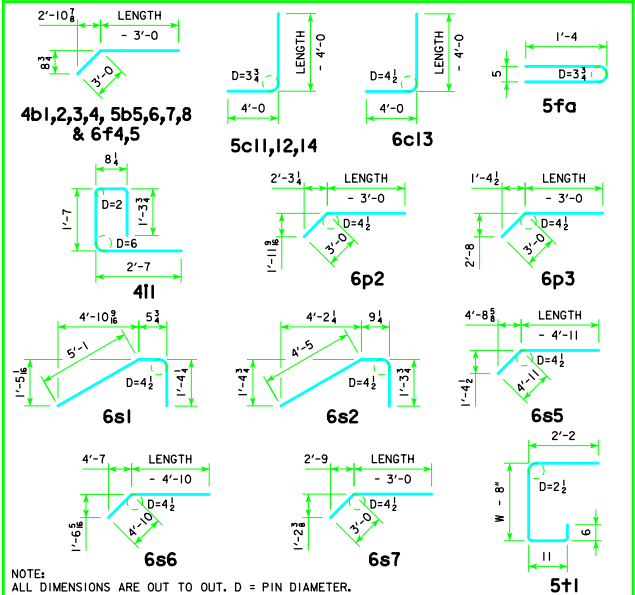


**BILL OF REINFORCING FOR ONE HEADWALL 15° SKEW CULVERT SPAN x CULVERT HEIGHT**

BAR	LOCATION	SHAPE	8' x 7'			8' x 6'			8' x 5'			8' 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	27'-11	19	1	24'-6	16	1	21'-0	14	1	17'-7	12	4b1
4b2	WINGWALL, B.F.H. SHORT		1	24'-9	17	1	21'-9	15	1	18'-9	13	1	15'-9	11	4b2
4b3	WINGWALL, B.F.H. LONG		5	12'-7 TO 26'-4	65	4	12'-7 TO 22'-11	47	3	12'-7 TO 19'-6	32	2	12'-7 TO 16'-0	19	4b3
4b4	WINGWALL, B.F.H. SHORT		5	11'-4 TO 23'-4	58	4	11'-4 TO 20'-4	42	3	11'-4 TO 17'-4	29	2	11'-4 TO 14'-4	17	4b4
5b5	WINGWALL, F.F.H. LONG		1	27'-11	29	1	24'-6	26	1	21'-1	22	1	17'-8	18	5b5
5b6	WINGWALL, F.F.H. SHORT		1	24'-9	26	1	21'-9	23	1	18'-9	20	1	15'-9	16	5b6
5b7	WINGWALL, F.F.H. LONG		6	9'-3 TO 26'-4	111	5	9'-3 TO 22'-11	84	4	9'-3 TO 19'-6	60	3	9'-2 TO 16'-0	40	5b7
5b8	WINGWALL, F.F.H. SHORT		6	8'-5 TO 23'-5	100	5	8'-5 TO 20'-5	75	4	8'-5 TO 17'-5	54	3	8'-5 TO 14'-5	36	5b8
5b9	INTERIOR WALL, BOTH F.H.		11	5'-3 TO 17'-9	132	9	5'-4 TO 15'-8	99	7	5'-5 TO 13'-7	69	5	5'-7 TO 11'-5	44	5b9
4c1	WINGWALL, F.F.V. LONG		25	2'-8 TO 9'-8	103	22	2'-8 TO 8'-10	85	18	2'-8 TO 7'-8	62	15	2'-8 TO 6'-9	47	4c1
4c2	WINGWALL, F.F.V. SHORT		22	2'-8 TO 9'-8	91	19	2'-8 TO 8'-10	72	16	2'-8 TO 7'-8	55	13	2'-8 TO 6'-8	41	4c2
4c3	WINGWALL, F.F.V. LONG		---	---	---	---	---	---	---	---	---	---	---	---	4c3
4c4	WINGWALL, F.F.V. SHORT		---	---	---	---	---	---	---	---	---	---	---	---	4c4
4c5	WINGWALL, F.F.V. LONG		2	8'-7	11	2	7'-7	10	2	6'-7	9	2	5'-7	7	4c5
4c6	INTERIOR WALL, BOTH F.V.		2	1'-7	2	2	1'-7	2	2	1'-7	2	2	1'-6	2	4c6
4c7	INTERIOR WALL, BOTH F.V.		28	1'-9 TO 7'-2	83	24	1'-9 TO 6'-2	63	20	1'-9 TO 5'-3	47	16	1'-8 TO 4'-3	32	4c7
4c8	INTERIOR WALL, BOTH F.V.		2	7'-5	10	2	6'-5	9	2	5'-5	7	2	4'-5	6	4c8
5c9	WINGWALL, B.F.V. LONG		9	2'-8 TO 5'-0	36	9	2'-8 TO 5'-0	36	9	2'-8 TO 5'-0	36	9	2'-8 TO 5'-0	36	5c9
5c10	WINGWALL, B.F.V. SHORT		6	2'-8 TO 4'-4	22	6	2'-8 TO 4'-4	22	6	2'-8 TO 4'-4	22	6	2'-8 TO 4'-4	22	5c10
5c11	WINGWALL, B.F.V. LONG		16	9'-4 TO 13'-8	192	13	9'-4 TO 12'-10	150	9	9'-4 TO 11'-8	99	6	9'-4 TO 10'-9	63	5c11
5c12	WINGWALL, B.F.V. SHORT		16	8'-8 TO 13'-8	186	13	8'-8 TO 12'-8	145	10	8'-8 TO 11'-8	106	7	8'-8 TO 10'-8	71	5c12
6c13	WINGWALL, B.F.V. LONG		10	10'-6	158	7	10'-6	110	---	---	---	---	---	---	6c13
6c13	WINGWALL, B.F.V. SHORT		9	10'-6	142	6	10'-6	95	---	---	---	---	---	---	6c13
5c14	WINGWALL, B.F.V. LONG		2	12'-7	26	1	11'-7	12	2	10'-7	22	2	9'-7	20	5c14
5c14	WINGWALL, B.F.V. SHORT		2	12'-7	26	2	11'-7	24	2	10'-7	22	2	9'-7	20	5c14
4d1	APRON, LONGIT., BOTT.		11	18'-1	133	11	16'-0	118	11	13'-11	102	11	11'-11	88	4d1
4d2	APRON, LONGIT., BOTT. LONG		3	22'-7	45	3	19'-3	39	3	15'-11	32	3	12'-7	25	4d2
4d3	APRON, LONGIT., BOTT. SHORT		3	20'-2	40	3	17'-3	35	3	14'-4	29	3	11'-5	23	4d3
6f1	APRON, LONGIT., TOP		16	18'-1	435	16	16'-0	385	16	13'-11	334	16	11'-11	286	6f1
6f2	APRON, LONGIT., TOP LONG		4	7'-7 TO 15'-3	69	4	5'-6 TO 13'-2	56	3	5'-11 TO 11'-1	38	2	6'-5 TO 9'-0	23	6f2
6f3	APRON, LONGIT., TOP SHORT		4	6'-7 TO 15'-4	66	4	4'-5 TO 13'-3	53	3	5'-3 TO 11'-2	37	2	6'-2 TO 9'-1	23	6f3
6f4	APRON, LONGIT., TOP LONG		1	27'-11	42	1	24'-6	37	1	21'-1	32	1	17'-8	27	6f4
6f5	APRON, LONGIT., TOP SHORT		1	24'-9	37	1	21'-9	33	1	18'-9	28	1	15'-9	24	6f5
4l1	PARAPET, VERTICAL		33	6'-2	136	33	6'-2	136	33	6'-2	136	33	6'-2	136	4l1
7j1	PARAPET, HORIZONTAL		4	18'-6	151	4	18'-6	151	4	18'-6	151	4	18'-6	151	7j1
6m1	APRON, TRANS., TOP		4	18'-9 TO 19'-4	114	4	18'-9 TO 19'-4	114	4	18'-9 TO 19'-4	114	4	18'-9 TO 19'-4	114	6m1
6m2	APRON, TRANS., TOP		15	19'-7 TO 24'-10	500	12	19'-7 TO 23'-8	390	9	19'-7 TO 22'-7	285	6	19'-7 TO 21'-5	185	6m2
6m3	APRON, TRANS., TOP		6	4'-5 TO 17'-6	99	6	4'-6 TO 17'-7	100	6	4'-8 TO 17'-9	101	6	4'-9 TO 17'-10	102	6m3
6m4	APRON, TRANS., BOTT.		14	12'-11 TO 19'-11	345	12	12'-11 TO 18'-10	286	10	12'-11 TO 17'-9	230	8	12'-11 TO 16'-8	178	6m4
6p1	CURTAIN, HORIZONTAL		4	17'-7	106	4	17'-7	106	4	17'-7	106	4	17'-7	106	6p1
6p2	CURTAIN, HORIZONTAL LONG		4	14'-2	85	4	12'-8	76	4	11'-2	67	4	9'-8	58	6p2
6p3	CURTAIN, HORIZONTAL SHORT		4	11'-3	68	4	10'-2	61	4	9'-1	55	4	7'-11	48	6p3
6s1	WING SLOPE, BOTH F. LONG		2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	6s1
6s2	WING SLOPE, BOTH F. SHORT		2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	6s2
6s3	WING SLOPE, BOTH F. LONG		2	23'-10	72	2	20'-3	61	2	16'-9	50	2	13'-2	40	6s3
6s4	WING SLOPE, BOTH F. SHORT		2	21'-6	65	2	18'-4	55	2	15'-2	46	2	12'-0	36	6s4
6s5	WING SLOPE, F.F. LONG		1	28'-1	42	1	24'-6	37	1	20'-11	31	1	17'-4	26	6s5
6s6	WING SLOPE, F.F. SHORT		1	25'-4	38	1	22'-2	33	1	19'-0	29	1	15'-10	24	6s6
6s7	INTERIOR WALL, BOTH F.H.		2	18'-11	57	2	16'-8	50	2	14'-4	43	2	12'-1	36	6s7
5t1	CURTAIN, VERTICAL		24	6'-8	167	22	6'-5	147	20	6'-5	134	18	6'-5	120	5t1
REINF. STEEL			4615 LB			3873 LB			3068 LB			2513 LB			
ESTIMATED QUANTITIES ONE HEADWALL			CONCRETE			PARAPET Δ WINGWALLS FOOTING			CONCRETE			PARAPET Δ WINGWALLS FOOTING			
			2.1			2.1			2.1			2.1			
			8.6			6.6			4.9			3.3			
			33.1 CY			27.5 CY			22.9 CY			18.5 CY			
			22.4			18.8			15.9			13.1			

**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 TWRCB 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 "d", "f", AND "g" 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.

Iowa Department of Transportation  
Highway Division

STANDARD DESIGN

**TWIN REINFORCED CONCRETE BOX CULVERTS**

APRIL, 2012

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

**FLARED WING HEADWALLS**

15° SKEW

**TWH 15-9-12**