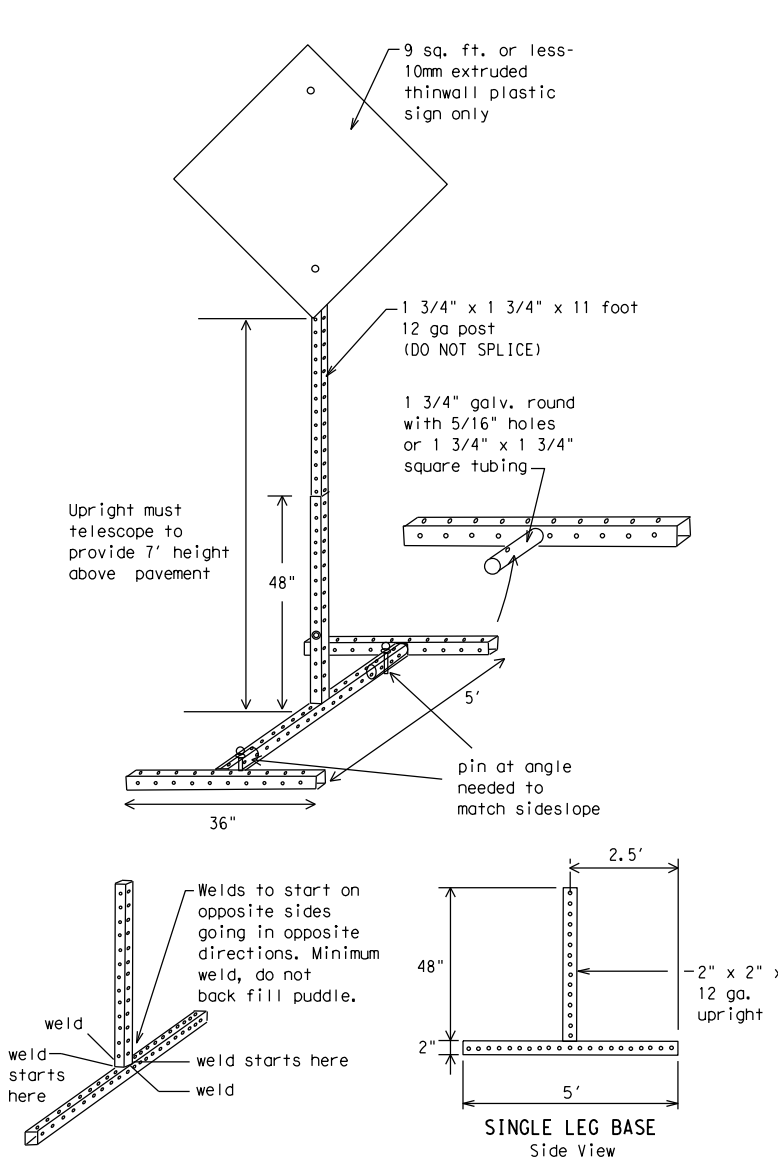
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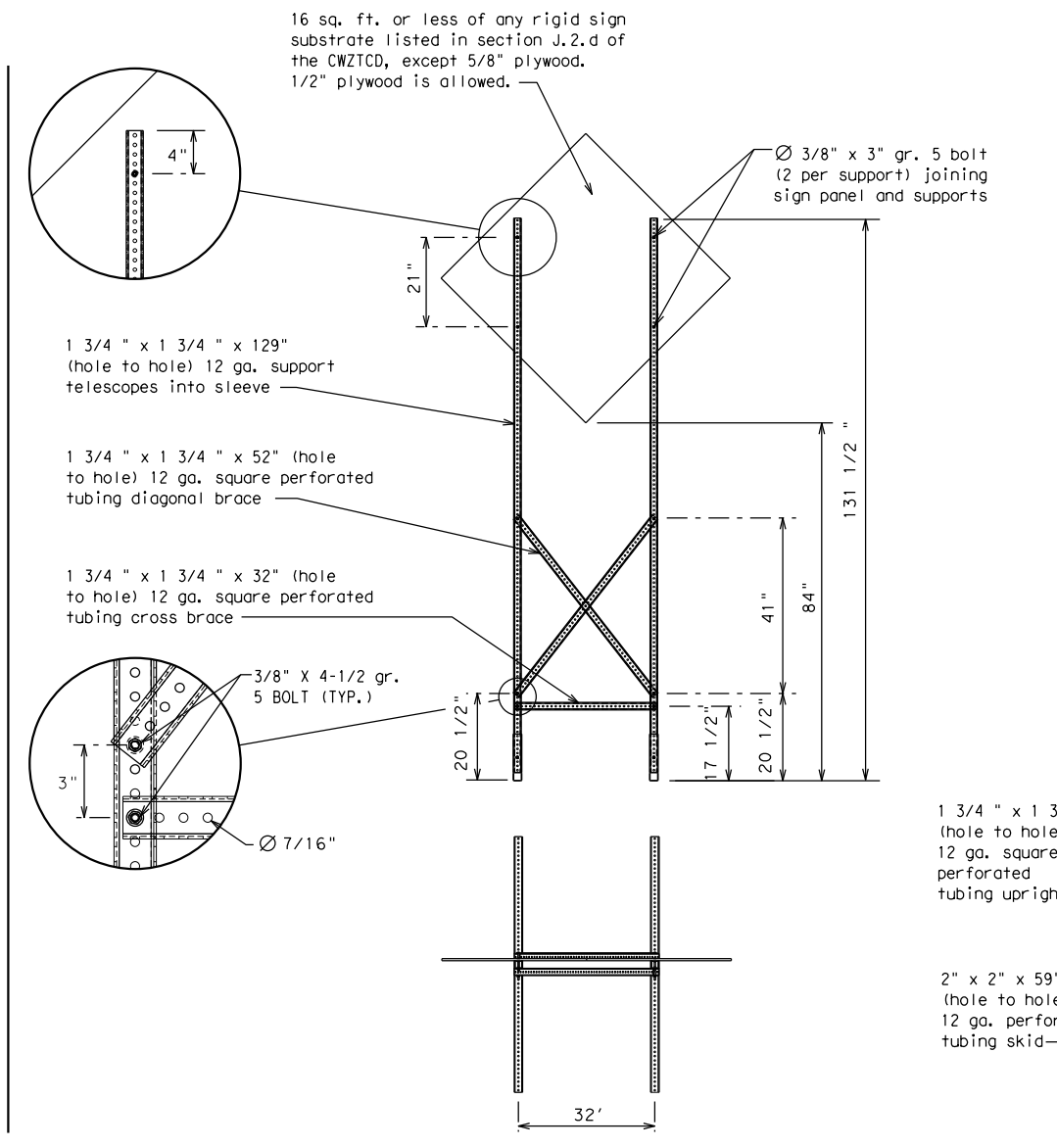
SKID MOUNTED WOOD SIGN SUPPORTS
 LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS □



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

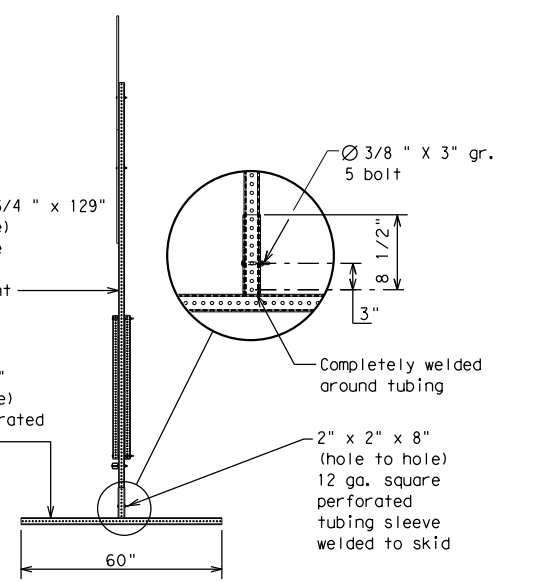


SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS



WOOD POST SYSTEM FOR GROUND MOUNTED SIGN SUPPORTS

Nominal Post Size	Number of Posts	Maximum Sq. feet of Sign Face	Minimum Soil Embedment	Drilled Hole(s) Required
4 x 4	1	12	36"	NO
4 x 4	2	21	36"	NO
4 x 6	1	21	36"	YES
4 x 6	2	36	36"	YES



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.

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
PREPARE TO STOP
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.

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

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

SHEET 6 OF 12



BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC (6) - 14

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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13	FTW	PARKER	18	

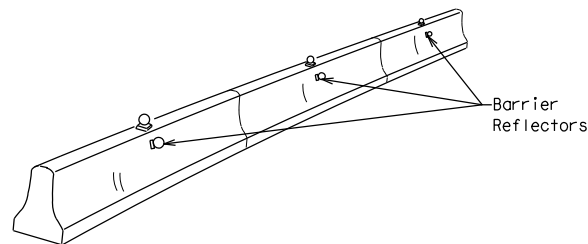
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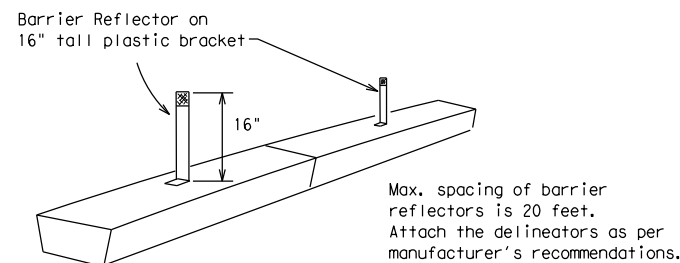
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors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



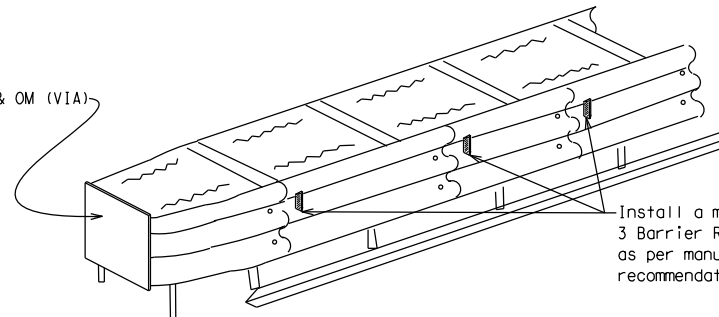
CONCRETE TRAFFIC BARRIER (CTB)



LOW PROFILE CONCRETE BARRIER (LPCB)

- 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.

See D & OM (VIA)



DELINEATION OF END TREATMENTS

END TREATMENTS FOR CTB'S USED IN WORK ZONES

End treatments used on CTB's in work zones shall meet crashworthy standards as defined in the National Cooperative Highway Research Report 350. Refer to the CWZTCD List for approved end treatments and manufacturers.

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS

WARNING LIGHTS

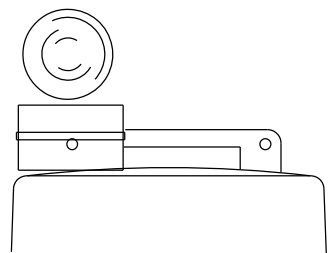
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet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

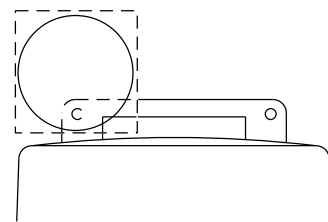
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing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



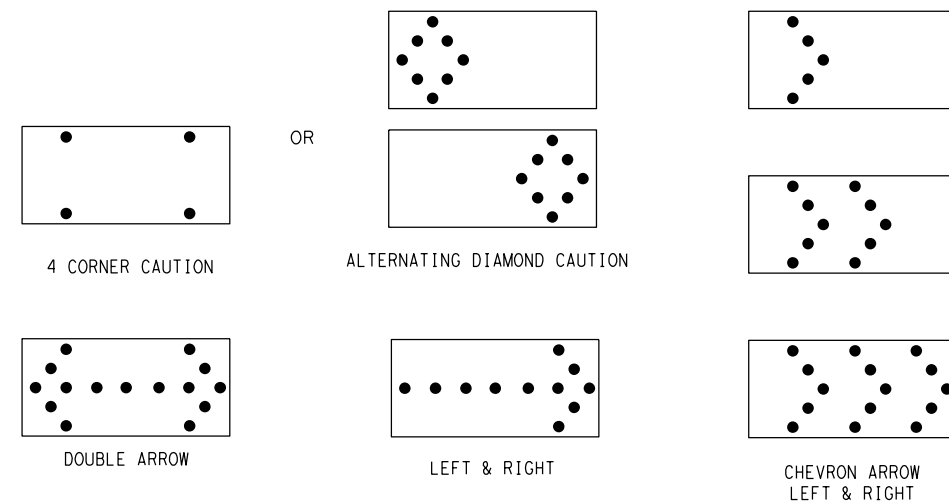
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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 National Cooperative Highway Research Report No. 350 (NCHRP 350) or the Manual for Assessing Safety Hardware (MASH).
- Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
- Refer to the CWZTCD for a list of approved TMAs.
- TMAs are required on freeways unless otherwise noted in the plans.
- A TMA should be used anytime that it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
- The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.



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

BC (7) - 14

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9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13		FTW	PARKER	19					

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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:

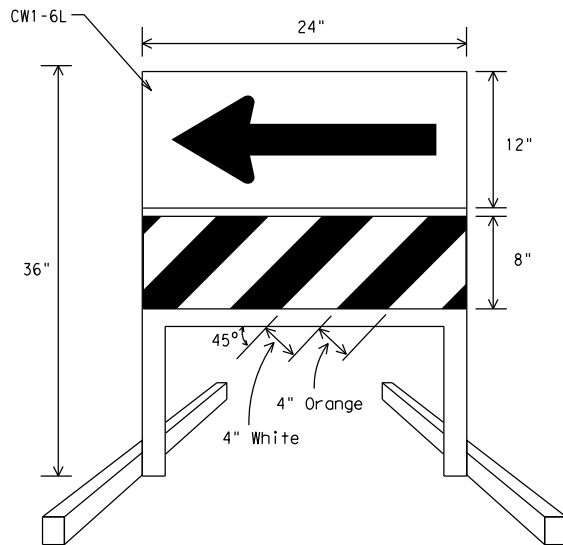
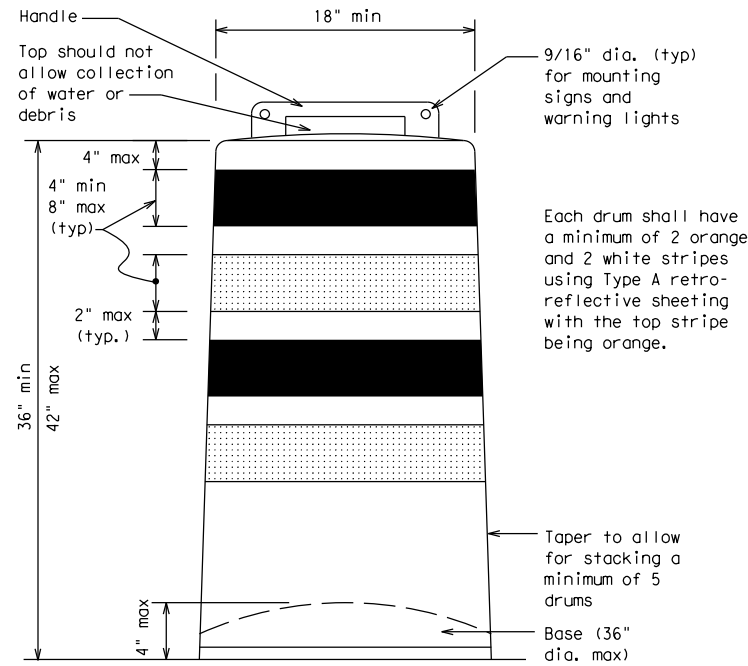
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
- The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents 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 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.

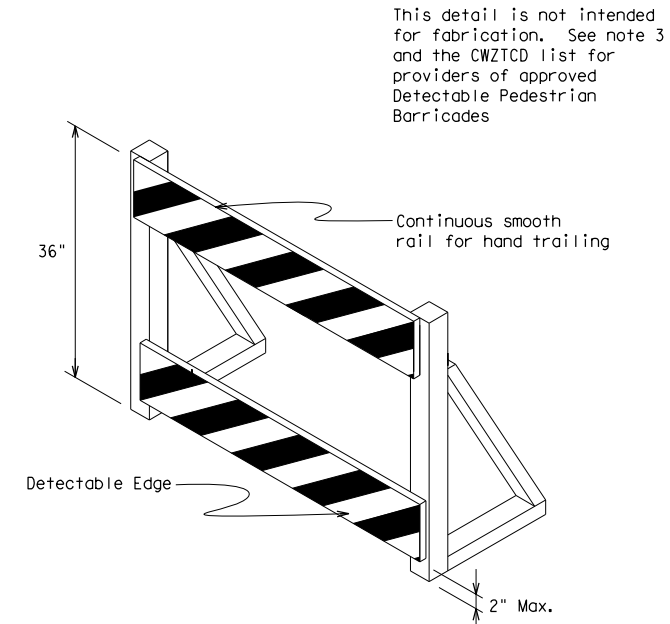
BALLAST

- 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.



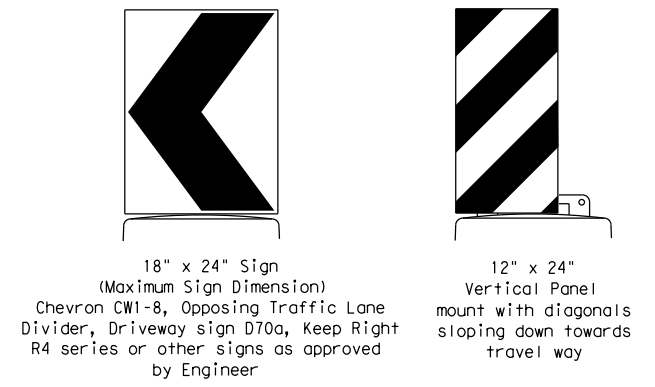
DIRECTION INDICATOR BARRICADE

- The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.
- If used, the Direction Indicator Barricade should be used in series to direct the driver through the transition and into the intended travel lane.
- The Direction Indicator Barricade shall consist of One-Direction Large Arrow (CW1-6) sign in the size shown with a black arrow on a background of Type B_{FL} or Type C_{FL} Orange retroreflective sheeting above a rail with Type A retroreflective sheeting in alternating 4" white and orange stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Sheeting types shall be as per DMS 8300.
- Double arrows on the Direction Indicator Barricade will not be allowed.
- Approved manufacturers are shown on the CWZTCD List. Ballast shall be as approved by the manufacturers instructions.



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.
- Where pedestrians with visual disabilities normally use the closed sidewalk, a device that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.
- 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 for Buildings and Facilities (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 may 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.



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_{FL} or Type C_{FL} 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 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



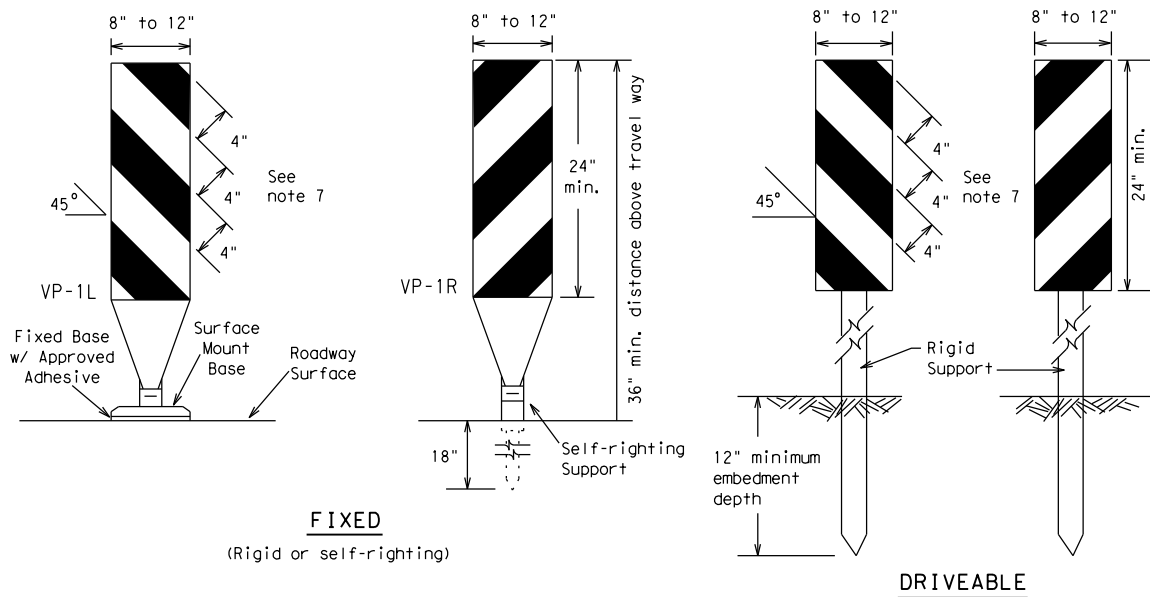
BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (8) - 14

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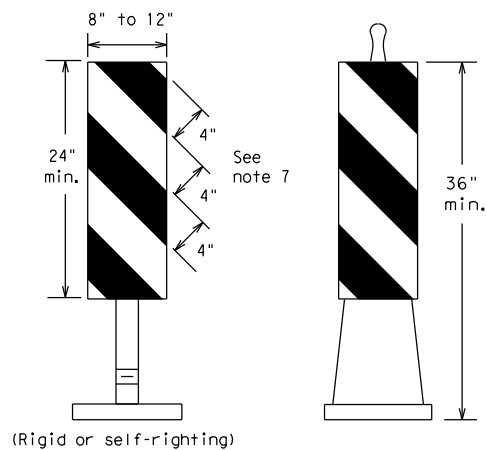
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FIXED
(Rigid or self-righting)

DRIVEABLE

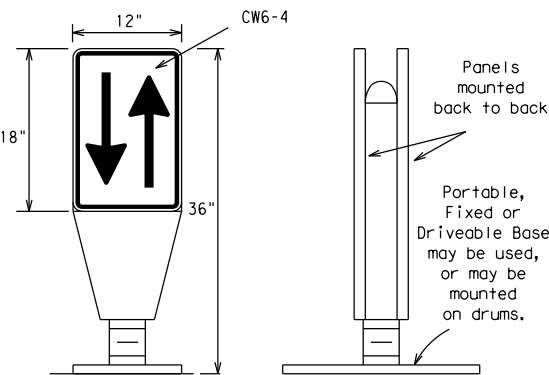


(Rigid or self-righting)

PORTABLE

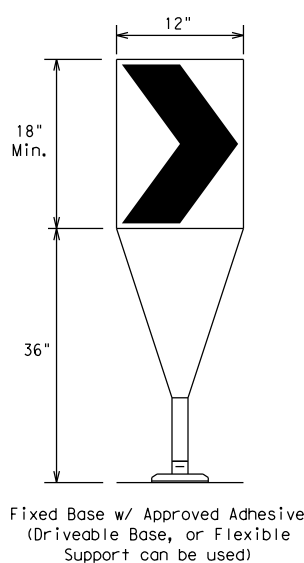
VERTICAL PANELS (VPs)

- 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 Appendix B "Treatment of Pavement Drop-offs in Work Zones" for additional guidelines on the use of 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 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)

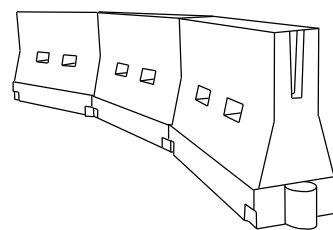
- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base 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_{FL} or Type C_{FL} conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



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

- The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
- Chevrons are intended to give notice of a sharp change of alignment with the direction of travel and provide additional emphasis and guidance for vehicle operators with regard to changes in horizontal alignment of the roadway.
- Chevrons, when used, shall be erected on the outside of a sharp curve or turn, or on the far side of an intersection. They shall be in line with and at right angles to approaching traffic. Spacing should be such that the motorist always has three in view, until the change in alignment eliminates its need.
- To be effective, the chevron should be visible for at least 500 feet.
- Chevrons shall be orange with a black nonreflective legend. Sheeting for the chevron shall be retroreflective Type B_{FL} or Type C_{FL} 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) placed 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 NCHRP 350 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 ² / 60	150'	165'	180'	30'	60'
35		205'	225'	245'	35'	70'
40		265'	295'	320'	40'	80'
45	L = WS	450'	495'	540'	45'	90'
50		500'	550'	600'	50'	100'
55		550'	605'	660'	55'	110'
60		600'	660'	720'	60'	120'
65		650'	715'	780'	65'	130'
70		700'	770'	840'	70'	140'
75		750'	825'	900'	75'	150'
80		800'	880'	960'	80'	160'

**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) - 14

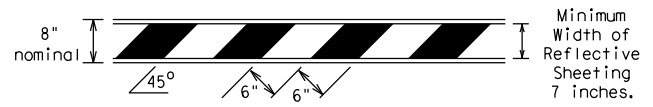
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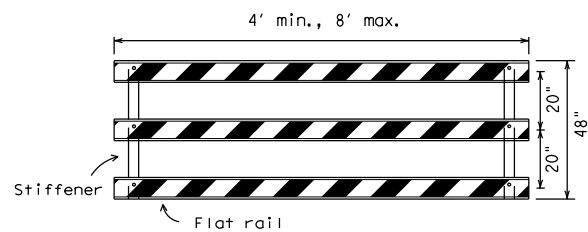
TYPE 3 BARRICADES

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 conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.



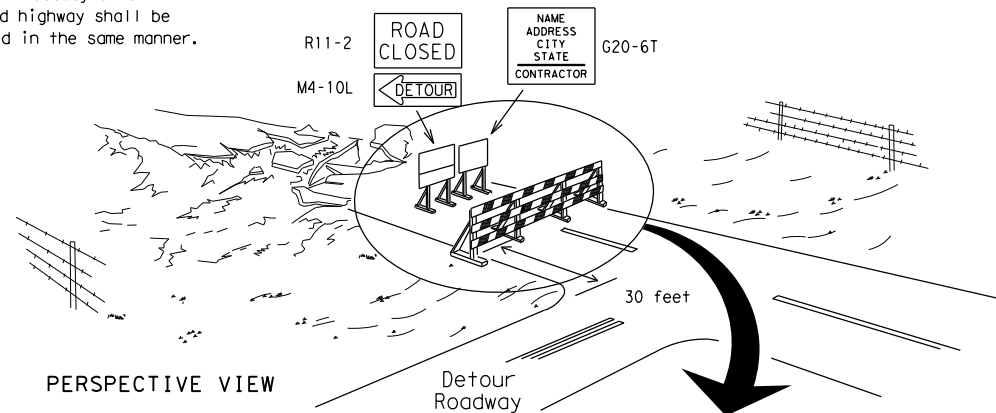
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

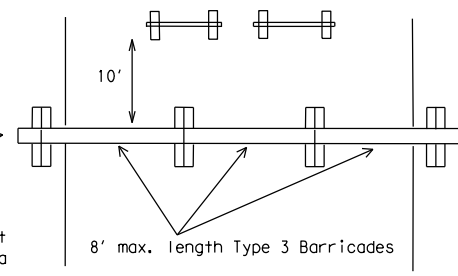
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

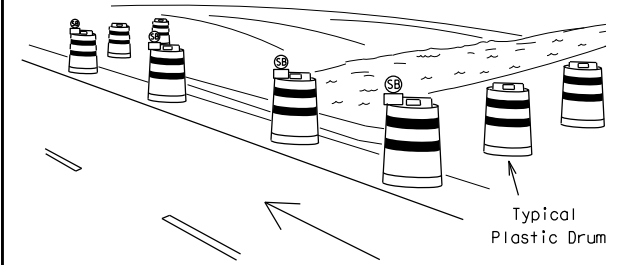
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



PLAN VIEW

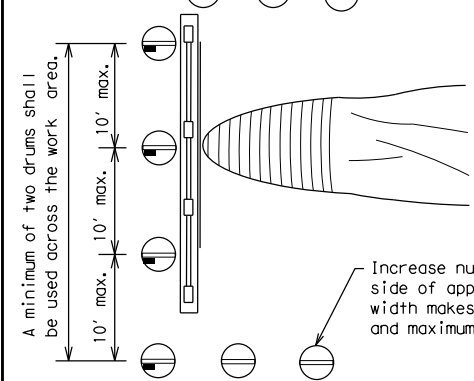
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

These drums are not required on one-way roadway

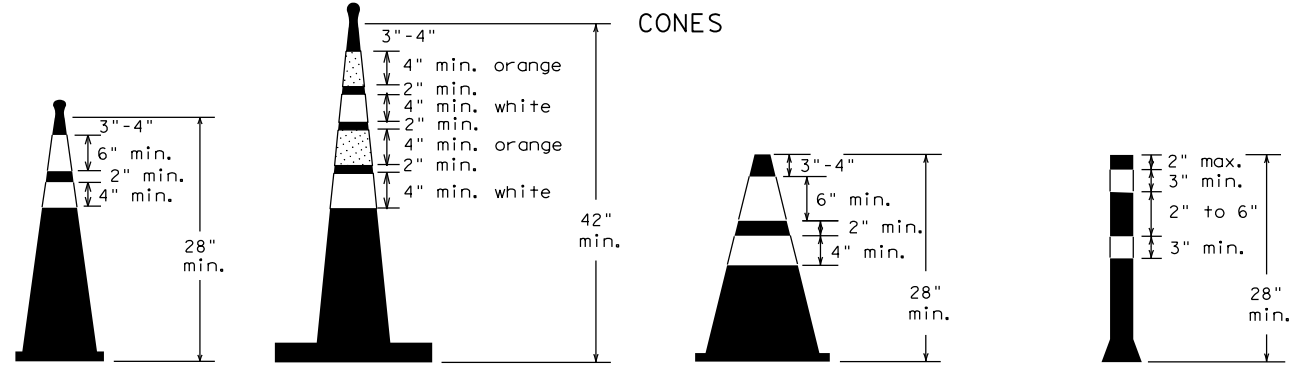


PLAN VIEW

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS

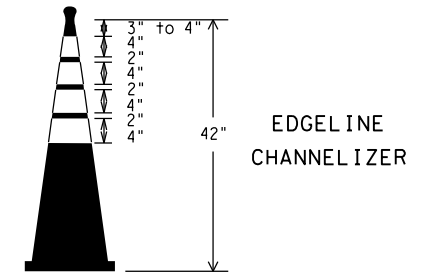
1. Where positive redirection capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



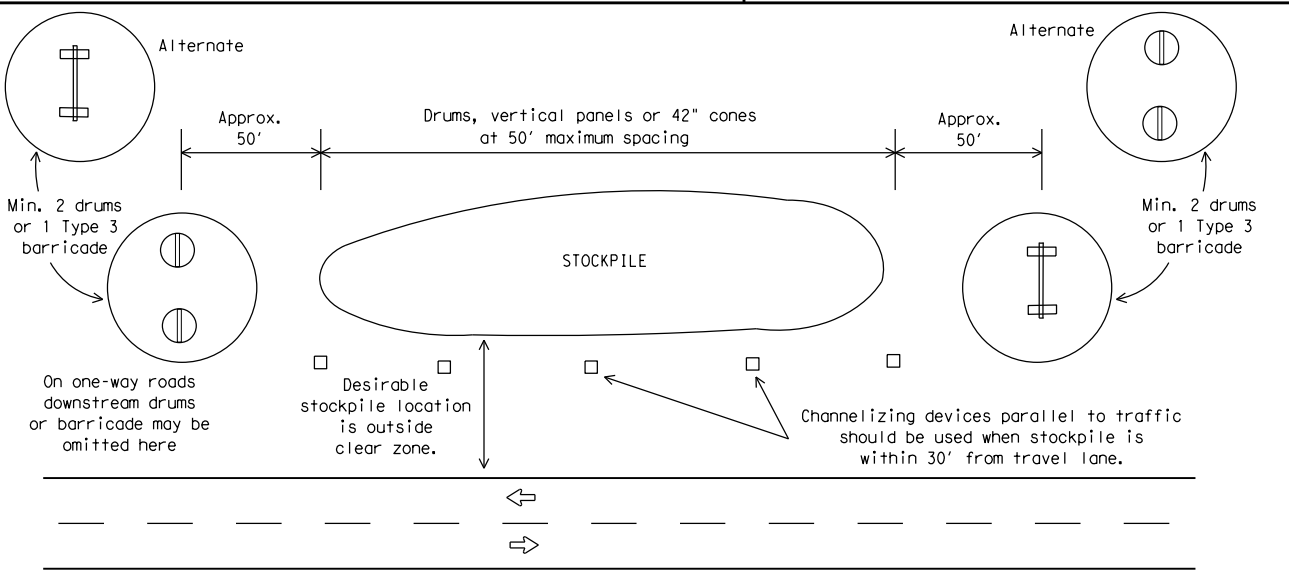
28" Cones shall have a minimum weight of 9 1/2 lbs.
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

THIS DEVICE SHALL NOT BE USED ON PROJECTS LET AFTER MARCH 2014.



EDGE LINE CHANNELIZER

1. This device is intended only for use in place of a vertical panel to channelize traffic by indicating the edge of the travel lane. It is not intended to be used in transitions or tapers.
2. This device shall not be used to separate lanes of traffic (opposing or otherwise) or warn of objects.
3. This device is based on a 42 inch, two-piece cone with an alternate striping pattern: four 4 inch retroreflective bands, with an approximate 2 inch gap between bands. The color of the band should correspond to the color of the edgeline (yellow for left edgeline, white for right edgeline) for which the device is substituted or for which it supplements. The reflectorized bands shall be retroreflective Type A conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
4. The base must weigh a minimum of 30 lbs.



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

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

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (10) - 14

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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.

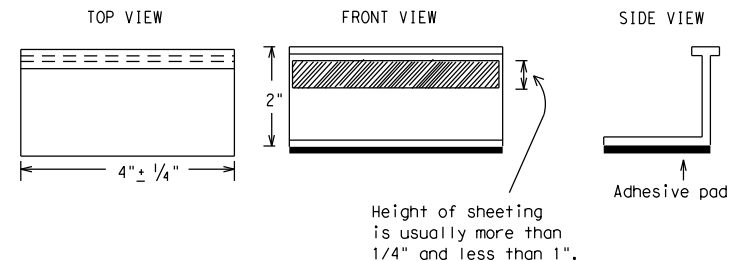
MAINTAINING WORK ZONE PAVEMENT MARKINGS

- 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

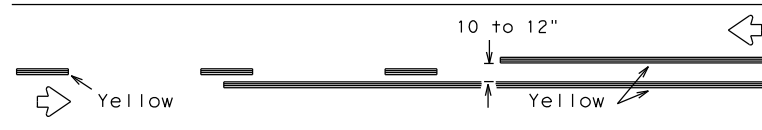
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1-02 7-13	FTW	PARKER	23	
11-02 8-14				

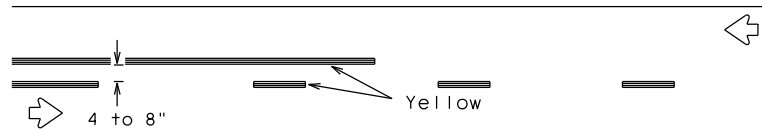
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act." No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

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 FILE: c:\pwworking\kha\pwworking\shawn.singh\dms30455\bc-14.dgn

PAVEMENT MARKING PATTERNS

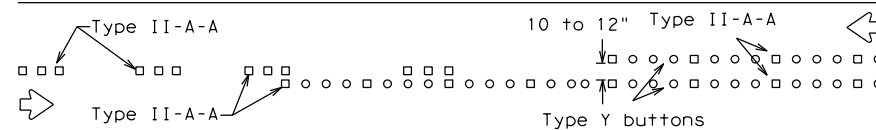


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

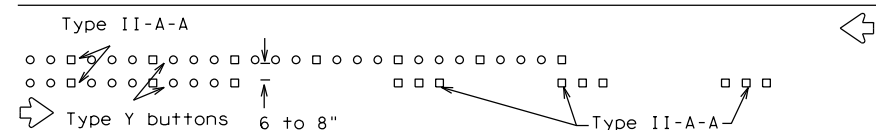


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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

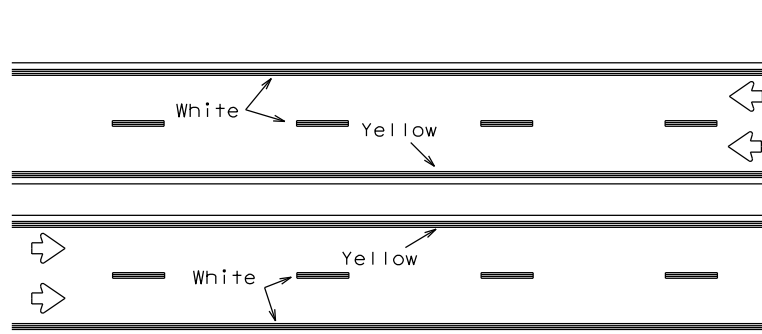


RAISED PAVEMENT MARKERS - PATTERN A



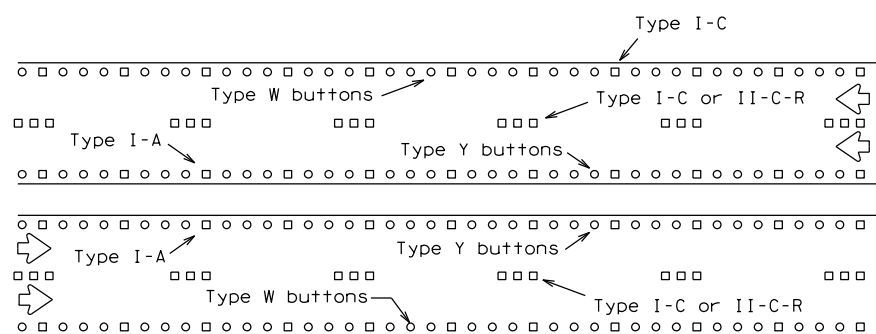
RAISED PAVEMENT MARKERS - PATTERN B

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



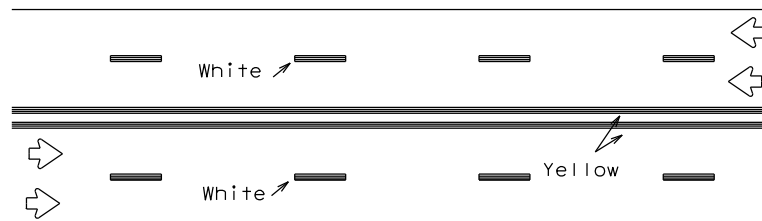
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



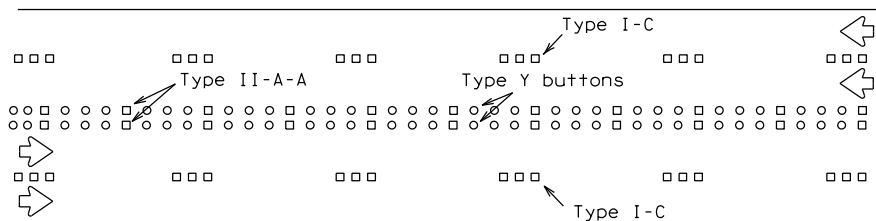
RAISED PAVEMENT MARKERS

EDGE & LANE LINES FOR DIVIDED HIGHWAY



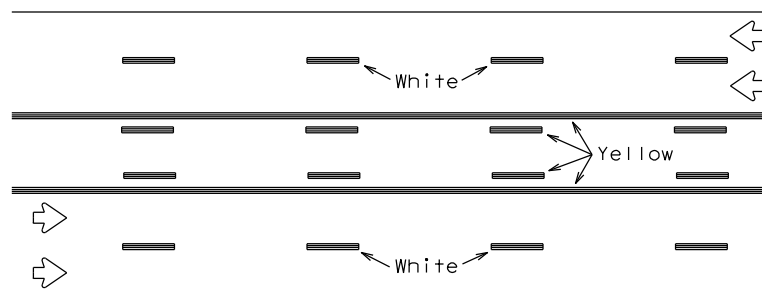
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



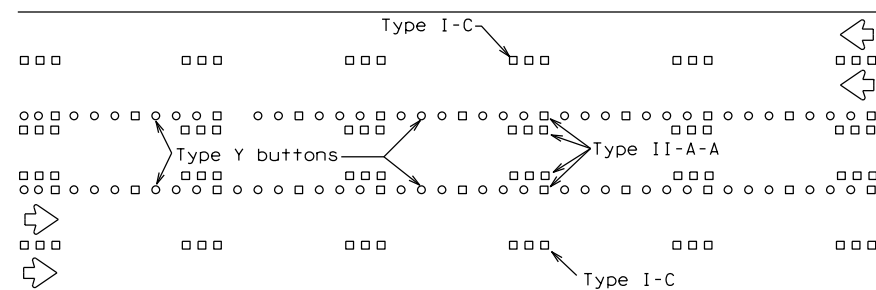
RAISED PAVEMENT MARKERS

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

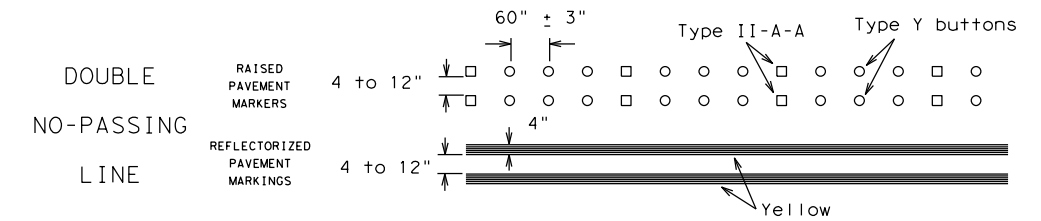
Prefabricated markings may be substituted for reflectORIZED pavement markings.



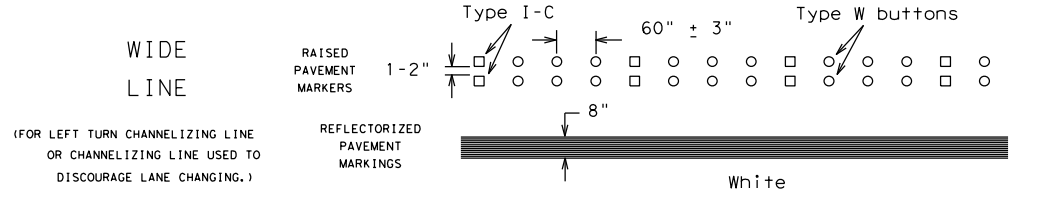
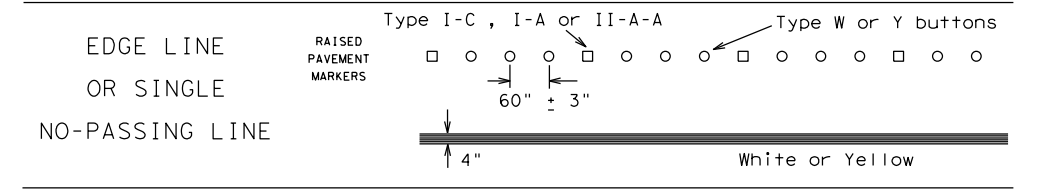
RAISED PAVEMENT MARKERS

TWO-WAY LEFT TURN LANE

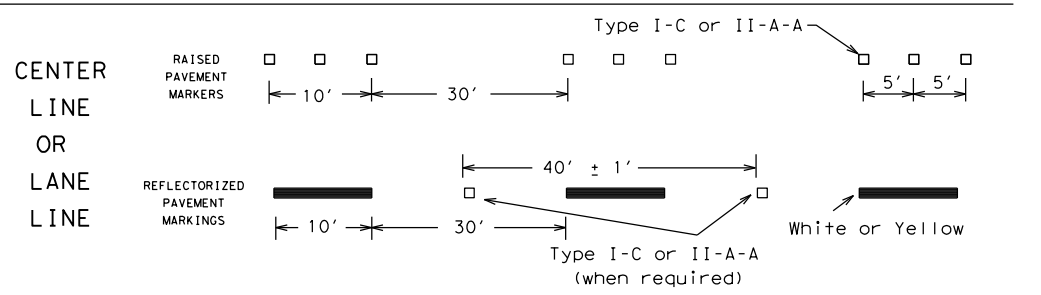
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



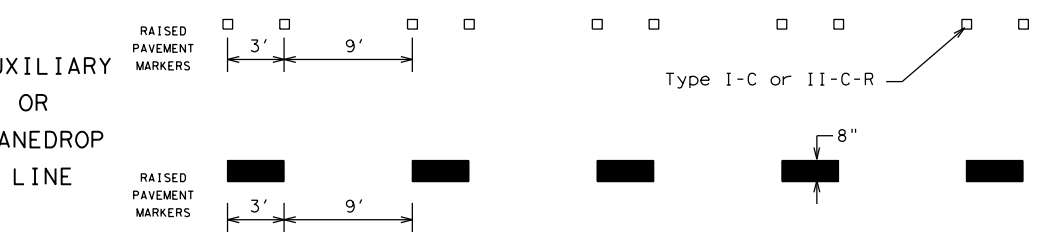
SOLID LINES



BROKEN LINES

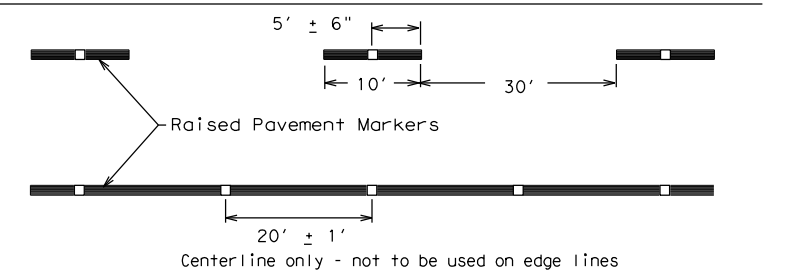


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



SHEET 12 OF 12

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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."



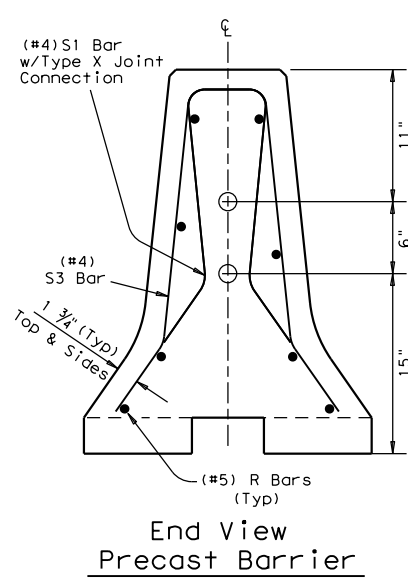
BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC (12) - 14

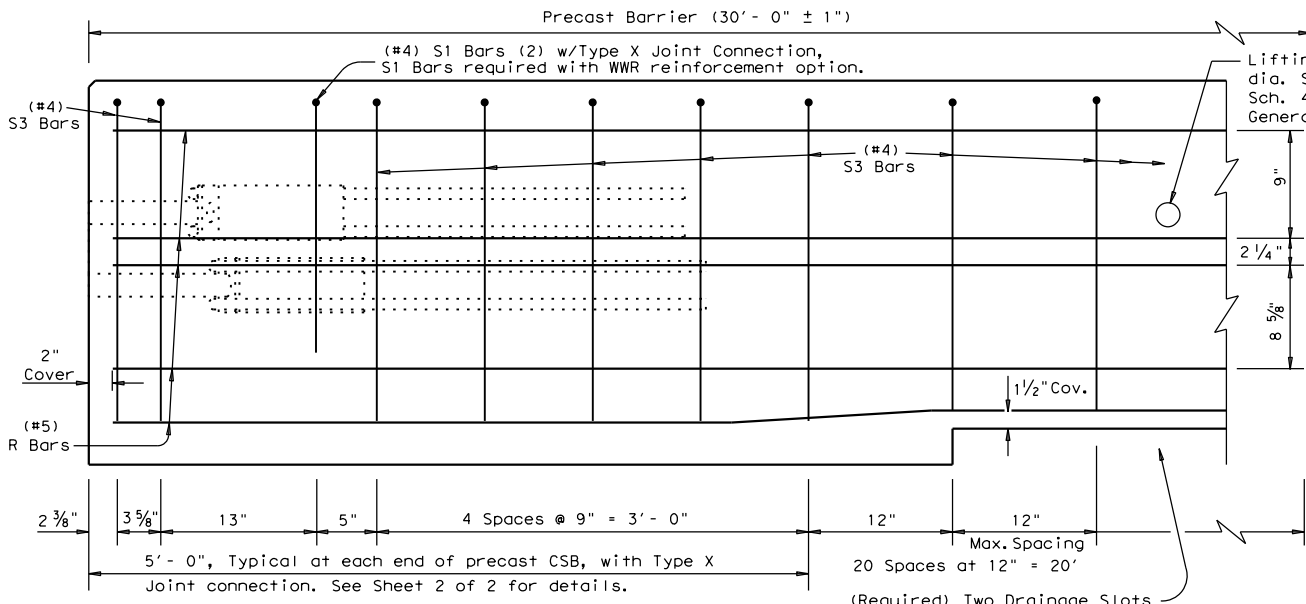
FILE: bc-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
1-97 9-07	0313	07	020	FM 51
2-98 7-13	DIST	COUNTY	SHEET NO.	
11-02 8-14	FTW	PARKER	24	

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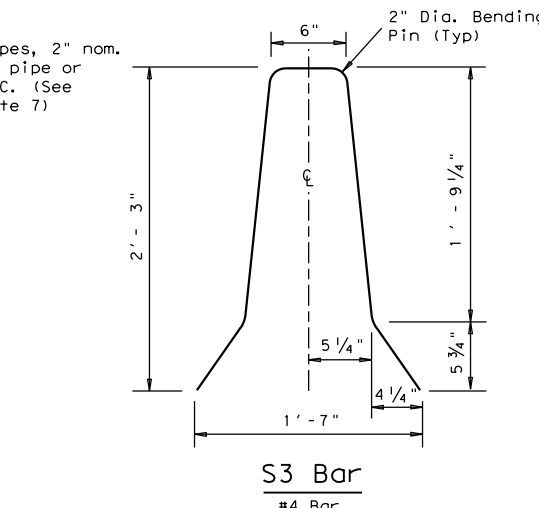
DATE: 10/19/2020 3:02:36 PM
 FILE: c:\pwworking\kna\pwwprod\shawn.singh\dms30455\csb110.dgn



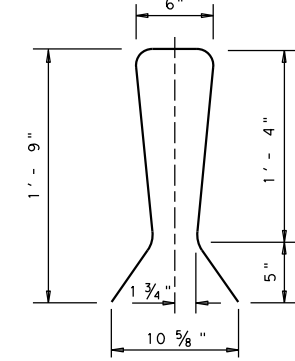
End View Precast Barrier
 See sheet 2 of 3 for Joint connection Type X



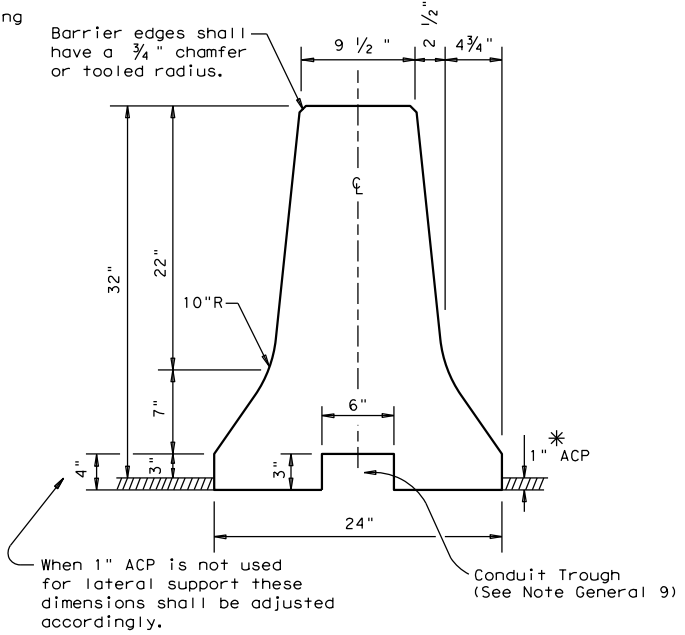
Reinforcement for Precast (CSB) Concrete Safety Barrier (Type 1)
 Showing reinforcement for Joint Type X



S3 Bar



S1 Bar

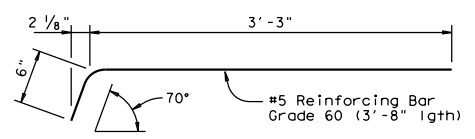


Concrete Safety Barrier

* When 1" ACP is "not" used as lateral support for permanent barrier placement. A permissible method of attaining the equivalent lateral support may be used, See CSB(6) sheet.

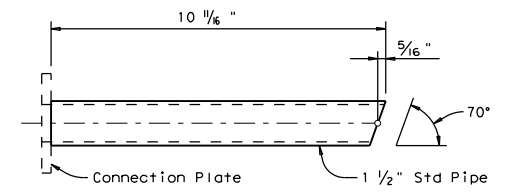
GENERAL NOTES

- Concrete shall be Class H with a minimum compressive strength of 3,600 psi.
- Where used, rebar reinforcement shall be Grade 60 and conform to ASTM A615.
- Precast barrier length shall be 30 ft. unless otherwise specified on the plans.
- All precast barrier edges shall have a 3/4" chamfer or tooled radius.
- All concrete, reinforcement, joint connection systems, grout etc. as shown, are considered as part of the barrier payment.
- All steel assemblies for joint shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."
- Regardless of the method of handling, barrier lifting points shall be approx. 7.5 feet from the ends of the barrier. Lifting devices and attachments to barrier sections shall be approved by the Engineer.
- Surface finishing and grouting (where required) shall be two parts sand one part cement with enough water to make the mixture plastic. Grouting shall be done in a manner that will assure a smooth surface. Surface finishing shall be considered subsidiary to the various bid items involved.
- Conduit trough when required shall be shown elsewhere on the plans, or as directed by the Engineer.



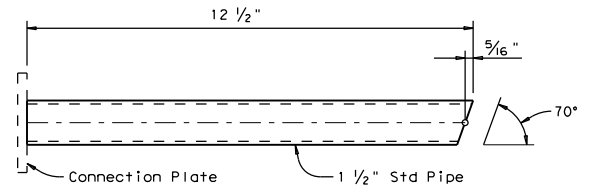
DEFORMED BAR ANCHOR DETAILS

Two (2) Bars required per assembly. Eight (8) required per joint.



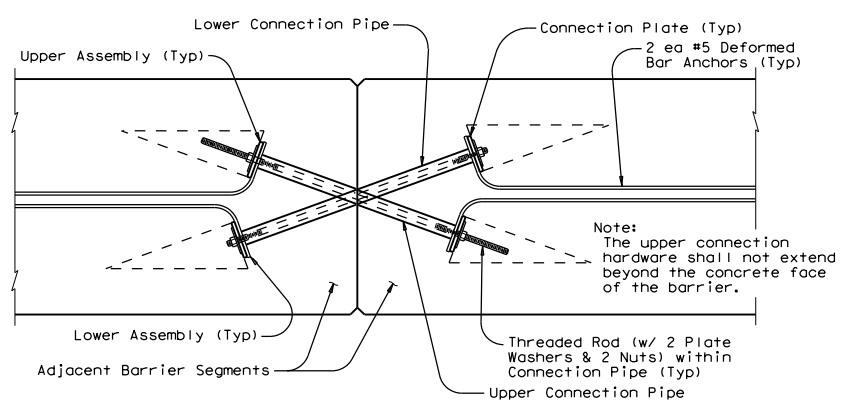
UPPER CONNECTION PIPE DETAILS

One (1) Steel Pipe required per Upper Assembly. Two (2) required per joint.



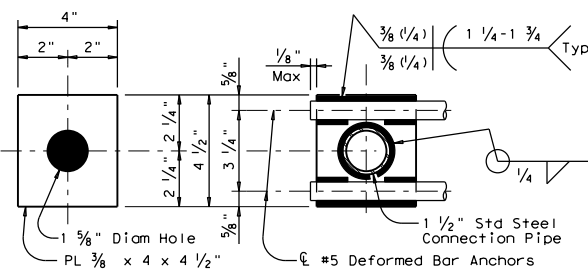
LOWER CONNECTION PIPE DETAILS

One (1) Steel Pipe required per Lower Assembly. Two (2) required per joint.



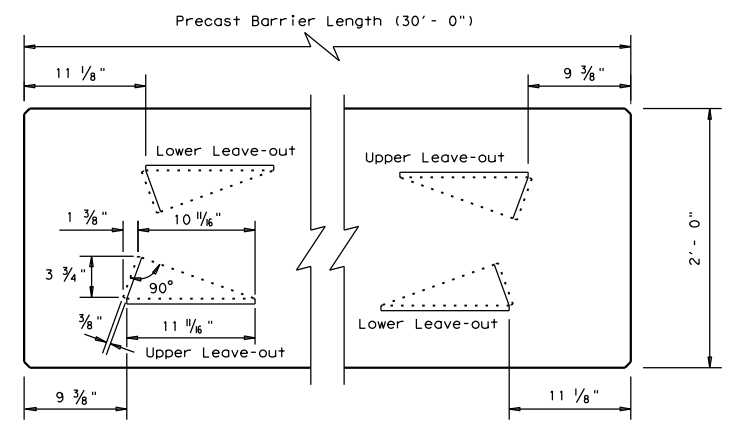
TYPE X JOINT INSTALLATION DETAIL

Barrier reinforcing and Type X Joint Leave-Out dimensions not shown for clarity.

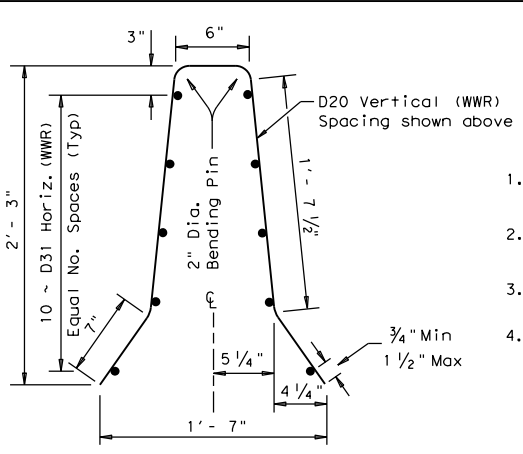


CONNECTION PLATE DETAILS

One (1) Plate required per assembly. Four (4) required per joint. All steel fittings for joint Type X shall be galvanized after fabrication in accordance with Item 445.



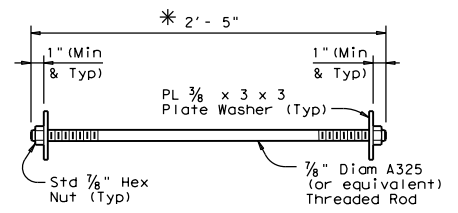
BARRIER PLAN AT END JOINTS



Welded Wire Reinforcement (WWR) Option for Bars R and S3

(WWR) General Notes

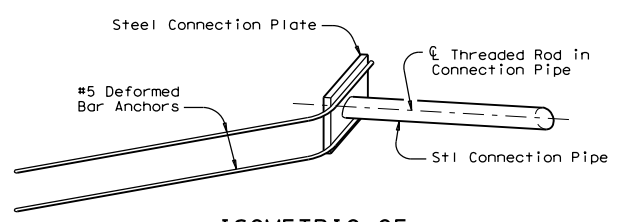
- Deformed Welded Wire Reinforcement (WWR) shall conform to ASTM A497.
- Welded wire cage may be cut or bent to accommodate the Type X joint connection and drainage slots, as directed by the Engineer.
- All reinforcement shall comply with Item 440, "Reinforcing Steel."
- Combinations of reinforcing steel and WWR will be permitted, as directed by the Engineer. The dimension from the end of the barrier section to the first wire shall not exceed 3".



CONNECTION BOLT OR THREADED ROD DETAIL

Two (2) Threaded Rods (or Equivalent Hex Hd. Bolts) (w/ Two (2) PL 3/8 x 3 x 3 Plate Washers & Two (2) Std Hex Nuts) required per joint.

* The connection hardware shall not extend beyond the concrete face of the barrier. Hex head bolts may be provided. The proper length of all hardware should be verified.



ISOMETRIC OF TYPICAL WELDED ASSEMBLY

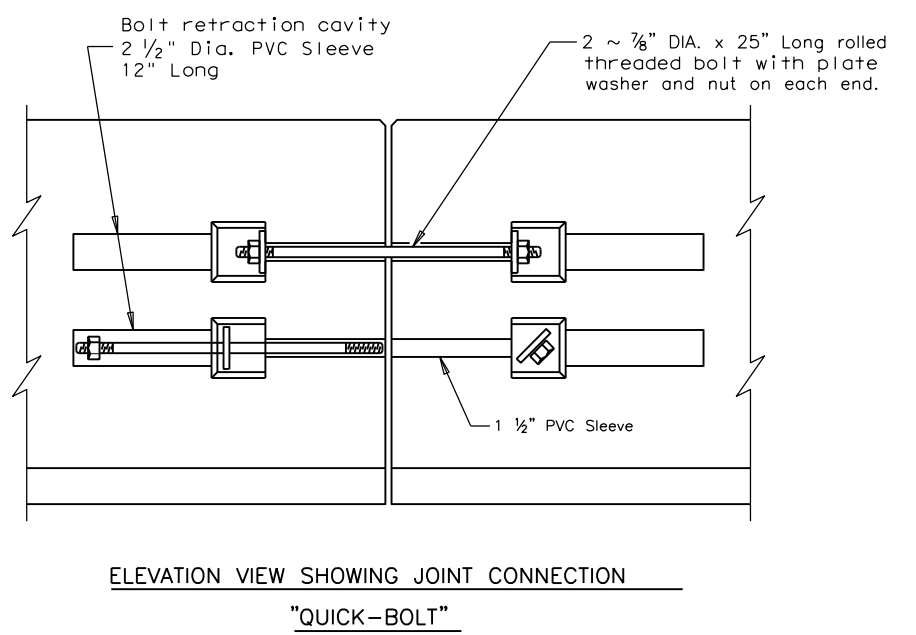
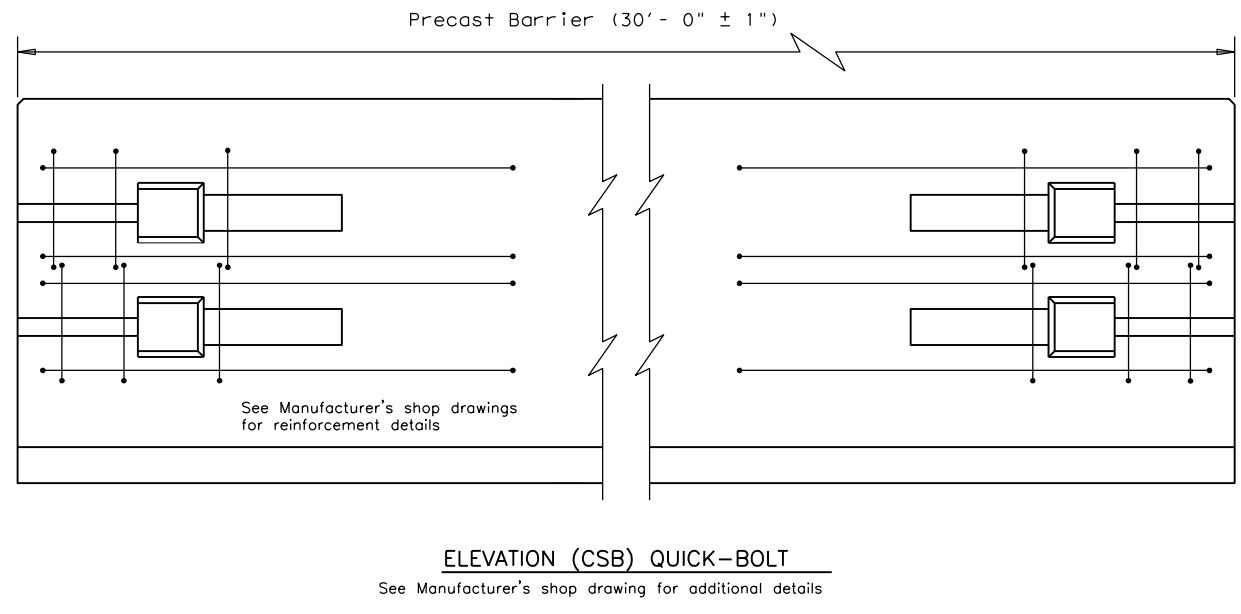
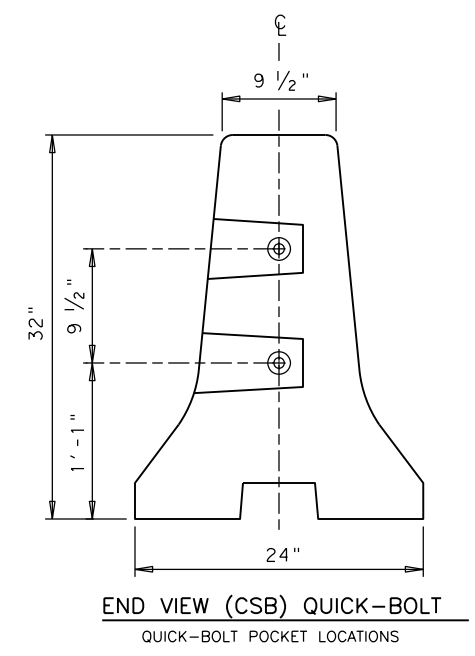
Four (4) [2 Upper & 2 Lower] Assemblies required per joint.

Weight of one Precast 30 ft. (CSB) segment = Approx. 6.5 Tons or 440 lbs per ft.

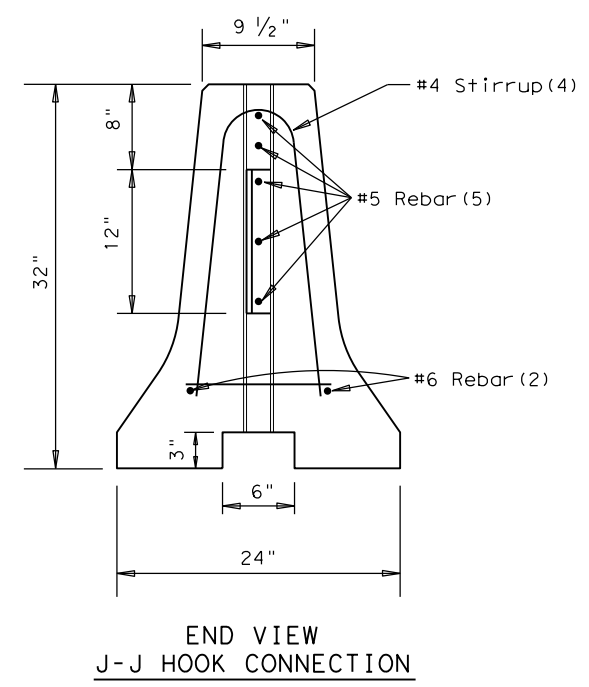
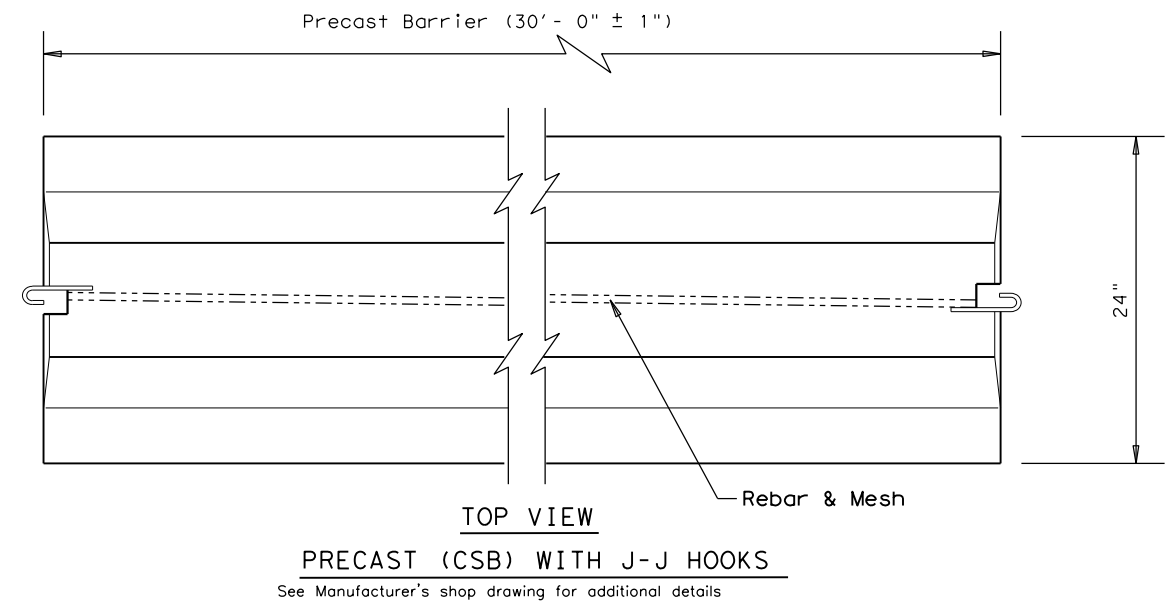
		Design Division Standard	
CONCRETE SAFETY BARRIER (F-SHAPE)			
PRECAST BARRIER (TYPE 1)			
CSB(1)-10			
FILE: csb110.dgn	DN: TxDOT	CK: AM	DW: BD
© TxDOT December 2010	CONT: 0313	SECT: 07	JOB: 020
REVISIONS	DIST: FTW	COUNTY: PARKER	HIGHWAY: FM 51
			SHEET NO.: 25

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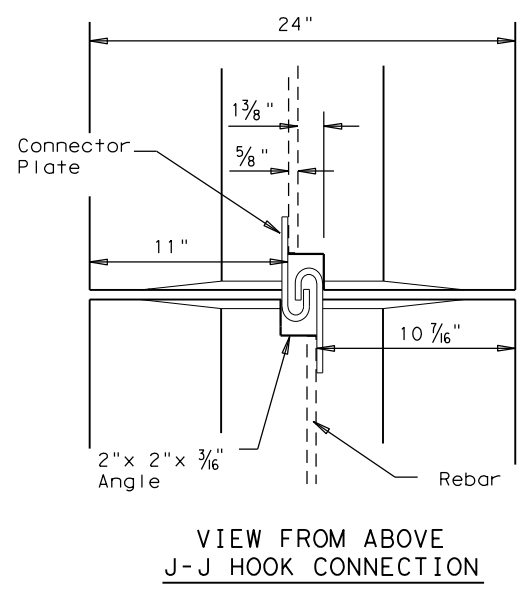
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Joint Connection (Type Q)



Joint Connection (Type J)



Proprietary Joint Connections (CSB)

Two proprietary joint connections are acceptable as alternates to the (Type X) connection shown, here on. These joint connections types are:

J-J Hooks by Easi-Set Industries, (800)547-4045
 Quick-Bolt by Bexar Concrete, (210)497-3773

If one of these connection systems are exclusively specified in the plans, prior approval for sole source use must be obtained. Details of the connection components and barrier reinforcement for these systems, will be shown on the manufacturer's shop drawing(s) furnished to the Engineer.

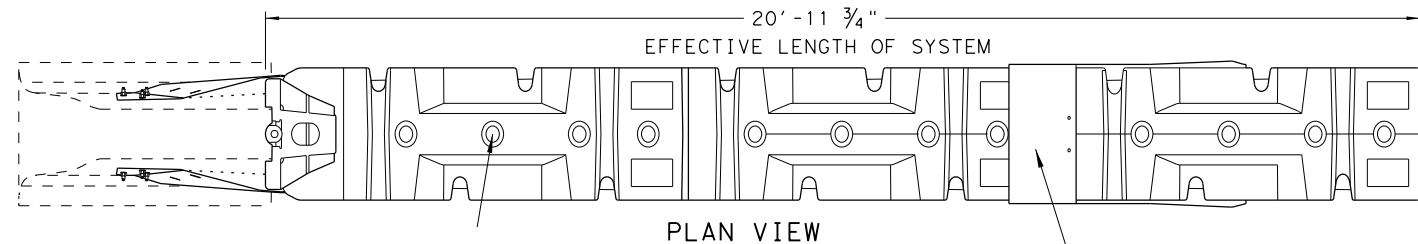
		Design Division Standard	
CONCRETE SAFETY BARRIER (F-SHAPE) PRECAST BARRIER (TYPE 1) CSB(1)-10			
FILE: csb110.dgn	DN: TxDOT	CK: AM	DW: BD
© TxDOT December 2010	CONT: 0313	SECT: 07	JOB: 020
REVISIONS		FTW	COUNTY: PARKER
			SHEET NO.: 26

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DATE: 10/19/2020
 FILE: c:\pwworking\kna\pwworking\shawn.singh\dms30455\absorb\absorb\19.dgn

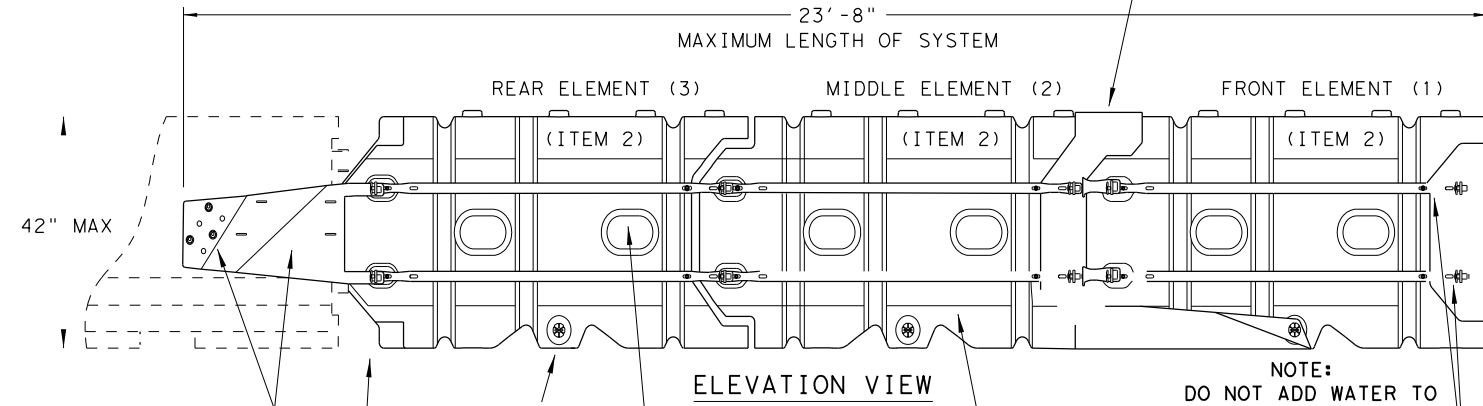
SYSTEM SHOWN - ABSORB-M TL-3

20'-11 3/4"
 EFFECTIVE LENGTH OF SYSTEM



PLAN VIEW

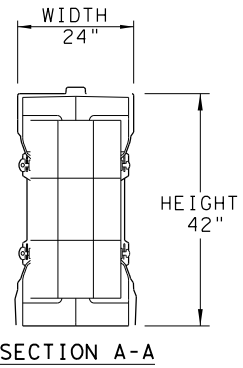
23'-8"
 MAXIMUM LENGTH OF SYSTEM



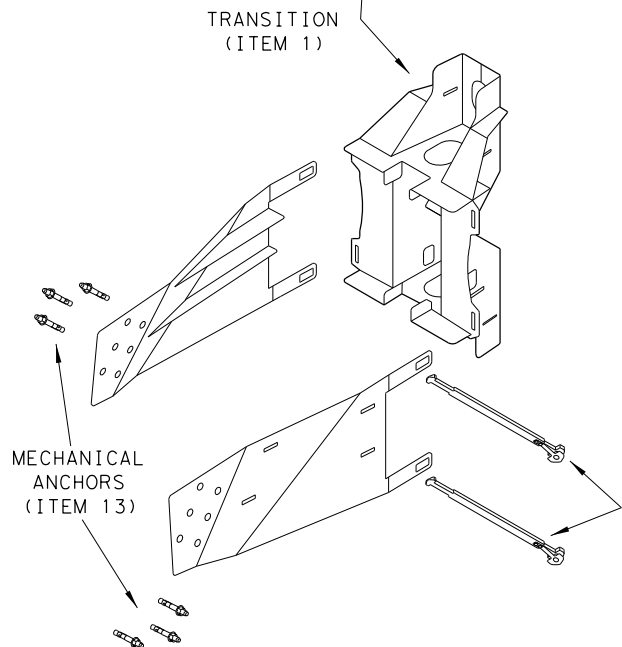
ELEVATION VIEW

TRAFFIC FLOW

TRAFFIC FLOW



SECTION A-A



TRANSITION (ITEM 1)

MECHANICAL ANCHORS (ITEM 13)

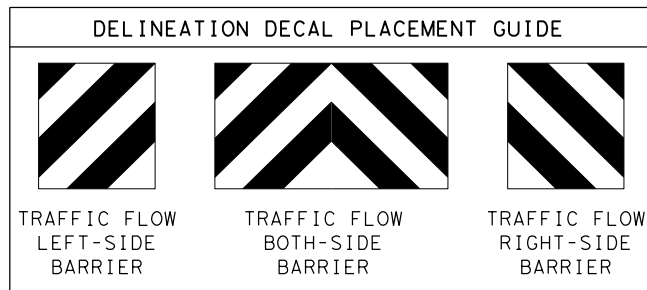
TEST LEVEL	NUMBER OF ELEMENTS	EFFECTIVE LENGTH	MAXIMUM LENGTH
TL-2	2	14' - 7 3/4"	17' - 4"
TL-3	3	20' - 11 3/4"	23' - 8"

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

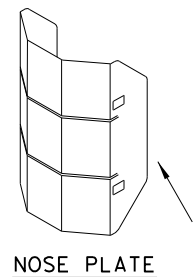
* COMPONENTS PRE-ASSEMBLED WITH ELEMENT ASSEMBLY

GENERAL NOTES

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



** APPLY DECAL



NOSE PLATE

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

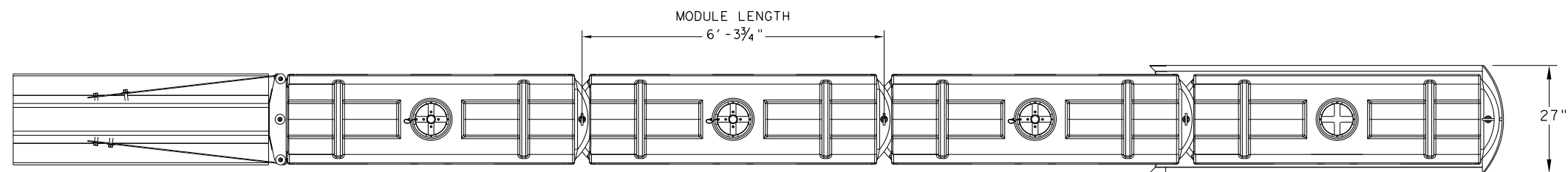
NOTE: APPLY A HIGH REFLECTIVE DECAL TO THE NOSE PLATE. DELINEATION DECAL ORIENTATION IS SHOWN ON THE CONSTRUCTION PLAN SET AND SHALL BE IN ACCORDANCE WITH THE TEXAS MUTCD FOR (TRAFFIC CONTROL DEVICES). DECALS ARE AVAILABLE FOR TRAFFIC FLOW ON THE LEFT-SIDE, BOTH -SIDES AND RIGHT-SIDE.

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

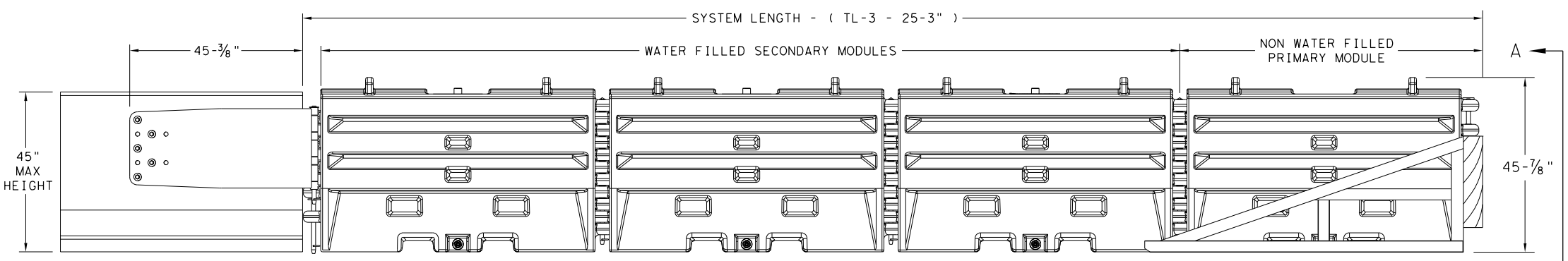
SACRIFICIAL

				Design Division Standard
LINDSAY TRANSPORTATION SOLUTIONS CRASH CUSHION (MASH TL-3 & TL-2) TEMPORARY - WORK ZONE ABSORB (M) - 19				
FILE: absorbm19	DN: TxDOT	CK: KM	DW: VP	CK:
© TXDOT: JULY 2019	CONT SECT	JOB	HIGHWAY	
REVISIONS	0313 07	020	FM 51	
	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	27	

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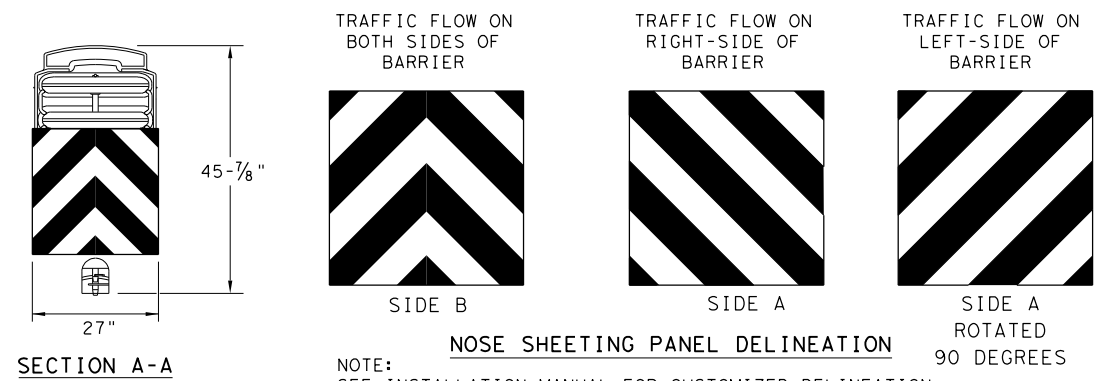
PLAN VIEW



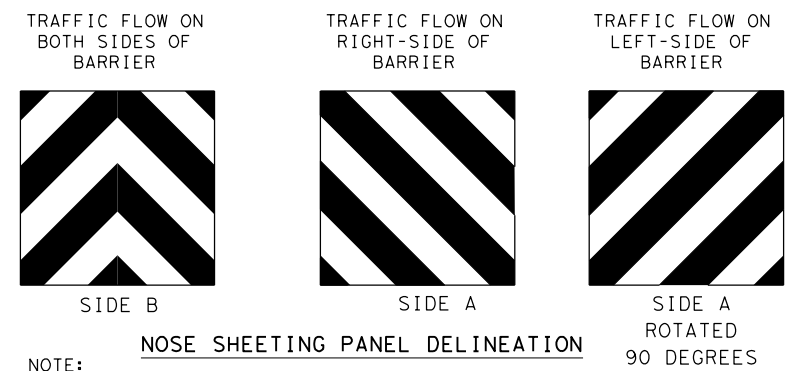
ELEVATION VIEW

GENERAL NOTES

1. REFER TO THE INSTALLATION MANUAL FOR SPECIFIC SYSTEM ASSEMBLY AND MODULE ORIENTATION. FOR ADDITIONAL INFORMATION, CONTACT TRAFFIX, INC. AT (949) 361-5663.
2. THE SLED SYSTEM IS A MASH APPROVED TEST LEVEL 3 (TL-3) CRASH CUSHION APPROVED FOR USE IN TEMPORARY WORK ZONES. THE SLED SYSTEM IS A NON-REDIRECTIVE, GATING CRASH CUSHION THAT DOES NOT NEED TO BE ATTACHED TO THE GROUND AND CAN BE INSTALLED ON CONCRETE, ASPHALT, GRAVEL OR COMPACTED SOIL.
3. MAXIMUM PERMISSIBLE CROSS SLOPE IS 8° (DEGREES) (14%).
4. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
5. THE SLED SYSTEM CAN BE ATTACHED TO:
 - CONCRETE BARRIER, TEMPORARY OR PERMANENT, 45" MAXIMUM HEIGHT
 - STEEL BARRIER
 - PLASTIC BARRIER
 - CONCRETE BRIDGE ABUTMENTS
 - W-BEAM GUARD RAIL
 - THRIE BEAM GUARD RAIL



SECTION A-A

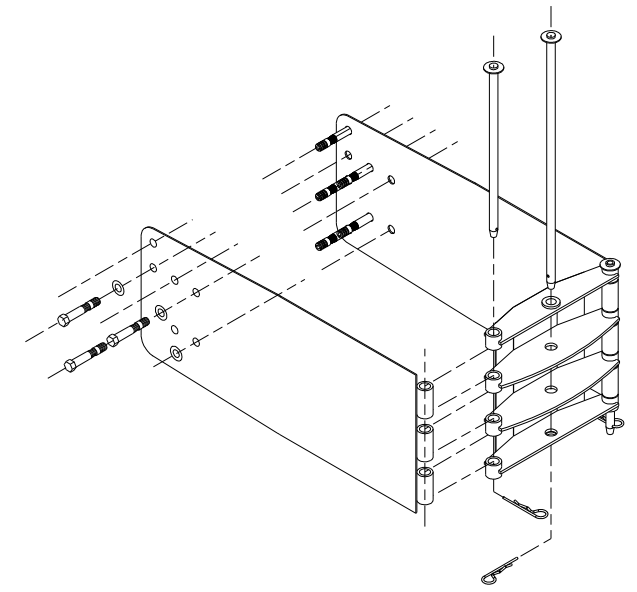


NOSE SHEETING PANEL DELINEATION

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

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

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



SLED TRANSITION COMPONENTS FOR ATTACHMENT TO CMB

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

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

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

SACRIFICIAL

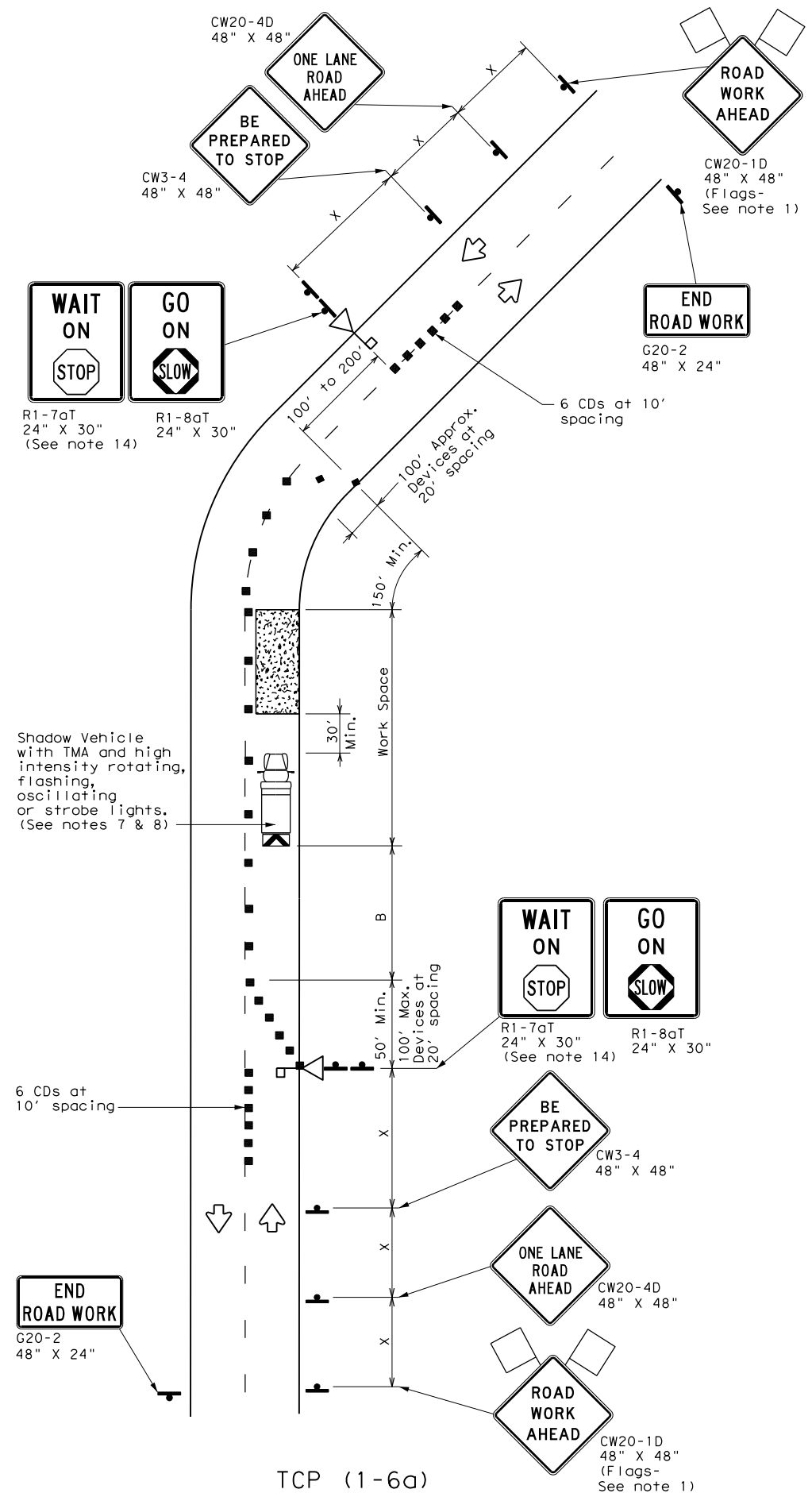
Design Division Standard

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

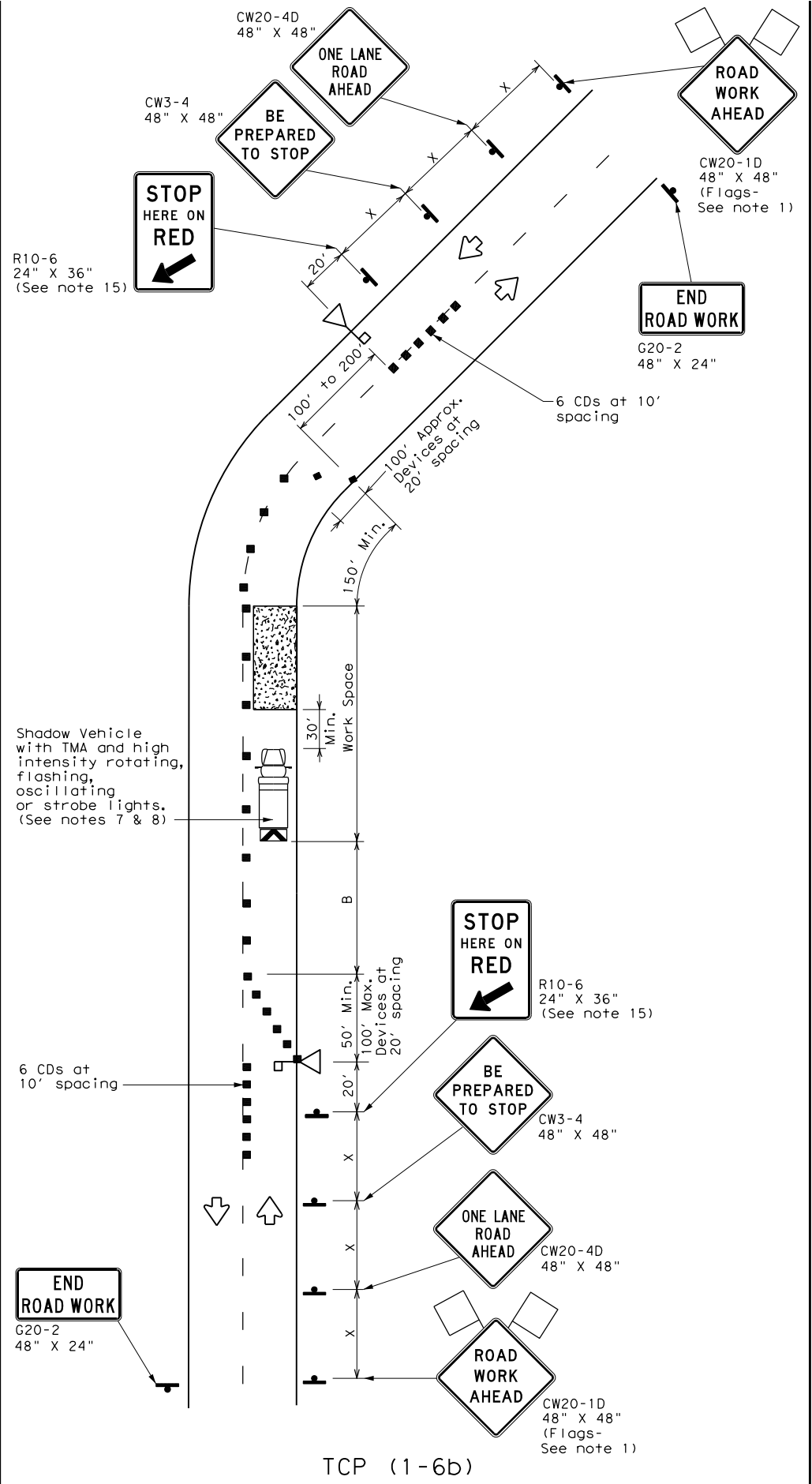
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© TxDOT: DECEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
DIST	COUNTY		SHEET NO.	
FTW	PARKER		28	

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DATE: 10/19/2020 3:02:55 PM
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TCP (1-6a)
 ONE LANE TWO-WAY
 CONTROL WITH STOP/SLOW AFADs



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

LEGEND			
	Type 3 Barricade		Channelizing Devices (CDs)
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Automated Flagger Assistance Device (AFAD)		Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

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

GENERAL NOTES

- Flags attached to signs where shown are REQUIRED.
- AFADs shall only be used in situations where there is one lane of approaching traffic in the direction to be controlled.
- Adequate stopping sight distance must be provided to each AFAD location for approaching traffic. (See table above).
- Each AFAD shall be operated by a qualified/certified flagger. Flaggers operating AFADs shall not leave them unattended while they are in use.
- One flagger may operate two AFADs only when the flagger has an unobstructed view of both AFADs and of the approaching traffic in both directions.
- When pilot cars are used, a flagger controlling traffic shall be located on each approach. AFADs shall not be operated by the pilot car operator.
- All AFADs shall be equipped with gate arms with an orange or fluorescent red-orange flag attached to the end of the gate arm. The flag shall be a minimum of 16" square.
- A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
- Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
- Flaggers should use two-way radios or other methods of communication to control traffic.
- Length of work space should be based on the ability of flaggers to communicate.
- If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the AFAD.
- Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
- The R1-7aT "WAIT ON STOP" sign and the R1-8aT "GO ON SLOW" sign shall be installed at the AFAD location on separate supports or they may be fabricated as one 48" x 30" sign. They shall not obscure the face of the STOP/SLOW AFAD.
- The R10-6 "STOP HERE ON RED" arrow sign shall be offset so as not to obscure the lenses of the AFAD.

Texas Department of Transportation
 Traffic Operations Division Standard

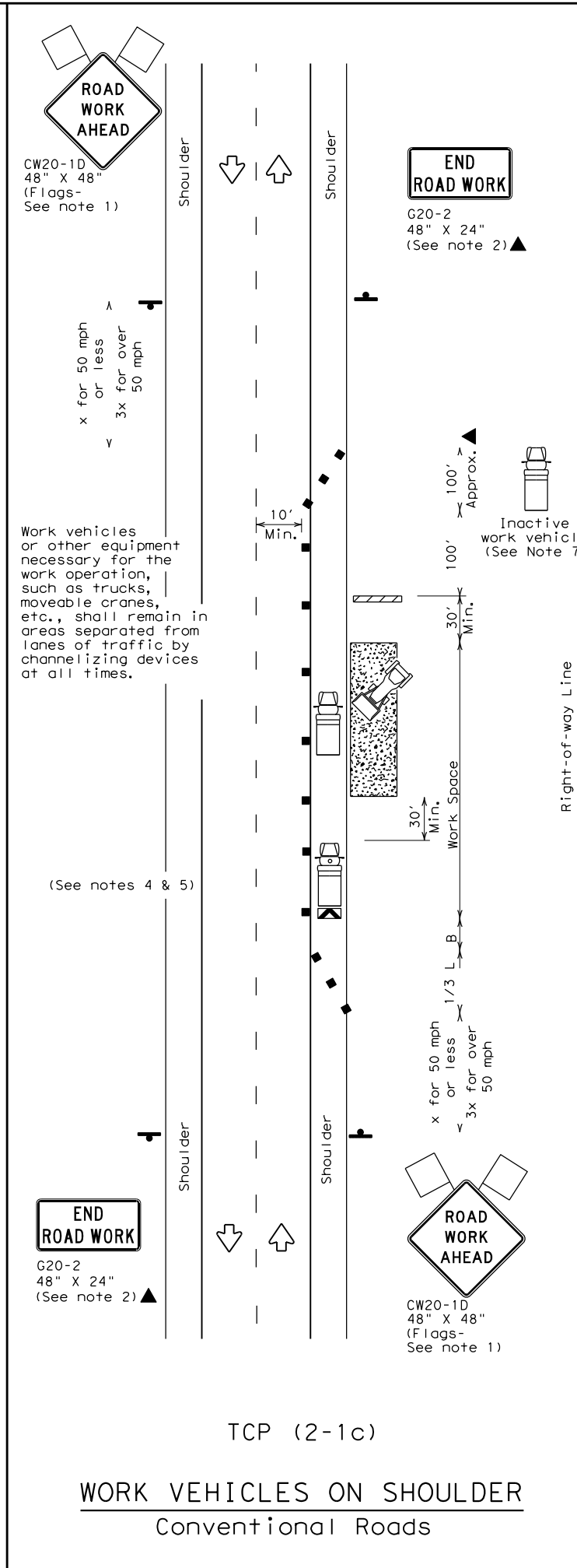
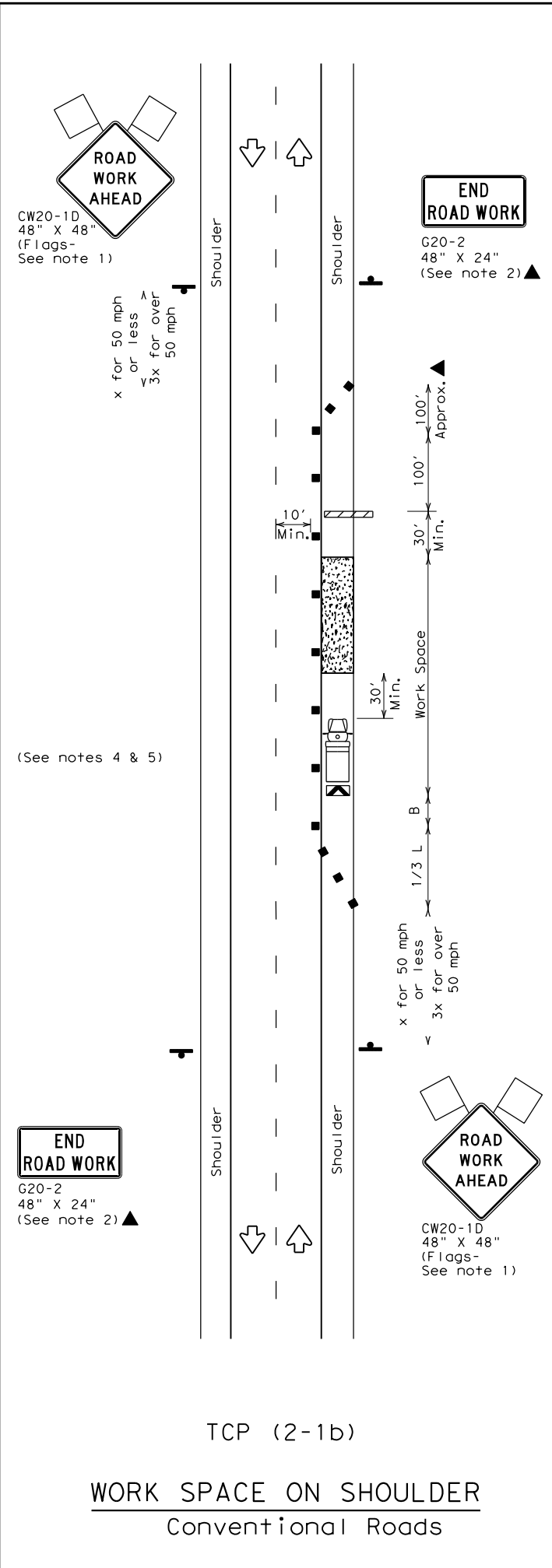
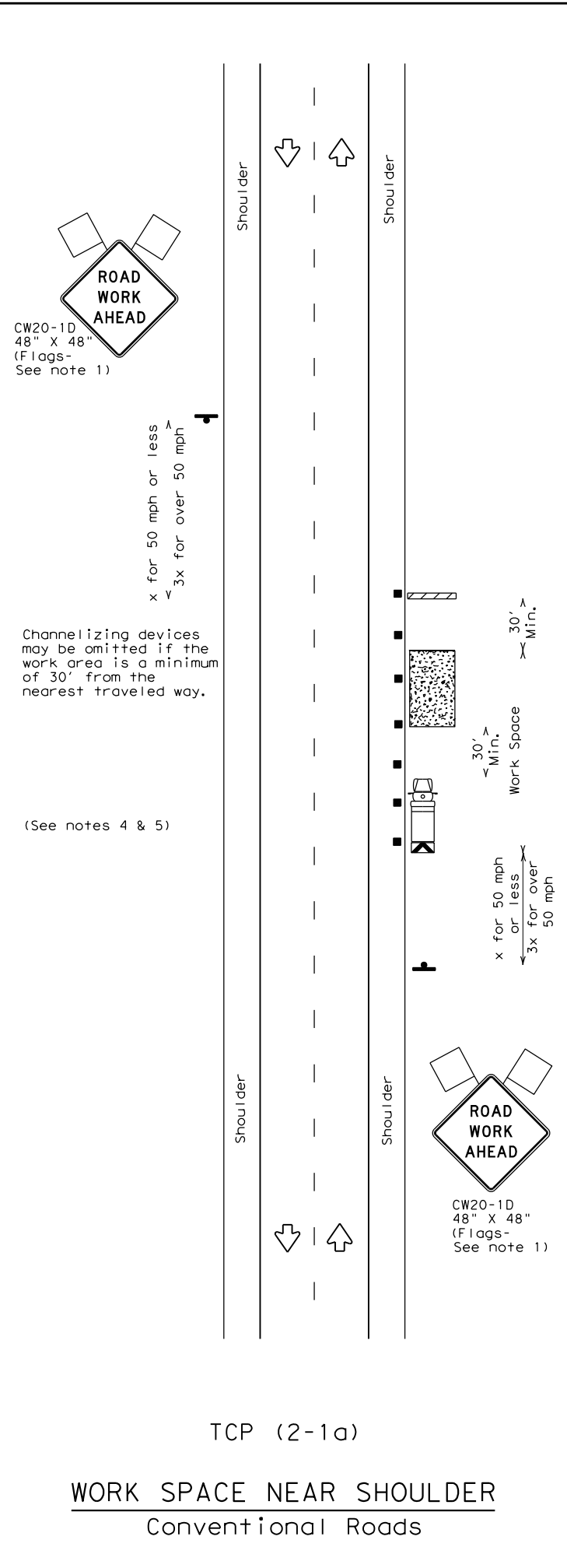
TRAFFIC CONTROL PLAN AUTOMATED FLAGGER ASSISTANCE DEVICES (AFADs)

TCP (1-6) - 18

FILE: tcp1-6-18.dgn	DN:	CK:	DW:	CK:
© TxDOT February 2012	CON:	SECT:	JOB:	HIGHWAY:
2-18	0313	07	020	FM 51
	DIST:	COUNTY:	SHEET NO.	
	FTW	PARKER	29	

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DATE: 10/19/2020 3:03:00 PM
 FILE: c:\pwworking\kna\pwwprod\shawn.singh\dms30455\tcp2-1-18.dgn



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

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

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

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

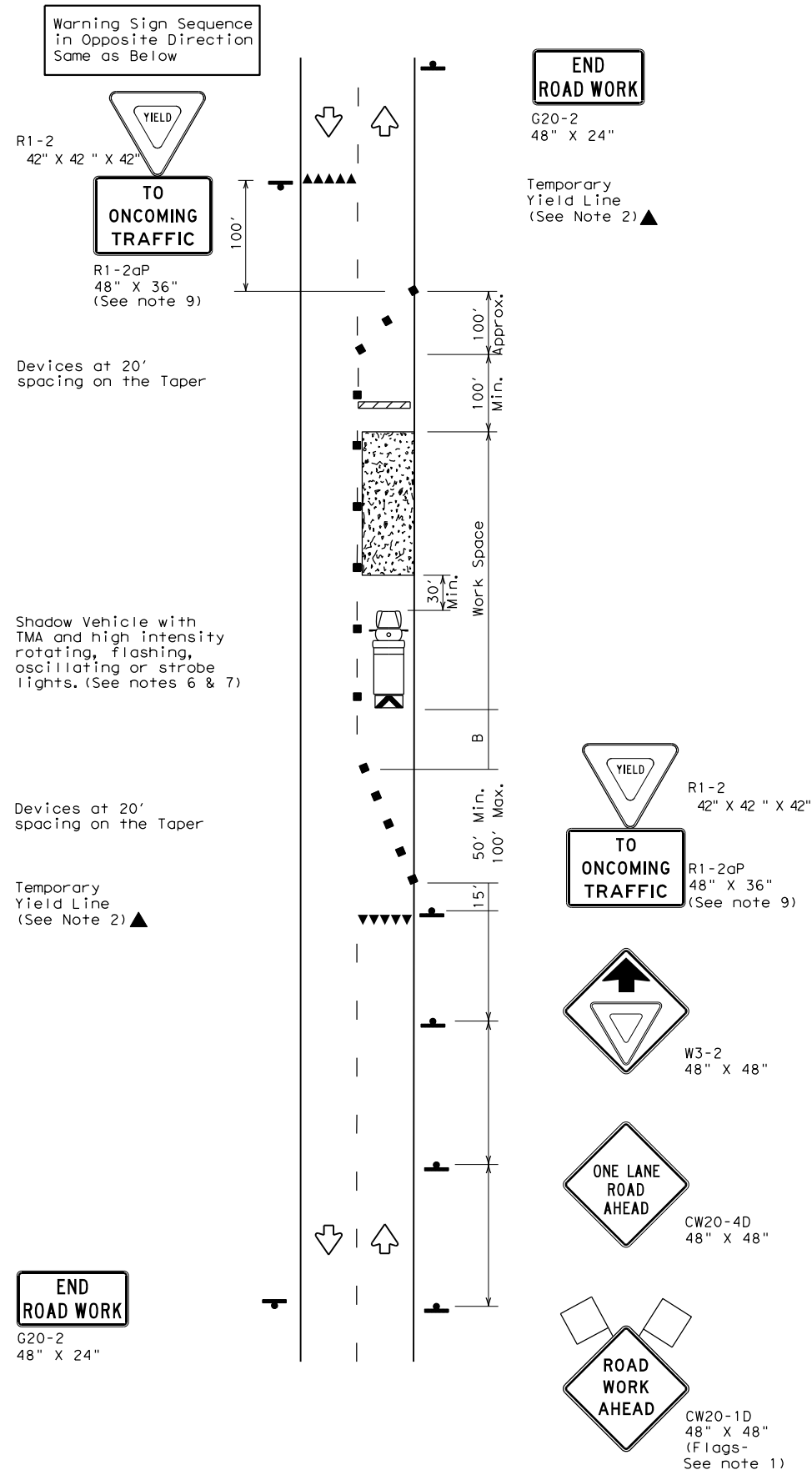
- GENERAL NOTES
- Flags attached to signs where shown, are REQUIRED.
 - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated in the plans, or for routine maintenance work, when approved by the Engineer.
 - Stockpiled material should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



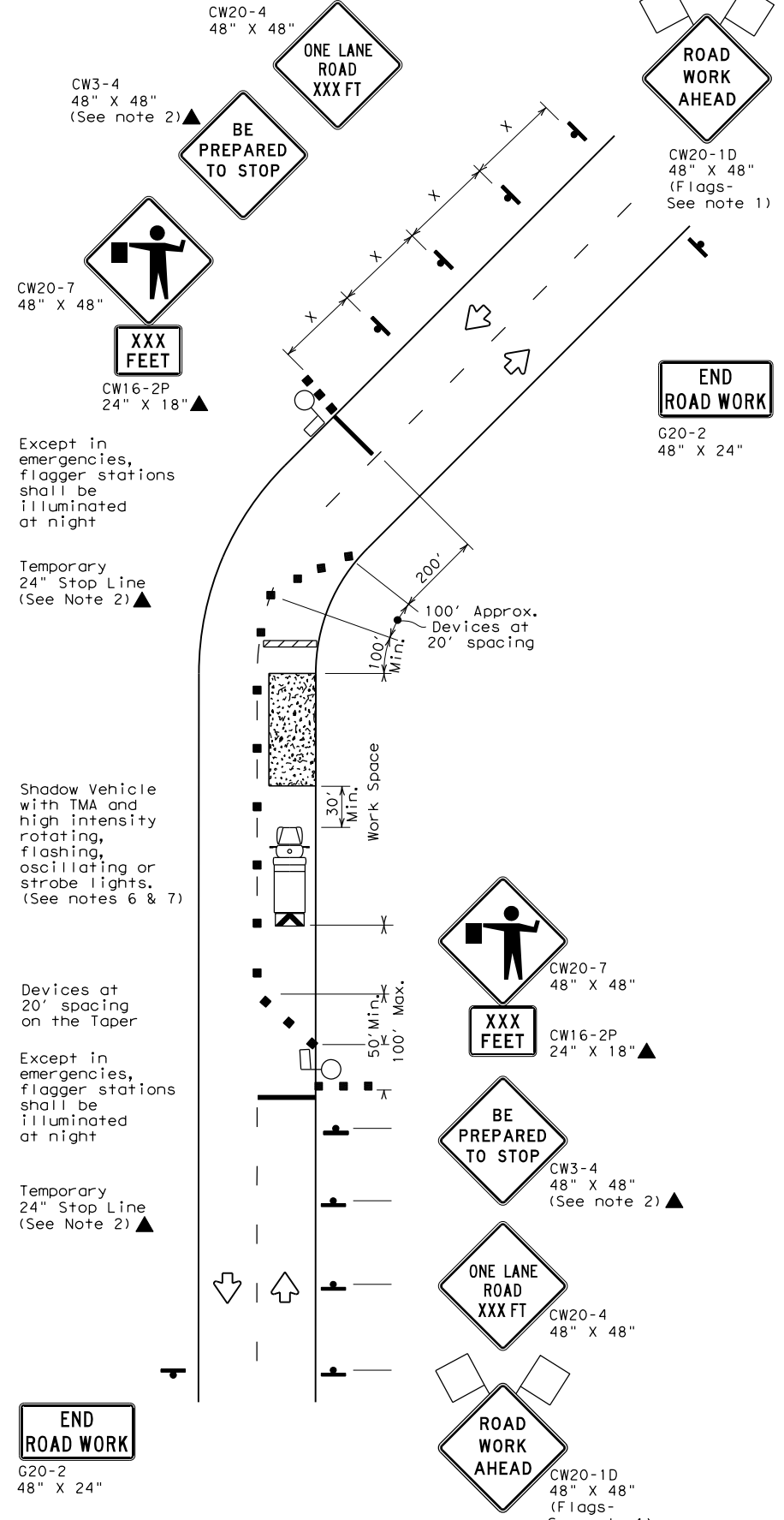
TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK				
TCP (2-1) - 18				
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© TxDOT	December 1985	CON:	SECT:	JOB:
REVISIONS		0313	07	020
2-94	4-98	COUNTY		FM 51
8-95	2-12	COUNTY		SHEET NO.
1-97	2-18	FTW	PARKER	30

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DATE: 10/19/2020 3:03:06 PM
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TCP (2-2a)
 2-LANE ROADWAY WITHOUT PAVED SHOULDERS
 ONE LANE TWO-WAY
 CONTROL WITH YIELD SIGNS
 (Less than 2000 ADT - See Note 9)



TCP (2-2b)
 2-LANE ROADWAY WITHOUT PAVED SHOULDERS
 ONE LANE TWO-WAY
 CONTROL WITH FLAGGERS

LEGEND

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

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	L = WS ² / 60	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	575'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

TYPICAL USAGE

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

GENERAL NOTES

- Flags attached to signs where shown, are REQUIRED.
 - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
 - The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4 "ONE LANE ROAD XXX FT" sign, but proper sign spacing shall be maintained.
 - Flaggers should use two-way radios or other methods of communication to control traffic.
 - Length of work space should be based on the ability of flaggers to communicate.
 - A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
 - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
- TCP (2-2a)
- The R1-2 "YIELD" sign traffic control may be used on projects with approaches that have adequate sight distance. For projects in urban areas, work space should be no longer than one half city block. In rural areas, roadways with less than 2000 ADT, work space should be no longer than 400 feet.
 - The R1-2aP "YIELD TO ONCOMING TRAFFIC" sign shall be placed on a support at a 7 foot minimum mounting height.
- TCP (2-2b)
- Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
 - If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the flagger and a queue of stopped vehicles. (See table above).
 - Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.



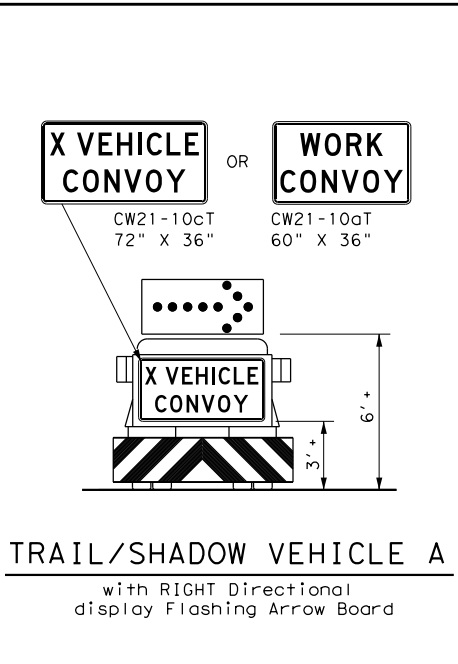
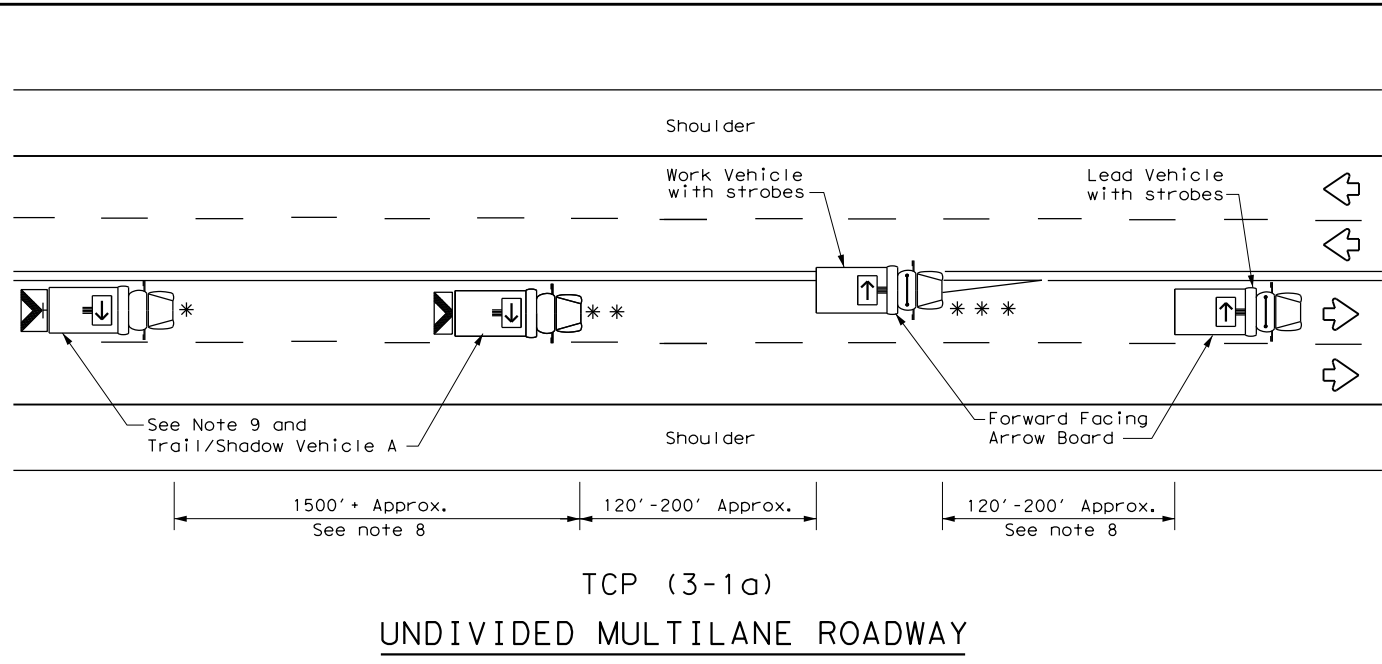
TRAFFIC CONTROL PLAN
 ONE-LANE TWO-WAY
 TRAFFIC CONTROL

TCP (2-2) - 18

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© TxDOT	December 1985	CON:	SECT:	JOB:	HIGHWAY:
REVISIONS		0313	07	020	FM 51
8-95	3-03	DIST:	COUNTY:	SHEET NO.	
1-97	2-12	FTW	PARKER	31	
4-98	2-18				

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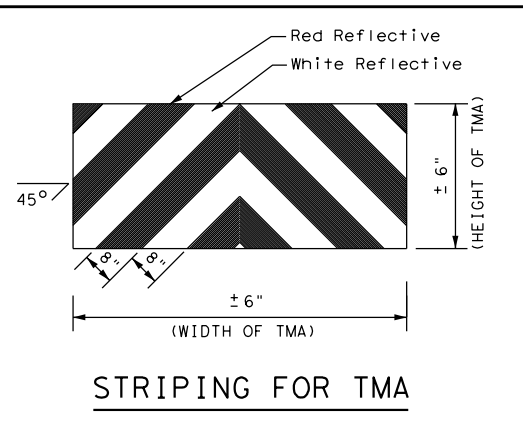
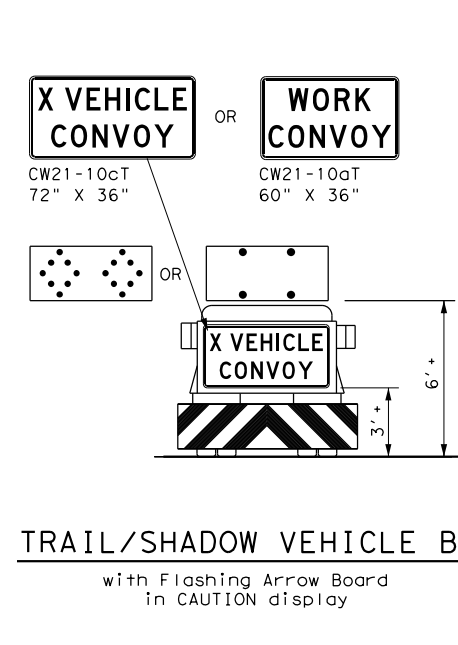
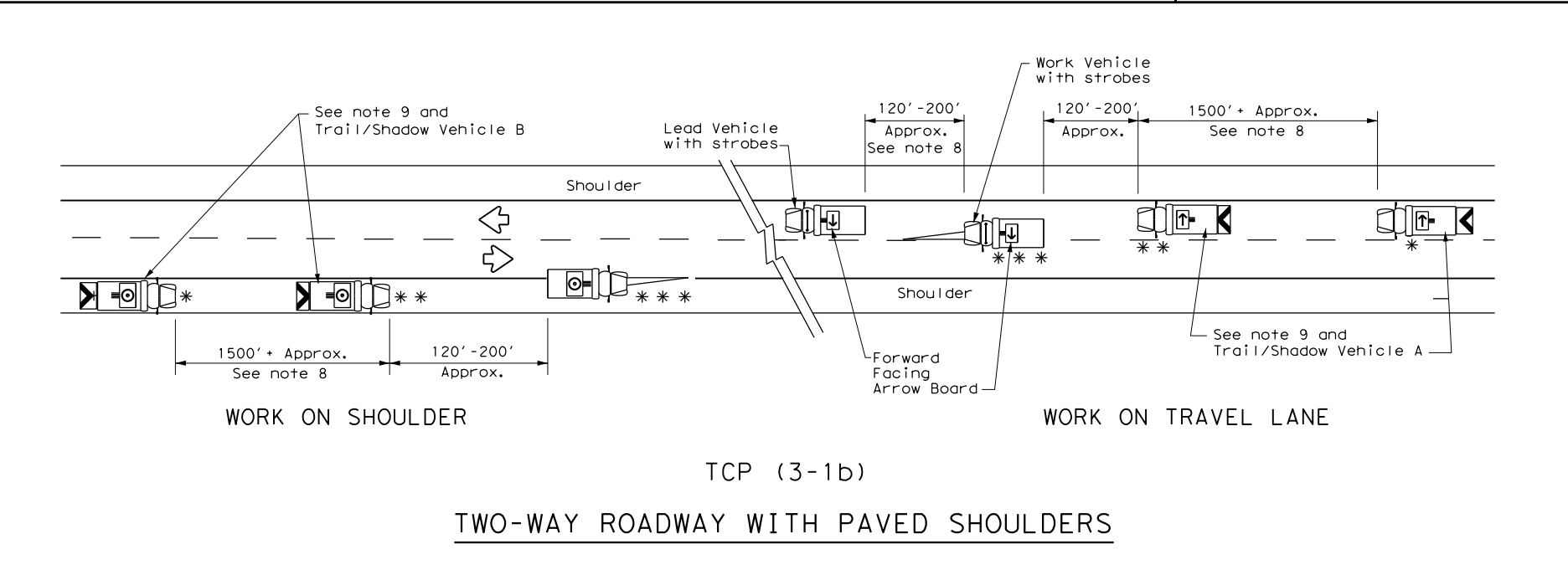


LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

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

GENERAL NOTES

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



Texas Department of Transportation
Traffic Operations Division Standard

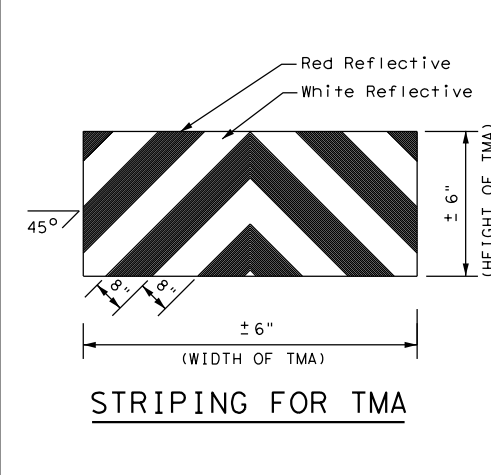
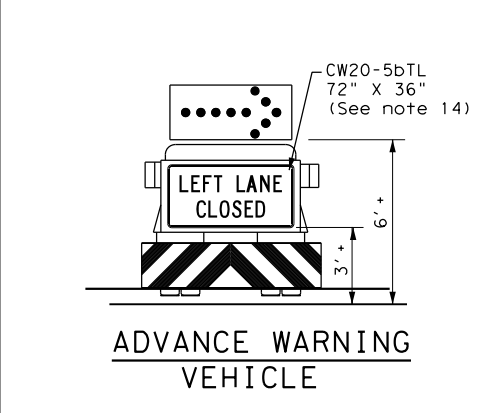
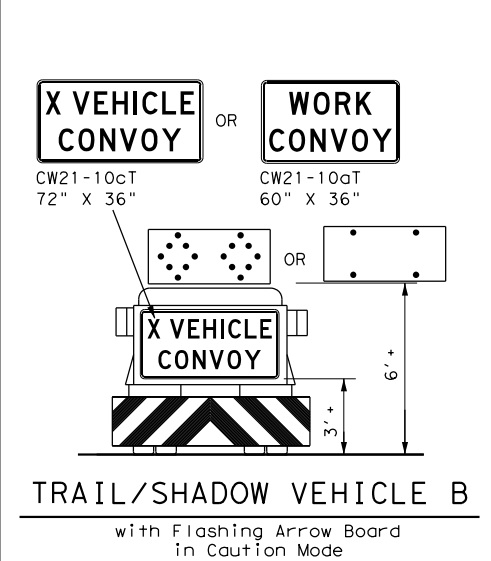
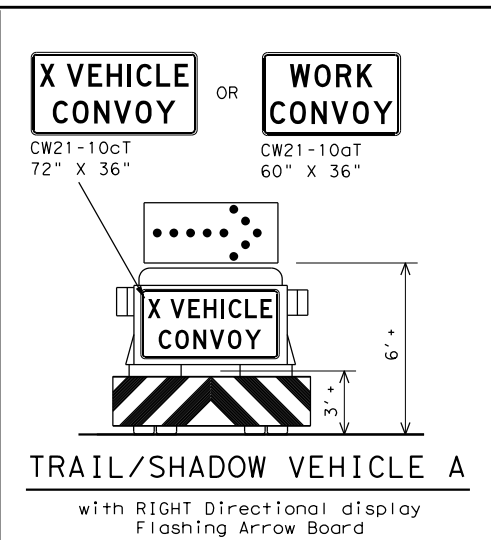
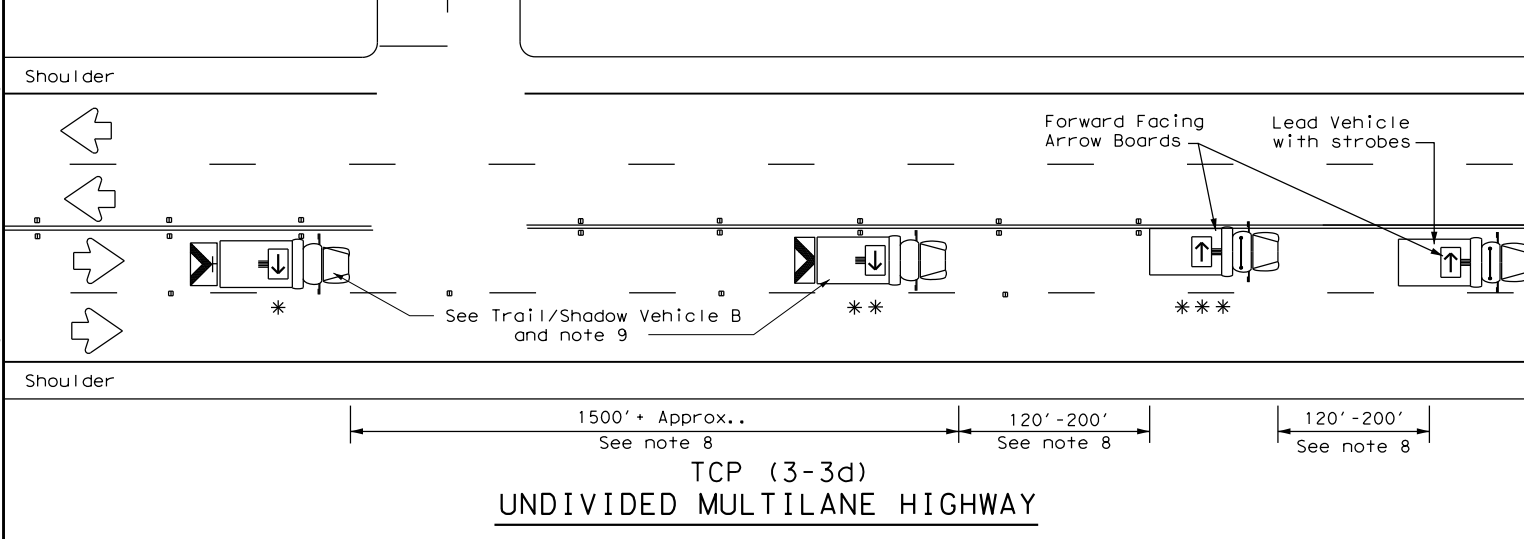
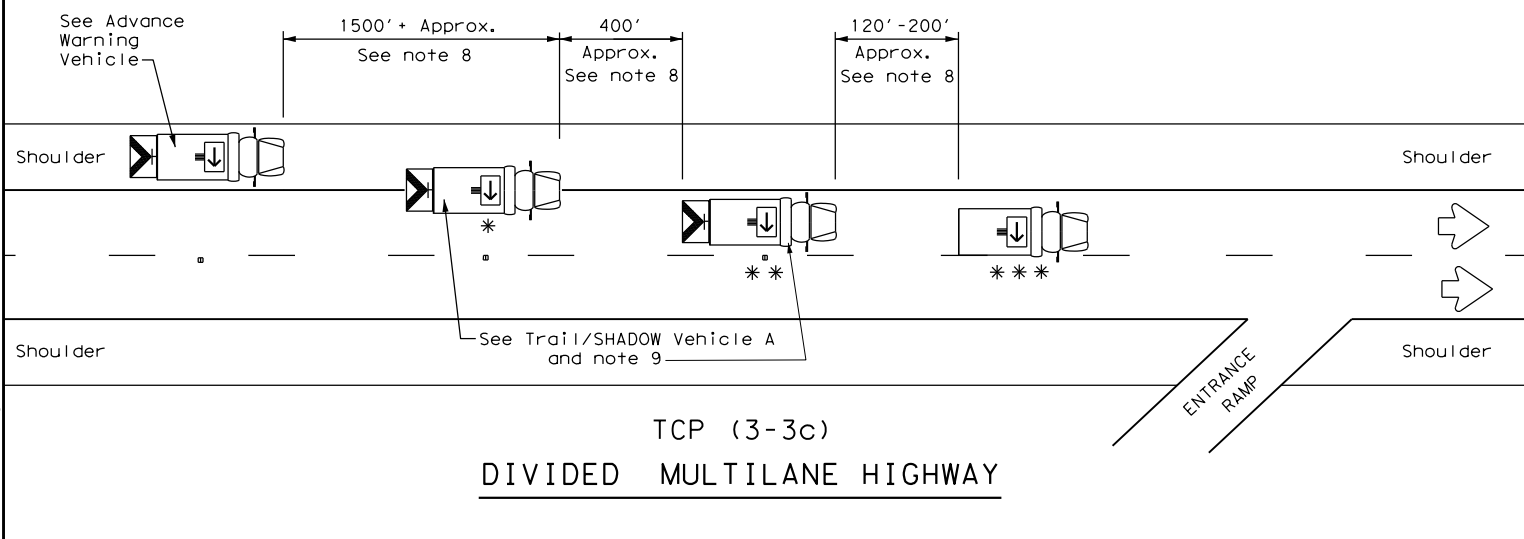
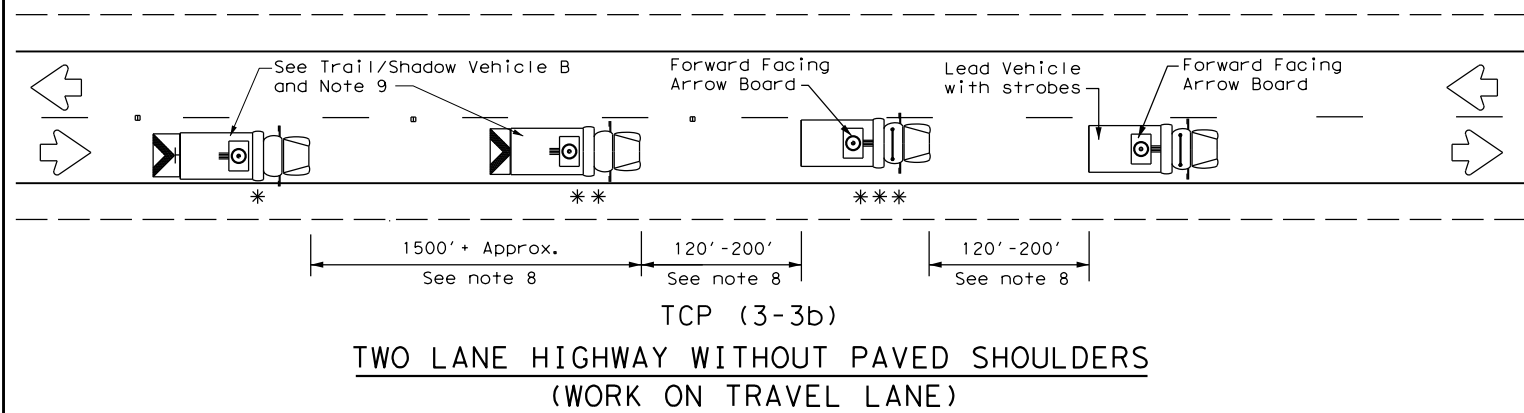
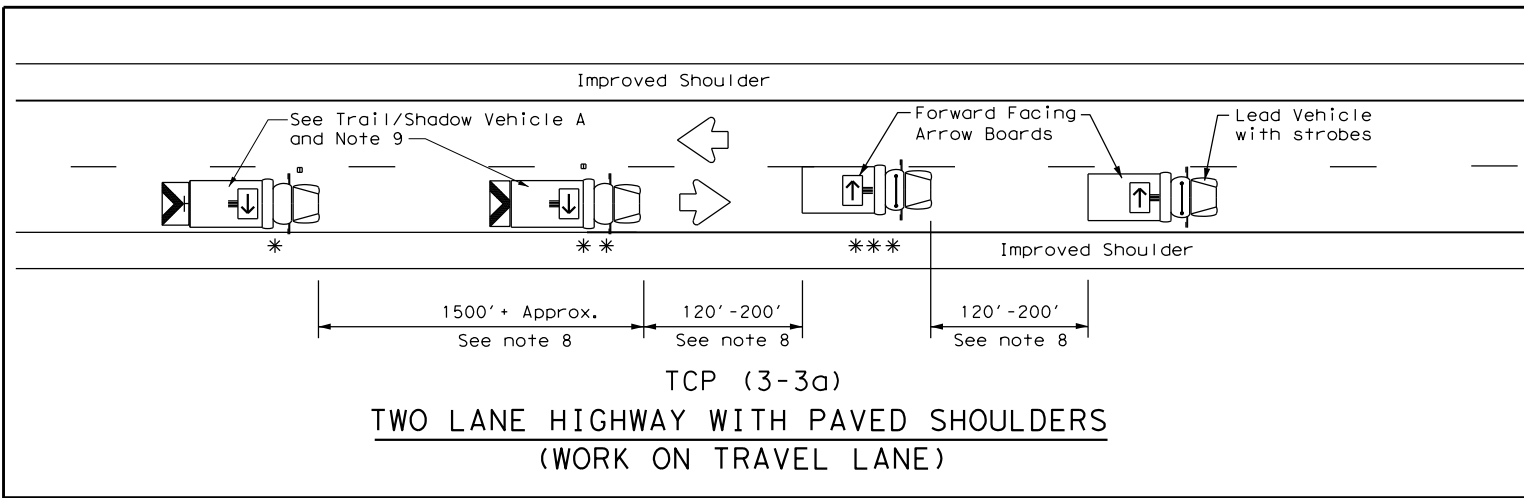
**TRAFFIC CONTROL PLAN
 MOBILE OPERATIONS
 UNDIVIDED HIGHWAYS**

TCP (3-1) - 13

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© TxDOT	December 1985	CONT	SECT	JOB	HIGHWAY				
REVISIONS		0313	07	020	FM 51				
2-94	4-98								
8-95	7-13								
1-97									
		DIST	COUNTY		SHEET NO.				
		FTW	PARKER		32				

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DATE: 10/19/2020 3:03:16 PM
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LEGEND		
*	Trail Vehicle	ARROW BOARD DISPLAY
**	Shadow Vehicle	
***	Work Vehicle	RIGHT Directional
□	Heavy Work Vehicle	LEFT Directional
▲	Truck Mounted Attenuator (TMA)	Double Arrow
↔	Traffic Flow	CAUTION (Alternating Diamond or 4 Corner Flash)

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

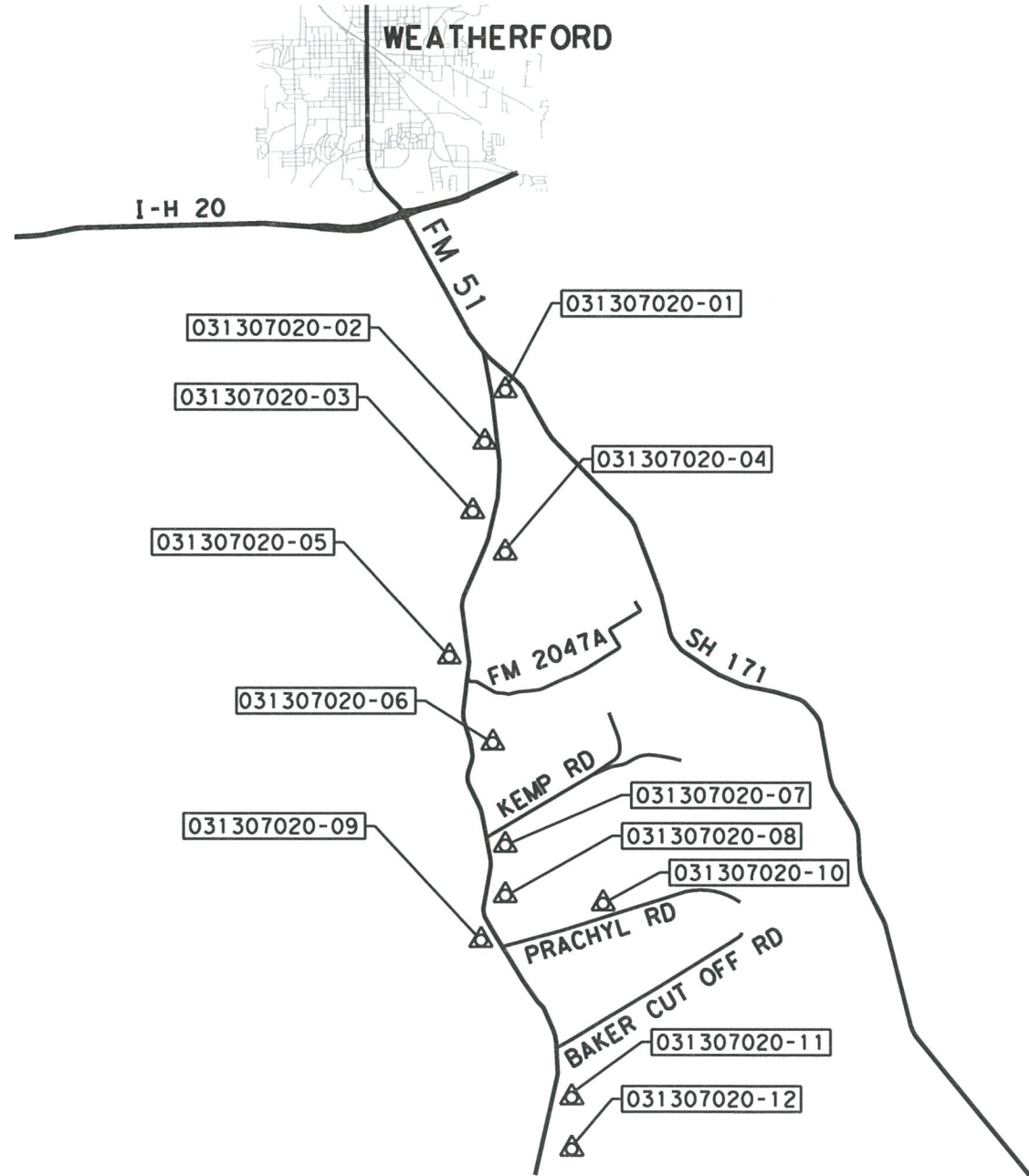
TRAFFIC CONTROL PLAN
 MOBILE OPERATIONS
 RAISED PAVEMENT
 MARKER INSTALLATION/
 REMOVAL
 TCP (3-3) - 14

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 7-13	FTW	PARKER		33
1-97 7-14				

177

CONTROL POINT	SURFACE COORDINATES		GRID COORDINATES		LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
	NORTHING	EASTING	NORTHING	EASTING				
031307020-01	6,939,609.519	2,193,023.784	6,938,776.866	2,192,760.653	32° 42' 03.89165"	97° 46' 15.34755"	1147.633	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-02	6,938,087.900	2,193,183.740	6,937,255.429	2,192,920.590	32° 41' 48.82565"	97° 46' 13.59943"	1169.359	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-03	6,930,212.117	2,193,770.527	6,929,380.591	2,193,507.306	32° 40' 30.86172"	97° 46' 07.37482"	1070.658	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-04	6,929,277.701	2,193,783.738	6,928,446.287	2,193,520.516	32° 40' 21.61563"	97° 46' 07.29636"	1055.555	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-05	6,916,751.900	2,191,353.203	6,915,921.989	2,191,090.272	32° 38' 17.85072"	97° 46' 36.73754"	901.807	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-06	6,915,555.464	2,191,305.312	6,914,725.697	2,191,042.387	32° 38' 06.01634"	97° 46' 37.39383"	871.141	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-07	6,908,321.186	2,191,797.780	6,907,492.287	2,191,534.796	32° 36' 54.40610"	97° 46' 32.21865"	809.729	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-08	6,907,728.564	2,192,060.564	6,906,899.736	2,191,797.548	32° 36' 48.52469"	97° 46' 26.19441"	798.289	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-09	6,898,494.097	2,192,948.738	6,897,666.377	2,192,685.616	32° 35' 17.09713"	97° 46' 19.55941"	899.829	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-10	6,898,845.738	2,194,232.640	6,898,017.976	2,193,969.364	32° 35' 20.48803"	97° 46' 04.52590"	888.605	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-11	6,888,065.363	2,197,461.648	6,887,238.894	2,197,197.984	32° 33' 33.60169"	97° 45' 27.67861"	874.153	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE
031307020-12	6,887,066.297	2,196,952.384	6,886,239.948	2,196,688.781	32° 33' 23.75240"	97° 45' 33.71071"	874.563	SET TxDOT 3-1/4" ALUMINUM DISK IN CONCRETE

- NOTES:
- ALL BEARINGS AND COORDINATES ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983 TEXAS NORTH CENTRAL ZONE (4202), NORTH AMERICAN DATUM OF 1983 (NAD83) 2011 ADJUSTMENT, EPOCH 2010 (GEOID 12A). ALL DISTANCES AND COORDINATES ARE SURFACE VALUES AND MAY BE CONVERTED TO GRID BY DIVIDING BY A COMBINED ADJUSTMENT FACTOR OF 1.00012
 - ALL HORIZONTAL CONTROL OF THIS PROJECT WAS ESTABLISHED BY TxDOT VIRTUAL REFERENCE SYSTEM NETWORK (WEATHERFORD), BASED ON THREE AVERAGED 180 EPOCH OBSERVATIONS
 - UNIT OF MEASURE IS U.S. SURVEY FOOT
 - VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), BASED ON THREE 180 EPOCH OBSERVATIONS UTILIZING THE TxDOT VIRTUAL REFERENCE SYSTEM NETWORK (WEATHERFORD)
 - FIELD SURVEYS WERE PERFORMED DURING AUGUST 2019



I HERBY CERTIFY THAT THE HORIZONTAL AND VERTICAL DATA SHOWN HEREON WAS DETERMINED BY MULTIPLE GPS OBSERVATIONS ACCESSING THE STATE VIRTUAL REFERENCE SYSTEM IN AUGUST 2019, AND IS CORRECTLY SHOWN HEREON.



Christopher R. Freeman
CHRISTOPHER R. FREEMAN - R.P.L.S. NO. 5701

LTRA LINA T. RAMEY & ASSOCIATES, INC.
3320 Belt Line Road
Farmers Branch, Texas 75234 - 214-979-1144
TBPELS FIRM NO. F-782, 10140700

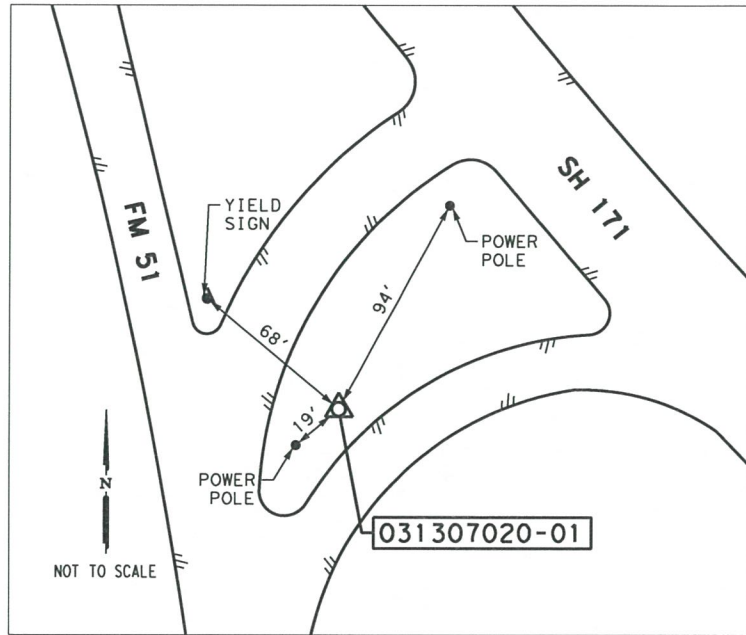
Texas Department of Transportation
© 2020

FM 51
SURVEY CONTROL DATA

SHEET 1 OF 3

STATE	CONT.	SECT.	JOB	SHEET NO.
TEXAS	0313	07	020	34
DIST	COUNTY	HIGHWAY		
02	PARKER	FM 51		

0:_ (086) Kimley-Horn\19_086_09 FM 51\Control\FM 51 CONTROL DATA SHEET 01.dgn 8/31/2020

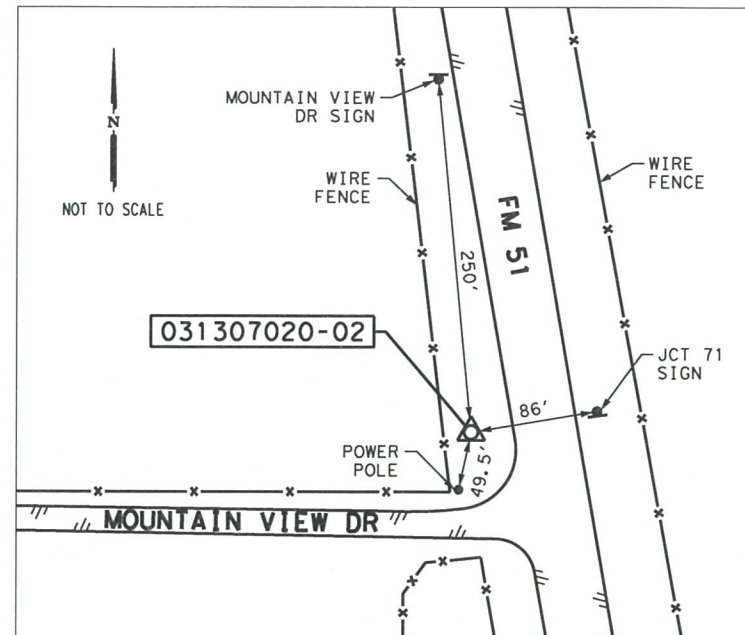


CONTROL POINT: 031307020-01

CP# 031307020-01 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, +/- 144.6' SOUTH OF THE INTERSECTION OF FM 51 AND SH 171

LATITUDE: 32° 42' 03.89165"
LONGITUDE: 97° 46' 15.34755"

SURFACE COORDINATES:	GRID COORDINATES:
NORTHING: 6,939,609.519	NORTHING: 6,938,776.866
EASTING: 2,193,023.784	EASTING: 2,192,760.653
ELEVATION: 1,147.633	ELEVATION: 1,147.633

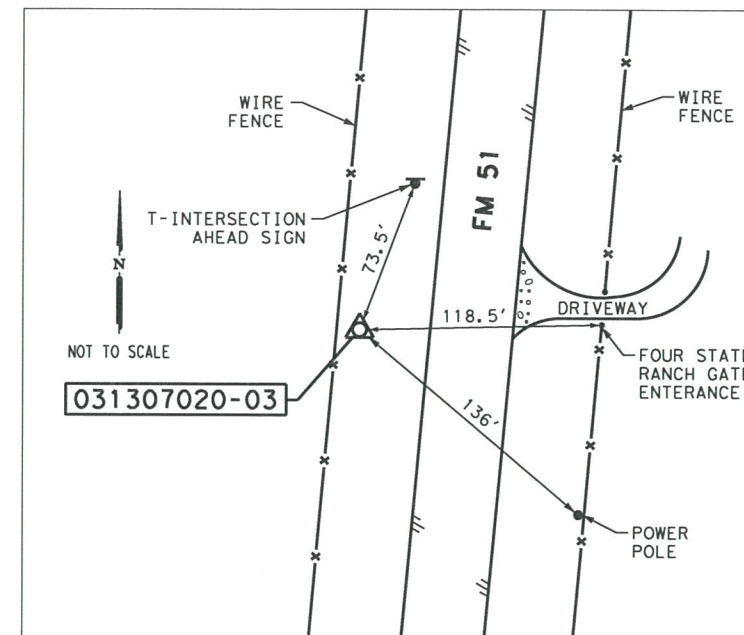


CONTROL POINT: 031307020-02

CP# 031307020-02 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE WEST SIDE OF FM 51, +/- 1,713.2' SOUTH OF THE INTERSECTION OF FM 51 AND SH 171

LATITUDE: 32° 41' 48.82565"
LONGITUDE: 97° 46' 13.59943"

SURFACE COORDINATES:	GRID COORDINATES:
NORTHING: 6,938,087.900	NORTHING: 6,937,255.429
EASTING: 2,193,183.740	EASTING: 2,192,920.590
ELEVATION: 1,169.359	ELEVATION: 1,169.359

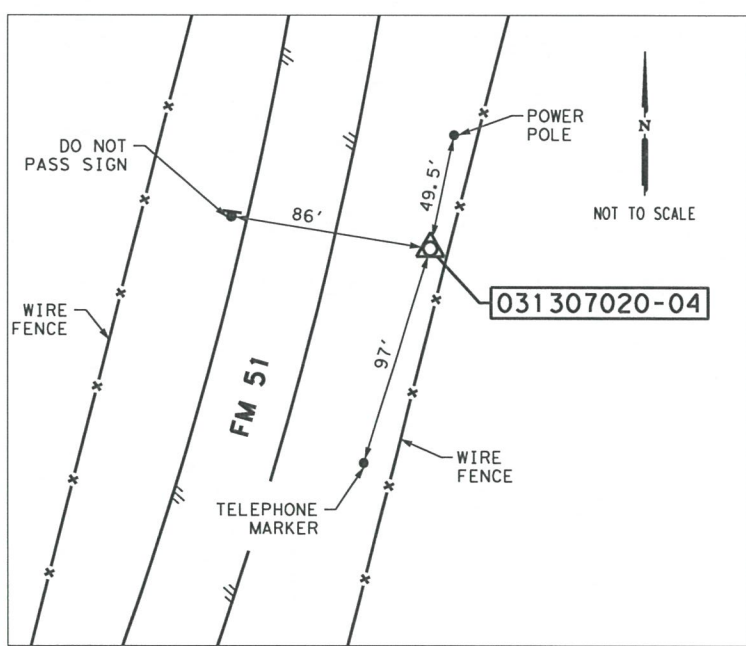


CONTROL POINT: 031307020-03

CP# 031307020-03 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE WEST SIDE OF FM 51, +/- 1.8 MILES SOUTH OF THE INTERSECTION OF FM 51 AND SH 171

LATITUDE: 32° 40' 30.86172"
LONGITUDE: 97° 46' 07.37482"

SURFACE COORDINATES:	GRID COORDINATES:
NORTHING: 6,930,212.117	NORTHING: 6,929,380.591
EASTING: 2,193,770.527	EASTING: 2,193,507.306
ELEVATION: 1,070.658	ELEVATION: 1,070.658

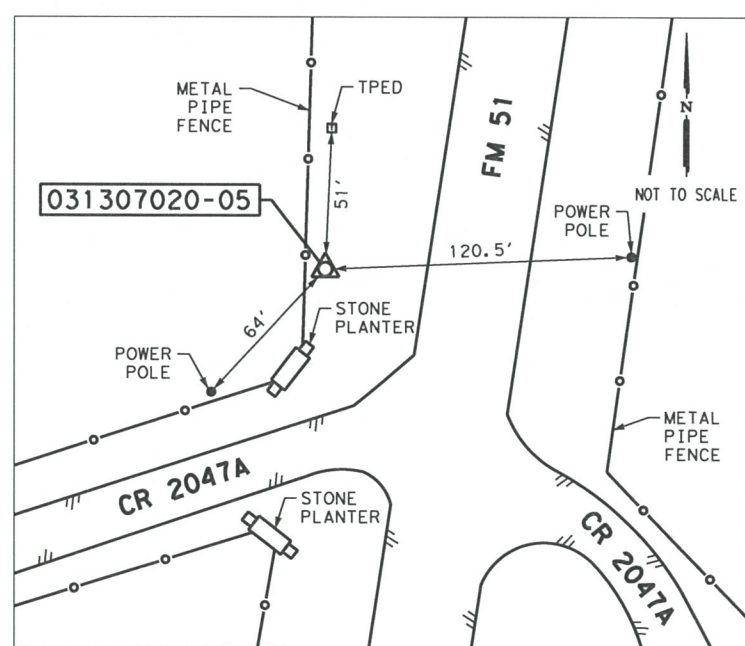


CONTROL POINT: 031307020-04

CP# 031307020-04 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, +/- 2 MILES SOUTH OF THE INTERSECTION OF FM 51 AND SH 171

LATITUDE: 32° 40' 21.61563"
LONGITUDE: 97° 46' 07.29636"

SURFACE COORDINATES:	GRID COORDINATES:
NORTHING: 6,929,277.701	NORTHING: 6,928,446.287
EASTING: 2,193,783.738	EASTING: 2,193,520.516
ELEVATION: 1,055.555	ELEVATION: 1,055.555

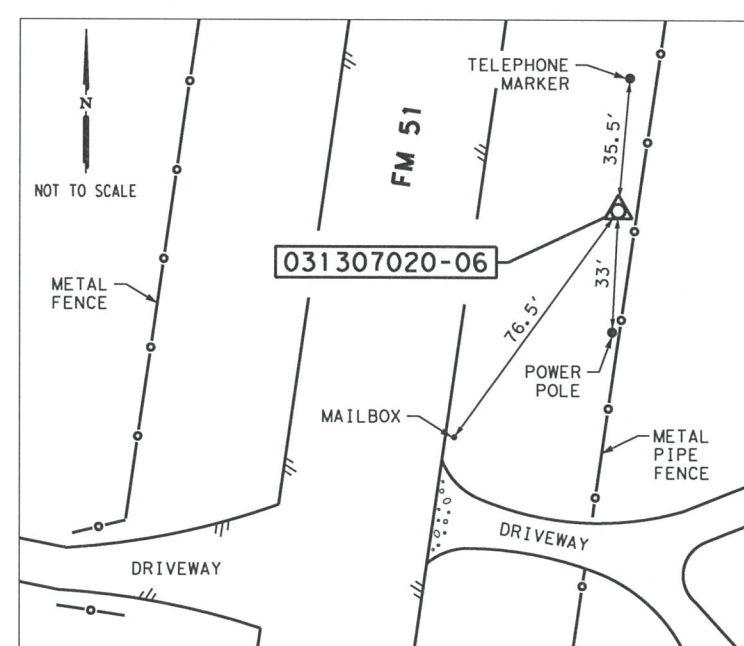


CONTROL POINT: 031307020-05

CP# 031307020-05 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE WEST SIDE OF FM 51, +/- 81.6' NORTH OF THE INTERSECTION OF FM 51 AND FM 2047A

LATITUDE: 32° 38' 17.85072"
LONGITUDE: 97° 46' 36.73754"

SURFACE COORDINATES:	GRID COORDINATES:
NORTHING: 6,916,751.900	NORTHING: 6,915,921.989
EASTING: 2,191,353.203	EASTING: 2,191,090.272
ELEVATION: 901.807	ELEVATION: 901.807



CONTROL POINT: 031307020-06

CP# 031307020-06 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, +/- 1,141.6' SOUTH OF THE INTERSECTION OF FM 51 AND FM 2047A

LATITUDE: 32° 38' 06.01634"
LONGITUDE: 97° 46' 37.39383"

SURFACE COORDINATES:	GRID COORDINATES:
NORTHING: 6,915,555.464	NORTHING: 6,914,725.697
EASTING: 2,191,305.312	EASTING: 2,191,042.387
ELEVATION: 871.141	ELEVATION: 871.141

- NOTES:**
- ALL BEARINGS AND COORDINATES ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983 TEXAS NORTH CENTRAL ZONE (4202), NORTH AMERICAN DATUM OF 1983 (NAD83) 2011 ADJUSTMENT, EPOCH 2010 (GEOID 12A). ALL DISTANCES AND COORDINATES ARE SURFACE VALUES AND MAY BE CONVERTED TO GRID BY DIVIDING BY A COMBINED ADJUSTMENT FACTOR OF 1.00012
 - ALL HORIZONTAL CONTROL OF THIS PROJECT WAS ESTABLISHED BY TxDOT VIRTUAL REFERENCE SYSTEM NETWORK (WEATHERFORD), BASED ON THREE AVERAGED 180 EPOCH OBSERVATIONS
 - UNIT OF MEASURE IS U.S. SURVEY FOOT
 - VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), BASED ON THREE 180 EPOCH OBSERVATIONS UTILIZING THE TxDOT VIRTUAL REFERENCE SYSTEM NETWORK (WEATHERFORD)
 - FIELD SURVEYS WERE PERFORMED DURING AUGUST 2019

I HERBY CERTIFY THAT THE HORIZONTAL AND VERTICAL DATA SHOWN HEREON WAS DETERMINED BY MULTIPLE GPS OBSERVATIONS ACCESSING THE STATE VIRTUAL REFERENCE SYSTEM IN AUGUST 2019, AND IS CORRECTLY SHOWN HEREON.



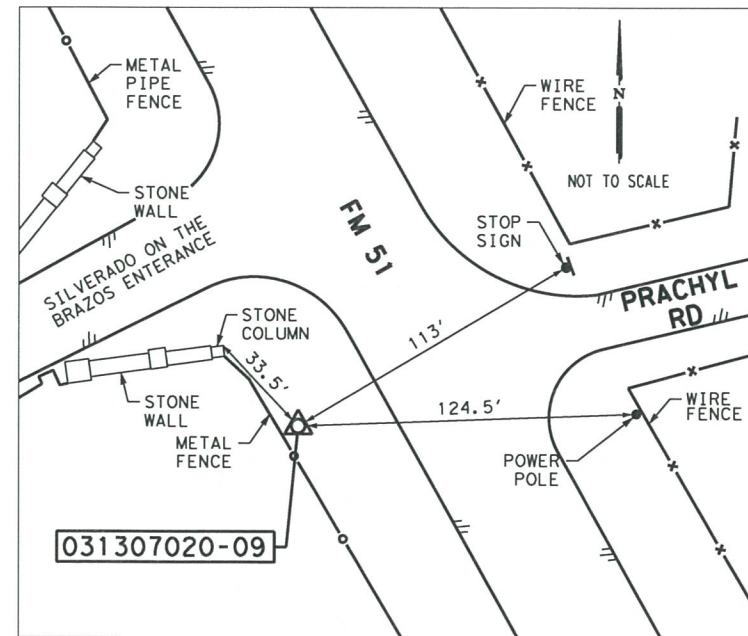
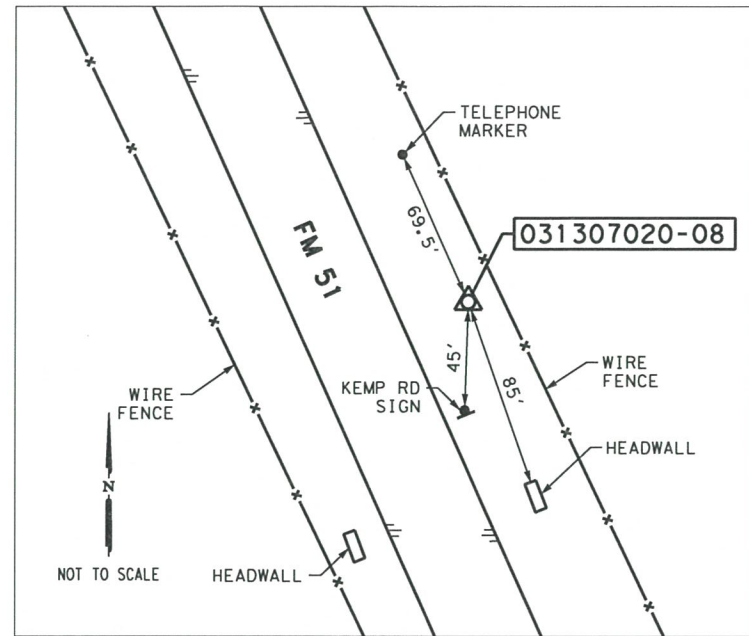
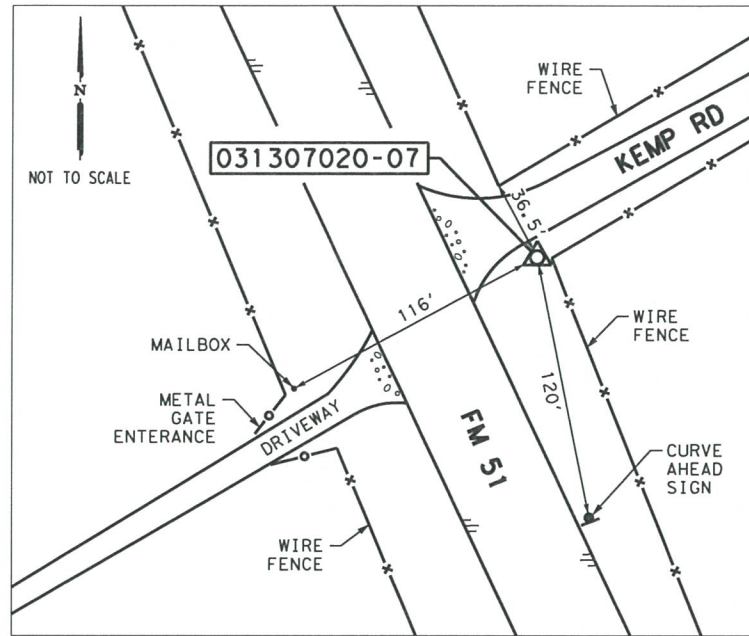
Christopher R. Freeman
CHRISTOPHER R. FREEMAN - R.P.L.S. NO. 5701

LTRA LINA T. RAMEY & ASSOCIATES, INC.
3320 Belt Line Road
Former's Branch, Texas 75234 - 214-979-1144
TBPELS FIRM NO. F-782, 10140700



**FM 51
SURVEY CONTROL DATA**

SHEET 2 OF 3			
STATE	CONT.	SECT.	JOB
TEXAS	0313	07	020
DIST	COUNTY	HIGHWAY	
02	PARKER	FM 51	
35			



CONTROL POINT: 031307020-07

CP# 031307020-07 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, ON THE SOUTH CORNER OF THE INTERSECTION OF FM 51 AND KEMP RD

LATITUDE: 32° 36' 54.40610"
LONGITUDE: 97° 46' 32.21865"

SURFACE COORDINATES: GRID COORDINATES:
NORTHING: 6,908,321.186 NORTHING: 6,907,492.287
EASTING: 2,191,797.780 EASTING: 2,191,534.796
ELEVATION: 809.729 ELEVATION: 809.729

CONTROL POINT: 031307020-08

CP# 031307020-08 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, +/- 662.5' SOUTH OF THE INTERSECTION OF FM 51 AND KEMP RD

LATITUDE: 32° 36' 48.52469"
LONGITUDE: 97° 46' 29.19441"

SURFACE COORDINATES: GRID COORDINATES:
NORTHING: 6,907,728.564 NORTHING: 6,906,899.736
EASTING: 2,192,060.564 EASTING: 2,191,797.548
ELEVATION: 798.289 ELEVATION: 798.289

CONTROL POINT: 031307020-09

CP# 031307020-09 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE WEST SIDE OF FM 51, +/- 39.3' WEST OF THE INTERSECTION OF FM 51 AND PRACHYL RD

LATITUDE: 32° 35' 17.09713"
LONGITUDE: 97° 46' 19.55941"

SURFACE COORDINATES: GRID COORDINATES:
NORTHING: 6,898,494.097 NORTHING: 6,897,666.377
EASTING: 2,192,948.738 EASTING: 2,192,685.616
ELEVATION: 899.829 ELEVATION: 899.829

NOTES:

1. ALL BEARINGS AND COORDINATES ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983 TEXAS NORTH CENTRAL ZONE (4202), NORTH AMERICAN DATUM OF 1983 (NAD83) 2011 ADJUSTMENT, EPOCH 2010 (GEOID 12A). ALL DISTANCES AND COORDINATES ARE SURFACE VALUES AND MAY BE CONVERTED TO GRID BY DIVIDING BY A COMBINED ADJUSTMENT FACTOR OF 1.00012
2. ALL HORIZONTAL CONTROL OF THIS PROJECT WAS ESTABLISHED BY TxDOT VIRTUAL REFERENCE SYSTEM NETWORK (WEATHERFORD), BASED ON THREE AVERAGED 180 EPOCH OBSERVATIONS
3. UNIT OF MEASURE IS U.S. SURVEY FOOT
4. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), BASED ON THREE 180 EPOCH OBSERVATIONS UTILIZING THE TxDOT VIRTUAL REFERENCE SYSTEM NETWORK (WEATHERFORD)
5. FIELD SURVEYS WERE PERFORMED DURING AUGUST 2019

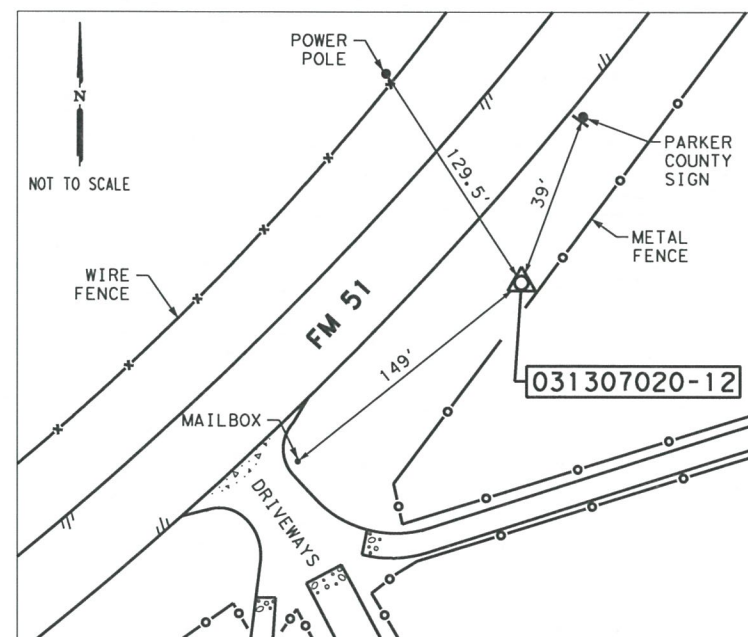
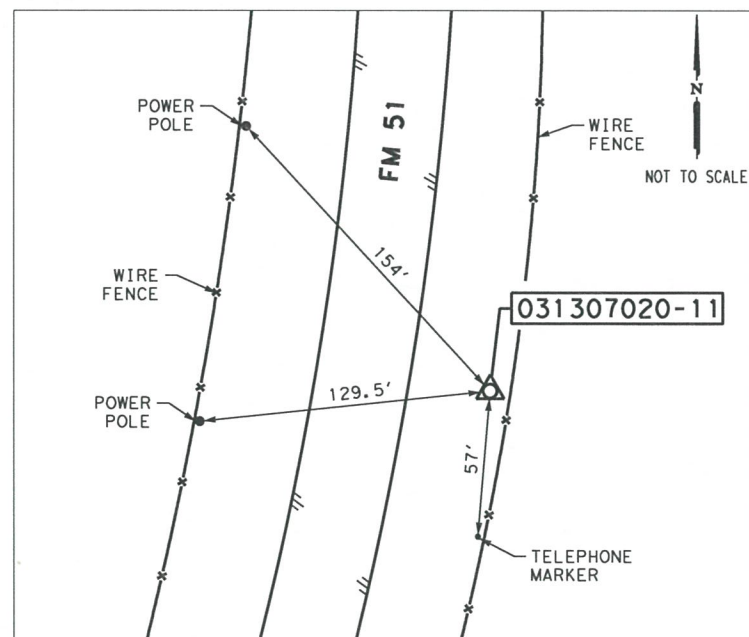
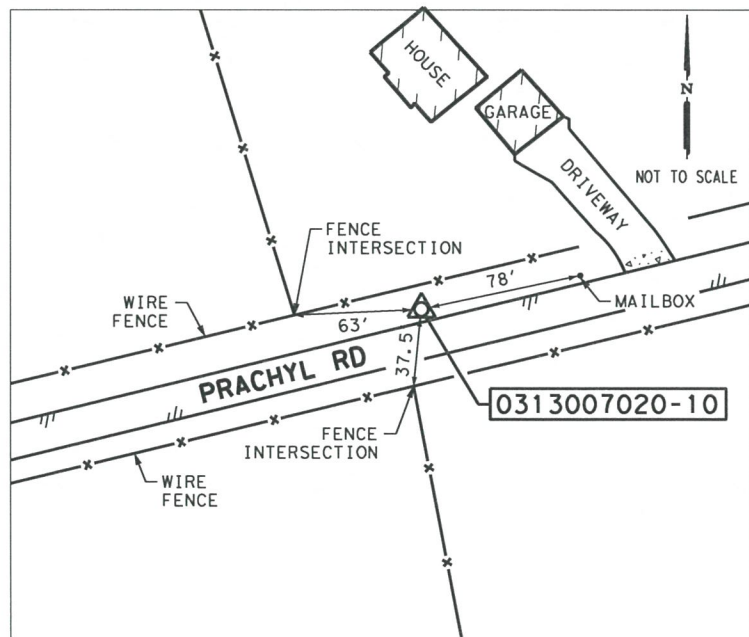
I HERBY CERTIFY THAT THE HORIZONTAL AND VERTICAL DATA SHOWN HEREON WAS DETERMINED BY MULTIPLE GPS OBSERVATIONS ACCESSING THE STATE VIRTUAL REFERENCE SYSTEM IN AUGUST 2019, AND IS CORRECTLY SHOWN HEREON.



Christopher R. Freeman
CHRISTOPHER R. FREEMAN - R.P.L.S. NO. 5701



LINA T. RAMEY & ASSOCIATES, INC.
3320 Belt Line Road
Farmers Branch, Texas 75234 - 214-979-1144
TBPELS FIRM NO. P-782, 10140700



CONTROL POINT: 031307020-10

CP# 031307020-10 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE NORTH SIDE OF PRACHYL RD, +/- 1,267.6' EAST OF THE INTERSECTION OF FM 51 AND PRACHYL RD

LATITUDE: 32° 35' 20.48803"
LONGITUDE: 97° 46' 04.52590"

SURFACE COORDINATES: GRID COORDINATES:
NORTHING: 6,898,845.738 NORTHING: 6,898,017.976
EASTING: 2,194,232.640 EASTING: 2,193,969.364
ELEVATION: 888.605 ELEVATION: 888.605

CONTROL POINT: 031307020-11

CP# 031307020-11 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, +/- 1996.4' SOUTH OF THE INTERSECTION OF FM 51 AND BAKER CUT OFF RD

LATITUDE: 32° 33' 33.60169"
LONGITUDE: 97° 45' 27.67861"

SURFACE COORDINATES: GRID COORDINATES:
NORTHING: 6,888,065.363 NORTHING: 6,887,238.894
EASTING: 2,197,461.648 EASTING: 2,197,197.984
ELEVATION: 874.153 ELEVATION: 874.153

CONTROL POINT: 031307020-12

CP# 031307020-12 IS A 3-1/4" TxDOT ALUMINUM DISK SET IN CONCRETE, LOCATED ON THE EAST SIDE OF FM 51, +/- 3,084.2' SOUTH OF THE INTERSECTION OF FM 51 AND BAKER CUT OFF RD

LATITUDE: 32° 33' 23.75240"
LONGITUDE: 97° 45' 33.71071"

SURFACE COORDINATES: GRID COORDINATES:
NORTHING: 6,887,066.297 NORTHING: 6,886,239.948
EASTING: 2,196,952.384 EASTING: 2,196,688.781
ELEVATION: 874.563 ELEVATION: 874.563

**FM 51
SURVEY CONTROL DATA**

SHEET 3 OF 3

STATE	CONT.	SECT.	JOB	SHEET NO.
TEXAS	0313	07	020	36
DIST	COUNTY	HIGHWAY		
02	PARKER	FM 51		

8/31/2020 O:_ (086) Kimley-Horn\19.086.09 FM 51\Control\FM 51 CONTROL DATA SHEET 02.dgn

HORIZONTAL ALIGNMENT FOR CL FM 51

Chain CL_FM51 contains:
 22 23 CUR CL_FM_51_5 CUR CL_FM_51_8 CUR CL_FM_51_11 CUR CL_FM_51_14 CUR CL_FM_51_17 CUR CL_FM_51_20 CUR CL_FM_51_23 CUR CL_FM_51_26 CUR CL_FM_51_29 CUR CL_FM_51_32 CUR CL_FM_51_35 CUR CL_FM_51_38 CUR CL_FM_51_41 CUR CL_FM_51_44 CUR CL_FM_51_47 CUR CL_FM_51_50 CUR CL_FM_51_53 CUR CL_FM_51_56 CUR CL_FM_51_59 CUR CL_FM_51_62

Beginning chain CL_FM51 description
 =====

Point 22 N 6,939,915.9977 E 2,192,935.2940 Sta 0+00.00
 Course from 22 to 23 S 9° 36' 00.00" E Dist 2,071.6000
 Point 23 N 6,937,873.4083 E 2,193,280.7721 Sta 20+71.60
 Course from 23 to PC CL_FM_51_5 S 8° 51' 00.00" E Dist 829.8000

Curve Data

 Curve CL_FM_51_5
 P.I. Station 30+48.23 N 6,936,908.4038 E 2,193,431.0251
 Delta = 2° 56' 09.58" (RT)
 Degree = 1° 00' 00.00"
 Tangent = 146.8318
 Length = 293.5994
 Radius = 5,729.5780
 External = 1.8811
 Long Chord = 293.5673
 Mid. Ord. = 1.8805
 P.C. Station 29+01.40 N 6,937,053.4875 E 2,193,408.4353
 P.T. Station 31+95.00 N 6,936,762.3535 E 2,193,446.1540
 C.C. Station 31+95.00 N 6,936,172.0024 E 2,187,747.0708
 Back = S 8° 51' 00.00" E
 Ahead = S 5° 54' 50.42" E
 Chord Bear = S 7° 22' 55.21" E

Course from PT CL_FM_51_5 to PC CL_FM_51_8 S 5° 54' 50.42" E Dist 4,499.5000

Curve Data

 Curve CL_FM_51_8
 P.I. Station 79+16.59 N 6,932,065.8900 E 2,193,932.6467
 Delta = 8° 52' 00.00" (RT)
 Degree = 2° 00' 00.54"
 Tangent = 222.0934
 Length = 443.3000
 Radius = 2,864.5740
 External = 8.5967
 Long Chord = 442.8578
 Mid. Ord. = 8.5709
 P.C. Station 76+94.50 N 6,932,286.8013 E 2,193,909.7631
 P.T. Station 81+37.80 N 6,931,844.0914 E 2,193,921.2065
 C.C. Station 81+37.80 N 6,931,991.6480 E 2,191,060.4354
 Back = S 5° 54' 50.42" E
 Ahead = S 2° 57' 09.57" W
 Chord Bear = S 1° 28' 50.42" E

Course from PT CL_FM_51_8 to PC CL_FM_51_11 S 2° 57' 09.57" W Dist 1,400.3000

Curve Data

 Curve CL_FM_51_11
 P.I. Station 96+38.11 N 6,930,345.7730 E 2,193,843.9243
 Delta = 2° 00' 00.00" (RT)
 Degree = 1° 00' 00.00"
 Tangent = 100.0102
 Length = 200.0000
 Radius = 5,729.5780
 External = 0.8728
 Long Chord = 199.9898
 Mid. Ord. = 0.8726
 P.C. Station 95+38.10 N 6,930,445.6504 E 2,193,849.0759
 P.T. Station 97+38.10 N 6,930,246.1363 E 2,193,835.2901
 C.C. Station 97+38.10 N 6,930,740.7857 E 2,188,127.1043
 Back = S 2° 57' 09.57" W
 Ahead = S 4° 57' 09.57" W
 Chord Bear = S 3° 57' 09.57" W

Course from PT CL_FM_51_11 to PC CL_FM_51_14 S 4° 57' 09.57" W Dist 687.7000

Curve Data

 Curve CL_FM_51_14
 P.I. Station 106+16.68 N 6,929,370.8346 E 2,193,759.4399
 Delta = 11° 24' 59.99" (RT)
 Degree = 3° 00' 01.57"
 Tangent = 190.8820
 Length = 380.5000
 Radius = 1,909.5810
 External = 9.5166
 Long Chord = 379.8708
 Mid. Ord. = 9.4694
 P.C. Station 104+25.80 N 6,929,561.0039 E 2,193,775.9192
 P.T. Station 108+06.30 N 6,929,187.6900 E 2,193,705.6440
 C.C. Station 108+06.30 N 6,929,725.8630 E 2,191,873.4679
 Back = S 4° 57' 09.57" W
 Ahead = S 16° 22' 09.56" W
 Chord Bear = S 10° 39' 39.57" W

Course from PT CL_FM_51_14 to PC CL_FM_51_17 S 16° 22' 09.56" W Dist 944.3000

Curve Data

 Curve CL_FM_51_17
 P.I. Station 119+20.65 N 6,928,118.5103 E 2,193,391.5893
 Delta = 3° 24' 00.00" (LT)
 Degree = 1° 00' 00.00"
 Tangent = 170.0499
 Length = 340.0000
 Radius = 5,729.5780
 External = 2.5229
 Long Chord = 339.9501
 Mid. Ord. = 2.5218
 P.C. Station 117+50.60 N 6,928,281.6672 E 2,193,439.5140
 P.T. Station 120+90.60 N 6,927,952.7983 E 2,193,353.4251
 C.C. Station 120+90.60 N 6,926,666.9129 E 2,198,936.8436
 Back = S 16° 22' 09.56" W
 Ahead = S 12° 58' 09.56" W
 Chord Bear = S 14° 40' 09.56" W

Course from PT CL_FM_51_17 to PC CL_FM_51_20 S 12° 58' 09.56" W Dist 1,140.6543

Curve Data

 Curve CL_FM_51_20
 P.I. Station 135+21.11 N 6,926,558.7773 E 2,193,032.3760
 Delta = 11° 32' 15.44" (RT)
 Degree = 1° 59' 49.09"
 Tangent = 289.8586
 Length = 577.7569
 Radius = 2,869.1380
 External = 14.6045
 Long Chord = 576.7812
 Mid. Ord. = 14.5305
 P.C. Station 132+31.25 N 6,926,841.2416 E 2,193,097.4288
 P.T. Station 138+09.01 N 6,926,295.0317 E 2,192,912.1417
 C.C. Station 138+09.01 N 6,927,485.1604 E 2,190,301.4814
 Back = S 12° 58' 09.56" W
 Ahead = S 24° 30' 25.00" W
 Chord Bear = S 18° 44' 17.28" W

Course from PT CL_FM_51_20 to PC CL_FM_51_23 S 24° 30' 25.00" W Dist 3,858.0599

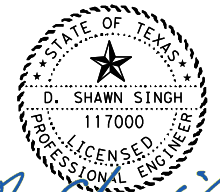
Curve Data

 Curve CL_FM_51_23
 P.I. Station 183+12.73 N 6,922,197.0469 E 2,191,043.9824
 Delta = 31° 27' 59.99" (LT)
 Degree = 2° 29' 59.76"
 Tangent = 645.6607
 Length = 1,258.7000
 Radius = 2,291.8920
 External = 89.2100
 Long Chord = 1,242.9410
 Mid. Ord. = 85.8677
 P.C. Station 176+67.07 N 6,922,784.5406 E 2,191,311.8048
 P.T. Station 189+25.77 N 6,921,556.1436 E 2,191,122.2181
 C.C. Station 189+25.77 N 6,921,833.8557 E 2,193,397.2225
 Back = S 24° 30' 25.00" W
 Ahead = S 6° 57' 34.99" E
 Chord Bear = S 8° 46' 25.01" W

Course from PT CL_FM_51_23 to PC CL_FM_51_26 S 6° 57' 34.99" E Dist 3,460.3189

NOTES:

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- HORIZONTAL ALIGNMENT DATA IS PROVIDED TO VERIFY 3R PROJECT REQUIREMENTS.



D. Shawn Singh
 10/19/2020

NO.	DATE	REVISION	APPROVED

Kimley»Horn
 F-928



FM 51
HORIZONTAL ALIGNMENT DATA

SHEET 1 OF 3

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			37

HORIZONTAL ALIGNMENT FOR CL FM 51 (CONTINUED)

Curve CL_FM_51_26

 P.I. Station = 226+37.53 N 6,917,871.7368 E 2,191,571.9773
 Delta = 15° 00' 00.01" (RT)
 Degree = 3° 00' 00.00"
 Tangent = 251.4377
 Length = 500.0000
 Radius = 1,909.8590
 External = 16.4801
 Long Chord = 498.5733
 Mid. Ord. = 16.3391
 P.C. Station = 223+86.09 N 6,918,121.3218 E 2,191,541.5102
 P.T. Station = 228+86.09 N 6,917,622.7707 E 2,191,536.8089
 C.C. = N 6,917,889.9013 E 2,189,645.7239
 Back = S 6° 57' 34.99" E
 Ahead = S 8° 02' 25.02" W
 Chord Bear = S 0° 32' 25.01" W

Course from PT CL_FM_51_26 to PC CL_FM_51_29 S 8° 02' 25.02" W Dist 3,296.8253

Curve CL_FM_51_29

 P.I. Station = 266+04.00 N 6,913,941.4120 E 2,191,016.7881
 Delta = 24° 52' 00.00" (LT)
 Degree = 2° 59' 59.85"
 Tangent = 421.0804
 Length = 828.9000
 Radius = 1,909.8850
 External = 45.8679
 Long Chord = 822.4098
 Mid. Ord. = 44.7922
 P.C. Station = 261+82.91 N 6,914,358.3532 E 2,191,075.6843
 P.T. Station = 270+11.81 N 6,913,538.3596 E 2,191,138.6793
 C.C. = N 6,914,091.2189 E 2,192,966.7951
 Back = S 8° 02' 25.02" W
 Ahead = S 16° 49' 34.98" E
 Chord Bear = S 4° 23' 34.98" E

Course from PT CL_FM_51_29 to PC CL_FM_51_32 S 16° 49' 34.98" E Dist 1,084.7053

Curve CL_FM_51_32

 P.I. Station = 283+66.06 N 6,912,242.0934 E 2,191,530.6966
 Delta = 10° 45' 00.00" (RT)
 Degree = 2° 00' 00.00"
 Tangent = 269.5412
 Length = 537.5000
 Radius = 2,864.7890
 External = 12.6523
 Long Chord = 536.7120
 Mid. Ord. = 12.5967
 P.C. Station = 280+96.52 N 6,912,500.0945 E 2,191,452.6718
 P.T. Station = 286+34.02 N 6,911,974.0666 E 2,191,559.2286
 C.C. = N 6,911,670.8166 E 2,188,710.5350
 Back = S 16° 49' 34.98" E
 Ahead = S 6° 04' 34.98" E
 Chord Bear = S 11° 27' 04.98" E

Course from PT CL_FM_51_32 to PC CL_FM_51_35 S 6° 04' 34.98" E Dist 730.2491

Curve CL_FM_51_35

 P.I. Station = 297+82.99 N 6,910,831.5503 E 2,191,680.8521
 Delta = 24° 44' 00.02" (RT)
 Degree = 3° 00' 00.58"
 Tangent = 418.7226
 Length = 824.4000
 Radius = 1,909.7560
 External = 45.3646
 Long Chord = 818.0139
 Mid. Ord. = 44.3120
 P.C. Station = 293+64.27 N 6,911,247.9203 E 2,191,636.5286
 P.T. Station = 301+88.67 N 6,910,434.8312 E 2,191,546.9022
 C.C. = N 6,911,045.7646 E 2,189,737.5022
 Back = S 6° 04' 34.98" E
 Ahead = S 18° 39' 25.04" W
 Chord Bear = S 6° 17' 25.03" W

Course from PT CL_FM_51_35 to PC CL_FM_51_38 S 18° 39' 25.04" W Dist 490.7602

Curve CL_FM_51_38

 P.I. Station = 312+52.11 N 6,909,427.2700 E 2,191,206.7050
 Delta = 43° 35' 00.04" (LT)
 Degree = 3° 59' 59.78"
 Tangent = 572.6840
 Length = 1,089.6000
 Radius = 1,432.4160
 External = 110.2384
 Long Chord = 1,063.5199
 Mid. Ord. = 102.3607
 P.C. Station = 306+79.43 N 6,909,969.8600 E 2,191,389.9074
 P.T. Station = 317+69.03 N 6,908,907.9315 E 2,191,448.0648
 C.C. = N 6,909,511.6283 E 2,192,747.0512
 Back = S 18° 39' 25.04" W
 Ahead = S 24° 55' 35.01" E
 Chord Bear = S 3° 08' 04.98" E

Course from PT CL_FM_51_38 to PC CL_FM_51_41 S 24° 55' 35.01" E Dist 1,675.6244

Curve CL_FM_51_41

 P.I. Station = 336+92.43 N 6,907,163.6957 E 2,192,258.6887
 Delta = 14° 47' 00.01" (RT)
 Degree = 2° 59' 59.52"
 Tangent = 247.7761
 Length = 492.8000
 Radius = 1,909.9450
 External = 16.0049
 Long Chord = 491.4342
 Mid. Ord. = 15.8719
 P.C. Station = 334+44.65 N 6,907,388.3915 E 2,192,154.2626
 P.T. Station = 339+37.45 N 6,906,919.7921 E 2,192,302.3237
 C.C. = N 6,906,583.4384 E 2,190,422.2290
 Back = S 24° 55' 35.01" E
 Ahead = S 10° 08' 34.99" E
 Chord Bear = S 17° 32' 05.00" E

Course from PT CL_FM_51_41 to PC CL_FM_51_44 S 10° 08' 34.99" E Dist 3,198.0505

Curve CL_FM_51_44

 P.I. Station = 376+01.47 N 6,903,313.0431 E 2,192,947.5801
 Delta = 21° 16' 56.24" (RT)
 Degree = 2° 18' 37.13"
 Tangent = 465.9629
 Length = 921.1861
 Radius = 2,480.0000
 External = 43.3948
 Long Chord = 915.8995
 Mid. Ord. = 42.6486
 P.C. Station = 371+35.50 N 6,903,771.7235 E 2,192,865.5211
 P.T. Station = 380+56.69 N 6,902,855.8586 E 2,192,857.5590
 C.C. = N 6,903,334.9795 E 2,190,424.2807
 Back = S 10° 08' 34.99" E
 Ahead = S 11° 08' 21.25" W
 Chord Bear = S 0° 29' 53.13" W

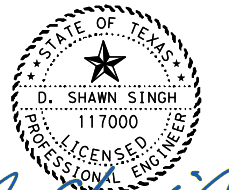
Course from PT CL_FM_51_44 to PC CL_FM_51_47 S 11° 08' 21.25" W Dist 2,562.3445

Curve CL_FM_51_47

 P.I. Station = 411+53.39 N 6,899,817.4993 E 2,192,259.2956
 Delta = 40° 55' 00.02" (LT)
 Degree = 4° 00' 00.24"
 Tangent = 534.3547
 Length = 1,022.9000
 Radius = 1,432.3710
 External = 96.4264
 Long Chord = 1,001.3023
 Mid. Ord. = 90.3445
 P.C. Station = 406+19.03 N 6,900,341.7871 E 2,192,362.5296
 P.T. Station = 416+41.93 N 6,899,353.7002 E 2,192,524.6733
 C.C. = N 6,900,065.0618 E 2,193,767.9156
 Back = S 11° 08' 21.25" W
 Ahead = S 29° 46' 38.77" E
 Chord Bear = S 9° 19' 08.76" E

Course from PT CL_FM_51_47 to PC CL_FM_51_50 S 29° 46' 38.77" E Dist 2,400.9308

- NOTES:
- HORIZONTAL ALIGNMENT DATA IS BASED ON AS-BUILT PLANS: CSJ 0313-07-007. THIS INFORMATION IS PROVIDED TO HELP AID THE CONTRACTOR LOCATE EXISTING CULVERT STRUCTURES ONLY.
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D. Shawn Singh
 10/19/2020

NO.	DATE	REVISION	APPROVED



FM 51
HORIZONTAL ALIGNMENT DATA

SHEET 2 OF 3

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			38

DATE: 10/19/2020 3:03:27 PM
 FILE: FM51_RDW_HAD_02.dgn

HORIZONTAL ALIGNMENT FOR CL FM 51 (CONTINUED)

Curve Data

Curve CL_FM_51_50
 P.I. Station = 441+57.87 N 6,897,169.9668 E 2,193,774.1674
 Delta = 1° 08' 45.92" (LT)
 Degree = 0° 29' 53.88"
 Tangent = 115.0038
 Length = 230.0000
 Radius = 11,498.2520
 External = 0.5751
 Long Chord = 229.9962
 Mid. Ord. = 0.5751
 P.C. Station = 440+42.87 N 6,897,269.7857 E 2,193,717.0528
 P.T. Station = 442+72.87 N 6,897,071.3103 E 2,193,833.2671
 C.C. = N 6,902,980.1876 E 2,203,697.0883
 Back = S 29° 46' 38.77" E
 Ahead = S 30° 55' 24.69" E
 Chord Bear = S 30° 21' 01.73" E

Course from PT CL_FM_51_50 to PC CL_FM_51_53 S 30° 55' 24.69" E Dist 2,081.9326

Curve Data

Curve CL_FM_51_53
 P.I. Station = 465+08.18 N 6,895,153.7328 E 2,194,981.9832
 Delta = 3° 04' 00.00" (LT)
 Degree = 0° 59' 59.61"
 Tangent = 153.3866
 Length = 306.7000
 Radius = 5,730.2010
 External = 2.0526
 Long Chord = 306.6634
 Mid. Ord. = 2.0518
 P.C. Station = 463+54.80 N 6,895,285.3161 E 2,194,903.1588
 P.T. Station = 466+61.50 N 6,895,026.5549 E 2,195,067.7341
 C.C. = N 6,898,230.0293 E 2,199,818.8345
 Back = S 30° 55' 24.69" E
 Ahead = S 33° 59' 24.69" E
 Chord Bear = S 32° 27' 24.69" E

Course from PT CL_FM_51_53 to PC CL_FM_51_56 S 33° 59' 24.69" E Dist 2,366.0651

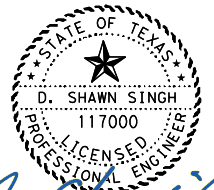
Curve Data

Curve CL_FM_51_56
 P.I. Station = 493+23.61 N 6,892,819.3090 E 2,196,555.9906
 Delta = 11° 48' 00.00" (RT)
 Degree = 2° 00' 00.00"
 Tangent = 296.0471
 Length = 590.0000
 Radius = 2,864.7890
 External = 15.2561
 Long Chord = 588.9579
 Mid. Ord. = 15.1753
 P.C. Station = 490+27.56 N 6,893,064.7716 E 2,196,390.4851
 P.T. Station = 496+17.56 N 6,892,545.1885 E 2,196,667.8023
 C.C. = N 6,891,463.2085 E 2,194,015.1932
 Back = S 33° 59' 24.69" E
 Ahead = S 22° 11' 24.69" E
 Chord Bear = S 28° 05' 24.69" E

Course from PT CL_FM_51_56 to PC CL_FM_51_59 S 22° 11' 24.69" E Dist 1,679.4040

=====
 Ending chain CL_FM51 description

- NOTES:**
- HORIZONTAL ALIGNMENT DATA IS BASED ON AS-BUILT PLANS: CSJ 0313-07-007. THIS INFORMATION IS PROVIDED TO HELP AID THE CONTRACTOR LOCATE EXISTING CULVERT STRUCTURES ONLY.
 - HORIZONTAL ALIGNMENT DATA IS PROVIDED TO VERIFY 3R PROJECT REQUIREMENTS.



D. Shawn Singh
 10/19/2020

NO.	DATE	REVISION	APPROVED



**FM 51
 HORIZONTAL ALIGNMENT DATA**

SHEET 3 OF 3

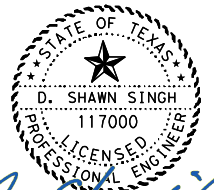
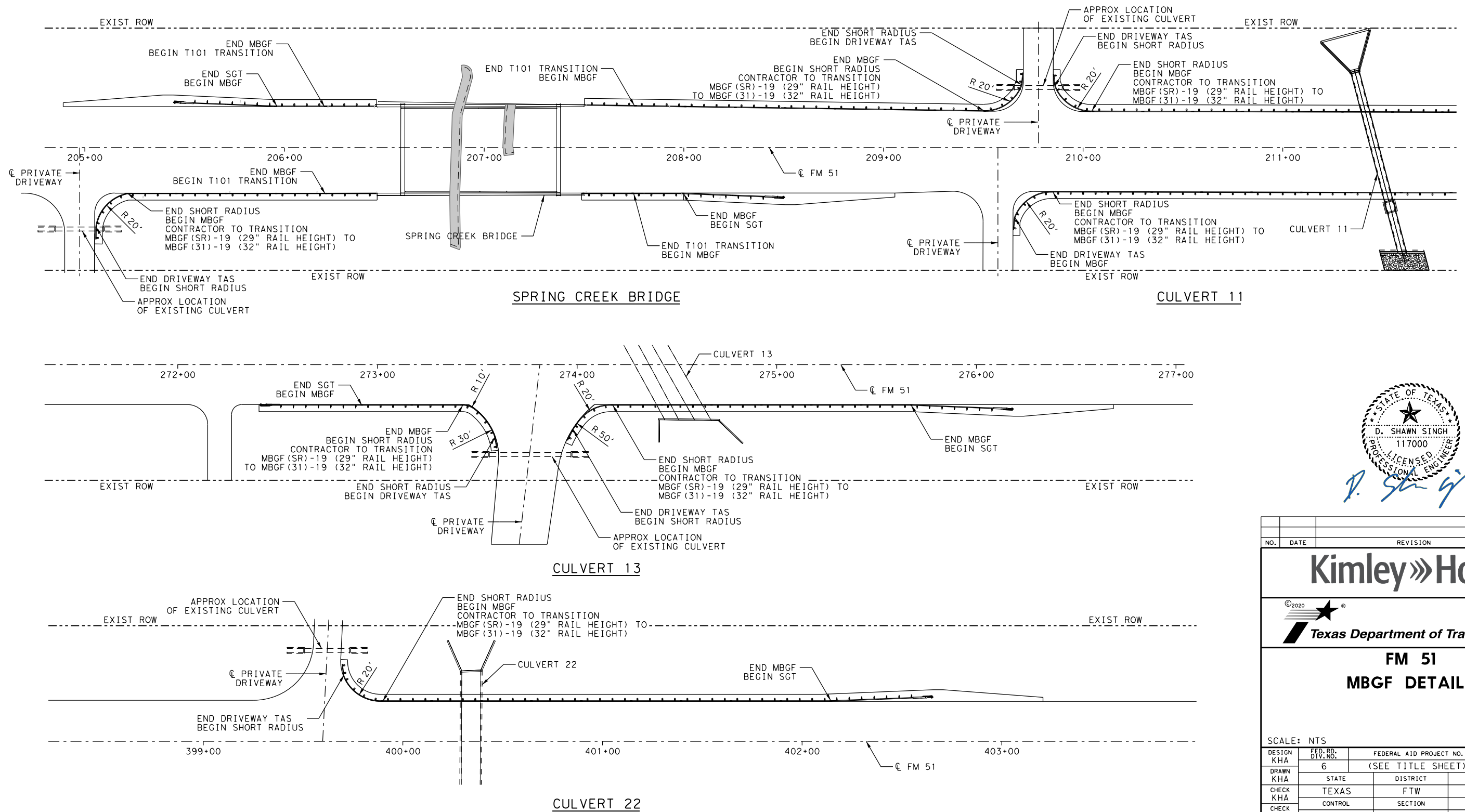
DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
CHECK KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
CHECK KHA	0313	07	020

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MBGF INFORMATION

LOCATION	LT/RT	* BEGIN MBGF	* END MBGF	MBGF LENGTH (LF)	T101 TRANSITION (EA)	SGT (EA)	**DRIVEWAY TAS (EA)	**SHORT RADIUS (LF)	MOW STRIP (CY)
SPRING CREEK BRIDGE	RT	205+20	206+20	100	1		1	25	8
		207+75	208+00	25	1	1			8
SPRING CREEK BRIDGE	LT	205+95	206+20	25	1				8
		207+75	209+50	175	1	1	1	25	14
CULVERT 11	RT	209+85	212+35	250		1	1	25	19
CULVERT 11	LT	210+05	213+05	300		1	1	25	21
CULVERT 13	RT	272+92	273+42	50		1	1	25	6
		274+18	275+68	150		1	1	25	14
CULVERT 13	LT	273+40	275+90	250		2			23
CULVERT 18	RT	330+10	332+85	275		2			24
CULVERT 18	LT	331+00	333+75	275		2			24
CULVERT 22	RT	398+60	401+10	250		2			23
CULVERT 22	LT	399+90	402+15	225		1	1	25	17

* SGT/TAS PAYMENT LIMITS END AT THIS STATION.
 ** REFER TO TXDOT STANDARD MBGF (SR)-19 FOR MORE INFORMATION.



D. Singh 10/19/2020

NO.	DATE	REVISION	APPROVED

Kimley»Horn
F-928



**FM 51
MBGF DETAILS**

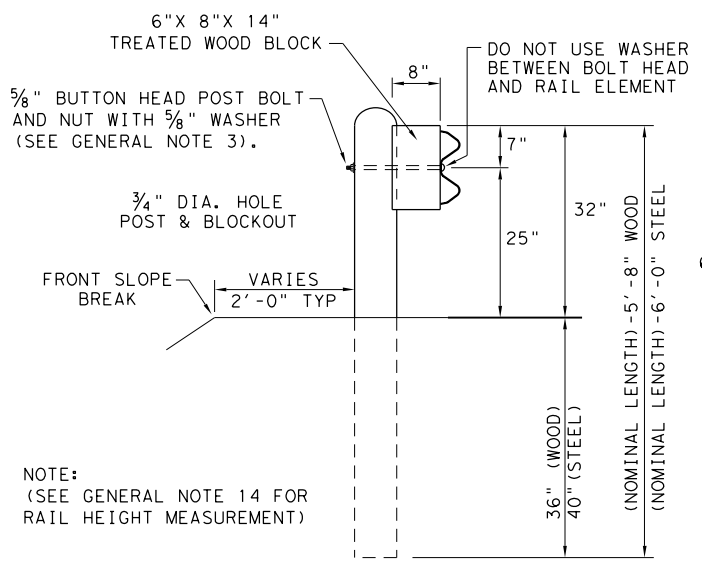
SCALE: NTS SHEET 1 OF 1

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
CHECK KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020

40

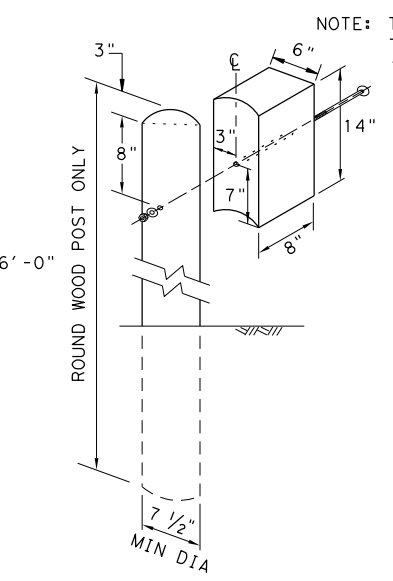
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DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.
 DATE: 10/19/2020
 FILE: c:\pwworking\kna\pwwpr\od\shawn.singh\dms30455\gf3119.dgn



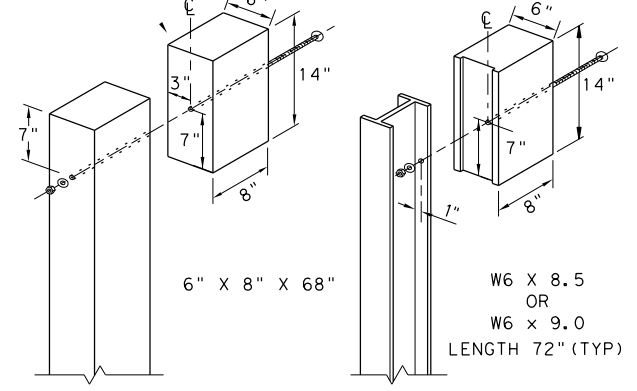
NOTE:
(SEE GENERAL NOTE 14 FOR RAIL HEIGHT MEASUREMENT)

TYPICAL POST PLACEMENT



WOOD BLOCK TO ROUND WOOD POST

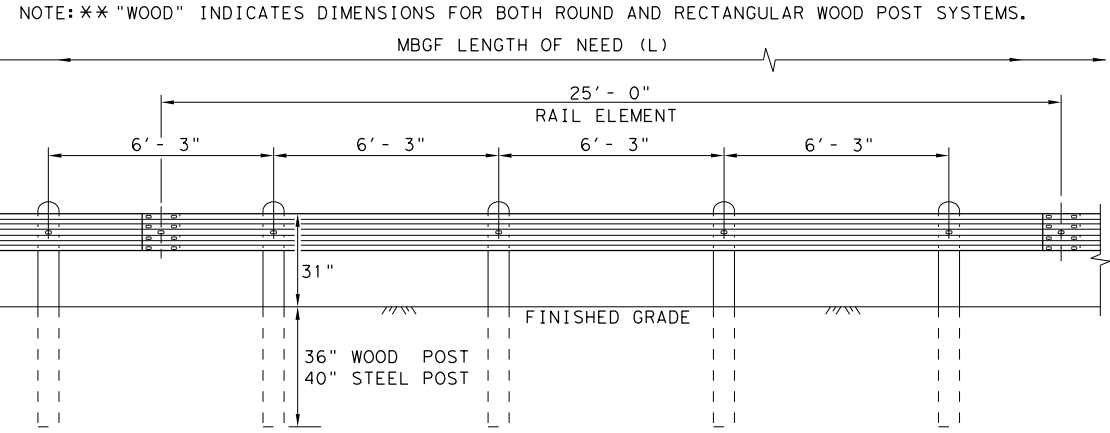
NOTE: TOENAIL WITH ONE 16D GALV. NAIL TO PREVENT BLOCK ROTATION.



WOOD BLOCK TO RECTANGULAR WOOD POST

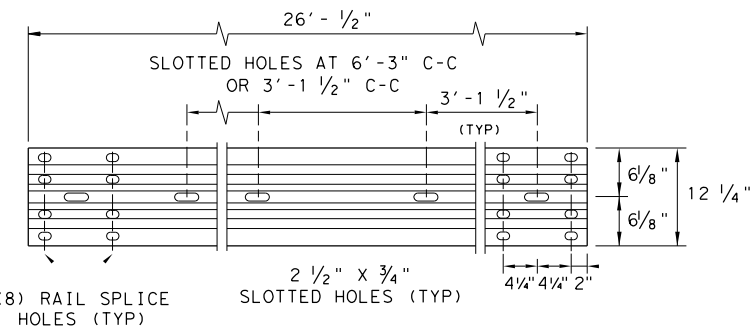
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

- 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.



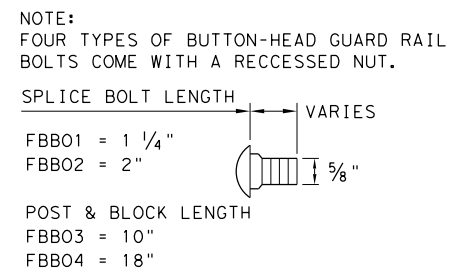
ELEVATION MID-SPAN RAIL SPLICE

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



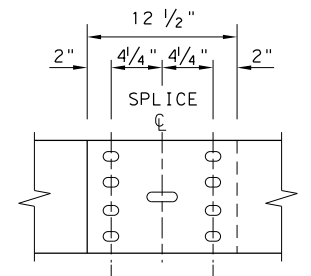
ELEVATION 25'-0" (NOM.) W-BEAM SECTION

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



BUTTON HEAD BOLT

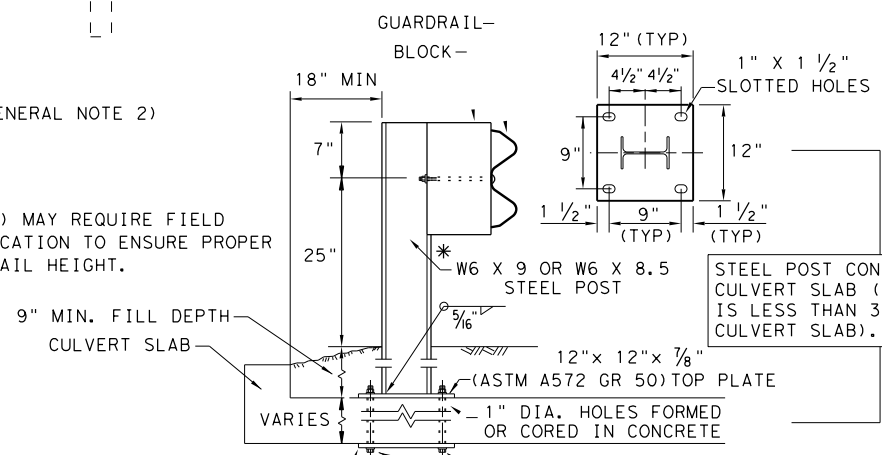
NOTE: SEE GENERAL NOTE 3 FOR SPLICE & POST BOLT DETAILS.



MID-SPAN RAIL SPLICE DETAIL

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

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



LOW FILL CULVERT POST

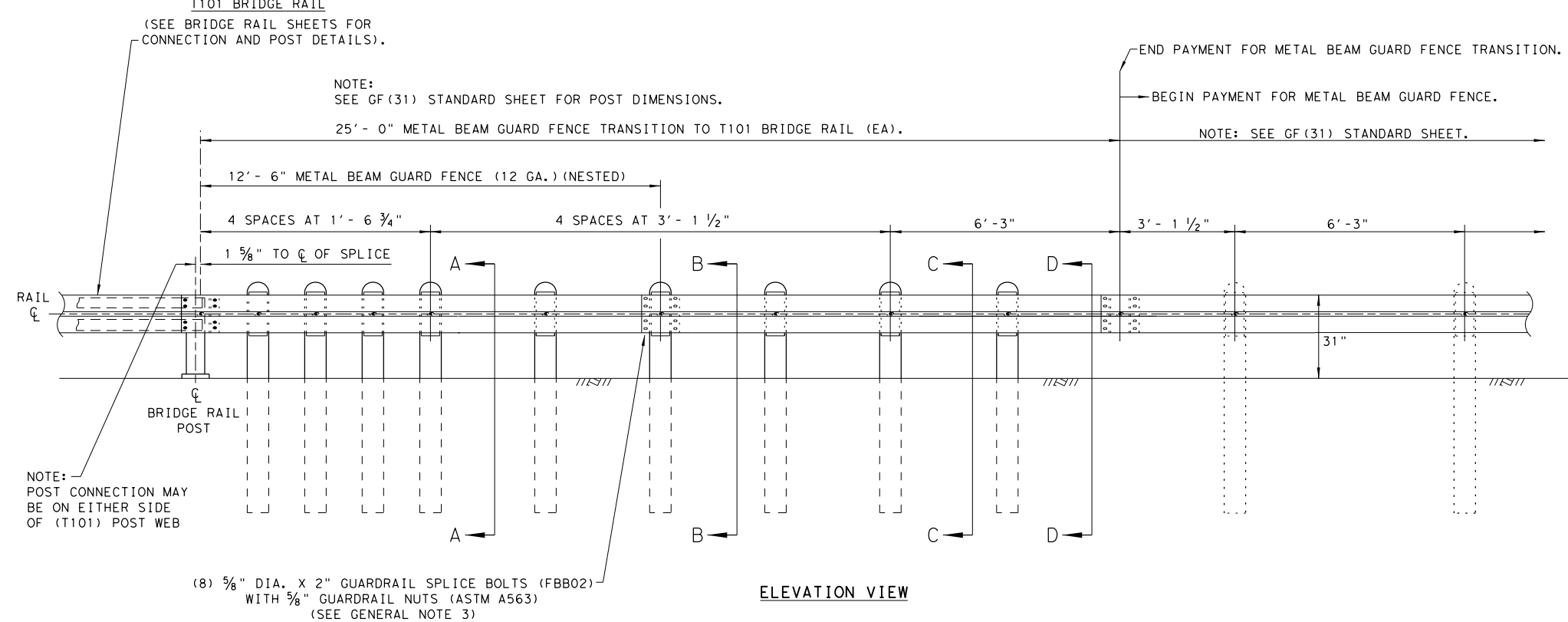
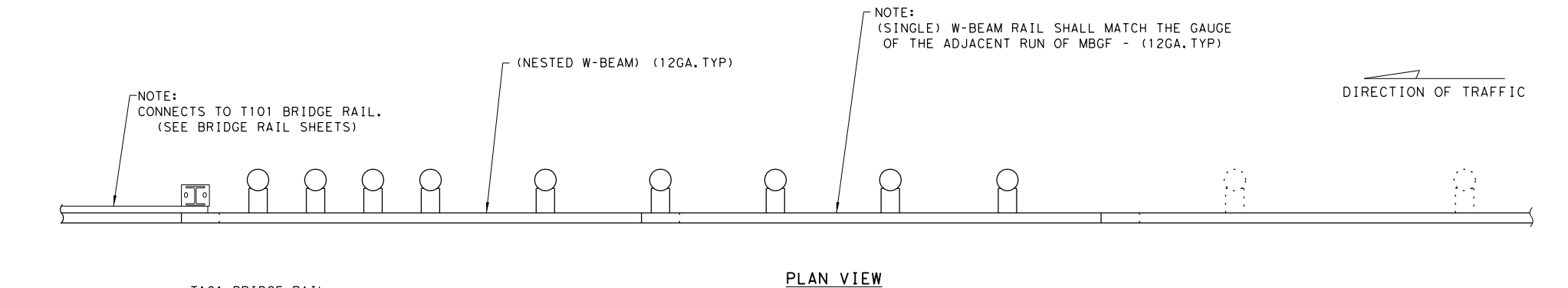
- NOTE: TWO INSTALLATION OPTIONS.
1. **BOLT-THROUGH OPTION:** REQUIRES A 6" MIN. SLAB THICKNESS. 7/8" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS. NOTE: BOLT LENGTH = SLAB PLUS 2 1/4" MIN.
 2. **EPOXY ANCHOR OPTION:** THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB 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.

				Design Division Standard	
METAL BEAM GUARD FENCE TL-3 MASH COMPLIANT GF(31)-19					
FILE: gf3119.dgn	DN: TXDOT	CK: KM	DW: VP	CK: CGL/AG	
© TXDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0313	07	020	FM 51	
	DIST	COUNTY		SHEET NO.	
	FTW	PARKER		41	

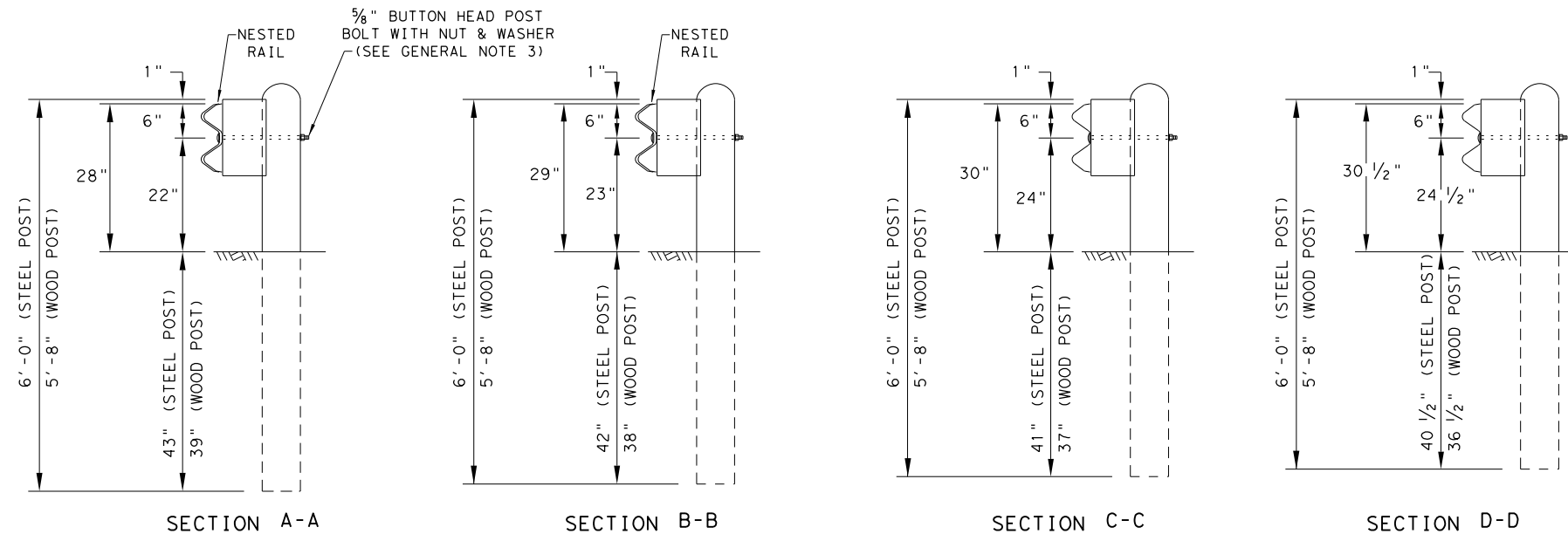
DISCLAIMER: THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. THE USE OF THIS STANDARD FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE. TXDOT ASSUMES NO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

DATE: 10/19/2020
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- GENERAL NOTES**
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
 2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
 3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR. A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1-1/4" WITH 5/8" NUTS (ASTM A563).
 4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
 5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
 6. WHERE SOLID ROCK IS ENCOUNTERED. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
 7. POSTS SHALL NOT BE SET IN CONCRETE.
 8. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
 9. REFER TO STANDARD GF(31) AND APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.

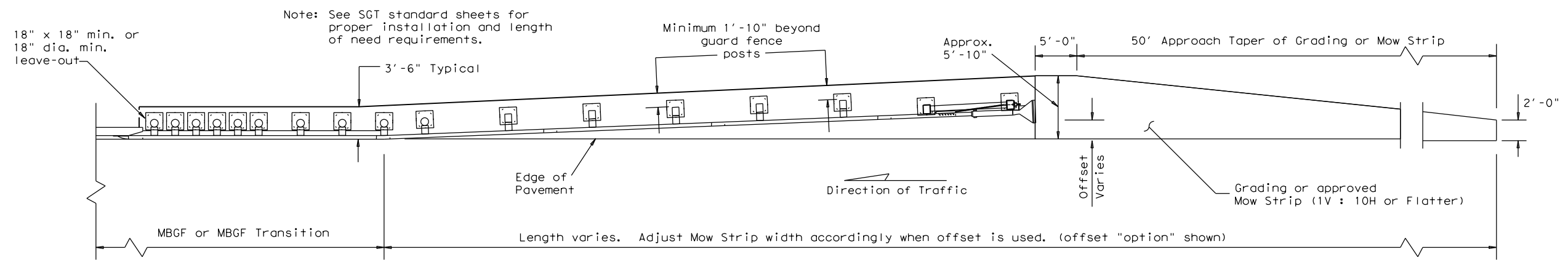
* "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



				Design Division Standard
METAL BEAM GUARD FENCE TRANSITION (T101) GF(31) T101-19				
FILE: gf31+10119	DN: TXDOT	CK: KM	DW: VP	CK: CGL/AG
© TXDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
	DIST	COUNTY		SHEET NO.
	FTW	PARKER		42

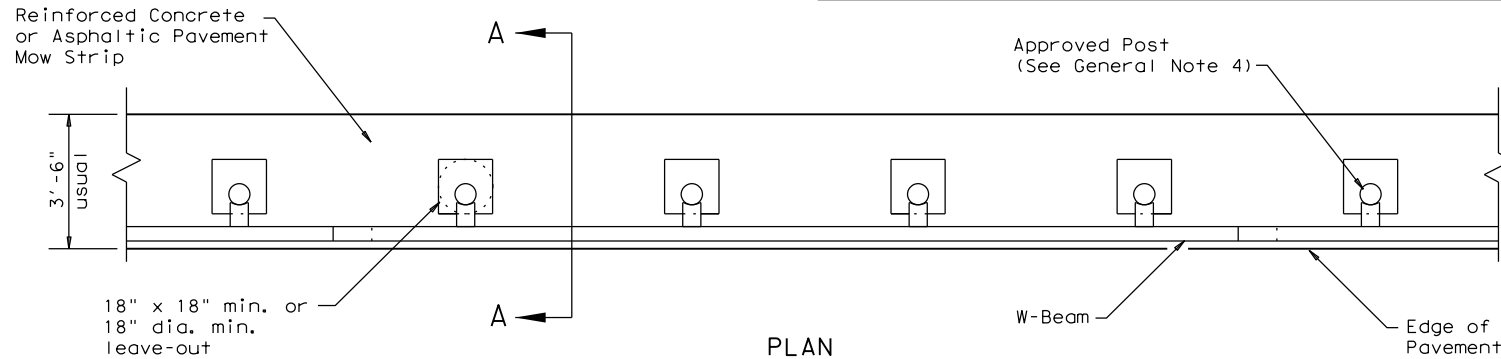
DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TxDOT FOR ANY PURPOSE WHATSOEVER. TxDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.

DATE: 10/19/2020
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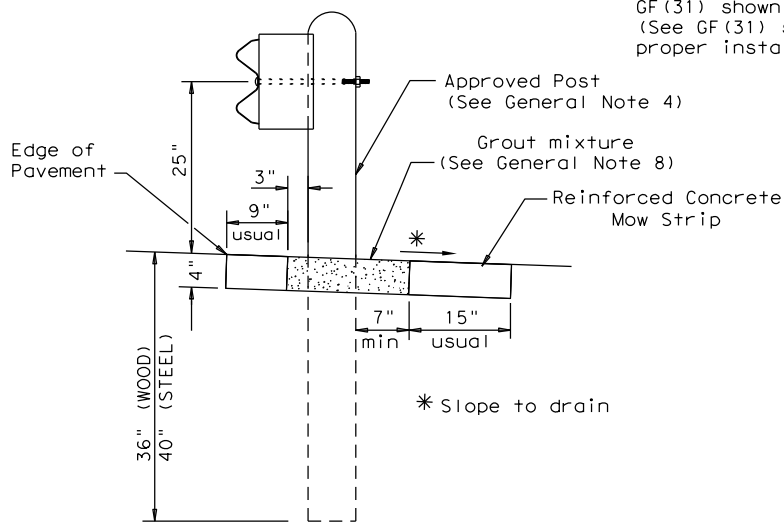
GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS

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



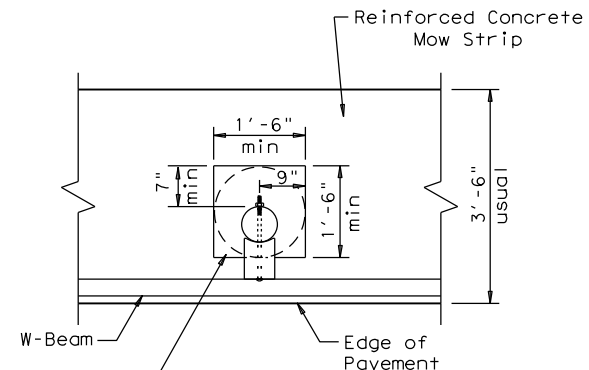
PLAN

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



SECTION A-A

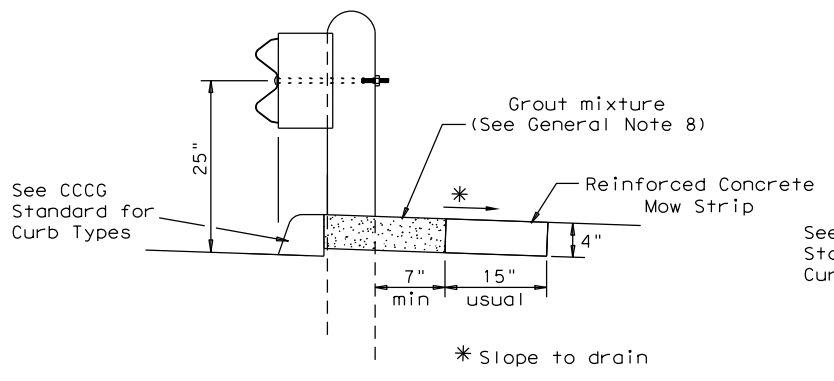
Typical



MOW STRIP DETAIL

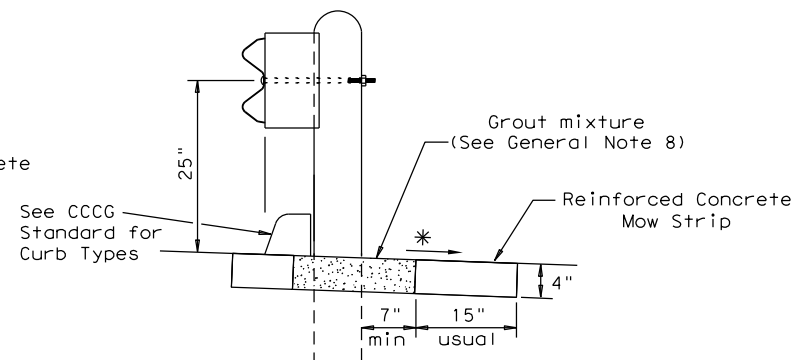
Reinforced Concrete Mow Strip with 18" x 18" Square or 18" Dia. minimum leave-out.

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



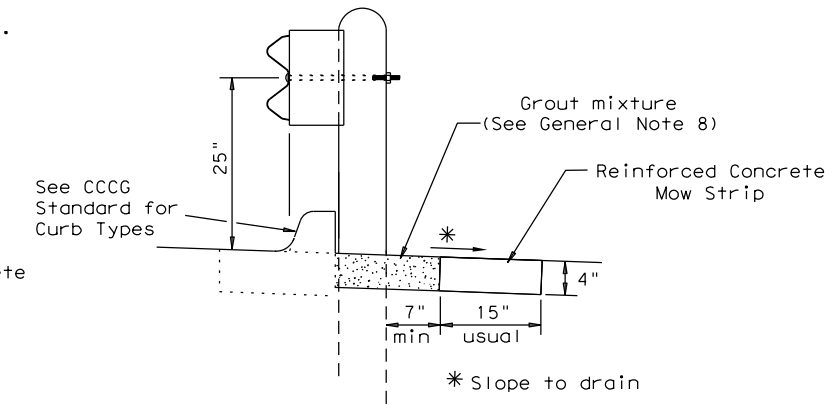
CURB OPTION (1)

This option will increase the post embedment throughout the system.

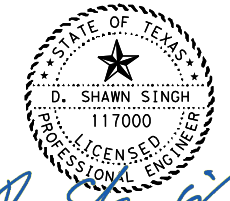


CURB OPTION (2)

Curb shown on top of mow strip



CURB OPTION (3)

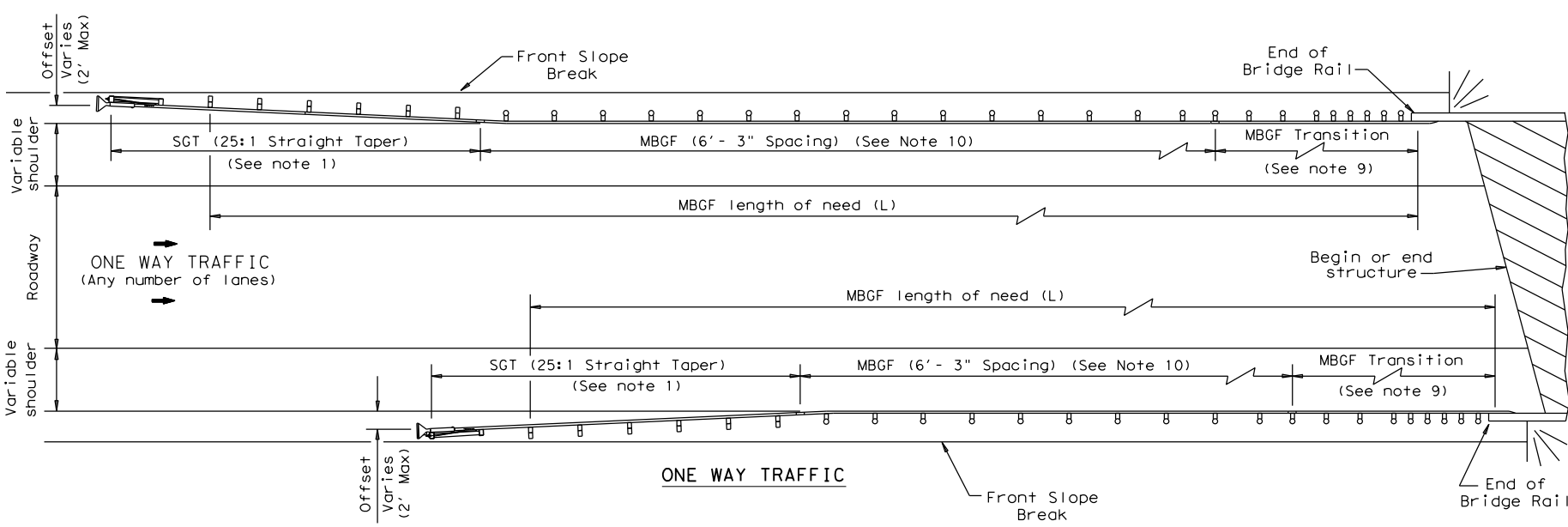
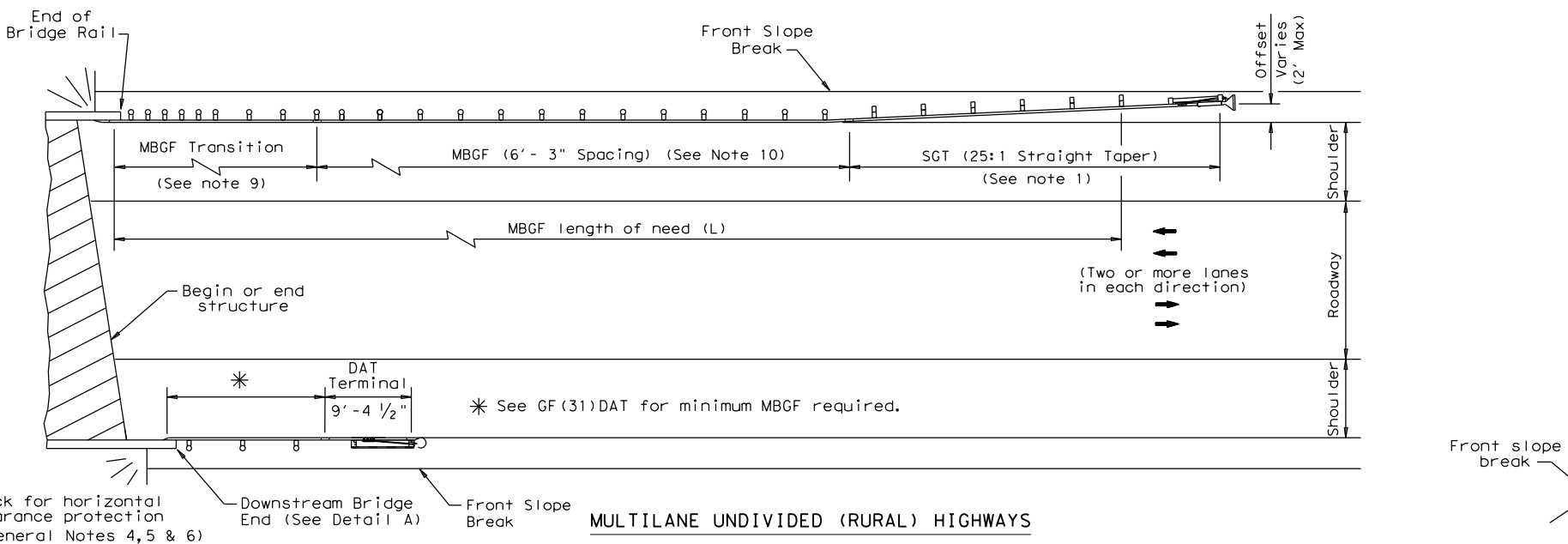
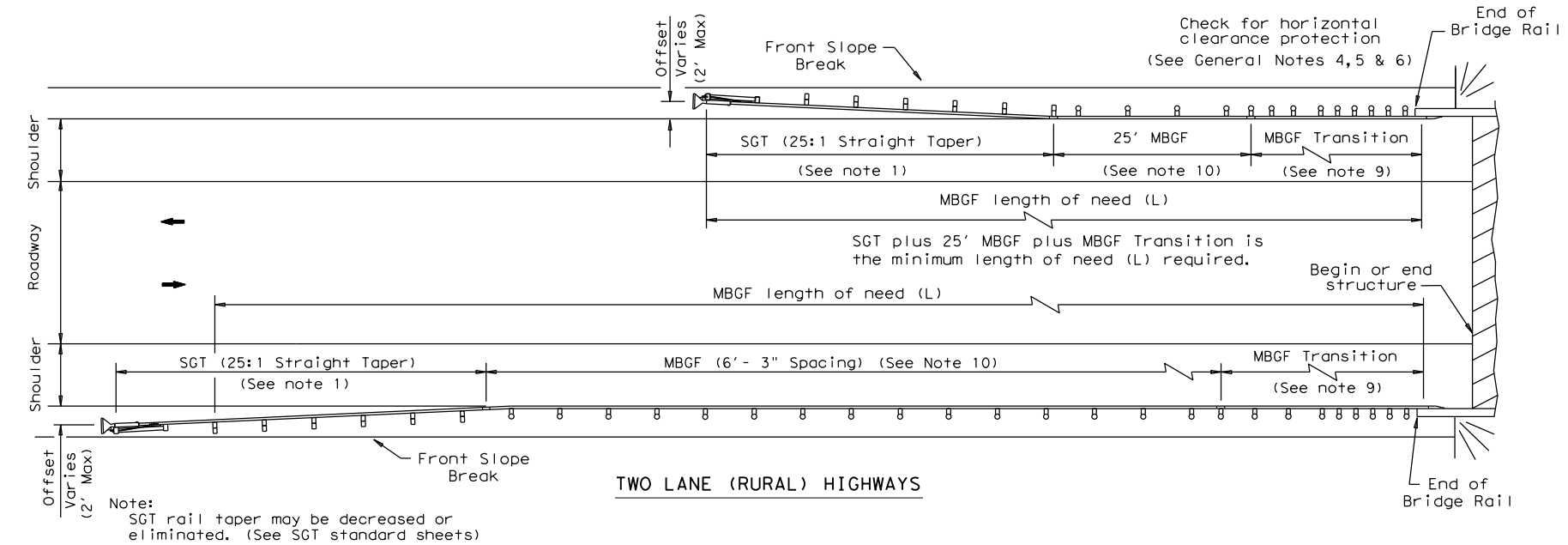


D. Singh
 10/19/2020

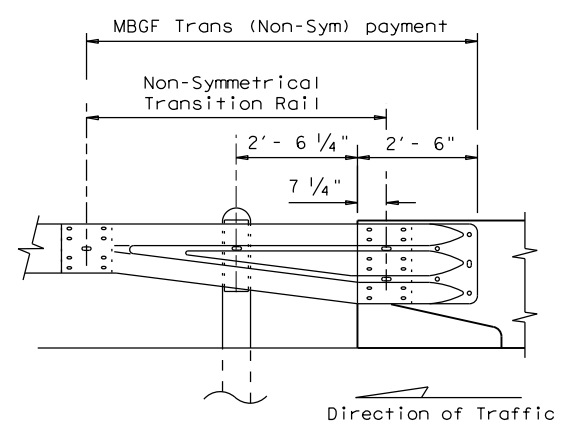
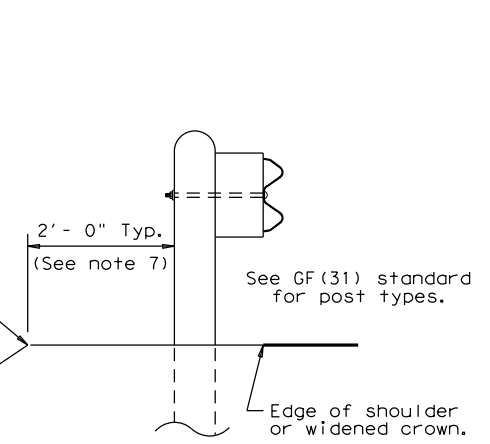
		Design Division Standard	
METAL BEAM GUARD FENCE (MOW STRIP) TL-3 MASH COMPLIANT GF(31)MS-19 (MOD)			
FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: NOVEMBER 2019	CONT: 0313	SECT: 07	JOB: 020
REVISIONS		FTW	FTW
		COUNTY: PARKER	SHEET NO.: 43

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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

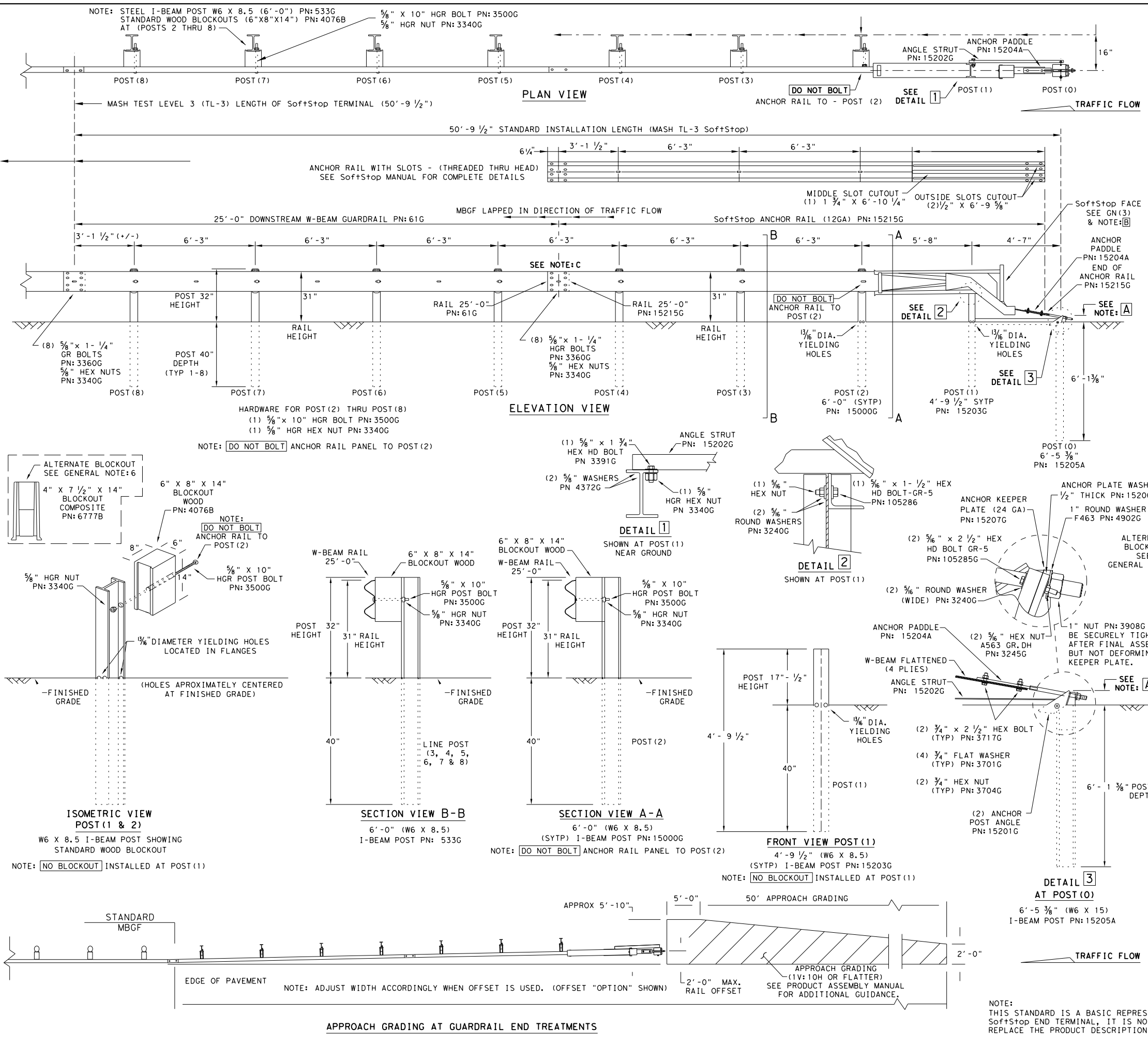
BRIDGE END DETAILS
(METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

BED-14

FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: CGL
© TxDOT: December 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
REVISED APRIL 2014 SEE (MEMO 0414)	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	44	

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

NOTE: A THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 3-3/4" MIN. TO 4" MAX. ABOVE FINISHED GRADE.

NOTE: B PART PN:5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) PART PN:5851B LEFT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING)

NOTE: C W-BEAM SPLICE LOCATED BETWEEN LINE POST (4) AND LINE POST (5) GUARDRAIL PANEL 25'-0" PN:61G ANCHOR RAIL 25'-0" PN:15215G LAP GUARDRAIL IN DIRECTION OF TRAFFIC FLOW.

PART	QTY	MAIN SYSTEM COMPONENTS
620237B	1	PRODUCT DESCRIPTION ASSEMBLY MANUAL (LATEST REV.)
15208A	1	SoftStop HEAD (SEE MANUAL FOR RIGHT-LEFT APPROACH)
15215G	1	SoftStop ANCHOR RAIL (12GA) WITH CUTOUT SLOTS
61G	1	SoftStop DOWNSTREAM W-BEAM RAIL (12GA) (25'-0")
15205A	1	POST #0 - ANCHOR POST (6'-5 3/8")
15203G	1	POST #1 - (SYTP) (4'-9 1/2")
15000G	1	POST #2 - (SYTP) (6'-0")
533G	6	POST #3 THRU #8 - I-BEAM (W6 X 8.5) (6'-0")
4076B	7	BLOCKOUT - WOOD (ROUTED) (6" X 8" X 14")
6777B	7	BLOCKOUT - COMPOSITE (4" X 7 1/2" X 14")
15204A	1	ANCHOR PADDLE
15207G	1	ANCHOR KEEPER PLATE (24 GA)
15206G	1	ANCHOR PLATE WASHER (1/2" THICK)
15201G	2	ANCHOR POST ANGLE (10" LONG)
15202G	1	ANGLE STRUT
HARDWARE		
4902G	1	1" WASHER F436
3908G	1	1" HEAVY HEX NUT A563 GR.DH
3717G	2	3/4" X 2 1/2" HEX BOLT A325
3701G	4	3/4" ROUND WASHER F436
3704G	2	3/4" HEAVY HEX NUT A563 GR.DH
3360G	16	5/8" X 1 1/4" W-BEAM RAIL SPLICE BOLTS HGR
3340G	25	5/8" W-BEAM RAIL SPLICE NUTS HGR
3500G	7	5/8" X 10" HGR POST BOLT A307
3391G	1	5/8" X 1 3/4" HEX HD BOLT A325
4489G	1	5/8" X 9" HEX HD BOLT A325
4372G	4	5/8" WASHER F436
105285G	2	5/8" X 2 1/2" HEX HD BOLT GR-5
105286G	1	5/8" X 1 1/2" HEX HD BOLT GR-5
3240G	6	5/8" ROUND WASHER (WIDE)
3245G	3	5/8" HEX NUT A563 GR.DH
5852B	1	HIGH INTENSITY REFLECTIVE SHEETING - SEE NOTE: B

Texas Department of Transportation
Design Division Standard

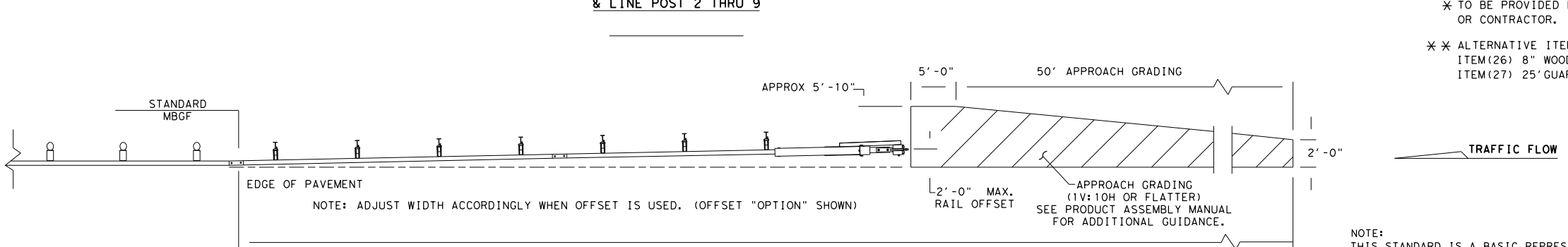
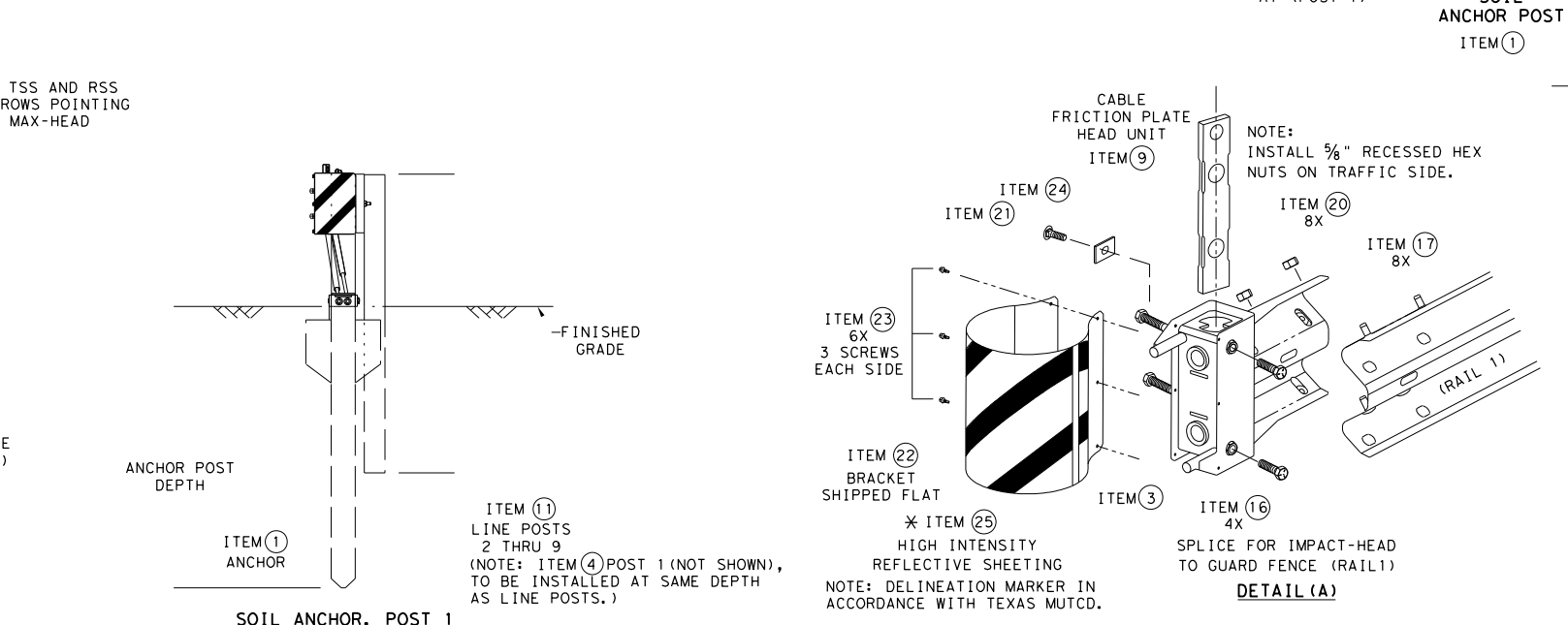
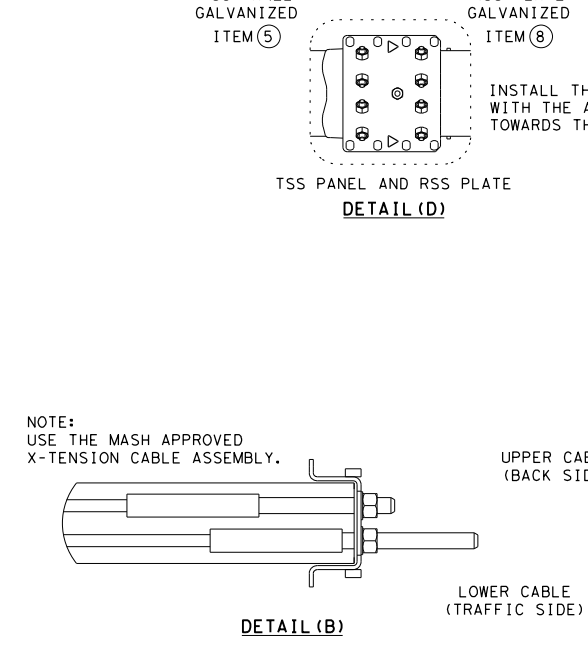
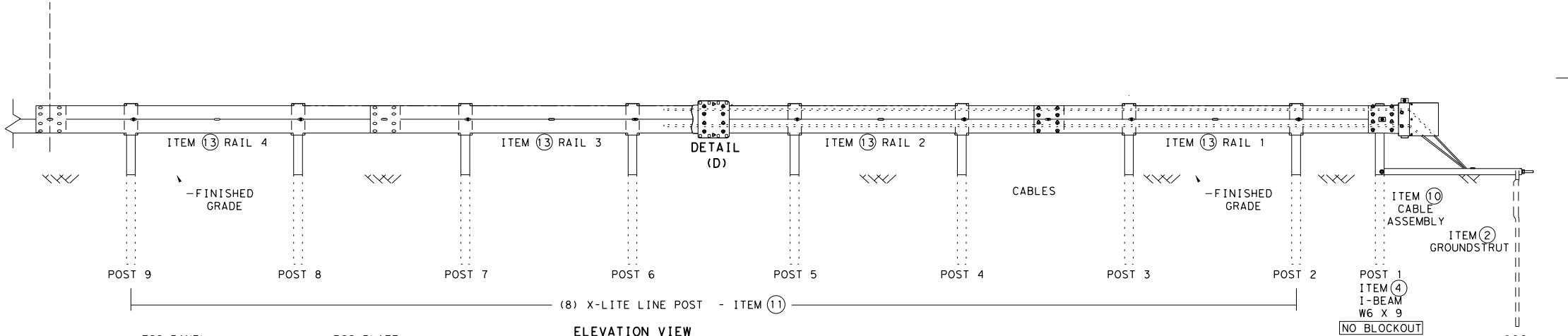
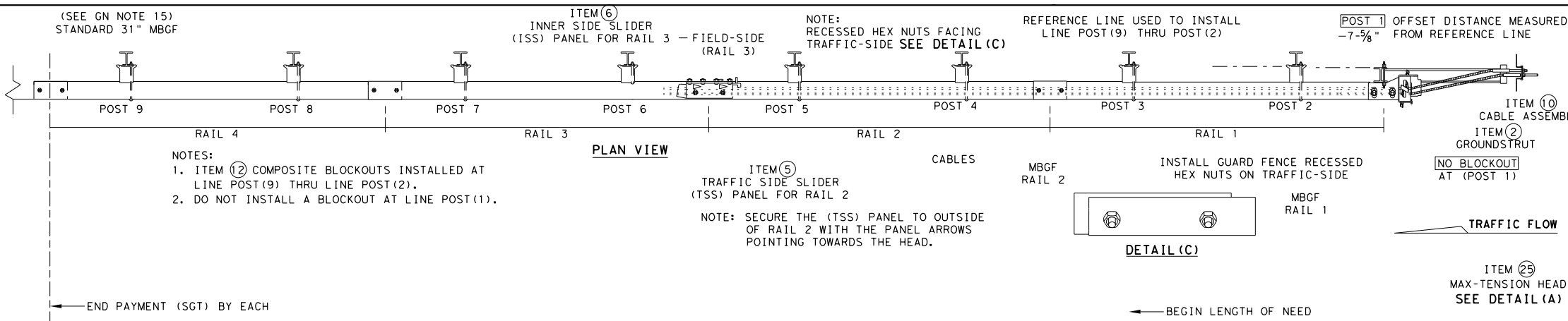
**TRINITY HIGHWAY
 SOFTSTOP END TERMINAL
 MASH - TL-3
 SGT (10S) 31-16**

FILE: sgt10s3116	DN: TxDOT	CR: KM	DN: VP	CR: MB/VP
©TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
	DIST	COUNTY		SHEET NO.
	FTW	PARKER		45

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

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

Texas Department of Transportation

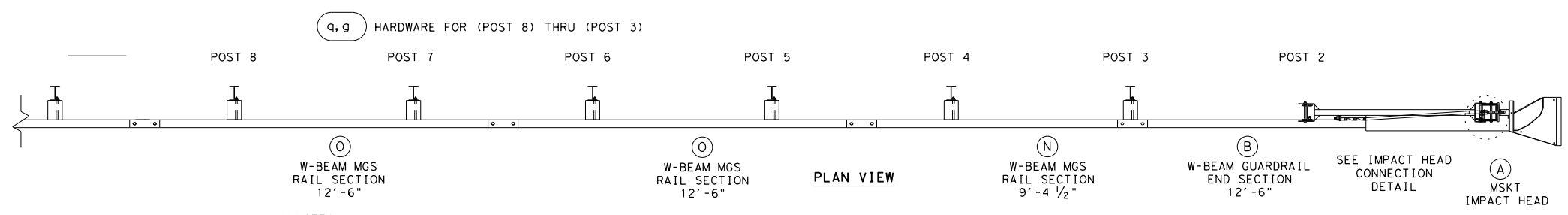
Design Division Standard

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

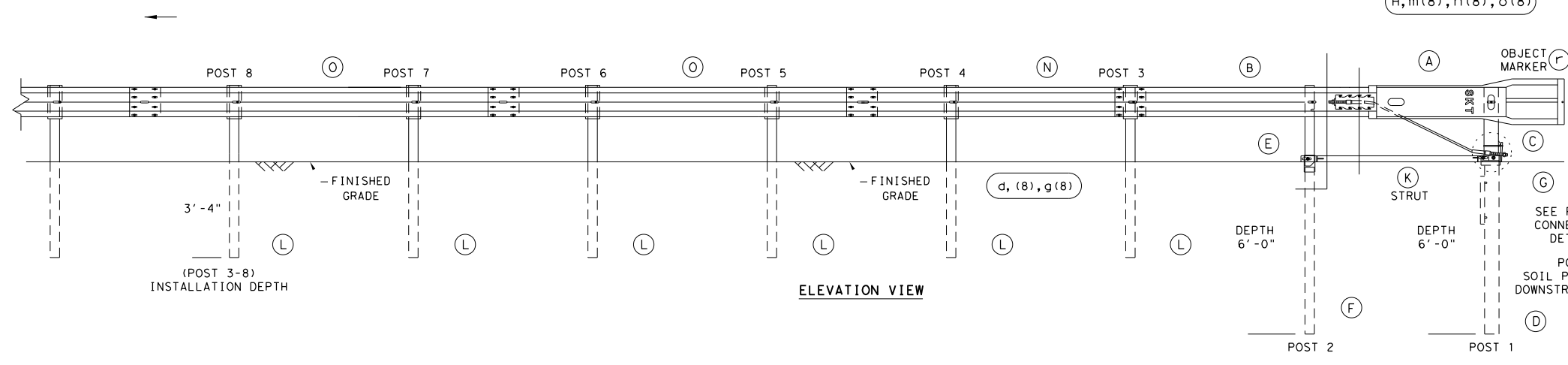
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© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	46	

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

DISCLAIMER: THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. THE USE OF THIS STANDARD 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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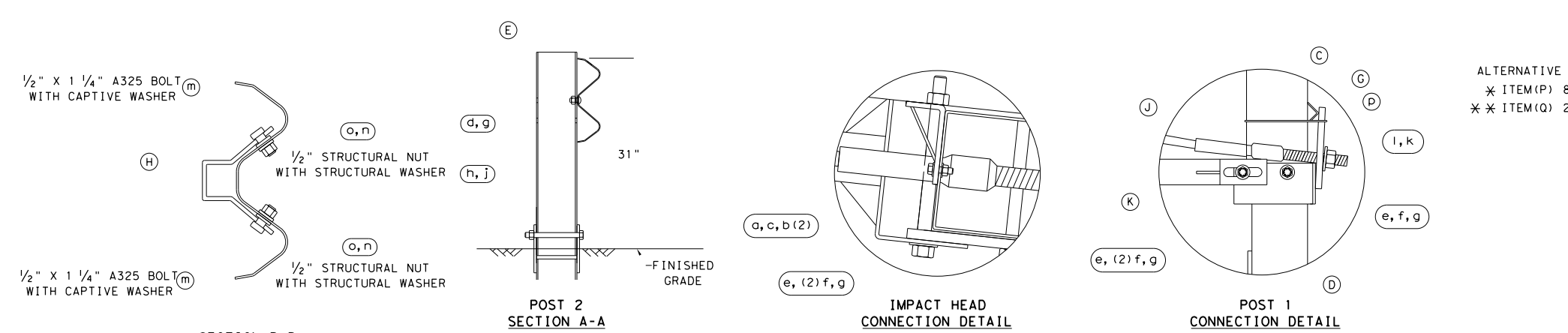


- NOTES:
- ITEM (M) COMPOSITE BLOCKOUTS INSTALLED AT LINE POST (8) THRU LINE POST (3).
 - ITEM (P) WOOD BLOCKOUTS CAN BE USED AS ALTERNATE.

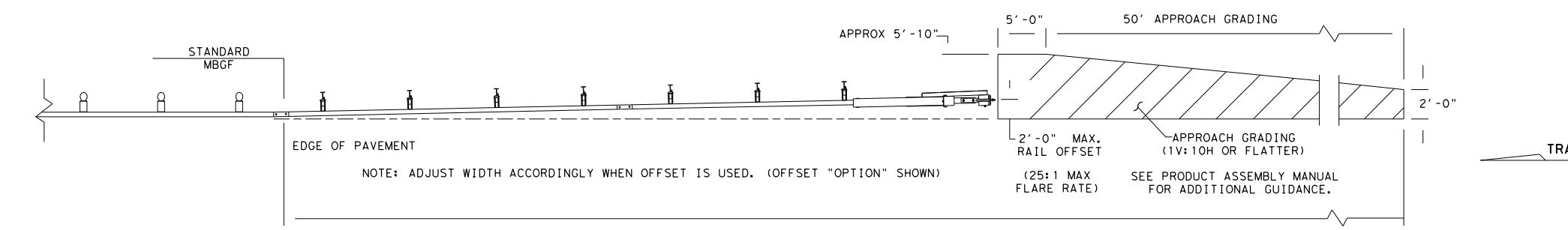


- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE: MSKT END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL (PUBLICATION-062717).
 - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
 - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
 - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
 - SYSTEM SHOWN USING STEEL WIDE FLANGE POSTS WITH COMPOSITE BLOCKOUTS.
 - A COMPOSITE MATERIAL BLOCKOUTS THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
 - IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, & REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
 - POSTS SHALL NOT BE SET IN CONCRETE.
 - SYSTEM MUST BE ATTACHED TO STANDARD 31" MBGF.
 - 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 ENCRANCHING 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" MBGF PANELS, ONE 25'-0" MBGF 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



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



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.

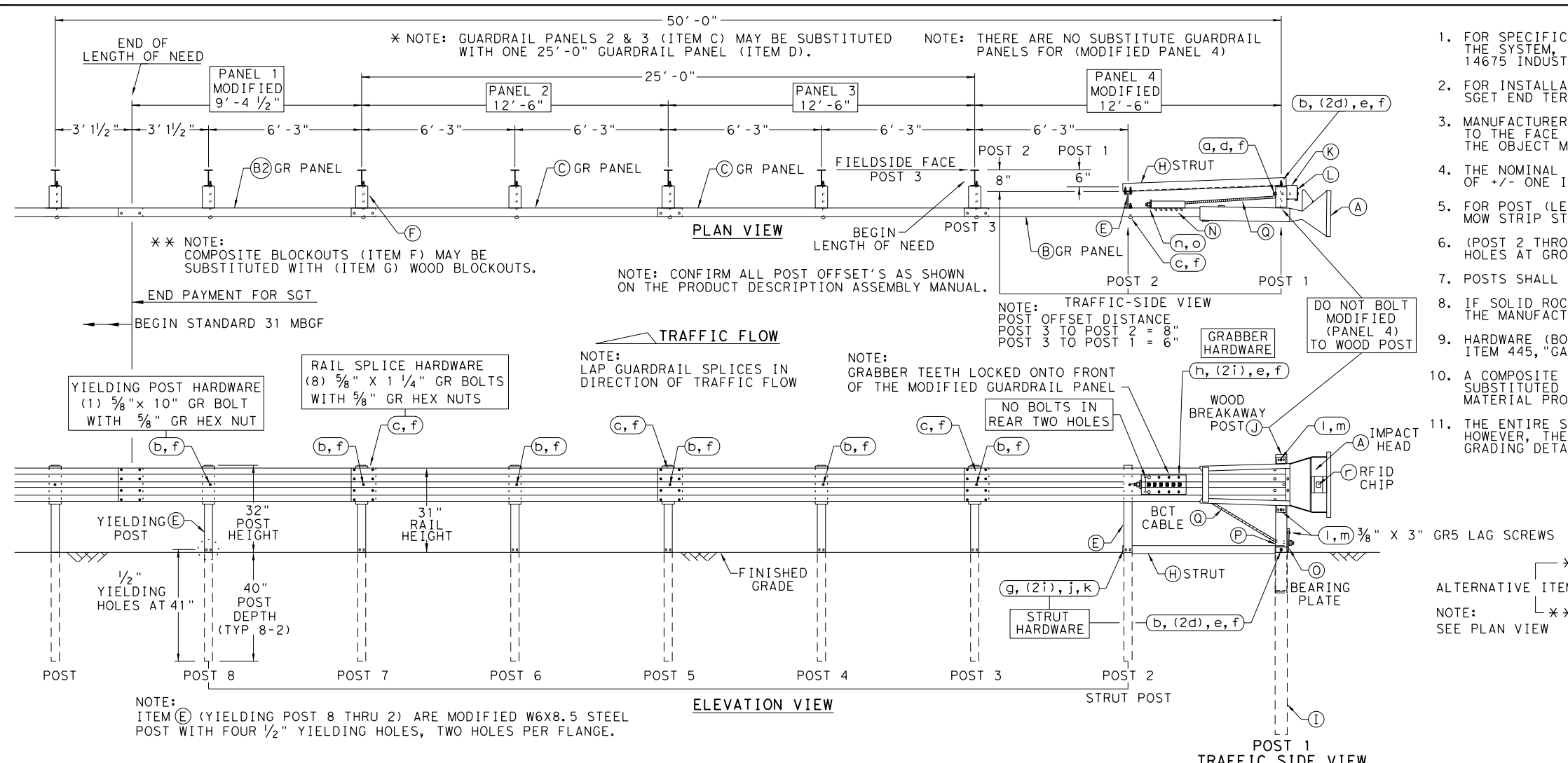
Design Division Standard

SINGLE GUARDRAIL TERMINAL
MSKT-MASH-TL-3
SGT (12S) 31-18

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REVISIONS	0313 07	020	FM 51	
	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	47	

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.

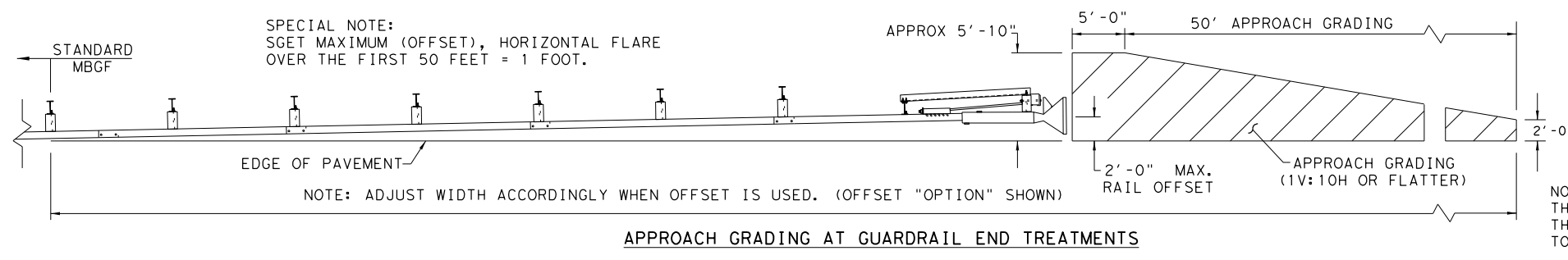
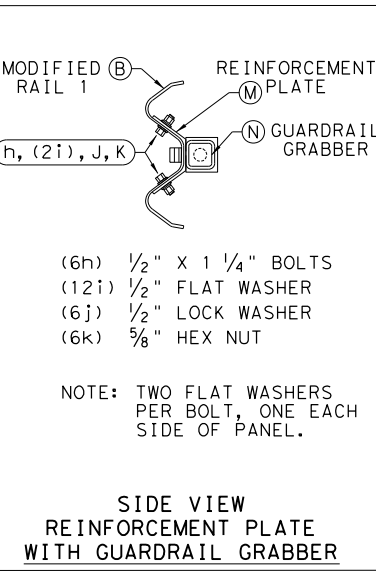
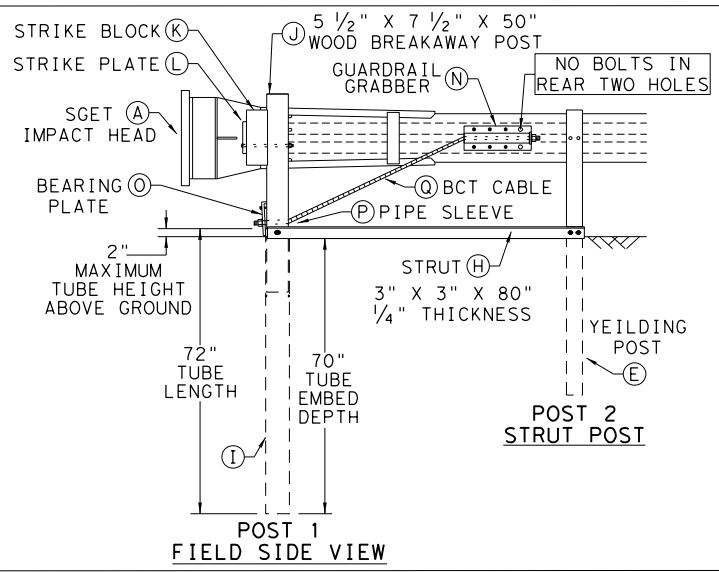
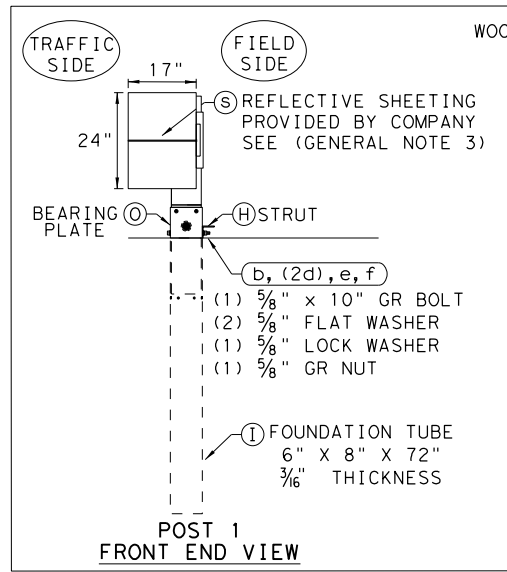
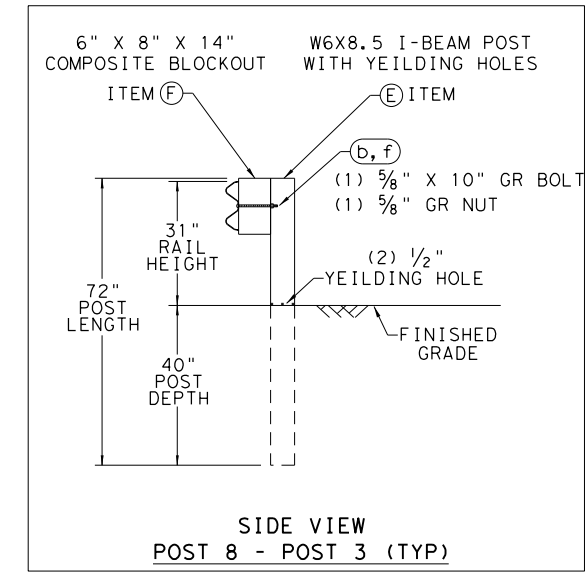
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- ### GENERAL NOTES
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
 - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER 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	YP6MOD
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	WSBLK14
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



NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE SGET TERMINAL SYSTEM AND IS NOT INTENDED TO REPLACE THE MANUFACTURER'S ASSEMBLY MANUAL.

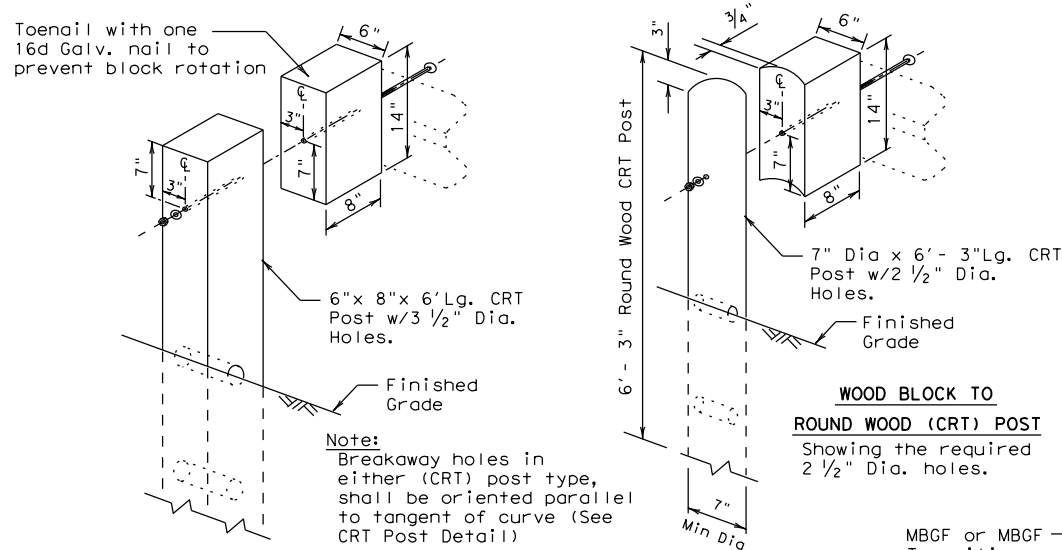
Design Division Standard

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

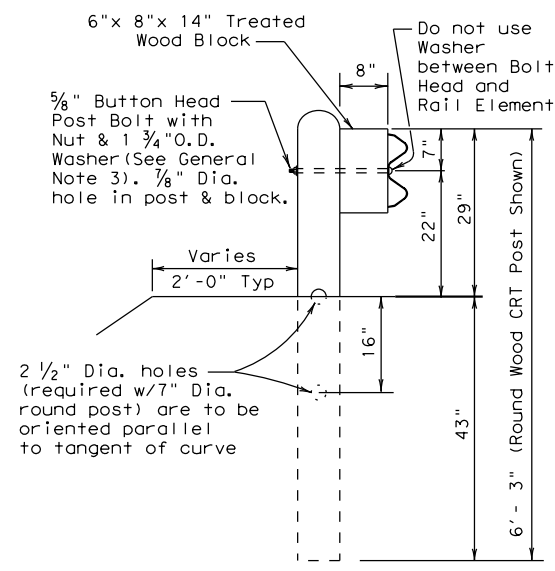
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REVISIONS	DIST: FTW	COUNTY: PARKER	SHEET NO. 48	

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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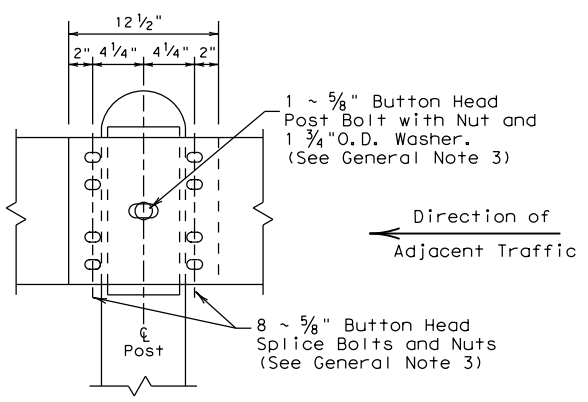


WOOD BLOCK TO RECTANGULAR WOOD (CRT) POST
 Showing the required 3 1/2" Dia. holes.

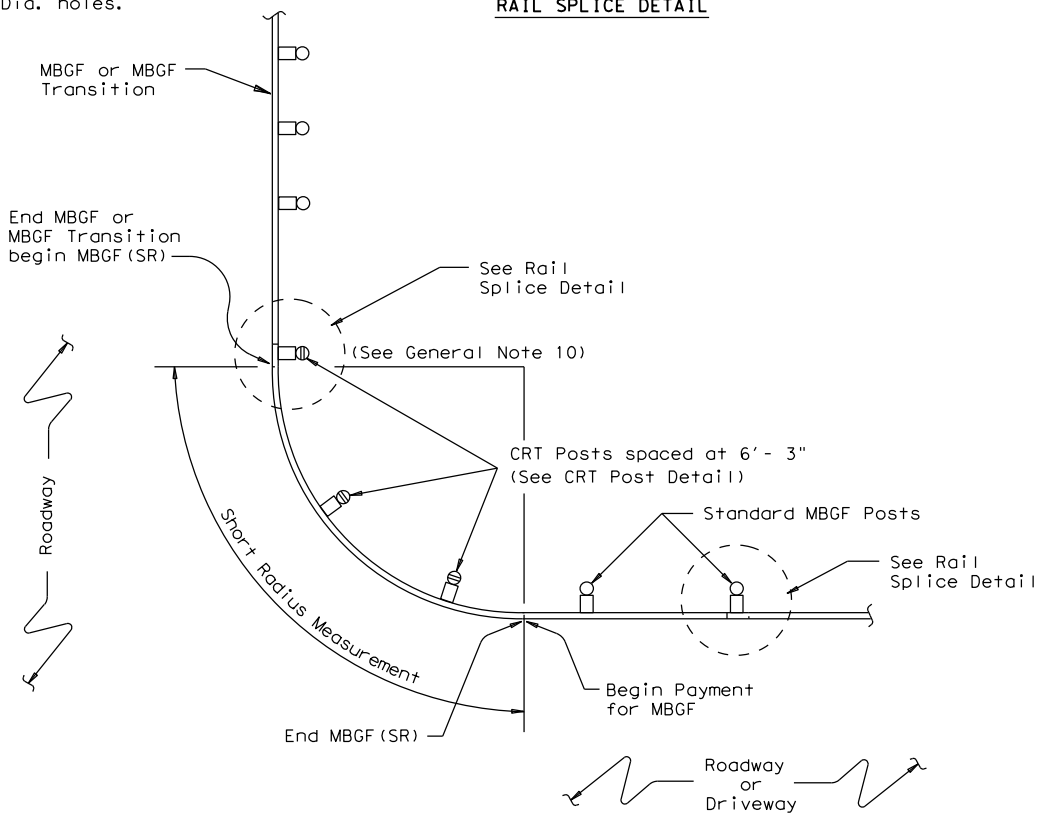


(CRT) POST DETAIL CONTROLLED RELEASE TERMINAL POST

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



RAIL SPLICE DETAIL

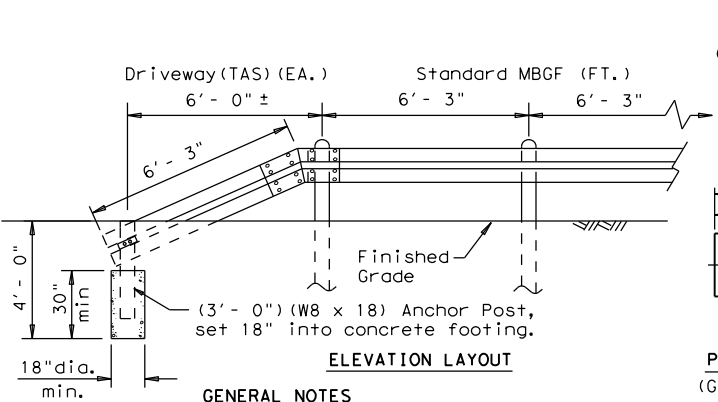


PLAN VIEW SHOWING TYPICAL RADIUS

The required radius is shown elsewhere on the plans.

GENERAL NOTES

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



ELEVATION LAYOUT

GENERAL NOTES

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

"DRIVEWAY" TERMINAL ANCHOR SECTION

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

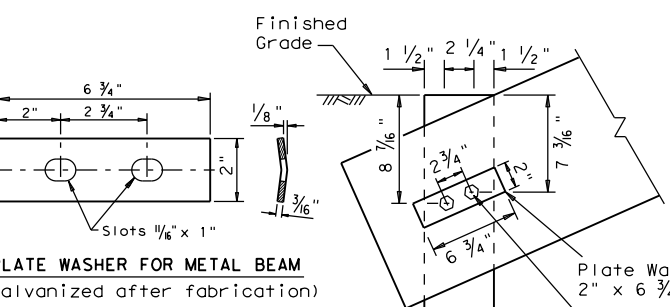
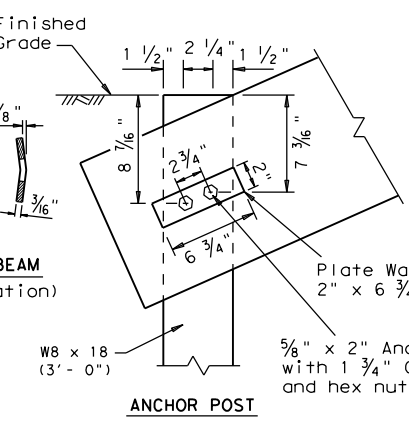
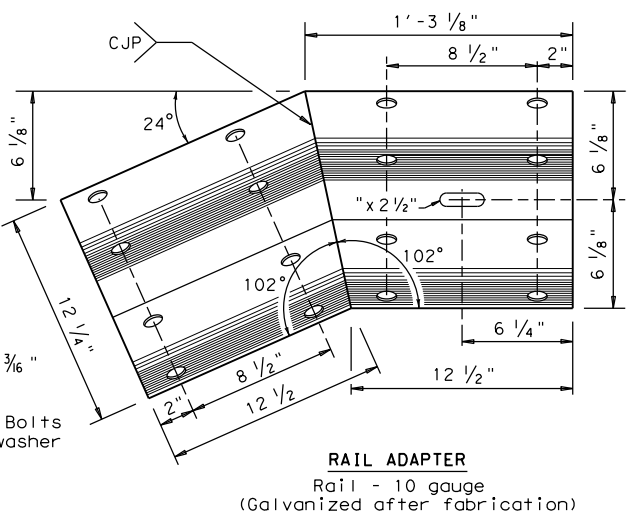


PLATE WASHER FOR METAL BEAM
(Galvanized after fabrication)



ANCHOR POST

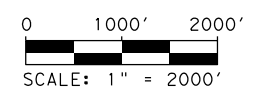
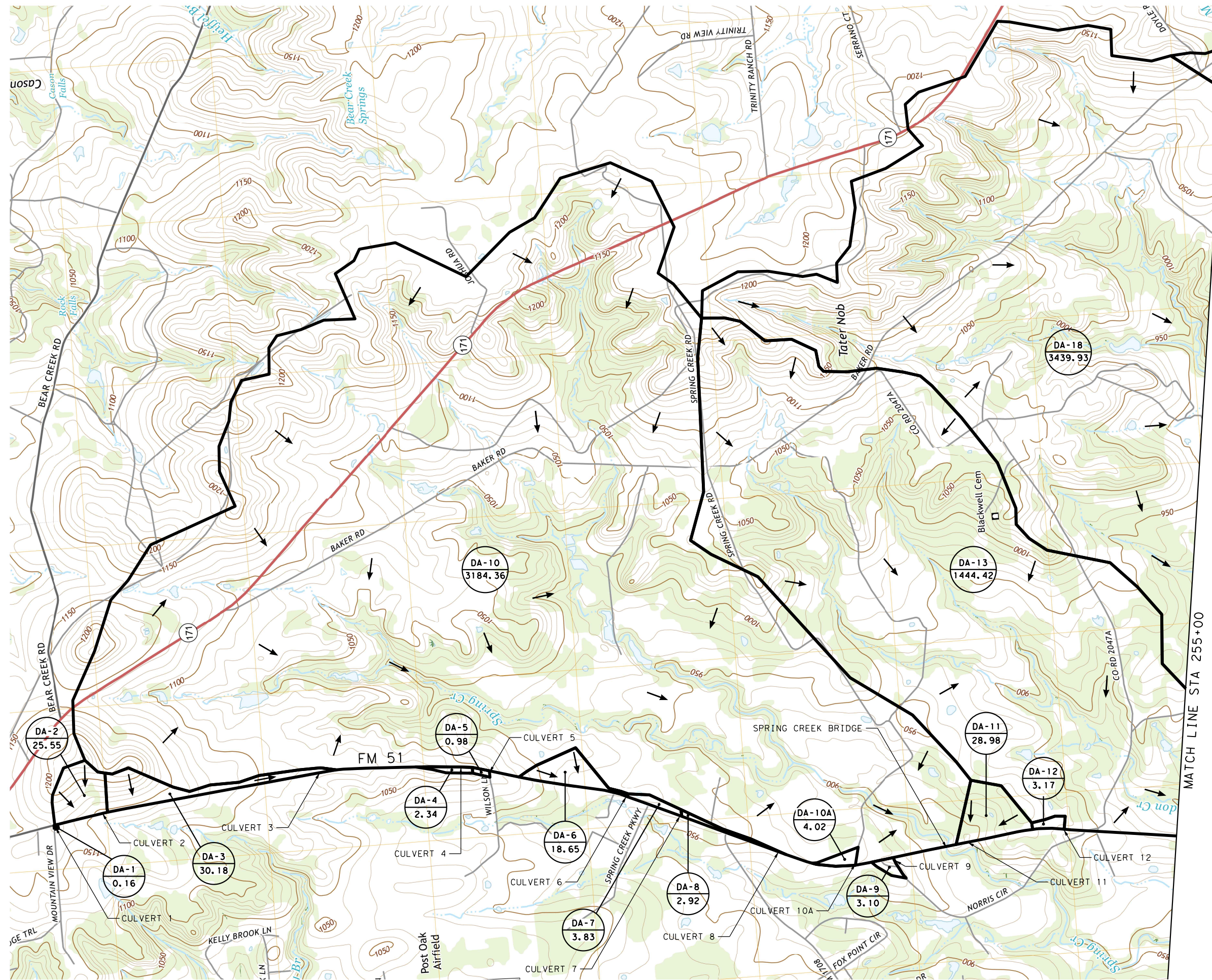


RAIL ADAPTER
 Rail - 10 gauge
 (Galvanized after fabrication)

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

		Design Division Standard	
METAL BEAM GUARD FENCE (SHORT RADIUS) MBGF (SR) - 19			
FILE: mbgfsr19.dgn	DN: TxDOT	CK: KM	DW: BD
© TxDOT NOVEMBER 2019	CONT: 0313	SECT: 07	JOB: 020
REVISIONS	DIST: FTW	COUNTY: PARKER	HIGHWAY: FM 51
			SHEET NO.: 49

DATE: 10/19/2020 3:09:36 PM
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- LEGEND:**
- x DRAINAGE AREA ID
 - xx DRAINAGE AREA (ACRES)
 - DRAINAGE BOUNDARY
 - DIRECTION OF FLOW

- NOTES:**
1. DRAINAGE AREAS WERE DELINEATED FROM USGS - NATIONAL ELEVATION DATASET - 1 METER (2019).
 2. REFER TO CULVERT LAYOUT SHEETS FOR ADDITIONAL INFORMATION.



S. T. Rutledge 10/19/2020

NO.	DATE	REVISION	APPROVED

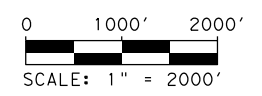
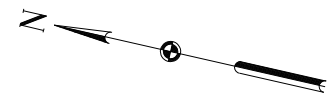
Kimley»Horn
F-928



**FM 51
DRAINAGE AREA MAP**

SCALE: 1"=2000' SHEET 1 OF 2

DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
CHECK KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			50



LEGEND:

- x DRAINAGE AREA ID
- xx DRAINAGE AREA (ACRES)
- DRAINAGE BOUNDARY
- DIRECTION OF FLOW

NOTES:

1. DRAINAGE AREAS WERE DELINEATED FROM USGS - NATIONAL ELEVATION DATASET - 1 METER (2019).
2. REFER TO CULVERT LAYOUT SHEETS FOR ADDITIONAL INFORMATION.



S. T. Rutledge 10/19/2020

NO.	DATE	REVISION	APPROVED

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F-928

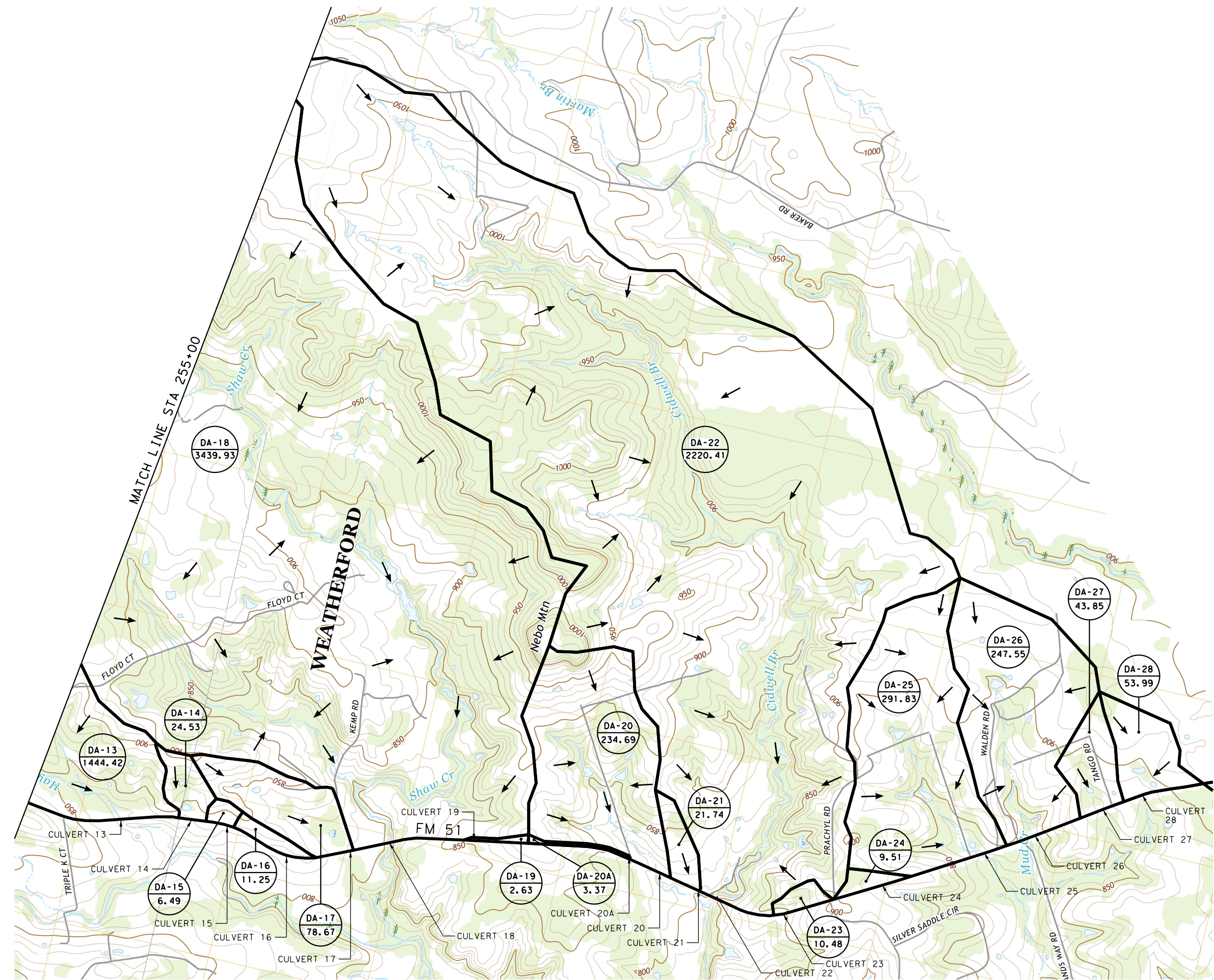


**FM 51
DRAINAGE AREA MAP**

SCALE: 1"=2000' SHEET 2 OF 2

DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
CHECK KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
CHECK KHA	0313	07	020

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RATIONAL METHOD CALCULATIONS

DRAINAGE AREA ID	AREA (AC)	BASIN UPSTREAM ELEVATION (FT)	BASIN DOWNSTREAM ELEVATION (FT)	BASIN LENGTH (FT)	BASIN AVERAGE SLOPE (%)	RURAL RUNOFF COEFFICIENT CALCULATIONS				WEIGHTED RUNOFF COEFF (Cwt)	TIME OF CONC (MIN)	INTENSITY						RUNOFF					
						Cr	Ci	Cv	Cs			(1-2 YR)	(1-5 YR)	(1-10 YR)	(1-25 YR)	(1-50 YR)	(1-100 YR)	(Q-2 YR)	(Q-5 YR)	(Q-10 YR)	(Q-25 YR)	(Q-50 YR)	(Q-100 YR)
												(IN/HR)	(IN/HR)	(IN/HR)	(IN/HR)	(IN/HR)	(IN/HR)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)
DA 1	0.16	1173.00	1167.90	83	6.1%	0.14	0.10	0.06	0.10	0.40	10	4.46	5.58	6.52	7.81	8.81	9.82	0.29	0.36	0.42	0.50	0.56	0.63
DA 2	25.55	1231.00	1148.35	1,183	7.0%	0.16	0.10	0.04	0.10	0.40	12	4.13	5.17	6.04	7.23	8.15	9.08	42.22	52.85	61.74	73.90	83.31	92.81
DA 3	30.18	1221.00	1082.99	5,175	2.7%	0.14	0.10	0.06	0.10	0.40	26	2.79	3.49	4.08	4.88	5.49	6.11	33.68	42.13	49.25	58.91	66.28	73.76
DA 4	2.34	1075.00	1053.95	711	3.0%	0.14	0.10	0.06	0.10	0.40	13	3.97	4.98	5.81	6.96	7.84	8.74	3.72	4.66	5.44	6.51	7.34	8.18
DA 5	0.98	1061.00	1040.10	360	5.8%	0.14	0.10	0.06	0.10	0.40	10	4.46	5.58	6.52	7.81	8.81	9.82	1.75	2.19	2.56	3.06	3.45	3.85
DA 6	18.65	1010.00	967.64	2,234	1.9%	0.10	0.10	0.06	0.10	0.36	22	3.08	3.87	4.51	5.40	6.08	6.76	20.68	25.98	30.28	36.26	40.82	45.39
DA 10A	4.02	938.00	929.50	649	1.3%	0.10	0.10	0.10	0.11	0.41	18	3.40	4.27	4.99	5.97	6.73	7.49	5.60	7.04	8.22	9.84	11.09	12.35
DA 9	3.10	922.00	910.00	343	3.5%	0.12	0.10	0.06	0.10	0.38	15	3.67	4.61	5.38	6.44	7.26	8.08	4.32	5.43	6.34	7.59	8.55	9.52
DA 11	28.98	938.00	881.30	1,410	4.0%	0.14	0.10	0.08	0.10	0.42	10	4.46	5.58	6.52	7.81	8.81	9.82	54.29	67.92	79.36	95.06	107.23	119.53
DA 15	6.49	862.70	838.20	563	4.4%	0.14	0.10	0.06	0.12	0.42	13	3.97	4.98	5.81	6.96	7.84	8.74	10.82	13.57	15.84	18.97	21.37	23.82
DA 16	11.25	853.80	825.40	1,389	2.0%	0.14	0.10	0.04	0.12	0.40	17	3.49	4.38	5.12	6.12	6.90	7.68	15.71	19.71	23.04	27.54	31.05	34.56
DA 17	78.67	900.00	805.90	3,743	2.5%	0.14	0.10	0.06	0.08	0.38	32	2.45	3.07	3.58	4.29	4.82	5.36	73.24	91.78	107.02	128.25	144.09	160.24
DA 20A	3.37	891.00	827.60	2,207	2.9%	0.12	0.10	0.04	0.10	0.36	18	3.40	4.27	4.99	5.97	6.73	7.49	4.12	5.18	6.05	7.24	8.16	9.09
DA 21	21.74	891.00	810.50	2,429	3.3%	0.12	0.10	0.04	0.10	0.36	26	2.79	3.49	4.08	4.88	5.49	6.11	21.84	27.31	31.93	38.19	42.97	47.82
DA 24	9.51	893.50	878.70	781	1.9%	0.10	0.10	0.06	0.12	0.38	40	2.18	2.74	3.19	3.82	4.30	4.79	7.88	9.90	11.53	13.80	15.54	17.31
DA 27	43.85	922.00	868.30	2,422	2.2%	0.14	0.10	0.06	0.08	0.38	28	2.65	3.32	3.88	4.64	5.22	5.81	44.16	55.32	64.65	77.32	86.98	96.81
DA 28	53.99	923.00	879.90	2,412	1.8%	0.10	0.10	0.06	0.08	0.34	27	2.72	3.41	3.98	4.76	5.35	5.96	49.93	62.60	73.06	87.38	98.21	109.41

NRCS UNIT HYDROGRAPAH METHOD CALCULATIONS

AREA ID	DRAINAGE AREA		TIME OF CONCENTRATION	AREA WEIGHTED CURVE NUMBER (CN)	2 YEAR		5 YEAR		10 YEAR		25 YEAR		50 YEAR		100 YEAR	
					24-HR RAINFALL	DISCHARGE	24-HR RAINFALL	DISCHARGE	24-HR RAINFALL	DISCHARGE	24-HR RAINFALL	DISCHARGE	24-HR RAINFALL	DISCHARGE	24-HR RAINFALL	DISCHARGE
					IN	CFS	IN	CFS	IN	CFS	IN	CFS	IN	CFS	IN	CFS
DA 20	234.69	0.367	30	69.9	3.82	213.1	4.89	351.3	5.79	476.4	7.07	656.8	8.06	801.2	9.11	949.4
DA 25	291.83	0.456	44	70.3	3.82	219.2	4.89	359.5	5.79	485.9	7.07	670.0	8.06	815.6	9.11	966.4
DA 26	247.55	0.387	45	74.2	3.82	226.4	4.89	351.6	5.79	462.1	7.07	620.2	8.06	743.7	9.11	870.6

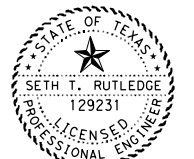
NOTES:

1. DRAINAGE ANALYSIS PERFORMED IN CONFORMANCE WITH TXDOT HYDRAULIC DESIGN MANUAL (SEPTEMBER 2018).
2. TIME OF CONCENTRATION CALCULATED USING THE NRCS METHOD.
3. DRAINAGE BASINS WITH AN AREA GREATER THAN 200 ACRES WERE ANALYZED USING HEC-HMS (4.3).

CULVERT INPUT DATA (HY-8, v7.60)*

CULVERT ID	STA	ROADWAY	DESCRIPTION	DRAINAGE AREA ID	INLET STATION (FT)	INLET ELEV (FT)	OUTLET STATION (FT)	OUTLET ELEV (FT)	TAILWATER DATA					
									CH SHAPE	BOT WIDTH (FT)	SIDE SLOPE (H:V)	CH SLOPE (FT/FT)	CH "n"	CH ELEV (FT)
CULVERT 1	19+80	CROSS STREET	1-18" X 41' CMP (EXIST) 1-18" X 45' RCP (PROP)	DA 1	0.00	1167.85	40.3	1167.73	TRAPZ	2	4.5 : 1	0.0050	0.03	1167.43
CULVERT 2	29+56	FM 51	3-DES 4 X 56' ARCH CMP (EXIST) 4-24" X 52' RCP (PROP)	DA 2	0.00	1148.38	55.2	1148.12	TRAPZ	8	20 : 1	0.0075	0.03	1148.10
CULVERT 3	74+97	FM 51	1-18" X 57' CMP (EXIST) 3-24" X 48' RCP (PROP)	DA 3	0.00	1083.01	56.5	1082.53	TRAPZ	8	10 : 1	0.0200	0.03	1082.65
CULVERT 4	104+07	FM 51	1-18" X 76' CMP (EXIST) 1-24" X 72' RCP (PROP)	DA 4	0.00	1053.98	75.2	1051.36	TRAPZ	2	30 : 1	0.0300	0.03	1052.75
CULVERT 5	110+25	CROSS STREET	1-18" X 41' CMP (EXIST) 1-18" X 45' RCP (PROP)	DA 5	0.00	1040.08	40.4	1038.41	TRAPZ	2	6	0.0667	0.03	1039.01
CULVERT 6	138+71	FM 51	1-DES 5 X 57' ARCH CMP (EXIST) 2-24" X 58' RCP (PROP)	DA 6	0.00	967.67	56.9	966.89	TRAPZ	4	50 : 1	0.0100	0.03	967.06
CULVERT 10A	188+50	CROSS STREET	1-18" X 41' RCP (EXIST) INSTALL SET LT/RT (PROP)	DA 10A	0.00	929.52	40.1	929.17	TRAPZ	2	4 : 1	0.0833	0.03	929.17
CULVERT 9	196+30	CROSS STREET	1-18" X 41' CMP (EXIST) 1-18" X 69' RCP (PROP)	DA 9	0.00	910.09	40.2	909.80	TRAPZ	2	4 : 1	0.0050	0.03	909.88
*CULVERT 11	211+88	FM 51	1-42" X 99' CMP (EXIST) 1-42" X 91' RCP (PROP)	DA 11										
CULVERT 15	296+57	FM 51	1-24" X 70' CMP (EXIST) 1-24" X 71' RCP (PROP)	DA 15	0.00	838.22	69.2	835.35	TRAPZ	2	10 : 1	0.0250	0.03	836.45
CULVERT 16	310+30	FM 51	1-DES 4 X 64' ARCH CMP (EXIST) 1-24" X 65' RCP (PROP)	DA 16	0.00	825.36	63.9	824.54	TRAPZ	2	10 : 1	0.0650	0.03	824.53
CULVERT 17	323+71	FM 51	2-DES 4 X 60' ARCH CMP (EXIST) 5-24" X 58' RCP (PROP)	DA 17	0.00	805.97	59.1	805.38	TRAPZ	5	10 : 1	0.0100	0.03	805.83
CULVERT 20A	381+79	CROSS STREET	2-18" X 40' RCP (EXIST) INSTALL SET LT/RT (PROP)	DA 20A	0.00	827.55	39.7	826.80	TRAPZ	2	6 : 1	0.0400	0.03	826.80
CULVERT 20	387+88	FM 51	3-DES 7 X 72' ARCH CMP (EXIST) 3 - 4' X 4' X 75' MBC (PROP)	DA 20	0.00	810.11	77.1	808.99	POND TAILWATER ELEV = 810.00		CHANNEL INVERT ELEV=808.40			
CULVERT 21	396+80	FM 51	1-30" X 59' CMP (EXIST) INSTALL SET LT/RT (PROP)	DA 21	0.00	801.56	58.7	800.31	POND TAILWATER ELEV = 797.00		CHANNEL INVERT ELEV=800.31			
CULVERT 24	435+93	FM 51	1-DES 5 X 63' ARCH CMP (EXIST) 1-36" X 60' RCP (PROP)	DA 24	0.00	878.78	62.8	878.21	TRAPZ	4	20 : 1	0.0100	0.03	878.35
CULVERT 25	457+83	FM 51	3-DES 9 X 71' ARCH CMP (EXIST) 3 - 5' X 4' X 63' MBC (PROP)	DA 25	0.00	827.08	70.7	826.99	TRAPZ	12	3 : 1	0.0010	0.03	828.13
CULVERT 26	468+76	FM 51	3-DES 9 X 74' ARCH CMP (EXIST) 3 - 5' X 4' X 71' MBC (PROP)	DA 26	0.00	831.24	73.3	830.71	TRAPZ	16	3 : 1	0.0900	0.03	830.79
CULVERT 27	483+66	FM 51	1-DES 4 X 63' ARCH CMP (EXIST) 2-30" X 63' RCP (PROP)	DA 27	0.00	868.27	63.0	867.55	TRAPZ	10	4 : 1	0.0010	0.03	867.50
CULVERT 28	492+25	FM 51	2-36" X 68' CMP (EXIST) 2-36" X 65' RCP (PROP)	DA 28	0.00	880.02	67.1	879.46	TRAPZ	10	10 : 1	0.0100	0.03	880.54

*CULVERT 11 ANALYSIS PERFORMED IN GEOPAK DRAINAGE



Seth T. Rutledge 10/19/2020

NO.	DATE	REVISION	APPROVED

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F-928



FM 51
HYDROLOGIC & HYDRAULIC CALCULATIONS

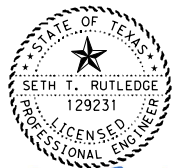
SHEET 1 OF 2

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			52

CULVERT HYDRAULIC DATA (HY-8, v7.60)*

CULVERT ID	STA	RDWY	DESCRIPTION	DRAINAGE AREA ID	ALLOW HW (FT)	10 YEAR (DESIGN)						100 YEAR (CHECK)							
						TOTAL DISCHARGE (CFS)	CULVERT DISCHARGE (CFS)	ROADWAY DISCHARGE (CFS)	HW ELEV (FT)	TW ELEV (FT)	OUTLET VELOCITY (FT/S)	TW VELOCITY (FT/S)	TOTAL DISCHARGE (CFS)	CULVERT DISCHARGE (CFS)	ROADWAY DISCHARGE (CFS)	HW ELEV (FT)	TW ELEV (FT)	OUTLET VELOCITY (FT/S)	TW VELOCITY (FT/S)
CULVERT 1	19+80	CROSS STREET	1-18" X 41' CMP (EXIST)	DA 1	1170.61	0.42	0.42	0.00	1168.26	1167.83	2.31	1.67	0.63	0.63	0.00	1168.35	1167.86	2.57	1.90
			1167.99						1167.60	2.41	0.90	1168.07				1167.64	2.72	1.02	
CULVERT 2	29+56	FM 51	3-DES 4 X 56' ARCH CMP (EXIST)	DA 2	1152.15	61.74	61.74	0.00	1150.84	1148.79	6.41	4.33	92.81	68.90	23.91	1151.22	1148.92	6.77	4.81
			1150.92						1148.97	7.23	2.77	1151.22				1149.15	7.41	3.07	
CULVERT 3	74+97	FM 51	1-18" X 57' CMP (EXIST)	DA 3	1086.40	49.25	49.25	0.00	1086.24	1083.54	6.28	3.47	73.76	59.98	13.78	1086.28	1083.73	6.26	3.84
			1085.49						1083.38	6.68	4.38	1086.17				1083.54	7.40	4.88	
CULVERT 4	104+07	FM 51	1-18" X 76' CMP (EXIST)	DA 4	1059.38	5.44	5.44	0.00	1055.30	1051.85	6.06	0.65	8.18	8.18	0.00	1055.80	1051.94	6.64	0.71
			1055.04						1053.00	7.12	2.31	1055.35				1053.05	7.88	2.55	
CULVERT 5	110+25	CROSS STREET	1-18" X 41' CMP (EXIST)	DA 5	1042.52	2.56	2.56	0.00	1040.97	1038.64	5.28	3.29	3.85	3.85	0.00	1041.23	1038.69	5.90	3.69
			1040.13						1039.22	4.09	3.65	1040.35				1039.27	4.55	4.09	
CULVERT 6	138+71	FM 51	1-DES 5 X 57' ARCH CMP (EXIST)	DA 6	972.40	30.28	30.28	0.00	970.08	967.46	6.83	1.60	45.39	45.39	0.00	971.48	967.56	8.37	1.77
			969.90						967.56	7.31	2.07	971.38				967.65	7.99	2.29	
CULVERT 10A	188+50	CROSS STREET	1-18" X 41' RCP (EXIST)	DA 10A	931.98	8.22	8.22	0.00	931.24	929.63	6.60	4.53	12.35	9.72	2.63	931.90	929.74	7.14	5.05
			931.53						929.56	6.60	5.92	931.97				929.64	6.83	6.61	
CULVERT 9	196+30	CROSS STREET	1-18" X 41' CMP (EXIST)	DA 9	913.03	6.34	6.34	0.00	911.88	910.38	5.22	2.54	9.52	9.42	0.10	912.70	910.50	5.98	2.83
			911.90						910.56	5.22	1.97	912.58				910.70	6.29	2.19	
*CULVERT 11	211+88	FM 51	1-42" X 99' CMP (EXIST)	DA 11	895.55	79.36	79.36	0.00	886.37	876.12	12.05		119.53	119.53	0.00	889.78	876.84	13.66	
			886.51						876.60	9.67		889.92				877.07	12.84		
CULVERT 15	296+57	FM 51	1-24" X 70' CMP (EXIST)	DA 15	844.54	15.84	15.84	0.00	839.00	836.45	6.57	1.11	23.82	23.82	0.00	841.17	836.65	8.25	1.23
			839.67						837.02	8.11	3.69	841.30				837.12	8.85	4.09	
CULVERT 16	310+30	FM 51	1-DES 4 X 64' ARCH CMP (EXIST)	DA 16	831.09	23.04	23.04	0.00	827.75	825.82	6.69	1.22	34.56	27.78	6.78	829.92	826.05	8.40	1.35
			828.80						825.07	8.07	5.79	830.01				825.17	9.24	6.42	
CULVERT 17	323+71	FM 51	2-DES 4 X 60' ARCH CMP (EXIST)	DA 17	810.46	107.02	107.02	0.00	810.76	806.75	8.52	4.21	160.24	129.46	30.78	811.09	807.00	8.66	4.67
			809.61						807.19	7.70	4.21	810.69				807.45	8.75	4.67	
CULVERT 20A	381+79	CROSS STREET	2-18" X 40' RCP (EXIST)	DA 20A	829.65	6.05	6.05	0.00	828.47	827.17	6.58	3.84	9.09	9.09	0.00	828.72	827.25	7.25	4.28
			828.54						827.17	6.58	3.84	828.80				827.25	7.25	4.28	
CULVERT 20	387+88	FM 51	3-DES 7 X 72' ARCH CMP (EXIST)	DA 20	816.83	476.40	476.40	0.00	817.76	810.00	11.87	0.00	949.40	719.79	229.61	818.87	810.00	12.68	0.00
			815.07						810.00	10.85	0.00	818.24				810.00	15.00	0.00	
CULVERT 21	396+80	FM 51	1-30" X 59' CMP (EXIST)	DA 21	805.80	31.93	31.93	0.00	804.63	797.00	7.88	0.00	47.82	38.57	9.25	805.98	797.00	8.92	0.00
			804.78						797.00	7.88	0.00	805.99				797.00	8.77	0.00	
CULVERT 24	435+93	FM 51	1-DES 5 X 63' ARCH CMP (EXIST)	DA 24	884.15	11.53	11.53	0.00	880.04	878.65	4.72	2.03	17.31	17.31	0.00	880.43	878.74	5.46	2.25
			880.21						878.79	5.81	2.03	880.61				878.88	6.48	2.25	
CULVERT 25	457+83	FM 51	3-DES 9 X 71' ARCH CMP (EXIST)	DA 25	835.98	485.90	485.90	0.00	835.53	832.18	9.23	3.40	966.40	471.01	495.39	836.67	834.12	8.06	4.06
			834.77						833.32	8.10	3.40	836.62				835.26	7.85	4.06	
CULVERT 26	468+76	FM 51	3-DES 9 X 74' ARCH CMP (EXIST)	DA 26	840.65	462.10	462.10	0.00	837.00	831.73	10.44	14.09	870.60	870.60	0.00	841.34	832.17	13.84	17.25
			835.96						832.20	9.97	16.24	839.79				832.79	14.51	19.78	
CULVERT 27	483+66	FM 51	1-DES 4 X 63' ARCH CMP (EXIST)	DA 27	873.03	64.65	64.65	0.00	873.70	869.48	8.25	1.89	96.81	89.79	7.02	873.83	869.91	7.95	2.11
			871.53						869.43	7.93	1.89	873.57				869.86	9.35	2.11	
CULVERT 28	492+25	FM 51	2-36" X 68' CMP (EXIST)	DA 28	887.20	73.06	73.06	0.00	883.71	880.45	7.46	3.74	109.41	109.41	0.00	886.44	880.66	9.07	4.17
			884.04						881.52	7.84	3.74	885.73				881.74	9.02	4.17	

*CULVERT 11 ANALYSIS PERFORMED IN GEOPAK DRAINAGE



Seth T. Rutledge 10/19/2020

NO.	DATE	REVISION	APPROVED
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Kimley»Horn
F-928



FM 51
HYDROLOGIC & HYDRAULIC
CALCULATIONS

SHEET 2 OF 2

NOTES:

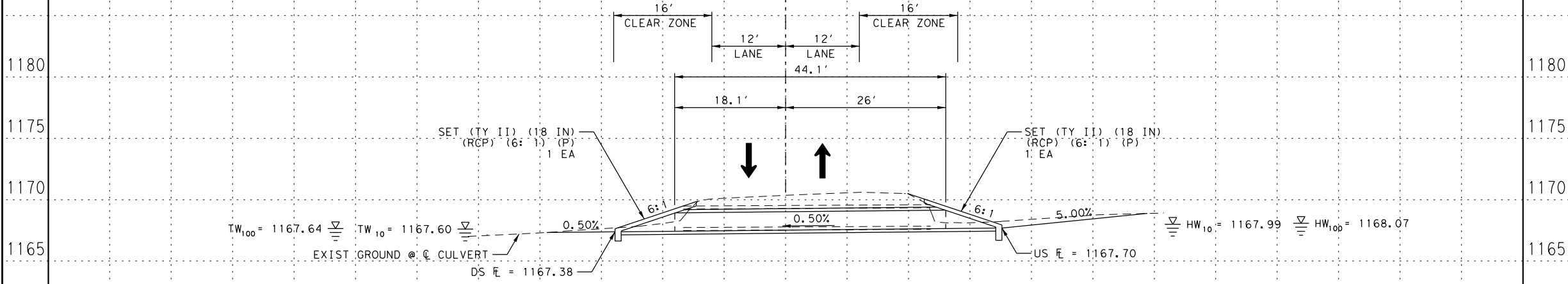
- DRAINAGE ANALYSIS PERFORMED IN CONFORMANCE WITH TXDOT HYDRAULIC DESIGN MANUAL (SEPTEMBER 2018).
- TIME OF CONCENTRATION CALCULATED USING THE NRCS METHOD.
- DRAINAGE BASINS WITH AN AREA GREATER THAN 200 ACRES WERE ANALYZED USING HEC-HMS (4.3).

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
DRAWN KHA	6	(SEE TITLE SHEET)	FM 51
CHECK KHA	STATE	DISTRICT	COUNTY
CHECK KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
CHECK KHA	0313	07	020

53

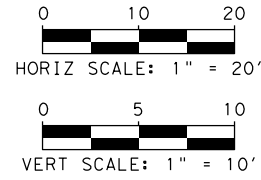
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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	11
464 6017	RC PIPE (CL IV) (18 IN)	LF	45
467 6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	2
496 6007	REMOV STR (PIPE)	LF	41
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



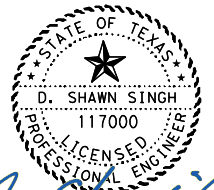
CULVERT 1 - STA 19+80 (PARALLEL TO FM 51)
 EXIST: 1 - 18" X 41' CMP (TO BE REMOVED)
 PROP: 1 - 18" X 45' RCP CL IV WITH SETP-PD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 0.42 CFS	0.63 CFS	Q = 0.42 CFS	0.63 CFS
V = 2.31 FT/S	2.57 FT/S	V = 2.41 FT/S	2.72 FT/S
HW = 1,168.26	1,168.35	HW = 1,167.99	1,168.07
TW = 1,167.83	1,167.86	TW = 1,167.60	1,167.64



NOTES:

1. C SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



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NO.	DATE	REVISION	APPROVED

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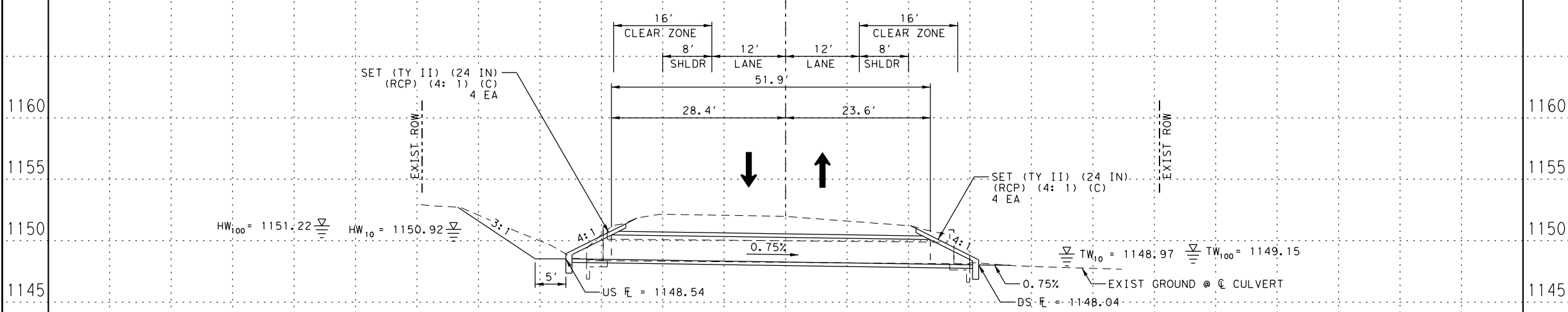


**FM 51
CULVERT LAYOUTS**

HORIZ: 1"=20'
 VERT: 1"=10' SHEET 1 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			54

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	83
464 6005	RC PIPE (CL III) (24 IN)	LF	208
467 6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	8
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	168
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



CULVERT 2 - STA 29+56
 EXIST: 3 - DES 4 X 56' ARCH CMP (TO BE REMOVED)
 PROP: 4 - 24" X 52' RCP WITH SETP-CD ON BOTH SIDES

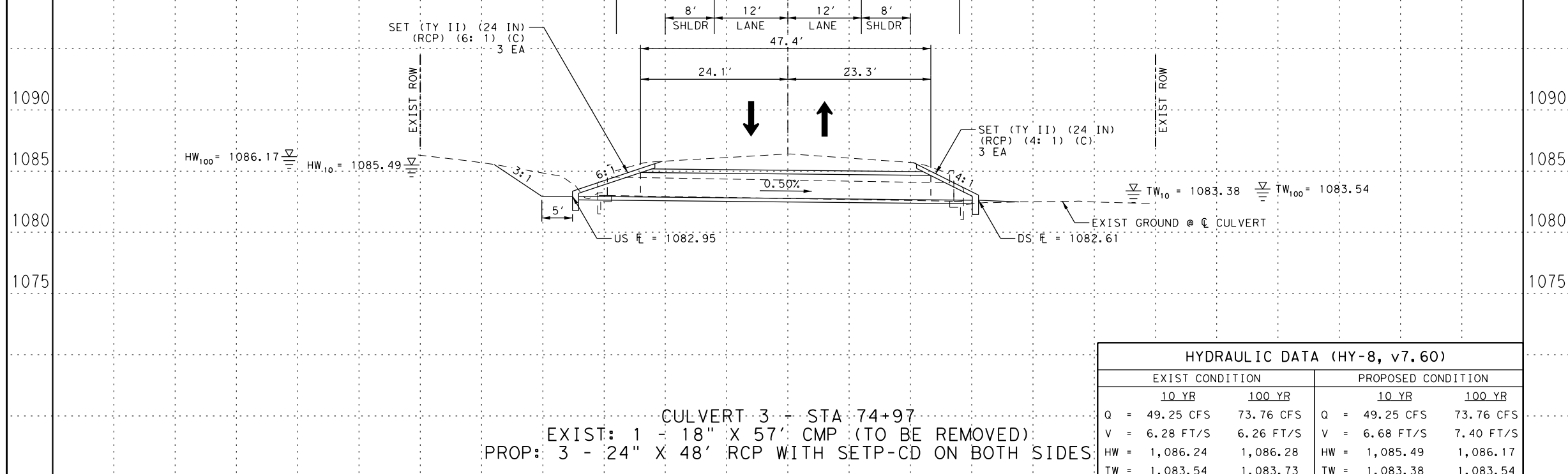
HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 61.74 CFS	92.81 CFS	Q = 61.74 CFS	92.81 CFS
V = 6.41 FT/S	6.77 FT/S	V = 7.23 FT/S	7.41 FT/S
HW = 1,150.84	1,151.22	HW = 1,150.92	1,151.22
TW = 1,148.79	1,148.92	TW = 1,148.97	1,149.15

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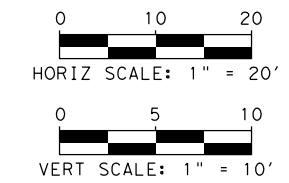
100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	52
464 6005	RC PIPE (CL III) (24 IN)	LF	144
467 6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	3
467 6394	SET (TY II) (24 IN) (RCP) (6: 1) (C)	EA	3
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	57
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



CULVERT 3 -- STA 74+97
 EXIST: 1 - 18" X 57' CMP (TO BE REMOVED)
 PROP: 3 - 24" X 48' RCP WITH SETP-CD ON BOTH SIDES

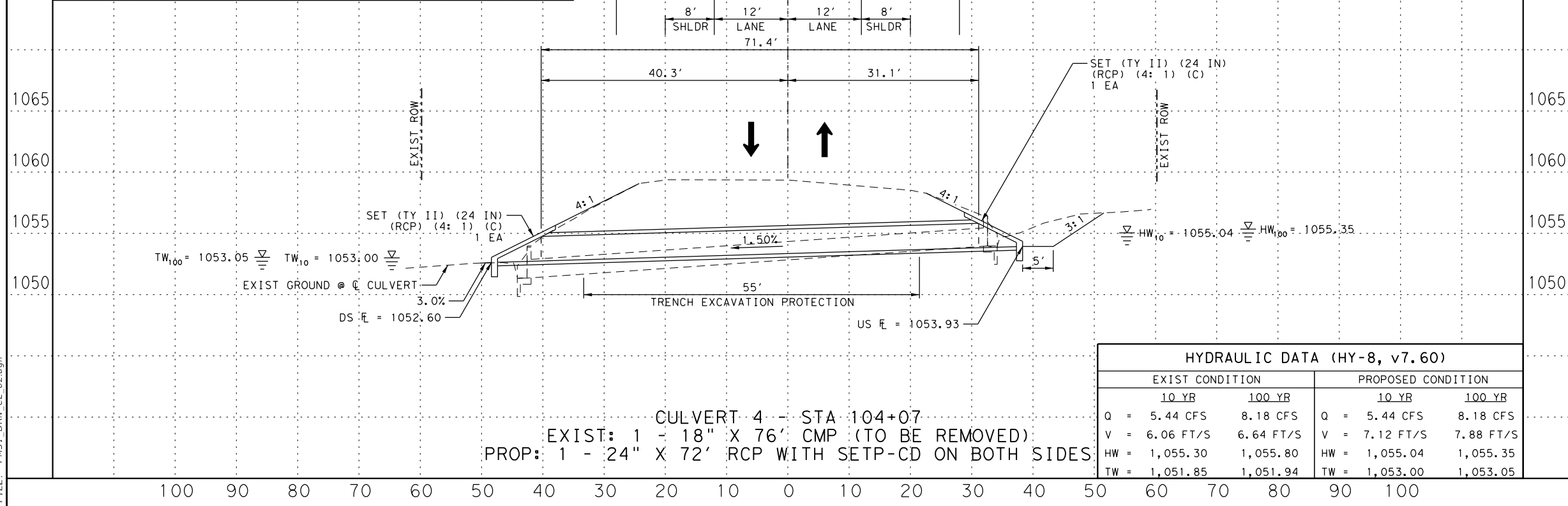
HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 49.25 CFS	73.76 CFS	Q = 49.25 CFS	73.76 CFS
V = 6.28 FT/S	6.26 FT/S	V = 6.68 FT/S	7.40 FT/S
HW = 1,086.24	1,086.28	HW = 1,085.49	1,086.17
TW = 1,083.54	1,083.73	TW = 1,083.38	1,083.54



NOTES:

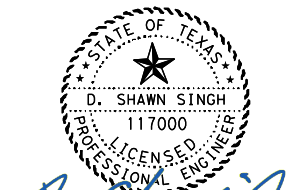
1. CL SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	20
402 6001	TRENCH EXCAVATION PROTECTION	LF	55
464 6005	RC PIPE (CL III) (24 IN)	LF	72
467 6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	2
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	76
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



CULVERT 4 -- STA 104+07
 EXIST: 1 - 18" X 76' CMP (TO BE REMOVED)
 PROP: 1 - 24" X 72' RCP WITH SETP-CD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 5.44 CFS	8.18 CFS	Q = 5.44 CFS	8.18 CFS
V = 6.06 FT/S	6.64 FT/S	V = 7.12 FT/S	7.88 FT/S
HW = 1,055.30	1,055.80	HW = 1,055.04	1,055.35
TW = 1,051.85	1,051.94	TW = 1,053.00	1,053.05



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**FM 51
CULVERT LAYOUTS**

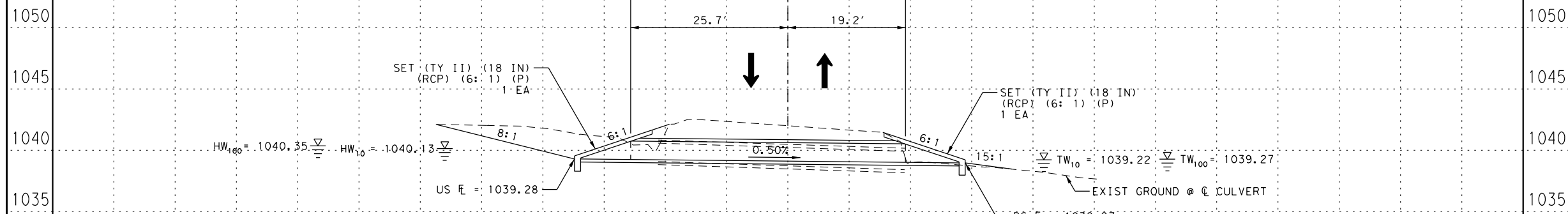
HORIZ: 1"=20'
 VERT: 1"=10' SHEET 2 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			55

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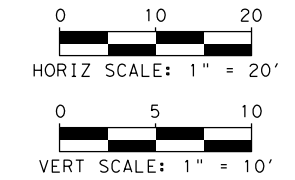
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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	13
464 6017	RC PIPE (CL IV) (18 IN)	LF	45
467 6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	2
496 6007	REMOV STR (PIPE)	LF	41
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



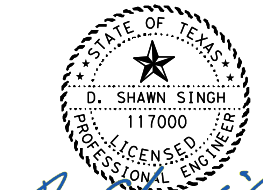
CULVERT 5 - STA 110+25 (PARALLEL TO FM 51)
 EXIST: 1 - 18" X 41' CMP (TO BE REMOVED)
 PROP: 1 - 18" X 45' RCP CL IV WITH SETP-PD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 2.56 CFS	3.85 CFS	Q = 2.56 CFS	3.85 CFS
V = 5.28 FT/S	5.90 FT/S	V = 4.09 FT/S	4.55 FT/S
HW = 1,040.97	1,041.23	HW = 1,040.13	1,040.35
TW = 1,038.64	1,038.69	TW = 1,039.22	1,039.27



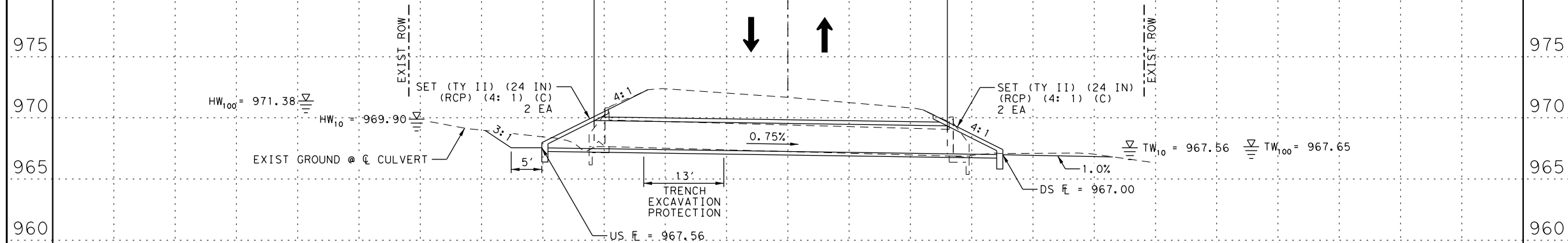
NOTES:

1. CL SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



D. Singh 10/19/2020

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	37
402 6001	TRENCH EXCAVATION PROTECTION	LF	13
464 6005	RC PIPE (CL III) (24 IN)	LF	116
467 6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	4
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	57
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



CULVERT 6 - STA 138+71
 EXIST: 1 - DES 5 X 57' ARCH CMP (TO BE REMOVED)
 PROP: 2 - 24" X 58' RCP WITH SETP-CD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 30.28 CFS	45.39 CFS	Q = 30.28 CFS	45.39 CFS
V = 6.83 FT/S	8.37 FT/S	V = 7.31 FT/S	7.99 FT/S
HW = 970.08	971.48	HW = 969.90	971.38
TW = 967.46	967.56	TW = 967.56	967.65

NO.	DATE	REVISION	APPROVED

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F-928



**FM 51
CULVERT LAYOUTS**

HORIZ: 1"=20'
 VERT: 1"=10' SHEET 3 OF 10

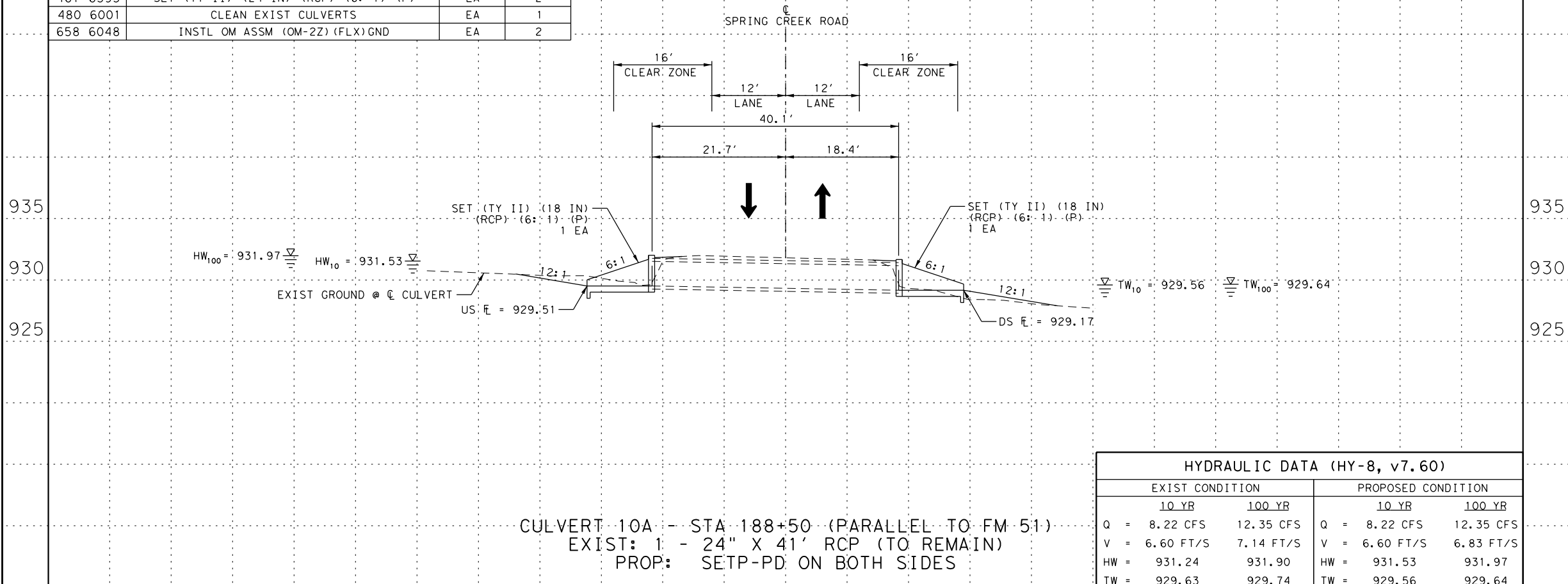
DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			56

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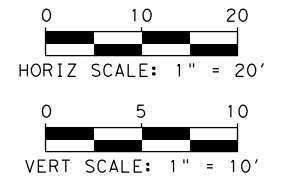
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ITEM	DESCRIPTION	UNIT	QTY
467 6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	2
480 6001	CLEAN EXIST CULVERTS	EA	1
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



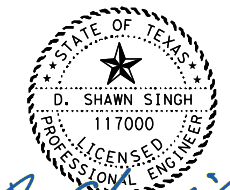
CULVERT 10A - STA 188+50 (PARALLEL TO FM 51)
 EXIST: 1 - 24" X 41' RCP (TO REMAIN)
 PROP: SETP-PD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 8.22 CFS	12.35 CFS	Q = 8.22 CFS	12.35 CFS
V = 6.60 FT/S	7.14 FT/S	V = 6.60 FT/S	6.83 FT/S
HW = 931.24	931.90	HW = 931.53	931.97
TW = 929.63	929.74	TW = 929.56	929.64



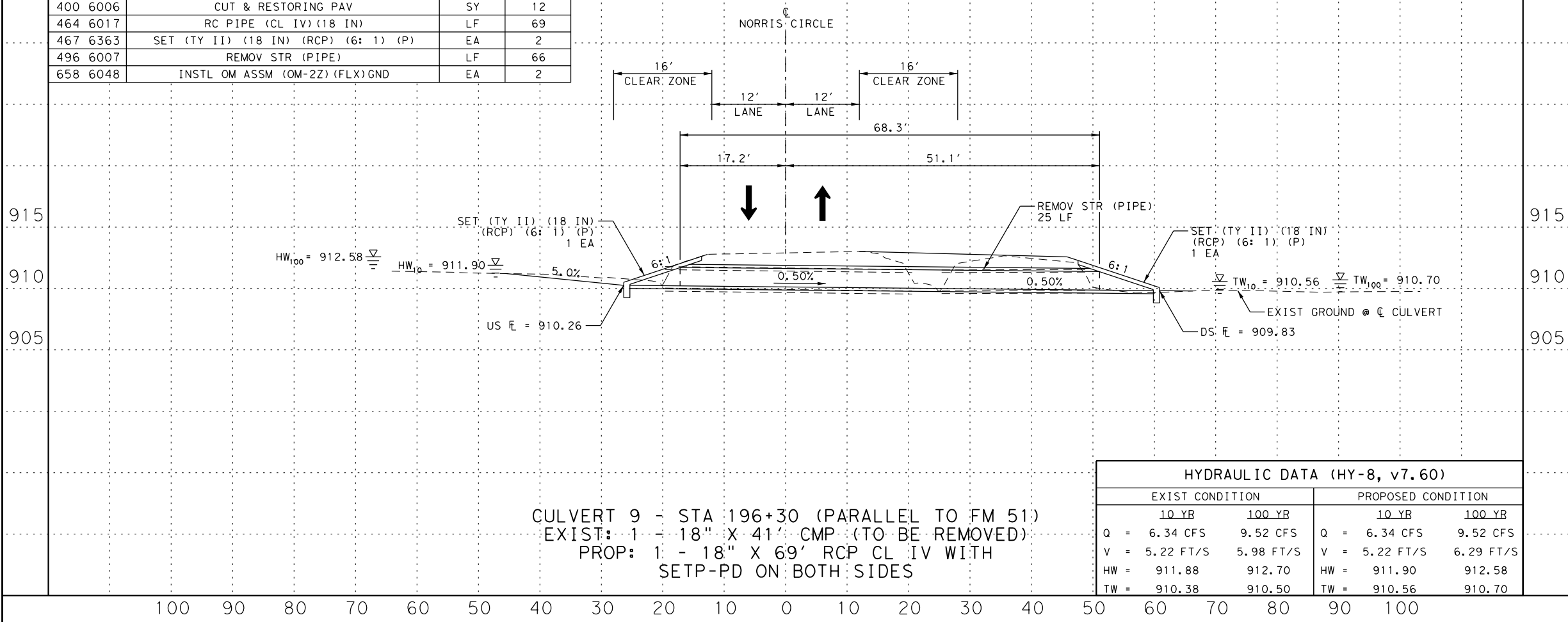
NOTES:

1. \O SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	12
464 6017	RC PIPE (CL IV) (18 IN)	LF	69
467 6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	2
496 6007	REMOV STR (PIPE)	LF	66
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



CULVERT 9 - STA 196+30 (PARALLEL TO FM 51)
 EXIST: 1 - 18" X 41' CMP (TO BE REMOVED)
 PROP: 1 - 18" X 69' RCP CL IV WITH
 SETP-PD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 6.34 CFS	9.52 CFS	Q = 6.34 CFS	9.52 CFS
V = 5.22 FT/S	5.98 FT/S	V = 5.22 FT/S	6.29 FT/S
HW = 911.88	912.70	HW = 911.90	912.58
TW = 910.38	910.50	TW = 910.56	910.70

NO.	DATE	REVISION	APPROVED

Kimley»Horn



**FM 51
 CULVERT LAYOUTS**

HORIZ: 1"=20'
 VERT: 1"=10' SHEET 4 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS <td>FTW <td>PARKER </td></td>	FTW <td>PARKER </td>	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			57

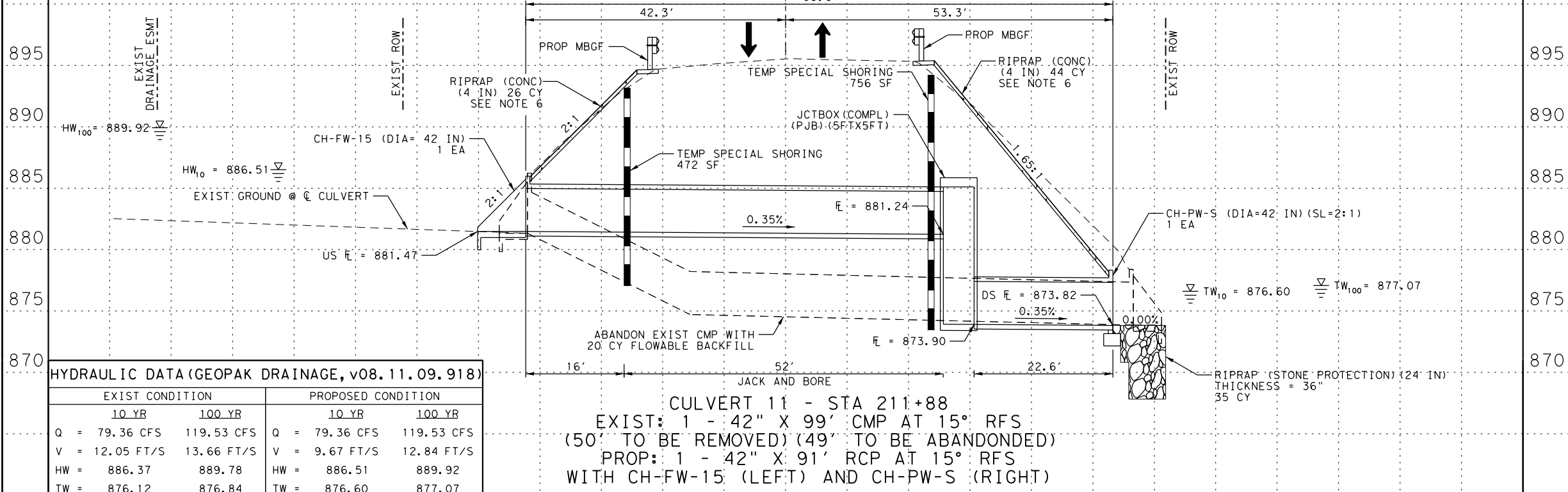
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100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	20
401 6001	FLOWABLE BACKFILL	CY	20
403 6001	TEMPORARY SPL SHORING	SF	1228
432 6001	RIPRAP (CONC) (4 IN)	CY	70
432 6035	RIPRAP (STONE PROTECTION) (24 IN)	CY	35
464 6021	RC PIPE (CL IV) (42 IN)	LF	39

ITEM	DESCRIPTION	UNIT	QTY
465 6009	JCTBOX (COMPL) (PJB) (5FTX5FT)	EA	1
466 6025	HEADWALL (CH - FW - 15) (DIA= 42 IN)	EA	1
466 6135	HEADWALL (CH - PW - S) (DIA= 42 IN)	EA	1
476 6030	JACK BOR OR TUN PIPE (42 IN) (RC) (CL IV)	LF	52
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	50



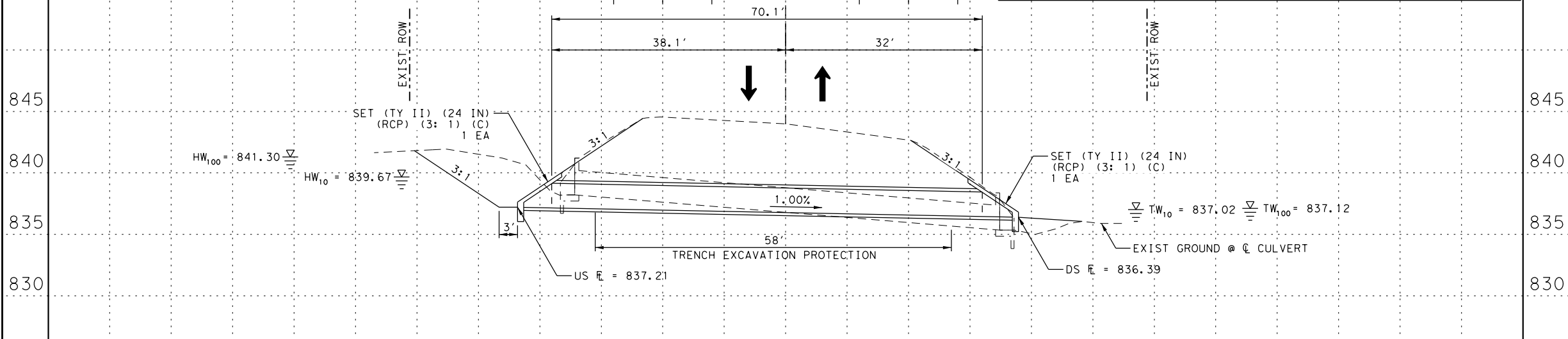
HYDRAULIC DATA (GEOPAK DRAINAGE, v08.11.09.918)

EXIST CONDITION		PROPOSED CONDITION	
10_YR	100_YR	10_YR	100_YR
Q = 79.36 CFS	119.53 CFS	Q = 79.36 CFS	119.53 CFS
V = 12.05 FT/S	13.66 FT/S	V = 9.67 FT/S	12.84 FT/S
HW = 886.37	889.78	HW = 886.51	889.92
TW = 876.12	876.84	TW = 876.60	877.07

CULVERT 11 - STA 211+88
 EXIST: 1 - 42" X 99' CMP AT 15° RFS
 (50' TO BE REMOVED) (49' TO BE ABANDONED)
 PROP: 1 - 42" X 91' RCP AT 15° RFS
 WITH CH-FW-15 (LEFT) AND CH-PW-S (RIGHT)

- NOTES:**
1. CL SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
 2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
 3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
 4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
 5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
 6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.

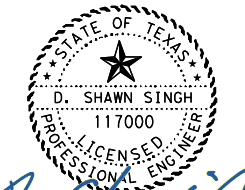
ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	21
402 6001	TRENCH EXCAVATION PROTECTION	LF	58
464 6005	RC PIPE (CL III) (24 IN)	LF	71
467 6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	2
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	70
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



HYDRAULIC DATA (HY-8, v7.60)

EXIST CONDITION		PROPOSED CONDITION	
10_YR	100_YR	10_YR	100_YR
Q = 15.84 CFS	23.82 CFS	Q = 15.84 CFS	23.82 CFS
V = 6.57 FT/S	8.25 FT/S	V = 8.11 FT/S	8.85 FT/S
HW = 839.00	841.17	HW = 839.67	841.30
TW = 836.45	836.65	TW = 837.02	837.12

CULVERT 15 - STA 296+57
 EXIST: 1 - 24" X 70' CMP (TO BE REMOVED)
 PROP: 1 - 24" X 71' RCP WITH SETP-CD ON BOTH SIDES



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NO.	DATE	REVISION	APPROVED

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**FM 51
CULVERT LAYOUTS**

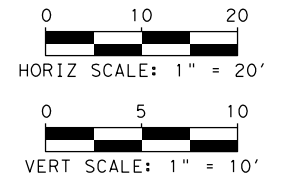
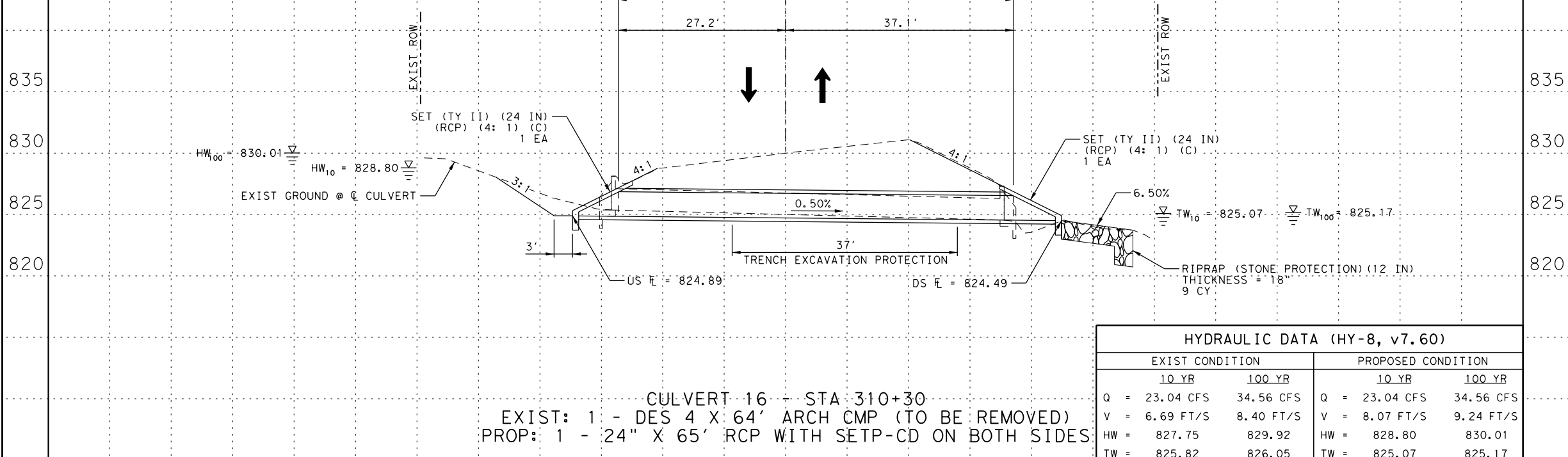
HORIZ: 1"=20'
VERT: 1"=10' SHEET 5 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			58

DATE: 10/19/2020 3:04:55 PM
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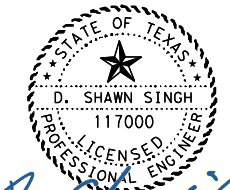
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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	21
402 6001	TRENCH EXCAVATION PROTECTION	LF	37
432 6031	RIPRAP (STONE PROTECTION) (12 IN)	CY	9
464 6005	RC PIPE (CL III) (24 IN)	LF	65
467 6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	2
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	64
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



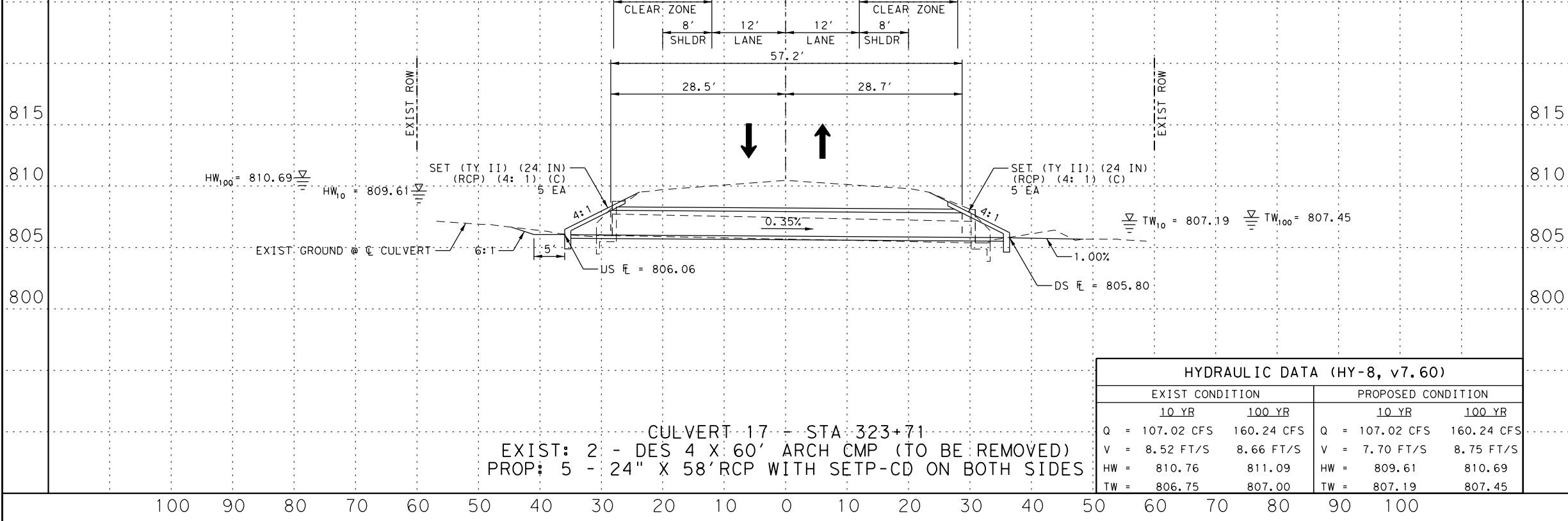
NOTES:

1. ϕ SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	83
464 6005	RC PIPE (CL III) (24 IN)	LF	290
467 6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	10
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	120
658 6048	INSTL OM ASSM (OM-2Z) (FLX)GND	EA	2



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**FM 51
 CULVERT LAYOUTS**

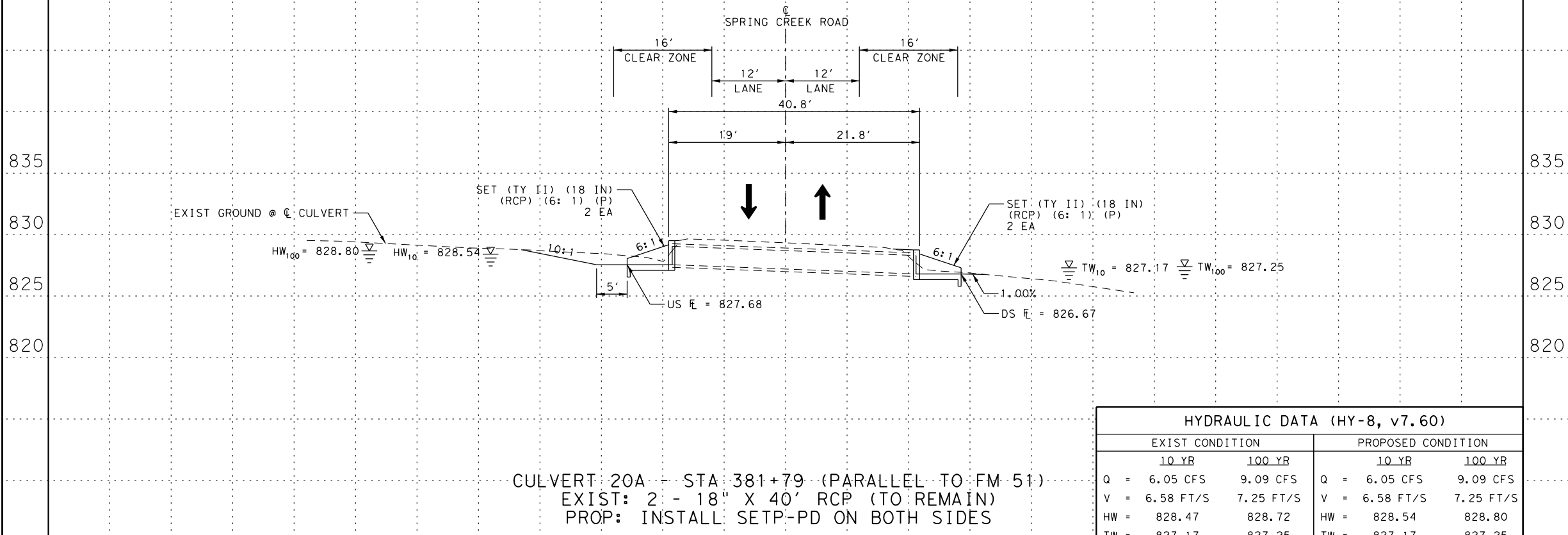
HORIZ: 1"=20'
 VERT: 1"=10' SHEET 6 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			59

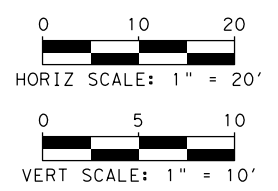
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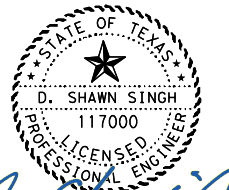
ITEM	DESCRIPTION	UNIT	QTY
467 6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	4
480 6001	CLEAN EXIST CULVERTS	EA	1
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 6.05 CFS	9.09 CFS	Q = 6.05 CFS	9.09 CFS
V = 6.58 FT/S	7.25 FT/S	V = 6.58 FT/S	7.25 FT/S
HW = 828.47	828.72	HW = 828.54	828.80
TW = 827.17	827.25	TW = 827.17	827.25

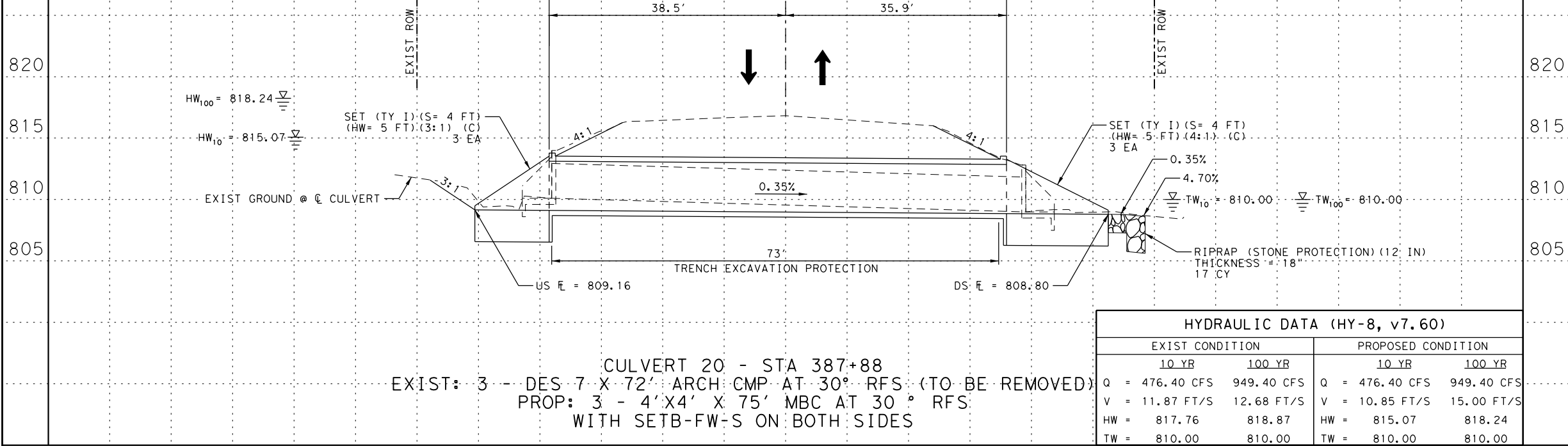


- NOTES:**
1. ϕ SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
 2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
 3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
 4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
 5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
 6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	103
402 6001	TRENCH EXCAVATION PROTECTION	LF	73
432 6031	RIPRAP (STONE PROTECTION) (12 IN)	CY	17
462 6005	CONC BOX CULV (4 FT X 4 FT)	LF	225
467 6148	SET (TY I) (S= 4 FT) (HW= 5 FT) (3:1) (C)	EA	3
467 6150	SET (TY I) (S= 4 FT) (HW= 5 FT) (4:1) (C)	EA	3
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	216
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 476.40 CFS	949.40 CFS	Q = 476.40 CFS	949.40 CFS
V = 11.87 FT/S	12.68 FT/S	V = 10.85 FT/S	15.00 FT/S
HW = 817.76	818.87	HW = 815.07	818.24
TW = 810.00	810.00	TW = 810.00	810.00

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FM 51
CULVERT LAYOUTS

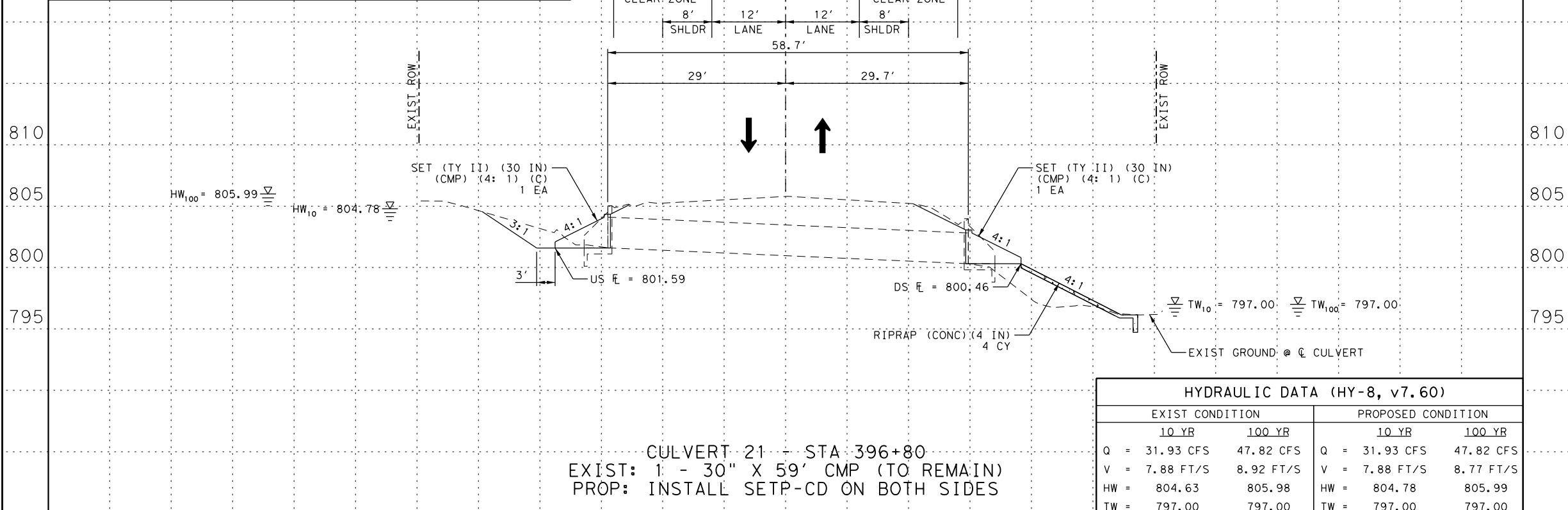
HORIZ: 1"=20'
 VERT: 1"=10' SHEET 7 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			60

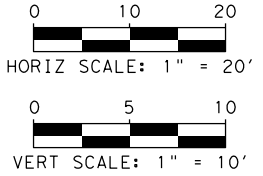
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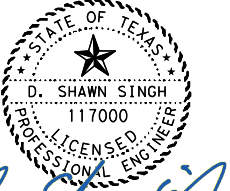
ITEM	DESCRIPTION	UNIT	QTY
432 6001	RIPRAP (CONC) (4 IN)	CY	4
467 6408	SET (TY II) (30 IN) (CMP) (4: 1) (C)	EA	2
480 6001	CLEAN EXIST CULVERTS	EA	1
496 6006	REMOV STR (HEADWALL)	EA	2
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 31.93 CFS	47.82 CFS	Q = 31.93 CFS	47.82 CFS
V = 7.88 FT/S	8.92 FT/S	V = 7.88 FT/S	8.77 FT/S
HW = 804.63	805.98	HW = 804.78	805.99
TW = 797.00	797.00	TW = 797.00	797.00

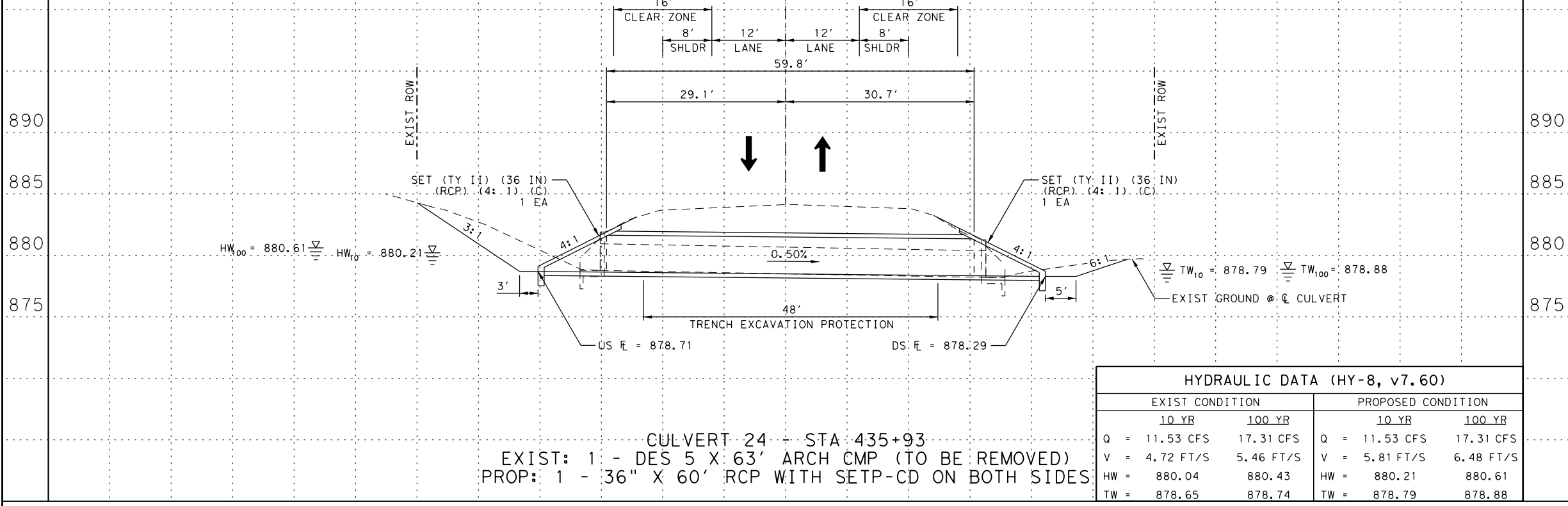


- NOTES:**
1. ϕ SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
 2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
 3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
 4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
 5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
 6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	26
402 6001	TRENCH EXCAVATION PROTECTION	LF	48
464 6008	RC PIPE (CL III) (36 IN)	LF	60
467 6450	SET (TY II) (36 IN) (RCP) (4: 1) (C)	EA	2
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	63
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 11.53 CFS	17.31 CFS	Q = 11.53 CFS	17.31 CFS
V = 4.72 FT/S	5.46 FT/S	V = 5.81 FT/S	6.48 FT/S
HW = 880.04	880.43	HW = 880.21	880.61
TW = 878.65	878.74	TW = 878.79	878.88

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**FM 51
 CULVERT LAYOUTS**

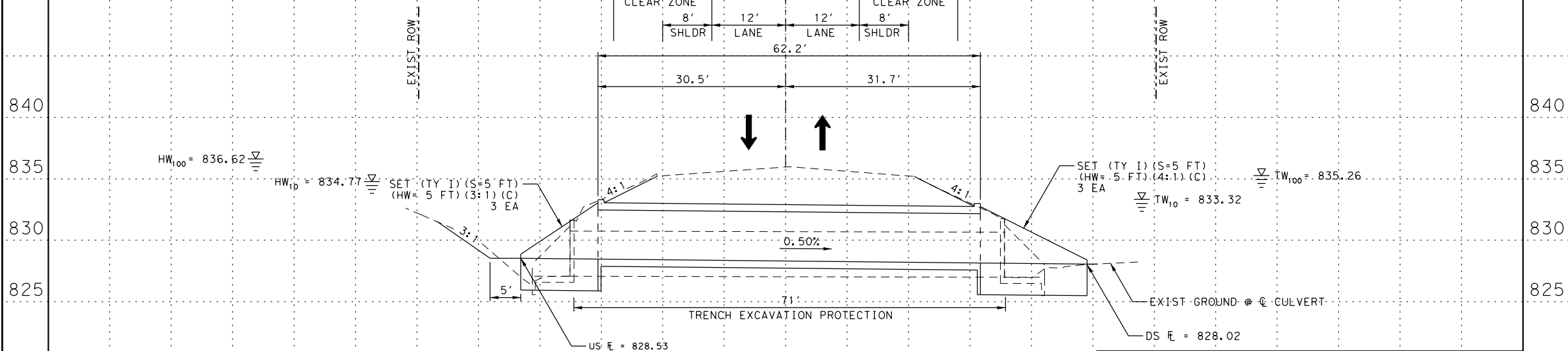
HORIZ: 1"=20'
 VERT: 1"=10' SHEET 8 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020

DATE: 10/19/2020 3:05:12 PM
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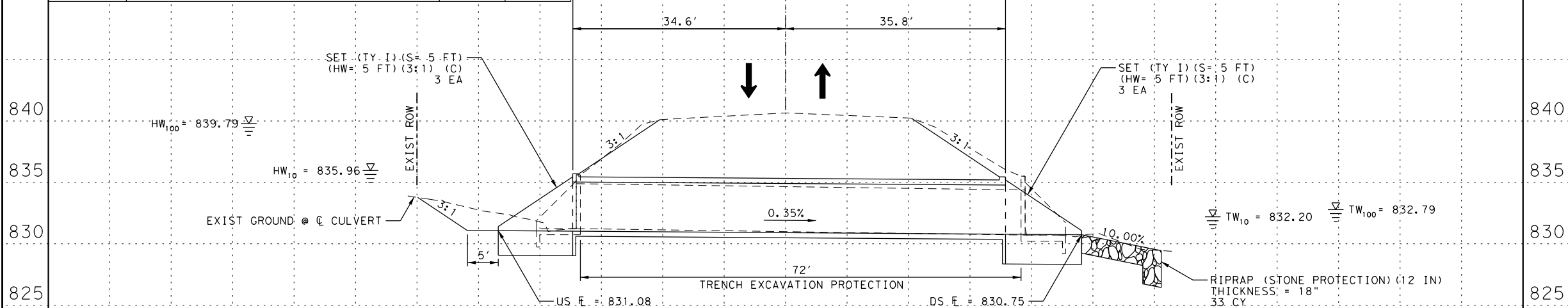
ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	107
402 6001	TRENCH EXCAVATION PROTECTION	LF	71
462 6008	CONC BOX CULV (5 FT X 4 FT)	LF	189
467 6181	SET (TY I) (S= 5 FT) (HW= 5 FT) (3:1) (C)	EA	3
467 6182	SET (TY I) (S= 5 FT) (HW= 5 FT) (4:1) (C)	EA	3
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	213
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 485.90 CFS	966.40 CFS	Q = 485.90 CFS	966.40 CFS
V = 9.23 FT/S	8.06 FT/S	V = 8.10 FT/S	7.85 FT/S
HW = 835.53	836.67	HW = 834.77	836.62
TW = 832.18	834.12	TW = 833.32	835.26

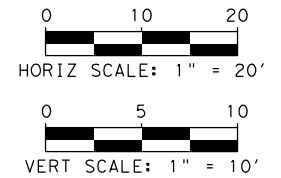
CULVERT 25 - STA 457+83
 EXIST: 3 - DES 9 X 71' ARCH CMP (TO BE REMOVED)
 PROP: 3 - 5'X4' X 63' MBC WITH SETB-CD ON BOTH SIDES

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	105
402 6001	TRENCH EXCAVATION PROTECTION	LF	72
432 6031	RIPRAP (STONE PROTECTION) (12 IN)	CY	33
462 6008	CONC BOX CULV (5 FT X 4 FT)	LF	213
467 6181	SET (TY I) (S= 5 FT) (HW= 5 FT) (3:1) (C)	EA	6
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	222
658 6048	INSTL OM ASSM (OM-2Z) (FLX) GND	EA	2



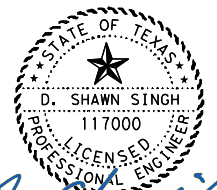
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 462.10 CFS	870.60 CFS	Q = 462.10 CFS	870.60 CFS
V = 10.44 FT/S	13.84 FT/S	V = 9.97 FT/S	14.51 FT/S
HW = 837.00	841.34	HW = 835.96	839.79
TW = 831.73	832.17	TW = 832.20	832.79

CULVERT 26 - STA 468+76
 EXIST: 3 - DES 9 X 74' ARCH CMP (TO BE REMOVED)
 PROP: 3 - 5'X4' X 71' MBC WITH SETB-CD ON BOTH SIDES



NOTES:

1. \bar{C} SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TxDOT BID ITEM EXCAVATION (CHANNEL).
5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



D. Singh 10/19/2020

NO.	DATE	REVISION	APPROVED

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**FM 51
CULVERT LAYOUTS**

HORIZ: 1"=20'
 VERT: 1"=10' SHEET 9 OF 10

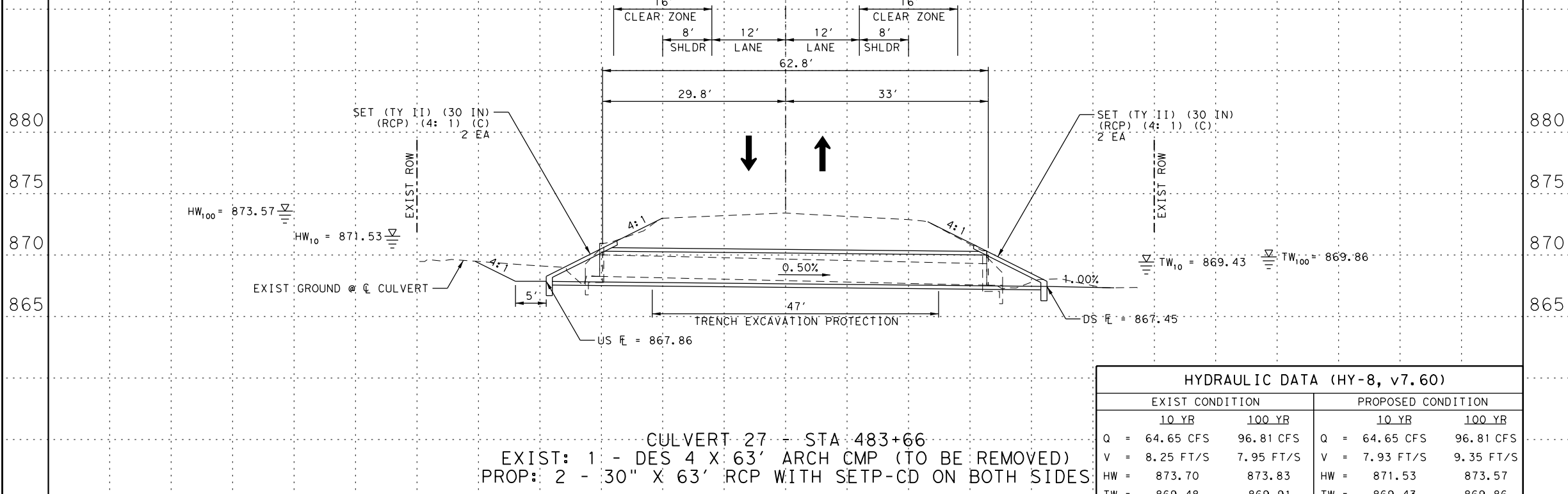
DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			62

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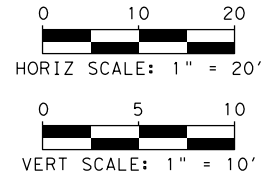
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ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	41
402 6001	TRENCH EXCAVATION PROTECTION	LF	47
464 6007	RC PIPE (CL III) (30 IN)	LF	126
467 6419	SET (TY II) (30 IN) (RCP) (4: 1) (C)	EA	4
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	63
658 6048	INSTR OM ASSM (OM-2Z) (FLX) GND	EA	2

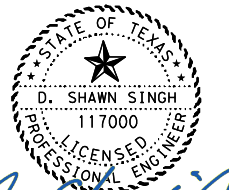


CULVERT 27 - STA 483+66
 EXIST: 1 - DES 4 X 63' ARCH CMP (TO BE REMOVED)
 PROP: 2 - 30" X 63' RCP WITH SETP-CD ON BOTH SIDES

HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 64.65 CFS	96.81 CFS	Q = 64.65 CFS	96.81 CFS
V = 8.25 FT/S	7.95 FT/S	V = 7.93 FT/S	9.35 FT/S
HW = 873.70	873.83	HW = 871.53	873.57
TW = 869.48	869.91	TW = 869.43	869.86



- NOTES:
1. CL SHOWN IS BASED ON CENTER OF EXISTING PAVEMENT.
 2. CONTRACTOR TO CONFIRM EXISTING GRADES PRIOR TO MODIFYING EXISTING STRUCTURES.
 3. CONTRACTOR SHALL CONFIRM LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION AND/OR EXCAVATION.
 4. CONTRACTOR SHALL REGRADE AND VERIFY THAT ALL EXISTING DITCHES HAVE POSITIVE AND UNOBSTRUCTED FLOW TO CULVERT LOCATIONS. ALL WORK SHALL BE PAID FOR BY TXDOT BID ITEM EXCAVATION (CHANNEL).
 5. SEE RIPRAP LAYOUT SHEET FOR ADDITIONAL INFORMATION.
 6. CONTRACTOR SHALL FIELD VERIFY LIMITS OF SIDE SLOPE RIPRAP.



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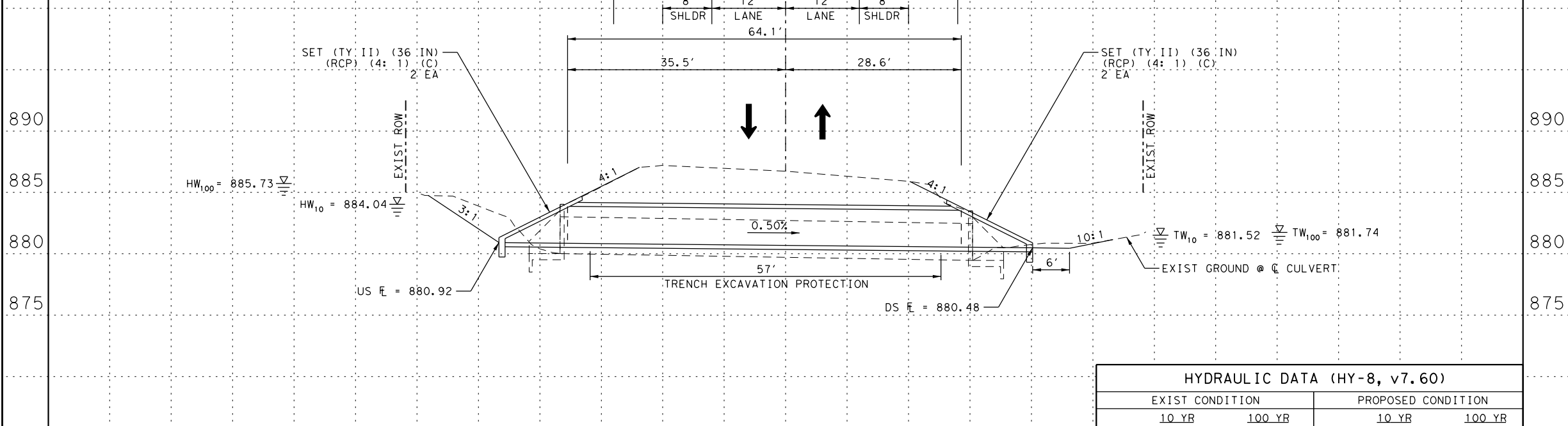


**FM 51
CULVERT LAYOUTS**

HORIZ: 1"=20'
 VERT: 1"=10' SHEET 10 OF 10

DESIGN KHA	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
	6	(SEE TITLE SHEET)	FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020
			63

ITEM	DESCRIPTION	UNIT	QTY
400 6006	CUT & RESTORING PAV	SY	46
402 6001	TRENCH EXCAVATION PROTECTION	LF	57
464 6008	RC PIPE (CL III) (36 IN)	LF	130
467 6450	SET (TY II) (36 IN) (RCP) (4: 1) (C)	EA	4
496 6006	REMOV STR (HEADWALL)	EA	2
496 6007	REMOV STR (PIPE)	LF	136
658 6048	INSTR OM ASSM (OM-2Z) (FLX) GND	EA	2

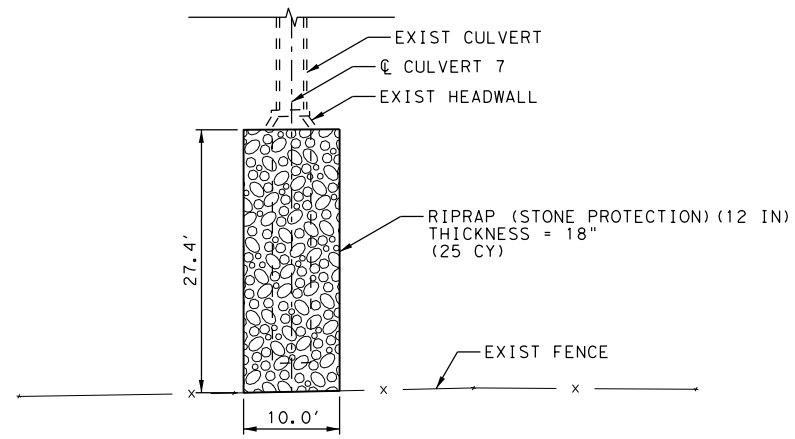


CULVERT 28 - STA 492+25
 EXIST: 2 - 36" X 68' CMP (TO BE REMOVED)
 PROP: 2 - 36" X 65' RCP WITH SETP-CD ON BOTH SIDES

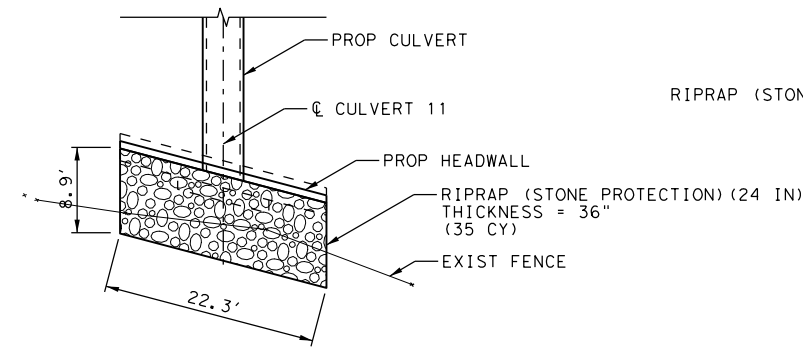
HYDRAULIC DATA (HY-8, v7.60)			
EXIST CONDITION		PROPOSED CONDITION	
10 YR	100 YR	10 YR	100 YR
Q = 73.06 CFS	109.41 CFS	Q = 73.06 CFS	109.41 CFS
V = 7.46 FT/S	9.07 FT/S	V = 7.84 FT/S	9.02 FT/S
HW = 883.71	886.44	HW = 884.04	885.73
TW = 880.45	880.66	TW = 881.52	881.74

DATE: 10/19/2020 3:05:23 PM
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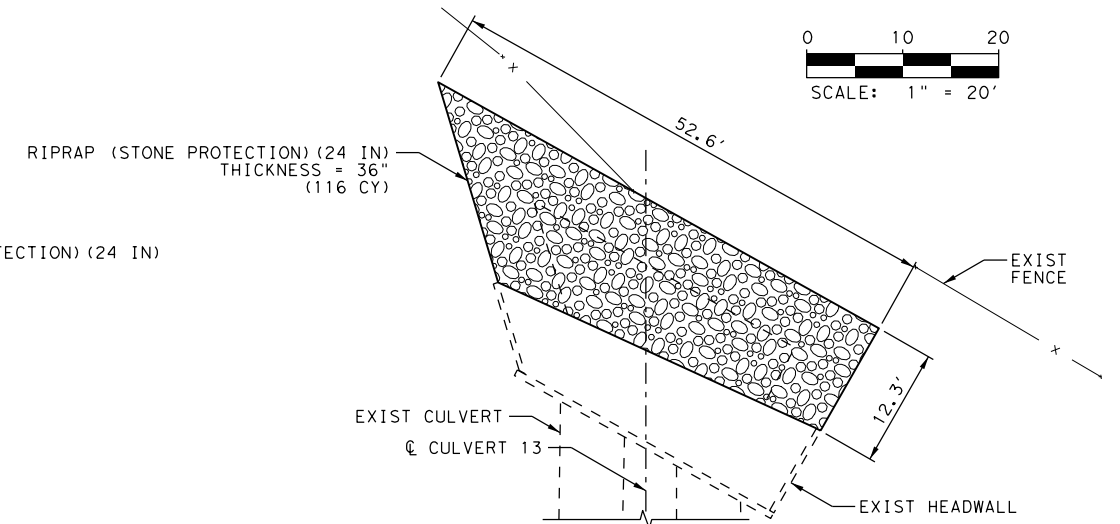
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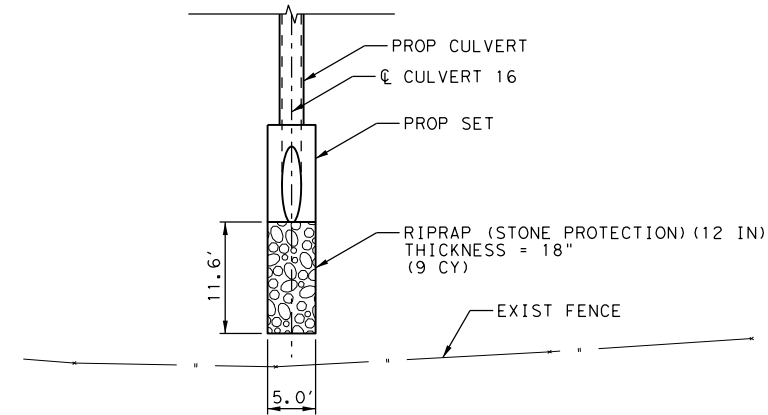
CULVERT 7 - STA 150+22



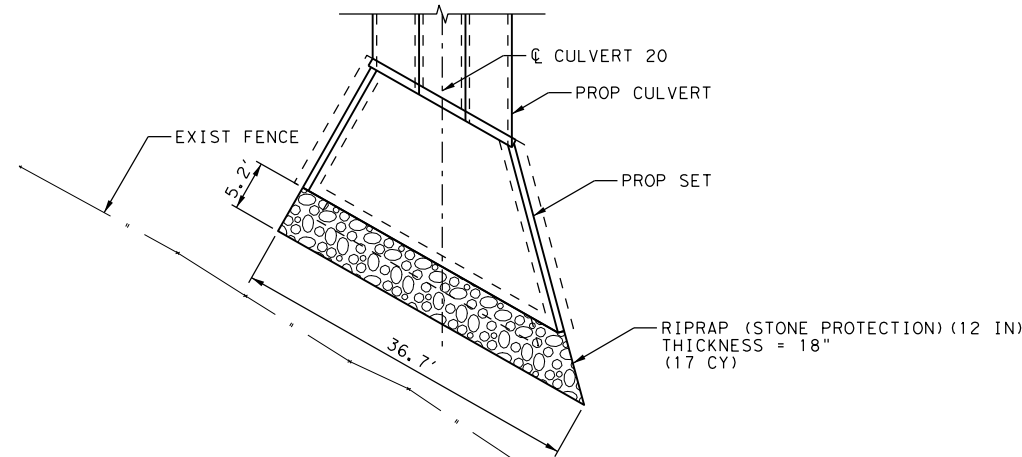
CULVERT 11 - STA 211+88



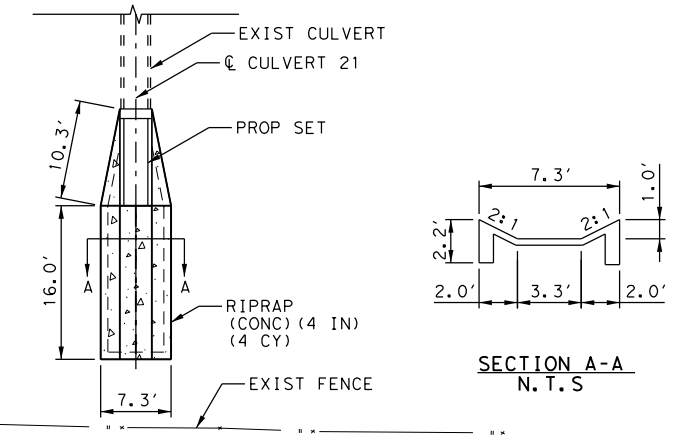
CULVERT 13 - STA 274+82



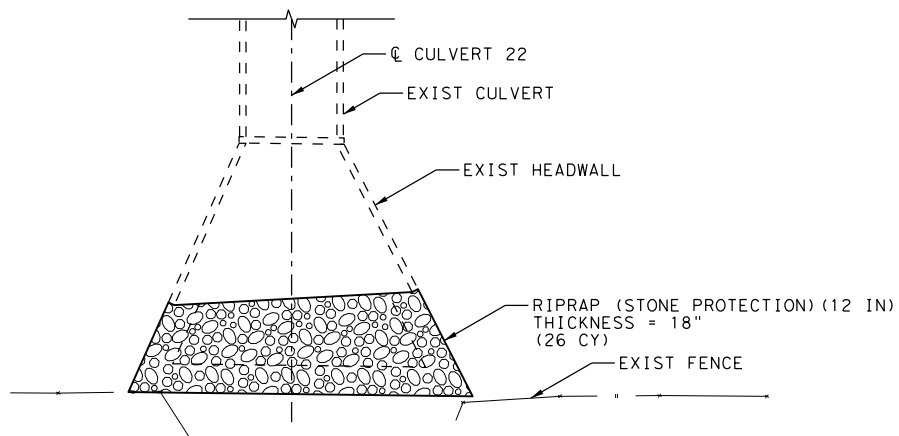
CULVERT 16 - STA 310+30



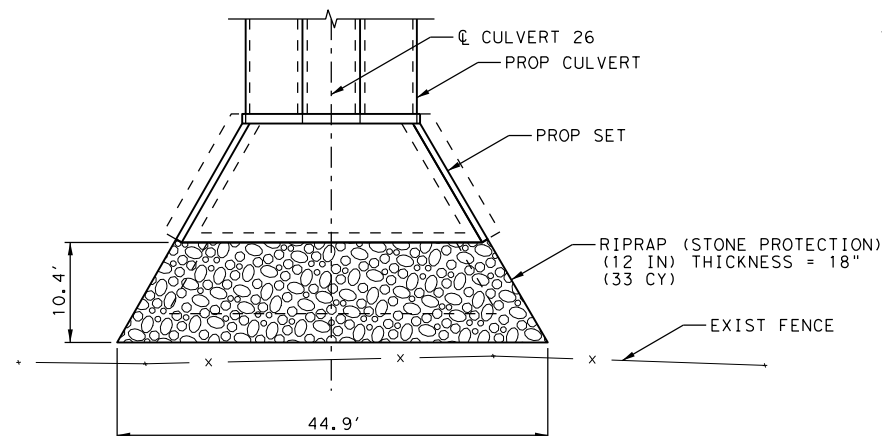
CULVERT 20 - STA 387+88



CULVERT 21 - STA 396+80



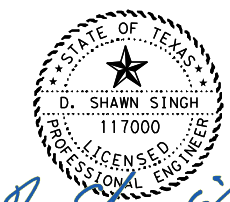
CULVERT 22 - STA 400+73



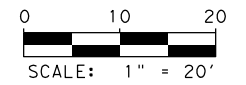
CULVERT 26 - STA 468+76

NOTES:

- 1. QUANTITIES SHOWN INCLUDE RIPRAP TOE. RIPRAP TOE QUANTIFIED USING STANDARD SRR.

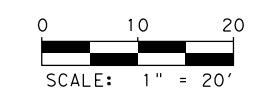
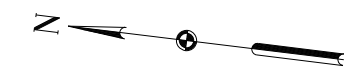


D. Singh
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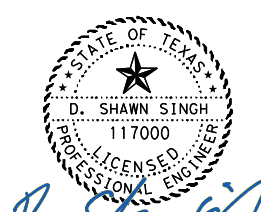
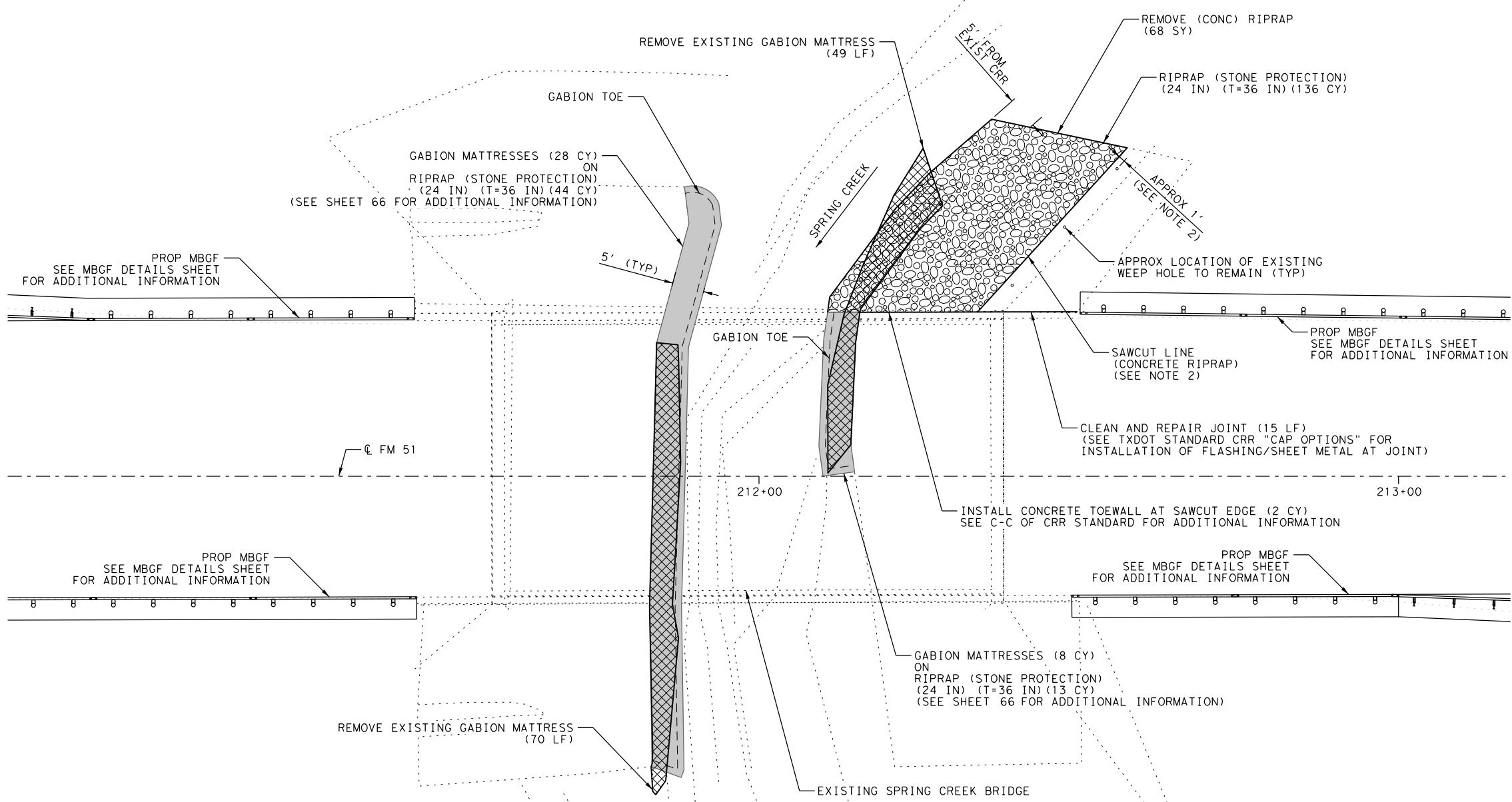
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NO.	DATE	REVISION	APPROVED
FM 51 RIPRAP LAYOUTS			
SCALE: 1"=20'		SHEET 1 OF 1	
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE TEXAS	DISTRICT FTW	COUNTY PARKER
CHECK KHA	CONTROL 0313	SECTION 07	JOB 020
			64



- LEGEND:**
- REMOVE EXISTING GABION MATTRESS
 - PROPOSED RIPRAP (STONE PROTECTION)
 - PROPOSED GABION MATTRESS ON PROPOSED RIPRAP (STONE PROTECTION)

- NOTES:**
1. REMOVE EXISTING GABION MATTRESS, BACKFILL EROSION WITH STONE PROTECTION, CONSTRUCT CONCRETE CONNECTION, INSTALL GABION MATTRESS.
 2. CONTRACTOR TO VERIFY LOCATION OF SAWCUT WITH FIELD ENGINEER, PRIOR TO CUTTING OR REMOVING EXISTING RIPRAP.
 3. CHANNEL CLEANING AND SMALL TREE REMOVAL SHALL BE PAID FOR UNDER ITEM 100 6002 PREPARING ROW. ACCESS ROUTES FOR EQUIPMENT SHOULD BE SELECTED TO MINIMIZE CLEARING OF VEGETATION IN THE FLOODPLAIN, LEAVE ROOT SYSTEMS FOR STABILIZATION. CONTRACTOR TO VERIFY CHANNEL LIMITS WITH FIELD ENGINEER.
 4. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING THE EXISTING BRIDGE STRUCTURE DURING ALL PHASES OF CONSTRUCTION. ANY DAMAGE TO EXISTING STRUCTURES OR SLOPES SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.



D. Singh
10/19/2020

NO.	DATE	REVISION	APPROVED

Kimley»Horn
F-928



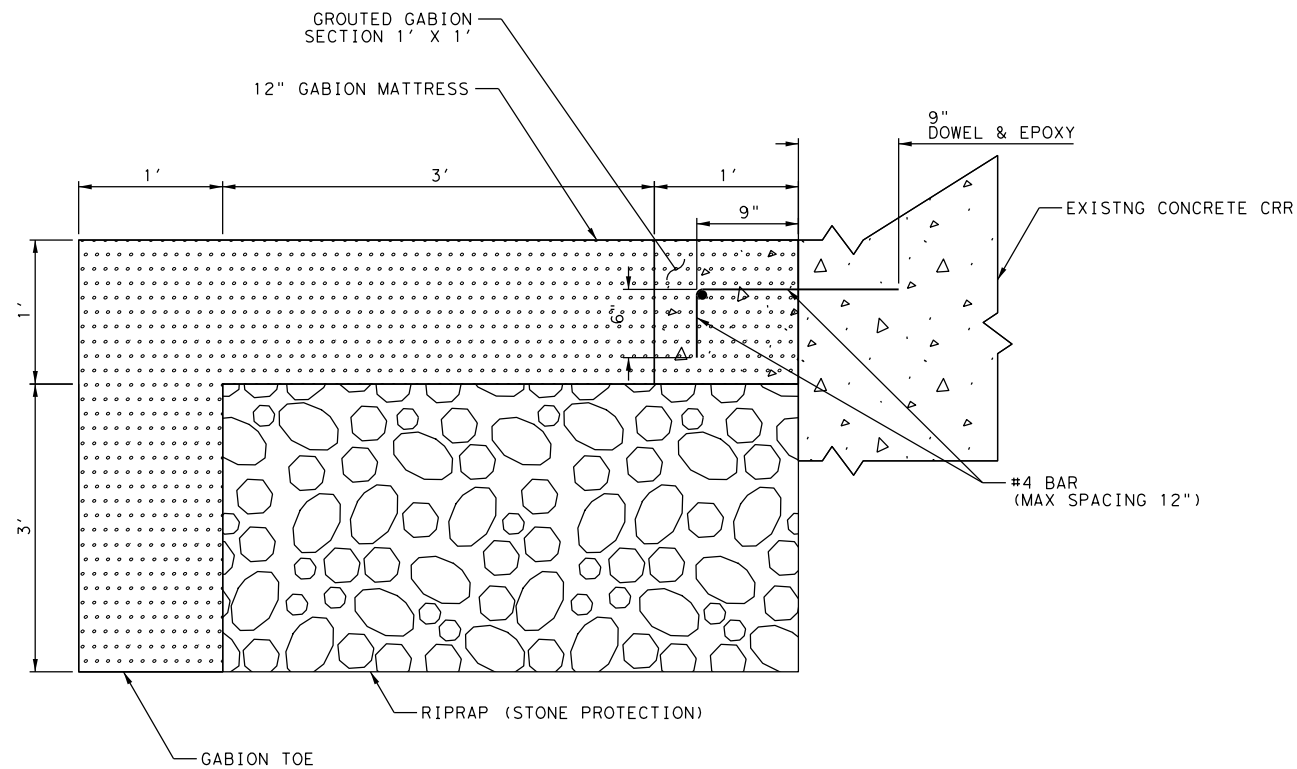
**FM 51
SPRING CREEK BRIDGE
RIPRAP HEADER REPAIR**

SCALE 1"=20' SHEET 1 OF 2

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
KHA	6	(SEE TITLE SHEET)	FM 51
DRAWN	STATE	DISTRICT	COUNTY
KHA	TEXAS	FTW	PARKER
CHECK	CONTROL	SECTION	JOB
KHA	0313	07	020

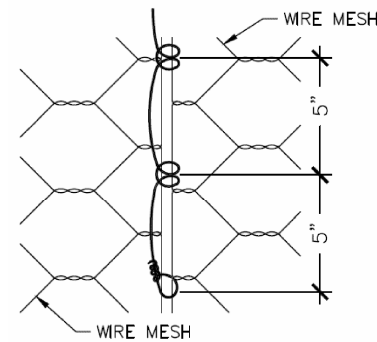
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CONCRETE CONNECTION SHALL BE SUBSIDIARY TO ITEM 459

**GABION MATTRESS AND
CONCRETE CONNECTION DETAIL
N. T. S.**



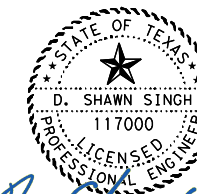
GABIONS MUST BE TIED IN THIS MANNER AT EACH STEP OF CONSTRUCTION AND IS SUBSIDIARY TO ITEM 459

1. INITIAL ASSEMBLY
2. TYING TO ADJACENT GABIONS ALONG ALL CONTACTING EDGES
3. TYING OF LIDS TO SIDES
4. TYING OF LID TO ALL DIAPHRAGMS
5. RE-TYING OF THE CUT GABION

**GABION TYING DETAIL
N. T. S.**

NOTES:

1. PROVIDE CEMENTITIOUS GROUTS SPECIFIED IN TXDOT DMS-4675.
2. ALL REINFORCEMENT SHALL BE GRADE 60.
3. FIELD BEND AS NECESSARY TO PROVIDE MINIMUM COVER OF 2" FOR REINFORCEMENT.



D. Singh 10/19/2020

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F-928



**FM 51
SPRING CREEK BRIDGE
RIPRAP HEADER REPAIR**

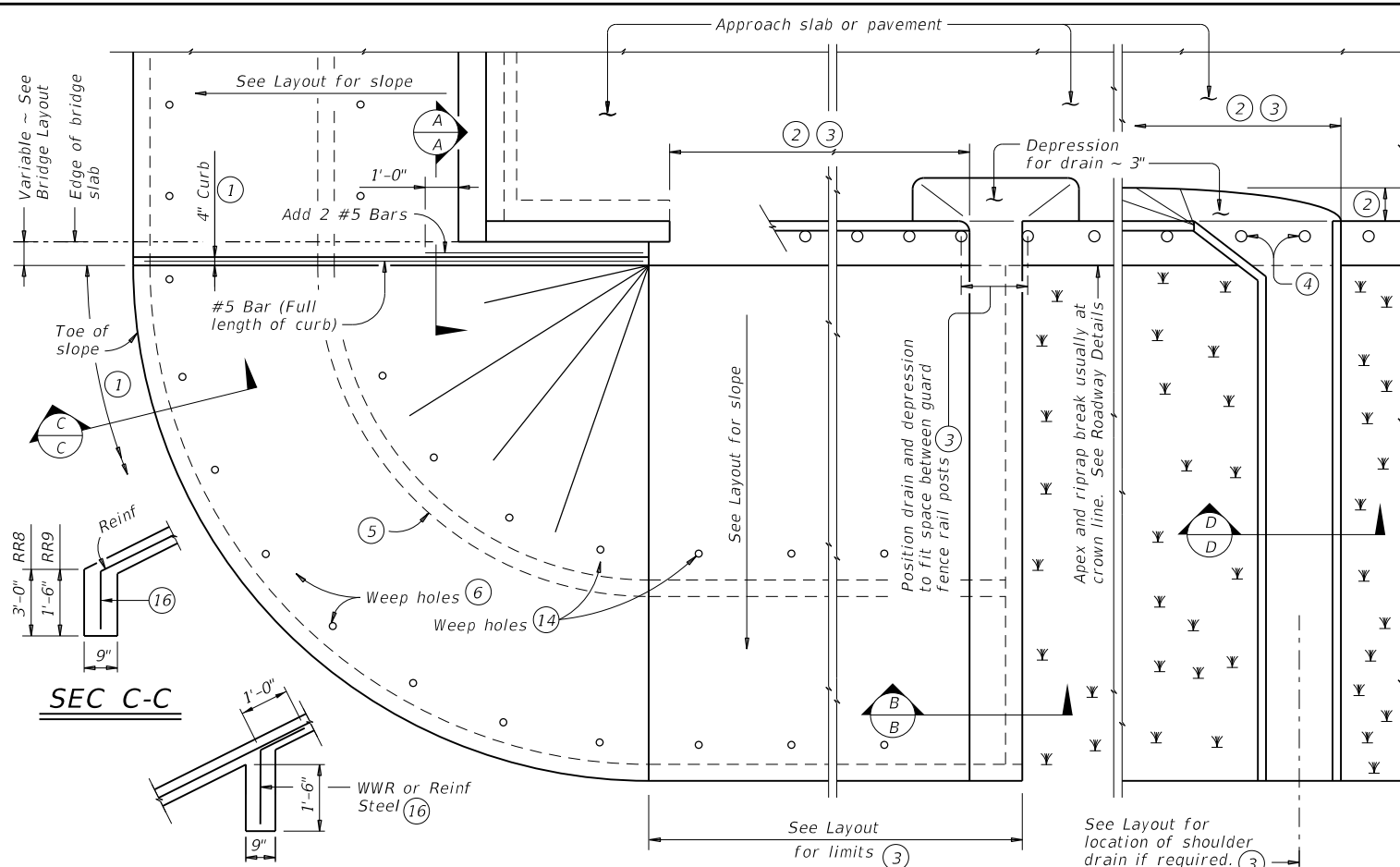
SCALE 1"=20' SHEET 2 OF 2

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DRAWN	STATE	DISTRICT	COUNTY
KHA	TEXAS	FTW	PARKER
CHECK	CONTROL	SECTION	JOB
KHA	0313	07	020

66

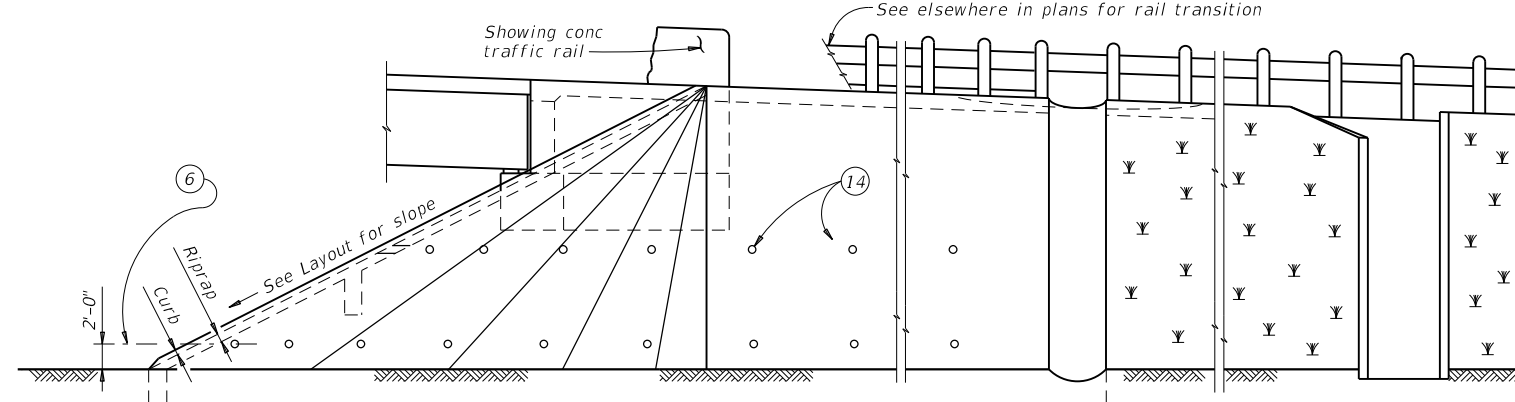
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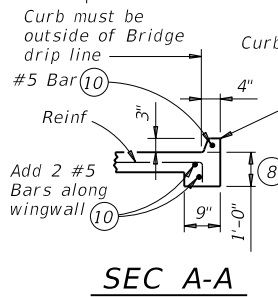


INTERMEDIATE TOEWALL 5

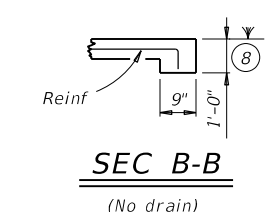
PLAN



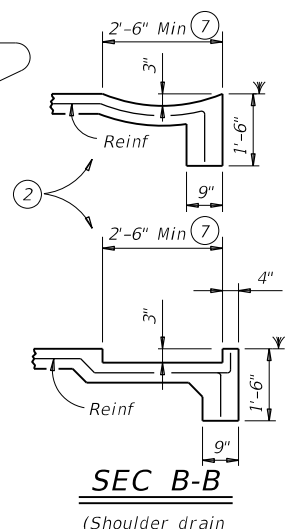
ELEVATION



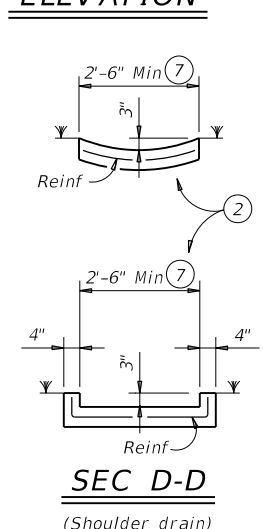
SEC A-A



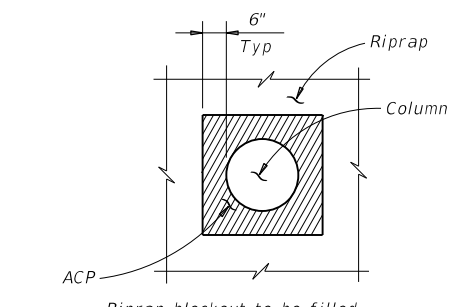
SEC B-B
(No drain)



SEC B-B
(Shoulder drain integral with riprap)

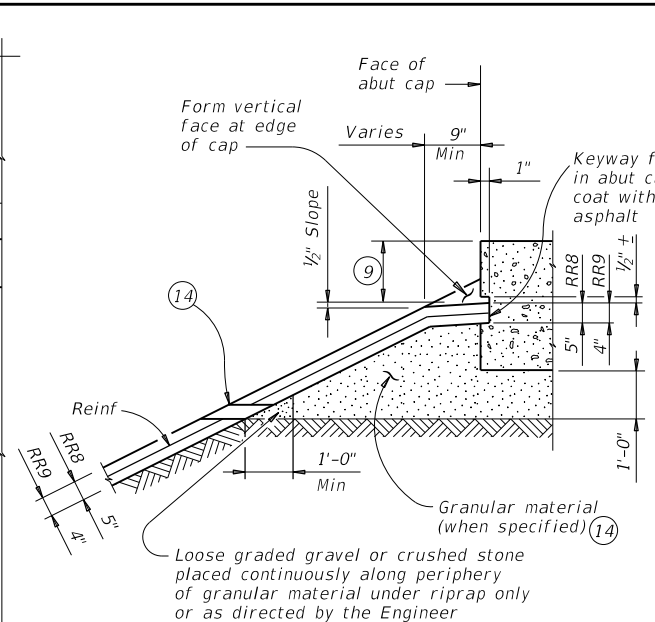


SEC D-D
(Shoulder drain)

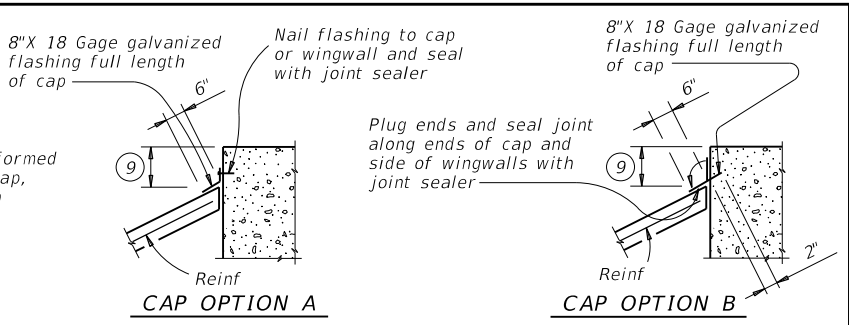


RIPRAP DETAIL AT COLUMNS

(As directed by the Engineer)

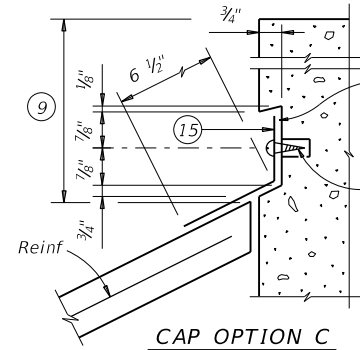


SHOWING KEYWAY OPTION

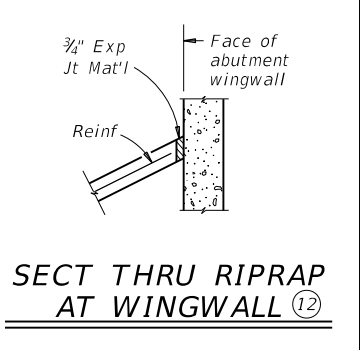


CAP OPTION A

CAP OPTION B

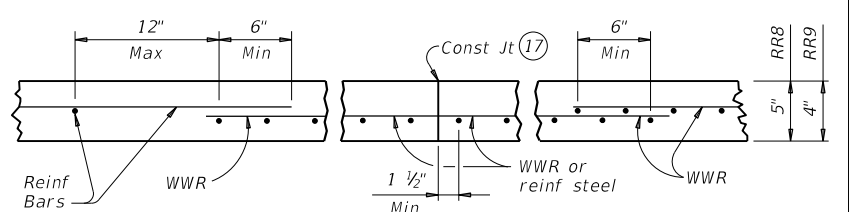


CAP OPTION C



SECT THRU RIPRAP AT WINGWALL 12

SECTIONS THRU RIPRAP AT CAP 11



REINFORCEMENT DETAILS 13

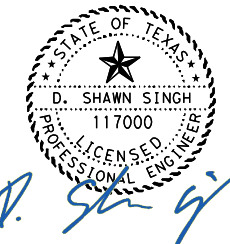
See General Notes for optional synthetic fiber reinforcement.

- 1 When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.
- 2 Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.
- 3 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.
- 4 See details elsewhere in plans for installation of guard fence posts through concrete riprap.
- 5 Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.
- 6 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.
- 7 Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.
- 8 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.
- 9 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.
- 10 #5 bars shown are required even when synthetic fiber reinforcing option is selected.
- 11 Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.
- 12 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.
- 13 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.
- 14 If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.
- 15 8" x 18 Gage Galv Sheet Metal
- 16 Provide WWR or #3 bars, with 1'-0" extension into slope.
- 17 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.

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.

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

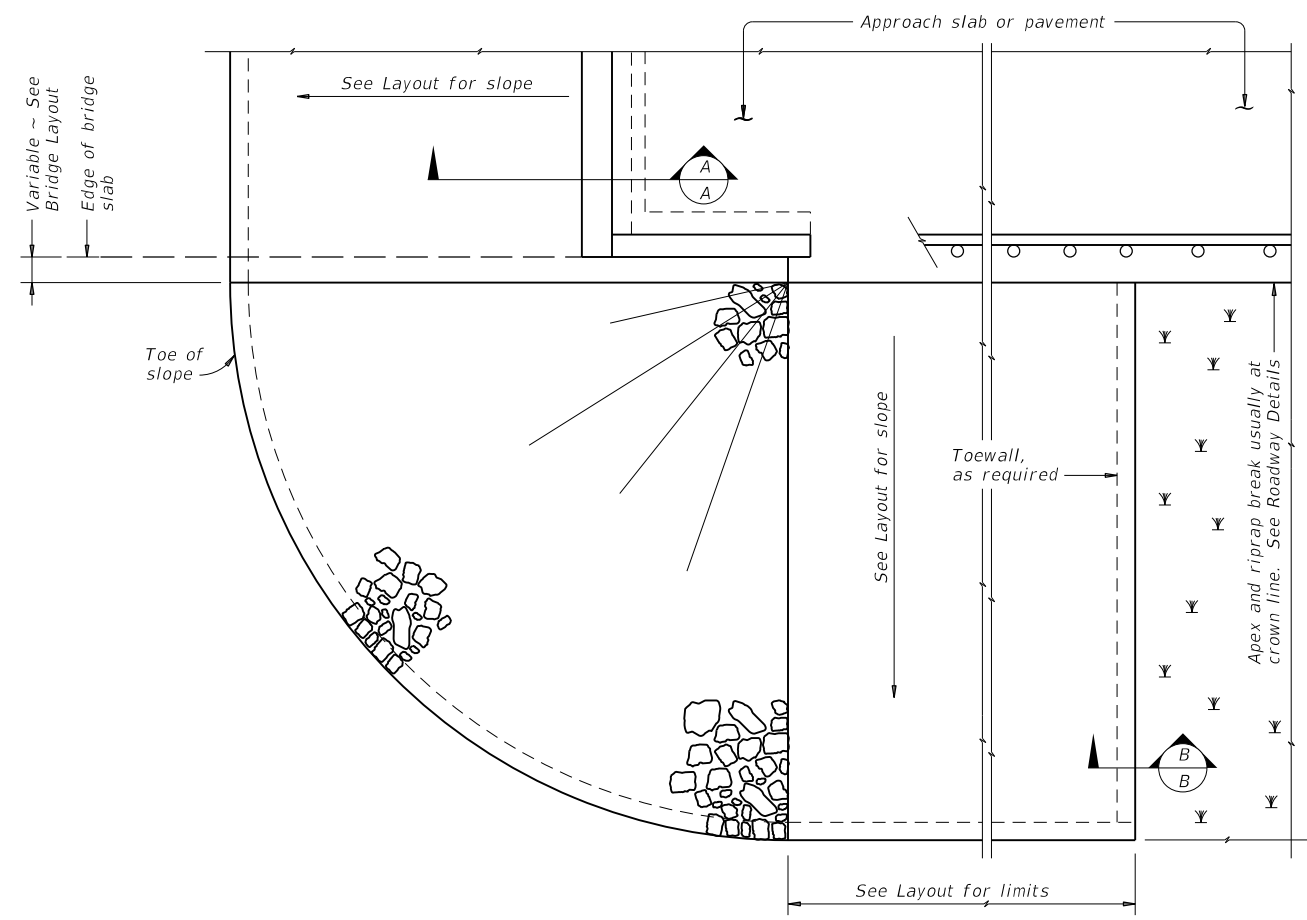


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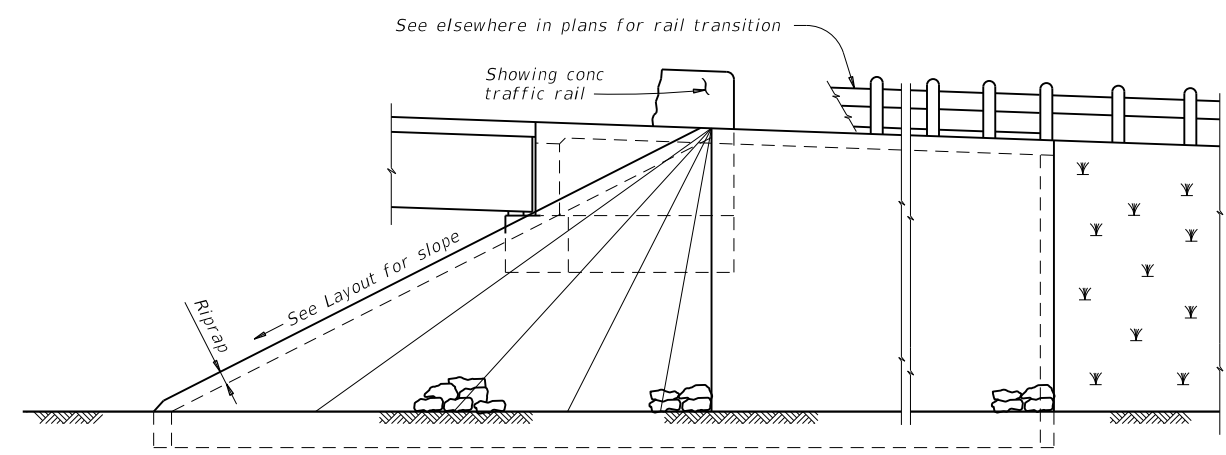
		Bridge Division Standard	
CONCRETE RIPRAP AND SHOULDER DRAINS EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 & RR9)			
CRR (MOD)			
FILE: crrstd-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT April 2019	CONTRACT NO. 0313 07	SECTION NO. 020	PROJECT NO. FM 51
REVISIONS	DIST. FTW	COUNTY. PARKER	SHEET NO. 67

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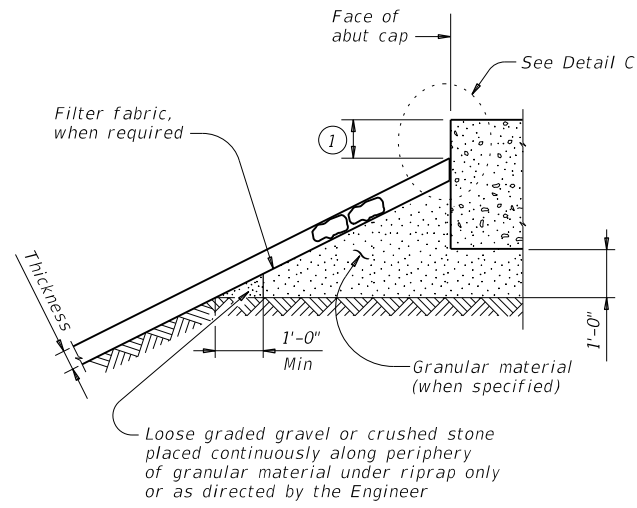
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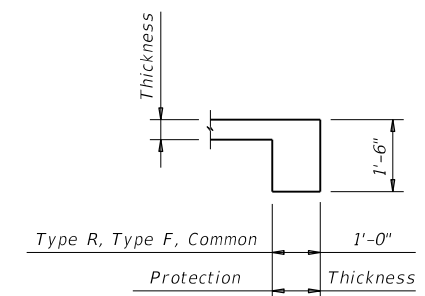
PLAN



ELEVATION

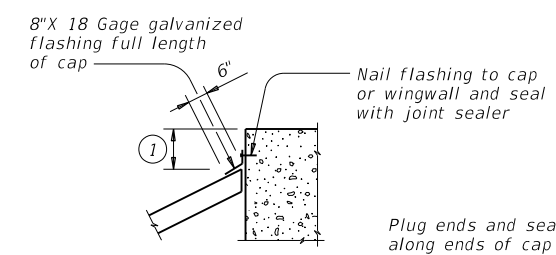


SECTION A-A AT CAP

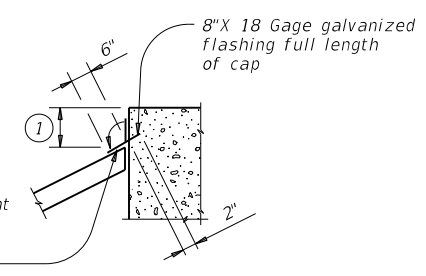


SECTION B-B

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

		Bridge Division Standard	
<h1>STONE RIPRAP</h1>			
<h2>SRR</h2>			
FILE: srrstdel-19.dgn	DN: AES	CK: JGD	DW: BWH
©TxDOT April 2019	CONTRACT: 0313	SECTION: 07	JOB: 020
REVISIONS	DIST: FTW		COUNTY: PARKER
			SHEET NO.: 68

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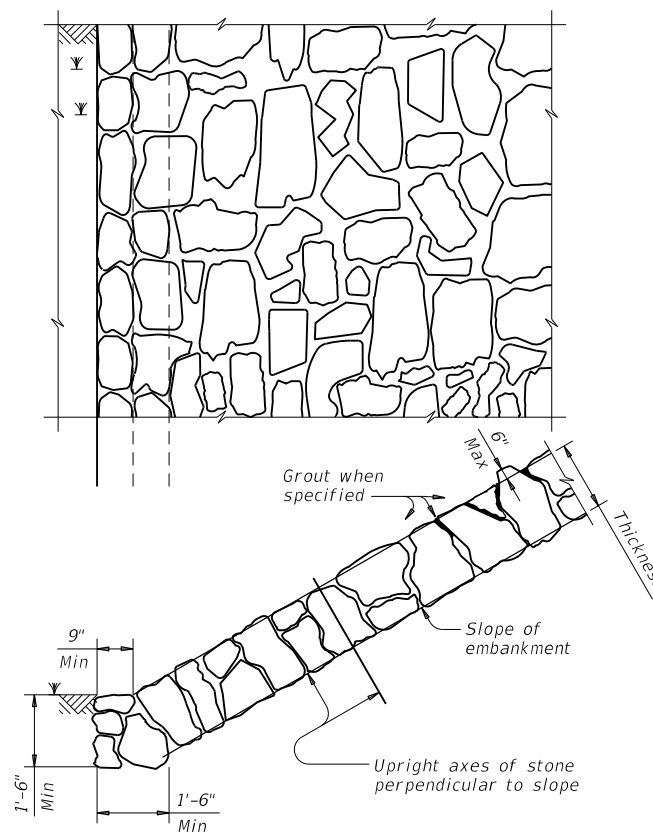


FIGURE 1 ~ TYPE R STONE RIPRAP
dry or grouted

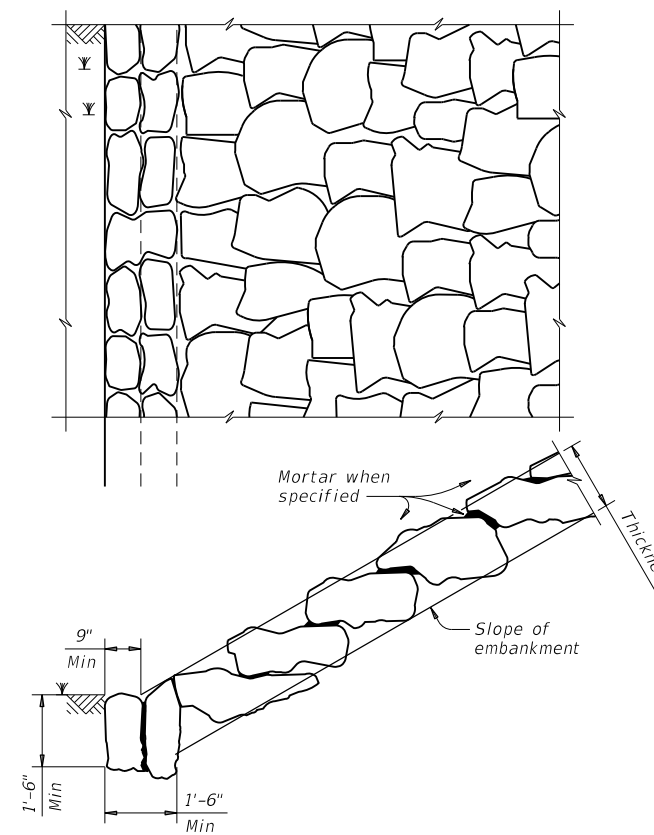


FIGURE 2 ~ TYPE F STONE RIPRAP
dry or mortared

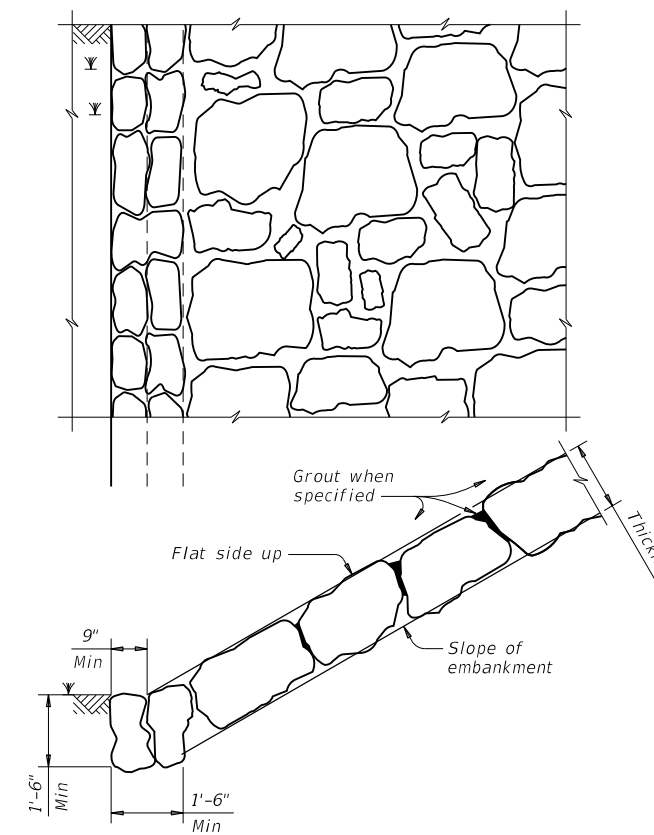


FIGURE 3 ~ TYPE F STONE RIPRAP
grouted

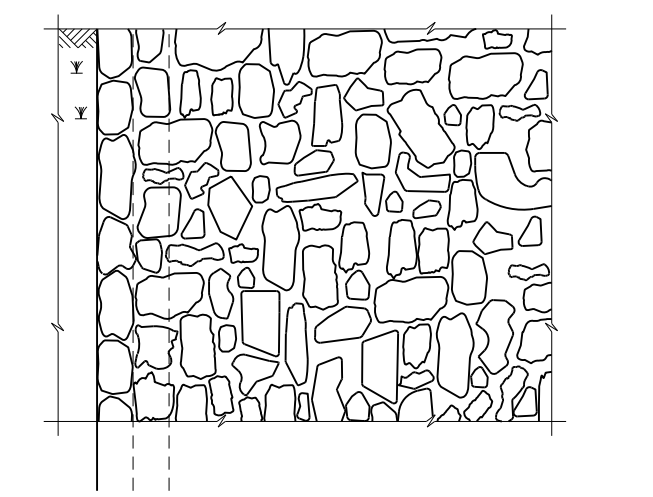


FIGURE 4 ~ COMMON STONE RIPRAP
dry or grouted

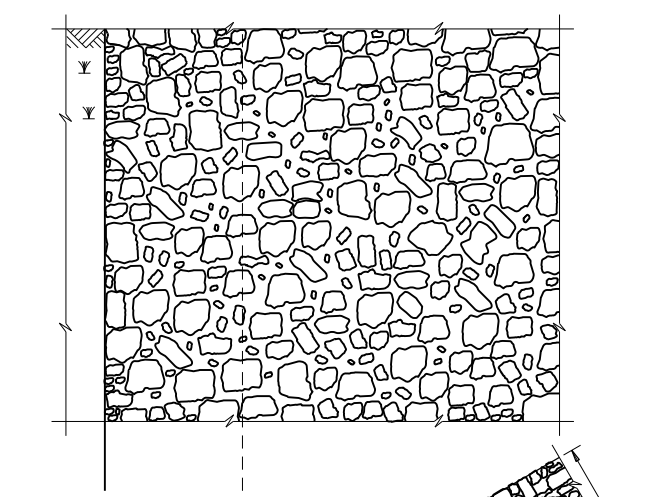
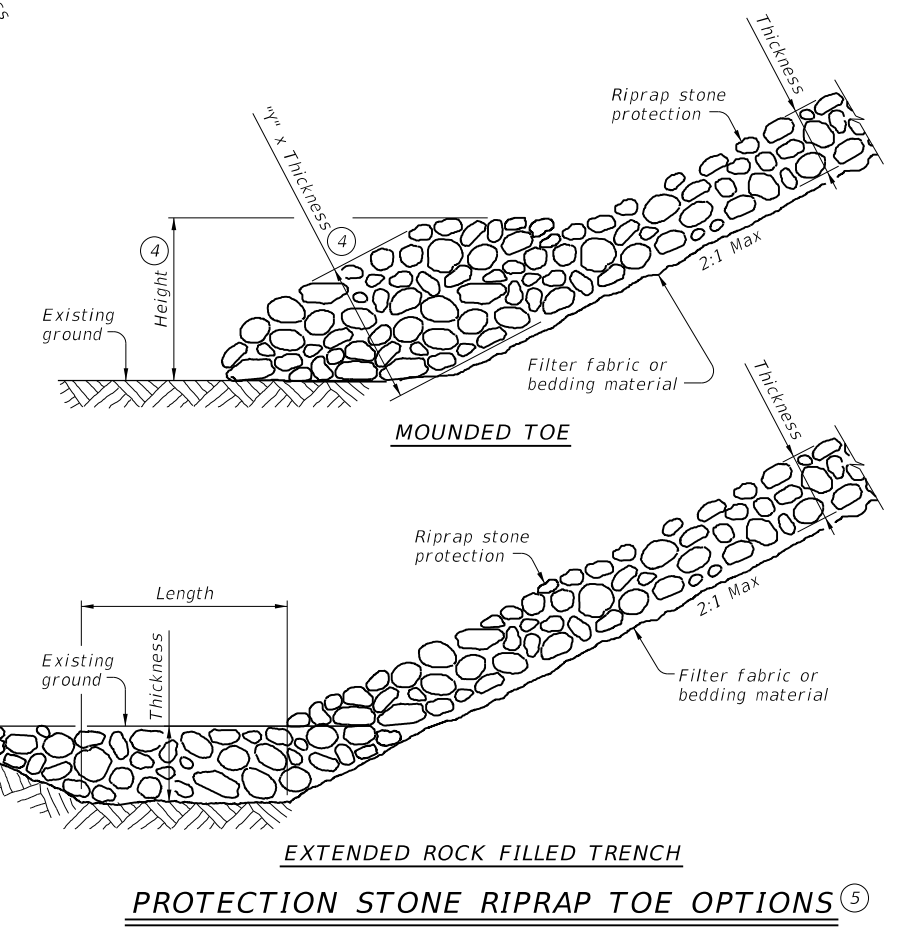


FIGURE 5 ~ PROTECTION STONE RIPRAP ⑤

- 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.



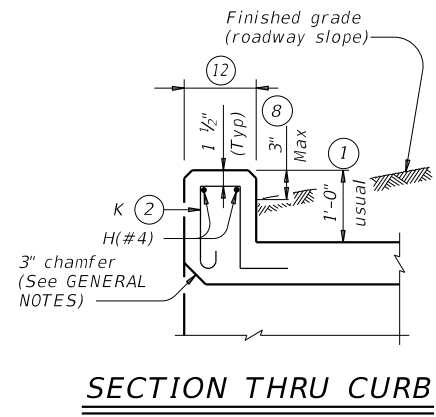
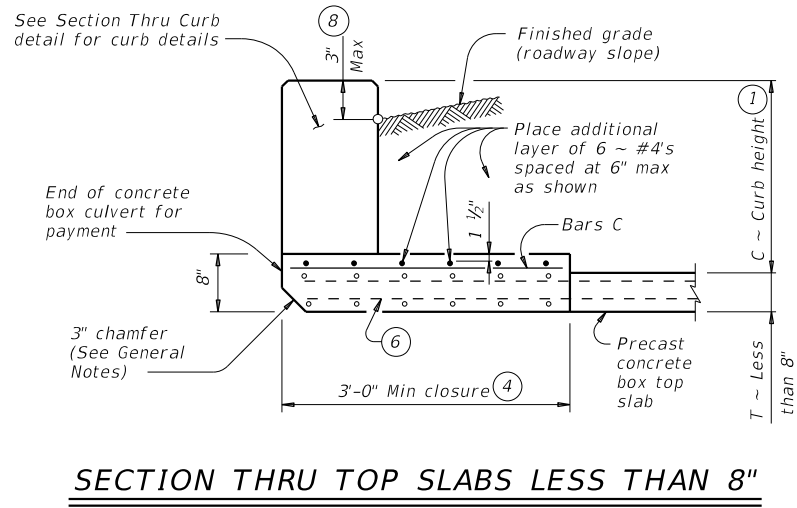
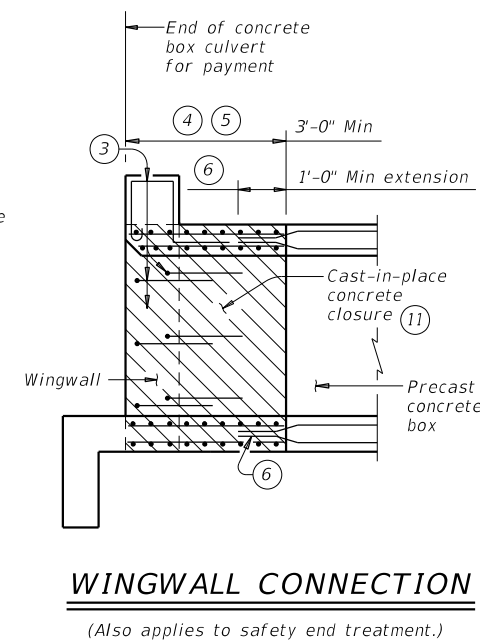
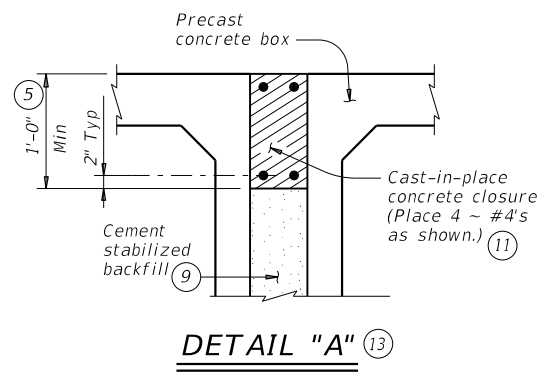
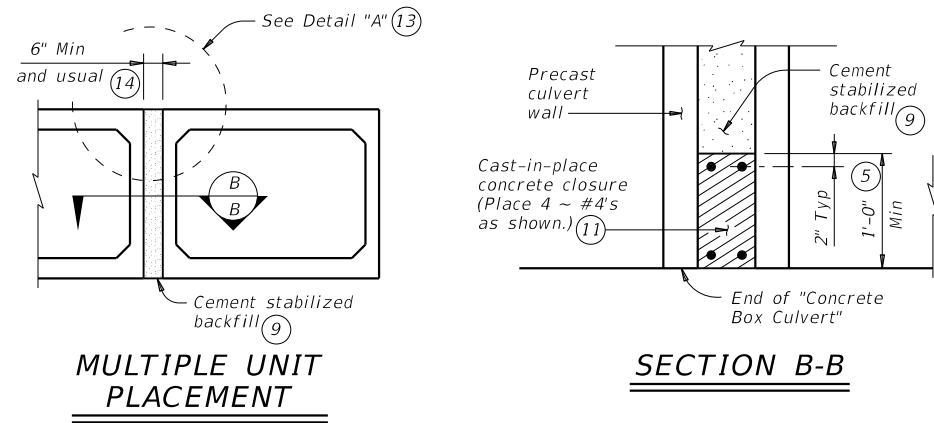
PROTECTION STONE RIPRAP TOE OPTIONS ⑤

SHEET 2 OF 2

		Bridge Division Standard	
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<h3>SRR</h3>			
FILE: srrstdel-19.dgn	DN: AES	CK: JGD	DW: BWH
©TxDOT April 2019	CONT: 0313	SECT: 07	JOB: 020
REVISIONS			HIGHWAY: FM 51
	DIST: FTW	COUNTY: PARKER	SHEET NO.: 69

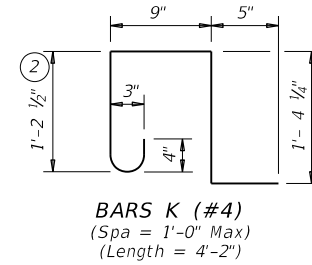
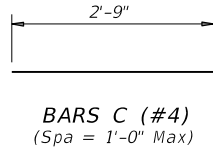
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QUANTITIES PER FOOT OF CURB (10)

Reinforcing Steel	4.12 Lb
Concrete	0.037 CY

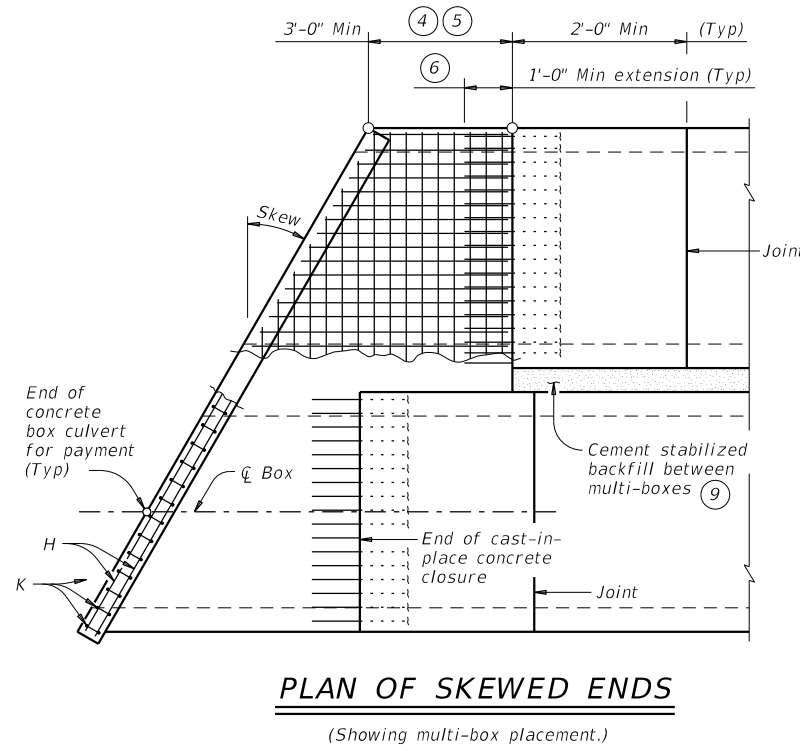
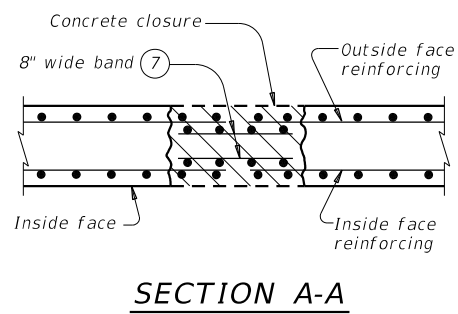
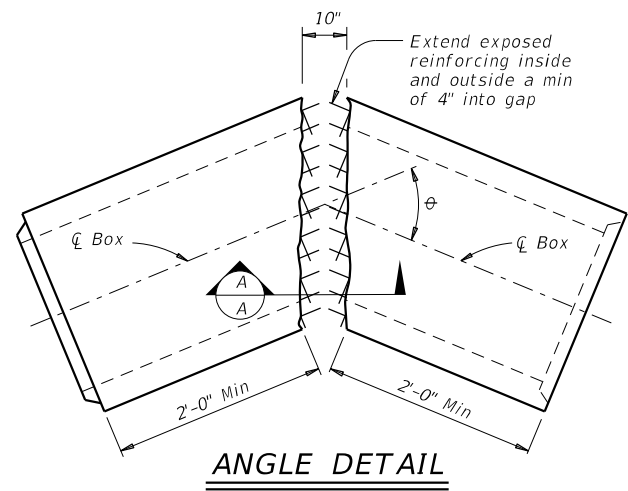


- 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail, or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
- For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.
- Extend curb, wingwall, or safety end treatment reinforcing into concrete closure. Bend or trim, as necessary, any reinforcing that does not fit into closure area.
- Provide a 3'-0" Min cast-in-place concrete closure. Break back boxes in the field or cast boxes short. Provide bands of reinforcing in the closure that are the same size and spacing as in the precast box section. Provide #4 longitudinal reinforcement spaced at 12 inches Max within the closure. Except where shown otherwise, construct the cast-in-place closure flush with the inside and outside faces of the precast box section.
- For multiple unit placements, adjust the length of the closure for the interior walls as necessary. Provide a 3'-0" Min cast-in-place closure in the top slab, bottom slab, and exterior wall. See Section B-B detail when interior walls are cast full length.
- Extend precast box reinforcing a minimum of 1'-0" into concrete closure (Typ).
- Place bands of reinforcing matching the inside and outside face reinforcing in the gaps of the top and bottom slabs. Place a band matching the outside face reinforcing of the wall in the gaps of the walls (placed in the outside face only). Tack weld the bands to the exposed reinforcing at each point of contact.
- For vehicle safety, the following requirements must be met:
 - For structures without bridge rail, construct curbs no more than 3" above finished grade.
 - For structures with bridge rail, construct curbs flush with finished grade. Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- Cement stabilized backfill between boxes is considered part of the box culvert for payment.
- All curb concrete and reinforcing is considered part of the box culvert for payment.
- Any additional concrete and reinforcing required for the closures will be considered subsidiary to the box culvert for payment.
- 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.
- For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in Detail "A".
- This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

MATERIAL NOTES:
 Provide Grade 60 reinforcing steel.
 Provide ASTM A1064 welded wire reinforcement.
 Provide Class C concrete (f'c = 3,600 psi) for the closures.
 Provide cement stabilized backfill meeting the requirements of Item 400, "Excavation and Backfill for Structures."
 Any additional concrete required for the closures will be considered subsidiary to the box culvert.

GENERAL NOTES:
 Designed according to AASHTO LRFD Bridge Design Specifications.
 Refer to the Single Box Culverts Precast (SCP) standard sheets for details and notes not shown.
 Chamfer the bottom edge of the top slab closure 3 inches at culvert closure ends.

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



HL93 LOADING

Texas Department of Transportation
 Bridge Division Standard

**BOX CULVERTS
 PRECAST
 MISCELLANEOUS DETAILS**

SCP-MD

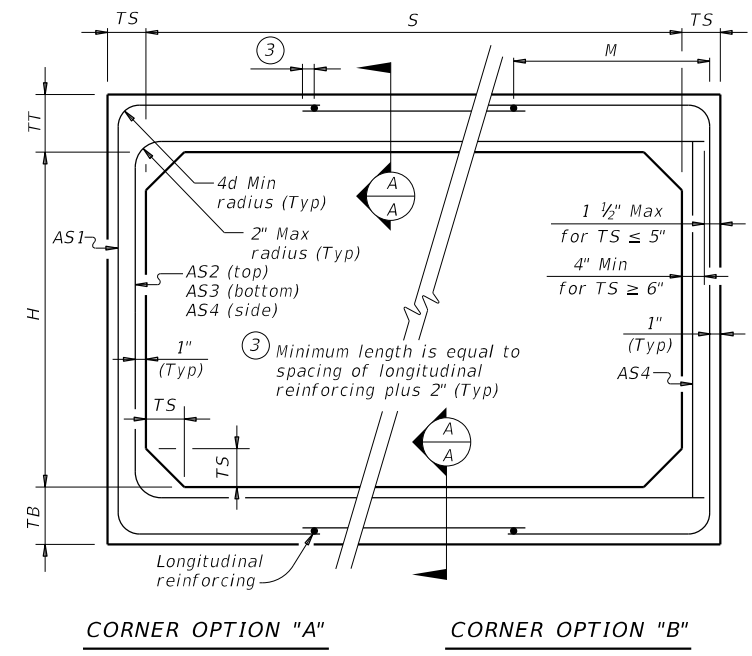
FILE: scpmdsts-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2020	CONTRACT	SECTION	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	70	

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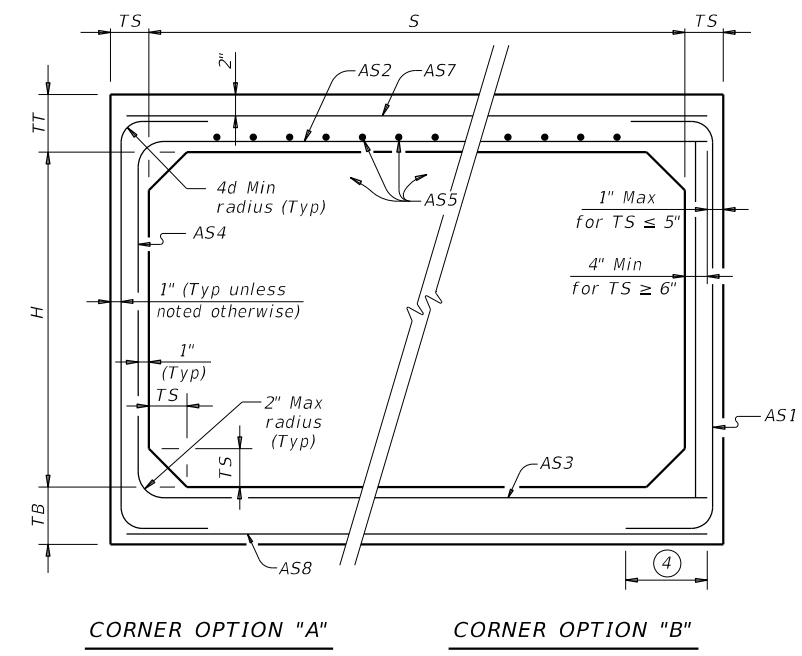
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BOX DATA

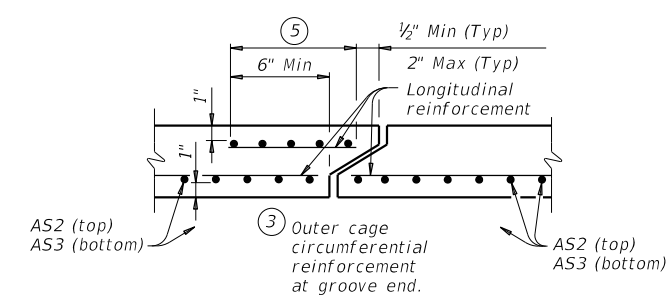
SECTION DIMENSIONS					Fill Height (ft.)	M (Min) (in.)	REINFORCING (sq. in. / ft.) ^②						① Lift Weight (tons)	
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)			AS1	AS2	AS3	AS4	AS5	AS7		AS8
4	2	7.5	6	5	< 2	-	0.18	0.27	0.15	0.12	0.18	0.18	0.14	4.5
4	2	5	5	5	2 < 3	38	0.18	0.19	0.17	0.12	-	-	-	3.6
4	2	5	5	5	3 - 5	38	0.13	0.13	0.13	0.12	-	-	-	3.6
4	2	5	5	5	10	38	0.12	0.12	0.12	0.12	-	-	-	3.6
4	2	5	5	5	15	38	0.14	0.16	0.16	0.12	-	-	-	3.6
4	2	5	5	5	20	38	0.18	0.20	0.21	0.12	-	-	-	3.6
4	2	5	5	5	25	38	0.23	0.25	0.25	0.12	-	-	-	3.6
4	2	5	5	5	30	38	0.28	0.30	0.30	0.12	-	-	-	3.6
4	3	7.5	6	5	< 2	-	0.18	0.31	0.18	0.12	0.18	0.18	0.14	5.0
4	3	5	5	5	2 < 3	38	0.15	0.23	0.20	0.12	-	-	-	4.1
4	3	5	5	5	3 - 5	38	0.12	0.16	0.16	0.12	-	-	-	4.1
4	3	5	5	5	10	38	0.12	0.14	0.14	0.12	-	-	-	4.1
4	3	5	5	5	15	38	0.12	0.18	0.18	0.12	-	-	-	4.1
4	3	5	5	5	20	38	0.14	0.23	0.24	0.12	-	-	-	4.1
4	3	5	5	5	25	38	0.17	0.29	0.29	0.12	-	-	-	4.1
4	3	5	5	5	30	38	0.21	0.35	0.35	0.12	-	-	-	4.1
4	4	7.5	6	5	< 2	-	0.18	0.33	0.20	0.12	0.18	0.18	0.14	5.5
4	4	5	5	5	2 < 3	38	0.12	0.26	0.23	0.12	-	-	-	4.6
4	4	5	5	5	3 - 5	38	0.12	0.18	0.18	0.12	-	-	-	4.6
4	4	5	5	5	10	38	0.12	0.15	0.15	0.12	-	-	-	4.6
4	4	5	5	5	15	38	0.12	0.19	0.20	0.12	-	-	-	4.6
4	4	5	5	5	20	38	0.12	0.25	0.25	0.12	-	-	-	4.6
4	4	5	5	5	25	38	0.14	0.31	0.31	0.12	-	-	-	4.6
4	4	5	5	5	30	38	0.17	0.37	0.37	0.12	-	-	-	4.6



FILL HEIGHT 2 FT AND GREATER



FILL HEIGHT LESS THAN 2 FT



SECTION A-A
 (Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:
 Provide 0.03 sq. in./ft. minimum longitudinal reinforcing at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.
 Provide Class H concrete (f'c = 5,000 psi).

GENERAL NOTES:
 Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.
 See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.
 In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

① For box length = 8'-0"
 ② AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.

HL93 LOADING

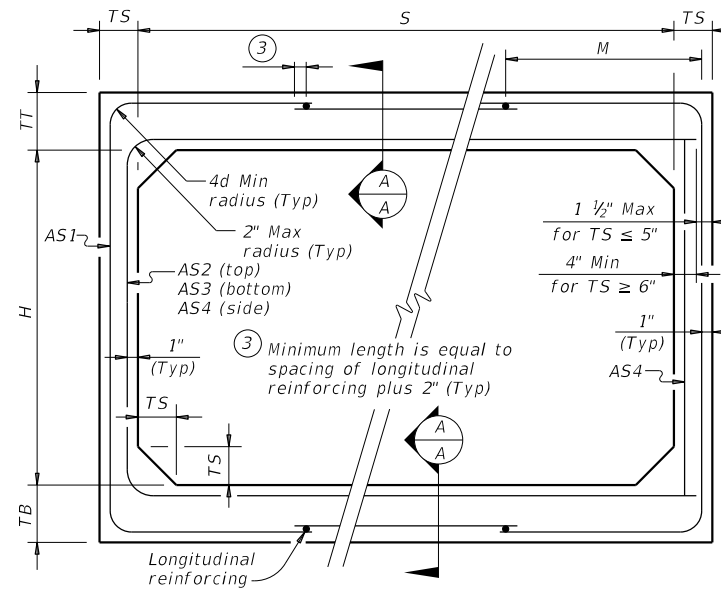
Texas Department of Transportation				Bridge Division Standard	
SINGLE BOX CULVERTS PRECAST 4'-0" SPAN					
SCP-4					
FILE: scp04sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT	
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0313	07	020	FM 51	
	DIST	COUNTY		SHEET NO.	
	FTW	PARKER		71	

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DATE: 10/19/2020 3:05:58 PM
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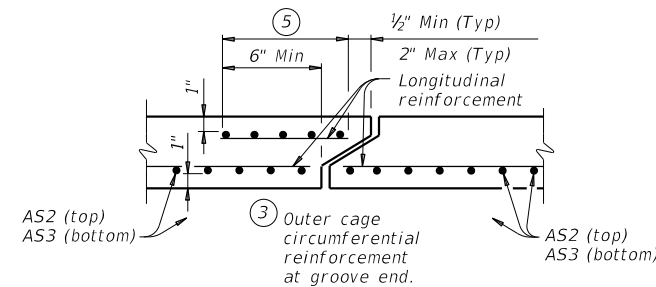
BOX DATA

SECTION DIMENSIONS					Fill Height (ft.)	M (Min) (in.)	REINFORCING (sq. in. / ft.) ^②							① Lift Weight (tons)
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)			AS1	AS2	AS3	AS4	AS5	AS7	AS8	
5	2	8	7	6	< 2	-	0.19	0.27	0.18	0.14	0.19	0.19	0.17	6.0
5	2	6	6	6	2 < 3	44	0.22	0.20	0.16	0.14	-	-	-	5.1
5	2	6	6	6	3 - 5	44	0.16	0.14	0.14	0.14	-	-	-	5.1
5	2	6	6	6	10	36	0.15	0.14	0.14	0.14	-	-	-	5.1
5	2	6	6	6	15	36	0.20	0.18	0.18	0.14	-	-	-	5.1
5	2	6	6	6	20	36	0.26	0.23	0.24	0.14	-	-	-	5.1
5	2	6	6	6	25	36	0.33	0.29	0.29	0.14	-	-	-	5.1
5	2	6	6	6	30	36	0.39	0.34	0.35	0.14	-	-	-	5.1
5	3	8	7	6	< 2	-	0.19	0.31	0.21	0.14	0.19	0.19	0.17	6.6
5	3	6	6	6	2 < 3	45	0.18	0.24	0.19	0.14	-	-	-	5.7
5	3	6	6	6	3 - 5	36	0.14	0.17	0.16	0.14	-	-	-	5.7
5	3	6	6	6	10	36	0.14	0.16	0.17	0.14	-	-	-	5.7
5	3	6	6	6	15	35	0.16	0.21	0.22	0.14	-	-	-	5.7
5	3	6	6	6	20	35	0.21	0.27	0.28	0.14	-	-	-	5.7
5	3	6	6	6	25	35	0.26	0.34	0.34	0.14	-	-	-	5.7
5	3	6	6	6	30	35	0.31	0.41	0.41	0.14	-	-	-	5.7
5	4	8	7	6	< 2	-	0.19	0.33	0.24	0.14	0.19	0.19	0.17	7.2
5	4	6	6	6	2 < 3	45	0.16	0.27	0.22	0.14	-	-	-	6.3
5	4	6	6	6	3 - 5	45	0.14	0.19	0.18	0.14	-	-	-	6.3
5	4	6	6	6	10	36	0.14	0.18	0.18	0.14	-	-	-	6.3
5	4	6	6	6	15	35	0.14	0.23	0.24	0.14	-	-	-	6.3
5	4	6	6	6	20	35	0.17	0.30	0.31	0.14	-	-	-	6.3
5	4	6	6	6	25	35	0.21	0.37	0.38	0.14	-	-	-	6.3
5	4	6	6	6	30	35	0.25	0.44	0.45	0.14	-	-	-	6.3
5	5	8	7	6	< 2	-	0.19	0.35	0.26	0.14	0.19	0.19	0.17	7.8
5	5	6	6	6	2 < 3	45	0.14	0.29	0.24	0.14	-	-	-	6.9
5	5	6	6	6	3 - 5	45	0.14	0.21	0.20	0.14	-	-	-	6.9
5	5	6	6	6	10	45	0.14	0.19	0.20	0.14	-	-	-	6.9
5	5	6	6	6	15	36	0.14	0.24	0.25	0.14	-	-	-	6.9
5	5	6	6	6	20	35	0.15	0.31	0.32	0.14	-	-	-	6.9
5	5	6	6	6	25	35	0.18	0.38	0.39	0.14	-	-	-	6.9
5	5	6	6	6	30	35	0.21	0.46	0.47	0.14	-	-	-	6.9



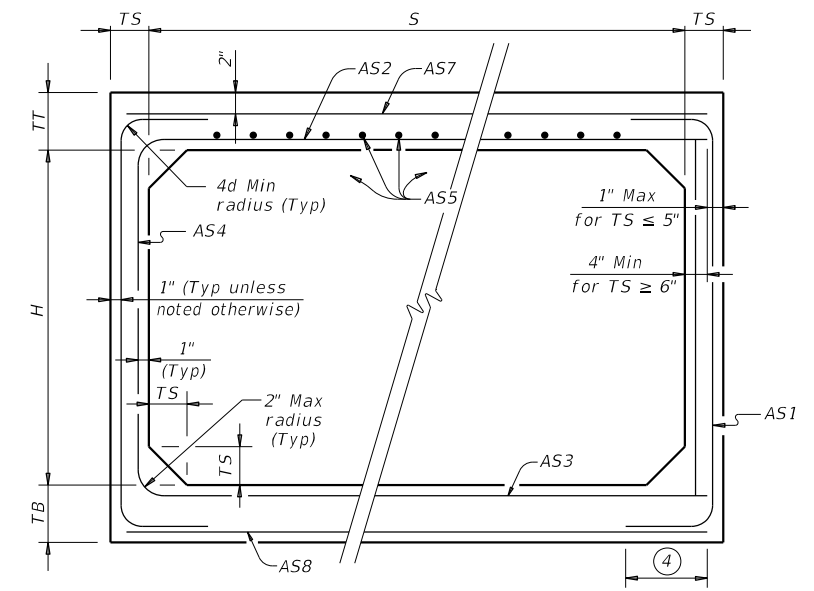
CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT 2 FT AND GREATER



SECTION A-A

(Showing top and bottom slab joint reinforcement.)



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

④ Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcing at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.
 Provide Class H concrete (f'c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.
 See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.
 In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

		Bridge Division Standard	
SINGLE BOX CULVERTS PRECAST 5'-0" SPAN			
SCP-5			
FILE: scp05sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
©TxDOT February 2020	CONT: 0313	SECT: 07	JOB: 020
REVISIONS	DIST: FTW		COUNTY: PARKER
			SHEET NO.: 72

① For box length = 8'-0"

② AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.

DATE: 10/19/2020 3:06:03 PM
 FILE: c:\pwworking\kno\pwworking\dms30455\chfw15se-20.dgn
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TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL ⑤

Slope	Dia of Pipe (D)	Values for One Pipe					Values to be Added for Each Add'l Pipe			
		W	X	Y	L	Reinf (Lbs)	Conc (CY) ①	X and W	Reinf (Lbs)	Conc (CY) ①
2:1	12"	3'-3 1/2"	2'-8 3/4"	2'-10"	3'-3 1/4"	85	0.5	1'-9 3/4"	20	0.2
	15"	3'-10 1/2"	3'-0 1/4"	3'-4"	3'-10 1/4"	97	0.6	2'-3"	25	0.3
	18"	4'-5 1/2"	3'-4"	3'-10"	4'-5"	119	0.8	2'-9 1/4"	32	0.4
	21"	5'-0 3/4"	3'-7 1/2"	4'-4"	5'-0"	134	0.9	3'-2 1/4"	43	0.5
	24"	5'-9 1/4"	4'-0 3/4"	4'-10"	5'-7"	154	1.1	3'-8 1/2"	51	0.6
	27"	6'-4 1/2"	4'-4 1/2"	5'-4"	6'-2"	164	1.3	4'-0 3/4"	57	0.7
	30"	6'-11 1/2"	4'-8"	5'-10"	6'-8 3/4"	187	1.5	4'-5 3/4"	67	0.8
	33"	7'-6 1/2"	4'-11 3/4"	6'-4"	7'-3 3/4"	205	1.7	4'-10"	73	0.9
	36"	8'-1 3/4"	5'-3 1/4"	6'-10"	7'-10 3/4"	231	1.9	5'-3 1/4"	82	1.1
	42"	9'-3 3/4"	5'-10 1/2"	7'-10"	9'-0 1/2"	271	2.4	6'-0 1/2"	100	1.4
	48"	10'-9 1/2"	6'-5 3/4"	9'-4"	10'-9 1/4"	325	3.2	6'-9 3/4"	121	1.8
	54"	11'-11 3/4"	7'-1"	10'-4"	11'-11 1/4"	384	3.8	7'-9 1/4"	154	2.2
60"	13'-1 3/4"	7'-8 1/4"	11'-4"	13'-1"	431	4.5	8'-6 3/4"	178	2.6	
66"	14'-4"	8'-3 1/2"	12'-4"	14'-3"	489	5.3	9'-0 3/4"	198	3.0	
72"	15'-6 1/4"	8'-10 3/4"	13'-4"	15'-4 3/4"	537	6.1	9'-8"	220	3.3	
3:1	12"	4'-1 1/4"	2'-8 3/4"	4'-3"	4'-11"	108	0.7	1'-9 3/4"	23	0.2
	15"	4'-10"	3'-0 1/4"	5'-0"	5'-9 1/4"	127	0.9	2'-3"	29	0.3
	18"	5'-7"	3'-4"	5'-9"	6'-7 3/4"	156	1.1	2'-9 1/4"	37	0.5
	21"	6'-3 3/4"	3'-7 1/2"	6'-6"	7'-6"	177	1.3	3'-2 1/4"	49	0.6
	24"	7'-2"	4'-0 3/4"	7'-3"	8'-4 1/2"	204	1.6	3'-8 1/2"	59	0.7
	27"	7'-11"	4'-4 1/2"	8'-0"	9'-2 3/4"	225	1.9	4'-0 3/4"	68	0.9
	30"	8'-7 3/4"	4'-8"	8'-9"	10'-1 1/4"	260	2.2	4'-5 3/4"	79	1.0
	33"	9'-4 1/2"	4'-11 3/4"	9'-6"	10'-11 3/4"	282	2.5	4'-10"	86	1.2
	36"	10'-1 1/4"	5'-3 1/4"	10'-3"	11'-10"	313	2.9	5'-3 1/4"	97	1.4
	42"	11'-7"	5'-10 1/2"	11'-9"	13'-6 3/4"	379	3.7	6'-0 1/2"	122	1.8
	48"	13'-5 3/4"	6'-5 3/4"	14'-0"	16'-2"	465	4.9	6'-9 3/4"	152	2.4
	54"	14'-11 1/2"	7'-1"	15'-6"	17'-10 3/4"	544	5.9	7'-9 1/4"	190	3.0
60"	16'-5"	7'-8 1/4"	17'-0"	19'-7 1/2"	616	7.0	8'-6 1/2"	224	3.5	
66"	17'-10 3/4"	8'-3 1/2"	18'-6"	21'-4 1/4"	701	8.1	9'-0 3/4"	248	4.0	
72"	19'-4 1/4"	8'-10 3/4"	20'-0"	23'-1 1/4"	786	9.4	9'-8"	281	4.6	
4:1	12"	4'-11"	2'-8 3/4"	5'-8"	6'-6 1/2"	136	0.9	1'-9 3/4"	26	0.3
	15"	5'-9 1/2"	3'-0 1/4"	6'-8"	7'-8 1/2"	162	1.2	2'-3"	33	0.4
	18"	6'-8 1/4"	3'-4"	7'-8"	8'-10 1/4"	198	1.5	2'-9 1/4"	43	0.6
	21"	7'-6 3/4"	3'-7 1/2"	8'-8"	10'-0"	232	1.8	3'-2 1/4"	57	0.7
	24"	8'-6 3/4"	4'-0 3/4"	9'-8"	11'-2"	264	2.2	3'-8 1/2"	68	0.9
	27"	9'-5 1/4"	4'-4 1/2"	10'-8"	12'-3 3/4"	292	2.6	4'-0 3/4"	79	1.1
	30"	10'-4"	4'-8"	11'-8"	13'-5 3/4"	333	3.0	4'-5 3/4"	91	1.3
	33"	11'-2 1/2"	4'-11 3/4"	12'-8"	14'-7 1/2"	368	3.5	4'-10"	104	1.5
	36"	12'-1"	5'-3 1/4"	13'-8"	15'-9 1/4"	411	4.0	5'-3 1/4"	115	1.7
	42"	13'-10"	5'-10 1/2"	15'-8"	18'-1"	495	5.1	6'-0 1/2"	144	2.2
	48"	16'-2 1/4"	6'-5 3/4"	18'-8"	21'-6 3/4"	612	6.8	6'-9 3/4"	183	3.0
	54"	17'-11 1/4"	7'-1"	20'-8"	23'-10 1/4"	729	8.2	7'-9 1/4"	231	3.7
60"	19'-8 1/4"	7'-8 1/4"	22'-8"	26'-2"	824	9.8	8'-6 1/2"	270	4.4	
66"	21'-5 1/2"	8'-3 1/2"	24'-8"	28'-5 3/4"	947	11.4	9'-0 3/4"	305	5.0	
72"	23'-2 1/2"	8'-10 3/4"	26'-8"	30'-9 1/2"	1,060	13.2	9'-8"	342	5.7	
6:1	12"	6'-6 3/4"	2'-8 3/4"	8'-6"	9'-9 3/4"	192	1.4	1'-9 3/4"	30	0.4
	15"	7'-8 3/4"	3'-0 1/4"	10'-0"	11'-6 1/2"	230	1.9	2'-3"	40	0.5
	18"	8'-10 3/4"	3'-4"	11'-6"	13'-3 1/4"	281	2.4	2'-9 1/4"	51	0.7
	21"	10'-0 3/4"	3'-7 1/2"	13'-0"	15'-0 1/4"	334	2.9	3'-2 1/4"	69	1.0
	24"	11'-4 1/4"	4'-0 3/4"	14'-6"	16'-9"	377	3.5	3'-8 1/2"	83	1.3
	27"	12'-6 1/4"	4'-4 1/2"	16'-0"	18'-5 3/4"	428	4.2	4'-0 3/4"	98	1.5
	30"	13'-8 1/4"	4'-8"	17'-6"	20'-2 1/2"	488	4.9	4'-5 3/4"	113	1.8
	33"	14'-10 1/4"	4'-11 3/4"	19'-0"	21'-11 1/4"	551	5.7	4'-10"	130	2.0
	36"	16'-0 1/4"	5'-3 1/4"	20'-6"	23'-8"	606	6.5	5'-3 1/4"	145	2.4
	42"	18'-4 1/2"	5'-10 1/2"	23'-6"	27'-1 1/2"	740	8.4	6'-0 1/2"	184	3.1
	48"	21'-6 3/4"	6'-5 3/4"	28'-0"	32'-4"	946	11.4	6'-9 3/4"	240	4.1
	54"	23'-10 3/4"	7'-1"	31'-0"	35'-9 1/2"	1,124	13.8	7'-9 1/4"	303	5.2
60"	26'-2 3/4"	7'-8 1/4"	34'-0"	39'-3"	1,278	16.4	8'-6 1/2"	358	6.2	

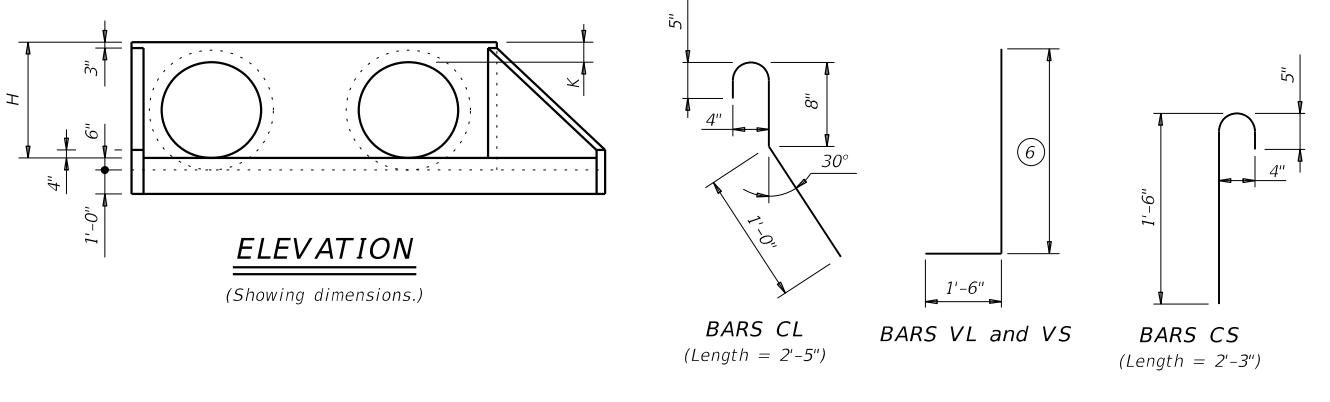
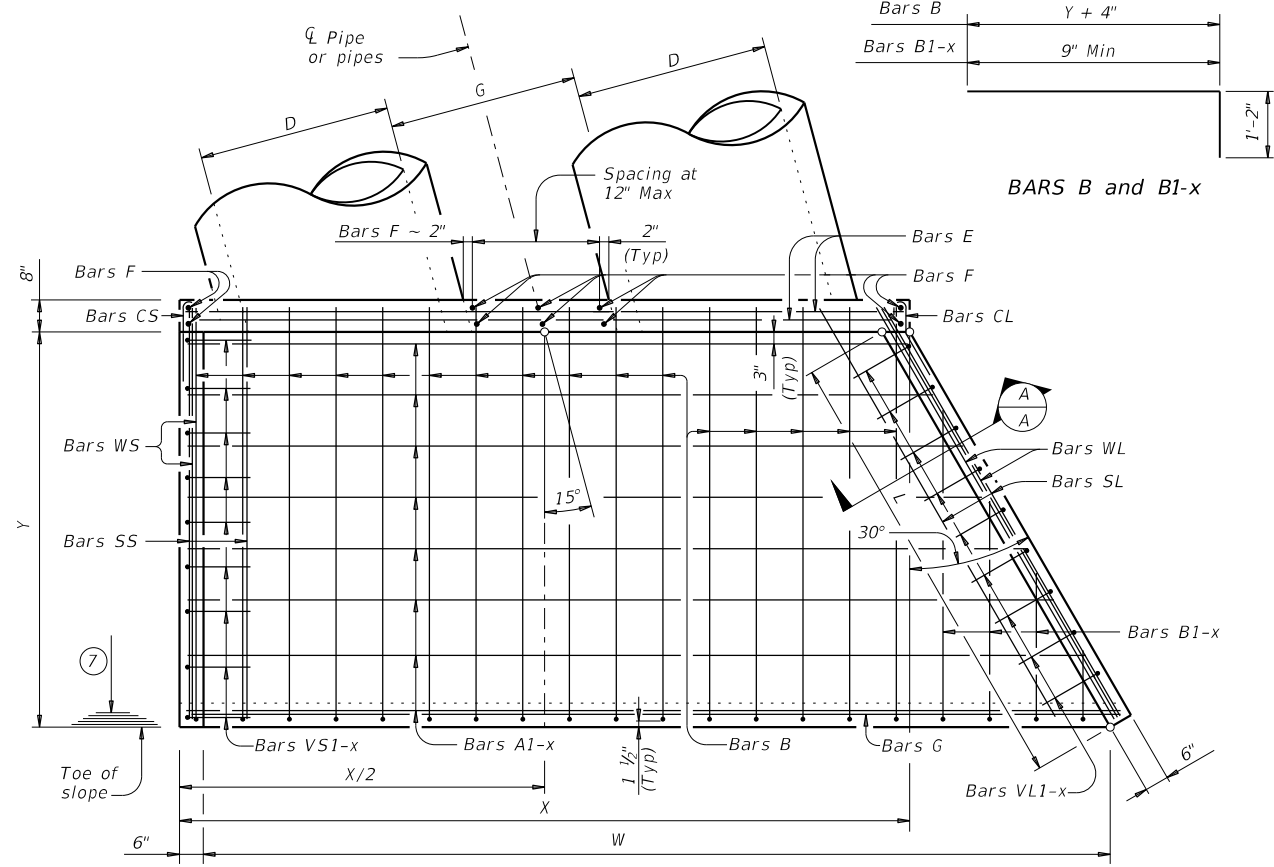


TABLE OF ⑤ REINFORCING STEEL

Bar	Size	Spa	No.
A	#4	1'-0"	~
B	#3	1'-6"	~
CL & CS	#4	1'-0"	~
D	#3	1'-0"	~
E	#5	~	4
F	#5	~	~
G	#3	~	2
SL & SS	#4	~	6
VL & VS	#4	1'-0"	~
WL & WS	#5	~	4

TABLE OF CONSTANT DIMENSIONS

Dia of Pipe (D)	G	K ④	H
12"	0'-9"	1'-0"	2'-0"
15"	0'-11"	1'-0"	2'-3"
18"	1'-2"	1'-0"	2'-6"
21"	1'-4"	1'-0"	2'-9"
24"	1'-7"	1'-0"	3'-0"
27"	1'-8"	1'-0"	3'-3"
30"	1'-10"	1'-0"	3'-6"
33"	1'-11"	1'-0"	3'-9"
36"	2'-1"	1'-0"	4'-0"
42"	2'-4"	1'-0"	4'-6"
48"	2'-7"	1'-3"	5'-3"
54"	3'-0"	1'-3"	5'-9"
60"	3'-3"	1'-3"	6'-3"
66"	3'-3"	1'-3"	6'-9"
72"	3'-4"	1'-3"	7'-3"

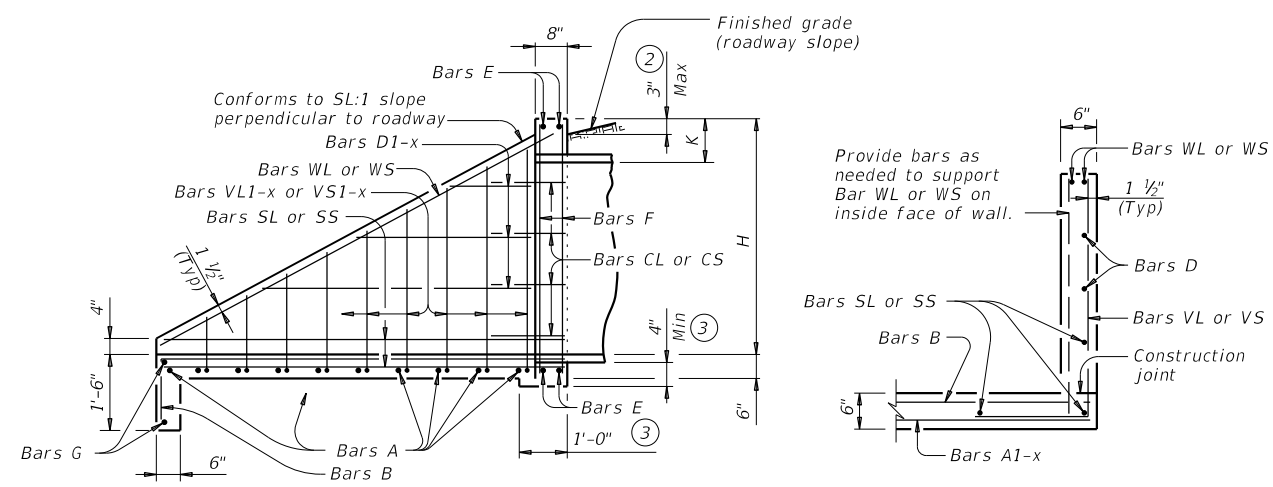


- ① Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.
- ② For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- ③ Provide a 1'-0" footing as shown where required to maintain 4" minimum cover for pipes.
- ④ Dimensions shown are usual and maximum.
- ⑤ Quantities shown are for one structure end only (one headwall).
- ⑥ $Min\ Length = 6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L} \right)$
 $Max\ Length = 12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L} \right) - 1"$
- ⑦ Lengths of wings based on SL:1 slope along this line.

MATERIAL NOTES:
Provide Grade 60 reinforcing steel.
Provide Class C concrete ($f'c = 3,600\ psi$).

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
Do not mount bridge rails of any type directly to these culvert headwalls.
This standard may not be used for wall heights, H, exceeding the values shown.

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



Texas Department of Transportation Bridge Division Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 15° SKEW PIPE CULVERTS

CH-FW-15

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REVISIONS	CONT	SECT	JOB	HIGHWAY
	0313	07	020	FM 51
DIST	COUNTY		SHEET NO.	
FTW	PARKER		73	

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TABLE OF DIMENSIONS AND REINFORCING STEEL
 (Wings for One Structure End)

Maximum Wingwall Height (10)Hw	Dimensions				Variable Reinforcing				Estimated Quantities per ft of wing length (Two-Wings)	
	W	X	Y	Z	Bars J1		Bars J2		Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721

TABLE OF WINGWALL REINFORCING (Two-Wings)

Bar	Size	No.	Spa
DL & DS	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
RL	#5	3	~
RS	#5	3	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)	2.45		
Conc (CY/Ft)	0.037		

TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES

Bar	Size	No.	Spa
K	#4	~	1'-0"
N	#5	6	~
OL	#4	3	~
OS	#4	3	~
Reinf (Lb/Ft)	9.82		
Conc (CY/Ft)	0.074		

- Extend Bars P 3'-0" Min into bottom slab of box culvert.
- Adjust to fit as necessary to maintain 11#2" clearcover and 4" Min between bars.
- Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by 0.5 (A+Lw).
- Recommended values of slope are: 3:1, 4:1, and 6:1. Provide 3:1 or flatter slope.
- When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, extend construction joints or grooved joints, oriented in the direction of flow, across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B is not required.
- At Contractor's option, end the culvert toewall flush with wingwall toewall. Adjust reinforcing as needed.
- 3" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet.
- For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.
- Culvert skew (limit to 15° or 30°)
- See Table of Maximum Wing Heights for various slopes. Height is limited based on a 33'-6" maximum safety pipe runner length.
- Typical wingwall angle for all skews.

TABLE OF MAXIMUM WING HEIGHTS

Side Slope	Hw Max
3:1	11'-5"
4:1	8'-10"
6:1	6'-1"

WING DIMENSION CALCULATIONS:

Formulas:
 $Hw = H + T + C - 0.250^{(10)}$
 $A = (Hw - 0.333') (SL)$
 $B = (A) [\tan(\theta + 15^\circ)]$
 $Lw = (A) + [\cos(\theta + 15^\circ)]$
 For cast-in-place culverts:
 $Ltw = [(N)(S) + (N + 1)(U)] \div (\cos \theta)$
 For precast culverts:
 $Ltw = [(N)(2U + S) + (N - 1)(0.500')] \div (\cos \theta)$
 $Lc = (Ltw) - (2U) \div (\cos \theta)$
 $Atw = (Lc) + (B)$
 Total Wingwall Area (two wings ~ S.F.)
 $= (0.5) (Hw + 0.333') (Lw + A)$

Hw = Height of wingwall (feet)
 SL:1 = Side slope ratio (horizontal : 1 vertical)
 Lw = Length of wingwall (feet)
 Ltw = Culvert toewall length (feet)
 Lc = Culvert curb between wings (feet)
 Atw = Anchor toewall length (feet)
 N = Number of culvert spans
 θ = Culvert skew
 See applicable box culvert standard for H, S, T, and U values.
 See Table of Maximum Wall Heights for limits on Hw.

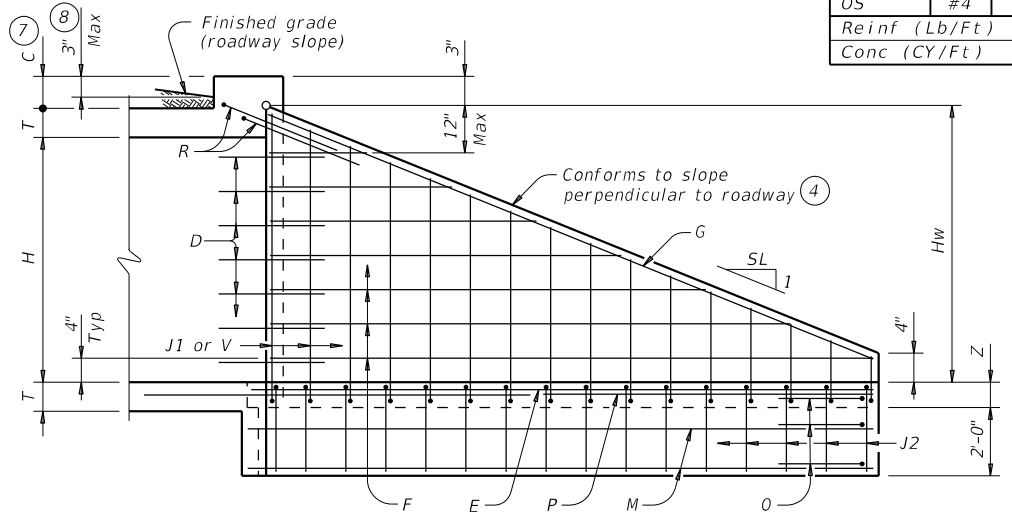
MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
 Provide galvanized reinforcing steel if required elsewhere in the plans.
 Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.
 Provide Class "C" concrete (f'c = 3,600 psi).
 Adjust reinforcing as necessary to provide a minimum clear cover of 1 1/2".
 Provide pipe runners and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
 Provide ASTM A307 bolts and nuts.
 Provide ASTM A36 steel plates.
 Galvanize all steel components, except reinforcing unless required elsewhere in the plans, after fabrication.
 Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".
 For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Provide anchorage rods that are clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

GENERAL NOTES:

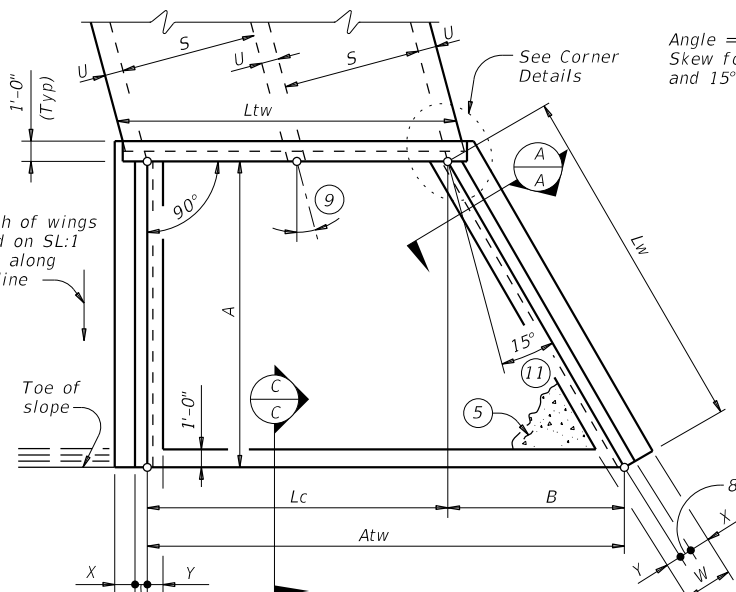
Designed according to AASHTO LRFD Bridge Design Specifications.
 The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.
 Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.
 When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
 All bolts, nuts, washers, brackets, angles, and pipe runners are considered parts of the safety end treatment for payment.
 The quantities for pipe runners, reinforcing steel, and concrete, resulting from the formulas given herein are for Contractor's information only.
 See Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.

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



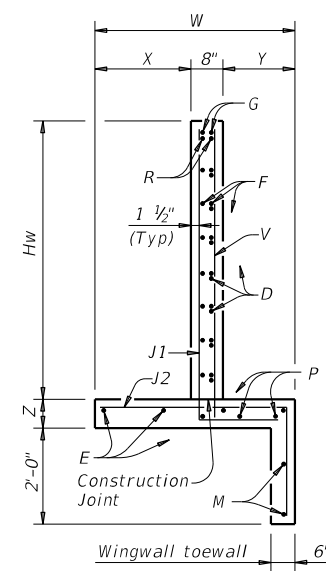
INSIDE ELEVATION OF WINGWALL

(Showing reinforcing. Culvert and culvert toewall reinforcing not shown for clarity.)

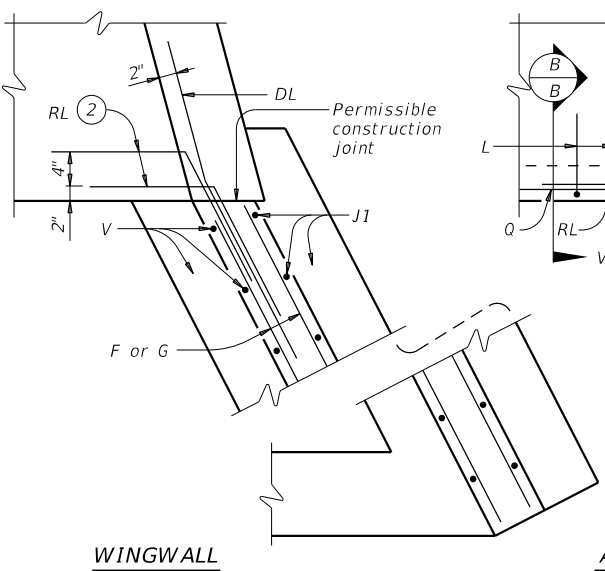


PLAN

(Showing dimensions and 15° skew.)

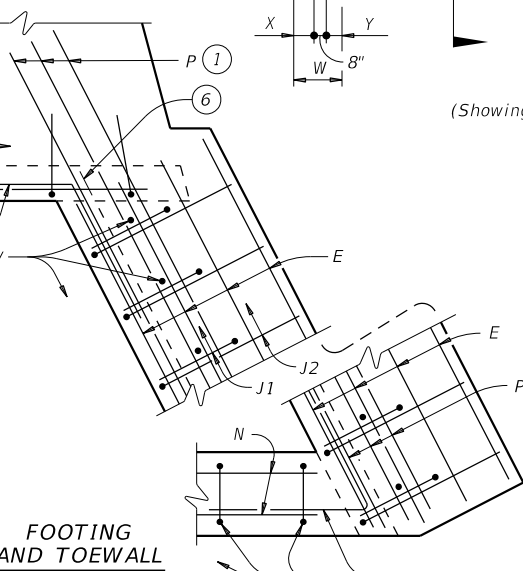


SECTION A-A

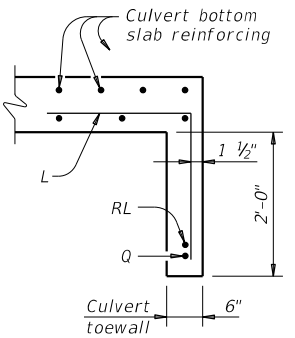


CORNER DETAILS

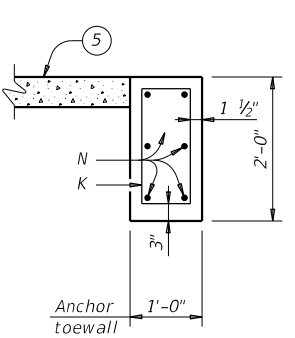
(Culvert and culvert toewall reinforcing not shown for clarity.)



FOOTING AND TOEWALL



SECTION B-B



SECTION C-C

Texas Department of Transportation
 Bridge Division Standard

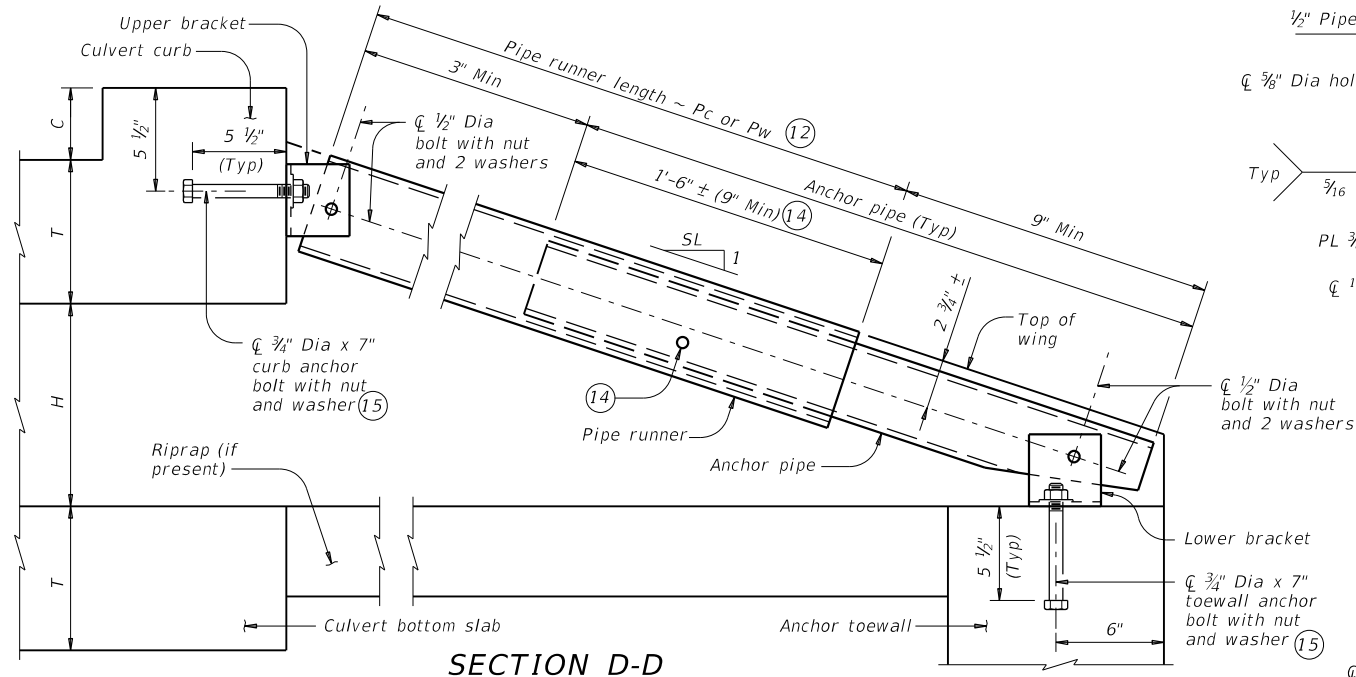
SAFETY END TREATMENT WITH FLARED WINGS
 FOR 15° AND 30° SKEW BOX CULVERTS
 TYPE I ~ CROSS DRAINAGE

SETB-FW-S

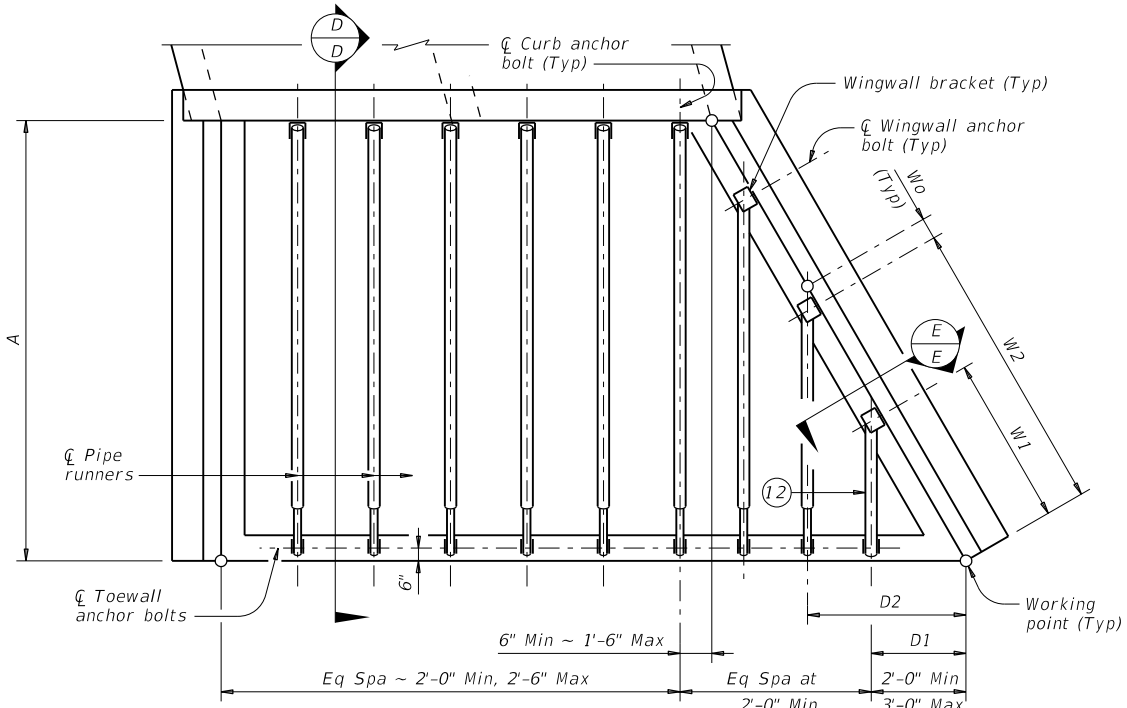
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REVISIONS	CONTRACT	SECTION	JOB	HIGHWAY
0313	07	020	FM 51	
DIST	COUNTY	SHEET NO.		
FTW	PARKER	75		

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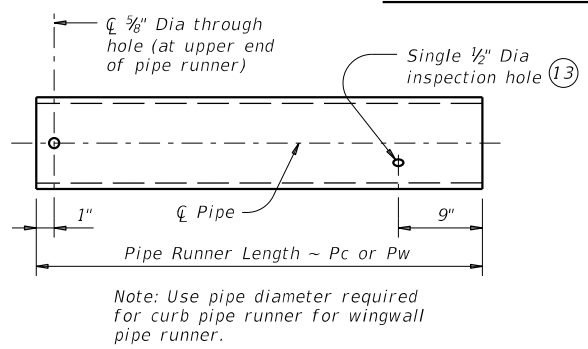
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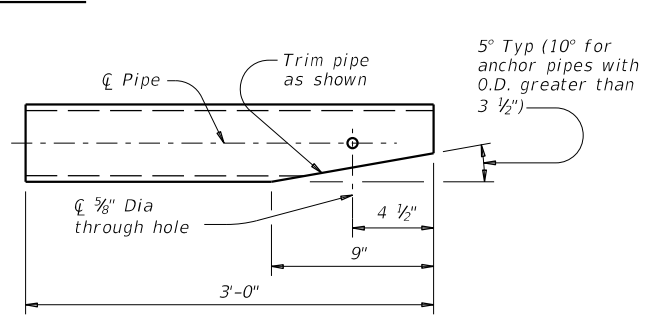
SECTION D-D
 (Showing curb pipe runner. Except for upper bracket, wingwall pipe runners are similar.)



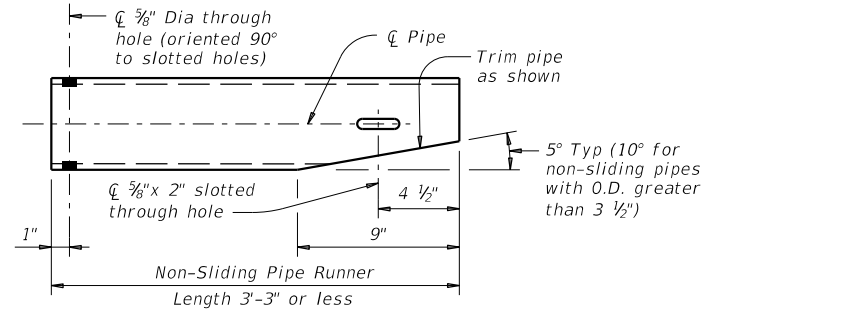
PIPE RUNNER PLAN



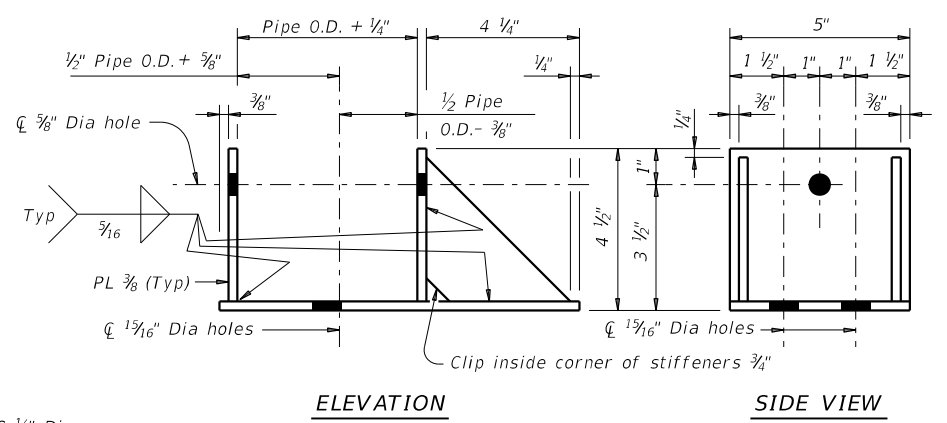
PIPE RUNNER DETAILS



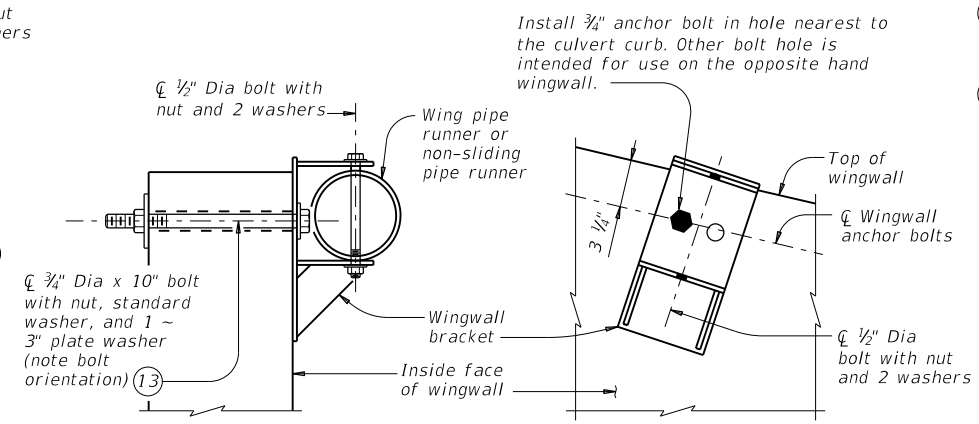
ANCHOR PIPE DETAILS



NON-SLIDING PIPE RUNNER DETAILS



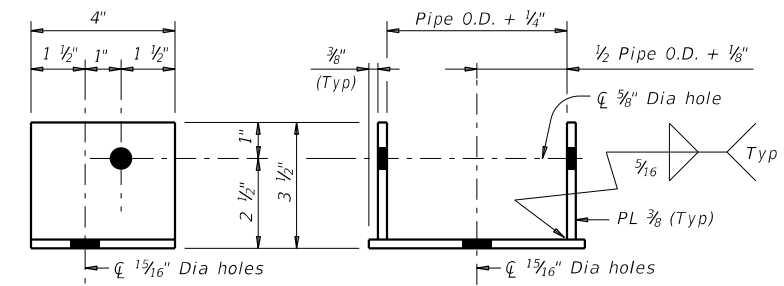
ELEVATION SIDE VIEW



SECTION E-E ELEVATION
 (Showing installed bracket.) (Showing installed bracket normal to wall. Pipe not shown for clarity.)

Note: Match wingwall bracket to the upper curb bracket size.

WINGWALL BRACKET DETAILS



SIDE VIEW ELEVATION

Note: Match upper and lower brackets, except for the brackets used with non-sliding pipe runners, to the required pipe diameters as shown in the table.

UPPER AND LOWER BRACKET DETAILS

MAXIMUM PIPE RUNNER LENGTHS AND REQUIRED PIPE RUNNER AND ANCHOR PIPE SIZES

Maximum Pipe Runner Length (Pc or Pw)	Required Pipe Runner Size			Required Anchor Pipe Size		
	Pipe Size	Pipe O.D.	Pipe I.D.	Pipe Size	Pipe O.D.	Pipe I.D.
9'-4"	3" STD	3.500"	3.068"	2" STD	2.375"	2.067"
19'-0"	4" STD	4.500"	4.026"	3" STD	3.500"	3.068"
33'-6"	5" STD	5.563"	5.047"	4" STD	4.500"	4.026"

- 12 If pipe runner length (Pw) is 1'-9" or less, replace the normal pipe runner and anchor pipe with a single non-sliding pipe runner. See Non-Sliding Pipe Runner Details for additional information.
- 13 At Contractor's option, 3/8" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.
- 14 After installation of pipe runner, use the 1/2" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.
- 15 At Contractor's option, an adhesive anchor may be used. Provide 3/4" Dia adhesive anchors that meet the requirements of ASTM A307, Gr A fully threaded rods. Embed threaded rods into curb, wingwalls, and toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 1/2". Provide anchor adhesive able to achieve a basic bond strength in tension, Nba, of 20 kips. 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.

PIPE RUNNER DIMENSION CALCULATIONS:

Wn = (K3) (Dn) - (Wo)
 Pwn = (Dn) (K2) - (2.063')
 Pw1 Non-Sliding Pipe Runner (If required)
 = (D1) (K2) - (0.563')
 Pc = (A) (K1) - (1.688')

Wn = Distance from working point to centerline anchor bolt measured along bottom inside face of wing (feet)
 Dn = Distance from working point to centerline pipe runner measured along outside face of anchor toewall (feet)
 Pw = Wingwall pipe runner length (feet)
 Pc = Curb pipe runner length (feet)
 K = Constant values for use in formulas
 Slope SL:1 K1 K2-15° Skew K2-30° Skew
 3:1 ~ 1.054 ~ 1.826 ~ 1.054
 4:1 ~ 1.031 ~ 1.785 ~ 1.031
 6:1 ~ 1.014 ~ 1.756 ~ 1.014
 K3 = 15° Skew ~ 2.000
 30° Skew ~ 1.414
 n = Wing pipe runner number
 Wo = 15° Skew ~ 5"
 30° Skew ~ 2 1/2"

Texas Department of Transportation
 Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS
 FOR 15° AND 30° SKEW BOX CULVERTS
 TYPE I ~ CROSS DRAINAGE

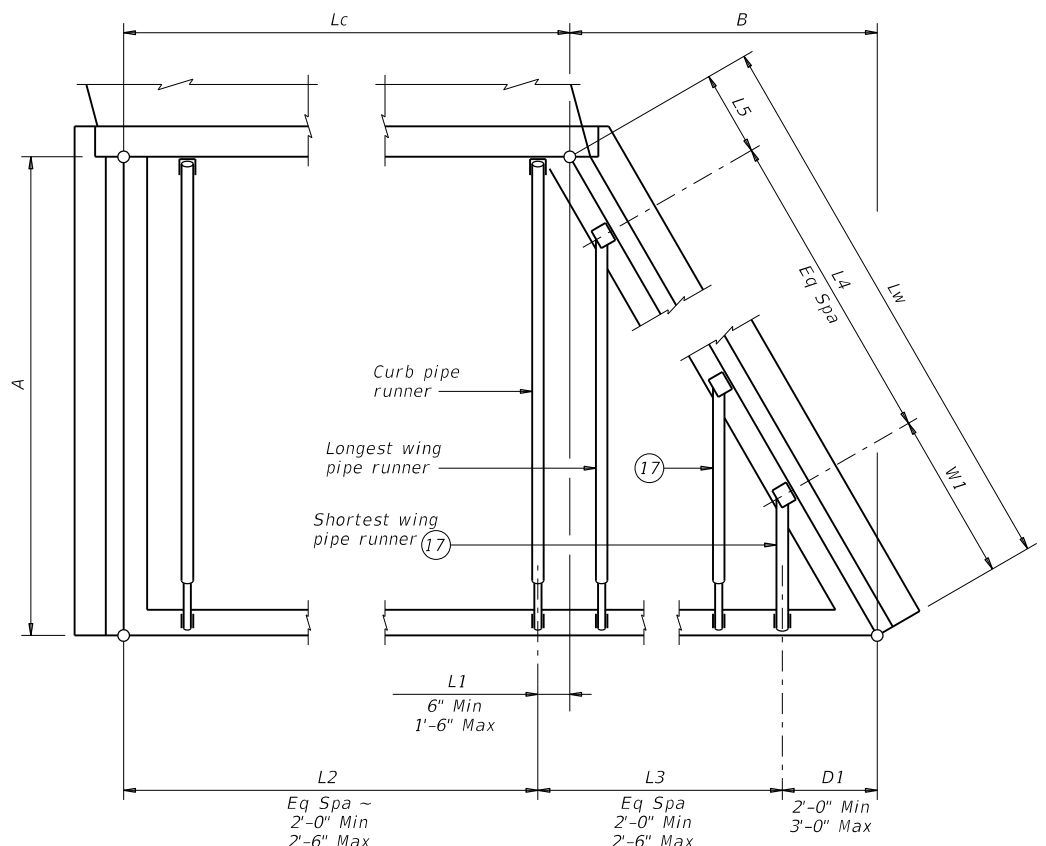
SETB-FW-S

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©TxDOT REVISIONS	0313	07	020	FM 51
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Culvert Station and/or Creek name followed by applicable end (Lt, Rt or Both) ⁽¹⁶⁾	Lc (Ft)	L1 (Ft)	L2			D1 (Ft)	L3			W1 (Ft)	L4			L5 (Ft)	Curb Pipe Runner (Pc)		Longest Wing Pipe Runner (Pw) (Ft)	Shortest Wing Pipe Runner (Pw) (Ft)	Non-Sliding Wing Pipe Runner (if applicable) (Ft)	Curb, Wing, and/or Non-Sliding Pipe Runners		3'-0" Anchor Pipe		
			No. Spa	Spa at (Ft)	Overall Length (Ft)		No. Spa	Spa at (Ft)	Overall Length (Ft)		No. Spa	Spa at (Ft)	Overall Length (Ft)		No.	Length (Ft)				Size (3", 4" or 5")	Total Length ⁽¹⁶⁾ (Ft)	Size (2", 3" or 4")	Total Length ⁽¹⁶⁾ (Ft)	



- ⁽¹⁶⁾ Quantities shown are for one structure end if Lt or Rt. Quantities shown are for two structure ends if Both.
- ⁽¹⁷⁾ If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner as the shortest.

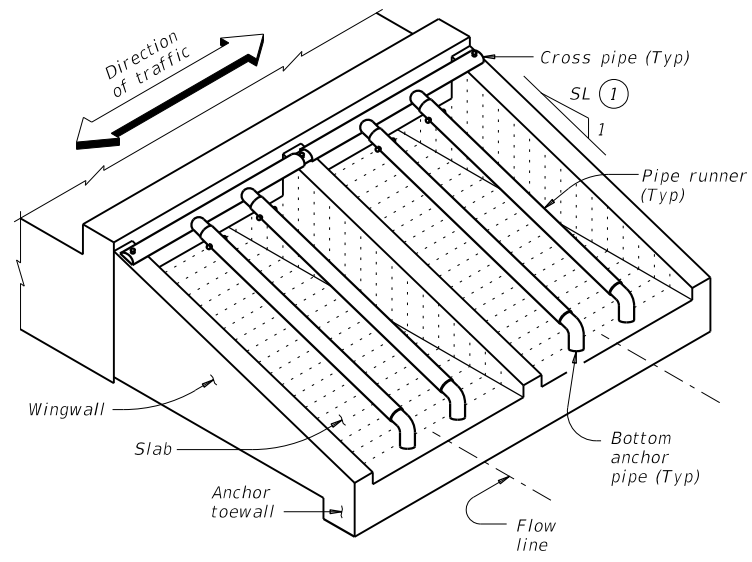
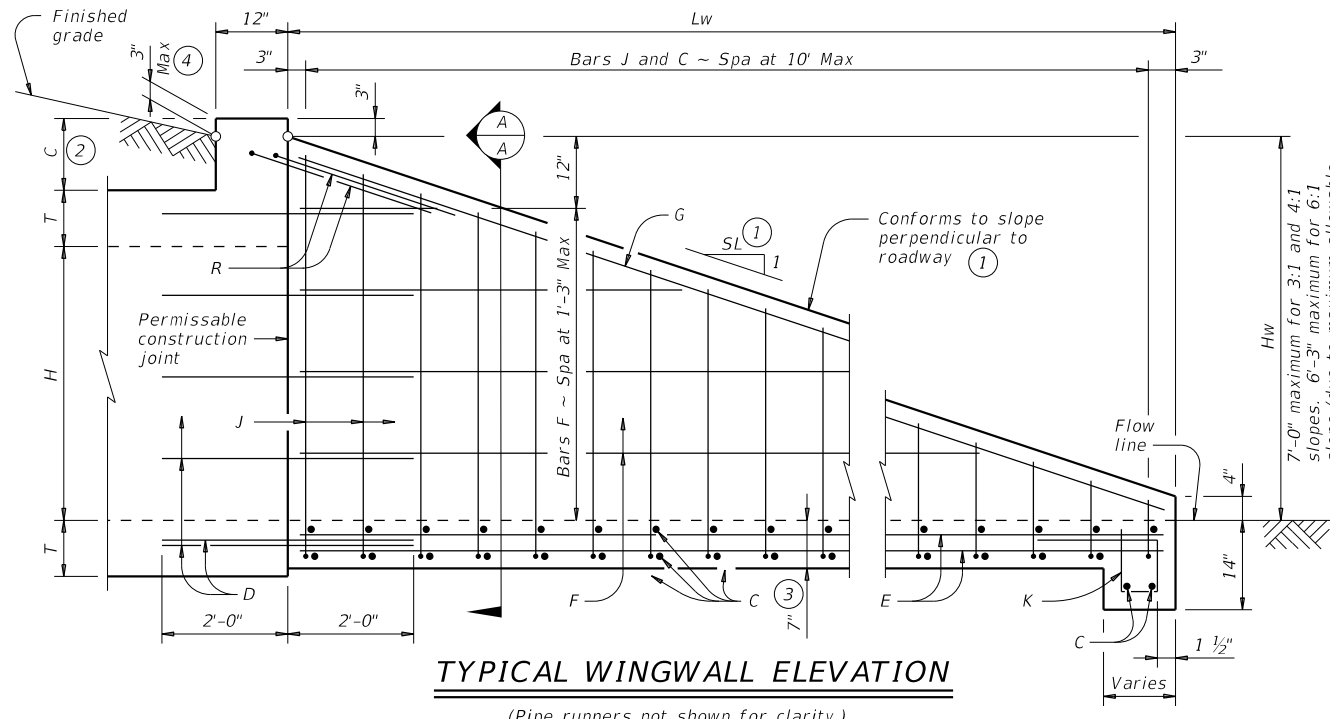
SPECIAL NOTE:
 This tabular sheet is to be filled out by the culvert specifier and provides information for the construction details and quantities of pipe runners.
 An Excel 2010 spreadsheet to assist in completing this table can be downloaded from the Bridge Standards (English) web page on the TxDOT web site. The completed sheet must be signed, sealed, and dated by a licensed Professional Engineer.
 Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions must be verified by the Contractor in the field prior to fabrication of the safety end treatment components.

PIPE RUNNER LAYOUT
 Note: Right forward culvert skew shown, actual culvert skew may be opposite hand.

		Bridge Division Standard	
SAFETY END TREATMENT WITH FLARED WINGS FOR 15° AND 30° SKEW BOX CULVERTS TYPE I ~ CROSS DRAINAGE			
SETB-FW-S			
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REVISIONS	HIGHWAY: FM 51		SHEET NO.:
FTW	COUNTY: PARKER		77

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WING DIMENSION CALCULATIONS:

$$H_w = H + T + C - 0.250'$$

$$L_w = (H_w - 0.333') (SL)$$

For cast-in-place culverts:
 $Atw = (N) (S) + (N + 1) (U)$

For precast culverts:
 $Atw = (N) (2U + S) + (N - 1) (0.500')$

Total Wingwall Area (SF)
 $= (0.5) (H_w + 0.333') (L_w) (N + 1)$

Total Concrete Volume (CY)
 $= [(Wingwall Area) (0.583') + (L_w) (Atw) (0.583') + (Atw) (1.167') (1.167' - 0.583')] \div (27)$

PIPE RUNNER DIMENSION CALCULATIONS:

Pipe Runner Length
 $= (L_w) (K1) - (1.917')$

Total Reinforcing (Lb)
 $= (1.55) (L_w) (Atw) + (4.43) (Atw) + (K2) (H_w) (N + 1) (\sqrt{L_w})$

C = Height of curb above top of top slab (feet)
 Hw = Height of wingwall (feet)
 K = Constant value for use in formulas

Slope SL:1	K1	K2
3:1	~ 1.054	~ 7.45
4:1	~ 1.031	~ 8.49
6:1	~ 1.014	~ 10.30

Atw = Anchor toewall length (feet)
 Lw = Length of wingwall (feet)
 N = Number of culvert barrels
 SL:1 = Side slope ratio (horizontal : 1 vertical)

See applicable box culvert standard for H, S, T, and U values.

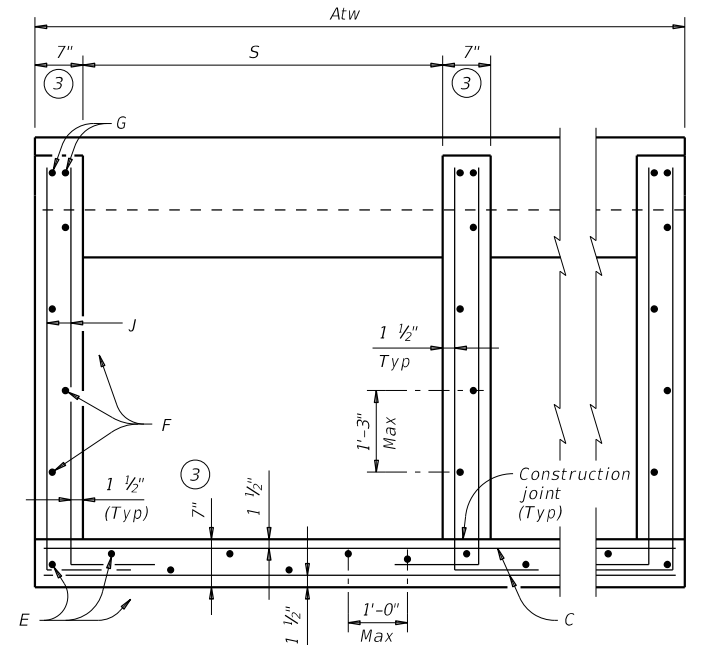
MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
 Provide galvanized reinforcing steel if required elsewhere in the plans.
 Adjust reinforcing as necessary to provide a minimum clear cover of 1 1/2".
 Provide Class "C" concrete (f'c = 3,600 psi).
 Provide pipe runners, cross pipes, and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
 Provide ASTM A307 bolts.
 Galvanize all steel components, except the concrete reinforcing, unless required elsewhere in the plans, after fabrication.
 Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".

GENERAL NOTES:

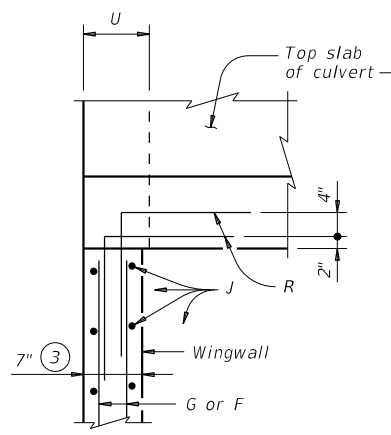
Designed according to AASHTO LRFD Bridge Design Specifications.
 The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.
 Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.
 The quantities for pipe runners, reinforcing steel, and concrete resulting from the formulas given herein are for Contractor's information only.
 See the Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
 Alternate design drawings bearing the seal of a professional engineer will be acceptable for precast construction of the safety end treatments.

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

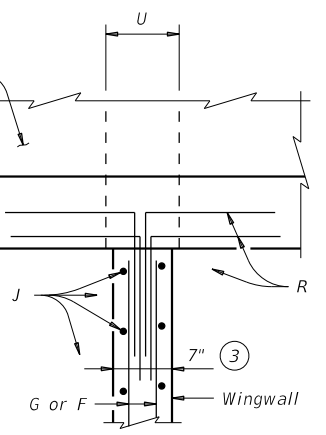


SECTION A-A

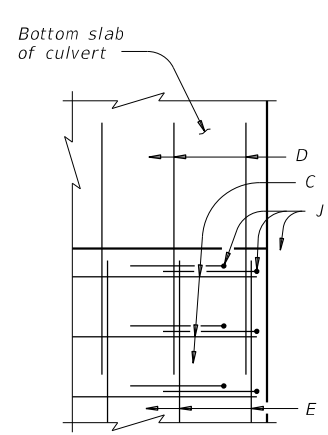
(Showing typical wingwall and wing slab reinforcing. Pipe runners not shown for clarity.)



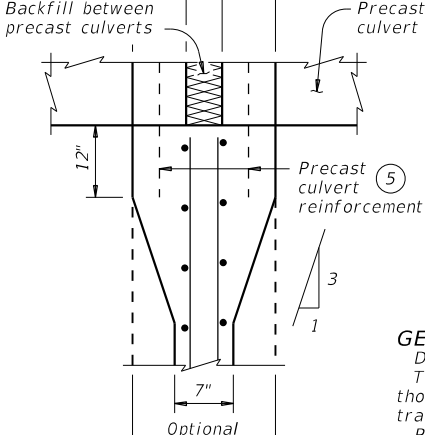
AT TOP OF EXTERIOR WINGWALL
(Cast-in-place culvert)



AT TOP OF INTERIOR WINGWALL
(Cast-in-place culvert)



AT OUTSIDE OF BOTTOM SLAB
(Cast-in-place culvert)



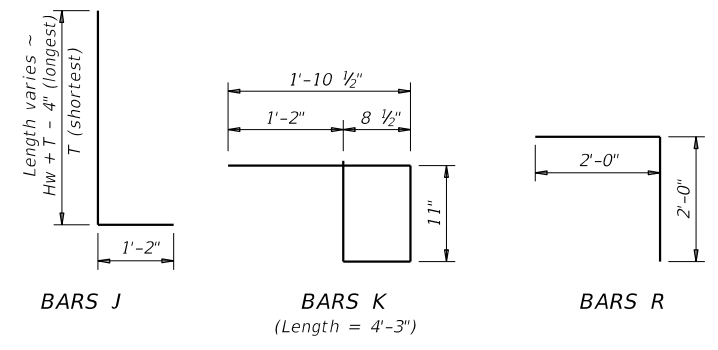
AT INTERIOR WINGWALL
(Precast culvert)

PLAN VIEWS OF CORNER DETAILS

- Recommended values of slope are: 3:1, 4:1, and 6:1. Provide 3:1 or flatter slope.
- 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet.
- Wingwall and slab thicknesses may be the same as the adjacent culvert wall and slab thicknesses (7" minimum). If thicknesses greater than the minimum (7") are used, no changes will be made in quantities and no additional compensation will be allowed.
- For vehicle safety, reduce curb height, if necessary, to provide a maximum 3" projection. No changes will be made in quantities and no additional compensation will be allowed for this work.
- For culverts with C = 0", the precast culvert reinforcing may extend 1'-0" minimum into wingwall. Wingwall Bars D and R may be omitted. Otherwise, refer to the Wingwall Connection detail on the Box Culvert Precast Miscellaneous Details (SCP-MD) standard sheet.

TABLE OF REINFORCING BAR SIZES AND SPACING

Bar	Size	Spacing
C	#4	10" Max
D	#4	Match F and E
E	#4	1'-0" Max
F	#4	1'-3" Max
G	#6	As shown
J	#4	10" Max
K	#4	1'-0" Max
R	#4	As shown



SHEET 1 OF 2

Bridge Division Standard

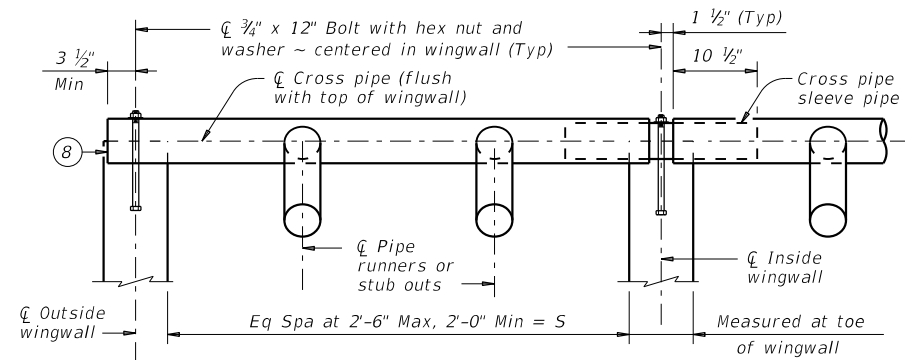
SAFETY END TREATMENT FOR 0° SKEW BOX CULVERTS (MAXIMUM Hw = 7'-0") TYPE I ~ CROSS DRAINAGE

SETB-CD

FILE: setbcdse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONTRACT NO. 0313	SECTION 07	JOB NO. 020	HIGHWAY FM 51
REVISIONS	DIST. FTW	COUNTY PARKER	SHEET NO. 78	

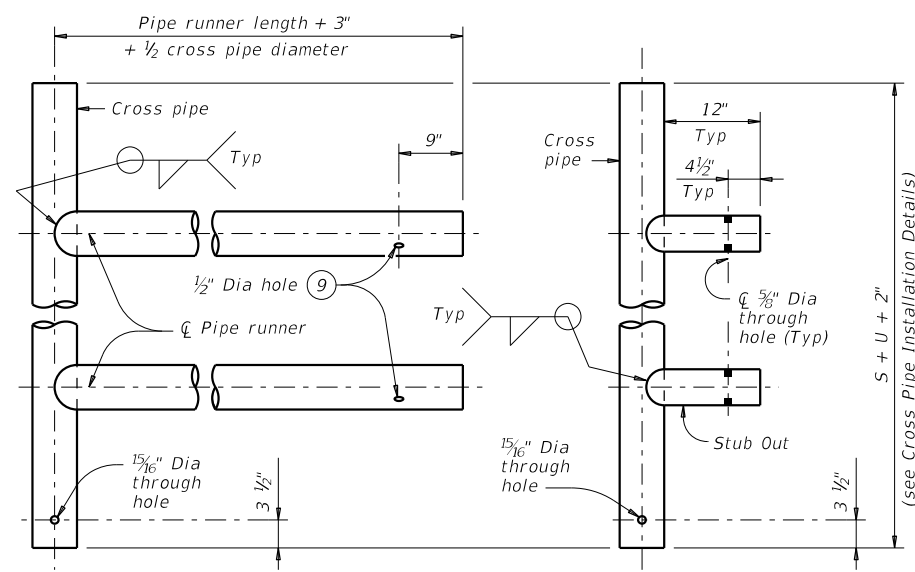
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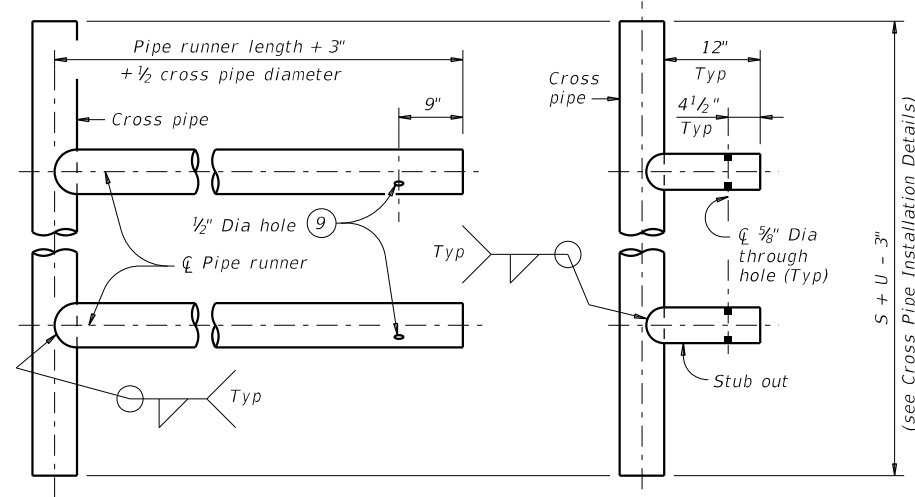


NOTE: At Contractor's option, make the cross pipe continuous across the inside wingwalls. If option is selected, omit the sleeve pipe and make a 1 5/16" diameter through hole in the cross pipe to accept the anchor bolt at the centerline of each inside wingwall.

CROSS PIPE INSTALLATION DETAILS

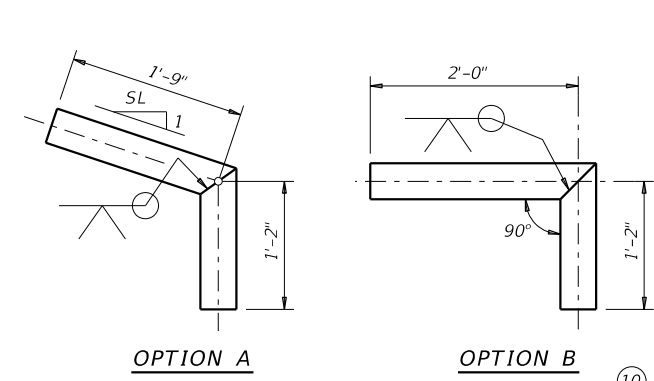


OPTION A2
OPTION A1
 FOR USE IN OUTSIDE CULVERT BAY

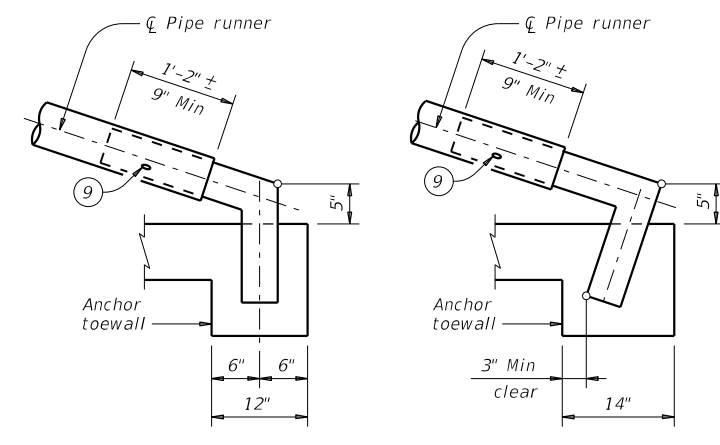


OPTION A2
OPTION A1
 FOR USE IN INSIDE CULVERT BAY

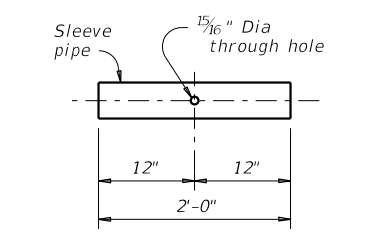
CROSS PIPE AND CONNECTIONS DETAILS



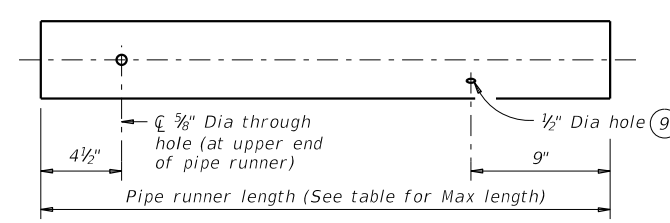
OPTION A
OPTION B
BOTTOM ANCHOR PIPE DETAILS



OPTION B1
OPTION B2
BOTTOM ANCHOR TOEWALL DETAILS
 (Wingwall not shown for clarity.)



CROSS PIPE SLEEVE PIPE DETAILS

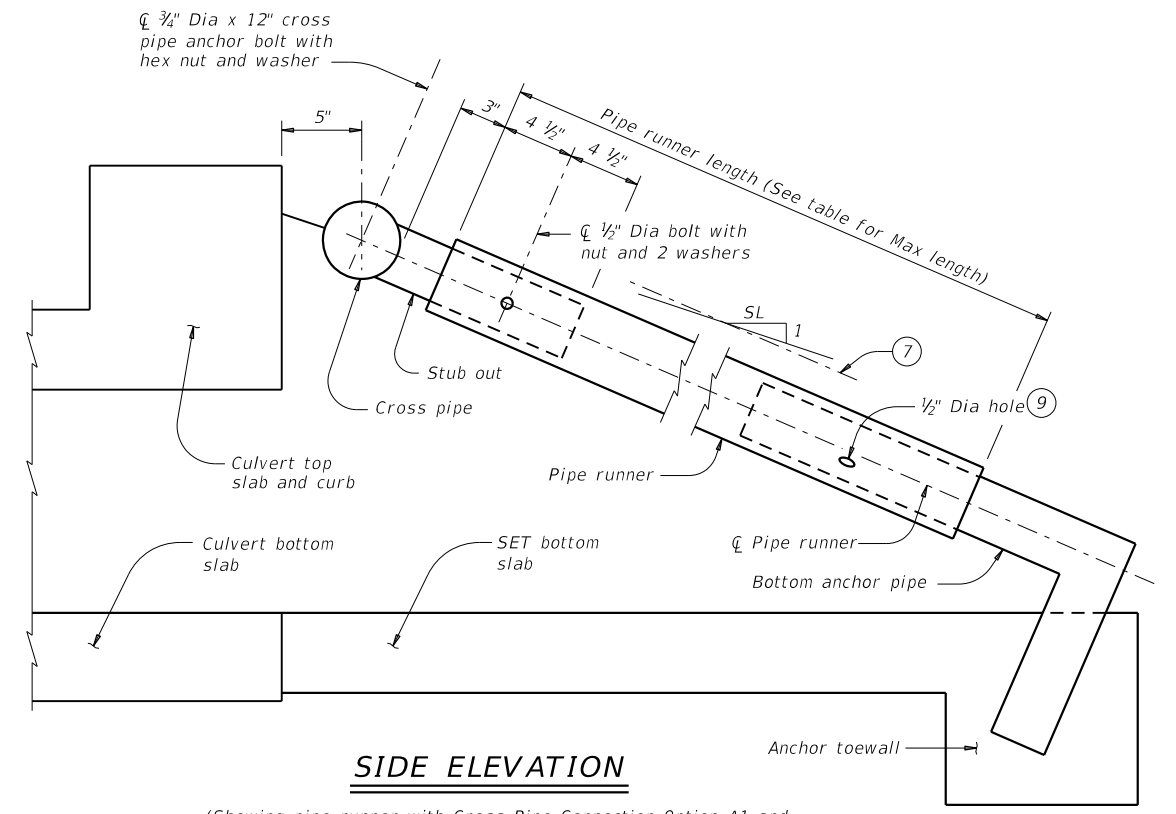


NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS

- ⑥ Cross pipe is the same size as the pipe runner. Cross pipe stub out is the same size as the anchor pipe.
- ⑦ Note that actual slope of safety pipe runner may vary slightly from side slope.
- ⑧ Take care to ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.
- ⑨ After installation, inspect the 1#2" hole to ensure that the lap of the safety pipe runner with the bottom anchor pipe is adequate.
- ⑩ At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

Maximum Pipe Runner Length	Required Pipe Runner Size			Required Anchor Pipe Size		
	Pipe Size	Pipe O.D.	Pipe I.D.	Pipe Size	Pipe O.D.	Pipe I.D.
10'- 0"	3" STD	3.500"	3.068"	2" STD	2.375"	2.067"
19'- 8"	4" STD	4.500"	4.026"	3" STD	3.500"	3.068"
34'- 2"	5" STD	5.563"	5.047"	4" STD	4.500"	4.026"



SIDE ELEVATION
 (Showing pipe runner with Cross Pipe Connection Option A1 and Bottom Anchor Toewall Option B2. Wingwall not shown for clarity.)

Texas Department of Transportation
 Bridge Division Standard

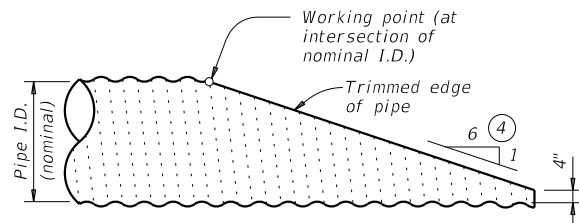
SAFETY END TREATMENT FOR 0° SKEW BOX CULVERTS (MAXIMUM Hw = 7'-0") TYPE I ~ CROSS DRAINAGE

SETB-CD

FILE: setbcdse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONTRACT: 0313	SECTION: 07	JOB: 020	HIGHWAY: FM 51
REVISIONS:	DIST: FTW	COUNTY: PARKER	SHEET NO. 79	

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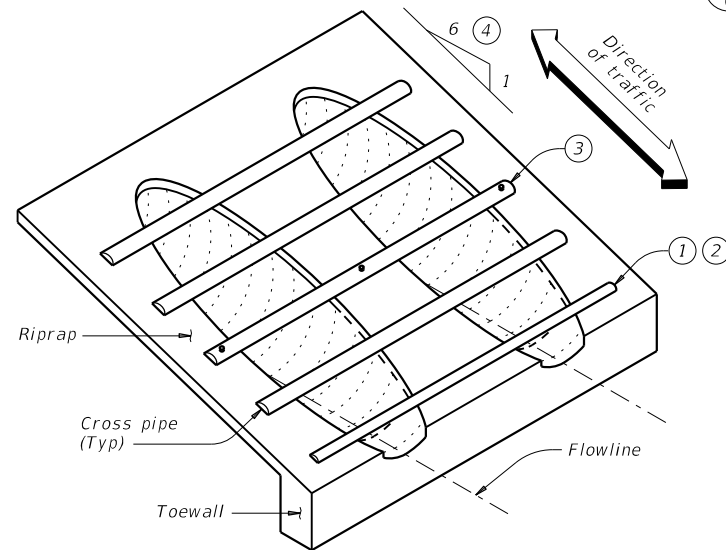
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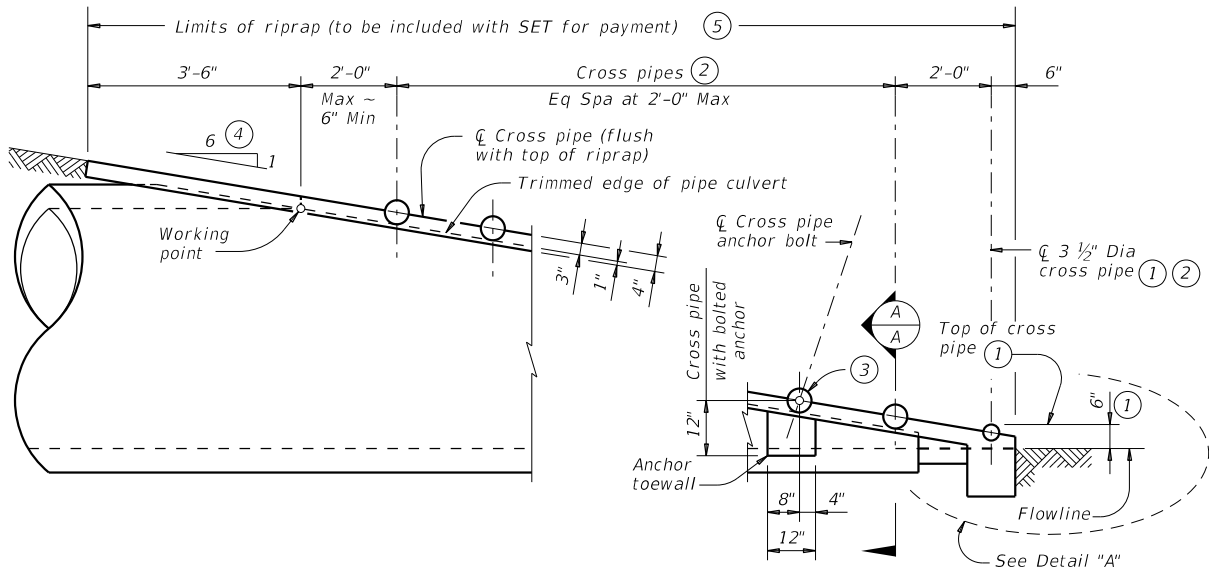
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(Showing corrugated metal pipe (CMP) culvert. Details at reinforced concrete pipe (RCP) culvert are similar.)

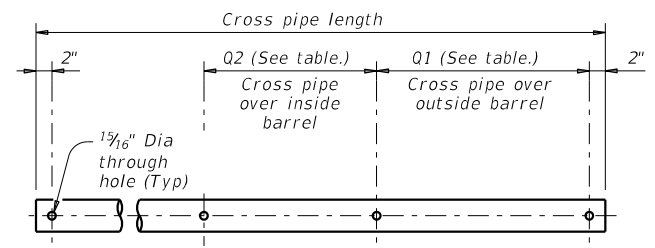


ISOMETRIC VIEW OF TYPICAL INSTALLATION

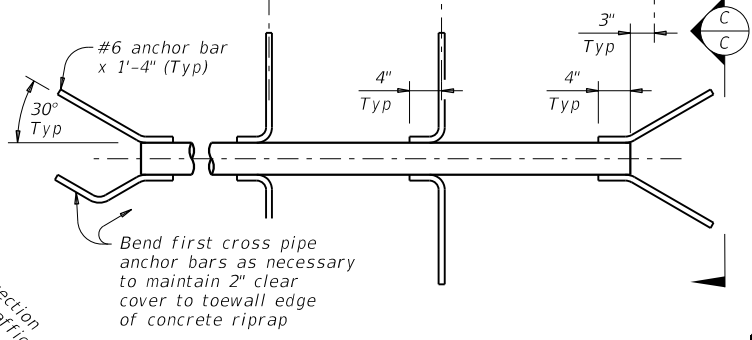


SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

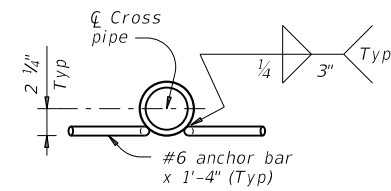
(Showing reinforced concrete pipe (RCP) culvert. Details at corrugated metal pipe (CMP) culvert are similar.)



PIPE WITH BOLTED ANCHOR

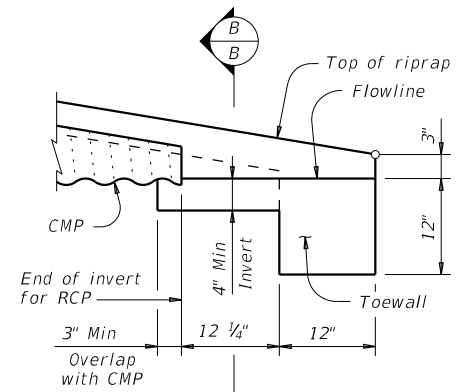


PIPE WITH ANCHOR BARS



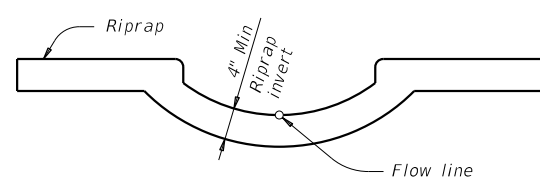
SECTION C-C

CROSS PIPE DETAILS



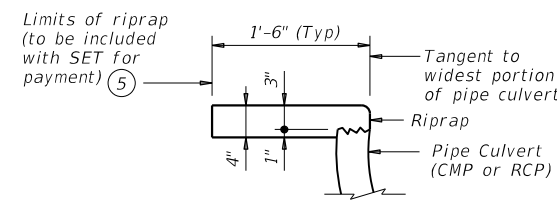
DETAIL "A"

(Showing invert with corrugated metal pipe (CMP) culvert. Reinforced concrete pipe (RCP) culvert details are similar. Cross pipes not shown for clarity.)

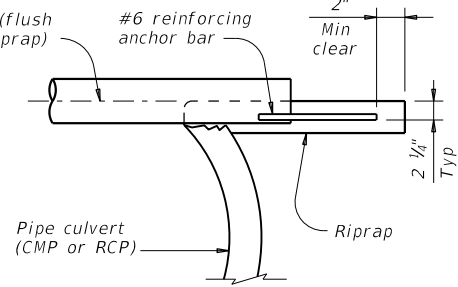


SECTION B-B

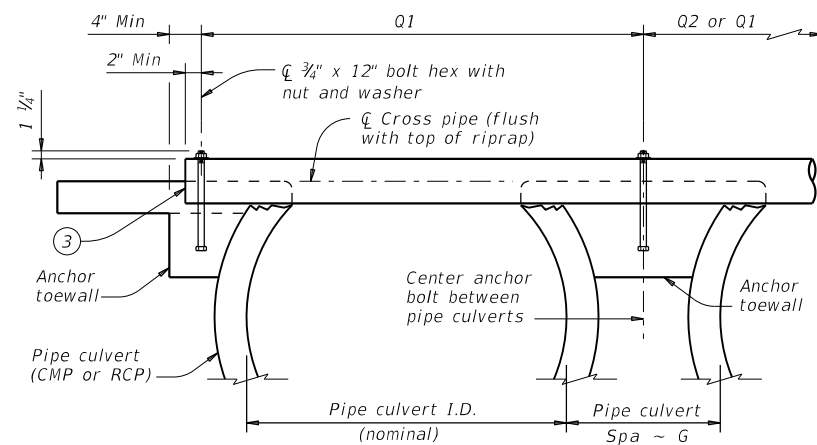
(Cross pipes not shown for clarity.)



SHOWING TYPICAL PIPE CULVERT AND RIPRAP



SHOWING CROSS PIPE WITH ANCHOR BAR



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for Use of Cross Pipes	Cross Pipe Sizes
12"	0.6	0' - 9"	N/A	2' - 1"	1' - 9"	3 or more pipe culverts	3" Std (3.500" O.D.)
15"	0.7	0' - 11"	N/A	2' - 5"	2' - 2"		
18"	0.8	1' - 2"	N/A	2' - 10"	2' - 8"		
21"	0.9	1' - 4"	N/A	3' - 2"	3' - 1"		
24"	0.9	1' - 7"	N/A	3' - 6"	3' - 7"	3 or more pipe culverts	3 1/2" Std (4.000" O.D.)
27"	1.0	1' - 8"	N/A	3' - 10"	3' - 11"		
30"	1.1	1' - 10"	N/A	4' - 2"	4' - 4"	2 or more pipe culverts	4" Std (4.500" O.D.)
33"	1.2	1' - 11"	4' - 2"	4' - 5"	4' - 8"		
36"	1.3	2' - 1"	4' - 5"	4' - 9"	5' - 1"	All pipe culverts	4" Std (4.500" O.D.)
42"	1.5	2' - 4"	4' - 11"	5' - 5"	5' - 10"		
48"	1.7	2' - 7"	5' - 5"	6' - 0"	6' - 7"	All pipe culverts	5" Std (5.563" O.D.)
54"	2.0	3' - 0"	5' - 11"	6' - 9"	7' - 6"		
60"	2.2	3' - 3"	6' - 5"	7' - 4"	8' - 3"		
66"	2.4	3' - 3"	6' - 11"	7' - 10"	8' - 9"		
72"	2.7	3' - 4"	7' - 5"	8' - 5"	9' - 4"		

- The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flowline.
- Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1/2" standard pipe (4" O.D.) for the first bottom pipe.
- Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.
- Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.
- Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".
- Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for contractor's information only.

MATERIAL NOTES:

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise. Provide cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52. Provide ASTM A307 bolts and nuts. Galvanize all steel components, except concrete reinforcing, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

GENERAL NOTES:

Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981. Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes. Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap". Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

Texas Department of Transportation Bridge Division Standard

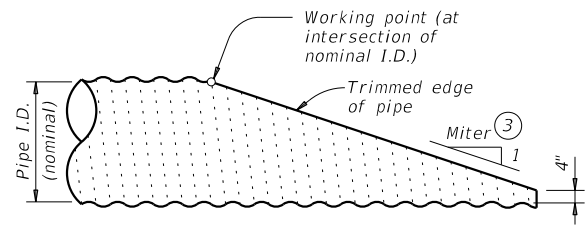
SAFETY END TREATMENT FOR 12" DIA TO 72" DIA PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE

SETP-PD

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©TxDOT REVISIONS	0313	07	020	FM 51
	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	80	

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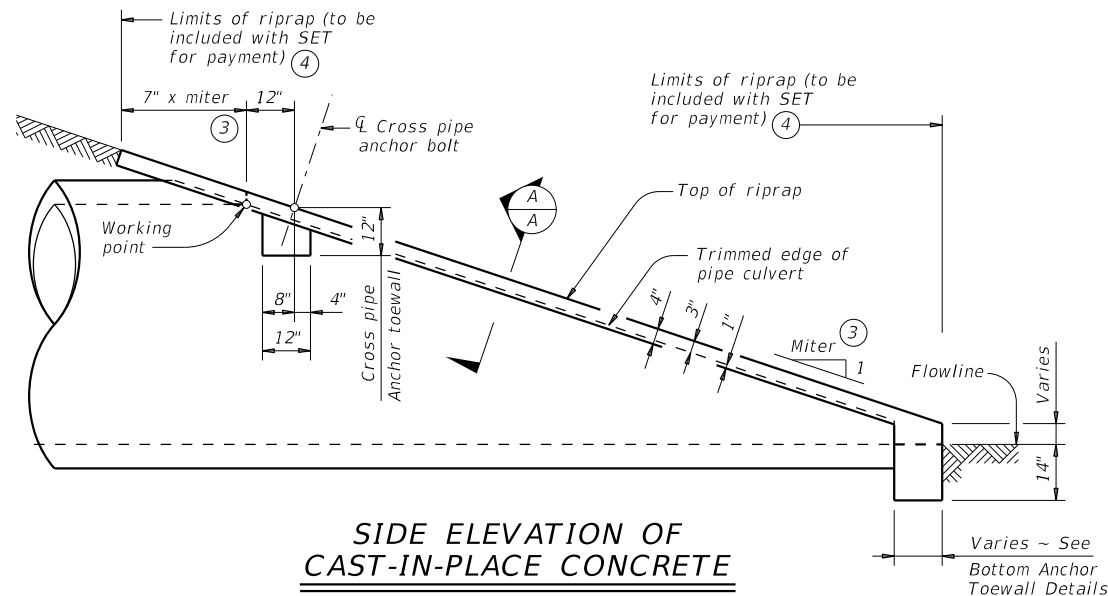
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NOTE: All pipe runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

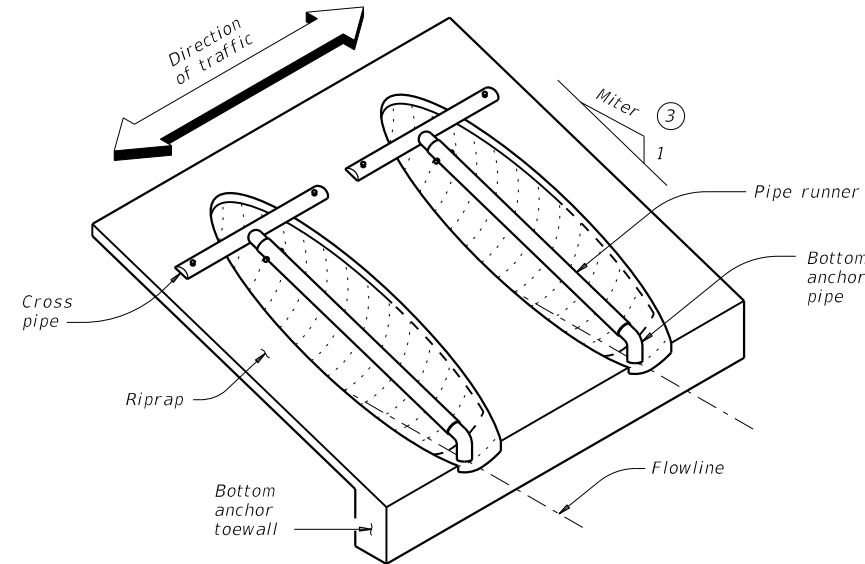
SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(Showing corrugated metal pipe (CMP) culvert. Details of reinforced concrete pipe (RCP) culvert are similar.)



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing reinforced concrete pipe (RCP) culvert. Details of corrugated metal pipe (CMP) culvert are similar. Pipe runners not shown for clarity)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing installation with no skew.)

CROSS PIPE LENGTHS AND PIPE RUNNER LENGTHS ① ②

Nominal Culvert I.D.	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
			3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
			0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
24"	1' - 7"	3' - 5"	N/A	N/A	N/A	5' - 10"	N/A	N/A	N/A	8' - 1"	N/A	N/A	N/A	12' - 9"
27"	1' - 8"	3' - 8"	N/A	N/A	5' - 5"	6' - 11"	N/A	N/A	N/A	7' - 7"	N/A	N/A	N/A	14' - 11"
30"	1' - 10"	3' - 11"	N/A	N/A	6' - 4"	8' - 0"	N/A	N/A	N/A	8' - 9"	N/A	N/A	N/A	17' - 0"
33"	1' - 11"	4' - 2"	6' - 2"	6' - 5"	7' - 3"	9' - 1"	8' - 6"	8' - 10"	10' - 0"	12' - 5"	13' - 3"	13' - 9"	15' - 5"	19' - 2"
36"	2' - 1"	4' - 5"	6' - 11"	7' - 3"	8' - 2"	10' - 2"	9' - 6"	9' - 11"	11' - 2"	13' - 10"	14' - 9"	15' - 3"	17' - 2"	21' - 3"
42"	2' - 4"	4' - 11"	8' - 6"	8' - 10"	9' - 11"	12' - 4"	11' - 7"	12' - 0"	13' - 6"	16' - 8"	17' - 9"	18' - 5"	20' - 8"	25' - 7"
48"	2' - 7"	5' - 5"	10' - 1"	10' - 5"	11' - 9"	N/A	13' - 7"	14' - 2"	15' - 10"	N/A	20' - 9"	21' - 6"	24' - 2"	N/A
54"	3' - 0"	5' - 11"	11' - 8"	12' - 1"	N/A	N/A	15' - 8"	16' - 3"	N/A	N/A	23' - 10"	24' - 8"	N/A	N/A
60"	3' - 3"	6' - 5"	13' - 3"	N/A	N/A	N/A	17' - 9"	N/A	N/A	N/A	26' - 10"	N/A	N/A	N/A

TYPICAL PIPE CULVERT MITERS ③

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED ②

Nominal Culvert I.D.	Single Pipe Culvert	Multiple Pipe Culverts
12" thru 21"	Skews thru 45°	Skews thru 45°
24"	Skews thru 45°	Skews thru 30°
27"	Skews thru 30°	Skews thru 15°
30"	Skews thru 15°	Skews thru 15°
33"	Skews thru 15°	Always required
36"	Normal (no skew)	Always required
42" thru 60"	Always required	Always required

STANDARD PIPE SIZES AND MAX PIPE RUNNER LENGTHS ①

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10' - 0"
4" STD	4.500"	4.026"	19' - 8"
5" STD	5.563"	5.047"	34' - 2"

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) ⑤

Nominal Culvert I.D.	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8
15"	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
18"	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2
24"	0.6	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.1	1.3
27"	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.4
30"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.2	1.2	1.3	1.6
33"	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.3	1.4	1.5	1.7
36"	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.8
42"	1.0	1.0	1.1	1.3	1.2	1.3	1.3	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.2	N/A	1.4	1.4	1.5	N/A	1.9	1.9	2.1	N/A
54"	1.3	1.3	N/A	N/A	1.6	1.6	N/A	N/A	2.1	2.1	N/A	N/A
60"	1.4	N/A	N/A	N/A	1.7	N/A	N/A	N/A	2.3	N/A	N/A	N/A

① Provide pipe runner of the size shown in the tables. Provide cross pipe of the same size as the pipe runner. Provide cross pipe stub out and bottom anchor pipe of the next smaller size pipe as shown in the Standard Pipe Sizes and Max Pipe Runner Lengths table.

② This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

- For 60" culvert pipes, the skew must not exceed 0°.
- For 54" culvert pipes, the skew must not exceed 15°.
- For 48" culvert pipes, the skew must not exceed 30°.
- For all culvert pipe sizes 42" and less, the skew must not exceed 45°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT Roadway Design Manual.

③ Miter = slope of mitered end of pipe culvert.

④ Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

⑤ Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

SHEET 1 OF 2

Texas Department of Transportation
 Bridge Division Standard

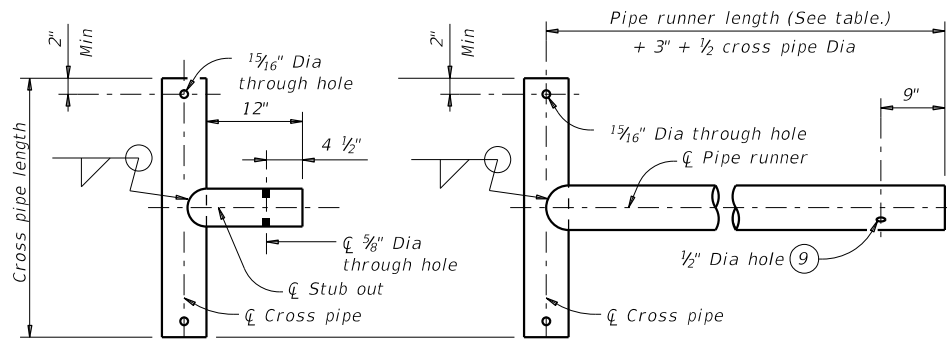
SAFETY END TREATMENT
 FOR 12" DIA TO 60" DIA
 PIPE CULVERTS
 TYPE II ~ CROSS DRAINAGE

SETP-CD

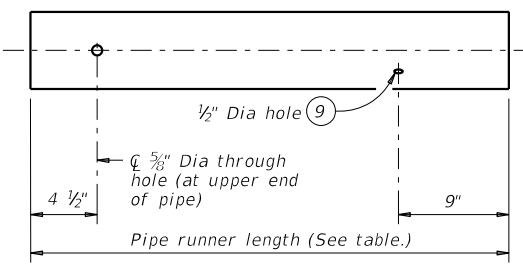
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©TxDOT February 2020	CONT SECT	JOB	HIGHWAY	
REVISIONS	0313 07	020	FM 51	
	DIST	COUNTY	SHEET NO.	
	FTW	PARKER	81	

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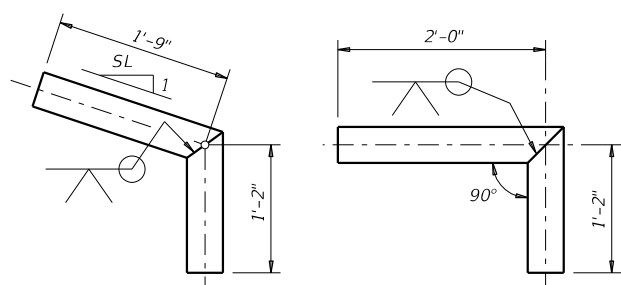


OPTION A1 **OPTION A2**
CROSS PIPE AND CONNECTIONS DETAILS

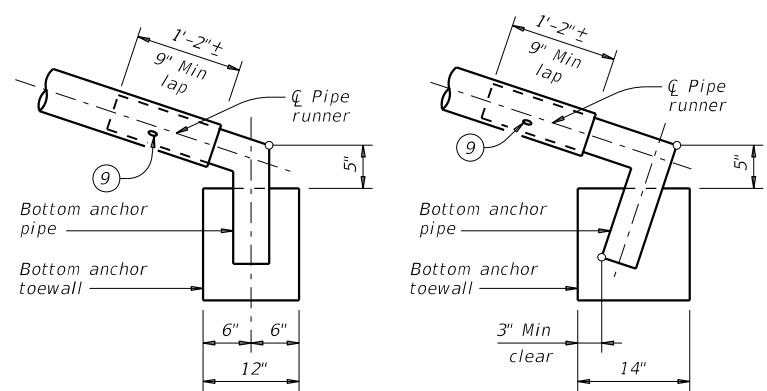


NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS



OPTION B1 **OPTION B2**
BOTTOM ANCHOR PIPE DETAILS ⑩



OPTION B1 **OPTION B2**
BOTTOM ANCHOR TOEWALL DETAILS

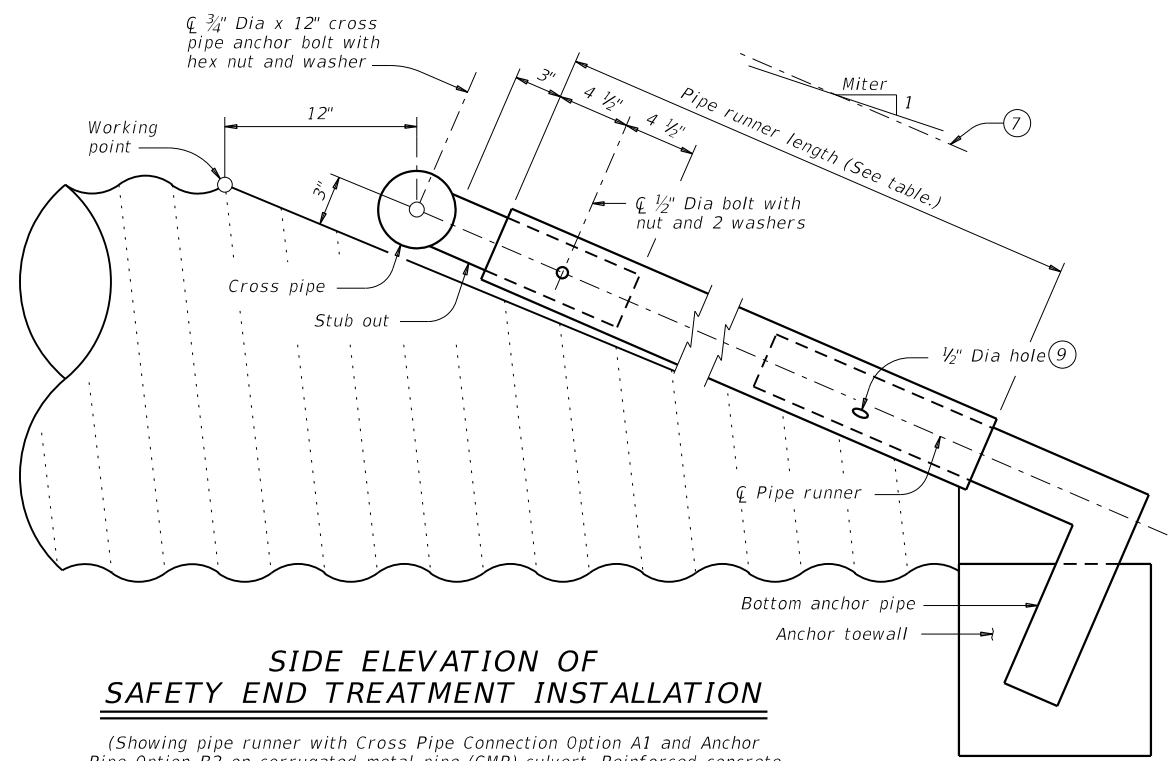
(Culvert and riprap not shown for clarity.)

MATERIAL NOTES:

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.
 Provide pipe runners, cross pipes, and anchor pipes conforming to the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
 Provide ASTM A307 bolts and nuts.
 Galvanize all steel components, except concrete reinforcing, after fabrication.
 Repair galvanizing damaged during transport or construction in accordance with the specifications.

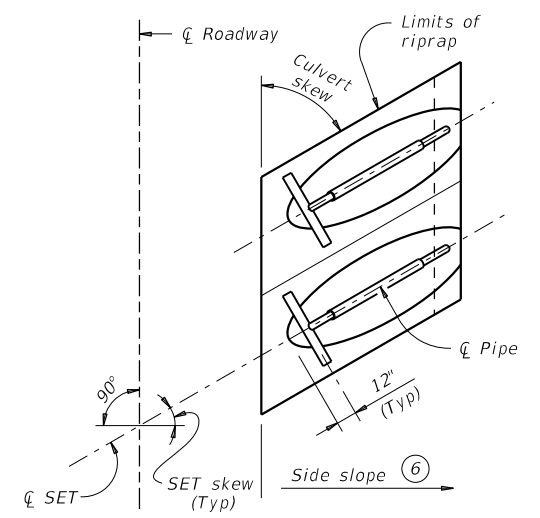
GENERAL NOTES:

Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.
 Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.
 Payment for riprap and toewall is included in the price bid for each safety end treatment.
 Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

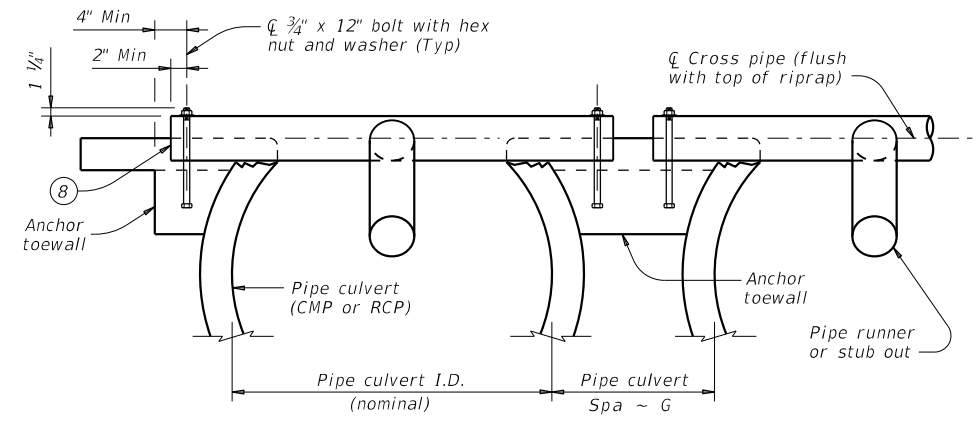


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

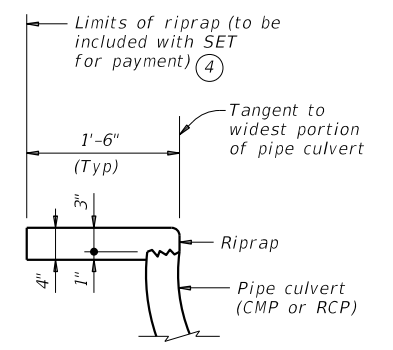
(Showing pipe runner with Cross Pipe Connection Option A1 and Anchor Pipe Option B2 on corrugated metal pipe (CMP) culvert. Reinforced concrete pipe culvert (RCP) details are similar. Riprap not shown for clarity)



PLAN OF SKEWED INSTALLATION



SECTION A-A
 SHOWING CROSS PIPE AND ANCHOR TOEWALL

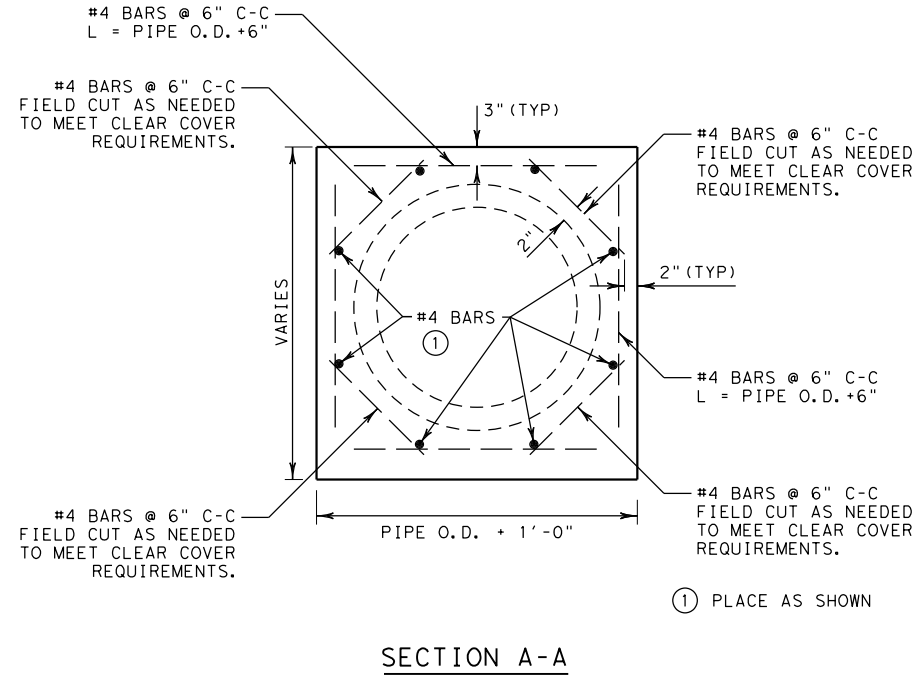
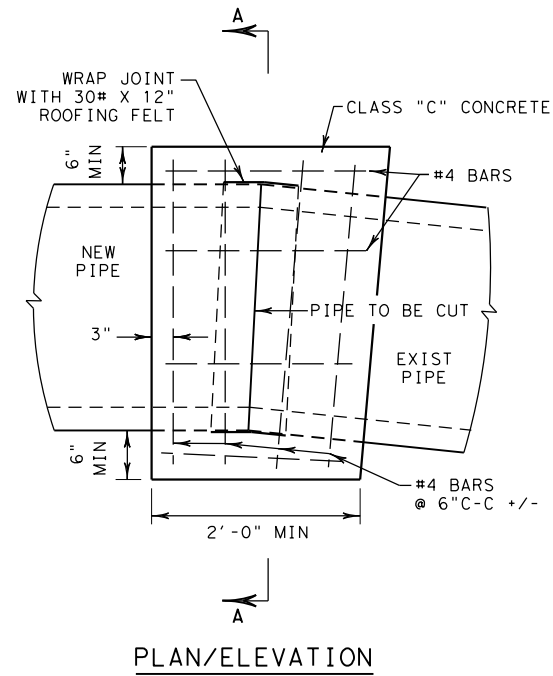


SHOWING TYPICAL PIPE CULVERT AND RIPRAP

		Bridge Division Standard	
SAFETY END TREATMENT FOR 12" DIA TO 60" DIA PIPE CULVERTS TYPE II ~ CROSS DRAINAGE			
SETP-CD			
FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP
©TxDOT February 2020	CONT: 0313	SECT: 07	JOB: 020
REVISIONS			HIGHWAY: FM 51
	DIST: FTW	COUNTY: PARKER	SHEET NO.: 82

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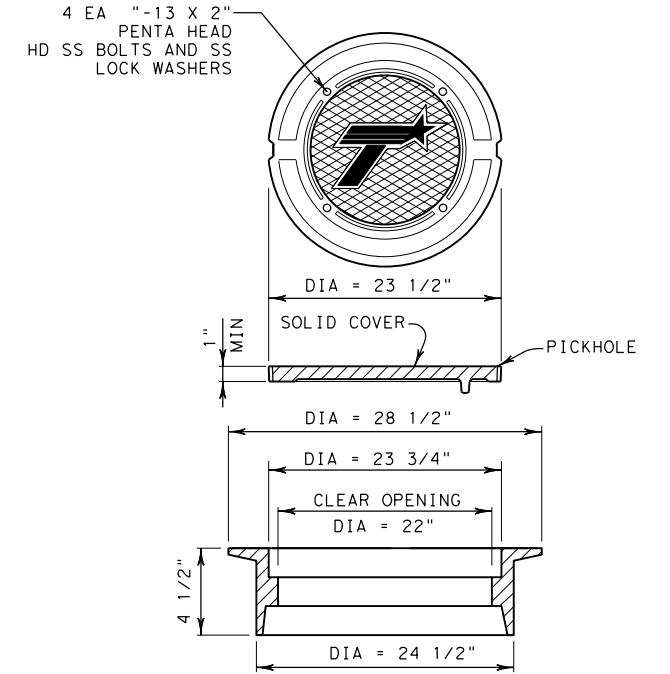
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PIPE COLLAR DETAIL
 FOR HORIZONTAL OR VERTICAL PLACEMENT
 N. T. S.

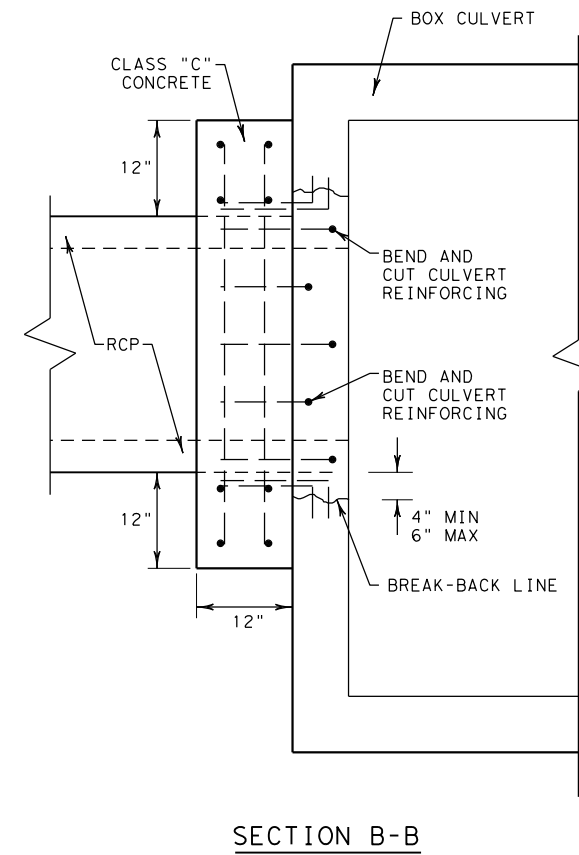
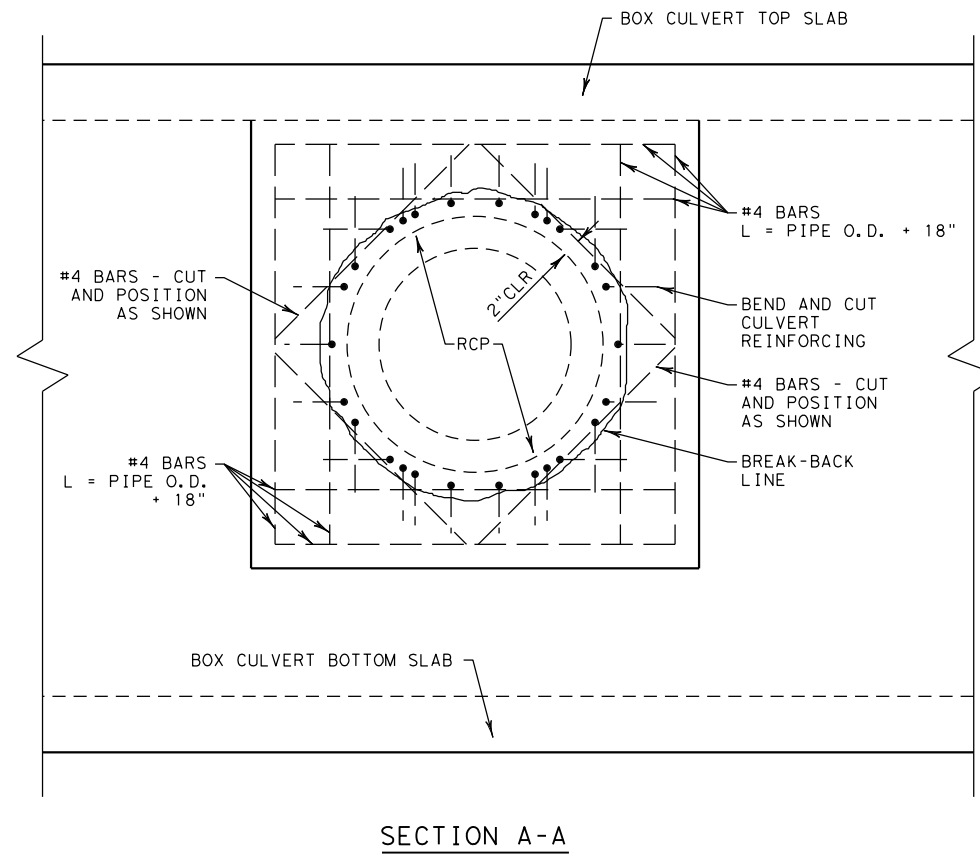
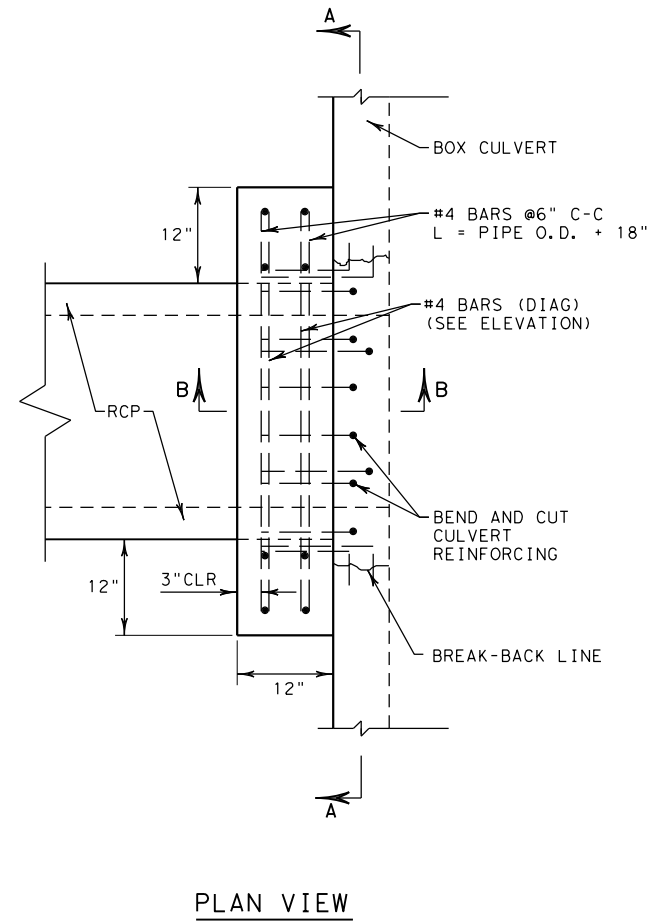
PIPE COLLAR GENERAL NOTES

1. THE CONTRACTOR SHALL TAKE STEPS TO ENSURE A SMOOTH JOINT ALONG THE INSIDE WALL OF PIPE.
2. ANY SPILLAGE OF CONCRETE THROUGH THE JOINT SHALL BE REMOVED AND THE INSIDE PIPE SURFACES SMOOTHED AS DIRECTED BY THE ENGINEER.
3. PIPE COLLARS WILL NOT BE PAID FOR DIRECTLY, BUT SHALL BE CONSIDERED SUBSIDIARY TO ITEM 464.



RING AND COVER DETAILS
 MANHOLES AND CURB INLETS
 N. T. S.

RING AND COVER SHALL CONFORM TO THE REQUIREMENTS OF ITEM 471 AND SHALL BE INCLUDED IN THE CURRENT TxDOT "APPROVED CAST IRON PRODUCTS SHEETS"



PIPE STUB-IN CONNECTION TO BOX CULVERT OR EXISTING DRAINAGE STRUCTURE
 N. T. S.

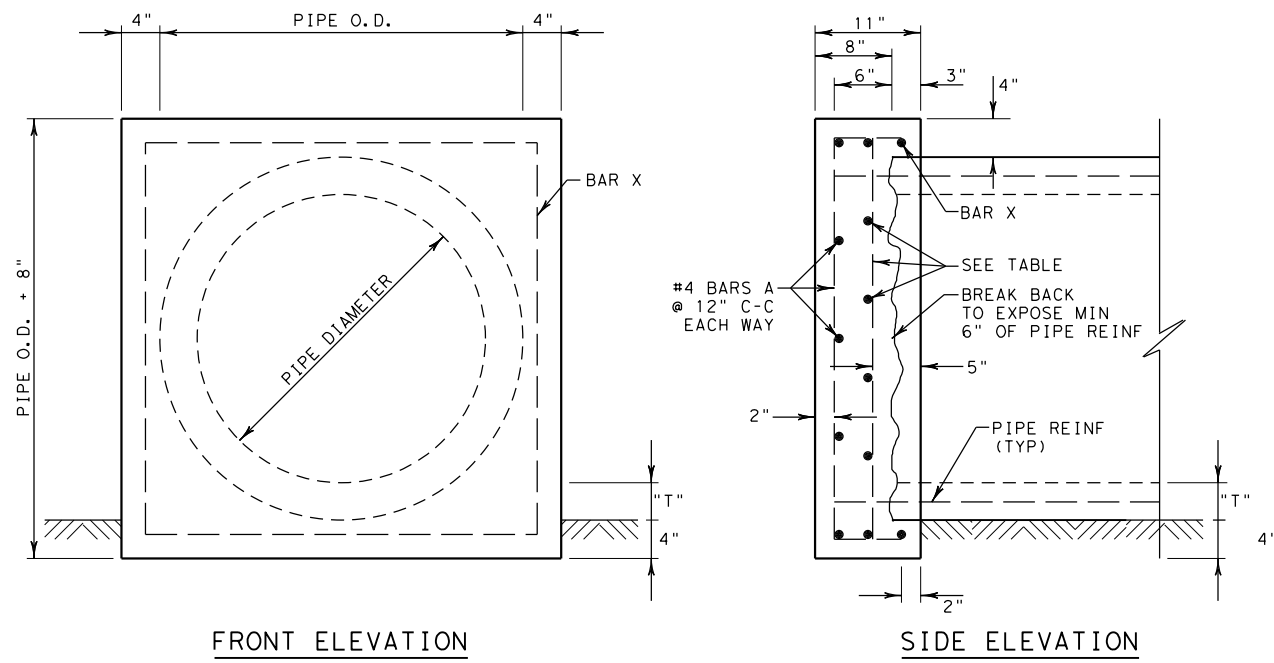
PIPE STUB-IN GENERAL NOTES

1. SAW CUT A MAXIMUM 1/2" DEPTH AT BREAK-BACK LINE. USE REMOVAL METHODS THAT WILL NOT DAMAGE REMAINING CONCRETE OR CULVERT REINFORCING.
2. EXPOSE AND CLEAN BOX CULVERT REINFORCING. BEND BARS INTO PROPOSED CONNECTION AND TIE TO CONNECTION REINFORCING.
3. ROUGHEN AND CLEAN EXISTING CONCRETE SURFACES THAT ARE IN CONTACT WITH NEW CONCRETE BEFORE PLACING FORMS.
4. MATERIAL & LABOR FOR PIPE/BOX CONNECTIONS WILL NOT BE PAID FOR DIRECTLY, BUT WILL BE SUBSIDIARY TO ITEMS 462 AND 464.

SHEET 1 OF 3 SHEETS

		Fort Worth District Standard	
MISCELLANEOUS DRAINAGE DETAILS MDD (FTW)			
ORIGINAL DRAWING: 05/2019	mdd-ftw.dgn	FED. RD. DIV. NO. 6	PROJECT NO. SEE TITLE SHEET
DATE 05/2019	REVISIONS NEW STANDARD	STATE TEXAS	SHEET NO. 83
		STATE DIST. NO. FTW	COUNTY PARKER
		CONT. 0313	SECT. 07
		JOB 020	HIGHWAY NO. FM 51

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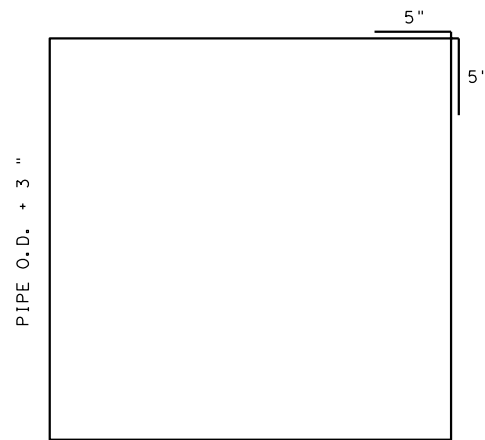
PIPE DIA (IN)	INNER REINFORCING SIZE/SPACING	
	MAXIMUM DEPTH	
	15'	30'
<48	#4 @ 12" C-C	#4 @ 12" C-C
60	#4 @ 12" C-C	#4 @ 10" C-C
72	#4 @ 12" C-C	#5 @ 10" C-C
84	#4 @ 10" C-C	#5 @ 8" C-C

PIPE END CAP GENERAL NOTES

- "T" = PIPE WALL THICKNESS.
- ALL CONCRETE SHALL BE CLASS "C".
- ALL REINFORCING STEEL SHALL BE GRADE 60.

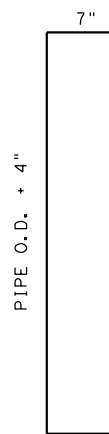
DRAINAGE PIPE END CAP OR PLUG DETAILS

N. T. S.



PIPE O.D. + 3 "

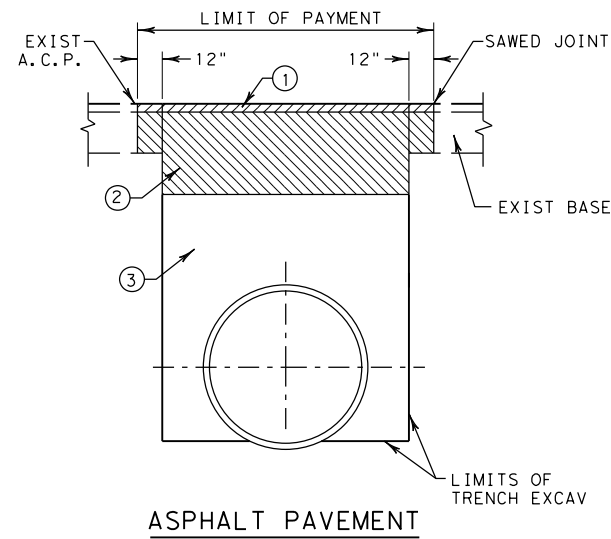
#4 BAR X



PIPE O.D. + 4 "

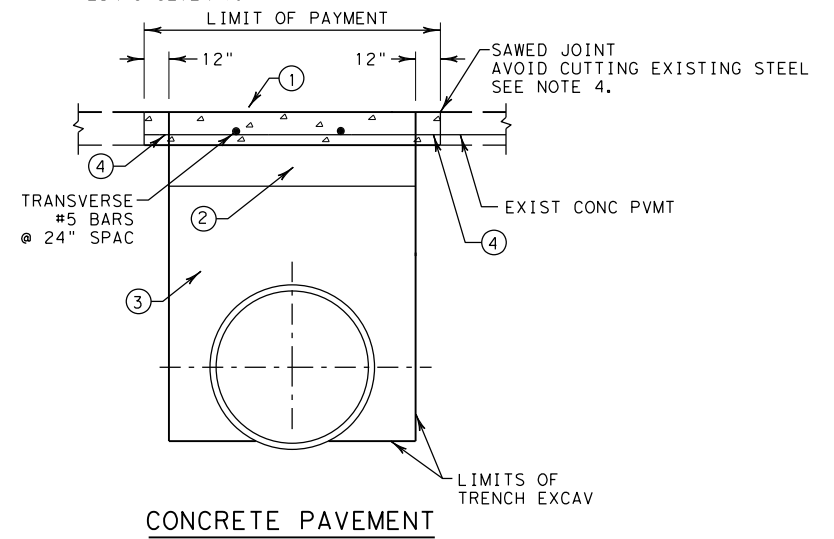
#4 BAR A

- APPROX 2" HOT MIX, TYPE D, OR AS DIRECTED.
- APPROX 10" HOT MIX BASE, TYPE B, OR AS DIRECTED.
- BACKFILL IN ACCORDANCE WITH ITEM 400.3.3.1 AND 400.3.3.3. PLACE BACKFILL IN 8" MAXIMUM LIFTS.



ASPHALT PAVEMENT

- CLASS "A", "P", OR "HES" CONCRETE PAVEMENT. MATCH EXISTING PAVEMENT DEPTH. USE CLASS "HES" IF OPENING TO TRAFFIC LESS THAN 72 HOURS AFTER PLACEMENT.
- 4" COLD MIX ASPHALT BASE. PLACE BASE MATERIAL IN ACCORDANCE WITH ITEM 361.2.2.2.
- BACKFILL IN ACCORDANCE WITH ITEM 400.3.3.1 AND 400.3.3.3. PLACE BACKFILL IN 8" MAXIMUM LIFTS.
- AT CONTRACTOR'S OPTION, USE FULL-DEPTH SAW CUT AND TIE TO EXISTING PAVEMENT IN ACCORDANCE WITH ITEM 361.4.2. FOR PARTIAL DEPTH SAW CUT, EXPOSE MINIMUM 8" OF LONGITUDINAL REINFORCING AND CONSTRUCT 8" WELDED LAP (MATCH LONGITUDINAL PAVEMENT REINFORCEMENT).



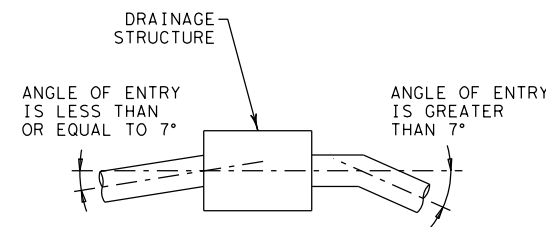
CONCRETE PAVEMENT

CUTTING AND RESTORING PAVEMENT DETAILS

N. T. S.

CUT AND RESTORE PAVEMENT GENERAL NOTES

- CONCRETE CURB OR CURB AND GUTTER WILL BE INCLUDED IN AREA OF "CUTTING AND RESTORING PAVEMENT". CONSTRUCT CURB OR CURB AND GUTTER ACCORDING TO PLAN DETAILS, OR AS DIRECTED. REMOVAL AND REPLACEMENT OF CONCRETE CURB OR CURB AND GUTTER WILL NOT BE PAID FOR DIRECTLY, BUT WILL BE SUBSIDIARY TO CUTTING AND RESTORING PAVEMENT.
- SEE STANDARD JS (FTW) FOR JOINT SEALING DETAILS.



CONNECT PIPES WITHIN 7° OF NORMAL TO INLET OR MANHOLE. IF NECESSARY, USE PIPE ELBOW OR CURVED APPROACH ALIGNMENT TO STAY WITHIN THIS LIMIT.

PIPE CONNECTION

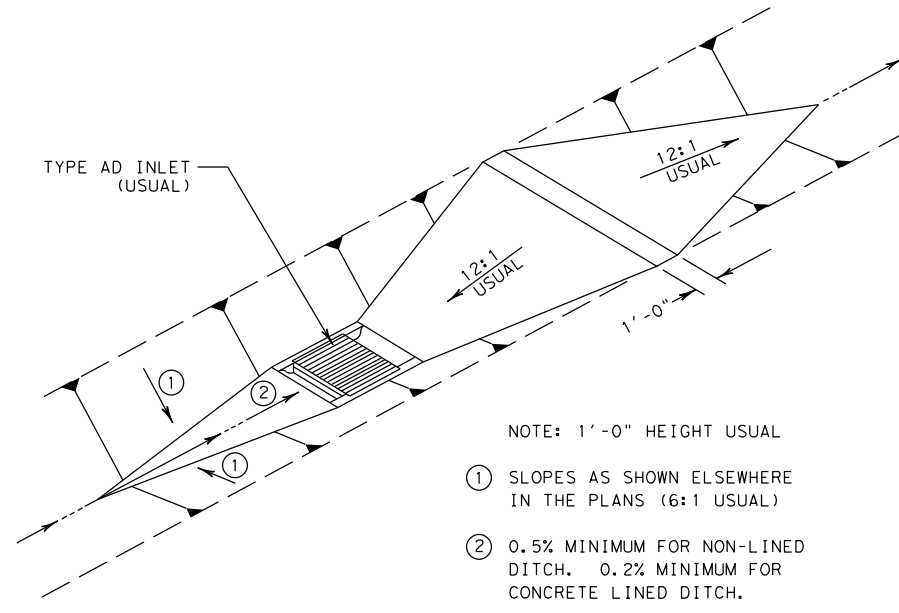
N. T. S.

SHEET 2 OF 3 SHEETS

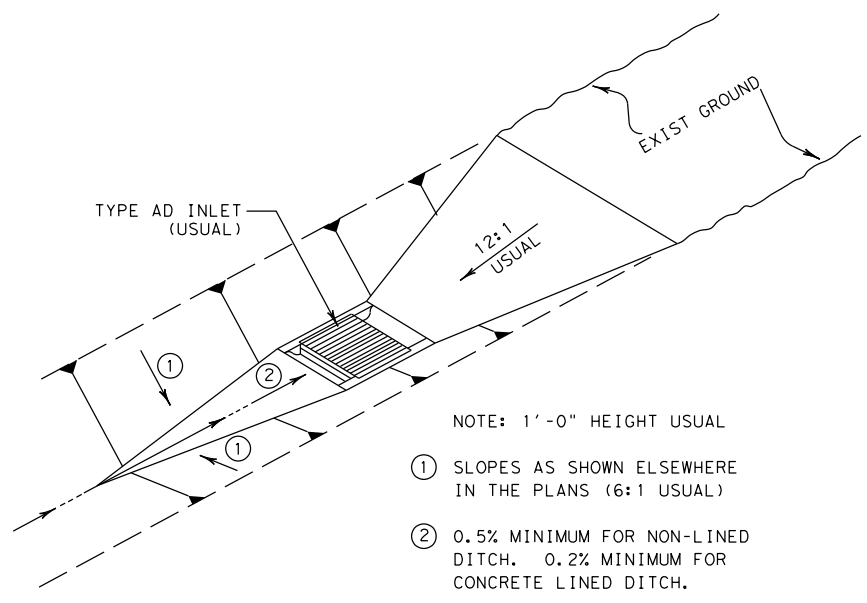
		Fort Worth District Standard	
MISCELLANEOUS DRAINAGE DETAILS MDD (FTW)			
ORIGINAL DRAWING: 05/2019	mdd-ftw.dgn	FED. RD. DIV. NO. 6	PROJECT NO.
DATE 10/19/2020	REVISIONS	STATE TEXAS	SHEET NO. 84
05/2019	NEW STANDARD	STATE DIST. NO. FTW	COUNTY PARKER
		CONT. 0313	SECT. 07
		JOB 020	HIGHWAY NO. FM 51

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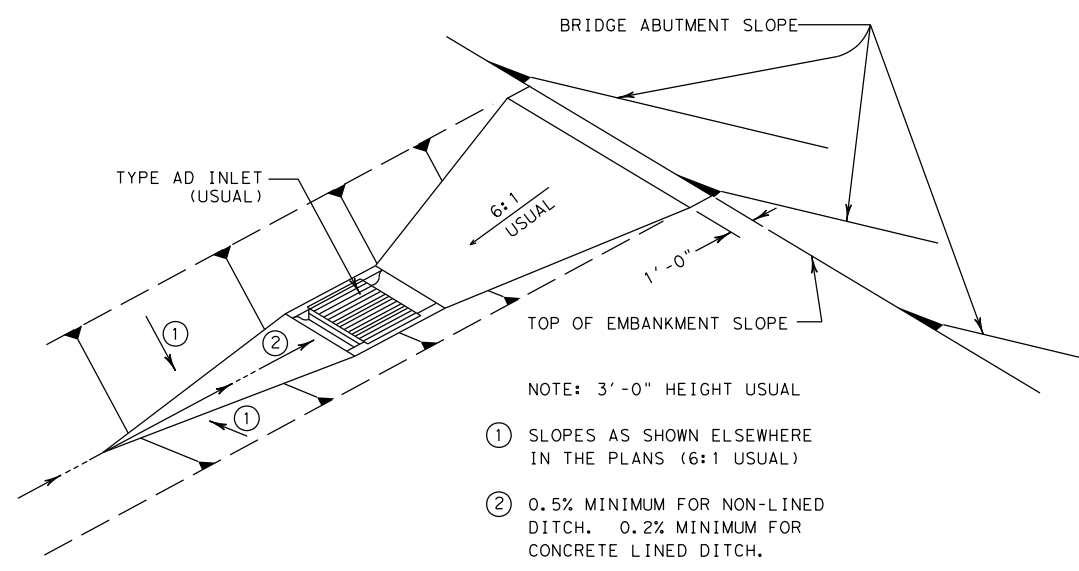
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CONTINUOUS DITCH



DITCH TERMINATION



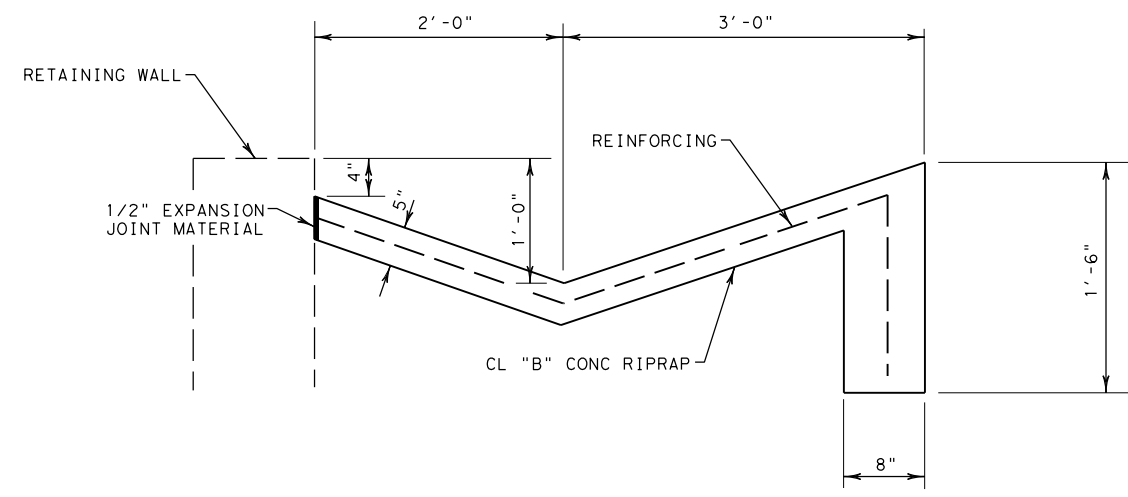
DITCH TERMINATION AT BRIDGE END

DITCH BLOCK GENERAL NOTES

1. DITCH BLOCK AND INLET LOCATIONS SHOWN ELSEWHERE IN THE PLANS.
2. DITCH BLOCKS WILL NOT BE PAID FOR DIRECTLY, BUT WILL BE SUBSIDIARY TO THE VARIOUS BID ITEMS.

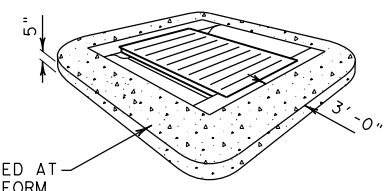
DITCH BLOCK DETAILS

N. T. S.



RIPRAP DITCH AT RETAINING WALL

N. T. S.



RIPRAP TO BE PLACED AT EACH INLET TO CONFORM TO ADJACENT SLOPES.
 SINGLE INLET: 1 CY
 DOUBLE INLET: 2 CY

TYPICAL RIPRAP APRON DETAIL

TYPE AD INLET SHOWN
 TYPE AD-2 INLET IS SIMILAR

SHEET 3 OF 3 SHEETS

		Fort Worth District Standard	
MISCELLANEOUS DRAINAGE DETAILS MDD (FTW)			
ORIGINAL DRAWING: 05/2019	mdd-ftw.dgn	FED. RD. DIV. NO. 6	PROJECT NO. SEE TITLE SHEET
DATE 05/2019	REVISIONS NEW STANDARD	STATE TEXAS	SHEET NO. 85
		STATE DIST. NO. FTW	COUNTY PARKER
		CONT. 0313	JOB HIGHWAY NO. 07 020 FM 51

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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	DEVICE	SINGLE		DOUBLE		INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX (XX) NUMBER OF REFLECTORS S = Single D = Double COLOR OF REFLECTORS W = White Y = Yellow R = Red REFLECTOR UNIT SIZE 1 or 2 TYPE OF POST OR DELINEATOR WC = Wing Channel Post YFLX = Yellow Flexible Post WFLX = White Flexible Post BRF = Barrier Reflector TYPE OF MOUNT GND = Embedded (drivable or set in concrete) CTB = Concrete Barrier Mount GF1 or GF2 = Guard Fence Attachment SRF = Surface Mount
								SHEETING Yellow, White or Red Type B or C reflective sheeting		
NOTE 1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx). 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									
DEVICE	Type 1 (OM-1)		Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4	
SHEETING	Yellow-Type B _{FL} or C _{FL} Sheeting		Yellow - Type B or C Sheeting			Alternating acrylic black and retroreflective yellow - Type B _{FL} or C _{FL} Sheeting			Red -Type B _{FL} or C _{FL} Sheeting
POST TYPE	TWT		WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP		GND	GND	GND, SRF	WAS, WAP			WAS, WAP

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	DEVICE				DEVICE	
NOTE 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.			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).				NOTE 1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.		
SHEETING Yellow, White, Red			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"				MOUNTING HEIGHT 7'-0"		

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



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	0313	07	020	FM 51
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	FTW	PARKER	86	

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POST TYPE AND SUPPORT FOUNDATION DETAILS

TYPE OF BARRIER MOUNTS

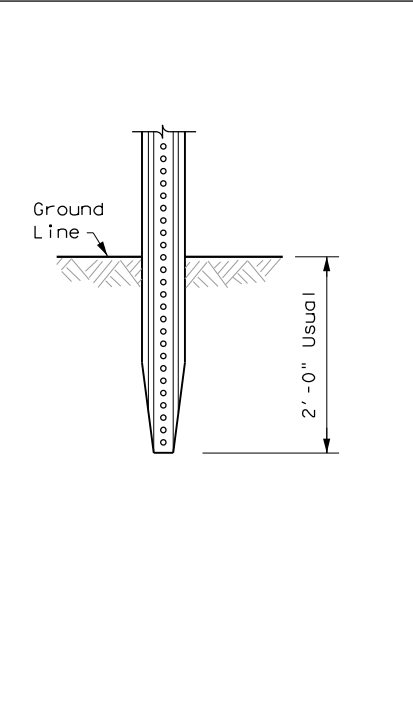
WING CHANNEL (WC)

FLEXIBLE POSTS (YFLX, WFLX)

WEDGE ANCHOR SYSTEMS

GUARD FENCE ATTACHMENT

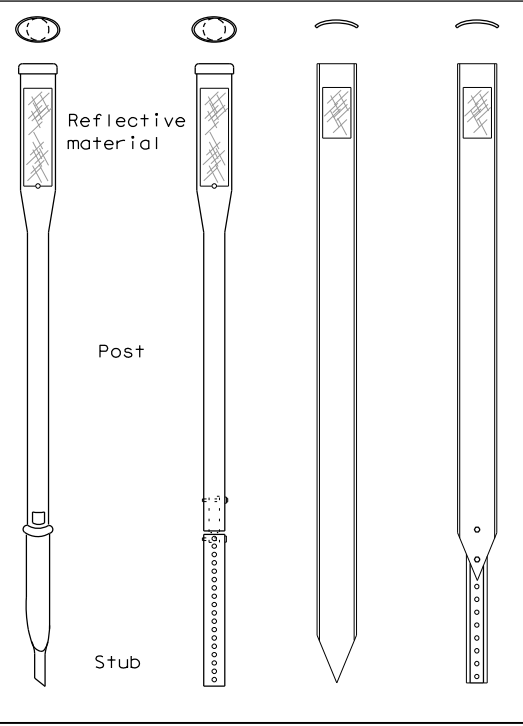
GND



NOTES

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

GND

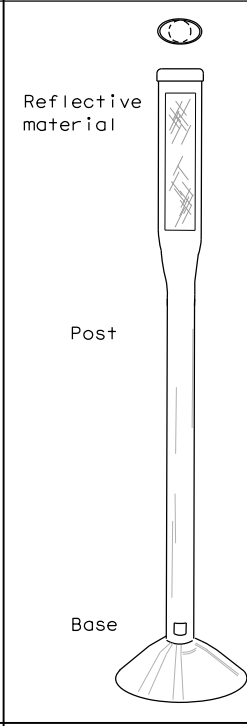


EMBEDDED

NOTES

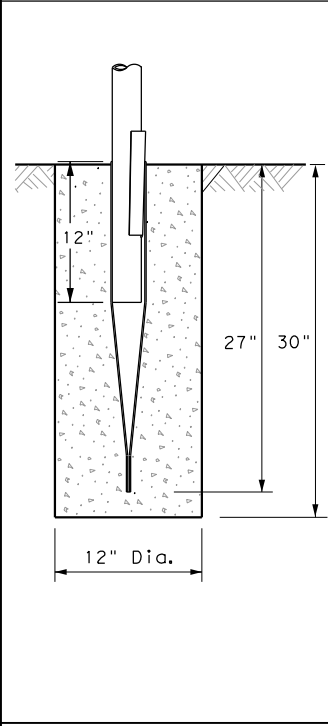
1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.
4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline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

SRF



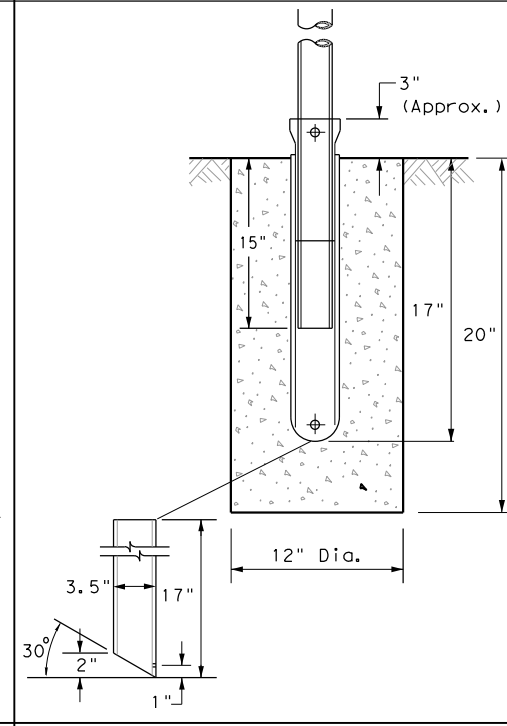
SURFACE MOUNT

WAS



STEEL

WAP



PLASTIC

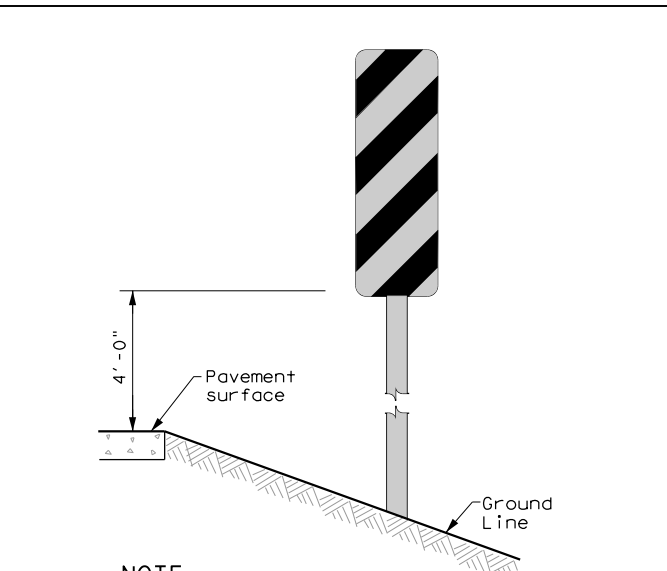
NOTE

1. Install per manufacturer's recommendations.

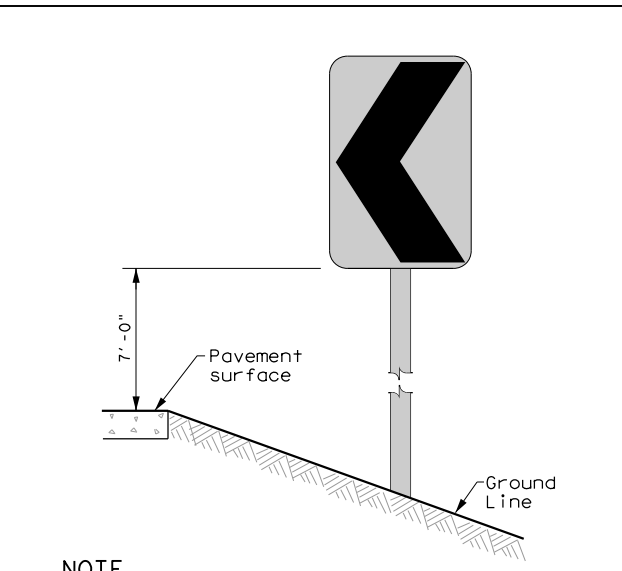
TYPES 1,3, AND 4 OBJECT MARKERS AND CHEVRONS

CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN

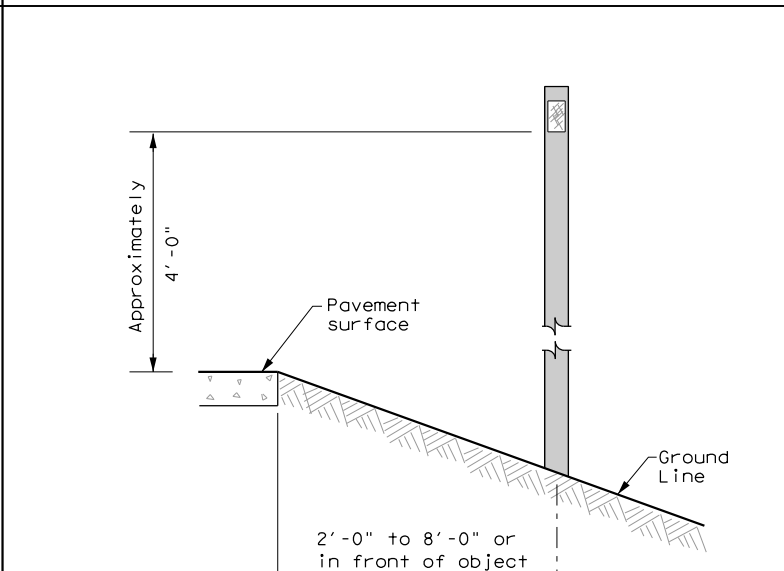
DELINEATORS AND TYPE 2 OBJECT MARKERS



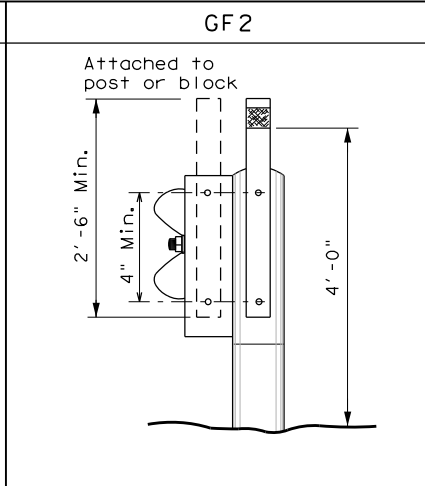
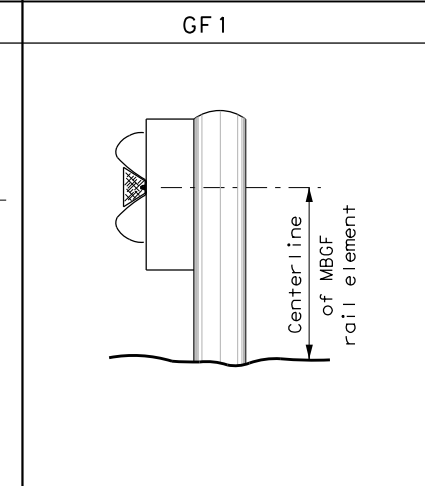
NOTE
 Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)



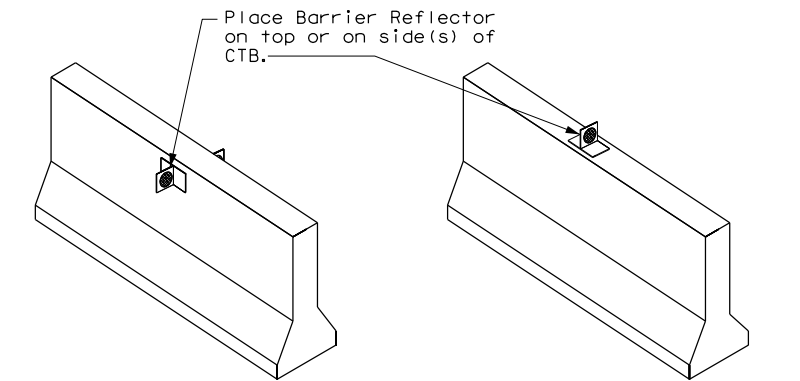
NOTE
 Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.



See general notes 1, 2 and 3.



CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

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

Texas Department of Transportation
 Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	FTW	PARKER		87

20B

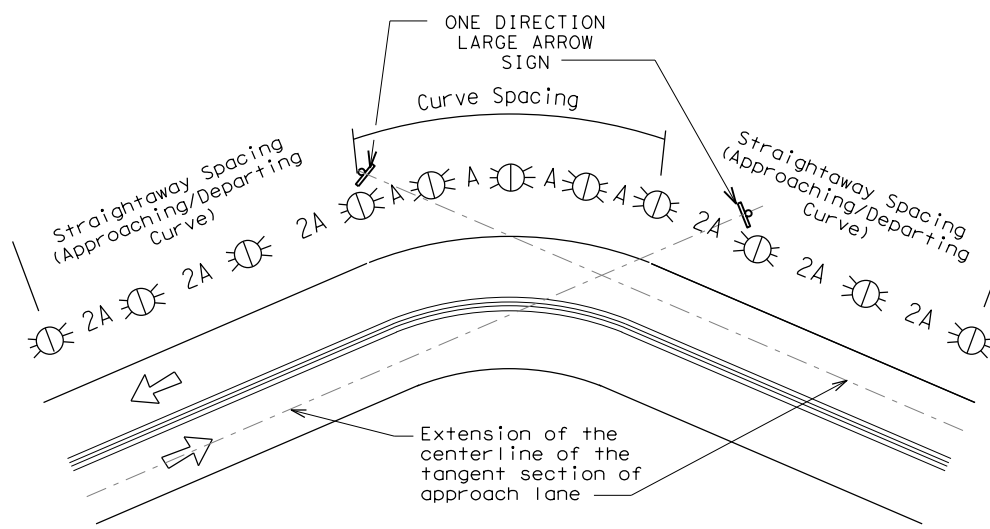
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: 10/19/2020 3:06:59 PM
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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

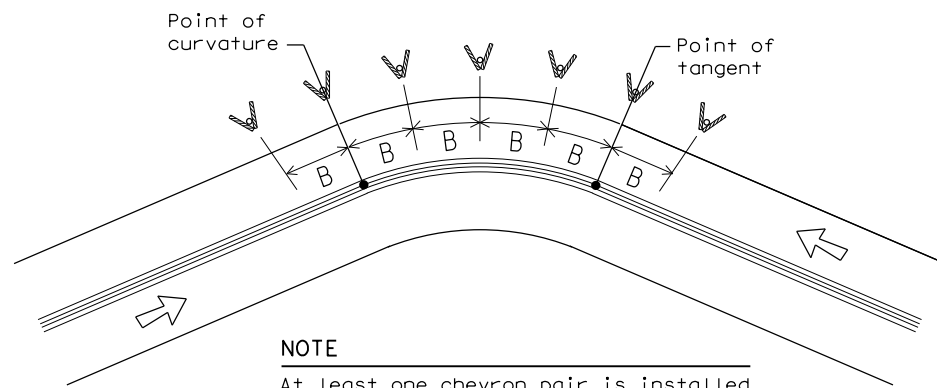
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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



DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

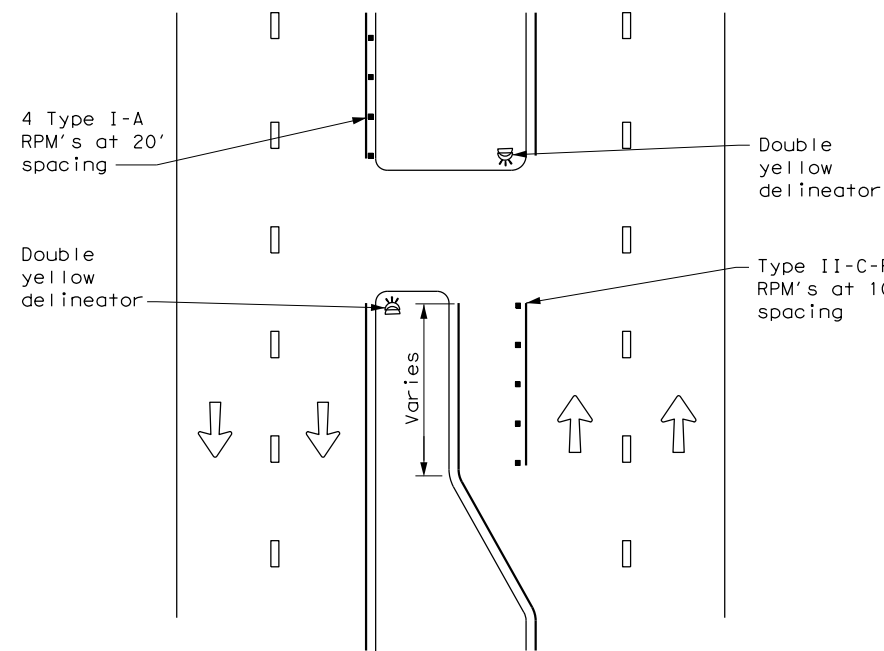
D & OM(3) -20

FILE: dom3-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
3-15 8-15	DIST	COUNTY	SHEET NO.	
8-15 7-20	FTW	PARKER	88	

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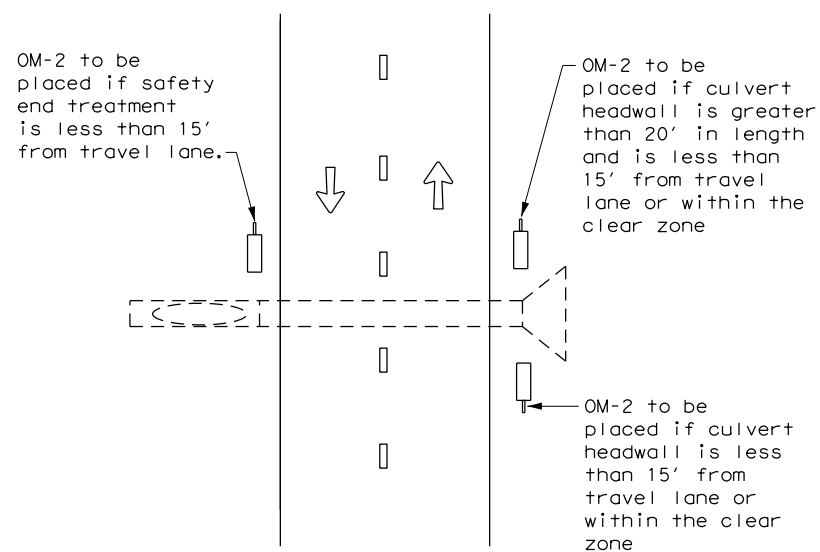
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CROSSOVERS



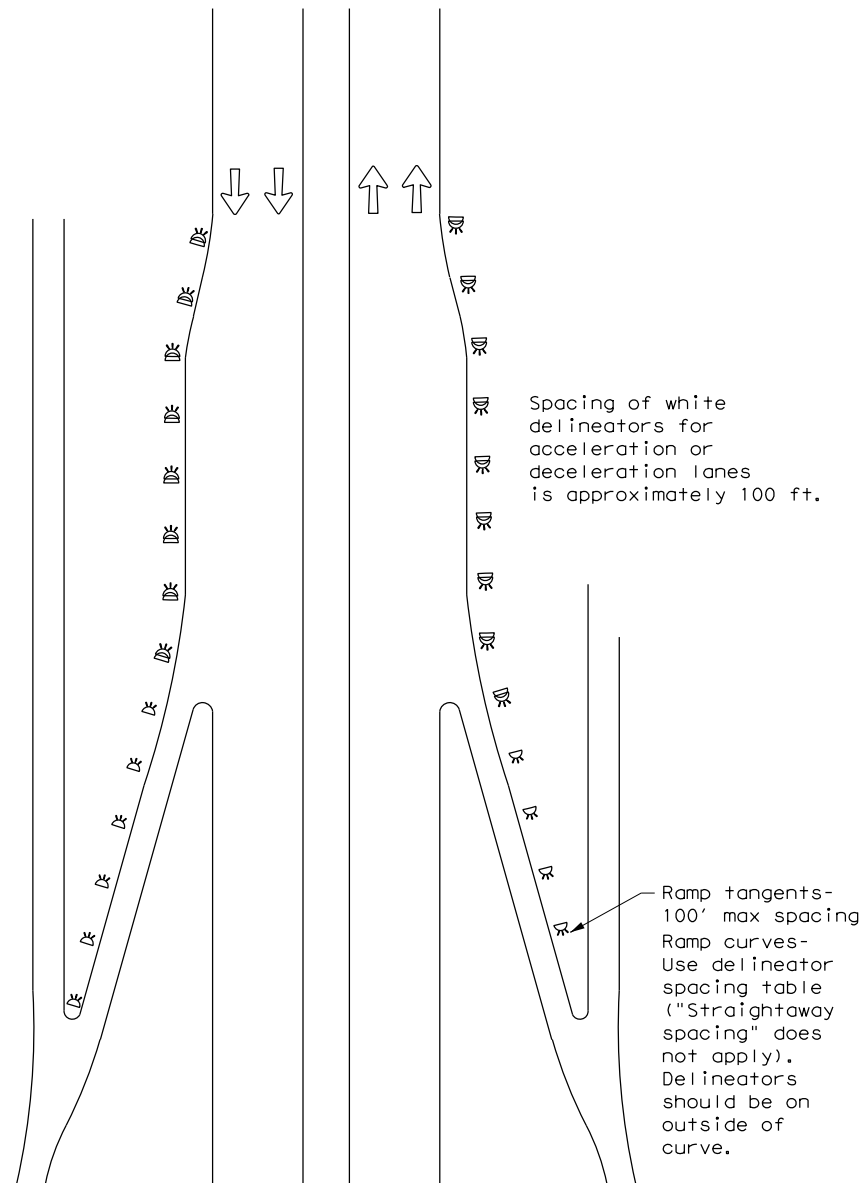
DETAIL 1

FOR CULVERTS WITHOUT MBGF



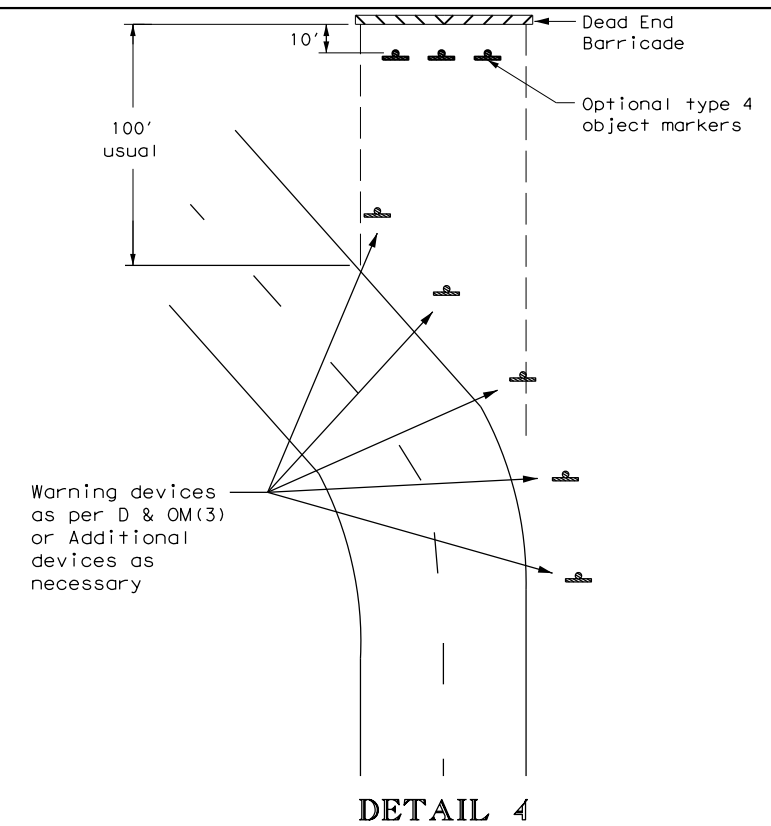
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



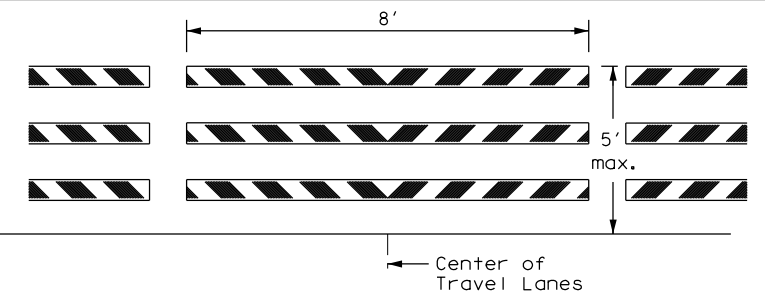
DETAIL 3

TYPICAL APPLICATION OF DEAD END BARRICADE



DETAIL 4

TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

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

DETAIL 5

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

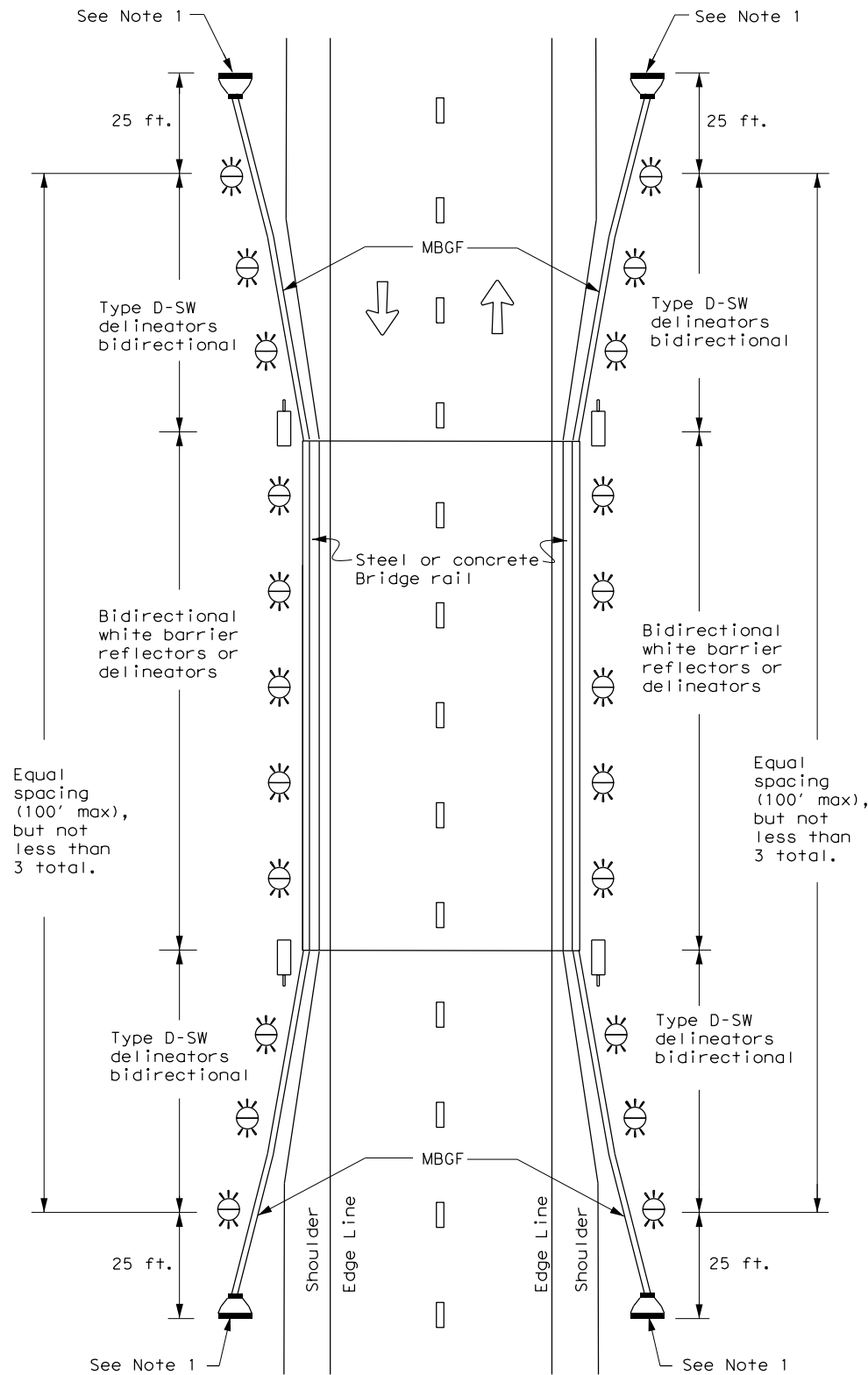


DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4) - 20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0313	07	020	FM 51
3-15	DIST	COUNTY	SHEET NO.	
7-20	FTW	PARKER	89	

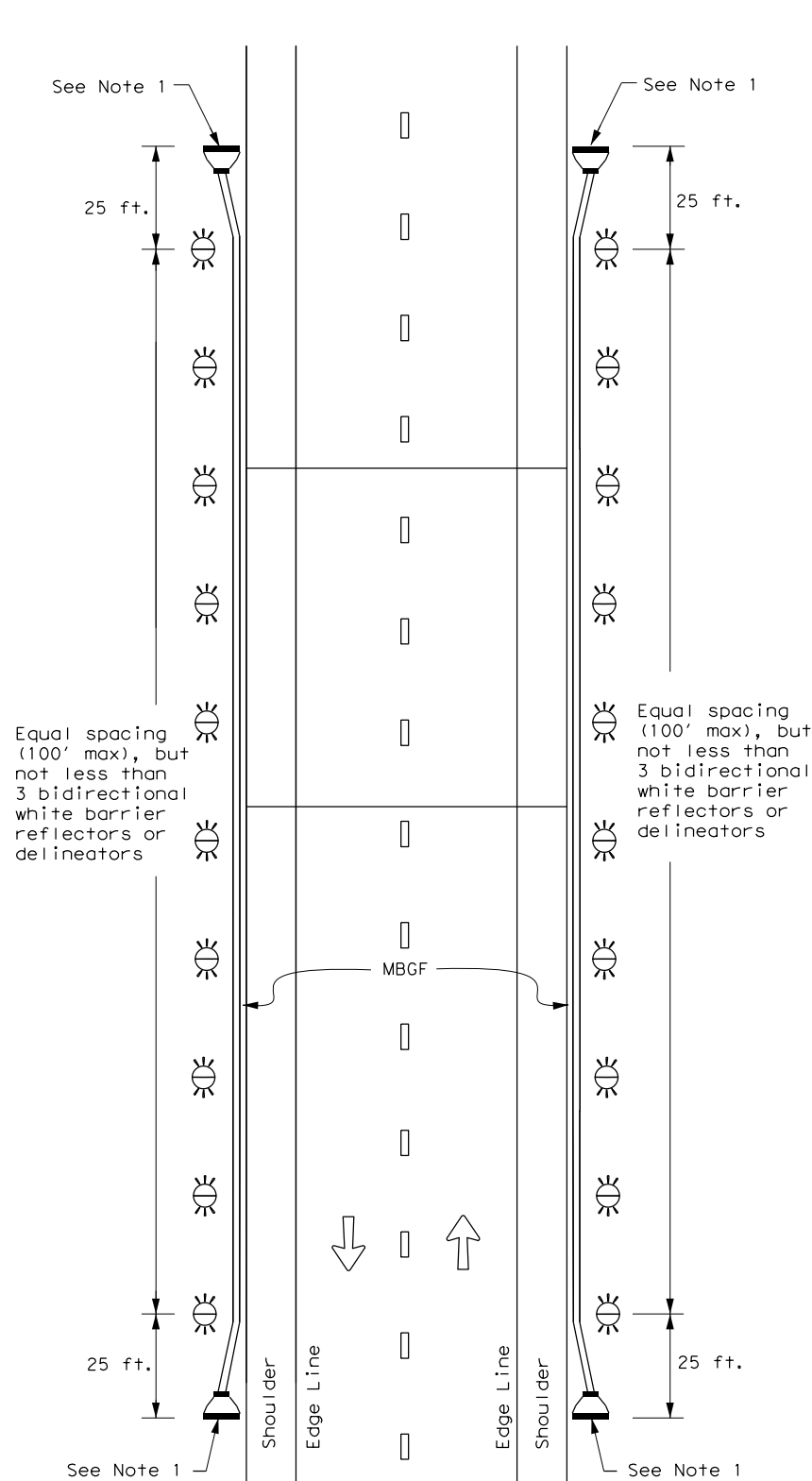
**TWO-WAY, TWO LANE ROADWAY
WITH REDUCED WIDTH APPROACH RAIL**



NOTE:

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

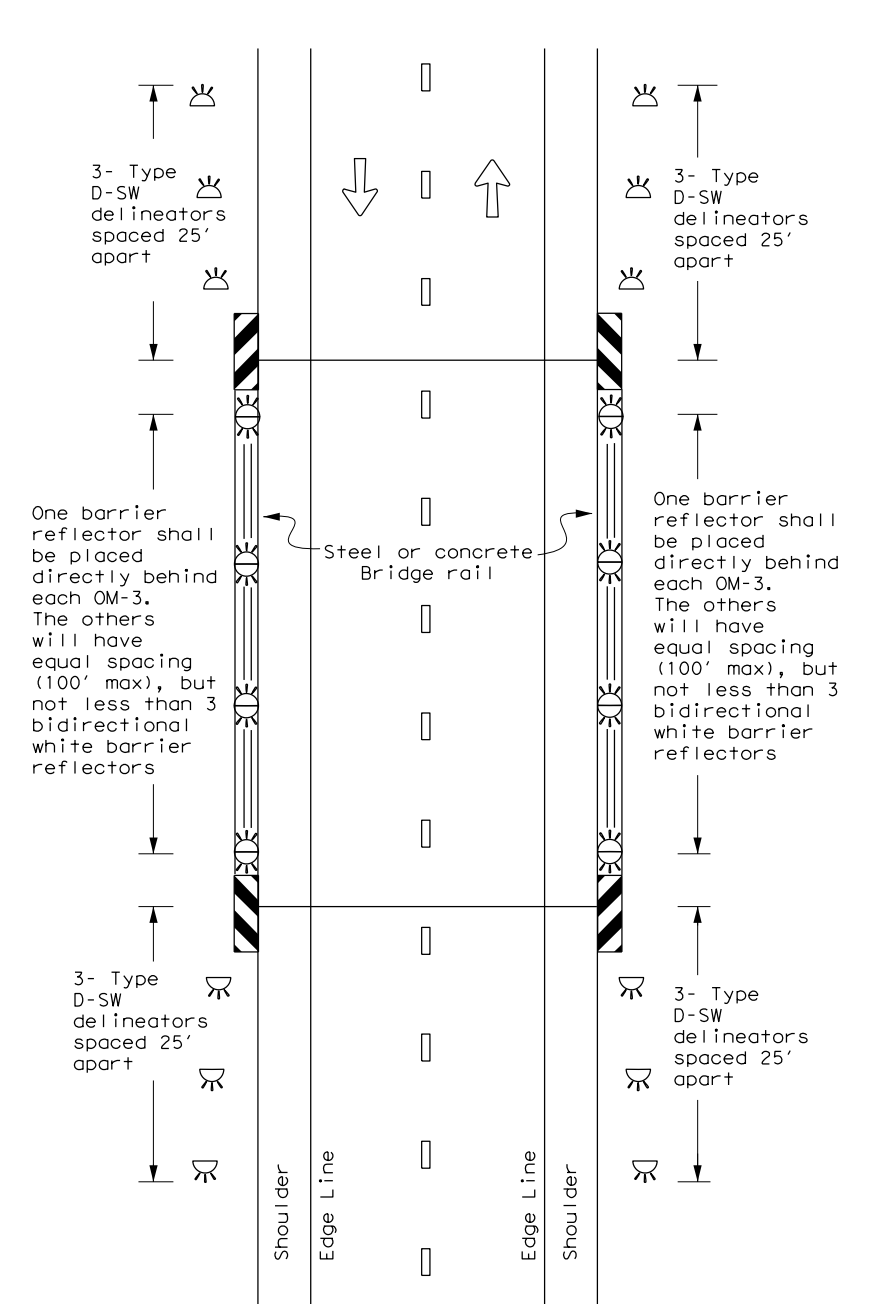
**TWO-WAY, TWO LANE ROADWAY
WITH METAL BEAM GUARD FENCE (MBGF)**



NOTE:

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

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



LEGEND

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



**DELINEATOR &
OBJECT MARKER
PLACEMENT DETAILS**

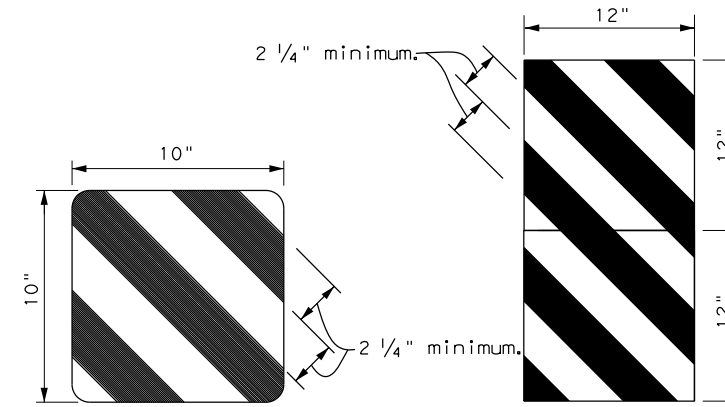
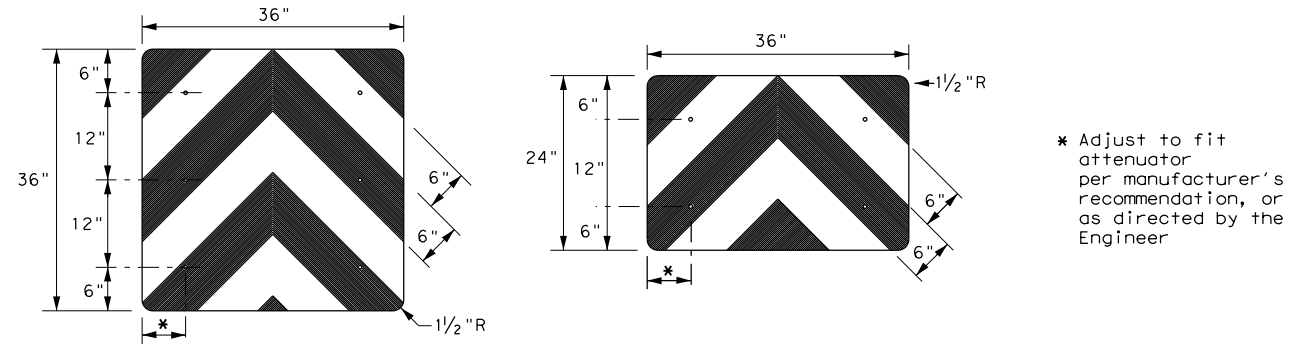
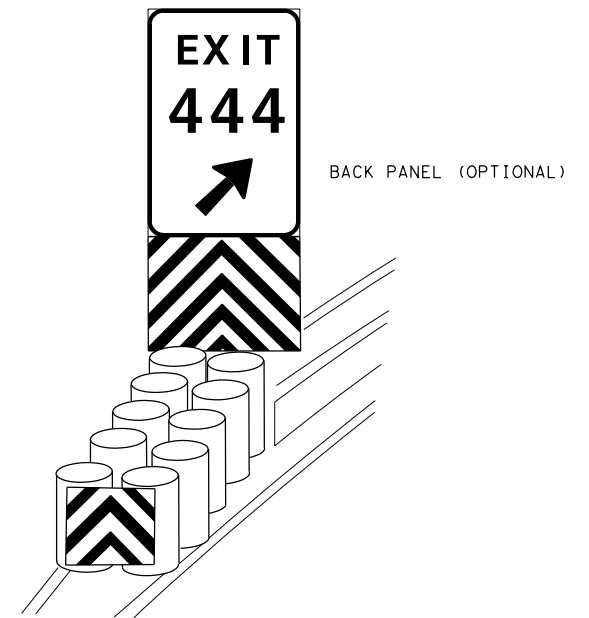
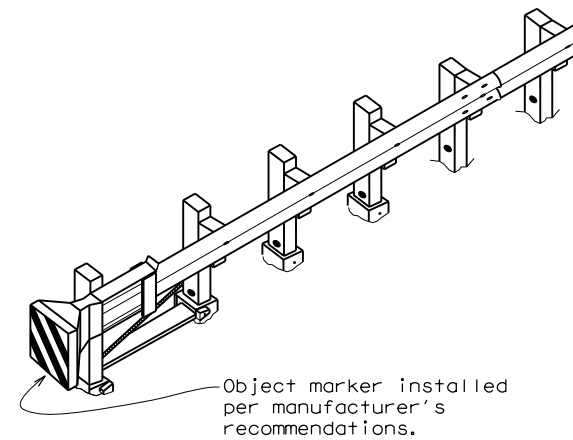
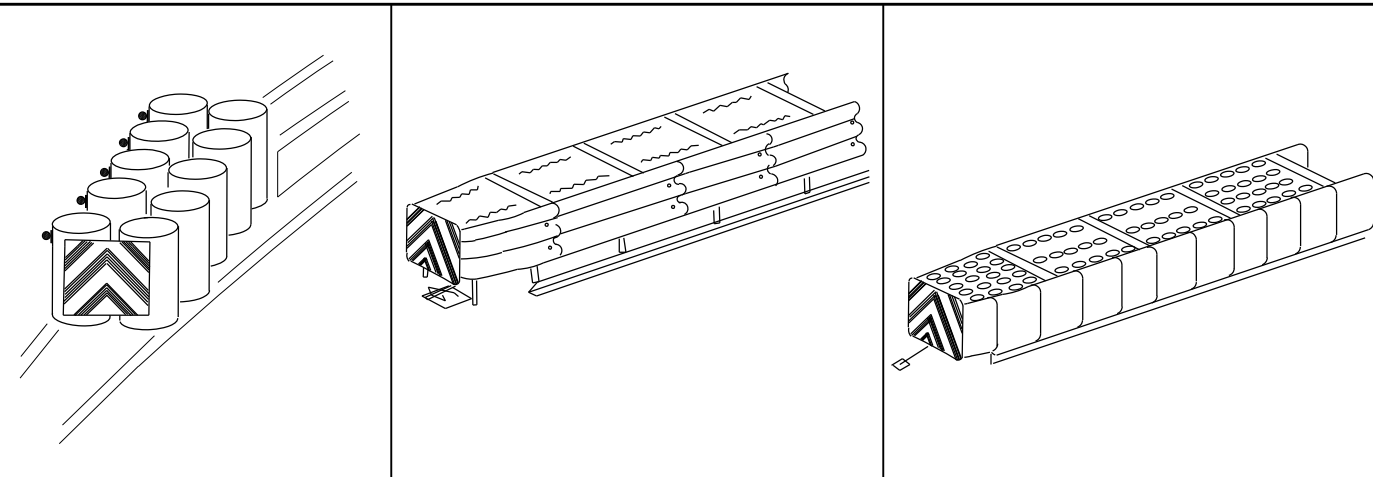
D & OM(5) - 20

FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2015	CON: 0313	SECT: 07	JOB: 020	HIGHWAY: FM 51
7-20	DIST: FTW	COUNTY: PARKER	SHEET NO. 90	

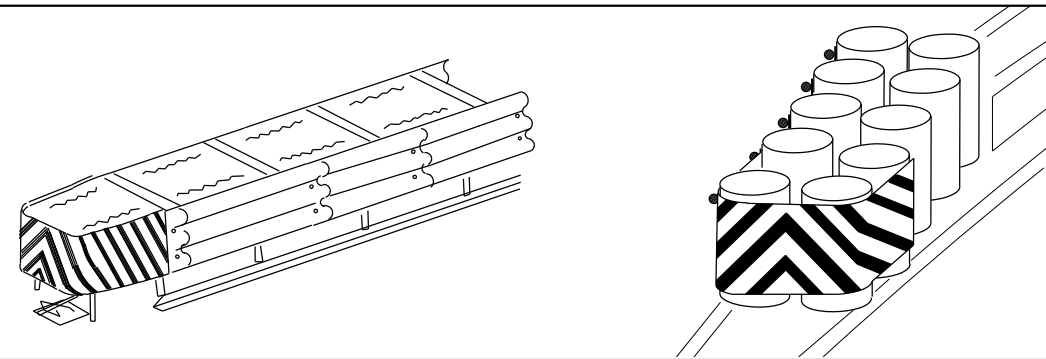
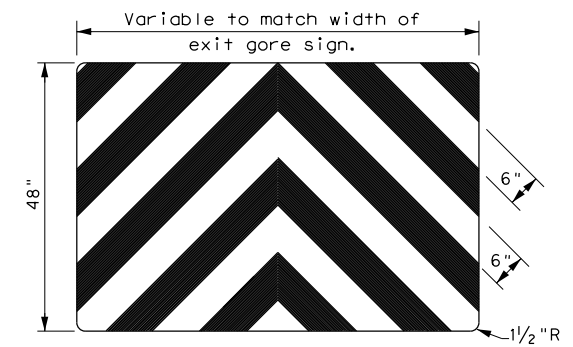
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OBJECT MARKERS SMALLER THAN 3 FT²

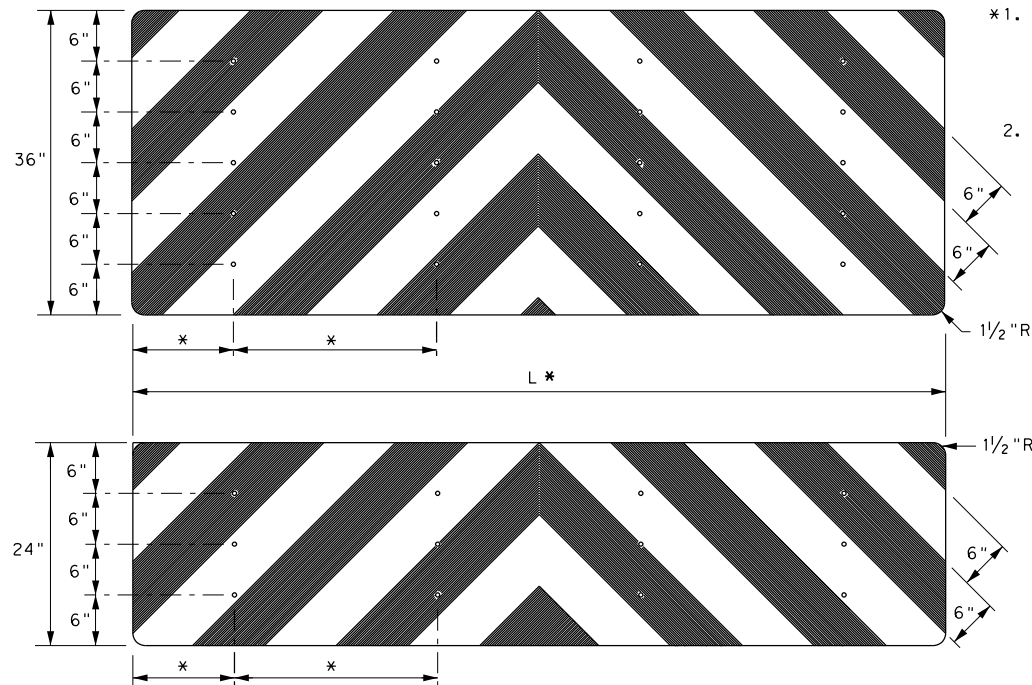


NOTES

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

NOTES

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

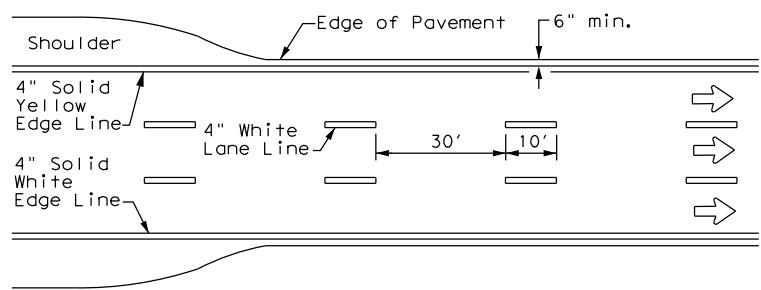


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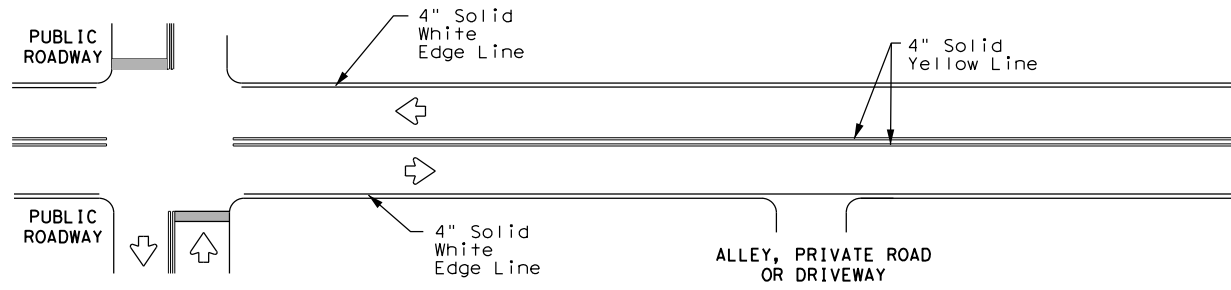
DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS D & OM(VIA) - 20			
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT
© TXDOT December 1989	CONT	SECT	JOB
REVISIONS		031307	020
4-92 8-04	DIST	COUNTY	SHEET NO.
8-95 3-15	FTW	PARKER	91
4-98 7-20			
20G			

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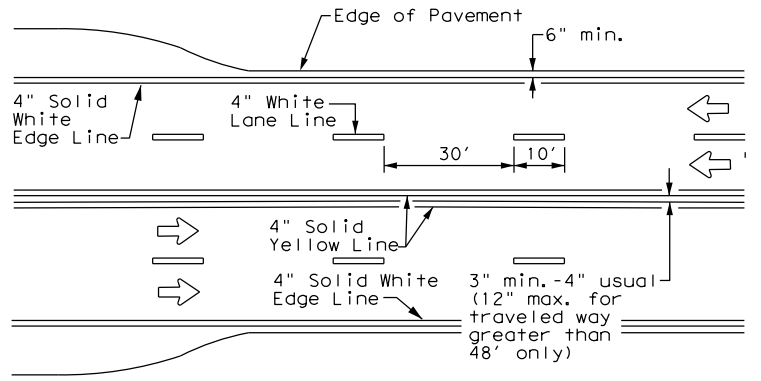
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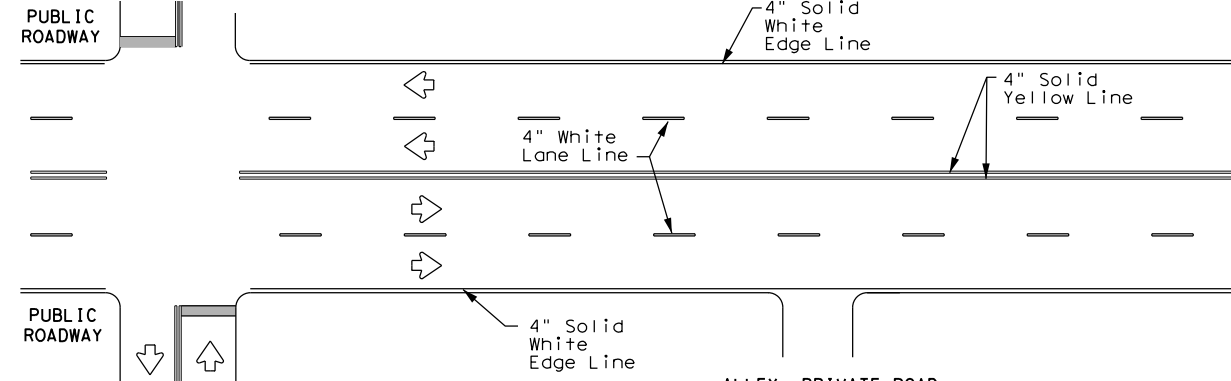
EDGE LINE AND LANE LINES
 ONE-WAY ROADWAY
 WITH OR WITHOUT SHOULDERS



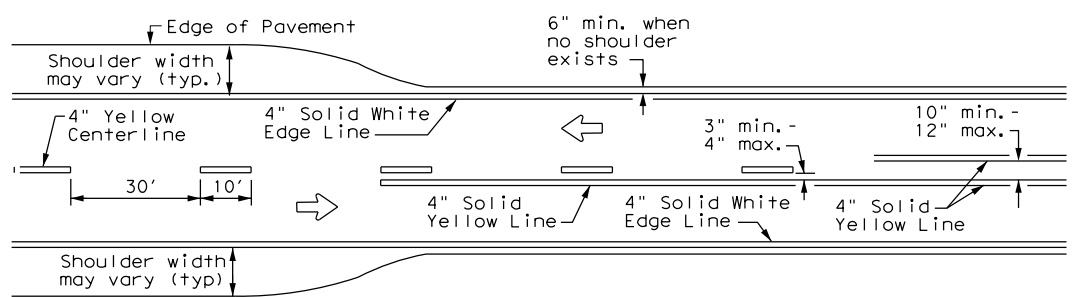
TYPICAL TWO-LANE, TWO-WAY PAVEMENT
 MARKINGS THROUGH INTERSECTIONS



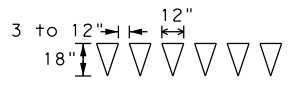
CENTERLINE AND LANE LINES
 FOUR LANE TWO-WAY ROADWAY
 WITH OR WITHOUT SHOULDERS



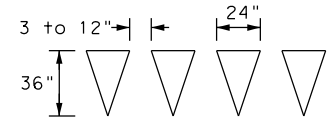
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT
 MARKINGS THROUGH INTERSECTIONS



TWO LANE TWO-WAY ROADWAY
 WITH OR WITHOUT SHOULDERS

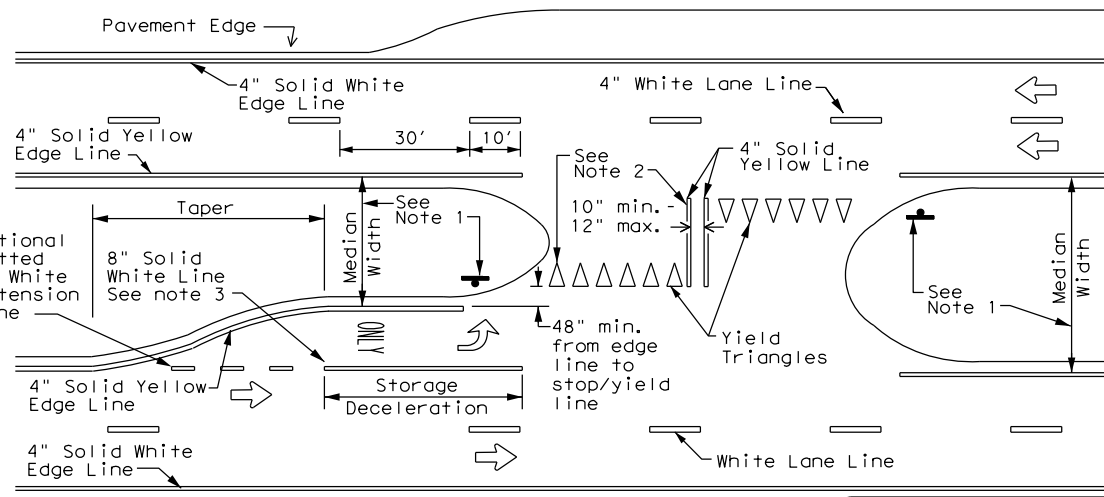


For posted speed on road being marked equal to or less than 40 MPH.



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

YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

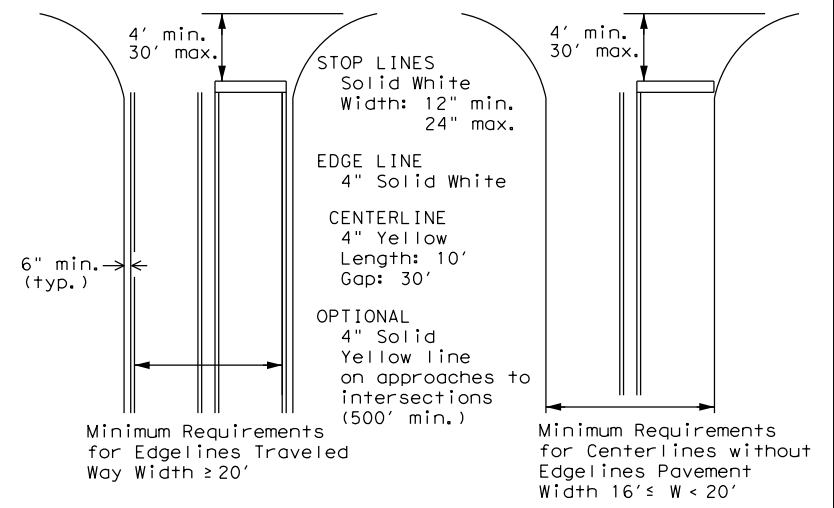
- Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling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

GENERAL NOTES

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

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

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



GUIDE FOR PLACEMENT OF STOP LINES,
 EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths
 for Undivided Highways



TYPICAL STANDARD
 PAVEMENT MARKINGS

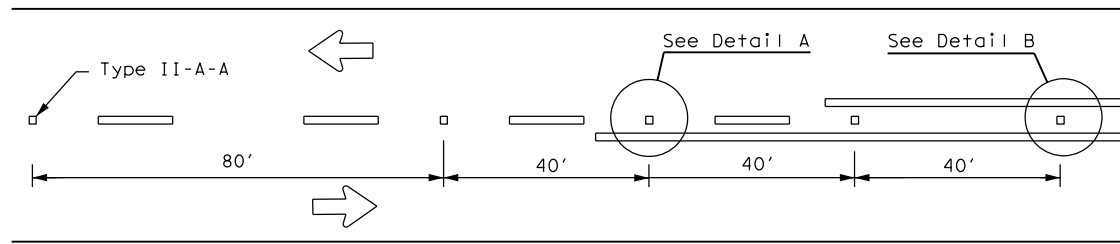
PM(1) - 20

FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
8-95 3-03 REVISIONS	0313	07	020	FM 51
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	FTW	PARKER		92

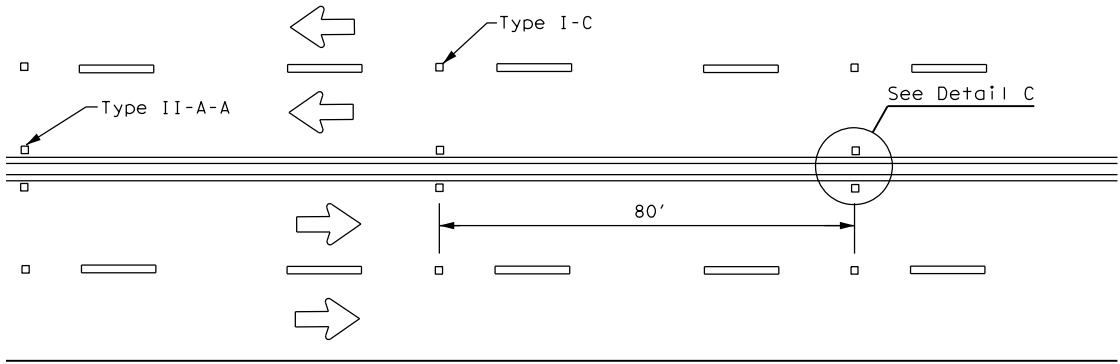
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

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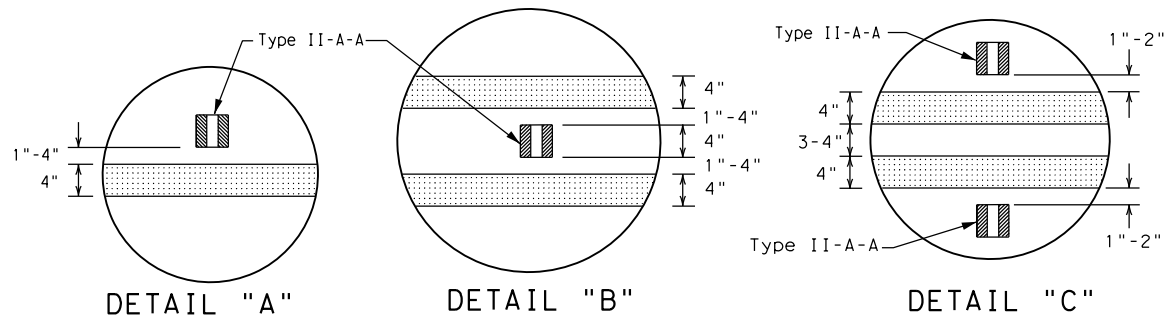
DATE: 10/19/2020 3:07:25 PM
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CENTERLINE FOR ALL TWO LANE ROADWAYS



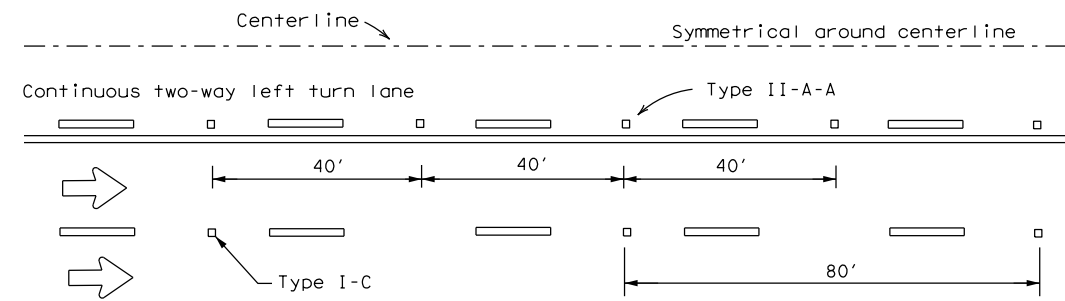
CENTERLINE & LANE LINES
FOR FOUR LANE TWO-WAY HIGHWAYS



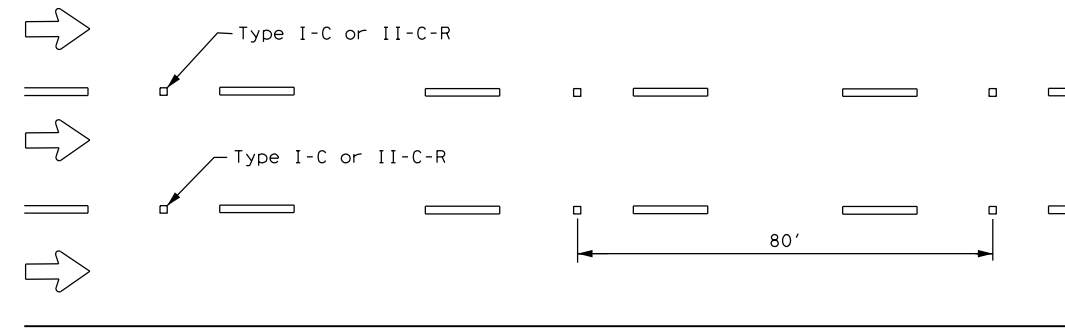
DETAIL "A"

DETAIL "B"

DETAIL "C"

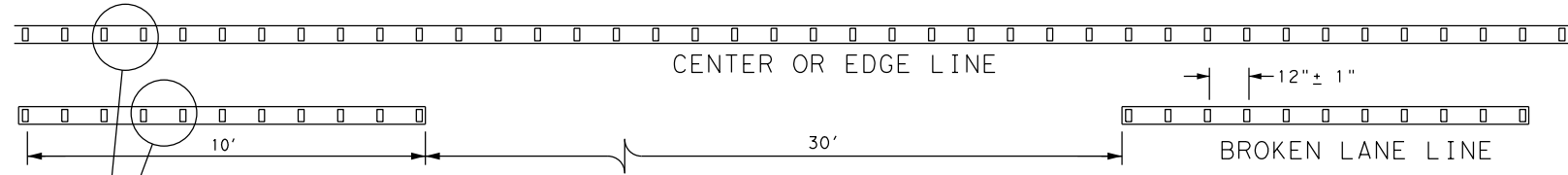


CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



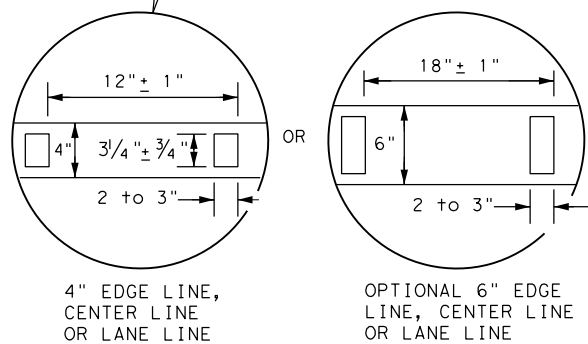
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

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



REFLECTORIZED PROFILE
PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



4" EDGE LINE,
CENTER LINE
OR LANE LINE

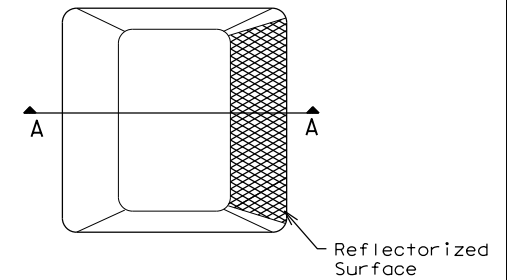
OPTIONAL 6" EDGE
LINE, CENTER LINE
OR LANE LINE

NOTE

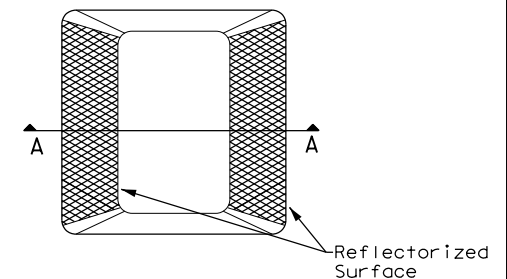
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

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

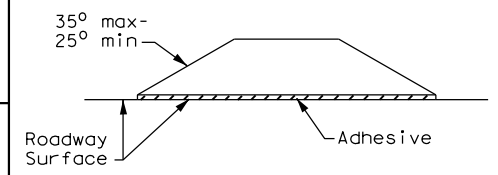
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

GENERAL NOTES

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



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

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
4-92 2-10 REVISIONS	0313	07	020	FM 51
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	FTW	PARKER		93

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A. GENERAL SITE DATA

- PROJECT LIMITS:** Highway: FM 51
 From: JUNCTION SH 171 SOUTH
 To: HOOD COUNTY LINE
 LATITUDE: 32° 37' 51.09"N LONGITUDE: 97° 46' 40.41"W
- PROJECT SITE MAPS:**
 - * Project Location Map: Title Sheet (Sheet 1)
 - * Drainage Patterns: Drainage Area Maps (Sheets 50- 51)
 - * Approx. Slopes Anticipated After Major Gradings and Areas of Soil Disturbance: Typical Sections (Sheet 5)
 - * Major Controls and Locations of Stabilization Practices: (Sheet 98)
 - * SW3P Site Map Sheets
 - * Project Specific Locations:
 - To be specified by Project Field Office and located in the Project SW3P File
 - * Surface Waters and Discharge Locations: Drainage and Culvert Layout Sheets (Sheets 54 - 63)
- PROJECT DESCRIPTION:**
 CONSTRUCTION OF MULTI LOCATION CULVERT REPLACEMENT AND BRIDGE GUARDRAIL UPGRADE
- MAJOR SOIL DISTURBING ACTIVITIES:**
 SOIL DISTURBING ACTIVITIES INCLUDE GRADING, EXCAVATION, BACKFILL, AND SEEDING.
- EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:**
 SOILS ARE CLASSIFIED AS A MIXTURE OF ALEDO-BOLAR, FRIO CLAY LOAM, KRUM CLAY, WINDTHROST SANDY LOAM.
 VEGETATIVE GRASSES COVER APPROX. 70% OF THE AREA.
- TOTAL PROJECT AREA:** 149.83 Acres
- TOTAL AREA TO BE DISTURBED:** 1.34 Acres (0.9% OF TOTAL PROJECT AREA)
- WEIGHTED RUNOFF COEFFICIENT**

BEFORE CONSTRUCTION:	0.57
AFTER CONSTRUCTION:	0.57
- NAME OF RECEIVING WATERS:**
 SPRING CREEK, HAYDON CREEK, SHAW CREEK, CIDWELL BRANCH AND MUD CREEK
- ENDANGERED SPECIES, DESIGNATED CRITICAL HABITAT AND HISTORIC PROPERTY:**
 No Endangered Species, Designated Critical Habitat or Historic Property has been found on this project site.

The documentation satisfying TPDES Construction General Permit eligibility pertaining to the existence or of any protective action taken with regards to endangered species or designated critical habitat or historical property in this project area is contained in the project's Environmental document (EA or EIS) and can be viewed under the State Open Records Act at the address shown below:

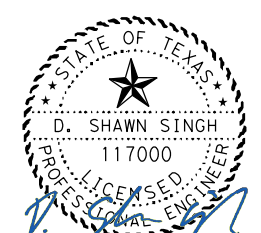
TEXAS DEPARTMENT OF TRANSPORTATION
 FORT WORTH DISTRICT HEADQUARTERS
 DISTRICT DESIGN SECTION
 2501 SW LOOP
 FORT WORTH, TX 76133
 PHONE: 817-370-6500

B. EROSION AND SEDIMENT CONTROLS

- SOIL STABILIZATION PRACTICES:**
 (Select T = Temporary or P = Permanent, as applicable)

<input type="checkbox"/> TEMPORARY SEEDING	<input type="checkbox"/> PRESERVATION OF NATURAL RESOURCES
<input type="checkbox"/> MULCHING (Hay or Straw)	<input type="checkbox"/> FLEXIBLE CHANNEL LINER
<input type="checkbox"/> BUFFER ZONES	<input type="checkbox"/> RIGID CHANNEL LINER
<input type="checkbox"/> PLANTING	<input type="checkbox"/> SOIL RETENTION BLANKET
<input checked="" type="checkbox"/> SEEDING	<input type="checkbox"/> COMPOST MANUFACTURED TOPSOIL
<input checked="" type="checkbox"/> SODDING	<input type="checkbox"/> OTHER: (Specify Practice)
- STRUCTURAL PRACTICES:**
 (Select T = Temporary or P = Permanent, as applicable)

<input checked="" type="checkbox"/> SILT FENCES	<input type="checkbox"/> DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
<input type="checkbox"/> HAY BALES	<input type="checkbox"/> DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
<input checked="" type="checkbox"/> ROCK FILTER DAMS	<input type="checkbox"/> DIVERSION DIKE AND SWALE COMBINATIONS
<input type="checkbox"/> PIPE SLOPE DRAINS	<input type="checkbox"/> ROCK BEDDING AT CONSTRUCTION EXIT
<input type="checkbox"/> PAVED FLUMES	<input type="checkbox"/> TIMBER MATTING AT CONSTRUCTION EXIT
<input type="checkbox"/> CHANNEL LINERS	<input type="checkbox"/> STONE OUTLET STRUCTURES
<input type="checkbox"/> SEDIMENT TRAPS	<input type="checkbox"/> VELOCITY CONTROL DEVICES
<input type="checkbox"/> SEDIMENT BASINS	<input type="checkbox"/> CURBS AND GUTTERS
<input type="checkbox"/> STORM SEWERS	<input type="checkbox"/> STORM INLET SEDIMENT TRAP
<input checked="" type="checkbox"/> OTHER: BIODEG EROSN CONT LOGS	
- STORM WATER MANAGEMENT:** (Example Below - May be used as applicable, revised or expanded)
 - Storm water drainage will be provided by the ditches, inlets and storm water systems that will carry drainage within the R.O.W. to the low points within the roadway and project site which drain to natural facilities.
 - Other permanent erosion controls include hydraulic design to limit structure outlet velocities and grading design generally consisting of 4:1 or flatter slopes with permanent vegetative cover.
- STORM WATER MANAGEMENT ACTIVITIES:** (Sequence of Construction)
 - For detailed construction activities see Traffic Control Plan Narrative.
 - Prior to the start of construction, install rock filter dams and silt fence as shown in the SW3P detail sheet or as directed by the engineer.
 - Minimize soil disturbance and preserve existing vegetation to reduce erosion and sedimentation, to the extent practicable.
 - When all construction activity is complete and the site is stabilized and approved by the Engineer, remove all temporary sediment control devices.
- NON-STORM WATER DISCHARGES:**
 Non-storm water discharges should be filtered, or held in retention basins, before being allowed to mix with storm water. These discharges consist of non-polluted ground water, spring water, foundation and/or footing drain water, and water used for dust control, pavement washing and vehicle washwater containing no detergents.


 Signature _____, P.E. 10/19/2020
 Date _____

Kimley»Horn F-928
 Texas Department of Transportation Fort Worth District Standard
 STORM WATER POLLUTION PREVENTION PLAN (SW3P)
 SHEET 1 OF 2 SHEETS

ORIGINAL DRAWING: 09/2002	sw3p-ftw.dgn	FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
DATE	REVISIONS	6	SEE TITLE SHEET	94
09/2008	NPDES TO TPDES	STATE	DIST. NO.	COUNTY
01/2012	CLARIFY NOTE C.2.	TEXAS	FTW	PARKER
08/2013	ADDED SIGN	CONT.	SECT.	JOB
05/2019	2-SHEET FORMAT	0313	07	020
				HIGHWAY NO.
				FM 51

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C. OTHER REQUIREMENTS & PRACTICES

1. MAINTENANCE:

All erosion and sediment controls shall be maintained in good working order. If a repair is necessary, it shall be performed at the earliest date possible but no later than 7 calendar days after the surrounding exposed ground has dried sufficiently to prevent further damage from heavy equipment. Disturbed areas on which construction activities have ceased, temporarily or permanently, shall be stabilized within 14 calendar days unless they are scheduled to and do resume within 21 calendar days. The areas adjacent to creeks and drainageways shall have priority followed by devices protecting storm sewer inlets.

2. INSPECTION:

An inspection shall be performed by a TxDOT Inspector every 14 calendar days as well as within 24 hours after any rainfall of one-half inch or more is recorded on a non-freezing rain gauge to be located at the project site, or every 7 calendar days. An Inspection and Maintenance Report shall be filed for each inspection. Based on the inspection results, the controls shall be revised in accordance with the inspection report.

3. WASTE MATERIALS:

Except as noted below, all waste materials shall be collected in a metal dumpster having a secure cover. The dumpster shall meet all state and local solid waste management regulations. All trash and debris from construction shall be deposited in the dumpster. The dumpster shall be emptied, as necessary or as required by local regulation, and hauled to a local approved land fill site. The burying of construction waste on the project site shall not be permitted.

Concrete washout areas shall be required and shall consist of a pit, lined with an impervious material, of sufficient size to contain, until evaporation, all water used and washout material produced during concrete washout operations. The concrete washout locations shall be as directed by the engineer.

Lime slaking tanks shall be surrounded by an earthen berm, capable of containing any overflow.

4. HAZARDOUS WASTE (INCLUDING SPILL REPORTING):

As a minimum, any products in the following categories are considered to be hazardous: paints, acids, solvents, asphalt products, chemical additives for soil stabilization, and concrete curing compounds or additives. In the event of a spill which may be hazardous, the spill coordinator shall be contacted immediately.

5. SANITARY WASTE:

All sanitary waste shall be collected from the portable units, as necessary or as required by local regulation, by a licensed sanitary waste management contractor.

6. OFFSITE VEHICLE TRACKING:

The Contractor shall be required, on a regular basis or as may be directed by the Engineer, to dampen haul roads for dust control, stabilize construction entrances and to remove excess dirt from the roadway.

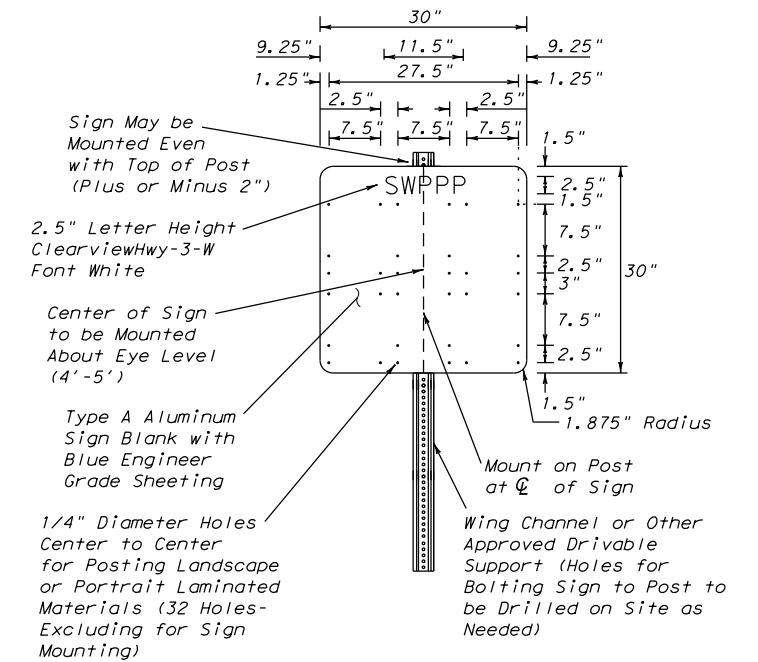
7. MANAGEMENT PRACTICES:

1. Disposal areas, stockpiles and haul roads shall be constructed in a manner that will minimize and control the amount of sediment that may enter receiving waters. Disposal areas shall not be located in any wetland, waterbody or streambed.
2. Construction staging areas and vehicle maintenance areas shall be constructed by the Contractor in a manner to minimize the runoff of pollutants.
3. All temporary fills placed in waterways shall be built of erosion resistant material. (NWP 14)
4. All waterways shall be cleared as soon as practicable of temporary embankment, temporary bridges, matting, falsework, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.

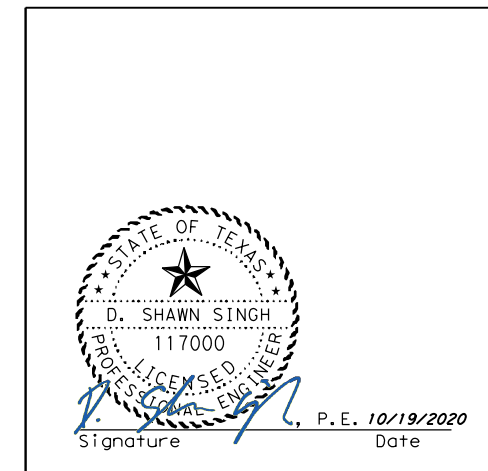
8. OTHER:


1. Listing of construction materials stored on site to be provided by Project Field Office.
2. The Project SW3P File located at the project field office shall contain the N.O.I., CGP Coverage Notice, TCEQ TPDES Form, Signature Authorization, Certification/Qualification Statements, Inspection Reports, Required Maps, and a copy of the TPDES General Permit No. TXRI50000.


STORM WATER POLLUTION PREVENTION PLAN PERMIT POSTING




No Permanent Installation Allowed.
Sign to be Removed After Project Completion.









STORM WATER POLLUTION PREVENTION PLAN (SW3P)

SHEET 2 OF 2 SHEETS

ORIGINAL DRAWING: 09/2002	sw3p-ftw.dgn	FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
DATE	REVISIONS	6	SEE TITLE SHEET	95
09/2008	NPDES TO TPDES	STATE	DIST. NO.	COUNTY
01/2012	CLARIFY NOTE C.2.	TEXAS	FTW	PARKER
08/2013	ADDED SIGN	CONT.	SECT.	JOB
05/2019	2-SHEET FORMAT	0313	07	020
				HIGHWAY NO.
				FM 51

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DATE: FILE:

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.

-
- No Action Required Required Action

Action No.

- Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
- Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
- Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
- 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.

- Spring Creek (Water 1) at 32.646660, -97.776854
- Haydon Creek (Water 2) at 32.628351, -97.777235
- Shaw Creek (Water 3) at 32.613175, -97.774792
- Cidwell Branch (Water 4) at 32.594753, -97.773592
- Mud Creek (Water 5) at 32.580657, -97.766861

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

1. FEMA Floodplain Notification
The project is located within a Federal Emergency Management Area (FEMA) designated 100 year floodplain. The hydraulic design for this project would be in accordance with current FHWA and TxDOT design policies. The facility would permit the conveyance of the 100-year flood, inundation of the roadway being acceptable, without causing significant damage to the facility, stream or other property. The proposed project would not increase the base flood elevation to a level that would violate applicable floodplain regulations and ordinances. Coordination with the local Floodplain Administrator will be required.

2. Section 402 of the Clean Water Act: Texas Pollutant Discharge Elimination System, Construction General Permit
This project would include five or more acres of earth disturbance. TxDOT would comply with TCEQ's Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit (CGP). A Storm Water Pollution Prevention Plan (SW3P) would be implemented, and a construction site notice would be posted on the construction site. A Notice of Intent (NOI) would be required.

3. Section 404 of the Clean Water Act: Waters of the US Nationwide Permits
The placement of temporary or permanent dredge or fill material into potentially jurisdictional Waters of the US would be authorized under Nationwide Permit (NWP) 14 without a Pre-Construction Notification (PCN). A PCN would not be required because the project's impacts to jurisdictional Waters of the US do not exceed the 0.10 acre threshold set by the United States Army Corps of Engineers (USACE) for NWP 14 and there would be no impacts to any wetlands, or other special aquatic sites. There is no potential to affect listed species or designated critical habitat, and there are no impacts to historic properties listed or eligible for listing on the National Register of Historic Places (NRHP).

4. Section 401 of the Clean Water Act: Water Quality Certification
The 401 Certification requirements for utilizing a NWP would be met by implementing approved Best Management Practices (BMPs) from TCEQ's 401 Water Quality Certification Conditions for NWPs. At a minimum, one BMP from each category would be selected and implemented for the proposed project.

5. Water Quality BMPs
In addition to BMPs required for a TCEQ Storm Water Pollution Prevention Plan and 401 water quality permit:

- Minimize the use of equipment in streams and riparian areas during construction. When possible, equipment access should be from the banks, bridge decks, or barges.
- When temporary stream crossings are unavoidable, remove stream crossings once they are no longer needed and stabilize banks and soils around the crossing.

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

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.

- Executive Order 13112 on Invasive Species and Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds

No landscaping would be a part of the proposed project. Disturbed areas would be re-vegetated according to TxDOT's standard practices for rural area, which to the extent practical, is in compliance with EO 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping (04/26/94).

- Vegetation Disturbance
During construction, efforts would be taken to avoid and minimizing disturbance of vegetation and soils. Areas within the existing ROW, but outside the limits of construction, would not be disturbed. Every effort would be made to preserve trees where they would neither compromise safety nor substantially interfere with the proposed projects.

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

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. Migratory Bird Treaty Act (MBTA)
Between October 1 and February 15, the contractor would remove all old migratory bird nests from any structure that would be affected by the proposed project, and complete any bridge work/demolition and/or vegetation clearing. In addition, the contractor would be prepared to prevent migratory birds from building nests by utilizing nest prevention methods, such as bird-deterrent netting and bird-repelling sprays and/or gels, between February 15 and October 1. In the event that migratory birds are encountered on-site during project construction, adverse impacts on protected birds, active nests, eggs, and/or young would be avoided.

2. Whooping Crane
The contractor and/or TxDOT personnel would be advised of potential for Whooping Cranes to occur within the project limits. Construction personnel will be advised to avoid adverse impacts to this species and to report any sightings to TxDOT District Environmental staff. Drainage modifications will be limited to the extent practical to accommodate the additional paved surface needed to bring the roadway up to current TxDOT safety standards. The construction personnel will report all sightings to TxDOT Fort Worth District Environmental staff. Reports should include the time, date and location and any available photos.

- Bird BMPs
In addition to complying with the Migratory Bird Treaty Act (MBTA) perform the following BMPs:
 - Prior to construction, perform daytime surveys for nests including under bridges and in culverts to determine if they are active before removal. Nests that are active should not be disturbed.
 - Do not disturb, destroy, or remove active nests, including ground nesting birds, during the nesting season.
 - Avoid the removal of unoccupied, inactive nests, as practicable;
 - Prevent the establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair;
 - Do not collect, capture, relocate, or transport birds, eggs, young, or active nests without a permit.

4. Bat BMPs
For bat species, the following BMPs would be implemented:

- For activities that have the potential to impact structures, cliffs or caves, or trees; perform a habitat assessment and occupancy survey of the feature(s) with roost potential as early in the planning process as possible or within one year before project letting.
- If bats are present or recent signs of occupation (i.e., piles of guano, distinct musky odor, or staining and rub marks at potential entry points) are observed, take appropriate measures to ensure that bats are not harmed, such as implementing non-lethal exclusion activities or timing or phasing of construction.
 - Exclusion devices can be installed by a qualified individual between September 1st and March 31st. Exclusion devices should be used for a minimum of seven days when minimum nighttime temperatures are above 50°F AND minimum daytime temperatures are above 70°F.
 - Before excluding bats from any occupied structure, bat species, weather, temperature, season, and geographic location must be incorporated into any exclusion plans to avoid unnecessary harm or death to bats. Winter exclusion must entail a survey to confirm either, 1) bats are absent or 2) present but active (i.e. continuously active - not intermittently active due to arousals from hibernation).
 - Avoid using materials that degrade quickly, like paper, steel wool or rags, to close holes.
 - Avoid using chemical and ultrasonic repellents.
 - Avoid the use of flexible netting attached with duct tape.
 - In order to avoid entombing bats, exclusion activities should be only implemented by a qualified individual. A qualified individual or company should possess at least the following minimum qualifications:
 - Experience in bat exclusion (the individual, not just the company)
 - Proof of rabies pre-exposure vaccinations.
 - Demonstrated knowledge of the relevant bat species, including maternity season date range and habitat requirements.
 - Demonstrated knowledge of rabies and histoplasmosis in relation to bat roosts

- Conversion of property containing cave or cliff features to transportation purposes should be avoided where feasible.
- Large hollow trees, snags (dead standing trees), and trees with shaggy bark should be surveyed for colonies and, if found, should not be disturbed until the bats are no longer occupying these features. Post occupancy surveys should be conducted by a qualified biologist prior to tree removal from the landscape.
- Retain mature, large diameter hardwood forest species and native/ornamental palm trees where feasible.
- In all instances, avoid harm or death to bats. Bats should only be handled as a last resort and after communication with TPWD.

		Design Division Standard	
ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS			
EPIC			
SHEET 1 OF 2			
FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP
©TxDOT: February 2015	CONT	SECT	JOB
12-12-2011 105 REVISIONS	0313	07	020
05-07-14 ADDED NOTE SECTION IV.	DIST	COUNTY	SHEET NO.
01-23-2015 SECTION I CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	FTW	PARKER	96

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DATE:
FILE:

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

5. Amphibian and Aquatic Reptile BMPs
For amphibian and aquatic reptiles, the following BMPs would be implemented:
- a) Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered.
 - b) Minimize impacts to wetland, temporary and permanent open water features, including depressions, and riverine habitats.
 - c) Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, using erosion control blankets or mats that contain no netting, or only contain loosely woven natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable.
 - d) Project specific locations (PSLs) proposed within state-owned ROW should be located in uplands away from aquatic features.
 - e) When work is directly adjacent to the water, minimize impacts to shoreline basking sites (e.g., downed trees, sand bars, exposed bedrock) and overwinter sites (e.g., brush and debris piles, crayfish burrows) where feasible.
 - f) Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter, which may be refugia for terrestrial amphibians, where feasible.
6. Terrestrial Reptile BMPs
- a) Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, utilize erosion control blankets or mats that contain no netting or contain loosely woven, natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable.
 - b) For open trenches and excavated pits, install escape ramps at an angle of less than 45 degrees (1:1) in areas left uncovered. Visually inspect excavation areas for trapped wildlife prior to backfilling.
 - c) Inform contractors that if reptiles are found on project site allow species to safely leave the project area.
 - d) Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter where feasible.
 - e) Contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered.
7. Bald and Golden Eagle Protection Act
The Bald and Golden Eagle Protection Act prohibits the taking or possession of and commerce in eagles, parts, feathers, nests, or eggs with limited exceptions. The definition of take includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. Eagles may not be taken for any purpose unless a permit is issued prior to the taking.
8. Plains Spotted Skunk
The contractor will be advised of potential occurrence of the Plains spotted skunk in the project area, and to avoid harming the species if encountered, and to avoid unnecessary impacts to dens.

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.

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

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

Contact the Engineer if any of the following are detected:

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

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

Yes No

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

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

Yes No

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

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

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

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

No Action Required Required Action

Action No.

- 1.
- 2.
- 3.


VII. OTHER ENVIRONMENTAL ISSUES

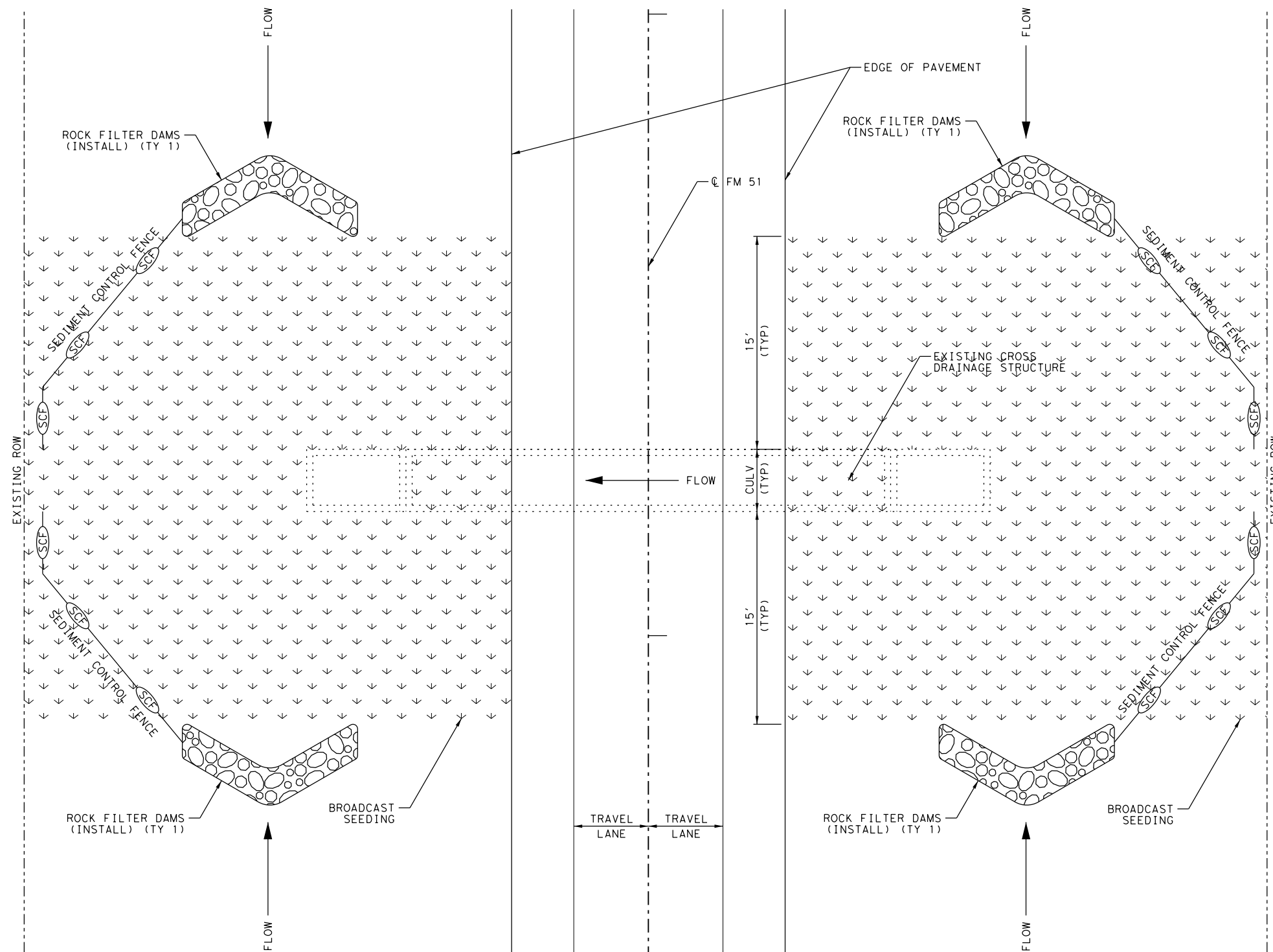
(includes regional issues such as Edwards Aquifer District, etc.)

No Action Required Required Action

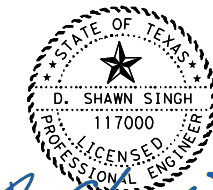
Action No.

- 1.
- 2.
- 3.

 Texas Department of Transportation				Design Division Standard	
ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS EPIC					
SHEET 2 OF 2					
FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR	
© TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY	
12-12-2011 (DS) REVISIONS	0313	07	020	FM 51	
05-07-14 ADDED NOTE SECTION IV.	DIST	COUNTY		SHEET NO.	
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	FTW	PARKER		97	



- NOTES:
1. EXACT QUANTITIES AND LOCATIONS OF SW3P ITEMS TO BE DETERMINED IN THE FIELD.
 2. CONSTRUCT AREAS PRIOR TO ENTERING CULVERT CROSSING FLOW.



D. Singh 10/19/2020

TYPICAL TEMPORARY EROSION CONTROL MEASURES
AT CROSS DRAINAGE STRUCTURE
NTS

NO.	DATE	REVISION	APPROVED
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Kimley»Horn
F-928



**FM 51
SW3P DETAIL**

SHEET 1 OF 1

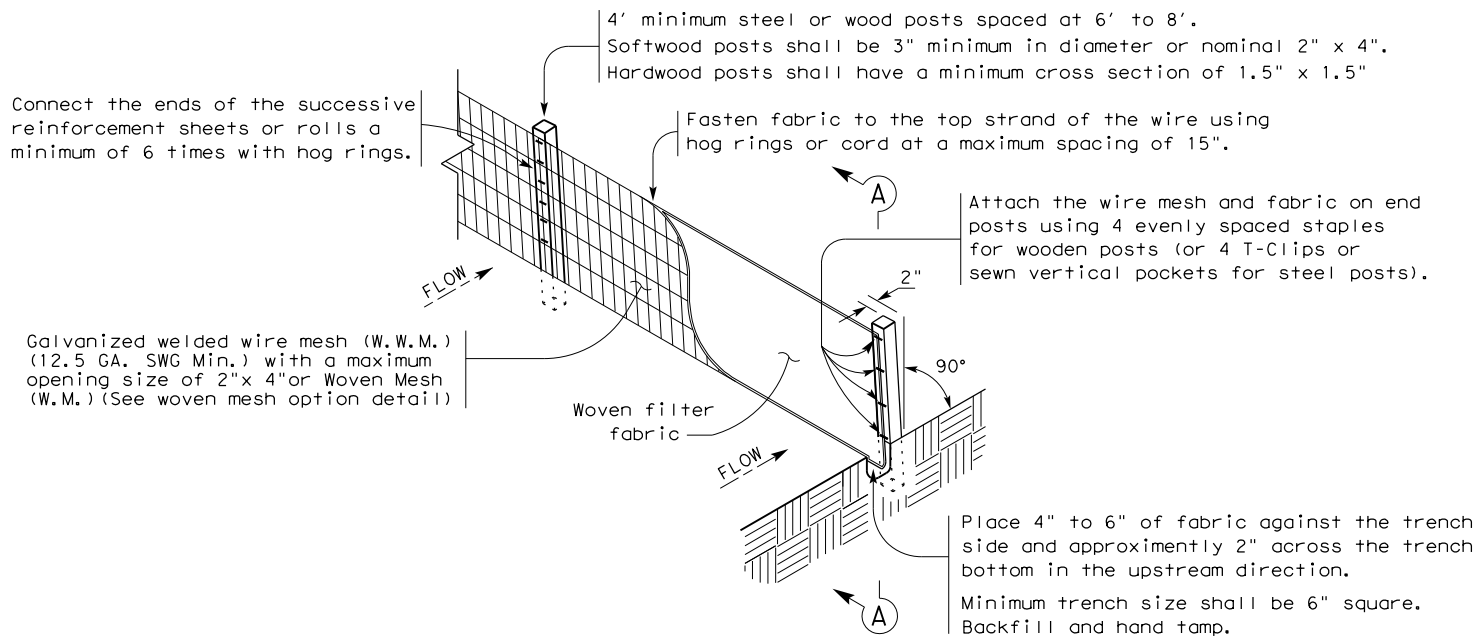
DESIGN KHA	FED. RD. DIV. NO. 6	FEDERAL AID PROJECT NO. (SEE TITLE SHEET)	HIGHWAY NO. FM 51
DRAWN KHA	STATE	DISTRICT	COUNTY
CHECK KHA	TEXAS	FTW	PARKER
CHECK KHA	CONTROL	SECTION	JOB
	0313	07	020

98

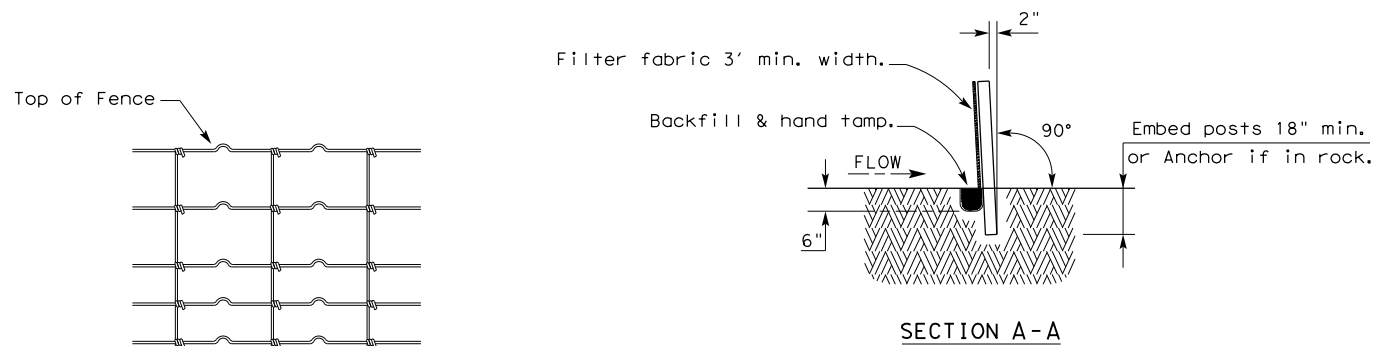
DATE: 10/19/2020 3:07:48 PM
FILE: FM51_EC_DET.dgn

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10/18/2020
 c:\baworking\kha\pwwprod\shawn.singh\dms30455\ec116.dgn



TEMPORARY SEDIMENT CONTROL FENCE



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/FT². Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

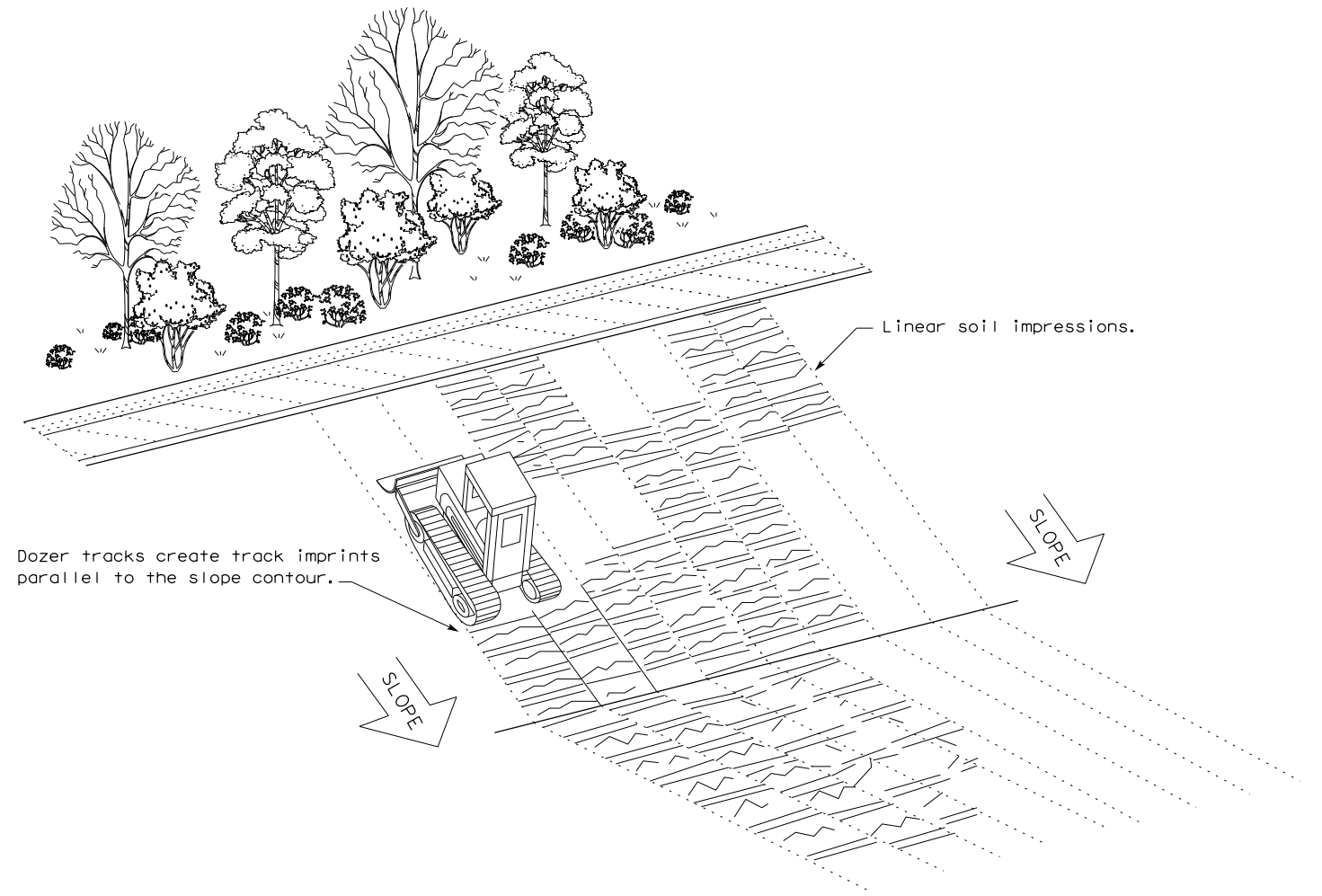
LEGEND

Sediment Control Fence



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.

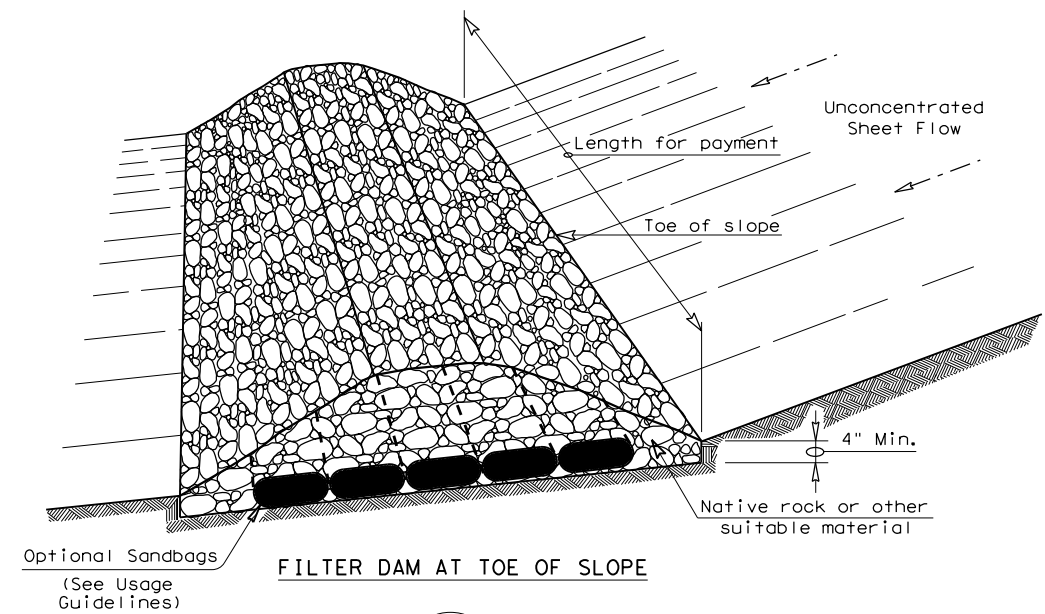


VERTICAL TRACKING

				Design Division Standard	
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE & VERTICAL TRACKING EC(1) - 16					
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0313	07	020	FM 51	
	DIST	COUNTY		SHEET NO.	
	FTW	PARKER		99	

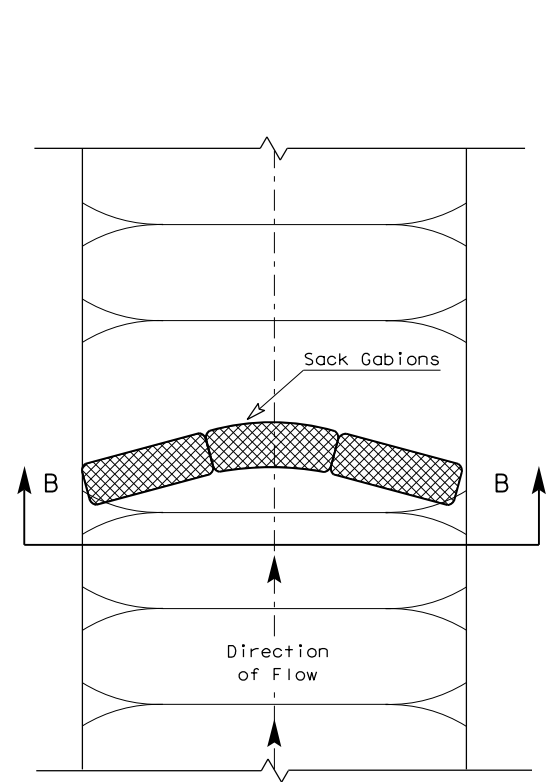
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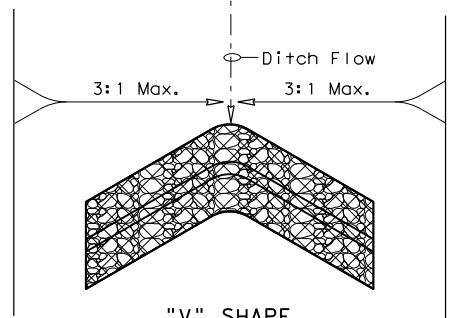


FILTER DAM AT TOE OF SLOPE

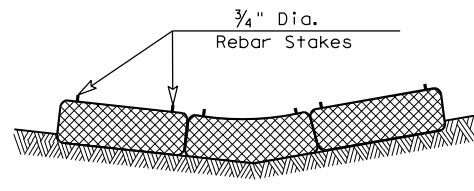
— (RFD1) —



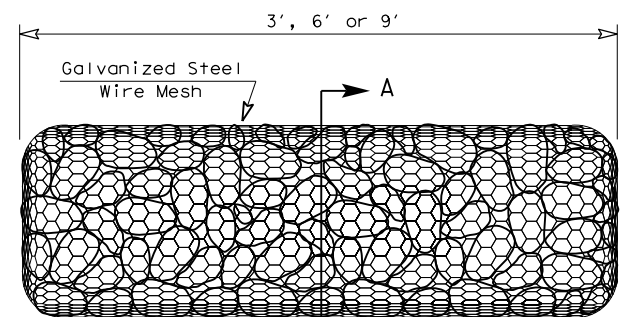
PLAN VIEW



"V" SHAPE PLAN VIEW

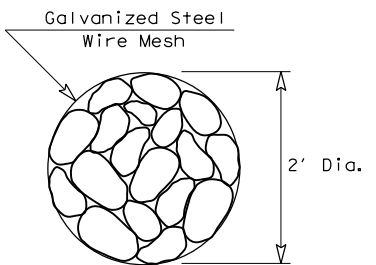


SECTION B-B

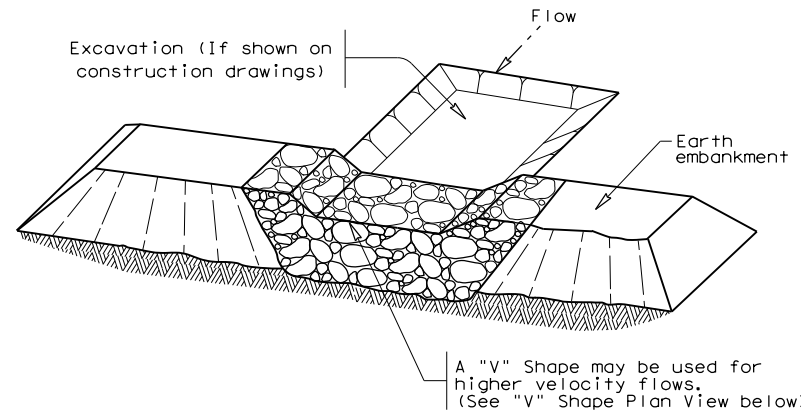


TYPE 4 (SACK GABIONS)

— (RFD4) —

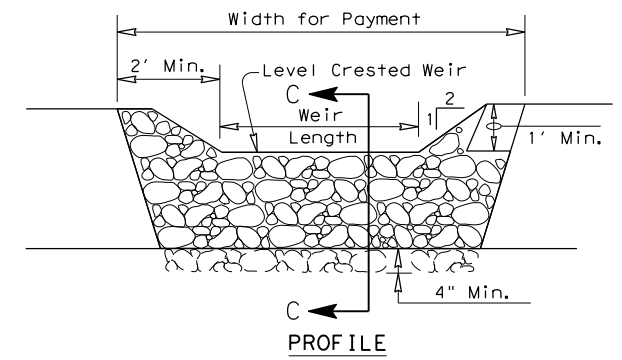


SECTION A-A

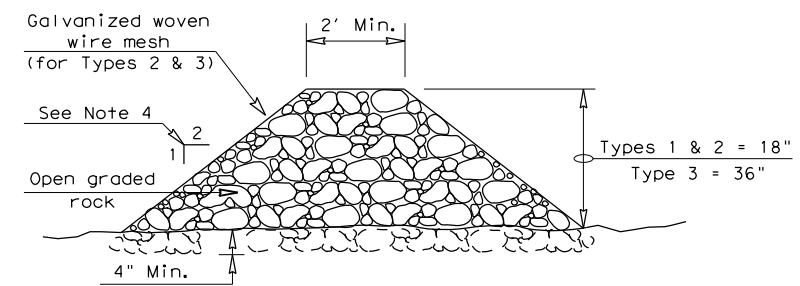


FILTER DAM AT SEDIMENT TRAP

— (RFD1) — OR — (RFD2) —



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/FT² of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

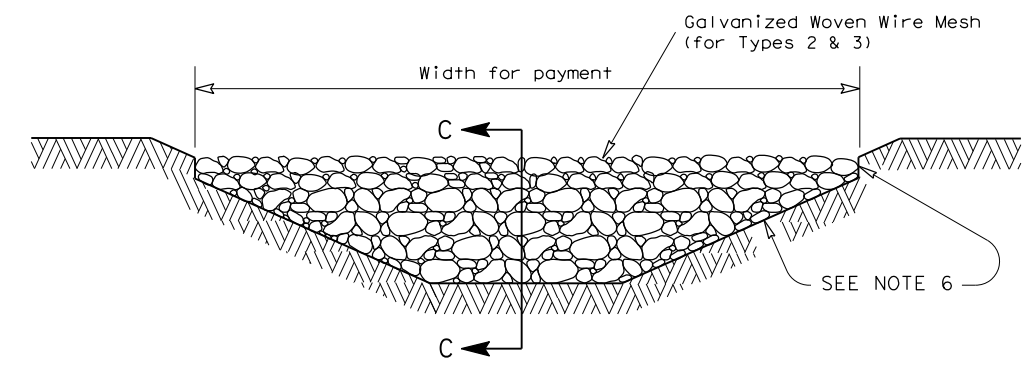
Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity 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

— (RFD1) — OR — (RFD2) — OR — (RFD3) —

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.

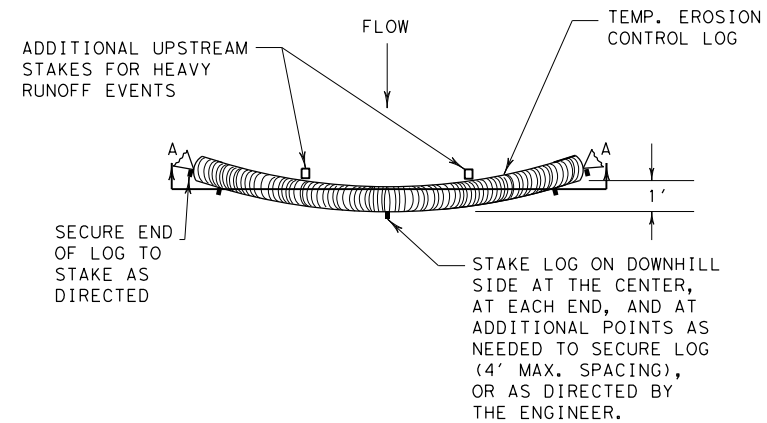
PLAN SHEET LEGEND

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

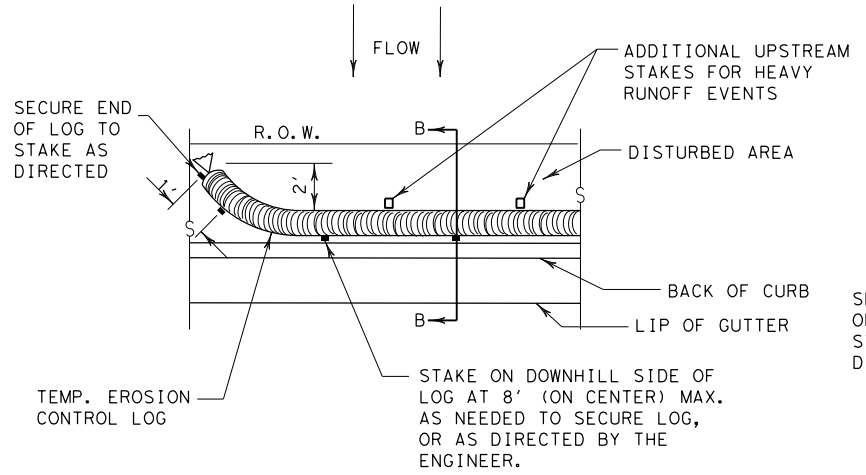
		Design Division Standard	
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES			
ROCK FILTER DAMS			
EC (2) - 16			
FILE: ec216	DN: TxDOT	CK: KM	DW: VP
© TxDOT: JULY 2016	CONT: 0313	SECT: 07	JOB: 020
REVISIONS		HIGHWAY: FM 51	
DIST: FTW	COUNTY: PARKER	SHEET NO.: 100	

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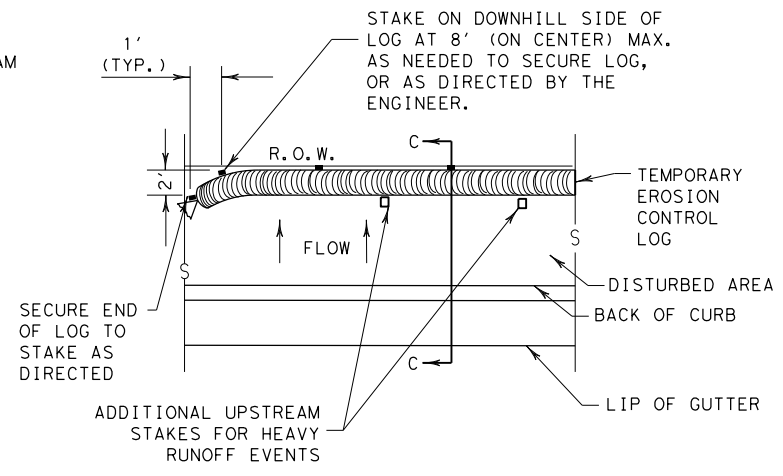
DATE: 10/19/2020
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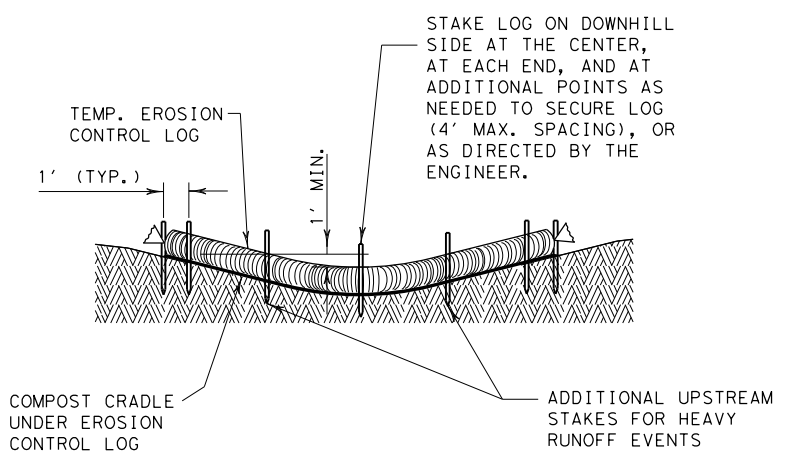
PLAN VIEW



PLAN VIEW



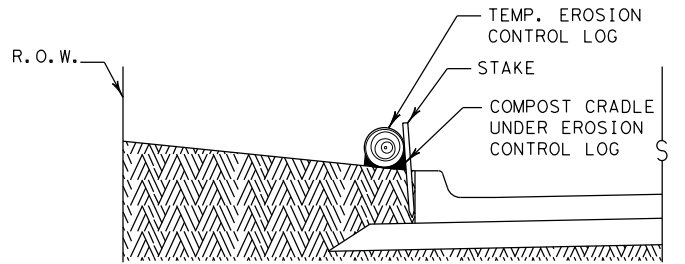
PLAN VIEW



SECTION A-A

EROSION CONTROL LOG DAM

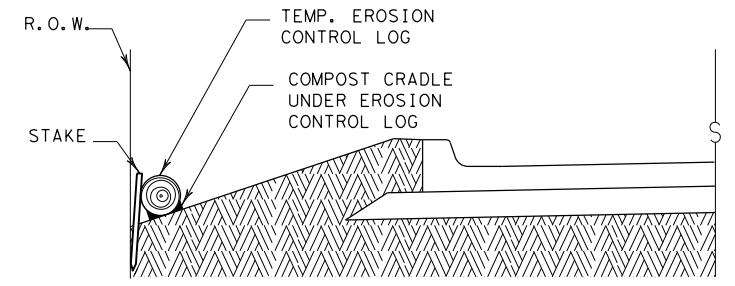
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

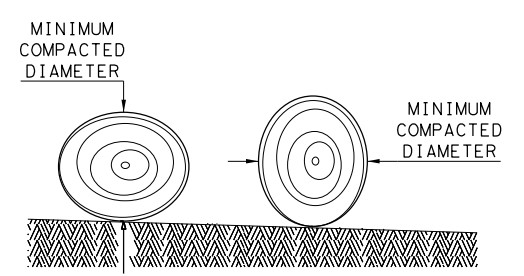
CL-BOC



SECTION C-C

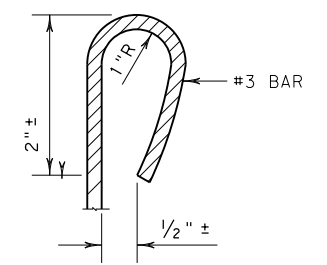
EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

- LEGEND**
- CL-D EROSION CONTROL LOG DAM
 - CL-BOC EROSION CONTROL LOG AT BACK OF CURB
 - CL-ROW EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY
 - CL-SST EROSION CONTROL LOGS ON SLOPES STAKE AND TRENCHING ANCHORING
 - CL-SSL EROSION CONTROL LOGS ON SLOPES STAKE AND LASHING ANCHORING
 - CL-DI EROSION CONTROL LOG AT DROP INLET
 - CL-CI EROSION CONTROL LOG AT CURB INLET
 - CL-GI EROSION CONTROL LOG AT CURB & GRATE INLET



REBAR STAKE DETAIL

SEDIMENT BASIN & TRAP USAGE GUIDELINES

An erosion control log sediment trap may be used to filter sediment out of runoff draining from an unstabilized area.

Log Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

Control logs should be placed in the following locations:

1. Within drainage ditches spaced as needed or min. 500' on center
2. Immediately preceding ditch inlets or drain inlets
3. Just before the drainage enters a water course
4. Just before the drainage leaves the right of way
5. Just before the drainage leaves the construction limits where drainage flows away from the project.

The logs should be cleaned when the sediment has accumulated to a depth of 1/2 the log diameter.

Cleaning and removal of accumulated sediment deposits is incidental and will not be paid for separately.

GENERAL NOTES:

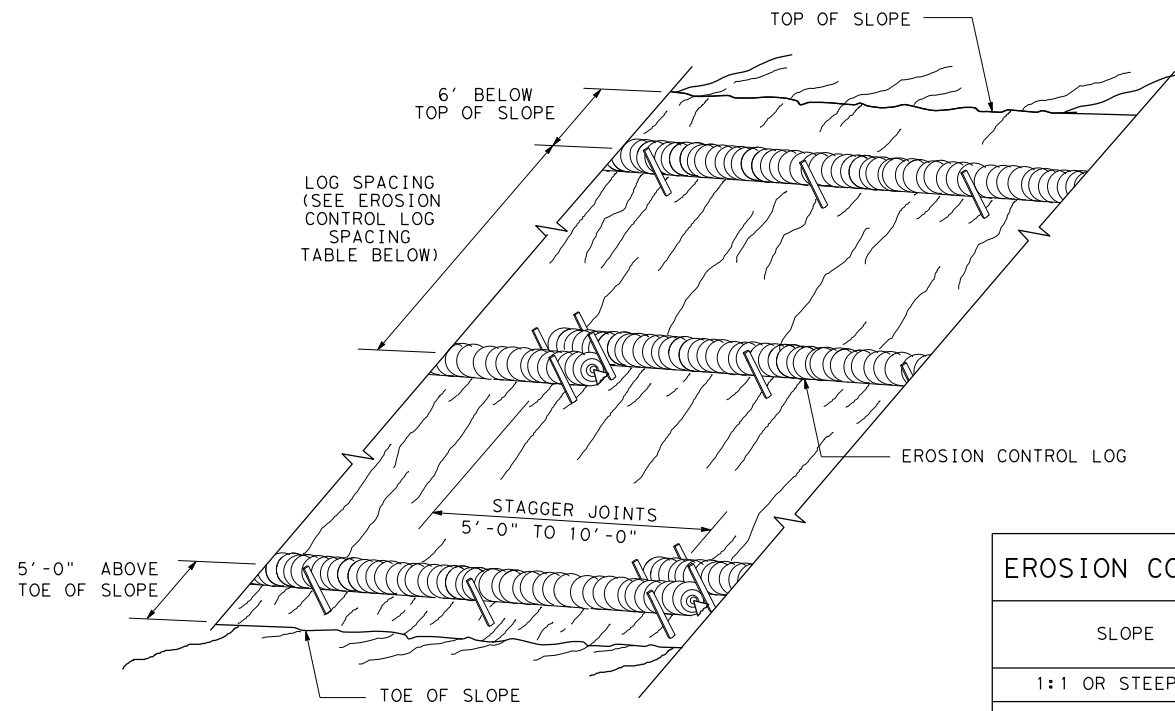
1. EROSION CONTROL LOGS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, OR AS DIRECTED BY THE ENGINEER.
2. LENGTHS OF EROSION CONTROL LOGS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS REQUIRED FOR THE PURPOSE INTENDED.
3. UNLESS OTHERWISE DIRECTED, USE BIODEGRADABLE OR PHOTODEGRADABLE CONTAINMENT MESH ONLY WHERE LOG WILL REMAIN IN PLACE AS PART OF A VEGETATIVE SYSTEM. FOR TEMPORARY INSTALLATIONS, USE RECYCLABLE CONTAINMENT MESH.
4. FILL LOGS WITH SUFFICIENT FILTER MATERIAL TO ACHIEVE THE MINIMUM COMPACTED DIAMETER SPECIFIED IN THE PLANS WITHOUT EXCESSIVE DEFORMATION.
5. STAKES SHALL BE 2" X 2" WOOD OR #3 REBAR, 2'-4' LONG, EMBEDDED SUCH THAT 2" PROTRUDES ABOVE LOG, OR AS DIRECTED BY THE ENGINEER.
6. DO NOT PLACE STAKES THROUGH CONTAINMENT MESH.
7. COMPOST CRADLE MATERIAL IS INCIDENTAL & WILL NOT BE PAID FOR SEPARATELY.
8. SANDBAGS USED AS ANCHORS SHALL BE PLACED ON TOP OF LOGS & SHALL BE OF SUFFICIENT SIZE TO HOLD LOGS IN PLACE.
9. TURN THE ENDS OF EACH ROW OF LOGS UPSLOPE TO PREVENT RUNOFF FROM FLOWING AROUND THE LOG.
10. FOR HEAVY RUNOFF EVENTS, ADDITIONAL UPSTREAM STAKES MAY BE NECESSARY TO KEEP LOG FROM FOLDING IN ON ITSELF.

SHEET 1 OF 3

		Design Division Standard	
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES EROSION CONTROL LOG EC (9) - 16			
FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT
© TxDOT: JULY 2016	CONT SECT	JOB	HIGHWAY
REVISIONS	0313 07	020	FM 51
	DIST	COUNTY	SHEET NO.
	FTW	PARKER	101

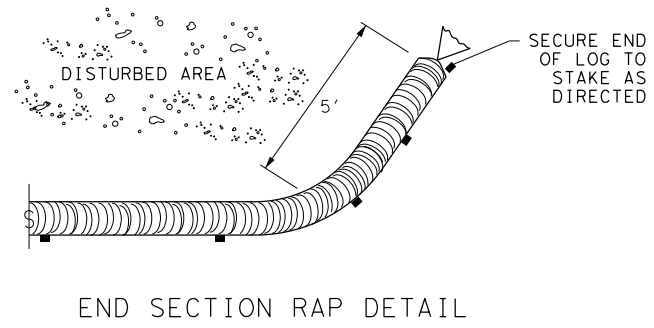
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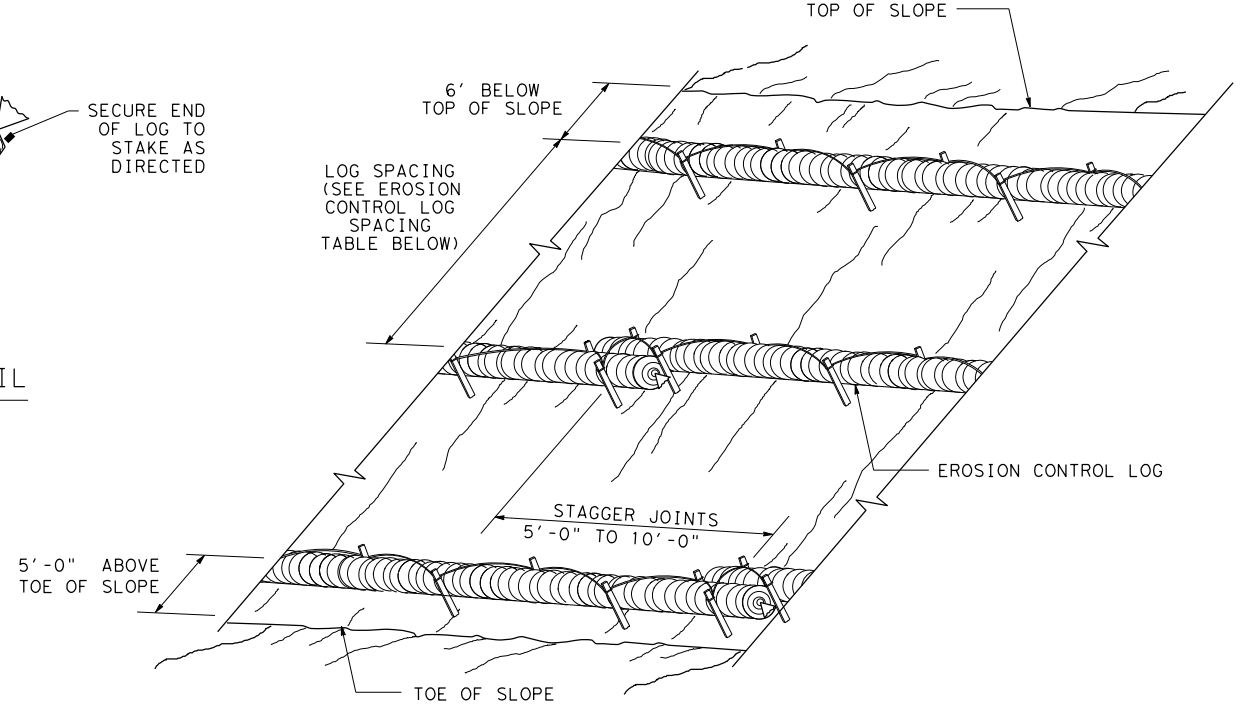
EROSION CONTROL LOGS ON SLOPES
 STAKE AND TRENCHING ANCHORING

CL-SST



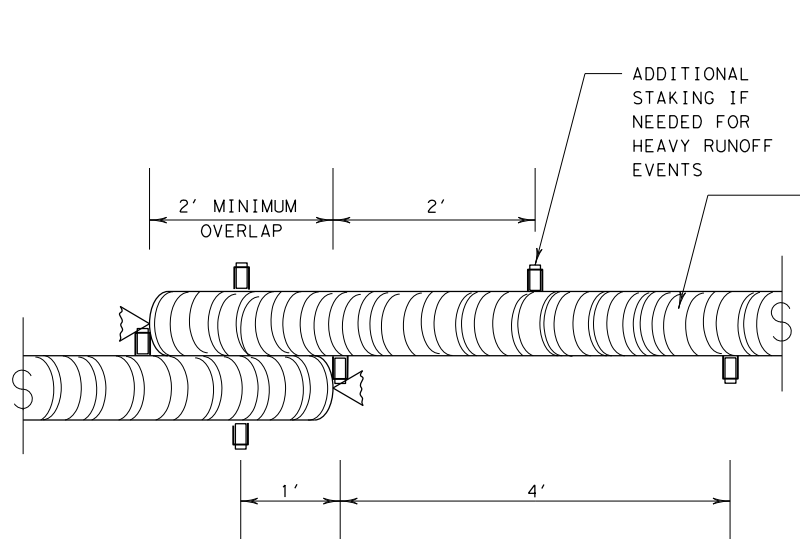
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
 SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
 HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



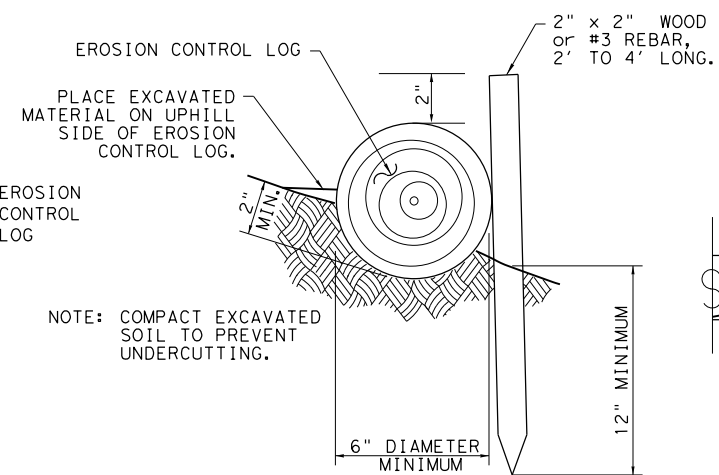
EROSION CONTROL LOGS ON SLOPES
 STAKE AND LASHING ANCHORING

CL-SSL



STAKE AND TRENCHING ANCHORING DETAIL

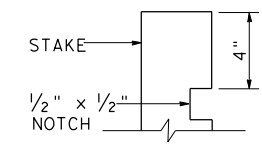
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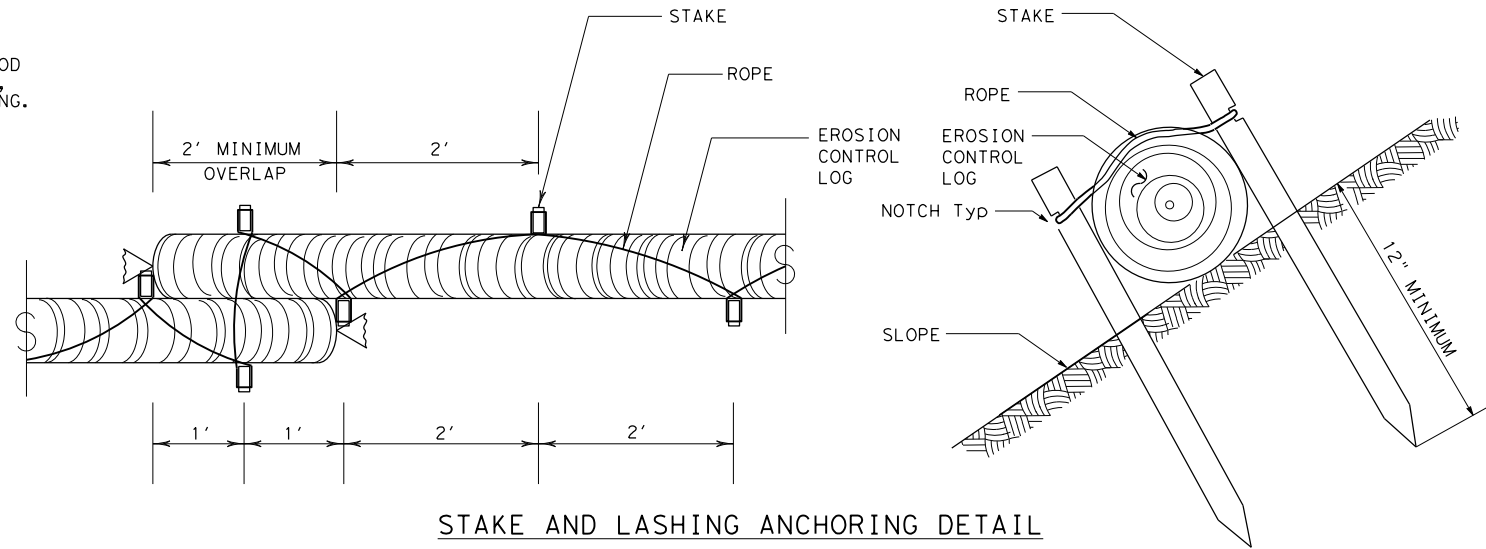
STAKE AND LASHING ANCHORING DETAIL

CL-SSL

LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"



STAKE NOTCH DETAIL

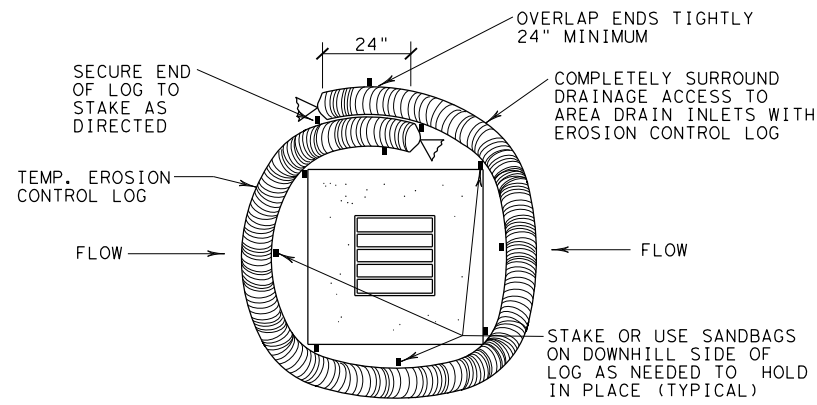


SHEET 2 OF 3

		Design Division Standard	
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES EROSION CONTROL LOG EC (9) - 16			
FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT
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REVISIONS	0313 07	020	FM 51
DIST	COUNTY	SHEET NO.	
FTW	PARKER	102	

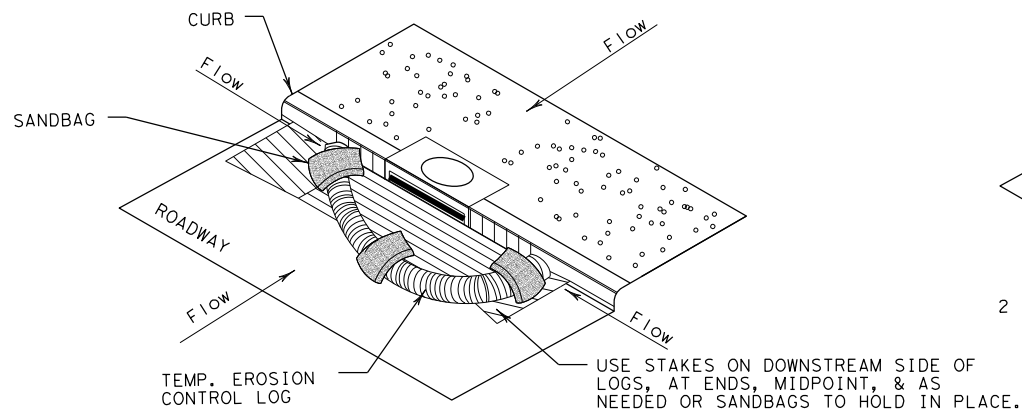
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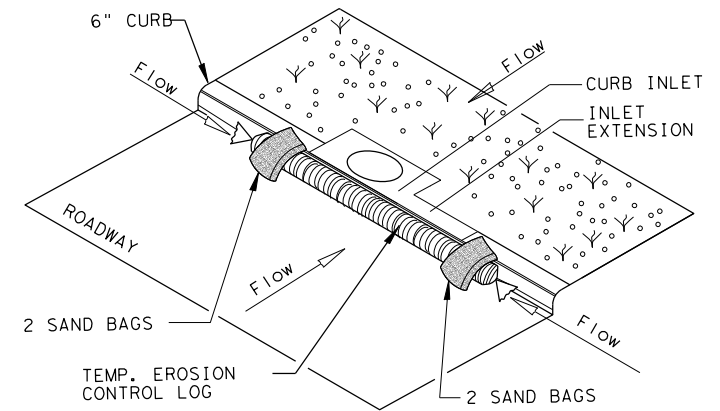
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

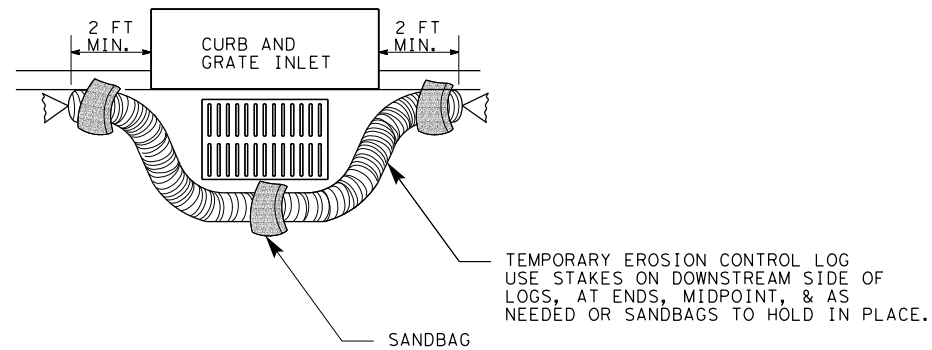
CL-CI



EROSION CONTROL LOG AT CURB INLET

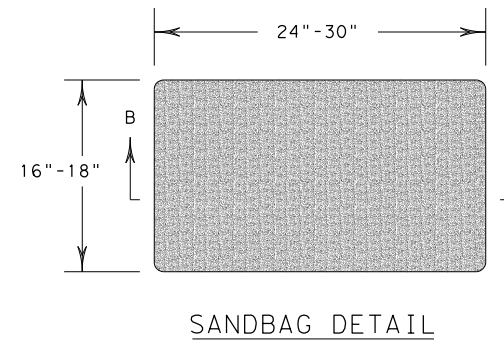
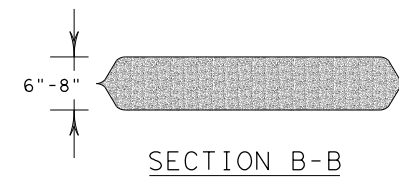
CL-CI

NOTE:
 EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI



SHEET 3 OF 3

				Design Division Standard	
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES EROSION CONTROL LOG EC (9) - 16					
FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0313	07	020	FM 51	
	DIST	COUNTY		SHEET NO.	
	FTW	PARKER		103	