

Revised 08-2022; Corrected Typo in Bill of Reinforcing bar "Location" with bars 711, 6m1, 6m2, 6m3, 6m4, 6p1, 6p2, 6p3, 6s1, 6s2, 6s3, 6s4, 6s5, 6s6, 6t1, ENGLISHLRFDDESIGNEDSINGLECULVERTSFHWHDGN - FWH 15-10-21 - THIS SHEET ISSUED 02-20-2021.

### Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

Bar	Location	Shape	8' x 10'		8' x 9'		8' x 8'		8' x 7'		8' x 6'		8' x 5'		8' x 4'		Bar							
			No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length								
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	38'-9"	26	1	35'-4"	24	1	31'-11"	21	1	28'-6"	19	1	25'-1"	17	4b1						
4b2	Wingwall, B.F.H, Short		1	34'-4"	23	1	31'-4"	21	1	28'-4"	19	1	25'-4"	17	1	22'-4"	15	4b2						
4b3	Wingwall, B.F.H, Long		8 Var.	13'-2 to 37'-2	134	7 Var.	13'-2 to 33'-9	110	6 Var.	13'-2 to 30'-4	87	5 Var.	13'-2 to 26'-11	67	4 Var.	13'-2 to 23'-6	49	3 Var.	13'-2 to 20'-1	33	2 Var.	13'-2 to 16'-7	20	4b3
4b4	Wingwall, B.F.H, Short		8 Var.	11'-11 to 32'-11	120	7 Var.	11'-11 to 29'-11	98	6 Var.	11'-11 to 26'-11	78	5 Var.	11'-11 to 23'-11	60	4 Var.	11'-11 to 20'-11	44	3 Var.	11'-11 to 17'-11	30	2 Var.	11'-11 to 14'-11	18	4b4
5b5	Wingwall, F.F.H, Long		1	38'-10"	41	1	35'-5"	37	1	31'-11"	33	1	28'-6"	30	1	25'-1"	26	1	21'-8"	23	1	18'-3"	19	5b5
5b6	Wingwall, F.F.H, Short		1	34'-4"	36	1	31'-4"	33	1	28'-4"	30	1	25'-4"	26	1	22'-4"	23	1	19'-4"	20	1	16'-4"	17	5b6
5b7	Wingwall, F.F.H, Long		9 Var.	9'-10 to 37'-3	221	8 Var.	9'-10 to 33'-10	182	7 Var.	9'-10 to 30'-5	147	6 Var.	9'-10 to 26'-11	115	5 Var.	9'-10 to 23'-6	87	4 Var.	9'-10 to 20'-1	62	3 Var.	9'-10 to 16'-8	41	5b7
5b8	Wingwall, F.F.H, Short		9 Var.	9'-0 to 33'-0	197	8 Var.	9'-0 to 30'-0	163	7 Var.	9'-0 to 27'-0	131	6 Var.	9'-0 to 24'-0	103	5 Var.	9'-0 to 21'-0	78	4 Var.	9'-0 to 18'-0	56	3 Var.	9'-0 to 15'-0	38	5b8
4c1	Wingwall, F.F.V, Long		35 Var.	2'-8 to 12'-7	178	32 Var.	2'-8 to 11'-9	154	29 Var.	2'-8 to 10'-10	131	25 Var.	2'-8 to 9'-8	103	22 Var.	2'-8 to 8'-10	85	18 Var.	2'-8 to 7'-8	62	15 Var.	2'-8 to 6'-9	47	4c1
4c2	Wingwall, F.F.V, Short		31 Var.	2'-8 to 12'-8	159	28 Var.	2'-8 to 11'-8	134	25 Var.	2'-8 to 10'-8	111	22 Var.	2'-8 to 9'-8	91	19 Var.	2'-8 to 8'-8	72	16 Var.	2'-8 to 7'-8	55	13 Var.	2'-8 to 6'-8	41	4c2
4c3	Wingwall, F.F.V, Long		12 Var.	9'-6 to 12'-9	89	9 Var.	9'-6 to 11'-10	64	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4c3
4c4	Wingwall, F.F.V, Short		11 Var.	9'-6 to 12'-10	82	8 Var.	9'-6 to 11'-10	57	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4c4
4c5	Wingwall, F.F.V, Long		2	11'-7"	15	2	10'-7"	14	1	9'-7"	13	1	8'-7"	11	1	7'-7"	10	1	6'-7"	9	1	5'-7"	8	4c5
4c5	Wingwall, F.F.V, Short		2	11'-7"	15	2	10'-7"	14	2	9'-7"	13	2	8'-7"	11	2	7'-7"	10	2	6'-7"	9	2	5'-7"	8	4c5
5c6	Wingwall, B.F.V, Long		9 Var.	2'-8 to 5'-0	36	9 Var.	2'-8 to 5'-0	36	9 Var.	2'-8 to 5'-0	36	9 Var.	2'-8 to 5'-0	36	9 Var.	2'-8 to 5'-0	36	9 Var.	2'-8 to 5'-0	36	9 Var.	2'-8 to 5'-0	36	5c6
5c7	Wingwall, B.F.V, Short		6 Var.	2'-8 to 4'-4	22	6 Var.	2'-8 to 4'-4	22	6 Var.	2'-8 to 4'-4	22	6 Var.	2'-8 to 4'-4	22	6 Var.	2'-8 to 4'-4	22	6 Var.	2'-8 to 4'-4	22	6 Var.	2'-8 to 4'-4	22	5c7
6c8	Wingwall, B.F.V, Long		26 Var.	9'-4 to 16'-7	506	23 Var.	9'-4 to 15'-9	433	20 Var.	9'-4 to 14'-10	363	16 Var.	9'-4 to 13'-8	276	13 Var.	9'-4 to 12'-10	216	9 Var.	9'-4 to 11'-8	142	6 Var.	9'-4 to 10'-9	90	6c8
6c9	Wingwall, B.F.V, Short		25 Var.	8'-8 to 16'-8	476	22 Var.	8'-8 to 15'-8	402	19 Var.	8'-8 to 14'-8	333	16 Var.	8'-8 to 13'-8	268	13 Var.	8'-8 to 12'-8	208	10 Var.	8'-8 to 11'-8	153	7 Var.	8'-8 to 10'-8	102	6c9
6c10	Wingwall, B.F.V, Long		19	10'-6	284	15	10'-6	237	12	10'-6	189	8	10'-6	126	--	--	--	--	--	--	--	--	--	6c10
6c10	Wingwall, B.F.V, Short		16	10'-6	252	13	10'-6	205	10	10'-6	158	7	10'-6	110	--	--	--	--	--	--	--	--	--	6c10
6c11	Wingwall, B.F.V, Long		2	15'-7"	47	2	14'-7"	44	1	13'-7"	40	1	12'-7"	38	1	11'-7"	35	2	10'-7"	32	1	9'-7"	29	6c11
6c11	Wingwall, B.F.V, Short		2	15'-7"	47	2	14'-7"	44	2	13'-7"	41	2	12'-7"	38	2	11'-7"	35	2	10'-7"	32	2	9'-7"	29	6c11
4d1	Apron, Longit., Bott.		5	24'-9"	83	5	22'-8"	76	5	20'-7"	69	5	18'-6"	62	5	16'-5"	55	5	14'-4"	48	5	12'-4"	41	4d1
4d2	Apron, Longit., Bott, Long		3	33'-5"	67	3	30'-0"	60	3	26'-7"	53	3	23'-1"	46	3	19'-8"	39	3	16'-3"	33	3	12'-10"	26	4d2
4d3	Apron, Longit., Bott, Short		3	29'-5"	59	3	26'-5"	53	3	23'-5"	47	3	20'-5"	41	3	17'-5"	35	3	14'-5"	29	3	11'-5"	23	4d3
6f1	Apron, Trans., Top		7	24'-9"	260	7	22'-8"	238	7	20'-7"	216	7	18'-6"	195	7	16'-5"	173	7	14'-4"	151	7	12'-4"	130	6f1
6f2	Apron, Longit., Top Long		7 Var.	6'-3 to 21'-5	145	6 Var.	6'-8 to 19'-5	118	5 Var.	7'-2 to 17'-4	92	4 Var.	7'-7 to 15'-3	69	4 Var.	5'-6 to 13'-2	56	3 Var.	5'-11 to 11'-1	38	2 Var.	6'-5 to 9'-0	23	6f2
6f3	Apron, Longit., Top Short		6 Var.	7'-0 to 21'-7	129	6 Var.	4'-11 to 19'-6	110	5 Var.	5'-9 to 17'-5	87	4 Var.	6'-7 to 15'-4	66	4 Var.	4'-5 to 13'-3	53	3 Var.	5'-3 to 11'-2	37	2 Var.	6'-2 to 9'-1	23	6f3
6f4	Apron, Longit., Top Long		1	38'-10"	58	1	35'-5"	53	1	31'-11"	48	1	28'-6"	43	1	25'-1"	38	1	21'-8"	33	1	18'-3"	27	6f4
6f5	Apron, Longit., Top Short		1	34'-4"	52	1	31'-4"	47	1	28'-4"	43	1	25'-4"	38	1	22'-4"	34	1	19'-4"	29	1	16'-4"	25	6f5
4i1	Parapet, Vertical		17	6'-2"	70	17	6'-2"	70	17	6'-2"	70	17	6'-2"	70	17	6'-2"	70	17	6'-2"	70	17	6'-2"	70	4i1
7j1	Parapet, Horizontal		4	9'-7"	78	4	9'-7"	78	4	9'-7"	78	4	9'-5"	77	4	9'-5"	77	4	9'-5"	77	4	9'-5"	77	7j1
6m1	Apron, Trans., Top		3 Var.	9'-11 to 10'-3	45	3 Var.	9'-11 to 10'-3	45	3 Var.	9'-11 to 10'-3	45	3 Var.	9'-9 to 10'-1	45	3 Var.	9'-9 to 10'-1	45	3 Var.	9'-9 to 10'-1	45	3 Var.	9'-9 to 10'-1	45	6m1
6m2	Apron, Trans., Top		25 Var.	10'-7 to 19'-7	566	23 Var.	10'-7 to 18'-10	508	20 Var.	10'-7 to 17'-9	426	17 Var.	10'-5 to 16'-5	343	14 Var.	10'-5 to 15'-4	271	12 Var.	10'-5 to 14'-7	225	9 Var.	10'-5 to 13'-5	161	6m2
6m3	Apron, Trans., Top		3 Var.	7'-11 to 13'-2	48	3 Var.	5'-5 to 10'-8	36	3 Var.	5'-6 to 10'-9	37	3 Var.	5'-7 to 10'-10	37	3 Var.	5'-8 to 10'-11	37	2 Var.	5'-9 to 8'-5	21	3 Var.	3'-3 to 8'-6	26	6m3
6m4	Apron, Trans., Bott.		20 Var.	3'-10 to 14'-1	269	18 Var.	3'-10 to 13'-0	228	16 Var.	3'-10 to 11'-11	189	14 Var.	3'-10 to 10'-10	154	12 Var.	3'-10 to 9'-9	122	10 Var.	3'-10 to 8'-9	95	8 Var.	3'-10 to 7'-8	69	6m4
6p1	Curtain, Horizontal		4	8'-6"	51	4	8'-6"	51	4	8'-6"	51	4	8'-6"	51	4	8'-6"	51	4	8'-6"	51	4	8'-6"	51	6p1
6p2	Curtain, Horizontal, Long		4	18'-9"	113	4	17'-3"	104	4	15'-9"	95	4	14'-2"	85	4	12'-8"	76	4	11'-2"	67	4	9'-8"	58	6p2
6p3	Curtain, Horizontal, Short		4	14'-7"	88	4	13'-6"	81	4	12'-5"	75	4	11'-3"	68	4	10'-2"	61	4	9'-1"	55	4	7'-11"	48	6p3
6s1	Wing Slope, Both F., Long		2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	6s1
6s2	Wing Slope, Both F., Short		2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	6s2
6s3	Wing Slope, Both F., Long		2	34'-2"	103	2	30'-7"	92	2	27'-0"	81	2	23'-5"	70	2	19'-10"	60	2	16'-3"	49	2	12'-8"	38	6s3
6s4	Wing Slope, Both F., Short		2	30'-7"	92	2	27'-5"	82	2	24'-3"	73	2	21'-1"	63	2	17'-11"	54	2	14'-9"	44	2	11'-7"	35	6s4
6s5	Wing Slope, F.F, Long		5	39'-3"	59	1	35'-8"	54	1	32'-1"	48	1	28'-7"	43	1	25'-0"	38	1	21'-5"	32	1	17'-10"	27	6s5
6s6	Wing Slope, F.F, Short		1	35'-4"	53	1	32'-2"	48	1	29'-0"	44	1	25'-10"	39	1	22'-8"	34	1	19'-6"	29	1	16'-4"	25	6s6
5t1	Curtain, Vertical		24	7'-5"	186	23	7'-2"	172	21	6'-11"	151	18	6'-8"	125	16	6'-5"	107	14	6'-5"	94	12	6'-5"	80	5t1
			Estimated Quantities One Headwall		Reinf. Steel		5727 LB		4979 LB		4134 LB		3444 LB		2678 LB		2202 LB		1743 LB					
			Concrete		40.6 CY		34.9 CY		29.6 CY		23.6 CY		19.3 CY		15.7 CY		12.5 CY							
			Parapet Δ		1.4		1.4		1.4		1.3		1.3		1.3		1.3		1.3					
			Wingwalls		13.9		11.6		9.5		6.8		5.2		3.8		3.8		3.8					
			Apron +		25.3		21.9		18.7		15.5		12.8		10.6		10.6		10.6					

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 FWH G2-21 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" and "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 AUGUST 2022	APPROVED BY BRIDGE ENGINEER 	 Standard Design - Single Reinforced Concrete Box Culverts <h3 style="margin: 0;">Flared Wing Headwalls</h3> February, 2021 <table style="width: 100%; border: none;"> <tr> <td style="width: 60%; border: none;">                             Quantity Tabulation                              8'-0" Span                              15° Skew                         </td> <td style="width: 40%; border: none; text-align: right;">                             FWH                              15-10-21                         </td> </tr> </table>	Quantity Tabulation 8'-0" Span 15° Skew	FWH 15-10-21
Quantity Tabulation 8'-0" Span 15° Skew	FWH 15-10-21			

