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

LOCATION	SHAPE	5′ x 6′				5′ x 5′				5′ x 4′				5′ x 3′			
		BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.
FENCE ANCHOR (GALV.)		5fa	2	3′-1	6	5fa	2	3′-1	6	5fa	2	3′-1	6	5fa	2	3′-1	6
WINGWALL, F.F.H.		5b1	2	30′-4	63	5b1	2	26′-1	54	5b1	2	21′-10	46	5b1	2	17′-7	37
WINGWALL, F.F.H.		5b2	10 VAR	2 EACH 11′-11₂28′-11	213	5b2	8 VAR	2 EACH 11′-11₂24′-8	153	5b2	6 VAR	2 EACH 11′-11₂20′-5	101	5b2	4 VAR	2 EACH 11′-11₂16′-2	59
WINGWALL, B.F.H.		4b3	2	30′-8	41	4b3	2	26′-5	35	4b3	2	22′-2	30	4b3	2	17′-11	24
WINGWALL, B.F.H.		4b4	8 VAR	2 EACH 16′-6₂29′-3	122	4b4	6 VAR	2 EACH 16′-6₂25′-0	83	4b4	4 VAR	2 EACH 16′-6₂20′-9	50	4b4	2	16′-6	22
WINGWALL, F.F.V.		4c1	54 VAR	2 EACH 2′-5₂8′-7	198	4c1	46 VAR	2 EACH 2′-5₂7′-8	155	4c1	36 VAR	2 EACH 2′-5₂6′-5	106	4c1	28 VAR	2 EACH 2′-5₂5′-6	74
WINGWALL, F.F.V. (O)		4c2	2	8′-9	12	4c2	2	7′-9	10	4c2	2	6′-9	9	4c2	2	5′-9	8
WINGWALL, F.F.V. (A)		4c2	3	8′-9	18	4c2	3	7′-9	16	4c2	3	6′-9	14	4c2	3	5′-9	12
WINGWALL, B.F.V.		6c3	54 VAR	2 EACH 6′-0₂12′-2	737	5c3	46 VAR	2 EACH 6′-0₂11′-3	414	5c3	36 VAR	2 EACH 6′-0₂10′-0	300	5c3	28 VAR	2 EACH 6′-0₂9′-1	220
WINGWALL, B.F.V. (O)		6c4	1	12′-3	18	5c4	1	11′-3	12	5c4	1	10′-3	11	5c4	1	9′-3	10
WINGWALL, B.F.V. (A)		6c4	4	12′-3	74	5c4	4	11′-3	47	5c4	4	10′-3	43	5c4	4	9′-3	39
WINGWALL, B.F.V.		c5	–	–	–	c5	–	–	–	c5	–	–	–	c5	–	–	–
APRON, LONGIT., BOTT.		4d1	5	30′-1	100	4d1	5	25′-10	86	4d1	5	21′-8	72	4d1	5	17′-5	58
APRON, LONGIT., TOP		6f1	6	30′-1	271	6f1	6	25′-10	233	6f1	6	21′-8	195	6f1	6	17′-5	157
PARAPET, VERTICAL		4l1	15	7′-10	78	4l1	15	7′-10	78	4l1	15	7′-10	78	4l1	15	7′-10	78
PARAPET, HORIZ.		7j1	4	8′-9	72	7j1	4	8′-9	72	7j1	4	8′-9	72	7j1	4	8′-9	72
APRON, TRANS., TOP		6m1	26	6′-8	260	6m1	22	6′-8	220	6m1	17	6′-8	170	6m1	13	6′-8	130
APRON, TRANS., TOP		6m2	4 VAR	2′-1₂5′-1	22	6m2	3 VAR	2′-10₂4′-10	17	6m2	4 VAR	2′-8₂5′-8	25	6m2	4 VAR	2′-5₂5′-5	24
APRON, TRANS., BOTT.		4m3	19	5′-1	65	4m3	16	5′-1	54	4m3	13	5′-1	44	4m3	10	5′-1	34
CURTAIN, HORIZ.		6p1	5	8′-9	66	6p1	5	8′-9	66	6p1	5	8′-9	66	6p1	5	8′-9	66
WING SLOPE, BOTH F.		6s1	4	21′-11	132	6s1	4	17′-7	106	6s1	4	13′-2	79	6s1	4	8′-10	53
WING SLOPE, BOTH F. (O)		6s2	2	9′-9	29	6s2	2	9′-9	29	6s2	2	9′-9	29	6s2	2	9′-9	29
WING SLOPE, BOTH F. (A)		6s3	2	10′-5	31	6s3	2	10′-5	31	6s3	2	10′-5	31	6s3	2	10′-5	31
WING SLOPE, F. F.		6s4	2	13′-8	41	6s4	2	13′-8	41	6s4	2	13′-8	41	6s4	2	13′-8	41
WING SLOPE, F. F.		6s5	2	19′-11	60	6s5	2	15′-7	47	6s5	2	11′-3	34	6s5	2	6′-10	21
CURTAIN, VERT.		5t1	8	6′-5	54	5t1	8	6′-5	54	5t1	8	6′-5	54	5t1	8	6′-5	54
CURTAIN, VERT., ENDS		5t2	4	6′-10	29	5t2	4	6′-10	29	5t2	4	6′-10	29	5t2	4	6′-10	29
BRACKET, VERT.		5u1	4	5′-3	22	5u1	4	5′-3	22	5u1	4	5′-3	22	5u1	4	5′-3	22

ESTIMATED QUANTITIES ONE HEADWALL	REINF. STEEL	2834 LBS.			2170 LBS.			1757 LBS.			1410 LBS.		
	CONCRETE	PARAPET Δ	1.3	17.4 CU.YD.	PARAPET Δ	1.3	14.4 CU.YD.	PARAPET Δ	1.3	11.7 CU.YD.	PARAPET Δ	1.3	9.1 CU.YD.
		WINGWALLS	7.0		WINGWALLS	5.2		WINGWALLS	3.6		WINGWALLS	2.2	
		APRON	9.1		APRON	7.9		APRON	6.8		APRON	5.6	

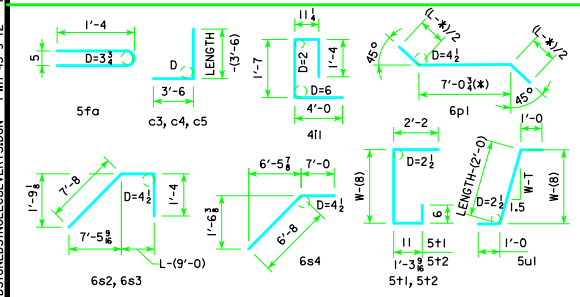
Δ INCLUDES TOP OF WINGWALL QUANTITIES.

NOTE: WEIGHT OF BARS OVER 40′-0 LONG INCLUDE AN ALLOWANCE OF 2′-0 FOR LAP.

(A) - INDICATES BAR LOCATED AT ACUTE CORNER.
(O) - INDICATES BAR LOCATED AT OBTUSE CORNER.
REFER TO SHEET PWH 45-1-12 FOR ACUTE AND OBTUSE CORNER LOCATIONS.

c BAR PIN DIAMETER	
BAR SIZE	D
4	3
5	3¾
6	4½

BENT BAR DETAILS



NOTE: ALL DIMENSIONS ARE OUT TO OUT.
SEE TABLE AT RIGHT FOR PIN DIAMETER "D" OF c BARS

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 ¾" 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 "4d1" AND "6f1" 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

APPROVED BY BRIDGE ENGINEER

Iowa Department of Transportation
Highway Division

STANDARD DESIGN - SINGLE REINFORCED CONCRETE BOX CULVERTS

PARALLEL WING HEADWALLS

APRIL, 2012

QUANTITY TABULATION
5′-0 SPAN
45° SKEW

PWH 45-9-12

ENGLISH\LRFDSIGNEDS\NGLECULVERTS.DGN - PWH 45-9-12 - THIS SHEET ISSUED 04-12.