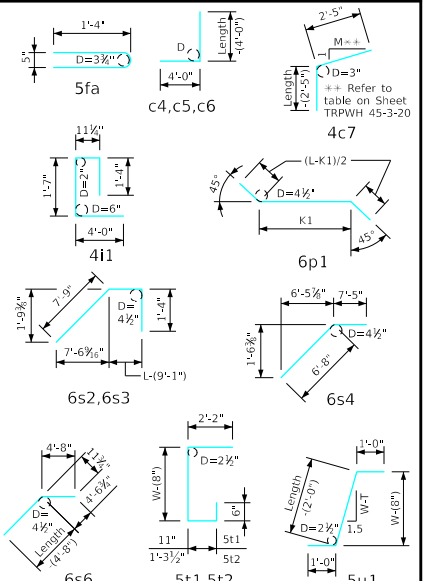
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"

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

Location	Shape	10' x 12' Bar	No.	Length	Wt.	10' x 11' Bar	No.	Length	Wt.	10' x 10' Bar	No.	Length	Wt.	10' x 9' Bar	No.	Length	Wt.	10' x 8' Bar	No.	Length	Wt.	10' x 7' 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	42 Var.	2 Each 8'-9 to 55'-5	1441	5b5	38 Var.	2 Each 8'-9 to 51'-2	1213	5b5	34 Var.	2 Each 8'-8 to 46'-11	1001	5b5	30 Var.	2 Each 8'-9 to 42'-8	815	5b5	26 Var.	2 Each 8'-10 to 38'-5	641	5b5	22 Var.	2 Each 8'-10 to 34'-2	493
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	94 Var.	2 Each 2'-7 to 10'-8	416	4c1	82 Var.	2 Each 2'-7 to 9'-8	336
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'-8	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	4	3'-9	10	4c7	4	3'-9	10	4c7	4	3'-9	10	4c7	4	3'-9	10	4c7	4	3'-9	10	4c7	4	3'-9	10
Interior Wall, Both F.V		4c8	202 Var.	2 Each 1'-5 to 12'-2	916	4c8	186 Var.	2 Each 1'-5 to 11'-2	782	4c8	170 Var.	2 Each 1'-5 to 10'-3	662	4c8	152 Var.	2 Each 1'-5 to 9'-2	537	4c8	136 Var.	2 Each 1'-5 to 8'-3	439	4c8	118 Var.	2 Each 1'-5 to 7'-2	338
Interior Wall, Both F.V		4c9	4	12'-6	33	4c9	4	11'-6	31	4c9	4	10'-6	28	4c9	4	9'-6	25	4c9	4	8'-6	23	4c9	4	7'-6	20
Apron, Longit., Bott.		4d1	33	55'-11	1286	4d1	33	51'-8	1192	4d1	33	47'-6	1100	4d1	33	43'-3	1007	4d1	33	39'-0	860	4d1	33	34'-9	766
Apron, Longit., Top		6f1	33	55'-11	2891	6f1	33	51'-8	2681	6f1	33	47'-6	2474	6f1	33	43'-3	2264	6f1	33	39'-0	1933	6f1	33	34'-9	1722
Parapet, Vertical		4i1	65	7'-10	340	4i1	65	7'-10	340	4i1	63	7'-10	330	4i1	63	7'-10	330	4i1	63	7'-10	330	4i1	63	7'-10	330
Parapet, Horiz.		7j1	4	47'-7	409	7j1	4	47'-7	409	7j1	4	46'-8	401	7j1	4	46'-8	401	7j1	4	46'-8	401	7j1	4	46'-2	397
Apron, Trans., Top		6m1	75	34'-2	3849	6m1	66	34'-2	3387	6m1	58	33'-6	2918	5m1	50	33'-6	1747	5m1	41	33'-6	1433	5m1	33	33'-2	1142
Apron, Trans., Top		6m2	62 Var.	2'-3 to 32'-9	1630	6m2	62 Var.	2'-6 to 33'-0	1653	6m2	61 Var.	2'-5 to 32'-5	1596	5m2	61 Var.	2'-2 to 32'-2	1092	5m2	61 Var.	2'-5 to 32'-5	1108	5m2	61 Var.	2'-0 to 32'-0	1082
Apron, Trans., Bott.		6m3	73	44'-5	5135	5m3	67	43'-7	3215	5m3	61	42'-8	2868	6m3	28	43'-5	1928	6m3	25	43'-5	1721	5m3	22	42'-2	1023
Curtain, Horiz.		6p1	6	47'-5	449	6p1	6	47'-5	449	6p1	6	46'-7	442	6p1	6	46'-7	442	6p1	6	46'-7	442	6p1	5	46'-2	365
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	4	56'-11	356	6s6	4	52'-7	330	6s6	4	48'-5	305	6s6	4	44'-0	279	6s6	4	39'-8	238	6s6	4	35'-5	213
Curtain, Vert.		5t1	46	7'-11	380	5t1	46	7'-8	368	5t1	45	7'-5	348	5t1	45	7'-2	336	5t1	45	6'-11	325	5t1	45	6'-8	313
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	Reinf. Steel			25,890 LB				21,415 LB				18,630 LB				14,758 LB				12,682 LB				10,524 LB	
	Concrete	Parapet Δ	4.7	147.9 CY		4.7	133.0 CY			4.4	110.1 CY			4.4	97.7 CY			4.4	85.8 CY			4.3	72.0 CY		
		Wingwalls	54.4			46.4				32.4				26.7				21.5				15.2			
		Apron ✳	88.8			81.9				73.3				66.6				59.9				52.5			

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 TRPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design - Triple Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
45° Skew

TRPWH
45-7-20
Sheet 1 of 2

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