

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DESIGN	SIZE OF PIPE ARCH		Values for one Pipe					Values to be added for each add'l Pipe				
		Span	Rise	W	X	Y	L	Reinf (Lbs)	Conc (CY)	X and W	Reinf (Lbs)	Conc (CY)	
													Reinf (Lbs)
3:1	4	35"	24"	11'-5 1/2"	4'-2 3/4"	7'-3"	8'-4 1/2"	237	2.1	4'-7"	83	1.0	
	5	42"	29"	13'-5 3/4"	4'-9 3/4"	8'-6"	9'-9 3/4"	295	2.7	5'-5"	113	1.3	
	6	49"	33"	15'-2 3/4"	5'-4 3/4"	9'-6"	10'-11 3/4"	339	3.3	6'-3"	130	1.7	
	7	57"	38"	17'-4"	6'-0 3/4"	10'-9"	12'-5"	394	4.2	7'-2"	159	2.1	
	8	64"	43"	19'-4 1/4"	6'-7 3/4"	12'-0"	13'-10 1/4"	471	5.1	8'-2"	199	2.6	
	9	71"	47"	21'-1 1/4"	7'-2 3/4"	13'-0"	15'-0 1/4"	523	5.9	9'-1"	226	3.1	
	4:1	4	35"	24"	14'-3"	4'-2 3/4"	9'-8"	11'-2"	311	2.9	4'-7"	94	1.2
		5	42"	29"	16'-9"	4'-9 3/4"	11'-4"	13'-1"	375	3.9	5'-5"	125	1.6
		6	49"	33"	18'-10 1/2"	5'-4 3/4"	12'-8"	14'-7 1/2"	449	4.7	6'-3"	152	2.0
7		57"	38"	21'-5 1/2"	6'-0 3/4"	14'-4"	16'-6 3/4"	526	5.9	7'-2"	180	2.6	
8		64"	43"	23'-11 3/4"	6'-7 3/4"	16'-0"	18'-5 3/4"	625	7.2	8'-2"	229	3.2	
9		71"	47"	26'-1 1/4"	7'-2 3/4"	17'-4"	20'-0 1/4"	698	8.4	9'-1"	261	3.9	
6:1		4	35"	24"	19'-10"	4'-2 3/4"	14'-6"	16'-9"	464	5.0	4'-7"	112	1.6
		5	42"	29"	23'-3 1/2"	4'-9 3/4"	17'-0"	19'-7 1/2"	581	6.6	5'-5"	154	2.2
		6	49"	33"	26'-2 1/4"	5'-4 3/4"	19'-0"	21'-11 1/4"	705	8.2	6'-3"	187	2.8
	7	57"	38"	29'-9"	6'-0 3/4"	21'-6"	24'-10"	846	10.3	7'-2"	233	3.5	
	8	64"	43"	33'-2 1/2"	6'-7 3/4"	24'-0"	27'-8 1/2"	990	12.6	8'-2"	289	4.4	
	9	71"	47"	36'-1 1/4"	7'-2 3/4"	26'-0"	30'-0 1/4"	1119	14.7	9'-1"	336	5.3	

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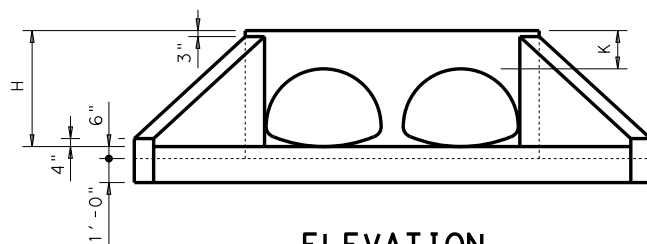
DATE: FILE:

TABLE OF (4) REINFORCING STEEL

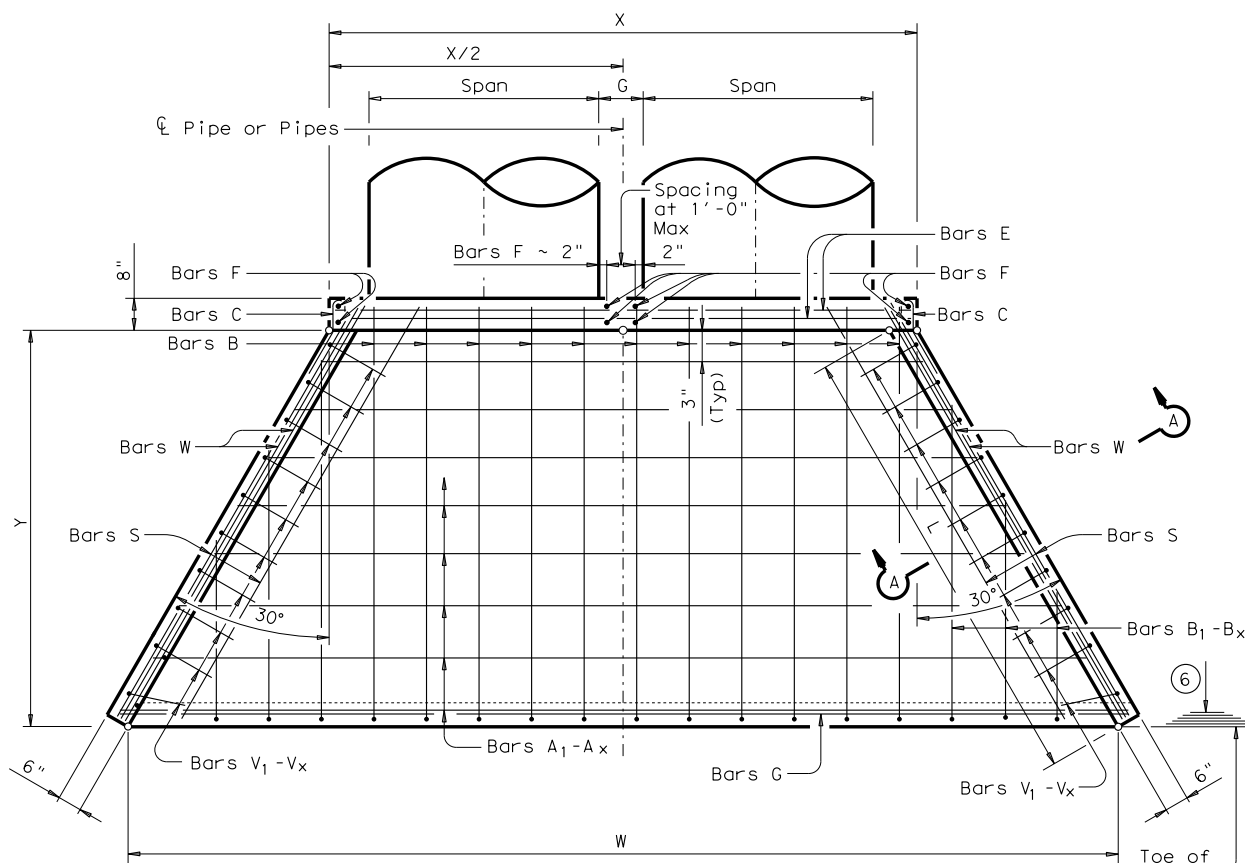
Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF DIMENSIONS NOT VARIED WITH SLOPE

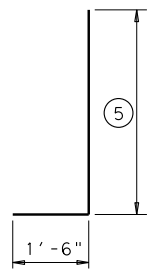
DESIGN	SIZE OF PIPE ARCH		G	K	H
	Span	Rise			
4	35"	24"	1'-8"	1'-0"	3'-0"
5	42"	29"	1'-11"	1'-0"	3'-5"
6	49"	33"	2'-2"	1'-0"	3'-9"
7	57"	38"	2'-5"	1'-0"	4'-2"
8	64"	43"	2'-10"	1'-0"	4'-7"
9	71"	47"	3'-2"	1'-0"	4'-11"



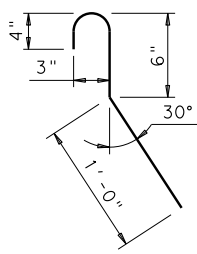
ELEVATION
Showing dimensions



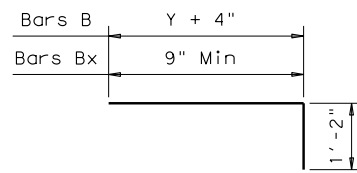
PLAN



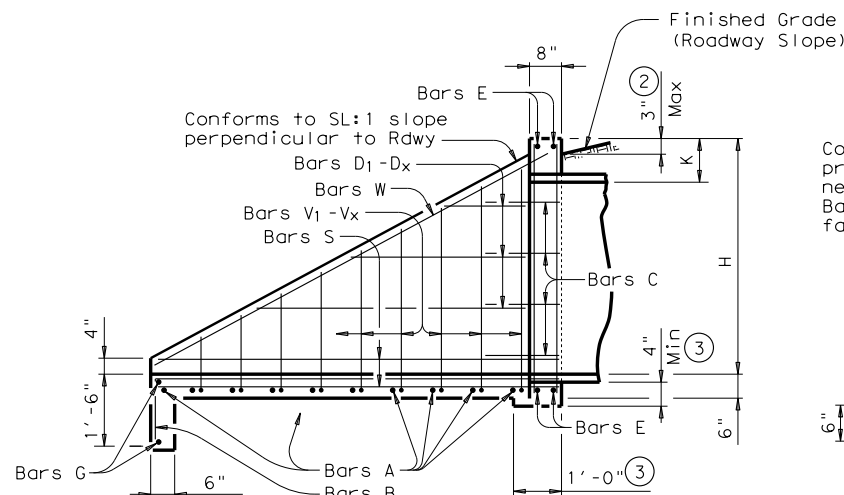
BARS V



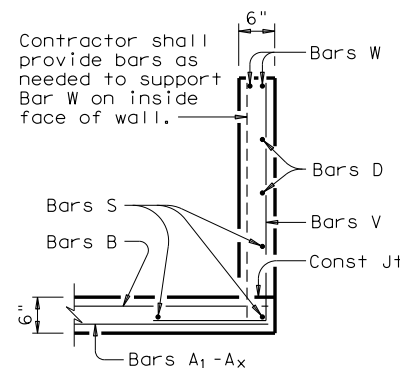
BARS C
(2'-0" long)



BARS B & B1-Bx



TYPICAL WING ELEVATION



SECTION A-A

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

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.
The Safety End Treatment 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.
The Safety 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.
Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.
All reinforcing steel shall be Grade 60.
All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.
All bolts, nuts, washers, brackets, angles and pipe runners are considered parts of the Safety End Treatment for payment.
Pipe Runners shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.
Bolts and nuts shall conform to ASTM A307.
Steel plates shall conform to ASTM A36. All steel components, except reinforcing, shall be galvanized. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

SHEET 1 OF 3

Texas Department of Transportation
Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS
FOR 0° SKEW ARCH PIPE CULVERTS
TYPE I ~ CROSS DRAINAGE

SETP-FW-A-0

FILE: stpa00se.dgn	DN: GAF	CK: CAT	DW: BWH	CK: GAF
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REVISIONS				
11-10: Removed Bars T.	DIST	COUNTY		SHEET NO.

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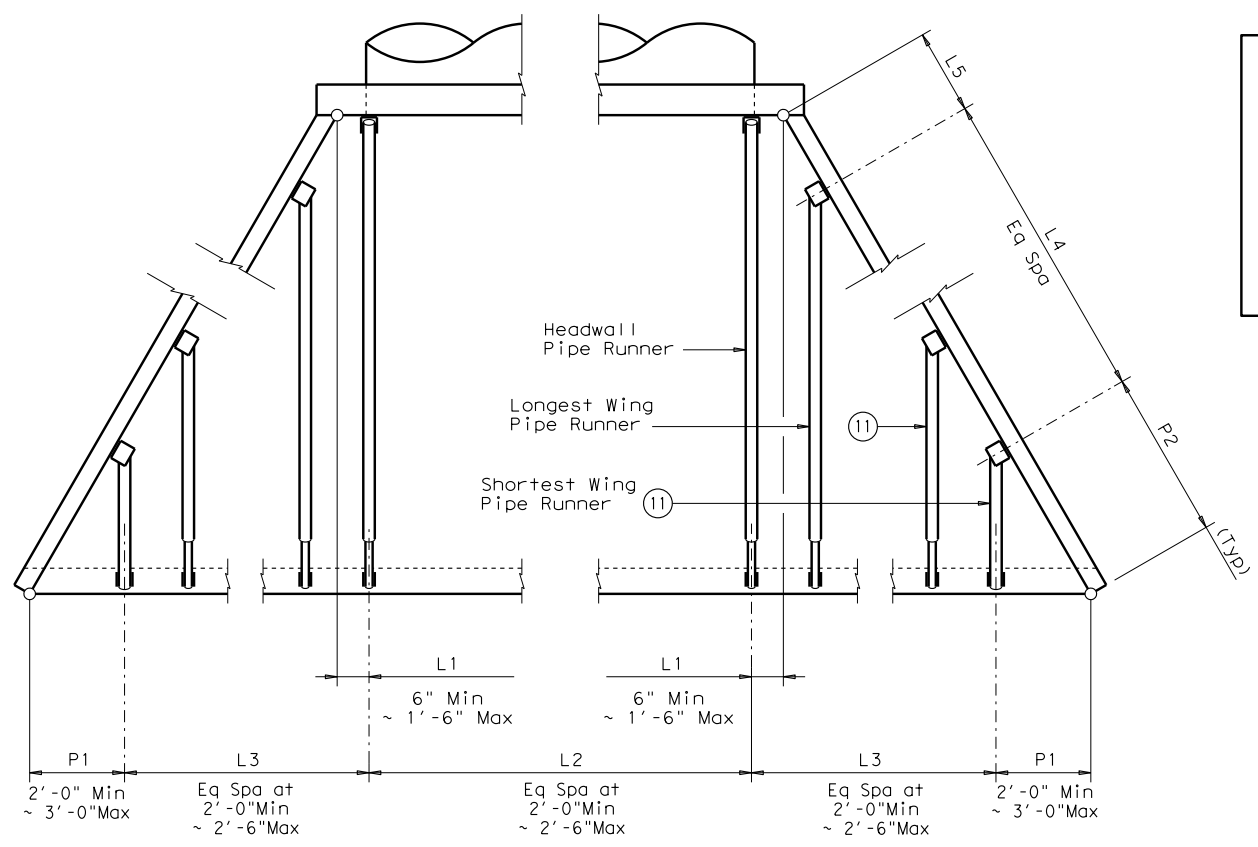
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Side Slope	Arch Pipe Culvert Design	L1 (Ft-In)	P1 (Ft-In)	Number of Spaces in L3	L3 Overall Dimension (Ft-In)	P2 (Ft-In)	Number of Spaces in L4	L4 Overall Dimension (Ft-In)	Headwall Pipe Runner Length (Ft-In)	No. of Wing Pipes (12)	Longest Wingwall Pipe Runner Length (Ft-In)	Shortest Wingwall Pipe Runner Length (Ft-In)	Non-Sliding Pipe Length (Ft-In)	Pipe Runner Size (13)	Total Length of Wingwall Pipe Runners (Ft-In) (12)
3:1	4	6"	2'-3"	1	2'-5 1/4"	4'-1"	0	N/A	5'-11 1/2"	2	2'-0 1/2"	2'-0 1/2"	N/A	3" STD	4'-1"
	5	7"	3'-0"	1	2'-6"	5'-7"	0	N/A	7'-3 1/4"	2	3'-5"	3'-5"	N/A	3" STD	6'-10"
	6	1'-0"	2'-0"	2	4'-5 3/4"	3'-7"	1	4'-5 3/4"	8'-4"	4	5'-8 1/4"	5'-8 1/4"	3'-1"	4" STD	17'-6 1/2"
	7	1'-3"	2'-6"	2	4'-11 1/2"	4'-7"	1	4'-11 1/2"	9'-7 3/4"	4	7'-0 1/4"	2'-6"	N/A	4" STD	19'-0 1/2"
	8	6"	2'-6"	2	4'-11 1/4"	4'-7"	1	4'-11 1/4"	10'-11 1/2"	4	7'-0"	2'-6"	N/A	4" STD	19'-0"
4:1	4	6"	2'-0"	2	4'-1"	3'-7"	1	4'-1"	8'-3 1/4"	4	5'-1 3/4"	5'-1 3/4"	3'-0"	4" STD	16'-3 1/2"
	5	7"	2'-2"	2	4'-11 1/2"	3'-11"	1	4'-11 1/2"	10'-0"	4	6'-2 3/4"	1'-9 3/4"	N/A	4" STD	16'-1"
	6	1'-0"	2'-0"	3	6'-3 3/4"	3'-7"	2	8'-5"	11'-4 1/2"	6	9'-0 1/4"	5'-3 1/4"	3'-0"	4" STD	34'-7"
	7	1'-3"	2'-0"	3	7'-6 1/4"	3'-7"	2	10'-0 1/2"	13'-1"	6	10'-5 1/2"	5'-11 3/4"	3'-0"	4" STD	38'-10 1/2"
	8	6"	2'-3"	3	7'-5 3/4"	4'-1"	2	9'-11 3/4"	14'-9 3/4"	6	10'-10 1/4"	1'-11 1/2"	N/A	5" STD	38'-5 1/4"
6:1	4	6"	2'-0"	3	6'-10 1/2"	3'-7"	2	9'-2"	13'-0 1/4"	6	9'-6"	5'-5 3/4"	2'-11 1/2"	4" STD	35'-10 1/2"
	5	7"	3'-0"	3	7'-4 3/4"	5'-7"	2	9'-10 1/4"	15'-6 1/2"	6	11'-10 1/2"	3'-2 1/2"	N/A	5" STD	45'-3"
	6	1'-0"	2'-0"	4	9'-11 3/4"	3'-7"	3	14'-11 1/2"	17'-7"	8	14'-7"	5'-10"	2'-11 1/2"	5" STD	67'-2"
	7	1'-3"	2'-0"	5	11'-8"	3'-7"	4	18'-8"	20'-1 1/4"	10	17'-10"	5'-6 1/2"	2'-11 1/2"	5" STD	99'-5"
	8	6"	2'-0"	5	12'-4 1/4"	3'-7"	4	19'-9 1/4"	22'-7 3/4"	10	18'-9 3/4"	5'-9 1/2"	2'-11 1/2"	5" STD	104'-4"
9	9"	2'-0"	6	13'-9 1/4"	3'-7"	5	22'-11 1/4"	24'-8"	12	21'-7"	5'-5 3/4"	2'-11 1/2"	5" STD	141'-2 3/4"	

- (11) If the outermost Wing Pipe Runner is a Non-Sliding Pipe Runner, the next outermost Wing Pipe Runner shall be considered the Shortest.
- (12) Quantities shown include, if present, the Non-Sliding Pipes.
- (13) Anchor Pipe size shall be the next smaller size than the Pipe Runner size.

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"

Arch Pipe Culvert Design	Number of Pipe Culverts	No. of L2 Spaces	L2 Overall Dimension (Ft-In)	Number of Headwall Pipes
4	1	1	2'-1"	2
	2	3	6'-8"	4
	3	5	11'-3"	6
	4	7	15'-10"	8
	5	9	20'-5"	10
	6	10	25'-0"	11
5	1	1	2'-6"	2
	2	4	7'-11"	5
	3	6	13'-4"	7
	4	8	18'-9"	9
	5	10	24'-2"	11
	6	12	29'-7"	13
6	1	1	2'-3"	2
	2	4	8'-6"	5
	3	6	14'-9"	7
	4	9	21'-0"	10
	5	11	27'-3"	12
	6	14	33'-6"	15
7	1	1	2'-5"	2
	2	4	9'-7"	5
	3	7	16'-9"	8
	4	10	23'-11"	11
	5	13	31'-1"	14
	6	16	38'-3"	17
8	1	2	4'-6"	3
	2	6	12'-8"	7
	3	9	20'-10"	10
	4	12	29'-0"	13
	5	15	37'-2"	16
	6	19	45'-4"	20
9	1	2	4'-7"	3
	2	6	13'-8"	7
	3	10	22'-9"	11
	4	13	31'-10"	14
	5	17	40'-11"	18
	6	20	50'-0"	21



PIPE RUNNER LAYOUT

TOTAL PIPE LENGTHS FORMULAS:

$$\text{Total Length of All Pipe Runners} = \text{Total Length of Wingwall Pipe Runners} + \left(\frac{\text{No. of Headwall Pipe Runners}}{\text{No. of Wing Pipe Runners}} \right) \left(\frac{\text{Headwall Pipe Runner Length}}{\text{No. of Wing Pipe Runners}} \right)$$

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

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, all dimensions shall be verified by the Contractor in the field prior to fabrication of the Safety End Treatment components.

		Bridge Division Standard	
SAFETY END TREATMENT WITH FLARED WINGS FOR 0° SKEW ARCH PIPE CULVERTS TYPE I ~ CROSS DRAINAGE			
SETP-FW-A-0			
FILE: stpa00se.dgn	DN: GAF	CK: CAT	DW: TxDOT
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REVISIONS	DIST		COUNTY
11-10: Removed Bars T.	SHEET NO.		