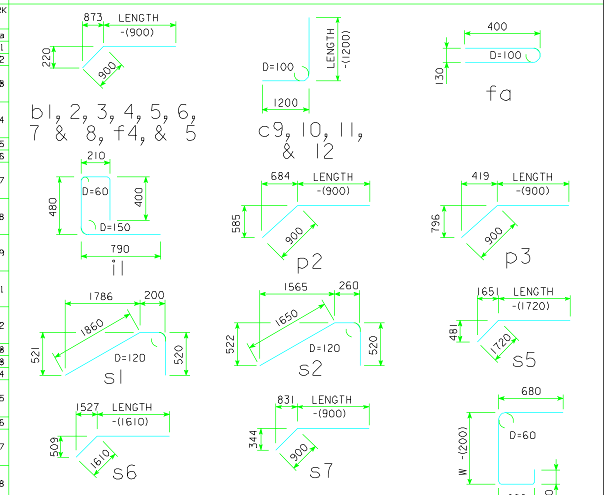
BILL OF REINFORCING FOR ONE HEADWALL 15° SKEW CULVERT SPAN X CULVERT HEIGHT

LOCATION	SHAPE	SIZE	MARK	3600x3600 NO.	LENGTH	MASS	3600x3000 NO.	LENGTH	MASS	3600x2400 NO.	LENGTH	MASS	3600x1800 NO.	LENGTH	MASS	3000x3600 NO.	LENGTH	MASS	3000x3000 NO.	LENGTH	MASS	3000x2400 NO.	LENGTH	MASS	3000x1800 NO.	LENGTH	MASS	MARK
FENCE ANCHOR		15	fa	2	930	3	2	930	3	2	930	3	2	930	3	2	930	3	2	930	3	2	930	3	2	930	3	fa
WINGWALL BFH L		15	b1	1	13 550	21	1	11 490	18	1	9430	15	1	7370	12	1	13 550	21	1	11 490	18	1	9430	15	1	7370	12	b1
WINGWALL BFH S		15	b2	1	11 950	19	1	10 150	16	1	8350	13	1	6550	10	1	11 950	19	1	10 150	16	1	8350	13	1	6550	10	b2
WINGWALL BFH L		15	b3	10 (LENGTH VARIES)	3720 TO 12 990	131	8 (LENGTH VARIES)	3720 TO 10 930	92	6 (LENGTH VARIES)	3720 TO 8870	59	4 (LENGTH VARIES)	3720 TO 6810	33	10 (LENGTH VARIES)	3720 TO 12 990	131	8 (LENGTH VARIES)	3720 TO 10 930	92	6 (LENGTH VARIES)	3720 TO 8870	59	4 (LENGTH VARIES)	3720 TO 6810	33	b3
WINGWALL BFH S		15	b4	10 (LENGTH VARIES)	3360 TO 11 470	116	8 (LENGTH VARIES)	3360 TO 9670	82	6 (LENGTH VARIES)	3360 TO 7870	53	4 (LENGTH VARIES)	3360 TO 6070	30	10 (LENGTH VARIES)	3360 TO 11 470	116	8 (LENGTH VARIES)	3360 TO 9670	82	6 (LENGTH VARIES)	3360 TO 7870	53	4 (LENGTH VARIES)	3360 TO 6070	30	b4
WINGWALL FFH L		15	b5	1	13 550	21	1	11 490	18	1	9430	15	1	7370	12	1	13 550	21	1	11 490	18	1	9430	15	1	7370	12	b5
WINGWALL FFH S		15	b6	1	11 950	19	1	10 150	16	1	8350	13	1	6550	10	1	11 950	19	1	10 150	16	1	8350	13	1	6550	10	b6
WINGWALL FFH L		15	b7	11 (LENGTH VARIES)	2690 TO 12 990	135	9 (LENGTH VARIES)	2690 TO 10 930	96	7 (LENGTH VARIES)	2690 TO 8870	64	5 (LENGTH VARIES)	2690 TO 6810	37	11 (LENGTH VARIES)	2690 TO 12 990	135	9 (LENGTH VARIES)	2690 TO 10 930	96	7 (LENGTH VARIES)	2690 TO 8870	64	5 (LENGTH VARIES)	2690 TO 6810	37	b7
WINGWALL FFH S		15	b8	11 (LENGTH VARIES)	2460 TO 11 470	120	9 (LENGTH VARIES)	2460 TO 9670	86	7 (LENGTH VARIES)	2460 TO 7870	57	5 (LENGTH VARIES)	2460 TO 6070	33	11 (LENGTH VARIES)	2460 TO 11 470	120	9 (LENGTH VARIES)	2460 TO 9670	86	7 (LENGTH VARIES)	2460 TO 7870	57	5 (LENGTH VARIES)	2460 TO 6070	33	b8
CENTER WALL EFH		15	b9	21 (LENGTH VARIES)	1440 TO 8330	161	17 (LENGTH VARIES)	1450 TO 7090	114	13 (LENGTH VARIES)	1470 TO 5850	75	9 (LENGTH VARIES)	1500 TO 4600	43	21 (LENGTH VARIES)	1440 TO 8330	161	17 (LENGTH VARIES)	1450 TO 7090	114	13 (LENGTH VARIES)	1470 TO 5850	75	9 (LENGTH VARIES)	1500 TO 4600	43	b9
WINGWALL FFV L		15	c1	42 (LENGTH VARIES)	840 TO 4430	174	35 (LENGTH VARIES)	840 TO 3810	128	29 (LENGTH VARIES)	840 TO 3290	94	22 (LENGTH VARIES)	840 TO 2680	61	42 (LENGTH VARIES)	820 TO 4410	172	35 (LENGTH VARIES)	820 TO 3790	127	29 (LENGTH VARIES)	820 TO 3270	93	22 (LENGTH VARIES)	820 TO 2660	60	c1
WINGWALL FFV S		15	c2	37 (LENGTH VARIES)	850 TO 4450	154	31 (LENGTH VARIES)	850 TO 3850	114	25 (LENGTH VARIES)	850 TO 3250	80	19 (LENGTH VARIES)	850 TO 2650	52	37 (LENGTH VARIES)	830 TO 4430	153	31 (LENGTH VARIES)	830 TO 3830	113	25 (LENGTH VARIES)	830 TO 3230	80	19 (LENGTH VARIES)	830 TO 2630	52	c2
WINGWALL FFV L		15	c3	2	4370	14	2	3770	12	2	3170	10	2	2570	8	2	4350	14	2	3750	12	2	3150	10	2	2550	8	c3
WINGWALL FFV S		15	c3	1	4370	7	1	3770	6	1	3170	5	1	2570	4	1	4350	7	1	3750	6	1	3150	5	1	2550	4	c3
CENTER WALL EFV		15	c4	2	510	2	2	510	2	2	510	2	2	500	2	2	490	2	2	490	2	2	490	2	2	480	2	c4
CENTER WALL EFV		15	c5	49 (LENGTH VARIES)	570 TO 3710	165	41 (LENGTH VARIES)	570 TO 3120	119	33 (LENGTH VARIES)	570 TO 2540	81	25 (LENGTH VARIES)	560 TO 1960	49	49 (LENGTH VARIES)	550 TO 3690	163	41 (LENGTH VARIES)	550 TO 3100	117	33 (LENGTH VARIES)	550 TO 2520	80	25 (LENGTH VARIES)	540 TO 1940	49	c5
CENTER WALL EFV		15	c6	2	3830	12	2	3230	10	2	2630	8	2	2030	6	2	3810	12	2	3210	10	2	2610	8	2	2010	6	c6
WINGWALL BFV L		15	c7	9 (LENGTH VARIES)	840 TO 1540	17	9 (LENGTH VARIES)	840 TO 1540	17	9 (LENGTH VARIES)	840 TO 1540	17	9 (LENGTH VARIES)	840 TO 1540	17	9 (LENGTH VARIES)	820 TO 1520	17	9 (LENGTH VARIES)	820 TO 1520	17	9 (LENGTH VARIES)	820 TO 1520	17	9 (LENGTH VARIES)	820 TO 1520	17	c7
WINGWALL BFV S		15	c8	6 (LENGTH VARIES)	850 TO 1350	10	6 (LENGTH VARIES)	850 TO 1350	10	6 (LENGTH VARIES)	850 TO 1350	10	6 (LENGTH VARIES)	850 TO 1350	10	6 (LENGTH VARIES)	830 TO 1330	10	6 (LENGTH VARIES)	830 TO 1330	10	6 (LENGTH VARIES)	830 TO 1330	10	6 (LENGTH VARIES)	830 TO 1330	10	c8
WINGWALL BFV L		15	c9	33 (LENGTH VARIES)	2830 TO 5630	219	26 (LENGTH VARIES)	2830 TO 5010	160	20 (LENGTH VARIES)	2830 TO 4490	115	13 (LENGTH VARIES)	2830 TO 3880	68	33 (LENGTH VARIES)	2810 TO 5610	218	26 (LENGTH VARIES)	2810 TO 4990	159	20 (LENGTH VARIES)	2810 TO 4470	114	13 (LENGTH VARIES)	2810 TO 3860	68	c9
WINGWALL BFV S		15	c10	31 (LENGTH VARIES)	2650 TO 5650	202	25 (LENGTH VARIES)	2650 TO 5050	151	19 (LENGTH VARIES)	2650 TO 4450	106	13 (LENGTH VARIES)	2650 TO 3850	66	31 (LENGTH VARIES)	2630 TO 5630	201	25 (LENGTH VARIES)	2630 TO 5030	150	19 (LENGTH VARIES)	2630 TO 4430	105	13 (LENGTH VARIES)	2630 TO 3830	66	c10
WINGWALL BFV L		15	c11	24	3220	121	17	3220	86	10	3220	51	-----	-----	0	24	3200	121	17	3200	85	10	3200	50	-----	-----	0	c11
WINGWALL BFV S		15	c11	19	3220	96	13	3220	66	7	3220	35	-----	-----	0	19	3200	95	13	3200	65	7	3200	35	-----	-----	0	c11
WINGWALL BFV L		15	c12	2	5570	17	2	4970	16	2	4370	14	2	3770	12	2	5550	17	2	4950	16	2	4350	14	2	3750	12	c12
WINGWALL BFV S		15	c12	1	5570	9	1	4970	8	1	4370	7	1	3770	6	1	5550	9	1	4950	8	1	4350	7	1	3750	6	c12
APRON LONG BOT		15	d1	17	8540	228	17	7300	195	17	6060	162	17	4810	128	13	8540	174	13	7300	149	13	6060	124	13	4810	98	d1
APRON LONG BOT L		15	d2	3	12 060	57	3	10 020	47	3	7980	38	3	5950	28	3	12 060	57	3	10 020	47	3	7980	38	3	5950	28	d2
APRON LONG BOT S		15	d3	3	10 580	50	3	8790	41	3	7010	33	3	5240	25	3	10 580	50	3	8790	41	3	7010	33	3	5240	25	d3
APRON LONG TOP		20	f1	24	8540	483	24	7300	413	24	6060	343	24	4810	272	20	8540	402	20	7300	344	20	6060	285	20	4810	227	f1
APRON LONG TOP L		20	f2	10 (LENGTH VARIES)	870 TO 7690	101	9 (LENGTH VARIES)	350 TO 6450	72	7 (LENGTH VARIES)	630 TO 5210	48	5 (LENGTH VARIES)	890 TO 3960	29	10 (LENGTH VARIES)	870 TO 7690	101	9 (LENGTH VARIES)	350 TO 6450	72	7 (LENGTH VARIES)	630 TO 5210	48	5 (LENGTH VARIES)	890 TO 3960	29	f2
APRON LONG TOP S		20	f3	9 (LENGTH VARIES)	770 TO 7720	90	8 (LENGTH VARIES)	380 TO 6480	65	6 (LENGTH VARIES)	860 TO 5240	43	5 (LENGTH VARIES)	460 TO 3990	26	9 (LENGTH VARIES)	770 TO 7720	90	8 (LENGTH VARIES)	380 TO 6480	65	6 (LENGTH VARIES)	860 TO 5240	43	5 (LENGTH VARIES)	460 TO 3990	26	f3
APRON LONG TOP L		20	f4	1	13 550	32	1	11 490	27	1	9430	22	1	7370	17	1	13 550	32	1	11 490	27	1	9430	22	1	7370	17	f4
APRON LONG TOP S		20	f5	1	11 950	28	1	10 150	24	1	8350	20	1	6550	15	1	11 950	28	1	10 150	24	1	8350	20	1	6550	15	f5
PARAPET VERT		15	i1	54	1880	159	53	1880	156	53	1880	156	52	1880	153	46	1880	136	45	1880	133	45	1880	133	44	1880	130	i1
PARAPET HORIZ		25	j1	4	8300	130	4	8140	128	4	8140	128	4	8070	127	4	7060	111	4	6900	108	4	6900	108	4	6820	107	j1
APRON TRANS TOP		20	m1	6 (LENGTH VARIES)	8220 TO 8480	118	6 (LENGTH VARIES)	8070 TO 8330	116	6 (LENGTH VARIES)	8070 TO 8330	116	6 (LENGTH VARIES)	7990 TO 8250	115	5 (LENGTH VARIES)	6980 TO 7190	83	5 (LENGTH VARIES)	6830 TO 7040	82	5 (LENGTH VARIES)	6830 TO 7040	82	5 (LENGTH VARIES)	6750 TO 6960	81	m1
APRON TRANS TOP		20	m2	26 (LENGTH VARIES)	8560 TO 11 180	604	19 (LENGTH VARIES)	8400 TO 10 290	418	14 (LENGTH VARIES)	8400 TO 9770	300	8 (LENGTH VARIES)	8330 TO 9060	164	27 (LENGTH VARIES)	7250 TO 9980	548	21 (LENGTH VARIES)	7100 TO 9200	403	15 (LENGTH VARIES)	7100 TO 8570	277	10 (LENGTH VARIES)	7020 TO 7970	177	m2
APRON TRANS TOP		20	m3	4 (LENGTH VARIES)	6030 TO 8220	67	5 (LENGTH VARIES)	5700 TO 8630	84	4 (LENGTH VARIES)	5450 TO 7650	62	5 (LENGTH VARIES)	4440 TO 7360	69	4 (LENGTH VARIES)	5470 TO 7660	62	4 (LENGTH VARIES)	5140 TO 7340	59	4 (LENGTH VARIES)	4900 TO 7090	56	4 (LENGTH VARIES)	3880 TO 6070	47	m3
APRON TRANS TOP		20	m4	3	5540	39	3	5280	37	3	4880	34	3	4550	32	2	5000	24	2	4650	22	2	4290	20	2	3990	19	m4
APRON TRANS BOT		20	m5	24 (LENGTH VARIES)	5460 TO 10 170	470	20 (LENGTH VARIES)	5410 TO 9470	374	16 (LENGTH VARIES)	6410 TO 8830	287	12 (LENGTH VARIES)	6380 TO 8190	205	24 (LENGTH VARIES)	5210 TO 8930	400	20 (LENGTH VARIES)	5160 TO 8230	315	16 (LENGTH VARIES)	5160 TO 7590	240	12 (LENGTH VARIES)	5140 TO 6910	170	m5
CURTAIN HORIZ		20	p1	4	7750	78	4	7700	73	4	7700	73	4	7670	72	4	6510	61	4	6460	61	4	6460	61	4	6430	61	p1
CURTAIN HORIZ L		20	p2	4	6560	62	4	5550	58	4	4750	45	4	3840	36	4	6560	62	4	5550	58	4	4750	45	4	3840	36	p2
CURTAIN HORIZ S		20	p3	4	5060	48	4	4890	41	4	3730	35	4	3060	29	4	5060	48	4	4890	41	4	3730	35	4	3060	29	p3
WING SLOPE EF L		20	s1	2	2580	12	2	2580	12	2	2580	12	2	2580	12	2	2580	12	2	2580	12	2	2580	12	2	2580	12	s1
WING SLOPE EF S		20	s2	2	2430	11	2	2430	11	2	2430	11	2	2430	11	2	2430	11	2	2430	11	2	2430	11	2	2430	11	s2
WING SLOPE EF L		20	s3	2	12 240	58	2	10 090	48	2	7950	37	2	5800	27	2	12 240	58	2	10 090	48	2	7950	37	2	5800	27	s3
WING SLOPE EF S		20	s4	2	10 930	51	2	9030	43	2	7130	34	2	5210	25	2	10 930	51	2	9030	43	2	7130	34	2	5210	25	s4
WING SLOPE FF L		20	s5	1	14 050	33	1	11 930	28	1	9780	23	1	7640	18	1	14 050	33	1	11 930	28	1	9780	23	1	7640	18	s5
WING SLOPE FF S		20	s6	1	12 540	31	1	10 640	25	1	8750	21	1	6850	16	1	12 540	31	1	10 640	25	1	8750	21	1	6850	16	s6
CENTER WALL EFH		20	s7	2	9160	43	2	7780	37	2	6410	30	2	5030	24	2	9160	43	2	7780	37	2	6410	30	2	5030	24	s7
CURTAIN VERT		15	t1	42	2410	159	38	2260	135	34	2110	113	29	1960	89	39	2410	148	35	2260	124	31	2110	103	26	1960	80	t1
	REINF STEEL			5203 kg			4149 kg			3228 kg			2348 kg			4813 kg			3812 kg			2938 kg			2118 kg			
ESTIMATED QUANTITIES ONE HEADWALL	CONC	PARAPET Δ		2.0	68.0 m³		1.9	49.9 m³		1.9	37.7 m³		1.9	26.3 m³		1.8	61.9 m³		1.7	44.9 m³		1.7	33.6 m³		1.7	23.1 m³		
		WINGS		21.7			18.1			8.8			4.8			21.7			18.1			8.8			4.8			
		FOOTING		44.3			34.9			27.0			19.6			38.4			30.1			23.1			16.6			

BENT BAR DETAILS



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

NOTE:

Δ INCLUDES TOP OF WINGWALL QUANTITIES
L DENOTES LONG WING
S DENOTES SHORT WING

HEADWALL NOTES:

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 20 mm 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 900 mm IN EITHER DIRECTION AS OUTLINED IN THE STANDARD SPECIFICATIONS.

CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 50 mm UNLESS OTHERWISE NOTED OR SHOWN. CLEARANCE TO THE BOTTOM ENDS OF VERTICAL BARS SHALL BE 75 mm.

CONCRETE QUANTITIES ARE ESTIMATED FROM BACK OF PARAPET.

HORIZONTAL TAILS OF BARS "b" & "s" ESTIMATED TO EXTEND 600 mm BEYOND BACK OF PARAPET (INTO END OF BARREL). LONGITUDINAL BARS "d", "f1", AND "f3" ESTIMATED TO PROJECT INTO END SECTION OF BARREL A MINIMUM OF 600 mm BEYOND BACK OF PARAPET.

THE "LENGTH" COLUMN REFLECTS TOTAL NUMBER OF MILLIMETERS NECESSARY TO MEET CLEARANCE REQUIREMENTS. "MASS" COLUMN INCLUDES AN ALLOWANCE OF 650 mm FOR LAP ON BARS THAT ARE OVER 12 000 mm LONG.

NOTES:

1. SEE SHEET MTWRCB-GI-95 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.

LATEST REVISION DATE: 04-02

APPROVED BY: [signature]

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
TWIN REINFORCED CONCRETE BOX CULVERTS

PROJECT DEVELOPMENT DIVISION
IOWA DEPARTMENT OF TRANSPORTATION

JULY, 1995

MTWH 15-5-95

REVISED 1/98; BEND DIMENSIONS OF i1 BAR CHANGED.

REVISED 04-02 - VARIOUS LENGTHS CHANGED FOR CONSISTENCY. CONCRETE QUANTITIES ADJUSTED.
TWH155M.SOI