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

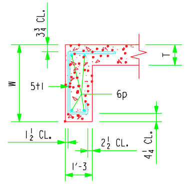
LOCATION		SHAPE	BAR	5' X 6'			5' X 5'			5' X 4'			5' X 3'			BAR
				NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	NO.	LENGTH	WT.	
FENCE ANCHOR			5fa	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	5fa
WINGWALL, B.F.H.	L		4b1	1	39'-9	27	1	33'-11	23	1	28'-1	19	1	22'-3	15	4b1
WINGWALL, B.F.H.	S		4b2	1	25'-0	17	1	21'-6	14	1	18'-0	12	1	14'-6	10	4b2
WINGWALL, B.F.H.	L		4b3	4 VAR	19'-5 TO 36'-10	75	3 VAR	19'-5 TO 31'-0	51	2 VAR	19'-5 TO 25'-2	30	1	19'-5	13	4b3
WINGWALL, B.F.H.	S		4b4	4 VAR	12'-9 TO 23'-3	48	3 VAR	12'-9 TO 19'-9	33	2 VAR	12'-9 TO 16'-3	19	1	12'-9	9	4b4
WINGWALL, F.F.H.	L		5b5	1	39'-9	41	1	33'-11	35	1	28'-1	29	1	22'-3	23	5b5
WINGWALL, F.F.H.	S		5b6	1	25'-0	26	1	21'-6	22	1	18'-0	19	1	14'-6	15	5b6
WINGWALL, F.F.H.	L		5b7	5 VAR	13'-6 TO 36'-10	131	4 VAR	13'-6 TO 31'-0	93	3 VAR	13'-6 TO 25'-2	60	2 VAR	13'-6 TO 19'-5	34	5b7
WINGWALL, F.F.H.	S		5b8	5 VAR	9'-3 TO 23'-3	85	4 VAR	9'-3 TO 19'-9	60	3 VAR	9'-3 TO 16'-3	40	2 VAR	9'-3 TO 12'-9	23	5b8
WINGWALL, F.F.V.	L		4c1	37 VAR	2'-7 TO 8'-9	140	31 VAR	2'-7 TO 7'-8	106	25 VAR	2'-7 TO 6'-8	77	19 VAR	2'-7 TO 5'-8	52	4c1
WINGWALL, F.F.V.	S		4c2	22 VAR	2'-7 TO 8'-7	82	19 VAR	2'-7 TO 7'-8	65	15 VAR	2'-7 TO 6'-7	46	12 VAR	2'-7 TO 5'-9	33	4c2
WINGWALL, F.F.V.	L		4c3	1	7'-6	5	2	6'-6	9	2	5'-6	7	2	4'-6	6	4c3
WINGWALL, F.F.V.	S		4c3	2	7'-6	10	1	6'-6	4	2	5'-6	7	1	4'-6	3	4c3
WINGWALL, B.F.V.	L		5c4	15 VAR	2'-7 TO 5'-0	59	15 VAR	2'-7 TO 5'-0	59	15 VAR	2'-7 TO 5'-0	59	15 VAR	2'-7 TO 5'-0	59	5c4
WINGWALL, B.F.V.	S		5c5	4 VAR	2'-7 TO 3'-5	13	4 VAR	2'-7 TO 3'-5	13	4 VAR	2'-7 TO 3'-5	13	4 VAR	2'-7 TO 3'-5	13	5c5
WINGWALL, B.F.V.	L		5c6	22 VAR	9'-2 TO 12'-9	251	16 VAR	9'-2 TO 11'-8	174	10 VAR	9'-2 TO 10'-8	103	4 VAR	9'-2 TO 9'-8	39	5c6
WINGWALL, B.F.V.	S		5c7	18 VAR	7'-9 TO 12'-7	191	15 VAR	7'-9 TO 11'-8	152	11 VAR	7'-9 TO 10'-7	105	8 VAR	7'-9 TO 9'-9	73	5c7
WINGWALL, B.F.V.	L		5c8	-	-	-	-	-	-	-	-	-	-	-	-	5c8
WINGWALL, B.F.V.	S		5c8	-	-	-	-	-	-	-	-	-	-	-	-	5c8
WINGWALL, B.F.V.	L		5c9	1	11'-5	12	2	10'-5	22	2	9'-5	20	2	8'-5	18	5c9
WINGWALL, B.F.V.	S		5c9	2	11'-5	24	1	10'-5	11	2	9'-5	20	1	8'-5	9	5c9
APRON, LONGIT., BOTT.			4d1	3	20'-8	41	3	17'-10	36	3	15'-0	30	3	12'-2	24	4d1
APRON, LONGIT., BOTT.	L		4d2	3	32'-6	65	3	26'-9	54	3	21'-0	42	3	15'-4	31	4d2
APRON, LONGIT., BOTT.	S		4d3	3	21'-0	42	3	17'-7	35	3	14'-2	28	3	10'-10	22	4d3
APRON, LONGIT., TOP			6f1	5	20'-8	155	5	17'-10	134	5	15'-0	113	5	12'-2	91	6f1
APRON, LONGIT., TOP	L		6f2	6 VAR	6'-10 TO 17'-0	107	5 VAR	6'-0 TO 14'-2	76	4 VAR	5'-2 TO 11'-4	50	3 VAR	4'-4 TO 8'-6	29	6f2
APRON, LONGIT., TOP	S		6f3	4 VAR	6'-5 TO 16'-9	70	3 VAR	6'-11 TO 13'-10	47	3 VAR	4'-4 TO 11'-0	35	2 VAR	4'-8 TO 8'-2	19	6f3
APRON, LONGIT., TOP	L		6f4	1	39'-9	60	1	33'-11	51	1	28'-1	42	1	22'-3	33	6f4
APRON, LONGIT., TOP	S		6f5	1	25'-0	38	1	21'-6	32	1	18'-0	27	1	14'-6	22	6f5
PARAPET, VERTICAL			4i1	11	6'-8	49	11	6'-8	49	11	6'-8	49	11	6'-8	49	4i1
PARAPET, HORIZONTAL			7j1	4	7'-4	60	4	7'-4	60	4	7'-4	60	4	7'-4	60	7j1
APRON, TRANS., TOP			6m1	5 VAR	7'-2 TO 7'-11	57	5 VAR	7'-2 TO 7'-11	57	5 VAR	7'-2 TO 7'-11	57	5 VAR	7'-2 TO 7'-11	57	6m1
APRON, TRANS., TOP			6m2	18 VAR	8'-0 TO 14'-5	303	14 VAR	8'-0 TO 12'-11	219	10 VAR	8'-0 TO 11'-5	146	7 VAR	8'-0 TO 10'-3	96	6m2
APRON, TRANS., TOP			6m3	4	9'-0	54	4	8'-1	49	4	7'-4	44	4	6'-10	41	6m3
APRON, TRANS., BOTT.			6m4	10 VAR	2'-9 TO 12'-4	113	8 VAR	2'-9 TO 10'-3	78	6 VAR	2'-9 TO 8'-1	49	4 VAR	2'-9 TO 6'-0	26	6m4
CURTAIN, HORIZONTAL			6p1	4	7'-3	44	4	7'-3	44	4	7'-3	44	4	7'-3	44	6p1
CURTAIN, HORIZONTAL	L		6p2	4	23'-4	140	4	20'-2	121	4	17'-0	102	4	13'-11	84	6p2
CURTAIN, HORIZONTAL	S		6p3	4	9'-7	58	4	8'-7	52	4	7'-6	45	4	6'-6	39	6p3
WING SLOPE, BOTH F.	L		6s1	2	8'-4	25	2	8'-4	25	2	8'-4	25	2	8'-4	25	6s1
WING SLOPE, BOTH F.	S		6s2	2	7'-11	24	2	7'-11	24	2	7'-11	24	2	7'-11	24	6s2
WING SLOPE, BOTH F.	L		6s3	2	33'-10	102	2	27'-11	84	2	22'-0	66	2	16'-2	49	6s3
WING SLOPE, BOTH F.	S		6s4	2	20'-6	62	2	16'-10	51	2	13'-2	40	2	9'-6	29	6s4
WING SLOPE, F.F	L		6s5	1	39'-1	59	1	33'-2	50	1	27'-3	41	1	21'-4	32	6s5
WING SLOPE, F.F	S		6s6	1	25'-6	38	1	21'-11	33	1	18'-3	27	1	14'-8	22	6s6
CURTAIN, VERT.			5t1	19	6'-5	127	17	6'-5	114	13	6'-5	87	10	6'-5	67	5t1

ESTIMATED QUANTITIES ONE HEADWALL			5' X 6'		5' X 5'		5' X 4'		5' X 3'	
	REINF. STEEL		3137 lbs.		2528 lbs.		1965 lbs.		1469 lbs.	
	CONCRETE	PARAPET Δ	1.5	25.9 cu. yd.	1.5	20.6 cu. yd.	1.5	15.9 cu. yd.	1.5	11.8 cu. yd.
		WINGWALLS	7.7		5.6		3.8		2.3	
		FOOTINGS	16.7		13.5		10.6		8.0	

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

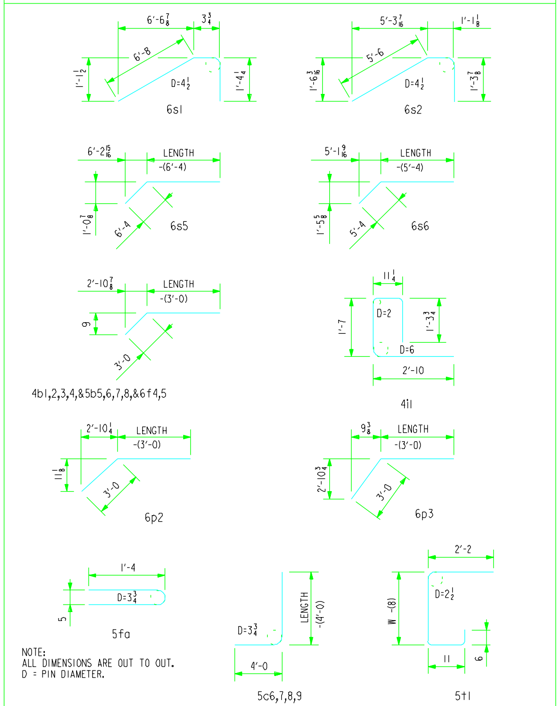
SUBSCRIPT L DENOTES LONG WING.
SUBSCRIPT S DENOTES SHORT WING.

FWH453.S01 REVISED 1/98; BEND DIMENSIONS OF 4i1 BAR CHANGED.



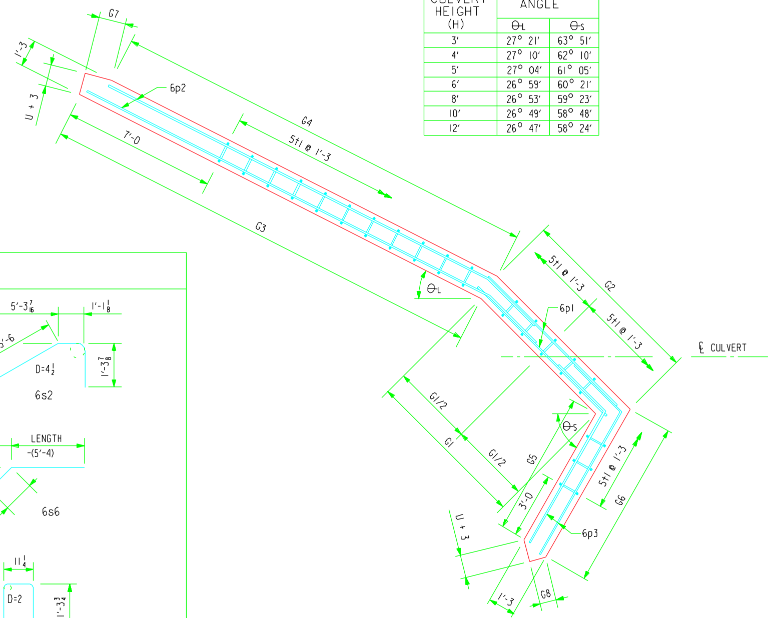
SECTION THRU CURTAIN WALL

BENT BAR DETAILS



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

CULVERT HEIGHT (H)	ANGLE	
	θ_L	θ_S
3'	27° 21'	63° 51'
4'	27° 10'	62° 10'
5'	27° 04'	61° 05'
6'	26° 59'	60° 21'
8'	26° 53'	59° 23'
10'	26° 49'	58° 48'
12'	26° 47'	58° 24'



CURTAIN WALL DETAIL

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.

NOTES:

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

LATEST REVISION DATE : 1-1-98

APPROVED BY : William A. Lundquist

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
REINFORCED CONCRETE BOX CULVERTS

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION

MAY , 1987

FWH 45-3-87

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