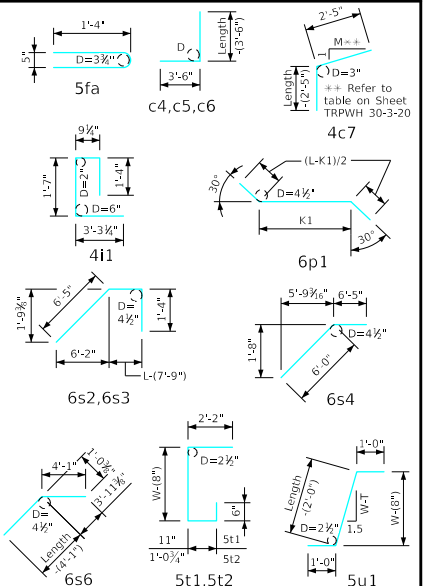
Bent Bar Details



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 30° 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	46'-2	101	5b1	2	42'-9	94	5b1	2	39'-3	82	5b1	2	35'-10	75	5b1	2	32'-4	67	5b1	2	28'-11	60
Wingwall, F.F.H.		5b2	22 Var.	2 Each 10'-0 to 44'-7	636	5b2	20 Var.	2 Each 10'-0 to 41'-2	539	5b2	18 Var.	2 Each 10'-0 to 37'-8	447	5b2	16 Var.	2 Each 10'-0 to 34'-3	369	5b2	14 Var.	2 Each 10'-0 to 30'-9	298	5b2	12 Var.	2 Each 10'-0 to 27'-4	234
Wingwall, B.F.H.		4b3	2	46'-6	65	4b3	2	43'-1	61	4b3	2	39'-6	53	4b3	2	36'-1	48	4b3	2	32'-7	44	4b3	2	29'-1	39
Wingwall, B.F.H.		4b4	20 Var.	2 Each 13'-9 to 44'-11	398	4b4	18 Var.	2 Each 13'-9 to 41'-6	335	4b4	16 Var.	2 Each 13'-8 to 37'-11	276	4b4	14 Var.	2 Each 13'-8 to 34'-5	225	4b4	12 Var.	2 Each 13'-8 to 31'-0	179	4b4	10 Var.	2 Each 13'-7 to 27'-6	137
Interior Wall, Both F.H.		5b5	42 Var.	2 Each 7'-4 to 45'-8	1176	5b5	38 Var.	2 Each 7'-5 to 42'-2	993	5b5	34 Var.	2 Each 7'-4 to 38'-9	817	5b5	30 Var.	2 Each 7'-5 to 35'-3	668	5b5	26 Var.	2 Each 7'-5 to 31'-9	531	5b5	22 Var.	2 Each 7'-6 to 28'-4	411
Wingwall, F.F.V.		5c1	86 Var.	2 Each 2'-7 to 14'-8	774	5c1	78 Var.	2 Each 2'-7 to 13'-7	658	4c1	72 Var.	2 Each 2'-7 to 12'-8	367	4c1	64 Var.	2 Each 2'-7 to 11'-6	301	4c1	76 Var.	2 Each 2'-7 to 10'-7	334	4c1	68 Var.	2 Each 2'-7 to 9'-9	280
Wingwall, F.F.V.		5c2	40 Var.	2 Each 9'-1 to 14'-7	494	5c2	34 Var.	2 Each 9'-1 to 13'-8	403	4c2	26 Var.	2 Each 9'-1 to 12'-6	187	4c2	20 Var.	2 Each 9'-1 to 11'-8	139	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	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, B.F.V.		6c4	86 Var.	2 Each 6'-3 to 18'-5	1593	5c4	78 Var.	2 Each 6'-3 to 17'-3	956	5c4	72 Var.	2 Each 6'-3 to 16'-4	848	5c4	64 Var.	2 Each 6'-3 to 15'-3	718	5c4	58 Var.	2 Each 6'-3 to 14'-4	623	5c4	50 Var.	2 Each 6'-3 to 13'-2	506
Wingwall, B.F.V. (O)		6c5	1	18'-6	28	5c5	1	17'-6	18	5c5	1	16'-6	17	5c5	1	15'-6	16	5c5	1	14'-6	15	5c5	1	13'-6	14
Wingwall, B.F.V. (A)		6c5	3	18'-6	83	5c5	3	17'-6	55	5c5	3	16'-6	52	5c5	3	15'-6	48	5c5	3	14'-6	45	5c5	3	13'-6	42
Wingwall, B.F.V.		6c6	56	8'-6	715	5c6	50	8'-6	443	5c6	42	8'-6	372	5c6	36	8'-6	319	5c6	28	8'-6	248	5c6	22	8'-6	195
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	166 Var.	2 Each 1'-6 to 12'-2	758	4c8	152 Var.	2 Each 1'-6 to 11'-2	643	4c8	138 Var.	2 Each 1'-6 to 10'-2	538	4c8	124 Var.	2 Each 1'-6 to 9'-2	442	4c8	110 Var.	2 Each 1'-6 to 8'-1	352	4c8	96 Var.	2 Each 1'-5 to 7'-1	273
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	46'-1	1069	4d1	33	42'-7	992	4d1	33	39'-2	863	4d1	33	35'-8	786	4d1	33	32'-3	711	4d1	33	28'-9	634
Apron, Longit., Top		6f1	33	46'-1	2404	6f1	33	42'-7	2230	6f1	33	39'-2	1941	6f1	33	35'-8	1768	6f1	33	32'-3	1599	6f1	33	28'-9	1425
Parapet, Vertical		4i1	65	7'-0	304	4i1	65	7'-0	304	4i1	63	7'-0	295	4i1	63	7'-0	295	4i1	63	7'-0	295	4i1	63	7'-0	295
Parapet, Horiz.		7j1	4	38'-10	318	7j1	4	38'-10	318	7j1	4	38'-1	311	7j1	4	38'-1	311	7j1	4	38'-1	311	7j1	4	37'-8	308
Apron, Trans., Top		5m1	46	34'-2	1639	5m1	41	34'-2	1461	5m1	37	33'-6	1293	5m1	32	33'-6	1118	5m1	28	33'-6	978	5m1	23	33'-2	796
Apron, Trans., Top		5m2	24 Var.	2'-6 to 32'-4	436	5m2	24 Var.	3'-0 to 32'-10	448	5m2	23 Var.	3'-2 to 31'-9	419	5m2	24 Var.	2'-4 to 32'-3	433	5m2	23 Var.	2'-10 to 31'-5	411	5m2	23 Var.	3'-2 to 31'-9	419
Apron, Trans., Bott.		6m3	73	36'-7	4011	6m3	67	36'-7	3682	6m3	61	35'-11	3291	6m3	55	35'-11	2967	5m3	25	35'-1	915	5m3	22	34'-8	795
Curtain, Horiz.		6p1	6	39'-1	352	6p1	6	39'-1	352	6p1	6	38'-4	345	6p1	6	38'-4	345	6p1	6	38'-4	345	6p1	5	38'-0	285
Wing Slope, Both F.		6s1	4	40'-4	257	6s1	4	36'-9	221	6s1	4	33'-2	199	6s1	4	29'-6	177	6s1	4	25'-11	156	6s1	4	22'-4	134
Wing Slope, Both F. (O)		6s2	2	8'-3	25	6s2	2	8'-3	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25
Wing Slope, Both F. (A)		6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	37'-11	114	6s5	2	34'-3	103	6s5	2	30'-8	92	6s5	2	27'-1	81	6s5	2	23'-5	70	6s5	2	19'-10	60
Interior Wall, Both F.		6s6	4	47'-5	299	6s6	4	43'-10	278	6s6	4	40'-4	257	6s6	4	36'-9	221	6s6	4	33'-1	199	6s6	4	29'-7	178
Curtain, Vert.		5t1	37	7'-11	306	5t1	37	7'-8	296	5t1	37	7'-5	286	5t1	37	7'-2	277	5t1	37	6'-11	267	5t1	37	6'-8	257
Curtain, Vert. Ends		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	5t2	4	6'-10	29
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		18,590 LB				16,135 LB				13,872 LB				12,364 LB				9204 LB				7979 LB		
	Concrete Parapet Δ	3.8	120.8 CY			3.8	108.7 CY			3.6	89.9 CY			3.6	79.8 CY			3.6	70.1 CY			3.5	58.8 CY		
	Concrete Wingwalls	44.4				37.9				26.4				21.8				17.6				12.4			
	Concrete Apron *	72.6				67.0				59.9				54.4				48.9				42.9			

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 30-1-20 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
30° Skew

TRPWH
30-7-20
Sheet 1 of 2

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