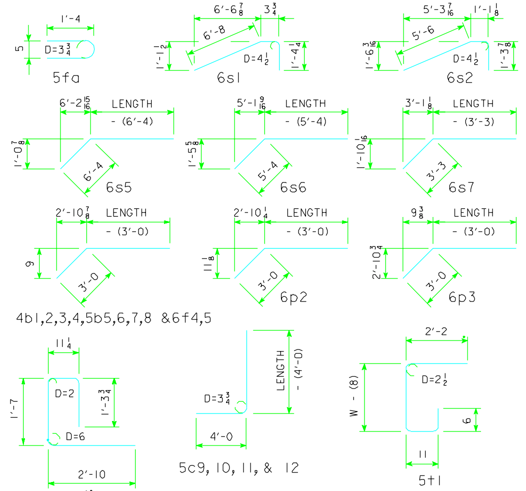
BILL OF REINFORCING FOR ONE HEADWALL 45° SKEW CULVERT SPAN x CULVERT HEIGHT

BAR	LOCATION	SHAPE	12' x 12'			12' x 10'			12' x 8'			12' x 6'			10' x 12'			10' x 10'			10' x 8'			10' x 6'			BAR
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	
5fa	FENCE ANCHOR (GALV.)		2	3'-1	6	2	3'-1	6	2	3'-1	6	2	3'-1	6	2	3'-1	6	2	3'-1	6	2	3'-1	6	2	3'-1	6	5fa
4b1	WINGWALL, B.F.H. LONG		1	74'-9	51	1	63'-1	43	1	51'-5	36	1	39'-9	27	1	74'-9	51	1	63'-1	43	1	51'-5	36	1	39'-9	27	4b1
4b2	WINGWALL, B.F.H. SHORT		1	46'-0	32	1	39'-0	26	1	32'-0	21	1	25'-0	17	1	46'-0	32	1	39'-0	26	1	32'-0	21	1	25'-0	17	4b2
4b3	WINGWALL, B.F.H. LONG		10 VAR	19'-6: 71'-11	313	8 VAR	19'-6: 60'-3	218	6 VAR	19'-6: 48'-8	139	4 VAR	19'-6: 37'-0	75	10 VAR	19'-6: 71'-11	313	8 VAR	19'-6: 60'-3	218	6 VAR	19'-6: 48'-8	139	4 VAR	19'-6: 37'-0	75	4b3
4b4	WINGWALL, B.F.H. SHORT		10 VAR	12'-10: 44'-4	194	8 VAR	12'-10: 37'-4	134	6 VAR	12'-10: 30'-4	86	4 VAR	12'-10: 23'-4	48	10 VAR	12'-10: 44'-4	194	8 VAR	12'-10: 37'-4	134	6 VAR	12'-10: 30'-4	86	4 VAR	12'-10: 23'-4	48	4b4
5b5	WINGWALL, F.F.H. LONG		1	74'-9	80	1	63'-1	68	1	51'-5	56	1	39'-9	41	1	74'-9	80	1	63'-1	68	1	51'-5	56	1	39'-9	41	5b5
5b6	WINGWALL, F.F.H. SHORT		1	46'-0	50	1	39'-0	41	1	32'-0	33	1	25'-0	26	1	46'-0	50	1	39'-0	41	1	32'-0	33	1	25'-0	26	5b6
5b7	WINGWALL, F.F.H. LONG		11 VAR	13'-8: 71'-11	503	9 VAR	13'-8: 60'-3	355	7 VAR	13'-8: 48'-8	232	5 VAR	13'-8: 37'-0	132	11 VAR	13'-8: 71'-11	503	9 VAR	13'-8: 60'-3	355	7 VAR	13'-8: 48'-8	232	5 VAR	13'-8: 37'-0	132	5b7
5b8	WINGWALL, F.F.H. SHORT		11 VAR	9'-4: 44'-4	312	9 VAR	9'-4: 37'-4	219	7 VAR	9'-4: 30'-4	145	5 VAR	9'-4: 23'-4	85	11 VAR	9'-4: 44'-4	312	9 VAR	9'-4: 37'-4	219	7 VAR	9'-4: 30'-4	145	5 VAR	9'-4: 23'-4	85	5b8
5b9	CENTER WALLS, BOTH F.H.		42 VAR	5'-11: 36'-9	935	34 VAR	6'-0: 31'-3	660	26 VAR	6'-1: 25'-7	429	18 VAR	6'-3: 20'-0	246	42 VAR	5'-11: 36'-9	935	34 VAR	6'-0: 31'-3	660	26 VAR	6'-1: 25'-7	429	18 VAR	6'-3: 20'-0	246	5b9
4c1	WINGWALL, F.F.V. LONG		72 VAR	2'-10: 15'-0	429	60 VAR	2'-10: 12'-11	316	49 VAR	2'-10: 11'-0	226	37 VAR	2'-10: 9'-0	146	72 VAR	2'-9: 14'-11	425	60 VAR	2'-9: 12'-10	312	49 VAR	2'-9: 10'-11	224	37 VAR	2'-9: 8'-11	144	4c1
4c2	WINGWALL, F.F.V. SHORT		43 VAR	2'-10: 14'-10	254	36 VAR	2'-10: 12'-10	188	29 VAR	2'-10: 10'-10	132	22 VAR	2'-10: 8'-10	86	43 VAR	2'-9: 14'-9	251	36 VAR	2'-9: 12'-9	186	29 VAR	2'-9: 10'-9	131	22 VAR	2'-9: 8'-9	85	4c2
4c3	WINGWALL, F.F.V. LONG		1	13'-9	9	2	11'-9	16	1	9'-9	7	1	7'-9	5	1	13'-8	9	2	11'-8	16	1	9'-8	6	1	7'-8	5	4c3
4c3	WINGWALL, F.F.V. SHORT		2	13'-9	18	2	11'-9	16	2	9'-9	13	2	7'-9	10	2	13'-8	18	2	11'-8	16	2	9'-8	13	2	7'-8	10	4c3
4c4	CENTER WALLS, BOTH F.V.		4	1'-9	5	4	1'-9	5	4	1'-9	5	4	1'-8	4	4	1'-8	4	4	1'-8	4	4	1'-8	4	4	1'-7	4	4c4
4c5	CENTER WALLS, BOTH F.V.		132 VAR	1'-10: 12'-5	628	110 VAR	1'-10: 10'-5	450	88 VAR	1'-10: 8'-6	304	66 VAR	1'-10: 6'-6	184	132 VAR	1'-9: 12'-4	621	110 VAR	1'-9: 10'-4	444	88 VAR	1'-9: 8'-5	299	66 VAR	1'-9: 6'-5	180	4c5
4c6	CENTER WALLS, BOTH F.V.		6	12'-7	50	6	10'-7	42	6	8'-7	34	6	6'-7	26	6	12'-6	50	6	10'-6	42	6	8'-6	34	6	6'-6	26	4c6
5c7	WINGWALL, B.F.V. LONG		15 VAR	2'-10: 5'-3	63	15 VAR	2'-10: 5'-3	63	15 VAR	2'-10: 5'-3	63	15 VAR	2'-10: 5'-3	63	15 VAR	2'-9: 5'-2	62	15 VAR	2'-9: 5'-2	62	15 VAR	2'-9: 5'-2	62	15 VAR	2'-9: 5'-2	62	5c7
5c8	WINGWALL, B.F.V. SHORT		4 VAR	2'-10: 3'-8	14	4 VAR	2'-10: 3'-8	14	4 VAR	2'-10: 3'-8	14	4 VAR	2'-10: 3'-8	14	4 VAR	2'-9: 3'-7	13	4 VAR	2'-9: 3'-7	13	4 VAR	2'-9: 3'-7	13	4 VAR	2'-9: 3'-7	13	5c8
5c9	WINGWALL, B.F.V. LONG		57 VAR	9'-5: 19'-0	845	45 VAR	9'-5: 16'-11	618	34 VAR	9'-5: 15'-0	433	22 VAR	9'-5: 13'-0	257	57 VAR	9'-4: 18'-11	840	45 VAR	9'-4: 16'-10	614	34 VAR	9'-4: 14'-11	430	22 VAR	9'-4: 12'-11	255	5c9
5c10	WINGWALL, B.F.V. SHORT		39 VAR	8'-0: 18'-10	546	32 VAR	8'-0: 16'-10	414	25 VAR	8'-0: 14'-10	298	18 VAR	8'-0: 12'-10	196	39 VAR	7'-11: 18'-9	542	32 VAR	7'-11: 16'-9	412	25 VAR	7'-11: 14'-9	296	18 VAR	7'-11: 12'-9	194	5c10
5c11	WINGWALL, B.F.V. LONG		43	10'-6	471	31	10'-6	340	19	10'-6	208	—	—	—	43	10'-6	471	31	10'-6	339	19	10'-6	208	—	—	—	5c11
5c11	WINGWALL, B.F.V. SHORT		26	10'-6	285	19	10'-6	208	12	10'-6	131	—	—	—	26	10'-6	285	19	10'-6	208	12	10'-6	131	—	—	—	5c11
5c12	WINGWALL, B.F.V. LONG		1	17'-8	18	2	15'-8	33	1	13'-8	14	1	11'-8	12	1	17'-7	18	2	15'-7	33	1	13'-7	14	1	11'-7	12	5c12
5c12	WINGWALL, B.F.V. SHORT		2	17'-8	37	2	15'-8	33	2	13'-8	29	2	11'-8	24	2	17'-7	37	2	15'-7	33	2	13'-7	28	2	11'-7	24	5c12
4d1	APRON, LONGIT., BOTTOM		25	38'-0	635	25	32'-4	540	25	26'-9	447	25	21'-1	352	21	38'-0	533	21	32'-4	454	21	26'-9	375	21	21'-1	296	4d1
4d2	APRON, LONGIT., BOTT. LONG		3	67'-3	139	3	55'-8	116	3	44'-0	92	3	32'-6	65	3	67'-3	139	3	55'-8	116	3	44'-0	92	3	32'-6	65	4d2
4d3	APRON, LONGIT. BOTT. SHORT		3	41'-10	88	3	34'-10	70	3	27'-11	56	3	21'-0	42	3	41'-10	88	3	34'-10	70	3	27'-11	56	3	21'-0	42	4d3
6f1	APRON, LONGIT., TOP		37	38'-0	2112	37	32'-4	1797	37	26'-9	1487	37	21'-1	1172	31	38'-0	1769	31	32'-4	1505	31	26'-9	1246	31	21'-1	982	6f1
6f2	APRON, LONGIT., TOP, LONG		15 VAR	6'-6: 34'-10	466	12 VAR	6'-11: 29'-2	325	9 VAR	7'-3: 23'-6	208	7 VAR	5'-7: 17'-10	123	15 VAR	6'-6: 34'-10	466	12 VAR	6'-11: 29'-2	325	9 VAR	7'-3: 23'-6	208	7 VAR	5'-7: 17'-10	123	6f2
6f3	APRON, LONGIT., TOP SHORT		9 VAR	8'-1: 35'-2	292	8 VAR	5'-9: 29'-6	212	6 VAR	6'-10: 23'-10	138	4 VAR	7'-11: 18'-2	78	9 VAR	8'-1: 35'-2	292	8 VAR	5'-9: 29'-6	212	6 VAR	6'-10: 23'-10	138	4 VAR	7'-11: 18'-2	78	6f3
6f4	APRON, LONGIT., TOP, LONG		1	74'-8	115	1	63'-1	98	1	51'-5	80	1	39'-9	60	1	74'-8	115	1	63'-1	98	1	51'-5	80	1	39'-9	60	6f4
6f5	APRON, LONGIT., TOP SHORT		1	45'-11	72	1	39'-0	59	1	32'-0	48	1	25'-0	38	1	45'-11	72	1	39'-0	59	1	32'-0	48	1	25'-0	38	6f5
4i1	PARAPET, VERTICAL		79	6'-8	352	77	6'-8	343	77	6'-8	343	77	6'-8	343	67	6'-8	298	65	6'-8	289	65	6'-8	289	65	6'-8	289	4i1
7j1	PARAPET, HORIZONTAL		4	56'-1	476	4	55'-1	468	4	55'-1	468	4	54'-8	465	4	47'-7	407	4	46'-8	399	4	46'-8	399	4	46'-2	395	7j1
6m1	APRON, TRANS., TOP		23 VAR	48'-9: 44'-8	1706	16 VAR	46'-9: 43'-11	1154	8 VAR	45'-3: 43'-11	568	1	43'-7	69	23 VAR	42'-0: 37'-11	1424	20 VAR	40'-9: 37'-2	1190	12 VAR	39'-3: 37'-2	689	5 VAR	37'-7: 36'-10	279	6m1
6m2	APRON, TRANS., TOP		4 VAR	38'-6: 36'-3	225	11 VAR	37'-9: 30'-3	562	19 VAR	38'-2: 24'-8	897	26 VAR	37'-7: 18'-10	1102	4 VAR	43'-5: 42'-3	273	3 VAR	31'-9: 30'-4	140	11 VAR	32'-2: 24'-8	470	18 VAR	31'-7: 18'-10	682	6m2
6m3	APRON, TRANS., TOP		47 VAR	35'-7: 9'-9	1600	39 VAR	29'-8: 8'-3	1111	31 VAR	24'-0: 7'-1	724	23 VAR	18'-2: 5'-10	415	42 VAR	33'-4: 10'-4	1377	39 VAR	29'-8: 8'-3	1111	31 VAR	24'-0: 7'-2	726	23 VAR	18'-2: 5'-10	415	6m3
6m5	APRON, TRANS., BOTTOM		24 VAR	71'-11: 47'-5	2229	20 VAR	67'-2: 46'-11	1779	16 VAR	62'-11: 46'-11	1372	12 VAR	58'-5: 46'-8	986	24 VAR	63'-5: 38'-11	1916	20 VAR	58'-8: 38'-5	1517	16 VAR	54'-5: 38'-5	1161	12 VAR	49'-11: 38'-2	826	6m5
6p1	CURTAIN, HORIZONTAL		4	53'-8	335	4	53'-2	332	4	53'-2	332	4	52'-11	331	4	45'-2	284	4	44'-9	281	4	44'-8	281	4	44'-5	280	6p1
6p2	CURTAIN, HORIZ. LONG		4	42'-4	267	4	36'-0	216	4	29'-8	178	4	23'-4	140	4	42'-4	267	4	36'-0	216	4	29'-8	178	4	23'-4	140	6p2
6p3	CURTAIN, HORIZ. SHORT		4	15'-9	95	4	13'-9	83	4	11'-8	70	4	9'-8	58	4	15'-10	95	4	13'-9	83	4	11'-8	70	4	9'-8	58	6p3
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	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	2	7'-11	24	6s2
6s3	WING SLOPE, BOTH F. LONG		2	69'-4	214	2	57'-6	179	2	45'-9	143	2	33'-10	102	2	69'-4	214	2	57'-6	179	2	45'-9	143	2	33'-10	102	6s3
6s4	WING SLOPE, BOTH F. SHORT		2	42'-3	133	2	35'-0	105	2	27'-9	83	2	20'-6	62	2	42'-3	133	2	35'-0	105	2	27'-9	83	2	20'-6	62	6s4
6s5	WING SLOPE, F.F. LONG		1	74'-6	115	1	62'-8	97	1	50'-10	79	1	39'-1	59	1	74'-6	115	1	62'-8	97	1	50'-10	79	1	39'-1	59	6s5
6s6	WING SLOPE, F.F. SHORT		1	47'-4	74	1	40'-1	63	1	32'-10	49	1	25'-6	38	1	47'-4	74	1	40'-1	63	1	32'-10	49	1	25'-6	38	6s6
6s7	CENTER WALL, BOTH F.HOR.		4	38'-8	232	4	32'-10	197	4	26'-10	161	4	20'-11	126	4	38'-8	232	4	32'-10	197	4	26'-10	161	4	20'-11	126	6s7
5t1	CURTAIN, VERTICAL		77	7'-11	636	69	7'-5	534	62	6'-11	447	55	6'-5	368	69	7'-11	570	63	7'-5	487	56	6'-11	404	49	6'-5	328	5t1

ESTIMATED QUANTITIES ONE HEADWALL			12' x 12'		12' x 10'		12' x 8'		12' x 6'		10' x 12'		10' x 10'		10' x 8'		10' x 6'	
REINFORCING STEEL			18,805 LBS.		15,015 LBS.		11,613 LBS.		8373 LBS.		17,324 LBS.		13,746 LBS.		10,550 LBS.		7529 LBS.	
CONC.	PARAPET Δ		5.2	171.7 CU. YD.	4.9	127.0 CU. YD.	4.9	96.5 CU. YD.	4.8	67.7 CU. YD.	4.5	155.0 CU. YD.	4.3	113.1 CU. YD.	4.3	85.2 CU. YD.	4.2	59.0 CU. YD.
CONC.	WINGWALLS		50.0		30.0		20.2		11.0		50.0		30.0		20.2		11.0	
CONC.	FOOTING ΔΔ		116.5		92.1		71.4		51.9		100.5		78.8		60.7		43.8	

BENT BAR DETAILS



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

"SHORT" DENOTES SHORT WINGWALL

"LONG" DENOTES LONG WINGWALL

VARIABLE LENGTH BARS DENOTED BY X:Y

WEIGHT OF BARS OVER 40'-0 LONG INCLUDES AN ALLOWANCE FOR LAP (2'-8 FOR TOP APRON "m" BARS AND 2'-2 ALL OTHER BARS).
LENGTHS SHOWN FOR BARS OVER 40'-0 LONG DO NOT INCLUDE LAP (2'-8 FOR TOP APRON "m" BARS AND 2'-2 ALL OTHER).

Δ NOTE: INCLUDES TOP OF WINGWALL QUANTITIES.

ΔΔ ASSUMES APRON AND FLOOR ARE EQUAL THICKNESS, ADJUST CONCRETE QUANTITIES FOR TRANSITION WHERE APRON AND FLOOR THICKNESS ARE NOT EQUAL.

HEADWALL NOTES:

SEE SHEET TRRCB-GI-01 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 EXPOSED CORNERS OF 90° OR SHARPER ARE TO BE FILLETED WITH A 3/4" DRESSED AND BEVELED STRIP.

ALL REINFORCING IS TO BE SECURELY WIRED IN PLACE BEFORE THE CONCRETE IS POURED. 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.

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", "f1", "f4", AND "f5" 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 :

APPROVED BY :

STANDARD DESIGN

FLARED WING HEADWALLS

FOR

TRIPLE REINFORCED CONCRETE BOX CULVERTS

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

SEPT., 2001

TRH 45-6-01

REVISED 06-02 - 4i1 BARS NUMBER CHANGED.
TRH456.S01 - 09-01 THIS SHEET ISSUED.

XXXXXXXXXXSYSTEMTIME XXXXXXXUSERNAME XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXDGNSPEC