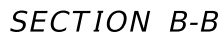
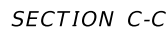


DATE: _____
FILE: _____



(Showing headwall pipe runner. Except for upper bracket, wingwall pipe runners are similar.)



(Showing installed bracket.)

(Showing installed bracket normal to wall.
Pipe not shown for clarity.)

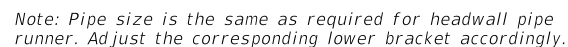
NOTE: Match the wingwall bracket to the upper bracket size.

WINGWALL BRACKET DETAILS



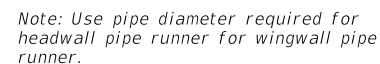
NOTE: Match upper and lower brackets, except for the brackets used with non-sliding pipe runners, match the required pipe diameters as shown in the table.

UPPER AND LOWER BRACKET DETAILS



NON-SLIDING PIPE RUNNER DETAILS ⑩

- ⑧ At Contractor's option, $\frac{7}{8}$ " diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.
- ⑨ After installation of the pipe runner, use the $\frac{1}{2}$ " inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.
- ⑩ Non-sliding pipe runners are used for those installations that would require pipe runner lengths of 1'-9" or less. The non-sliding pipe runner, when required, replaces the outermost pipe runner and anchor pipe. See table on Sheet 3 of 3 to determine if the non-sliding pipe runner is required.
- ⑪ At Contractor's option, an adhesive anchor may be used. Provide adhesive anchors that are $\frac{3}{4}$ " Dia ASTM A307 Grade A fully threaded rods. Embed threaded rods into curb, wingwalls, and/or toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 $\frac{1}{2}$ ". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, N_{ba} , 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.



Note: Use pipe diameter required for headwall pipe runner for wingwall pipe runner.

PIPE RUNNER DETAILS



SHEET 2 OF 3



Texas Department of Transportation

**Bridge
Division
Standard**

*SAFETY END TREATMENT
WITH FLARED WINGS
FOR 15° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE*

SETP-FW-A-15

FILE: CD-SETP-FWA15-20.dgn		DN: GAF		CK: CAT		DW: TxDOT		CK: GAF	
 TxDOT February 2020 REVISIONS		CONT SECT		JOB		HIGHWAY			
		DIST		COUNTY				SHEET NO.	

DISCLAIMER:
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DATE:
FILE:

Arch Pipe Culvert Design	No. of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension	No. of Headwall Pipes	Side Slope	Arch Pipe Culvert Design	L1	P1	No. of Spaces in L3	L3 Overall Dimension	P2	No. of Spaces in L4	L4 Overall Dimension	Headwall Pipe Runner Length	No. of Wing Pipes (13)	Longest Wingwall Pipe Runner Length	Shortest Wingwall Pipe Runner Length	Non-Sliding Pipe Length	Pipe Runner Size (14)	Total Length of Wingwall Pipe Runners (15)	
3	1	1	2' - 4"	1	3:1	3	0' - 6"	2' - 0"	1	2' - 1 1/4"	3' - 7"	0	N/A	4' - 10 3/4"	1	1' - 7"	5' - 5 1/4"	3' - 1"	3" STD	3' - 1"	
	2	3	6' - 2 1/2"	3		4	1' - 0"	2' - 9"	1	2' - 5 1/4"	5' - 1"	0	N/A	5' - 11 1/2"	1	2' - 11 1/2"	N/A	N/A	3" STD	2' - 11 1/2"	
	3	5	10' - 1"	5		5	1' - 6"	2' - 0"	2	4' - 5"	3' - 7"	1	4' - 5"	7' - 3 1/4"	2	5' - 7 1/4"	N/A	3' - 1"	3" STD	8' - 8 1/4"	
	4	7	13' - 11 1/2"	7		6	0' - 7 1/2"	2' - 0"	2	4' - 1 1/4"	3' - 7"	1	4' - 1 1/4"	8' - 4"	2	5' - 4"	N/A	3' - 1"	3" STD	8' - 5"	
	5	9	17' - 10"	9		7	0' - 6"	2' - 0"	2	4' - 8 1/2"	3' - 7"	1	4' - 8 1/2"	9' - 7 3/4"	2	5' - 10 3/4"	N/A	3' - 1"	3" STD	8' - 11 3/4"	
	6	11	21' - 8 1/2"	11		8	1' - 0"	3' - 0"	2	4' - 11 1/4"	5' - 7"	1	4' - 11 1/4"	10' - 11 1/2"	2	7' - 11"	3' - 5"	N/A	3" STD	11' - 4"	
4	1	1	2' - 5 1/4"	1	4:1	9	0' - 6"	3' - 0"	2	5' - 0"	5' - 7"	1	5' - 0"	12' - 0 1/4"	2	7' - 11 3/4"	3' - 5"	N/A	4" STD	11' - 4 3/4"	
	2	3	7' - 2 1/4"	3		3	0' - 6"	2' - 10"	1	2' - 5 3/4"	5' - 3"	0	N/A	6' - 10 3/4"	1	3' - 0"	N/A	N/A	3" STD	3' - 0"	
	3	5	11' - 11 1/4"	5		4	1' - 0"	2' - 0"	2	4' - 7"	3' - 7"	1	4' - 7"	8' - 3 1/4"	2	5' - 7 1/4"	N/A	3' - 0"	3" STD	8' - 7 1/4"	
	4	7	16' - 8 1/4"	7		5	1' - 6"	3' - 0"	2	5' - 0 1/2"	5' - 7"	1	5' - 0 1/2"	10' - 0"	2	7' - 9 1/2"	3' - 3 1/2"	N/A	4" STD	11' - 1"	
	5	9	21' - 5 1/4"	9		6	0' - 7 1/2"	3' - 0"	2	4' - 11 1/4"	5' - 7"	1	4' - 11 1/4"	11' - 4 1/2"	2	7' - 8 1/2"	3' - 3 1/2"	N/A	4" STD	11' - 0"	
	6	11	26' - 2 1/4"	11		7	0' - 6"	2' - 0"	3	6' - 9 1/4"	3' - 7"	2	9' - 0 1/2"	13' - 1"	3	9' - 6 3/4"	5' - 6 1/2"	3' - 0"	4" STD	18' - 1 1/4"	
5	1	1	2' - 6 1/2"	1	6:1	8	1' - 0"	2' - 9"	3	7' - 5 3/4"	5' - 1"	2	9' - 11 3/4"	14' - 9 3/4"	3	11' - 9"	2' - 10 1/4"	N/A	4" STD	21' - 11"	
	2	4	8' - 1 3/4"	4		9	0' - 6"	3' - 0"	3	7' - 6"	5' - 7"	2	10' - 0"	16' - 2 1/4"	3	12' - 2 3/4"	3' - 3 1/2"	N/A	4" STD	23' - 3 1/2"	
	3	6	13' - 9"	6		3	0' - 6"	2' - 9"	2	4' - 11 1/2"	5' - 1"	1	4' - 11 1/2"	10' - 11 3/4"	2	7' - 1 1/2"	2' - 9 1/4"	N/A	4" STD	9' - 10 3/4"	
	4	8	19' - 4 1/4"	8		4	1' - 0"	2' - 0"	3	7' - 4 1/2"	3' - 7"	2	9' - 10"	13' - 0 1/4"	3	10' - 1"	5' - 9 1/4"	2' - 11 1/2"	4" STD	18' - 9 3/4"	
	5	10	24' - 11 1/2"	10		5	1' - 6"	2' - 0"	4	9' - 3 3/4"	3' - 7"	3	13' - 11 3/4"	15' - 6 1/2"	4	13' - 8 1/2"	5' - 6 1/2"	2' - 11 1/2"	4" STD	31' - 10"	
	6	13	30' - 6 3/4"	13		6	0' - 7 1/2"	2' - 0"	4	9' - 7 1/4"	3' - 7"	3	14' - 4 3/4"	17' - 7"	4	14' - 1"	5' - 8"	2' - 11 1/2"	4" STD	32' - 7"	
6	1	2	4' - 0 1/4"	2		7	0' - 6"	3' - 0"	4	9' - 11"	5' - 7"	3	14' - 10 1/2"	20' - 1 1/4"	4	16' - 3 1/4"	3' - 2 1/2"	N/A	4" STD	38' - 11 1/2"	
	2	5	10' - 6"	5		8	1' - 0"	2' - 6"	5	12' - 4 1/4"	4' - 7"	4	19' - 9 1/4"	22' - 7 3/4"	5	19' - 8 1/4"	2' - 4"	N/A	5" STD	55' - 0 3/4"	
	3	7	16' - 11 3/4"	7		9	0' - 6"	3' - 0"	5	12' - 6 1/4"	5' - 7"	4	20' - 0 1/4"	24' - 8"	5	20' - 9 1/4"	3' - 2 1/2"	N/A	5" STD	59' - 11 1/2"	
	4	10	23' - 5 1/2"	10																	
	5	12	29' - 11 1/4"	12																	
	6	15	36' - 5"	15																	
7	1	2	4' - 10"	2																	
	2	5	12' - 3"	5																	
	3	8	19' - 8"	8																	
	4	11	27' - 1"	11																	
	5	14	34' - 6"	14																	
	6	17	41' - 11"	17																	
8	1	2	4' - 11 1/4"	2																	
	2	6	13' - 4 3/4"	6																	
	3	9	21' - 10 1/4"	9																	
	4	13	30' - 3 3/4"	13																	
	5	16	38' - 9 1/4"	16																	
	6	19	47' - 2 3/4"	19																	
9	1	3	6' - 0 1/2"	3																	
	2	7	15' - 5 1/4"	7																	
	3	10	24' - 10"	10																	
	4	14	34' - 2 3/4"	14																	
	5	18	43' - 7 1/2"	18																	
	6	22	53' - 0 1/4"	22																	

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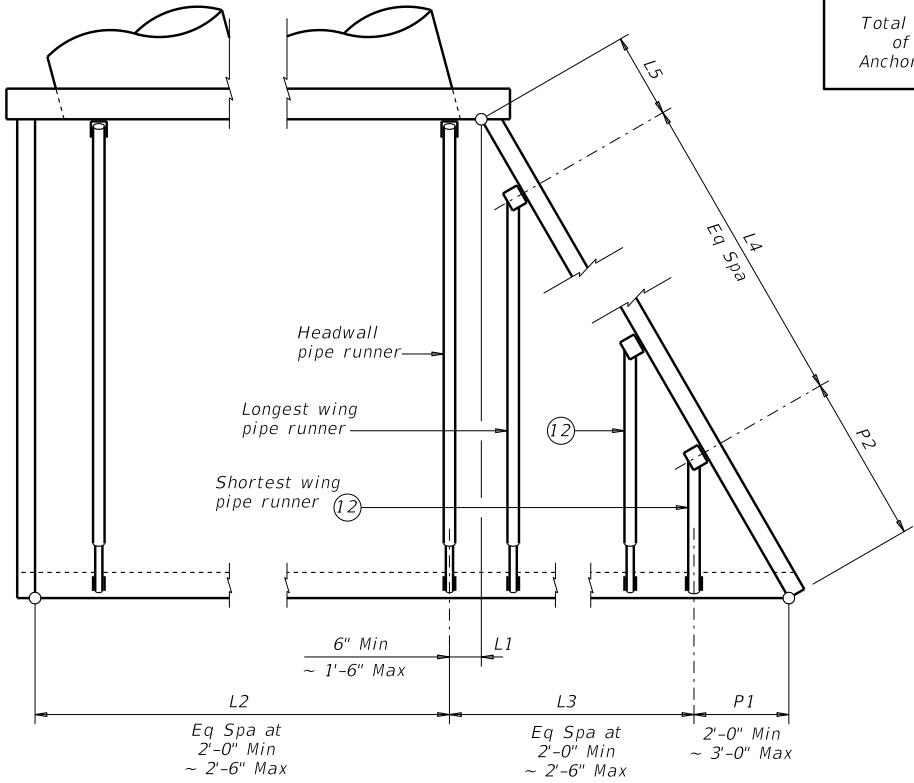
- ⑫ If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner be considered the shortest.
- ⑬ Quantities shown include, if present, the non-sliding pipes.
- ⑭ The anchor pipe size is the next smaller size than the pipe runner size.

SPECIAL NOTE:
Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, verify all dimensions in the field prior to fabrication of the safety end treatment components.

STANDARD PIPE RUNNER AND ANCHOR PIPE SIZES ^⑭		
Pipe Size	Pipe O.D.	Pipe I.D.
2" STD	2.375"	2.067"
3" STD	3.500"	3.068"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"

TOTAL PIPE LENGTHS FORMULAS:

$$\begin{aligned} \text{Total Length of All Pipe Runners} &= \text{Total Length of Wingwall Pipe Runners} + \left(\frac{\text{No. of Headwall Pipe Runners}}{\text{Pipe Runners}} \right) \left(\frac{\text{Headwall Pipe Runner Length}}{\text{Length}} \right) \\ \text{Total Length of All Anchor Pipes} &= (3.000') \left(\frac{\text{No. of Wing Pipe Runners}}{\text{Pipe Runners}} + \frac{\text{No. of Headwall Pipe Runners}}{\text{Pipe Runners}} - \frac{\text{No. of Non-Sliding Pipe Runners}}{\text{Pipe Runners}} \right) \end{aligned}$$



PIPE RUNNER LAYOUT

Note: Left forward culvert skew shown, actual culvert skew may be opposite hand.



Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS FOR 15° SKEW ARCH PIPE CULVERTS TYPE I ~ CROSS DRAINAGE

SETP-FW-A-15

FILE: CD-SETP-FWA15-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
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REVISIONS				
	DIST		COUNTY	SHEET NO.