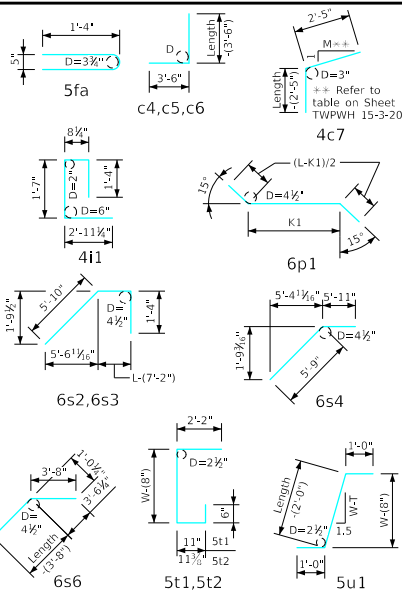


ENGLISHLRFDDESIGNEDTWINCULVERTS.DGN - TWPWH 15-6-20 51 - THIS SHEET ISSUED 07-20-2020

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	3 3/4"
6	4 1/2"

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

Location	Shape	12' x 12'				12' x 11'				12' x 10'				12' x 9'				12' x 8'				12' x 7'			
		Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.
Fence Anchor (Galv.)	5fa	2	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	2	4'-1"	92	5b1	2	38'-6"	80	5b1	2	35'-5"	74	5b1	2	32'-4"	67	5b1	2	29'-2"	61	5b1	2	26'-1"	54
Wingwall, F.F.H.	5b2	22	2	Each 9'-2 to 40'-2	571	5b2	20	2	Each 9'-2 to 37'-1	482	5b2	18	2	Each 9'-2 to 34'-0	405	5b2	16	2	Each 9'-2 to 30'-11	334	5b2	14	2	Each 9'-2 to 27'-9	270
Wingwall, B.F.H.	4b3	2	2	4'-1"	59	4b3	2	38'-8"	52	4b3	2	35'-6"	47	4b3	2	32'-5"	43	4b3	2	29'-3"	39	4b3	2	26'-2"	35
Wingwall, B.F.H.	4b4	20	2	Each 12'-5 to 40'-4	356	4b4	18	2	Each 12'-5 to 37'-3	299	4b4	16	2	Each 12'-4 to 34'-1	248	4b4	14	2	Each 12'-4 to 31'-0	203	4b4	12	2	Each 12'-4 to 27'-11	161
Interior Wall, Both F.H.	5b5	21	2	6'-7 to 41'-2	525	5b5	19	2	6'-8 to 38'-1	443	5b5	17	2	6'-8 to 35'-0	369	5b5	15	2	6'-9 to 31'-10	301	5b5	13	2	6'-10 to 28'-9	241
Wingwall, F.F.V.	5c1	76	2	Each 2'-8 to 14'-9	684	5c1	70	2	Each 2'-8 to 13'-7	593	4c1	64	2	Each 2'-8 to 12'-8	328	4c1	58	2	Each 2'-8 to 11'-8	278	4c1	68	2	Each 2'-8 to 10'-8	303
Wingwall, F.F.V.	5c2	36	2	Each 9'-3 to 14'-9	451	5c2	30	2	Each 9'-3 to 13'-9	360	4c2	24	2	Each 9'-3 to 12'-10	177	4c2	16	2	Each 9'-3 to 11'-6	111	c2	--	--	--	--
Wingwall, F.F.V. (O)	5c3	2	2	15'-1	31	5c3	2	14'-1	29	4c3	2	13'-1	17	4c3	2	12'-1	16	4c3	2	11'-1	15	4c3	2	10'-1	13
Wingwall, F.F.V. (A)	5c3	2	2	15'-1	31	5c3	2	14'-1	29	4c3	2	13'-1	17	4c3	2	12'-1	16	4c3	2	11'-1	15	4c3	2	10'-1	13
Wingwall, B.F.V.	6c4	76	2	Each 6'-4 to 18'-3	1403	5c4	70	2	Each 6'-4 to 17'-4	864	5c4	64	2	Each 6'-4 to 16'-4	757	5c4	58	2	Each 6'-4 to 15'-5	658	5c4	52	2	Each 6'-4 to 14'-5	563
Wingwall, B.F.V. (O)	6c5	1	1	18'-7	28	5c5	1	17'-7	18	5c5	1	16'-7	17	5c5	1	15'-7	16	5c5	1	14'-7	15	5c5	1	13'-7	14
Wingwall, B.F.V. (A)	6c5	2	2	18'-7	56	5c5	2	17'-7	37	5c5	2	16'-7	35	5c5	2	15'-7	33	5c5	2	14'-7	30	5c5	2	13'-7	28
Wingwall, B.F.V.	6c6	50	8	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	30	8'-6	266	5c6	24	8'-6	213	5c6	18	8'-6	160
Interior Wall, Both F.V	4c7	2	2	3'-10"	5	4c7	2	3'-10"	5	4c7	2	3'-10"	5	4c7	2	3'-10"	5	4c7	2	3'-10"	5	4c7	2	3'-10"	5
Interior Wall, Both F.V	4c8	75	2	1'-7 to 12'-3	347	4c8	68	2	1'-7 to 11'-2	290	4c8	62	2	1'-7 to 10'-2	243	4c8	56	2	1'-7 to 9'-3	203	4c8	50	2	1'-7 to 8'-3	164
Interior Wall, Both F.V	4c9	2	2	12'-7	17	4c9	2	11'-7	15	4c9	2	10'-7	14	4c9	2	9'-7	13	4c9	2	8'-7	11	4c9	2	7'-7	10
Apron, Longit., Bott.	4d1	26	4	4'-7	764	4d1	26	38'-5	667	4d1	26	35'-4	614	4d1	26	32'-3	560	4d1	26	29'-2	507	4d1	26	26'-0	452
Apron, Longit., Top	6f1	26	4	4'-7	1718	6f1	26	38'-5	1500	6f1	26	35'-4	1380	6f1	26	32'-3	1259	6f1	26	29'-2	1139	6f1	26	26'-0	1015
Parapet, Vertical	4i1	51	6	6'-7	224	4i1	51	6'-7	224	4i1	49	6'-7	215	4i1	49	6'-7	215	4i1	49	6'-7	215	4i1	49	6'-7	215
Parapet, Horiz.	7j1	4	4	2'-7"	226	7j1	4	2'-7"	226	7j1	4	2'-7"	221	7j1	4	2'-7"	221	7j1	4	2'-7"	221	7j1	4	2'-7"	219
Apron, Trans., Top	5m1	48	2	2'-2	1360	5m1	44	2'-2	1247	5m1	39	2'-2	1085	5m1	35	2'-2	973	5m1	31	2'-2	862	5m1	27	2'-2	744
Apron, Trans., Top	5m2	8	2	4'-6 to 24'-1	119	5m2	8	4'-2 to 23'-9	116	5m2	9	3'-6 to 25'-11	138	5m2	9	3'-1 to 25'-6	134	5m2	9	2'-9 to 25'-1	131	5m2	9	2'-2 to 24'-7	126
Apron, Trans., Bott.	5m3	73	2	24'-7	1872	5m3	67	24'-7	1718	6m3	31	24'-10	1156	5m3	28	24'-1	703	5m3	25	24'-1	628	5m3	22	23'-10	547
Curtain, Horiz.	6p1	6	6	28'-0	252	6p1	6	28'-0	252	6p1	6	27'-6	248	6p1	6	27'-6	248	6p1	6	27'-6	248	6p1	6	27'-3	205
Wing Slope, Both F.	6s1	4	4	36'-8	220	6s1	4	33'-5	201	6s1	4	30'-2	181	6s1	4	26'-11	162	6s1	4	23'-8	142	6s1	4	20'-5	123
Wing Slope, Both F. (O)	6s2	2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)	6s3	2	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.	6s4	2	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.	6s5	2	2	34'-2	103	6s5	2	30'-11	93	6s5	2	27'-8	83	6s5	2	24'-5	73	6s5	2	21'-2	64	6s5	2	17'-11	54
Interior Wall, Both F.	6s6	2	2	43'-1	137	6s6	2	39'-9	119	6s6	2	36'-7	110	6s6	2	33'-4	100	6s6	2	30'-1	90	6s6	2	26'-10	81
Curtain, Vert.	5t1	26	7	7'-11	215	5t1	26	7'-8	208	5t1	26	7'-5	201	5t1	26	7'-2	194	5t1	26	6'-11	188	5t1	26	6'-8	181
Curtain, Vert, Ends	5t2	4	4	7'-11	33	5t2	4	7'-8	32	5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28
Bracket, Vert.	5u1	4	4	6'-7	27	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-9	24	5u1	4	5'-6	23
Estimated Quantities One Headwall	Reinf. Steel	12,652 LB				10,704 LB				8868 LB				7549 LB				6683 LB				5807 LB			
	Concrete	88.7 CY				79.9 CY				66.6 CY				59.3 CY				52.1 CY				43.9 CY			
	Parapet Δ	2.8				2.8				2.7				2.7				2.6				2.6			
	Wingwalls	31.0				26.5				18.6				15.4				12.4				8.8			
Apron *	54.9				50.6				43.3				41.2				37.0				32.5				

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 TWPWH 15-1-20 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	APPROVED BY BRIDGE ENGINEER	IOWA DOT Highway Division	
		Standard Design - Twin Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls	
		July, 2020	
Quantity Tabulation		TWPWH	
12'-0" Span		15-6-20	
15° Skew		Sheet 1 of 2	