

ENGLISHRFDISIGNEDWINCULVERTSFHW.DGN - TWFH 15-7-21 51 - THIS SHEET ISSUED 02-2021.

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

Bar	Location	Shape	10' x 12'			10' x 11'			10' x 10'			10' x 9'			10' 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	45'-7"	32	1	42'-2"	30	1	38'-9"	26	1	35'-4"	24	1	31'-11"	21	4b1		
4b2	Wingwall, B.F.H. Short		1	40'-4"	29	1	37'-4"	25	1	34'-4"	23	1	31'-4"	21	1	28'-4"	19	4b2		
4b3	Wingwall, B.F.H. Long		10 Var.	13'-2" to 44'-0"	194	9 Var.	13'-2" to 40'-7"	163	8 Var.	13'-2" to 37'-2"	134	7 Var.	13'-2" to 33'-9"	110	6 Var.	13'-2" to 30'-4"	87	4b3		
4b4	Wingwall, B.F.H. Short		10 Var.	11'-1" to 38'-11"	170	9 Var.	11'-1" to 35'-11"	144	8 Var.	11'-1" to 32'-11"	120	7 Var.	11'-1" to 29'-11"	98	6 Var.	11'-1" to 26'-11"	78	4b4		
5b5	Wingwall, F.F.H. Long		1	45'-8"	50	1	42'-3"	47	1	38'-10"	41	1	35'-5"	37	1	31'-11"	33	5b5		
5b6	Wingwall, F.F.H. Short		1	40'-4"	45	1	37'-4"	39	1	34'-4"	36	1	31'-4"	33	1	28'-4"	30	5b6		
5b7	Wingwall, F.F.H. Long		11 Var.	9'-10" to 44'-1"	314	10 Var.	9'-10" to 40'-8"	266	9 Var.	9'-10" to 37'-3"	221	8 Var.	9'-10" to 33'-10"	182	7 Var.	9'-10" to 30'-5"	147	5b7		
5b8	Wingwall, F.F.H. Short		11 Var.	9'-0" to 39'-0"	275	10 Var.	9'-0" to 36'-0"	235	9 Var.	9'-0" to 33'-0"	197	8 Var.	9'-0" to 30'-0"	163	7 Var.	9'-0" to 27'-0"	131	5b8		
5b9	Interior Wall, Both F.H.		21 Var.	5'-6" to 28'-6"	372	19 Var.	5'-6" to 26'-5"	316	17 Var.	5'-6" to 24'-4"	264	15 Var.	5'-7" to 22'-3"	218	13 Var.	5'-7" to 20'-2"	175	5b9		
4c1	Wingwall, F.F.V. Long		42 Var.	2'-9" to 14'-9"	245	39 Var.	2'-9" to 13'-10"	216	35 Var.	2'-9" to 12'-8"	180	32 Var.	2'-9" to 11'-10"	156	29 Var.	2'-9" to 10'-11"	132	4c1		
4c2	Wingwall, F.F.V. Short		37 Var.	2'-9" to 14'-9"	216	34 Var.	2'-9" to 13'-9"	187	31 Var.	2'-9" to 12'-9"	160	28 Var.	2'-9" to 11'-9"	136	25 Var.	2'-9" to 10'-9"	113	4c2		
4c3	Wingwall, F.F.V. Long		19 Var.	9'-7" to 14'-10"	155	16 Var.	9'-7" to 14'-0"	126	12 Var.	9'-7" to 12'-10"	90	9 Var.	9'-7" to 11'-11"	65	--	--	--	4c3		
4c4	Wingwall, F.F.V. Short		17 Var.	9'-7" to 14'-11"	139	14 Var.	9'-7" to 13'-11"	110	11 Var.	9'-7" to 12'-11"	83	8 Var.	9'-7" to 11'-11"	57	--	--	--	4c4		
4c5	Wingwall, F.F.V. Long		2	13'-8"	18	2	12'-8"	8	2	11'-8"	16	2	10'-8"	14	1	9'-8"	6	4c5		
4c5	Wingwall, F.F.V. Short		2	13'-8"	18	2	12'-8"	17	2	11'-8"	16	2	10'-8"	14	2	9'-8"	13	4c5		
4c6	Interior Wall, Both F.V.		2	4'-1"	5	2	4'-1"	5	2	4'-1"	5	2	4'-1"	5	2	4'-1"	5	4c6		
4c7	Interior Wall, Both F.V.		49 Var.	1'-11" to 12'-4"	233	45 Var.	1'-10" to 11'-4"	198	41 Var.	1'-10" to 10'-4"	167	37 Var.	1'-10" to 9'-5"	139	33 Var.	1'-10" to 8'-5"	113	4c7		
4c8	Interior Wall, Both F.V.		2	12'-6"	17	2	11'-6"	15	2	10'-6"	14	2	9'-6"	13	2	8'-6"	11	4c8		
5e9	Wingwall, B.F.V. Long		9 Var.	2'-9" to 5'-1"	37	9 Var.	2'-9" to 5'-1"	37	9 Var.	2'-9" to 5'-1"	37	9 Var.	2'-9" to 5'-1"	37	9 Var.	2'-9" to 5'-1"	37	5e9		
5e10	Wingwall, B.F.V. Short		6 Var.	2'-9" to 4'-5"	22	6 Var.	2'-9" to 4'-5"	22	6 Var.	2'-9" to 4'-5"	22	6 Var.	2'-9" to 4'-5"	22	6 Var.	2'-9" to 4'-5"	22	5e10		
5e11	Wingwall, B.F.V. Long		33 Var.	9'-5" to 18'-9"	485	30 Var.	9'-5" to 17'-10"	426	26 Var.	9'-5" to 16'-8"	354	23 Var.	9'-5" to 15'-10"	303	20 Var.	9'-5" to 14'-11"	254	5e11		
5e12	Wingwall, B.F.V. Short		31 Var.	8'-9" to 18'-9"	445	28 Var.	8'-9" to 17'-9"	387	25 Var.	8'-9" to 16'-9"	332	22 Var.	8'-9" to 15'-9"	281	19 Var.	8'-9" to 14'-9"	233	5e12		
6c13	Wingwall, B.F.V. Long		24	10'-6"	426	24	10'-6"	379	20	10'-6"	315	17	10'-6"	268	14	10'-6"	221	6c13		
6c13	Wingwall, B.F.V. Short		24	10'-6"	379	21	10'-6"	331	18	10'-6"	284	15	10'-6"	237	12	10'-6"	189	6c13		
5c14	Wingwall, B.F.V. Long		2	17'-8"	37	1	16'-8"	17	2	15'-8"	33	2	14'-8"	31	1	13'-8"	14	5c14		
5c14	Wingwall, B.F.V. Short		2	17'-8"	37	2	16'-8"	35	2	15'-8"	33	2	14'-8"	31	2	13'-8"	29	5c14		
4d1	Apron, Longit., Bott.		15	28'-10"	289	13	26'-9"	232	13	24'-9"	215	13	22'-8"	197	13	20'-7"	179	4d1		
4d2	Apron, Longit., Bott. Long		3	40'-3"	86	3	36'-10"	74	3	33'-5"	67	3	30'-0"	60	3	26'-7"	53	4d2		
4d3	Apron, Longit., Bott. Short		3	35'-6"	71	3	32'-5"	65	3	29'-5"	59	3	26'-5"	53	3	23'-5"	47	4d3		
6f1	Apron, Longit., Top		20	28'-10"	866	20	26'-9"	804	20	24'-9"	743	20	22'-8"	681	20	20'-7"	618	6f1		
6f2	Apron, Longit., Top Long		9 Var.	5'-5" to 25'-7"	210	8 Var.	5'-10" to 23'-6"	176	7 Var.	6'-3" to 21'-5"	145	6 Var.	6'-8" to 19'-5"	118	5 Var.	7'-2" to 17'-4"	92	6f2		
6f3	Apron, Longit., Top Short		8 Var.	5'-5" to 25'-8"	187	7 Var.	6'-3" to 23'-8"	157	6 Var.	7'-0" to 21'-7"	129	6 Var.	4'-11" to 19'-5"	110	5 Var.	5'-9" to 17'-5"	87	6f3		
6f4	Apron, Longit., Top Long		1	45'-8"	72	1	42'-3"	67	1	38'-10"	58	1	35'-5"	53	1	31'-11"	48	6f4		
6f5	Apron, Longit., Top Short		1	40'-4"	64	1	37'-4"	56	1	34'-4"	52	1	31'-4"	47	1	28'-4"	43	6f5		
4f1	Parapet, Vertical		43	6'-2"	177	41	6'-2"	169	41	6'-2"	169	41	6'-2"	169	41	6'-2"	169	4f1		
7j1	Parapet, Horizontal		4	23'-5"	191	4	23'-2"	189	4	22'-11"	187	4	22'-11"	187	4	22'-11"	187	7j1		
6m1	Apron, Trans., Top		5 Var.	23'-8" to 24'-5"	181	5 Var.	23'-5" to 24'-2"	179	5 Var.	23'-2" to 23'-11"	177	5 Var.	23'-2" to 23'-11"	177	5 Var.	23'-2" to 23'-11"	177	6m1		
6m2	Apron, Trans., Top		27 Var.	24'-9" to 34'-6"	1201	24 Var.	24'-6" to 33'-1"	1038	21 Var.	24'-2" to 31'-8"	881	18 Var.	24'-2" to 30'-7"	740	16 Var.	24'-2" to 29'-10"	649	6m2		
6m3	Apron, Trans., Top		7 Var.	8'-9" to 24'-5"	174	7 Var.	8'-9" to 24'-5"	174	8 Var.	6'-1" to 24'-4"	183	8 Var.	6'-2" to 24'-6"	184	7 Var.	6'-4" to 22'-0"	149	6m3		
6m4	Apron, Trans., Bott.		24 Var.	17'-4" to 29'-8"	847	22 Var.	17'-3" to 28'-6"	756	20 Var.	17'-2" to 27'-5"	670	18 Var.	17'-2" to 26'-4"	588	16 Var.	17'-2" to 25'-3"	510	6m4		
6p1	Curtain, Horizontal		4	22'-0"	132	4	21'-10"	132	4	21'-10"	131	4	21'-10"	131	4	21'-10"	131	6p1		
6p2	Curtain, Horizontal, Long		4	21'-9"	131	4	20'-3"	122	4	18'-9"	113	4	17'-3"	104	4	15'-9"	95	6p2		
6p3	Curtain, Horizontal, Short		4	16'-10"	101	4	15'-9"	95	4	14'-7"	88	4	13'-6"	81	4	12'-5"	75	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	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	6s2		
6s3	Wing Slope, Both F., Long		2	41'-3"	131	2	37'-9"	113	2	34'-2"	103	2	30'-7"	92	2	27'-0"	81	6s3		
6s4	Wing Slope, Both F., Short		2	36'-11"	111	2	33'-9"	101	2	30'-7"	92	2	27'-5"	82	2	24'-3"	73	6s4		
6s5	Wing Slope, F.F. Long		1	46'-5"	73	1	42'-10"	68	1	39'-3"	59	1	35'-8"	54	1	32'-1"	48	6s5		
6s6	Wing Slope, F.F. Short		1	41'-8"	66	1	38'-6"	58	1	35'-4"	53	1	32'-2"	48	1	29'-0"	44	6s6		
6s7	Interior Wall, Both F.H.		2	30'-9"	92	2	28'-6"	86	2	26'-3"	79	2	23'-11"	72	2	21'-8"	65	6s7		
5t1	Curtain, Vertical		38	7'-11"	314	36	7'-8"	288	34	7'-5"	263	33	7'-2"	247	31	6'-11"	224	5t1		
Estimated Quantities			Reinf. Steel			Reinf. Steel			Reinf. Steel			Reinf. Steel			Reinf. Steel			Reinf. Steel		
One Headwall			Concrete			Concrete			Concrete			Concrete			Concrete			Concrete		
Parapet Δ			Wingwalls			Apron *			Parapet Δ			Wingwalls			Apron *			Parapet Δ		
2.6			29.5			52.0			2.5			23.2			46.2			2.5		
10,209 LB			84.1 CY			9027 LB			7966 LB			7017 LB			6004 LB			45.9 CY		

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.

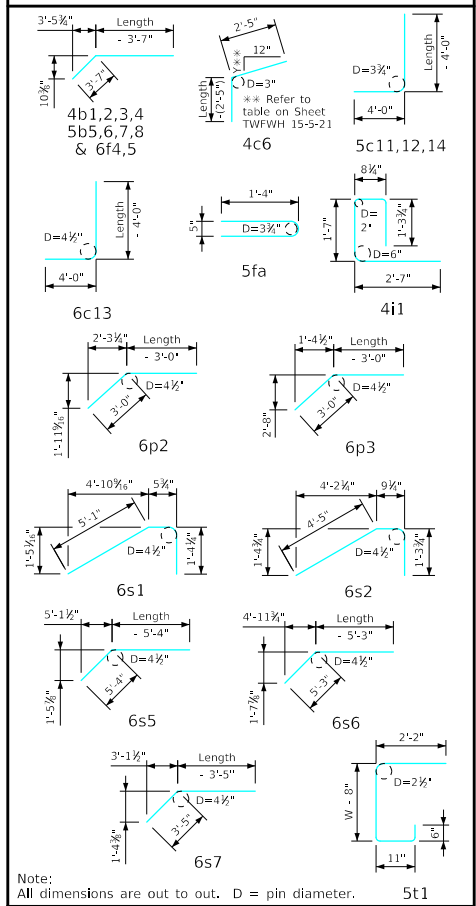
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

"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	<b>IOWA DOT Highway Division</b>	
		Standard Design - Twin Reinforced Concrete Box Culverts	
		Flared Wing Headwalls	
		February, 2021	
		Quantity Tabulation	TWFH
		10'-0" Span	15-7-21
		15° Skew	Sheet 1 of 2