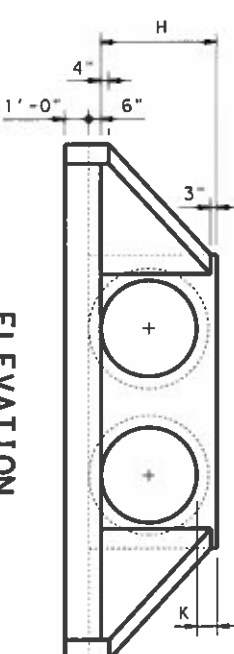


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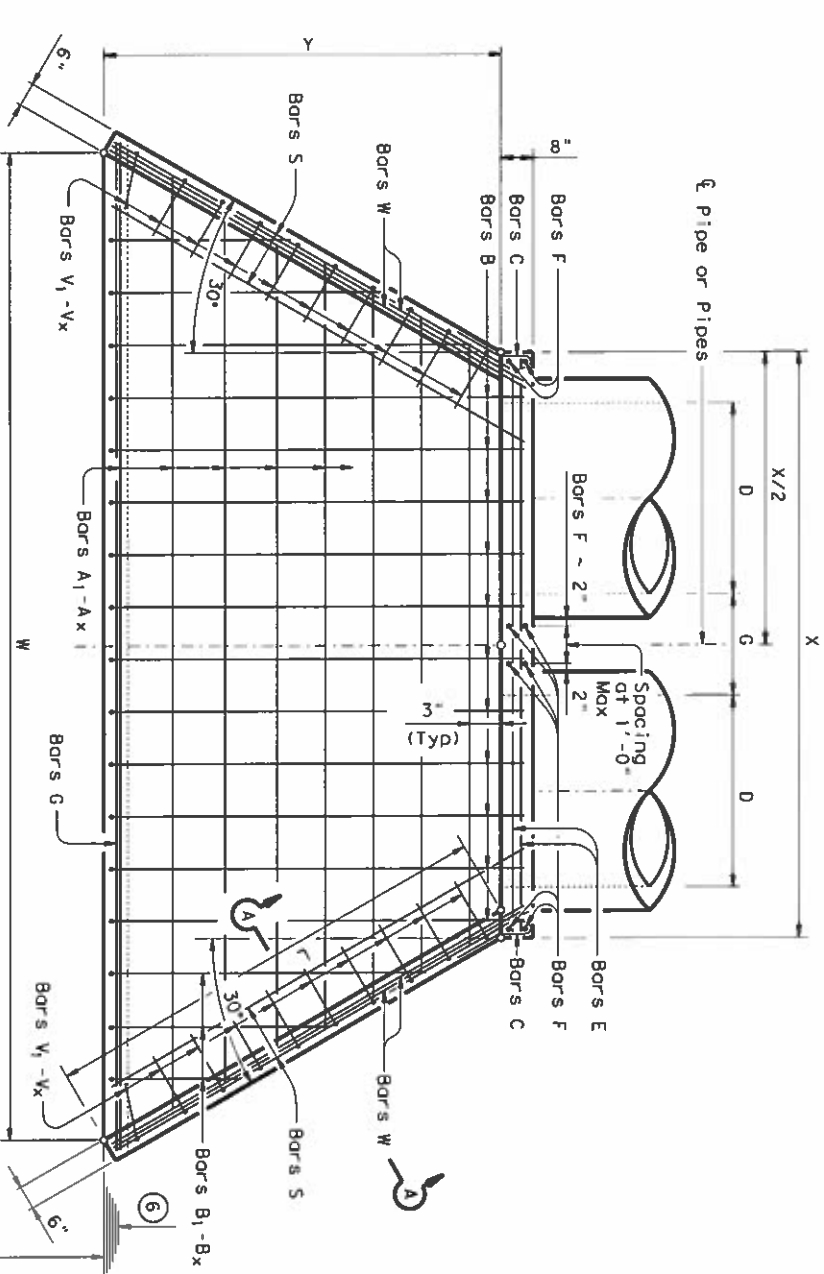
DATE:
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TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

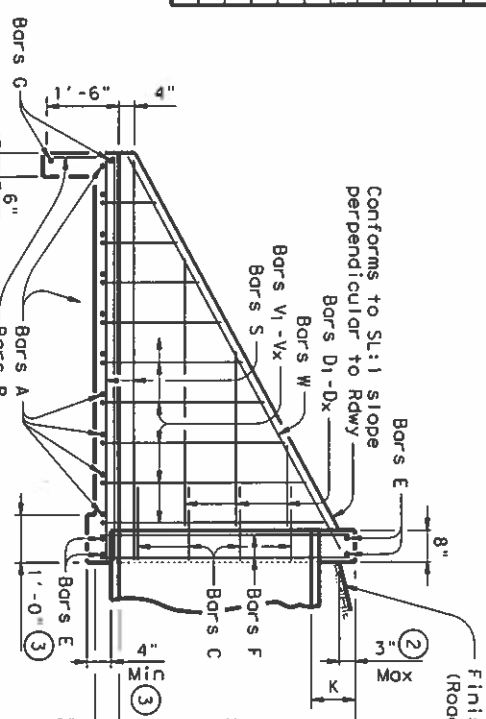
SLOPE	Values for one Pipe					Values to be added for each odd-1 pipe			
	W	X	Y	L	Reinf Conc (lbs) (CY)	X and W	Reinf Conc (lbs) (CY)		
12"	4'-7 1/2"	2'-6"	2'-10"	3'-3 1/4"	84	0.6	1'-9"	20	0.2
15"	5'-5 3/4"	2'-9 1/2"	3'-4"	3'-10 1/4"	99	0.7	2'-2"	24	0.3
18"	6'-4 1/4"	3'-1"	3'-10"	4'-5"	120	0.9	2'-8"	32	0.3
21"	7'-2 3/4"	3'-4 1/2"	4'-4"	5'-0"	137	1.1	3'-1"	43	0.4
24"	8'-2 1/2"	3'-9 1/2"	4'-10"	5'-7"	158	1.3	3'-7"	50	0.5
27"	9'-1"	4'-1"	5'-4"	6'-2"	173	1.5	3'-11"	56	0.6
30"	9'-11 1/2"	4'-4 1/2"	5'-10"	6'-8 3/4"	197	1.7	4'-4"	65	0.8
33"	10'-10"	4'-8"	6'-4"	7'-3 3/4"	216	2.0	4'-8"	71	0.9
36"	11'-8 1/4"	4'-11 1/2"	6'-10"	7'-10 3/4"	241	2.2	5'-1"	81	1.0
42"	13'-5 1/4"	5'-6 1/2"	7'-10"	9'-0 1/2"	290	2.8	5'-10"	97	1.3
48"	15'-9"	6'-1 1/2"	9'-4"	10'-9 1/4"	350	3.8	6'-7"	117	1.7
54"	17'-5 3/4"	6'-8 1/2"	10'-4"	11'-11 1/4"	415	4.5	7'-6"	151	2.1
60"	19'-2 3/4"	7'-3 1/2"	11'-4"	13'-1"	469	5.3	8'-3"	174	2.5
66"	20'-11 1/2"	7'-10 1/2"	12'-4"	14'-3"	530	6.2	8'-9"	194	2.9
72"	22'-8 1/2"	8'-5 1/2"	13'-4"	15'-4 3/4"	587	7.1	9'-4"	213	3.3
12"	6'-3"	2'-6"	4'-3"	4'-11"	114	0.8	1'-9"	22	0.2
15"	7'-5"	2'-9 1/2"	5'-0"	5'-9 1/4"	133	1.1	2'-2"	28	0.3
18"	8'-6 3/4"	3'-1"	5'-9"	6'-7 3/4"	166	1.3	2'-8"	37	0.5
21"	9'-8 3/4"	3'-4 1/2"	6'-6"	7'-6"	189	1.6	3'-1"	48	0.6
24"	11'-0"	3'-9 1/2"	7'-3"	8'-4 1/2"	221	2.0	3'-7"	58	0.7
27"	12'-2"	4'-1"	8'-0"	9'-2 3/4"	245	2.3	3'-11"	67	0.8
30"	13'-4"	4'-4 1/2"	8'-9"	10'-1 1/4"	287	2.7	4'-4"	77	1.0
33"	14'-5 3/4"	4'-8"	9'-6"	10'-11 3/4"	310	3.1	4'-8"	84	1.2
36"	15'-7 1/4"	4'-11 1/2"	10'-3"	11'-10"	343	3.5	5'-1"	96	1.4
42"	17'-11 1/2"	5'-6 1/2"	11'-4"	13'-6 3/4"	424	4.5	5'-10"	119	1.7
48"	21'-1 3/4"	6'-1 1/2"	14'-0"	16'-2"	527	6.1	6'-7"	146	2.3
54"	23'-5 1/2"	6'-8 1/2"	15'-6"	17'-10 3/4"	618	7.3	7'-6"	186	2.9
60"	25'-9 1/4"	7'-3 1/2"	17'-0"	19'-7 1/2"	707	8.7	8'-3"	219	3.4
66"	28'-1"	7'-10 1/2"	18'-0"	21'-1 1/4"	797	10.1	8'-9"	242	3.9
72"	30'-4 3/4"	8'-5 1/2"	20'-0"	23'-1 1/4"	910	11.7	9'-4"	272	4.4
12"	7'-10 3/4"	2'-6"	5'-8"	6'-6 1/2"	144	1.1	1'-9"	24	0.3
15"	9'-4"	2'-9 1/2"	6'-8"	7'-8 1/2"	177	1.5	2'-2"	32	0.4
18"	10'-9 1/2"	3'-1"	7'-8"	8'-10 1/4"	217	1.9	2'-8"	42	0.5
21"	12'-2 3/4"	3'-4 1/2"	8'-8"	10'-0"	254	2.3	3'-1"	57	0.7
24"	13'-9 1/2"	3'-9 1/2"	9'-8"	11'-0"	295	2.8	3'-7"	67	0.9
27"	15'-3"	4'-1"	10'-8"	12'-3 3/4"	328	3.3	3'-11"	77	1.0
30"	16'-8 1/4"	4'-4 1/2"	11'-8"	13'-5 3/4"	379	3.8	4'-4"	89	1.3
33"	18'-1 3/4"	4'-8"	12'-8"	14'-7 1/2"	417	4.5	4'-8"	101	1.4
36"	19'-7"	4'-11 1/2"	13'-8"	15'-9 1/4"	464	5.1	5'-1"	115	1.7
42"	22'-5 3/4"	5'-6 1/2"	15'-8"	18'-1"	575	6.5	5'-10"	141	2.1
48"	26'-6 1/4"	6'-1 1/2"	18'-8"	21'-6 3/4"	720	8.9	6'-7"	175	2.8
54"	29'-5"	6'-8 1/2"	20'-8"	23'-10 1/4"	863	10.7	7'-6"	226	3.6
60"	32'-3 3/4"	7'-3 1/2"	22'-8"	26'-2"	984	12.7	8'-3"	264	4.3
66"	35'-2 1/2"	7'-10 1/2"	24'-8"	28'-5 3/4"	1126	14.9	8'-9"	300	4.9
72"	38'-1 1/4"	8'-5 1/2"	26'-8"	30'-9 1/2"	1283	17.3	9'-4"	334	5.6
12"	11'-2"	2'-6"	8'-6"	9'-9 3/4"	220	1.9	1'-9"	28	0.4
15"	13'-2 1/4"	2'-9 1/2"	10'-0"	11'-6 1/2"	264	2.5	2'-2"	37	0.5
18"	15'-2 1/2"	3'-1"	11'-6"	13'-3 1/4"	326	3.2	2'-8"	50	0.7
21"	17'-2 3/4"	3'-4 1/2"	13'-0"	15'-0 1/4"	381	3.9	3'-1"	69	0.9
24"	19'-4 1/2"	3'-9 1/2"	14'-6"	16'-9"	447	4.8	3'-7"	80	1.2
27"	21'-4 3/4"	4'-1"	16'-0"	18'-5 3/4"	506	5.7	3'-11"	96	1.4
30"	23'-5 1/4"	4'-4 1/2"	17'-6"	20'-2 1/2"	587	6.7	4'-4"	110	1.7
33"	25'-5 1/2"	4'-8"	19'-0"	21'-11 1/4"	667	7.8	4'-8"	127	2.0
36"	27'-5 3/4"	4'-11 1/2"	20'-6"	23'-8"	727	9.0	5'-1"	144	2.3
42"	31'-6 1/4"	5'-6 1/2"	23'-6"	27'-1 1/2"	914	11.5	5'-10"	179	3.0
48"	37'-3 1/2"	6'-1 1/2"	28'-0"	32'-4"	1181	15.9	6'-7"	231	4.0
54"	41'-4 1/4"	6'-8 1/2"	31'-0"	35'-9 1/2"	1412	19.2	7'-6"	300	5.0
60"	45'-4 3/4"	7'-3 1/2"	34'-0"	39'-3"	1619	22.9	8'-3"	353	6.0



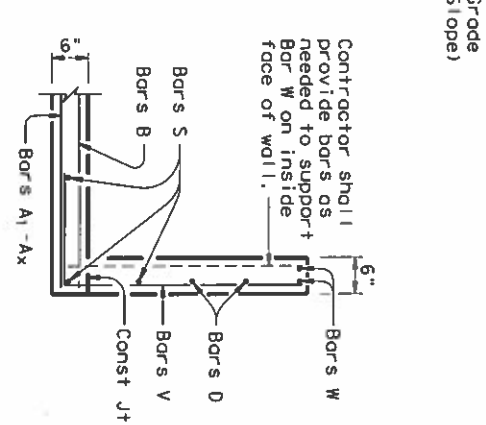
ELEVATION



PLAN



TYPICAL WING ELEVATION



SECTION A-A

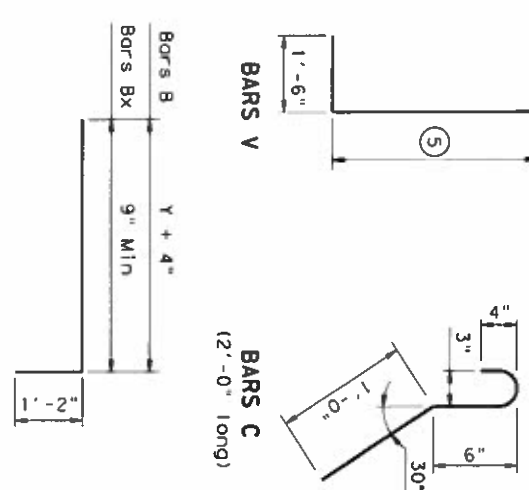
- Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.
- For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional 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' x $\left(\frac{12 \times H - 7}{12 \times L}\right)$
Max Length = 12 x H - 3' x $\left(\frac{12 \times H - 7}{12 \times L}\right) - 1'$
- Lengths of wings based on SL:1 Slope along this line.

TABLE OF REINFORCING STEEL (4)

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

TABLE OF CONSTANT DIMENSIONS

U.O. PL. ID.	G	K	H
12"	9"	1'-0"	2'-0"
15"	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'-4"	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"



GENERAL NOTES:
Designed according to AASHTO LRFD Specifications.
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.
No bridge rolls of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation
Bridge Division
Standard

CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW PIPE CULVERTS

CH-FW-0

FILE	CH-FW-0	DATE	February 2010
REV		BY	
NO.		DATE	

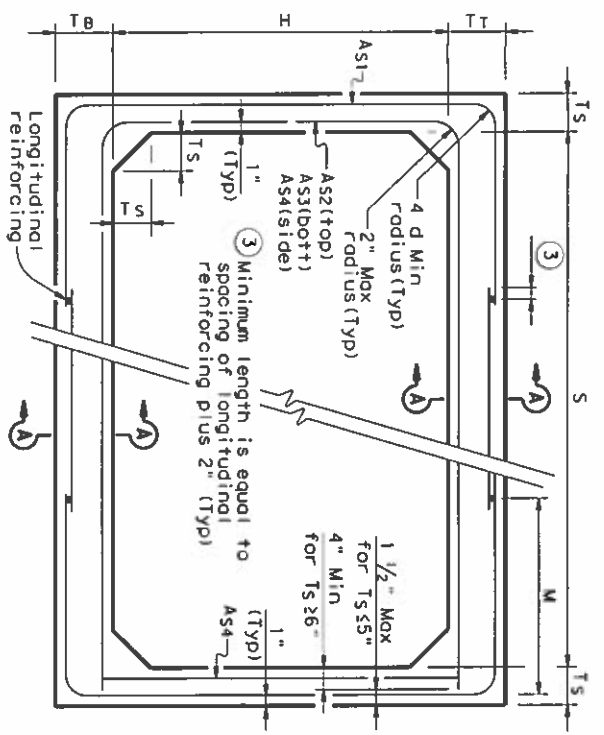
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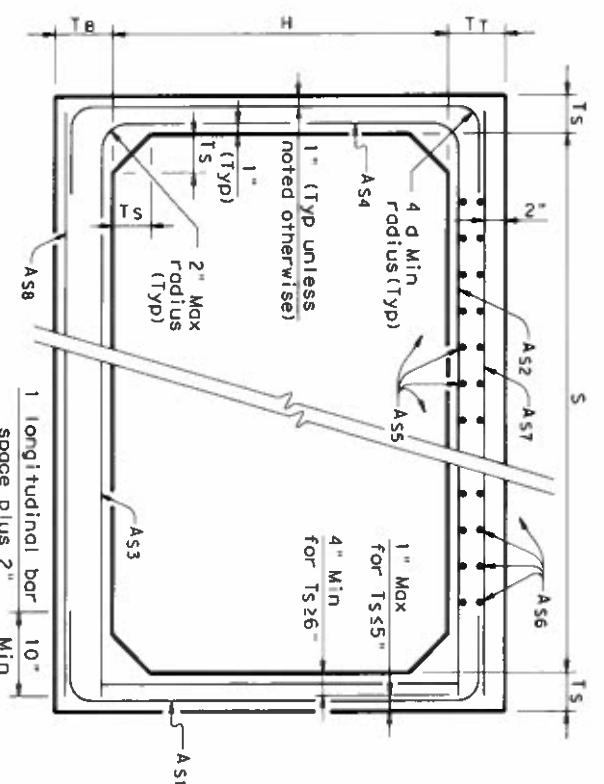
BOX DATA

SECTION DIMENSIONS				Fill Height (ft)	M (in)	REINFORCING (in ² /ft)								Lift Weight (tons)
S (ft)	H (ft)	T ₁ (in)	T _B (in)			T _S (in)	As1	As2	As3	As4	As5	As6	As7	
7	4	8	8	<2	-	0.21	0.34	0.25	0.19	0.19	0.19	0.19	0.19	10.4
7	4	8	8	<2	43	0.23	0.28	0.28	0.19	-	-	-	-	10.4
7	4	8	8	3-5	43	0.19	0.22	0.19	0.19	-	-	-	-	10.4
7	4	8	8	10	43	0.19	0.23	0.23	0.19	-	-	-	-	10.4
7	4	8	8	15	41	0.24	0.30	0.30	0.19	-	-	-	-	10.4
7	4	8	8	20	41	0.31	0.38	0.39	0.19	-	-	-	-	10.4
7	4	8	8	25	41	0.38	0.47	0.48	0.19	-	-	-	-	10.4
7	4	8	8	30	41	0.46	0.57	0.57	0.19	-	-	-	-	10.4
7	5	8	8	<2	-	0.19	0.36	0.27	0.19	0.19	0.19	0.19	0.19	11.2
7	5	8	8	<3	47	0.21	0.31	0.31	0.19	-	-	-	-	11.2
7	5	8	8	3-5	43	0.19	0.24	0.21	0.19	-	-	-	-	11.2
7	5	8	8	10	43	0.19	0.25	0.26	0.19	-	-	-	-	11.2
7	5	8	8	15	41	0.21	0.32	0.33	0.19	-	-	-	-	11.2
7	5	8	8	20	41	0.27	0.41	0.42	0.19	-	-	-	-	11.2
7	5	8	8	25	41	0.33	0.51	0.52	0.19	-	-	-	-	11.2
7	5	8	8	30	41	0.40	0.61	0.62	0.19	-	-	-	-	11.2
7	6	8	8	<2	-	0.19	0.38	0.30	0.19	0.19	0.19	0.19	0.19	12.0
7	6	8	8	<3	59	0.19	0.33	0.34	0.19	-	-	-	-	12.0
7	6	8	8	3-5	47	0.19	0.25	0.23	0.19	-	-	-	-	12.0
7	6	8	8	10	43	0.19	0.26	0.27	0.19	-	-	-	-	12.0
7	6	8	8	15	41	0.19	0.34	0.35	0.19	-	-	-	-	12.0
7	6	8	8	20	41	0.24	0.43	0.45	0.19	-	-	-	-	12.0
7	6	8	8	25	41	0.29	0.53	0.55	0.19	-	-	-	-	12.0
7	6	8	8	30	41	0.35	0.64	0.65	0.19	-	-	-	-	12.0
7	7	8	8	<2	-	0.19	0.40	0.33	0.19	0.19	0.19	0.19	0.19	12.8
7	7	8	8	<3	59	0.19	0.36	0.37	0.19	-	-	-	-	12.8
7	7	8	8	3-5	59	0.19	0.27	0.25	0.19	-	-	-	-	12.8
7	7	8	8	10	47	0.19	0.27	0.29	0.19	-	-	-	-	12.8
7	7	8	8	15	43	0.19	0.35	0.37	0.19	-	-	-	-	12.8
7	7	8	8	20	43	0.22	0.44	0.46	0.19	-	-	-	-	12.8
7	7	8	8	25	43	0.27	0.54	0.57	0.19	-	-	-	-	12.8
7	7	8	8	30	41	0.32	0.65	0.67	0.19	-	-	-	-	12.8
7	3	8	8	<2	-	0.28	0.36	0.24	0.19	0.21	0.19	0.19	0.19	9.6
7	3	8	8	30	58	0.53	0.49	0.50	0.19	-	-	-	-	9.6

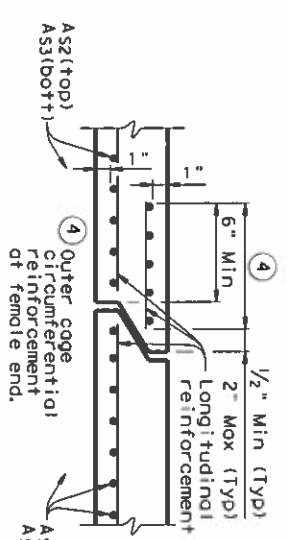
- ① For Box Length = 8'-0"
- ② As1 thru As4, As7 and As8 are minimum required areas of reinforcement per linear foot of box length. As5 and As6 are minimum required areas of reinforcement per linear foot of box width.
- ③ These designs were created by TxDOT and are not shown in the ASTM Specifications.



FILL HEIGHT 2 FT AND GREATER



FILL HEIGHT LESS THAN 2 FT



**SECTION A-A
(TOP AND BOTTOM SLAB JOINT REINFORCEMENT)**

GENERAL NOTES:
Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.
All concrete shall be Class "H" Concrete with a minimum compressive strength of 5,000 psi.
See SCP-MD standard sheet for miscellaneous 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. Shop plans for alternate designs shall be submitted in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS

PRECAST

7'-0" SPAN

SCP-7

FILE	5190745.dgn	DESIGNED BY	cc LNW	CHECKED BY	BMH/TXDOT	DATE	10/10/10
REVISED BY		DATE		REVISIONS			

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DATE: _____
FILE: _____

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

Dimensions	W	X	Y	Z	Variable Reinforcing		Estimated Quantities per ft of wing length (2-Wings)	
					Bars J1	Bars J2		Reinf (lb/ft)
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	48.43	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#5	1'-0"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	1'-0"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#5	1'-0"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	11"	#8	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	11"	#9	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	11"	#9	6"	297.02	1.234

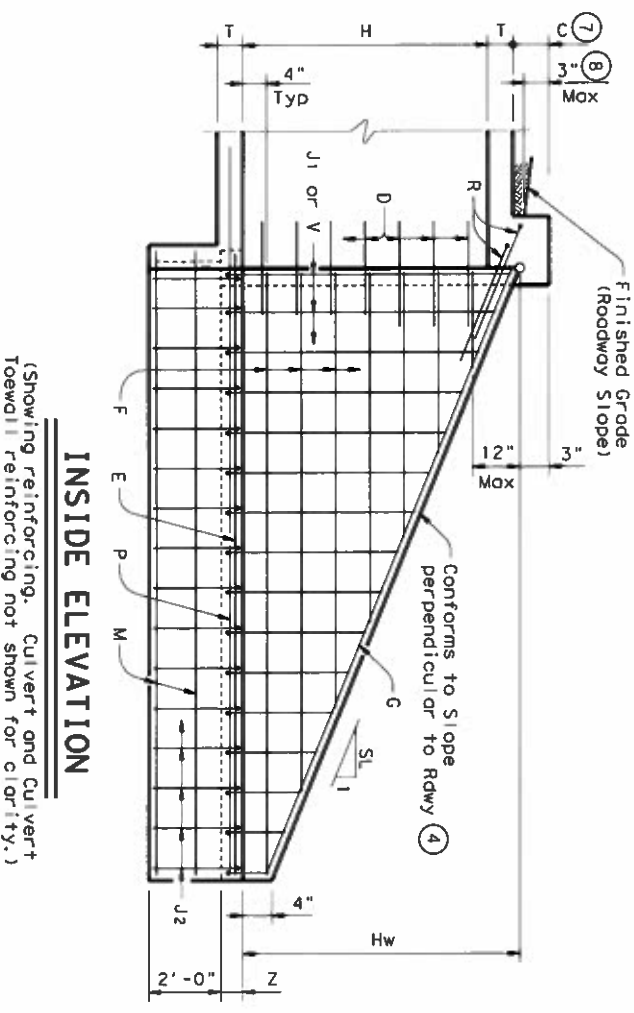
TABLE OF ESTIMATED REINFORCING (2-Wings)

Bar Size	No.	Spd	Reinf (lb/ft)	Conc (CY/ft)
D #5	~	1'-0"	~	~
E #4	~	1'-0"	~	~
F #4	~	1'-0"	~	~
G #6	4	~	~	~
M #4	4	~	~	~
P #4	~	1'-0"	~	~
R #5	6	~	~	~
V #4	~	1'-0"	~	~
Bar Size No.	Spd			
L #4	~	1'-6"	2.45	
Q #4	1	~	~	
Reinf (lb/ft)			0.037	
Conc (CY/ft)				0.037

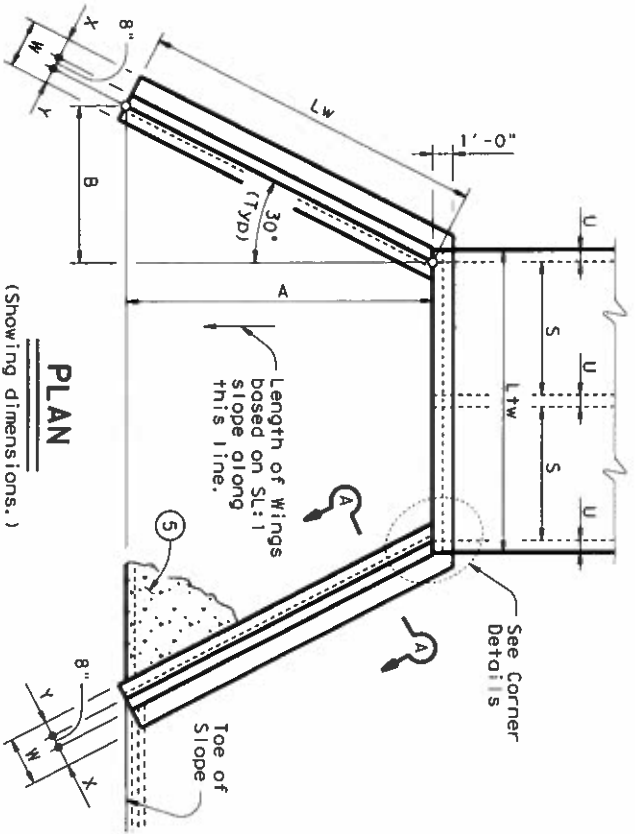
WING DIMENSION CALCULATIONS:

Formulas: (All values are in feet)
 $Hw = H + T + C - 0.250'$
 $A = (Hw - 0.333') (SL)$
 $B = (A) \text{ Tangent } (30^\circ)$
 $Lw = (A) \div \text{Cosine } (30^\circ)$
 For Cost-in-place culverts:
 $Ltw = (N) (S) + (N+1) (U)$
 For Precast culverts:
 $Ltw = (N) (2U+S) + (N-1) (0.500')$
 Total Wingwall Area (Two Wings ~ S.F.) = $(Hw + 0.333') (Lw)$

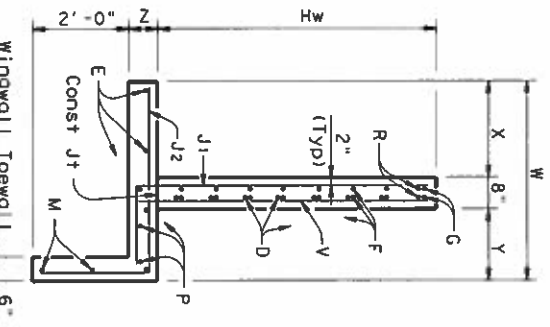
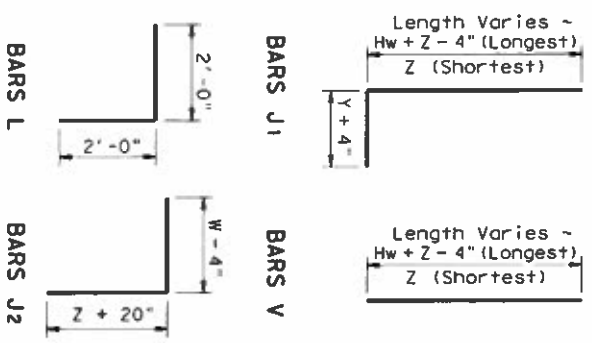
Hw = Height of Wingwall
 SL = Side Slope Ratio (Horizontal: Vertical)
 Lw = Length of Wingwall
 Ltw = Culvert Toewall Length
 N = Number of Culvert Spans
 See applicable box culvert standard for H, S, T, and U values.



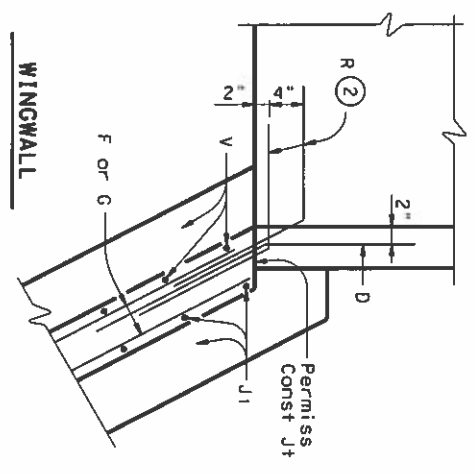
INSIDE ELEVATION
(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)



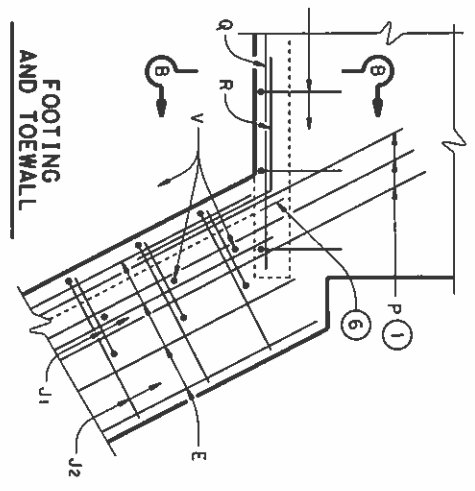
PLAN
(Showing dimensions.)



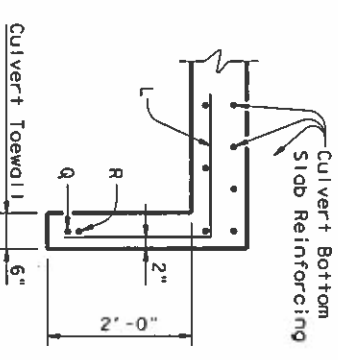
SECTION A-A



WINGWALL



FOOTING AND TOEWALL



SECTION B-B

- Extend Bars p 3'-0" minimum into bottom slab of Box Culvert.
- Adjust to fit as necessary to maintain 1/4" clear cover and 4" minimum 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 Lw.
- Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1. When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Payment for riprap shall be as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend 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 will not be required.
- At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.
- 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 ECD standard. For structures with 16 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
- For vehicle safety, curb heights and wall heights shall be reduced, 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.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications. All reinforcing steel shall be Grade 60. 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. All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi. All reinforcing bars shall be adjusted to provide a minimum of 1/4" clear cover. When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer. See BCS sheet for additional dimensions and information. The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.



CONCRETE WINGWALLS WITH FLARED WINGS FOR 0° SKEW BOX CULVERTS

FW-0

FILE	FW-0StdEdgn	PK. GAF	JK. CAT	OW. TxDOT	CK. GAF
REVISED	FEBRUARY 2010	CONV. SECT	308	HIGHWAY	
11-10 Add note for synthetic fibers.					