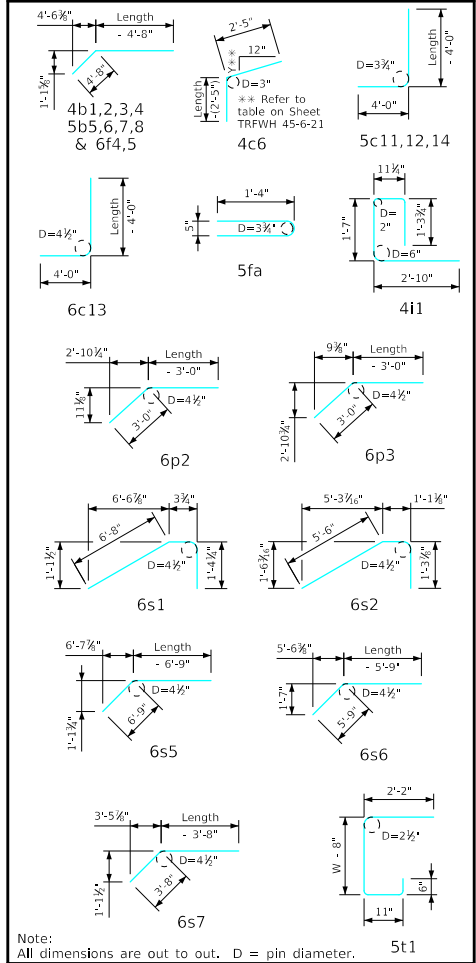


ENGLISH\FDSIGNEDTRIPLECULVERTS\FH.DGN - TRFWH 45-7-21 S1 - THIS SHEET ISSUED 02-2021.

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

Bar	Location	Shape	12' x 12'		12' x 11'		12' x 10'		12' x 9'		12' x 8'		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	76'-3"	53	1	70'-6"	49	1	64'-8"	45	1	58'-10"	41	4b1			
4b2	Wingwall, B.F.H. Short		1	47'-6"	33	1	44'-0"	31	1	40'-7"	29	1	37'-1"	25	4b2			
4b3	Wingwall, F.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	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	4b4			
5b5	Wingwall, F.F.H. Long		1	76'-4"	82	1	70'-6"	76	1	64'-8"	70	1	58'-10"	64	5b5			
5b6	Wingwall, F.F.H. Short		1	47'-7"	52	1	44'-1"	48	1	40'-7"	45	1	37'-1"	39	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	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	5b8			
5b9	Interior Wall, Both F.V.		2 Each 42 Var.	6'-11 to 37'-9	978	2 Each 38 Var.	6'-11 to 34'-11	829	2 Each 34 Var.	6'-11 to 32'-2	693	2 Each 30 Var.	6'-11 to 29'-4	567	26 Var.	7'-0 to 26'-6	454	5b9
4c1	Wingwall, F.F.V. Long		72	Var. 2'-9 to 15'-0	427	66	Var. 2'-9 to 13'-11	367	60	Var. 2'-9 to 12'-11	314	54	Var. 2'-9 to 11'-11	265	49	Var. 2'-9 to 11'-0	225	4c1
4c2	Wingwall, F.F.V. Short		43	Var. 2'-10 to 14'-10	254	40	Var. 2'-10 to 14'-0	225	36	Var. 2'-10 to 12'-10	188	33	Var. 2'-10 to 12'-0	163	29	Var. 2'-10 to 10'-10	132	4c2
4c3	Wingwall, F.F.V. Long		33	Var. 9'-7 to 15'-1	272	27	Var. 9'-7 to 14'-0	213	21	Var. 9'-7 to 13'-0	158	15	Var. 9'-7 to 12'-0	108	--	--	--	4c3
4c4	Wingwall, F.F.V. Short		20	Var. 9'-7 to 13'-0	164	17	Var. 9'-7 to 14'-1	134	13	Var. 9'-7 to 13'-0	98	10	Var. 9'-7 to 12'-1	72	--	--	--	4c4
4c5	Wingwall, F.F.V. Long		1	13'-9	9	2	12'-9	17	2	11'-9	16	2	10'-9	14	1	9'-9	7	4c5
4c5	Wingwall, F.F.V. Short		2	13'-9	18	1	12'-9	9	2	11'-9	16	1	10'-9	7	2	9'-9	13	4c5
4c6	Interior Wall, Both F.V.		4	4'-1	11	4	4'-1	11	4	4'-1	11	4	4'-1	11	4	4'-1	11	4c6
4c7	Interior Wall, Both F.V.		2 Each 132 Var.	1'-10 to 12'-5	628	2 Each 122 Var.	1'-10 to 11'-6	543	2 Each 110 Var.	1'-10 to 10'-5	466	2 Each 100 Var.	1'-10 to 9'-6	379	88	Var. 1'-10 to 8'-6	304	4c7
4c8	Interior Wall, Both F.V.		6	12'-7	50	6	11'-7	46	6	10'-7	42	6	9'-7	38	6	8'-7	34	4c8
5c9	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	15	Var. 2'-9 to 5'-2	62	15	Var. 2'-9 to 5'-2	62	5c9
5c10	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	4	Var. 2'-10 to 3'-8	14	4	Var. 2'-10 to 3'-8	14	5c10
5c11	Wingwall, B.F.V. Long		57	Var. 9'-4 to 19'-0	842	51	Var. 9'-4 to 17'-11	725	45	Var. 9'-4 to 16'-11	616	39	Var. 9'-4 to 15'-11	514	34	Var. 9'-4 to 15'-0	431	5c11
5c12	Wingwall, B.F.V. Short		39	Var. 8'-0 to 18'-10	546	36	Var. 8'-0 to 18'-0	488	32	Var. 8'-0 to 16'-10	414	29	Var. 8'-0 to 16'-0	363	25	Var. 8'-0 to 14'-10	298	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'-9	19	2	16'-9	35	2	15'-9	33	2	14'-9	31	1	13'-9	14	5c14
5c14	Wingwall, B.F.V. Short		2	17'-9	37	1	16'-9	17	2	15'-9	33	1	14'-9	15	2	13'-9	29	5c14
4d1	Apron, Longit., Bott.		25	38'-6	643	25	35'-8	596	25	32'-10	548	25	30'-0	501	25	27'-2	454	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		37	38'-6	2140	37	35'-8	1982	37	32'-10	1825	37	30'-0	1667	37	27'-2	1510	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		77	6'-8	343	75	6'-8	334	75	6'-8	334	75	6'-8	334	75	6'-8	334	7j1
7j1	Parapet, Horizontal		4	56'-1	478	4	55'-7	474	4	55'-1	470	4	55'-1	470	4	55'-1	470	7j1
6m1	Apron, Trans., Top		23	Var. 44'-8 to 48'-9	1697	20	Var. 44'-3 to 47'-10	1456	16	Var. 43'-11 to 46'-9	1148	12	Var. 43'-11 to 46'-0	854	9	Var. 43'-11 to 45'-5	636	6m1
6m2	Apron, Trans., Top		4	Var. 36'-5 to 38'-6	225	7	Var. 33'-3 to 37'-9	373	11	Var. 30'-3 to 37'-9	562	15	Var. 27'-5 to 37'-11	736	18	Var. 24'-7 to 37'-4	837	6m2
6m3	Apron, Trans., Top		46	Var. 10'-3 to 35'-7	1583	42	Var. 9'-7 to 32'-7	1330	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. 47'-4 to 71'-10	2235	22	Var. 47'-1 to 69'-6	2006	20	Var. 46'-10 to 67'-1	1784	18	Var. 46'-10 to 65'-0	1577	16	Var. 46'-10 to 62'-10	1376	6m4
6p1	Curtain, Horizontal		4	53'-8	337	4	53'-6	336	4	53'-3	334	4	53'-3	334	4	53'-3	334	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.H.		4	39'-1	235	4	36'-2	217	4	33'-3	200	4	30'-3	182	4	27'-3	164	6s7
5t1	Curtain, Vertical		77	7'-11	636	74	7'-8	592	69	7'-5	534	66	7'-2	493	62	6'-11	447	5t1
Estimated Quantities One Headwall			Reinf. Steel	19,815 LB		17,748 LB		15,748 LB		13,875 LB		11,994 LB						
			Concrete	172.5 CY	5.3	149.0 CY	5.2	127.7 CY	5.2	112.0 CY	5.2	97.0 CY						
			Parapet Δ Wingwalls Apron *	116.6	39.6	104.1	30.3	92.2	25.2	81.6	20.4	71.4						

Bent Bar Details



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 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.

IOWADOT Highway Division

Standard Design - Triple Reinforced Concrete Box Culverts

Flared Wing Headwalls

February, 2021

Quantity Tabulation 12'-0" Span 45° Skew	TRFWH 45-7-21 Sheet 1 of 2
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