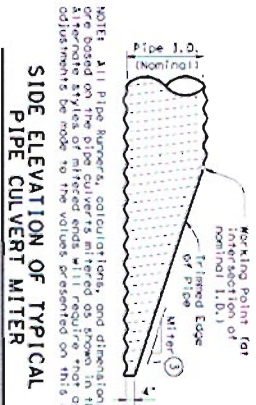
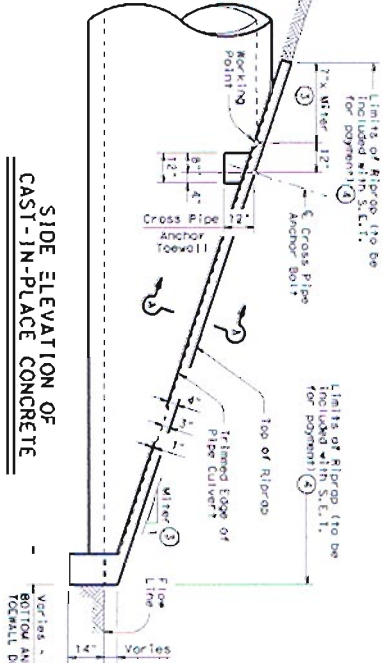


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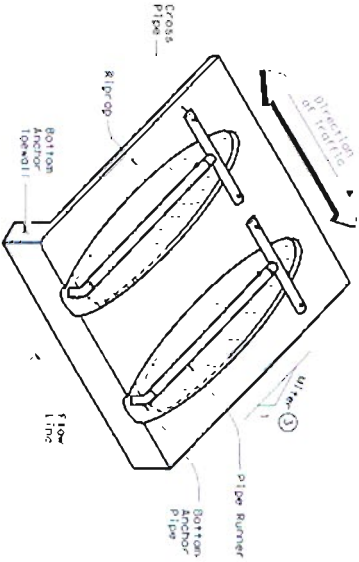
**SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER**

(Showing Curved Concrete Miter Pipe Culvert. Details of Concrete Pipe Culvert are similar.)



**SIDE ELEVATION OF CAST-IN-PLACE CONCRETE**

(Showing Concrete Pipe Culvert for similar. Pipe Runners not shown for clarity.)



**ISOMETRIC VIEW OF TYPICAL INSTALLATION**

(Showing Installation with no skew.)

**CROSS PIPE LENGTHS & PIPE RUNNER LENGTHS (1) (2)**

Nominal Culvert 1.0 D.	Pipe Slope	Cross Pipe Length	Pipe Runner Length														
			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	7'-2"	9'-7"	8'-1"	8'-1"	N/A	N/A	11'-11"	14'-11"
27"	1-8	3-5	N/A	N/A	N/A	5'-11"	N/A	N/A	N/A	8'-0"	9'-7"	8'-1"	8'-1"	N/A	N/A	11'-11"	14'-11"
30"	1-10	3-11	N/A	N/A	N/A	6'-4"	N/A	N/A	N/A	8'-0"	9'-7"	8'-1"	8'-1"	N/A	N/A	11'-11"	14'-11"
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"	15'-2"	N/A	N/A	19'-2"
36"	2-1	4-5	6'-11"	7-3"	8-2"	9'-11"	9'-6"	9'-11"	11'-2"	13'-10"	14'-9"	15'-3"	17'-2"	21'-3"	N/A	N/A	25'-7"
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"	N/A	N/A	30'-0"
48"	2-7	5-5	10'-1"	10'-1"	11-9"	13'-7"	13'-7"	14'-2"	15'-10"	18'-5"	20'-3"	21'-6"	24'-8"	29'-0"	N/A	N/A	34'-2"
54"	3-0	5-11	11-8"	12'-1"	13'-1"	15-8"	15-8"	16-3"	18-5"	21-10"	24-8"	26-10"	29-0"	34-2"	N/A	N/A	38'-0"
60"	3-3	6-5	13-3"	13-3"	N/A	N/A	17-9"	N/A	N/A	26-10"	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**TYPICAL PIPE CULVERT MITERS (3)**

Nominal Culvert 1.0 D.	0° Skew	15° Skew	30° Skew	45° Skew	CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED												
					12" thru 21" Skews thru 45°	24" Skews thru 30°	27" Skews thru 15°	30" Skews thru 15°	33" Normal (no skew)	36" Always required	42" to 60" Always required						
36"	3:1	3:1.06:1	3:0.66:1	4:2.23:1	12" thru 21" Skews thru 45°	24" Skews thru 30°	27" Skews thru 15°	30" Skews thru 15°	33" Normal (no skew)	36" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required
48"	4:1	4:1.14:1	4:0.91:1	5:0.57:1	12" thru 21" Skews thru 45°	24" Skews thru 30°	27" Skews thru 15°	30" Skews thru 15°	33" Normal (no skew)	36" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required
60"	6:1	6:2.12:1	6:0.92:1	8:0.48:1	12" thru 21" Skews thru 45°	24" Skews thru 30°	27" Skews thru 15°	30" Skews thru 15°	33" Normal (no skew)	36" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required	42" to 60" Always required

**ESTIMATED CONCRETE RIPRAP QUANTITIES (C1) (3)**

Nominal Culvert 1.0 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	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	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	0.8	0.8	0.8	0.9	1.0
18"	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.2
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.3
24"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.4
27"	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.6
30"	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.7
33"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.7
36"	0.9	0.9	0.9	0.9	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.8
42"	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.1	1.2	1.4	1.4	1.4	1.5	1.5	1.5	1.9	1.9	2.1	2.1	2.1	2.4
54"	1.3	1.3	1.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.1	2.1	2.1	2.1	2.1	N/A
60"	1.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.3	2.3	2.3	N/A	N/A	N/A

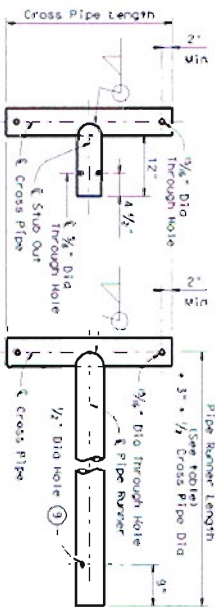
**Texas Department of Transportation**  
 Safety End Treatment  
 FOR 12" DIA TO 60" DIA  
 PIPE CULVERTS  
 TYPE 11 - CROSS DRAINAGE

**SETP-CD**

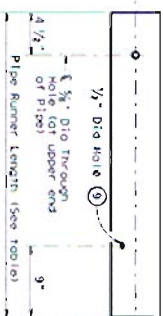
DATE	APPROVALS	REV	DESCRIPTION

LEVEL	DISPLACEMENT	ACCENT

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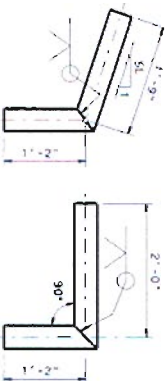


CROSS PIPE AND CONNECTIONS DETAILS

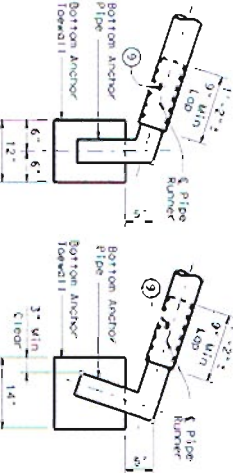


PIPE RUNNER DETAILS

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



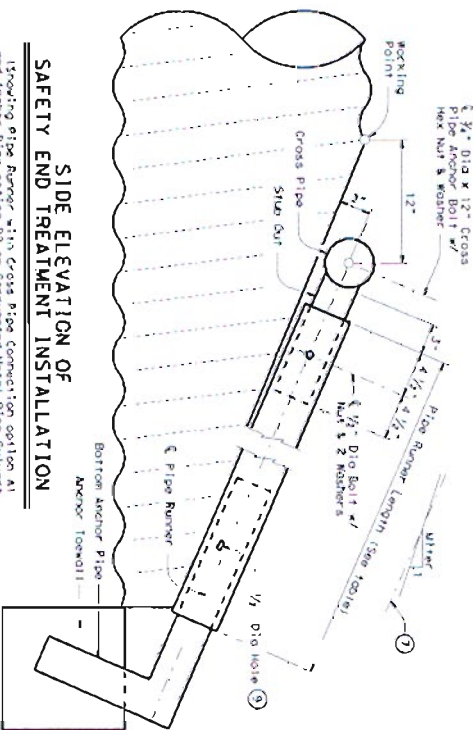
BOTTOM ANCHOR PIPE DETAILS



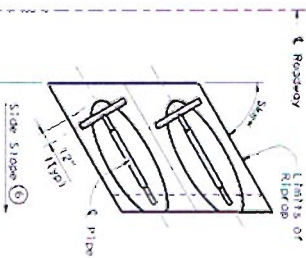
BOTTOM ANCHOR TOEWALL DETAILS

SAFETY END TREATMENT INSTALLATION

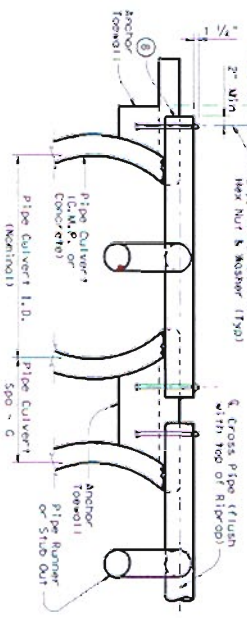
Showing pipe runner with cross pipe connection option A1 and anchor pipe option B2 on corrugated metal pipe culvert. Concrete pipe culvert details are similar. Riprap not shown for clarity.



PLAN OF SKEWED INSTALLATION

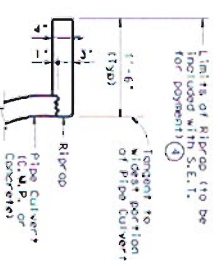


SHOWING CROSS PIPE & ANCHOR TOEWALL



SECTION A-A

SHOWING TYPICAL PIPE CULVERT & RIPRAP



- Recommended values of side slope are 3:1, 4:1 & 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.
- Note that original slope of pipe runner may vary slightly from side slope of riprap and rimmed culvert pipe edge.
- Care shall be taken to ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow clearance access.
- After installation, the 1/2" hole shall be inspected to assure that the top of the pipe runner with the bottom anchor pipe is adequate.
- As specified, option A bolt head to a smooth 5' radius or a rounded edge (to the nearest 1/2") shall be used. Option B shall be used for the altered and welded joint in the bottom anchor pipe.

GENERAL NOTES:

Pipe Runners are designed for a repeating load of 1,800 pounds of yield as recommended by Research Report 7801. Safety Treatments of Roadside Safety End Treatments are shown herein and are intended for use in those situations where out of control vehicles are likely to reverse the openings approximately perpendicular to the pipe runner. The requirements of Item 432, Riprap, shall be concrete riprap conforming to Safety End Treatment. Riprap and anchor pipe shall conform to the requirements of ASTM A53 Type E or G, Grade B, ASTM A500 (Grade B), or A51 S1552. Bolts and nuts shall conform to ASTM A307. All steel components, except concrete reinforcement, shall be galvanized or all steel components, except concrete reinforcement, shall be galvanized or shall be required in accordance with the specifications.

Texas Department of Transportation  
 Safety End Treatment  
 FOR 12" DIA TO 60" DIA  
 PIPE CULVERTS  
 TYPE II - CROSS DRAINAGE

SETP-CD

NO.	DESCRIPTION	DATE	BY	CHECKED	APP. (DATE)
1	DESIGN	1/2/02	...	...	...
2	REVISION	...	...	...	...