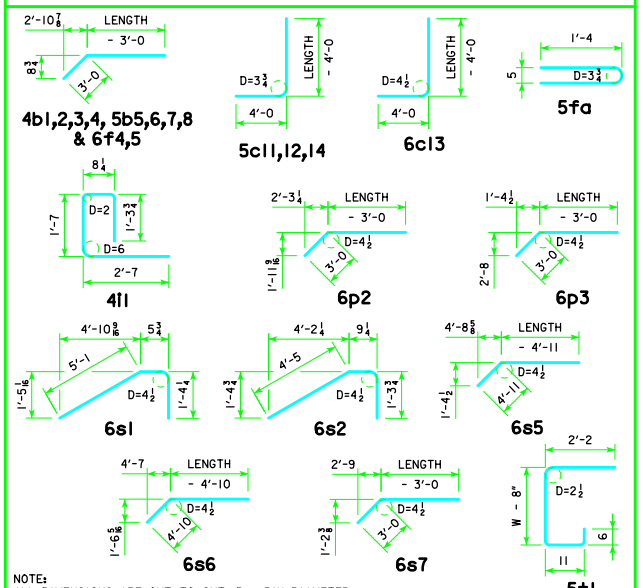
BILL OF REINFORCING FOR ONE HEADWALL 15° SKEW CULVERT SPAN x CULVERT HEIGHT

BAR	LOCATION	SHAPE	10' x 7' NO.	10' x 7' LENGTH	10' x 7' WT.	10' x 6' NO.	10' x 6' LENGTH	10' x 6' WT.	10' x 5' NO.	10' x 5' LENGTH	10' x 5' WT.	10' x 4' NO.	10' x 4' LENGTH	10' x 4' WT.	BAR
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 VAR.	12'-7 TO 26'-4	65	4 VAR.	12'-7 TO 22'-11	47	3 VAR.	12'-7 TO 19'-6	32	2 VAR.	12'-7 TO 16'-0	19	4b3
4b4	WINGWALL, B.F.H. SHORT		5 VAR.	11'-4 TO 23'-4	58	4 VAR.	11'-4 TO 20'-4	42	3 VAR.	11'-4 TO 17'-4	29	2 VAR.	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 VAR.	9'-3 TO 26'-4	111	5 VAR.	9'-3 TO 22'-11	84	4 VAR.	9'-3 TO 19'-6	60	3 VAR.	9'-2 TO 16'-1	40	5b7
5b8	WINGWALL, F.F.H. SHORT		6 VAR.	8'-5 TO 23'-5	100	5 VAR.	8'-5 TO 20'-5	75	4 VAR.	8'-5 TO 17'-5	54	3 VAR.	8'-5 TO 14'-5	36	5b8
5b9	INTERIOR WALLS, BOTH F.H.		22 VAR.	2 EA. 5'-3 TO 17'-9	264	18 VAR.	2 EA. 5'-4 TO 15'-8	197	14 VAR.	2 EA. 5'-5 TO 13'-7	139	10 VAR.	2 EA. 5'-7 TO 11'-5	89	5b9
4c1	WINGWALL, F.F.V. LONG		25 VAR.	2'-9 TO 9'-9	104	22 VAR.	2'-9 TO 8'-11	86	18 VAR.	2'-9 TO 7'-9	63	15 VAR.	2'-9 TO 6'-10	48	4c1
4c2	WINGWALL, F.F.V. SHORT		22 VAR.	2'-9 TO 9'-9	92	19 VAR.	2'-9 TO 8'-9	73	16 VAR.	2'-9 TO 7'-9	56	13 VAR.	2'-9 TO 6'-9	41	4c2
4c3	WINGWALL, F.F.V. LONG		---	---	---	---	---	---	---	---	---	---	---	---	4c3
4c4	WINGWALL, F.F.V. SHORT		---	---	---	---	---	---	---	---	---	---	---	---	4c4
4c5	WINGWALL, F.F.V. LONG		2	8'-8	12	1	7'-8	5	2	6'-8	9	2	5'-8	8	4c5
4c5	WINGWALL, F.F.V. SHORT		2	8'-8	12	2	7'-8	10	2	6'-8	9	2	5'-8	8	4c5
4c6	INTERIOR WALLS, BOTH F.V.		4	1'-8	4	4	1'-8	4	4	1'-8	4	4	1'-7	4	4c6
4c7	INTERIOR WALLS, BOTH F.V.		56 VAR.	2 EA. 1'-10 TO 7'-3	170	48 VAR.	2 EA. 1'-10 TO 6'-3	130	40 VAR.	2 EA. 1'-10 TO 5'-4	96	32 VAR.	2 EA. 1'-9 TO 4'-4	65	4c7
4c8	INTERIOR WALLS, BOTH F.V.		4	7'-6	20	4	6'-6	17	4	5'-6	15	4	4'-6	12	4c8
5c9	WINGWALL, B.F.V. LONG		9 VAR.	2'-9 TO 5'-1	37	9 VAR.	2'-9 TO 5'-1	37	9 VAR.	2'-9 TO 5'-1	37	9 VAR.	2'-9 TO 5'-1	37	5c9
5c10	WINGWALL, B.F.V. SHORT		6 VAR.	2'-9 TO 4'-5	22	6 VAR.	2'-9 TO 4'-5	22	6 VAR.	2'-9 TO 4'-5	22	6 VAR.	2'-9 TO 4'-5	22	5c10
5c11	WINGWALL, B.F.V. LONG		16 VAR.	9'-5 TO 13'-9	193	13 VAR.	9'-5 TO 12'-11	151	9 VAR.	9'-5 TO 11'-9	99	6 VAR.	9'-5 TO 10'-10	63	5c11
5c12	WINGWALL, B.F.V. SHORT		16 VAR.	8'-9 TO 13'-9	188	13 VAR.	8'-9 TO 12'-9	146	10 VAR.	8'-9 TO 11'-9	107	7 VAR.	8'-9 TO 10'-9	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'-8	26	1	11'-8	12	2	10'-8	22	2	9'-8	20	5c14
5c14	WINGWALL, B.F.V. SHORT		2	12'-8	26	2	11'-8	24	2	10'-8	22	2	9'-8	20	5c14
4d1	APRON, LONGIT., BOTT.		21	18'-1	254	21	16'-0	224	21	13'-11	195	21	11'-11	167	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		31	18'-1	842	31	16'-0	745	31	13'-11	648	31	11'-11	555	6f1
6f2	APRON, LONGIT., TOP LONG		4 VAR.	7'-7 TO 15'-3	69	4 VAR.	5'-6 TO 13'-2	56	3 VAR.	5'-11 TO 11'-1	38	2 VAR.	6'-5 TO 9'-0	23	6f2
6f3	APRON, LONGIT., TOP SHORT		4 VAR.	6'-7 TO 15'-4	66	4 VAR.	4'-5 TO 13'-3	53	3 VAR.	5'-3 TO 11'-2	37	2 VAR.	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		63	6'-2	260	63	6'-2	260	63	6'-2	260	63	6'-2	260	4l1
7j1	PARAPET, HORIZONTAL		4	33'-9	276	4	33'-9	276	4	33'-9	276	4	33'-9	276	7j1
6m1	APRON, TRANS., TOP		7 VAR.	34'-0 TO 35'-2	364	7 VAR.	34'-0 TO 35'-2	364	7 VAR.	34'-0 TO 35'-2	364	7 VAR.	34'-0 TO 35'-2	364	6m1
6m2	APRON, TRANS., TOP		9 VAR.	35'-5 TO 38'-5	499	6 VAR.	35'-5 TO 37'-4	328	3 VAR.	35'-5 TO 36'-2	161	1 VAR.	35'-5 TO 35'-5	53	6m2
6m3	APRON, TRANS., TOP		11 VAR.	6'-1 TO 32'-2	316	11 VAR.	6'-2 TO 32'-4	318	12 VAR.	3'-8 TO 32'-5	325	11 VAR.	3'-9 TO 29'-11	278	6m3
6m4	APRON, TRANS., BOTT.		14 VAR.	28'-2 TO 35'-2	666	12 VAR.	28'-2 TO 34'-1	561	10 VAR.	28'-2 TO 33'-1	460	8 VAR.	28'-2 TO 31'-11	361	6m4
6p1	CURTAIN, HORIZONTAL		4	32'-10	197	4	32'-10	197	4	32'-10	197	4	32'-10	197	6p1
6p2	CURTAIN, HORIZONTAL LONG		4	14'-2	85	4	12'-8	76	4	11'-2	67	4	9'-8	58	6p1
6p3	CURTAIN, HORIZONTAL SHORT		4	11'-3	68	4	10'-2	61	4	9'-1	55	4	7'-11	48	6p2
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 WALLS, BOTH F.H.		4	18'-11	114	4	16'-8	100	4	14'-4	86	4	12'-1	73	6s7
5t1	CURTAIN, VERTICAL		36	6'-8	250	34	6'-5	228	32	6'-5	214	30	6'-5	201	5t1
ESTIMATED QUANTITIES ONE HEADWALL	REINF. STEEL			6649 LB			5671 LB			4651 LB			3886 LB		
	CONCRETE	PARAPET Δ	3.2			3.2			3.2			3.2			
		WINGWALLS	10.3	48.9 CY		7.9	41.3 CY		5.8	34.8 CY		3.9	28.7 CY		
		FOOTING *	35.4			30.2			25.8			21.6			

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:

1. SEE DRAWING TRRCB GI-12 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.
2. THIS HEADWALL IS BASED ON A 3:1 SLOPE NORMAL TO CENTERLINE OF ROADWAY.
3. THE SIDES OF THE FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.
4. 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.
5. 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.
6. CONCRETE QUANTITIES ARE ESTIMATED FROM BACK OF PARAPET.
7. HORIZONTAL TAILS OF BARS "b" & "s" ESTIMATED TO EXTEND 2'-0 BEYOND BACK OF PARAPET (INTO END OF BARREL). LONGITUDINAL BARS "d", "6f1", AND "6f3" ESTIMATED TO PROJECT INTO END SECTION OF BARREL A MINIMUM OF 2'-0 BEYOND BACK OF PARAPET.
8. THE "LENGTH" COLUMN REFLECTS TOTAL NUMBER OF FEET NECESSARY TO MEET THESE REQUIREMENTS.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

Iowa Department of Transportation
Highway Division

STANDARD DESIGN

TRIPLE REINFORCED CONCRETE BOX CULVERTS

APRIL, 2012

FLARED WING HEADWALLS

15° SKEW

TRH 15-9-12

ENGLISH\LRFDS\GENDTRIPLECULVERTS.DGN - TRH 15-9-12 - THIS SHEET ISSUED 04-12.