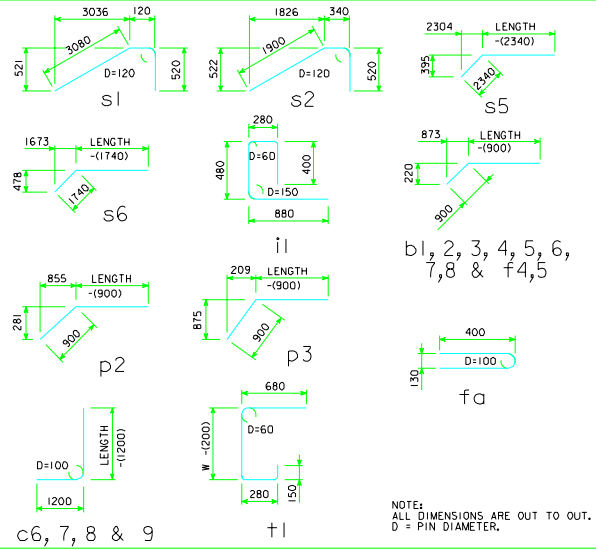
BILL OF REINF. FOR ONE HEADWALL 45° SKEW CULVERT SPAN X CULVERT HEIGHT

LOCATION ΔΔ	SHAPE	SIZE	MARK	3000×3600 NO.	3000×3600 LENGTH	3000×3600 MASS	3000×3000 NO.	3000×3000 LENGTH	3000×3000 MASS	3000×2400 NO.	3000×2400 LENGTH	3000×2400 MASS	3000×1800 NO.	3000×1800 LENGTH	3000×1800 MASS	3000×1500 NO.	3000×1500 LENGTH	3000×1500 MASS	3000×1200 NO.	3000×1200 LENGTH	3000×1200 MASS	MARK
FENCE ANCHOR		15	fa	2	930	9	2	930	3	2	930	3	2	930	3	2	930	3	2	930	3	fa
WINGWALL, BFH L		15	b1	1	22 430	35	1	18 930	30	1	15 430	24	1	11 930	19	1	10 180	16	1	8430	13	b1
WINGWALL, BFH S		15	b2	1	13 800	22	1	11 700	18	1	9600	15	1	7500	12	1	6450	10	1	5400	8	b2
WINGWALL BFH L		15	b3	10 (LENGTH VARIES)	5700 TO 21 450	219	8 (LENGTH VARIES)	5700 TO 17 950	153	6 (LENGTH VARIES)	5700 TO 14 450	97	4 (LENGTH VARIES)	5700 TO 10 950	52	3 (LENGTH VARIES)	5700 TO 9200	35	2 (LENGTH VARIES)	5700 TO 7450	21	b3
WINGWALL BFH S		15	b4	10 (LENGTH VARIES)	3780 TO 13 220	135	8 (LENGTH VARIES)	3780 TO 11 120	94	6 (LENGTH VARIES)	3780 TO 9020	60	4 (LENGTH VARIES)	3780 TO 6920	34	3 (LENGTH VARIES)	3780 TO 5880	23	2 (LENGTH VARIES)	3780 TO 4830	14	b4
WINGWALL FFH L		15	b5	1	22 430	35	1	18 930	30	1	15 430	24	1	11 930	19	1	10 180	16	1	8430	13	b5
WINGWALL FFH S		15	b6	1	13 800	23	1	11 700	18	1	9600	15	1	7500	12	1	6450	10	1	5400	8	b6
WINGWALL FFH L		15	b7	11 (LENGTH VARIES)	3960 TO 21 450	226	9 (LENGTH VARIES)	3960 TO 17 950	159	7 (LENGTH VARIES)	3960 TO 14 450	103	5 (LENGTH VARIES)	3960 TO 10 950	59	4 (LENGTH VARIES)	3960 TO 9200	41	3 (LENGTH VARIES)	3960 TO 7450	27	b7
WINGWALL FFH S		15	b8	11 (LENGTH VARIES)	2730 TO 13 220	140	9 (LENGTH VARIES)	2730 TO 11 120	98	7 (LENGTH VARIES)	2730 TO 9020	65	5 (LENGTH VARIES)	2730 TO 6920	38	4 (LENGTH VARIES)	2730 TO 5880	27	3 (LENGTH VARIES)	2730 TO 4830	18	b8
WINGWALL FFV L		15	c1	72 (LENGTH VARIES)	810 TO 4460	298	60 (LENGTH VARIES)	810 TO 3840	219	49 (LENGTH VARIES)	810 TO 3270	157	37 (LENGTH VARIES)	810 TO 2660	101	31 (LENGTH VARIES)	810 TO 2350	77	25 (LENGTH VARIES)	810 TO 2040	56	c1
WINGWALL FFV S		15	c2	43 (LENGTH VARIES)	820 TO 4420	177	36 (LENGTH VARIES)	820 TO 3820	131	29 (LENGTH VARIES)	820 TO 3220	92	22 (LENGTH VARIES)	820 TO 2620	59	19 (LENGTH VARIES)	820 TO 2360	47	15 (LENGTH VARIES)	820 TO 2020	33	c2
WINGWALL FFV L		15	c3	2	4850	14	2	3750	12	2	3150	10	2	2550	8	2	2250	7	2	1950	6	c3
WINGWALL FFV S		15	c3	2	4850	14	2	3750	12	2	3150	10	2	2550	8	2	2250	7	2	1950	6	c3
WINGWALL BFV L		15	c4	15 (LENGTH VARIES)	810 TO 1530	28	15 (LENGTH VARIES)	810 TO 1530	28	15 (LENGTH VARIES)	810 TO 1530	28	15 (LENGTH VARIES)	810 TO 1530	28	15 (LENGTH VARIES)	810 TO 1530	28	15 (LENGTH VARIES)	810 TO 1530	28	c4
WINGWALL BFV S		15	c5	4 (LENGTH VARIES)	820 TO 1080	6	4 (LENGTH VARIES)	820 TO 1080	6	4 (LENGTH VARIES)	820 TO 1080	6	4 (LENGTH VARIES)	820 TO 1080	6	4 (LENGTH VARIES)	820 TO 1080	6	4 (LENGTH VARIES)	820 TO 1080	6	c5
WINGWALL BFV L		15	c6	57 (LENGTH VARIES)	2780 TO 5660	378	45 (LENGTH VARIES)	2780 TO 5040	276	34 (LENGTH VARIES)	2780 TO 4470	194	22 (LENGTH VARIES)	2780 TO 3860	115	16 (LENGTH VARIES)	2780 TO 3550	80	10 (LENGTH VARIES)	2780 TO 3240	47	c6
WINGWALL BFV S		15	c7	39 (LENGTH VARIES)	2360 TO 5620	244	32 (LENGTH VARIES)	2360 TO 5020	185	25 (LENGTH VARIES)	2360 TO 4420	133	18 (LENGTH VARIES)	2360 TO 3820	87	15 (LENGTH VARIES)	2360 TO 3560	70	11 (LENGTH VARIES)	2360 TO 3220	48	c7
WINGWALL BFV L		15	c8	41	3150	203	30	3150	148	18	3150	89	---	---	0	---	---	0	---	---	0	c8
WINGWALL BFV S		15	c8	26	3150	129	19	3150	94	12	3150	59	---	---	0	---	---	0	---	---	0	c8
WINGWALL BFV L		15	c9	1	5550	9	1	4950	8	1	4350	7	1	3750	6	1	3450	5	1	3150	5	c9
WINGWALL BFV S		15	c9	2	5550	17	2	4950	16	2	4350	14	2	3750	12	2	3450	11	2	3150	10	c9
APRON, LONG BOT		15	d1	7	11 670	128	7	9970	110	7	8270	91	7	6580	72	7	5730	63	7	4880	54	d1
APRON, LONG BOT L		15	d2	3	21 170	100	3	17 680	83	3	14 200	67	3	10 730	51	3	9000	42	3	7280	34	d2
APRON, LONG BOT S		15	d3	3	12 790	60	3	10 700	50	3	8610	41	3	6540	31	3	5510	26	3	4480	21	d3
APRON, LONG TOP		20	f1	10	11 670	275	10	9970	235	10	8270	195	10	6580	155	10	5730	135	10	4880	115	f1
APRON, LONG TOP L		20	f2	17 (LENGTH VARIES)	460 TO 10 150	212	14 (LENGTH VARIES)	570 TO 8450	149	11 (LENGTH VARIES)	670 TO 6750	96	8 (LENGTH VARIES)	780 TO 5060	55	7 (LENGTH VARIES)	830 TO 4210	39	6 (LENGTH VARIES)	280 TO 3360	26	f2
APRON, LONG TOP S		20	f3	10 (LENGTH VARIES)	920 TO 10 060	129	9 (LENGTH VARIES)	220 TO 8360	91	8 (LENGTH VARIES)	530 TO 6660	59	5 (LENGTH VARIES)	840 TO 4960	34	4 (LENGTH VARIES)	1000 TO 4110	24	3 (LENGTH VARIES)	1170 TO 3250	16	f3
APRON, LONG TOP L		20	f4	1	22 430	53	1	18 930	45	1	15 430	36	1	11 930	28	1	10 180	24	1	8430	20	f4
APRON, LONG TOP S		20	f5	1	13 800	32	1	11 700	28	1	9600	23	1	7500	18	1	6450	15	1	5400	13	f5
PARAPET, VERT		15	j1	21	2040	67	21	2040	67	21	2040	67	21	2040	67	21	2040	67	21	2040	67	j1
PARAPET, HORIZ		25	j1	4	4960	78	4	4820	76	4	4820	76	4	4750	75	4	4750	75	4	4750	75	j1
APRON, TRANS TOP		20	m1	8 (LENGTH VARIES)	3810 TO 4200	75	8 (LENGTH VARIES)	3710 TO 4100	74	8 (LENGTH VARIES)	3710 TO 4100	74	8 (LENGTH VARIES)	3660 TO 4040	73	8 (LENGTH VARIES)	3660 TO 4040	73	8 (LENGTH VARIES)	3660 TO 4040	73	m1
APRON, TRANS TOP		20	m2	34 (LENGTH VARIES)	4240 TO 7870	485	26 (LENGTH VARIES)	4140 TO 6890	338	18 (LENGTH VARIES)	4140 TO 6010	215	10 (LENGTH VARIES)	4090 TO 5080	108	7 (LENGTH VARIES)	4090 TO 4750	73	3 (LENGTH VARIES)	4090 TO 4310	30	m2
APRON, TRANS TOP		20	m3	9	5160	109	9	4700	100	9	4270	91	9	3810	81	9	3730	79	9	3380	72	m3
APRON, TRANS BOT		20	m4	25 (LENGTH VARIES)	2000 TO 9680	344	21 (LENGTH VARIES)	2000 TO 8400	257	17 (LENGTH VARIES)	2000 TO 7120	183	13 (LENGTH VARIES)	2000 TO 5840	120	11 (LENGTH VARIES)	2000 TO 5200	93	9 (LENGTH VARIES)	2000 TO 4560	70	m4
CURTAIN, HORIZ		20	p1	4	4140	39	4	4140	39	4	4140	39	4	4140	39	4	4140	39	4	4140	39	p1
CURTAIN, HORIZ L		20	p2	4	12 740	126	4	10 840	102	4	8940	84	4	7040	66	4	6090	57	4	5150	49	p2
CURTAIN, HORIZ S		20	p3	4	4700	44	4	4090	39	4	3480	33	4	2870	27	4	2570	24	4	2260	21	p3
WING SLOPE EF L		20	s1	2	3720	18	2	3720	18	2	3720	18	2	3720	18	2	3720	18	2	3720	18	s1
WING SLOPE EF S		20	s2	2	2760	13	2	2760	13	2	2760	13	2	2760	13	2	2760	13	2	2760	13	s2
WING SLOPE EF L		20	s3	2	19 670	93	2	16 120	76	2	12 570	59	2	9020	42	2	7250	34	2	5470	26	s3
WING SLOPE EF S		20	s4	2	12 450	62	2	10 270	48	2	8080	38	2	5900	28	2	4810	23	2	3720	18	s4
WING SLOPE FF L		20	s5	1	22 720	54	1	19 180	45	1	15 620	37	1	12 070	28	1	10 300	24	1	8530	20	s5
WING SLOPE FF S		20	s6	1	14 260	35	1	12 080	30	1	9910	23	1	7710	18	1	6620	16	1	5530	13	s6
CURTAIN, VERT		15	t1	47	2410	178	40	2260	142	34	2110	113	27	1960	83	23	1960	71	20	1960	62	t1
	REINF STEEL			5163 kg			3993 kg			2976 kg			2008 kg			1666 kg			1335 kg		
ESTIMATED QUANTITIES ONE HEADWALL	CONC	PARAPET Δ		1.7	71.2 m³		1.5	50.3 m³		1.5	36.5 m³		1.5	23.9 m³		1.5	19.4 m³		1.5	15.3 m³		
		WINGS		24.6			14.9			10.2			5.6			4.1			2.8			
		FOOTING		44.9			33.9			24.8			16.8			13.8			11.0			

NOTES: Δ INCLUDES TOP OF WINGWALL QUANTITIES.

ΔΔSUBSCRIPT L DENOTES LONG WING.
SUBSCRIPT S DENOTES SHORT WING.

BENT BAR DETAILS



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

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", "f4" AND "f5" 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.

ALL DIMENSIONS ARE IN MILLIMETERS (mm) UNLESS OTHERWISE NOTED OR SHOWN.

NOTES:

1. SEE SHEET MRCB-G1-95 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.

LATEST REVISION DATE : 04-02

APPROVED BY : William A. Kuehnpast

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
REINFORCED CONCRETE BOX CULVERTS

PROJECT DEVELOPMENT DIVISION
IOWA DEPARTMENT OF TRANSPORTATION

JULY, 1995

MFWH 45-2-95

REVISED 04-02 - CONCRETE QUANTITIES ADJUSTED.
FWH452CM.SQI

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

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