

ENGLISH\FRDSIGNSINGLESINGLECULVERT\FWH.DGN - FW 45-9-21 S2 - THIS SHEET ISSUED 02-2021.

Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

Bar	Location	Shape	12' x 6'			12' x 5'			12' x 4'			Bar		
			No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.			
5fa	Fence Anchor (Galv.)		2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	5fa		
4b1	Wingwall, B.F.H. Long		1	41'-4"	29	1	35'-6"	24	1	29'-8"	20	4b1		
4b2	Wingwall, B.F.H. Short		1	26'-7"	18	1	23'-1"	15	1	19'-7"	13	4b2		
4b3	Wingwall, B.F.H. Long		4 Var.	21'-1 to 38'-7"	80	3 Var.	21'-1 to 32'-9"	54	2 Var.	21'-1 to 26'-11"	32	4b3		
4b4	Wingwall, B.F.H. Short		4 Var.	14'-6 to 24'-11"	53	3 Var.	14'-6 to 21'-5"	36	2 Var.	14'-6 to 17'-11"	22	4b4		
5b5	Wingwall, F.F.H. Long		46	41'-4"	46	1	35'-6"	37	1	29'-9"	31	5b5		
5b6	Wingwall, F.F.H. Short		1	26'-7"	28	1	23'-1"	24	1	19'-7"	20	5b6		
5b7	Wingwall, F.F.H. Long		5 Var.	15'-4 to 38'-7"	141	4 Var.	15'-4 to 32'-9"	100	3 Var.	15'-4 to 26'-11"	66	5b7		
5b8	Wingwall, F.F.H. Short		5 Var.	11'-0 to 25'-0"	94	4 Var.	11'-0 to 21'-6"	68	3 Var.	11'-0 to 18'-0"	45	5b8		
4c1	Wingwall, F.F.V. Long		37 Var.	2'-9 to 9'-0"	145	31 Var.	2'-9 to 7'-11"	110	25 Var.	2'-9 to 6'-11"	81	4c1		
4c2	Wingwall, F.F.V. Short		22 Var.	2'-10 to 8'-10"	86	19 Var.	2'-10 to 8'-0"	69	15 Var.	2'-10 to 6'-10"	48	4c2		
4c3	Wingwall, F.F.V. Long		--	--	--	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.V. Short		--	--	--	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.V. Long		1	7'-9"	5	2	6'-9"	9	2	5'-9"	8	4c5		
4c5	Wingwall, F.F.V. Short		2	7'-9"	10	1	6'-9"	5	2	5'-9"	8	4c5		
5c6	Wingwall, B.F.V. Long		15 Var.	2'-9 to 5'-2"	62	15 Var.	2'-9 to 5'-2"	62	15 Var.	2'-9 to 5'-2"	62	5c6		
5c7	Wingwall, B.F.V. Short		4 Var.	2'-10 to 3'-8"	14	4 Var.	2'-10 to 3'-8"	14	4 Var.	2'-10 to 3'-8"	14	5c7		
6c8	Wingwall, B.F.V. Long		22 Var.	9'-4 to 13'-0"	369	16 Var.	9'-4 to 11'-11"	255	10 Var.	9'-4 to 10'-11"	152	6c8		
6c9	Wingwall, B.F.V. Short		18 Var.	8'-0 to 12'-10"	282	15 Var.	8'-0 to 12'-0"	225	11 Var.	8'-0 to 10'-10"	156	6c9		
6c10	Wingwall, B.F.V. Long		--	--	--	--	--	--	--	--	--	6c10		
6c10	Wingwall, B.F.V. Short		--	--	--	--	--	--	--	--	--	6c10		
6c11	Wingwall, B.F.V. Long		1	11'-9"	18	2	10'-9"	32	2	9'-9"	29	6c11		
6c11	Wingwall, B.F.V. Short		2	11'-9"	35	1	10'-9"	16	2	9'-9"	29	6c11		
4d1	Apron, LongR., Bott.		9	21'-7"	130	9	18'-9"	113	9	15'-11"	96	4d1		
4d2	Apron, LongL., Bott. Long		3	33'-11"	68	3	28'-1"	56	3	22'-3"	45	4d2		
4d3	Apron, LongL., Bott. Short		3	21'-7"	43	3	18'-1"	36	3	14'-7"	29	4d3		
6f1	Apron, LongL., Top		11	21'-7"	357	11	18'-9"	310	11	15'-11"	263	6f1		
6f2	Apron, LongL., Top Long		7 Var.	5'-7 to 17'-10"	123	5 Var.	6'-10 to 15'-0"	82	4 Var.	6'-0 to 12'-2"	55	6f2		
6f3	Apron, LongL., Top Short		4 Var.	7'-11 to 18'-2"	78	3 Var.	8'-6 to 15'-4"	54	2 Var.	9'-1 to 12'-6"	32	6f3		
6f4	Apron, LongL., Top Long		1	41'-4"	66	1	35'-6"	53	1	29'-9"	45	6f4		
6f5	Apron, LongL., Top Short		1	26'-7"	40	1	23'-1"	35	1	19'-7"	29	6f5		
4i1	Parapet, Vertical		25	6'-8"	111	25	6'-8"	111	25	6'-8"	111	4i1		
9j1	Parapet, Horizontal		4	18'-7"	253	4	18'-7"	253	4	18'-7"	253	9j1		
6m1	Apron, Trans., Top		10 Var.	14'-11 to 16'-7"	237	10 Var.	14'-11 to 16'-7"	237	10 Var.	14'-11 to 16'-7"	237	6m1		
6m2	Apron, Trans., Top		8 Var.	16'-11 to 19'-6"	219	4 Var.	16'-11 to 18'-0"	105	--	--	--	6m2		
6m3	Apron, Trans., Top		15 Var.	5'-10 to 13'-8"	220	16 Var.	4'-8 to 13'-1"	213	16 Var.	4'-1 to 12'-6"	199	6m3		
6m4	Apron, Trans., Bott.		12 Var.	10'-6 to 22'-3"	295	10 Var.	10'-6 to 20'-2"	230	8 Var.	10'-6 to 18'-0"	171	6m4		
6p1	Curtain, Horizontal		4	16'-11"	102	4	16'-11"	102	4	16'-10"	101	6p1		
6p2	Curtain, Horizontal, Long		4	23'-4"	140	4	20'-2"	121	4	17'-0"	102	6p2		
6p3	Curtain, Horizontal, Short		4	9'-6"	57	4	8'-6"	51	4	7'-6"	45	6p3		
6s1	Wing Slope, Both F., Long		2	8'-4"	25	2	8'-4"	25	2	8'-4"	25	6s1		
6s2	Wing Slope, Both F., Short		2	7'-11"	24	2	7'-11"	24	2	7'-11"	24	6s2		
6s3	Wing Slope, Both F., Long		2	33'-1"	99	2	27'-2"	82	2	21'-3"	64	6s3		
6s4	Wing Slope, Both F., Short		2	19'-10"	60	2	16'-2"	49	2	12'-7"	38	6s4		
6s5	Wing Slope, F.F. Long		1	39'-2"	59	1	33'-3"	50	1	27'-5"	41	6s5		
6s6	Wing Slope, F.F. Short		1	25'-10"	39	1	22'-2"	33	1	18'-6"	28	6s6		
5t1	Curtain, Vertical		30	6'-5"	201	27	6'-5"	181	24	6'-5"	161	5t1		
Estimated Quantities One Headwall			Reinf. Steel			Concrete			Reinf. Steel			Concrete		
			Parapet Δ			Wingwalls			Apron *					
			2.3			7.5			25.8			35.6 CY		
			4567 LB			3767 LB			3036 LB					
			2.3			5.5			23.3			29.1 CY		
			3.8			17.0			23.1 CY					

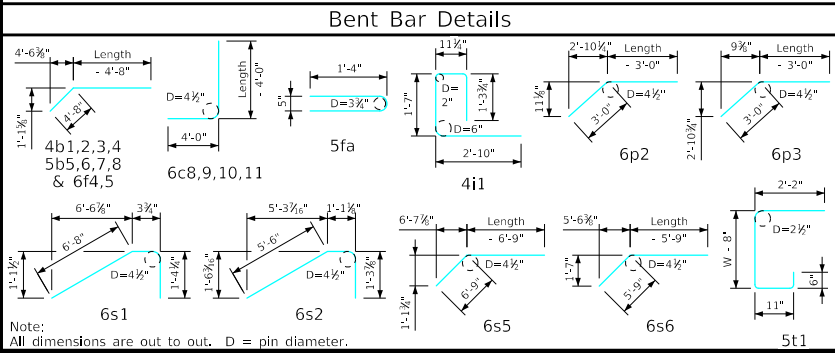
Δ Includes top of wingwall quantities.
 * Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

"Short" Denotes Short Wingwall
 "Long" Denotes Long Wingwall

Headwall Notes:

- See Sheet FWH G2-21 for General Notes, Specifications, and Design Stresses.
- This headwall is based on a 3:1 slope normal to centerline of roadway.
- The sides of the apron are to be formed to ensure correct line and grade.
- All apron 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 "b1" & "5" estimated to extend 2'-5" 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'-5" beyond back of parapet. The "length" column reflects total number of feet necessary to meet these requirements.
- Dimensions are in feet and inches unless otherwise noted.



Note:
 All dimensions are out to out. D = pin diameter.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	IOWA DOT Highway Division	
		Standard Design - Single Reinforced Concrete Box Culverts	
		Flared Wing Headwalls	
		February, 2021	
Quantity Tabulation		12'-0" Span	FWH 45-9-21
45° Skew		Sheet 2 of 2	