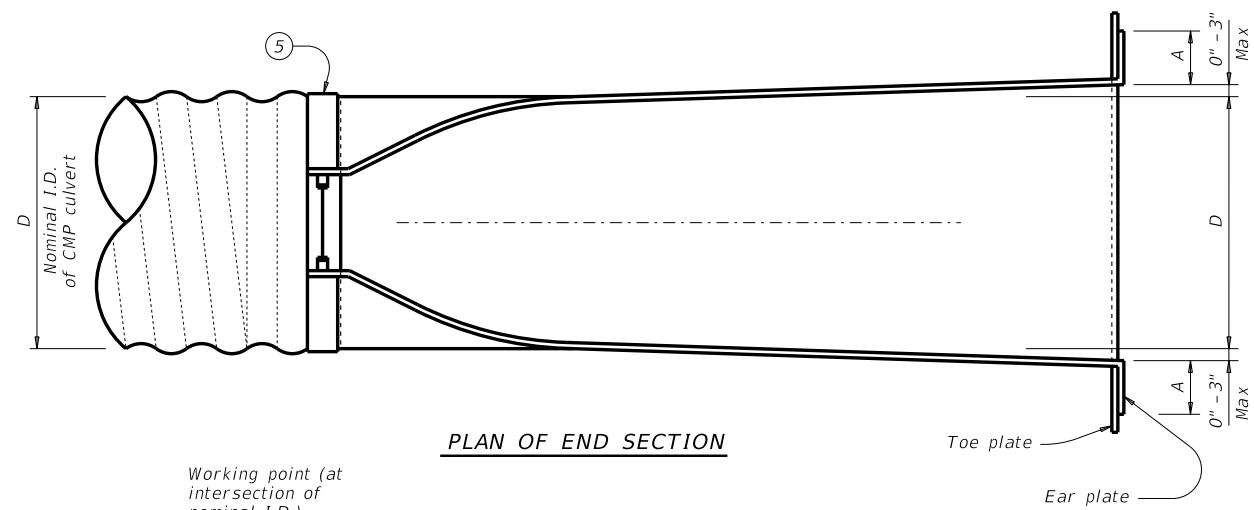
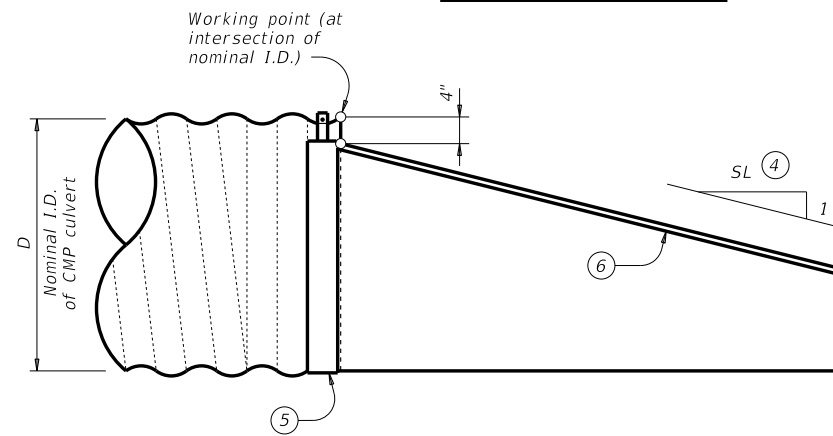


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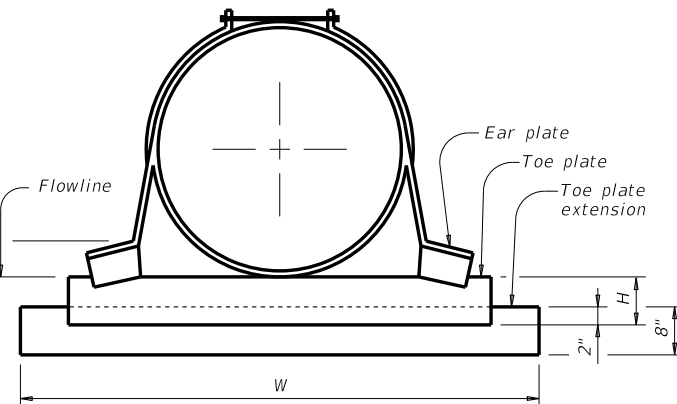


PLAN OF END SECTION



SIDE ELEVATION OF END SECTION

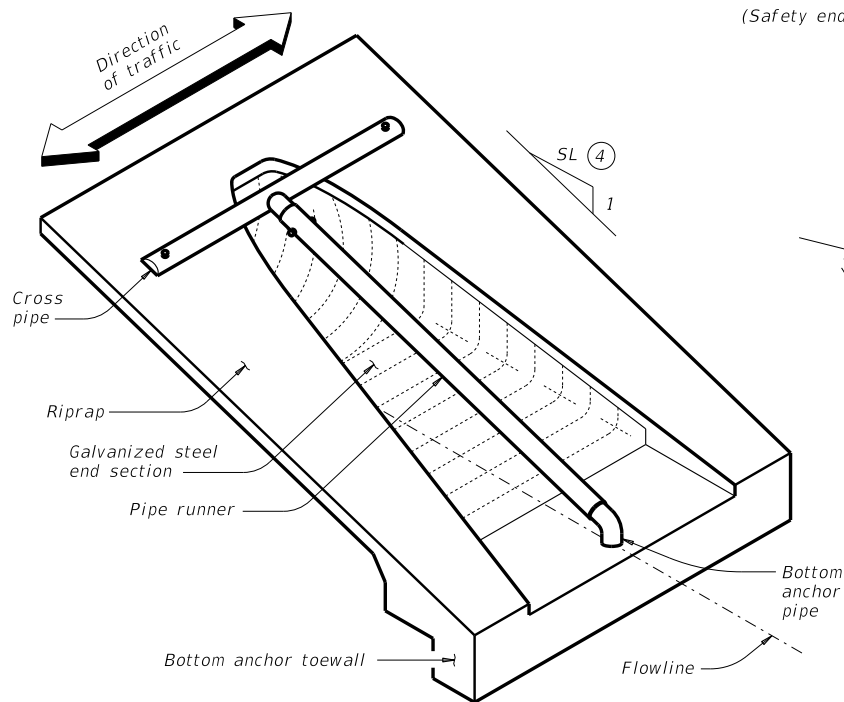
- 1 Provide size of pipe runner as shown in the tables. Cross pipe is the same size as the pipe runner. Cross pipe stub out and bottom anchor pipe are the next smaller size pipe as shown in the Standard Pipe Sizes and Max Pipe Runner Length table.
- 2 Values shown are minimum requirements.
- 3 Provide all 3-piece apron sections with 12 gage sides and 10 gage center panels.
- 4 Recommended values of slope are 3:1, 4:1, and 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.
- 5 Connection between corrugated metal pipe (CMP) culvert and galvanized prefabricated end section may be with strap and bolt as shown or other combinations of threaded rods and/or coupling bands.
- 6 Reinforce upper edge of prefabricated end section with minimum 3/8" dia smooth or deformed bar (pre-galvanized).
- 7 Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap."



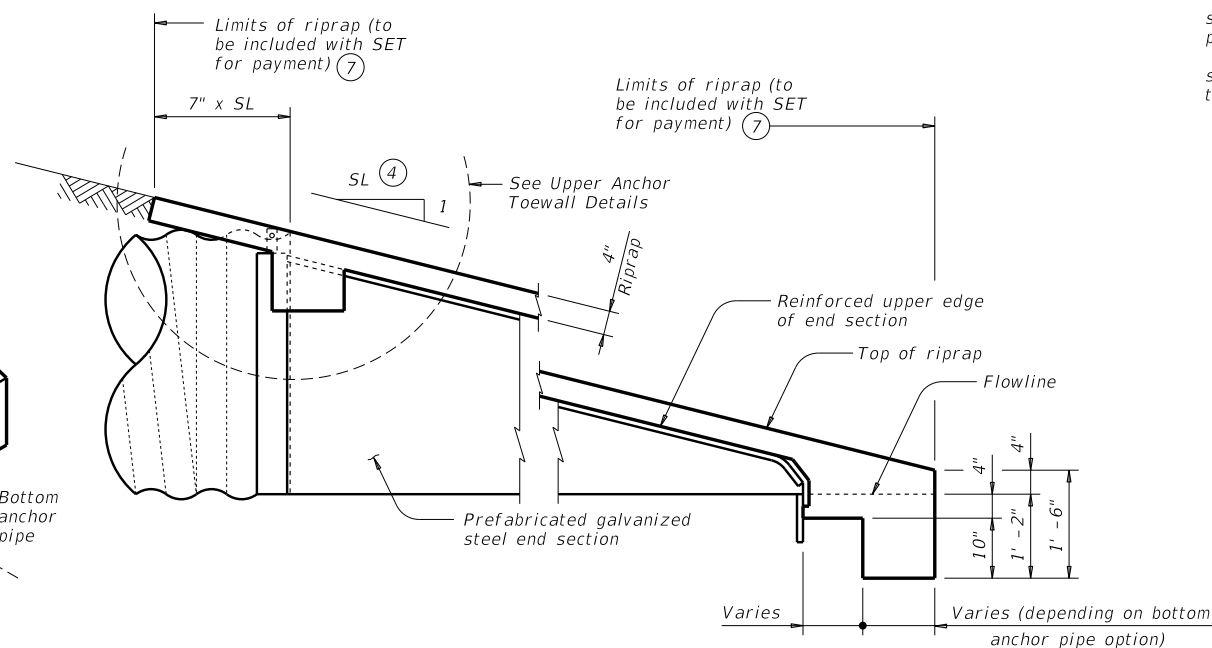
END ELEVATION OF END SECTION

PREFABRICATED GALVANIZED STEEL END SECTION DETAILS

(Safety end treatment and riprap not shown for clarity.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Pipe runners are not shown for clarity.)

CROSS PIPE LENGTHS, PIPE RUNNER LENGTHS, AND REQUIRED PIPE SIZES 1

D (Nominal) (Culvert I.D.)	Cross Pipe Length	3:1 Side Slope		4:1 Side Slope		6:1 Side Slope	
		Pipe Runner Length	Pipe Runner Size	Pipe Runner Length	Pipe Runner Size	Pipe Runner Length	Pipe Runner Size
≤ 24"	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30"	3' - 11"	5' - 0"	3.500 x 0.216	7' - 1"	3.500 x 0.216	11' - 3"	4.500 x 0.237
36"	4' - 5"	6' - 7"	3.500 x 0.216	9' - 2"	3.500 x 0.216	14' - 4"	4.500 x 0.237
42"	4' - 11"	8' - 2"	3.500 x 0.216	11' - 2"	4.500 x 0.237	17' - 4"	4.500 x 0.237
48"	5' - 5"	9' - 9"	3.500 x 0.216	13' - 3"	4.500 x 0.237	20' - 4"	5.563 x 0.258
54"	5' - 11"	11' - 3"	4.500 x 0.237	15' - 4"	4.500 x 0.237	23' - 5"	5.563 x 0.258
60"	6' - 5"	12' - 10"	4.500 x 0.237	17' - 4"	4.500 x 0.237	26' - 5"	5.563 x 0.258

PREFABRICATED END SECTION INFORMATION

D (Nominal) (Culvert I.D.)	Pipe Runner Required	H 2	A 2	W 2	Gage 2
≤ 24"	No	6"	9"	D + 24"	16
30"	Skew > 15°	9"	12"	D + 32"	14
36"	All skews	9"	12"	D + 32"	14
≥ 42"	All skews	12"	16"	D + 40"	12/10 3

STANDARD PIPE SIZES AND MAX PIPE RUNNER LENGTH 1

HSS Size	STD Size	Max Pipe Runner Length
2.375 x 0.154	2"	N/A
3.500 x 0.216	3"	10' - 0"
4.500 x 0.237	4"	19' - 8"
5.563 x 0.258	5"	34' - 2"

MATERIAL NOTES:

Provide pipe runners, cross pipes, and anchor pipes conforming to ASTM A1085, A500 Gr B, A53 (Type E or S, Gr B), or API 5LX52.
 Provide ASTM A307 bolts and nuts.
 Galvanize all steel components, except reinforcement, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specification.
 Toe plate extensions are required only when shown elsewhere in the plans.
 Concrete riprap is required only when pipe runners are required, unless otherwise shown in the plans. Provide concrete riprap in accordance with Item 432, "Riprap." Use Bottom Anchor Toewall Option B1 when an alternate end section with pre-attached pipe runners is supplied.
 Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of reinforcing steel in concrete riprap unless noted otherwise.

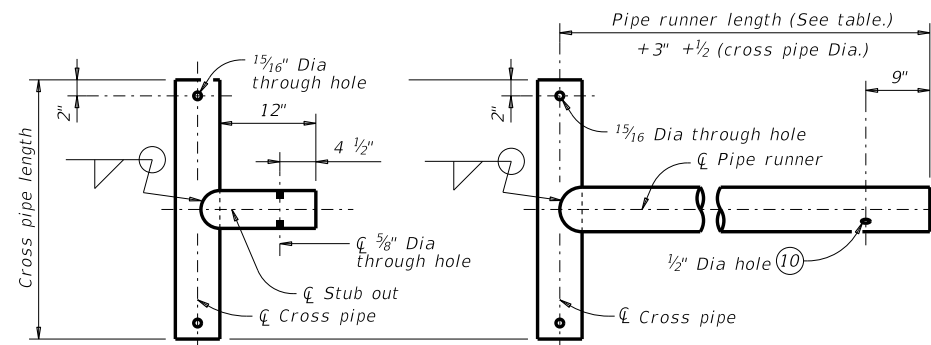
GENERAL NOTES:

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.
 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.
 Alternate styles of end sections, including those with pre-attached pipe runners, may be supplied. Alternate styles must meet all of the following: design values shown in tables for pipe runner size; H, A, W, and gage for end section; and material requirements noted.
 All pipe runners, calculations, and dimensions are based on the End Section shown on this standard. Alternate styles of end sections will require that appropriate adjustments be made to the values presented on this standard.
 Payment for riprap and toewall is included in price bid for each safety end treatment.

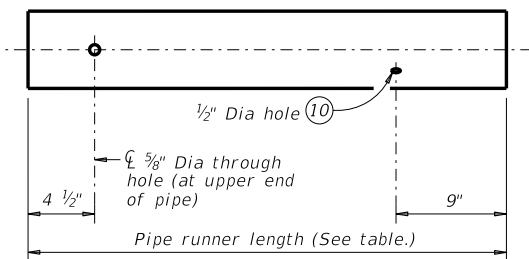
SHEET 1 OF 2

		Bridge Division Standard	
PREFABRICATED GALVANIZED STEEL END SECTION SAFETY END TREATMENT FOR 12" TO 60" DIA CMP CULVERTS TYPE II ~ CROSS DRAINAGE GS-ES-CD			
FILE: CD-GSES-CD-20.dgn	DN: TxDOT	CK: TxDOT	DW: JRP
©TxDOT February 2020	CONT	SECT	JOB
REVISIONS			HIGHWAY
	DIST	COUNTY	SHEET NO.

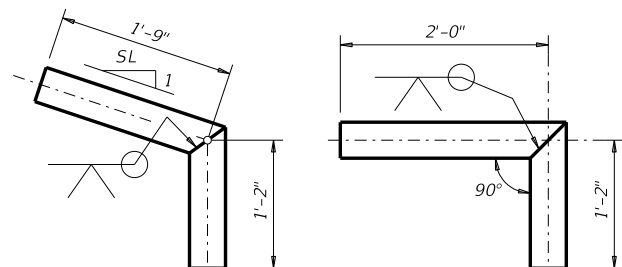
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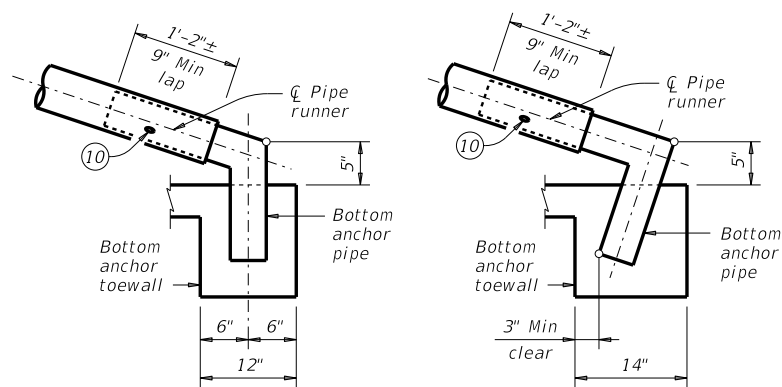
OPTION A1 **OPTION A2**
CROSS PIPE AND CONNECTIONS DETAILS



PIPE RUNNER DETAILS

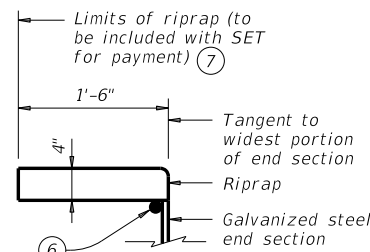


OPTION B1 **OPTION B2**
BOTTOM ANCHOR PIPE DETAILS

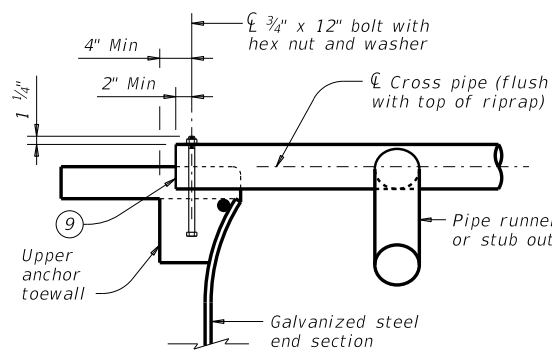


OPTION B1 **OPTION B2**
BOTTOM ANCHOR TOEWALL DETAILS

(End section and riprap are not shown for clarity.)

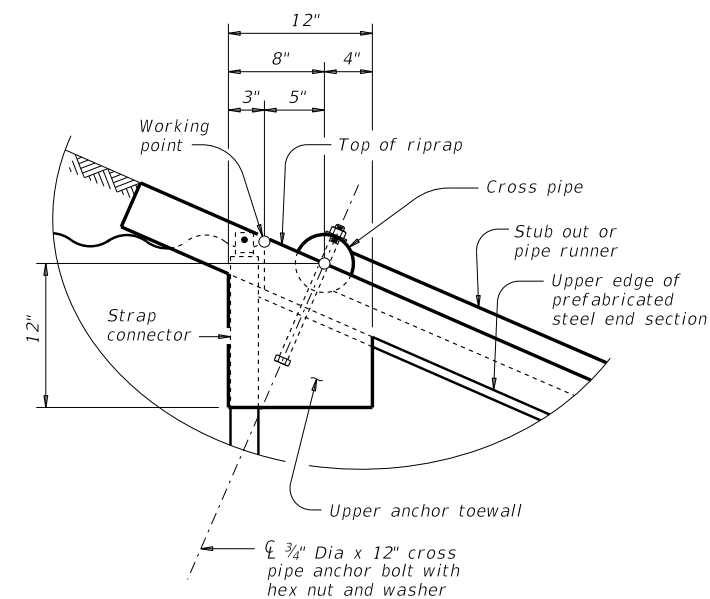


SHOWING TYPICAL RIPRAP

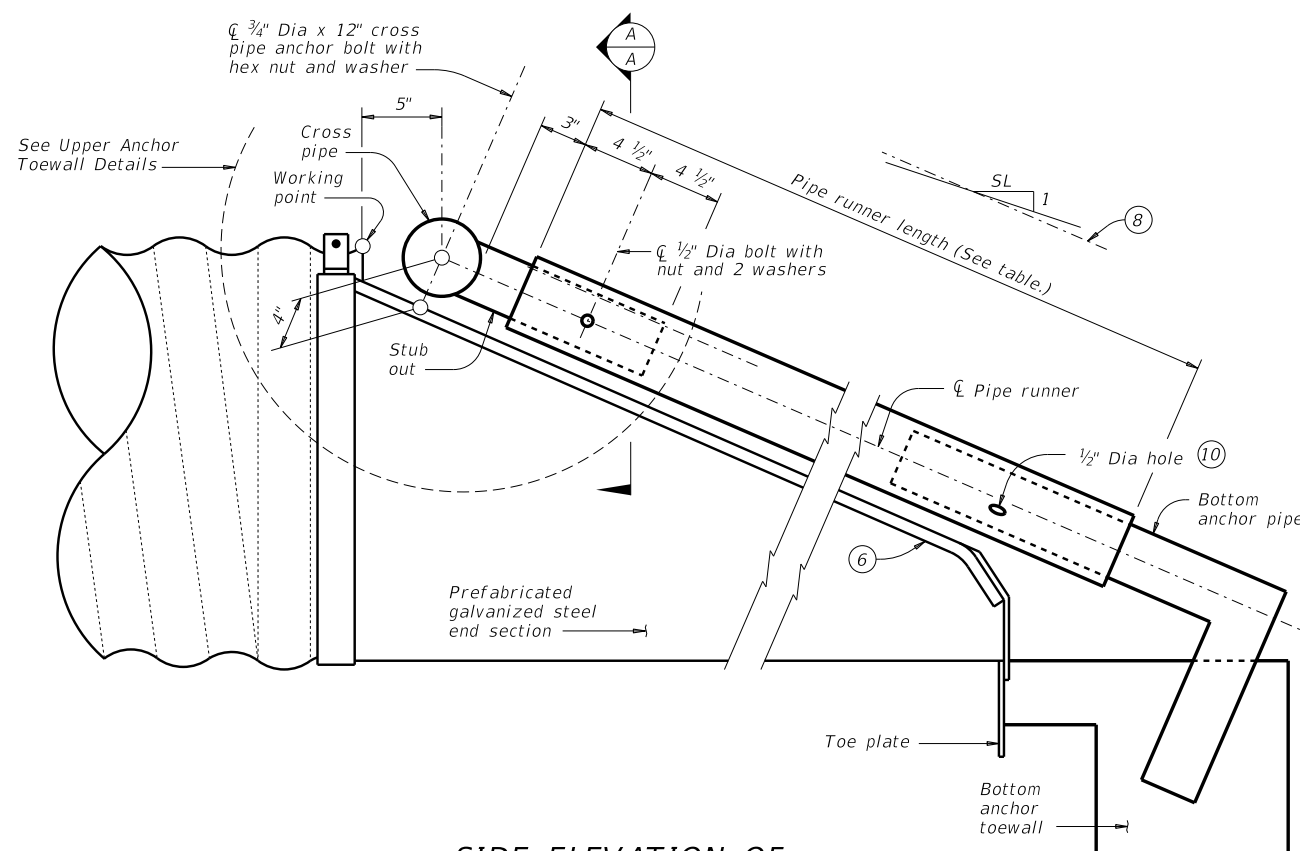


SHOWING CROSS PIPE AND UPPER ANCHOR TOEWALL

SECTION A-A



UPPER ANCHOR TOEWALL DETAILS



SIDE ELEVATION OF PIPE RUNNER INSTALLATION

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

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY)

Nominal Culvert I.D.	3:1 Side Slope	4:1 Side Slope	6:1 Side Slope
12"	0.5	0.6	0.9
15"	0.6	0.7	1.0
18"	0.6	0.8	1.1
21"	0.7	0.8	1.2
24"	0.7	0.9	1.3
27"	0.8	1.0	1.4
30"	0.9	1.1	1.5
33"	0.9	1.1	1.6
36"	1.0	1.2	1.7
42"	1.1	1.4	1.9
48"	1.2	1.5	2.1
54"	1.3	1.7	2.3
60"	1.5	1.8	2.6

- ⑥ Reinforce upper edge of prefabricated end section with minimum 3/8" dia smooth or deformed bar (pre-galvanized).
- ⑦ Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap."
- ⑧ Note that actual slope of pipe runner may vary slightly from side slope of riprap and upper edge of prefabricated end section.
- ⑨ 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.
- ⑩ After installation, inspect the 3/8" hole to ensure that the lap of the pipe runner with the bottom anchor pipe is adequate.
- ⑪ 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.
- ⑫ Quantities shown are for one end of one corrugated metal pipe (CMP) culvert. For multiple pipe culverts quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

SHEET 2 OF 2

Texas Department of Transportation **Bridge Division Standard**

PREFABRICATED GALVANIZED STEEL END SECTION SAFETY END TREATMENT FOR 12" TO 60" DIA CMP CULVERTS TYPE II ~ CROSS DRAINAGE GS-ES-CD

FILE: CD-GSES-CD-20.dgn	DN: TxDOT	CK: TxDOT	DW: JRP	CK: GAF
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	DIST	COUNTY		SHEET NO.

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