

ENGLISHLRFDDESIGNEDSINGLECULVERTSFHW.DGN - FW 45-13-21 - THIS SHEET ISSUED 02-2021.

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

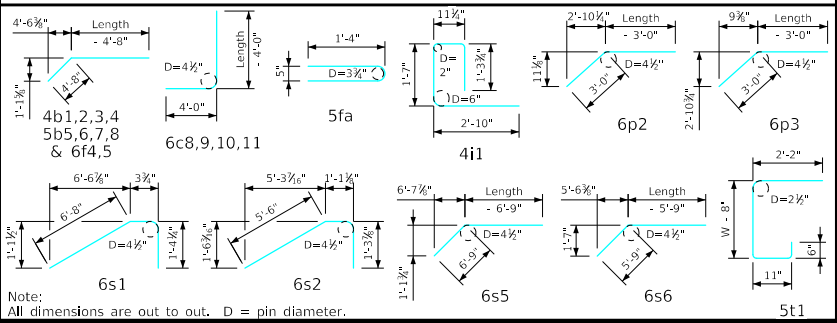
Bar	Location	Shape	5' x 6'			5' x 5'			5' x 4'			5' x 3'			Bar		
			No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.			
5fa	Fence Anchor (Galv.)		2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	5fa		
4b1	Wingwall, B.F.H, Long		1	41'-4"	29	1	35'-6"	24	1	29'-8"	20	1	23'-10"	16	4b1		
4b2	Wingwall, B.F.H, Short		1	26'-7"	18	1	23'-1"	15	1	19'-7"	13	1	16'-1"	11	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	1	21'-1"	14	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	1	14'-6"	10	4b4		
5b5	Wingwall, F.F.H, Long		1	41'-4"	46	1	35'-6"	37	1	29'-9"	31	1	23'-11"	25	5b5		
5b6	Wingwall, F.F.H, Short		1	26'-7"	28	1	23'-1"	24	1	19'-7"	20	1	16'-1"	17	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	2 Var.	15'-4 to 21'-1"	38	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	2 Var.	11'-0 to 14'-6"	27	5b8		
4c1	Wingwall, F.F.V, Long		37 Var.	2'-7 to 8'-10"	141	31 Var.	2'-7 to 7'-9"	107	25 Var.	2'-7 to 6'-9"	78	19 Var.	2'-7 to 5'-9"	53	4c1		
4c2	Wingwall, F.F.V, Short		22 Var.	2'-8 to 8'-8"	83	19 Var.	2'-8 to 7'-10"	67	15 Var.	2'-8 to 6'-8"	47	12 Var.	2'-8 to 5'-10"	34	4c2		
4c3	Wingwall, F.F.V, Long		--	--	--	--	--	--	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.V, Short		--	--	--	--	--	--	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.V, Long		1	7'-7"	5	2	6'-7"	9	2	5'-7"	7	2	4'-7"	6	4c5		
4c5	Wingwall, F.F.V, Short		2	7'-7"	10	1	6'-7"	4	2	5'-7"	7	1	4'-7"	3	4c5		
5c6	Wingwall, B.F.V, Long		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	5c6		
5c7	Wingwall, B.F.V, Short		4 Var.	2'-8 to 3'-6"	13	4 Var.	2'-8 to 3'-6"	13	4 Var.	2'-8 to 3'-6"	13	4 Var.	2'-8 to 3'-6"	13	5c7		
6c8	Wingwall, B.F.V, Long		22 Var.	9'-2 to 12'-10"	363	16 Var.	9'-2 to 11'-9"	251	10 Var.	9'-2 to 10'-9"	150	4 Var.	9'-2 to 9'-9"	57	6c8		
6c9	Wingwall, B.F.V, Short		18 Var.	7'-10 to 12'-8"	277	15 Var.	7'-10 to 11'-10"	222	11 Var.	7'-10 to 10'-8"	153	8 Var.	7'-10 to 9'-10"	106	6c9		
6c10	Wingwall, B.F.V, Long		--	--	--	--	--	--	--	--	--	--	--	--	6c10		
6c10	Wingwall, B.F.V, Short		--	--	--	--	--	--	--	--	--	--	--	--	6c10		
6c11	Wingwall, B.F.V, Long		1	11'-7"	17	2	10'-7"	32	2	9'-7"	29	2	8'-7"	26	6c11		
6c11	Wingwall, B.F.V, Short		2	11'-7"	35	1	10'-7"	16	2	9'-7"	29	1	8'-7"	13	6c11		
4d1	Apron, Longit., Bott.		3	21'-7"	43	3	18'-9"	38	3	15'-11"	32	3	13'-1"	26	4d1		
4d2	Apron, Longit., Bott, Long		3	33'-11"	68	3	28'-1"	56	3	22'-3"	45	3	16'-5"	33	4d2		
4d3	Apron, Longit., Bott, Short		3	21'-7"	43	3	18'-1"	36	3	14'-7"	29	3	11'-1"	22	4d3		
6f1	Apron, Longit., Top		4	21'-7"	130	4	18'-9"	113	4	15'-11"	96	4	13'-1"	79	6f1		
6f2	Apron, Longit., 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	2 Var.	7'-3 to 9'-4"	25	6f2		
6f3	Apron, Longit., 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	2 Var.	6'-2 to 9'-8"	24	6f3		
6f4	Apron, Longit., Top Long		1	41'-4"	66	1	35'-6"	53	1	29'-9"	45	1	23'-11"	36	6f4		
6f5	Apron, Longit., Top Short		1	26'-7"	40	1	23'-1"	35	1	19'-7"	29	1	16'-1"	24	6f5		
4i1	Parapet, Vertical		11	6'-8"	49	11	6'-8"	49	11	6'-8"	49	11	6'-8"	49	4i1		
7j1	Parapet, Horizontal		4	8'-8"	71	4	8'-8"	71	4	8'-8"	71	4	8'-8"	71	7j1		
6m1	Apron, Trans., Top		5 Var.	7'-0 to 7'-9"	55	5 Var.	7'-0 to 7'-9"	55	5 Var.	7'-0 to 7'-9"	55	5 Var.	7'-0 to 7'-9"	55	6m1		
6m2	Apron, Trans., Top		18 Var.	8'-0 to 14'-5"	303	14 Var.	8'-0 to 12'-11"	220	10 Var.	8'-0 to 11'-5"	146	6 Var.	8'-0 to 9'-11"	81	6m2		
6m3	Apron, Trans., Top		6 Var.	5'-5 to 8'-3"	62	6 Var.	4'-10 to 7'-8"	56	6 Var.	4'-3 to 7'-1"	51	6 Var.	3'-8 to 6'-6"	46	6m3		
6m4	Apron, Trans., Bott.		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		
6p1	Curtain, Horizontal		4	7'-0"	42	4	7'-0"	42	4	7'-0"	42	4	6'-11"	42	6p1		
6p2	Curtain, Horizontal, Long		4	23'-4"	140	4	20'-2"	121	4	17'-0"	102	4	13'-10"	83	6p2		
6p3	Curtain, Horizontal, Short		4	9'-6"	57	4	8'-6"	51	4	7'-6"	45	4	6'-6"	39	6p3		
6s1	Wing Slope, Both F., Long		2	8'-4"	25	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	2	7'-11"	24	6s2		
6s3	Wing Slope, Both F., Long		2	33'-1"	99	2	27'-2"	82	2	21'-3"	64	2	15'-4"	46	6s3		
6s4	Wing Slope, Both F., Short		2	19'-10"	60	2	16'-2"	49	2	12'-7"	38	2	8'-11"	27	6s4		
6s5	Wing Slope, F.F, Long		1	39'-2"	59	1	33'-3"	50	1	27'-5"	41	1	21'-5"	32	6s5		
6s6	Wing Slope, F.F, Short		1	25'-10"	39	1	22'-2"	33	1	18'-6"	28	1	14'-11"	22	6s6		
5t1	Curtain, Vertical		22	6'-5"	147	19	6'-5"	127	16	6'-5"	107	12	6'-5"	80	5t1		
Estimated Quantities One Headwall			Reinf. Steel			3434 LB			2744 LB			2127 LB			1551 LB		
			Parapet Δ			1.5			1.5			1.5			1.5		
			Concrete Wingwalls			7.5			5.5			3.8			2.3		
			Apron ≈			17.4			14.0			11.0			8.2		
			26.4 CY			21.0 CY			16.3 CY			12.0 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

### Bent Bar Details



### 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 "b" & "s" 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.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	<b>IOWA DOT Highway Division</b>	
		Standard Design - Single Reinforced Concrete Box Culverts	
		Flared Wing Headwalls	
		February, 2021	
Quantity Tabulation		FWH	
5'-0" Span		45-13-21	
45° Skew			