

Bill of Reinforcing for One Headwall 45° 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	64'-8"	45	1	58'-10"	41	1	53'-0"	37	1	47'-2"	33	4b1		
4b2	Wingwall, B.F.H. Short		1	40'-7"	29	1	37'-1"	25	1	33'-7"	22	1	30'-1"	20	4b2		
4b3	Wingwall, B.F.H. Long		8 Var.	21'-2 to 61'-11	228	7 Var.	21'-2 to 56'-1	185	6 Var.	21'-2 to 50'-3	146	5 Var.	21'-2 to 44'-5	111	4b3		
4b4	Wingwall, B.F.H. Short		8 Var.	14'-6 to 38'-11	143	7 Var.	14'-6 to 35'-5	117	6 Var.	14'-6 to 31'-11	93	5 Var.	14'-6 to 28'-5	72	4b4		
5b5	Wingwall, F.F.H. Long		1	64'-8"	70	1	58'-10"	64	1	53'-0"	58	1	47'-2"	52	5b5		
5b6	Wingwall, F.F.H. Short		1	40'-7"	45	1	37'-1"	39	1	33'-7"	35	1	30'-1"	31	5b6		
5b7	Wingwall, F.F.H. Long		9 Var.	15'-5 to 61'-11	373	8 Var.	15'-5 to 56'-1	306	7 Var.	15'-4 to 50'-3	244	6 Var.	15'-4 to 44'-5	189	5b7		
5b8	Wingwall, F.F.H. Short		9 Var.	11'-1 to 39'-0	235	8 Var.	11'-1 to 35'-6	194	7 Var.	11'-1 to 32'-0	157	6 Var.	11'-0 to 28'-6	124	5b8		
5b9	Interior Wall, Both F.H.		17 Var.	6'-11 to 32'-2	346	15 Var.	6'-11 to 29'-4	284	13 Var.	7'-0 to 26'-6	227	11 Var.	7'-0 to 23'-8	176	5b9		
4c1	Wingwall, F.F.V. Long		60 Var.	2'-7 to 12'-9	307	54 Var.	2'-7 to 11'-9	259	49 Var.	2'-7 to 10'-10	220	43 Var.	2'-7 to 9'-10	178	4c1		
4c2	Wingwall, F.F.V. Short		36 Var.	2'-8 to 12'-8	184	33 Var.	2'-8 to 11'-10	160	29 Var.	2'-8 to 10'-8	129	26 Var.	2'-8 to 9'-10	109	4c2		
4c3	Wingwall, F.F.V. Long		21 Var.	9'-5 to 12'-10	156	15 Var.	9'-5 to 11'-10	106	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.V. Short		13 Var.	9'-5 to 12'-10	97	10 Var.	9'-5 to 11'-11	71	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.V. Long		2	11'-7"	15	2	10'-7"	14	1	9'-7"	6	1	8'-7"	6	4c5		
4c6	Wingwall, F.F.V. Short		2	11'-7"	15	1	10'-7"	7	2	9'-7"	13	1	8'-7"	6	4c6		
4c7	Interior Wall, Both F.V.		2	3'-11"	5	2	3'-11"	5	2	3'-11"	5	2	3'-11"	5	4c7		
4c8	Interior Wall, Both F.V.		55 Var.	1'-8 to 10'-3	219	50 Var.	1'-8 to 9'-4	184	44 Var.	1'-8 to 8'-4	147	38 Var.	1'-8 to 7'-3	113	4c8		
5c9	Wingwall, B.F.V. Long		3	10'-5"	21	3	9'-5"	19	3	8'-5"	17	3	7'-5"	15	5c9		
5c10	Wingwall, B.F.V. Short		15 Var.	2'-7 to 5'-0	59	15 Var.	2'-7 to 5'-0	59	15 Var.	2'-7 to 5'-0	59	15 Var.	2'-7 to 5'-0	59	5c10		
5c11	Wingwall, B.F.V. Long		4 Var.	2'-8 to 3'-6	13	4 Var.	2'-8 to 3'-6	13	4 Var.	2'-8 to 3'-6	13	4 Var.	2'-8 to 3'-6	13	5c11		
5c12	Wingwall, B.F.V. Short		45 Var.	9'-2 to 16'-9	608	39 Var.	9'-2 to 15'-9	507	34 Var.	9'-2 to 14'-10	426	28 Var.	9'-2 to 13'-10	336	5c12		
6c13	Wingwall, B.F.V. Long		32 Var.	7'-10 to 18'-8	409	29 Var.	7'-10 to 15'-10	358	25 Var.	7'-10 to 14'-8	293	22 Var.	7'-10 to 13'-10	249	6c13		
6c13	Wingwall, B.F.V. Short		35	10'-6"	552	29	10'-6"	457	24	10'-6"	379	18	10'-6"	284	6c13		
5c14	Wingwall, B.F.V. Long		21	10'-6"	331	18	10'-6"	284	14	10'-6"	221	11	10'-6"	173	5c14		
5c14	Wingwall, B.F.V. Short		2	15'-7"	33	2	14'-7"	30	1	13'-7"	14	1	12'-7"	13	5c14		
5c14	Wingwall, B.F.V. Short		2	15'-7"	33	1	14'-7"	15	2	13'-7"	28	1	12'-7"	13	5c14		
4d1	Apron, Longit., Bott.		11	32'-10"	241	11	30'-0"	220	11	27'-2"	200	11	24'-5"	179	4d1		
4d2	Apron, Longit., Bott. Long		3	57'-2"	119	3	51'-5"	108	3	45'-7"	96	3	39'-9"	80	4d2		
4d3	Apron, Longit., Bott. Short		3	35'-7"	71	3	32'-1"	64	3	28'-7"	57	3	25'-1"	50	4d3		
6f1	Apron, Longit., Top		16	32'-10"	789	16	30'-0"	721	16	27'-2"	653	16	24'-5"	587	6f1		
6f2	Apron, Longit., Top Long		12 Var.	6'-11 to 29'-2	325	11 Var.	6'-1 to 26'-4	268	9 Var.	7'-3 to 23'-6	208	8 Var.	6'-5 to 20'-8	163	6f2		
6f3	Apron, Longit., Top Short		8 Var.	5'-9 to 29'-6	212	7 Var.	6'-4 to 26'-8	173	6 Var.	6'-10 to 23'-10	138	5 Var.	7'-4 to 21'-0	106	6f3		
6f4	Apron, Longit., Top Long		1	64'-8"	101	1	58'-10"	92	1	53'-0"	83	1	47'-2"	74	6f4		
6f5	Apron, Longit., Top Short		1	40'-7"	65	1	37'-1"	56	1	33'-7"	50	1	30'-1"	45	6f5		
4f1	Parapet, Vertical		33	6'-8"	147	33	6'-8"	147	33	6'-8"	147	33	6'-8"	147	4f1		
7j1	Parapet, Horizontal		4	25'-8"	210	4	25'-8"	210	4	25'-8"	210	4	25'-4"	207	7j1		
6m1	Apron, Trans., Top		13 Var.	20'-6 to 22'-9	422	13 Var.	20'-6 to 22'-9	422	13 Var.	20'-6 to 22'-9	422	13 Var.	20'-3 to 22'-6	417	6m1		
6m2	Apron, Trans., Top		17 Var.	23'-0 to 29'-0	664	13 Var.	23'-0 to 27'-6	493	9 Var.	23'-0 to 26'-0	331	6 Var.	22'-9 to 24'-8	214	6m2		
6m3	Apron, Trans., Top		22 Var.	8'-4 to 20'-2	471	22 Var.	7'-9 to 19'-7	452	22 Var.	7'-2 to 19'-0	432	21 Var.	6'-6 to 17'-9	382	6m3		
6m4	Apron, Trans., Bott.		20 Var.	17'-4 to 37'-8	826	18 Var.	17'-4 to 35'-6	714	16 Var.	17'-4 to 33'-4	609	14 Var.	17'-3 to 31'-1	508	6m4		
6p1	Curtain, Horizontal		4	23'-9"	143	4	23'-9"	143	4	23'-9"	143	4	23'-7"	142	6p1		
6p2	Curtain, Horizontal, Long		4	36'-0"	216	4	32'-10"	197	4	29'-8"	178	4	26'-6"	159	6p2		
6p3	Curtain, Horizontal, Short		4	13'-7"	82	4	12'-7"	76	4	11'-7"	70	4	10'-7"	64	6p3		
6s1	Wing Slope, Both F., Long		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	6s2		
6s3	Wing Slope, Both F., Long		2	56'-9"	178	2	50'-10"	160	2	44'-11"	142	2	39'-0"	117	6s3		
6s4	Wing Slope, Both F., Short		2	34'-5"	103	2	30'-9"	92	2	27'-1"	81	2	23'-6"	71	6s4		
6s5	Wing Slope, F.F. Long		1	62'-10"	98	1	56'-11"	89	1	51'-0"	80	1	45'-1"	71	6s5		
6s6	Wing Slope, F.F. Short		1	40'-4"	64	1	36'-9"	55	1	33'-1"	50	1	29'-5"	44	6s6		
6s7	Interior Wall, Both F.H.		2	33'-3"	100	2	30'-3"	91	2	27'-3"	82	2	24'-4"	73	6s7		
5t1	Curtain, Vertical		47	7'-5"	364	44	7'-2"	329	40	6'-11"	289	37	6'-8"	257	5t1		
			Reinf. Steel			9230 LB			7795 LB			6592 LB					
Estimated Quantities One Headwall			Concrete			82.2 CY			71.0 CY			60.6 CY			49.0 CY		
			Parapet Δ			3.0			3.0			2.8					
			Wingwalls			25.4			17.2			12.3					
			Apron *			53.8			46.9			33.9					

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.

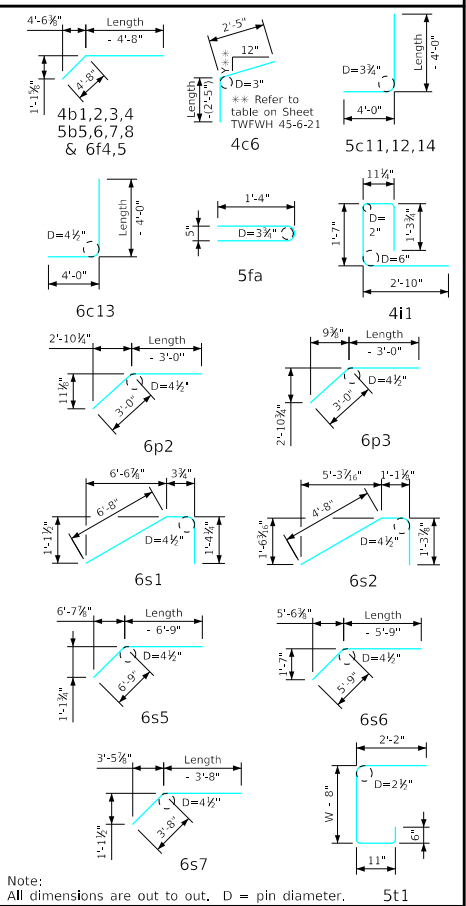
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

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

Headwall Notes:

- See Sheet TWFH 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



LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	 Standard Design - Twin Reinforced Concrete Box Culverts <h3 style="margin: 0;">Flared Wing Headwalls</h3> February, 2021 <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">Quantity Tabulation 8'-0" Span 45° Skew</td> <td style="width: 50%; text-align: center;">TWFH 45-9-21 Sheet 1 of 2</td> </tr> </table>	Quantity Tabulation 8'-0" Span 45° Skew	TWFH 45-9-21 Sheet 1 of 2
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