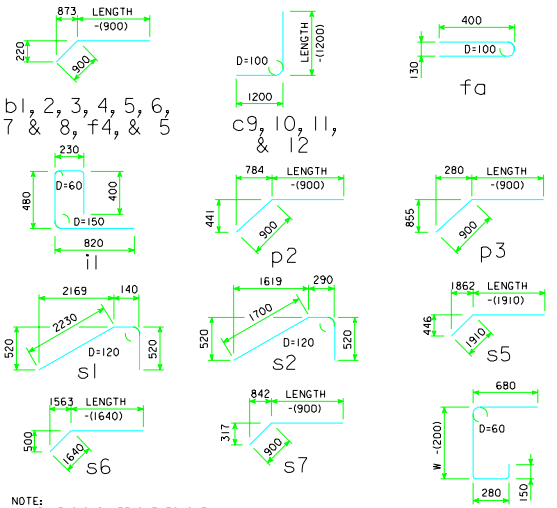
BILL OF REINFORCING FOR ONE HEADWALL 30° SKEW CULVERT SPAN X CULVERT HEIGHT

LOCATION	SHAPE	SIZE	MARK	3600×3600 NO.	3600×3600 LENGTH	3600×3600 MASS	3600×3000 NO.	3600×3000 LENGTH	3600×3000 MASS	3600×2400 NO.	3600×2400 LENGTH	3600×2400 MASS	3600×1800 NO.	3600×1800 LENGTH	3600×1800 MASS
FENCE ANCHOR		15	fa	2	930	3	2	930	3	2	930	3	2	930	3
WINGWALL BFH L		15	b1	1	16 290	26	1	13 790	22	1	11 280	18	1	8780	14
WINGWALL BFH S		15	b2	1	12 400	19	1	10 520	17	1	8650	14	1	6780	11
WINGWALL BFH L		15	b3	10 (LENGTH VARIES)	4330 TO 15 600	156	8 (LENGTH VARIES)	4330 TO 13 100	109	6 (LENGTH VARIES)	4330 TO 10 590	70	4 (LENGTH VARIES)	4330 TO 8090	39
WINGWALL BFH S		15	b4	10 (LENGTH VARIES)	3460 TO 11 890	120	8 (LENGTH VARIES)	3460 TO 10 020	85	6 (LENGTH VARIES)	3460 TO 8140	55	4 (LENGTH VARIES)	3460 TO 6270	31
WINGWALL FFH L		15	b5	1	16 290	26	1	13 790	22	1	11 280	18	1	8780	14
WINGWALL FFH S		15	b6	1	12 400	19	1	10 520	17	1	8650	14	1	6780	11
WINGWALL FFH L		15	b7	11 (LENGTH VARIES)	3080 TO 15 600	161	9 (LENGTH VARIES)	3080 TO 13 100	114	7 (LENGTH VARIES)	3080 TO 10 590	75	5 (LENGTH VARIES)	3080 TO 8090	44
WINGWALL FFH S		15	b8	11 (LENGTH VARIES)	2530 TO 11 890	125	9 (LENGTH VARIES)	2530 TO 10 020	89	7 (LENGTH VARIES)	2530 TO 8140	59	5 (LENGTH VARIES)	2530 TO 6270	35
CENTER WALL EFH		15	b9	21 (LENGTH VARIES)	1550 TO 9150	176	17 (LENGTH VARIES)	1550 TO 7780	125	13 (LENGTH VARIES)	1560 TO 6390	81	9 (LENGTH VARIES)	1590 TO 5000	47
WINGWALL FFV L		15	c1	51 (LENGTH VARIES)	830 TO 4430	211	43 (LENGTH VARIES)	830 TO 3850	158	35 (LENGTH VARIES)	830 TO 3280	113	26 (LENGTH VARIES)	830 TO 2630	71
WINGWALL FFV S		15	c2	58 (LENGTH VARIES)	840 TO 4400	156	52 (LENGTH VARIES)	840 TO 3830	117	26 (LENGTH VARIES)	840 TO 3250	83	20 (LENGTH VARIES)	840 TO 2670	55
WINGWALL EFV L		15	c3	2	4370	14	2	3770	12	1	3170	5	1	2570	4
WINGWALL EFV S		15	c3	2	4370	14	2	3770	12	1	3170	5	2	2570	8
CENTER WALL EFV		15	c4	2	500	2	2	500	2	2	500	2	2	500	2
CENTER WALL EFV		15	c5	55 (LENGTH VARIES)	560 TO 8760	187	46 (LENGTH VARIES)	560 TO 8160	134	36 (LENGTH VARIES)	560 TO 2520	87	27 (LENGTH VARIES)	550 TO 1930	53
CENTER WALL EFV		15	c6	2	4830	12	2	4230	10	2	2630	8	2	2030	5
WINGWALL BFV L		15	c7	11 (LENGTH VARIES)	830 TO 1550	21	11 (LENGTH VARIES)	830 TO 1550	21	11 (LENGTH VARIES)	830 TO 1550	21	11 (LENGTH VARIES)	830 TO 1550	21
WINGWALL BFV S		15	c8	6 (LENGTH VARIES)	840 TO 1330	10	6 (LENGTH VARIES)	840 TO 1330	10	6 (LENGTH VARIES)	840 TO 1330	10	6 (LENGTH VARIES)	840 TO 1330	10
WINGWALL BFV L		15	c9	40 (LENGTH VARIES)	2830 TO 5630	266	32 (LENGTH VARIES)	2830 TO 5050	198	24 (LENGTH VARIES)	2830 TO 4480	138	15 (LENGTH VARIES)	2830 TO 3830	78
WINGWALL BFV S		15	c10	32 (LENGTH VARIES)	2620 TO 5600	206	26 (LENGTH VARIES)	2620 TO 5030	156	20 (LENGTH VARIES)	2620 TO 4450	111	14 (LENGTH VARIES)	2620 TO 3870	71
WINGWALL BFV L		15	c11	29	3150	143	21	3150	104	13	3150	64	---	---	0
WINGWALL BFV S		15	c11	21	3150	104	14	3150	69	8	3150	40	---	---	0
WINGWALL BFV L		15	c12	2	5570	17	2	4970	15	1	4370	7	1	3770	5
WINGWALL BFV S		15	c12	2	5570	17	2	4970	15	1	4370	7	2	3770	12
APRON LONG BOT		15	d1	17	9530	254	17	8140	217	17	6760	180	17	5370	143
APRON LONG BOT L		15	d2	3	14 850	70	3	12 460	58	3	9870	46	3	7400	35
APRON LONG BOT S		15	d3	3	11 160	53	3	9800	44	3	7450	35	3	5600	26
APRON LONG TOP		20	f1	24	9530	589	24	8140	460	24	6760	382	24	5370	304
APRON LONG TOP L		20	f2	12 (LENGTH VARIES)	930 TO 8660	134	10 (LENGTH VARIES)	920 TO 7170	95	8 (LENGTH VARIES)	900 TO 5790	63	6 (LENGTH VARIES)	890 TO 4400	37
APRON LONG TOP S		20	f3	9 (LENGTH VARIES)	1180 TO 8630	104	8 (LENGTH VARIES)	700 TO 7240	75	6 (LENGTH VARIES)	1160 TO 5850	50	5 (LENGTH VARIES)	680 TO 4470	30
APRON LONG TOP L		20	f4	1	16 290	38	1	13 790	32	1	11 280	27	1	8780	21
APRON LONG TOP S		20	f5	1	12 400	29	1	10 520	25	1	8650	20	1	6780	16
PARAPET VERT		15	j1	54	1930	164	53	1930	161	53	1930	161	52	1930	158
PARAPET HORIZ		25	j1	4	8260	145	4	9080	143	4	9080	143	4	9000	141
APRON TRANS TOP		20	m1	12 (LENGTH VARIES)	8500 TO 9080	248	12 (LENGTH VARIES)	8450 TO 8930	244	12 (LENGTH VARIES)	8450 TO 8930	244	11 (LENGTH VARIES)	8270 TO 8800	241
APRON TRANS TOP		20	m2	18 (LENGTH VARIES)	9170 TO 10 950	426	12 (LENGTH VARIES)	9010 TO 10 170	271	5 (LENGTH VARIES)	9010 TO 9430	109	---	---	0
APRON TRANS TOP		20	m3	10 (LENGTH VARIES)	5740 TO 8540	168	10 (LENGTH VARIES)	5140 TO 7940	154	10 (LENGTH VARIES)	4910 TO 7720	149	10 (LENGTH VARIES)	4350 TO 7150	135
APRON TRANS BOT		20	m4	6	5540	78	5	5130	72	5	4800	68	5	4400	62
APRON TRANS BOT		20	m5	24 (LENGTH VARIES)	7170 TO 11 870	538	20 (LENGTH VARIES)	7120 TO 11 000	427	16 (LENGTH VARIES)	7120 TO 10 180	326	12 (LENGTH VARIES)	7090 TO 9330	232
CURTAIN HORIZ		20	p1	4	8620	81	4	8560	81	4	8560	81	4	8530	80
CURTAIN HORIZ L		20	p2	4	8450	80	4	7240	68	4	6030	57	4	4820	45
CURTAIN HORIZ S		20	p3	4	4790	45	4	4170	39	4	3540	33	4	2920	28
WING SLOPE EF L		20	s1	2	2890	14	2	2890	14	2	2890	14	2	2890	14
WING SLOPE EF S		20	s2	2	2510	12	2	2510	12	2	2510	12	2	2510	12
WING SLOPE EF L		20	s3	2	14 560	68	2	11 980	56	2	9410	44	2	6840	32
WING SLOPE EF S		20	s4	2	11 300	53	2	9350	44	2	7880	35	2	5410	25
WING SLOPE FF L		20	s5	1	16 700	39	1	14 120	33	1	11 550	27	1	8970	21
WING SLOPE FF S		20	s6	1	12 910	30	1	10 940	26	1	8980	21	1	7010	17
CENTER WALL EFH		20	s7	2	8940	47	2	8440	40	2	6950	33	2	5430	26
CURTAIN VERT		15	t1	48	2410	182	43	2260	159	38	2110	126	34	1960	105
REINF STEEL				5850 kg			4682 kg			3594 kg			2682 kg		
ESTIMATED CONC QUANTITIES ONE HEADWALL			PARAPET	2.3			2.2			2.2			2.1		
			WINGS	24.4	77.8 m³		14.7	57.0 m³		9.9	43.0 m³		5.4	29.8 m³	
			FOOTING	51.1			40.1			30.9			22.3		

LOCATION	SHAPE	SIZE	MARK	8000×3600 NO.	8000×3600 LENGTH	8000×3600 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	MARK
FENCE ANCHOR		15	fa	2	930	3	2	930	3	2	930	3	2	930	3	fa
WINGWALL BFH L		15	b1	1	16 290	26	1	13 790	22	1	11 280	18	1	8780	14	b1
WINGWALL BFH S		15	b2	1	12 400	19	1	10 520	17	1	8650	14	1	6780	11	b2
WINGWALL BFH L		15	b3	10 (LENGTH VARIES)	4330 TO 15 600	156	8 (LENGTH VARIES)	4330 TO 13 100	109	6 (LENGTH VARIES)	4330 TO 10 590	70	4 (LENGTH VARIES)	4330 TO 8090	39	b3
WINGWALL BFH S		15	b4	10 (LENGTH VARIES)	3460 TO 11 890	120	8 (LENGTH VARIES)	3460 TO 10 020	85	6 (LENGTH VARIES)	3460 TO 8140	55	4 (LENGTH VARIES)	3460 TO 6270	31	b4
WINGWALL FFH L		15	b5	1	16 290	26	1	13 790	22	1	11 280	18	1	8780	14	b5
WINGWALL FFH S		15	b6	1	12 400	19	1	10 520	17	1	8650	14	1	6780	11	b6
WINGWALL FFH L		15	b7	11 (LENGTH VARIES)	3080 TO 15 600	161	9 (LENGTH VARIES)	3080 TO 13 100	114	7 (LENGTH VARIES)	3080 TO 10 590	75	5 (LENGTH VARIES)	3080 TO 8090	44	b7
WINGWALL FFH S		15	b8	11 (LENGTH VARIES)	2530 TO 11 890	125	9 (LENGTH VARIES)	2530 TO 10 020	89	7 (LENGTH VARIES)	2530 TO 8140	59	5 (LENGTH VARIES)	2530 TO 6270	35	b8
CENTER WALL EFH		15	b9	21 (LENGTH VARIES)	1550 TO 9150	176	17 (LENGTH VARIES)	1550 TO 7780	125	13 (LENGTH VARIES)	1560 TO 6390	81	9 (LENGTH VARIES)	1590 TO 5000	47	b9
WINGWALL FFV L		15	c1	51 (LENGTH VARIES)	810 TO 4410	209	43 (LENGTH VARIES)	810 TO 3830	157	35 (LENGTH VARIES)	810 TO 3260	112	26 (LENGTH VARIES)	810 TO 2610	70	c1
WINGWALL FFV S		15	c2	38 (LENGTH VARIES)	820 TO 4380	155	32 (LENGTH VARIES)	820 TO 3810	116	26 (LENGTH VARIES)	820 TO 3230	88	20 (LENGTH VARIES)	820 TO 2650	54	c2
WINGWALL EFV L		15	c3	2	4350	14	2	3750	12	1	3150	5	1	2550	4	c3
WINGWALL EFV S		15	c3	2	4350	14	2	3750	12	1	3150	5	2	2550	8	c3
CENTER WALL EFV		15	c4	2	480	2	2	480	2	2	480	2	2	480	2	c4
CENTER WALL EFV		15	c5	55 (LENGTH VARIES)	540 TO 2740	185	46 (LENGTH VARIES)	540 TO 2140	123	36 (LENGTH VARIES)	540 TO 2500	86	27 (LENGTH VARIES)	530 TO 1910	52	c5
CENTER WALL EFV		15	c6	2	3810	12	2	3210	10	2	2610	8	2	2010	6	c6
WINGWALL BFV L		15	c7	11 (LENGTH VARIES)	810 TO 1530	20	11 (LENGTH VARIES)	810 TO 1530	20	11 (LENGTH VARIES)	810 TO 1530	20	11 (LENGTH VARIES)	810 TO 1530	20	c7
WINGWALL BFV S		15	c8	6 (LENGTH VARIES)	820 TO 1310	10	6 (LENGTH VARIES)	820 TO 1310	10	6 (LENGTH VARIES)	820 TO 1310	10	6 (LENGTH VARIES)	820 TO 1310	10	c8
WINGWALL BFV L		15	c9	40 (LENGTH VARIES)	2810 TO 5030	197	32 (LENGTH VARIES)	2810 TO 4460	137	24 (LENGTH VARIES)	2810 TO 3810	78	15 (LENGTH VARIES)	2810 TO 3810	78	c9
WINGWALL BFV S		15	c10	26 (LENGTH VARIES)	2600 TO 5010	155	20 (LENGTH VARIES)	2600 TO 4430	110	14 (LENGTH VARIES)	2600 TO 3850	71	8 (LENGTH VARIES)	2600 TO 3850	71	c10
WINGWALL BFV L		15	c11	21	3150	104	13	3150	64	---	---	0	---	---	0	c11
WINGWALL BFV S		15	c11	14	3150	69	8	3150	40	---	---	0	---	---	0	c11
WINGWALL BFV L		15	c12	2	4950	16	1	4350	7	1	3750	6	1	3750	6	c12
WINGWALL BFV S		15	c12	2	4950	16	1	4350	7	2	3750	12	2	3750	12	c12
APRON LONG BOT		15	d1	13	8140	166	13	6760	138	13	5370	110	13	5370	110	d1
APRON LONG BOT L		15	d2	3	12 360	58	3	9870	46	3	7400	35	3	7400	35	d2
APRON LONG BOT S		15	d3	3	9300	44	3	7450	35	3	5600	26	3	5600	26	d3
APRON LONG TOP		20	f1	20	8140	383	20	6760	318	20	5370	253	20	5370	253	f1
APRON LONG TOP L		20	f2	10 (LENGTH VARIES)	920 TO 7170	95	8 (LENGTH VARIES)	900 TO 5790	63	6 (LENGTH VARIES)	890 TO 4400	37	6 (LENGTH VARIES)	890 TO 4400	37	f2
APRON LONG TOP S		20	f3	9 (LENGTH VARIES)	1180 TO 7240	104	8 (LENGTH VARIES)	700 TO 5850	75	6 (LENGTH VARIES)	1160 TO 5850	50	5 (LENGTH VARIES)	680 TO 4470	30	f3
APRON LONG TOP L		20	f4	1	16 290	38	1	13 790	32	1	11 280	27	1	8780	21	f4
APRON LONG TOP S		20	f5	1	12 400	29	1	10 520	25	1	8650	20	1	6780	16	f5
PARAPET VERT		15	j1	45	1930	136	45	1930	136	45	1930	136	44	1930	133	j1
PARAPET HORIZ		25	j1	4	7700	121	4	7700	121	4	7700	121	4	7610	119	j1
APRON TRANS TOP		20	m1	10 (LENGTH VARIES)	7060 TO 7530	172	10 (LENGTH VARIES)	7060 TO 7530	172	10 (LENGTH VARIES)	7060 TO 7530	172	10 (LENGTH VARIES)	6980 TO 7460	170	m1
APRON TRANS TOP		20	m2	16 (LENGTH VARIES)	7600 TO 9180	316	9 (LENGTH VARIES)	7600 TO 8440	170	9 (LENGTH VARIES)	7600 TO 8440	170	2 (LENGTH VARIES)	7530 TO 7640	36	m2
APRON TRANS TOP		20	m3	8 (LENGTH VARIES)	4620 TO 6800	108	8 (LENGTH VARIES)	4400 TO 6580	103	8 (LENGTH VARIES)	4400 TO 6580	103	8 (LENGTH VARIES)	4140 TO 6520	99	m3
APRON TRANS BOT		20	m4	5	4520	54	5	4240	50	5	3840	45	5	3840	45	m4
APRON TRANS BOT		20	m5	20 (LENGTH VARIES)	5730 TO 9610	361	16 (LENGTH VARIES)	5730 TO 8790	274	16 (LENGTH VARIES)	5730 TO 8790	274	12 (LENGTH VARIES)	5700 TO 7950	193	m5
CURTAIN HORIZ		20	p1	4	7180	68	4	7180	68	4	7180	68	4	7150	67	p1
CURTAIN HORIZ L		20	p2	4	7240	68	4	6030	57	4	4820	45	4	4820	45	p2
CURTAIN HORIZ S		20	p3	4	4170	39	4	3540	33	4	2920	28	4	2920	28	p3
WING SLOPE EF L		20	s1	2	2890	14	2	2890	14	2	2890	14	2	2890	14	s1
WING SLOPE EF S		20	s2	2	2510	12	2	2510	12	2	2510	12	2	2510	12	s2
WING SLOPE EF L		20	s3	2	11 980	56	2	9410	44	2	6840	32	2	6840	32	s3
WING SLOPE EF S		20	s4	2	9350	44	2	7880	35	2	5410	25	2	5410	25	s4
WING SLOPE FF L		20	s5	1	16 700	39	1	14 120	33	1	11 550	27	1	8970	21	s5
WING SLOPE FF S		20	s6	1	12 910	30	1	10 940	26	1	8980	21	1	7010	17	s6
CENTER WALL EFH		20	s7	2	8440	40	2	6950	33	2	5430	26	2	5430	26	s7
CURTAIN VERT		15	t1	40	2260	142	34	2110	113	30	1960	92	30	1960	92	t1
REINF STEEL				5485 kg			4320 kg			3283 kg			2844 kg			
ESTIMATED CONC QUANTITIES ONE HEADWALL			PARAPET	2.0			2.0			2.0			1.9			
			WINGS	24.4	71.0 m³		14.7	51.4 m³		9.9	38.4 m³		5.4	26.3 m³		
			FOOTING	44.6			34.7			28.5			19.0			

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-G1-95 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.

LATEST REVISION DATE : 04-02

APPROVED BY : William A. Kruckenberg

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
TWIN REINFORCED CONCRETE BOX CULVERTS

PROJECT DEVELOPMENT DIVISION
IOWA DEPARTMENT OF TRANSPORTATION

JULY, 1995

MTWH 30-5-95

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

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

TWH30SM.S01

XXXXXXXXXXSYSTEMTIME XXXXXXXXUSERNAME XXXXXXXXXX