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

LOCATION	SHAPE	BAR	8' X 10'			8' X 8'			8' X 6'			8' X 5'			8' X 4'			6' X 8'			6' X 6'			6' X 5'			6' X 4'			6' X 3'			BAR
			NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	
FENCE ANCHOR		5fa	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	5fa
WINGWALL, B.F.H. L		4b1	1	38'-3	26	1	31'-5	21	1	24'-6	16	1	21'-1	14	1	17'-8	12	1	31'-5	21	1	24'-6	16	1	21'-1	14	1	17'-8	12	1	14'-3	10	4b1
WINGWALL, B.F.H. S		4b2	1	33'-10	23	1	27'-10	19	1	21'-10	15	1	18'-10	13	1	15'-10	11	1	27'-10	19	1	21'-10	15	1	18'-10	13	1	15'-10	11	1	12'-10	9	4b2
WINGWALL, B.F.H. L		4b3	8 VAR	12'-8 TO 36'-8	132	6 VAR	12'-8 TO 29'-10	85	4 VAR	12'-7 TO 22'-11	47	3 VAR	12'-8 TO 19'-6	32	2 VAR	12'-8 TO 16'-1	19	6 VAR	12'-8 TO 29'-10	85	4 VAR	12'-7 TO 22'-11	47	3 VAR	12'-8 TO 19'-6	32	2 VAR	12'-8 TO 16'-1	19	1	12'-7	8	4b3
WINGWALL, B.F.H. S		4b4	8 VAR	11'-3 TO 32'-3	116	6 VAR	11'-3 TO 26'-3	75	4 VAR	11'-3 TO 20'-3	42	3 VAR	11'-3 TO 17'-3	29	2 VAR	11'-3 TO 14'-3	17	6 VAR	11'-3 TO 26'-3	75	4 VAR	11'-3 TO 20'-3	42	3 VAR	11'-3 TO 17'-3	29	2 VAR	11'-3 TO 14'-3	17	1	11'-3	8	4b4
WINGWALL, F.F.H. L		5b5	1	38'-3	40	1	31'-5	33	1	24'-6	26	1	21'-1	22	1	17'-8	18	1	31'-5	33	1	24'-6	26	1	21'-1	22	1	17'-8	18	1	14'-3	15	5b5
WINGWALL, F.F.H. S		5b6	1	33'-10	35	1	27'-10	29	1	21'-10	23	1	18'-10	20	1	15'-10	17	1	27'-10	29	1	21'-10	23	1	18'-10	20	1	15'-10	17	1	12'-10	13	5b6
WINGWALL, F.F.H. L		5b7	9 VAR	9'-2 TO 36'-8	215	7 VAR	9'-2 TO 29'-10	142	5 VAR	9'-2 TO 22'-11	84	4 VAR	9'-2 TO 19'-6	60	3 VAR	9'-2 TO 16'-1	40	7 VAR	9'-2 TO 29'-10	142	5 VAR	9'-2 TO 22'-11	84	4 VAR	9'-2 TO 19'-6	60	3 VAR	9'-2 TO 16'-1	40	2 VAR	9'-2 TO 12'-7	23	5b7
WINGWALL, F.F.H. S		5b8	9 VAR	8'-3 TO 32'-3	190	7 VAR	8'-3 TO 26'-3	126	5 VAR	8'-3 TO 20'-3	74	4 VAR	8'-3 TO 17'-3	53	3 VAR	8'-3 TO 14'-3	35	7 VAR	8'-3 TO 26'-3	126	5 VAR	8'-3 TO 20'-3	74	4 VAR	8'-3 TO 17'-3	53	3 VAR	8'-3 TO 14'-3	35	2 VAR	8'-3 TO 11'-3	20	5b8
WINGWALL, F.F.V. L		4c1	35 VAR	2'-7 TO 12'-6	176	28 VAR	2'-7 TO 10'-5	122	21 VAR	2'-7 TO 8'-5	77	18 VAR	2'-7 TO 7'-7	62	14 VAR	2'-7 TO 6'-4	41	28 VAR	2'-7 TO 10'-5	122	21 VAR	2'-7 TO 8'-5	77	18 VAR	2'-7 TO 7'-7	62	14 VAR	2'-7 TO 6'-4	41	11 VAR	2'-7 TO 5'-6	30	4c1
WINGWALL, F.F.V. S		4c2	31 VAR	2'-8 TO 12'-8	159	25 VAR	2'-8 TO 10'-8	111	19 VAR	2'-8 TO 8'-8	72	16 VAR	2'-8 TO 7'-8	55	13 VAR	2'-8 TO 6'-8	41	25 VAR	2'-8 TO 10'-8	111	19 VAR	2'-8 TO 8'-8	72	16 VAR	2'-8 TO 7'-8	55	13 VAR	2'-8 TO 6'-8	41	10 VAR	2'-8 TO 5'-8	28	4c2
WINGWALL, F.F.V. L		4c3	2	11'-6	15	2	9'-6	13	2	7'-6	10	2	6'-6	9	2	5'-6	7	2	9'-6	13	2	7'-6	10	2	6'-6	9	2	5'-6	7	2	4'-6	6	4c3
WINGWALL, F.F.V. S		4c3	1	11'-6	8	1	9'-6	6	1	7'-6	5	1	6'-6	4	1	5'-6	4	1	9'-6	6	1	7'-6	5	1	6'-6	4	1	5'-6	4	1	4'-6	3	4c3
WINGWALL, B.F.V. L		5c4	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	9 VAR	2'-7 TO 4'-11	35	5c4
WINGWALL, B.F.V. S		5c5	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	6 VAR	2'-8 TO 4'-4	22	5c5
WINGWALL, B.F.V. L		5c6	26 VAR	9'-2 TO 16'-5	347	19 VAR	9'-2 TO 14'-5	234	12 VAR	9'-2 TO 12'-4	135	9 VAR	9'-2 TO 11'-6	97	5 VAR	9'-2 TO 10'-4	51	19 VAR	9'-2 TO 14'-5	234	12 VAR	9'-2 TO 12'-4	135	9 VAR	9'-2 TO 11'-6	97	5 VAR	9'-2 TO 10'-4	51	2 VAR	9'-2 TO 9'-5	19	5c6
WINGWALL, B.F.V. S		5c7	25 VAR	8'-8 TO 16'-8	330	19 VAR	8'-8 TO 14'-8	231	13 VAR	8'-8 TO 12'-8	145	10 VAR	8'-8 TO 11'-8	106	7 VAR	8'-8 TO 10'-8	71	19 VAR	8'-8 TO 14'-8	231	13 VAR	8'-8 TO 12'-8	145	10 VAR	8'-8 TO 11'-8	106	7 VAR	8'-8 TO 10'-8	71	4 VAR	8'-8 TO 9'-8	38	5c7
WINGWALL, B.F.V. L		5c8	17	10'-6	186	10	10'-6	110	-	-	-	-	-	-	-	-	-	10	10'-6	110	-	-	-	-		-	-	-	-	-	-	-	5c8
WINGWALL, B.F.V. S		5c8	13	10'-6	142	7	10'-6	77	-	-	-	-	-	-	-	-	-	7	10'-6	77	-	-	-	-		-	-	-	-	-	-	-	5c8
WINGWALL, B.F.V. L		5c9	2	15'-5	32	2	13'-5	28	2	11'-5	24	2	10'-5	22	2	9'-5	20	2	13'-5	28	2	11'-5	24	2	10'-5	22	2	9'-5	20	2	8'-5	18	5c9
WINGWALL, B.F.V. S		5c9	1	15'-5	16	1	13'-5	14	1	11'-5	12	1	10'-5	11	1	9'-5	10	1	13'-5	14	1	11'-5	12	1	10'-5	11	1	9'-5	10	1	8'-5	9	5c9
APRON, LONGIT., BOTT.		4d1	5	24'-2	81	5	20'-0	67	5	15'-11	53	5	13'-10	46	5	11'-9	39	5	20'-0	67	5	15'-11	53	5	13'-10	46	5	11'-9	39	5	9'-8	32	4d1
APRON, LONGIT., BOTT. L		4d2	3	32'-8	65	3	25'-11	52	3	19'-1	38	3	15'-10	32	3	12'-5	25	3	25'-11	52	3	19'-1	38	3	15'-10	32	3	12'-5	25	3	9'-2	18	4d2
APRON, LONGIT., BOTT. S		4d3	3	29'-0	58	3	23'-1	47	3	17'-2	35	3	14'-3	29	3	11'-4	23	3	23'-1	47	3	17'-2	35	3	14'-3	29	3	11'-4	23	3	8'-6	17	4d3
APRON, LONGIT., TOP		6f1	8	24'-2	290	8	20'-0	240	8	15'-11	191	8	13'-10	166	8	11'-9	141	6	20'-0	180	6	15'-11	143	6	13'-10	125	6	11'-9	106	6	9'-8	87	6f1
APRON, LONGIT., TOP L		6f2	6 VAR	7'-9 TO 20'-5	127	5 VAR	6'-0 TO 16'-3	84	3 VAR	6'-11 TO 12'-1	43	2 VAR	7'-1 TO 9'-8	25	1	7'-7	11	5 VAR	6'-0 TO 16'-3	84	3 VAR	6'-11 TO 12'-1	43	2 VAR	7'-1 TO 9'-8	25	1	7'-7	11	1	5'-6	8	6f2
APRON, LONGIT., TOP S		6f3	5 VAR	8'-8 TO 20'-4	109	4 VAR	7'-5 TO 16'-2	71	3 VAR	6'-1 TO 12'-0	41	2 VAR	6'-7 TO 9'-7	24	1	7'-6	11	4 VAR	7'-5 TO 16'-2	71	3 VAR	6'-1 TO 12'-0	41	2 VAR	6'-7 TO 9'-7	24	1	7'-6	11	1	5'-5	8	6f3
APRON, LONGIT., TOP L		6f4	1	38'-3	57	1	31'-5	47	1	24'-6	37	1	21'-1	32	1	17'-8	27	1	31'-5	47	1	24'-6	37	1	21'-1	32	1	17'-8	27	1	14'-2	21	6f4
APRON, LONGIT., TOP S		6f5	1	33'-10	51	1	27'-10	42	1	21'-10	33	1	18'-10	28	1	15'-10	24	1	27'-10	42	1	21'-10	33	1	18'-10	28	1	15'-10	24	1	12'-10	19	6f5
PARAPET, VERTICAL		4i1	17	6'-2	70	17	6'-2	70	17	6'-2	70	17	6'-2	70	17	6'-2	70	13	6'-2	54	13	6'-2	54	13	6'-2	54	13	6'-2	54	13	6'-2	54	4i1
PARAPET, HORIZONTAL		7j1	4	8'-7	70	4	8'-7	70	4	8'-7	70	4	8'-7	70	4	8'-7	70	4	6'-6	53	4	6'-6	53	4	6'-6	53	4	6'-6	53	4	6'-6	53	7j1
APRON, TRANS., TOP		6m1	3 VAR	10'-1 TO 10'-5	46	3 VAR	10'-1 TO 10'-5	46	3 VAR	9'-11 TO 10'-3	45	3 VAR	9'-11 TO 10'-3	45	3 VAR	9'-11 TO 10'-3	45	2 VAR	7'-10 TO 8'-0	24	2 VAR	7'-10 TO 8'-0	24	2 VAR	7'-10 TO 8'-0	24	2 VAR	7'-10 TO 8'-0	24	2 VAR	7'-10 TO 8'-0	24	6m1
APRON, TRANS., TOP		6m2	25 VAR	10'-7 TO 19'-7	566	20 VAR	10'-7 TO 17'-9	426	14 VAR	10'-5 TO 15'-4	271	12 VAR	10'-5 TO 14'-7	225	9 VAR	10'-5 TO 13'-5	161	21 VAR	8'-1 TO 15'-7	373	16 VAR	8'-1 TO 13'-8	261	13 VAR	8'-1 TO 12'-7	202	10 VAR	8'-1 TO 11'-5	146	8 VAR	8'-1 TO 10'-8	113	6m2
APRON, TRANS., TOP		6m3	3	13'-3	60	3	12'-5	56	3	11'-1	50	3	10'-9	48	3	10'-3	46	3	10'-4	47	3	9'-6	43	3	8'-10	40	3	8'-3	37	3	7'-8	35	6m3
APRON, TRANS., BOTT.		6m4	20 VAR	3'-10 TO 14'-1	269	16 VAR	3'-8 TO 12'-0	188	12 VAR	3'-8 TO 9'-9	121	10 VAR	3'-10 TO 8'-8	94	8 VAR	3'-9 TO 7'-8	69	16 VAR	1'-10 TO 9'-10	140	12 VAR	1'-10 TO 7'-9	86	10 VAR	1'-10 TO 6'-8	64	8 VAR	1'-10 TO 5'-7	45	6 VAR	1'-10 TO 4'-3	27	6m4
CURTAIN, HORIZONTAL		6p1	4	8'-9	53	4	8'-9	53	4	8'-9	53	4	8'-9	53	4	8'-9	53	4	6'-8	40	4	6'-8	40	4	6'-8	40	4	6'-8	40	4	6'-8	40	6p1
CURTAIN, HORIZONTAL L		6p2	4	18'-9	113	4	15'-9	95	4	12'-9	77	4	11'-3	68	4	9'-8	58	4	15'-9	95	4	12'-9	77	4	11'-3	68	4	9'-8	58	4	8'-2	49	6p2
CURTAIN, HORIZONTAL S		6p3	4	14'-7	88	4	12'-5	75	4	10'-2	61	4	9'-1	55	4	8'-0	48	4	12'-5	75	4	10'-2	61	4	9'-1	55	4	8'-0	48	4	6'-10	41	6p3
WING SLOPE, BOTH F. L		6s1	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	6s1
WING SLOPE, BOTH F. S		6s2	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	6s2
WING SLOPE, BOTH F. L		6s3	2	34'-7	104	2	27'-6	83	2	20'-4	61	2	16'-9	50	2	13'-2	40	2	27'-6	83	2	20'-4	61	2	16'-9	50	2	13'-2	40	2	9'-7	29	6s3
WING SLOPE, BOTH F. S		6s4	2	31'-0	93	2	24'-8	74	2	18'-4	55	2	15'-3	46	2	12'-0	36	2	24'-8	74	2	18'-4	55	2	15'-3	46	2	12'-0	36	2	8'-10	27	6s4
WING SLOPE, F.F L		6s5	1	38'-11	58	1	31'-9	48	1	24'-7	37	1	21'-1	32	1	17'-6	26	1	31'-9	48	1	24'-7	37	1	21'-1	32	1	17'-6	26	1	13'-11	21	6s5
WING SLOPE, F.F S		6s6	1	34'-11	52	1	28'-8	43	1	22'-4	34	1	19'-2	29	1	15'-11	24	1	28'-8	43	1	22'-4	34	1	19'-2	29	1	15'-11	24	1	12'-10	19	6s6
CURTAIN, VERT.		5t1	24	7'-5	186	22	6'-11	159	16	6'-5	107	14	6'-5	94	12	6'-5	80	19	6'-11	137	14	6'-5	94	12	6'-5	80	10	6'-5	67	8	6'-5	54	5t1
ESTIMATED QUANTITIES ONE HEADWALL	REINF. STEEL		4959 lbs.			3717 lbs.			2495 lbs.			2075 lbs.			1646 lbs.			3457 lbs.			2315 lbs.			1892 lbs.			1483 lbs.			1158 lbs.			
	CONCRETE	PARAPET △	1.4	39.6 cu. yd.		1.4	28.9 cu. yd.		1.3	18.8 cu. yd.		1.3	15.4 cu. yd.		1.3	12.2 cu. yd.		1.3	27.0 cu. yd.		1.2	17.6 cu. yd.		1.2	14.2 cu. yd.		1.2	11.3 cu. yd.		1.2	8.4 cu. yd.		
		WINGWALLS	14.1			9.6			5.3			3.9			2.7			9.6			5.3			3.9			2.7			1.6			
		FOOTINGS	24.1			17.9			12.2			10.2			8.2			16.1			11.1			9.1			7.4			5.6			

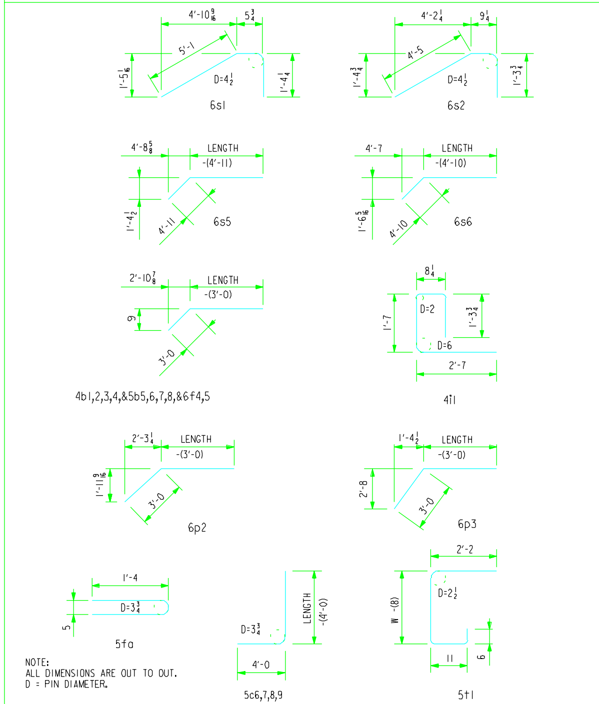
△ NOTE: INCLUDES TOP OF WINGWALL QUANTITIES.
WEIGHT OF BARS OVER 40'-0 LONG INCLUDE AN ALLOWANCE OF 2'-0 FOR LAP.

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

NOTES:

1. SEE DRAWING RCB-GI-87 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.

BENT BAR DETAILS



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 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. CLEARANCE TO THE BOTTOM ENDS OF VERTICAL BARS SHALL BE 3 INCHES.

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", "6f1", "6f4" AND "6f5" 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: 1-1-98

APPROVED BY: [signature]

STANDARD DESIGN

FLARED WING HEADWALLS

FOR REINFORCED CONCRETE BOX CULVERTS

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION

MAY, 1987

FWH 15-2-87

FWH152.SOI REVISED 1/98; BEND DIMENSIONS OF 4i1 BAR CHANGED.

XXXXXXXXXXSYSTEMTIME XXXXXXXUSERNAME XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXDGNSPEC