

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

Bar	Location	Shape	8' x 10'			8' x 9'			8' x 8'			8' x 7'			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	46'-10"	33	1	42'-8"	30	1	38'-6"	26	1	34'-4"	23	4b1
4b2	Wingwall, B.F.H. Short		1	36'-0"	24	1	32'-10"	22	1	29'-9"	20	1	26'-7"	18	4b2
4b3	Wingwall, B.F.H. Long		8 Var.	15'-8 to 44'-11	165	7 Var.	15'-8 to 40'-9	134	6 Var.	15'-8 to 36'-7	105	5 Var.	15'-8 to 32'-5	80	4b3
4b4	Wingwall, B.F.H. Short		8 Var.	12'-11 to 34'-7	127	7 Var.	12'-10 to 31'-5	103	6 Var.	12'-10 to 28'-4	82	5 Var.	12'-10 to 25'-3	64	4b4
5b5	Wingwall, F.F.H. Long		1	46'-11"	51	1	42'-9"	47	1	38'-7"	40	1	34'-5"	36	5b5
5b6	Wingwall, F.F.H. Short		1	36'-0"	38	1	32'-11"	34	1	29'-9"	31	1	26'-8"	28	5b6
5b7	Wingwall, F.F.H. Long		9 Var.	11'-7 to 44'-11	270	8 Var.	11'-7 to 40'-9	221	7 Var.	11'-7 to 36'-7	176	6 Var.	11'-7 to 32'-5	138	5b7
5b8	Wingwall, F.F.H. Short		9 Var.	9'-10 to 34'-7	208	8 Var.	9'-10 to 31'-6	172	7 Var.	9'-9 to 28'-4	139	6 Var.	9'-9 to 25'-3	110	5b8
5b9	Interior Wall, Both F.H.		17 Var.	6'-0 to 26'-9	290	15 Var.	6'-0 to 24'-5	238	13 Var.	6'-1 to 22'-2	192	11 Var.	6'-1 to 19'-10	149	5b9
4c1	Wingwall, F.F.V. Long		43 Var.	2'-8 to 12'-9	221	39 Var.	2'-8 to 11'-9	188	35 Var.	2'-8 to 10'-10	158	31 Var.	2'-8 to 9'-10	129	4c1
4c2	Wingwall, F.F.V. Short		32 Var.	2'-8 to 12'-8	164	29 Var.	2'-8 to 11'-8	139	26 Var.	2'-8 to 10'-8	116	23 Var.	2'-8 to 9'-9	95	4c2
4c3	Wingwall, F.F.V. Long		15 Var.	9'-6 to 12'-10	112	11 Var.	9'-6 to 11'-11	79	--	--	--	--	--	--	4c3
4c4	Wingwall, F.F.V. Short		12 Var.	9'-3 to 12'-9	88	9 Var.	9'-3 to 11'-10	63	--	--	--	--	--	--	4c4
4c5	Wingwall, F.F.V. Long		2	11'-7"	15	1	10'-7"	7	1	9'-7"	6	1	8'-7"	6	4c5
4c6	Wingwall, F.F.V. Short		2	11'-7"	15	2	10'-7"	14	2	9'-7"	13	1	8'-7"	6	4c6
4c7	Interior Wall, Both F.V.		2	4'-0"	5	2	4'-0"	5	2	4'-0"	5	2	4'-0"	5	4c7
4c8	Interior Wall, Both F.V.		45 Var.	1'-9 to 10'-3	180	41 Var.	1'-9 to 9'-4	152	36 Var.	1'-9 to 8'-3	120	32 Var.	1'-9 to 7'-4	97	4c8
5c9	Wingwall, B.F.V. Long		11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	11 Var.	2'-8 to 5'-1	44	5c9
5c10	Wingwall, B.F.V. Short		5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5 Var.	2'-8 to 4'-0	17	5c10
5c11	Wingwall, B.F.V. Long		32 Var.	9'-4 to 16'-9	435	28 Var.	9'-4 to 15'-9	366	24 Var.	9'-4 to 14'-10	302	20 Var.	9'-4 to 13'-10	242	5c11
5c12	Wingwall, B.F.V. Short		27 Var.	8'-4 to 16'-8	352	24 Var.	8'-4 to 15'-8	300	21 Var.	8'-4 to 14'-8	252	18 Var.	8'-4 to 13'-9	207	5c12
6c13	Wingwall, B.F.V. Long		25	10'-6"	394	21	10'-6"	331	17	10'-6"	268	13	10'-6"	205	6c13
6c13	Wingwall, B.F.V. Short		19	10'-6"	300	16	10'-6"	252	13	10'-6"	205	10	10'-6"	158	6c13
5c14	Wingwall, B.F.V. Long		2	15'-7"	33	1	14'-7"	15	1	13'-7"	14	1	12'-7"	13	5c14
5c14	Wingwall, B.F.V. Short		2	15'-7"	33	2	14'-7"	30	2	13'-7"	28	1	12'-7"	13	5c14
4d1	Apron, Longit., Bott.		11	27'-3"	200	11	25'-0"	184	11	22'-8"	167	11	20'-4"	149	4d1
4d2	Apron, Longit., Bott. Long		3	40'-5"	86	3	36'-3"	73	3	32'-1"	64	3	27'-11"	56	4d2
4d3	Apron, Longit., Bott. Short		3	31'-0"	62	3	27'-11"	56	3	24'-9"	50	3	21'-8"	43	4d3
6f1	Apron, Longit., Top		16	27'-3"	655	16	25'-0"	601	16	22'-8"	545	16	20'-4"	489	6f1
6f2	Apron, Longit., Top Long		9 Var.	5'-4 to 23'-10	197	8 Var.	5'-4 to 21'-7	162	7 Var.	5'-3 to 19'-3	129	6 Var.	5'-3 to 16'-11	100	6f2
6f3	Apron, Longit., Top Short		7 Var.	5'-5 to 24'-1	155	6 Var.	6'-2 to 19'-9	126	5 Var.	6'-11 to 19'-6	99	4 Var.	7'-9 to 17'-2	75	6f3
6f4	Apron, Longit., Top Long		1	46'-11"	74	1	42'-9"	68	1	38'-7"	58	1	34'-5"	52	6f4
6f5	Apron, Longit., Top Short		1	36'-0"	54	1	32'-11"	49	1	29'-9"	45	1	26'-8"	40	6f5
4f1	Parapet, Vertical		33	6'-4"	140	33	6'-4"	140	33	6'-4"	140	33	6'-4"	140	4f1
7j1	Parapet, Horizontal		4	20'-11"	171	4	20'-11"	171	4	20'-11"	171	4	20'-8"	169	7j1
6m1	Apron, Trans., Top		8 Var.	19'-8 to 21'-0	244	8 Var.	19'-8 to 21'-0	244	8 Var.	19'-8 to 21'-0	244	8 Var.	19'-5 to 20'-9	241	6m1
6m2	Apron, Trans., Top		19 Var.	21'-3 to 28'-0	703	16 Var.	21'-3 to 26'-11	579	13 Var.	21'-3 to 25'-9	459	10 Var.	21'-0 to 24'-5	341	6m2
6m3	Apron, Trans., Top		13 Var.	7'-0 to 20'-4	267	13 Var.	6'-4 to 19'-8	254	12 Var.	6'-9 to 19'-0	232	12 Var.	6'-0 to 18'-2	218	6m3
6m4	Apron, Trans., Bott.		20 Var.	14'-5 to 27'-4	627	18 Var.	14'-5 to 26'-0	546	16 Var.	14'-5 to 24'-8	470	14 Var.	14'-4 to 23'-2	394	6m4
6p1	Curtain, Horizontal		4	19'-7"	118	4	19'-7"	118	4	19'-7"	118	4	19'-6"	117	6p1
6p2	Curtain, Horizontal, Long		4	24'-0"	144	4	22'-0"	132	4	20'-0"	120	4	18'-0"	108	6p2
6p3	Curtain, Horizontal, Short		4	13'-10"	83	4	12'-10"	77	4	11'-9"	71	4	10'-9"	65	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	40'-4"	128	2	36'-0"	108	2	31'-9"	95	2	27'-5"	82	6s3
6s4	Wing Slope, Both F., Short		2	31'-6"	95	2	28'-2"	85	2	24'-11"	75	2	21'-8"	65	6s4
6s5	Wing Slope, F.F. Long		1	46'-5"	73	1	42'-2"	67	1	37'-10"	57	1	33'-7"	50	6s5
6s6	Wing Slope, F.F. Short		1	36'-9"	55	1	33'-6"	50	1	30'-3"	45	1	26'-11"	40	6s6
6s7	Interior Wall, Both F.H.		2	28'-4"	85	2	25'-10"	78	2	23'-4"	70	2	20'-10"	63	6s7
5t1	Curtain, Vertical		35	7'-5"	271	33	7'-2"	247	30	6'-11"	216	28	6'-8"	195	5t1
Estimated Quantities			Reinf. Steel			7282 LB			6161 LB			5236 LB			
Concrete			8366 LB			2.4			2.3			37.7 CY			
One Headwall			64.8 CY			16.7			48.0 CY			9.7			
Parapet Δ			2.4			32.0			32.0			25.7			
Wingwalls			20.1			54.3 CY			13.6			37.7 CY			
Apron *			42.3			35.2			32.0			25.7			

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.

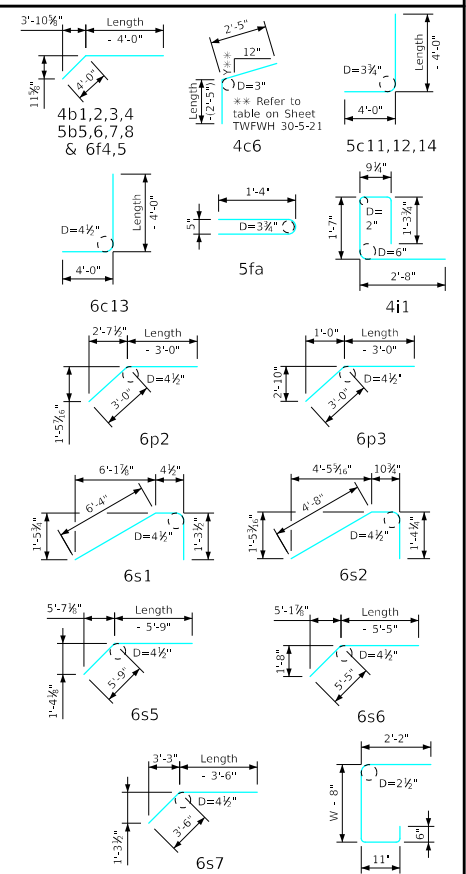
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

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

Headwall Notes:

- See Sheet TWFHW 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



Note: All dimensions are out to out, D = pin diameter.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	 Standard Design - Twin Reinforced Concrete Box Culverts <h3 style="margin: 0;">Flared Wing Headwalls</h3> February, 2021
		Quantity Tabulation 8'-0" Span 30° Skew
		TWFHW 30-8-21 Sheet 1 of 2