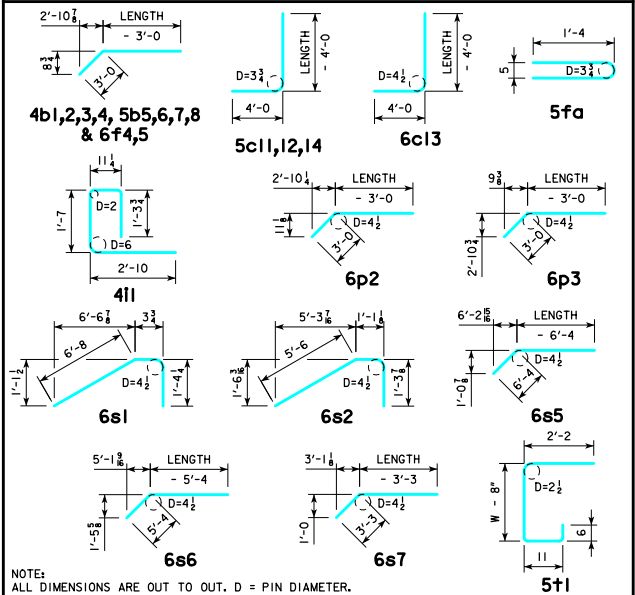


ENGLISH/DFSD/DESIGNED/TRIPLE/CULVERTS.DGN - TRH 45-9-12 - THIS SHEET ISSUED 04-12.

**BILL OF REINFORCING FOR ONE HEADWALL 45° SKEW CULVERT SPAN x CULVERT HEIGHT**

BAR	LOCATION	SHAPE	10' x 7'			10' x 6'			10' x 5'			10' x 4'			BAR
			NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	
5fa	FENCE ANCHOR (GALV.)		2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	5fa
4b1	WINGWALL, B.F.H. LONG		1	45'-6"	32	1	39'-8"	26	1	33'-10"	23	1	28'-0"	19	4b1
4b2	WINGWALL, B.F.H. SHORT		1	28'-5"	19	1	24'-11"	17	1	21'-5"	14	1	17'-11"	12	4b2
4b3	WINGWALL, B.F.H. LONG		5 VAR.	19'-6 TO 42'-9	105	4 VAR.	19'-5 TO 36'-11	75	3 VAR.	19'-5 TO 31'-1	51	2 VAR.	19'-5 TO 25'-3	30	4b3
4b4	WINGWALL, B.F.H. SHORT		5 VAR.	12'-10 TO 26'-9	66	4 VAR.	12'-10 TO 23'-3	48	3 VAR.	12'-10 TO 19'-9	33	2 VAR.	12'-10 TO 16'-3	19	4b4
5b5	WINGWALL, F.F.H. LONG		1	45'-6"	50	1	39'-9"	41	1	33'-11"	35	1	28'-1"	29	5b5
5b6	WINGWALL, F.F.H. SHORT		1	28'-5"	30	1	24'-11"	26	1	21'-5"	22	1	17'-11"	19	5b6
5b7	WINGWALL, F.F.H. LONG		6 VAR.	13'-8 TO 42'-9	179	5 VAR.	13'-8 TO 36'-11	132	4 VAR.	13'-8 TO 31'-1	93	3 VAR.	13'-8 TO 25'-3	61	5b7
5b8	WINGWALL, F.F.H. SHORT		6 VAR.	9'-4 TO 26'-10	113	5 VAR.	9'-4 TO 23'-4	85	4 VAR.	9'-4 TO 19'-10	61	3 VAR.	9'-4 TO 16'-4	40	5b8
5b9	INTERIOR WALLS, BOTH F.H.		22 VAR.	2 EA. 6'-7 TO 23'-3	342	18 VAR.	2 EA. 6'-8 TO 20'-5	254	14 VAR.	2 EA. 6'-10 TO 17'-7	178	10 VAR.	2 EA. 7'-0 TO 14'-8	113	5b9
4c1	WINGWALL, F.F.V. LONG		43	2'-8 TO 9'-11	181	37	2'-8 TO 8'-11	143	31	2'-8 TO 7'-10	109	25	2'-8 TO 6'-10	79	4c1
4c2	WINGWALL, F.F.V. SHORT		26	2'-9 TO 9'-11	110	22	2'-9 TO 8'-9	85	19	2'-9 TO 7'-11	68	15	2'-9 TO 6'-9	48	4c2
4c3	WINGWALL, F.F.V. LONG		---	---	---	---	---	---	---	---	---	---	---	---	4c3
4c4	WINGWALL, F.F.V. SHORT		---	---	---	---	---	---	---	---	---	---	---	---	4c4
4c5	WINGWALL, F.F.V. LONG		1	8'-8"	6	1	7'-8"	5	2	6'-8"	9	2	5'-8"	8	4c5
4c5	WINGWALL, F.F.V. SHORT		1	8'-8"	6	2	7'-8"	10	1	6'-8"	4	2	5'-8"	8	4c5
4c6	INTERIOR WALLS, BOTH F.V.		4	1'-7"	4	4	1'-7"	4	4	1'-7"	4	4	1'-7"	4	4c6
4c7	INTERIOR WALLS, BOTH F.V.		76 VAR.	2 EA. 1'-9 TO 7'-4	231	66 VAR.	2 EA. 1'-9 TO 6'-5	180	54 VAR.	2 EA. 1'-9 TO 5'-4	128	44 VAR.	2 EA. 1'-9 TO 4'-5	91	4c7
4c8	INTERIOR WALLS, BOTH F.V.		6	7'-6"	30	6	6'-6"	26	6	5'-6"	22	6	4'-6"	18	4c8
5c9	WINGWALL, B.F.V. LONG		15 VAR.	2'-8 TO 5'-1	61	15 VAR.	2'-8 TO 5'-1	61	15 VAR.	2'-8 TO 5'-1	61	15 VAR.	2'-8 TO 5'-1	61	5c9
5c10	WINGWALL, B.F.V. SHORT		4 VAR.	2'-9 TO 3'-7	13	4 VAR.	2'-9 TO 3'-7	13	4 VAR.	2'-9 TO 3'-7	13	4 VAR.	2'-9 TO 3'-7	13	5c10
5c11	WINGWALL, B.F.V. LONG		22 VAR.	7'-11 TO 13'-11	338	22 VAR.	9'-3 TO 12'-11	254	16 VAR.	9'-3 TO 11'-10	176	10 VAR.	9'-3 TO 10'-10	105	5c11
5c12	WINGWALL, B.F.V. SHORT		22 VAR.	7'-11 TO 13'-11	250	18 VAR.	7'-11 TO 12'-9	194	15 VAR.	7'-11 TO 11'-11	155	11 VAR.	7'-11 TO 10'-9	107	5c12
6c13	WINGWALL, B.F.V. LONG		18	10'-6"	284	12	10'-6"	189	---	---	---	---	---	---	6c13
6c13	WINGWALL, B.F.V. SHORT		11	10'-6"	173	7	10'-6"	110	---	---	---	---	---	---	6c13
5c14	WINGWALL, B.F.V. LONG		1	12'-8"	13	1	11'-8"	12	2	10'-8"	22	2	9'-8"	20	5c14
5c14	WINGWALL, B.F.V. SHORT		1	12'-8"	13	2	11'-8"	24	1	10'-8"	11	2	9'-8"	20	5c14
4d1	APRON, LONGIT., BOT.		21	24'-0"	337	21	21'-2"	297	21	18'-4"	257	21	15'-6"	217	4d1
4d2	APRON, LONGIT., BOT. LONG		3	39'-3"	79	3	33'-6"	67	3	27'-8"	55	3	22'-0"	44	4d2
4d3	APRON, LONGIT., BOT. SHORT		3	24'-8"	49	3	21'-3"	43	3	17'-10"	36	3	14'-5"	29	4d3
6f1	APRON, LONGIT., TOP		31	24'-0"	1117	31	21'-2"	986	31	18'-4"	854	31	15'-6"	722	6f1
6f2	APRON, LONGIT., TOP LONG		8 VAR.	6'-5 TO 20'-8	163	7 VAR.	5'-7 TO 17'-10	123	5 VAR.	6'-10 TO 15'-0	82	4 VAR.	6'-0 TO 12'-2	55	6f2
6f3	APRON, LONGIT., TOP SHORT		5 VAR.	7'-4 TO 21'-0	106	4 VAR.	7'-11 TO 18'-2	78	3 VAR.	8'-6 TO 15'-4	54	2 VAR.	9'-1 TO 12'-6	32	6f3
6f4	APRON, LONGIT., TOP LONG		1	45'-6"	72	1	39'-9"	60	1	33'-11"	51	1	28'-1"	42	6f4
6f5	APRON, LONGIT., TOP SHORT		1	28'-5"	43	1	24'-11"	37	1	21'-5"	32	1	17'-11"	27	6f5
4i1	PARAPET, VERTICAL		63	6'-8"	281	63	6'-8"	281	63	6'-8"	281	63	6'-8"	281	4i1
7j1	PARAPET, HORIZONTAL		4	46'-2"	396	4	46'-2"	396	4	46'-2"	396	4	46'-2"	396	7j1
6m1	APRON, TRANS., TOP		9 VAR.	36'-10 TO 38'-4	508	5 VAR.	36'-10 TO 37'-7	279	1 VAR.	36'-10 TO 36'-10	55	23 VAR.	13'-2 TO 29'-8	740	6m1
6m2	APRON, TRANS., TOP		14 VAR.	21'-8 TO 31'-5	558	18 VAR.	18'-10 TO 31'-7	682	22 VAR.	16'-0 TO 31'-9	789	16 VAR.	4'-1 TO 12'-6	199	6m2
6m3	APRON, TRANS., TOP		27 VAR.	6'-5 TO 21'-0	556	23 VAR.	5'-10 TO 18'-2	415	20 VAR.	4'-8 TO 15'-4	300	---	---	---	6m3
6m4	APRON, TRANS., BOT.		14 VAR.	38'-1 TO 52'-0	988	12 VAR.	38'-1 TO 49'-10	826	10 VAR.	38'-1 TO 47'-9	672	8 VAR.	38'-1 TO 45'-7	523	6m4
6p1	CURTAIN, HORIZONTAL		4	44'-6"	281	4	44'-6"	281	4	44'-5"	280	4	44'-5"	280	6p1
6p2	CURTAIN, HORIZONTAL LONG		4	26'-6"	159	4	23'-4"	140	4	20'-2"	121	4	17'-0"	102	6p1
6p3	CURTAIN, HORIZONTAL SHORT		4	10'-7"	64	4	9'-6"	57	4	8'-6"	51	4	7'-6"	45	6p2
6s1	WING SLOPE, BOTH F. LONG		2	8'-4"	25	2	8'-4"	25	2	8'-4"	25	2	8'-4"	25	6s1
6s2	WING SLOPE, BOTH F. SHORT		2	7'-11"	24	2	7'-11"	24	2	7'-11"	24	2	7'-11"	24	6s2
6s3	WING SLOPE, BOTH F. LONG		2	39'-5"	118	2	33'-6"	101	2	27'-7"	83	2	21'-8"	65	6s3
6s4	WING SLOPE, BOTH F. SHORT		2	23'-11"	72	2	20'-3"	61	2	16'-8"	50	2	13'-0"	39	6s4
6s5	WING SLOPE, F.F. LONG		1	44'-8"	70	1	38'-9"	58	1	32'-10"	49	1	26'-11"	40	6s5
6s6	WING SLOPE, F.F. SHORT		1	28'-11"	43	1	25'-3"	38	1	21'-7"	32	1	18'-0"	27	6s6
6s7	INTERIOR WALLS, BOTH F.H.		4	23'-11"	144	4	20'-11"	126	4	17'-11"	108	4	14'-11"	90	6s7
5f1	CURTAIN, VERTICAL		53	6'-8"	369	49	6'-5"	328	47	6'-5"	315	43	6'-5"	288	5f1
REINF. STEEL			9277 LB			7829 LB			6350 LB			5262 LB			
ESTIMATED QUANTITIES ONE HEADWALL			CONCRETE			CONCRETE			CONCRETE			CONCRETE			
			PARAPET	4.4		4.4		4.4		4.4		4.4			
			WINGWALLS	14.6	70.8 CY	11.1	59.4 CY	8.1	49.7 CY	5.5	40.7 CY				
			FOOTING	51.8		43.9		37.2		30.8					

**BENT BAR DETAILS**



NOTE: ALL DIMENSIONS ARE OUT TO OUT. D = PIN DIAMETER.

Δ INCLUDES TOP OF WINGWALL QUANTITIES.  
 \* ASSUMES APRON AND FLOOR ARE EQUAL THICKNESS, ADJUST CONCRETE QUANTITIES FOR TRANSITION WHERE APRON AND FLOOR THICKNESS ARE NOT EQUAL.

NOTE: WEIGHT OF BARS OVER 40'-0" LONG INCLUDES AN ALLOWANCE OF 2'-3" FOR LAP. LENGTHS SHOWN FOR BARS OVER 40'-0" LONG DO NOT INCLUDE LAP.

\*SHORT\* DENOTES SHORT WINGWALL  
 \*LONG\* DENOTES LONG WINGWALL

**HEADWALL NOTES:**

- SEE DRAWING TRRCB G1-12 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.
- THIS HEADWALL IS BASED ON A 3:1 SLOPE NORMAL TO CENTERLINE OF ROADWAY.
- THE SIDES OF THE FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.
- ALL SLAB AND FLOOR REINFORCING STEEL IS TO BE SUPPORTED BY BAR CHAIRS AT INTERVALS OF NOT MORE THAN 3'-0" IN EITHER DIRECTION AS OUTLINED IN THE STANDARD SPECIFICATIONS.
- CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN. CLEARANCE TO THE BOTTOM ENDS OF VERTICAL BARS SHALL BE 3 INCHES.
- CONCRETE QUANTITIES ARE ESTIMATED FROM BACK OF PARAPET.
- HORIZONTAL TAILS OF BARS "b" & "s" ESTIMATED TO EXTEND 2'-0" BEYOND BACK OF PARAPET (INTO END OF BARREL). LONGITUDINAL BARS "f", "6f1", AND "6f3" ESTIMATED TO PROJECT INTO END SECTION OF BARREL A MINIMUM OF 2'-0" BEYOND BACK OF PARAPET.
- THE "LENGTH" COLUMN REFLECTS TOTAL NUMBER OF FEET NECESSARY TO MEET THESE REQUIREMENTS.

LATEST REVISION DATE

*Thomas E. McQuill*

APPROVED BY BRIDGE ENGINEER

Iowa Department of Transportation  
Highway Division

STANDARD DESIGN

**TRIPLE REINFORCED CONCRETE BOX CULVERTS**

APRIL, 2012

**FLARED WING HEADWALLS**  
45° SKEW

**TRH 45-9-12**