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

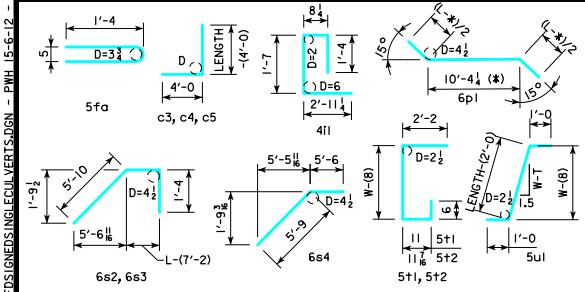
LOCATION	SHAPE	10′ x 12″				10′ x 11″				10′ x 10′				10′ x 9′				10′ x 8′				10′ x 7′				10′ x 6′				10′ x 5′				10′ x 4′			
		BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.	BAR	NO.	LENGTH	WT.
FENCE ANCHOR (GALV.)		5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6	5fa	2	2′-10	6
WINGWALL, F.F.H.		5b1	2	41′-3	90	5b1	2	38′-2	80	5b1	2	35′-0	73	5b1	2	31′-11	67	5b1	2	28′-10	60	5b1	2	25′-8	54	5b1	2	22′-7	47	5b1	2	19′-6	41	5b1	2	16′-5	34
WINGWALL, F.F.H.		5b2	22 VAR	2 EACH 9′-2±40′-2	570	5b2	20 VAR	2 EACH 9′-2±37′-1	482	5b2	18 VAR	2 EACH 9′-2±34′-0	405	5b2	16 VAR	2 EACH 9′-2±30′-11	334	5b2	14 VAR	2 EACH 9′-2±27′-9	270	5b2	12 VAR	2 EACH 9′-2±24′-8	212	5b2	10 VAR	2 EACH 9′-2±21′-7	160	5b2	8 VAR	2 EACH 9′-2±18′-5	115	5b2	6 VAR	2 EACH 9′-2±15′-4	77
WINGWALL, B.F.H.		4b3	2	41′-5	58	4b3	2	38′-3	51	4b3	2	35′-1	47	4b3	2	32′-0	43	4b3	2	28′-11	39	4b3	2	25′-9	34	4b3	2	22′-8	30	4b3	2	19′-7	26	4b3	2	16′-6	22
WINGWALL, B.F.H.		4b4	20 VAR	2 EACH 12′-5±40′-4	355	4b4	18 VAR	2 EACH 12′-5±37′-3	299	4b4	16 VAR	2 EACH 12′-4±34′-1	248	4b4	14 VAR	2 EACH 12′-4±31′-0	203	4b4	12 VAR	2 EACH 12′-4±27′-11	161	4b4	10 VAR	2 EACH 12′-4±24′-9	124	4b4	8 VAR	2 EACH 12′-4±21′-8	91	4b4	6 VAR	2 EACH 12′-4±18′-6	62	4b4	4 VAR	2 EACH 12′-4±15′-5	37
WINGWALL, F.F.V.		5c1	152 VAR	2 EACH 2′-8±14′-9	1381	6c1	70 VAR	2 EACH 2′-8±13′-7	854	5c1	86 VAR	2 EACH 2′-8±12′-10	695	5c1	76 VAR	2 EACH 2′-8±11′-7	565	5c1	52 VAR	2 EACH 2′-8±10′-9	364	4c1	46 VAR	2 EACH 2′-8±9′-9	191	4c1	40 VAR	2 EACH 2′-8±8′-9	153	4c1	34 VAR	2 EACH 2′-8±7′-10	119	4c1	26 VAR	2 EACH 2′-8±6′-6	80
WINGWALL, F.F.V. (O)		5c2	2	14′-11	31	6c2	2	13′-11	42	5c2	2	12′-11	27	5c2	2	11′-11	25	5c2	2	10′-11	23	4c2	2	9′-11	13	4c2	2	8′-11	12	4c2	2	7′-11	11	4c2	2	6′-11	9
WINGWALL, F.F.V. (A)		5c2	2	14′-11	31	6c2	2	13′-11	42	5c2	2	12′-11	27	5c2	2	11′-11	25	5c2	2	10′-11	23	4c2	2	9′-11	13	4c2	2	8′-11	12	4c2	2	7′-11	11	4c2	2	6′-11	9
WINGWALL, B.F.V.		6c3	76 VAR	2 EACH 6′-9±18′-8	1451	6c3	70 VAR	2 EACH 6′-9±17′-8	1284	6c3	64 VAR	2 EACH 6′-9±16′-9	1130	5c3	58 VAR	2 EACH 6′-9±15′-9	681	5c3	52 VAR	2 EACH 6′-9±14′-10	585	5c3	46 VAR	2 EACH 6′-9±13′-10	494	6c3	40 VAR	2 EACH 6′-9±12′-10	588	6c3	34 VAR	2 EACH 6′-9±11′-11	477	5c3	26 VAR	2 EACH 6′-9±10′-7	235
WINGWALL, B.F.V. (O)		6c4	1	18′-11	28	6c4	1	17′-11	27	6c4	2	16′-11	51	5c4	2	15′-11	33	5c4	2	14′-11	31	5c4	2	13′-11	29	6c4	2	12′-11	39	6c4	2	11′-11	36	5c4	2	10′-11	23
WINGWALL, B.F.V. (A)		6c4	2	18′-11	57	6c4	2	17′-11	54	6c4	2	16′-11	51	5c4	2	15′-11	33	5c4	2	14′-11	31	5c4	2	13′-11	29	6c4	2	12′-11	39	6c4	2	11′-11	36	5c4	2	10′-11	23
WINGWALL, B.F.V.		6c5	50	9′-0	676	6c5	46	9′-0	622	6c5	42	9′-0	568	5c5	36	9′-0	338	5c5	34	9′-0	319	5c5	30	9′-0	282	c5	—	—	—	c5	—	—	—	c5	—	—	—
APRON, LONGIT., BOTT.		4d1	9	41′-2	260	4d1	9	38′-1	229	4d1	9	35′-0	210	4d1	9	31′-10	191	4d1	9	28′-9	173	4d1	9	25′-8	154	4d1	9	22′-6	135	4d1	9	19′-5	117	4d1	9	16′-4	98
APRON, LONGIT., TOP		6f1	11	41′-2	713	6f1	11	38′-1	629	6f1	11	35′-0	578	6f1	11	31′-10	526	6f1	11	28′-9	475	6f1	11	25′-8	424	6f1	11	22′-6	372	6f1	11	19′-5	321	6f1	11	16′-4	270
PARAPET, VERTICAL		4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92	4l1	21	6′-7	92
PARAPET, HORIZ.		7j1	4	12′-1	99	7j1	4	12′-1	99	7j1	4	11′-9	96	7j1	4	11′-9	96	7j1	4	11′-9	96	7j1	4	11′-7	95	7j1	4	11′-7	95	7j1	4	11′-7	95	7j1	4	11′-7	95
APRON, TRANS., TOP		6m1	51	12′-2	932	6m1	47	12′-2	859	6m1	42	11′-10	746	6m1	38	11′-10	675	6m1	34	11′-10	604	6m1	30	11′-8	526	6m1	26	11′-8	456	6m1	22	11′-8	386	6m1	18	11′-8	315
APRON, TRANS., TOP		6m2	3 VAR	3′-2±8′-9	27	6m2	3 VAR	2′-9±8′-4	25	6m2	4 VAR	2′-2±10′-7	38	6m2	3 VAR	4′-7±10′-2	33	6m2	3 VAR	4′-2±9′-10	32	6m2	3 VAR	3′-9±9′-4	29	6m2	3 VAR	3′-4±8′-11	28	6m2	3 VAR	2′-11±8′-6	26	6m2	3 VAR	2′-6±8′-2	24
APRON, TRANS., BOTT.		5m3	73	8′-4	634	6m3	34	9′-2	468	6m3	31	8′-10	411	6m3	28	8′-10	371	5m3	25	8′-0	209	4m3	22	7′-0	103	4m3	19	7′-0	89	4m3	16	7′-0	75	4m3	13	7′-0	61
CURTAIN, HORIZ.		6p1	6	12′-6	113	6p1	6	12′-6	113	6p1	6	12′-2	110	6p1	6	12′-2	110	6p1	6	12′-2	110	6p1	5	12′-0	90	6p1	5	12′-0	90	6p1	5	12′-0	90	6p1	5	12′-0	90
WING SLOPE, BOTH F.		6s1	4	36′-9	221	6s1	4	33′-5	201	6s1	4	30′-2	181	6s1	4	26′-11	162	6s1	4	23′-8	142	6s1	4	20′-5	123	6s1	4	17′-2	103	6s1	4	13′-11	84	6s1	4	10′-7	64
WING SLOPE, BOTH F. (O)		6s2	2	7′-10	24	6s2	2	7′-10	24	6s2	2	7′-11	24	6s2	2	7′-11	24	6s2	2	7′-11	24	6s2	2	7′-10	24	6s2	2	7′-10	24	6s2	2	7′-10	24	6s2	2	7′-10	24
WING SLOPE, BOTH F. (A)		6s3	2	8′-1	24	6s3	2	8′-1	24	6s3	2	8′-1	24	6s3	2	8′-1	24	6s3	2	8′-1	24	6s3	2	8′-0	24	6s3	2	8′-0	24	6s3	2	8′-0	24	6s3	2	8′-0	24
WING SLOPE, F. F.		6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34	6s4	2	11′-3	34
WING SLOPE, F. F.		6s5	2	34′-5	103	6s5	2	31′-2	94	6s5	2	27′-11	84	6s5	2	24′-8	74	6s5	2	21′-5	64	6s5	2	18′-1	54	6s5	2	14′-10	45	6s5	2	11′-7	35	6s5	2	8′-4	25
CURTAIN, VERT.		5t1	11	7′-11	91	5t1	11	7′-8	88	5t1	11	7′-5	85	5t1	11	7′-2	82	5t1	11	6′-11	79	5t1	11	6′-8	76	5t1	11	6′-5	74	5t1	11	6′-5	74	5t1	11	6′-5	74
CURTAIN, VERT., ENDS		5t2	4	7′-11	33	5t2	4	7′-8	32	5t2	4	7′-5	31	5t2	4	7′-2	30	5t2	4	6′-11	29	5t2	4	6′-8	28	5t2	4	6′-5	27	5t2	4	6′-5	27	5t2	4	6′-5	27
BRACKET, VERT.		5u1	4	6′-8	28	5u1	4	6′-5	27	5u1	4	6′-2	26	5u1	4	6′-0	25	5u1	4	5′-9	24	5u1	4	5′-6	23	5u1	4	5′-4	22	5u1	4	5′-4	22	5u1	4	5′-4	22
ESTIMATED QUANTITIES ONE HEADWALL	REINF. STEEL	8162 LBS.				6881 LBS.				6098 LBS.				4902 LBS.				4123 LBS.				3380 LBS.				2887 LBS.				2466 LBS.				1894 LBS.			
	CONCRETE	PARAPET Δ	1.6	48.1 CU.YD.		PARAPET Δ	1.6	43.0 CU.YD.		PARAPET Δ	1.4	34.6 CU.YD.		PARAPET Δ	1.4	30.7 CU.YD.		PARAPET Δ	1.4	26.8 CU.YD.		PARAPET Δ	1.4	22.1 CU.YD.		PARAPET Δ	1.4	18.7 CU.YD.		PARAPET Δ	1.4	15.8 CU.YD.		PARAPET Δ	1.4	13.0 CU.YD.	
		WINGWALLS	22.5			WINGWALLS	19.3			WINGWALLS	13.6			WINGWALLS	11.4			WINGWALLS	9.3			WINGWALLS	6.7			WINGWALLS	5.1			WINGWALLS	3.8			WINGWALLS	2.6	
		APRON	24.0			APRON	22.1			APRON	19.6			APRON	17.9			APRON	16.1			APRON	14.0			APRON	12.2			APRON	10.6			APRON	9.0	

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 15-1-12 FOR ACUTE AND OBTUSE CORNER LOCATIONS.

BENT BAR DETAILS



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

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

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.

07-2016
LATEST REVISION DATE

Marcus K. McDonald
APPROVED BY BRIDGE ENGINEER

Iowa Department of Transportation
Highway Division

STANDARD DESIGN - SINGLE REINFORCED CONCRETE BOX CULVERTS

PARALLEL WING HEADWALLS

APRIL, 2012

QUANTITY TABULATION 10′-0 SPAN 15° SKEW

PWH 15-6-12

REVISED 07-2016 - CHANGED FENCE ANCHOR BAR (5fa) FROM 3′-1 TO 2′-10.
ENGLISH\RFDSIGNEDSINGLECULVERTS.DGN - PWH 15-6-12 - THIS SHEET ISSUED 04-12.