

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

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	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	
Fence Anchor (Galv.)		5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	
Wingwall, F.F.H.		5b1	2	47'-8"	104	5b1	2	43'-5"	96	5b1	2	39'-2"	82	5b1	2	34'-11"	73	5b1	2	30'-9"	64	5b1	2	26'-6"	55	5b1	2	22'-3"	46	
Wingwall, F.F.H.		5b2	18 Var.	2 Each 11'-9 to 45'-9	550	5b2	16 Var.	2 Each 11'-9 to 41'-6	449	5b2	14 Var.	2 Each 11'-9 to 37'-3	358	5b2	12 Var.	2 Each 11'-9 to 33'-0	280	5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100	
Wingwall, B.F.H.		4b3	2	48'-1"	67	4b3	2	43'-10"	62	4b3	2	39'-7"	53	4b3	2	35'-3"	47	4b3	2	31'-0"	41	4b3	2	26'-9"	36	4b3	2	22'-6"	30	
Wingwall, B.F.H.		4b4	16 Var.	2 Each 16'-5 to 46'-1	340	4b4	14 Var.	2 Each 16'-5 to 41'-10	276	4b4	12 Var.	2 Each 16'-5 to 37'-7	216	4b4	10 Var.	2 Each 16'-4 to 33'-3	166	4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49	
Interior Wall, Both F.H.		5b5	17 Var.	8'-8 to 46'-11	500	5b5	15 Var.	8'-9 to 42'-8	407	5b5	13 Var.	8'-10 to 38'-5	320	5b5	11 Var.	8'-10 to 34'-2	247	5b5	9 Var.	9'-0 to 29'-10	182	5b5	7 Var.	9'-2 to 25'-7	127	5b5	5 Var.	9'-6 to 21'-3	80	
Wingwall, F.F.V.		4c1	88 Var.	2 Each 2'-5 to 12'-6	438	4c1	80 Var.	2 Each 2'-5 to 11'-7	374	4c1	94 Var.	2 Each 2'-5 to 10'-6	406	4c1	82 Var.	2 Each 2'-5 to 9'-6	326	4c1	72 Var.	2 Each 2'-5 to 8'-7	265	4c1	46 Var.	2 Each 2'-5 to 7'-7	154	4c1	36 Var.	2 Each 2'-5 to 6'-5	106	
Wingwall, F.F.V.		4c2	32 Var.	2 Each 8'-10 to 12'-5	227	4c2	24 Var.	2 Each 8'-10 to 11'-6	163	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10"	17	4c3	2	11'-10"	16	4c3	2	10'-10"	14	4c3	2	9'-10"	13	4c3	2	8'-10"	12	4c3	2	7'-10"	10	4c3	2	6'-10"	9	
Wingwall, F.F.V. (A)		4c3	3	12'-10"	26	4c3	3	11'-10"	24	4c3	3	10'-10"	22	4c3	3	9'-10"	20	4c3	3	8'-10"	18	4c3	3	7'-10"	16	4c3	3	6'-10"	14	
Wingwall, B.F.V.		5c4	88 Var.	2 Each 6'-7 to 16'-8	1067	5c4	80 Var.	2 Each 6'-7 to 15'-9	932	5c4	70 Var.	2 Each 6'-7 to 14'-7	773	5c4	62 Var.	2 Each 6'-7 to 13'-8	655	5c4	54 Var.	2 Each 6'-7 to 12'-8	542	5c4	60 Var.	2 Each 6'-7 to 11'-8	571	5c4	48 Var.	2 Each 6'-7 to 10'-8	432	
Wingwall, B.F.V. (O)		5c5	1	16'-10"	18	5c5	1	15'-10"	17	5c5	1	14'-10"	15	5c5	1	13'-10"	14	5c5	1	12'-10"	13	5c5	1	11'-10"	12	5c5	1	10'-10"	11	
Wingwall, B.F.V. (A)		5c5	4	16'-10"	70	5c5	4	15'-10"	66	5c5	4	14'-10"	62	5c5	4	13'-10"	58	5c5	4	12'-10"	54	5c5	4	11'-10"	49	5c5	4	10'-10"	45	
Wingwall, B.F.V.		6c6	50	9'-0"	676	6c6	42	9'-0"	568	5c6	34	9'-0"	319	5c6	26	9'-0"	244	5c6	16	9'-0"	150	c6	--	9'-0"	--	c6	--	9'-0"	--	
Interior Wall, Both F.V		4c7	2	3'-7"	5	4c7	2	3'-7"	5	4c7	2	3'-7"	5	4c7	2	3'-7"	5	4c7	2	3'-7"	5	4c7	2	3'-7"	5	4c7	2	3'-7"	5	
Interior Wall, Both F.V		4c8	85 Var.	1'-3 to 10'-1	322	4c8	76 Var.	1'-3 to 9'-0	260	4c8	68 Var.	1'-3 to 8'-1	212	4c8	59 Var.	1'-3 to 7'-0	163	4c8	51 Var.	1'-3 to 6'-0	123	4c8	42 Var.	1'-3 to 5'-0	88	4c8	34 Var.	1'-3 to 4'-0	60	
Interior Wall, Both F.V		4c9	2	10'-4"	14	4c9	2	9'-4"	12	4c9	2	8'-4"	11	4c9	2	7'-4"	10	4c9	2	6'-4"	8	4c9	2	5'-4"	7	4c9	2	4'-4"	6	
Apron, Longit., Bott.		4d1	18	47'-6"	600	4d1	18	43'-3"	549	4d1	18	39'-0"	469	4d1	18	34'-9"	418	4d1	18	30'-6"	367	4d1	18	26'-3"	316	4d1	18	22'-0"	265	
Apron, Longit., Top		6f1	18	47'-6"	1350	6f1	18	43'-3"	1235	6f1	18	39'-0"	1054	6f1	18	34'-9"	940	6f1	18	30'-6"	825	6f1	18	26'-3"	710	6f1	18	22'-0"	595	
Parapet, Vertical		4i1	33	7'-10"	173	4i1	33	7'-10"	173	4i1	33	7'-10"	173	4i1	33	7'-10"	173	4i1	33	7'-10"	173	4i1	33	7'-10"	173	4i1	33	7'-10"	173	
Parapet, Horiz.		7j1	4	25'-8"	210	7j1	4	25'-8"	210	7j1	4	25'-8"	207	7j1	4	25'-4"	207	7j1	4	25'-4"	207	7j1	4	25'-4"	207	7j1	4	25'-4"	207	
Apron, Trans., Top		5m1	73	18'-8"	1421	5m1	65	18'-8"	1266	5m1	56	18'-8"	1090	5m1	48	18'-5"	922	5m1	39	18'-5"	749	5m1	21	18'-5"	403	5m1	15	18'-5"	288	
Apron, Trans., Top		5m2	32 Var.	2'-0 to 17'-6	325	5m2	31 Var.	2'-3 to 17'-3	315	5m2	32 Var.	2'-0 to 17'-6	325	5m2	31 Var.	2'-2 to 17'-2	313	5m2	31 Var.	2'-5 to 17'-5	321	5m2	20 Var.	2'-8 to 16'-11	204	5m2	21 Var.	2'-2 to 17'-2	212	
Apron, Trans., Bott.		5m3	61	21'-8"	1378	5m3	55	21'-8"	1243	6m3	25	22'-5"	842	5m3	22	21'-4"	490	5m3	19	21'-4"	423	5m3	16	21'-4"	356	5m3	13	21'-4"	289	
Curtain, Horiz.		6p1	6	25'-7"	231	6p1	6	25'-7"	231	6p1	6	25'-7"	231	6p1	5	25'-4"	190	6p1	5	25'-4"	190	6p1	5	25'-4"	190	6p1	5	25'-4"	190	
Wing Slope, Both F.		6s1	4	39'-7"	238	6s1	4	35'-3"	212	6s1	4	30'-10"	185	6s1	4	26'-6"	159	6s1	4	22'-2"	133	6s1	4	17'-9"	107	6s1	4	13'-5"	81	
Wing Slope, Both F. (O)		6s2	2	9'-7"	29	6s2	2	9'-7"	29	6s2	2	9'-7"	29	6s2	2	9'-8"	29	6s2	2	9'-8"	29	6s2	2	9'-8"	29	6s2	2	9'-8"	29	
Wing Slope, Both F. (A)		6s3	2	10'-5"	31	6s3	2	10'-5"	31	6s3	2	10'-5"	31	6s3	2	10'-5"	31	6s3	2	10'-5"	31	6s3	2	10'-5"	31	6s3	2	10'-5"	31	
Wing Slope, F.F.		6s4	2	14'-1"	42	6s4	2	14'-1"	42	6s4	2	14'-1"	42	6s4	2	14'-1"	42	6s4	2	14'-1"	42	6s4	2	14'-1"	42	6s4	2	14'-1"	42	
Wing Slope, F.F.		6s5	2	37'-2"	112	6s5	2	32'-9"	98	6s5	2	28'-5"	85	6s5	2	24'-1"	72	6s5	2	19'-8"	59	6s5	2	15'-4"	46	6s5	2	11'-0"	33	
Interior Wall, Both F.		6s6	2	48'-5"	153	6s6	2	44'-0"	139	6s6	2	39'-8"	119	6s6	2	35'-5"	106	6s6	2	31'-1"	93	6s6	2	26'-8"	80	6s6	2	22'-4"	67	
Curtain, Vert.		5t1	24	7'-5"	186	5t1	24	7'-2"	179	5t1	24	6'-11"	173	5t1	24	6'-8"	167	5t1	24	6'-5"	161	5t1	24	6'-5"	161	5t1	24	6'-5"	161	
Curtain, Vert. Ends		5t2	4	7'-10"	33	5t2	4	7'-7"	32	5t2	4	7'-4"	31	5t2	4	7'-1"	30	5t2	4	6'-10"	29	5t2	4	6'-10"	29	5t2	4	6'-10"	29	
Bracket, Vert.		5u1	4	6'-1"	25	5u1	4	5'-11"	25	5u1	4	5'-8"	24	5u1	4	5'-5"	23	5u1	4	5'-3"	22	5u1	4	5'-3"	22	5u1	4	5'-3"	22	
Reinf. Steel		10,984 LB				9742 LB				7987 LB				6639 LB				5669 LB				4475 LB				3713 LB				
Concrete		65.0 CY				57.3 CY				50.0 CY				41.2 CY				35.0 CY				29.5 CY				24.4 CY				
Estimated Quantities One Headwall		2.8				2.8				2.8				2.7				2.7				2.7				2.7				
Parapet Δ		25.4				21.0				17.0				12.1				9.2				6.7				4.5				
Wingwalls		36.8				33.5				30.2				26.4				23.1				20.1				17.2				
Apron *																														

c Bar Pin Diameter	
Bar Size	D
5	3 3/8"
6	4 1/2"

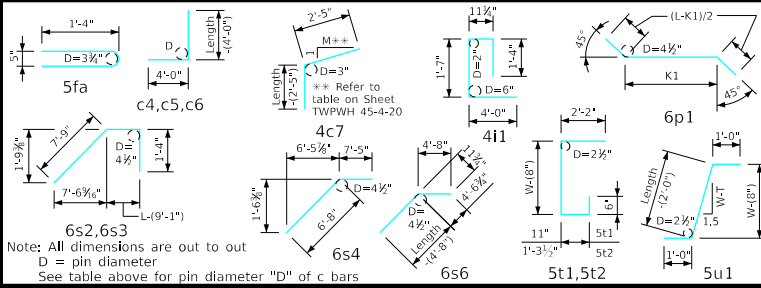
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Δ Includes top of wingwall quantities. \* Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal. (A) - Indicates bar located at acute corner. (O) - Indicates bar located at obtuse corner. Refer to Sheet TWPWH 45-1-20 for acute and obtuse corner locations.

#### Headwall Notes:

- 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 "4d1" and "6f1" 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	 Highway Division	Standard Design - Twin Reinforced Concrete Box Culverts  <b>Parallel Wing Headwalls</b>  July, 2020  Quantity Tabulation 8'-0" Span 45° Skew	TWPWH 45-9-20
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#### Bent Bar Details



ENGLISH REDSIGNED WINCULVERTS.DGN - TWPWH 45-9-20 - THIS SHEET ISSUED 07-2020.