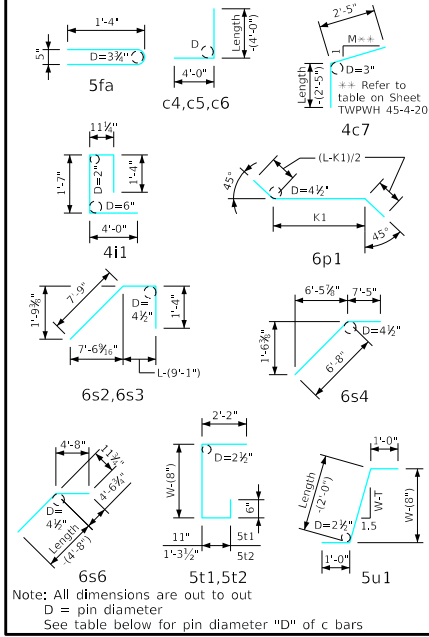


ENGLISHLRFD\DESIGNED\TWINCULVERTS.DGN - TWPWH 45-8-20 51 - THIS SHEET ISSUED 07-20-2020

Bent Bar Details



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

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

Location	Shape	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' x 7'			
		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	
Wingwall, F.F.H.	5b1	2	56'-2	122	5b1	2	51'-11	113	5b1	2	47'-8	104	5b1	2	43'-5	96	5b1	2	39'-2	82	5b1	2	34'-11	73	
Wingwall, F.F.H.	5b2	22 Var.	2 Each 11'-9 to 54'-2	776	5b2	20 Var.	2 Each 11'-9 to 49'-11	658	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	
Wingwall, B.F.H.	4b3	2	56'-9	79	4b3	2	52'-6	73	4b3	2	48'-1	67	4b3	2	43'-10	62	4b3	2	39'-7	53	4b3	2	35'-3	47	
Wingwall, B.F.H.	4b4	20 Var.	2 Each 16'-7 to 54'-9	489	4b4	18 Var.	2 Each 16'-7 to 50'-6	413	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	
Interior Wall, Both F.H.	5b5	21 Var.	8'-9 to 55'-5	720	5b5	19 Var.	8'-9 to 51'-2	606	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	
Wingwall, F.F.V.	5c1	104 Var.	2 Each 2'-7 to 14'-7	931	5c1	96 Var.	2 Each 2'-7 to 13'-8	814	4c1	88 Var.	2 Each 2'-7 to 12'-8	448	4c1	80 Var.	2 Each 2'-7 to 11'-9	383	4c1	72 Var.	2 Each 2'-7 to 10'-8	316	4c1	64 Var.	2 Each 2'-7 to 9'-8	249	
Wingwall, F.F.V.	5c2	50 Var.	2 Each 9'-0 to 14'-8	617	5c2	42 Var.	2 Each 9'-0 to 13'-9	498	4c2	32 Var.	2 Each 9'-0 to 12'-7	231	4c2	24 Var.	2 Each 9'-0 to 11'-9	166	c2	--	--	--	c2	--	--	--	
Wingwall, F.F.V. (O)	5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13	
Wingwall, F.F.V. (A)	5c3	3	15'-0	47	5c3	3	14'-0	44	4c3	3	13'-0	26	4c3	3	12'-0	24	4c3	3	11'-0	22	4c3	3	10'-0	20	
Wingwall, B.F.V.	6c4	104 Var.	2 Each 6'-9 to 18'-9	1992	5c4	96 Var.	2 Each 6'-9 to 17'-10	1231	5c4	88 Var.	2 Each 6'-9 to 16'-10	1082	5c4	80 Var.	2 Each 6'-9 to 15'-11	946	5c4	70 Var.	2 Each 6'-9 to 14'-9	785	5c4	62 Var.	2 Each 6'-9 to 13'-10	666	
Wingwall, B.F.V. (O)	6c5	1	19'-0	29	5c5	1	18'-0	19	5c5	1	17'-0	18	5c5	1	16'-0	17	5c5	1	15'-0	16	5c5	1	14'-0	15	
Wingwall, B.F.V. (A)	6c5	4	19'-0	114	5c5	4	18'-0	75	5c5	4	17'-0	71	5c5	4	16'-0	67	5c5	4	15'-0	63	5c5	4	14'-0	58	
Wingwall, B.F.V.	6c6	68	9'-0	919	6c6	60	9'-0	811	6c6	50	9'-0	676	6c6	42	9'-0	568	5c6	34	9'-0	319	5c6	26	9'-0	244	
Interior Wall, Both F.V	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	
Interior Wall, Both F.V	4c8	101 Var.	1'-5 to 12'-2	458	4c8	93 Var.	1'-5 to 11'-2	391	4c8	85 Var.	1'-5 to 10'-3	331	4c8	76 Var.	1'-5 to 9'-2	269	4c8	68 Var.	1'-5 to 8'-3	220	4c8	59 Var.	1'-5 to 7'-2	169	
Interior Wall, Both F.V	4c9	2	12'-6	17	4c9	2	11'-6	15	4c9	2	10'-6	14	4c9	2	9'-6	13	4c9	2	8'-6	11	4c9	2	7'-6	10	
Apron, Longit., Bott.	4d1	22	55'-11	857	4d1	22	51'-8	795	4d1	22	47'-6	734	4d1	22	43'-3	671	4d1	22	39'-0	573	4d1	22	34'-9	511	
Apron, Longit., Top	6f1	22	55'-11	1928	6f1	22	51'-8	1787	6f1	22	47'-6	1649	6f1	22	43'-3	1509	6f1	22	39'-0	1289	6f1	22	34'-9	1148	
Parapet, Vertical	4i1	43	7'-10	225	4i1	43	7'-10	225	4i1	41	7'-10	215	4i1	41	7'-10	215	4i1	41	7'-10	215	4i1	41	7'-10	215	
Parapet, Horiz.	7j1	4	32'-0	262	7j1	4	32'-0	262	7j1	4	31'-4	256	7j1	4	31'-4	256	7j1	4	31'-4	256	7j1	4	31'-0	253	
Apron, Trans., Top	6m1	86	23'-2	2992	6m1	77	23'-2	2679	6m1	69	22'-8	2349	5m1	61	22'-8	1442	5m1	52	22'-8	1229	5m1	44	22'-5	1029	
Apron, Trans., Top	6m2	40 Var.	2'-3 to 21'-9	721	6m2	40 Var.	2'-6 to 22'-0	736	6m2	40 Var.	2'-0 to 21'-6	706	5m2	39 Var.	2'-3 to 21'-3	478	5m2	40 Var.	2'-0 to 21'-6	490	5m2	39 Var.	2'-2 to 21'-2	475	
Apron, Trans., Bott.	6m3	73	28'-10	3161	5m3	67	28'-0	1957	5m3	61	27'-4	1739	6m3	28	28'-1	1181	6m3	25	28'-1	1055	5m3	22	27'-0	620	
Curtain, Horiz.	6p1	6	31'-10	287	6p1	6	31'-10	287	6p1	6	31'-3	282	6p1	6	31'-3	282	6p1	6	31'-3	282	6p1	5	31'-0	233	
Wing Slope, Both F.	6s1	4	48'-4	305	6s1	4	43'-11	278	6s1	4	39'-7	238	6s1	4	35'-3	212	6s1	4	30'-10	185	6s1	4	26'-6	159	
Wing Slope, Both F. (O)	6s2	2	9'-5	28	6s2	2	9'-5	28	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-7	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	
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	
Wing Slope, F.F.	6s5	2	45'-10	145	6s5	2	41'-6	132	6s5	2	37'-2	112	6s5	2	32'-9	98	6s5	2	28'-5	85	6s5	2	24'-1	72	
Interior Wall, Both F.	6s6	2	56'-11	178	6s6	2	52'-7	165	6s6	2	48'-5	153	6s6	2	44'-0	139	6s6	2	39'-8	119	6s6	2	35'-5	106	
Curtain, Vert.	5t1	30	7'-11	248	5t1	30	7'-8	240	5t1	30	7'-5	232	5t1	30	7'-2	224	5t1	30	6'-11	216	5t1	30	6'-8	209	
Curtain, Vert, Ends	5t2	4	8'-4	35	5t2	4	8'-1	34	5t2	4	7'-10	33	5t2	4	7'-7	32	5t2	4	7'-4	31	5t2	4	7'-1	30	
Bracket, Vert.	5u1	4	6'-7	27	5u1	4	6'-4	26	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-6	23	
Estimated Quantities One Headwall	Rein. Steel	18,824 LB				15,505 LB				13,312 LB				10,636 LB				9,058 LB				7,540 LB			
	Concrete	Parapet Δ	3.5		3.5		3.2		3.2		3.2		3.2		3.1		3.1		3.1		3.1		3.1		
		Wingwalls	42.4		36.2		25.4		25.4		21.0		17.0		12.1		12.1		12.1		12.1		12.1		
		Apron *	60.8		56.1		50.1		45.5		40.9		35.9		30.9		25.9		20.9		15.9		10.9		
			106.7 CY		95.8 CY		78.7 CY		69.7 CY		61.1 CY		51.1 CY		42.1 CY		33.1 CY		24.1 CY		15.1 CY		6.1 CY		

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.

IOWADOT Highway Division

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 10'-0" Span 45° Skew	TWPWH 45-8-20 Sheet 1 of 2
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LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER