

ENGLISHRFD\DESIGNEDTWINCULVERTS\FWH.DGN - TWFH 30-6-21 51 - THIS SHEET ISSUED 02-2021.

### Bill of Reinforcing for One Headwall 30° 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.	No.	Length	Wt.			
5fa	Fence Anchor (Galv.)		2	2'-10"	6	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	46'-10	33	1	42'-8	30	1	38'-6	26	4b1		
4b2	Wingwall, B.F.H. Short		1	42'-2	30	1	39'-1	26	1	36'-0	24	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'-11 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.H.		21 Var.	6'-0 to 31'-4	409	19 Var.	6'-0 to 29'-1	348	17 Var.	6'-0 to 26'-9	290	15 Var.	6'-0 to 24'-5	238	13 Var.	6'-1 to 22'-2	192	5b9		
4c1	Wingwall, F.F.V. Long		51 Var.	2'-10 to 14'-10	301	47 Var.	2'-10 to 13'-10	262	43 Var.	2'-10 to 12'-11	226	39 Var.	2'-10 to 11'-11	192	35 Var.	2'-10 to 11'-0	162	4c1		
4c2	Wingwall, F.F.V. Short		38 Var.	2'-10 to 14'-9	223	35 Var.	2'-10 to 13'-9	194	32 Var.	2'-10 to 12'-10	167	29 Var.	2'-10 to 11'-10	142	26 Var.	2'-10 to 10'-10	119	4c2		
4c3	Wingwall, F.F.V. Long		23 Var.	9'-8 to 14'-11	189	19 Var.	9'-8 to 14'-0	150	15 Var.	9'-8 to 13'-0	114	11 Var.	9'-8 to 12'-1	80	--	--	--	4c3		
4c4	Wingwall, F.F.V. Short		18 Var.	9'-5 to 14'-11	146	15 Var.	9'-5 to 13'-11	117	12 Var.	9'-5 to 12'-11	90	9 Var.	9'-5 to 12'-0	64	--	--	--	4c4		
4c5	Wingwall, F.F.V. Long		2	13'-9	18	2	12'-9	17	2	11'-9	16	1	10'-9	7	1	9'-9	7	4c5		
4c5	Wingwall, F.F.V. Short		2	13'-9	18	2	12'-9	17	2	11'-9	16	2	10'-9	14	2	9'-9	13	4c5		
4c6	Interior Wall, Both F.V.		2	4'-2	6	2	4'-2	6	2	4'-2	6	2	4'-2	6	2	4'-2	6	4c6		
4c7	Interior Wall, Both F.V.		54 Var.	1'-11 to 12'-4	257	50 Var.	1'-11 to 11'-6	224	45 Var.	1'-11 to 10'-5	185	41 Var.	1'-11 to 9'-6	156	36 Var.	1'-11 to 8'-5	124	4c7		
4c8	Interior Wall, Both F.V.		2	12'-7	17	2	11'-7	15	2	10'-7	14	2	9'-7	13	2	8'-7	11	4c8		
5e9	Wingwall, B.F.V. Long		11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	11 Var.	2'-10 to 5'-3	46	5e9		
5e10	Wingwall, B.F.V. Short		5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5 Var.	2'-10 to 4'-2	18	5e10		
5e11	Wingwall, B.F.V. Long		40 Var.	9'-6 to 18'-10	591	36 Var.	9'-6 to 17'-10	513	32 Var.	9'-6 to 16'-11	441	28 Var.	9'-6 to 15'-11	371	24 Var.	9'-6 to 15'-0	307	5e11		
5e12	Wingwall, B.F.V. Short		33 Var.	8'-6 to 18'-9	469	30 Var.	8'-6 to 17'-9	411	27 Var.	8'-6 to 16'-10	357	24 Var.	8'-6 to 15'-10	305	21 Var.	8'-6 to 14'-10	256	5e12		
6c13	Wingwall, B.F.V. Long		25	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'-9	37	2	16'-9	35	2	15'-9	33	1	14'-9	15	1	13'-9	14	5c14		
5c14	Wingwall, B.F.V. Short		2	17'-9	37	2	16'-9	35	2	15'-9	33	2	14'-9	31	2	13'-9	29	5c14		
4d1	Apron, Longit., Bott.		17	31'-11	362	17	29'-7	336	17	27'-3	309	17	25'-0	284	17	22'-8	257	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		24	31'-11	1151	24	29'-7	1066	24	27'-3	982	24	25'-0	901	24	22'-8	817	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.	5'-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	54	1	32'-11	49	1	29'-9	45	6f5		
4f1	Parapet, Vertical		51	6'-4	216	49	6'-4	207	49	6'-4	207	49	6'-4	207	49	6'-4	207	4f1		
7j1	Parapet, Horizontal		4	30'-9	251	4	30'-6	249	4	30'-2	247	4	30'-2	247	4	30'-2	247	7j1		
6m1	Apron, Trans., Top		11 Var.	28'-9 to 30'-8	491	11 Var.	28'-6 to 30'-4	486	11 Var.	28'-3 to 30'-1	482	11 Var.	28'-3 to 30'-1	482	11 Var.	28'-3 to 30'-1	482	6m1		
6m2	Apron, Trans., Top		19 Var.	30'-11 to 37'-8	979	16 Var.	30'-8 to 36'-3	804	13 Var.	30'-5 to 34'-11	638	10 Var.	30'-5 to 33'-9	482	7 Var.	30'-5 to 32'-8	332	6m2		
6m3	Apron, Trans., Top		19 Var.	8'-8 to 28'-8	533	19 Var.	7'-10 to 27'-10	509	19 Var.	7'-1 to 27'-1	488	19 Var.	6'-5 to 26'-5	468	19 Var.	5'-9 to 25'-9	449	6m3		
6m4	Apron, Trans., Bott.		24 Var.	23'-10 to 39'-6	1142	22 Var.	23'-9 to 38'-1	1022	20 Var.	23'-8 to 36'-7	905	18 Var.	23'-8 to 35'-3	796	16 Var.	23'-8 to 33'-10	691	6m4		
6p1	Curtain, Horizontal		4	29'-1	175	4	28'-11	174	4	28'-10	173	4	28'-10	173	4	28'-10	173	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	73	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.		2	33'-3	100	2	30'-10	93	2	28'-4	85	2	25'-10	78	2	23'-4	70	6s7		
5t1	Curtain, Vertical		48	7'-11	396	46	7'-8	368	43	7'-5	333	41	7'-2	306	38	6'-11	274	5t1		
Estimated Quantities			Reinf. Steel			12,319 LB			11,012 LB			9,768 LB			8,572 LB			7,354 LB		
One Headwall			Concrete			105.9 CY			90.0 CY			77.6 CY			67.8 CY			58.5 CY		
Parapet Δ			3.3			2.2			3.1			3.1			3.1					
Wingwalls			33.3			26.2			20.1			16.7			13.6					
Apron *			69.3			61.6			54.4			48.0			41.8					

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.

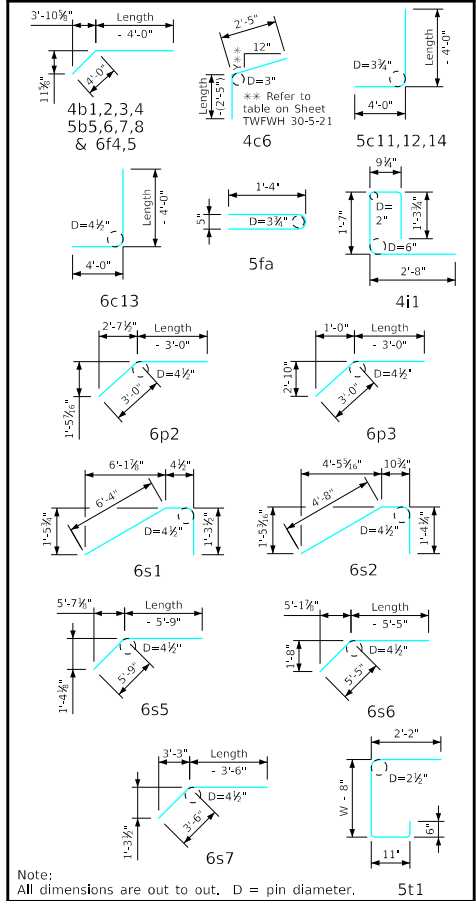
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

"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: 5px 0;">Flared Wing Headwalls</h3> February, 2021 <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Quantity Tabulation 12'-0" Span 30° Skew</td> <td style="width: 50%; border: none; text-align: right;">TWFH 30-6-21 Sheet 1 of 2</td> </tr> </table>	Quantity Tabulation 12'-0" Span 30° Skew	TWFH 30-6-21 Sheet 1 of 2
Quantity Tabulation 12'-0" Span 30° Skew	TWFH 30-6-21 Sheet 1 of 2			