

ENGLISHLRFDDESIGNEDSINGLECULVERTSFHW.DGN - FW 30-11-21 - THIS SHEET ISSUED 02-2021.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Bar	Location	Shape	6' x 8'			6' x 7'			6' x 6'			6' x 5'			6' x 4'			6' x 3'			Bar		
			No.	Length	Wt.	No.	Length	Wt.	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	2	2'-10	6	2	2'-10	6	5fa		
4b1	Wingwall, B.F.H, Long		1	38'-6	26	1	34'-4	23	1	30'-2	20	1	26'-0	17	1	21'-10	15	1	17'-8	12	4b1		
4b2	Wingwall, B.F.H, Short		1	29'-9	20	1	26'-7	18	1	23'-6	16	1	20'-5	14	1	17'-3	12	1	14'-2	9	4b2		
4b3	Wingwall, B.F.H, Long		6 Var.	15'-8 to 36'-7	105	5 Var.	15'-8 to 32'-5	80	4 Var.	15'-8 to 28'-3	59	3 Var.	15'-8 to 24'-1	40	2 Var.	15'-8 to 19'-10	24	1	15'-8	10	4b3		
4b4	Wingwall, B.F.H, Short		6 Var.	12'-10 to 28'-4	82	5 Var.	12'-10 to 25'-3	64	4 Var.	12'-10 to 22'-1	47	3 Var.	12'-9 to 19'-0	32	2 Var.	12'-9 to 15'-10	19	1	12'-9	9	4b4		
5b5	Wingwall, F.F.H, Long		1	38'-7	40	1	34'-5	36	1	30'-2	31	1	26'-0	27	1	21'-10	23	1	17'-8	18	5b5		
5b6	Wingwall, F.F.H, Short		1	29'-9	31	1	26'-8	28	1	23'-6	25	1	20'-5	21	1	17'-4	18	1	14'-2	15	5b6		
5b7	Wingwall, F.F.H, Long		7 Var.	11'-7 to 36'-7	176	6 Var.	11'-7 to 32'-5	138	5 Var.	11'-7 to 28'-3	104	4 Var.	11'-7 to 24'-1	74	3 Var.	11'-7 to 19'-11	49	2 Var.	11'-7 to 15'-9	29	5b7		
5b8	Wingwall, F.F.H, Short		7 Var.	9'-9 to 28'-4	139	6 Var.	9'-9 to 25'-3	110	5 Var.	9'-9 to 22'-1	83	4 Var.	9'-9 to 19'-0	60	3 Var.	9'-8 to 15'-11	40	2 Var.	9'-8 to 12'-9	23	5b8		
4c1	Wingwall, F.F.W, Long		35 Var.	2'-8 to 10'-10	158	31 Var.	2'-8 to 9'-10	129	26 Var.	2'-8 to 8'-9	98	22 Var.	2'-8 to 7'-8	76	18 Var.	2'-8 to 6'-9	57	14 Var.	2'-8 to 5'-9	39	4c1		
4c2	Wingwall, F.F.W, Short		26 Var.	2'-8 to 10'-8	116	23 Var.	2'-8 to 9'-9	95	20 Var.	2'-8 to 8'-9	76	17 Var.	2'-8 to 7'-10	60	14 Var.	2'-8 to 6'-10	44	10 Var.	2'-8 to 5'-7	28	4c2		
4c3	Wingwall, F.F.W, Long		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.W, Short		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.W, Long		1	9'-7	6	1	8'-7	6	2	7'-7	10	2	6'-7	9	2	5'-7	7	1	4'-7	3	4c5		
4c5	Wingwall, F.F.W, Short		2	9'-7	13	1	8'-7	6	1	7'-7	5	1	6'-7	4	1	5'-7	4	2	4'-7	6	4c5		
5c6	Wingwall, B.F.V, Long		11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	5c6		
5c7	Wingwall, B.F.V, Short		5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5c7		
6c9	Wingwall, B.F.V, Long		24 Var.	9'-4 to 14'-10	436	20 Var.	9'-4 to 13'-10	348	15 Var.	9'-4 to 12'-8	248	11 Var.	9'-4 to 11'-8	173	7 Var.	9'-4 to 10'-9	106	3 Var.	9'-4 to 9'-9	43	6c9		
6c9	Wingwall, B.F.V, Short		21 Var.	8'-4 to 14'-8	363	18 Var.	8'-4 to 13'-9	299	15 Var.	8'-4 to 12'-9	238	12 Var.	8'-4 to 11'-10	182	9 Var.	8'-4 to 10'-10	130	5 Var.	8'-4 to 9'-7	67	6c9		
6c10	Wingwall, B.F.V, Long		15	10'-6	237	11	10'-6	173	--	--	--	--	--	--	--	--	--	--	--	--	6c10		
6c10	Wingwall, B.F.V, Short		11	10'-6	173	8	10'-6	126	--	--	--	--	--	--	--	--	--	--	--	--	6c10		
6c11	Wingwall, B.F.V, Long		1	13'-7	20	1	12'-7	19	2	11'-7	35	2	10'-7	32	2	9'-7	29	1	8'-7	13	6c11		
6c11	Wingwall, B.F.V, Short		2	13'-7	41	1	12'-7	19	1	11'-7	17	1	10'-7	16	1	9'-7	14	2	8'-7	26	6c11		
4d1	Apron, Longit., Bott.		5	22'-8	76	5	20'-4	68	5	18'-1	60	5	15'-9	53	5	13'-5	45	5	11'-1	37	4d1		
4d2	Apron, Longit., Bott, Long		3	32'-1	64	3	27'-11	56	3	23'-9	48	3	19'-7	39	3	15'-4	31	3	11'-2	22	4d2		
4d3	Apron, Longit., Bott, Short		3	24'-9	50	3	21'-8	43	3	18'-7	37	3	15'-5	31	3	12'-4	25	3	9'-2	18	4d3		
6f1	Apron, Longit., Top		5	22'-8	170	5	20'-4	153	5	18'-1	136	5	15'-9	118	5	13'-5	101	5	11'-1	83	6f1		
6f2	Apron, Longit., Top Long		7 Var.	5'-3 to 19'-3	129	6 Var.	5'-3 to 16'-11	100	5 Var.	5'-3 to 14'-7	74	4 Var.	5'-3 to 12'-4	53	3 Var.	5'-3 to 10'-0	34	2 Var.	5'-4 to 7'-8	20	6f2		
6f3	Apron, Longit., Top Short		5 Var.	6'-11 to 19'-6	99	4 Var.	7'-9 to 17'-2	75	4 Var.	5'-5 to 14'-10	61	3 Var.	6'-2 to 12'-6	42	2 Var.	7'-0 to 10'-3	26	1	7'-11	12	6f3		
6f4	Apron, Longit., Top Long		1	38'-7	58	1	34'-5	52	1	30'-2	45	1	26'-0	39	1	21'-10	33	1	17'-8	27	6f4		
6f5	Apron, Longit., Top Short		1	29'-9	45	1	26'-8	40	1	23'-6	35	1	20'-5	31	1	17'-4	26	1	14'-2	21	6f5		
4i1	Parapet, Vertical		13	6'-4	55	13	6'-4	55	13	6'-4	55	13	6'-4	55	13	6'-4	55	13	6'-4	55	4i1		
7j1	Parapet, Horizontal		4	8'-5	69	4	8'-3	67	4	8'-3	67	4	8'-3	67	4	8'-3	67	4	8'-3	67	7j1		
6m1	Apron, Trans., Top		4 Var.	8'-1 to 8'-7	50	4 Var.	7'-11 to 8'-5	49	4 Var.	7'-11 to 8'-5	49	4 Var.	7'-11 to 8'-5	49	4 Var.	7'-11 to 8'-5	49	4 Var.	7'-11 to 8'-5	49	6m1		
6m2	Apron, Trans., Top		21 Var.	8'-11 to 16'-5	400	18 Var.	8'-9 to 15'-2	323	15 Var.	8'-9 to 14'-0	256	12 Var.	8'-9 to 12'-11	195	9 Var.	8'-9 to 11'-9	139	6 Var.	8'-9 to 10'-8	87	6m2		
6m3	Apron, Trans., Top		4 Var.	6'-7 to 9'-11	50	4 Var.	5'-10 to 9'-2	45	4 Var.	5'-2 to 8'-6	41	4 Var.	4'-6 to 7'-10	37	4 Var.	3'-10 to 7'-2	33	4 Var.	3'-2 to 6'-6	29	6m3		
6m4	Apron, Trans., Bott.		16 Var.	1'-11 to 12'-1	168	14 Var.	1'-11 to 10'-9	133	12 Var.	1'-11 to 9'-5	102	10 Var.	1'-11 to 8'-0	74	8 Var.	1'-11 to 7'-2	52	6 Var.	1'-11 to 5'-4	33	6m4		
6p1	Curtain, Horizontal		4	7'-1	43	4	7'-1	43	4	7'-1	43	4	7'-1	43	4	7'-1	43	4	7'-1	43	6p1		
6p2	Curtain, Horizontal, Long		4	20'-0	120	4	18'-0	108	4	16'-0	96	4	13'-11	84	4	11'-11	72	4	9'-11	60	6p2		
6p3	Curtain, Horizontal, Short		4	11'-9	71	4	10'-9	65	4	9'-8	58	4	8'-8	52	4	7'-7	46	4	6'-7	40	6p3		
6s1	Wing Slope, Both F., Long		2	8'-0	24	2	8'-0	24	2	8'-0	24	2	8'-0	24	2	8'-0	24	2	8'-0	24	6s1		
6s2	Wing Slope, Both F., Short		2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	6s2		
6s3	Wing Slope, Both F., Long		2	31'-9	95	2	27'-5	82	2	23'-2	70	2	18'-10	57	2	14'-7	44	2	10'-3	31	6s3		
6s4	Wing Slope, Both F., Short		2	24'-11	75	2	21'-8	65	2	18'-4	55	2	15'-1	45	2	11'-10	36	2	8'-7	26	6s4		
6s5	Wing Slope, F.F, Long		1	37'-10	57	1	33'-7	50	1	29'-3	44	1	25'-0	38	1	20'-8	31	1	16'-5	25	6s5		
6s6	Wing Slope, F.F, Short		1	30'-2	45	1	26'-10	40	1	23'-7	35	1	20'-4	31	1	17'-0	26	1	13'-9	21	6s6		
5t1	Curtain, Vertical		21	6'-11	151	18	6'-8	125	16	6'-5	107	14	6'-5	94	12	6'-5	80	9	6'-5	60	5t1		
Estimated Quantities One Headwall			Reinf. Steel			4434 LB			3666 LB			2798 LB			2276 LB			1797 LB			1327 LB		
			Concrete			32.1 CY			25.5 CY			20.7 CY			16.6 CY			13.0 CY			9.8 CY		
			Parapet Δ			1.4			1.3			1.3			1.3			1.3			1.3		
			Wingwalls			10.7			7.7			5.9			4.3			2.9			1.8		
			Apron *			20.0			16.5			13.5			11.0			8.8			6.7		

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.

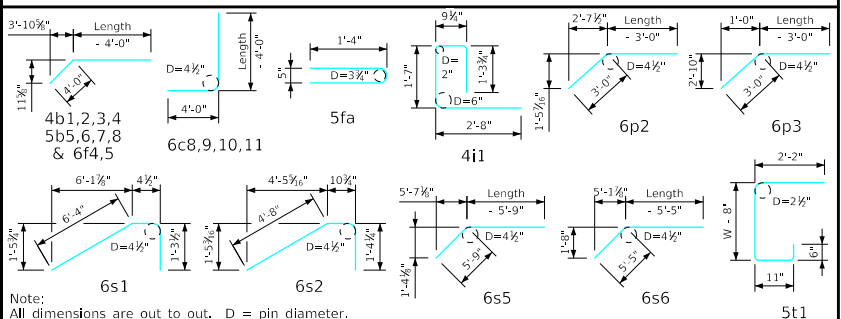
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

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

Headwall Notes:

- See Sheet FW 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" and "s" estimated to extend 2'-5" beyond back of parapet (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.

Bent Bar Details



LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	IOWADOT Highway Division	
		Standard Design - Single Reinforced Concrete Box Culverts	
		Flared Wing Headwalls	
		February, 2021	
Quantity Tabulation		FWH	
6'-0" Span		30-11-21	
30° Skew			