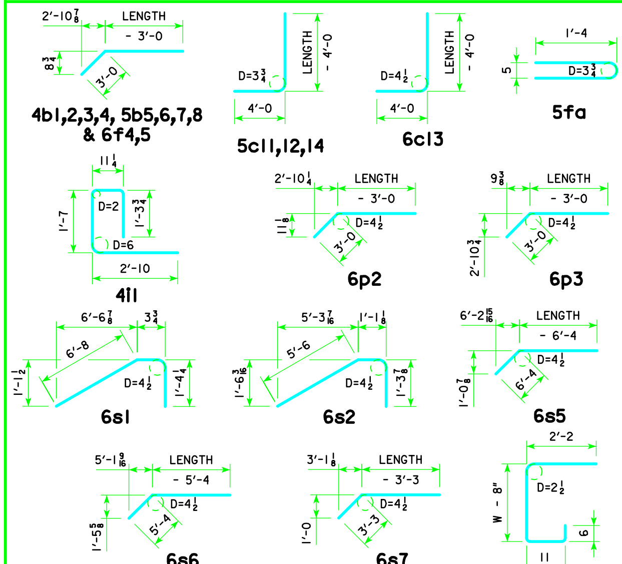
ENGLISHLRFDSIGNEDTRIPLECULVERTS.DGN - TRH 45-8-12 - THIS SHEET ISSUED 04-12.

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

BAR	LOCATION	SHAPE	12' x 5' NO.	12' x 5' LENGTH	12' x 5' WT.	12' x 4' NO.	12' x 4' LENGTH	12' x 4' WT.	10' x 12' NO.	10' x 12' LENGTH	10' x 12' WT.	10' x 11' NO.	10' x 11' LENGTH	10' x 11' WT.	10' x 10' NO.	10' x 10' LENGTH	10' x 10' WT.	10' x 9' NO.	10' x 9' LENGTH	10' x 9' WT.	10' x 8' NO.	10' x 8' LENGTH	10' x 8' WT.	BAR
5fa	FENCE ANCHOR (GALV.)		2	2'-10	6	2	2'-10	6	2	2'-10	6	2	2'-10	6	2	2'-10	6	2	2'-10	6	2	2'-10	6	5fa
4b1	WINGWALL, B.F.H. LONG		1	33'-10	23	1	28'-0	19	1	74'-8	51	1	68'-10	47	1	63'-0	44	1	57'-2	40	1	51'-4	36	4b1
4b2	WINGWALL, B.F.H. SHORT		1	21'-5	14	1	17'-11	12	1	45'-10	32	1	42'-4	30	1	38'-10	26	1	35'-5	24	1	31'-11	21	4b2
4b3	WINGWALL, B.F.H. LONG		3 VAR.	19'-5 TO 31'-1	51	2 VAR.	19'-5 TO 25'-3	30	10 VAR.	19'-6 TO 71'-10	314	9 VAR.	19'-6 TO 66'-1	265	8 VAR.	19'-6 TO 60'-3	219	7 VAR.	19'-6 TO 54'-5	177	6 VAR.	19'-6 TO 48'-7	139	4b3
4b4	WINGWALL, B.F.H. SHORT		3 VAR.	12'-10 TO 19'-9	33	2 VAR.	12'-10 TO 16'-3	19	10 VAR.	12'-10 TO 44'-3	194	9 VAR.	12'-10 TO 40'-9	163	8 VAR.	12'-10 TO 37'-3	134	7 VAR.	12'-10 TO 33'-9	109	6 VAR.	12'-10 TO 30'-3	86	4b4
5b5	WINGWALL, F.F.H. LONG		1	33'-11	35	1	28'-1	29	1	74'-8	80	1	68'-10	74	1	63'-0	68	1	57'-2	62	1	51'-4	56	5b5
5b6	WINGWALL, F.F.H. SHORT		1	21'-5	22	1	17'-11	19	1	45'-11	50	1	42'-5	47	1	38'-11	41	1	35'-5	37	1	31'-11	33	5b6
5b7	WINGWALL, F.F.H. LONG		4 VAR.	13'-8 TO 31'-1	93	3 VAR.	13'-8 TO 25'-3	61	11 VAR.	13'-9 TO 71'-11	506	10 VAR.	13'-9 TO 66'-1	428	9 VAR.	13'-9 TO 60'-3	357	8 VAR.	13'-9 TO 54'-5	291	7 VAR.	13'-8 TO 48'-7	232	5b7
5b8	WINGWALL, F.F.H. SHORT		4 VAR.	9'-4 TO 19'-10	61	3 VAR.	9'-4 TO 16'-4	40	11 VAR.	9'-5 TO 44'-4	313	10 VAR.	9'-5 TO 40'-10	264	9 VAR.	9'-5 TO 37'-4	219	8 VAR.	9'-5 TO 33'-10	180	7 VAR.	9'-5 TO 30'-4	145	5b8
5b9	INTERIOR WALLS, BOTH F.H.		14 VAR.	2 EA. 6'-10 TO 17'-7	178	10 VAR.	2 EA. 7'-0 TO 14'-8	113	42 VAR.	2 EA. 6'-6 TO 37'-4	960	38 VAR.	2 EA. 6'-6 TO 34'-6	812	34 VAR.	2 EA. 6'-6 TO 31'-9	678	30 VAR.	2 EA. 6'-6 TO 28'-11	554	26 VAR.	2 EA. 6'-7 TO 26'-1	443	5b9
4c1	WINGWALL, F.F.V. LONG		31 VAR.	2'-9 TO 7'-11	110	25 VAR.	2'-9 TO 6'-11	81	72 VAR.	2'-8 TO 14'-11	423	66 VAR.	2'-8 TO 13'-10	364	60 VAR.	2'-8 TO 12'-10	311	54 VAR.	2'-8 TO 11'-10	262	49 VAR.	2'-8 TO 10'-11	222	4c1
4c2	WINGWALL, F.F.V. SHORT		19 VAR.	2'-10 TO 8'-0	69	15 VAR.	2'-10 TO 6'-10	48	43 VAR.	2'-9 TO 14'-9	251	40 VAR.	2'-9 TO 13'-11	223	36 VAR.	2'-9 TO 12'-9	186	33 VAR.	2'-9 TO 11'-11	162	29 VAR.	2'-9 TO 10'-9	131	4c2
4c3	WINGWALL, F.F.V. LONG		---	---	---	---	---	---	33 VAR.	6'-9 TO 12'-3	209	27 VAR.	6'-9 TO 11'-2	162	21 VAR.	6'-9 TO 10'-2	119	15 VAR.	6'-9 TO 9'-2	80	---	---	---	4c3
4c4	WINGWALL, F.F.V. SHORT		---	---	---	---	---	---	20 VAR.	8'-7 TO 14'-1	151	17 VAR.	8'-7 TO 13'-2	123	13 VAR.	8'-7 TO 12'-1	90	10 VAR.	8'-7 TO 11'-2	66	---	---	---	4c4
4c5	WINGWALL, F.F.V. LONG		2	6'-9	9	2	5'-9	8	1	13'-8	9	2	12'-8	17	2	11'-8	16	2	10'-8	14	1	9'-8	6	4c5
4c5	WINGWALL, F.F.V. SHORT		1	6'-9	5	2	5'-9	8	2	13'-8	18	1	12'-8	8	2	11'-8	16	1	10'-8	7	2	9'-8	13	4c5
4c6	INTERIOR WALLS, BOTH F.V.		4	1'-8	4	4	1'-8	4	4	1'-7	4	4	1'-7	4	4	1'-7	4	4	1'-7	4	4	1'-7	4	4c6
4c7	INTERIOR WALLS, BOTH F.V.		54 VAR.	2 EA. 1'-10 TO 5'-5	131	44 VAR.	2 EA. 1'-10 TO 4'-6	93	132 VAR.	2 EA. 1'-9 TO 12'-4	621	122 VAR.	2 EA. 1'-9 TO 11'-5	537	110 VAR.	2 EA. 1'-9 TO 10'-4	444	100 VAR.	2 EA. 1'-9 TO 9'-5	373	88 VAR.	2 EA. 1'-9 TO 8'-5	299	4c7
4c8	INTERIOR WALLS, BOTH F.V.		6	5'-7	22	6	4'-7	18	6	12'-6	50	6	11'-6	46	6	10'-6	42	6	9'-6	38	6	8'-6	34	4c8
5c9	WINGWALL, B.F.V. LONG		15 VAR.	2'-9 TO 5'-2	62	15 VAR.	2'-9 TO 5'-2	62	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	15 VAR.	2'-8 TO 5'-1	61	5c9
5c10	WINGWALL, B.F.V. SHORT		4 VAR.	2'-10 TO 3'-8	14	4 VAR.	2'-10 TO 3'-8	14	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	4 VAR.	2'-9 TO 3'-7	13	5c10
5c11	WINGWALL, B.F.V. LONG		16 VAR.	9'-4 TO 11'-11	177	10 VAR.	9'-4 TO 10'-11	106	57 VAR.	9'-3 TO 18'-11	837	51 VAR.	9'-3 TO 17'-10	720	45 VAR.	9'-3 TO 16'-10	612	39 VAR.	9'-3 TO 15'-10	510	34 VAR.	9'-3 TO 14'-11	428	5c11
5c12	WINGWALL, B.F.V. SHORT		15 VAR.	8'-0 TO 12'-0	156	11 VAR.	8'-0 TO 10'-10	108	39 VAR.	7'-11 TO 18'-9	542	36 VAR.	7'-11 TO 17'-11	485	32 VAR.	7'-11 TO 16'-9	412	29 VAR.	7'-11 TO 15'-11	360	25 VAR.	7'-11 TO 14'-9	296	5c12
6c13	WINGWALL, B.F.V. LONG		---	---	---	---	---	---	47	10'-6	741	41	10'-6	647	35	10'-6	552	29	10'-6	457	24	10'-6	379	6c13
6c13	WINGWALL, B.F.V. SHORT		---	---	---	---	---	---	28	10'-6	442	25	10'-6	394	21	10'-6	331	18	10'-6	284	14	10'-6	221	6c13
5c14	WINGWALL, B.F.V. LONG		2	10'-9	22	2	9'-9	20	1	17'-8	18	2	16'-8	35	2	15'-8	33	2	14'-8	31	1	13'-8	14	5c14
5c14	WINGWALL, B.F.V. SHORT		1	10'-9	11	2	9'-9	20	2	17'-8	37	1	16'-8	17	2	15'-8	33	1	14'-8	15	2	13'-8	29	5c14
4d1	APRON, LONGIT., BOTT.		25	18'-4	306	25	15'-6	259	21	38'-1	534	21	35'-3	494	21	32'-5	455	21	29'-7	415	21	26'-9	375	4d1
4d2	APRON, LONGIT., BOTT. LONG		3	27'-8	55	3	22'-0	44	3	68'-5	142	3	62'-7	130	3	56'-8	118	3	50'-10	106	3	45'-0	95	4d2
4d3	APRON, LONGIT., BOTT. SHORT		3	17'-10	36	3	14'-5	29	3	42'-2	89	3	38'-8	77	3	35'-1	70	3	31'-7	63	3	28'-2	56	4d3
6f1	APRON, LONGIT., TOP		37	18'-4	1019	37	15'-6	861	31	38'-1	1773	31	35'-3	1641	31	32'-5	1509	31	29'-7	1377	31	26'-9	1246	6f1
6f2	APRON, LONGIT., TOP LONG		5 VAR.	6'-10 TO 15'-0	82	4 VAR.	6'-0 TO 12'-2	55	15 VAR.	6'-6 TO 34'-10	466	14 VAR.	5'-8 TO 32'-0	396	12 VAR.	6'-11 TO 29'-2	325	11 VAR.	6'-1 TO 26'-4	268	9 VAR.	7'-3 TO 23'-6	208	6f2
6f3	APRON, LONGIT., TOP SHORT		3 VAR.	8'-6 TO 15'-4	54	2 VAR.	9'-1 TO 12'-6	32	9 VAR.	8'-1 TO 35'-2	292	8 VAR.	8'-8 TO 32'-4	246	8 VAR.	5'-9 TO 29'-6	212	7 VAR.	6'-4 TO 26'-8	173	6 VAR.	6'-10 TO 23'-10	138	6f3
6f4	APRON, LONGIT., TOP LONG		1	33'-11	51	1	28'-1	42	1	74'-8	116	1	68'-10	107	1	63'-0	98	1	57'-2	89	1	51'-4	80	6f4
6f5	APRON, LONGIT., TOP SHORT		1	21'-5	32	1	17'-11	27	1	45'-11	72	1	42'-5	67	1	38'-11	58	1	35'-5	53	1	31'-11	48	6f5
4i1	PARAPET, VERTICAL		75	6'-8	334	75	6'-8	334	65	6'-8	289	63	6'-8	281	63	6'-8	281	63	6'-8	281	63	6'-8	281	4i1
7ji	PARAPET, HORIZONTAL		4	54'-8	465	4	54'-8	465	4	47'-7	407	4	47'-1	403	4	46'-8	400	4	46'-8	400	4	46'-8	400	7ji
6m1	APRON, TRANS., TOP		27 VAR.	16'-0 TO 35'-6	1044	27 VAR.	13'-2 TO 32'-8	929	23 VAR.	37'-11 TO 42'-0	1417	23 VAR.	37'-6 TO 41'-8	1398	20 VAR.	37'-2 TO 40'-9	1184	16 VAR.	37'-2 TO 40'-0	930	13 VAR.	37'-2 TO 39'-5	748	6m1
6m2	APRON, TRANS., TOP		20 VAR.	4'-8 TO 15'-4	300	16 VAR.	4'-1 TO 12'-6	199	4 VAR.	42'-3 TO 43'-5	271	1 VAR.	41'-11 TO 41'-11	66	3 VAR.	30'-3 TO 31'-9	140	7 VAR.	27'-5 TO 31'-11	312	10 VAR.	24'-7 TO 31'-4	420	6m2
6m3	APRON, TRANS., TOP		---	---	---	---	---	---	42 VAR.	10'-3 TO 33'-4	1375	41 VAR.	9'-7 TO 32'-1	1283	39 VAR.	8'-3 TO 29'-8	1111	35 VAR.	7'-8 TO 26'-10	907	31 VAR.	7'-1 TO 24'-0	724	6m3
6m4	APRON, TRANS., BOTT.		10 VAR.	46'-7 TO 56'-2	805	8 VAR.	46'-7 TO 54'-1	632	24 VAR.	38'-10 TO 63'-4	1916	22 VAR.	38'-7 TO 61'-0	1713	20 VAR.	38'-4 TO 58'-7	1516	18 VAR.	38'-4 TO 56'-6	1336	16 VAR.	38'-4 TO 54'-4	1161	6m4
6p1	CURTAIN, HORIZONTAL		4	52'-11	331	4	52'-11	331	4	45'-3	285	4	45'-0	284	4	44'-9	282	4	44'-9	282	4	44'-9	282	6p1
6p2	CURTAIN, HORIZONTAL LONG		4	20'-2	121	4	17'-0	102	4	42'-4	268	4	39'-2	235	4	36'-0	216	4	32'-10	197	4	29'-8	178	6p1
6p3	CURTAIN, HORIZONTAL SHORT		4	8'-6	51	4	7'-6	45	4	15'-8	94	4	14'-7	88	4	13'-7	82	4	12'-7	76	4	11'-7	70	6p2
6s1	WING SLOPE, BOTH F. LONG		2	8'-4	25	2	8'-4	25	2	8'-4	25	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	2	7'-11	24	2	7'-11	24	2	7'-11	24	6s2
6s3	WING SLOPE, BOTH F. LONG		2	27'-7	83	2	21'-8	65	2	69'-0	214	2	63'-1	196	2	57'-2	178	2	51'-3	161	2	45'-4	143	6s3
6s4	WING SLOPE, BOTH F. SHORT		2	16'-8	50	2	13'-0	39	2	42'-1	133	2	38'-6	116	2	34'-10	105	2	31'-2	94	2	27'-7	83	6s4
6s5	WING SLOPE, F.F. LONG		1	32'-10	49	1	26'-11	40	1	74'-3	115	1	68'-4	106	1	62'-5	97	1	56'-6	88	1	50'-7	79	6s5
6s6	WING SLOPE, F.F. SHORT		1	21'-7	32	1	18'-0	27	1	47'-1	74	1	43'-5	69	1	39'-10	60	1	36'-2	54	1	32'-6	49	6s6
6s7	INTERIOR WALLS, BOTH F.H.		4	17'-11	108	4	14'-11	90	4	38'-8	232	4	35'-9	215	4	32'-10	197	4	29'-10	179	4	26'-10	161	6s7
5t1	CURTAIN, VERTICAL		53	6'-5	355	49	6'-5	328	69	7'-11	570	66	7'-8	528	63	7'-5	487	60	7'-2	448	56	6'-11	404	5t1

ESTIMATED QUANTITIES ONE HEADWALL			12' x 5'		12' x 4'		10' x 12'		10' x 11'		10' x 10'		10' x 9'		10' x 8'	
	REINF. STEEL		7120 LB		5962 LB		18,126 LB		16,180 LB		14,297 LB		12,555 LB		10,825 LB	
	CONCRETE	PARAPET Δ	5.1	57.4 CY	5.1	47.3 CY	4.8	155.8 CY	4.7	133.7 CY	4.6	113.8 CY	4.6	99.4 CY	4.6	85.7 CY
		WINGWALLS	8.1		5.5		50.5		39.6		30.3		25.2		20.4	
		FOOTING *	44.2		36.7		100.5		89.4		78.9		69.6		60.7	

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

Norman L. McDonald
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 45-8-12