

ENGLISHLRFDDESIGNEDSINGLECULVERTSFHW.DGN - FW30-7-21 S2 - THIS SHEET ISSUED 02-2021.

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

Bar	Location	Shape	14' x 7'			14' x 6'			14' x 5'			14' x 4'			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	34'-4"	23	1	30'-2"	20	1	26'-0"	17	1	21'-10"	15	4b1		
4b2	Wingwall, B.F.H, Short		1	26'-7"	18	1	23'-6"	16	1	20'-5"	14	1	17'-3"	12	4b2		
4b3	Wingwall, B.F.H, Long		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	4b3		
4b4	Wingwall, B.F.H, Short		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	4b4		
5b5	Wingwall, F.F.H, Long		1	34'-5"	36	1	30'-2"	31	1	26'-0"	27	1	21'-10"	23	5b5		
5b6	Wingwall, F.F.H, Short		1	26'-8"	28	1	23'-6"	25	1	20'-5"	21	1	17'-4"	18	5b6		
5b7	Wingwall, F.F.H, Long		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	5b7		
5b8	Wingwall, F.F.H, Short		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	5b8		
4c1	Wingwall, F.F.V, Long		31 Var.	2'-10 to 10'-0	133	26 Var.	2'-10 to 8'-10	101	22 Var.	2'-10 to 7'-10	78	18 Var.	2'-10 to 6'-11	59	4c1		
4c2	Wingwall, F.F.V, Short		23 Var.	2'-10 to 9'-11	98	20 Var.	2'-10 to 8'-11	78	17 Var.	2'-10 to 8'-0	62	14 Var.	2'-10 to 7'-0	46	4c2		
4c3	Wingwall, F.F.V, Long		--	--	--	--	--	--	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.V, Short		--	--	--	--	--	--	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.V, Long		1	8'-9"	6	2	7'-9"	10	2	6'-9"	9	2	5'-9"	8	4c5		
4c5	Wingwall, F.F.V, Short		1	8'-9"	6	1	7'-9"	5	1	6'-9"	5	1	5'-9"	4	4c5		
5c6	Wingwall, B.F.V, Long		11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	5c6		
5c7	Wingwall, B.F.V, Short		5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5c7		
6c8	Wingwall, B.F.V, Long		20 Var.	9'-6 to 14'-0	353	15 Var.	9'-6 to 12'-10	252	11 Var.	9'-6 to 11'-10	176	7 Var.	9'-6 to 10'-11	107	6c8		
6c9	Wingwall, B.F.V, Short		18 Var.	8'-6 to 13'-11	303	15 Var.	8'-6 to 12'-11	241	12 Var.	8'-6 to 12'-0	185	9 Var.	8'-6 to 11'-0	132	6c9		
6c10	Wingwall, B.F.V, Long		11	10'-6"	173	--	--	--	--	--	--	--	--	--	6c10		
6c10	Wingwall, B.F.V, Short		8	10'-6"	126	--	--	--	--	--	--	--	--	--	6c10		
6c11	Wingwall, B.F.V, Long		1	12'-9"	19	2	11'-9"	35	2	10'-9"	32	2	9'-9"	29	6c11		
6c11	Wingwall, B.F.V, Short		1	12'-9"	19	1	11'-9"	18	1	10'-9"	16	1	9'-9"	15	6c11		
4d1	Apron, Longit., Bott.		9	20'-4"	122	9	18'-1"	109	9	15'-9"	95	9	13'-5"	81	4d1		
4d2	Apron, Longit., Bott, Long		3	27'-11"	56	3	23'-9"	48	3	19'-7"	39	3	15'-4"	31	4d2		
4d3	Apron, Longit., Bott, Short		3	21'-8"	43	3	18'-7"	37	3	15'-5"	31	3	12'-4"	25	4d3		
6f1	Apron, Longit., Top		13	20'-4"	397	13	18'-1"	353	13	15'-9"	308	13	13'-5"	262	6f1		
6f2	Apron, Longit., Top Long		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	6f2		
6f3	Apron, Longit., Top Short		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	6f3		
6f4	Apron, Longit., Top Long		1	34'-5"	52	1	30'-2"	45	1	26'-0"	39	1	21'-10"	33	6f4		
6f5	Apron, Longit., Top Short		1	26'-8"	40	1	23'-6"	35	1	20'-5"	31	1	17'-4"	26	6f5		
4j1	Parapet, Vertical		29	6'-4"	123	29	6'-4"	123	29	6'-4"	123	29	6'-4"	123	4j1		
9j1	Parapet, Horizontal		4	17'-6"	238	4	17'-6"	238	4	17'-6"	238	4	17'-6"	238	9j1		
6m1	Apron, Trans., Top		7 Var.	16'-5 to 17'-7"	179	7 Var.	16'-5 to 17'-7"	179	7 Var.	16'-5 to 17'-7"	179	7 Var.	16'-5 to 17'-7"	179	6m1		
6m2	Apron, Trans., Top		12 Var.	17'-11 to 22'-0	360	9 Var.	17'-11 to 20'-11	262	6 Var.	17'-11 to 19'-9"	170	3 Var.	17'-11 to 18'-8"	82	6m2		
6m3	Apron, Trans., Top		10 Var.	5'-11 to 15'-11	164	10 Var.	5'-3 to 15'-3"	154	10 Var.	4'-7 to 14'-7"	144	10 Var.	3'-11 to 13'-11	134	6m3		
6m4	Apron, Trans., Bott.		14 Var.	11'-2 to 20'-0	328	12 Var.	11'-2 to 18'-8"	269	10 Var.	11'-2 to 17'-3"	213	8 Var.	11'-2 to 15'-11	163	6m4		
6p1	Curtain, Horizontal		4	16'-4"	98	4	16'-4"	98	4	16'-4"	98	4	16'-3"	98	6p1		
6p2	Curtain, Horizontal, Long		4	18'-0"	108	4	16'-0"	96	4	13'-11"	84	4	11'-11"	72	6p2		
6p3	Curtain, Horizontal, Short		4	10'-9"	65	4	9'-8"	58	4	8'-8"	52	4	7'-7"	46	6p3		
6s1	Wing Slope, Both F., Long		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	6s2		
6s3	Wing Slope, Both F., Long		2	27'-5"	82	2	23'-2"	70	2	18'-10"	57	2	14'-7"	44	6s3		
6s4	Wing Slope, Both F., Short		2	21'-8"	65	2	18'-4"	55	2	15'-1"	45	2	11'-10"	36	6s4		
6s5	Wing Slope, F.F, Long		1	33'-7"	50	1	29'-3"	44	1	25'-0"	38	1	20'-8"	31	6s5		
6s6	Wing Slope, F.F, Short		1	26'-10"	40	1	23'-7"	35	1	20'-4"	31	1	17'-0"	26	6s6		
5t1	Curtain, Vertical		26	6'-8"	181	24	6'-5"	161	22	6'-5"	147	20	6'-5"	134	5t1		
Estimated Quantities One Headwall			Reinf., Steel			4814 LB			3844 LB			3220 LB			2639 LB		
			Concrete			35.0 CY			29.0 CY			23.9 CY			19.2 CY		
			Parapet Δ			2.0			2.0			2.0			2.0		
			Wingwalls			7.7			5.9			4.3			2.9		
			Apron =			21.1			21.1			17.6			14.3		

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 FW30-21 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 (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" requirements reflect 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	IOWADOT Highway Division	
		Standard Design - Single Reinforced Concrete Box Culverts	
		Flared Wing Headwalls	
		February, 2021	
Quantity Tabulation		14'-0" Span	FWH 30-7-21
		30° Skew	Sheet 2 of 2

Bent Bar Details

