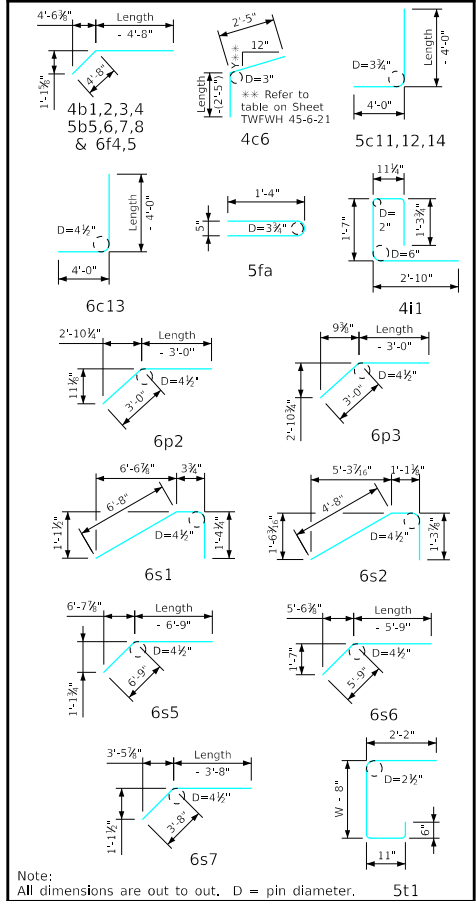


### Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

Bar	Location	Shape	10' x 7'			10' x 6'			10' x 5'			10' x 4'			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	47'-2"	33	1	41'-4"	29	1	35'-6"	24	1	29'-8"	20	4b1		
4b2	Wingwall, B.F.H. Short		1	30'-1"	20	1	26'-7"	18	1	23'-1"	15	1	19'-7"	13	4b2		
4b3	Wingwall, B.F.H. Long		5 Var.	21'-2" to 44'-5"	111	4 Var.	21'-1" to 38'-7"	80	3 Var.	21'-1" to 32'-9"	54	2 Var.	21'-1" to 26'-11"	32	4b3		
4b4	Wingwall, B.F.H. Short		5 Var.	14'-6" to 28'-5"	72	4 Var.	14'-6" to 24'-11"	53	3 Var.	14'-6" to 21'-5"	36	2 Var.	14'-6" to 17'-11"	22	4b4		
5b5	Wingwall, F.F.H. Long		1	47'-2"	52	1	41'-4"	46	1	35'-6"	37	1	29'-8"	31	5b5		
5b6	Wingwall, F.F.H. Short		1	30'-1"	31	1	26'-7"	28	1	23'-1"	24	1	19'-7"	20	5b6		
5b7	Wingwall, F.F.H. Long		6 Var.	15'-4" to 44'-5"	189	5 Var.	15'-4" to 38'-7"	141	4 Var.	15'-4" to 32'-9"	100	3 Var.	15'-4" to 26'-11"	66	5b7		
5b8	Wingwall, F.F.H. Short		6 Var.	11'-0" to 28'-6"	124	5 Var.	11'-0" to 25'-0"	94	4 Var.	11'-0" to 21'-6"	68	3 Var.	11'-0" to 18'-0"	45	5b8		
5b9	Interior Wall, Both F.H.		11 Var.	7'-0" to 23'-8"	176	9 Var.	7'-1" to 20'-10"	131	7 Var.	7'-3" to 18'-0"	92	5 Var.	7'-5" to 15'-1"	59	5b9		
4c1	Wingwall, F.F.V. Long		43 Var.	2'-8" to 9'-11"	181	37 Var.	2'-8" to 8'-11"	143	31 Var.	2'-8" to 7'-10"	109	25 Var.	2'-8" to 6'-10"	79	4c1		
4c2	Wingwall, F.F.V. Short		26 Var.	2'-9" to 9'-11"	110	22 Var.	2'-9" to 8'-9"	85	19 Var.	2'-9" to 7'-11"	68	15 Var.	2'-9" to 6'-9"	48	4c2		
4c3	Wingwall, F.F.V. Long		--	--	--	--	--	--	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.V. Short		--	--	--	--	--	--	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.V. Long		1	8'-8"	6	1	7'-8"	5	2	6'-8"	9	2	5'-8"	8	4c5		
4c6	Wingwall, F.F.V. Short		1	8'-8"	6	2	7'-8"	10	1	6'-8"	4	2	5'-8"	8	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.		38 Var.	1'-9" to 7'-4"	115	33 Var.	1'-9" to 6'-5"	90	27 Var.	1'-9" to 5'-4"	64	22 Var.	1'-9" to 4'-5"	45	4c8		
5c9	Wingwall, B.F.V. Long		15 Var.	2'-8" to 5'-1"	61	15 Var.	2'-8" to 5'-1"	61	15 Var.	2'-8" to 5'-1"	61	15 Var.	2'-8" to 5'-1"	61	5c9		
5c10	Wingwall, B.F.V. Short		4 Var.	2'-9" to 3'-7"	13	4 Var.	2'-9" to 3'-7"	13	4 Var.	2'-9" to 3'-7"	13	4 Var.	2'-9" to 3'-7"	13	5c10		
5c11	Wingwall, B.F.V. Long		28 Var.	9'-3" to 13'-11"	338	22 Var.	9'-3" to 12'-11"	254	16 Var.	9'-3" to 11'-10"	176	10 Var.	9'-3" to 10'-10"	105	5c11		
5c12	Wingwall, B.F.V. Short		22 Var.	7'-1" to 13'-11"	250	18 Var.	7'-1" to 12'-9"	194	15 Var.	7'-1" to 11'-11"	155	11 Var.	7'-1" to 10'-9"	107	5c12		
6c13	Wingwall, B.F.V. Long		18	10'-6"	284	12	10'-6"	189	--	--	--	--	--	--	6c13		
6c13	Wingwall, B.F.V. Short		11	10'-6"	173	7	10'-6"	110	--	--	--	--	--	--	6c13		
5c14	Wingwall, B.F.V. Long		1	12'-8"	13	1	11'-8"	12	2	10'-8"	22	2	9'-8"	20	5c14		
5c14	Wingwall, B.F.V. Short		1	12'-8"	13	2	11'-8"	24	1	10'-8"	11	2	9'-8"	20	5c14		
4d1	Apron, Longit., Bott.		13	24'-5"	212	13	21'-7"	187	13	18'-9"	163	13	15'-11"	138	4d1		
4d2	Apron, Longit., Bott. Long		3	39'-9"	80	3	33'-11"	68	3	28'-1"	56	3	22'-3"	45	4d2		
4d3	Apron, Longit., Bott. Short		3	25'-1"	50	3	21'-7"	43	3	18'-1"	36	3	14'-7"	29	4d3		
6f1	Apron, Longit., Top		20	24'-5"	733	20	21'-7"	648	20	18'-9"	563	20	15'-11"	478	6f1		
6f2	Apron, Longit., Top Long		8 Var.	6'-5" to 20'-8"	163	7 Var.	5'-7" to 17'-10"	123	5 Var.	6'-10" to 15'-0"	82	4 Var.	6'-0" to 12'-2"	55	6f2		
6f3	Apron, Longit., Top Short		5 Var.	7'-4" to 21'-0"	106	4 Var.	7'-11" to 18'-2"	78	3 Var.	8'-6" to 15'-4"	54	2 Var.	9'-1" to 12'-6"	32	6f3		
6f4	Apron, Longit., Top Long		1	47'-2"	74	1	41'-4"	66	1	35'-6"	53	1	29'-8"	45	6f4		
6f5	Apron, Longit., Top Short		1	30'-1"	45	1	26'-7"	40	1	23'-1"	35	1	19'-7"	29	6f5		
4f1	Parapet, Vertical		41	6'-8"	183	41	6'-8"	183	41	6'-8"	183	41	6'-8"	183	4f1		
7j1	Parapet, Horizontal		4	30'-11"	253	4	30'-11"	253	4	30'-11"	253	4	30'-11"	253	7j1		
6m1	Apron, Trans., Top		15 Var.	24'-9" to 27'-4"	587	12 Var.	24'-9" to 26'-9"	464	8 Var.	24'-9" to 26'-0"	305	5 Var.	24'-9" to 25'-6"	189	6m1		
6m2	Apron, Trans., Top		1 Var.	27'-6" to 27'-6"	41	4 Var.	18'-8" to 20'-11"	119	7 Var.	16'-7" to 21'-1"	198	11 Var.	13'-0" to 20'-6"	277	6m2		
6m3	Apron, Trans., Top		27 Var.	6'-3" to 20'-11"	551	23 Var.	5'-9" to 18'-1"	412	20 Var.	5'-2" to 15'-10"	315	16 Var.	4'-0" to 12'-5"	197	6m3		
6m4	Apron, Trans., Bott.		14 Var.	22'-11" to 36'-9"	627	12 Var.	22'-11" to 34'-8"	519	10 Var.	22'-11" to 32'-6"	416	8 Var.	22'-11" to 30'-4"	320	6m4		
6p1	Curtain, Horizontal		4	29'-3"	176	4	29'-3"	176	4	29'-3"	176	4	29'-3"	176	6p1		
6p2	Curtain, Horizontal, Long		4	26'-6"	159	4	23'-4"	140	4	20'-2"	121	4	17'-0"	102	6p2		
6p3	Curtain, Horizontal, Short		4	10'-7"	64	4	9'-6"	57	4	8'-6"	51	4	7'-6"	45	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	39'-0"	117	2	33'-1"	99	2	27'-2"	82	2	21'-3"	64	6s3		
6s4	Wing Slope, Both F., Short		2	23'-6"	71	2	19'-10"	60	2	16'-2"	49	2	12'-7"	38	6s4		
6s5	Wing Slope, F.F. Long		1	45'-1"	71	1	39'-2"	59	1	33'-3"	50	1	27'-5"	41	6s5		
6s6	Wing Slope, F.F. Short		1	29'-5"	44	1	25'-10"	39	1	22'-2"	33	1	18'-6"	28	6s6		
6s7	Interior Wall, Both F.H.		2	24'-4"	73	2	21'-4"	64	2	18'-4"	55	2	15'-4"	46	6s7		
5t1	Curtain, Vertical		41	8'-8"	285	37	8'-5"	248	35	8'-5"	234	31	8'-5"	207	5t1		
Estimated Quantities			Reinf. Steel			7211 LB			6028 LB			4776 LB			3908 LB		
Concrete			55.4 CY			9.4			46.1 CY			6.9			30.9 CY		
Parapet Δ			3.3			3.3			3.3			3.3			3.3		
Wingwalls			12.3			9.4			6.9			4.7			30.9 CY		
Apron *			39.8			33.4			28.0			22.9			22.9		

### 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 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.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	Standard Design - Twin Reinforced Concrete Box Culverts <h3 style="text-align: center;">Flared Wing Headwalls</h3> February, 2021 <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Quantity Tabulation 10'-0" Span 45° Skew</td> <td style="width: 50%; border: none;">TWFH 45-8-21 Sheet 2 of 2</td> </tr> </table>	Quantity Tabulation 10'-0" Span 45° Skew	TWFH 45-8-21 Sheet 2 of 2
Quantity Tabulation 10'-0" Span 45° Skew	TWFH 45-8-21 Sheet 2 of 2			