

ENGLISH\FDSIGNED\TRIPLE\CULVERTS\FH.DGN - TRFWH 45-8-21 S1 - THIS SHEET ISSUED 02-2021.

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

Bar	Location	Shape	10' x 12'		10' x 11'		10' x 10'		10' x 9'		10' x 8'		Bar					
			No.	Length	No.	Length	No.	Length	No.	Length	No.	Length						
5fa	Fence Anchor (Galv.)		2	2'-10"	6	2'-10"	6	2'-10"	6	2'-10"	6	2'-10"	6	5fa				
4b1	Wingwall, B.F.H. Long		1	76'-3"	53	1	70'-6"	49	1	64'-8"	45	1	53'-0"	37	4b1			
4b2	Wingwall, B.F.H. Short		1	47'-6"	33	1	44'-0"	31	1	40'-7"	29	1	37'-1"	22	4b2			
4b3	Wingwall, B.F.H. Long		10	Var. 21'-2 to 73'-6	326	9	Var. 21'-2 to 67'-8	275	8	Var. 21'-2 to 61'-11	228	7	Var. 21'-2 to 56'-1	185	6	Var. 21'-2 to 50'-3	146	4b3
4b4	Wingwall, B.F.H. Short		10	Var. 14'-6 to 45'-11	205	9	Var. 14'-6 to 42'-5	173	8	Var. 14'-6 to 38'-11	143	7	Var. 14'-6 to 35'-5	117	6	Var. 14'-6 to 31'-11	93	4b4
5b5	Wingwall, F.F.H. Long		1	76'-4"	82	1	70'-6"	76	1	64'-8"	70	1	58'-10"	64	1	53'-0"	58	5b5
5b6	Wingwall, F.F.H. Short		1	47'-7"	52	1	44'-1"	48	1	40'-7"	45	1	37'-1"	39	1	33'-7"	35	5b6
5b7	Wingwall, F.F.H. Long		11	Var. 15'-5 to 73'-7	526	10	Var. 15'-5 to 67'-9	446	9	Var. 15'-5 to 61'-11	373	8	Var. 15'-5 to 56'-1	306	7	Var. 15'-4 to 50'-3	244	5b7
5b8	Wingwall, F.F.H. Short		11	Var. 11'-1 to 46'-0	333	10	Var. 11'-1 to 42'-6	282	9	Var. 11'-1 to 39'-0	235	8	Var. 11'-1 to 35'-6	194	7	Var. 11'-1 to 32'-0	157	5b8
5b9	Interior Wall, Both F.V.		42	Var. 2 Each 6'-11 to 37'-9	978	38	Var. 2 Each 6'-11 to 34'-11	829	34	Var. 2 Each 6'-11 to 32'-2	693	30	Var. 2 Each 6'-11 to 29'-4	567	26	Var. 2 Each 7'-0 to 26'-6	454	5b9
4c1	Wingwall, F.F.V. Long		72	Var. 2'-8 to 14'-11	423	66	Var. 2'-8 to 13'-10	364	60	Var. 2'-8 to 12'-10	311	54	Var. 2'-8 to 11'-10	262	49	Var. 2'-8 to 10'-11	222	4c1
4c2	Wingwall, F.F.V. Short		43	Var. 2'-9 to 14'-9	251	40	Var. 2'-9 to 13'-11	223	36	Var. 2'-9 to 12'-9	186	33	Var. 2'-9 to 11'-11	162	29	Var. 2'-9 to 10'-9	131	4c2
4c3	Wingwall, F.F.V. Long		33	Var. 9'-6 to 15'-0	270	27	Var. 9'-6 to 13'-11	211	21	Var. 9'-6 to 12'-11	157	15	Var. 9'-6 to 11'-11	107	--	--	--	4c3
4c4	Wingwall, F.F.V. Short		20	Var. 9'-6 to 14'-11	163	17	Var. 9'-6 to 14'-0	133	13	Var. 9'-6 to 12'-11	97	10	Var. 9'-6 to 12'-0	72	--	--	--	4c4
4c5	Wingwall, F.F.V. Long		1	13'-8"	9	2	12'-8"	17	2	11'-8"	16	2	10'-8"	14	1	9'-8"	6	4c5
4c5	Wingwall, F.F.V. Short		2	13'-8"	18	1	12'-8"	8	2	11'-8"	16	1	10'-8"	7	2	9'-8"	13	4c5
4c6	Interior Wall, Both F.V.		4	4'-0"	11	4	4'-0"	11	4	4'-0"	11	4	4'-0"	11	4	4'-0"	11	4c6
4c7	Interior Wall, Both F.V.		132	Var. 2 Each 1'-9 to 12'-4	621	122	Var. 2 Each 1'-9 to 11'-5	537	110	Var. 2 Each 1'-9 to 10'-4	444	100	Var. 2 Each 1'-9 to 9'-5	373	88	Var. 2 Each 1'-9 to 8'-5	299	4c7
4c8	Interior Wall, Both F.V.		6	12'-6"	50	6	11'-6"	46	6	10'-6"	42	6	9'-6"	38	6	8'-6"	34	4c8
5c9	Wingwall, B.F.V. Long		15	Var. 2'-8 to 5'-1	61	15	Var. 2'-8 to 5'-1	61	15	Var. 2'-8 to 5'-1	61	15	Var. 2'-8 to 5'-1	61	15	Var. 2'-8 to 5'-1	61	5c9
5c10	Wingwall, B.F.V. Short		4	Var. 2'-9 to 3'-7	13	4	Var. 2'-9 to 3'-7	13	4	Var. 2'-9 to 3'-7	13	4	Var. 2'-9 to 3'-7	13	4	Var. 2'-9 to 3'-7	13	5c10
5c11	Wingwall, B.F.V. Long		57	Var. 9'-3 to 18'-11	837	51	Var. 9'-3 to 17'-10	720	45	Var. 9'-3 to 16'-10	612	39	Var. 9'-3 to 15'-10	510	34	Var. 9'-3 to 14'-11	428	5c11
5c12	Wingwall, B.F.V. Short		39	Var. 7'-11 to 18'-9	542	36	Var. 7'-11 to 17'-11	485	32	Var. 7'-11 to 16'-9	412	29	Var. 7'-11 to 15'-11	360	25	Var. 7'-11 to 14'-9	296	5c12
6c13	Wingwall, B.F.V. Long		47	10'-6"	741	41	10'-6"	647	35	10'-6"	552	29	10'-6"	457	24	10'-6"	379	6c13
6c13	Wingwall, B.F.V. Short		28	10'-6"	442	25	10'-6"	394	21	10'-6"	331	18	10'-6"	284	14	10'-6"	221	6c13
5c14	Wingwall, B.F.V. Long		1	17'-8"	18	2	16'-8"	35	2	15'-8"	33	2	14'-8"	31	1	13'-8"	14	5c14
5c14	Wingwall, B.F.V. Short		2	17'-8"	37	1	16'-8"	17	2	15'-8"	33	1	14'-8"	15	2	13'-8"	29	5c14
4d1	Apron, Longit., Bott.		21	38'-6"	540	21	35'-8"	500	21	32'-10"	461	21	30'-0"	421	21	27'-2"	381	4d1
4d2	Apron, Longit., Bott. Long		3	68'-10"	143	3	63'-0"	131	3	57'-2"	119	3	51'-5"	108	3	45'-7"	96	4d2
4d3	Apron, Longit., Bott. Short		3	42'-7"	90	3	39'-1"	78	3	35'-7"	71	3	32'-1"	64	3	28'-7"	57	4d3
6f1	Apron, Longit., Top		31	38'-6"	1793	31	35'-8"	1661	31	32'-10"	1529	31	30'-0"	1397	31	27'-2"	1265	6f1
6f2	Apron, Longit., Top Long		15	Var. 6'-7 to 34'-10	467	14	Var. 5'-8 to 32'-0	396	12	Var. 6'-11 to 29'-2	325	11	Var. 6'-1 to 26'-4	268	9	Var. 7'-3 to 23'-6	208	6f2
6f3	Apron, Longit., Top Short		9	Var. 8'-1 to 35'-2	292	8	Var. 8'-8 to 32'-4	246	8	Var. 5'-9 to 29'-6	212	7	Var. 6'-4 to 26'-8	173	6	Var. 6'-10 to 23'-10	138	6f3
6f4	Apron, Longit., Top Long		1	76'-4"	118	1	70'-6"	110	1	64'-8"	101	1	58'-10"	92	1	53'-0"	83	6f4
6f5	Apron, Longit., Top Short		1	47'-7"	75	1	44'-1"	70	1	40'-7"	65	1	37'-1"	56	1	33'-7"	50	6f5
7j1	Parapet, Vertical		65	6'-8"	289	63	6'-8"	281	63	6'-8"	281	63	6'-8"	281	63	6'-8"	281	7j1
4j1	Parapet, Horizontal		4	47'-7"	409	4	47'-1"	405	4	46'-8"	401	4	46'-8"	401	4	46'-8"	401	4j1
6m1	Apron, Trans., Top		23	Var. 37'-11 to 42'-0	1420	23	Var. 37'-6 to 41'-8	1400	20	Var. 37'-2 to 40'-9	1185	16	Var. 37'-2 to 40'-0	931	13	Var. 37'-2 to 39'-5	748	6m1
6m2	Apron, Trans., Top		4	Var. 42'-5 to 43'-5	272	1	41'-11"	67	3	Var. 37'-3 to 40'-9	140	7	Var. 27'-5 to 31'-11	312	10	Var. 24'-7 to 31'-4	420	6m2
6m3	Apron, Trans., Top		42	Var. 10'-3 to 33'-4	1375	41	Var. 9'-7 to 32'-1	1283	39	Var. 8'-3 to 29'-8	1111	35	Var. 7'-8 to 26'-10	907	31	Var. 7'-1 to 24'-0	724	6m3
6m4	Apron, Trans., Bott.		24	Var. 38'-10 to 63'-4	1921	22	Var. 38'-7 to 61'-0	1718	20	Var. 38'-4 to 58'-7	1521	18	Var. 38'-4 to 56'-6	1340	16	Var. 38'-4 to 54'-4	1164	6m4
6p1	Curtain, Horizontal		4	45'-3"	286	4	45'-0"	285	4	44'-9"	283	4	44'-9"	283	4	44'-9"	283	6p1
6p2	Curtain, Horizontal, Long		4	42'-4"	269	4	39'-2"	235	4	36'-0"	216	4	32'-10"	197	4	29'-8"	178	6p2
6p3	Curtain, Horizontal, Short		4	15'-8"	94	4	14'-7"	88	4	13'-7"	82	4	12'-7"	76	4	11'-7"	70	6p3
6s1	Wing Slope, Both F., Long		2	8'-4"	25	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	2	7'-11"	24	6s2
6s3	Wing Slope, Both F., Long		2	68'-7"	213	2	62'-8"	196	2	56'-9"	178	2	50'-10"	160	2	44'-11"	142	6s3
6s4	Wing Slope, Both F., Short		2	41'-8"	132	2	38'-0"	114	2	34'-5"	103	2	30'-9"	92	2	27'-1"	81	6s4
6s5	Wing Slope, F.F. Long		1	74'-8"	116	1	68'-9"	107	1	62'-10"	98	1	56'-11"	89	1	51'-0"	80	6s5
6s6	Wing Slope, F.F. Short		1	47'-8"	75	1	44'-0"	70	1	40'-4"	64	1	36'-9"	55	1	33'-1"	50	6s6
6s7	Interior Wall, Both F.V.		4	39'-1"	235	4	36'-2"	217	4	33'-3"	200	4	30'-3"	182	4	27'-3"	164	6s7
5t1	Curtain, Vertical		69	7'-11"	570	66	7'-8"	528	63	7'-5"	487	60	7'-2"	448	56	6'-11"	404	5t1
Estimated Quantities One Headwall			Reinf. Steel	18,344 LB		16,372 LB		14,476 LB		12,703 LB		10,926 LB						
			Concrete	155.8 CY	4.7	133.7 CY	4.6	113.8 CY	4.6	99.4 CY	4.6	85.7 CY						
			Wingwalls	39.6		39.6		30.3		25.2		20.4						
			Apron *	100.5		89.4		78.9		69.6		60.7						

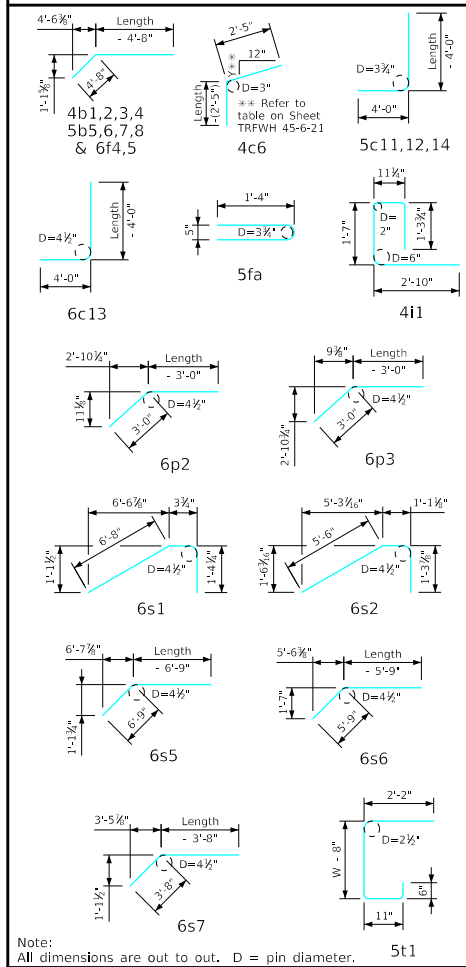
A Includes top of wingwall quantities.
 * Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal.
 Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

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

Headwall Notes:

- See Sheet TRFWH G1-21 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.

Bent Bar Details



IOWADOT Highway Division

Standard Design - Triple Reinforced Concrete Box Culverts

Flated Wing Headwalls

February, 2021

Quantity Tabulation 10'-0" Span 45° Skew	TRFWH 45-8-21 Sheet 1 of 2
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