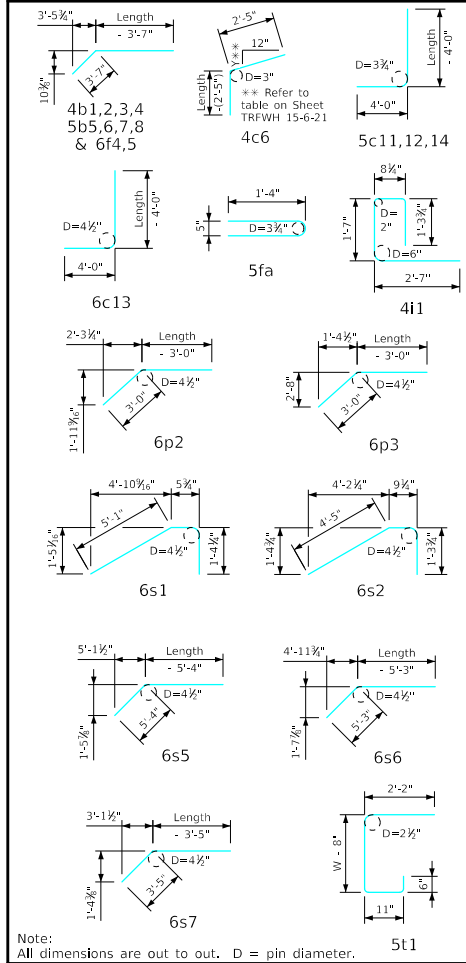


ENGLISHRFDISIGNEDTRIPLECULVERTSFHW.DGN - TRFWH 15-8-21 S1 - THIS SHEET ISSUED 02-2021.

Bill of Reinforcing for One Headwall 15° 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	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	45'-7"	32	1	42'-2"	30	1	38'-9"	26	1	31'-11"	21	4b1			
4b2	Wingwall, B.F.H. Short		1	40'-4"	29	1	37'-4"	25	1	34'-4"	23	1	31'-4"	21	4b2			
4b3	Wingwall, B.F.H. Long		10	Var. 13'-2 to 44'-0	194	9	Var. 13'-2 to 40'-7	163	8	Var. 13'-2 to 37'-2	134	7	Var. 13'-2 to 33'-9	110	4b3			
4b4	Wingwall, B.F.H. Short		10	Var. 11'-11 to 38'-11	170	9	Var. 11'-11 to 35'-11	144	8	Var. 11'-11 to 32'-11	120	7	Var. 11'-11 to 29'-11	98	4b4			
5b5	Wingwall, F.F.H. Long		1	45'-8"	50	1	42'-3"	47	1	38'-10"	41	1	35'-5"	37	5b5			
5b6	Wingwall, F.F.H. Short		1	40'-4"	45	1	37'-4"	39	1	34'-4"	36	1	31'-4"	33	5b6			
5b7	Wingwall, F.F.H. Long		11	Var. 9'-10 to 44'-1	314	10	Var. 9'-10 to 40'-8	266	9	Var. 9'-10 to 37'-3	221	8	Var. 9'-10 to 33'-10	182	5b7			
5b8	Wingwall, F.F.H. Short		11	Var. 9'-0 to 39'-0	275	10	Var. 9'-0 to 36'-0	235	9	Var. 9'-0 to 33'-0	197	8	Var. 9'-0 to 30'-0	163	5b8			
5b9	Interior Wall, Both F.H.		42	Var. 2 Each 5'-6 to 28'-6	745	38	Var. 2 Each 5'-6 to 26'-5	632	34	Var. 2 Each 5'-6 to 24'-4	529	30	Var. 2 Each 5'-7 to 22'-3	435	26	Var. 2 Each 5'-7 to 20'-2	349	5b9
4c1	Wingwall, F.F.V. Long		42	Var. 2'-9 to 14'-9	245	39	Var. 2'-9 to 13'-10	216	35	Var. 2'-9 to 12'-8	180	32	Var. 2'-9 to 11'-10	156	29	Var. 2'-9 to 10'-11	132	4c1
4c2	Wingwall, F.F.V. Short		37	Var. 2'-9 to 14'-9	216	34	Var. 2'-9 to 13'-9	187	31	Var. 2'-9 to 12'-9	160	28	Var. 2'-9 to 11'-9	136	25	Var. 2'-9 to 10'-9	113	4c2
4c3	Wingwall, F.F.V. Long		19	Var. 9'-7 to 14'-11	155	16	Var. 9'-7 to 14'-0	126	12	Var. 9'-7 to 12'-10	90	9	Var. 9'-7 to 11'-11	65	--	--	--	4c3
4c4	Wingwall, F.F.V. Short		17	Var. 9'-7 to 14'-11	139	14	Var. 9'-7 to 13'-11	110	11	Var. 9'-7 to 12'-11	83	8	Var. 9'-7 to 11'-11	57	--	--	--	4c4
4c5	Wingwall, F.F.V. Long		2	13'-8"	18	1	12'-8"	8	2	11'-8"	16	2	10'-8"	14	1	9'-8"	6	4c5
4c5	Wingwall, F.F.V. Short		2	13'-8"	18	2	12'-8"	17	2	11'-8"	16	2	10'-8"	14	2	9'-8"	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.		98	Var. 2 Each 1'-11 to 12'-4	466	90	Var. 2 Each 1'-10 to 11'-4	396	82	Var. 2 Each 1'-10 to 10'-4	333	74	Var. 2 Each 1'-10 to 9'-5	278	66	Var. 2 Each 1'-10 to 8'-5	226	4c7
4c8	Interior Wall, Both F.V.		4	12'-6"	33	4	11'-6"	31	4	10'-6"	28	4	9'-6"	25	4	8'-6"	23	4c8
5c9	Wingwall, B.F.V. Long		9	Var. 2'-9 to 5'-1	37	9	Var. 2'-9 to 5'-1	37	9	Var. 2'-9 to 5'-1	37	9	Var. 2'-9 to 5'-1	37	9	Var. 2'-9 to 5'-1	37	5c9
5c10	Wingwall, B.F.V. Short		6	Var. 2'-9 to 4'-5	22	6	Var. 2'-9 to 4'-5	22	6	Var. 2'-9 to 4'-5	22	6	Var. 2'-9 to 4'-5	22	6	Var. 2'-9 to 4'-5	22	5c10
5c11	Wingwall, B.F.V. Long		33	Var. 9'-5 to 18'-9	485	30	Var. 9'-5 to 17'-10	426	26	Var. 9'-5 to 16'-8	354	23	Var. 9'-5 to 15'-10	303	20	Var. 9'-5 to 14'-11	254	5c11
5c12	Wingwall, B.F.V. Short		31	Var. 8'-9 to 18'-9	445	28	Var. 8'-9 to 17'-9	387	25	Var. 8'-9 to 16'-9	332	22	Var. 8'-9 to 15'-9	281	19	Var. 8'-9 to 14'-9	233	5c12
6c13	Wingwall, B.F.V. Long		27	10'-6"	426	24	10'-6"	379	20	10'-6"	315	17	10'-6"	268	14	10'-6"	221	6c13
6c13	Wingwall, B.F.V. Short		24	10'-6"	379	21	10'-6"	331	18	10'-6"	284	15	10'-6"	237	12	10'-6"	189	6c13
5c14	Wingwall, B.F.V. Long		2	17'-8"	37	1	16'-8"	17	2	15'-8"	33	2	14'-8"	31	1	13'-8"	14	5c14
5c14	Wingwall, B.F.V. Short		2	17'-8"	37	2	16'-8"	35	2	15'-8"	33	2	14'-8"	31	2	13'-8"	29	5c14
4d1	Apron, Longit., Bott.		21	28'-10"	404	21	26'-9"	375	21	24'-9"	347	21	22'-8"	318	21	20'-7"	289	4d1
4d2	Apron, Longit., Bott. Long		3	40'-3"	86	3	36'-10"	74	3	33'-5"	67	3	30'-0"	60	3	26'-7"	53	4d2
4d3	Apron, Longit., Bott. Short		3	35'-6"	71	3	32'-5"	65	3	29'-5"	59	3	26'-5"	53	3	23'-5"	47	4d3
6f1	Apron, Longit., Top		31	28'-10"	1343	31	26'-9"	1246	31	24'-9"	1152	31	22'-8"	1055	31	20'-7"	958	6f1
6f2	Apron, Longit., Top Long		9	Var. 5'-5 to 25'-7	210	8	Var. 5'-10 to 23'-6	176	7	Var. 6'-3 to 21'-5	145	6	Var. 6'-8 to 19'-5	118	5	Var. 7'-2 to 17'-4	92	6f2
6f3	Apron, Longit., Top Short		8	Var. 5'-5 to 25'-8	187	7	Var. 6'-3 to 23'-8	157	6	Var. 7'-0 to 21'-7	129	6	Var. 4'-11 to 19'-6	110	5	Var. 5'-9 to 17'-5	87	6f3
6f4	Apron, Longit., Top Long		1	45'-8"	72	1	42'-3"	67	1	38'-10"	58	1	35'-5"	53	1	31'-11"	48	6f4
6f5	Apron, Longit., Top Short		1	40'-4"	64	1	37'-4"	56	1	34'-4"	52	1	31'-4"	47	1	28'-4"	43	6f5
4j1	Parapet, Vertical		65	6'-2"	268	63	6'-2"	260	63	6'-2"	260	63	6'-2"	260	63	6'-2"	260	4j1
7j1	Parapet, Horizontal		4	34'-10"	285	4	34'-6"	282	4	34'-1"	279	4	34'-1"	279	4	34'-1"	279	7j1
6m1	Apron, Trans., Top		7	Var. 35'-11 to 36'-2	375	7	Var. 34'-9 to 35'-10	371	7	Var. 34'-4 to 35'-6	367	7	Var. 34'-4 to 35'-6	367	7	Var. 34'-4 to 35'-6	367	6m1
6m2	Apron, Trans., Top		23	Var. 36'-6 to 44'-9	1451	20	Var. 36'-2 to 43'-3	1225	17	Var. 35'-9 to 41'-9	1008	14	Var. 35'-9 to 40'-8	811	12	Var. 35'-9 to 39'-11	682	6m2
6m3	Apron, Trans., Top		11	Var. 8'-8 to 34'-9	359	11	Var. 8'-7 to 34'-8	357	12	Var. 5'-11 to 34'-8	366	12	Var. 6'-0 to 34'-9	367	11	Var. 6'-2 to 32'-3	317	6m3
6m4	Apron, Trans., Bott.		24	Var. 28'-8 to 41'-1	1268	22	Var. 28'-6 to 39'-10	1129	20	Var. 28'-4 to 38'-7	1005	18	Var. 28'-4 to 37'-6	890	16	Var. 28'-4 to 36'-5	778	6m4
6p1	Curtain, Horizontal		4	33'-5"	201	4	33'-2"	199	4	33'-0"	198	4	33'-0"	198	4	33'-0"	198	6p1
6p2	Curtain, Horizontal, Long		4	21'-9"	131	4	20'-3"	122	4	18'-9"	113	4	17'-3"	104	4	15'-9"	95	6p2
6p3	Curtain, Horizontal, Short		4	16'-10"	101	4	15'-9"	95	4	14'-7"	88	4	13'-6"	81	4	12'-5"	75	6p3
6s1	Wing Slope, Both F., Long		2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	6s1
6s2	Wing Slope, Both F., Short		2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	6s2
6s3	Wing Slope, Both F., Long		2	41'-3"	131	2	37'-9"	113	2	34'-2"	103	2	30'-7"	92	2	27'-0"	81	6s3
6s4	Wing Slope, Both F., Short		2	36'-11"	111	2	33'-9"	101	2	30'-7"	92	2	27'-5"	82	2	24'-3"	73	6s4
6s5	Wing Slope, F.F., Long		1	46'-5"	73	1	42'-10"	68	1	39'-3"	59	1	35'-8"	54	1	32'-1"	48	6s5
6s6	Wing Slope, F.F., Short		1	41'-8"	66	1	38'-6"	58	1	35'-4"	53	1	32'-2"	48	1	29'-0"	44	6s6
6s7	Interior Wall, Both F.H.		4	30'-9"	185	4	28'-6"	171	4	26'-3"	158	4	23'-11"	144	4	21'-8"	130	6s7
5t1	Curtain, Vertical		46	7'-11"	380	44	7'-8"	352	42	7'-5"	325	41	7'-2"	306	39	6'-11"	281	5t1
Estimated Quantities One Headwall			Reinf. Steel	12,892 LB		11,483 LB		10,184 LB		9,013 LB		7,790 LB						
			Concrete	105.6 CY	3.4	90.9 CY	3.3	77.6 CY	3.3	68.0 CY	3.3	58.9 CY						
			Parapet Δ	28.0		21.5		17.8		14.4		11.4						
			Wingwalls	59.5		52.8		46.9		41.2		36.1						
			Apron *															

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 10'-0" Span 15° Skew	TRFWH 15-8-21 Sheet 1 of 2
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