

ENGLISHLRFDSTGDRIPLEULVERTSFVHW.DGN - TRFWH 30-8-21 S1 - THIS SHEET ISSUED 02-2021.

Bill of Reinforcing for One Headwall 30° 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	55'-2"	38	1	51'-0"	36	1	42'-8"	30	1	38'-6"	26	4b1			
4b2	Wingwall, B.F.H. Short		1	42'-2"	30	1	39'-1"	26	1	32'-10"	22	1	29'-9"	20	4b2			
4b3	Wingwall, B.F.H. Long		10 Var.	15'-8 to 53'-3	237	9 Var.	15'-8 to 49'-1	199	8 Var.	15'-8 to 44'-11	165	7 Var.	15'-8 to 40'-9	134	6 Var.	15'-8 to 36'-7	105	4b3
4b4	Wingwall, B.F.H. Short		10 Var.	12'-11 to 40'-9	181	9 Var.	12'-11 to 37'-8	152	8 Var.	12'-11 to 34'-7	127	7 Var.	12'-10 to 31'-5	103	6 Var.	12'-10 to 28'-4	82	4b4
5b5	Wingwall, F.F.H. Long		1	55'-3"	60	1	51'-1"	56	1	46'-11"	51	1	42'-9"	47	1	38'-7"	40	5b5
5b6	Wingwall, F.F.H. Short		1	42'-3"	46	1	39'-2"	41	1	36'-0"	38	1	32'-11"	34	1	29'-9"	31	5b6
5b7	Wingwall, F.F.H. Long		11 Var.	11'-7 to 53'-4	382	10 Var.	11'-7 to 49'-1	324	9 Var.	11'-7 to 44'-11	270	8 Var.	11'-7 to 40'-9	221	7 Var.	11'-7 to 36'-7	176	5b7
5b8	Wingwall, F.F.H. Short		11 Var.	9'-10 to 40'-10	293	10 Var.	9'-10 to 37'-9	248	9 Var.	9'-10 to 34'-7	208	8 Var.	9'-10 to 31'-6	172	7 Var.	9'-9 to 28'-4	139	5b8
5b9	Interior Wall, Both F.V.		42 Var.	2 Each 6'-0 to 31'-4	818	38 Var.	2 Each 6'-0 to 29'-1	695	34 Var.	2 Each 6'-0 to 26'-9	581	30 Var.	2 Each 6'-0 to 24'-5	476	26 Var.	2 Each 6'-1 to 22'-2	383	5b9
4c1	Wingwall, F.F.V. Long		51 Var.	2'-9 to 14'-9	298	47 Var.	2'-9 to 13'-9	259	43 Var.	2'-9 to 12'-10	224	39 Var.	2'-9 to 11'-10	190	35 Var.	2'-9 to 10'-11	160	4c1
4c2	Wingwall, F.F.V. Short		38 Var.	2'-9 to 14'-8	221	35 Var.	2'-9 to 13'-8	192	32 Var.	2'-9 to 12'-9	166	29 Var.	2'-9 to 11'-9	140	26 Var.	2'-9 to 10'-9	117	4c2
4c3	Wingwall, F.F.V. Long		23 Var.	9'-7 to 14'-10	188	19 Var.	9'-7 to 13'-11	149	15 Var.	9'-7 to 12'-11	113	11 Var.	9'-7 to 12'-0	79	--	--	--	4c3
4c4	Wingwall, F.F.V. Short		18 Var.	9'-4 to 14'-10	145	15 Var.	9'-4 to 13'-10	116	12 Var.	9'-4 to 12'-10	89	9 Var.	9'-4 to 11'-11	64	--	--	--	4c4
4c5	Wingwall, F.F.V. Long		2	13'-8	18	2	12'-8	17	2	11'-8	16	1	10'-8	7	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.		108 Var.	2 Each 1'-10 to 12'-3	508	100 Var.	2 Each 1'-10 to 11'-5	443	90 Var.	2 Each 1'-10 to 10'-4	366	82 Var.	2 Each 1'-10 to 9'-5	272	72 Var.	2 Each 1'-10 to 8'-4	244	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		11 Var.	2'-9 to 5'-2	45	11 Var.	2'-9 to 5'-2	45	11 Var.	2'-9 to 5'-2	45	11 Var.	2'-9 to 5'-2	45	11 Var.	2'-9 to 5'-2	45	5c9
5c10	Wingwall, B.F.V. Short		5 Var.	2'-9 to 4'-1	18	5 Var.	2'-9 to 4'-1	18	5 Var.	2'-9 to 4'-1	18	5 Var.	2'-9 to 4'-1	18	5 Var.	2'-9 to 4'-1	18	5c10
5c11	Wingwall, B.F.V. Long		40 Var.	9'-5 to 18'-9	588	36 Var.	9'-5 to 17'-9	510	32 Var.	9'-5 to 16'-10	438	28 Var.	9'-5 to 15'-10	369	24 Var.	9'-5 to 14'-11	305	5c11
5c12	Wingwall, B.F.V. Short		33 Var.	8'-5 to 18'-8	466	30 Var.	8'-5 to 17'-8	408	27 Var.	8'-5 to 16'-9	354	24 Var.	8'-5 to 15'-9	302	21 Var.	8'-5 to 14'-9	254	5c12
6c13	Wingwall, B.F.V. Long		33	10'-6	520	29	10'-6	457	25	10'-6	394	21	10'-6	331	17	10'-6	268	6c13
6c13	Wingwall, B.F.V. Short		25	10'-6	394	22	10'-6	347	19	10'-6	300	16	10'-6	252	13	10'-6	205	6c13
5c14	Wingwall, B.F.V. Long		2	17'-8	37	2	16'-8	35	2	15'-8	33	1	14'-8	15	1	13'-8	14	5c14
5c14	Wingwall, B.F.V. Short		2	17'-8	37	2	16'-8	35	2	15'-8	33	1	14'-8	15	1	13'-8	14	5c14
4d1	Apron, Longit., Bott.		21	31'-11	448	21	29'-7	415	21	27'-3	382	21	25'-0	353	21	22'-8	318	4d1
4d2	Apron, Longit., Bott. Long		3	48'-9	102	3	44'-7	94	3	40'-5	86	3	36'-3	73	3	32'-1	64	4d2
4d3	Apron, Longit., Bott. Short		3	37'-3	75	3	34'-2	68	3	31'-0	62	3	27'-11	56	3	24'-9	50	4d3
6f1	Apron, Longit., Top		31	31'-11	1486	31	29'-7	1377	31	27'-3	1269	31	25'-0	1164	31	22'-8	1055	6f1
6f2	Apron, Longit., Top Long		11 Var.	5'-4 to 28'-6	279	10 Var.	5'-4 to 26'-2	237	9 Var.	5'-4 to 23'-10	197	8 Var.	5'-4 to 21'-7	162	7 Var.	5'-3 to 19'-3	129	6f2
6f3	Apron, Longit., Top Short		8 Var.	7'-0 to 28'-8	214	7 Var.	7'-9 to 26'-5	180	7 Var.	5'-5 to 24'-1	155	6 Var.	6'-2 to 21'-9	126	5 Var.	6'-11 to 19'-6	99	6f3
6f4	Apron, Longit., Top Long		1	55'-3"	86	1	51'-1"	80	1	46'-11"	74	1	42'-9"	68	1	38'-7"	58	6f4
6f5	Apron, Longit., Top Short		1	42'-3"	67	1	39'-2"	59	1	36'-0"	51	1	32'-11"	49	1	29'-9"	45	6f5
4j1	Parapet, Vertical		65	6'-4	275	63	6'-4	267	63	6'-4	267	63	6'-4	267	63	6'-4	267	4j1
7j1	Parapet, Horizontal		4	38'-10	318	4	38'-5	314	4	38'-1	311	4	38'-1	311	4	38'-1	311	7j1
6m1	Apron, Trans., Top		14 Var.	36'-3 to 38'-8	788	14 Var.	35'-11 to 38'-4	781	14 Var.	35'-7 to 38'-0	774	13 Var.	35'-7 to 37'-10	717	14 Var.	35'-7 to 38'-0	774	6m1
6m2	Apron, Trans., Top		13 Var.	39'-0 to 43'-6	842	10 Var.	38'-8 to 42'-1	628	7 Var.	38'-4 to 40'-7	422	5 Var.	38'-0 to 39'-6	291	1	38'-4	58	6m2
6m3	Apron, Trans., Top		25 Var.	8'-4 to 35'-0	814	24 Var.	8'-7 to 34'-2	771	24 Var.	7'-9 to 33'-4	740	24 Var.	7'-1 to 32'-8	716	24 Var.	6'-5 to 32'-0	692	6m3
6m4	Apron, Trans., Bott.		24 Var.	31'-11 to 47'-7	1476	22 Var.	31'-9 to 46'-0	1317	20 Var.	31'-7 to 44'-6	1168	18 Var.	31'-7 to 43'-1	1027	16 Var.	31'-7 to 41'-9	892	6m4
6p1	Curtain, Horizontal		4	37'-2	223	4	36'-11	222	4	36'-9	221	4	36'-9	221	4	36'-9	221	6p1
6p2	Curtain, Horizontal, Long		4	28'-0	168	4	26'-0	156	4	24'-0	144	4	22'-0	132	4	20'-0	120	6p2
6p3	Curtain, Horizontal, Short		4	15'-11	96	4	14'-11	90	4	13'-10	83	4	12'-10	77	4	11'-9	71	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	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	6s2
6s3	Wing Slope, Both F., Long		2	48'-11	154	2	44'-7	141	2	40'-4	128	2	36'-0	108	2	31'-9	95	6s3
6s4	Wing Slope, Both F., Short		2	38'-0	114	2	34'-9	104	2	31'-6	95	2	28'-2	85	2	24'-11	75	6s4
6s5	Wing Slope, F.F., Long		1	55'-0	86	1	50'-9	80	1	46'-5	75	1	42'-2	67	1	37'-10	57	6s5
6s6	Wing Slope, F.F., Short		1	43'-4	68	1	40'-1	64	1	36'-9	55	1	33'-6	50	1	30'-3	45	6s6
6s7	Interior Wall, Both F.H.		4	33'-3	200	4	30'-10	185	4	28'-4	170	4	25'-10	155	4	23'-4	140	6s7
5t1	Curtain, Vertical		54	7'-11	446	52	7'-8	416	49	7'-5	379	47	7'-2	351	44	6'-11	317	5t1
Estimated Quantities One Headwall			Reinf. Steel	14,506 LB		12,964 LB		11,501 LB		10,115 LB		8,718 LB						
			Concrete	120.5 CY	3.8	103.6 CY	3.7	88.3 CY	3.7	77.3 CY	3.7	67.0 CY						
			Parapet Δ Wingwalls Apron *	40.1	31.5	24.1	20.0	16.3	16.3	16.3	16.3	16.3						
				76.5	68.3	60.5	53.6	47.0	47.0	47.0	47.0	47.0						

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.

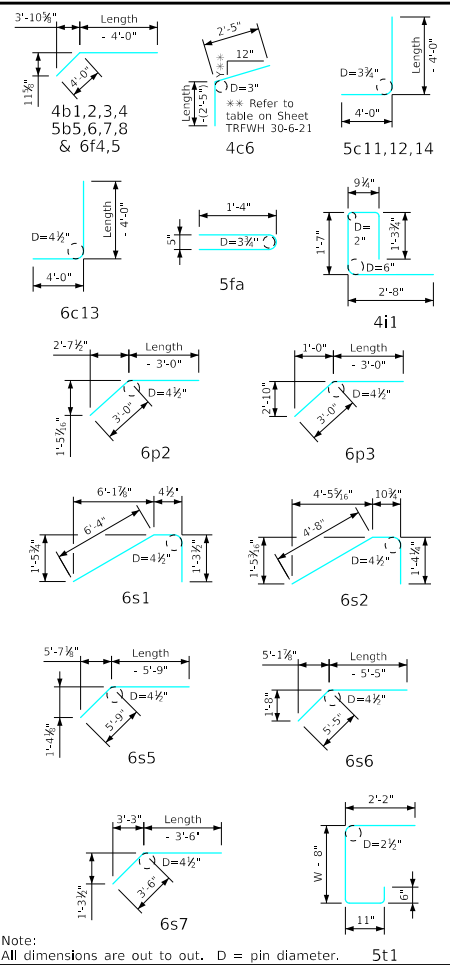
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

"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.

Bent Bar Details



Standard Design - Triple Reinforced Concrete Box Culverts

Flated Wing Headwalls

February, 2021

Quantity Tabulation
 10'-0" Span
 30° Skew

TRFWH
 30-8-21
 Sheet 1 of 2