Single Reinforced Concrete Box Culvert Standards

Index for Single Culvert Standards:

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Index for Single Culvert Standards (cont'd):

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IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Index of Sheets

RCB G1-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB G1-20 - THIS SHEET ISSUED 07-2020.

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Single Reinforced Concrete Box Culvert Standards

General Notes:

1. The RCB culvert sections are designed for HL-93 live load and earth fills of varying heights.
2. Vertical earth pressure, EV=0.120 kcf.
   Horizontal earth pressure, EHmax = 0.060 kcf max, EHmin = 0.030 kcf.
3. The RCB culvert sections are designed for Class 1 exposure conditions except:
   Class 2 exposure condition is utilized for the slab design in 0' fill instances.
4. All slab and floor reinforcing steel is to be supported at intervals of not more than 3'-0" in either direction as outlined in the Standard Specifications.
5. The clear distance from face of concrete to near edge or end of reinforcing bar to be 2" unless otherwise noted.
6. Except for dowel bars 5r1 in slab, longitudinal reinforcing is not to extend thru the construction joints.
7. Floor of barrel is to be finished smooth. Sides of footing are to be formed to insure correct line and grade.
8. The permissible construction joint at the top of the walls may be lowered at the Contractor's option with Engineer's approval.
9. The reinforcement supplied for this structure shall be Grade 60 reinforcement in accordance with the Standard Specifications. The design stresses are based on ASTM A706 Grade 60 reinforcement.
10. The vertical bars in the walls may be spliced above the footing at the Contractor's option as follows:

Bar Size Number	4	5	6	7	8	9
Minimum Splice Length	20"	24"	29"	34"	38"	47"

    This splice, if used, will be at the Contractor's expense.
11. Reinforcing bar clearances will be as follows:
    Edge clearances: 2" except
    Top of floor 2¼" to near transverse reinforcing bar
    Bottom of floor 3½" to near transverse reinforcing bar
    End clearances:
    Vertical top 2"
    Vertical bottom 3" or 3½" if overall height of the culvert is not to a full inch
    Transverse 2"
12. All construction joints shall be formed with a beveled keyway except at bell joints.
13. All beveled keyways shall be centered.
14. Keyway size shall be 2"x4" except as follows:
    Keyway between the floor and wall shall be 2"x6" when the wall is greater than 10 inches wide.
15. Keyway dimensions shown on the plans are based on nominal dimensions unless stated otherwise. In addition, the bevel used on the keyway shall be limited to a maximum of 10 degrees from vertical.
16. If 0' of fill is specified, details for paving notch and reference to epoxy coating of slab reinforcing steel, if applicable, shall be included in the final plans.
17. All dimensions are in feet and inches unless otherwise noted or shown.
18. See current Standard Specifications regarding concrete form removal.
19. These culvert standards label all reinforcing steel with English notation (5a1 is ⅝ inch diameter bar). English reinforcing steel received in the field may display the following "bar designation". The "bar designation" is the stamped impression on the reinforcing bars, and is equivalent to the bar diameter in millimeters.

English Size	4	5	6	7	8	9
Bar Designation	13	16	19	22	25	29

20. In the event the slab thickness at the barrel end section exceeds 18 inches, the culvert parapet shall extend a minimum of 6 inches above the top of the culvert slab. Refer to the Culvert Design Manual for instructions. These details are to be included in the design plans to address these situations.

Specifications:

Design:
AASHTO LRFD Bridge Design Specifications, 8th Ed., Series of 2017.

Construction:
Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction, current series, plus applicable General Supplemental Specifications, Developmental Specifications, Supplemental Specifications and Special Provisions

Design Stresses:

Design stresses for the following materials are in accordance with the AASHTO LRFD Bridge Design Specifications, 8th Ed., Series of 2017:
Reinforcing steel in accordance with AASHTO LRFD Section 5, Grade 60.
Concrete in accordance with AASHTO LRFD Section 5, f'c = 4.0 ksi.

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Single Reinforced Concrete Box Culverts

July, 2020

General Notes & Specifications

RCB G2-20

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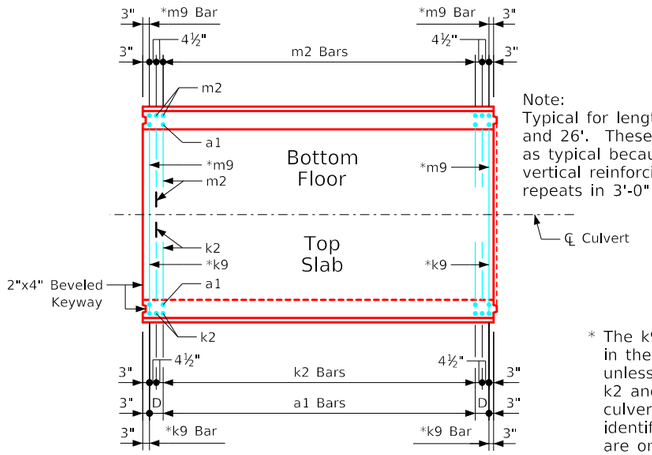
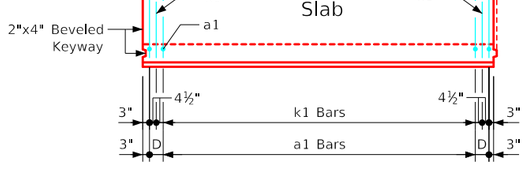


Note:
Typical for lengths of 38', 35', 32', 29', and 26'. These lengths are shown as typical because all transverse and vertical reinforcing steel spacing repeats in 3'-0" intervals.

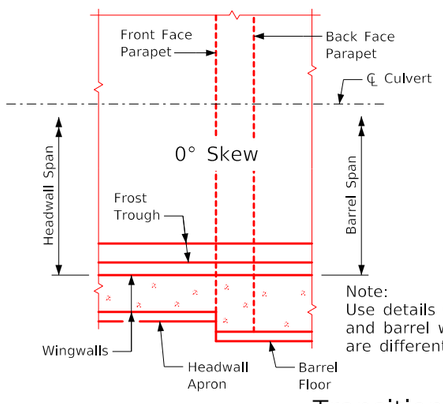
* The k9 and m9 bars are to be placed in the top slab and bottom floor unless the horizontal legs of the k2 and m2 bars touch or lap. The culvert barrel detail standards identify when the k9 and m9 bars are omitted.

Standard Section Plan View
(Keyway is to be omitted when bell joints are used)

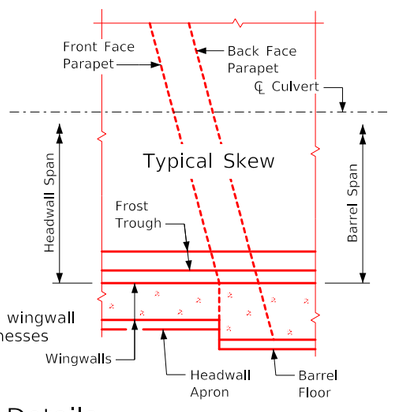


Note:
Typical for lengths of 38', 35', 32', 29', and 26'. These lengths are shown as typical because all transverse and vertical reinforcing steel spacing repeats in 3'-0" intervals.

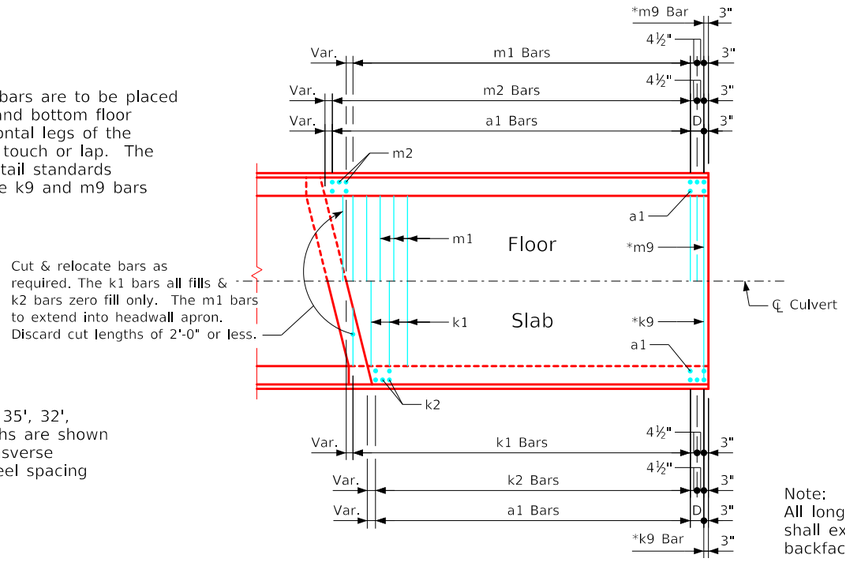
Standard Section Plan View
(Keyway is to be omitted when bell joints are used)



Note:
Use details when the wingwall and barrel wall thicknesses are different.



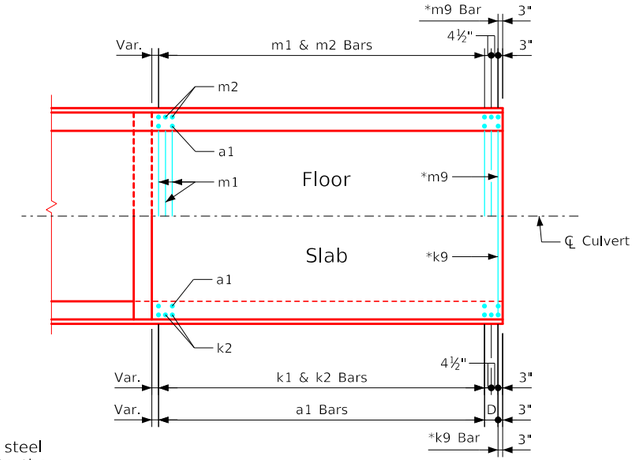
Transition Wall Details



Cut & relocate bars as required. The k1 bars all fills & k2 bars zero fill only. The m1 bars to extend into headwall apron. Discard cut lengths of 2'-0" or less.

Typical Skew

Note:
All longitudinal barrel steel shall extend at least to the backface of parapet.



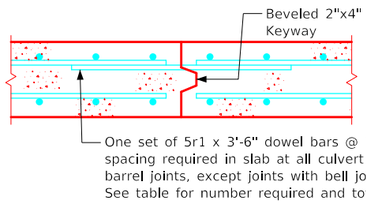
0° Skew

End Section Plan Views
(Keyways not shown)

Note:
End section details shown are for a 15° skew barrel. Use for skews of 30° & 45° by increasing the number of transverse reinforcing bars required to be cut and relocated.

5r1 Bars - One Const. Jt.

Span	No.	Weight (LB)
3'-0"	4	15
4'-0"	5	18
5'-0"	6	22
6'-0"	7	26
8'-0"	9	33
10'-0"	11	40
12'-0"	13	47
14'-0"	15	55
16'-0"	17	62



Top Slab Construction Joint Detail

Note:
Dimensions listed on this sheet to be used in conjunction with dimensions and quantities for barrel section sheets.

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Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Typical Culvert Barrel Details

RCB G3-20

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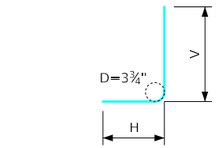
Variable Dimensions and Quantities for 3' x 3' Barrel Sections

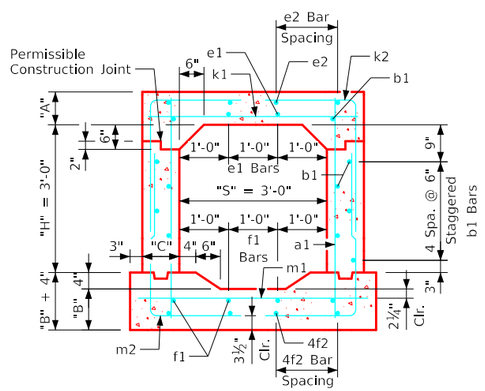
Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	3	3	9	10	9	9	4	9	4'-6	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	6	4'-2	5	12	6'-4	3'-2	3'-2	--	--	4	9	4'-8	5	12	6'-6	3'-3	3'-3	--	--	0.157	0.191	0.146	0.494	64.18
1	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	9	4'-2	5	12	6'-2	3'-1	3'-1	--	--	4	9	4'-8	5	12	6'-6	3'-3	3'-3	--	--	0.144	0.191	0.146	0.481	61.89
2	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	9	4'-2	5	12	6'-2	3'-1	3'-1	--	--	4	9	4'-8	5	12	5'-7	2'-4	3'-3	--	--	0.144	0.191	0.146	0.481	59.84
3-5	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	12	4'-2	5	12	5'-5	2'-4	3'-1	--	--	4	12	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	55.71
6-8	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	12	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	12	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	55.53
9-10	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	12	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	12	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	55.53
11-15	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	12	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	12	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	55.53
16-20	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	9	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	9	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	57.39
21-25	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	9	4'-2	5	12	5'-4	2'-3	3'-1	--	--	5	12	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	58.32
26-30	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	9	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	6	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	59.37
31-35	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	6	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	6	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	61.11
36-40	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	6	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	6	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	61.11
41-45	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	4	6	4'-2	5	12	5'-4	2'-3	3'-1	--	--	4	6	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	61.11
46-50	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	6	9	4'-2	5	12	5'-4	2'-3	3'-1	--	--	6	9	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	67.66
51-55	3	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	2	4	9	4	4	12	4	4	9	4	6	9	4'-2	5	12	5'-4	2'-3	3'-1	--	--	6	9	4'-8	5	12	5'-4	2'-1	3'-3	--	--	0.144	0.191	0.146	0.481	67.66

Bent Bar Detail



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



3' x 3' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

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Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

3' x 3' Barrel Sections

RCB 3-3-20

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Variable Dimensions and Quantities for 4' x 4' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	4	4	10	10	9	9	4	9	5'-7	4	6	16	4	12	3	4	15	4	4	12	5	4	15	4	4	6	5'-2	5	12	7'-2	3'-7	3'-7	--	--	5	12	5'-8	5	12	7'-5	3'-2	4'-3	--	--	0.202	0.222	0.202	0.626	77.39
1	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	15	4	4	12	5	4	15	4	4	6	5'-2	5	12	6'-8	3'-7	3'-1	--	--	5	12	5'-8	5	12	7'-10	3'-7	4'-3	--	--	0.168	0.222	0.202	0.592	76.92
2	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	15	4	4	12	5	4	15	4	4	9	5'-2	5	12	6'-8	3'-7	3'-1	--	--	5	12	5'-8	5	12	7'-0	2'-9	4'-3	--	--	0.168	0.222	0.202	0.592	72.87
3-5	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	9	6	4	12	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	4	9	5'-8	5	12	6'-5	2'-2	4'-3	5	5'-8	0.168	0.222	0.202	0.592	69.63
6-8	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	4	9	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	4	9	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	69.21
9-10	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	4	12	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	4	9	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	68.13
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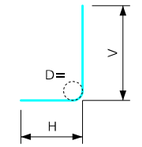
16-20	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	4	6	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	4	6	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	73.76
21-25	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	4	6	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	4	6	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	73.76
26-30	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	4	6	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	6	9	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	77.97
31-35	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	6	9	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	6	9	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	81.79
36-40	4	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	3	4	10	6	4	12	5	4	18	4	6	9	5'-2	5	12	5'-4	2'-3	3'-1	5	5'-2	5	6	5'-8	5	12	6'-4	2'-1	4'-3	5	5'-8	0.168	0.222	0.202	0.592	81.89
41-45	4	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	3	4	17	4	4	12	5	4	15	4	5	6	5'-2	4	6	4'-9	2'-0	2'-9	4	5'-2	5	6	5'-8	4	6	6'-1	1'-10	4'-3	4	5'-8	0.168	0.222	0.202	0.592	81.26
46-50	4	4	8	10.5	9	6	4	6	5'-5	4	6	16	4	12	3	4	17	4	4	12	5	4	15	4	7	9	5'-2	4	6	4'-8	2'-0	2'-8	4	5'-2	7	9	5'-8	4	6	6'-2	1'-10	4'-4	4	5'-8	0.168	0.231	0.202	0.601	96.29
51-55	4	4	8	10.5	9	6	4	6	5'-5	4	6	16	4	12	3	4	17	4	4	12	5	4	15	4	6	6	5'-2	4	6	4'-8	2'-0	2'-8	4	5'-2	6	6	5'-8	4	6	6'-2	1'-10	4'-4	4	5'-8	0.168	0.231	0.202	0.601	98.37

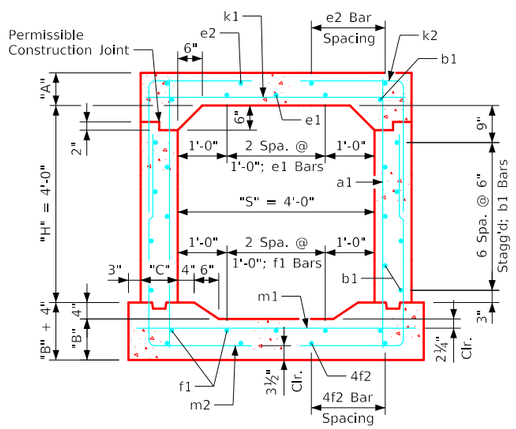
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



4' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

4' x 4' Barrel Sections

RCB 4-4-20

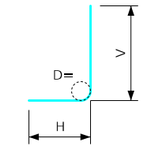
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 4-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 5' x 3' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	3	10	10	9	9	4	9	4'-7	4	6	12	4	12	4	4	11	6	4	12	6	4	11	6	4	6	6'-2	5	12	5'-9	2'-6	3'-3	5	6'-2	4	6	6'-8	5	12	5'-9	2'-6	3'-3	5	6'-8	0.233	0.253	0.146	0.632	74.71
1	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	11	6	4	12	6	4	11	6	4	6	6'-2	5	12	5'-6	2'-5	3'-1	5	6'-2	4	6	6'-8	5	12	5'-8	2'-5	3'-3	5	6'-8	0.193	0.253	0.146	0.592	73.66
2	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	10	6	4	12	6	4	9	6	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	5'-5	2'-2	3'-3	5	6'-8	0.193	0.253	0.146	0.592	72.71
3-4	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	10	6	4	12	6	4	18	4	4	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	5	12	6'-8	5	12	5'-4	2'-1	3'-3	5	6'-8	0.193	0.253	0.146	0.592	67.08
5-8	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	10	6	4	12	6	4	18	4	4	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	5'-4	2'-1	3'-3	5	6'-8	0.193	0.253	0.146	0.592	68.61
9-10	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	10	6	4	12	6	4	18	4	4	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	5'-4	2'-1	3'-3	5	6'-8	0.193	0.253	0.146	0.592	68.61
11-15	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	10	6	4	12	6	4	18	4	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	5'-4	2'-1	3'-3	5	6'-8	0.193	0.253	0.146	0.592	71.21
16-20	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	10	6	4	12	6	4	18	4	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	5'-4	2'-1	3'-3	5	6'-8	0.193	0.253	0.146	0.592	71.21
21-25	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	17	4	4	12	6	4	15	4	6	9	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	5	6	6'-8	4	6	5'-1	1'-10	3'-3	4	6'-8	0.193	0.253	0.146	0.592	81.89
26-30	5	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	4	4	17	4	4	12	6	4	15	4	5	6	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	5	6	6'-8	4	6	5'-1	1'-10	3'-3	4	6'-8	0.193	0.253	0.146	0.592	82.00
31-35	5	3	8	10.5	9	9	5	12	4'-5	4	6	12	4	12	4	4	17	4	4	12	6	4	15	4	7	9	6'-2	4	6	4'-8	2'-0	2'-8	4	6'-2	6	6	6'-8	4	6	5'-2	1'-10	3'-4	4	6'-8	0.193	0.263	0.146	0.602	94.29
36-40	5	3	8.5	11	9	9	5	12	4'-6	4	6	12	4	12	4	4	17	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	6	6	6'-8	4	6	5'-2	1'-10	3'-4	4	6'-8	0.203	0.274	0.146	0.623	95.89
41-45	5	3	9.5	11.5	9	9	5	12	4'-8	4	6	12	4	12	4	4	16	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-9	1'-11	2'-10	4	6'-2	6	6	6'-8	4	6	5'-3	1'-10	3'-5	4	6'-8	0.223	0.285	0.146	0.654	96.47
46-50	5	3	10	12	9	9	5	12	4'-9	4	6	12	4	12	4	4	16	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-10	1'-11	2'-11	4	6'-2	6	6	6'-8	4	6	5'-3	1'-10	3'-5	4	6'-8	0.233	0.296	0.146	0.675	96.84
51-55	5	3	10.5	12.5	9	9	5	12	4'-10	4	6	12	4	12	4	4	16	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-10	1'-11	2'-11	4	6'-2	6	6	6'-8	4	6	5'-4	1'-10	3'-6	4	6'-8	0.243	0.307	0.146	0.696	97.26

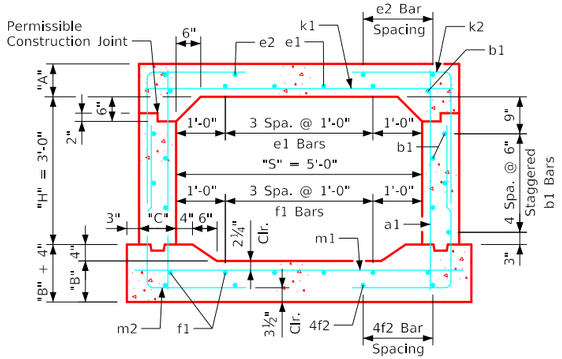
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



5' x 3' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

5' x 3' Barrel Sections

RCB 5-3-20

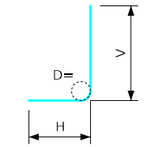
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 5-3-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 5' x 4' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	4	10	10	9	9	4	9	5'-7	4	6	16	4	12	4	4	11	6	4	12	6	4	12	6	4	6	6'-2	5	12	7'-4	4'-1	3'-3	--	--	4	6	6'-8	5	12	6'-10	2'-7	4'-3	5	6'-8	0.233	0.253	0.202	0.688	84.79
1	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	11	6	4	12	6	4	12	6	4	6	6'-2	5	12	7'-2	4'-1	3'-1	--	--	4	6	6'-8	5	12	6'-11	2'-8	4'-3	5	6'-8	0.193	0.253	0.202	0.648	84.34
2	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	12	6	4	12	6	4	11	6	4	6	6'-2	5	12	5'-8	2'-7	3'-1	5	6'-2	4	6	6'-8	5	12	6'-8	2'-5	4'-3	5	6'-8	0.193	0.253	0.202	0.648	80.74
3-4	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	10	6	4	12	6	4	10	6	4	9	6'-2	5	12	5'-5	2'-4	3'-1	5	6'-2	4	6	6'-8	5	12	6'-6	2'-3	4'-3	5	6'-8	0.193	0.253	0.202	0.648	77.18
5-8	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	10	6	4	12	6	4	10	6	4	9	6'-2	5	12	5'-5	2'-4	3'-1	5	6'-2	4	6	6'-8	5	12	6'-6	2'-3	4'-3	5	6'-8	0.193	0.253	0.202	0.648	77.18
9-10	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	10	6	4	12	6	4	18	4	4	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	6'-4	2'-1	4'-3	5	6'-8	0.193	0.253	0.202	0.648	75.32
11-15	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	10	6	4	12	6	4	18	4	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	6'-4	2'-1	4'-3	5	6'-8	0.193	0.253	0.202	0.648	77.92
16-20	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	10	6	4	12	6	4	18	4	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	6	9	6'-8	5	12	6'-4	2'-1	4'-3	5	6'-8	0.193	0.253	0.202	0.648	82.87
21-25	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	10	6	4	12	6	4	18	4	6	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	5	6	6'-8	5	12	6'-4	2'-1	4'-3	5	6'-8	0.193	0.253	0.202	0.648	87.55
26-30	5	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	4	4	17	4	4	12	6	4	15	4	5	6	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	5	6	6'-8	4	6	6'-1	1'-10	4'-3	4	6'-8	0.193	0.253	0.202	0.648	89.16
31-35	5	4	8	10.5	9	9	4	9	5'-5	4	6	16	4	12	4	4	17	4	4	12	6	4	15	4	7	9	6'-2	4	6	4'-8	2'-0	2'-8	4	6'-2	6	6	6'-8	4	6	6'-2	1'-10	4'-4	4	6'-8	0.193	0.263	0.202	0.658	99.89
36-40	5	4	8.5	11	9	9	4	9	5'-6	4	6	16	4	12	4	4	17	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	6	6	6'-8	4	6	6'-2	1'-10	4'-4	4	6'-8	0.203	0.274	0.202	0.679	101.47
41-45	5	4	9.5	11.5	9	9	4	9	5'-8	4	6	16	4	12	4	4	16	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-9	1'-11	2'-10	4	6'-2	6	6	6'-8	4	6	6'-3	1'-10	4'-5	4	6'-8	0.223	0.285	0.202	0.710	102.00
46-50	5	4	10	12	9	9	4	9	5'-9	4	6	16	4	12	4	4	16	4	4	12	6	4	15	4	6	6	6'-2	4	6	4'-10	1'-11	2'-11	4	6'-2	6	6	6'-8	4	6	6'-3	1'-10	4'-5	4	6'-8	0.233	0.296	0.202	0.731	102.37
51-55	5	4	10.5	12.5	9	9	4	9	5'-10	4	6	16	4	12	4	4	16	4	4	12	6	4	15	4	8	9	6'-2	4	6	4'-10	1'-11	2'-11	4	6'-2	8	9	6'-8	4	6	6'-4	1'-10	4'-6	4	6'-8	0.243	0.307	0.202	0.752	111.47

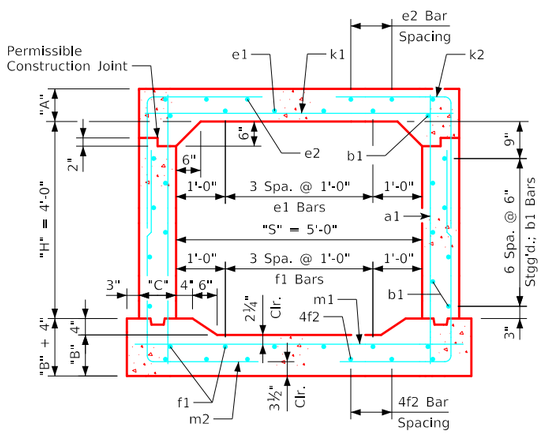
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



5' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

5' x 4' Barrel Sections

RCB 5-4-20

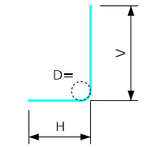
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 5-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 5' x 5' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	5	10	10	9	9	4	9	6'-7	4	6	20	4	12	4	4	11	6	4	12	6	4	11	6	5	9	6'-2	5	12	7'-4	4'-1	3'-3	--	--	4	6	6'-8	5	12	8'-10	3'-7	5'-3	--	--	0.233	0.253	0.257	0.743	94.00
1	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	11	6	4	12	6	4	11	6	4	6	6'-2	5	12	7'-2	4'-1	3'-1	--	--	4	6	6'-8	5	12	9'-4	4'-1	5'-3	--	--	0.193	0.253	0.257	0.703	93.82
2	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	11	6	4	12	6	4	11	6	4	6	6'-2	5	12	7'-2	4'-1	3'-1	--	--	4	6	6'-8	5	12	8'-4	3'-1	5'-3	--	--	0.193	0.253	0.257	0.703	91.58
3-4	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	11	6	4	12	6	4	13	6	4	9	6'-2	5	12	6'-2	3'-1	3'-1	5	6'-2	4	6	6'-8	5	12	8'-0	2'-9	5'-3	5	6'-8	0.193	0.253	0.257	0.703	86.32
5-8	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	11	6	4	12	6	4	11	6	4	9	6'-2	5	12	5'-7	2'-6	3'-1	5	6'-2	4	6	6'-8	5	12	7'-8	2'-5	5'-3	5	6'-8	0.193	0.253	0.257	0.703	84.63
9-10	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	10	6	4	12	6	4	18	4	4	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	7'-4	2'-1	5'-3	5	6'-8	0.193	0.253	0.257	0.703	81.97
11-15	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	10	6	4	12	6	4	18	4	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	4	6	6'-8	5	12	7'-4	2'-1	5'-3	5	6'-8	0.193	0.253	0.257	0.703	84.58
16-20	5	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	4	4	10	6	4	12	6	4	18	4	4	6	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	6	9	6'-8	5	12	7'-4	2'-1	5'-3	5	6'-8	0.193	0.253	0.257	0.703	89.53
21-25	5	5	8	10	9	9	4	12	6'-5	4	6	20	4	12	4	4	17	4	4	12	6	4	16	4	6	9	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	5	6	6'-8	4	6	7'-2	1'-11	5'-3	4	6'-8	0.193	0.253	0.257	0.703	93.68
26-30	5	5	8	10	9	9	4	12	6'-5	4	6	20	4	12	4	4	17	4	4	12	6	4	16	4	5	6	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	7	9	6'-8	4	6	7'-2	1'-11	5'-3	4	6'-8	0.193	0.253	0.257	0.703	98.71
31-35	5	5	8	10.5	9	9	4	9	6'-5	4	6	20	4	12	4	4	17	4	4	12	6	4	16	4	7	9	6'-2	4	6	4'-8	2'-0	2'-8	4	6'-2	6	6	6'-8	4	6	7'-3	1'-11	5'-4	4	6'-8	0.193	0.263	0.257	0.713	107.26
36-40	5	5	8.5	11	9	9	4	9	6'-6	4	6	20	4	12	4	4	17	4	4	12	6	4	16	4	6	6	6'-2	4	6	4'-9	2'-0	2'-9	4	6'-2	6	6	6'-8	4	6	7'-3	1'-11	5'-4	4	6'-8	0.203	0.274	0.257	0.734	108.84
41-45	5	5	9.5	11.5	9	9	5	12	6'-8	4	6	20	4	12	4	4	16	4	4	12	6	4	17	4	6	6	6'-2	4	6	4'-9	1'-11	2'-10	4	6'-2	6	6	6'-8	4	6	7'-5	2'-0	5'-5	4	6'-8	0.223	0.285	0.257	0.765	111.89
46-50	5	5	10	12	9	9	5	12	6'-9	4	6	20	4	12	4	4	17	4	4	12	6	4	17	4	6	6	6'-2	4	6	4'-11	2'-0	2'-11	4	6'-2	6	6	6'-8	4	6	7'-5	2'-0	5'-5	4	6'-8	0.233	0.296	0.257	0.786	112.53
51-55	5	5	10.5	12.5	9.5	9	5	12	6'-10	4	6	20	4	12	4	4	11	6	4	12	6	4	11	6	6	6	6'-3	6	12	6'-2	2'-6	3'-8	6	6'-3	6	6	6'-9	6	12	8'-0	2'-6	5'-6	6	6'-9	0.247	0.311	0.271	0.829	128.97

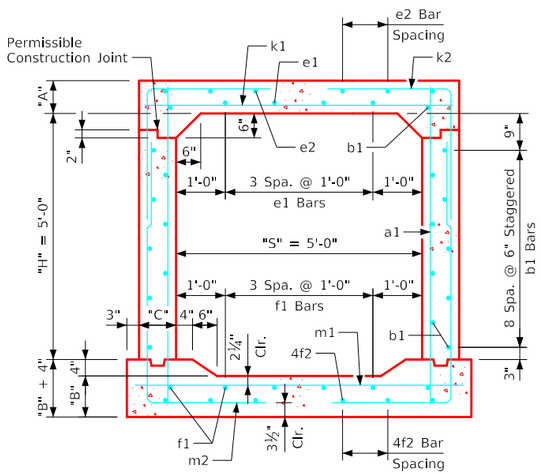
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



5' x 5' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

5' x 5' Barrel Sections

RCB 5-5-20

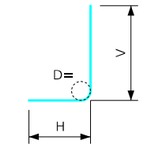
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 5-5-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 5' x 6' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	6	10	10	9	9	4	9	7'-7	4	6	24	5	12	4	4	11	6	4	12	6	4	11	6	6	9	6'-2	5	12	7'-4	4'-1	3'-3	--	--	4	6	6'-8	5	12	10'-4	4'-1	6'-3	--	--	0.233	0.253	0.313	0.799	107.26
1	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	11	6	4	12	6	4	11	6	4	6	6'-2	5	12	7'-2	4'-1	3'-1	--	--	4	6	6'-8	5	12	10'-4	4'-1	6'-3	--	--	0.193	0.253	0.313	0.759	100.53
2	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	11	6	4	12	6	4	11	6	4	6	6'-2	5	12	7'-2	4'-1	3'-1	--	--	4	6	6'-8	5	12	10'-4	4'-1	6'-3	--	--	0.193	0.253	0.313	0.759	100.53
3-4	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	11	6	4	12	6	4	11	6	4	9	6'-2	5	12	7'-2	4'-1	3'-1	--	--	4	6	6'-8	5	12	10'-4	4'-1	6'-3	--	--	0.193	0.253	0.313	0.759	97.92
5-7	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	11	6	4	12	6	4	11	6	4	9	6'-2	5	12	6'-9	3'-8	3'-1	5	6'-2	4	6	6'-8	5	12	9'-4	3'-1	6'-3	5	6'-8	0.193	0.253	0.313	0.759	94.71
8-10	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	11	6	4	12	6	4	12	6	4	9	6'-2	5	12	6'-2	3'-1	3'-1	5	6'-2	4	6	6'-8	5	12	8'-11	2'-8	6'-3	5	6'-8	0.193	0.253	0.313	0.759	92.84
11-15	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	10	6	4	12	6	4	10	6	4	6	6'-2	5	12	5'-5	2'-4	3'-1	5	6'-2	4	6	6'-8	5	12	8'-7	2'-4	6'-3	5	6'-8	0.193	0.253	0.313	0.759	93.34
16-20	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	10	6	4	12	6	4	10	6	6	9	6'-2	5	12	5'-4	2'-3	3'-1	5	6'-2	6	9	6'-8	5	12	8'-6	2'-3	6'-3	5	6'-8	0.193	0.253	0.313	0.759	102.50
21-25	5	6	8	10	9	9	4	12	7'-5	4	6	24	4	12	4	4	18	4	4	12	6	4	9	6	6	9	6'-2	4	6	4'-10	2'-1	2'-9	4	6'-2	5	6	6'-8	4	6	8'-5	2'-2	6'-3	4	6'-8	0.193	0.253	0.313	0.759	102.63
26-30	5	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	4	4	18	4	4	12	6	4	9	6	5	6	6'-2	4	6	4'-10	2'-1	2'-9	4	6'-2	7	9	6'-8	4	6	8'-5	2'-2	6'-3	4	6'-8	0.193	0.253	0.313	0.759	110.79
31-35	5	6	8	10.5	9	9	4	9	7'-5	4	6	24	4	12	4	4	18	4	4	12	6	4	9	6	7	9	6'-2	4	6	4'-9	2'-1	2'-8	4	6'-2	6	6	6'-8	4	6	8'-6	2'-2	6'-4	4	6'-8	0.193	0.263	0.313	0.769	116.63
36-40	5	6	8.5	11	9.5	9	5	12	7'-6	4	6	24	4	12	4	4	17	4	4	12	6	4	9	6	7	9	6'-3	4	6	4'-10	2'-1	2'-9	4	6'-3	6	6	6'-9	4	6	8'-7	2'-3	6'-4	4	6'-9	0.206	0.278	0.330	0.814	120.34
41-45	5	6	9	11.5	10	6	4	6	7'-7	4	6	24	4	12	4	4	18	4	4	12	6	4	10	6	6	6	6'-4	4	6	4'-11	2'-2	2'-9	4	6'-4	6	6	6'-10	4	6	8'-9	2'-4	6'-5	4	6'-10	0.220	0.293	0.347	0.860	126.92
46-50	5	6	9.5	12	10.5	6	4	6	7'-8	4	6	24	4	12	4	4	11	6	4	12	6	4	11	6	6	6	6'-5	6	12	6'-4	2'-8	3'-8	6	6'-5	6	6	6'-11	6	12	9'-0	2'-7	6'-5	6	6'-11	0.234	0.307	0.366	0.907	142.26
51-55	5	6	10	12.5	11	6	4	6	7'-9	4	6	24	4	12	4	4	11	6	4	12	6	4	11	6	6	6	6'-6	6	12	6'-4	2'-8	3'-8	6	6'-6	6	6	7'-0	6	12	9'-1	2'-7	6'-6	6	7'-0	0.248	0.322	0.383	0.953	143.34

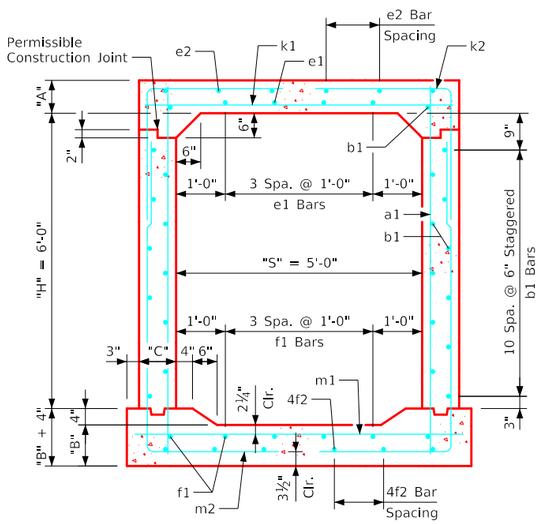
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



5' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

5' x 6' Barrel Sections

RCB 5-6-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 5-6-20 - THIS SHEET ISSUED 07-2020.

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Variable Dimensions and Quantities for 6' x 3' Barrel Sections

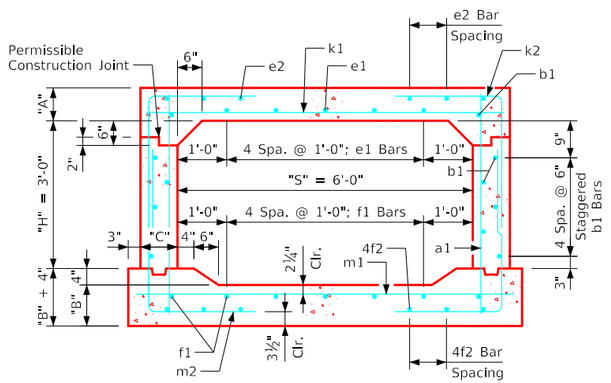
Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	3	10.5	10	9	9	4	12	4'-7	4	6	12	4	12	5	4	10	6	4	12	7	4	16	6	4	6	7'-2	4	6	5'-3	2'-4	2'-11	4	7'-2	4	6	7'-8	4	6	6'-6	3'-3	3'-3	4	7'-8	0.275	0.284	0.146	0.705	82.55
1	6	3	9	10	9	9	4	12	4'-6	4	6	12	4	12	5	4	10	6	4	12	7	4	11	6	4	6	7'-2	4	6	5'-1	2'-3	2'-10	4	7'-2	4	6	7'-8	4	6	5'-9	2'-6	3'-3	4	7'-8	0.241	0.284	0.146	0.671	79.95
2	6	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	5	4	10	6	4	12	7	4	10	6	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	5'-7	2'-4	3'-3	5	7'-8	0.218	0.284	0.146	0.648	77.24
3	6	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	5	4	10	6	4	12	7	4	9	6	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	5'-5	2'-2	3'-3	5	7'-8	0.218	0.284	0.146	0.648	76.84
4-6	6	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	5	4	10	6	4	12	7	4	9	6	4	9	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	5'-5	2'-2	3'-3	5	7'-8	0.218	0.284	0.146	0.648	73.82
7-10	6	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	5	4	10	6	4	12	7	4	18	4	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	5'-4	2'-1	3'-3	5	7'-8	0.218	0.284	0.146	0.648	75.34
11-15	6	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	5	4	10	6	4	12	7	4	18	4	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	5'-4	2'-1	3'-3	5	7'-8	0.218	0.284	0.146	0.648	75.34
16-20	6	3	8	10	9	9	4	9	4'-5	4	6	12	4	12	5	4	17	4	4	12	7	4	16	4	5	6	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	5	6	7'-8	4	6	5'-2	1'-11	3'-3	4	7'-8	0.218	0.284	0.146	0.648	87.89
21-25	6	3	8	10	9	6	4	6	4'-5	4	6	12	4	12	5	4	17	4	4	12	7	4	16	4	7	9	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	6	6	7'-8	4	6	5'-2	1'-11	3'-3	4	7'-8	0.218	0.284	0.146	0.648	104.16
26-30	6	3	8.5	11	9	6	4	6	4'-6	4	6	12	4	12	5	4	12	6	4	12	7	4	11	6	6	6	7'-2	6	12	6'-2	2'-7	3'-7	6	7'-2	6	6	7'-8	6	12	5'-9	2'-5	3'-4	6	7'-8	0.229	0.308	0.146	0.683	120.84
31-35	6	3	9.5	12	9	6	4	6	4'-8	4	6	12	4	12	5	4	11	6	4	12	7	4	11	6	6	6	7'-2	6	12	6'-2	2'-6	3'-8	6	7'-2	6	6	7'-8	6	12	5'-10	2'-5	3'-5	6	7'-8	0.252	0.333	0.146	0.731	121.55
36-40	6	3	10.5	12.5	9	6	4	6	4'-10	4	6	12	4	12	5	4	16	4	4	12	7	4	15	4	6	6	7'-2	4	6	4'-10	1'-11	2'-11	4	7'-2	6	6	7'-8	4	6	5'-4	1'-10	3'-6	4	7'-8	0.275	0.345	0.146	0.766	107.34
41-45	6	3	11	13	9	6	4	6	4'-11	4	6	12	4	12	5	4	15	4	4	12	7	4	15	4	8	9	7'-2	4	6	4'-10	1'-10	3'-0	4	7'-2	7	6	7'-8	4	6	5'-4	1'-10	3'-6	4	7'-8	0.287	0.358	0.146	0.791	120.84
46-50	6	3	11.5	14	9	6	4	6	5'-0	4	6	12	4	12	5	4	11	6	4	12	7	4	11	6	7	6	7'-2	6	12	6'-3	2'-5	3'-10	6	7'-2	7	6	7'-8	6	12	6'-0	2'-5	3'-7	6	7'-8	0.299	0.382	0.146	0.827	139.55
51-55	6	3	12	14.5	9	6	4	6	5'-1	4	6	12	4	12	5	4	11	6	4	12	7	4	11	6	7	6	7'-2	6	12	6'-3	2'-5	3'-10	6	7'-2	7	6	7'-8	6	12	6'-1	2'-5	3'-8	6	7'-8	0.310	0.395	0.146	0.851	140.03

Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"

k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



6' x 3' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

6' x 3' Barrel Sections

RCB 6-3-20

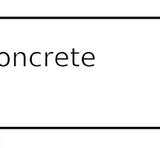
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 6-3-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 6' x 4' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	4	10.5	10	9	9	4	12	5'-7	4	6	16	4	12	5	4	16	6	4	12	7	4	13	6	5	9	7'-2	4	6	6'-6	3'-3	3'-3	4	7'-2	4	6	7'-8	4	6	7'-0	2'-9	4'-3	4	7'-8	0.275	0.284	0.202	0.761	92.03
1	6	4	9	10	9	9	4	9	5'-6	4	6	16	4	12	5	4	15	6	4	12	7	4	13	6	4	6	7'-2	5	12	6'-4	3'-2	3'-2	5	7'-2	4	6	7'-8	5	12	7'-0	2'-9	4'-3	5	7'-8	0.241	0.284	0.202	0.727	87.29
2	6	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	5	4	11	6	4	12	7	4	11	6	4	6	7'-2	5	12	5'-7	2'-6	3'-1	5	7'-2	4	6	7'-8	5	12	6'-8	2'-5	4'-3	5	7'-8	0.218	0.284	0.202	0.704	84.68
3	6	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	5	4	10	6	4	12	7	4	10	6	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	6'-6	2'-3	4'-3	5	7'-8	0.218	0.284	0.202	0.704	83.74
4-6	6	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	5	4	10	6	4	12	7	4	9	6	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	6'-5	2'-2	4'-3	5	7'-8	0.218	0.284	0.202	0.704	83.55
7-10	6	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	5	4	10	6	4	12	7	4	18	4	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	6'-4	2'-1	4'-3	5	7'-8	0.218	0.284	0.202	0.704	82.05
11-15	6	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	5	4	10	6	4	12	7	4	18	4	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	6	9	7'-8	5	12	6'-4	2'-1	4'-3	5	7'-8	0.218	0.284	0.202	0.704	87.74
16-20	6	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	5	4	17	4	4	12	7	4	16	4	5	6	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	5	6	7'-8	4	6	6'-2	1'-11	4'-3	4	7'-8	0.218	0.284	0.202	0.704	92.74
21-25	6	4	8	10	9	9	5	12	5'-5	4	6	16	4	12	5	4	17	4	4	12	7	4	16	4	7	9	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	6	6	7'-8	4	6	6'-2	1'-11	4'-3	4	7'-8	0.218	0.284	0.202	0.704	109.32
26-30	6	4	8.5	11	9	6	4	6	5'-6	4	6	16	4	12	5	4	17	4	4	12	7	4	15	4	6	6	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	6	6	7'-8	4	6	6'-2	1'-10	4'-4	4	7'-8	0.229	0.308	0.202	0.739	113.79
31-35	6	4	9.5	12	9	6	4	6	5'-8	4	6	16	4	12	5	4	16	4	4	12	7	4	16	4	6	6	7'-2	4	6	4'-9	1'-11	2'-10	4	7'-2	6	6	7'-8	4	6	6'-4	1'-11	4'-5	4	7'-8	0.252	0.333	0.202	0.787	114.71
36-40	6	4	10.5	12.5	9	9	5	12	5'-10	4	6	16	4	12	5	4	16	4	4	12	7	4	16	4	8	9	7'-2	4	6	4'-10	1'-11	2'-11	4	7'-2	8	9	7'-8	4	6	6'-5	1'-11	4'-6	4	7'-8	0.275	0.345	0.202	0.822	122.58
41-45	6	4	11	13	9	6	4	6	5'-11	4	6	16	4	12	5	4	15	4	4	12	7	4	16	4	8	9	7'-2	4	6	4'-10	1'-10	3'-0	4	7'-2	7	6	7'-8	4	6	6'-5	1'-11	4'-6	4	7'-8	0.287	0.358	0.202	0.847	129.11
46-50	6	4	11.5	14	9	6	4	6	6'-0	4	6	16	4	12	5	4	16	4	4	12	7	4	16	4	7	6	7'-2	4	6	4'-11	1'-11	3'-0	4	7'-2	7	6	7'-8	4	6	6'-6	1'-11	4'-7	4	7'-8	0.299	0.382	0.202	0.883	132.79
51-55	6	4	12	14.5	9	6	4	6	6'-1	4	6	16	4	12	5	4	16	4	4	12	7	4	17	4	7	6	7'-2	4	6	4'-11	1'-11	3'-0	4	7'-2	7	6	7'-8	4	6	6'-8	2'-0	4'-8	4	7'-8	0.310	0.395	0.202	0.907	133.47

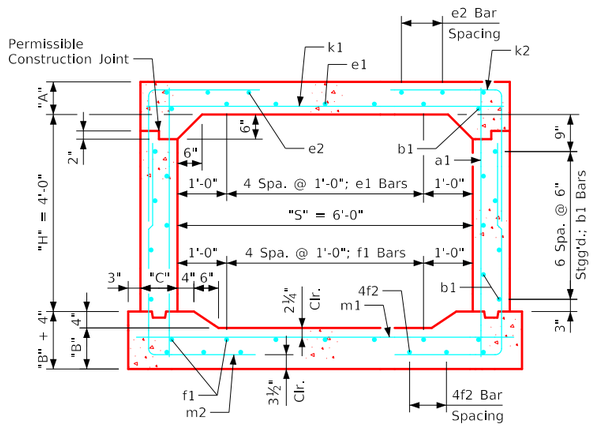
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



6' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

6' x 4' Barrel Sections

RCB 6-4-20

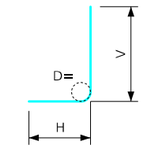
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 6-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 6' x 5' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	5	10.5	10	9	9	4	9	6'-7	4	6	20	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	5	12	7'-11	4'-7	3'-4	--	--	6	9	7'-8	5	12	8'-2	2'-11	5'-3	5	7'-8	0.275	0.284	0.257	0.816	110.47
1	6	5	9	10	9	9	4	9	6'-6	4	6	20	4	12	5	4	14	6	4	12	7	4	15	6	4	6	7'-2	5	12	7'-9	4'-7	3'-2	--	--	6	9	7'-8	5	12	8'-4	3'-1	5'-3	5	7'-8	0.241	0.284	0.257	0.782	103.18
2	6	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	5	4	15	6	4	12	7	4	13	6	5	9	7'-2	5	12	6'-2	3'-1	3'-1	5	7'-2	6	9	7'-8	5	12	8'-0	2'-9	5'-3	5	7'-8	0.218	0.284	0.257	0.759	99.79
3	6	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	5	4	15	6	4	12	7	4	12	6	4	6	7'-2	5	12	6'-2	3'-1	3'-1	5	7'-2	4	6	7'-8	5	12	7'-10	2'-7	5'-3	5	7'-8	0.218	0.284	0.257	0.759	93.03
4-8	6	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	5	4	11	6	4	12	7	4	11	6	4	6	7'-2	5	12	5'-7	2'-6	3'-1	5	7'-2	4	6	7'-8	5	12	7'-8	2'-5	5'-3	5	7'-8	0.218	0.284	0.257	0.759	91.37
9-10	6	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	5	4	10	6	4	12	7	4	18	4	4	6	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	4	6	7'-8	5	12	7'-4	2'-1	5'-3	5	7'-8	0.218	0.284	0.257	0.759	88.71
11-15	6	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	5	4	10	6	4	12	7	4	18	4	6	9	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	6	9	7'-8	5	12	7'-4	2'-1	5'-3	5	7'-8	0.218	0.284	0.257	0.759	99.71
16-20	6	5	8	10	9	9	4	12	6'-5	4	6	20	4	12	5	4	17	4	4	12	7	4	17	4	5	6	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	5	6	7'-8	4	6	7'-3	2'-0	5'-3	4	7'-8	0.218	0.284	0.257	0.759	99.68
21-25	6	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	5	4	17	4	4	12	7	4	17	4	6	6	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	6	6	7'-8	4	6	7'-3	2'-0	5'-3	4	7'-8	0.218	0.284	0.257	0.759	116.18
26-30	6	5	8.5	11	9	9	5	12	6'-6	4	6	20	4	12	5	4	17	4	4	12	7	4	17	4	6	6	7'-2	4	6	4'-9	2'-0	2'-9	4	7'-2	6	6	7'-8	4	6	7'-4	2'-0	5'-4	4	7'-8	0.229	0.308	0.257	0.794	118.82
31-35	6	5	9.5	12	9	9	5	12	6'-8	4	6	20	4	12	5	4	16	4	4	12	7	4	17	4	6	6	7'-2	4	6	4'-9	1'-11	2'-10	4	7'-2	6	6	7'-8	4	6	7'-5	2'-0	5'-5	4	7'-8	0.252	0.333	0.257	0.842	119.39
36-40	6	5	10.5	12.5	9	6	4	6	6'-10	4	6	20	4	12	5	4	17	4	4	12	7	4	18	4	8	9	7'-2	4	6	4'-11	2'-0	2'-11	4	7'-2	8	9	7'-8	4	6	7'-7	2'-1	5'-6	4	7'-8	0.275	0.345	0.257	0.877	134.37
41-45	6	5	11	13.5	9	6	4	6	6'-11	4	6	20	4	12	5	4	17	4	4	12	7	4	18	4	8	9	7'-2	4	6	4'-11	2'-0	2'-11	4	7'-2	8	9	7'-8	4	6	7'-8	2'-1	5'-7	4	7'-8	0.287	0.370	0.257	0.914	134.82
46-50	6	5	11.5	14	9	6	4	6	7'-0	4	6	20	4	12	5	4	18	4	4	12	7	4	9	6	8	9	7'-2	4	6	5'-1	2'-1	3'-0	4	7'-2	7	6	7'-8	4	6	7'-9	2'-2	5'-7	4	7'-8	0.299	0.382	0.257	0.938	140.24
51-55	6	5	12.5	14.5	9.5	6	4	6	7'-2	4	6	20	4	12	5	4	11	6	4	12	7	4	11	6	7	6	7'-3	6	12	6'-4	2'-6	3'-10	6	7'-3	7	6	7'-9	6	12	8'-2	2'-6	5'-8	6	7'-9	0.326	0.399	0.271	0.996	158.61

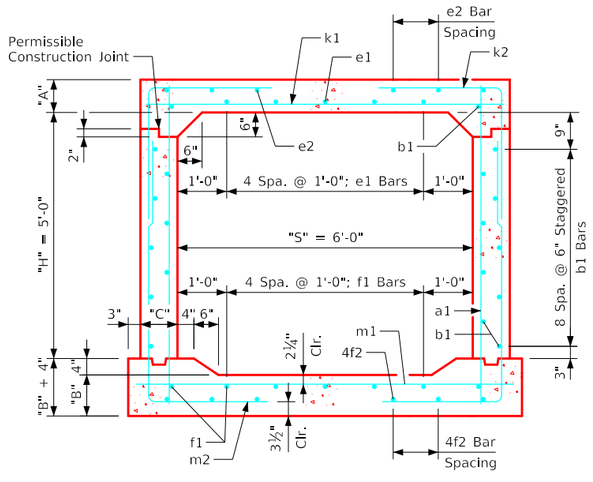
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



6' x 5' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

6' x 5' Barrel Sections

RCB 6-5-20

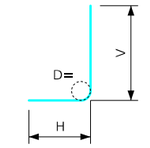
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 6-5-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 6' x 6' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	6	10.5	10	9	9	4	12	7'-7	4	6	24	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	4	6	7'-4	4'-5	2'-11	--	--	6	9	7'-8	4	6	10'-1	3'-10	6'-3	--	--	0.275	0.284	0.313	0.872	122.24
1	6	6	9	10	9	9	4	9	7'-6	4	6	24	4	12	5	4	14	6	4	12	7	4	14	6	5	9	7'-2	5	12	7'-9	4'-7	3'-2	--	--	6	9	7'-8	5	12	10'-10	4'-7	6'-3	--	--	0.241	0.284	0.313	0.838	113.55
2	6	6	8	10	9	9	4	9	7'-5	4	6	24	5	12	5	4	14	6	4	12	7	4	17	6	6	9	7'-2	5	12	7'-8	4'-7	3'-1	--	--	6	9	7'-8	5	12	9'-9	3'-6	6'-3	5	7'-8	0.218	0.284	0.313	0.815	117.63
3	6	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	5	4	17	6	4	12	7	4	15	6	4	6	7'-2	5	12	7'-0	3'-6	3'-6	5	7'-2	4	6	7'-8	5	12	9'-4	3'-1	6'-3	5	7'-8	0.218	0.284	0.313	0.815	102.74
4-7	6	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	5	4	15	6	4	12	7	4	13	6	4	6	7'-2	5	12	6'-2	3'-1	3'-1	5	7'-2	4	6	7'-8	5	12	9'-1	2'-10	6'-3	5	7'-8	0.218	0.284	0.313	0.815	100.29
8-10	6	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	5	4	11	6	4	12	7	4	11	6	4	6	7'-2	5	12	5'-7	2'-6	3'-1	5	7'-2	4	6	7'-8	5	12	8'-9	2'-6	6'-3	5	7'-8	0.218	0.284	0.313	0.815	98.24
11-15	6	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	5	4	10	6	4	12	7	4	10	6	6	9	7'-2	5	12	5'-4	2'-3	3'-1	5	7'-2	6	9	7'-8	5	12	8'-6	2'-3	6'-3	5	7'-8	0.218	0.284	0.313	0.815	108.11
16-20	6	6	8	10	9	9	4	12	7'-5	4	6	24	4	12	5	4	18	4	4	12	7	4	18	4	5	6	7'-2	4	6	4'-10	2'-1	2'-9	4	7'-2	5	6	7'-8	4	6	8'-4	2'-1	6'-3	4	7'-8	0.218	0.284	0.313	0.815	106.84
21-25	6	6	8	10	9	9	5	12	7'-5	4	6	24	4	12	5	4	18	4	4	12	7	4	18	4	6	6	7'-2	4	6	4'-10	2'-1	2'-9	4	7'-2	6	6	7'-8	4	6	8'-4	2'-1	6'-3	4	7'-8	0.218	0.284	0.313	0.815	126.34
26-30	6	6	8.5	11	9	6	4	6	7'-6	4	6	24	4	12	5	4	18	4	4	12	7	4	9	6	6	6	7'-2	4	6	4'-10	2'-1	2'-9	4	7'-2	6	6	7'-8	4	6	8'-6	2'-2	6'-4	4	7'-8	0.229	0.308	0.313	0.850	132.29
31-35	6	6	9.5	12	9	6	4	6	7'-8	4	6	24	4	12	5	4	18	4	4	12	7	4	10	6	6	6	7'-2	4	6	4'-11	2'-1	2'-10	4	7'-2	6	6	7'-8	4	6	8'-8	2'-3	6'-5	4	7'-8	0.252	0.333	0.313	0.898	133.42
36-40	6	6	10.5	12.5	9.5	6	4	6	7'-10	4	6	24	4	12	5	4	11	6	4	12	7	4	11	6	8	9	7'-3	6	12	6'-2	2'-6	3'-8	6	7'-3	8	9	7'-9	6	12	9'-0	2'-6	6'-6	6	7'-9	0.279	0.349	0.330	0.958	158.92
41-45	6	6	11	13.5	10	6	4	6	7'-11	4	6	24	4	12	5	4	11	6	4	12	7	4	11	6	8	9	7'-4	6	12	6'-4	2'-7	3'-9	6	7'-4	8	9	7'-10	6	12	9'-1	2'-6	6'-7	6	7'-10	0.295	0.379	0.347	1.021	160.61
46-50	6	6	11.5	14	11	9	4	12	8'-0	4	6	24	4	12	5	4	10	6	4	12	7	4	10	6	8	9	7'-6	5	6	5'-10	2'-5	3'-5	5	7'-6	8	9	8'-0	5	6	9'-1	2'-6	6'-7	5	8'-0	0.316	0.399	0.383	1.098	164.39
51-55	6	6	12	14.5	11.5	9	4	9	8'-1	4	6	24	4	12	5	4	9	6	4	12	7	4	10	6	8	9	7'-7	5	6	5'-10	2'-5	3'-5	5	7'-7	8	9	8'-1	5	6	9'-2	2'-6	6'-8	5	8'-1	0.332	0.417	0.400	1.149	168.89

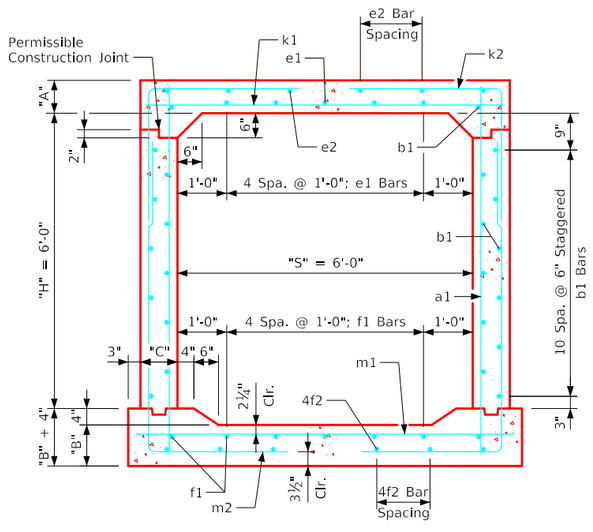
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



6' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

6' x 6' Barrel Sections

RCB 6-6-20

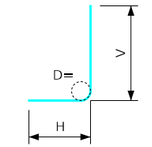
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 6-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 6' x 7' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	7	10.5	10	9	9	4	12	8'-7	4	6	28	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	4	6	7'-4	4'-5	2'-11	--	--	6	9	7'-8	4	6	11'-8	4'-5	7'-3	--	--	0.275	0.284	0.368	0.927	130.55
1	6	7	9	10	9	9	4	9	8'-6	4	6	28	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	5	12	7'-9	4'-7	3'-2	--	--	6	9	7'-8	5	12	11'-10	4'-7	7'-3	--	--	0.241	0.284	0.368	0.893	126.68
2	6	7	8	10	9	9	4	9	8'-5	4	6	28	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	5	12	7'-8	4'-7	3'-1	--	--	6	9	7'-8	5	12	11'-10	4'-7	7'-3	--	--	0.218	0.284	0.368	0.870	126.34
3	6	7	8	10	9	9	4	9	8'-5	4	6	28	4	12	5	4	14	6	4	12	7	4	14	6	4	6	7'-2	5	12	7'-8	4'-7	3'-1	--	--	4	6	7'-8	5	12	11'-10	4'-7	7'-3	--	--	0.218	0.284	0.368	0.870	113.50
4-7	6	7	8	10	9	9	4	9	8'-5	4	6	28	4	12	5	4	14	6	4	12	7	4	14	6	4	6	7'-2	5	12	7'-8	4'-7	3'-1	5	7'-2	4	6	7'-8	5	12	11'-2	3'-11	7'-3	5	7'-8	0.218	0.284	0.368	0.870	112.00
8-10	6	7	8	10	9	9	4	9	8'-5	4	6	28	4	12	5	4	15	6	4	14	7	4	14	6	4	6	7'-2	5	12	6'-2	3'-1	3'-1	5	7'-2	4	6	7'-8	5	12	10'-2	2'-11	7'-3	5	7'-8	0.218	0.284	0.368	0.870	107.18
11-15	6	7	8	10	9	9	4	12	8'-5	4	6	28	4	12	5	4	13	6	4	12	7	4	11	6	6	9	7'-2	4	6	5'-6	2'-9	2'-9	4	7'-2	6	9	7'-8	4	6	9'-8	2'-5	7'-3	4	7'-8	0.218	0.284	0.368	0.870	119.11
16-20	6	7	8	10	9	9	4	9	8'-5	4	6	28	4	12	5	4	13	6	4	12	7	4	10	6	5	6	7'-2	4	6	5'-6	2'-9	2'-9	4	7'-2	5	6	7'-8	4	6	9'-7	2'-4	7'-3	4	7'-8	0.218	0.284	0.368	0.870	122.71
21-25	6	7	8	10.5	9	9	5	12	8'-5	4	6	28	4	12	5	4	12	6	4	12	7	4	11	6	7	9	7'-2	4	6	5'-4	2'-8	2'-8	4	7'-2	6	6	7'-8	4	6	9'-9	2'-5	7'-4	4	7'-8	0.218	0.296	0.368	0.882	138.05
26-30	6	7	8.5	11	9	9	4	12	8'-6	4	6	28	4	12	5	4	11	6	4	12	7	4	11	6	6	6	7'-2	5	6	5'-7	2'-5	3'-2	5	7'-2	6	6	7'-8	5	6	9'-10	2'-6	7'-4	5	7'-8	0.229	0.308	0.368	0.905	157.24
31-35	6	7	9.5	12	10	9	4	12	8'-8	4	6	28	4	12	5	4	10	6	4	12	7	4	11	6	6	6	7'-4	5	6	5'-8	2'-5	3'-3	5	7'-4	6	6	7'-10	5	6	10'-0	2'-7	7'-5	5	7'-10	0.260	0.341	0.409	1.010	159.53
36-40	6	7	10	12.5	11	9	4	12	8'-9	4	6	28	4	12	5	4	10	6	4	12	7	4	11	6	6	6	7'-6	5	6	5'-9	2'-6	3'-3	5	7'-6	6	6	8'-0	5	6	10'-1	2'-7	7'-6	5	8'-0	0.279	0.361	0.451	1.091	161.42
41-45	6	7	11	13.5	11.5	9	4	12	8'-11	4	6	28	4	12	5	4	10	6	4	12	7	4	11	6	8	9	7'-7	5	6	5'-11	2'-7	3'-4	5	7'-7	8	9	8'-1	5	6	10'-4	2'-9	7'-7	5	8'-1	0.308	0.391	0.471	1.170	174.58
46-50	6	7	11.5	14	12.5	9	4	9	9'-0	4	6	28	4	12	5	4	10	6	4	12	7	4	11	6	8	9	7'-9	5	6	6'-1	2'-8	3'-5	5	7'-9	8	9	8'-3	5	6	10'-5	2'-10	7'-7	5	8'-3	0.328	0.413	0.512	1.253	180.76
51-55	6	7	12	14.5	13	9	4	9	9'-1	4	6	28	4	12	5	4	11	6	4	12	7	4	11	6	8	9	7'-10	5	6	6'-2	2'-9	3'-5	5	7'-10	8	9	8'-4	5	6	10'-6	2'-10	7'-8	5	8'-4	0.345	0.431	0.532	1.308	182.26

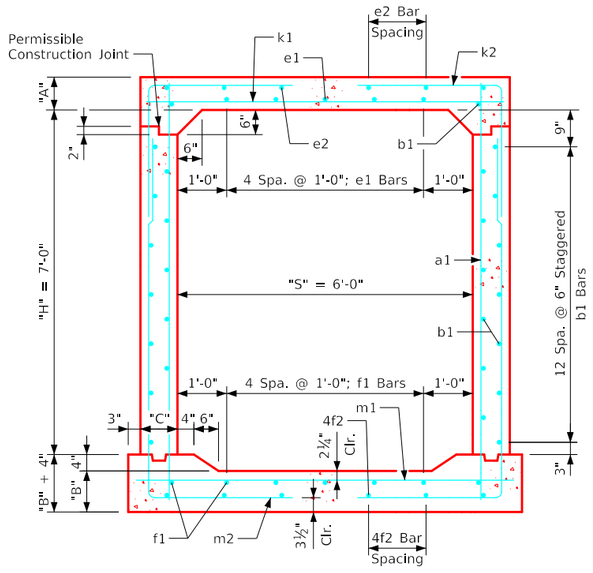
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



6' x 7' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

6' x 7' Barrel Sections

RCB 6-7-20

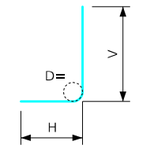
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 6-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 6' x 8' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2						m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	8	10.5	10	9	9	4	12	9'-7	4	6	32	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	4	6	7'-4	4'-5	2'-11	--	--	6	9	7'-8	4	6	12'-8	4'-5	8'-3	--	--	0.275	0.284	0.424	0.983	137.26
1	6	8	8.5	10	9	9	4	12	9'-5	4	6	32	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	4	6	7'-2	4'-5	2'-9	--	--	6	9	7'-8	4	6	12'-8	4'-5	8'-3	--	--	0.229	0.284	0.424	0.937	136.61
2	6	8	8	10	9	9	4	12	9'-5	4	6	32	5	12	5	4	14	6	4	12	7	4	14	6	6	9	7'-2	4	6	7'-2	4'-5	2'-9	--	--	6	9	7'-8	4	6	12'-8	4'-5	8'-3	--	--	0.218	0.284	0.424	0.926	136.61
3	6	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	5	4	14	6	4	12	7	4	14	6	4	6	7'-2	5	12	7'-8	4'-7	3'-1	--	--	4	6	7'-8	5	12	12'-10	4'-7	8'-3	--	--	0.218	0.284	0.424	0.926	120.21
4-8	6	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	5	4	14	6	4	12	7	4	14	6	4	6	7'-2	5	12	7'-8	4'-7	3'-1	--	--	4	6	7'-8	5	12	12'-10	4'-7	8'-3	--	--	0.218	0.284	0.424	0.926	120.21
9-10	6	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	5	4	15	6	4	12	7	4	14	6	4	6	7'-2	5	12	6'-2	3'-1	3'-1	5	7'-2	4	6	7'-8	5	12	11'-3	3'-0	8'-3	5	7'-8	0.218	0.284	0.424	0.926	114.05
11-15	6	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	5	4	13	6	4	12	7	4	13	6	6	9	7'-2	4	6	5'-8	2'-10	2'-10	4	7'-2	5	6	7'-8	4	6	11'-1	2'-10	8'-3	4	7'-8	0.218	0.284	0.424	0.926	131.08
16-20	6	8	8	10	9	9	5	12	9'-5	4	6	32	4	12	5	4	15	6	4	12	7	4	13	6	5	6	7'-2	5	9	6'-2	3'-1	3'-1	5	7'-2	5	6	7'-8	5	9	11'-1	2'-10	8'-3	5	7'-8	0.218	0.284	0.424	0.926	139.61
21-25	6	8	8	10.5	9.5	9	4	9	9'-5	4	6	32	4	12	5	4	13	6	4	12	7	4	13	6	7	9	7'-3	6	9	6'-4	2'-10	3'-6	6	7'-3	6	6	7'-9	6	9	11'-3	2'-11	8'-4	6	7'-9	0.221	0.300	0.447	0.968	173.05
26-30	6	8	8.5	11	10.5	9	4	9	9'-6	4	6	32	4	12	5	4	14	6	4	12	7	4	12	6	7	9	7'-5	5	6	6'-4	3'-2	3'-2	5	7'-5	6	6	7'-11	5	6	11'-2	2'-10	8'-4	5	7'-11	0.240	0.318	0.496	1.054	174.16
31-35	6	8	9.5	12	11.5	9	5	12	9'-8	4	6	32	4	12	5	4	11	6	4	12	7	4	12	6	7	9	7'-7	5	6	6'-0	2'-9	3'-3	5	7'-7	6	6	8'-1	5	6	11'-4	2'-11	8'-5	5	8'-1	0.271	0.352	0.542	1.165	178.13
36-40	6	8	10	12.5	12.5	9	5	12	9'-9	4	6	32	4	12	5	4	14	6	4	12	7	4	12	6	6	6	7'-9	5	6	6'-6	3'-3	3'-3	5	7'-9	6	6	8'-3	5	6	11'-5	2'-11	8'-6	5	8'-3	0.291	0.373	0.589	1.253	183.24
41-45	6	8	11	13.5	13	6	4	6	9'-11	4	6	32	4	12	5	4	14	6	4	12	7	4	13	6	6	6	7'-10	5	6	6'-8	3'-4	3'-4	5	7'-10	6	6	8'-4	5	6	11'-8	3'-1	8'-7	5	8'-4	0.320	0.404	0.613	1.337	191.16
46-50	6	8	11.5	14	14	6	4	6	10'-0	4	6	32	4	12	5	4	12	6	4	12	7	4	12	6	8	9	8'-0	6	9	6'-10	3'-0	3'-10	6	8'-0	8	9	8'-6	6	9	11'-8	3'-1	8'-7	6	8'-6	0.341	0.427	0.659	1.427	204.05
51-55	6	8	12	15	14.5	6	4	6	10'-2	4	6	32	4	12	5	4	12	6	4	12	7	4	13	6	8	9	8'-1	6	9	6'-11	3'-1	3'-10	6	8'-1	8	9	8'-7	6	9	11'-11	3'-3	8'-8	6	8'-7	0.358	0.459	0.683	1.500	206.53

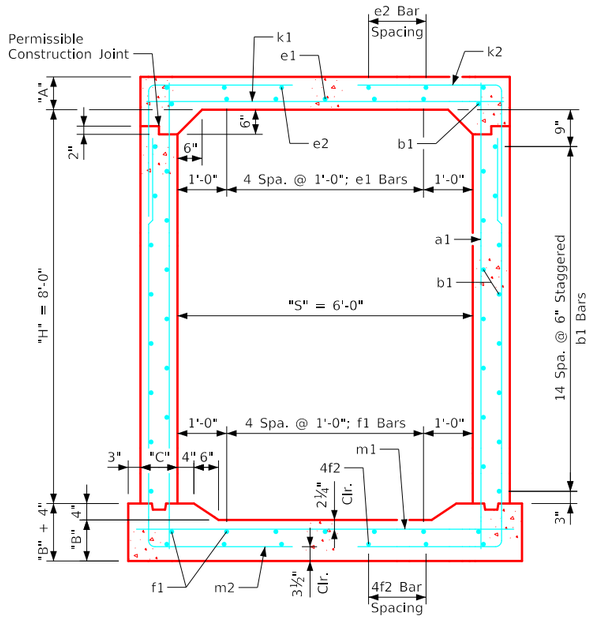
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



6' x 8' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

6' x 8' Barrel Sections

RCB 6-8-20

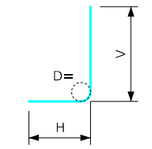
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 6-8-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 4' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	4	12.5	11	9	9	5	12	5'-10	4	6	16	5	12	7	4	15	6	4	12	9	4	16	6	6	9	9'-2	4	6	6'-2	3'-3	3'-1	4	9'-2	6	9	9'-8	4	6	7'-7	3'-3	4'-4	4	9'-8	0.399	0.376	0.202	0.977	121.58
1	8	4	10.5	10.5	9	9	5	12	5'-8	4	6	16	5	12	7	4	14	6	4	12	9	4	14	6	6	9	9'-2	4	6	5'-10	2'-11	2'-11	4	9'-2	6	9	9'-8	4	6	7'-4	3'-0	4'-4	4	9'-8	0.340	0.361	0.202	0.903	119.63
2	8	4	8	10	9	6	4	6	5'-5	4	6	16	5	12	7	4	13	6	4	12	9	4	12	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	6'-10	2'-7	4'-3	4	9'-8	0.267	0.345	0.202	0.814	119.89
3	8	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	7	4	13	6	4	12	9	4	11	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	6	9	9'-8	4	6	6'-8	2'-5	4'-3	4	9'-8	0.267	0.345	0.202	0.814	111.92
4-7	8	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	7	4	13	6	4	12	9	4	11	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	6'-8	2'-5	4'-3	4	9'-8	0.267	0.345	0.202	0.814	109.79
8-10	8	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	7	4	10	6	4	12	9	4	10	6	6	9	9'-2	4	6	5'-0	2'-3	2'-9	4	9'-2	5	6	9'-8	4	6	6'-7	2'-4	4'-3	4	9'-8	0.267	0.345	0.202	0.814	110.47
11-15	8	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	7	4	10	6	4	12	9	4	10	6	6	6	9'-2	5	6	5'-5	2'-4	3'-1	5	9'-2	6	6	9'-8	5	6	6'-7	2'-4	4'-3	5	9'-8	0.267	0.345	0.202	0.814	145.61
16-20	8	4	8.5	11	9	9	4	12	5'-6	4	6	16	4	12	7	4	10	6	4	12	9	4	9	6	6	6	9'-2	5	6	5'-5	2'-3	3'-2	5	9'-2	6	6	9'-8	5	6	6'-6	2'-2	4'-4	5	9'-8	0.282	0.376	0.202	0.860	145.39
21-25	8	4	10	12.5	9	9	4	12	5'-9	4	6	16	4	12	7	4	9	6	4	12	9	4	18	4	8	9	9'-2	5	6	5'-5	2'-2	3'-3	5	9'-2	7	6	9'-8	5	6	6'-7	2'-1	4'-6	5	9'-8	0.326	0.422	0.202	0.950	161.61
26-30	8	4	11	13.5	9	9	4	12	5'-11	4	6	16	4	12	7	4	9	6	4	12	9	4	18	4	7	6	9'-2	5	6	5'-6	2'-2	3'-4	5	9'-2	7	6	9'-8	5	6	6'-8	2'-1	4'-7	5	9'-8	0.355	0.453	0.202	1.010	166.37
31-35	8	4	12.5	14.5	9	6	4	6	6'-2	4	6	16	4	12	7	4	11	6	4	12	9	4	11	6	7	6	9'-2	6	12	6'-3	2'-5	3'-10	6	9'-2	7	6	9'-8	6	12	7'-1	2'-5	4'-8	6	9'-8	0.399	0.484	0.202	1.085	168.32
36-40	8	4	13.5	16	9	6	4	6	6'-4	4	6	16	4	12	7	4	11	6	4	12	9	4	11	6	9	9	9'-2	6	12	6'-5	2'-5	4'-0	6	9'-2	9	9	9'-8	6	12	7'-2	2'-5	4'-9	6	9'-8	0.428	0.530	0.202	1.160	180.89
41-45	8	4	14.5	17	9	6	4	6	6'-6	4	6	16	4	12	7	4	11	6	4	12	9	4	11	6	9	9	9'-2	6	12	6'-6	2'-5	4'-1	6	9'-2	8	6	9'-8	6	12	7'-3	2'-5	4'-10	6	9'-8	0.458	0.561	0.202	1.221	188.34
46-50	8	4	15.5	17.5	9.5	6	4	6	6'-8	4	6	16	4	12	7	4	14	6	4	12	9	4	11	6	8	6	9'-3	6	12	7'-1	3'-0	4'-1	6	9'-3	8	6	9'-9	6	12	7'-5	2'-6	4'-11	6	9'-9	0.492	0.582	0.213	1.287	198.24
51-55	8	4	16	18.5	10	6	4	6	6'-9	4	6	16	4	12	7	4	14	6	4	12	9	4	11	6	8	6	9'-4	6	12	7'-3	3'-1	4'-2	6	9'-4	8	6	9'-10	6	12	7'-6	2'-6	5'-0	6	9'-10	0.512	0.619	0.224	1.355	200.21

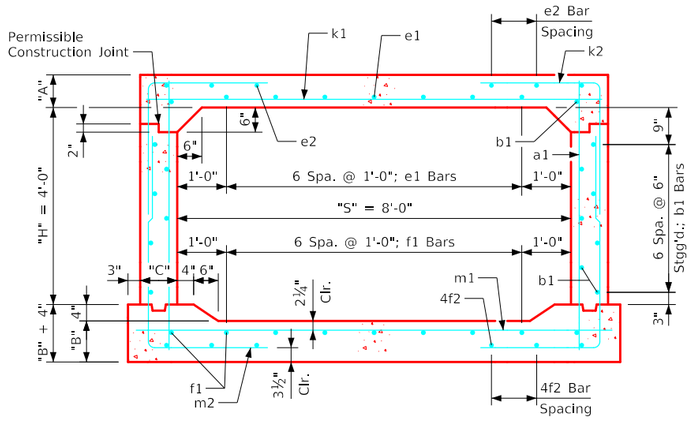
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 4' Barrel Sections

RCB 8-4-20

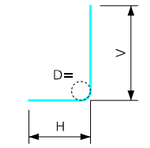
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 8-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 5' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	5	12.5	11	9	9	4	9	6'-10	4	6	20	5	12	7	4	18	6	4	12	9	4	16	6	6	9	9'-2	4	6	6'-8	3'-7	3'-1	4	9'-2	6	9	9'-8	4	6	8'-8	3'-4	5'-4	4	9'-8	0.399	0.376	0.257	1.032	128.29
1	8	5	10.5	10.5	9	9	4	9	6'-8	4	6	20	5	12	7	4	17	6	4	12	9	4	15	6	6	9	9'-2	4	6	6'-5	3'-6	2'-11	4	9'-2	6	9	9'-8	4	6	8'-5	3'-1	5'-4	4	9'-8	0.340	0.361	0.257	0.958	126.61
2	8	5	8	10	9	9	5	12	6'-5	4	6	20	5	12	7	4	13	6	4	12	9	4	12	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	7'-11	2'-8	5'-3	4	9'-8	0.267	0.345	0.257	0.869	125.16
3	8	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	7	4	13	6	4	12	9	4	11	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	7'-9	2'-6	5'-3	4	9'-8	0.267	0.345	0.257	0.869	119.87
4-7	8	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	7	4	13	6	4	12	9	4	11	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	7'-9	2'-6	5'-3	4	9'-8	0.267	0.345	0.257	0.869	119.87
8-10	8	5	8	10	9	9	4	9	6'-5	4	6	20	4	12	7	4	13	6	4	12	9	4	10	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	7'-7	2'-4	5'-3	4	9'-8	0.267	0.345	0.257	0.869	119.42
11-15	8	5	8	10	9	6	4	6	6'-5	4	6	20	4	12	7	4	10	6	4	12	9	4	10	6	6	6	9'-2	4	6	5'-0	2'-3	2'-9	4	9'-2	6	6	9'-8	4	6	7'-6	2'-3	5'-3	4	9'-8	0.267	0.345	0.257	0.869	140.74
16-20	8	5	8.5	11	9	9	4	12	6'-6	4	6	20	4	12	7	4	10	6	4	12	9	4	9	6	6	6	9'-2	5	6	5'-5	2'-3	3'-2	5	9'-2	7	6	9'-8	5	6	7'-6	2'-2	5'-4	5	9'-8	0.282	0.376	0.257	0.915	164.24
21-25	8	5	10	12.5	9	9	4	12	6'-9	4	6	20	4	12	7	4	9	6	4	12	9	4	18	4	7	6	9'-2	5	6	5'-5	2'-2	3'-3	5	9'-2	7	6	9'-8	5	6	7'-7	2'-1	5'-6	5	9'-8	0.326	0.422	0.257	1.005	173.68
26-30	8	5	11	13.5	9	9	4	9	6'-11	4	6	20	4	12	7	4	9	6	4	12	9	4	18	4	7	6	9'-2	5	6	5'-6	2'-2	3'-4	5	9'-2	7	6	9'-8	5	6	7'-8	2'-1	5'-7	5	9'-8	0.355	0.453	0.257	1.065	177.50
31-35	8	5	12.5	14.5	9	6	4	6	7'-2	4	6	20	4	12	7	4	11	6	4	12	9	4	11	6	7	6	9'-2	6	12	6'-3	2'-5	3'-10	6	9'-2	7	6	9'-8	6	12	8'-1	2'-5	5'-8	6	9'-8	0.399	0.484	0.257	1.140	176.89
36-40	8	5	13.5	15.5	9	6	4	6	7'-4	4	6	20	4	12	7	4	11	6	4	12	9	4	11	6	9	9	9'-2	6	12	6'-4	2'-5	3'-11	6	9'-2	8	6	9'-8	6	12	8'-2	2'-5	5'-9	6	9'-8	0.428	0.515	0.257	1.200	195.63
41-45	8	5	14.5	17	9	6	4	6	7'-6	4	6	20	4	12	7	4	11	6	4	12	9	4	11	6	9	9	9'-2	6	12	6'-6	2'-5	4'-1	6	9'-2	8	6	9'-8	6	12	8'-3	2'-5	5'-10	6	9'-8	0.458	0.561	0.257	1.276	196.89
46-50	8	5	15.5	17.5	9.5	6	4	6	7'-8	4	6	20	4	12	7	4	14	6	4	12	9	4	11	6	8	6	9'-3	6	12	7'-1	3'-0	4'-1	6	9'-3	8	6	9'-9	6	12	8'-5	2'-6	5'-11	6	9'-9	0.492	0.582	0.271	1.345	206.79
51-55	8	5	16	18.5	9.5	9	4	12	7'-9	4	6	20	4	12	7	4	11	6	4	12	9	4	10	6	8	6	9'-3	5	6	6'-4	2'-7	3'-9	5	9'-3	8	6	9'-9	5	6	8'-4	2'-4	6'-0	5	9'-9	0.507	0.613	0.271	1.391	208.24

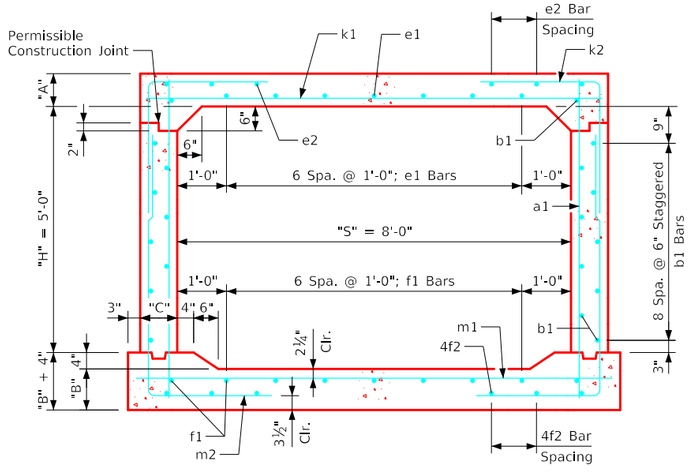
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 5' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 5' Barrel Sections

RCB 8-5-20

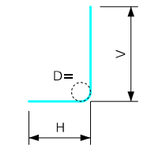
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 8-5-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 6' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	6	12.5	11	9	9	4	9	7'-10	4	6	24	5	12	7	4	13	8	4	12	9	4	17	6	6	9	9'-2	4	6	8'-6	5'-5	3'-1	--	--	6	9	9'-8	4	6	9'-9	3'-5	6'-4	4	9'-8	0.399	0.376	0.313	1.088	141.61
1	8	6	10.5	10.5	9	9	4	9	7'-8	4	6	24	5	12	7	4	13	8	4	12	9	4	16	6	6	9	9'-2	4	6	8'-4	5'-5	2'-11	--	--	5	6	9'-8	4	6	9'-8	3'-4	6'-4	4	9'-8	0.340	0.361	0.313	1.014	140.76
2	8	6	8	10	9	9	5	12	7'-5	4	6	24	5	12	7	4	15	6	4	12	9	4	14	6	5	6	9'-2	4	6	6'-4	3'-2	3'-2	4	9'-2	5	6	9'-8	4	6	9'-2	2'-11	6'-3	4	9'-8	0.267	0.345	0.313	0.925	135.32
3	8	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	7	4	13	6	4	12	9	4	13	6	6	9	9'-2	4	6	5'-8	2'-10	2'-10	4	9'-2	5	6	9'-8	4	6	9'-0	2'-9	6'-3	4	9'-8	0.267	0.345	0.313	0.925	127.71
4-7	8	6	8	10	9	9	4	12	7'-5	4	6	24	4	12	7	4	13	6	4	12	9	4	12	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	8'-11	2'-8	6'-3	4	9'-8	0.267	0.345	0.313	0.925	123.89
8-10	8	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	7	4	13	6	4	12	9	4	11	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	8'-8	2'-5	6'-3	4	9'-8	0.267	0.345	0.313	0.925	126.82
11-15	8	6	8	10	9	6	4	6	7'-5	4	6	24	4	12	7	4	11	6	4	12	9	4	11	6	6	6	9'-2	5	9	5'-6	2'-5	3'-1	5	9'-2	6	6	9'-8	5	9	8'-8	2'-5	6'-3	5	9'-8	0.267	0.345	0.313	0.925	153.79
16-20	8	6	8.5	11	9	9	4	12	7'-6	4	6	24	4	12	7	4	10	6	4	12	9	4	10	6	7	6	9'-2	5	6	5'-6	2'-4	3'-2	5	9'-2	7	6	9'-8	5	6	8'-7	2'-3	6'-4	5	9'-8	0.282	0.376	0.313	0.971	183.26
21-25	8	6	10	12.5	9	9	4	12	7'-9	4	6	24	4	12	7	4	9	6	4	12	9	4	10	6	7	6	9'-2	5	6	5'-5	2'-2	3'-3	5	9'-2	7	6	9'-8	5	6	8'-9	2'-3	6'-6	5	9'-8	0.326	0.422	0.313	1.061	183.95
26-30	8	6	11	13.5	9	9	4	12	7'-11	4	6	24	4	12	7	4	10	6	4	12	9	4	10	6	7	6	9'-2	5	6	5'-7	2'-3	3'-4	5	9'-2	7	6	9'-8	5	6	8'-10	2'-3	6'-7	5	9'-8	0.355	0.453	0.313	1.121	185.24
31-35	8	6	12.5	15	9	6	4	6	8'-2	4	6	24	4	12	7	4	11	6	4	12	9	4	11	6	7	6	9'-2	6	12	6'-4	2'-5	3'-11	6	9'-2	7	6	9'-8	6	12	9'-1	2'-5	6'-8	6	9'-8	0.399	0.500	0.313	1.212	185.71
36-40	8	6	13.5	16	9.5	9	4	12	8'-4	4	6	24	4	12	7	4	10	6	4	12	9	4	10	6	9	9	9'-3	5	6	5'-11	2'-4	3'-7	5	9'-3	9	9	9'-9	5	6	9'-2	2'-5	6'-9	5	9'-9	0.433	0.536	0.330	1.299	200.71
41-45	8	6	14.5	16.5	10.5	9	4	9	8'-6	4	6	24	4	12	7	4	10	6	4	12	9	4	11	6	9	9	9'-5	5	6	6'-1	2'-6	3'-7	5	9'-5	8	6	9'-11	5	6	9'-5	2'-7	6'-10	5	9'-11	0.473	0.560	0.366	1.399	214.58
46-50	8	6	15	17.5	10.5	9	4	9	8'-7	4	6	24	4	12	7	4	11	6	4	12	9	4	11	6	8	6	9'-5	5	6	6'-4	2'-8	3'-8	5	9'-5	8	6	9'-11	5	6	9'-6	2'-7	6'-11	5	9'-11	0.488	0.592	0.366	1.446	222.42
51-55	8	6	16	18.5	11	9	4	9	8'-9	4	6	24	4	12	7	4	12	6	4	12	9	4	11	6	8	6	9'-6	5	6	6'-6	2'-9	3'-9	5	9'-6	8	6	10'-0	5	6	9'-8	2'-8	7'-0	5	10'-0	0.523	0.629	0.383	1.535	225.03

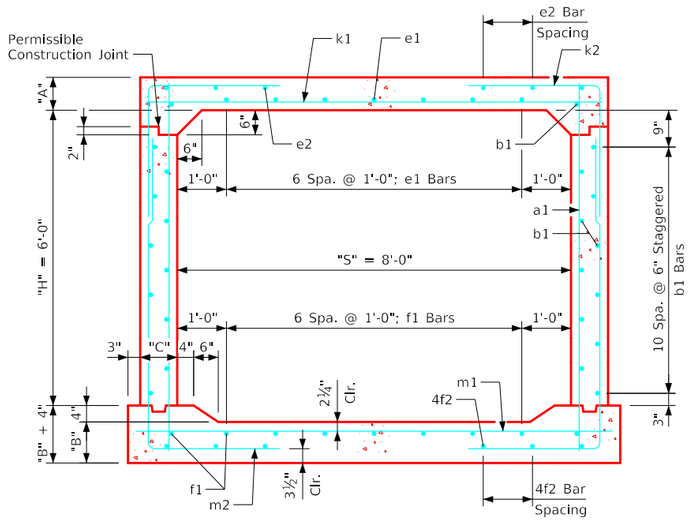
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 6' Barrel Sections

RCB 8-6-20

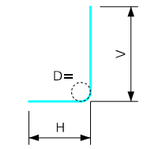
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 8-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 7' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	7	12.5	11	9	9	4	9	8'-10	4	6	28	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-6	5'-5	3'-1	--	--	5	6	9'-8	4	6	11'-3	3'-11	7'-4	4	9'-8	0.399	0.376	0.368	1.143	151.58
1	8	7	10.5	10.5	9	9	4	9	8'-8	4	6	28	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-4	5'-5	2'-11	--	--	5	6	9'-8	4	6	11'-4	4'-0	7'-4	4	9'-8	0.340	0.361	0.368	1.069	151.08
2	8	7	8	10	9	9	5	12	8'-5	4	6	28	5	12	7	4	14	8	4	12	9	4	17	6	5	6	9'-2	4	6	6'-10	4'-1	2'-9	4	9'-2	7	9	9'-8	4	6	10'-8	3'-5	7'-3	4	9'-8	0.267	0.345	0.368	0.980	153.97
3	8	7	8	10	9	9	4	9	8'-5	4	6	28	4	12	7	4	16	6	4	12	9	4	15	6	6	9	9'-2	4	6	6'-1	3'-4	2'-9	4	9'-2	5	6	9'-8	4	6	10'-5	3'-2	7'-3	4	9'-8	0.267	0.345	0.368	0.980	137.13
4-8	8	7	8	10	9	9	4	12	8'-5	4	6	28	4	12	7	4	15	6	4	12	9	4	14	6	6	9	9'-2	4	6	6'-2	3'-1	3'-1	4	9'-2	5	6	9'-8	4	6	10'-3	3'-0	7'-3	4	9'-8	0.267	0.345	0.368	0.980	133.34
9-10	8	7	8	10	9	9	4	12	8'-5	4	6	28	4	12	7	4	13	6	4	12	9	4	11	6	6	9	9'-2	4	6	5'-6	2'-9	2'-9	4	9'-2	5	6	9'-8	4	6	9'-8	2'-5	7'-3	4	9'-8	0.267	0.345	0.368	0.980	129.97
11-15	8	7	8	10	9	9	4	12	8'-5	4	6	28	4	12	7	4	11	6	4	12	9	4	11	6	6	6	9'-2	5	6	5'-7	2'-6	3'-1	5	9'-2	6	6	9'-8	5	6	9'-9	2'-6	7'-3	5	9'-8	0.267	0.345	0.368	0.980	171.79
16-20	8	7	9	11	9	9	4	12	8'-7	4	6	28	4	12	7	4	11	6	4	12	9	4	11	6	8	9	9'-2	5	6	5'-7	2'-5	3'-2	5	9'-2	7	6	9'-8	5	6	9'-9	2'-5	7'-4	5	9'-8	0.296	0.376	0.368	1.040	188.84
21-25	8	7	10	12.5	9	9	4	12	8'-9	4	6	28	4	12	7	4	11	6	4	12	9	4	11	6	7	6	9'-2	6	9	6'-2	2'-6	3'-8	6	9'-2	7	6	9'-8	6	9	9'-11	2'-5	7'-6	6	9'-8	0.326	0.422	0.368	1.116	195.97
26-30	8	7	11	13.5	9	9	4	9	8'-11	4	6	28	4	12	7	4	11	6	4	12	9	4	11	6	7	6	9'-2	6	9	6'-3	2'-6	3'-9	6	9'-2	7	6	9'-8	6	9	10'-1	2'-6	7'-7	6	9'-8	0.355	0.453	0.368	1.176	201.00
31-35	8	7	12.5	14.5	10.5	9	4	9	9'-2	4	6	28	4	12	7	4	11	6	4	12	9	4	11	6	7	6	9'-5	5	6	6'-0	2'-7	3'-5	5	9'-5	7	6	9'-11	5	6	10'-4	2'-8	7'-8	5	9'-11	0.412	0.497	0.431	1.340	203.74
36-40	8	7	13.5	16	11	6	4	6	9'-4	4	6	28	4	12	7	4	11	6	4	12	9	4	12	6	7	6	9'-6	6	9	6'-8	2'-8	4'-0	6	9'-6	7	6	10'-0	6	9	10'-6	2'-9	7'-9	6	10'-0	0.447	0.549	0.451	1.447	216.26
41-45	8	7	14.5	17	11.5	6	4	6	9'-6	4	6	28	4	12	7	4	11	6	4	12	9	4	12	6	9	9	9'-7	6	9	6'-10	2'-9	4'-1	6	9'-7	9	9	10'-1	6	9	10'-8	2'-10	7'-10	6	10'-1	0.483	0.587	0.471	1.541	230.61
46-50	8	7	15	17.5	12.5	6	4	6	9'-7	4	6	28	4	12	7	4	12	6	4	12	9	4	12	6	9	9	9'-9	5	6	6'-7	2'-11	3'-8	5	9'-9	9	9	10'-3	5	6	10'-11	3'-0	7'-11	5	10'-3	0.508	0.614	0.512	1.634	232.55
51-55	8	7	16	18.5	13	6	4	6	9'-9	4	6	28	4	12	7	4	12	6	4	12	9	4	13	6	8	6	9'-10	5	6	6'-9	3'-0	3'-9	5	9'-10	8	6	10'-4	5	6	11'-1	3'-1	8'-0	5	10'-4	0.545	0.652	0.532	1.729	248.74

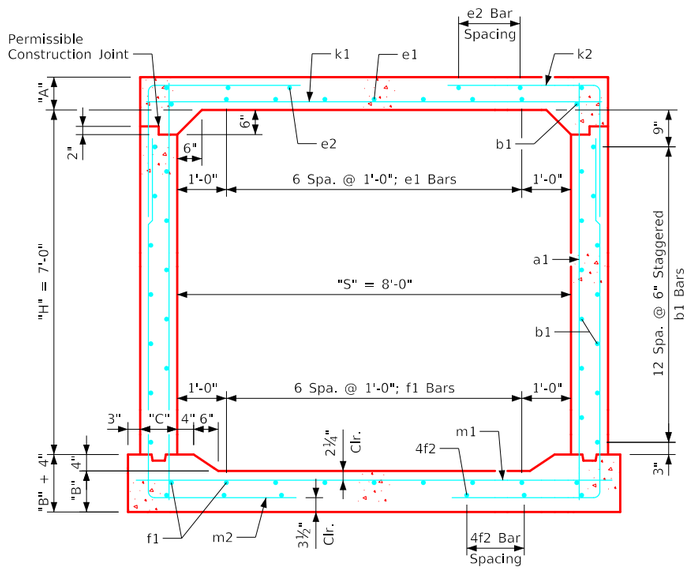
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 7' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 7' Barrel Sections

RCB 8-7-20

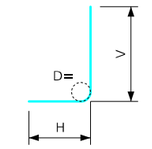
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 8-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 8' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2						m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	8	12.5	11	9	9	5	12	9'-10	4	6	32	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-6	5'-5	3'-1	--	--	5	6	9'-8	4	6	13'-9	5'-5	8'-4	--	--	0.399	0.376	0.424	1.199	165.84
1	8	8	10.5	11	9	9	4	9	9'-8	4	6	32	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-4	5'-5	2'-11	--	--	5	6	9'-8	4	6	13'-9	5'-5	8'-4	--	--	0.340	0.376	0.424	1.140	161.68
2	8	8	8	10	9	9	5	12	9'-5	4	6	32	5	12	7	4	13	8	4	12	9	4	13	8	5	6	9'-2	4	6	8'-2	5'-5	2'-9	--	--	6	6	9'-8	4	6	12'-10	4'-7	8'-3	--	--	0.267	0.345	0.424	1.036	170.74
3	8	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	7'-7	4'-10	2'-9	--	--	5	6	9'-8	4	6	12'-1	3'-10	8'-3	4	9'-8	0.267	0.345	0.424	1.036	152.45
4-7	8	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	7	4	12	8	4	12	9	4	17	6	6	9	9'-2	4	6	6'-6	3'-9	2'-9	4	9'-2	5	6	9'-8	4	6	11'-8	3'-5	8'-3	4	9'-8	0.267	0.345	0.424	1.036	147.39
8-10	8	8	8	10	9	9	4	9	9'-5	4	6	32	4	12	7	4	14	6	4	12	9	4	14	6	5	6	9'-2	4	6	5'-10	2'-11	2'-11	4	9'-2	5	6	9'-8	4	6	11'-2	2'-11	8'-3	4	9'-8	0.267	0.345	0.424	1.036	143.08
11-15	8	8	8	10	9	9	4	12	9'-5	4	6	32	4	12	7	4	15	6	4	12	9	4	12	6	6	6	9'-2	5	6	6'-2	3'-1	3'-1	5	9'-2	6	6	9'-8	5	6	10'-11	2'-8	8'-3	5	9'-8	0.267	0.345	0.424	1.036	183.18
16-20	8	8	9	11	9	9	4	9	9'-7	4	6	32	4	12	7	4	13	6	4	12	9	4	13	6	8	9	9'-2	6	9	6'-4	2'-9	3'-7	6	9'-2	7	6	9'-8	6	9	11'-1	2'-9	8'-4	6	9'-8	0.296	0.376	0.424	1.096	205.53
21-25	8	8	10	12.5	9.5	9	4	12	9'-9	4	6	32	4	12	7	4	11	6	4	12	9	4	12	6	7	6	9'-3	5	6	5'-10	2'-7	3'-3	5	9'-3	7	6	9'-9	5	6	11'-2	2'-8	8'-6	5	9'-9	0.329	0.427	0.447	1.203	204.68
26-30	8	8	11	13.5	10.5	9	5	12	9'-11	4	6	32	4	12	7	4	12	6	4	12	9	4	12	6	7	6	9'-5	5	6	6'-1	2'-9	3'-4	5	9'-5	7	6	9'-11	5	6	11'-5	2'-10	8'-7	5	9'-11	0.367	0.465	0.496	1.328	216.08
31-35	8	8	12.5	15	11.5	6	4	6	10'-2	4	6	32	4	12	7	4	12	6	4	12	9	4	13	6	7	6	9'-7	6	9	6'-9	2'-10	3'-11	6	9'-7	7	6	10'-1	6	9	11'-8	3'-0	8'-8	6	10'-1	0.421	0.522	0.542	1.485	227.03
36-40	8	8	13.5	16	12.5	6	4	6	10'-4	4	6	32	4	12	7	4	12	6	4	12	9	4	13	6	7	6	9'-9	5	6	6'-7	3'-0	3'-7	5	9'-9	7	6	10'-3	5	6	11'-10	3'-1	8'-9	5	10'-3	0.462	0.565	0.589	1.616	229.08
41-45	8	8	14.5	17	13.5	9	6	12	10'-6	4	6	32	4	12	7	4	13	6	4	12	9	4	13	6	7	6	9'-11	5	6	6'-10	3'-2	3'-8	5	9'-11	7	6	10'-5	5	6	12'-1	3'-3	8'-10	5	10'-5	0.503	0.608	0.636	1.747	237.39
46-50	8	8	15.5	18	14.5	9	4	12	10'-8	4	6	32	4	12	7	4	16	6	4	12	9	4	13	6	9	9	10'-1	7	9	8'-4	3'-10	4'-6	7	10'-1	9	9	10'-7	7	9	12'-3	3'-4	8'-11	7	10'-7	0.545	0.653	0.683	1.881	271.92
51-55	8	8	16	18.5	15	9	6	9	10'-9	4	6	32	4	12	7	4	16	6	4	12	9	4	14	6	9	9	10'-2	5	6	7'-6	3'-9	3'-9	5	10'-2	9	9	10'-8	5	6	12'-5	3'-5	9'-0	5	10'-8	0.566	0.675	0.706	1.947	267.16

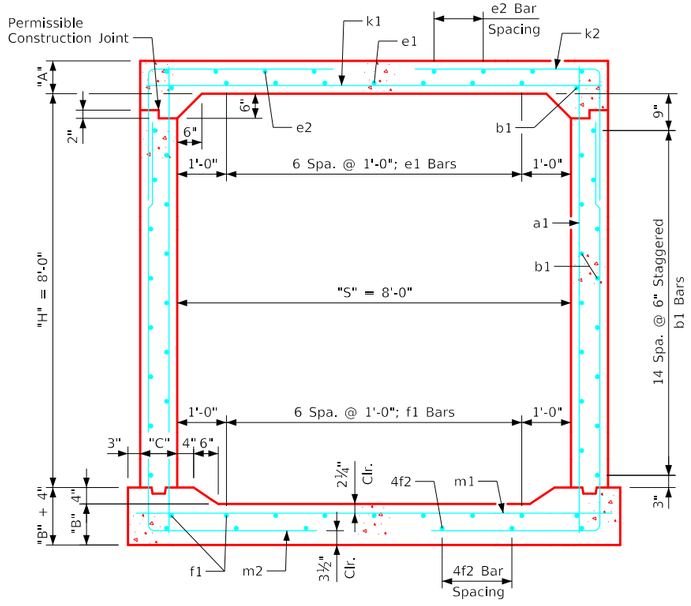
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 8' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 8' Barrel Sections

RCB 8-8-20

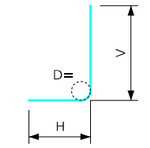
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 8-8-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 9' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2						m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	9	12.5	11	9	6	4	6	10'-10	4	6	36	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-6	5'-5	3'-1	--	--	5	6	9'-8	4	6	14'-9	5'-5	9'-4	--	--	0.399	0.376	0.479	1.254	179.11
1	8	9	10.5	11	9	9	5	12	10'-8	4	6	36	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-4	5'-5	2'-11	--	--	5	6	9'-8	4	6	14'-9	5'-5	9'-4	--	--	0.340	0.376	0.479	1.195	172.55
2	8	9	8	10	9	6	4	6	10'-5	4	6	36	5	12	7	4	13	8	4	12	9	4	13	8	7	9	9'-2	4	6	8'-2	5'-5	2'-9	--	--	6	6	9'-8	4	6	14'-8	5'-5	9'-3	--	--	0.267	0.345	0.479	1.091	192.82
3	8	9	8	10	9	9	5	12	10'-5	4	6	36	4	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-2	5'-5	2'-9	--	--	7	9	9'-8	4	6	14'-8	5'-5	9'-3	--	--	0.267	0.345	0.479	1.091	175.87
4-8	8	9	8	10	9	9	5	12	10'-5	4	6	36	4	12	7	4	13	8	4	12	9	4	13	8	5	6	9'-2	5	9	8'-8	5'-7	3'-1	5	9'-2	5	6	9'-8	5	9	13'-11	4'-8	9'-3	5	9'-8	0.267	0.345	0.479	1.091	172.79
9-10	8	9	8	10	9	9	4	9	10'-5	4	6	36	4	12	7	4	14	6	4	12	9	4	14	6	5	6	9'-2	4	6	5'-10	2'-11	2'-11	4	9'-2	5	6	9'-8	4	6	12'-2	2'-11	9'-3	4	9'-8	0.267	0.345	0.479	1.091	150.24
11-15	8	9	8	10	9	9	4	12	10'-5	4	6	36	4	12	7	4	15	6	4	12	9	4	14	6	6	6	9'-2	5	6	6'-2	3'-1	3'-1	5	9'-2	6	6	9'-8	5	6	12'-3	3'-0	9'-3	5	9'-8	0.267	0.345	0.479	1.091	192.87
16-20	8	9	9	11	9.5	9	4	12	10'-7	4	6	36	4	12	7	4	15	6	4	12	9	4	13	6	8	9	9'-3	5	6	6'-4	3'-2	3'-2	5	9'-3	7	6	9'-9	5	6	12'-3	2'-11	9'-4	5	9'-9	0.300	0.380	0.506	1.186	211.29
21-25	8	9	10	12.5	11	6	4	6	10'-9	4	6	36	4	12	7	4	14	6	4	12	9	4	14	6	8	9	9'-6	6	9	6'-9	3'-1	3'-8	6	9'-6	7	6	10'-0	6	9	12'-7	3'-1	9'-6	6	10'-0	0.341	0.438	0.587	1.366	230.45
26-30	8	9	11.5	14	12	9	6	12	11'-0	4	6	36	4	12	7	4	13	6	4	12	9	4	14	6	8	9	9'-8	6	9	6'-11	3'-1	3'-10	6	9'-8	7	6	10'-2	6	9	12'-9	3'-2	9'-7	6	10'-2	0.395	0.495	0.640	1.530	238.37
31-35	8	9	12.5	15	13	9	6	9	11'-2	4	6	36	4	12	7	4	13	6	4	12	9	4	14	6	8	9	9'-10	6	9	7'-1	3'-2	3'-11	6	9'-10	7	6	10'-4	6	9	13'-0	3'-4	9'-8	6	10'-4	0.435	0.537	0.693	1.665	252.58
36-40	8	9	13.5	16	14	9	6	9	11'-4	4	6	36	4	12	7	4	15	6	4	12	9	4	14	6	7	6	10'-0	5	6	7'-2	3'-7	3'-7	5	10'-0	7	6	10'-6	5	6	13'-2	3'-5	9'-9	5	10'-6	0.476	0.580	0.746	1.802	260.05
41-45	8	9	14.5	17	15	9	4	9	11'-6	4	6	36	4	12	7	4	14	6	4	12	9	4	15	6	7	6	10'-2	7	9	7'-10	3'-5	4'-5	7	10'-2	7	6	10'-8	7	9	13'-5	3'-7	9'-10	7	10'-8	0.518	0.625	0.799	1.942	272.71
46-50	8	9	15.5	18	15.5	9	6	9	11'-8	4	6	36	4	12	7	4	15	6	4	12	9	4	15	6	7	6	10'-3	5	6	7'-6	3'-9	3'-9	5	10'-3	7	6	10'-9	5	6	13'-7	3'-8	9'-11	5	10'-9	0.555	0.664	0.825	2.044	266.63
51-55	8	9	16	19	16.5	9	5	12	11'-10	4	6	36	4	12	7	4	16	6	4	12	9	4	15	6	9	9	10'-5	7	9	8'-7	4'-0	4'-7	7	10'-5	9	9	10'-11	7	9	13'-9	3'-9	10'-0	7	10'-11	0.583	0.710	0.878	2.171	298.53

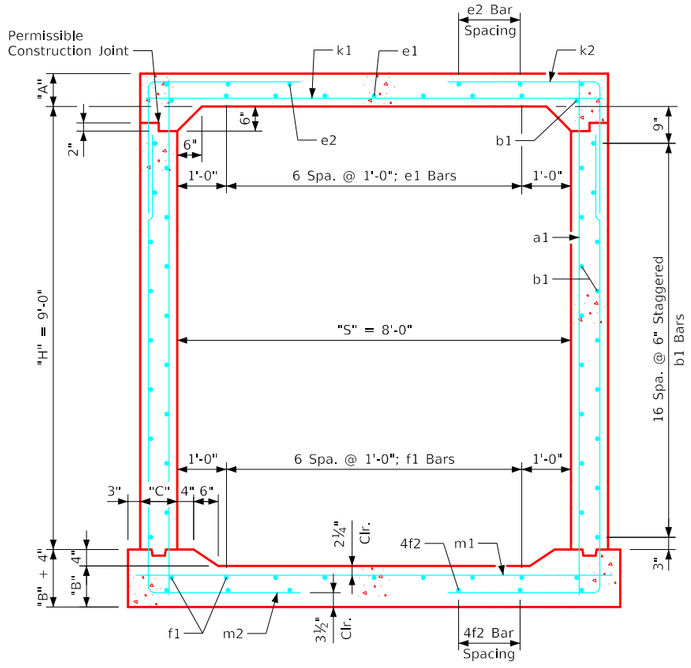
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 9' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 9' Barrel Sections

RCB 8-9-20

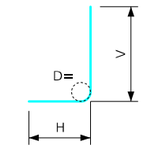
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 8-9-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 8' x 10' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	8	10	12.5	11	10	6	4	6	11'-10	4	6	40	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-4	4	6	8'-7	5'-6	3'-1	--	--	5	6	9'-10	4	6	15'-10	5'-6	10'-4	--	--	0.408	0.384	0.594	1.386	188.32
1	8	10	10.5	11	10	6	4	6	11'-8	4	6	40	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-4	4	6	8'-5	5'-6	2'-11	--	--	5	6	9'-10	4	6	15'-10	5'-6	10'-4	--	--	0.348	0.384	0.594	1.326	187.42
2	8	10	8	10	10	6	4	6	11'-5	4	6	40	5	12	7	4	13	8	4	12	9	4	13	8	5	6	9'-4	5	9	8'-9	5'-8	3'-1	--	--	6	6	9'-10	5	9	15'-11	5'-8	10'-3	--	--	0.274	0.352	0.594	1.220	202.16
3-4	8	10	8	10	10	9	5	12	11'-5	4	6	40	4	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-4	4	6	8'-3	5'-6	2'-9	--	--	5	6	9'-10	4	6	15'-9	5'-6	10'-3	--	--	0.274	0.352	0.594	1.220	177.39
5-8	8	10	8	10	10	9	4	9	11'-5	4	6	40	4	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-4	4	6	8'-3	5'-6	2'-9	4	9'-4	5	6	9'-10	5	6	14'-11	4'-8	10'-3	5	9'-10	0.274	0.352	0.594	1.220	193.84
9-10	8	10	8	10	10	9	4	12	11'-5	4	6	40	4	12	7	4	17	6	4	12	9	4	17	6	6	9	9'-4	6	9	7'-0	3'-6	3'-6	6	9'-4	5	6	9'-10	6	9	13'-9	3'-6	10'-3	6	9'-10	0.274	0.352	0.594	1.220	189.45
11-15	8	10	8	10	10	9	4	9	11'-5	4	6	40	4	12	7	4	16	6	4	12	9	4	15	6	6	6	9'-4	5	6	6'-8	3'-4	3'-4	5	9'-4	6	6	9'-10	5	6	13'-6	3'-3	10'-3	5	9'-10	0.274	0.352	0.594	1.220	210.08
16-20	8	10	9	11	11	9	4	9	11'-7	4	6	40	4	12	7	4	16	6	4	12	9	4	16	6	6	6	9'-6	7	9	7'-6	3'-6	4'-0	7	9'-6	7	6	10'-0	7	9	13'-10	3'-6	10'-4	7	10'-0	0.311	0.390	0.655	1.356	259.84
21-25	8	10	10	12.5	12	6	4	6	11'-9	4	6	40	4	12	7	4	14	6	4	12	9	4	15	6	8	9	9'-8	5	6	6'-6	3'-3	3'-3	5	9'-8	7	6	10'-2	5	6	13'-11	3'-5	10'-6	5	10'-2	0.349	0.446	0.714	1.509	241.87
26-30	8	10	11.5	14	13	9	5	9	12'-0	4	6	40	4	12	7	4	15	6	4	12	9	4	16	6	8	9	9'-10	5	6	6'-10	3'-5	3'-5	5	9'-10	8	9	10'-4	5	6	14'-2	3'-7	10'-7	5	10'-4	0.404	0.504	0.773	1.681	243.61
31-35	8	10	12.5	15	14	6	4	6	12'-2	4	6	40	4	12	7	4	15	6	4	12	9	4	16	6	8	9	10'-0	7	9	7'-10	3'-7	4'-3	7	10'-0	7	6	10'-6	7	9	14'-4	3'-8	10'-8	7	10'-6	0.444	0.547	0.832	1.823	286.84
36-40	8	10	13.5	16	15.5	9	6	9	12'-4	4	6	40	4	12	7	4	15	6	4	12	9	4	15	6	8	9	10'-3	5	6	7'-4	3'-8	3'-8	5	10'-3	7	6	10'-9	5	6	14'-6	3'-9	10'-9	5	10'-9	0.490	0.596	0.921	2.007	270.84
41-45	8	10	14.5	17	16	6	4	6	12'-6	4	6	40	4	12	7	4	15	6	4	12	9	4	16	6	7	6	10'-4	8	12	8'-7	3'-9	4'-10	8	10'-4	7	6	10'-10	8	12	14'-9	3'-11	10'-10	8	10'-10	0.528	0.635	0.951	2.114	303.45
46-50	8	10	15	18	17.5	6	4	6	12'-8	4	6	40	4	12	7	4	16	6	4	12	9	4	16	6	7	6	10'-7	6	6	8'-2	4'-1	4'-1	6	10'-7	7	6	11'-1	6	6	14'-11	4'-0	10'-11	6	11'-1	0.560	0.687	1.039	2.286	310.79
51-55	8	10	16	19	18.5	6	4	6	12'-10	4	6	40	4	12	7	4	12	8	4	12	9	4	16	6	7	6	10'-9	7	9	9'-2	4'-7	4'-7	7	10'-9	9	9	11'-3	7	9	15'-2	4'-2	11'-0	7	11'-3	0.604	0.734	1.098	2.436	319.58

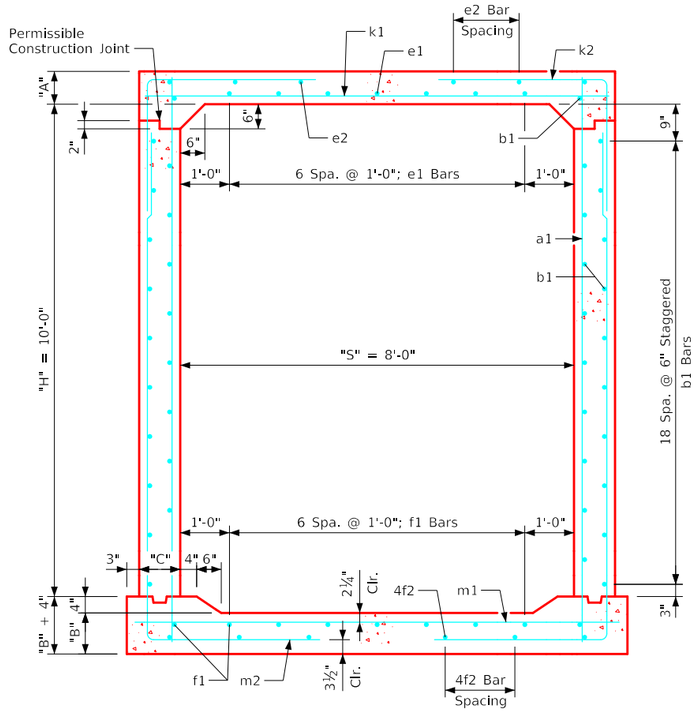
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



8' x 10' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

8' x 10' Barrel Sections

RCB 8-10-20

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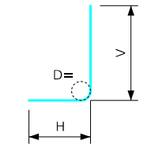
Variable Dimensions and Quantities for 10' x 4' Barrel Sections

Dimensions							Bar List																																		Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	4	12.5	12	9	9	4	12	5'-11	4	6	16	4	12	9	4	14	6	4	12	11	4	13	8	6	9	11'-2	6	12	6'-10	2'-11	3'-11	6	11'-2	6	9	11'-8	7	12	8'-3	3'-10	4'-5	7	11'-8	0.476	0.481	0.202	1.159	149.76
1	10	4	11.5	12	9	9	5	12	5'-10	4	6	16	4	12	9	4	14	6	4	12	11	4	15	6	6	9	11'-2	4	6	6'-0	3'-0	3'-0	4	11'-2	6	9	11'-8	5	6	7'-6	3'-1	4'-5	5	11'-8	0.441	0.481	0.202	1.124	141.11
2	10	4	8	10	9	9	4	9	5'-5	4	6	16	5	12	9	4	15	6	4	12	11	4	15	6	7	9	11'-2	5	6	6'-4	3'-2	3'-2	5	11'-2	7	9	11'-8	5	6	7'-5	3'-2	4'-3	5	11'-8	0.316	0.407	0.202	0.925	169.32
3	10	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	9	4	15	6	4	12	11	4	14	6	7	9	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	5	6	11'-8	5	6	7'-2	2'-11	4'-3	5	11'-8	0.316	0.407	0.202	0.925	153.32
4-6	10	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	9	4	15	6	4	12	11	4	14	6	5	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	7'-2	2'-11	4'-3	5	11'-8	0.316	0.407	0.202	0.925	155.92
7-10	10	4	8	10	9	9	4	9	5'-5	4	6	16	4	12	9	4	15	6	4	12	11	4	13	6	6	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	7'-1	2'-10	4'-3	5	11'-8	0.316	0.407	0.202	0.925	168.24
11-15	10	4	8.5	10.5	9	6	4	6	5'-6	4	6	16	4	12	9	4	12	6	4	12	11	4	12	6	7	6	11'-2	5	6	5'-8	2'-7	3'-1	5	11'-2	7	6	11'-8	5	6	7'-0	2'-8	4'-4	5	11'-8	0.334	0.425	0.202	0.961	195.79
16-20	10	4	10.5	13	9	6	4	6	5'-10	4	6	16	4	12	9	4	10	6	4	12	11	4	10	6	7	6	11'-2	5	6	5'-8	2'-4	3'-4	5	11'-2	7	6	11'-8	5	6	6'-9	2'-3	4'-6	5	11'-8	0.405	0.518	0.202	1.125	195.63
21-25	10	4	12.5	14.5	9	9	4	9	6'-2	4	6	16	4	12	9	4	9	6	4	12	11	4	9	6	9	9	11'-2	5	6	5'-7	2'-2	3'-5	5	11'-2	8	6	11'-8	5	6	6'-10	2'-2	4'-8	5	11'-8	0.476	0.574	0.202	1.252	212.66
26-30	10	4	14	16	9.5	9	4	9	6'-5	4	6	16	4	12	9	4	9	6	4	12	11	4	10	6	8	6	11'-3	5	6	5'-10	2'-3	3'-7	5	11'-3	8	6	11'-9	5	6	7'-1	2'-4	4'-9	5	11'-9	0.534	0.634	0.213	1.381	223.61
31-35	10	4	15	17.5	10	9	5	12	6'-7	4	6	16	4	12	9	4	12	6	4	12	11	4	10	6	8	6	11'-4	5	6	6'-4	2'-8	3'-8	5	11'-4	8	6	11'-10	5	6	7'-4	2'-5	4'-11	5	11'-10	0.575	0.696	0.224	1.495	230.29
36-40	10	4	16.5	18.5	10.5	9	5	12	6'-10	4	6	16	4	12	9	4	11	6	4	12	11	4	10	6	8	6	11'-5	5	6	6'-5	2'-8	3'-9	5	11'-5	8	6	11'-11	5	6	7'-6	2'-6	5'-0	5	11'-11	0.635	0.738	0.236	1.609	232.79
41-45	10	4	17.5	20	11	6	4	6	7'-0	4	6	16	4	12	9	4	12	6	4	12	11	4	11	6	9	6	11'-6	5	6	6'-8	2'-9	3'-11	5	11'-6	9	6	12'-0	5	6	7'-8	2'-7	5'-1	5	12'-0	0.677	0.800	0.247	1.724	274.29
46-50	10	4	19	21	11.5	9	5	12	7'-3	4	6	16	4	12	9	4	11	6	4	12	11	4	11	6	9	6	11'-7	5	6	6'-9	2'-9	4'-0	5	11'-7	9	6	12'-1	5	6	7'-11	2'-9	5'-2	5	12'-1	0.738	0.845	0.258	1.841	273.66
51-55	10	4	20	22	12	6	4	6	7'-5	4	6	16	4	12	9	4	12	6	5	12	11	4	12	6	9	6	11'-8	5	6	6'-11	2'-10	4'-1	5	11'-8	9	6	12'-2	5	6	8'-1	2'-10	5'-3	5	12'-2	0.781	0.890	0.269	1.940	284.55

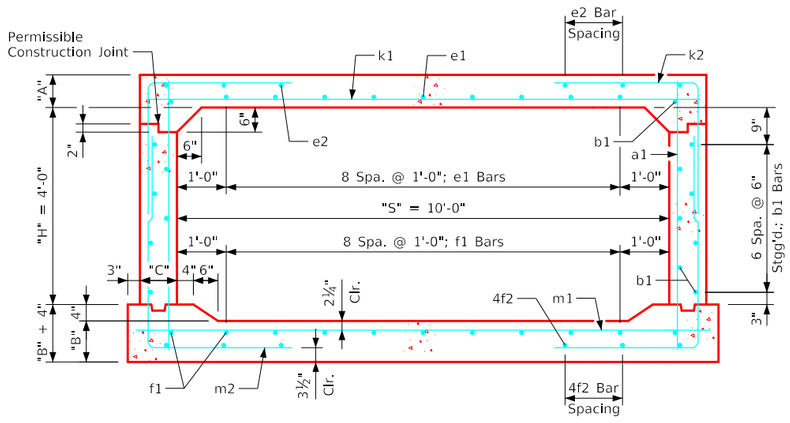
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 4' Barrel Sections

RCB 10-4-20

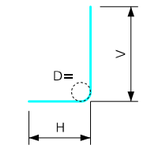
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 10' x 5' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	5	12.5	12	9	9	4	12	6'-11	4	6	20	4	12	9	4	15	6	4	12	11	4	13	8	6	9	11'-2	6	12	7'-1	3'-2	3'-11	6	11'-2	6	9	11'-8	7	12	9'-4	3'-11	5'-5	7	11'-8	0.476	0.481	0.257	1.214	159.32
1	10	5	11.5	12	9	6	4	6	6'-10	4	6	20	4	12	9	4	15	6	4	12	11	4	15	6	6	9	11'-2	4	6	6'-4	3'-2	3'-2	4	11'-2	6	9	11'-8	4	6	8'-6	3'-1	5'-5	4	11'-8	0.441	0.481	0.257	1.179	141.50
2	10	5	8	10	9	9	4	9	6'-5	4	6	20	5	12	9	4	15	6	4	12	11	4	15	6	7	9	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	8'-4	3'-1	5'-3	5	11'-8	0.316	0.407	0.257	0.980	179.18
3	10	5	8	10	9	9	4	12	6'-5	4	6	20	4	12	9	4	15	6	4	12	11	4	14	6	7	9	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	7	9	11'-8	5	6	8'-2	2'-11	5'-3	5	11'-8	0.316	0.407	0.257	0.980	170.16
4-7	10	5	8	10	9	9	4	12	6'-5	4	6	20	4	12	9	4	15	6	4	12	11	4	14	6	7	9	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	8'-2	2'-11	5'-3	5	11'-8	0.316	0.407	0.257	0.980	172.39
8-10	10	5	8	10.5	9	9	4	12	6'-5	4	6	20	4	12	9	4	15	6	4	12	11	4	12	6	6	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	8'-0	2'-8	5'-4	5	11'-8	0.316	0.425	0.257	0.998	173.82
11-15	10	5	8.5	10.5	9	9	5	12	6'-6	4	6	20	4	12	9	4	12	6	4	12	11	4	12	6	7	6	11'-2	5	6	5'-8	2'-7	3'-1	5	11'-2	7	6	11'-8	5	6	7'-11	2'-7	5'-4	5	11'-8	0.334	0.425	0.257	1.016	201.55
16-20	10	5	10.5	13	9	9	5	12	6'-10	4	6	20	4	12	9	4	10	6	4	12	11	4	10	6	7	6	11'-2	5	6	5'-7	2'-3	3'-4	5	11'-2	7	6	11'-8	5	6	7'-9	2'-3	5'-6	5	11'-8	0.405	0.518	0.257	1.180	201.21
21-25	10	5	12.5	14.5	9	9	4	9	7'-2	4	6	20	4	12	9	4	9	6	4	12	11	4	10	6	8	6	11'-2	5	6	5'-7	2'-2	3'-5	5	11'-2	8	6	11'-8	5	6	7'-11	2'-3	5'-8	5	11'-8	0.476	0.574	0.257	1.307	229.13
26-30	10	5	14	16	9	9	4	12	7'-5	4	6	20	4	12	9	4	10	6	4	12	11	4	10	6	8	6	11'-2	5	6	5'-10	2'-3	3'-7	5	11'-2	8	6	11'-8	5	6	8'-0	2'-3	5'-9	5	11'-8	0.529	0.629	0.257	1.415	227.84
31-35	10	5	15	17.5	9.5	9	4	9	7'-7	4	6	20	4	12	9	4	11	6	4	12	11	4	10	6	8	6	11'-3	5	6	6'-3	2'-7	3'-8	5	11'-3	8	6	11'-9	5	6	8'-4	2'-5	5'-11	5	11'-9	0.570	0.690	0.271	1.531	235.39
36-40	10	5	16.5	19	10	9	4	9	7'-10	4	6	20	4	12	9	4	12	6	4	12	11	4	11	6	8	6	11'-4	5	6	6'-6	2'-8	3'-10	5	11'-4	8	6	11'-10	5	6	8'-6	2'-6	6'-0	5	11'-10	0.629	0.752	0.285	1.666	238.50
41-45	10	5	17.5	20	10.5	9	4	9	8'-0	4	6	20	4	12	9	4	11	6	4	12	11	4	11	6	9	6	11'-5	5	6	6'-7	2'-8	3'-11	5	11'-5	9	6	11'-11	5	6	8'-8	2'-7	6'-1	5	11'-11	0.671	0.794	0.301	1.766	275.26
46-50	10	5	19	21	11	9	4	9	8'-3	4	6	20	4	12	9	4	12	6	4	12	11	4	12	6	9	6	11'-6	5	6	6'-9	2'-9	4'-0	5	11'-6	9	6	12'-0	5	6	8'-11	2'-9	6'-2	5	12'-0	0.731	0.839	0.315	1.885	278.63
51-55	10	5	20	22.5	11.5	9	5	12	8'-5	4	6	20	4	12	9	4	12	6	5	12	11	4	12	6	9	6	11'-7	5	6	6'-11	2'-10	4'-1	5	11'-7	9	6	12'-1	5	6	9'-2	2'-10	6'-4	5	12'-1	0.774	0.902	0.329	2.005	288.84

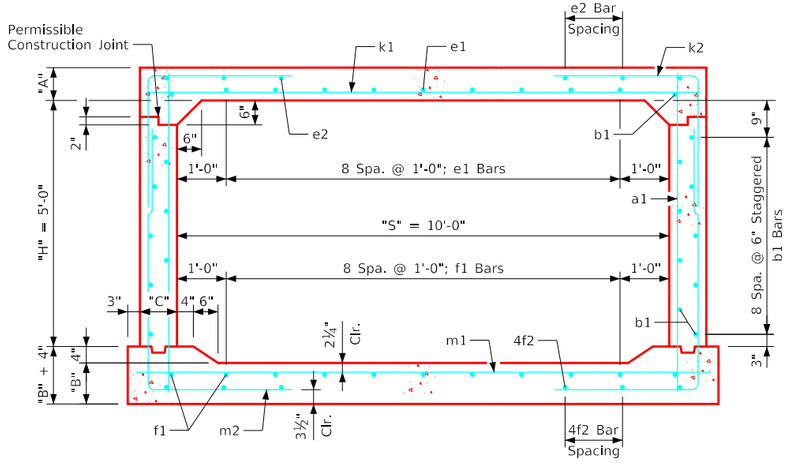
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 5' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 5' Barrel Sections

RCB 10-5-20

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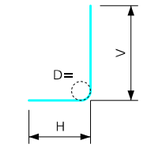
Variable Dimensions and Quantities for 10' x 6' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	6	12	12	9	6	4	6	7'-11	4	6	24	4	12	9	4	13	8	4	12	11	4	13	8	5	6	11'-2	4	6	6'-11	3'-10	3'-1	4	11'-2	5	6	11'-8	4	6	10'-3	3'-10	6'-5	4	11'-8	0.458	0.481	0.313	1.252	156.42
1	10	6	11.5	12	9	6	4	6	7'-10	4	6	24	4	12	9	4	13	8	4	12	11	4	17	6	5	6	11'-2	4	6	6'-11	3'-11	3'-0	4	11'-2	5	6	11'-8	4	6	9'-10	3'-5	6'-5	4	11'-8	0.441	0.481	0.313	1.235	153.76
2	10	6	8	10	9	9	4	12	7'-5	4	6	24	5	12	9	4	15	6	4	12	11	4	15	6	6	6	11'-2	5	6	6'-4	3'-2	3'-2	5	11'-2	6	6	11'-8	5	6	9'-5	3'-2	6'-3	5	11'-8	0.316	0.407	0.313	1.036	187.89
3	10	6	8	10	9	9	4	12	7'-5	4	6	24	4	12	9	4	15	6	4	12	11	4	14	6	7	9	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	9'-3	3'-0	6'-3	5	11'-8	0.316	0.407	0.313	1.036	181.00
4-7	10	6	8	10	9	9	4	12	7'-5	4	6	24	4	12	9	4	15	6	4	12	11	4	14	6	7	9	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	9'-2	2'-11	6'-3	5	11'-8	0.316	0.407	0.313	1.036	180.63
8-10	10	6	8	10.5	9	9	4	12	7'-5	4	6	24	4	12	9	4	15	6	4	12	11	4	13	6	6	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	7	6	11'-8	5	6	9'-1	2'-9	6'-4	5	11'-8	0.316	0.425	0.313	1.054	195.24
11-15	10	6	8.5	10.5	9	9	5	12	7'-6	4	6	24	4	12	9	4	12	6	4	12	11	4	12	6	7	6	11'-2	5	6	5'-8	2'-7	3'-1	5	11'-2	7	6	11'-8	5	6	8'-11	2'-7	6'-4	5	11'-8	0.334	0.425	0.313	1.072	210.55
16-20	10	6	10.5	13	9	9	4	9	7'-10	4	6	24	4	12	9	4	10	6	4	12	11	4	10	6	7	6	11'-2	5	6	5'-8	2'-4	3'-4	5	11'-2	7	6	11'-8	5	6	8'-10	2'-4	6'-6	5	11'-8	0.405	0.518	0.313	1.236	208.21
21-25	10	6	12.5	14.5	9	9	4	9	8'-2	4	6	24	4	12	9	4	10	6	4	12	11	4	10	6	8	6	11'-2	5	6	5'-8	2'-3	3'-5	5	11'-2	8	6	11'-8	5	6	9'-0	2'-4	6'-8	5	11'-8	0.476	0.574	0.313	1.363	238.50
26-30	10	6	14	16	9	9	4	9	8'-5	4	6	24	4	12	9	4	11	6	4	12	11	4	11	6	8	6	11'-2	6	9	6'-5	2'-5	4'-0	6	11'-2	8	6	11'-8	6	9	9'-2	2'-5	6'-9	6	11'-8	0.529	0.629	0.313	1.471	242.82
31-35	10	6	15	17.5	9.5	9	4	9	8'-7	4	6	24	4	12	9	4	11	6	4	12	11	4	11	6	8	6	11'-3	6	9	6'-3	2'-7	3'-8	5	11'-3	8	6	11'-9	5	6	9'-5	2'-6	6'-11	5	11'-9	0.570	0.690	0.330	1.590	244.42
36-40	10	6	16.5	19	10	9	4	9	8'-10	4	6	24	4	12	9	4	12	6	4	12	11	4	11	6	9	6	11'-4	5	6	6'-6	2'-8	3'-10	5	11'-4	8	6	11'-10	5	6	9'-7	2'-7	7'-0	5	11'-10	0.629	0.752	0.347	1.728	264.29
41-45	10	6	17.5	20	10.5	9	5	12	9'-0	4	6	24	4	12	9	4	11	6	4	12	11	4	11	6	9	6	11'-5	5	6	6'-7	2'-8	3'-11	5	11'-5	9	6	11'-11	5	6	9'-9	2'-8	7'-1	5	11'-11	0.671	0.794	0.366	1.831	287.42
46-50	10	6	19	21	11	9	5	12	9'-3	4	6	24	4	12	9	4	12	6	4	12	11	4	12	6	9	6	11'-6	5	6	6'-9	2'-9	4'-0	5	11'-6	9	6	12'-0	5	6	10'-0	2'-10	7'-2	5	12'-0	0.731	0.839	0.383	1.953	290.89
51-55	10	6	20	22.5	11.5	6	4	6	9'-5	4	6	24	4	12	9	4	14	6	5	12	11	4	12	6	9	6	11'-7	6	9	7'-8	3'-2	4'-6	6	11'-7	9	6	12'-1	6	9	10'-3	2'-11	7'-4	6	12'-1	0.774	0.902	0.400	2.076	306.32

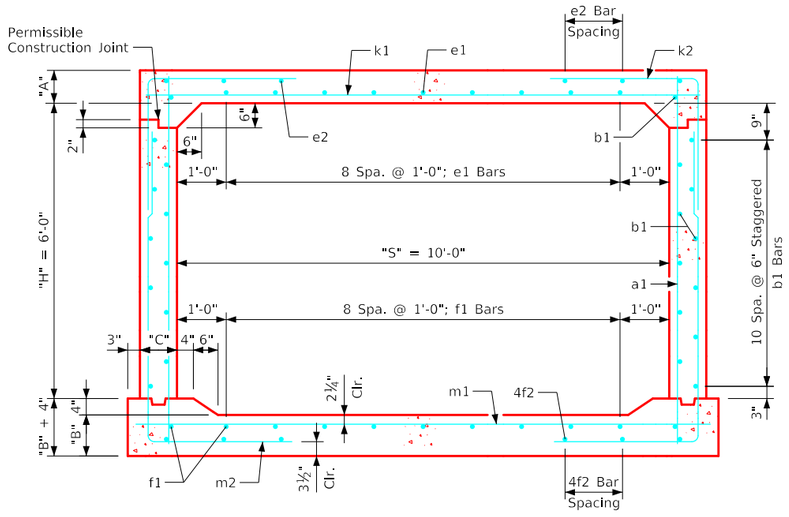
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 6' Barrel Sections

RCB 10-6-20

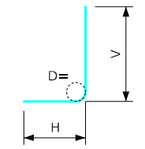
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 10' x 7' Barrel Sections

Dimensions							Bar List																																		Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)					Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	7	12	12	9	6	4	6	8'-11	4	6	28	4	12	9	4	14	10	4	12	11	4	13	8	5	6	11'-2	4	6	8'-5	5'-4	3'-1	4	11'-2	7	9	11'-8	4	6	11'-5	4'-0	7'-5	4	11'-8	0.458	0.481	0.368	1.307	178.89
1	10	7	11.5	12	9	6	4	6	8'-10	4	6	28	4	12	9	4	17	8	4	12	11	4	13	8	5	6	11'-2	4	6	8'-8	5'-8	3'-0	--	--	5	6	11'-8	4	6	11'-4	3'-11	7'-5	4	11'-8	0.441	0.481	0.368	1.290	168.82
2	10	7	8	10	9	9	4	9	8'-5	4	6	28	5	12	9	4	12	8	4	12	11	4	17	6	6	6	11'-2	6	9	7'-4	3'-8	3'-8	6	11'-2	6	6	11'-8	6	9	10'-9	3'-6	7'-3	6	11'-8	0.316	0.407	0.368	1.091	206.58
3	10	7	8	10	9	9	4	12	8'-5	4	6	28	4	12	9	4	16	6	4	12	11	4	15	6	7	9	11'-2	5	6	6'-6	3'-3	3'-3	5	11'-2	6	6	11'-8	5	6	10'-5	3'-2	7'-3	5	11'-8	0.316	0.407	0.368	1.091	191.37
4-8	10	7	8	10	9	9	4	12	8'-5	4	6	28	4	12	9	4	15	6	4	12	11	4	15	6	6	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	10'-4	3'-1	7'-3	5	11'-8	0.316	0.407	0.368	1.091	191.76
9-10	10	7	8	10.5	9	9	4	12	8'-5	4	6	28	4	12	9	4	15	6	4	12	11	4	13	6	6	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	7	6	11'-8	5	6	10'-1	2'-9	7'-4	5	11'-8	0.316	0.425	0.368	1.109	203.53
11-15	10	7	9	10.5	9	9	5	12	8'-6	4	6	28	4	12	9	4	12	6	4	12	11	4	12	6	7	6	11'-2	5	6	5'-9	2'-7	3'-2	5	11'-2	7	6	11'-8	5	6	10'-0	2'-8	7'-4	5	11'-8	0.352	0.425	0.368	1.145	220.32
16-20	10	7	10.5	13	9	6	4	6	8'-10	4	6	28	4	12	9	4	11	6	4	12	11	4	11	6	7	6	11'-2	6	9	6'-3	2'-6	3'-9	6	11'-2	8	6	11'-8	6	9	10'-0	2'-6	7'-6	6	11'-8	0.405	0.518	0.368	1.291	242.61
21-25	10	7	12.5	14.5	9	6	4	6	9'-2	4	6	28	4	12	9	4	11	6	4	12	11	4	11	6	8	6	11'-2	6	9	6'-3	2'-5	3'-10	6	11'-2	8	6	11'-8	6	9	10'-2	2'-6	7'-8	6	11'-8	0.476	0.574	0.368	1.418	258.39
26-30	10	7	14	16	9.5	9	5	12	9'-5	4	6	28	4	12	9	4	11	6	4	12	11	4	11	6	8	6	11'-3	5	6	6'-1	2'-6	3'-7	5	11'-3	8	6	11'-9	5	6	10'-4	2'-7	7'-9	5	11'-9	0.534	0.634	0.389	1.557	255.00
31-35	10	7	15	17.5	10	9	5	12	9'-7	4	6	28	4	12	9	4	12	6	4	12	11	4	12	6	8	6	11'-4	5	6	6'-4	2'-8	3'-8	5	11'-4	8	6	11'-10	5	6	10'-7	2'-8	7'-11	5	11'-10	0.575	0.696	0.409	1.680	258.39
36-40	10	7	16.5	19	11	6	4	6	9'-10	4	6	28	4	12	9	4	12	6	4	12	11	4	13	6	8	6	11'-6	5	6	6'-8	2'-10	3'-10	5	11'-6	8	6	12'-0	5	6	10'-11	2'-11	8'-0	5	12'-0	0.640	0.762	0.451	1.853	268.74
41-45	10	7	17.5	20	11.5	9	6	9	10'-0	4	6	28	4	12	9	4	14	6	4	12	11	4	13	6	9	6	11'-7	6	9	7'-6	3'-2	4'-4	6	11'-7	9	6	12'-1	6	9	11'-1	3'-0	8'-1	6	12'-1	0.682	0.807	0.471	1.960	322.84
46-50	10	7	19	21.5	12	9	6	12	10'-3	4	6	28	4	12	9	4	14	6	4	12	11	4	13	6	9	6	11'-8	6	9	7'-8	3'-3	4'-5	6	11'-8	9	6	12'-2	6	9	11'-4	3'-1	8'-3	6	12'-2	0.744	0.871	0.492	2.107	317.03
51-55	10	7	20	22.5	13	9	6	9	10'-5	4	6	28	4	12	9	4	14	6	5	12	11	4	14	6	9	6	11'-10	6	9	7'-10	3'-4	4'-6	6	11'-10	9	6	12'-4	6	9	11'-7	3'-3	8'-4	6	12'-4	0.794	0.923	0.532	2.249	335.58

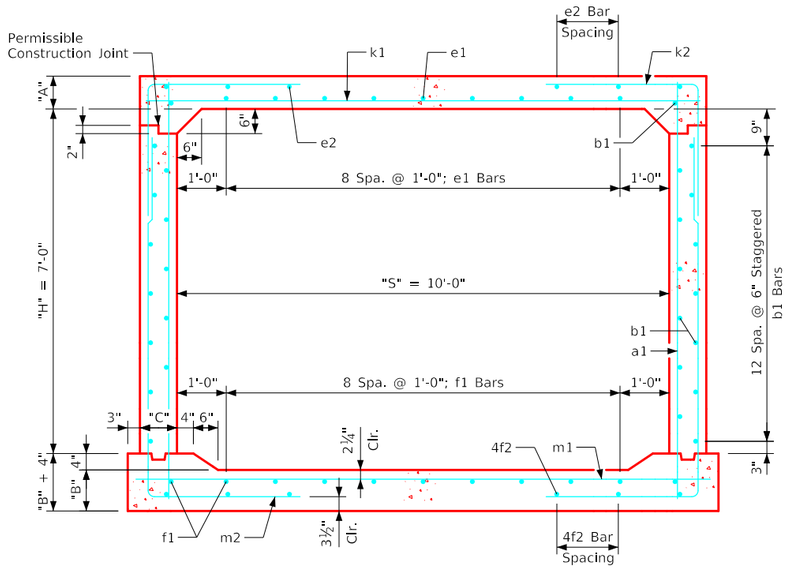
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 7' Barrel Sections

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 7' Barrel Sections

RCB 10-7-20

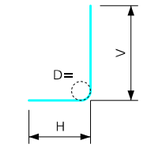
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 10' x 8' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	8	12.5	12.5	9	6	4	6	10'-0	4	6	32	4	12	9	4	17	8	4	12	11	4	16	8	5	6	11'-2	4	6	9'-6	6'-5	3'-1	--	--	7	9	11'-8	4	6	13'-3	4'-9	8'-6	4	11'-8	0.476	0.500	0.424	1.400	190.58
1	10	8	12	12	9	6	4	6	9'-11	4	6	32	4	12	9	4	17	8	4	12	11	4	17	8	5	6	11'-2	4	6	9'-6	6'-5	3'-1	--	--	7	9	11'-8	4	6	13'-3	4'-10	8'-5	4	11'-8	0.458	0.481	0.424	1.363	190.37
2-3	10	8	8	10	9	9	5	12	9'-5	4	6	32	5	12	9	4	15	8	4	12	11	4	13	8	6	6	11'-2	6	9	7'-10	4'-4	3'-6	6	11'-2	6	6	11'-8	6	9	12'-2	3'-11	8'-3	6	11'-8	0.316	0.407	0.424	1.147	223.61
4-6	10	8	8	10	9	9	4	12	9'-5	4	6	32	4	12	9	4	17	6	4	12	11	4	16	6	7	9	11'-2	5	6	6'-10	3'-5	3'-5	5	11'-2	6	6	11'-8	5	6	11'-7	3'-4	8'-3	5	11'-8	0.316	0.407	0.424	1.147	201.74
7-8	10	8	8	10.5	9	9	4	12	9'-5	4	6	32	4	12	9	4	15	6	4	12	11	4	14	6	6	6	11'-2	5	6	6'-2	3'-1	3'-1	5	11'-2	6	6	11'-8	5	6	11'-4	3'-0	8'-4	5	11'-8	0.316	0.425	0.424	1.165	199.97
9-10	10	8	8.5	10.5	9	9	4	9	9'-6	4	6	32	4	12	9	4	14	6	4	12	11	4	15	6	6	6	11'-2	6	9	6'-6	3'-0	3'-6	6	11'-2	7	6	11'-8	6	9	11'-5	3'-1	8'-4	6	11'-8	0.334	0.425	0.424	1.183	218.58
11-15	10	8	9	11.5	9	9	5	12	9'-7	4	6	32	4	12	9	4	13	6	4	12	11	4	13	6	7	6	11'-2	6	9	6'-5	2'-10	3'-7	6	11'-2	7	6	11'-8	6	9	11'-3	2'-10	8'-5	6	11'-8	0.352	0.463	0.424	1.239	233.29
16-20	10	8	10.5	13	9	6	4	6	9'-10	4	6	32	4	12	9	4	12	6	4	12	11	4	12	6	9	9	11'-2	6	9	6'-5	2'-8	3'-9	6	11'-2	8	6	11'-8	6	9	11'-2	2'-8	8'-6	6	11'-8	0.405	0.518	0.424	1.347	260.21
21-25	10	8	12.5	15	9.5	6	4	6	10'-2	4	6	32	4	12	9	4	12	6	4	12	11	4	12	6	9	9	11'-3	6	9	6'-7	2'-8	3'-11	6	11'-3	8	6	11'-9	6	9	11'-5	2'-9	8'-8	6	11'-9	0.481	0.597	0.447	1.525	263.68
26-30	10	8	14	16.5	10.5	9	6	12	10'-5	4	6	32	4	12	9	4	12	6	4	12	11	4	13	6	8	6	11'-5	6	9	6'-10	2'-10	4'-0	6	11'-5	8	6	11'-11	6	9	11'-9	2'-11	8'-10	6	11'-11	0.544	0.662	0.496	1.702	280.42
31-35	10	8	15	17.5	11.5	9	4	9	10'-7	4	6	32	4	12	9	4	14	6	4	12	11	4	14	6	8	6	11'-7	8	12	8'-1	3'-3	4'-10	8	11'-7	8	6	12'-1	8	12	12'-2	3'-3	8'-11	8	12'-1	0.591	0.711	0.542	1.844	309.39
36-40	10	8	16.5	19	12.5	9	6	9	10'-10	4	6	32	4	12	9	4	13	6	4	12	11	4	14	6	8	6	11'-9	5	6	7'-0	3'-2	3'-10	5	11'-9	8	6	12'-3	5	6	12'-3	3'-3	9'-0	5	12'-3	0.657	0.780	0.589	2.026	298.61
41-45	10	8	18	20.5	13.5	9	4	9	11'-1	4	6	32	4	12	9	4	16	6	4	12	11	4	14	6	8	6	11'-11	7	9	8'-5	3'-9	4'-8	7	11'-11	8	6	12'-5	7	9	12'-7	3'-5	9'-2	7	12'-5	0.725	0.851	0.636	2.212	316.26
46-50	10	8	19	21.5	14	9	6	9	11'-3	4	6	32	4	12	9	4	14	6	4	12	11	4	15	6	9	6	12'-0	5	6	7'-5	3'-5	4'-0	5	12'-0	9	6	12'-6	5	6	12'-9	3'-6	9'-3	5	12'-6	0.769	0.897	0.659	2.325	343.11
51-55	10	8	20	22.5	15	9	5	12	11'-5	4	6	32	4	12	9	4	16	6	5	12	11	4	15	6	9	6	12'-2	7	9	8'-8	3'-10	4'-10	7	12'-2	9	6	12'-8	7	9	13'-0	3'-8	9'-4	7	12'-8	0.819	0.950	0.706	2.475	368.21

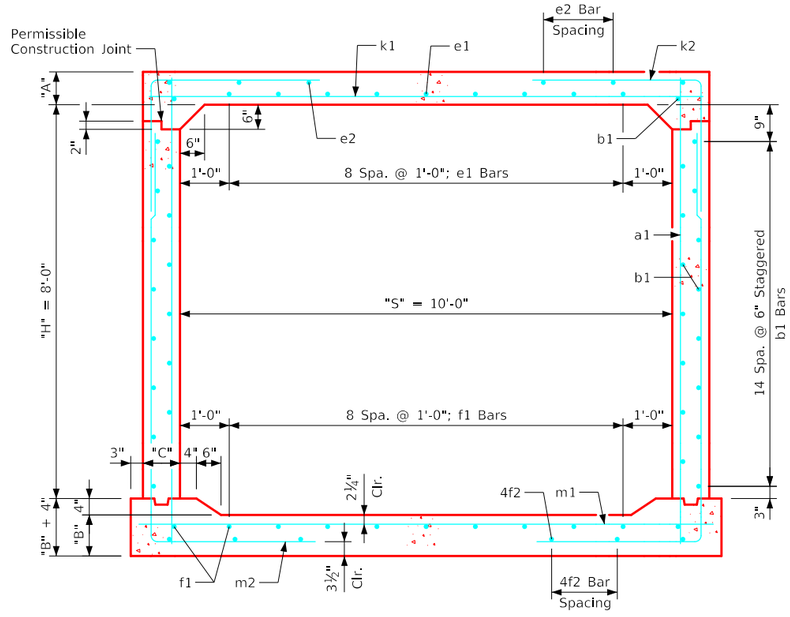
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 8' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 8' Barrel Sections

RCB 10-8-20

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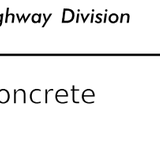
Variable Dimensions and Quantities for 10' x 9' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	9	12.5	12.5	9	6	4	6	11'-0	4	6	36	5	12	9	4	17	8	4	12	11	4	17	8	8	12	11'-2	4	6	9'-6	6'-5	3'-1	--	--	7	9	11'-8	4	6	15'-11	6'-5	9'-6	--	--	0.476	0.500	0.479	1.455	214.63
1	10	9	12	12	9	9	4	12	10'-11	4	6	36	5	12	9	4	17	8	4	12	11	4	17	8	8	12	11'-2	6	12	10'-8	6'-10	3'-10	--	--	7	9	11'-8	7	12	16'-5	7'-0	9'-5	--	--	0.458	0.481	0.479	1.418	238.42
2-3	10	9	8	10	9	9	4	9	10'-5	4	6	36	5	12	9	4	17	8	4	12	11	4	16	8	6	6	11'-2	6	9	10'-4	6'-10	3'-6	--	--	6	6	11'-8	6	9	13'-11	4'-8	9'-3	6	11'-8	0.316	0.407	0.479	1.202	241.71
4-5	10	9	8	10	9	9	4	12	10'-5	4	6	36	4	12	9	4	13	8	4	12	11	4	12	8	7	9	11'-2	5	6	7'-0	3'-11	3'-1	5	11'-2	6	6	11'-8	5	6	13'-0	3'-9	9'-3	5	11'-8	0.316	0.407	0.479	1.202	215.05
6-8	10	9	8	10.5	9	9	4	12	10'-5	4	6	36	4	12	9	4	17	6	4	12	11	4	17	6	6	6	11'-2	5	6	7'-0	3'-6	3'-6	5	11'-2	6	6	11'-8	5	6	12'-10	3'-6	9'-4	5	11'-8	0.316	0.425	0.479	1.220	213.84
9-10	10	9	8.5	10.5	9	9	5	12	10'-6	4	6	36	4	12	9	4	17	6	4	12	11	4	16	6	8	9	11'-2	6	9	7'-0	3'-6	3'-6	6	11'-2	7	6	11'-8	6	9	12'-7	3'-3	9'-4	6	11'-8	0.334	0.425	0.479	1.238	241.24
11-15	10	9	9	11.5	9	9	4	9	10'-7	4	6	36	4	12	9	4	15	6	4	12	11	4	14	6	7	6	11'-2	5	6	6'-4	3'-2	3'-2	5	11'-2	7	6	11'-8	5	6	12'-4	2'-11	9'-5	5	11'-8	0.352	0.463	0.479	1.294	238.68
16-20	10	9	10.5	13	9.5	6	4	6	10'-10	4	6	36	4	12	9	4	13	6	4	12	11	4	13	6	7	6	11'-3	5	6	6'-2	2'-10	3'-4	5	11'-3	8	6	11'-9	5	6	12'-5	2'-11	9'-6	5	11'-9	0.409	0.522	0.506	1.437	263.97
21-25	10	9	12.5	15	10.5	9	6	9	11'-2	4	6	36	4	12	9	4	13	6	4	12	11	4	14	6	9	9	11'-5	6	9	6'-11	3'-0	3'-11	6	11'-5	8	6	11'-11	6	9	12'-9	3'-1	9'-8	6	11'-11	0.490	0.605	0.560	1.655	292.89
26-30	10	9	14	16.5	12	9	4	12	11'-5	4	6	36	4	12	9	4	14	6	4	12	11	4	14	6	9	9	11'-8	7	9	7'-6	3'-2	4'-4	7	11'-8	8	6	12'-2	7	9	13'-1	3'-3	9'-10	7	12'-2	0.559	0.678	0.640	1.877	301.76
31-35	10	9	15	18	13	9	5	12	11'-8	4	6	36	4	12	9	4	14	6	4	12	11	4	15	6	8	6	11'-10	8	12	8'-2	3'-4	4'-10	8	11'-10	8	6	12'-4	8	12	13'-4	3'-5	9'-11	8	12'-4	0.606	0.747	0.693	2.046	328.03
36-40	10	9	16.5	19	14	9	4	12	11'-10	4	6	36	4	12	9	4	15	6	4	12	11	4	15	6	8	6	12'-0	6	6	7'-9	3'-6	4'-3	6	12'-0	8	6	12'-6	6	6	13'-7	3'-7	10'-0	6	12'-6	0.673	0.798	0.746	2.217	325.63
41-45	10	9	17.5	20.5	15	6	4	6	12'-1	4	6	36	4	12	9	4	16	6	4	12	11	4	16	6	8	6	12'-2	7	9	8'-6	3'-10	4'-8	7	12'-2	8	6	12'-8	7	9	13'-11	3'-9	10'-2	7	12'-8	0.723	0.870	0.799	2.392	342.16
46-50	10	9	19	21.5	15.5	9	4	9	12'-3	4	6	36	4	12	9	4	15	6	4	12	11	4	16	6	8	6	12'-3	6	6	8'-2	3'-9	4'-5	6	12'-3	9	6	12'-9	6	6	14'-1	3'-10	10'-3	6	12'-9	0.787	0.917	0.825	2.529	358.53
51-55	10	9	20	22.5	16.5	9	5	12	12'-5	4	6	36	4	12	9	4	16	6	5	12	11	4	16	6	9	6	12'-5	6	6	8'-5	3'-11	4'-6	6	12'-5	9	6	12'-11	6	6	14'-4	4'-0	10'-4	6	12'-11	0.839	0.971	0.878	2.688	390.71

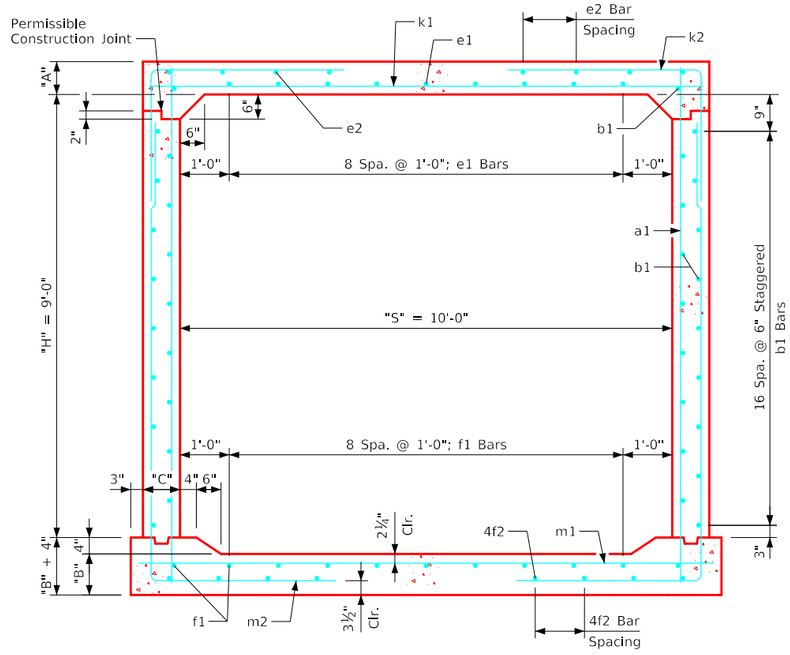
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 9' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 9' Barrel Sections

RCB 10-9-20

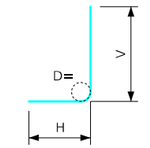
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-9-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 10' x 10' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	10	12.5	12.5	10	9	4	12	12'-0	4	6	40	4	12	9	4	17	8	4	12	11	4	17	8	5	6	11'-4	5	6	10'-1	6'-8	3'-5	--	--	7	9	11'-10	5	6	17'-2	6'-8	10'-6	--	--	0.485	0.508	0.594	1.587	239.61
1	10	10	12	12.5	10	9	4	12	11'-11	4	6	40	4	12	9	4	17	8	4	12	11	4	17	8	5	6	11'-4	5	6	10'-1	6'-8	3'-5	--	--	7	9	11'-10	5	6	17'-2	6'-8	10'-6	--	--	0.467	0.508	0.594	1.569	239.50
2	10	10	8	10	10	9	4	9	11'-5	4	6	40	5	12	9	4	17	8	4	12	11	4	17	8	6	6	11'-4	6	9	10'-5	6'-11	3'-6	--	--	6	6	11'-10	6	9	15'-3	5'-0	10'-3	6	11'-10	0.323	0.414	0.594	1.331	253.13
3	10	10	8	10	10	9	4	12	11'-5	4	6	40	4	12	9	4	17	8	4	12	11	4	14	8	7	9	11'-4	5	6	8'-2	5'-1	3'-1	5	11'-4	6	6	11'-10	5	6	14'-7	4'-4	10'-3	5	11'-10	0.323	0.414	0.594	1.331	231.74
4-7	10	10	8	10	10	9	4	12	11'-5	4	6	40	4	12	9	4	15	8	4	12	11	4	13	8	6	6	11'-4	5	6	7'-6	4'-5	3'-1	5	11'-4	6	6	11'-10	5	6	14'-4	4'-1	10'-3	5	11'-10	0.323	0.414	0.594	1.331	230.05
8-10	10	10	8	10.5	10	9	4	12	11'-5	4	6	40	4	12	9	4	12	8	4	12	11	4	12	8	8	9	11'-4	7	9	7'-8	3'-10	3'-10	7	11'-4	7	6	11'-10	7	9	14'-2	3'-10	10'-4	7	11'-10	0.323	0.433	0.594	1.350	284.11
11-15	10	10	9	11	10	9	4	12	11'-7	4	6	40	4	12	9	4	16	6	4	12	11	4	16	6	7	6	11'-4	7	9	7'-5	3'-5	4'-0	7	11'-4	7	6	11'-10	7	9	13'-9	3'-5	10'-4	7	11'-10	0.359	0.452	0.594	1.405	282.66
16-20	10	10	10.5	13.5	11	9	5	9	11'-11	4	6	40	4	12	9	4	17	6	4	12	11	4	15	6	7	6	11'-6	6	6	7'-4	3'-8	3'-8	6	11'-6	7	6	12'-0	5	6	13'-11	3'-4	10'-7	5	12'-0	0.421	0.553	0.655	1.629	283.39
21-25	10	10	12.5	15	12	9	4	12	12'-2	4	6	40	4	12	9	4	15	6	4	12	11	4	15	6	7	6	11'-8	7	9	7'-7	3'-4	4'-3	7	11'-8	9	9	12'-2	7	9	14'-1	3'-5	10'-8	7	12'-2	0.503	0.620	0.714	1.837	296.45
26-30	10	10	14	16.5	13	9	5	12	12'-5	4	6	40	4	12	9	4	15	6	4	12	11	4	16	6	9	9	11'-10	8	12	8'-3	3'-6	4'-9	8	11'-10	8	6	12'-4	8	12	14'-5	3'-7	10'-10	8	12'-4	0.568	0.688	0.773	2.029	331.05
31-35	10	10	15	18	14.5	9	4	9	12'-8	4	6	40	4	12	9	4	12	8	4	12	11	4	16	6	9	9	12'-1	6	6	8'-2	4'-1	4'-1	6	12'-1	8	6	12'-7	6	6	14'-8	3'-9	10'-11	6	12'-7	0.621	0.764	0.862	2.247	338.00
36-40	10	10	16.5	19	15.5	9	4	9	12'-10	4	6	40	4	12	9	4	12	8	4	12	11	4	16	6	8	6	12'-3	6	6	8'-6	4'-3	4'-3	6	12'-3	8	6	12'-9	6	6	14'-11	3'-11	11'-0	6	12'-9	0.690	0.816	0.921	2.427	351.71
41-45	10	10	17.5	20.5	16.5	9	5	12	13'-1	4	6	40	4	12	9	4	12	8	4	12	11	4	17	6	8	6	12'-5	6	6	8'-6	4'-3	4'-3	6	12'-5	8	6	12'-11	6	6	15'-3	4'-1	11'-2	6	12'-11	0.740	0.889	0.980	2.609	360.61
46-50	10	10	19	21.5	17.5	9	6	9	13'-3	4	6	40	4	12	9	4	16	6	4	12	11	4	17	6	8	6	12'-7	7	9	8'-10	4'-1	4'-9	7	12'-7	8	6	13'-1	7	9	15'-5	4'-2	11'-3	7	13'-1	0.812	0.943	1.039	2.794	380.95
51-55	10	10	20	23	18.5	6	4	6	13'-6	4	6	40	4	12	9	4	12	8	5	12	11	4	17	6	8	6	12'-9	6	6	9'-0	4'-6	4'-6	6	12'-9	9	6	13'-3	6	6	15'-8	4'-4	11'-4	6	13'-3	0.864	1.019	1.098	2.981	401.61

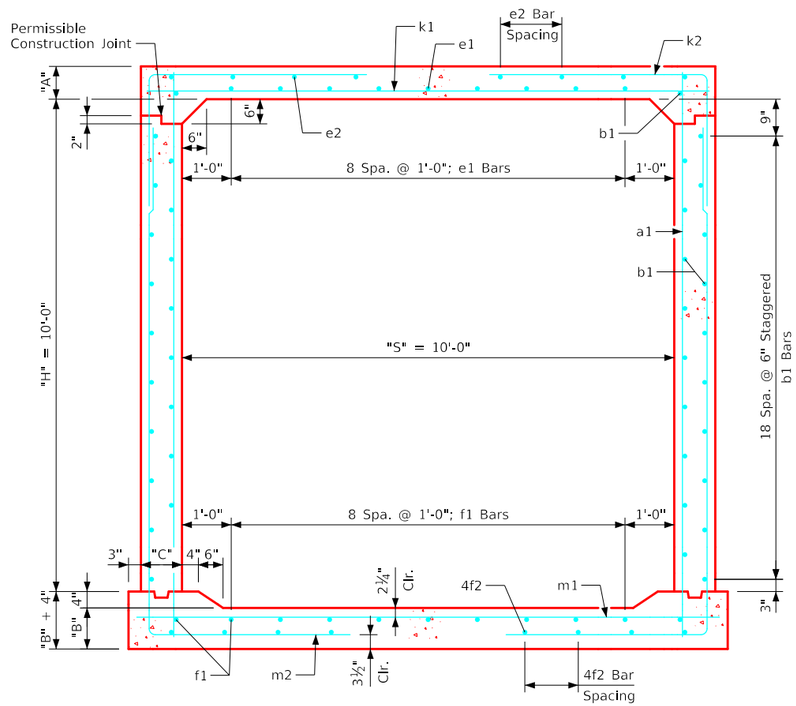
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 10' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 10' Barrel Sections

RCB 10-10-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-10-20 - THIS SHEET ISSUED 07-2020.

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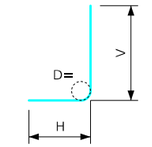
Variable Dimensions and Quantities for 10' x 11' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	11	12	12.5	11	9	4	12	12'-11	4	6	44	4	12	9	4	17	8	4	12	11	4	17	8	5	6	11'-6	6	9	10'-10	7'-0	3'-10	--	--	7	9	12'-0	6	9	18'-6	7'-0	11'-6	--	--	0.476	0.515	0.723	1.714	252.08
1	10	11	11.5	12.5	11	9	4	9	12'-11	4	6	44	4	12	9	4	17	8	4	12	11	4	17	8	5	6	11'-6	6	9	10'-9	7'-0	3'-9	--	--	7	9	12'-0	6	9	18'-6	7'-0	11'-6	--	--	0.458	0.515	0.723	1.696	257.18
2	10	11	8	10	11	9	4	9	12'-5	4	6	44	5	12	9	4	17	8	4	12	11	4	17	8	6	6	11'-6	5	6	9'-10	6'-9	3'-1	--	--	6	6	12'-0	5	6	16'-5	5'-2	11'-3	5	12'-0	0.330	0.420	0.723	1.473	261.71
3-6	10	11	8	10	11	9	4	9	12'-5	4	6	44	4	12	9	4	17	8	4	12	11	4	15	8	7	9	11'-6	5	6	9'-6	6'-5	3'-1	5	11'-6	6	6	12'-0	5	6	15'-11	4'-8	11'-3	5	12'-0	0.330	0.420	0.723	1.473	252.63
7-8	10	11	8	10	11	9	4	12	12'-5	4	6	44	4	12	9	4	13	8	4	12	11	4	13	8	6	6	11'-6	5	6	7'-1	4'-0	3'-1	5	11'-6	6	6	12'-0	6	6	15'-3	4'-0	11'-3	6	12'-0	0.330	0.420	0.723	1.473	265.84
9-10	10	11	8	10.5	11	9	4	9	12'-5	4	6	44	4	12	9	4	13	8	4	12	11	4	13	8	6	6	11'-6	7	9	8'-0	4'-0	4'-0	7	11'-6	7	6	12'-0	7	9	15'-4	4'-0	11'-4	7	12'-0	0.330	0.439	0.723	1.492	295.47
11-15	10	11	9	11	11	9	4	12	12'-7	4	6	44	4	12	9	4	13	8	4	12	11	4	18	6	7	6	11'-6	7	9	8'-0	4'-0	4'-0	7	11'-6	7	6	12'-0	7	9	15'-1	3'-9	11'-4	7	12'-0	0.366	0.458	0.723	1.547	300.37
16-20	10	11	10.5	13.5	12	9	4	12	12'-11	4	6	44	4	12	9	4	13	8	4	12	11	4	17	6	7	6	11'-8	7	9	8'-2	4'-1	4'-1	7	11'-8	7	6	12'-2	7	9	15'-4	3'-9	11'-7	7	12'-2	0.429	0.562	0.788	1.779	304.61
21-25	10	11	12.5	15	13	9	4	9	13'-2	4	6	44	4	12	9	4	16	6	4	12	11	4	17	6	7	6	11'-10	7	9	7'-11	3'-8	4'-3	7	11'-10	7	6	12'-4	7	9	15'-5	3'-9	11'-8	7	12'-4	0.512	0.630	0.853	1.995	309.61
26-30	10	11	14	16.5	14.5	9	4	9	13'-5	4	6	44	4	12	9	4	17	6	4	12	11	4	17	6	7	6	12'-1	6	6	8'-0	4'-0	4'-0	6	12'-1	9	9	12'-7	6	6	15'-9	3'-11	11'-10	6	12'-7	0.583	0.704	0.951	2.238	330.61
31-35	10	11	15.5	18	15.5	9	4	9	13'-8	4	6	44	4	12	9	4	12	8	4	12	11	4	17	6	9	9	12'-3	6	6	8'-4	4'-2	4'-2	6	12'-3	9	9	12'-9	6	6	16'-0	4'-1	11'-11	6	12'-9	0.651	0.775	1.017	2.443	344.79
36-40	10	11	16.5	19.5	17	9	6	9	13'-11	4	6	44	4	12	9	4	17	6	4	12	11	4	18	6	9	9	12'-6	7	9	8'-8	4'-1	4'-7	7	12'-6	8	6	13'-0	7	9	16'-4	4'-3	12'-1	7	13'-0	0.707	0.854	1.115	2.676	381.32
41-45	10	11	17.5	20.5	18	9	6	9	14'-1	4	6	44	4	12	9	4	13	8	4	12	11	4	18	6	8	6	12'-8	7	9	9'-4	4'-8	4'-8	7	12'-8	8	6	13'-2	7	9	16'-6	4'-4	12'-2	7	13'-2	0.758	0.908	1.180	2.846	398.26
46-50	10	11	19	21.5	19.5	9	6	9	14'-3	4	6	44	4	12	9	4	13	8	4	12	11	4	12	8	8	6	12'-11	7	9	9'-6	4'-9	4'-9	7	12'-11	8	6	13'-5	7	9	16'-9	4'-6	12'-3	7	13'-5	0.836	0.969	1.278	3.083	405.37
51-55	10	11	20	23	20.5	9	4	9	14'-6	4	6	44	4	12	9	4	12	8	5	12	11	4	12	8	8	6	13'-1	8	9	9'-11	4'-8	5'-3	8	13'-1	8	6	13'-7	8	9	17'-0	4'-8	12'-4	8	13'-7	0.890	1.047	1.343	3.280	431.55

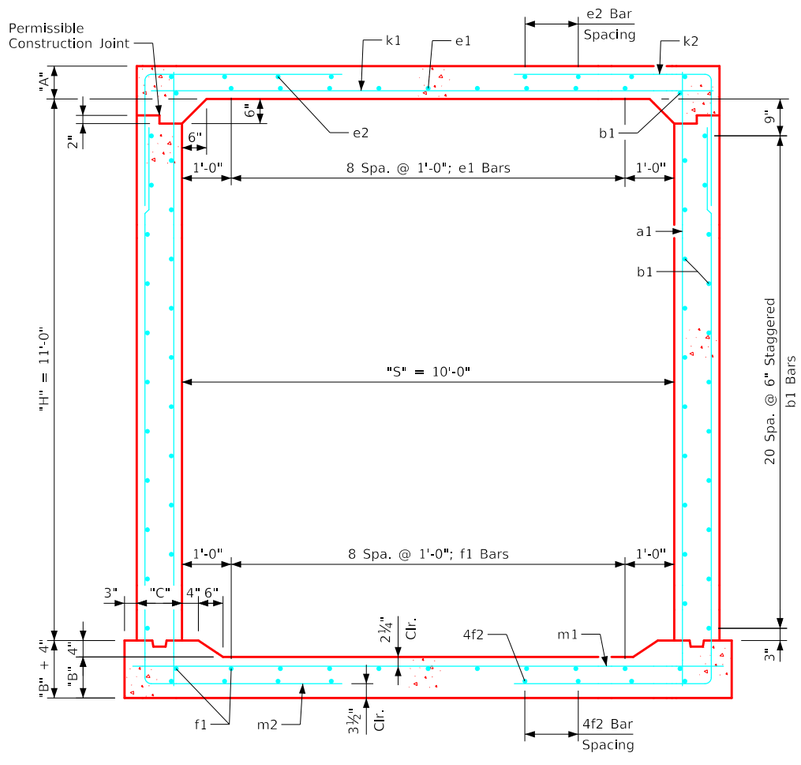
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 11' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 11' Barrel Sections

RCB 10-11-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-11-20 - THIS SHEET ISSUED 07-2020.

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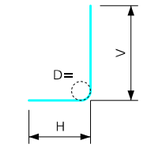
Variable Dimensions and Quantities for 10' x 12' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	10	12	12.5	13	12	9	4	9	14'-0	4	6	48	4	12	9	4	17	8	4	12	11	4	17	8	5	6	11'-8	6	9	11'-0	7'-1	3'-11	--	--	7	9	12'-2	6	9	19'-7	7'-1	12'-6	--	--	0.503	0.543	0.862	1.908	268.18
1	10	12	12	12.5	12	9	5	12	13'-11	4	6	48	4	12	9	4	17	8	4	12	11	4	17	8	6	9	11'-8	6	9	10'-11	7'-1	3'-10	--	--	7	9	12'-2	6	9	19'-7	7'-1	12'-6	--	--	0.485	0.523	0.862	1.870	272.32
2	10	12	8	10	12	9	4	9	13'-5	4	6	48	5	12	9	4	17	8	4	12	11	4	14	10	6	6	11'-8	7	9	11'-2	7'-3	3'-11	--	--	6	6	12'-2	7	9	17'-10	5'-7	12'-3	7	12'-2	0.336	0.427	0.862	1.625	323.55
3	10	12	8	10	12	6	4	6	13'-5	4	6	48	4	12	9	4	17	8	4	12	11	4	16	8	7	9	11'-8	5	6	9'-11	6'-10	3'-1	--	--	6	6	12'-2	5	6	17'-2	4'-11	12'-3	5	12'-2	0.336	0.427	0.862	1.625	276.87
4-8	10	12	8	10	12	6	4	6	13'-5	4	6	48	4	12	9	4	14	10	4	12	11	4	16	8	6	6	11'-8	7	9	9'-7	5'-8	3'-11	7	11'-8	6	6	12'-2	7	9	17'-1	4'-10	12'-3	7	12'-2	0.336	0.427	0.862	1.625	319.92
9-10	10	12	8	10.5	12	9	5	12	13'-5	4	6	48	4	12	9	4	13	8	4	12	11	4	13	8	6	6	11'-8	6	6	7'-8	4'-2	3'-6	6	11'-8	7	6	12'-2	6	6	16'-6	4'-2	12'-4	6	12'-2	0.336	0.446	0.862	1.644	319.21
11-15	10	12	9	11	12	9	4	9	13'-7	4	6	48	4	12	9	4	12	8	4	12	11	4	12	8	8	9	11'-8	6	6	7'-10	3'-11	3'-11	6	11'-8	7	6	12'-2	6	6	16'-3	3'-11	12'-4	6	12'-2	0.373	0.466	0.862	1.701	322.32
16-20	10	12	10.5	13.5	13	9	5	12	13'-11	4	6	48	4	12	9	4	18	6	4	12	11	4	12	8	7	6	11'-10	6	6	7'-10	3'-11	3'-11	6	11'-10	7	6	12'-4	6	6	16'-7	4'-0	12'-7	6	12'-4	0.437	0.571	0.934	1.942	334.71
21-25	10	12	12.5	15	14.5	6	4	6	14'-2	4	6	48	4	12	9	4	12	8	4	12	11	4	12	8	7	6	12'-1	7	9	8'-6	4'-3	4'-3	7	12'-1	7	6	12'-7	7	9	16'-10	4'-2	12'-8	7	12'-7	0.526	0.644	1.041	2.211	342.68
26-30	10	12	13.5	16.5	16	6	4	6	14'-5	4	6	48	4	12	9	4	17	6	4	12	11	4	12	8	7	6	12'-4	6	6	8'-2	4'-1	4'-1	6	12'-4	9	9	12'-10	6	6	17'-1	4'-3	12'-10	6	12'-10	0.578	0.720	1.148	2.446	360.47
31-35	10	12	15.5	18	17	9	6	9	14'-8	4	6	48	4	12	9	4	13	8	4	12	11	4	12	8	9	9	12'-6	7	9	9'-0	4'-6	4'-6	7	12'-6	9	9	13'-0	7	9	17'-4	4'-5	12'-11	7	13'-0	0.667	0.792	1.220	2.679	388.55
36-40	10	12	16.5	19.5	18	9	6	9	14'-11	4	6	48	4	12	9	4	13	8	4	12	11	4	13	8	9	9	12'-8	7	9	9'-2	4'-7	4'-7	7	12'-8	8	6	13'-2	7	9	17'-8	4'-7	13'-1	7	13'-2	0.718	0.866	1.291	2.875	402.84
41-45	10	12	17.5	20.5	19.5	9	8	12	15'-1	4	6	48	4	12	9	4	14	8	4	12	11	4	13	8	8	6	12'-11	8	12	10'-0	5'-0	5'-0	8	12'-11	8	6	13'-5	8	12	17'-11	4'-9	13'-2	8	13'-5	0.775	0.927	1.398	3.100	445.29
46-50	10	12	19	22	21	6	4	6	15'-4	4	6	48	4	12	9	4	14	8	5	12	11	4	13	8	8	6	13'-2	8	9	10'-4	5'-2	5'-2	8	13'-2	8	6	13'-8	8	9	18'-2	4'-11	13'-3	8	13'-8	0.855	1.010	1.506	3.371	461.89
51-55	10	12	20	23	22	9	8	12	15'-6	5	6	48	4	12	9	4	14	8	5	12	11	4	13	8	8	6	13'-4	8	12	10'-6	5'-3	5'-3	8	13'-4	8	6	13'-10	8	12	18'-4	5'-0	13'-4	8	13'-10	0.909	1.067	1.577	3.553	479.39

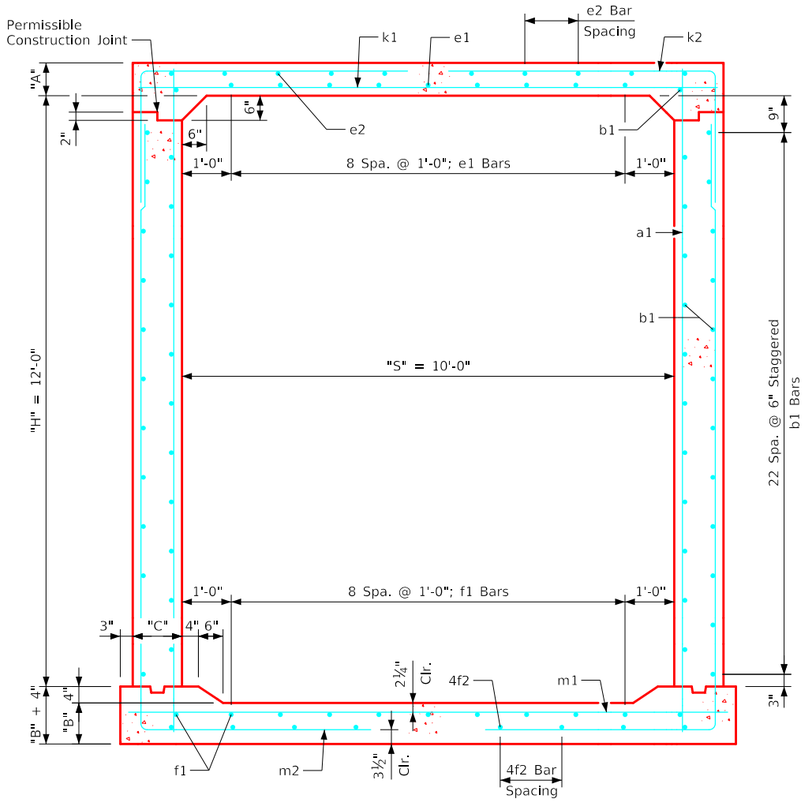
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



10' x 12' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 12' Barrel Sections

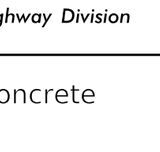
RCB 10-12-20

Variable Dimensions and Quantities for 12' x 4' Barrel Sections

Dimensions							Bar List																														Quantities					
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	4	13.5	13	9	9	4	9	6'-1	4	6	16	5	12	11	4	14	6	4	12	13	4	13	8	8	12	13'-2	6	9	7'-0	3'-0	4'-0	6	13'-2	5	6	13'-8	6	9	8'-5	3'-11	4'-6	6	13'-8	0.595	0.598	0.202	1.395	184.26
1	12	4	12.5	13	9	9	4	12	6'-0	4	6	16	5	12	11	4	17	6	4	12	13	4	17	6	8	12	13'-2	5	6	7'-0	3'-6	3'-6	5	13'-2	5	6	13'-8	5	6	7'-11	3'-5	4'-6	5	13'-8	0.553	0.598	0.202	1.353	178.11
2-3	12	4	8.5	10	9	9	4	12	5'-5	4	6	16	5	12	11	4	13	8	4	12	13	4	14	8	6	6	13'-2	7	9	7'-10	3'-11	3'-11	7	13'-2	6	6	13'-8	7	9	8'-6	4'-3	4'-3	7	13'-8	0.387	0.469	0.202	1.058	226.29
4-5	12	4	8	10	9	9	4	12	5'-5	4	6	16	4	12	11	4	13	8	4	12	13	4	17	6	6	6	13'-2	7	9	7'-10	3'-11	3'-11	7	13'-2	6	6	13'-8	7	9	7'-9	3'-6	4'-3	7	13'-8	0.366	0.469	0.202	1.037	216.61
6-7	12	4	8	10.5	9	6	4	6	5'-5	4	6	16	4	12	11	4	17	6	4	12	13	4	16	6	6	6	13'-2	6	6	7'-0	3'-6	3'-6	6	13'-2	7	6	13'-8	5	6	7'-7	3'-3	4'-4	5	13'-8	0.366	0.490	0.202	1.058	222.08
8-10	12	4	9	10.5	9	9	4	12	5'-6	4	6	16	4	12	11	4	18	6	4	12	13	4	16	6	7	6	13'-2	6	6	7'-2	3'-7	3'-7	6	13'-2	7	6	13'-8	6	6	7'-7	3'-3	4'-4	6	13'-8	0.407	0.490	0.202	1.099	245.05
11-15	12	4	10.5	12.5	9	9	4	12	5'-10	4	6	16	4	12	11	4	13	6	4	12	13	4	13	6	7	6	13'-2	6	6	6'-6	2'-10	3'-8	6	13'-2	7	6	13'-8	6	6	7'-3	2'-9	4'-6	6	13'-8	0.470	0.577	0.202	1.249	239.42
16-20	12	4	12.5	15	9	9	4	12	6'-2	4	6	16	4	12	11	4	13	6	4	12	13	4	13	6	8	6	13'-2	7	9	7'-0	2'-9	4'-3	7	13'-2	8	6	13'-8	7	9	7'-5	2'-9	4'-8	7	13'-8	0.553	0.685	0.202	1.440	273.18
21-25	12	4	14.5	17	10	9	6	9	6'-6	4	6	16	4	12	11	4	13	6	4	12	13	4	11	6	8	6	13'-4	7	9	7'-3	2'-10	4'-5	7	13'-4	8	6	13'-10	6	9	7'-5	2'-7	4'-10	6	13'-10	0.647	0.782	0.224	1.653	282.61
26-30	12	4	16.5	18.5	11	9	6	9	6'-10	4	6	16	4	12	11	4	12	6	4	12	13	4	12	6	8	6	13'-6	5	6	6'-6	2'-9	3'-9	5	13'-6	8	6	14'-0	5	6	7'-9	2'-9	5'-0	5	14'-0	0.742	0.858	0.247	1.847	272.50
31-35	12	4	18	20.5	11.5	9	4	12	7'-1	4	6	16	4	12	11	4	14	6	4	12	13	4	12	6	9	6	13'-7	6	6	7'-6	3'-2	4'-4	6	13'-7	9	6	14'-1	6	6	8'-0	2'-10	5'-2	6	14'-1	0.812	0.952	0.258	2.022	331.29
36-40	12	4	19.5	22	12	9	5	12	7'-4	4	6	16	4	12	11	4	16	6	5	12	13	4	13	6	9	6	13'-8	7	9	8'-5	3'-7	4'-10	7	13'-8	9	6	14'-2	7	9	8'-3	3'-0	5'-3	7	14'-2	0.883	1.026	0.269	2.178	344.79
41-45	12	4	21	23.5	13	9	4	9	7'-7	4	6	16	4	12	11	4	14	6	5	12	13	4	13	6	9	6	13'-10	6	6	7'-11	3'-4	4'-7	6	13'-10	9	6	14'-4	6	6	8'-7	3'-2	5'-5	6	14'-4	0.961	1.107	0.292	2.360	349.61
46-50	12	4	22.5	25	13.5	6	4	6	7'-10	4	6	16	5	12	11	4	16	6	5	12	13	4	13	6	9	6	13'-11	7	9	8'-10	3'-9	5'-1	7	13'-11	9	6	14'-5	7	9	8'-9	3'-3	5'-6	7	14'-5	1.034	1.182	0.303	2.519	362.79
51-55	12	4	24	26	14	9	6	9	8'-1	4	6	16	5	12	11	4	14	6	5	12	13	4	14	6	10	6	14'-0	5	6	7'-9	3'-4	4'-5	5	14'-0	10	6	14'-6	5	6	8'-11	3'-4	5'-7	5	14'-6	1.107	1.236	0.314	2.657	396.45

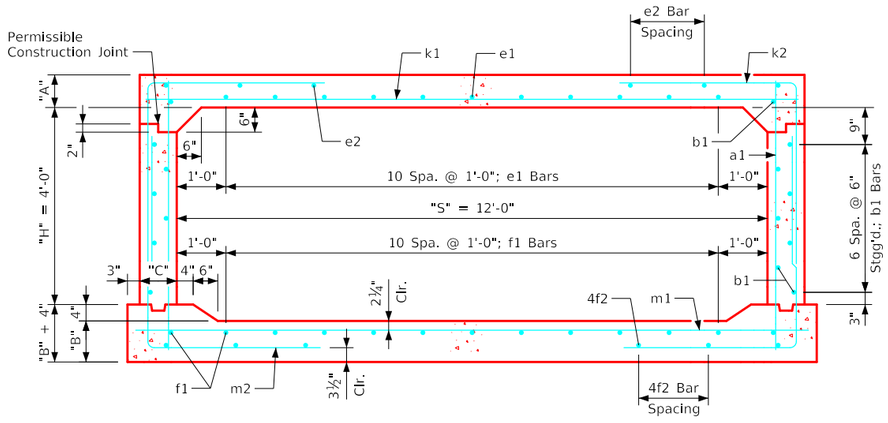
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 4' Barrel Sections

RCB 12-4-20

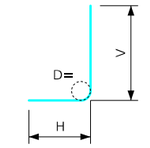
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 12' x 5' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	5	13.5	13	9	9	4	12	7'-1	4	6	20	5	12	11	4	14	6	4	12	13	4	13	8	8	12	13'-2	5	6	6'-7	3'-0	3'-7	5	13'-2	7	9	13'-8	5	6	9'-5	3'-11	5'-6	5	13'-8	0.595	0.598	0.257	1.450	198.18
1	12	5	12.5	13	9	6	4	6	7'-0	4	6	20	5	12	11	4	16	6	4	12	13	4	17	6	8	12	13'-2	4	6	6'-8	3'-4	3'-4	4	13'-2	5	6	13'-8	5	6	8'-11	3'-5	5'-6	5	13'-8	0.553	0.598	0.257	1.408	183.66
2-3	12	5	8.5	10	9	9	4	12	6'-5	4	6	20	5	12	11	4	13	8	4	12	13	4	13	8	8	9	13'-2	7	9	7'-10	3'-11	3'-11	7	13'-2	6	6	13'-8	7	9	9'-1	3'-10	5'-3	7	13'-8	0.387	0.469	0.257	1.113	242.55
4-6	12	5	8	10.5	9	6	4	6	6'-5	4	6	20	4	12	11	4	17	6	4	12	13	4	16	6	6	6	13'-2	6	6	7'-0	3'-6	3'-6	6	13'-2	6	6	13'-8	5	6	8'-8	3'-4	5'-4	5	13'-8	0.366	0.490	0.257	1.113	216.97
7-9	12	5	8.5	10.5	9	9	4	12	6'-6	4	6	20	4	12	11	4	16	6	4	12	13	4	16	6	7	6	13'-2	7	9	7'-3	3'-4	3'-11	7	13'-2	7	6	13'-8	7	9	8'-8	3'-4	5'-4	7	13'-8	0.387	0.490	0.257	1.134	250.79
10	12	5	9	10.5	9	9	4	12	6'-6	4	6	20	4	12	11	4	15	6	4	12	13	4	15	6	7	6	13'-2	6	6	6'-8	3'-1	3'-7	6	13'-2	7	6	13'-8	6	6	8'-6	3'-2	5'-4	6	13'-8	0.407	0.490	0.257	1.154	251.58
11-15	12	5	10.5	12.5	9	9	4	12	6'-10	4	6	20	4	12	11	4	13	6	4	12	13	4	13	6	7	6	13'-2	7	9	6'-11	2'-10	4'-1	7	13'-2	8	6	13'-8	7	9	8'-4	2'-10	5'-6	7	13'-8	0.470	0.577	0.257	1.304	264.79
16-20	12	5	12.5	15	9	6	4	6	7'-2	4	6	20	4	12	11	4	11	6	4	12	13	4	11	6	8	6	13'-2	5	6	5'-11	2'-5	3'-6	5	13'-2	8	6	13'-8	5	6	8'-1	2'-5	5'-8	5	13'-8	0.553	0.685	0.257	1.495	262.05
21-25	12	5	14.5	17	10	9	6	9	7'-6	4	6	20	4	12	11	4	11	6	4	12	13	4	11	6	8	6	13'-4	5	6	6'-3	2'-7	3'-8	5	13'-4	8	6	13'-10	5	6	8'-5	2'-7	5'-10	5	13'-10	0.647	0.782	0.285	1.714	277.79
26-30	12	5	16.5	18.5	10.5	6	4	6	7'-10	4	6	20	4	12	11	4	11	6	4	12	13	4	11	6	9	6	13'-5	5	6	6'-5	2'-8	3'-9	5	13'-5	9	6	13'-11	5	6	8'-8	2'-8	6'-0	5	13'-11	0.736	0.852	0.301	1.889	311.55
31-35	12	5	18	20.5	11.5	9	4	12	8'-1	4	6	20	4	12	11	4	14	6	4	12	13	4	12	6	9	6	13'-7	6	6	7'-6	3'-2	4'-4	6	13'-7	9	6	14'-1	6	6	9'-0	2'-10	6'-2	6	14'-1	0.812	0.952	0.329	2.093	341.39
36-40	12	5	19.5	22	12	9	6	9	8'-4	4	6	20	4	12	11	4	12	6	5	12	13	4	13	6	9	6	13'-8	5	6	7'-0	2'-11	4'-1	5	13'-8	9	6	14'-2	5	6	9'-3	3'-0	6'-3	5	14'-2	0.883	1.026	0.344	2.253	337.53
41-45	12	5	21	23.5	12.5	9	6	9	8'-7	4	6	20	4	12	11	4	13	6	5	12	13	4	13	6	9	6	13'-9	5	6	7'-3	3'-1	4'-2	5	13'-9	9	6	14'-3	5	6	9'-6	3'-1	6'-5	5	14'-3	0.954	1.100	0.358	2.412	341.82
46-50	12	5	22.5	25	13.5	9	6	9	8'-10	4	6	20	5	12	11	4	13	6	5	12	13	4	14	6	9	6	13'-11	5	6	7'-7	3'-3	4'-4	5	13'-11	9	6	14'-5	5	6	9'-10	3'-4	6'-6	5	14'-5	1.034	1.182	0.386	2.602	351.95
51-55	12	5	24	26	14	9	6	9	9'-1	4	6	20	5	12	11	4	14	6	5	12	13	4	14	6	10	6	14'-0	5	6	7'-9	3'-4	4'-5	5	14'-0	10	6	14'-6	5	6	10'-0	3'-5	6'-7	5	14'-6	1.107	1.236	0.400	2.743	407.71

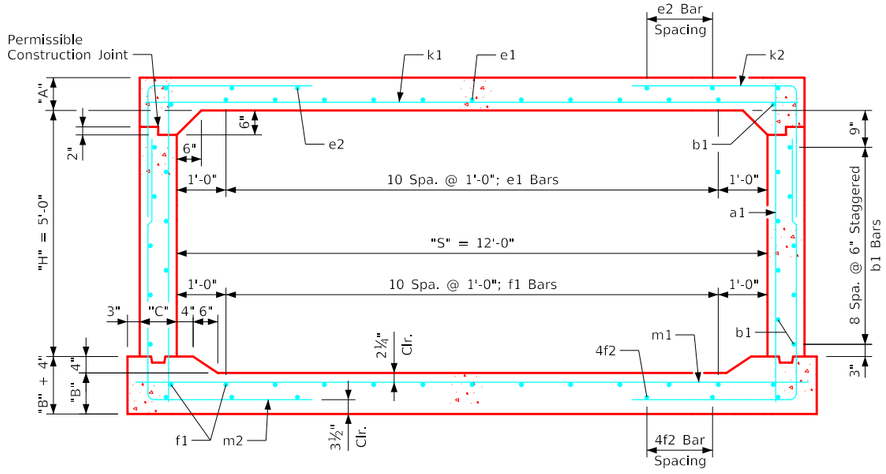
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 5' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 5' Barrel Sections

RCB 12-5-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-5-20 - THIS SHEET ISSUED 07-2020.

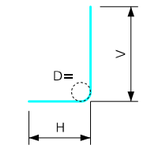
6/30/2020 9:32:28 AM bkloss W:\Highway\Bridge\Standards\Culverts\LRFD\EnglishLRFDSignedSingleCulverts.dgn RCB 12-5-20 11x17_pdf.pltcfg

Variable Dimensions and Quantities for 12' x 6' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2						m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	6	13.5	13	9	9	4	12	8'-1	4	6	24	5	12	11	5	18	6	4	12	13	4	13	8	8	12	13'-2	5	6	7'-2	3'-7	3'-7	5	13'-2	7	9	13'-8	5	6	10'-5	3'-11	6'-6	5	13'-8	0.595	0.598	0.313	1.506	211.13
1	12	6	12.5	13	9	9	4	12	8'-0	4	6	24	5	12	11	4	18	6	4	12	13	4	17	6	7	9	13'-2	5	6	7'-2	3'-7	3'-7	5	13'-2	7	9	13'-8	5	6	10'-0	3'-6	6'-6	5	13'-8	0.553	0.598	0.313	1.464	205.32
2	12	6	8.5	10.5	9	6	4	6	7'-6	4	6	24	5	12	11	4	17	6	4	12	13	4	17	6	8	9	13'-2	5	6	7'-0	3'-6	3'-6	5	13'-2	6	6	13'-8	5	6	9'-10	3'-6	6'-4	5	13'-8	0.387	0.490	0.313	1.190	227.11
3-7	12	6	8.5	10.5	9	6	4	6	7'-6	4	6	24	4	12	11	4	17	6	4	12	13	4	17	6	8	9	13'-2	5	6	6'-10	3'-5	3'-5	5	13'-2	7	6	13'-8	5	6	9'-9	3'-5	6'-4	5	13'-8	0.387	0.490	0.313	1.190	237.00
8-9	12	6	8.5	10.5	9	9	4	12	7'-6	4	6	24	4	12	11	4	16	6	4	12	13	4	16	6	7	6	13'-2	7	9	7'-3	3'-4	3'-11	7	13'-2	7	6	13'-8	7	9	9'-8	3'-4	6'-4	7	13'-8	0.387	0.490	0.313	1.190	260.50
10	12	6	9	11	9	6	4	6	7'-7	4	6	24	4	12	11	4	15	6	4	12	13	4	15	6	7	6	13'-2	5	6	6'-4	3'-2	3'-2	5	13'-2	7	6	13'-8	6	6	9'-5	3'-1	6'-4	6	13'-8	0.407	0.512	0.313	1.232	257.00
11-15	12	6	10.5	12.5	9	9	4	12	7'-10	4	6	24	4	12	11	4	13	6	4	12	13	4	13	6	8	6	13'-2	7	9	6'-11	2'-10	4'-1	7	13'-2	8	6	13'-8	7	9	9'-4	2'-10	6'-6	7	13'-8	0.470	0.577	0.313	1.360	291.21
16-20	12	6	12.5	15	9	6	4	6	8'-2	4	6	24	4	12	11	4	11	6	4	12	13	4	11	6	8	6	13'-2	5	6	5'-11	2'-5	3'-6	5	13'-2	8	6	13'-8	5	6	9'-1	2'-5	6'-8	5	13'-8	0.553	0.685	0.313	1.551	271.61
21-25	12	6	14.5	17	9.5	9	6	12	8'-6	4	6	24	4	12	11	4	11	6	4	12	13	4	11	6	9	6	13'-3	6	9	6'-7	2'-6	4'-1	6	13'-3	9	6	13'-9	6	9	9'-5	2'-7	6'-10	6	13'-9	0.642	0.777	0.330	1.749	321.13
26-30	12	6	16.5	18.5	10.5	6	4	6	8'-10	4	6	24	4	12	11	4	11	6	4	12	13	4	12	6	9	6	13'-5	5	6	6'-5	2'-8	3'-9	5	13'-5	9	6	13'-11	5	6	9'-9	2'-9	7'-0	5	13'-11	0.736	0.852	0.366	1.954	321.47
31-35	12	6	18	20.5	11	6	4	6	9'-1	4	6	24	4	12	11	4	12	6	4	12	13	4	12	6	9	6	13'-6	5	6	6'-9	2'-10	3'-11	5	13'-6	9	6	14'-0	5	6	10'-0	2'-10	7'-2	5	14'-0	0.806	0.946	0.383	2.135	325.74
36-40	12	6	19.5	22	12	9	6	9	9'-4	4	6	24	4	12	11	4	14	6	5	12	13	4	13	6	9	6	13'-8	6	9	7'-9	3'-3	4'-6	6	13'-8	9	6	14'-2	6	9	10'-3	3'-0	7'-3	6	14'-2	0.883	1.026	0.418	2.327	351.61
41-45	12	6	21	23.5	12.5	9	6	12	9'-7	4	6	24	4	12	11	4	13	6	5	12	13	4	13	6	9	6	13'-9	5	6	7'-3	3'-1	4'-2	5	13'-9	9	6	14'-3	5	6	10'-7	3'-2	7'-5	5	14'-3	0.954	1.100	0.435	2.489	344.00
46-50	12	6	22.5	25	13	9	6	9	9'-10	4	6	24	5	12	11	4	14	6	5	12	13	4	14	6	10	6	13'-10	6	9	8'-1	3'-4	4'-9	6	13'-10	10	6	14'-4	6	9	10'-10	3'-4	7'-6	6	14'-4	1.026	1.175	0.452	2.653	415.39
51-55	12	6	24	26.5	13.5	9	6	12	10'-1	4	6	24	5	12	11	4	14	6	5	12	13	4	14	6	10	6	13'-11	5	6	7'-10	3'-5	4'-5	5	13'-11	10	6	14'-5	5	6	11'-1	3'-5	7'-8	5	14'-5	1.100	1.251	0.469	2.820	408.29

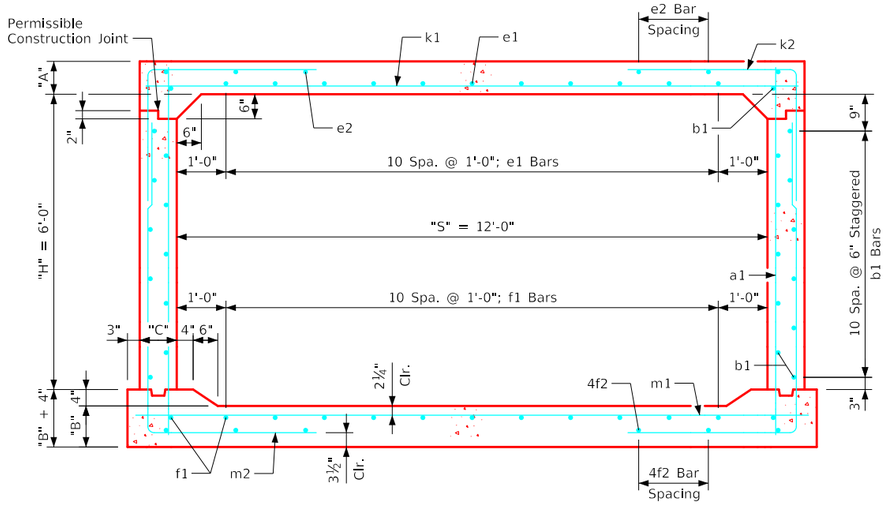
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 6' Barrel Sections

RCB 12-6-20

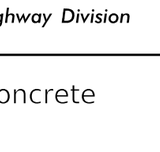
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 12' x 7' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	7	13.5	13	9	9	4	12	9'-1	4	6	28	5	12	11	4	14	8	4	12	13	4	14	8	7	9	13'-2	6	12	8'-6	4'-3	4'-3	6	13'-2	7	9	13'-8	7	12	11'-8	4'-2	7'-6	7	13'-8	0.595	0.598	0.368	1.561	219.58
1	12	7	12.5	13	9	9	4	12	9'-0	4	6	28	5	12	11	4	15	8	4	12	13	4	13	8	7	9	13'-2	5	6	7'-10	4'-4	3'-6	5	13'-2	7	9	13'-8	5	6	11'-4	3'-10	7'-6	5	13'-8	0.553	0.598	0.368	1.519	220.42
2-3	12	7	8.5	10.5	9	6	4	6	8'-6	4	6	28	5	12	11	4	18	6	4	12	13	4	18	6	8	9	13'-2	5	6	6'-8	3'-7	3'-1	5	13'-2	7	6	13'-8	5	6	10'-11	3'-7	7'-4	5	13'-8	0.387	0.490	0.368	1.245	250.61
4-6	12	7	8.5	10.5	9	9	5	9	8'-6	4	6	28	4	12	11	4	17	6	4	12	13	4	17	6	8	9	13'-2	5	6	6'-10	3'-5	3'-5	5	13'-2	7	6	13'-8	5	6	10'-9	3'-5	7'-4	5	13'-8	0.387	0.490	0.368	1.245	247.63
7-8	12	7	8.5	10.5	9	9	5	12	8'-6	4	6	28	4	12	11	4	16	6	4	12	13	4	16	6	7	6	13'-2	5	6	6'-6	3'-3	3'-3	5	13'-2	7	6	13'-8	6	6	10'-7	3'-3	7'-4	6	13'-8	0.387	0.490	0.368	1.245	265.42
9-10	12	7	9	11.5	9	9	4	12	8'-7	4	6	28	4	12	11	4	16	6	4	12	13	4	15	6	7	6	13'-2	7	9	7'-2	3'-3	3'-11	7	13'-2	7	6	13'-8	7	9	10'-7	3'-2	7'-5	7	13'-8	0.407	0.534	0.368	1.309	269.39
11-15	12	7	10.5	12.5	9	9	4	12	8'-10	4	6	28	4	12	11	4	14	6	4	12	13	4	14	6	8	6	13'-2	7	9	7'-0	2'-11	4'-1	7	13'-2	8	6	13'-8	7	9	10'-5	2'-11	7'-6	7	13'-8	0.470	0.577	0.368	1.415	301.89
16-20	12	7	12.5	15	9	6	4	6	9'-2	4	6	28	4	12	11	4	11	6	4	12	13	4	12	6	8	6	13'-2	5	6	6'-0	2'-6	3'-6	5	13'-2	8	6	13'-8	5	6	10'-3	2'-7	7'-8	5	13'-8	0.553	0.685	0.368	1.606	282.24
21-25	12	7	14.5	17	9.5	9	6	12	9'-6	4	6	28	4	12	11	4	11	6	4	12	13	4	11	6	9	6	13'-3	6	9	6'-8	2'-7	4'-1	6	13'-3	9	6	13'-9	6	9	10'-5	2'-7	7'-10	6	13'-9	0.642	0.777	0.389	1.808	331.39
26-30	12	7	16.5	19	10.5	6	4	6	9'-10	4	6	28	4	12	11	4	12	6	4	12	13	4	12	6	9	6	13'-5	5	6	6'-7	2'-9	3'-10	5	13'-5	9	6	13'-11	5	6	10'-10	2'-10	8'-0	5	13'-11	0.736	0.874	0.431	2.041	332.05
34-35	12	7	18	20.5	11	9	5	9	10'-1	4	6	28	4	12	11	4	13	6	4	12	13	4	13	6	9	6	13'-6	5	6	6'-10	2'-11	3'-11	5	13'-6	9	6	14'-0	5	6	11'-1	2'-11	8'-2	5	14'-0	0.806	0.946	0.451	2.203	337.32
36-40	12	7	19.5	22	11.5	9	6	9	10'-4	4	6	28	4	12	11	4	14	6	5	12	13	4	13	6	9	6	13'-7	6	9	7'-8	3'-2	4'-6	6	13'-7	9	6	14'-1	6	9	11'-4	3'-1	8'-3	6	14'-1	0.876	1.019	0.471	2.366	361.29
41-45	12	7	21	23.5	12.5	9	6	9	10'-7	4	6	28	4	12	11	4	13	6	5	12	13	4	14	6	9	6	13'-9	5	6	7'-4	3'-2	4'-2	5	13'-9	9	6	14'-3	5	6	11'-8	3'-3	8'-5	5	14'-3	0.954	1.100	0.512	2.566	364.68
46-50	12	7	22.5	25	13	9	6	9	10'-10	4	6	28	5	12	11	4	14	6	5	12	13	4	15	6	10	6	13'-10	6	9	8'-1	3'-4	4'-9	6	13'-10	10	6	14'-4	6	9	11'-11	3'-5	8'-6	6	14'-4	1.026	1.175	0.532	2.733	426.61
51-55	12	7	24	26.5	13.5	9	6	9	11'-1	4	6	28	5	12	11	4	15	6	5	12	13	4	15	6	10	6	13'-11	5	6	7'-11	3'-6	4'-5	5	13'-11	10	6	14'-5	5	6	12'-2	3'-6	8'-8	5	14'-5	1.100	1.251	0.553	2.904	429.50

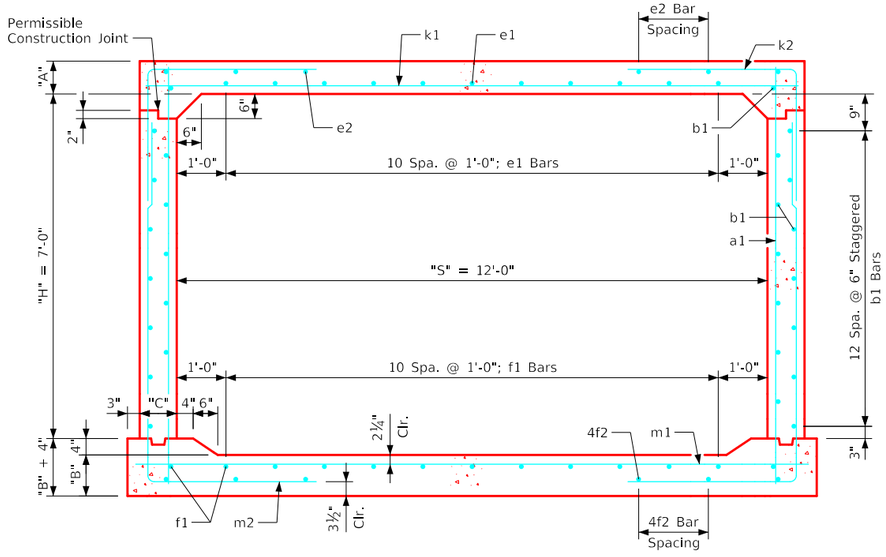
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 7' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 7' Barrel Sections

RCB 12-7-20

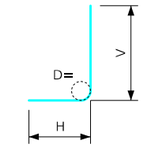
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 12' x 8' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	8	13.5	13.5	9	9	4	12	10'-2	4	6	32	5	12	11	4	15	10	4	12	13	4	15	8	7	9	13'-2	6	12	9'-6	5'-7	3'-11	6	13'-2	7	9	13'-8	7	12	13'-0	4'-5	8'-7	7	13'-8	0.595	0.620	0.424	1.639	234.18
1	12	8	12.5	13	9	9	4	12	10'-0	4	6	32	5	12	11	4	15	10	4	12	13	4	15	8	7	9	13'-2	5	6	9'-3	5'-9	3'-6	5	13'-2	7	9	13'-8	5	6	12'-11	4'-5	8'-6	5	13'-8	0.553	0.598	0.424	1.575	238.47
2	12	8	8.5	10.5	9	6	4	6	9'-6	4	6	32	6	12	11	4	14	8	4	12	13	4	13	8	7	6	13'-2	5	6	7'-2	4'-1	3'-1	5	13'-2	7	6	13'-8	5	6	12'-3	3'-11	8'-4	5	13'-8	0.387	0.490	0.424	1.301	276.82
3-6	12	8	8.5	10.5	9	9	5	12	9'-6	4	6	32	4	12	11	4	12	8	4	12	13	4	12	8	8	9	13'-2	5	6	6'-9	3'-8	3'-1	5	13'-2	7	6	13'-8	5	6	12'-0	3'-8	8'-4	5	13'-8	0.387	0.490	0.424	1.301	254.34
7-9	12	8	8.5	11	9	6	4	6	9'-6	4	6	32	4	12	11	4	18	6	4	12	13	4	16	6	7	6	13'-2	6	6	7'-2	3'-7	3'-7	6	13'-2	7	6	13'-8	5	6	11'-7	3'-3	8'-4	5	13'-8	0.387	0.512	0.424	1.323	275.97
10	12	8	9	12	9	6	4	6	9'-8	4	6	32	4	12	11	4	15	6	4	12	13	4	14	6	7	6	13'-2	5	6	6'-4	3'-2	3'-2	5	13'-2	7	6	13'-8	5	6	11'-5	3'-0	8'-5	5	13'-8	0.407	0.555	0.424	1.386	258.50
11-15	12	8	10.5	13	9	9	4	12	9'-10	4	6	32	4	12	11	4	15	6	4	12	13	4	14	6	8	6	13'-2	7	9	7'-2	3'-1	4'-1	7	13'-2	8	6	13'-8	7	9	11'-6	3'-0	8'-6	7	13'-8	0.470	0.598	0.424	1.492	313.03
16-20	12	8	12.5	15	9	6	4	6	10'-2	4	6	32	4	12	11	4	12	6	4	12	13	4	13	6	8	6	13'-2	5	6	6'-2	2'-8	3'-6	5	13'-2	8	6	13'-8	5	6	11'-5	2'-9	8'-8	5	13'-8	0.553	0.685	0.424	1.662	293.18
21-25	12	8	14.5	17	9.5	9	4	12	10'-6	4	6	32	4	12	11	4	12	6	4	12	13	4	12	6	9	6	13'-3	7	9	7'-2	2'-9	4'-5	7	13'-3	9	6	13'-9	7	9	11'-7	2'-9	8'-10	7	13'-9	0.642	0.777	0.447	1.866	355.26
26-30	12	8	16.5	19	10.5	9	6	9	10'-10	4	6	32	4	12	11	4	14	6	4	12	13	4	13	6	9	6	13'-5	6	9	7'-4	3'-1	4'-3	6	13'-5	9	6	13'-11	6	9	12'-0	3'-0	9'-0	6	13'-11	0.736	0.874	0.496	2.106	360.18
31-35	12	8	18	20.5	12	9	4	9	11'-1	4	6	32	4	12	11	4	16	6	4	12	13	4	14	6	9	6	13'-8	7	9	8'-3	3'-7	4'-8	7	13'-8	9	6	14'-2	7	9	12'-4	3'-2	9'-2	7	14'-2	0.818	0.959	0.566	2.343	377.00
36-40	12	8	19.5	22	12.5	9	6	9	11'-4	4	6	32	4	12	11	4	14	6	5	12	13	4	14	6	9	6	13'-9	5	6	7'-4	3'-3	4'-1	5	13'-9	9	6	14'-3	5	6	12'-7	3'-4	9'-3	5	14'-3	0.889	1.032	0.589	2.510	374.21
41-45	12	8	21	23.5	13	9	5	12	11'-7	4	6	32	4	12	11	4	16	6	5	12	13	4	15	6	9	6	13'-10	7	9	8'-7	3'-8	4'-11	7	13'-10	9	6	14'-4	7	9	12'-10	3'-5	9'-5	7	14'-4	0.961	1.107	0.613	2.681	393.89
46-50	12	8	22.5	25	14	9	6	9	11'-10	4	6	32	5	12	11	4	15	6	5	12	13	4	16	6	10	6	14'-0	5	6	7'-11	3'-7	4'-4	5	14'-0	10	6	14'-6	5	6	13'-2	3'-8	9'-6	5	14'-6	1.041	1.190	0.659	2.890	440.84
51-55	12	8	24	26.5	14.5	9	4	9	12'-1	4	6	32	5	12	11	4	15	6	5	12	13	4	16	6	10	6	14'-1	6	6	8'-6	3'-8	4'-10	6	14'-1	10	6	14'-7	6	6	13'-5	3'-9	9'-8	6	14'-7	1.114	1.266	0.683	3.063	461.21

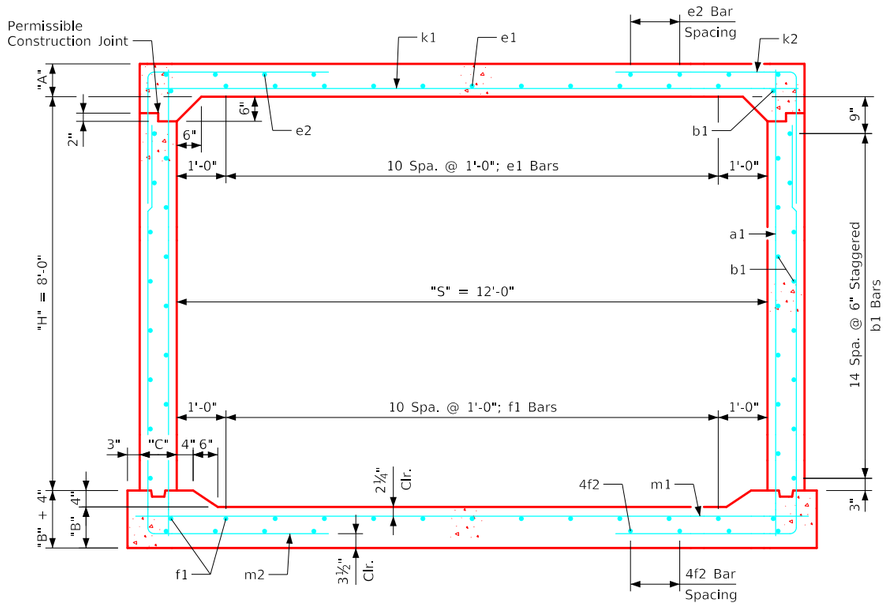
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 8' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 8' Barrel Sections

RCB 12-8-20

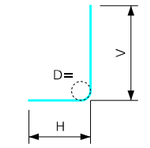
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-8-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 12' x 9' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	9	13.5	13.5	9	9	4	12	11'-2	4	6	36	5	12	11	4	16	10	4	12	13	4	14	10	7	9	13'-2	5	6	11'-1	7'-7	3'-6	--	--	7	9	13'-8	5	6	14'-10	5'-3	9'-7	5	13'-8	0.595	0.620	0.479	1.694	259.21
1	12	9	12.5	13	9	6	4	6	11'-0	4	6	36	5	12	11	4	16	10	4	12	13	4	14	10	7	9	13'-2	4	6	10'-6	7'-5	3'-1	--	--	7	9	13'-8	5	6	14'-11	5'-5	9'-6	5	13'-8	0.553	0.598	0.479	1.630	255.21
2	12	9	8.5	10.5	9	6	4	6	10'-6	4	6	36	6	12	11	4	16	8	4	12	13	4	15	8	7	6	13'-2	5	6	7'-10	4'-9	3'-1	5	13'-2	7	6	13'-8	5	6	13'-8	4'-4	9'-4	5	13'-8	0.387	0.490	0.479	1.356	290.92
3-5	12	9	8.5	10.5	9	9	5	12	10'-6	4	6	36	4	12	11	4	14	8	4	12	13	4	14	8	8	9	13'-2	5	6	7'-3	4'-2	3'-1	5	13'-2	7	6	13'-8	5	6	13'-5	4'-1	9'-4	5	13'-8	0.387	0.490	0.479	1.356	267.26
6-7	12	9	8.5	10.5	9	9	4	12	10'-6	4	6	36	4	12	11	4	13	8	4	12	13	4	12	8	7	6	13'-2	7	9	7'-10	3'-11	3'-11	7	13'-2	7	6	13'-8	7	9	13'-0	3'-8	9'-4	7	13'-8	0.387	0.490	0.479	1.356	297.53
8-10	12	9	9	12.5	9	9	4	12	10'-8	4	6	36	4	12	11	4	13	8	4	12	13	4	17	6	7	6	13'-2	7	9	7'-10	3'-11	3'-11	7	13'-2	7	6	13'-8	7	9	12'-11	3'-5	9'-6	7	13'-8	0.407	0.577	0.479	1.463	295.97
11-15	12	9	10.5	13	9	9	4	12	10'-10	4	6	36	4	12	11	4	16	6	4	12	13	4	16	6	8	6	13'-2	7	9	7'-4	3'-3	4'-1	7	13'-2	8	6	13'-8	7	9	12'-9	3'-3	9'-6	7	13'-8	0.470	0.598	0.479	1.547	325.11
16-20	12	9	12.5	15	9.5	9	4	12	11'-2	4	6	36	4	12	11	4	13	6	4	12	13	4	14	6	8	6	13'-3	7	9	7'-2	2'-11	4'-3	7	13'-3	8	6	13'-9	7	9	12'-8	3'-0	9'-8	7	13'-9	0.558	0.690	0.506	1.754	325.05
21-25	12	9	14.5	17	10.5	9	6	9	11'-6	4	6	36	4	12	11	4	14	6	4	12	13	4	14	6	8	6	13'-5	7	9	7'-6	3'-1	4'-5	7	13'-5	9	6	13'-11	6	9	13'-0	3'-2	9'-10	6	13'-11	0.652	0.786	0.560	1.998	362.29
26-30	12	9	16.5	19	12	9	5	12	11'-10	4	6	36	4	12	11	4	16	6	4	12	13	4	15	6	9	6	13'-8	7	9	8'-2	3'-7	4'-7	7	13'-8	9	6	14'-2	7	9	13'-4	3'-4	10'-0	7	14'-2	0.753	0.892	0.640	2.285	390.37
31-35	12	9	18	20.5	13	9	4	9	12'-1	4	6	36	4	12	11	4	15	6	4	12	13	4	15	6	9	6	13'-10	6	6	7'-9	3'-5	4'-4	6	13'-10	9	6	14'-4	6	6	13'-8	3'-6	10'-2	6	14'-4	0.830	0.971	0.693	2.494	396.00
36-40	12	9	19.5	22	14	9	4	9	12'-4	4	6	36	4	12	11	4	15	6	5	12	13	4	16	6	9	6	14'-0	6	6	8'-1	3'-7	4'-6	6	14'-0	9	6	14'-6	6	6	13'-11	3'-8	10'-3	6	14'-6	0.908	1.053	0.746	2.707	407.16
41-45	12	9	21	23.5	14.5	9	5	12	12'-7	4	6	36	4	12	11	4	16	6	5	12	13	4	16	6	9	6	14'-1	6	6	8'-4	3'-9	4'-7	6	14'-1	9	6	14'-7	6	6	14'-3	3'-10	10'-5	6	14'-7	0.981	1.128	0.772	2.881	416.71
46-50	12	9	22.5	25	15.5	9	6	12	12'-10	4	6	36	5	12	11	4	16	6	5	12	13	4	17	6	9	6	14'-3	7	9	9'-0	3'-11	5'-1	7	14'-3	9	6	14'-9	7	9	14'-6	4'-0	10'-6	7	14'-9	1.062	1.212	0.825	3.099	433.11
51-55	12	9	24	26.5	16.5	6	4	6	13'-1	4	6	36	5	12	11	4	17	6	5	12	13	4	17	6	10	6	14'-5	6	6	8'-11	4'-1	4'-10	6	14'-5	10	6	14'-11	6	6	14'-10	4'-2	10'-8	6	14'-11	1.144	1.298	0.878	3.320	494.18

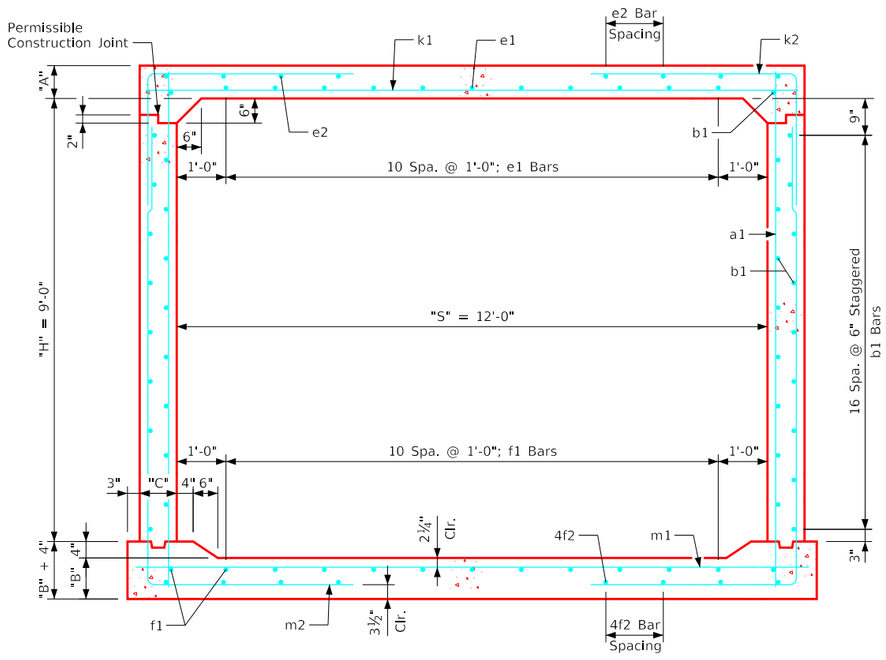
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 9' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 9' Barrel Sections

RCB 12-9-20

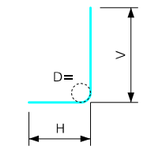
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-9-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 12' x 10' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	10	13.5	13.5	10	9	4	12	12'-2	4	6	40	5	12	11	4	16	10	4	12	13	4	16	10	7	9	13'-4	5	6	11'-2	7'-8	3'-6	--	--	7	9	13'-10	5	6	16'-7	6'-0	10'-7	5	13'-10	0.604	0.629	0.594	1.827	271.92
1	12	10	12.5	13.5	10	9	4	12	12'-1	4	6	40	5	12	11	4	16	10	4	12	13	4	16	10	7	9	13'-4	5	6	11'-1	7'-8	3'-5	--	--	7	9	13'-10	5	6	17'-6	6'-11	10'-7	--	--	0.562	0.629	0.594	1.785	274.55
2	12	10	8.5	10.5	10	9	4	12	11'-6	4	6	40	6	12	11	4	14	10	4	12	13	4	16	8	7	6	13'-4	7	9	9'-5	5'-6	3'-11	7	13'-4	7	6	13'-10	7	9	15'-2	4'-10	10'-4	7	13'-10	0.394	0.498	0.594	1.486	334.76
3	12	10	8.5	10.5	10	9	5	12	11'-6	4	6	40	4	12	11	4	15	8	4	12	13	4	14	8	8	9	13'-4	5	6	7'-8	4'-7	3'-1	5	13'-4	7	6	13'-10	5	6	14'-8	4'-4	10'-4	5	13'-10	0.394	0.498	0.594	1.486	280.42
4-7	12	10	8.5	10.5	10	9	4	12	11'-6	4	6	40	4	12	11	4	15	8	4	12	13	4	14	8	7	6	13'-4	7	9	8'-4	4'-5	3'-11	7	13'-4	7	6	13'-10	7	9	14'-7	4'-3	10'-4	7	13'-10	0.394	0.498	0.594	1.486	314.87
8-10	12	10	9	12	10	9	4	12	11'-8	4	6	40	4	12	11	4	13	8	4	12	13	4	12	8	7	6	13'-4	7	9	8'-0	4'-0	4'-0	7	13'-4	7	6	13'-10	7	9	14'-2	3'-9	10'-5	7	13'-10	0.415	0.563	0.594	1.572	310.79
11-15	12	10	10.5	13	10	9	6	9	11'-10	4	6	40	4	12	11	4	12	8	4	12	13	4	17	6	8	6	13'-4	6	6	7'-6	3'-9	3'-9	6	13'-4	8	6	13'-10	5	6	14'-0	3'-6	10'-6	5	13'-10	0.478	0.607	0.594	1.679	352.97
16-20	12	10	12.5	15	11	9	5	12	12'-2	4	6	40	4	12	11	4	15	6	4	12	13	4	15	6	8	6	13'-6	7	9	7'-7	3'-4	4'-3	7	13'-6	8	6	14'-0	7	9	14'-0	3'-4	10'-8	7	14'-0	0.571	0.703	0.655	1.929	351.13
21-25	12	10	14.5	17	12	9	4	12	12'-6	4	6	40	4	12	11	4	15	6	4	12	13	4	16	6	8	6	13'-8	6	6	7'-6	3'-5	4'-1	6	13'-8	8	6	14'-2	6	6	14'-4	3'-6	10'-10	6	14'-2	0.667	0.802	0.714	2.183	353.16
26-30	12	10	16.5	19	13.5	9	4	9	12'-10	4	6	40	4	12	11	4	16	6	4	12	13	4	16	6	8	6	13'-11	6	6	7'-11	3'-8	4'-3	6	13'-11	9	6	14'-5	6	6	14'-9	3'-9	11'-0	6	14'-5	0.770	0.909	0.803	2.482	388.13
31-35	12	10	18	20.5	14.5	6	4	6	13'-1	4	6	40	4	12	11	4	16	6	4	12	13	4	17	6	9	6	14'-1	6	6	8'-2	3'-10	4'-4	6	14'-1	9	6	14'-7	6	6	15'-1	3'-11	11'-2	6	14'-7	0.847	0.990	0.862	2.699	426.55
36-40	12	10	19.5	22.5	15.5	9	6	9	13'-5	4	6	40	4	12	11	4	17	6	5	12	13	4	17	6	9	6	14'-3	7	9	8'-10	4'-0	4'-10	7	14'-3	9	6	14'-9	7	9	15'-5	4'-1	11'-4	7	14'-9	0.927	1.096	0.921	2.944	450.42
41-45	12	10	21	24	16.5	9	4	12	13'-8	4	6	40	4	12	11	4	12	8	5	12	13	4	12	8	9	6	14'-5	8	9	9'-8	4'-4	5'-4	8	14'-5	9	6	14'-11	8	9	15'-8	4'-3	11'-5	8	14'-11	1.008	1.180	0.980	3.168	471.42
46-50	12	10	22.5	25.5	17.5	6	5	6	13'-11	4	6	40	5	12	11	4	12	8	5	12	13	4	12	8	9	6	14'-7	8	12	9'-10	4'-5	5'-5	8	14'-7	9	6	15'-1	8	12	16'-0	4'-5	11'-7	8	15'-1	1.090	1.266	1.039	3.395	477.34
51-55	12	10	24	26.5	18	9	6	9	14'-1	4	6	40	5	12	11	4	12	8	5	12	13	4	12	8	9	6	14'-8	7	9	9'-7	4'-5	5'-2	7	14'-8	10	6	15'-2	7	9	16'-2	4'-6	11'-8	7	15'-2	1.167	1.321	1.069	3.557	501.97

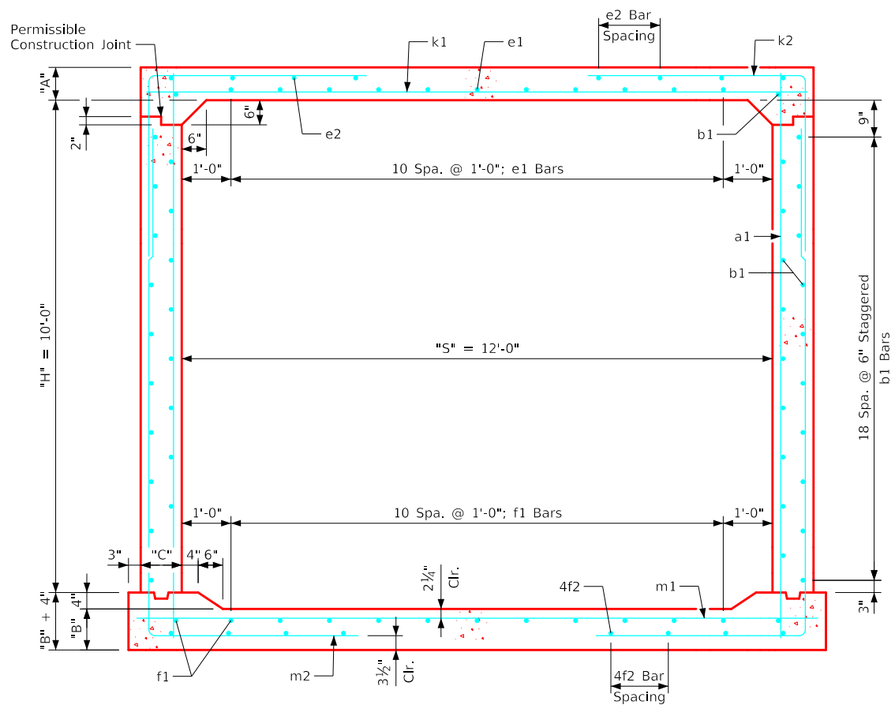
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 10' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 10' Barrel Sections

RCB 12-10-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-10-20 - THIS SHEET ISSUED 07-2020.

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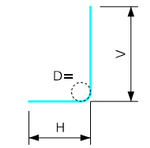
Variable Dimensions and Quantities for 12' x 11' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	11	13.5	13.5	11	9	4	9	13'-2	4	6	44	5	12	11	4	16	10	4	12	13	4	16	10	7	9	13'-6	6	9	11'-11	8'-0	3'-11	--	--	7	9	14'-0	6	9	18'-9	7'-2	11'-7	--	--	0.614	0.636	0.723	1.973	292.84
1	12	11	12.5	13.5	11	9	4	9	13'-1	4	6	44	5	12	11	4	16	10	4	12	13	4	16	10	7	9	13'-6	6	9	11'-10	8'-0	3'-10	--	--	7	9	14'-0	6	9	19'-7	8'-0	11'-7	--	--	0.571	0.636	0.723	1.930	295.84
2	12	11	8.5	10.5	11	9	4	12	12'-6	4	6	44	5	12	11	4	16	10	4	12	13	4	17	8	8	9	13'-6	7	9	10'-1	6'-2	3'-11	7	13'-6	7	6	14'-0	7	9	16'-5	5'-1	11'-4	7	14'-0	0.400	0.504	0.723	1.627	340.45
3	12	11	8	10.5	11	9	4	12	12'-5	4	6	44	4	12	11	4	17	8	4	12	13	4	16	8	8	9	13'-6	7	9	8'-10	5'-0	3'-10	7	13'-6	6	6	14'-0	7	9	16'-1	4'-9	11'-4	7	14'-0	0.379	0.504	0.723	1.606	310.53
4-8	12	11	8.5	10.5	11	9	4	12	12'-6	4	6	44	4	12	11	4	15	8	4	12	13	4	14	8	7	6	13'-6	6	6	8'-1	4'-7	3'-6	6	13'-6	7	6	14'-0	6	6	15'-9	4'-5	11'-4	6	14'-0	0.400	0.504	0.723	1.627	333.89
9-10	12	11	9	11.5	11	9	4	12	12'-7	4	6	44	4	12	11	4	12	8	4	12	13	4	12	8	7	6	13'-6	6	6	7'-10	3'-11	3'-11	6	13'-6	7	6	14'-0	6	6	15'-4	3'-11	11'-5	6	14'-0	0.422	0.548	0.723	1.693	329.97
11-15	12	11	10.5	13	11	9	4	9	12'-10	4	6	44	4	12	11	4	13	8	4	12	13	4	12	8	7	6	13'-6	7	9	8'-2	4'-1	4'-1	7	13'-6	8	6	14'-0	7	9	15'-5	3'-11	11'-6	7	14'-0	0.486	0.614	0.723	1.823	347.66
16-20	12	11	12.5	15	12	9	4	12	13'-2	4	6	44	4	12	11	4	12	8	4	12	13	4	17	6	8	6	13'-8	6	6	7'-10	3'-11	3'-11	6	13'-8	8	6	14'-2	6	6	15'-4	3'-8	11'-8	6	14'-2	0.580	0.713	0.788	2.081	366.18
21-25	12	11	14.5	17.5	13.5	9	5	12	13'-7	4	6	44	4	12	11	4	12	8	4	12	13	4	17	6	8	6	13'-11	6	6	8'-0	4'-0	4'-0	6	13'-11	8	6	14'-5	6	6	15'-10	3'-11	11'-11	6	14'-5	0.682	0.841	0.886	2.409	383.95
26-30	12	11	16.5	19	14.5	9	6	9	13'-10	4	6	44	4	12	11	4	17	6	4	12	13	4	17	6	8	6	14'-1	7	9	8'-6	3'-11	4'-7	7	14'-1	8	6	14'-7	7	9	16'-0	4'-0	12'-0	7	14'-7	0.781	0.921	0.951	2.653	406.63
31-35	12	11	18	21	16	6	5	6	14'-2	4	6	44	4	12	11	4	18	6	4	12	13	4	12	8	9	6	14'-4	7	9	8'-11	4'-2	4'-9	7	14'-4	9	6	14'-10	7	9	16'-5	4'-3	12'-2	7	14'-10	0.865	1.032	1.049	2.946	461.92
36-40	12	11	19.5	22.5	17	9	4	9	14'-5	4	6	44	4	12	11	4	12	8	5	12	13	4	12	8	9	6	14'-6	8	9	9'-7	4'-5	5'-2	8	14'-6	9	6	15'-0	8	9	16'-9	4'-5	12'-4	8	15'-0	0.946	1.116	1.115	3.177	489.79
41-45	12	11	21	24	18	9	8	12	14'-8	4	6	44	4	12	11	4	12	8	5	12	13	4	13	8	9	6	14'-8	8	12	9'-10	4'-6	5'-4	8	14'-8	9	6	15'-2	8	12	17'-0	4'-7	12'-5	8	15'-2	1.028	1.202	1.180	3.410	505.16
46-50	12	11	22.5	25.5	19	9	6	9	14'-11	4	6	44	5	12	11	4	13	8	5	12	13	4	13	8	9	6	14'-10	6	6	9'-4	4'-8	4'-8	6	14'-10	9	6	15'-4	6	6	17'-4	4'-9	12'-7	6	15'-4	1.111	1.289	1.245	3.645	497.18
51-55	12	11	24	26.5	20	9	8	12	15'-1	4	6	44	5	12	11	4	13	8	5	12	13	4	13	8	9	6	15'-0	8	12	10'-4	4'-9	5'-7	8	15'-0	9	6	15'-6	8	12	17'-6	4'-10	12'-8	8	15'-6	1.197	1.353	1.311	3.861	521.95

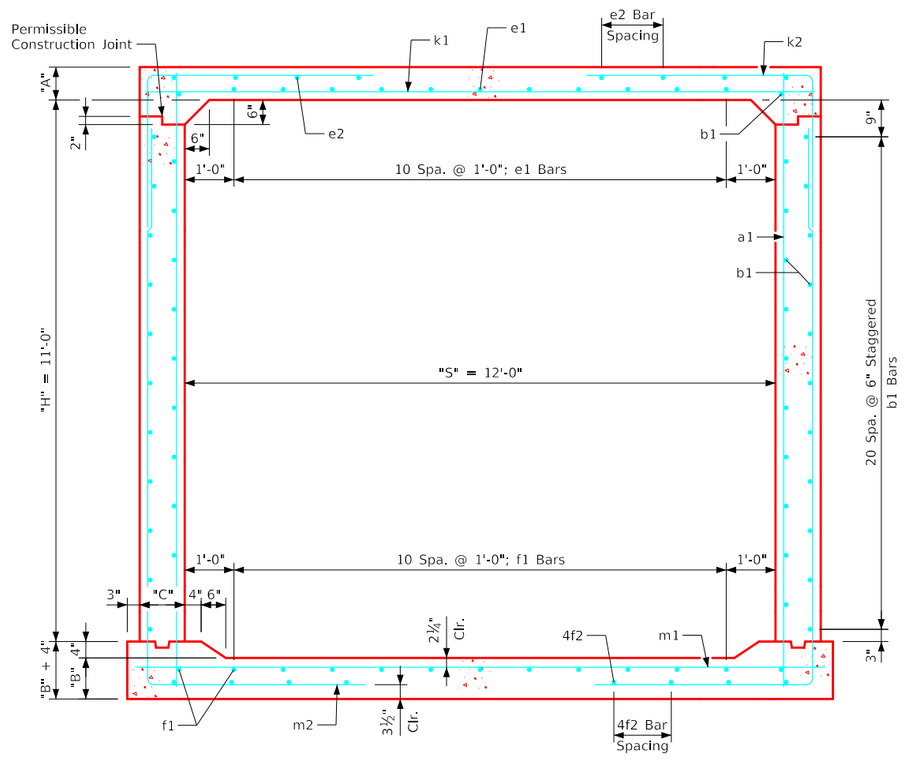
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 11' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 11' Barrel Sections

RCB 12-11-20

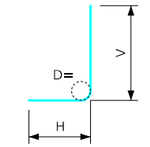
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-11-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 12' x 12' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2						m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	12	12	13.5	14	12	9	5	12	14'-2	4	6	48	5	12	11	4	16	10	4	12	13	4	16	10	8	12	13'-8	6	9	12'-1	8'-1	4'-0	--	--	7	9	14'-2	6	9	20'-8	8'-1	12'-7	--	--	0.623	0.668	0.862	2.153	312.34
1	12	12	12.5	13.5	12	6	4	6	14'-1	4	6	48	5	12	11	4	16	10	4	12	13	4	16	10	7	9	13'-8	6	9	11'-11	8'-1	3'-10	--	--	7	9	14'-2	6	9	20'-8	8'-1	12'-7	--	--	0.580	0.645	0.862	2.087	318.53
2	12	12	8.5	10.5	12	9	4	9	13'-6	4	6	48	5	12	11	4	16	10	4	12	13	4	17	8	8	9	13'-8	7	9	11'-4	7'-5	3'-11	--	--	7	6	14'-2	7	9	17'-7	5'-3	12'-4	7	14'-2	0.407	0.511	0.862	1.780	363.89
3	12	12	8	10.5	12	9	4	9	13'-5	4	6	48	4	12	11	4	17	8	4	12	13	4	16	8	8	9	13'-8	6	6	8'-9	5'-3	3'-6	6	13'-8	6	6	14'-2	6	6	17'-2	4'-10	12'-4	6	14'-2	0.386	0.511	0.862	1.759	336.29
4-7	12	12	8.5	10.5	12	9	4	9	13'-6	4	6	48	4	12	11	4	16	8	4	12	13	4	15	8	6	6	13'-8	6	6	8'-5	4'-11	3'-6	6	13'-8	7	6	14'-2	6	6	17'-0	4'-8	12'-4	6	14'-2	0.407	0.511	0.862	1.780	339.68
8-10	12	12	9	11.5	12	9	4	9	13'-7	4	6	48	4	12	11	4	14	8	4	12	13	4	14	8	7	6	13'-8	6	6	7'-11	4'-4	3'-7	6	13'-8	7	6	14'-2	6	6	16'-9	4'-4	12'-5	6	14'-2	0.429	0.556	0.862	1.847	350.26
11-15	12	12	10.5	12.5	12	9	4	9	13'-10	4	6	48	4	12	11	4	13	8	4	12	13	4	13	8	7	6	13'-8	6	6	7'-10	4'-2	3'-8	6	13'-8	8	6	14'-2	6	6	16'-8	4'-2	12'-6	6	14'-2	0.494	0.601	0.862	1.957	367.68
16-20	12	12	12.5	15	13	9	4	9	14'-2	4	6	48	4	12	11	4	18	6	4	12	13	4	12	8	9	9	13'-10	6	6	7'-10	3'-11	3'-11	6	13'-10	8	6	14'-4	6	6	16'-8	4'-0	12'-8	6	14'-4	0.589	0.722	0.934	2.245	376.87
21-25	12	12	14.5	17.5	14.5	9	6	9	14'-7	4	6	48	4	12	11	4	13	8	4	12	13	4	12	8	8	6	14'-1	7	9	8'-10	4'-5	4'-5	7	14'-1	8	6	14'-7	7	9	17'-1	4'-2	12'-11	7	14'-7	0.692	0.852	1.041	2.585	423.00
26-30	12	12	16.5	19	16	9	8	12	14'-10	4	6	48	4	12	11	4	13	8	4	12	13	4	12	8	8	6	14'-4	7	9	9'-2	4'-7	4'-7	7	14'-4	8	6	14'-10	7	9	17'-4	4'-4	13'-0	7	14'-10	0.797	0.939	1.148	2.884	451.63
31-35	12	12	18	21	17.5	9	4	9	15'-2	4	6	48	4	12	11	4	12	8	4	12	13	4	13	8	8	6	14'-7	8	9	9'-6	4'-5	5'-1	8	14'-7	9	6	15'-1	8	9	17'-9	4'-7	13'-2	8	15'-1	0.883	1.052	1.255	3.190	475.42
36-40	12	12	19.5	22.5	18.5	9	7	12	15'-5	4	6	48	4	12	11	4	12	8	5	12	13	4	13	8	9	6	14'-9	6	6	9'-2	4'-7	4'-7	6	14'-9	9	6	15'-3	6	6	18'-1	4'-9	13'-4	6	15'-3	0.965	1.137	1.327	3.429	502.71
41-45	12	12	21	24	19.5	9	8	12	15'-8	4	6	48	4	12	11	4	13	8	5	12	13	4	13	8	9	6	14'-11	6	6	9'-6	4'-9	4'-9	6	14'-11	9	6	15'-5	6	6	18'-4	4'-11	13'-5	6	15'-5	1.048	1.223	1.398	3.669	529.76
46-50	12	12	22.5	25.5	20.5	9	4	12	15'-11	4	6	48	5	12	11	4	14	8	5	12	13	4	13	8	9	6	15'-1	7	6	10'-2	5'-1	5'-1	7	15'-1	9	6	15'-7	7	6	18'-7	5'-0	13'-7	7	15'-7	1.133	1.311	1.470	3.914	541.76
51-55	12	12	24	27	21.5	9	8	12	16'-2	5	6	48	5	12	11	4	13	8	5	12	13	4	14	8	9	6	15'-3	6	6	10'-2	5'-1	5'-1	6	15'-3	9	6	15'-9	6	6	18'-11	5'-3	13'-8	6	15'-9	1.219	1.401	1.541	4.161	566.68

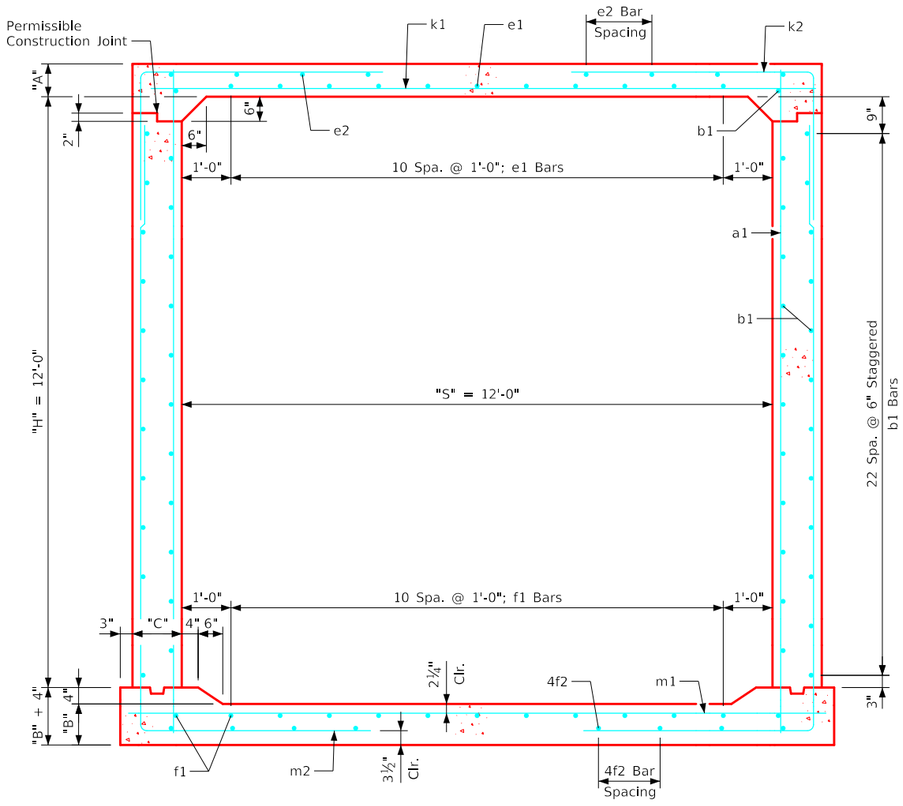
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



12' x 12' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 12' Barrel Sections

RCB 12-12-20

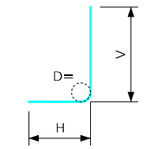
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 12-12-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 4' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)					Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	14	4	14	14	9	6	4	6	6'-3	4	6	16	5	12	13	4	16	6	4	12	15	4	14	8	7	9	15'-2	6	9	7'-3	3'-3	4'-0	6	15'-2	7	9	15'-8	6	9	8'-8	4'-1	4'-7	6	15'-8	0.702	0.728	0.202	1.632	216.97
1	14	4	13.5	13.5	9	6	4	6	6'-2	4	6	16	5	12	13	4	16	6	4	12	15	4	13	8	7	9	15'-2	6	9	7'-3	3'-4	3'-11	6	15'-2	7	9	15'-8	6	9	8'-5	3'-10	4'-7	6	15'-8	0.678	0.703	0.202	1.583	215.68
2	14	4	9	10.5	9	9	4	12	5'-6	4	6	16	6	12	13	4	13	8	4	12	15	4	15	8	7	6	15'-2	7	6	8'-0	4'-0	4'-0	7	15'-2	7	6	15'-8	6	6	8'-8	4'-4	4'-4	6	15'-8	0.463	0.555	0.202	1.220	307.61
3-5	14	4	8.5	10.5	9	9	4	12	5'-6	4	6	16	4	12	13	4	13	8	4	12	15	4	15	8	7	6	15'-2	7	6	7'-10	3'-11	3'-11	7	15'-2	7	6	15'-8	6	6	8'-8	4'-4	4'-4	6	15'-8	0.439	0.555	0.202	1.196	295.50
6-8	14	4	9	11	9	9	4	12	5'-7	4	6	16	4	12	13	4	13	8	4	12	15	4	12	8	7	6	15'-2	7	6	8'-0	4'-0	4'-0	7	15'-2	7	6	15'-8	7	6	8'-0	3'-8	4'-4	7	15'-8	0.463	0.580	0.202	1.245	310.92
9-10	14	4	10	12.5	9	9	4	12	5'-9	4	6	16	4	12	13	4	17	6	4	12	15	4	16	6	7	6	15'-2	7	6	7'-5	3'-5	4'-0	7	15'-2	8	6	15'-8	7	6	7'-9	3'-3	4'-6	7	15'-8	0.511	0.654	0.202	1.367	321.53
11-13	14	4	11.5	13.5	9	9	4	12	6'-0	4	6	16	4	12	13	4	14	6	4	12	15	4	14	6	8	6	15'-2	7	6	7'-2	3'-0	4'-2	7	15'-2	8	6	15'-8	7	6	7'-7	3'-0	4'-7	7	15'-8	0.583	0.703	0.202	1.488	337.63
14-16	14	4	12.5	14	9.5	9	4	12	6'-1	4	6	16	4	12	13	4	14	8	4	12	15	4	14	6	8	6	15'-3	7	6	8'-6	4'-3	4'-3	7	15'-3	8	6	15'-9	7	6	7'-8	3'-1	4'-7	7	15'-9	0.635	0.733	0.213	1.581	351.68

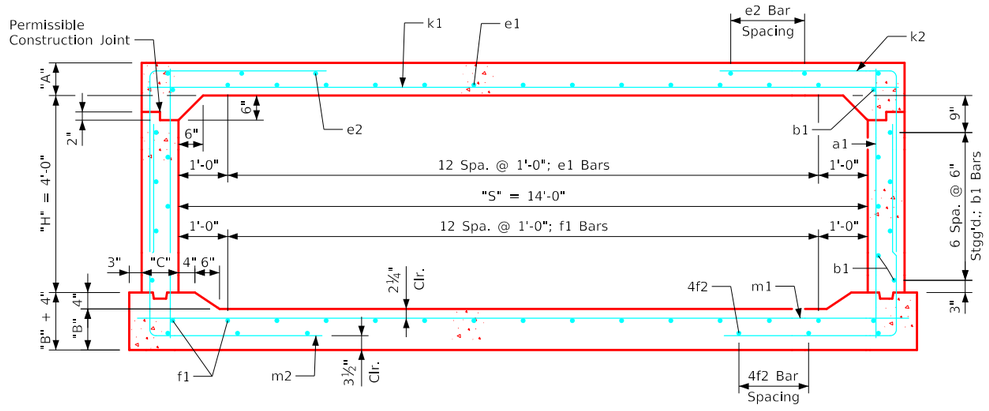
Bent Bar Detail

Bars	D
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 4' Barrel Sections

RCB 14-4-20

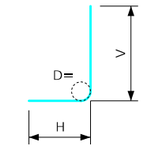
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 5' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)					Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	14	5	14	14	9	9	5	12	7'-3	4	6	20	5	12	13	4	15	6	4	12	15	4	13	8	7	9	15'-2	6	9	7'-1	3'-1	4'-0	6	15'-2	7	9	15'-8	6	9	9'-7	4'-0	5'-7	6	15'-8	0.702	0.728	0.257	1.687	221.58
1	14	5	13.5	14	9	9	4	9	7'-2	4	6	20	5	12	13	4	16	6	4	12	15	4	12	8	7	9	15'-2	6	9	7'-4	3'-4	4'-0	6	15'-2	7	9	15'-8	6	9	9'-4	3'-9	5'-7	6	15'-8	0.678	0.728	0.257	1.663	218.89
2	14	5	9	10.5	9	9	4	12	6'-6	4	6	20	6	12	13	4	13	8	4	12	15	4	14	8	7	6	15'-2	6	6	7'-10	3'-11	3'-11	6	15'-2	7	6	15'-8	6	6	9'-5	4'-1	5'-4	6	15'-8	0.463	0.555	0.257	1.275	297.16
3-5	14	5	8.5	10.5	9	9	4	12	6'-6	4	6	20	4	12	13	4	13	8	4	12	15	4	13	8	7	6	15'-2	7	6	7'-10	3'-11	3'-11	7	15'-2	7	6	15'-8	6	6	9'-2	3'-10	5'-4	6	15'-8	0.439	0.555	0.257	1.251	302.53
6-8	14	5	9	11.5	9	9	4	12	6'-7	4	6	20	4	12	13	4	13	8	4	12	15	4	18	6	7	6	15'-2	7	6	7'-10	3'-11	3'-11	7	15'-2	7	6	15'-8	6	6	9'-0	3'-7	5'-5	6	15'-8	0.463	0.604	0.257	1.324	300.32
9-10	14	5	10	12.5	9	9	4	12	6'-9	4	6	20	4	12	13	4	17	6	4	12	15	4	15	6	8	6	15'-2	7	6	7'-5	3'-5	4'-0	7	15'-2	8	6	15'-8	6	6	8'-8	3'-2	5'-6	6	15'-8	0.511	0.654	0.257	1.422	332.87
11-13	14	5	11.5	13.5	9	9	4	12	7'-0	4	6	20	4	12	13	4	15	6	4	12	15	4	14	6	8	6	15'-2	8	9	7'-7	3'-1	4'-6	8	15'-2	8	6	15'-8	8	9	8'-7	3'-0	5'-7	8	15'-8	0.583	0.703	0.257	1.543	340.87
14-16	14	5	12.5	14	9.5	9	4	12	7'-1	4	6	20	4	12	13	4	12	6	4	12	15	4	13	6	8	6	15'-3	6	6	6'-8	2'-9	3'-11	6	15'-3	8	6	15'-9	7	6	8'-6	2'-11	5'-7	7	15'-9	0.635	0.733	0.271	1.639	331.03

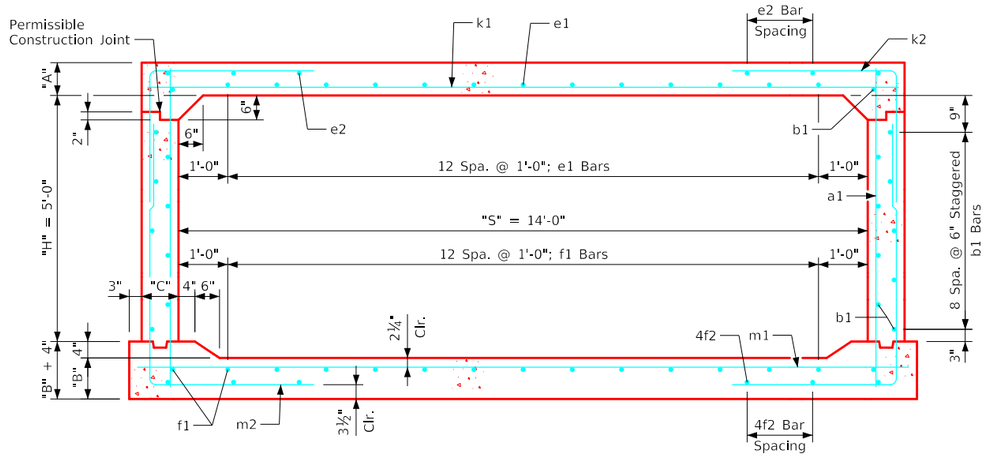
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 5' Barrel Sections

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 5' Barrel Sections

RCB 14-5-20

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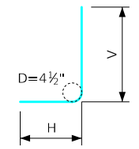
Variable Dimensions and Quantities for 14' x 6' Barrel Sections

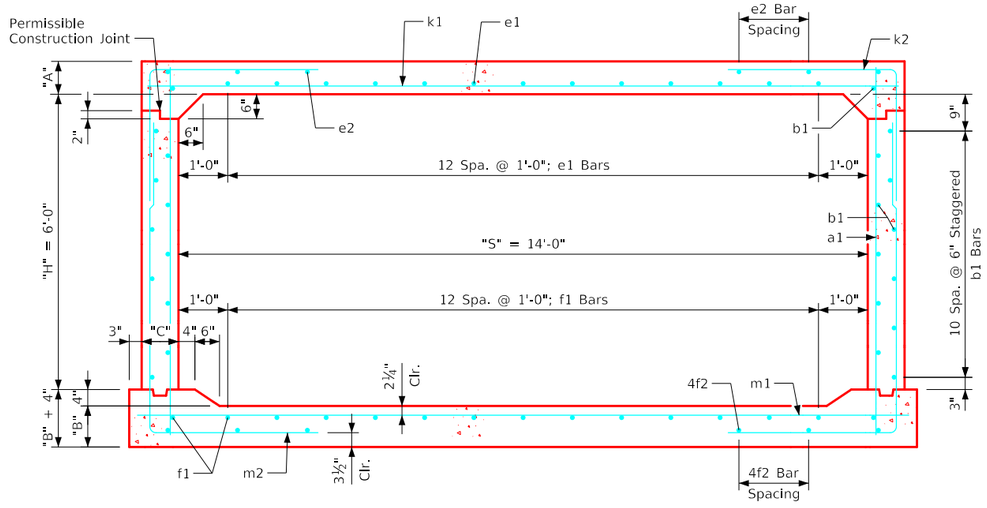
Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	14	6	14	14	9	9	4	9	8'-3	4	6	24	5	12	13	4	16	6	4	12	15	4	13	8	6	6	15'-2	6	9	7'-4	3'-4	4'-0	6	15'-2	7	9	15'-8	6	9	10'-7	4'-0	6'-7	6	15'-8	0.702	0.728	0.313	1.743	231.66
1	14	6	13.5	14	9	9	4	9	8'-2	4	6	24	5	12	13	4	17	6	4	12	15	4	13	8	6	6	15'-2	6	9	7'-5	3'-5	4'-0	6	15'-2	7	9	15'-8	6	9	10'-5	3'-10	6'-7	6	15'-8	0.678	0.728	0.313	1.719	231.13
2	14	6	9	10.5	9	9	4	12	7'-6	4	6	24	6	12	13	4	13	8	4	12	15	4	14	8	7	6	15'-2	6	6	8'-0	4'-0	4'-0	6	15'-2	7	6	15'-8	6	6	10'-5	4'-1	6'-4	6	15'-8	0.463	0.555	0.313	1.331	308.26
3-5	14	6	8.5	10.5	9	9	4	12	7'-6	4	6	24	4	12	13	4	13	8	4	12	15	4	13	8	7	6	15'-2	6	6	7'-10	3'-11	3'-11	6	15'-2	7	6	15'-8	6	6	10'-3	3'-11	6'-4	6	15'-8	0.439	0.555	0.313	1.307	295.53
6-8	14	6	9.5	12.5	9	9	4	12	7'-9	4	6	24	4	12	13	4	18	6	4	12	15	4	16	6	7	6	15'-2	6	6	7'-2	3'-7	3'-7	6	15'-2	7	6	15'-8	6	6	9'-9	3'-3	6'-6	6	15'-8	0.487	0.654	0.313	1.454	286.13
9-10	14	6	10	12.5	9	9	4	12	7'-9	4	6	24	4	12	13	4	12	8	4	12	15	4	15	6	8	6	15'-2	6	6	7'-4	3'-8	3'-8	6	15'-2	8	6	15'-8	6	6	9'-8	3'-2	6'-6	6	15'-8	0.511	0.654	0.313	1.478	327.05
11-13	14	6	11.5	14	9	9	4	12	8'-0	4	6	24	4	12	13	4	14	6	4	12	15	4	13	6	8	6	15'-2	6	6	6'-9	2'-11	3'-10	6	15'-2	8	6	15'-8	6	6	9'-4	2'-9	6'-7	6	15'-8	0.583	0.728	0.313	1.624	320.50
14-16	14	6	12.5	15	9.5	9	4	12	8'-2	4	6	24	4	12	13	4	13	6	4	12	15	4	12	6	8	6	15'-3	6	6	6'-9	2'-10	3'-11	6	15'-3	8	6	15'-9	6	6	9'-5	2'-9	6'-8	6	15'-9	0.635	0.782	0.330	1.747	322.13

Bent Bar Detail



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 6' Barrel Sections

RCB 14-6-20

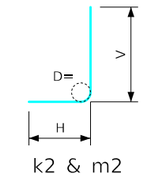
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 7' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	14	7	14	14	9	9	4	9	9'-3	4	6	28	5	12	13	4	13	8	4	12	15	4	13	8	6	6	15'-2	6	9	8'-0	4'-0	4'-0	6	15'-2	7	9	15'-8	6	9	11'-7	4'-0	7'-7	6	15'-8	0.702	0.728	0.368	1.798	244.39
1	14	7	13.5	14	9	9	4	9	9'-2	4	6	28	5	12	13	4	13	8	4	12	15	4	13	8	6	6	15'-2	6	9	8'-0	4'-0	4'-0	6	15'-2	7	9	15'-8	6	9	11'-7	4'-0	7'-7	6	15'-8	0.678	0.728	0.368	1.774	244.26
2	14	7	9	10.5	9	9	4	12	8'-6	4	6	28	6	12	13	4	13	8	4	12	15	4	14	8	7	6	15'-2	6	6	8'-0	4'-0	4'-0	6	15'-2	7	6	15'-8	6	6	11'-5	4'-1	7'-4	6	15'-8	0.463	0.555	0.368	1.386	318.39
3-5	14	7	8.5	10.5	9	9	4	12	8'-6	4	6	28	4	12	13	4	13	8	4	12	15	4	13	8	7	6	15'-2	6	6	7'-10	3'-11	3'-11	6	15'-2	7	6	15'-8	6	6	11'-3	3'-11	7'-4	6	15'-8	0.439	0.555	0.368	1.362	305.63
6-8	14	7	10	12.5	9	9	4	12	8'-9	4	6	28	4	12	13	4	17	6	4	12	15	4	16	6	7	6	15'-2	7	9	7'-6	3'-6	4'-0	7	15'-2	8	6	15'-8	7	9	10'-10	3'-4	7'-6	7	15'-8	0.511	0.654	0.368	1.533	312.45
9-10	14	7	10	12.5	9	9	4	12	8'-9	4	6	28	4	12	13	4	12	8	4	12	15	4	15	6	8	6	15'-2	6	6	7'-4	3'-8	3'-8	6	15'-2	8	6	15'-8	6	6	10'-8	3'-2	7'-6	6	15'-8	0.511	0.654	0.368	1.533	337.16
11-13	14	7	11.5	14.5	9	9	4	12	9'-1	4	6	28	4	12	13	4	14	6	4	12	15	4	13	6	8	6	15'-2	6	6	6'-8	2'-11	3'-9	6	15'-2	8	6	15'-8	6	6	10'-5	2'-9	7'-8	6	15'-8	0.583	0.753	0.368	1.704	330.71
14-16	14	7	12.5	15	9.5	9	4	12	9'-2	4	6	28	4	12	13	4	13	6	4	12	15	4	13	6	8	6	15'-3	6	6	6'-9	2'-10	3'-11	6	15'-3	9	6	15'-9	6	6	10'-6	2'-10	7'-8	6	15'-9	0.635	0.782	0.389	1.806	356.05

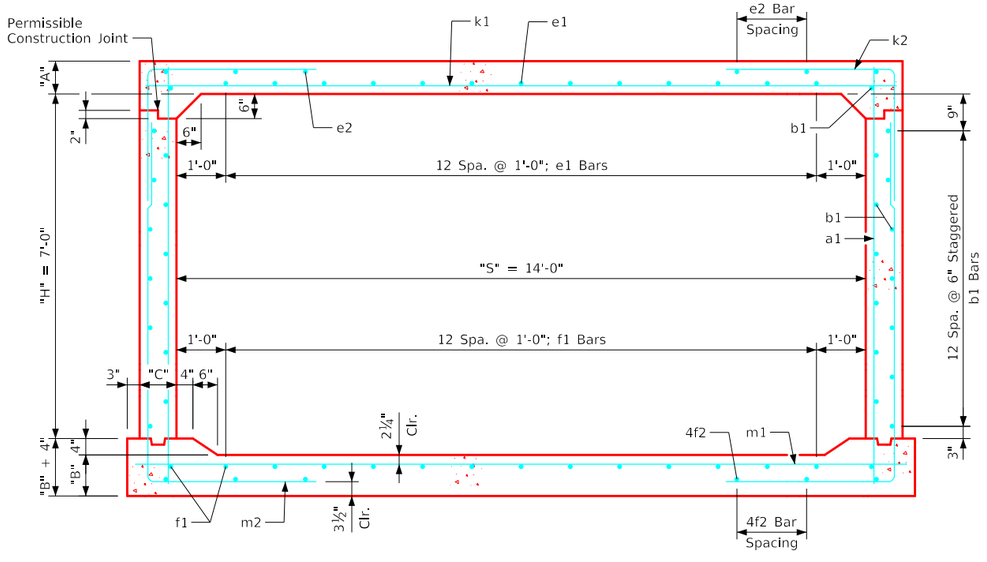
Bent Bar Detail

Bars	D
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 7' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 7' Barrel Sections

RCB 14-7-20

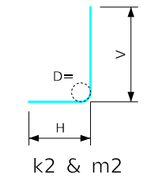
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 8' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	14	8	14	14	9	9	4	9	10'-3	4	6	32	5	12	13	4	16	8	4	12	15	4	14	8	6	6	15'-2	6	9	8'-7	4'-7	4'-0	6	15'-2	7	9	15'-8	6	9	12'-9	4'-2	8'-7	6	15'-8	0.702	0.728	0.424	1.854	256.16
1	14	8	13.5	14	9	9	4	9	10'-2	4	6	32	5	12	13	4	16	8	4	12	15	4	15	8	6	6	15'-2	6	9	8'-9	4'-9	4'-0	6	15'-2	7	9	15'-8	6	9	12'-11	4'-4	8'-7	6	15'-8	0.678	0.728	0.424	1.830	257.39
2	14	8	9	10.5	9	9	4	12	9'-6	4	6	32	6	12	13	4	14	8	4	12	15	4	14	8	9	9	15'-2	7	9	8'-2	4'-1	4'-1	7	15'-2	7	6	15'-8	7	9	12'-5	4'-1	8'-4	7	15'-8	0.463	0.555	0.424	1.442	331.53
3-5	14	8	8.5	11	9	9	4	12	9'-6	4	6	32	4	12	13	4	13	8	4	12	15	4	13	8	7	6	15'-2	6	6	8'-0	4'-0	4'-0	6	15'-2	7	6	15'-8	6	6	12'-4	4'-0	8'-4	6	15'-8	0.439	0.580	0.424	1.443	317.24
6-8	14	8	10	12.5	9	9	4	12	9'-9	4	6	32	4	12	13	4	13	8	4	12	15	4	17	6	7	6	15'-2	7	9	8'-0	4'-0	4'-0	7	15'-2	8	6	15'-8	7	9	12'-0	3'-6	8'-6	7	15'-8	0.511	0.654	0.424	1.589	327.26
9-10	14	8	10	12.5	9	9	4	12	9'-9	4	6	32	4	12	13	4	12	8	4	12	15	4	16	6	8	6	15'-2	6	6	7'-4	3'-8	3'-8	6	15'-2	8	6	15'-8	6	6	11'-9	3'-3	8'-6	6	15'-8	0.511	0.654	0.424	1.589	347.76
11-13	14	8	11.5	14.5	9	9	4	12	10'-1	4	6	32	4	12	13	4	15	6	4	12	15	4	14	6	8	6	15'-2	6	6	6'-10	3'-1	3'-9	6	15'-2	9	6	15'-8	6	6	11'-7	2'-11	8'-8	6	15'-8	0.583	0.753	0.424	1.760	366.03
14-16	14	8	12.5	15	9	9	4	12	10'-2	4	6	32	4	12	13	4	13	6	4	12	15	4	13	6	9	6	15'-2	7	9	7'-1	2'-10	4'-3	7	15'-2	9	6	15'-8	7	9	11'-6	2'-10	8'-8	7	15'-8	0.630	0.777	0.424	1.831	383.34

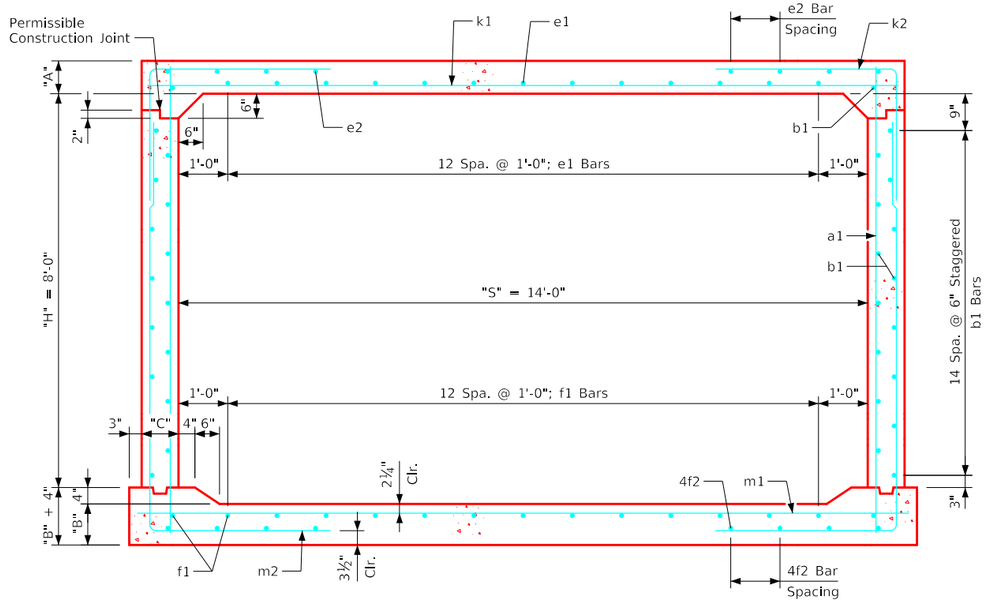
Bent Bar Detail

Bars	D
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 8' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 8' Barrel Sections

RCB 14-8-20

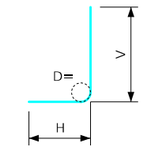
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-8-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 9' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	14	9	14	14	9	9	4	9	11'-3	4	6	36	5	12	13	4	15	10	4	12	15	4	17	8	6	6	15'-2	6	9	9'-10	5'-10	4'-0	6	15'-2	6	6	15'-8	6	9	14'-5	4'-10	9'-7	6	15'-8	0.702	0.728	0.479	1.909	277.21
1	14	9	13.5	14	9	9	4	9	11'-2	4	6	36	5	12	13	4	16	10	4	12	15	4	17	8	6	6	15'-2	6	9	10'-2	6'-2	4'-0	6	15'-2	6	6	15'-8	6	9	14'-7	5'-0	9'-7	6	15'-8	0.678	0.728	0.479	1.885	279.16
2	14	9	9	10.5	9	9	4	12	10'-6	4	6	36	6	12	13	4	16	8	4	12	15	4	15	8	9	9	15'-2	7	9	8'-6	4'-7	3'-11	7	15'-2	7	6	15'-8	7	9	13'-9	4'-5	9'-4	7	15'-8	0.463	0.555	0.479	1.497	345.08
3-5	14	9	9	11	9	9	4	12	10'-7	4	6	36	4	12	13	4	14	8	4	12	15	4	14	8	7	6	15'-2	7	9	8'-4	4'-2	4'-2	7	15'-2	7	6	15'-8	7	9	13'-5	4'-1	9'-4	7	15'-8	0.463	0.580	0.479	1.522	322.50
6-8	14	9	10	12.5	9	9	4	12	10'-9	4	6	36	4	12	13	4	13	8	4	12	15	4	12	8	8	6	15'-2	7	9	8'-0	4'-0	4'-0	7	15'-2	8	6	15'-8	7	9	13'-2	3'-8	9'-6	7	15'-8	0.511	0.654	0.479	1.644	358.50
9-10	14	9	10	12.5	9	9	4	12	10'-9	4	6	36	4	12	13	4	12	8	4	12	15	4	17	6	8	6	15'-2	6	6	7'-4	3'-8	3'-8	6	15'-2	8	6	15'-8	6	6	12'-11	3'-5	9'-6	6	15'-8	0.511	0.654	0.479	1.644	358.89
11-13	14	9	12	14.5	9	9	4	12	11'-1	4	6	36	4	12	13	4	15	6	4	12	15	4	15	6	8	6	15'-2	6	6	7'-0	3'-2	3'-10	6	15'-2	9	6	15'-8	6	6	12'-10	3'-2	9'-8	6	15'-8	0.606	0.753	0.479	1.838	378.66
14-16	14	9	12.5	15	9	9	4	12	11'-2	4	6	36	4	12	13	4	14	6	4	12	15	4	15	6	9	6	15'-2	6	6	6'-11	3'-0	3'-11	6	15'-2	9	6	15'-8	6	6	12'-9	3'-1	9'-8	6	15'-8	0.630	0.777	0.479	1.886	400.24

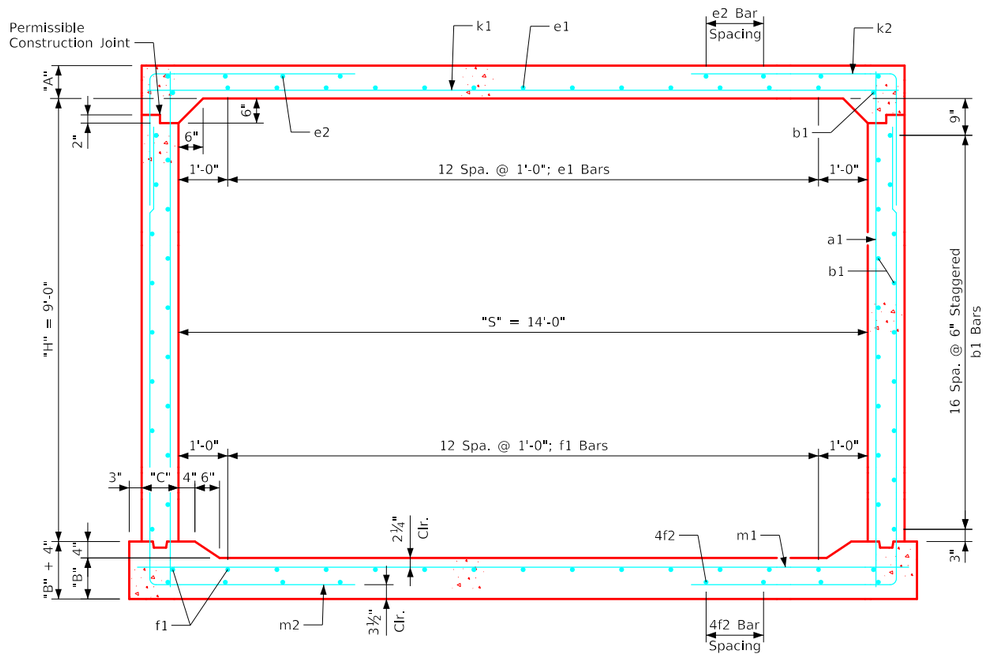
Bent Bar Detail

Bars	D
6	4½"
7	5¼"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 9' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 9' Barrel Sections

RCB 14-9-20

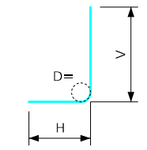
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-9-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 10' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	14	10	14	14.5	10	9	5	12	12'-3	4	6	40	5	12	13	4	15	12	4	12	15	4	14	10	6	6	15'-4	6	9	12'-7	8'-7	4'-0	--	--	6	6	15'-10	6	9	16'-2	5'-6	10'-8	6	15'-10	0.712	0.762	0.594	2.068	307.21
1	14	10	13.5	14	10	9	4	12	12'-2	4	6	40	5	12	13	4	15	12	4	12	15	4	15	10	6	6	15'-4	7	12	13'-5	9'-1	4'-4	--	--	6	6	15'-10	8	12	16'-3	5'-8	10'-7	8	15'-10	0.688	0.737	0.594	2.019	331.00
2	14	10	9	10.5	10	9	4	12	11'-6	4	6	40	6	12	13	4	17	8	4	12	15	4	16	8	7	6	15'-4	6	6	8'-8	5'-1	3'-7	6	15'-4	7	6	15'-10	6	6	15'-2	4'-10	10'-4	6	15'-10	0.470	0.563	0.594	1.627	358.71
3-5	14	10	8.5	11	10	9	4	12	11'-6	4	6	40	4	12	13	4	15	8	4	12	15	4	15	8	7	6	15'-4	6	6	8'-2	4'-7	3'-7	6	15'-4	7	6	15'-10	6	6	14'-10	4'-6	10'-4	6	15'-10	0.446	0.588	0.594	1.628	342.89
6-8	14	10	9.5	12.5	10	9	4	12	11'-9	4	6	40	4	12	13	4	13	8	4	12	15	4	13	8	9	9	15'-4	6	6	7'-8	4'-1	3'-7	6	15'-4	8	6	15'-10	6	6	14'-6	4'-0	10'-6	6	15'-10	0.494	0.662	0.594	1.750	367.45
9-10	14	10	10	12.5	10	9	4	12	11'-9	4	6	40	4	12	13	4	12	8	4	12	15	4	12	8	8	6	15'-4	6	6	7'-8	3'-10	3'-10	6	15'-4	8	6	15'-10	6	6	14'-3	3'-9	10'-6	6	15'-10	0.519	0.662	0.594	1.775	376.16
11-13	14	10	11.5	14.5	10	9	4	12	12'-1	4	6	40	4	12	13	4	12	8	4	12	15	4	17	6	8	6	15'-4	6	6	7'-6	3'-9	3'-9	6	15'-4	8	6	15'-10	6	6	14'-2	3'-6	10'-8	6	15'-10	0.591	0.762	0.594	1.947	373.82
14-16	14	10	12.5	15	10	9	4	12	12'-2	4	6	40	4	12	13	4	16	6	4	12	15	4	16	6	8	6	15'-4	6	6	7'-4	3'-5	3'-11	6	15'-4	9	6	15'-10	6	6	14'-1	3'-5	10'-8	6	15'-10	0.639	0.787	0.594	2.020	394.50

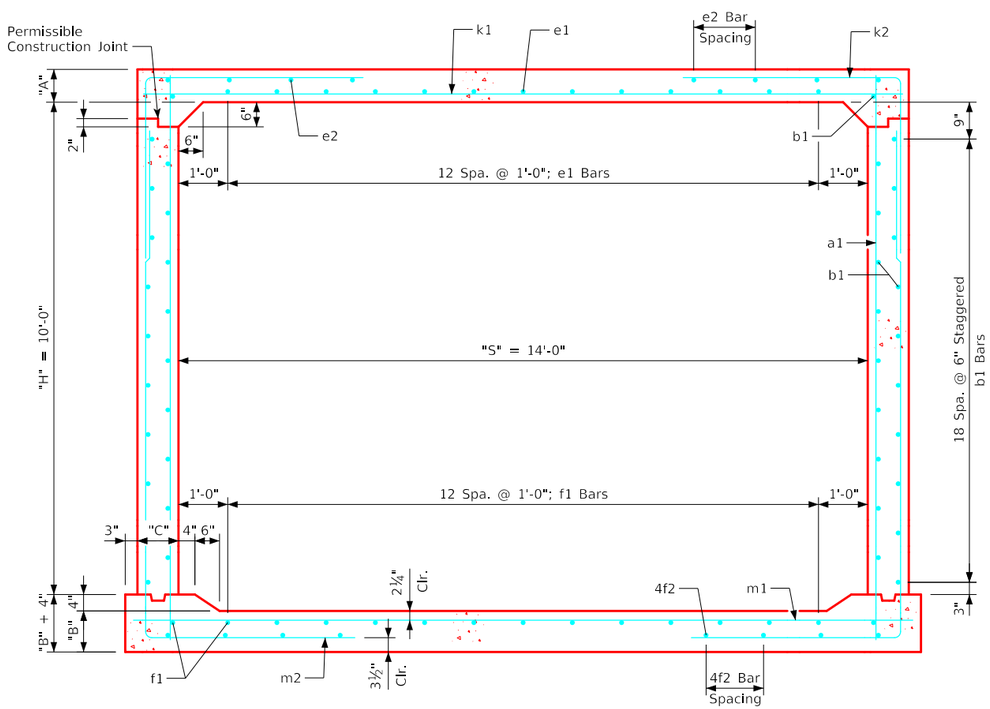
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 10' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 10' Barrel Sections

RCB 14-10-20

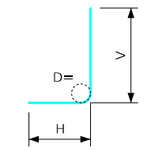
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-10-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 11' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	14	11	14	14.5	11	6	4	6	13'-3	4	6	44	5	12	13	4	15	12	4	12	15	4	16	10	6	6	15'-6	6	9	13'-0	9'-0	4'-0	--	--	7	9	16'-0	6	9	17'-9	6'-1	11'-8	6	16'-0	0.722	0.770	0.723	2.215	325.37
1	14	11	13.5	14.5	11	6	4	6	13'-3	4	6	44	5	12	13	4	15	12	4	12	15	4	17	10	6	6	15'-6	6	9	12'-11	9'-0	3'-11	--	--	7	9	16'-0	6	9	18'-1	6'-5	11'-8	6	16'-0	0.697	0.770	0.723	2.190	326.39
2	14	11	9	10.5	11	9	4	12	12'-6	4	6	44	6	12	13	4	14	10	4	12	15	4	18	8	7	6	15'-6	8	9	10'-0	5'-8	4'-4	8	15'-6	7	6	16'-0	8	9	16'-7	5'-3	11'-4	8	16'-0	0.477	0.568	0.723	1.768	420.32
3-5	14	11	8.5	10.5	11	9	4	12	12'-6	4	6	44	4	12	13	4	17	8	4	12	15	4	16	8	7	6	15'-6	8	9	9'-4	5'-1	4'-3	8	15'-6	7	6	16'-0	8	9	16'-3	4'-11	11'-4	8	16'-0	0.453	0.568	0.723	1.744	400.82
6-8	14	11	9.5	12.5	11	9	4	12	12'-9	4	6	44	4	12	13	4	14	8	4	12	15	4	14	8	7	6	15'-6	6	6	7'-11	4'-4	3'-7	6	15'-6	8	6	16'-0	6	6	15'-10	4'-4	11'-6	6	16'-0	0.502	0.669	0.723	1.894	373.53
9-10	14	11	10	12.5	11	9	4	9	12'-9	4	6	44	4	12	13	4	13	8	4	12	15	4	13	8	8	6	15'-6	6	6	8'-2	4'-1	4'-1	6	15'-6	8	6	16'-0	6	6	15'-7	4'-1	11'-6	6	16'-0	0.526	0.669	0.723	1.918	398.61
11-13	14	11	11.5	14.5	11	9	5	12	13'-1	4	6	44	4	12	13	4	12	8	4	12	15	4	12	8	8	6	15'-6	6	6	7'-10	3'-11	3'-11	6	15'-6	8	6	16'-0	6	6	15'-7	3'-11	11'-8	6	16'-0	0.600	0.770	0.723	2.093	401.71
14-16	14	11	12.5	15	11	6	4	6	13'-2	4	6	44	4	12	13	4	18	6	4	12	15	4	18	6	8	6	15'-6	7	9	8'-0	3'-9	4'-3	7	15'-6	9	6	16'-0	7	9	15'-5	3'-9	11'-8	7	16'-0	0.648	0.795	0.723	2.166	421.76

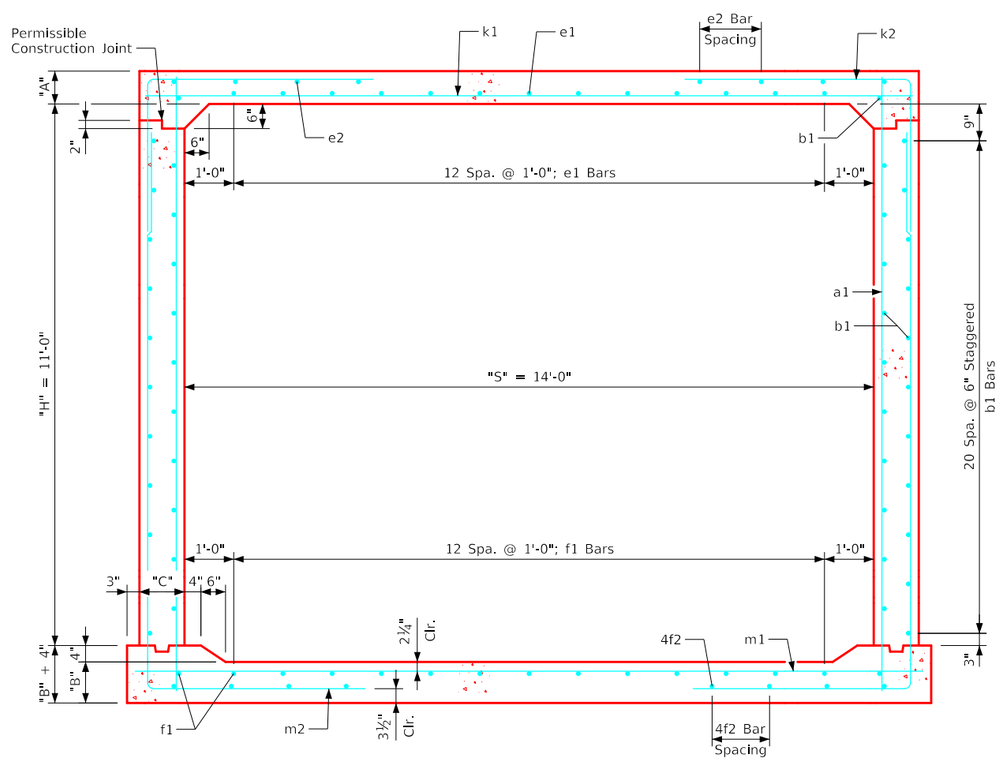
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 11' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 11' Barrel Sections

RCB 14-11-20

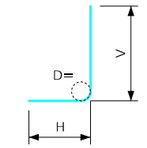
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-11-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 14' x 12' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	14	12	14	15	12	9	6	9	14'-4	4	6	48	5	12	13	4	15	12	4	12	15	4	14	12	6	6	15'-8	6	9	13'-1	9'-1	4'-0	--	--	6	6	16'-2	6	9	19'-8	7'-0	12'-8	6	16'-2	0.731	0.805	0.862	2.398	364.24
1	14	12	13.5	14.5	12	9	6	12	14'-3	4	6	48	5	12	13	4	15	12	4	12	15	4	15	12	7	9	15'-8	6	9	13'-0	9'-1	3'-11	--	--	7	9	16'-2	6	9	19'-9	7'-1	12'-8	6	16'-2	0.707	0.780	0.862	2.349	344.21
2	14	12	9	10.5	12	9	4	12	13'-6	4	6	48	6	12	13	4	16	10	4	12	15	4	14	10	7	6	15'-8	8	9	10'-6	6'-2	4'-4	8	15'-8	7	6	16'-2	8	9	17'-10	5'-6	12'-4	8	16'-2	0.485	0.576	0.862	1.923	440.16
3-5	14	12	8.5	10.5	12	9	4	12	13'-6	4	6	48	4	12	13	4	13	10	4	12	15	4	17	8	7	6	15'-8	8	9	9'-8	5'-5	4'-3	8	15'-8	7	6	16'-2	8	9	17'-5	5'-1	12'-4	8	16'-2	0.460	0.576	0.862	1.898	418.76
6-8	14	12	9	12.5	12	9	4	12	13'-8	4	6	48	4	12	13	4	15	8	4	12	15	4	15	8	7	6	15'-8	7	6	8'-7	4'-8	3'-11	7	15'-8	7	6	16'-2	6	6	17'-2	4'-8	12'-6	6	16'-2	0.485	0.678	0.862	2.025	390.05
9-10	14	12	10	12.5	12	9	4	12	13'-9	4	6	48	4	12	13	4	14	8	4	12	15	4	14	8	8	6	15'-8	8	9	9'-0	4'-6	4'-6	8	15'-8	8	6	16'-2	8	9	17'-0	4'-6	12'-6	8	16'-2	0.534	0.678	0.862	2.074	450.08
11-13	14	12	11.5	14	12	6	4	6	14'-0	4	6	48	4	12	13	4	13	8	4	12	15	4	13	8	8	6	15'-8	6	6	8'-6	4'-3	4'-3	6	15'-8	8	6	16'-2	6	6	16'-10	4'-3	12'-7	6	16'-2	0.608	0.754	0.862	2.224	427.29
14-16	14	12	12.5	15	12	6	4	6	14'-2	4	6	48	4	12	13	4	13	8	4	12	15	4	13	8	8	6	15'-8	6	6	8'-2	4'-1	4'-1	6	15'-8	8	6	16'-2	6	6	16'-9	4'-1	12'-8	6	16'-2	0.657	0.805	0.862	2.324	425.16

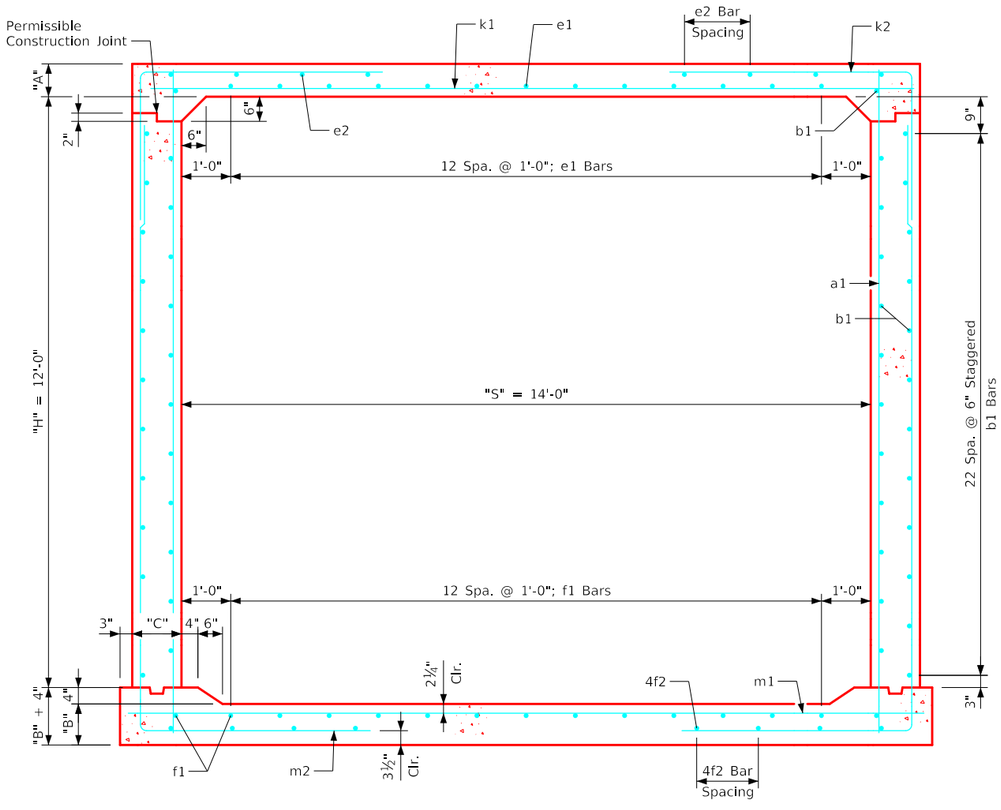
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 12' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 12' Barrel Sections

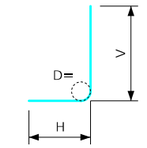
RCB 14-12-20

Variable Dimensions and Quantities for 14' x 13' Barrel Sections

Dimensions							Bar List																														Quantities					
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	14	13	14	15	13	9	4	9	15'-4	4	6	52	5	12	13	4	15	12	4	12	15	4	15	12	7	9	15'-10	8	12	14'-3	9'-6	4'-9	--	--	6	6	16'-4	8	12	21'-7	7'-11	13'-8	--	--	0.741	0.815	1.014	2.570	402.47
1	14	13	13.5	14.5	13	9	6	9	15'-3	4	6	52	5	12	13	4	15	12	4	12	15	4	15	12	7	9	15'-10	6	9	13'-1	9'-2	3'-11	--	--	7	9	16'-4	6	9	21'-8	8'-0	13'-8	--	--	0.716	0.789	1.014	2.519	372.45
2	14	13	9	11	13	9	4	9	14'-7	4	6	52	6	12	13	4	17	10	4	12	15	4	14	10	7	6	15'-10	8	9	11'-0	6'-8	4'-4	8	15'-10	7	6	16'-4	8	9	19'-0	5'-8	13'-4	8	16'-4	0.492	0.609	1.014	2.115	464.29
3-5	14	13	8.5	10.5	13	9	4	12	14'-6	4	6	52	4	12	13	4	14	10	4	12	15	4	17	8	7	6	15'-10	7	6	9'-6	5'-7	3'-11	7	15'-10	7	6	16'-4	7	6	18'-6	5'-2	13'-4	7	16'-4	0.467	0.583	1.014	2.064	453.39
6-8	14	13	9	12.5	13	9	4	9	14'-8	4	6	52	4	12	13	4	16	8	4	12	15	4	16	8	7	6	15'-10	7	6	8'-10	4'-11	3'-11	7	15'-10	7	6	16'-4	6	6	18'-6	5'-0	13'-6	6	16'-4	0.492	0.686	1.014	2.192	411.84
9-10	14	13	10	12.5	13	9	4	12	14'-9	4	6	52	4	12	13	4	15	8	4	12	15	4	15	8	7	6	15'-10	7	6	8'-8	4'-8	4'-0	7	15'-10	8	6	16'-4	7	6	18'-2	4'-8	13'-6	7	16'-4	0.542	0.686	1.014	2.242	463.45
11-13	14	13	11.5	14	13	9	4	12	15'-0	4	6	52	4	12	13	4	15	8	4	12	15	4	15	8	8	6	15'-10	8	9	9'-4	4'-8	4'-8	8	15'-10	8	6	16'-4	8	9	18'-3	4'-8	13'-7	8	16'-4	0.617	0.763	1.014	2.394	468.11
14-16	14	13	12.5	15	13	9	6	12	15'-2	4	6	52	4	12	13	4	13	8	4	12	15	4	14	8	8	6	15'-10	6	6	8'-8	4'-4	4'-4	6	15'-10	8	6	16'-4	6	6	18'-1	4'-5	13'-8	6	16'-4	0.666	0.815	1.014	2.495	449.71

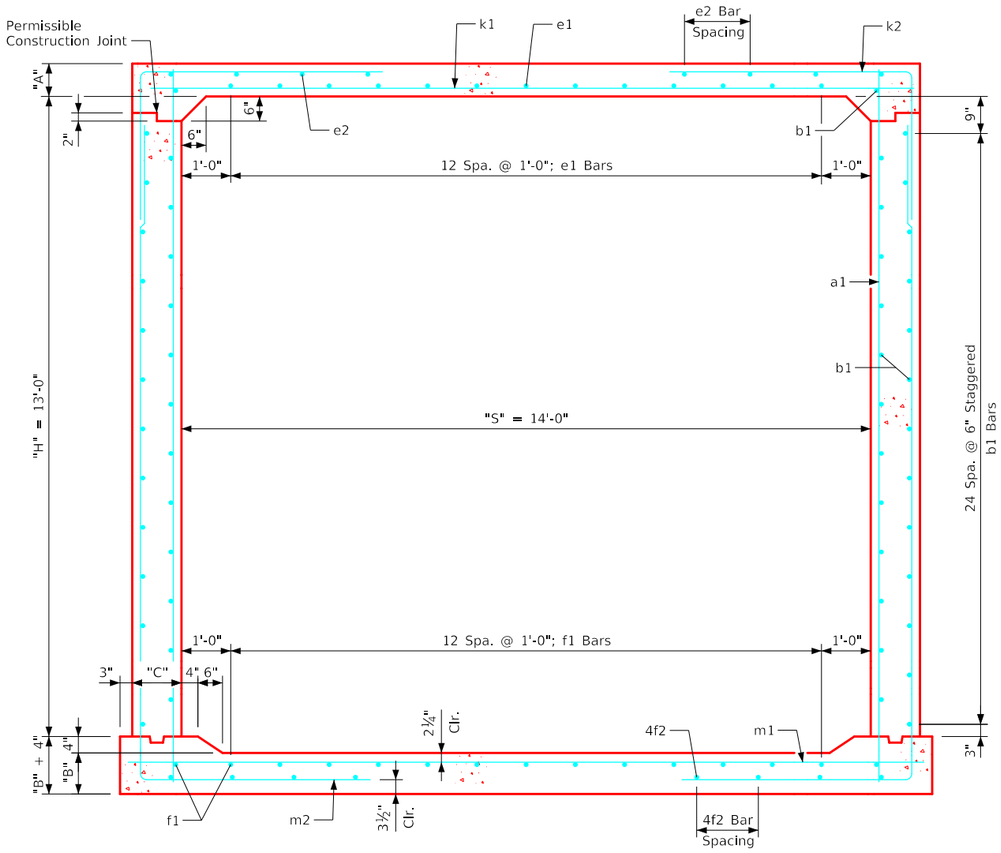
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 13' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 13' Barrel Sections

RCB 14-13-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-13-20 - THIS SHEET ISSUED 07-2020.

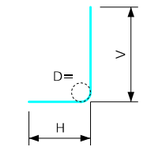
6/30/2020 9:33:37 AM bkloss W:\Highway\Bridge\Standards\Culverts\LRFD\EnglishLRFDSignedSingleCulverts.dgn RCB 14-13-20 11x17_pdf.pltcfg

Variable Dimensions and Quantities for 14' x 14' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	14	14	14	15	14	9	5	12	16'-4	4	6	56	5	12	13	4	15	12	4	12	15	4	15	12	7	9	16'-0	8	12	14'-4	9'-7	4'-9	--	--	6	6	16'-6	8	12	24'-3	9'-7	14'-8	--	--	0.751	0.825	1.178	2.754	429.42
1	14	14	13.5	14.5	14	9	6	9	16'-3	4	6	56	5	12	13	4	15	12	4	12	15	4	15	12	7	9	16'-0	5	6	12'-6	9'-0	3'-6	--	--	6	6	16'-6	5	6	23'-8	9'-0	14'-8	--	--	0.726	0.799	1.178	2.703	390.55
2	14	14	9	11	14	9	5	12	15'-7	4	6	56	6	12	13	4	14	12	4	12	15	4	14	10	7	6	16'-0	8	9	11'-6	7'-2	4'-4	8	16'-0	7	6	16'-6	8	9	20'-2	5'-10	14'-4	8	16'-6	0.499	0.617	1.178	2.294	489.32
3-5	14	14	8.5	10.5	14	9	5	12	15'-6	4	6	56	4	12	13	4	14	10	4	12	15	4	17	8	7	6	16'-0	7	6	9'-9	5'-10	3'-11	7	16'-0	7	6	16'-6	7	6	19'-8	5'-4	14'-4	7	16'-6	0.474	0.591	1.178	2.243	482.47
6-8	14	14	9	12	14	9	4	9	15'-8	4	6	56	4	12	13	4	16	8	4	12	15	4	16	8	7	6	16'-0	7	6	9'-2	5'-2	4'-0	7	16'-0	7	6	16'-6	7	6	19'-7	5'-2	14'-5	7	16'-6	0.499	0.669	1.178	2.346	470.47
9-10	14	14	10	12.5	14	9	4	9	15'-9	4	6	56	4	12	13	4	16	8	4	12	15	4	15	8	7	6	16'-0	7	6	9'-0	5'-0	4'-0	7	16'-0	8	6	16'-6	7	6	19'-5	4'-11	14'-6	7	16'-6	0.549	0.695	1.178	2.422	488.82
11-13	14	14	11.5	14	14	9	4	9	16'-0	4	6	56	4	12	13	4	15	8	4	12	15	4	15	8	8	6	16'-0	7	6	9'-1	4'-11	4'-2	7	16'-0	8	6	16'-6	7	6	19'-6	4'-11	14'-7	7	16'-6	0.625	0.773	1.178	2.576	510.92
14-16	14	14	12.5	15.5	14	9	5	12	16'-3	4	6	56	4	12	13	4	15	8	4	12	15	4	15	8	8	6	16'-0	8	9	9'-8	4'-10	4'-10	8	16'-0	8	6	16'-6	8	9	19'-8	4'-11	14'-9	8	16'-6	0.675	0.851	1.178	2.704	499.82

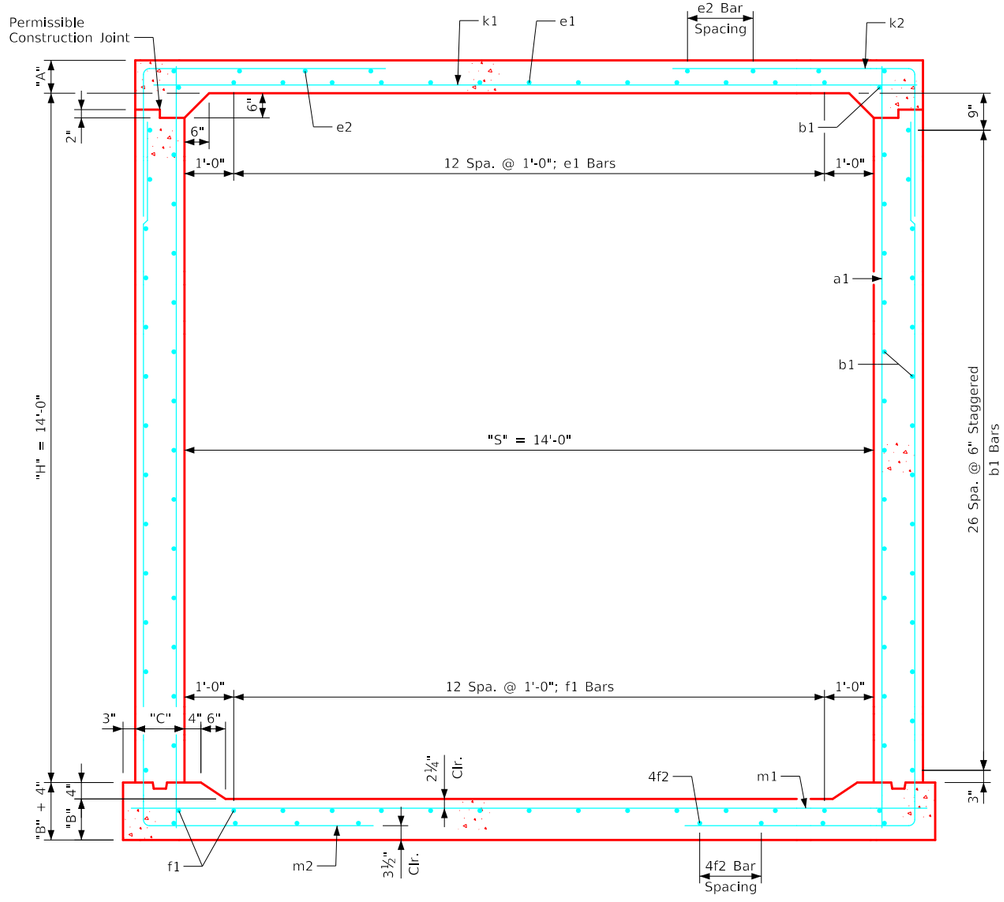
Bent Bar Detail

Bars	D
5	3¾"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



14' x 14' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

14' x 14' Barrel Sections

RCB 14-14-20

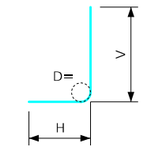
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 14-14-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 4' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	16	4	15	14.5	9	9	4	9	6'-4	4	6	16	5	12	15	4	14	6	4	12	17	4	16	8	6	6	17'-2	6	9	7'-1	3'-0	4'-1	6	17'-2	7	9	17'-8	7	9	9'-4	4'-8	4'-8	7	17'-8	0.843	0.842	0.202	1.887	246.76
1	16	4	14	14.5	9	9	4	12	6'-3	4	6	16	5	12	15	4	12	8	4	12	17	4	14	8	6	6	17'-2	7	9	8'-0	3'-8	4'-4	7	17'-2	7	9	17'-8	7	9	8'-10	4'-2	4'-8	7	17'-8	0.789	0.842	0.202	1.833	258.84
2	16	4	9.5	10.5	9	9	4	12	5'-7	4	6	16	5	12	15	4	15	8	4	12	17	4	17	8	7	6	17'-2	7	6	8'-10	4'-5	4'-5	7	17'-2	7	6	17'-8	7	6	9'-2	4'-10	4'-4	7	17'-8	0.546	0.620	0.202	1.368	352.74
3-5	16	4	9	11	9	9	4	12	5'-7	4	6	16	4	12	15	4	15	8	4	12	17	4	15	8	7	6	17'-2	7	6	8'-10	4'-5	4'-5	7	17'-2	7	6	17'-8	7	6	8'-8	4'-4	4'-4	7	17'-8	0.519	0.648	0.202	1.369	343.03
6-8	16	4	10	12.5	9	9	4	12	5'-9	4	6	16	4	12	15	4	15	8	4	12	17	4	13	8	8	6	17'-2	8	6	8'-10	4'-5	4'-5	8	17'-2	8	6	17'-8	7	6	8'-5	3'-11	4'-6	7	17'-8	0.573	0.731	0.202	1.506	408.32
9-10	16	4	11	13	9.5	9	4	12	5'-11	4	6	16	4	12	15	4	12	8	4	12	17	4	12	8	8	6	17'-3	8	6	8'-4	3'-10	4'-6	8	17'-3	8	6	17'-9	8	6	8'-4	3'-10	4'-6	8	17'-9	0.631	0.763	0.213	1.607	425.05
11-13	16	4	13	14.5	10	9	4	12	6'-2	4	6	16	4	12	15	4	17	6	4	12	17	4	17	6	8	6	17'-4	7	6	7'-9	3'-6	4'-3	7	17'-4	8	6	17'-10	8	6	8'-3	3'-7	4'-8	8	17'-10	0.744	0.852	0.224	1.820	396.29
14-16	16	4	14.5	16.5	11	9	4	12	6'-6	4	6	16	4	12	15	4	16	6	4	12	17	4	16	6	8	6	17'-6	7	6	7'-10	3'-5	4'-5	7	17'-6	9	6	18'-0	7	6	8'-3	3'-5	4'-10	7	18'-0	0.836	0.973	0.247	2.056	404.42

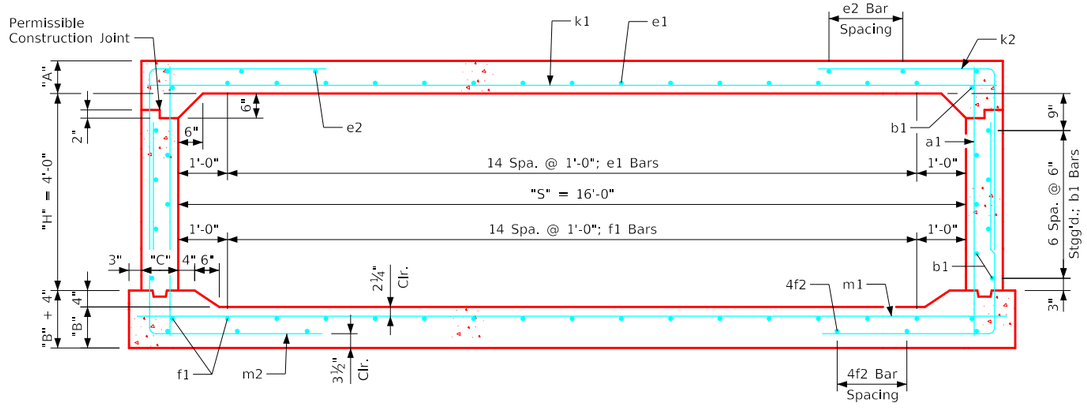
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 4' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 4' Barrel Sections

RCB 16-4-20

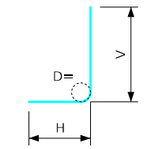
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-4-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 5' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)					Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	16	5	15	14.5	9	9	4	12	7'-4	4	6	20	5	12	15	4	14	6	4	12	17	4	15	8	9	12	17'-2	5	6	6'-8	3'-0	3'-8	5	17'-2	6	6	17'-8	6	6	10'-0	4'-4	5'-8	6	17'-8	0.843	0.842	0.257	1.942	267.45
1	16	5	14	14.5	9	6	4	6	7'-3	4	6	20	5	12	15	4	18	6	4	12	17	4	14	8	8	9	17'-2	5	6	7'-2	3'-7	3'-7	5	17'-2	6	6	17'-8	5	6	9'-10	4'-2	5'-8	5	17'-8	0.789	0.842	0.257	1.888	260.08
2	16	5	9.5	10.5	9	9	4	12	6'-7	4	6	20	6	12	15	4	15	8	4	12	17	4	16	8	9	9	17'-2	7	6	8'-10	4'-5	4'-5	7	17'-2	7	6	17'-8	7	6	10'-0	4'-8	5'-4	7	17'-8	0.546	0.620	0.257	1.423	380.79
3-5	16	5	9.5	11.5	9	9	4	12	6'-8	4	6	20	4	12	15	4	15	8	4	12	17	4	14	8	7	6	17'-2	8	9	8'-8	4'-4	4'-4	8	17'-2	7	6	17'-8	8	9	9'-8	4'-3	5'-5	8	17'-8	0.546	0.675	0.257	1.478	339.87
6-8	16	5	10	12.5	9	9	4	12	6'-9	4	6	20	4	12	15	4	13	8	4	12	17	4	13	8	8	6	17'-2	7	6	8'-0	4'-0	4'-0	7	17'-2	8	6	17'-8	7	6	9'-4	3'-10	5'-6	7	17'-8	0.573	0.731	0.257	1.561	390.03
9-10	16	5	11	13	9.5	9	4	12	6'-11	4	6	20	4	12	15	4	14	8	4	12	17	4	12	8	8	6	17'-3	7	6	8'-4	4'-2	4'-2	7	17'-3	8	6	17'-9	8	6	9'-3	3'-9	5'-6	8	17'-9	0.631	0.763	0.271	1.665	417.29
11-13	16	5	13	14.5	10	9	4	12	7'-2	4	6	20	4	12	15	4	16	6	4	12	17	4	17	6	8	6	17'-4	7	6	7'-7	3'-4	4'-3	7	17'-4	9	6	17'-10	7	6	9'-2	3'-6	5'-8	7	17'-10	0.744	0.852	0.285	1.881	411.37
14-16	16	5	14.5	17	11	9	4	12	7'-6	4	6	20	4	12	15	4	15	6	4	12	17	4	15	6	9	6	17'-6	7	6	7'-9	3'-4	4'-5	7	17'-6	9	6	18'-0	7	6	9'-1	3'-3	5'-10	7	18'-0	0.836	1.001	0.315	2.152	440.53

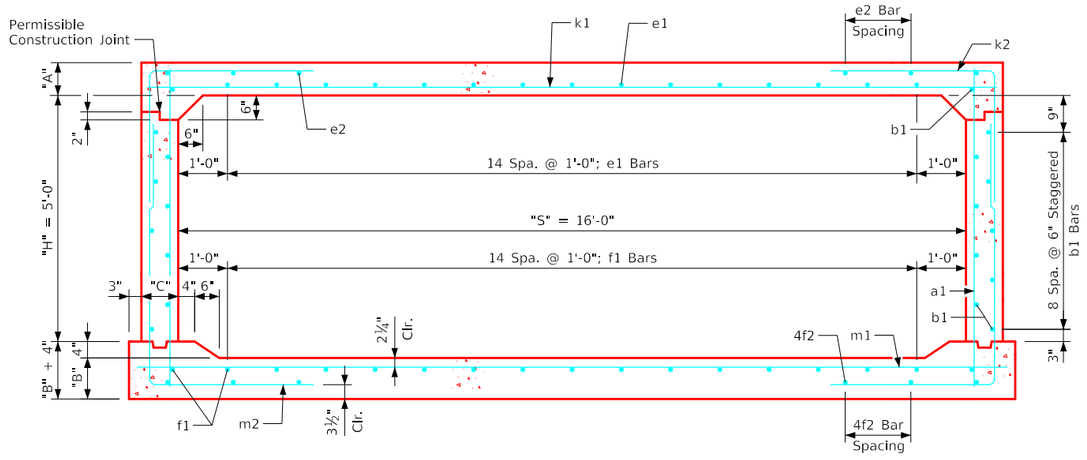
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 5' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 5' Barrel Sections

RCB 16-5-20

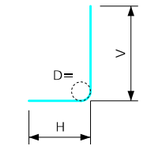
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-5-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 6' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	16	6	14.5	15	9	6	4	6	8'-4	4	6	24	5	12	15	8	12	8	4	12	17	4	14	8	8	9	17'-2	5	6	7'-4	3'-8	3'-8	5	17'-2	6	6	17'-8	5	6	10'-11	4'-3	6'-8	5	17'-8	0.816	0.870	0.313	1.999	288.13
1	16	6	14	14.5	9	6	4	6	8'-3	4	6	24	5	12	15	4	18	6	4	12	17	4	14	8	8	9	17'-2	5	6	7'-2	3'-7	3'-7	5	17'-2	6	6	17'-8	5	6	10'-11	4'-3	6'-8	5	17'-8	0.789	0.842	0.313	1.944	270.00
2	16	6	9.5	11	9	9	4	12	7'-7	4	6	24	6	12	15	4	15	8	4	12	17	4	15	8	9	9	17'-2	8	9	8'-10	4'-5	4'-5	8	17'-2	7	6	17'-8	8	9	10'-10	4'-6	6'-4	8	17'-8	0.546	0.648	0.313	1.507	376.42
3-5	16	6	10	12	9	9	4	12	7'-9	4	6	24	4	12	15	4	14	8	4	12	17	4	14	8	7	6	17'-2	7	6	8'-6	4'-3	4'-3	7	17'-2	7	6	17'-8	6	6	10'-7	4'-2	6'-5	6	17'-8	0.573	0.703	0.313	1.589	340.66
6-8	16	6	10	12.5	9	9	4	12	7'-9	4	6	24	4	12	15	4	13	8	4	12	17	4	12	8	8	6	17'-2	7	6	8'-0	4'-0	4'-0	7	17'-2	8	6	17'-8	7	6	10'-3	3'-9	6'-6	7	17'-8	0.573	0.731	0.313	1.617	401.63
9-10	16	6	11	13.5	9.5	9	4	12	7'-11	4	6	24	4	12	15	4	13	8	4	12	17	4	17	6	8	6	17'-3	7	6	8'-2	4'-1	4'-1	7	17'-3	8	6	17'-9	7	6	10'-1	3'-6	6'-7	7	17'-9	0.631	0.791	0.330	1.752	401.50
11-13	16	6	13	14.5	10	9	4	12	8'-2	4	6	24	4	12	15	4	15	6	4	12	17	4	16	6	9	6	17'-4	7	6	7'-5	3'-2	4'-3	7	17'-4	9	6	17'-10	7	6	10'-1	3'-5	6'-8	7	17'-10	0.744	0.852	0.347	1.943	447.29
14-16	16	6	14.5	17	11	9	4	12	8'-6	4	6	24	4	12	15	4	15	6	4	12	17	4	14	6	9	6	17'-6	8	9	8'-1	3'-3	4'-10	8	17'-6	9	6	18'-0	8	9	10'-0	3'-2	6'-10	8	18'-0	0.836	1.001	0.383	2.220	440.92

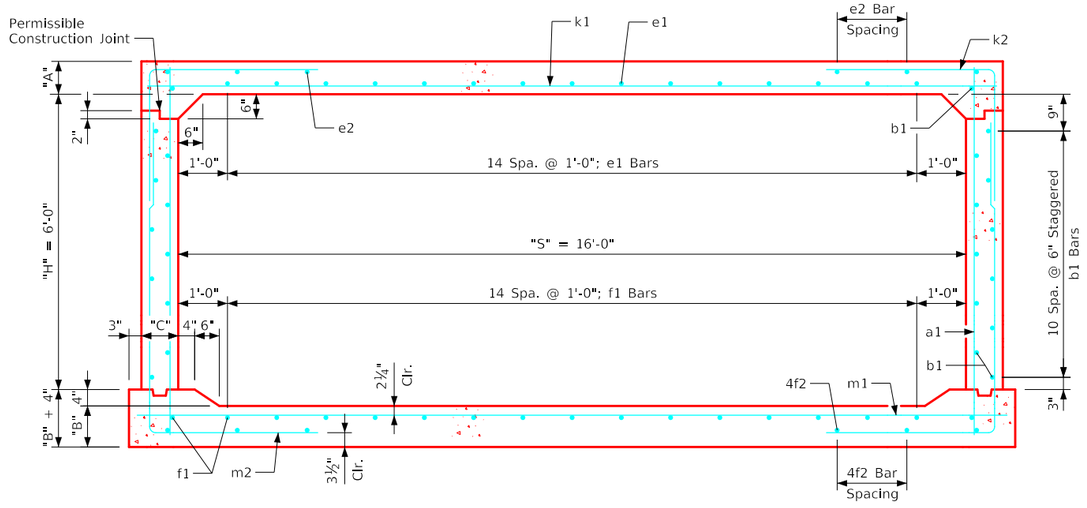
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 6' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 6' Barrel Sections

RCB 16-6-20

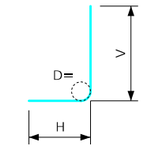
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 7' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)					Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	16	7	14.5	15	9	9	4	12	9'-4	4	6	28	5	12	15	4	12	8	4	12	17	4	15	8	8	9	17'-2	7	12	8'-1	3'-8	4'-5	7	17'-2	8	9	17'-8	8	12	12'-0	4'-4	7'-8	8	17'-8	0.816	0.870	0.368	2.054	307.50
1	16	7	14	14.5	9	6	4	6	9'-3	4	6	28	5	12	15	4	13	8	4	12	17	4	15	8	8	9	17'-2	5	6	7'-8	3'-10	3'-10	5	17'-2	8	9	17'-8	5	6	12'-0	4'-4	7'-8	5	17'-8	0.789	0.842	0.368	1.999	295.34
2	16	7	10	11.5	9	9	4	12	8'-8	4	6	28	6	12	15	4	15	8	4	12	17	4	15	8	9	9	17'-2	6	6	8'-1	4'-5	3'-8	6	17'-2	7	6	17'-8	7	6	11'-10	4'-5	7'-5	7	17'-8	0.573	0.675	0.368	1.616	379.71
3-5	16	7	10	12.5	9	9	4	12	8'-9	4	6	28	4	12	15	4	14	8	4	12	17	4	14	8	9	9	17'-2	6	6	8'-6	4'-3	4'-3	6	17'-2	7	6	17'-8	6	6	11'-7	4'-1	7'-6	6	17'-8	0.573	0.731	0.368	1.672	341.89
6-8	16	7	10	12.5	9	9	4	12	8'-9	4	6	28	4	12	15	4	13	8	4	12	17	4	12	8	8	6	17'-2	7	6	8'-0	4'-0	4'-0	7	17'-2	8	6	17'-8	7	6	11'-3	3'-9	7'-6	7	17'-8	0.573	0.731	0.368	1.672	413.95
9-10	16	7	12	14.5	9	9	4	12	9'-1	4	6	28	4	12	15	4	15	6	4	12	17	4	15	6	8	6	17'-2	6	6	7'-0	3'-2	3'-10	6	17'-2	9	6	17'-8	6	6	10'-9	3'-1	7'-8	6	17'-8	0.681	0.842	0.368	1.891	385.53
11-13	16	7	13	15.5	10	9	4	12	9'-3	4	6	28	4	12	15	4	15	6	4	12	17	4	15	6	9	6	17'-4	8	9	7'-11	3'-3	4'-8	8	17'-4	9	6	17'-10	8	9	10'-11	3'-2	7'-9	8	17'-10	0.744	0.908	0.409	2.061	447.89
14-16	16	7	14.5	17	10.5	9	4	9	9'-6	4	6	28	4	12	15	4	14	6	4	12	17	4	14	6	9	6	17'-5	7	6	7'-6	3'-1	4'-5	7	17'-5	9	6	17'-11	6	6	10'-11	3'-1	7'-10	6	17'-11	0.831	0.996	0.431	2.258	440.03

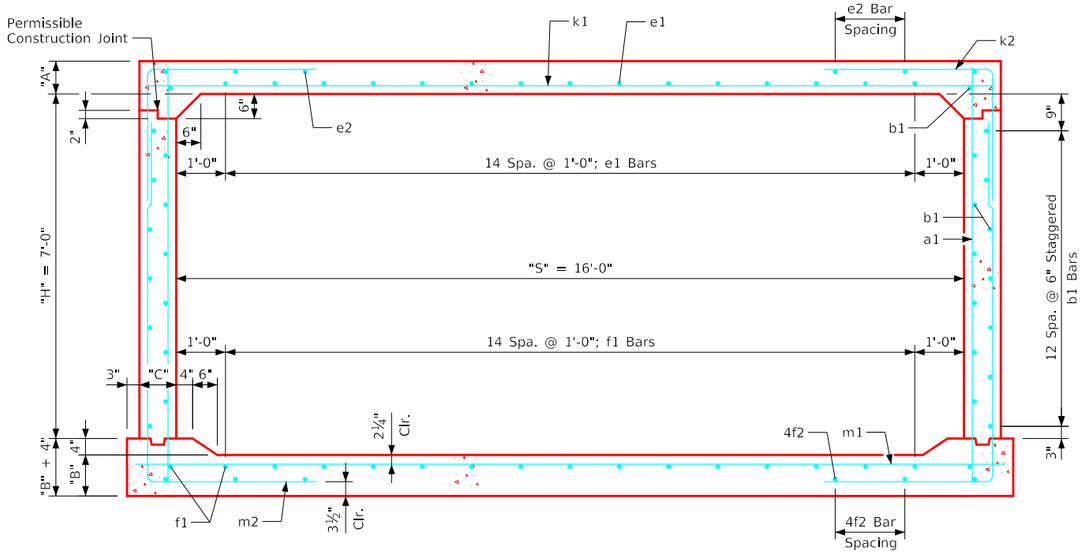
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 7' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 7' Barrel Sections

RCB 16-7-20

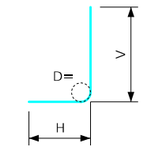
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 8' Barrel Sections

Dimensions							Bar List																																	Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	16	8	14.5	15	9	9	4	12	10'-4	4	6	32	5	12	15	4	15	8	4	12	17	4	15	8	8	9	17'-2	7	12	8'-10	4'-5	4'-5	7	17'-2	8	9	17'-8	8	12	13'-1	4'-5	8'-8	8	17'-8	0.816	0.870	0.424	2.110	321.05
1	16	8	14	15	9	9	4	12	10'-4	4	6	32	5	12	15	4	15	8	4	12	17	4	15	8	8	9	17'-2	7	12	8'-10	4'-5	4'-5	7	17'-2	8	9	17'-8	8	12	13'-1	4'-5	8'-8	8	17'-8	0.789	0.870	0.424	2.083	321.05
2	16	8	10	12	9	9	4	12	9'-9	4	6	32	6	12	15	4	15	8	4	12	17	4	15	8	8	6	17'-2	6	6	8'-2	4'-6	3'-8	6	17'-2	7	6	17'-8	6	6	12'-10	4'-5	8'-5	6	17'-8	0.573	0.703	0.424	1.700	375.37
3-5	16	8	10	12.5	9	9	4	12	9'-9	4	6	32	4	12	15	4	15	8	4	12	17	4	14	8	8	6	17'-2	6	6	8'-0	4'-4	3'-8	6	17'-2	8	6	17'-8	6	6	12'-8	4'-2	8'-6	6	17'-8	0.573	0.731	0.424	1.728	383.32
6-8	16	8	10	13	9	9	4	12	9'-10	4	6	32	4	12	15	4	14	8	4	12	17	4	12	8	8	6	17'-2	7	6	8'-2	4'-1	4'-1	7	17'-2	8	6	17'-8	6	6	12'-2	3'-8	8'-6	6	17'-8	0.573	0.759	0.424	1.756	399.82
9-10	16	8	12	14.5	9	9	4	12	10'-1	4	6	32	4	12	15	4	16	6	4	12	17	4	16	6	8	6	17'-2	6	6	7'-1	3'-3	3'-10	6	17'-2	9	6	17'-8	6	6	11'-11	3'-3	8'-8	6	17'-8	0.681	0.842	0.424	1.947	397.11
11-13	16	8	13	15.5	10	9	4	12	10'-3	4	6	32	4	12	15	4	16	6	4	12	17	4	15	6	9	6	17'-4	7	6	7'-7	3'-4	4'-3	7	17'-4	9	6	17'-10	6	6	12'-0	3'-3	8'-9	6	17'-10	0.744	0.908	0.471	2.123	445.82
14-16	16	8	14.5	17	10.5	9	4	9	10'-6	4	6	32	4	12	15	4	14	6	4	12	17	4	15	6	9	6	17'-5	7	6	7'-7	3'-2	4'-5	7	17'-5	9	6	17'-11	6	6	12'-1	3'-3	8'-10	6	17'-11	0.831	0.996	0.496	2.323	452.24

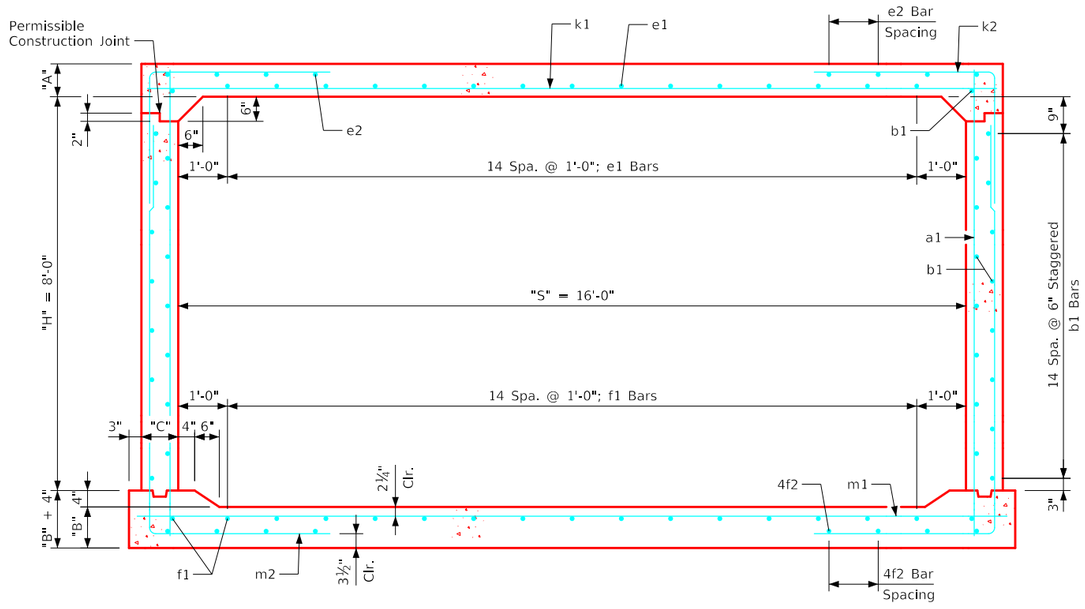
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 8' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 8' Barrel Sections

RCB 16-8-20

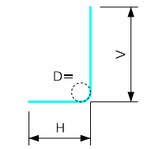
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-8-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 9' Barrel Sections

Dimensions							Bar List																																		Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	16	9	14.5	15	9	6	4	6	11'-4	4	6	36	5	12	15	5	17	8	4	12	17	4	16	8	8	9	17'-2	5	6	8'-8	5'-0	3'-8	5	17'-2	8	9	17'-8	5	6	14'-5	4'-9	9'-8	5	17'-8	0.816	0.870	0.479	2.165	323.66
1	16	9	14	15	9	6	4	6	11'-4	4	6	36	5	12	15	4	14	10	4	12	17	4	17	8	8	9	17'-2	5	6	8'-10	5'-3	3'-7	5	17'-2	8	9	17'-8	5	6	14'-6	4'-10	9'-8	5	17'-8	0.789	0.870	0.479	2.138	323.08
2	16	9	10	12.5	9	9	4	12	10'-9	4	6	36	6	12	15	4	16	8	4	12	17	4	16	8	8	6	17'-2	6	6	8'-3	4'-7	3'-8	6	17'-2	7	6	17'-8	6	6	14'-1	4'-7	9'-6	6	17'-8	0.573	0.731	0.479	1.783	387.53
3-5	16	9	10	12.5	9	9	4	12	10'-9	4	6	36	4	12	15	4	15	8	4	12	17	4	15	8	8	6	17'-2	6	6	8'-1	4'-5	3'-8	6	17'-2	8	6	17'-8	6	6	13'-10	4'-4	9'-6	6	17'-8	0.573	0.731	0.479	1.783	394.97
6-8	16	9	10.5	13.5	9	9	4	12	10'-11	4	6	36	4	12	15	4	14	8	4	12	17	4	12	8	8	6	17'-2	7	6	8'-2	4'-1	4'-1	7	17'-2	8	6	17'-8	6	6	13'-4	3'-9	9'-7	6	17'-8	0.600	0.787	0.479	1.866	411.08
9-10	16	9	12	14.5	9	9	4	12	11'-1	4	6	36	4	12	15	4	13	8	4	12	17	4	17	6	9	6	17'-2	6	6	7'-8	3'-10	3'-10	6	17'-2	9	6	17'-8	6	6	13'-1	3'-5	9'-8	6	17'-8	0.681	0.842	0.479	2.002	438.50
11-13	16	9	13	15.5	10	9	4	12	11'-3	4	6	36	4	12	15	4	16	6	4	12	17	4	16	6	9	6	17'-4	8	9	8'-1	3'-5	4'-8	8	17'-4	9	6	17'-10	8	9	13'-2	3'-5	9'-9	8	17'-10	0.744	0.908	0.532	2.184	473.89
14-16	16	9	14.5	17.5	10.5	6	4	6	11'-7	4	6	36	4	12	15	4	15	6	4	12	17	4	15	6	9	6	17'-5	8	9	8'-1	3'-4	4'-9	8	17'-5	9	6	17'-11	7	9	13'-3	3'-4	9'-11	7	17'-11	0.831	1.024	0.560	2.415	467.50

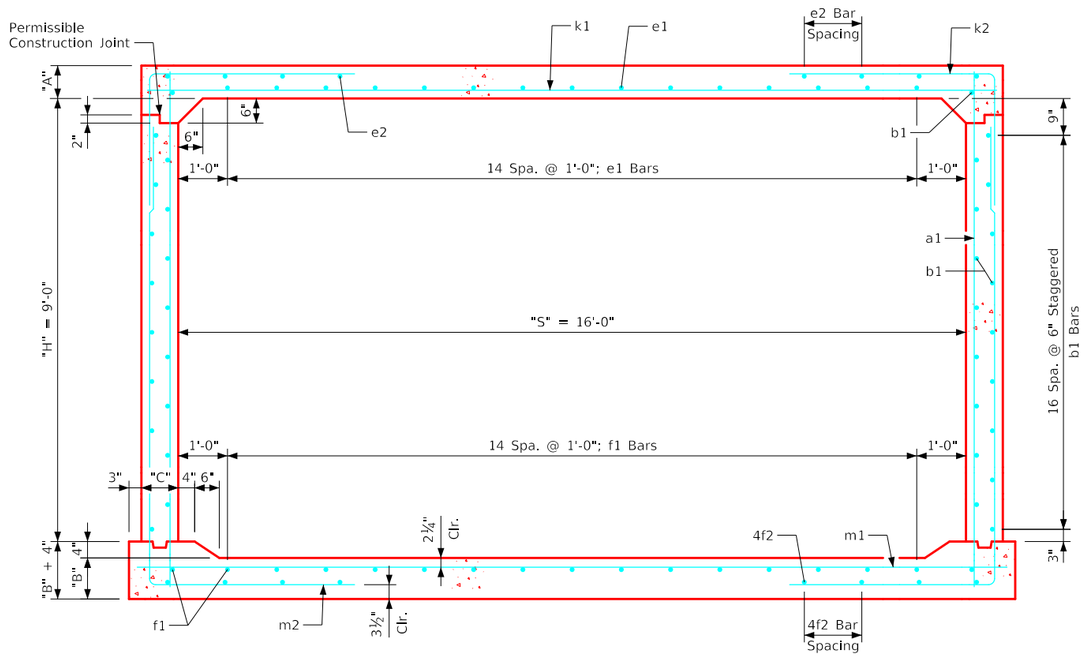
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 9' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 9' Barrel Sections

RCB 16-9-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-9-20 - THIS SHEET ISSUED 07-2020.

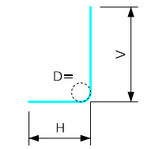
6/30/2020 9:33:52 AM bkloss W:\Highway\Bridge\Standards\Culverts\LRFD\EnglishLRFDSignedSingleCulverts.dgn RCB 16-9-20 11x17_pdf.pltcfg

Variable Dimensions and Quantities for 16' x 10' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2				k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	16	10	14.5	15	10	9	6	12	12'-4	4	6	40	5	12	15	4	16	10	4	12	17	4	14	10	8	9	17'-4	5	6	9'-9	6'-1	3'-8	5	17'-4	8	9	17'-10	5	6	16'-0	5'-4	10'-8	5	17'-10	0.826	0.880	0.594	2.300	346.26
1	16	10	14	15	10	9	6	12	12'-4	4	6	40	5	12	15	4	16	10	4	12	17	4	14	10	8	9	17'-4	5	6	9'-10	6'-3	3'-7	5	17'-4	8	9	17'-10	5	6	16'-2	5'-6	10'-8	5	17'-10	0.798	0.880	0.594	2.272	347.32
2	16	10	10	12	10	9	4	12	11'-9	4	6	40	6	12	15	4	17	8	4	12	17	4	17	8	9	9	17'-4	6	6	8'-9	5'-1	3'-8	6	17'-4	7	6	17'-10	6	6	15'-4	4'-11	10'-5	6	17'-10	0.580	0.711	0.594	1.885	392.21
3-5	16	10	10	12.5	10	9	5	12	11'-9	4	6	40	4	12	15	4	16	8	4	12	17	4	16	8	9	9	17'-4	7	9	8'-8	4'-8	4'-0	7	17'-4	8	6	17'-10	7	9	15'-2	4'-8	10'-6	7	17'-10	0.580	0.740	0.594	1.914	401.74
6-8	16	10	10	12.5	10	9	4	12	11'-9	4	6	40	4	12	15	4	15	8	4	12	17	4	14	8	8	6	17'-4	8	9	8'-10	4'-5	4'-5	8	17'-4	8	6	17'-10	8	9	14'-9	4'-3	10'-6	8	17'-10	0.580	0.740	0.594	1.914	445.21
9-10	16	10	11.5	14.5	10	9	4	12	12'-1	4	6	40	4	12	15	4	14	8	4	12	17	4	12	8	8	6	17'-4	7	6	8'-4	4'-2	4'-2	7	17'-4	9	6	17'-10	6	6	14'-5	3'-9	10'-8	6	17'-10	0.662	0.852	0.594	2.108	451.55
11-13	16	10	13	15.5	10	9	4	12	12'-3	4	6	40	4	12	15	4	17	6	4	12	17	4	17	6	9	6	17'-4	8	9	8'-3	3'-7	4'-8	8	17'-4	9	6	17'-10	8	9	14'-4	3'-7	10'-9	8	17'-10	0.744	0.908	0.594	2.246	487.84
14-16	16	10	14.5	17.5	11	6	4	6	12'-7	4	6	40	4	12	15	4	17	6	4	12	17	4	17	6	9	6	17'-6	8	9	8'-4	3'-7	4'-9	8	17'-6	9	6	18'-0	7	9	14'-6	3'-7	10'-11	7	18'-0	0.836	1.029	0.655	2.520	482.95

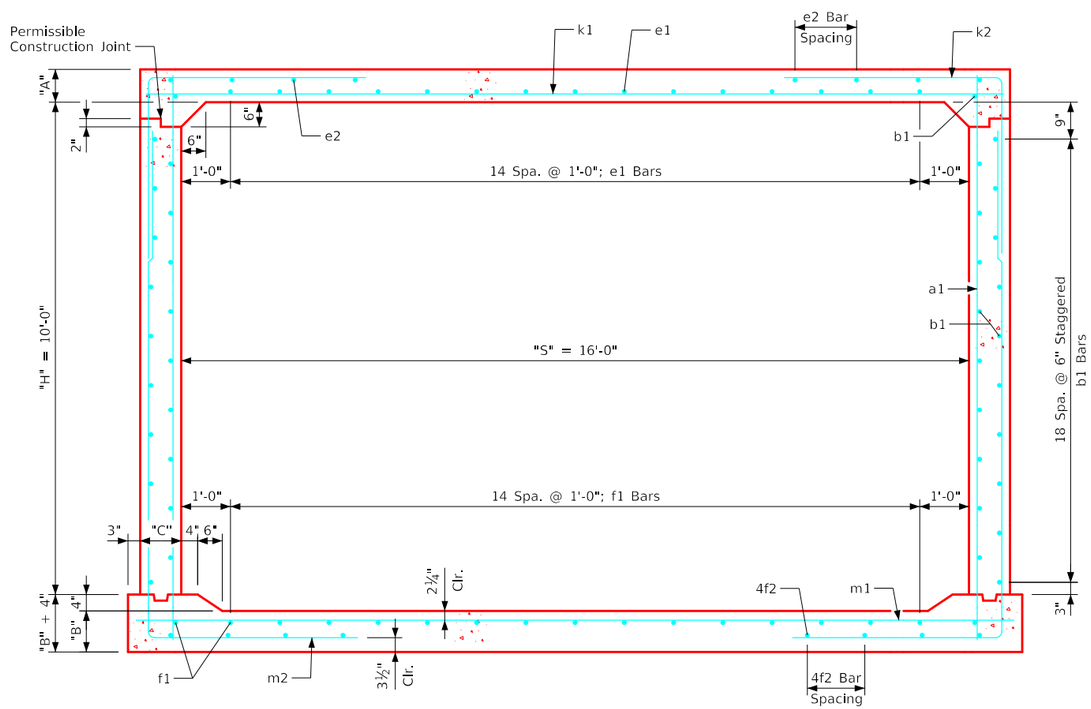
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 10' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 10' Barrel Sections

RCB 16-10-20

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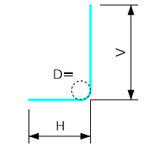
Variable Dimensions and Quantities for 16' x 11' Barrel Sections

Dimensions							Bar List																												Quantities					
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	16	11	14.5	15	11	9	6	9	13'-4	4	6	44	5	12	15	4	16	12	4	12	17	4	15	10	8	9	17'-6	5	6	11'-2	7'-6	3'-8	5	17'-6	8	9	18'-0	5	6	17'-6	5'-10	11'-8	5	18'-0	0.836	0.888	0.723	2.447	379.58
1	16	11	14	15	11	9	6	9	13'-4	4	6	44	5	12	15	4	16	12	4	12	17	4	15	10	8	9	17'-6	5	6	11'-3	7'-8	3'-7	5	17'-6	8	9	18'-0	5	6	17'-8	6'-0	11'-8	5	18'-0	0.808	0.888	0.723	2.419	380.63
2	16	11	10	11.5	11	6	4	6	12'-8	4	6	44	6	12	15	4	14	10	4	12	17	4	13	10	9	9	17'-6	7	9	9'-7	5'-7	4'-0	7	17'-6	7	6	18'-0	8	9	16'-9	5'-4	11'-5	8	18'-0	0.588	0.690	0.723	2.001	451.21
3-5	16	11	9.5	12.5	11	6	4	6	12'-9	4	6	44	4	12	15	4	17	8	4	12	17	4	17	8	9	9	17'-6	8	9	9'-5	5'-1	4'-4	8	17'-6	7	6	18'-0	7	9	16'-6	5'-0	11'-6	7	18'-0	0.560	0.746	0.723	2.029	421.13
6-8	16	11	10	12.5	11	9	4	12	12'-9	4	6	44	4	12	15	4	15	8	4	12	17	4	15	8	8	6	17'-6	7	6	8'-7	4'-7	4'-0	7	17'-6	8	6	18'-0	7	6	16'-1	4'-7	11'-6	7	18'-0	0.588	0.746	0.723	2.057	478.63
9-10	16	11	11	14.5	11	9	5	12	13'-0	4	6	44	4	12	15	4	14	8	4	12	17	4	13	8	8	6	17'-6	7	6	8'-8	4'-4	4'-4	7	17'-6	9	6	18'-0	6	6	15'-10	4'-2	11'-8	6	18'-0	0.643	0.860	0.723	2.226	478.89
11-13	16	11	13	16	11	9	4	12	13'-4	4	6	44	4	12	15	4	13	8	4	12	17	4	12	8	9	6	17'-6	8	9	8'-8	4'-0	4'-8	8	17'-6	9	6	18'-0	8	9	15'-8	3'-11	11'-9	8	18'-0	0.753	0.945	0.723	2.421	509.97
14-16	16	11	14.5	17.5	12	9	6	12	13'-7	4	6	44	4	12	15	4	12	8	4	12	17	4	12	8	9	6	17'-8	7	6	8'-4	3'-11	4'-5	7	17'-8	9	6	18'-2	6	6	15'-11	4'-0	11'-11	6	18'-2	0.846	1.040	0.788	2.674	518.89

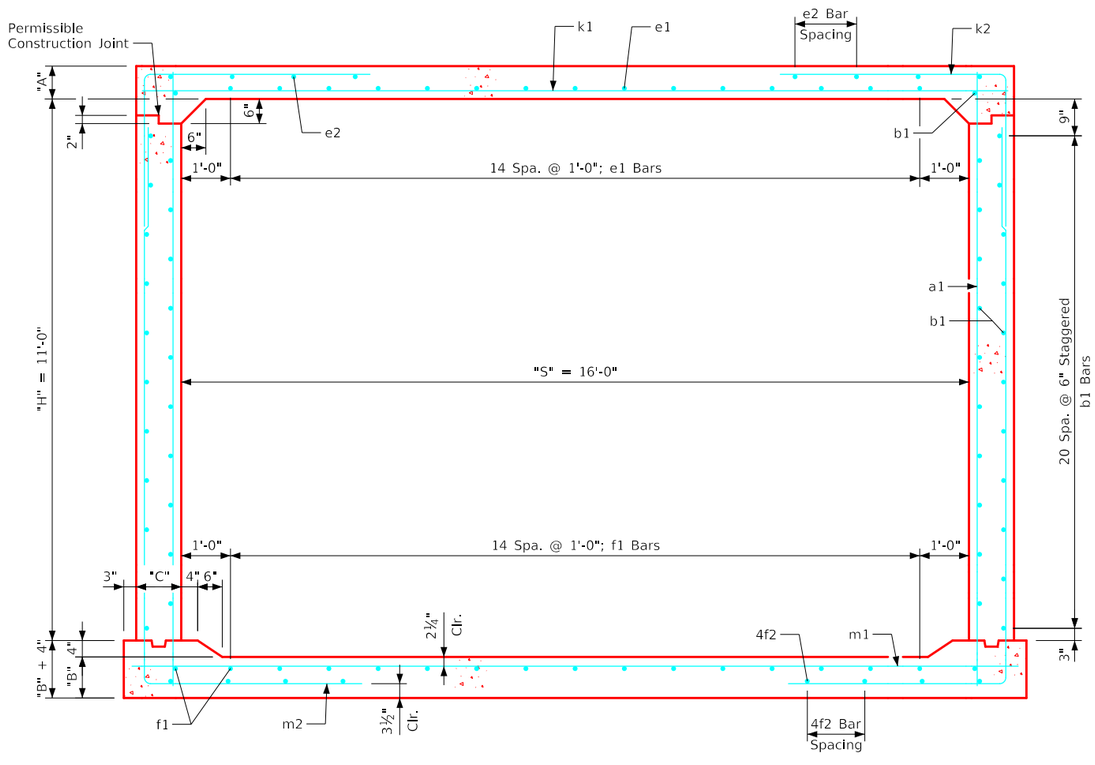
Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 11' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 11' Barrel Sections

RCB 16-11-20

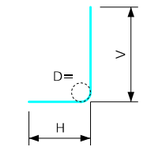
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-11-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for 16' x 12' Barrel Sections

Dimensions							Bar List																														Quantities					
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	16	12	15	15.5	12	9	4	9	14'-5	4	6	48	5	12	15	5	18	12	4	12	17	4	16	10	8	9	17'-8	8	12	15'-3	10'-5	4'-10	--	--	8	9	18'-2	8	12	19'-1	6'-4	12'-9	8	18'-2	0.873	0.926	0.862	2.661	437.24
1	16	12	14	15.5	12	9	4	12	14'-4	4	6	48	5	12	15	4	18	12	4	12	17	4	17	10	8	9	17'-8	8	12	15'-2	10'-5	4'-9	--	--	8	9	18'-2	8	12	19'-4	6'-7	12'-9	8	18'-2	0.818	0.926	0.862	2.606	427.58
2	16	12	9.5	11.5	12	9	4	12	13'-8	4	6	48	6	12	15	4	15	10	4	12	17	4	14	10	9	9	17'-8	8	9	10'-3	5'-11	4'-4	8	17'-8	7	6	18'-2	8	9	18'-1	5'-8	12'-5	8	18'-2	0.568	0.698	0.862	2.128	472.47
3-5	16	12	9.5	12.5	12	9	4	12	13'-9	4	6	48	4	12	15	4	14	10	4	12	17	4	18	8	7	6	17'-8	7	6	9'-6	5'-6	4'-0	7	17'-8	7	6	18'-2	6	6	17'-10	5'-4	12'-6	6	18'-2	0.568	0.755	0.862	2.185	422.74
6-8	16	12	10	12.5	12	9	4	12	13'-9	4	6	48	4	12	15	4	16	8	4	12	17	4	16	8	8	6	17'-8	7	6	8'-10	4'-10	4'-0	7	17'-8	8	6	18'-2	7	6	17'-4	4'-10	12'-6	7	18'-2	0.596	0.755	0.862	2.213	496.87
9-10	16	12	11	14	12	9	6	12	14'-0	4	6	48	4	12	15	4	15	8	4	12	17	4	15	8	8	6	17'-8	7	6	9'-2	4'-7	4'-7	7	17'-8	8	6	18'-2	6	6	17'-2	4'-7	12'-7	6	18'-2	0.651	0.841	0.862	2.354	484.34
11-13	16	12	13	16	12	9	6	12	14'-4	4	6	48	4	12	15	4	14	8	4	12	17	4	14	8	9	6	17'-8	7	6	8'-8	4'-4	4'-4	7	17'-8	9	6	18'-2	6	6	17'-1	4'-4	12'-9	6	18'-2	0.762	0.955	0.862	2.579	533.74
14-16	16	12	14.5	17.5	13	9	5	12	14'-7	4	6	48	4	12	15	4	13	8	4	12	17	4	13	8	9	6	17'-10	8	9	9'-0	4'-3	4'-9	8	17'-10	9	6	18'-4	8	9	17'-3	4'-4	12'-11	8	18'-4	0.856	1.052	0.934	2.842	544.53

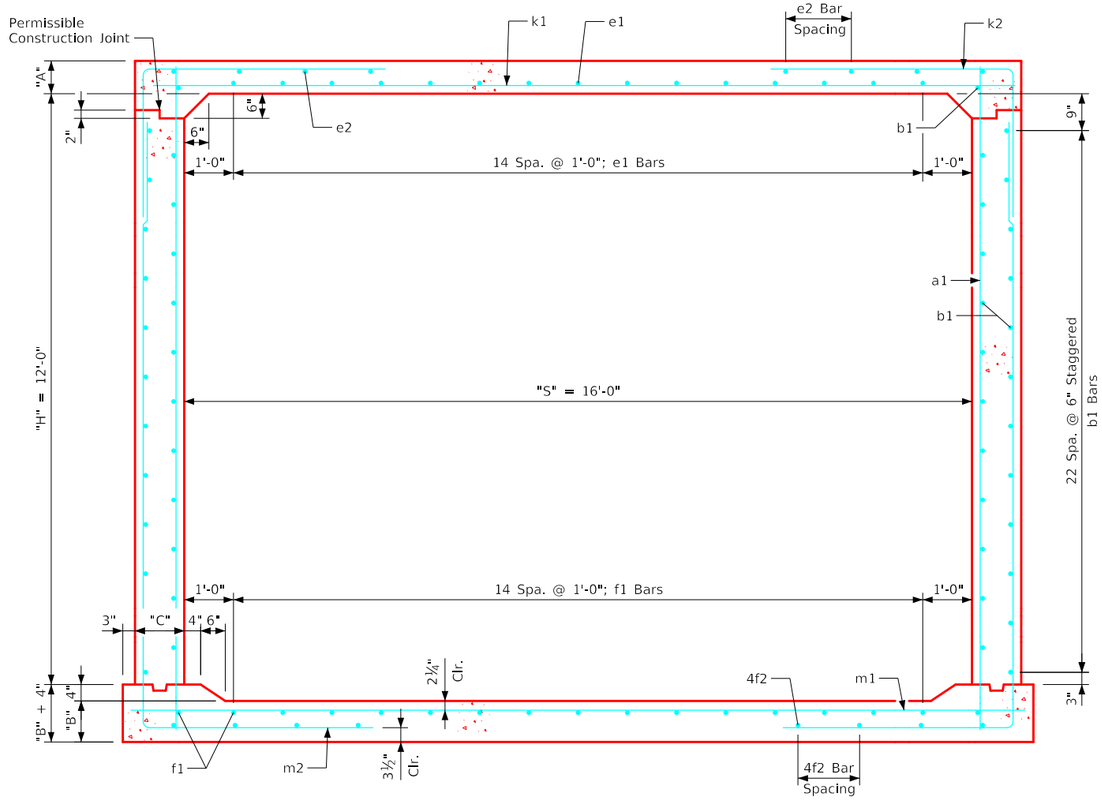
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 12' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 12' Barrel Sections

RCB 16-12-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-12-20 - THIS SHEET ISSUED 07-2020.

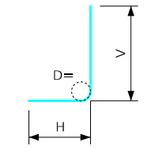
6/30/2020 9:33:57 AM bkloss W:\Highway\Bridge\Standards\Culverts\LRFD\EnglishLRFDSignedSingleCulverts.dgn RCB 16-12-20 11x17_pdf.pltcfg

Variable Dimensions and Quantities for 16' x 13' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	(LB/FT)
0	16	13	15	15.5	13	9	5	12	15'-5	4	6	52	5	12	15	5	18	12	4	12	17	4	17	10	8	9	17'-10	8	12	15'-4	10'-6	4'-10	--	--	8	9	18'-4	8	12	20'-7	6'-10	13'-9	8	18'-4	0.884	0.936	1.014	2.834	457.42
1	16	13	14	15.5	13	9	4	9	15'-4	4	6	52	5	12	15	4	18	12	4	12	17	4	15	12	8	9	17'-10	8	12	15'-3	10'-6	4'-9	--	--	8	9	18'-4	8	12	21'-0	7'-3	13'-9	8	18'-4	0.828	0.936	1.014	2.778	450.71
2	16	13	9.5	11.5	13	9	4	12	14'-8	4	6	52	6	12	15	4	16	10	4	12	17	4	15	10	9	9	17'-10	8	9	10'-8	6'-4	4'-4	8	17'-10	7	6	18'-4	8	9	19'-4	5'-11	13'-5	8	18'-4	0.575	0.706	1.014	2.295	490.42
3-5	16	13	9	12	13	9	4	12	14'-8	4	6	52	4	12	15	4	15	10	4	12	17	4	14	10	9	9	17'-10	9	9	11'-0	5'-11	5'-1	9	17'-10	7	6	18'-4	8	9	19'-0	5'-7	13'-5	8	18'-4	0.547	0.735	1.014	2.296	501.05
6-8	16	13	10	12.5	13	9	4	12	14'-9	4	6	52	4	12	15	4	17	8	4	12	17	4	16	8	8	6	17'-10	7	6	9'-2	5'-2	4'-0	7	17'-10	8	6	18'-4	7	6	18'-7	5'-1	13'-6	7	18'-4	0.603	0.763	1.014	2.380	515.84
9-10	16	13	11	13.5	13	9	4	12	14'-11	4	6	52	4	12	15	4	15	8	4	12	17	4	15	8	8	6	17'-10	7	6	8'-11	4'-10	4'-1	7	17'-10	8	6	18'-4	7	6	18'-5	4'-10	13'-7	7	18'-4	0.659	0.821	1.014	2.494	512.61
11-13	16	13	13	16	13	9	4	9	15'-4	4	6	52	4	12	15	4	15	8	4	12	17	4	15	8	8	6	17'-10	8	9	9'-4	4'-8	4'-8	8	17'-10	9	6	18'-4	8	9	18'-5	4'-8	13'-9	8	18'-4	0.772	0.965	1.014	2.751	528.24
14-16	16	13	14.5	17.5	14	6	4	6	15'-7	4	6	52	4	12	15	4	15	8	4	12	17	4	14	8	9	6	18'-0	8	9	9'-6	4'-9	4'-9	8	18'-0	9	6	18'-6	8	9	18'-7	4'-8	13'-11	8	18'-6	0.866	1.063	1.091	3.020	573.55

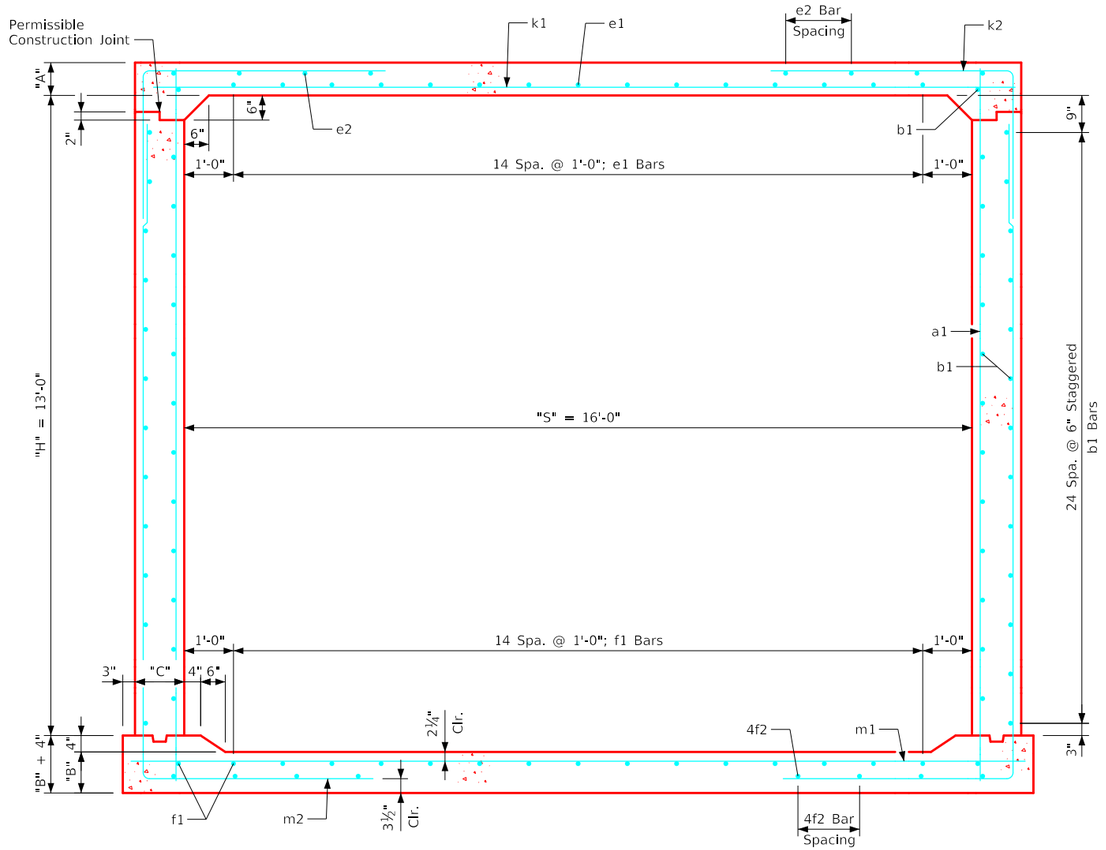
Bent Bar Detail

Bars	D
7	5¼"
8	6"
9	9½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 13' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 13' Barrel Sections

RCB 16-13-20

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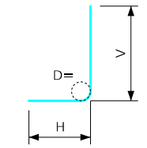
Variable Dimensions and Quantities for 16' x 14' Barrel Sections

Dimensions							Bar List																														Quantities				
							a1			b1			e1			e2			f1			f2			k1			k2					k9		m1			m2					m9		Concrete (CY/FT)				Steel (LB/FT)
Fill	S	H	A	B	C	D	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	L	Slab	Floor	Walls	Total	
0	16	14	15	16	14	9	4	9	16'-6	4	6	56	5	12	15	5	18	12	4	12	17	4	15	12	6	6	18'-0	6	6	14'-8	10'-7	4'-1	--	--	6	6	18'-6	6	6	22'-4	7'-7	14'-9	6	18'-6	0.894	0.975	1.178	3.047	451.58
1	16	14	14	15.5	14	9	5	12	16'-4	4	6	56	5	12	15	4	18	12	4	12	17	4	16	12	6	6	18'-0	6	6	14'-3	10'-3	4'-0	--	--	8	9	18'-6	6	6	22'-6	7'-9	14'-9	6	18'-6	0.837	0.946	1.178	2.961	463.55
2	16	14	9.5	11.5	14	9	4	9	15'-8	4	6	56	5	12	15	4	17	10	4	12	17	4	15	10	7	6	18'-0	7	6	10'-8	6'-8	4'-0	7	18'-0	7	6	18'-6	7	6	20'-6	6'-1	14'-5	7	18'-6	0.583	0.714	1.178	2.475	518.50
3-5	16	14	9	12	14	9	4	9	15'-8	4	6	56	4	12	15	4	15	10	4	12	17	4	14	10	7	6	18'-0	9	9	11'-4	6'-3	5'-1	9	18'-0	7	6	18'-6	8	9	20'-3	5'-10	14'-5	8	18'-6	0.555	0.743	1.178	2.476	514.92
6-8	16	14	10	12.5	14	9	4	12	15'-9	4	6	56	4	12	15	4	17	8	4	12	17	4	17	8	8	6	18'-0	7	6	9'-5	5'-5	4'-0	7	18'-0	8	6	18'-6	7	6	19'-11	5'-5	14'-6	7	18'-6	0.611	0.772	1.178	2.561	534.84
9-10	16	14	11	13.5	14	9	4	12	15'-11	4	6	56	4	12	15	4	16	8	4	12	17	4	16	8	8	6	18'-0	7	6	9'-3	5'-2	4'-1	7	18'-0	8	6	18'-6	7	6	19'-9	5'-2	14'-7	7	18'-6	0.668	0.830	1.178	2.676	532.32
11-13	16	14	13	15.5	14	6	4	6	16'-3	4	6	56	4	12	15	4	16	8	4	12	17	4	16	8	8	6	18'-0	8	9	10'-0	5'-0	5'-0	8	18'-0	9	6	18'-6	8	9	19'-9	5'-0	14'-9	8	18'-6	0.781	0.946	1.178	2.905	563.82
14-16	16	14	14.5	18	15	9	4	12	16'-7	4	6	56	4	12	15	4	15	8	4	12	17	4	15	8	9	6	18'-2	7	6	9'-8	4'-10	4'-10	7	18'-2	9	6	18'-8	7	6	19'-11	5'-0	14'-11	7	18'-8	0.876	1.103	1.262	3.241	594.34

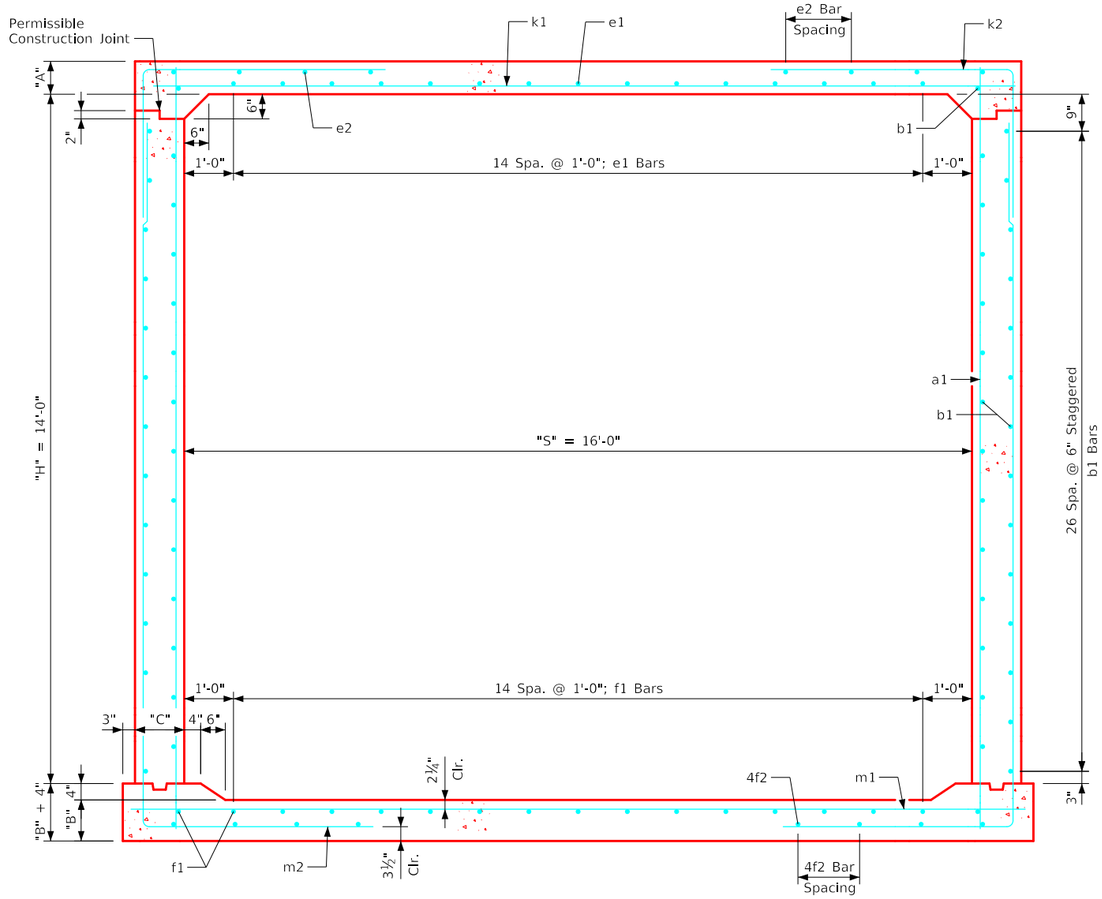
Bent Bar Detail

Bars	D
6	4½"
7	5¼"
8	6"
9	9½"



k2 & m2

Note:
All dimensions are out to out.
D = pin diameter.



16' x 14' Barrel Section

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

16' x 14' Barrel Sections

RCB 16-14-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 16-14-20 - THIS SHEET ISSUED 07-2020.

Dimension Table

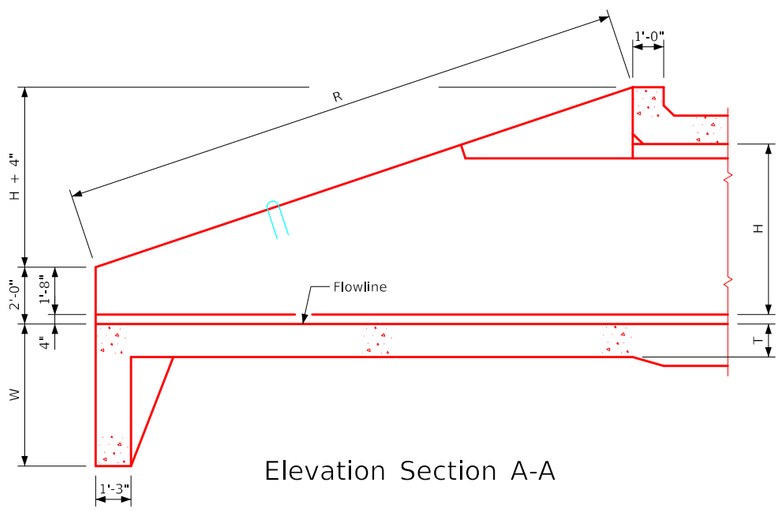
	S x H	16' x 14'	16' x 13'	16' x 12'	16' x 11'	16' x 10'	16' x 9'	16' x 8'	16' x 7'	16' x 6'	16' x 5'	16' x 4'	14' x 14'	14' x 13'	14' x 12'	14' x 11'	14' x 10'	14' x 9'	14' x 8'	14' x 7'	14' x 6'	14' x 5'	14' x 4'	S x H
Headwall Dimensions	A	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	H	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	P	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	P
	R	45'-3⅞	42'-2	39'-0	35'-10⅛	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	45'-3⅞	42'-2	39'-0	35'-10⅛	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	R
	S	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	S
	T	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	T
	U	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	9	9	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	9	9	U
	W	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	B
	C	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	9	9	9	E

Dimension Table

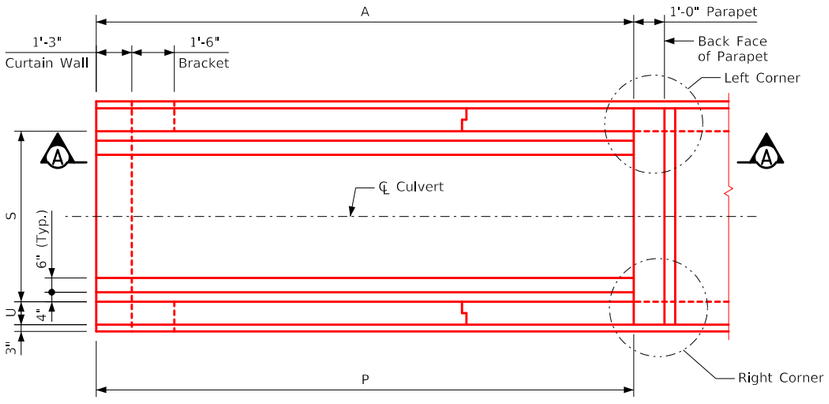
	S x H	12' x 12'	12' x 11'	12' x 10'	12' x 9'	12' x 8'	12' x 7'	12' x 6'	12' x 5'	12' x 4'	10' x 12'	10' x 11'	10' x 10'	10' x 9'	10' x 8'	10' x 7'	10' x 6'	10' x 5'	10' x 4'	S x H
Headwall Dimensions	A	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	H	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	P	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	P
	R	39'-0	35'-10⅛	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	39'-0	35'-10⅛	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	R
	S	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	S
	T	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	T
	U	1'-0	1'-0	10	10	10	9	9	9	9	1'-0	1'-0	10	10	10	9	9	9	9	U
	W	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	9	1'-0	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	E

Dimension Table

	S x H	8' x 10'	8' x 9'	8' x 8'	8' x 7'	8' x 6'	8' x 5'	8' x 4'	6' x 8'	6' x 7'	6' x 6'	6' x 5'	6' x 4'	6' x 3'	5' x 6'	5' x 5'	5' x 4'	5' x 3'	4' x 4'	3' x 3'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	13'-0	10'-0	A
	H	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	8'-0	7'-0	6'-0	5'-0	4'-0	3'-0	6'-0	5'-0	4'-0	3'-0	4'-0	3'-0	H
	P	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	13'-0	10'-0	P
	R	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	10'-6½	20'-0⅜	16'-10⅜	13'-8½	10'-6½	13'-8½	10'-6½	R
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	5'-0	5'-0	5'-0	5'-0	4'-0	3'-0	S
	T	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	T
	U	10	10	10	9	9	9	9	10	9	9	9	9	9	9	9	9	9	9	9	U
	W	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	4'-0	3'-9	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	C
	D	6	6	9	1'-0	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	--	--	D
	E	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E



Elevation Section A-A



Plan View

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets PWH 0-2-20 thru 0-4-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Dimension Table
0° Skew

PWH 0-1-20

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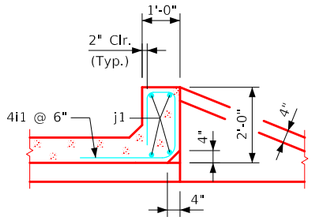
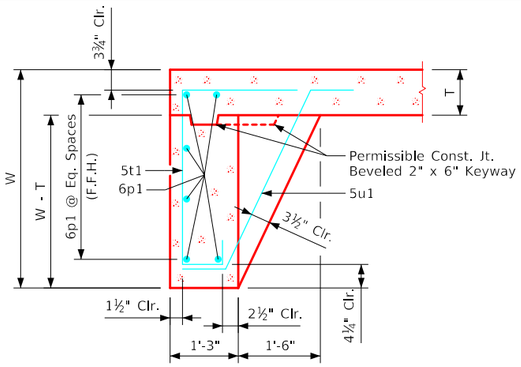
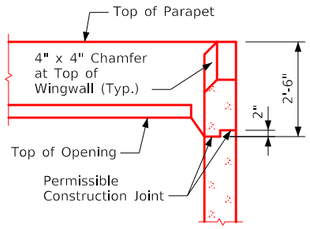
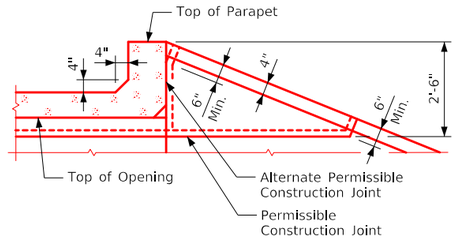


Section thru Parapet

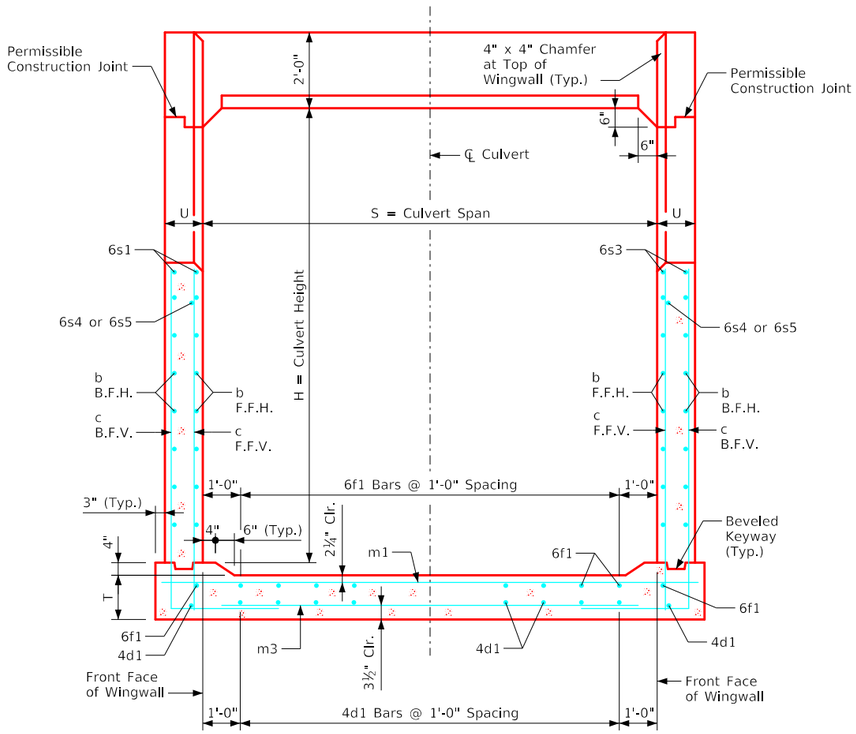


Section thru Curtain Wall

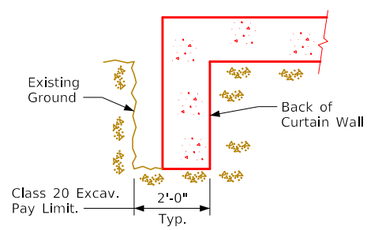




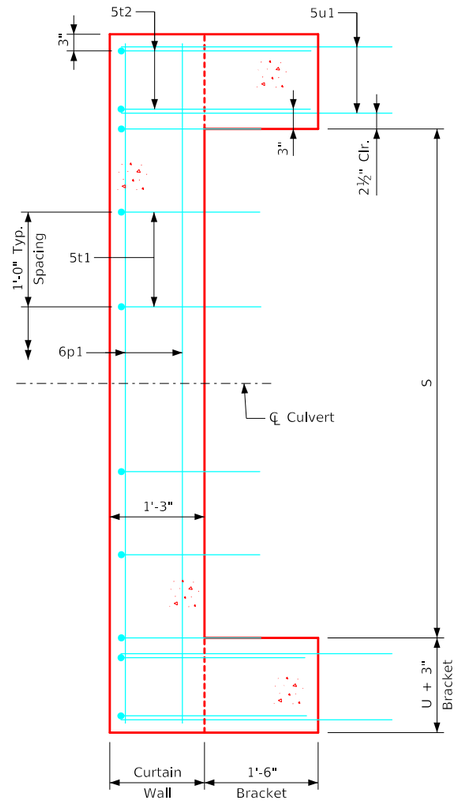
Top of Wingwall Details



Typical Cross Section - thru Headwall



Curtain Wall
Class 20 Excavation



Curtain Wall Detail - Plan View
(Apron is not shown)

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. For dimension table see Sheet PWH 0-1-20.

IOWADOT *Highway Division*

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Cross Section Details 0° Skew

PWH 0-2-20

LATEST REVISION DATE

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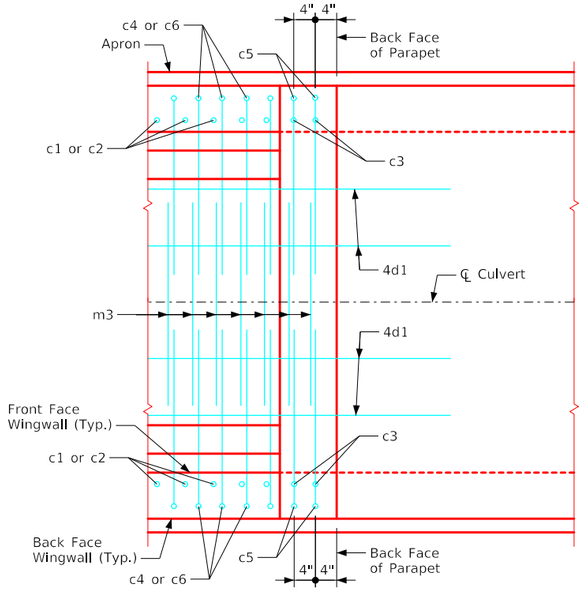
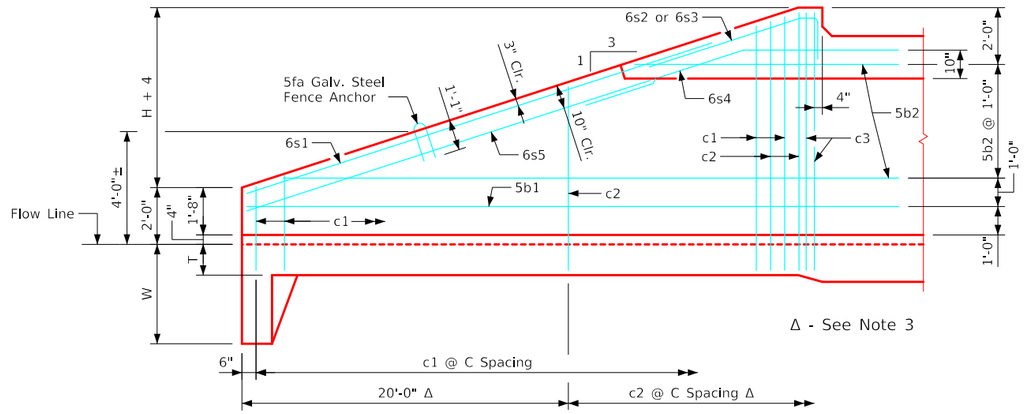
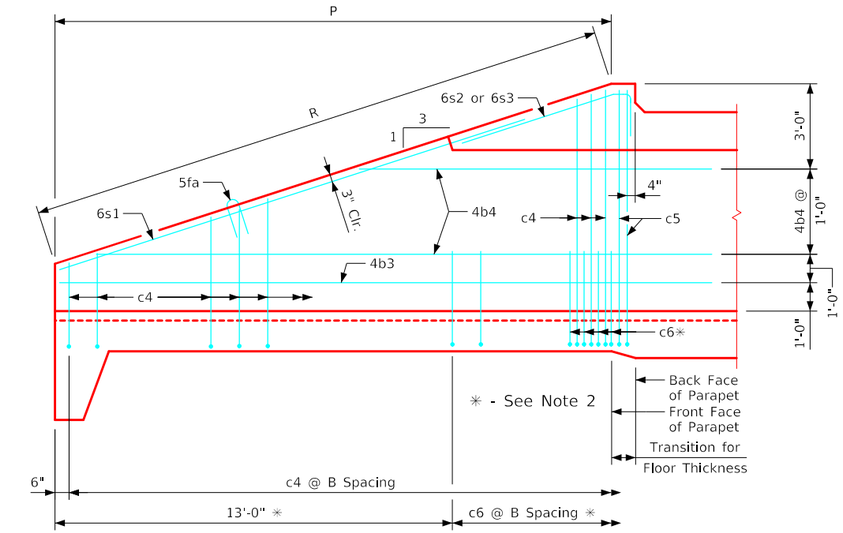


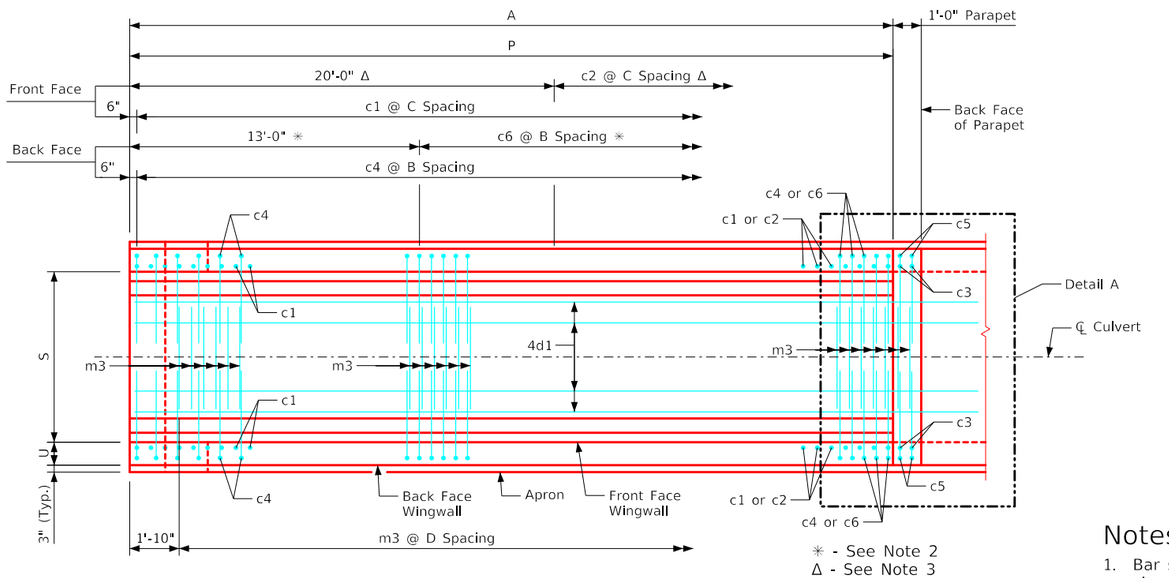
Detail A



Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing



Plan View - Bottom Apron Reinforcing

(Curtain Wall Reinforcing not shown, See Sheet PWH 0-2-20)

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. Not applicable for 3' thru 5' height headwalls.
3. Not applicable for 3' thru 8' height headwalls.
4. For headwall dimensions and bar spacing see Sheet PWH 0-1-20.
5. Apron m3 bars are to be centered on ℄ culvert.
6. B.F.V. (c5) and F.F.V. (c3) bars are approximately 4" from the back of parapet for all headwalls.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations & Bottom Apron Reinforcing 0° Skew

PWH 0-3-20

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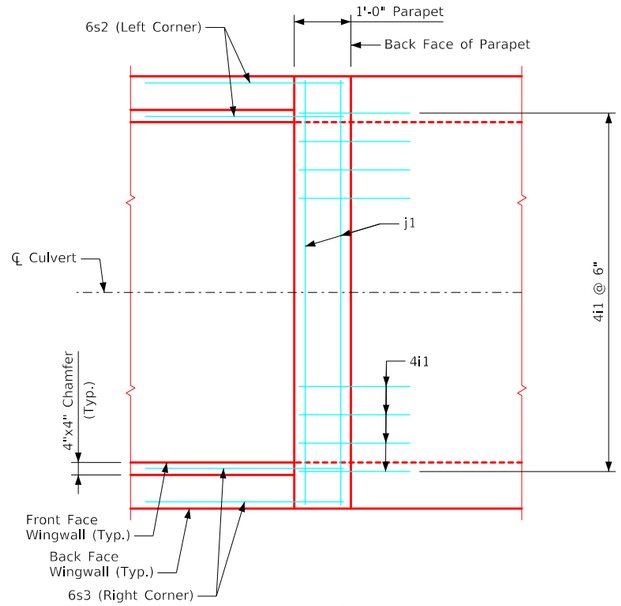
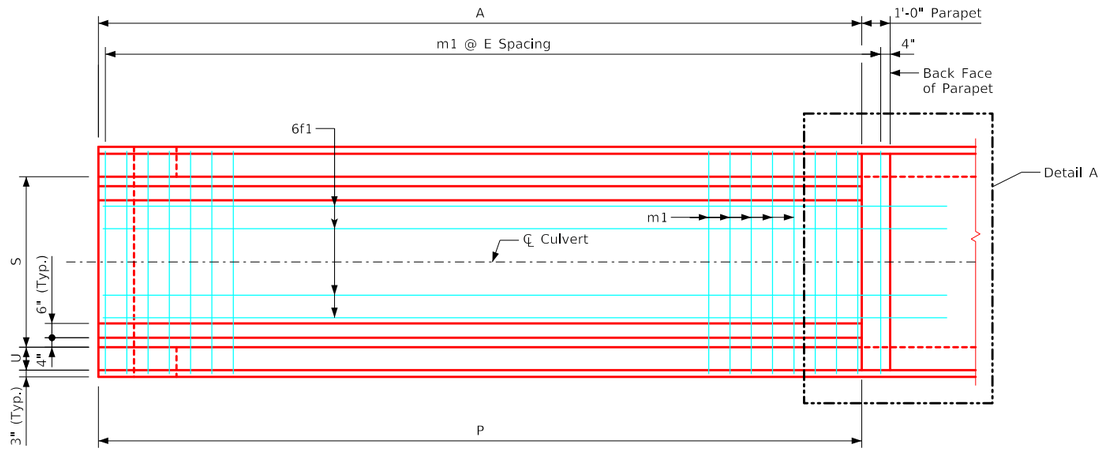


Detail A
(Showing parapet bars only)



Plan View - Top Apron Reinforcing
(Wall Reinforcing not shown for clarity)

Notes:
1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. For headwall dimensions and bar spacing see Sheet PWH 0-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 0° Skew

PWH 0-4-20

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6/30/2020 9:34:08 AM bkloss W:\Highway\Bridge\Standards\Culverts\LRFD\EnglishLRFDSignedSingleCulverts.dgn PWH 0-4-20 11x17_pdf.pltcfg

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	16' x 14'				16' x 13'				16' x 12'				16' x 11'				16' x 10'				16' x 9'				16' x 8'				16' 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.	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	46'-3	102	5b1	2	43'-3	95	5b1	2	40'-3	89	5b1	2	37'-3	78	5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53
Wingwall, F.F.H.		5b2	26 Var.	2 Each 8'-10 To 44'-10	738	5b2	24 Var.	2 Each 8'-10 to 41'-10	639	5b2	22 Var.	2 Each 8'-10 to 38'-10	547	5b2	20 Var.	2 Each 8'-10 to 35'-10	466	5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204
Wingwall, B.F.H.		4b3	2	46'-3	65	4b3	2	43'-3	61	4b3	2	40'-3	57	4b3	2	37'-3	50	4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34
Wingwall, B.F.H.		4b4	24 Var.	2 Each 11'-10 To 44'-10	461	4b4	22 Var.	2 Each 11'-10 to 41'-10	398	4b4	20 Var.	2 Each 11'-10 to 38'-10	338	4b4	18 Var.	2 Each 11'-10 to 35'-10	287	4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119
Wingwall, F.F.V.		5c1	86 Var.	2 Each 2'-10 To 16'-10	882	5c1	80 Var.	2 Each 2'-10 to 15'-10	779	5c1	74 Var.	2 Each 2'-10 to 14'-10	682	5c1	68 Var.	2 Each 2'-10 to 13'-10	591	4c1	62 Var.	2 Each 2'-10 to 12'-10	324	4c1	56 Var.	2 Each 2'-10 to 11'-10	274	4c1	66 Var.	2 Each 2'-10 to 10'-10	301	4c1	58 Var.	2 Each 2'-10 to 9'-10	245
Wingwall, F.F.V.		5c2	48 Var.	2 Each 9'-4 To 17'-0	659	5c2	42 Var.	2 Each 9'-4 to 16'-0	555	5c2	36 Var.	2 Each 9'-4 to 15'-0	457	5c2	30 Var.	2 Each 9'-4 to 14'-0	365	4c2	24 Var.	2 Each 9'-4 to 13'-0	179	4c2	18 Var.	2 Each 9'-4 to 12'-0	128	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, F.F.V. (R)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, B.F.V.		6c4	86 Var.	2 Each 6'-6 To 20'-6	1744	6c4	80 Var.	2 Each 6'-6 to 19'-6	1562	6c4	74 Var.	2 Each 6'-6 to 18'-6	1389	5c4	68 Var.	2 Each 6'-6 to 17'-6	851	5c4	62 Var.	2 Each 6'-6 to 16'-6	744	5c4	56 Var.	2 Each 6'-6 to 15'-6	642	5c4	50 Var.	2 Each 6'-6 to 14'-6	548	5c4	44 Var.	2 Each 6'-6 to 13'-6	459
Wingwall, B.F.V. (L)		6c5	2	20'-9	62	6c5	2	19'-9	59	6c5	2	18'-9	56	5c5	2	17'-9	37	5c5	2	16'-9	35	5c5	2	15'-9	33	5c5	2	14'-9	31	5c5	2	13'-9	29
Wingwall, B.F.V. (R)		6c5	2	20'-9	62	6c5	2	19'-9	59	6c5	2	18'-9	56	5c5	2	17'-9	37	5c5	2	16'-9	35	5c5	2	15'-9	33	5c5	2	14'-9	31	5c5	2	13'-9	29
Wingwall, B.F.V.		7c6	62	9'-3	1172	6c6	56	8'-6	715	6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177
Apron, Longit., Bott.		4d1	17	46'-3	553	4d1	17	43'-3	519	4d1	17	40'-3	485	4d1	17	37'-3	423	4d1	17	34'-3	389	4d1	17	31'-3	355	4d1	17	28'-3	321	4d1	17	25'-3	287
Apron, Longit., Top		6f1	17	46'-3	1243	6f1	17	43'-3	1166	6f1	17	40'-3	1089	6f1	17	37'-3	951	6f1	17	34'-3	875	6f1	17	31'-3	798	6f1	17	28'-3	721	6f1	17	25'-3	645
Parapet, Vertical		4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141
Parapet, Horiz.		9j1	4	17'-10	243	9j1	4	17'-10	243	9j1	4	17'-8	240	9j1	4	17'-8	240	9j1	4	17'-4	236	9j1	4	17'-4	236	9j1	4	17'-4	236	9j1	4	17'-2	233
Apron, Trans., Top		5m1	88	18'-4	1683	5m1	82	18'-4	1568	5m1	76	18'-2	1440	5m1	70	18'-2	1326	5m1	64	17'-10	1190	5m1	58	17'-10	1079	5m1	52	17'-10	967	5m1	46	17'-8	848
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		6m3	85	15'-7	1990	5m3	79	14'-9	1215	5m3	73	14'-7	1110	6m3	34	15'-5	787	6m3	31	15'-1	702	5m3	28	14'-3	416	5m3	25	14'-3	372	5m3	22	14'-1	323
Curtain, Horiz.		6p1	7	18'-4	193	6p1	7	18'-4	193	6p1	6	18'-2	164	6p1	6	18'-2	164	6p1	6	17'-10	161	6p1	6	17'-10	161	6p1	6	17'-10	161	6p1	5	17'-8	133
Wing Slope, Both F.		6s1	4	42'-0	267	6s1	4	38'-10	233	6s1	4	35'-8	214	6s1	4	32'-7	196	6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	39'-5	118	6s5	2	36'-4	109	6s5	2	33'-2	100	6s5	2	30'-0	90	6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52
Curtain, Vert.		5t1	17	8'-5	149	5t1	17	8'-2	145	5t1	17	7'-11	140	5t1	17	7'-8	136	5t1	17	7'-5	132	5t1	17	7'-2	127	5t1	17	6'-11	123	5t1	17	6'-8	118
Curtain, Vert., Ends		5t2	4	8'-5	35	5t2	4	8'-2	34	5t2	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	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23

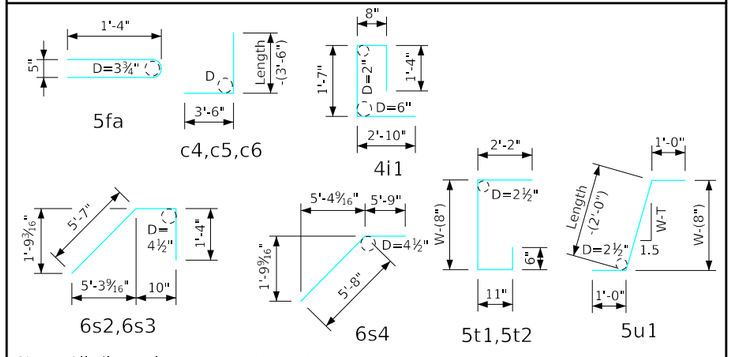
Estimated Quantities One Headwall			16' x 14'		16' x 13'		16' x 12'		16' x 11'		16' x 10'		16' x 9'		16' x 8'		16' x 7'	
Reinf. Steel			12,750 LB		10,671 LB		9643 LB		7811 LB		6664 LB		5734 LB		5066 LB		4414 LB	
Concrete	Parapet Δ	2.1	79.4 CY		72.6 CY		63.3 CY		57.1 CY		47.8 CY		42.5 CY		37.5 CY		31.6 CY	
	Wingwalls	30.7		26.9		21.5		18.4		13.0		10.8		8.8		6.3		
	Apron ✳	46.6		43.6		39.8		36.7		32.9		29.8		26.8		23.5		

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
0° Skew

PWH 0-5-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-5-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	16' x 6' Bar	No.	Length	Wt.	16' x 5' Bar	No.	Length	Wt.	16' x 4' Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-10 to 8'-10	195	4c1	32 Var.	2 Each 2'-10 to 7'-10	114	4c1	26 Var.	2 Each 2'-10 to 6'-10	84
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, F.F.V. (R)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-6 to 12'-6	377	6c4	42 Var.	2 Each 6'-6 to 11'-6	568	5c4	34 Var.	2 Each 6'-6 to 10'-6	301
Wingwall, B.F.V. (L)		5c5	2	12'-9	27	6c5	2	11'-9	35	5c5	2	10'-9	22
Wingwall, B.F.V. (R)		5c5	2	12'-9	27	6c5	2	11'-9	35	5c5	2	10'-9	22
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	17	22'-3	253	4d1	17	19'-3	219	4d1	17	16'-3	185
Apron, Longit., Top		6f1	17	22'-3	568	6f1	17	19'-3	492	6f1	17	16'-3	415
Parapet, Vertical		4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141
Parapet, Horiz.		9j1	4	17'-2	233	9j1	4	17'-2	233	9j1	4	17'-2	233
Apron, Trans., Top		5m1	40	17'-8	737	5m1	34	17'-8	626	5m1	28	17'-8	516
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	13'-4	169	4m3	16	13'-10	148	4m3	13	13'-4	116
Curtain, Horiz.		6p1	5	17'-8	133	6p1	5	17'-8	133	6p1	5	17'-8	133
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Curtain, Vert.		5t1	17	6'-5	114	5t1	17	6'-5	114	5t1	17	6'-5	114
Curtain, Vert., Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-5	23	5u1	4	5'-5	23	5u1	4	5'-5	23

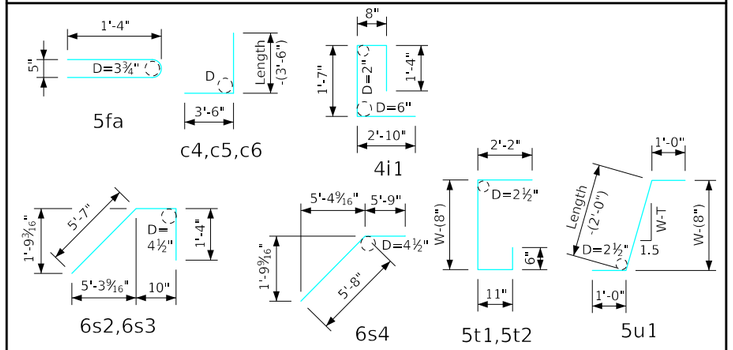
Estimated Quantities One Headwall			16' x 6'		16' x 5'		16' x 4'	
	Reinf. Steel		3720 LB		3367 LB		2691 LB	
	Concrete	Parapet Δ	1.8	27.1 CY	1.8	23.0 CY	1.8	19.1 CY
		Wingwalls	4.8		3.5		2.4	
		Apron ✳	20.5		17.7		14.9	

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
0° Skew

PWH 0-5-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-5-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	14' x 14'				14' x 13'				14' x 12'				14' x 11'				14' x 10'				14' x 9'				14' x 8'				14' 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.	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	46'-3	102	5b1	2	43'-3	95	5b1	2	40'-3	89	5b1	2	37'-3	78	5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53
Wingwall, F.F.H.		5b2	26 Var.	2 Each 8'-10 to 44'-10	738	5b2	24 Var.	2 Each 8'-10 to 41'-10	639	5b2	22 Var.	2 Each 8'-10 to 38'-10	547	5b2	20 Var.	2 Each 8'-10 to 35'-10	466	5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204
Wingwall, B.F.H.		4b3	2	46'-3	65	4b3	2	43'-3	61	4b3	2	40'-3	57	4b3	2	37'-3	50	4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34
Wingwall, B.F.H.		4b4	24 Var.	2 Each 11'-10 to 44'-10	461	4b4	22 Var.	2 Each 11'-10 to 41'-10	398	4b4	20 Var.	2 Each 11'-10 to 38'-10	338	4b4	18 Var.	2 Each 11'-10 to 35'-10	287	4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119
Wingwall, F.F.V.		5c1	86 Var.	2 Each 2'-9 to 16'-9	875	5c1	80 Var.	2 Each 2'-9 to 15'-9	772	5c1	74 Var.	2 Each 2'-9 to 14'-9	675	5c1	68 Var.	2 Each 2'-9 to 13'-9	585	4c1	62 Var.	2 Each 2'-9 to 12'-9	321	4c1	56 Var.	2 Each 2'-9 to 11'-9	271	4c1	66 Var.	2 Each 2'-9 to 10'-9	298	4c1	58 Var.	2 Each 2'-9 to 9'-9	242
Wingwall, F.F.V.		5c2	48 Var.	2 Each 9'-3 to 16'-11	655	5c2	42 Var.	2 Each 9'-3 to 15'-11	551	5c2	36 Var.	2 Each 9'-3 to 14'-11	454	5c2	30 Var.	2 Each 9'-3 to 13'-11	362	4c2	24 Var.	2 Each 9'-3 to 12'-11	178	4c2	18 Var.	2 Each 9'-3 to 11'-11	127	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, F.F.V. (R)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, B.F.V.		6c4	86 Var.	2 Each 6'-5 to 20'-5	1733	6c4	80 Var.	2 Each 6'-5 to 19'-5	1552	6c4	74 Var.	2 Each 6'-5 to 18'-5	1380	5c4	68 Var.	2 Each 6'-5 to 17'-5	845	5c4	62 Var.	2 Each 6'-5 to 16'-5	738	5c4	56 Var.	2 Each 6'-5 to 15'-5	638	5c4	50 Var.	2 Each 6'-5 to 14'-5	543	5c4	44 Var.	2 Each 6'-5 to 13'-5	455
Wingwall, B.F.V. (L)		6c5	2	20'-8	62	6c5	2	19'-8	59	6c5	2	18'-8	56	5c5	2	17'-8	37	5c5	2	16'-8	35	5c5	2	15'-8	33	5c5	2	14'-8	31	5c5	2	13'-8	29
Wingwall, B.F.V. (R)		6c5	2	20'-8	62	6c5	2	19'-8	59	6c5	2	18'-8	56	5c5	2	17'-8	37	5c5	2	16'-8	35	5c5	2	15'-8	33	5c5	2	14'-8	31	5c5	2	13'-8	29
Wingwall, B.F.V.		7c6	62	9'-3	1172	6c6	56	8'-6	715	6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177
Apron, Longit., Bott.		4d1	15	46'-3	488	4d1	15	43'-3	458	4d1	15	40'-3	428	4d1	15	37'-3	373	4d1	15	34'-3	343	4d1	15	31'-3	313	4d1	15	28'-3	283	4d1	15	25'-3	253
Apron, Longit., Top		6f1	15	46'-3	1096	6f1	15	43'-3	1029	6f1	15	40'-3	961	6f1	15	37'-3	839	6f1	15	34'-3	772	6f1	15	31'-3	704	6f1	15	28'-3	636	6f1	15	25'-3	569
Parapet, Vertical		4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124
Parapet, Horiz.		9j1	4	15'-10	215	9j1	4	15'-10	215	9j1	4	15'-8	213	9j1	4	15'-8	213	9j1	4	15'-4	209	9j1	4	15'-4	209	9j1	4	15'-4	209	9j1	4	15'-2	206
Apron, Trans., Top		5m1	88	16'-4	1499	5m1	82	16'-4	1397	5m1	76	16'-2	1281	5m1	70	16'-2	1180	5m1	64	15'-10	1057	5m1	58	15'-10	958	5m1	52	15'-10	859	5m1	46	15'-8	752
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		6m3	85	13'-7	1734	5m3	79	12'-9	1051	5m3	73	12'-7	958	6m3	34	13'-5	685	6m3	31	13'-1	609	5m3	28	12'-3	358	5m3	25	12'-3	319	5m3	22	12'-1	277
Curtain, Horiz.		6p1	7	16'-4	172	6p1	7	16'-4	172	6p1	6	16'-2	146	6p1	6	16'-2	146	6p1	6	15'-10	143	6p1	6	15'-10	143	6p1	6	15'-10	143	6p1	5	15'-8	118
Wing Slope, Both F.		6s1	4	42'-0	267	6s1	4	38'-10	233	6s1	4	35'-8	214	6s1	4	32'-7	196	6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	39'-5	118	6s5	2	36'-4	109	6s5	2	33'-2	100	6s5	2	30'-0	90	6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52
Curtain, Vert.		5t1	15	8'-5	132	5t1	15	8'-2	128	5t1	15	7'-11	124	5t1	15	7'-8	120	5t1	15	7'-5	116	5t1	15	7'-2	112	5t1	15	6'-11	108	5t1	15	6'-8	104
Curtain, Vert., Ends		5t2	4	8'-5	35	5t2	4	8'-2	34	5t2	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	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23

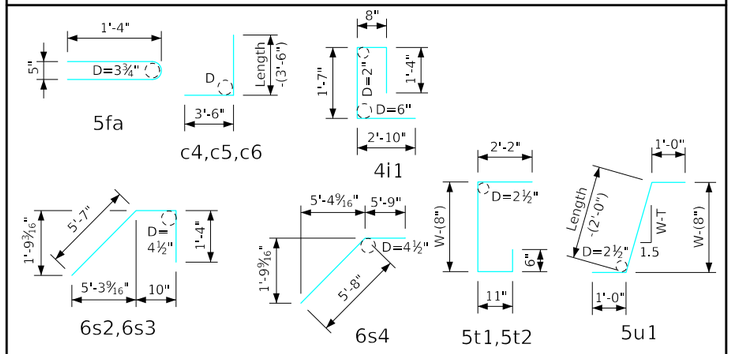
Estimated Quantities One Headwall			14' x 14'		14' x 13'		14' x 12'		14' x 11'		14' x 10'		14' x 9'		14' x 8'		14' x 7'	
Reinf. Steel			11,993 LB		10,034 LB		9050 LB		7308 LB		6201 LB		5334 LB		4697 LB		4082 LB	
Concrete	Parapet Δ		2.0		2.0		1.9		1.9		1.8		1.8		1.8		1.7	
	Wingwalls		30.7	72.3 CY	26.9	65.9 CY	21.5	57.3 CY	18.4	51.5 CY	13.0	42.7 CY	10.8	37.9 CY	8.8	33.4 CY	6.3	27.9 CY
	Apron ✳		39.6		37.0		33.9		31.2		27.9		25.3		22.8		19.9	

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
0° Skew

PWH 0-6-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-6-20 S1 - THIS SHEET ISSUED 07-2020.

6/30/2020 9:34:13 AM bkloss W:\Highway\Bridge\Standards\Culverts\LRFD\EnglishLRFDSignedSingleCulverts.dgn PWH 0-6-20 S1 11x17_pdf.pltcfg

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	14' x 6' Bar	No.	Length	Wt.	14' x 5' Bar	No.	Length	Wt.	14' x 4' Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-9 to 8'-9	192	4c1	32 Var.	2 Each 2'-9 to 7'-9	112	4c1	26 Var.	2 Each 2'-9 to 6'-9	82
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, F.F.V. (R)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-5 to 12'-5	373	5c4	42 Var.	2 Each 6'-5 to 11'-5	391	5c4	34 Var.	2 Each 6'-5 to 10'-5	298
Wingwall, B.F.V. (L)		5c5	2	12'-8	26	5c5	2	11'-8	24	5c5	2	10'-8	22
Wingwall, B.F.V. (R)		5c5	2	12'-8	26	5c5	2	11'-8	24	5c5	2	10'-8	22
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	15	22'-3	223	4d1	15	19'-3	193	4d1	15	16'-3	163
Apron, Longit., Top		6f1	15	22'-3	501	6f1	15	19'-3	434	6f1	15	16'-3	366
Parapet, Vertical		4i1	29	6'-5	124	4i1	29	6'-5	124	4i1	29	6'-5	124
Parapet, Horiz.		9j1	4	15'-2	206	9j1	4	15'-2	206	9j1	4	15'-2	206
Apron, Trans., Top		5m1	27	15'-8	441	5m1	23	15'-8	376	5m1	19	15'-8	310
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	11'-4	144	4m3	16	11'-4	121	4m3	13	11'-4	98
Curtain, Horiz.		6p1	5	15'-8	118	6p1	5	15'-8	118	6p1	5	15'-8	118
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Curtain, Vert.		5t1	15	6'-5	100	5t1	15	6'-5	100	5t1	15	6'-5	100
Curtain, Vert., Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

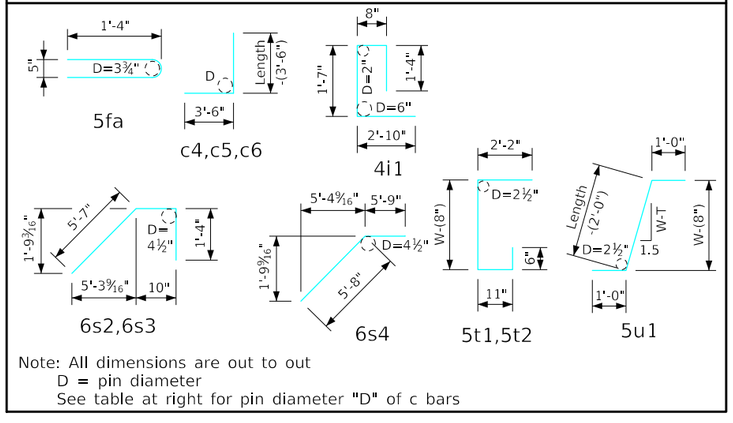
Estimated Quantities One Headwall													
	Reinf. Steel		3219 LB			2731 LB			2317 LB				
	Concrete	Parapet Δ	1.7	23.9 CY		1.7	20.2 CY		1.7	16.8 CY			
		Wingwalls	4.8			3.5			2.4				
		Apron ✳	17.4			15.0			12.7				

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
0° Skew

PWH 0-6-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-6-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° 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.	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	40'-3	89	5b1	2	37'-3	78	5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53
Wingwall, F.F.H.		5b2	22 Var.	2 Each 8'-10 to 38'-10	547	5b2	20 Var.	2 Each 8'-10 to 35'-10	466	5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204
Wingwall, B.F.H.		4b3	2	40'-3	57	4b3	2	37'-3	50	4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34
Wingwall, B.F.H.		4b4	20 Var.	2 Each 11'-10 to 38'-10	338	4b4	18 Var.	2 Each 11'-10 to 35'-10	287	4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119
Wingwall, F.F.V.		5c1	74 Var.	2 Each 2'-8 to 14'-8	669	5c1	68 Var.	2 Each 2'-8 to 13'-8	579	4c1	62 Var.	2 Each 2'-8 to 12'-8	318	4c1	56 Var.	2 Each 2'-8 to 11'-8	268	4c1	66 Var.	2 Each 2'-8 to 10'-8	294	4c1	58 Var.	2 Each 2'-8 to 9'-8	239
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-2 to 14'-10	451	5c2	30 Var.	2 Each 9'-2 to 13'-10	360	4c2	24 Var.	2 Each 9'-2 to 12'-10	176	4c2	18 Var.	2 Each 9'-2 to 11'-10	126	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		5c3	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. (R)		5c3	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	74 Var.	2 Each 6'-4 to 18'-4	1371	5c4	68 Var.	2 Each 6'-4 to 17'-4	839	5c4	62 Var.	2 Each 6'-4 to 16'-4	733	5c4	56 Var.	2 Each 6'-4 to 15'-4	633	5c4	50 Var.	2 Each 6'-4 to 14'-4	539	5c4	44 Var.	2 Each 6'-4 to 13'-4	451
Wingwall, B.F.V. (L)		6c5	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. (R)		6c5	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'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177
Apron, Longit., Bott.		4d1	13	40'-3	371	4d1	13	37'-3	323	4d1	13	34'-3	297	4d1	13	31'-3	271	4d1	13	28'-3	245	4d1	13	25'-3	219
Apron, Longit., Top		6f1	13	40'-3	833	6f1	13	37'-3	727	6f1	13	34'-3	669	6f1	13	31'-3	610	6f1	13	28'-3	552	6f1	13	25'-3	493
Parapet, Vertical		4i1	25	6'-5	107	4i1	25	6'-5	107	4i1	25	6'-5	107	4i1	25	6'-5	107	4i1	25	6'-5	107	4i1	25	6'-5	107
Parapet, Horiz.		7j1	4	13'-8	112	7j1	4	13'-8	112	7j1	4	13'-4	109	7j1	4	13'-4	109	7j1	4	13'-4	109	7j1	4	13'-2	108
Apron, Trans., Top		5m1	51	14'-2	754	5m1	47	14'-2	694	5m1	43	13'-10	620	5m1	39	13'-10	563	5m1	35	13'-10	505	5m1	31	13'-8	442
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	73	10'-7	806	5m3	67	10'-7	740	6m3	31	11'-1	516	5m3	28	10'-3	299	5m3	25	10'-3	267	5m3	22	10'-1	231
Curtain, Horiz.		6p1	6	14'-2	128	6p1	6	14'-2	128	6p1	6	13'-10	125	6p1	6	13'-10	125	6p1	6	13'-10	125	6p1	5	13'-8	103
Wing Slope, Both F.		6s1	4	35'-8	214	6s1	4	32'-7	196	6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	33'-2	100	6s5	2	30'-0	90	6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52
Curtain, Vert.		5t1	13	7'-11	107	5t1	13	7'-8	104	5t1	13	7'-5	101	5t1	13	7'-2	97	5t1	13	6'-11	94	5t1	13	6'-8	90
Curtain, Vert., Ends		5t2	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	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

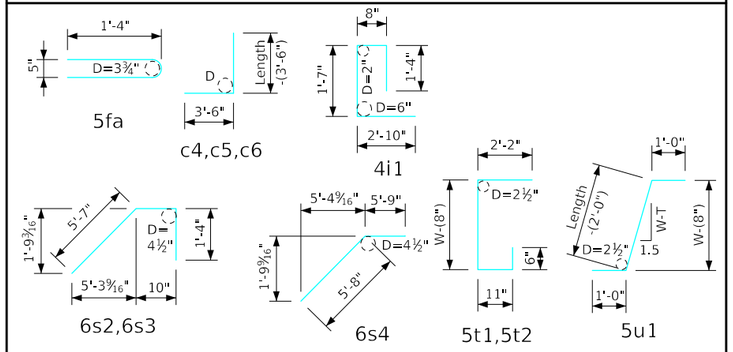
Estimated Quantities One Headwall																									
	Reinf. Steel		8012 LB			6547 LB			5360 LB			4585 LB			4010 LB			3461 LB							
	Concrete	Parapet Δ	1.8			1.8			1.6			1.6			1.6			1.5							
		Wingwalls	21.5	51.7 CY		18.4	46.4 CY		13.0	37.9 CY		10.8	33.6 CY		8.8	29.4 CY		6.3	24.4 CY						
		Apron ✳	28.4			26.2			23.3			21.2			19.0			16.6							

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
0° Skew

PWH 0-7-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-7-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	12' x 6' Bar	No.	Length	Wt.	12' x 5' Bar	No.	Length	Wt.	12' x 4' Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-8 to 8'-8	189	4c1	32 Var.	2 Each 2'-8 to 7'-8	110	4c1	26 Var.	2 Each 2'-8 to 6'-8	81
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (R)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-4 to 12'-4	370	5c4	42 Var.	2 Each 6'-4 to 11'-4	387	5c4	26 Var.	2 Each 6'-4 to 10'-4	226
Wingwall, B.F.V. (L)		5c5	2	12'-7	26	5c5	2	11'-7	24	5c5	2	10'-7	22
Wingwall, B.F.V. (R)		5c5	2	12'-7	26	5c5	2	11'-7	24	5c5	2	10'-7	22
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	13	22'-3	193	4d1	13	19'-3	167	4d1	13	16'-3	141
Apron, Longit., Top		6f1	13	22'-3	434	6f1	13	19'-3	376	6f1	13	16'-3	317
Parapet, Vertical		4i1	25	6'-5	107	4i1	25	6'-5	107	4i1	25	6'-5	107
Parapet, Horiz.		7j1	4	13'-2	108	7j1	4	13'-2	108	7j1	4	13'-2	108
Apron, Trans., Top		5m1	27	13'-8	385	5m1	23	13'-8	328	5m1	19	13'-8	271
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	9'-4	118	4m3	21	9'-4	131	4m3	13	9'-4	81
Curtain, Horiz.		6p1	5	13'-8	103	6p1	5	13'-8	103	6p1	5	13'-8	103
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Curtain, Vert.		5t1	13	6'-5	87	5t1	13	6'-5	87	5t1	13	6'-5	87
Curtain, Vert., Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

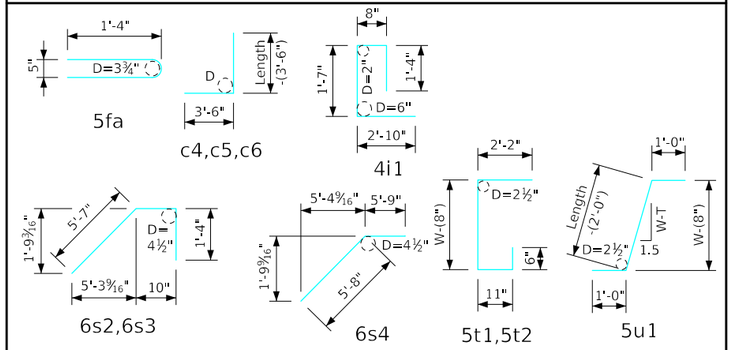
Estimated Quantities One Headwall													
	Reinf. Steel		2891 LB			2460 LB			1972 LB				
	Concrete	Parapet Δ	1.5	20.8 CY		1.5	17.6 CY		1.5	14.6 CY			
		Wingwalls	4.8			3.5			2.4				
		Apron ✳	14.5			12.6			10.7				

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
0° Skew

PWH 0-7-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-7-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° 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	40'-3	89	5b1	2	37'-3	78	5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53
Wingwall, F.F.H.		5b2	22 Var.	2 Each 8'-10 to 38'-10	547	5b2	20 Var.	2 Each 8'-10 to 35'-10	466	5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204
Wingwall, B.F.H.		4b3	2	40'-3	57	4b3	2	37'-3	50	4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34
Wingwall, B.F.H.		4b4	20 Var.	2 Each 11'-10 to 38'-10	338	4b4	18 Var.	2 Each 11'-10 to 35'-10	287	4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119
Wingwall, F.F.V.		5c1	74 Var.	2 Each 2'-7 to 14'-7	662	5c1	68 Var.	2 Each 2'-7 to 13'-7	573	4c1	62 Var.	2 Each 2'-7 to 12'-7	314	4c1	56 Var.	2 Each 2'-7 to 11'-7	265	4c1	66 Var.	2 Each 2'-7 to 10'-7	290	4c1	58 Var.	2 Each 2'-7 to 9'-7	236
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-1 to 14'-9	447	5c2	30 Var.	2 Each 9'-1 to 13'-9	357	4c2	24 Var.	2 Each 9'-1 to 12'-9	175	4c2	18 Var.	2 Each 9'-1 to 11'-9	125	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		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. (R)		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	74 Var.	2 Each 6'-3 to 18'-3	1362	5c4	68 Var.	2 Each 6'-3 to 17'-3	833	5c4	62 Var.	2 Each 6'-3 to 16'-3	727	5c4	56 Var.	2 Each 6'-3 to 15'-3	628	5c4	50 Var.	2 Each 6'-3 to 14'-3	535	5c4	44 Var.	2 Each 6'-3 to 13'-3	447
Wingwall, B.F.V. (L)		6c5	2	18'-6	56	5c5	2	17'-6	37	5c5	2	16'-6	34	5c5	2	15'-6	32	5c5	2	14'-6	30	5c5	2	13'-6	28
Wingwall, B.F.V. (R)		6c5	2	18'-6	56	5c5	2	17'-6	37	5c5	2	16'-6	34	5c5	2	15'-6	32	5c5	2	14'-6	30	5c5	2	13'-6	28
Wingwall, B.F.V.		6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177
Apron, Longit., Bott.		4d1	11	40'-3	314	4d1	11	37'-3	274	4d1	11	34'-3	252	4d1	11	31'-3	230	4d1	11	28'-3	208	4d1	11	25'-3	186
Apron, Longit., Top		6f1	11	40'-3	705	6f1	11	37'-3	615	6f1	11	34'-3	566	6f1	11	31'-3	516	6f1	11	28'-3	467	6f1	11	25'-3	417
Parapet, Vertical		4i1	21	6'-5	90	4i1	21	6'-5	90	4i1	21	6'-5	90	4i1	21	6'-5	90	4i1	21	6'-5	90	4i1	21	6'-5	90
Parapet, Horiz.		7j1	4	11'-8	95	7j1	4	11'-8	95	7j1	4	11'-4	93	7j1	4	11'-4	93	7j1	4	11'-4	93	7j1	4	11'-2	91
Apron, Trans., Top		5m1	51	12'-2	647	5m1	47	12'-2	596	5m1	43	11'-10	531	5m1	39	11'-10	481	5m1	35	11'-10	432	5m1	31	11'-8	377
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	73	8'-7	654	5m3	67	8'-7	600	6m3	31	9'-1	423	5m3	28	8'-3	241	5m3	25	8'-3	215	5m3	22	8'-1	185
Curtain, Horiz.		6p1	6	12'-2	110	6p1	6	12'-2	110	6p1	6	11'-10	107	6p1	6	11'-10	107	6p1	6	11'-10	107	6p1	5	11'-8	88
Wing Slope, Both F.		6s1	4	35'-8	214	6s1	4	32'-7	196	6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	33'-2	100	6s5	2	30'-0	90	6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52
Curtain, Vert.		5t1	11	7'-11	91	5t1	11	7'-8	88	5t1	11	7'-5	85	5t1	11	7'-2	82	5t1	11	6'-11	79	5t1	11	6'-8	76
Curtain, Vert., Ends		5t2	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	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

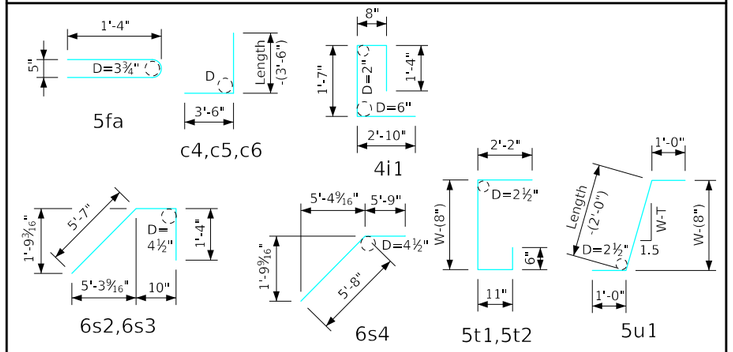
Estimated Quantities One Headwall			10' x 12'		10' x 11'		10' x 10'		10' x 9'		10' x 8'		10' x 7'	
Reinf. Steel			7480 LB		6064 LB		4950 LB		4233 LB		3689 LB		3171 LB	
Concrete	Parapet Δ		1.6		1.6		1.5		1.5		1.5		1.4	
	Wingwalls		21.5	46.4 CY	18.4	41.5 CY	13.0	33.6 CY	10.8	29.6 CY	8.8	25.9 CY	6.3	21.3 CY
	Apron ✳		23.3		21.5		19.1		17.3		15.6		13.6	

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
0° Skew

PWH 0-8-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-8-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	10' x 6' Bar	No.	Length	Wt.	10' x 5' Bar	No.	Length	Wt.	10' x 4' Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-7 to 8'-7	186	4c1	32 Var.	2 Each 2'-7 to 7'-7	109	4c1	26 Var.	2 Each 2'-7 to 6'-7	80
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (R)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-3 to 12'-3	367	5c4	32 Var.	2 Each 6'-3 to 11'-3	292	5c4	26 Var.	2 Each 6'-3 to 10'-3	224
Wingwall, B.F.V. (L)		5c5	2	12'-6	26	5c5	2	11'-6	24	5c5	2	10'-6	22
Wingwall, B.F.V. (R)		5c5	2	12'-6	26	5c5	2	11'-6	24	5c5	2	10'-6	22
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	11	22'-3	163	4d1	11	19'-3	141	4d1	11	16'-3	119
Apron, Longit., Top		6f1	11	22'-3	368	6f1	11	19'-3	318	6f1	11	16'-3	268
Parapet, Vertical		4i1	21	6'-5	90	4i1	21	6'-5	90	4i1	21	6'-5	90
Parapet, Horiz.		7j1	4	11'-2	91	7j1	4	11'-2	91	7j1	4	11'-2	91
Apron, Trans., Top		5m1	27	11'-8	329	5m1	23	11'-8	280	5m1	19	11'-8	231
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	7'-4	93	4m3	16	7'-4	78	4m3	13	7'-4	64
Curtain, Horiz.		6p1	5	11'-8	88	6p1	5	11'-8	88	6p1	5	11'-8	88
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Curtain, Vert.		5t1	11	6'-5	74	5t1	11	6'-5	74	5t1	11	6'-5	74
Curtain, Vert., Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

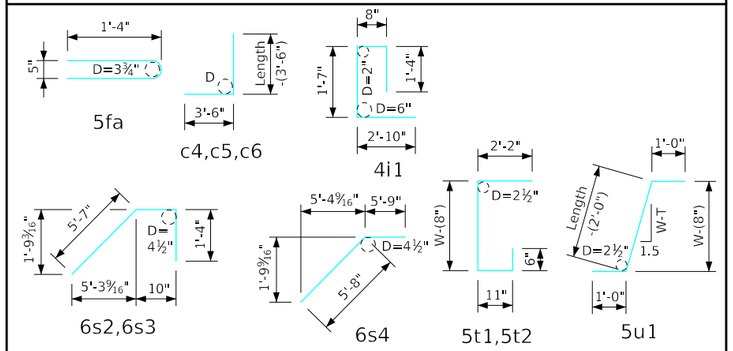
Estimated Quantities One Headwall												
	Reinf. Steel		2646 LB			2117 LB			1779 LB			
	Concrete	Parapet Δ	1.4	18.1 CY		1.4	15.2 CY		1.4	12.6 CY		
		Wingwalls	4.8			3.5			2.4			
		Apron ✳	11.9			10.3			8.8			

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



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

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

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
0° Skew

PWH 0-8-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-8-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53	5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204	5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34	4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119	4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Wingwall, F.F.V.		4c1	62 Var.	2 Each 2'-5 to 12'-5	307	4c1	56 Var.	2 Each 2'-5 to 11'-5	259	4c1	66 Var.	2 Each 2'-5 to 10'-5	283	4c1	58 Var.	2 Each 2'-5 to 9'-5	229	4c1	50 Var.	2 Each 2'-5 to 8'-5	181	4c1	32 Var.	2 Each 2'-5 to 7'-5	105	4c1	26 Var.	2 Each 2'-5 to 6'-5	77
Wingwall, F.F.V.		4c2	24 Var.	2 Each 8'-11 to 12'-7	172	4c2	18 Var.	2 Each 8'-11 to 11'-7	123	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (R)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, B.F.V.		5c4	62 Var.	2 Each 6'-1 to 16'-1	717	5c4	56 Var.	2 Each 6'-1 to 15'-1	618	5c4	50 Var.	2 Each 6'-1 to 14'-1	526	5c4	44 Var.	2 Each 6'-1 to 13'-1	440	5c4	38 Var.	2 Each 6'-1 to 12'-1	360	5c4	32 Var.	2 Each 6'-1 to 11'-1	286	5c4	26 Var.	2 Each 6'-1 to 10'-1	219
Wingwall, B.F.V. (L)		5c5	2	16'-4	34	5c5	2	15'-4	32	5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22
Wingwall, B.F.V. (R)		5c5	2	16'-4	34	5c5	2	15'-4	32	5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22
Wingwall, B.F.V.		5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177	5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	9	34'-3	206	4d1	9	31'-3	188	4d1	9	28'-3	170	4d1	9	25'-3	152	4d1	9	22'-3	134	4d1	9	19'-3	116	4d1	9	16'-3	98
Apron, Longit., Top		6f1	9	34'-3	463	6f1	9	31'-3	422	6f1	9	28'-3	382	6f1	9	25'-3	341	6f1	9	22'-3	301	6f1	9	19'-3	260	6f1	9	16'-3	220
Parapet, Vertical		4i1	17	6'-5	73	4i1	17	6'-5	73	4i1	17	6'-5	73	4i1	17	6'-5	73	4i1	17	6'-5	73	4i1	17	6'-5	73	4i1	17	6'-5	73
Parapet, Horiz.		7j1	4	9'-4	76	7j1	4	9'-4	76	7j1	4	9'-4	76	7j1	4	9'-2	75	7j1	4	9'-2	75	7j1	4	9'-2	75	7j1	4	9'-2	75
Apron, Trans., Top		5m1	32	9'-10	328	5m1	29	9'-10	297	5m1	26	9'-10	267	5m1	23	9'-8	232	5m1	20	9'-8	202	5m1	17	9'-8	171	5m1	14	9'-8	141
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	61	6'-3	398	5m3	55	6'-3	359	5m3	33	6'-3	215	5m3	22	6'-1	140	4m3	19	5'-4	68	4m3	16	5'-4	57	4m3	13	5'-4	46
Curtain, Horiz.		6p1	6	9'-10	89	6p1	6	9'-10	89	6p1	6	9'-10	89	6p1	5	9'-8	73	6p1	5	9'-8	73	6p1	5	9'-8	73	6p1	5	9'-8	73
Wing Slope, Both F.		6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120	6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52	6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Curtain, Vert.		5t1	9	7'-5	70	5t1	9	7'-2	67	5t1	9	6'-11	65	5t1	9	6'-8	63	5t1	9	6'-5	60	5t1	9	6'-5	60	5t1	9	6'-5	60
Curtain, Vert., Ends		5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

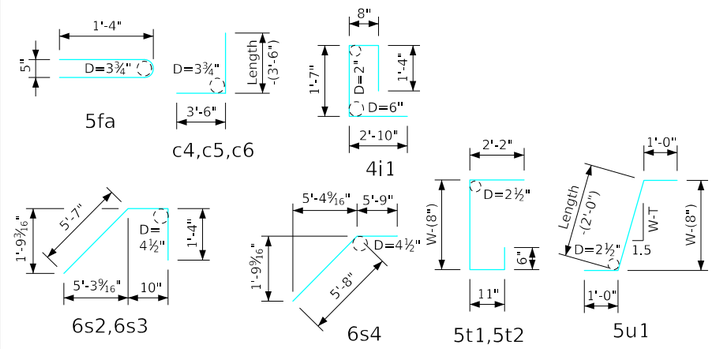
Estimated Quantities One Headwall			8' x 10'		8' x 9'		8' x 8'		8' x 7'		8' x 6'		8' x 5'		8' x 4'	
Reinf. Steel			4485 LB		3946 LB		3317 LB		2796 LB		2324 LB		1830 LB		1532 LB	
Concrete	Parapet Δ	1.3	28.6 CY		1.3	25.1 CY	1.3	21.8 CY	1.2	17.7 CY	1.2	14.9 CY	1.2	12.5 CY	1.2	10.2 CY
	Wingwalls	13.0			10.8		8.8		6.3		4.8		3.5		2.4	
	Apron ✳	14.3			13.0		11.7		10.2		8.9		7.8		6.6	

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
0° Skew

PWH 0-9-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-9-20 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	6' x 8'				6' x 7'				6' x 6'				6' x 5'				6' x 4'				6' x 3'			
		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	28'-3	59	5b1	2	25'-3	53	5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34	5b1	2	13'-3	28
Wingwall, F.F.H.		5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204	5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74	5b2	4 Var.	2 Each 8'-10 to 11'-10	43
Wingwall, B.F.H.		4b3	2	28'-3	38	4b3	2	25'-3	34	4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22	4b3	2	13'-3	18
Wingwall, B.F.H.		4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119	4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36	4b4	2	11'-10	16
Wingwall, F.F.V.		4c1	66 Var.	2 Each 2'-5 to 10'-5	283	4c1	58 Var.	2 Each 2'-5 to 9'-5	229	4c1	50 Var.	2 Each 2'-5 to 8'-5	181	4c1	32 Var.	2 Each 2'-5 to 7'-5	105	4c1	26 Var.	2 Each 2'-5 to 6'-5	77	4c1	20 Var.	2 Each 2'-5 to 5'-5	52
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (R)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, B.F.V.		5c4	50 Var.	2 Each 6'-1 to 14'-1	526	5c4	44 Var.	2 Each 6'-1 to 13'-1	440	5c4	38 Var.	2 Each 6'-1 to 12'-1	360	5c4	32 Var.	2 Each 6'-1 to 11'-1	286	5c4	26 Var.	2 Each 6'-1 to 10'-1	219	5c4	20 Var.	2 Each 6'-1 to 9'-1	158
Wingwall, B.F.V. (L)		5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22	5c5	2	9'-4	19
Wingwall, B.F.V. (R)		5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22	5c5	2	9'-4	19
Wingwall, B.F.V.		5c6	26	8'-6	231	5c6	20	8'-6	177	5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	7	28'-3	132	4d1	7	25'-3	118	4d1	7	22'-3	104	4d1	7	19'-3	90	4d1	7	16'-3	76	4d1	7	13'-3	62
Apron, Longit., Top		6f1	7	28'-3	297	6f1	7	25'-3	265	6f1	7	22'-3	234	6f1	7	19'-3	202	6f1	7	16'-3	171	6f1	7	13'-3	139
Parapet, Vertical		4i1	13	6'-5	56	4i1	13	6'-5	56	4i1	13	6'-5	56	4i1	13	6'-5	56	4i1	13	6'-5	56	4i1	13	6'-5	56
Parapet, Horiz.		7j1	4	7'-4	60	7j1	4	7'-2	59	7j1	4	7'-2	59	7j1	4	7'-2	59	7j1	4	7'-2	59	7j1	4	7'-2	59
Apron, Trans., Top		5m1	26	7'-10	212	5m1	23	7'-8	184	5m1	20	7'-8	160	5m1	17	7'-8	136	5m1	14	7'-8	112	5m1	11	7'-8	88
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	33	4'-3	146	5m3	22	4'-1	94	4m3	19	3'-4	42	4m3	16	3'-4	36	4m3	13	3'-4	29	4m3	10	3'-4	22
Curtain, Horiz.		6p1	6	7'-10	71	6p1	5	7'-8	58	6p1	5	7'-8	58	6p1	5	7'-8	58	6p1	5	7'-8	58	6p1	5	7'-8	58
Wing Slope, Both F.		6s1	4	23'-1	139	6s1	4	19'-11	120	6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63	6s1	4	7'-3	44
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	20'-6	62	6s5	2	17'-4	52	6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24	6s5	2	4'-8	14
Curtain, Vert.		5t1	7	6'-11	50	5t1	7	6'-8	49	5t1	7	6'-5	47	5t1	7	6'-5	47	5t1	7	6'-5	47	5t1	7	6'-5	47
Curtain, Vert., Ends		5t2	4	6'-11	29	5t2	4	6'-8	28	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

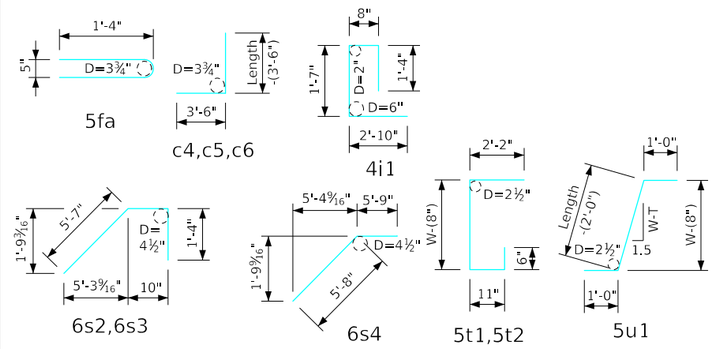
Estimated Quantities One Headwall			6' x 8'		6' x 7'		6' x 6'		6' x 5'		6' x 4'		6' x 3'	
Reinf. Steel			3004 LB		2530 LB		2098 LB		1629 LB		1354 LB		1093 LB	
Concrete	Parapet Δ	1.2	19.6 CY		1.1	15.8 CY	1.1	13.2 CY	1.1	11.0 CY	1.1	9.0 CY	1.1	7.1 CY
	Wingwalls	8.8			6.3		4.8		3.5		2.4		1.5	
	Apron ✳	9.6			8.4		7.3		6.4		5.5		4.5	

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
6'-0" Span
0° Skew

PWH 0-10-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-10-20 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	5' x 6'				5' x 5'				5' x 4'				5' x 3'				4' x 4'				3' x 3'			
		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	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34	5b1	2	13'-3	28	5b1	2	16'-3	34	5b1	2	13'-3	28
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74	5b2	4 Var.	2 Each 8'-10 to 11'-10	43	5b2	6 Var.	2 Each 8'-10 to 14'-10	74	5b2	4 Var.	2 Each 8'-10 to 11'-10	43
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22	4b3	2	13'-3	18	4b3	2	16'-3	22	4b3	2	13'-3	18
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36	4b4	2	11'-10	16	4b4	4 Var.	2 Each 11'-10 to 14'-10	36	4b4	2	11'-10	16
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-5 to 8'-5	181	4c1	32 Var.	2 Each 2'-5 to 7'-5	105	4c1	26 Var.	2 Each 2'-5 to 6'-5	77	4c1	20 Var.	2 Each 2'-5 to 5'-5	52	4c1	26 Var.	2 Each 2'-5 to 6'-5	77	4c1	20 Var.	2 Each 2'-5 to 5'-5	52
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (R)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-1 to 12'-1	360	5c4	32 Var.	2 Each 6'-1 to 11'-1	286	5c4	26 Var.	2 Each 6'-1 to 10'-1	219	5c4	20 Var.	2 Each 6'-1 to 9'-1	158	5c4	26 Var.	2 Each 6'-1 to 10'-1	219	5c4	20 Var.	2 Each 6'-1 to 9'-1	158
Wingwall, B.F.V. (L)		5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22	5c5	2	9'-4	19	5c5	2	10'-4	22	5c5	2	9'-4	19
Wingwall, B.F.V. (R)		5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22	5c5	2	9'-4	19	5c5	2	10'-4	22	5c5	2	9'-4	19
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	6	22'-3	89	4d1	6	19'-3	77	4d1	6	16'-3	65	4d1	6	13'-3	53	4d1	5	16'-3	54	4d1	4	13'-3	35
Apron, Longit., Top		6f1	6	22'-3	201	6f1	6	19'-3	173	6f1	6	16'-3	146	6f1	6	13'-3	119	6f1	5	16'-3	122	6f1	4	13'-3	80
Parapet, Vertical		4i1	11	6'-5	47	4i1	11	6'-5	47	4i1	11	6'-5	47	4i1	11	6'-5	47	4i1	9	6'-5	39	4i1	7	6'-5	30
Parapet, Horiz.		7j1	4	6'-2	50	7j1	4	6'-2	50	7j1	4	6'-2	50	7j1	4	6'-2	50	7j1	4	5'-2	42	7j1	4	4'-2	34
Apron, Trans., Top		5m1	20	6'-8	139	5m1	17	6'-8	118	5m1	14	6'-8	97	5m1	11	6'-8	76	5m1	14	5'-8	83	5m1	11	4'-8	54
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	2'-4	30	4m3	16	2'-4	25	4m3	13	2'-4	20	4m3	10	2'-4	16	m3	--	--	--	m3	--	--	--
Curtain, Horiz.		6p1	5	6'-8	50	6p1	5	6'-8	50	6p1	5	6'-8	50	6p1	5	6'-8	50	6p1	5	5'-8	43	6p1	5	4'-8	35
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63	6s1	4	7'-3	44	6s1	4	10'-5	63	6s1	4	7'-3	44
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24	6s5	2	4'-8	14	6s5	2	7'-10	24	6s5	2	4'-8	14
Curtain, Vert.		5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	5	6'-5	33	5t1	4	6'-5	27
Curtain, Vert., Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

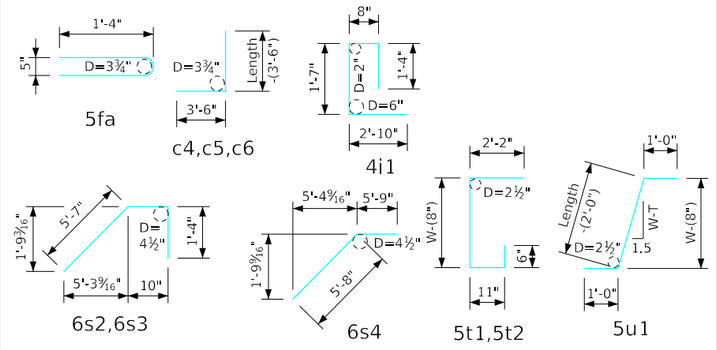
Estimated Quantities One Headwall																									
	Reinf. Steel		1984 LB			1525 LB				1261 LB				1013 LB				1162 LB				857 LB			
	Concrete	Parapet Δ	1.0	12.3 CY		1.0	10.2 CY			1.0	8.3 CY			1.0	6.5 CY			0.9	7.6 CY			0.9	5.4 CY		
		Wingwalls	4.8			3.5				2.4				1.5				2.4				1.5			
		Apron ✳	6.5			5.7				4.9				4.0				4.3				3.0			

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet PWH 0-1-20 for left and right corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
5'-0", 4'-0" & 3'-0" Spans
0° Skew

PWH 0-11-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 0-11-20 - THIS SHEET ISSUED 07-2020.

Dimension Table

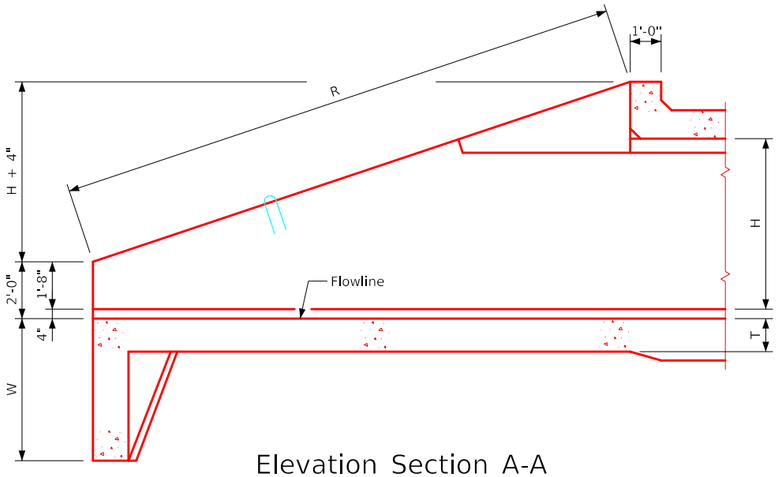
	S x H	16' x 14'	16' x 13'	16' x 12'	16' x 11'	16' x 10'	16' x 9'	16' x 8'	16' x 7'	16' x 6'	16' x 5'	16' x 4'	14' x 14'	14' x 13'	14' x 12'	14' x 11'	14' x 10'	14' x 9'	14' x 8'	14' x 7'	14' x 6'	14' x 5'	14' x 4'	S x H
Headwall Dimensions	A	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	H	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	P	44'-6¼	41'-4⅞	38'-3⅝	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	44'-6¼	41'-4⅞	38'-3⅝	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	P
	R	46'-9¼	43'-6	40'-2⅞	36'-11¾	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	46'-9¼	43'-6	40'-2⅞	36'-11¾	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	R
	S	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	S
	S1	16'-6⅜	16'-6⅜	16'-6⅜	16'-6⅜	16'-6⅜	16'-6¾	16'-6¾	16'-6¾	16'-6¾	16'-6¾	16'-6¾	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	14'-5⅞	S1
	T	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	T
	U	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	9	9	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	9	9	U
	W	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	B
	C	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	9	9	9	E

Dimension Table

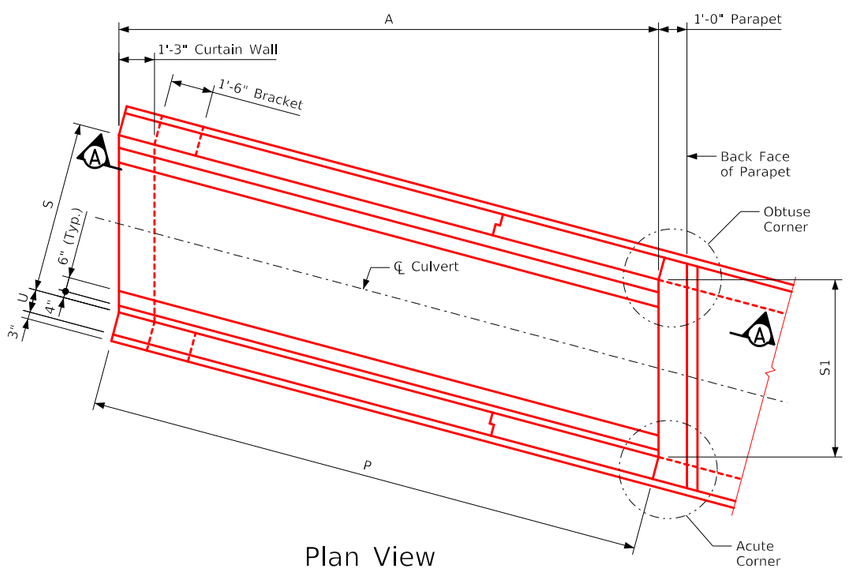
	S x H	12' x 12'	12' x 11'	12' x 10'	12' x 9'	12' x 8'	12' x 7'	12' x 6'	12' x 5'	12' x 4'	10' x 12'	10' x 11'	10' x 10'	10' x 9'	10' x 8'	10' x 7'	10' x 6'	10' x 5'	10' x 4'	S x H
Headwall Dimensions	A	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	H	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	P	38'-3⅝	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	38'-3⅝	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	P
	R	40'-2⅞	36'-11¾	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	40'-2⅞	36'-11¾	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	R
	S	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	S
	S1	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	S1
	T	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	T
	U	1'-0	1'-0	10	10	10	9	9	9	9	1'-0	1'-0	10	10	10	9	9	9	9	U
	W	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	9	1'-0	6	6	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	E

Dimension Table

	S x H	8' x 10'	8' x 9'	8' x 8'	8' x 7'	8' x 6'	8' x 5'	8' x 4'	6' x 8'	6' x 7'	6' x 6'	6' x 5'	6' x 4'	6' x 3'	5' x 6'	5' x 5'	5' x 4'	5' x 3'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	A
	H	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	8'-0	7'-0	6'-0	5'-0	4'-0	3'-0	6'-0	5'-0	4'-0	3'-0	H
	P	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	10'-4¼	19'-8	16'-6¾	13'-5½	10'-4¼	P
	R	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	10'-10½	20'-8	17'-4⅞	14'-1⅝	10'-10½	R
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	5'-0	5'-0	5'-0	5'-0	S
	S1	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	6'-2½	6'-2½	6'-2½	6'-2½	6'-2½	6'-2½	5'-2⅛	5'-2⅛	5'-2⅛	5'-2⅛	S1
	T	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	T
	U	10	10	10	9	9	9	9	10	9	9	9	9	9	9	9	9	9	U
	W	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	4'-0	3'-9	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	C
	D	6	6	9	1'-0	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E



Elevation Section A-A



Plan View

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets PWH 15-2-20 thru 15-4-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

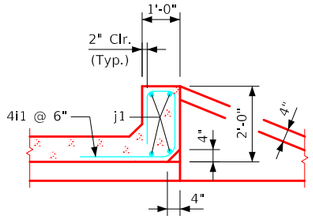
Parallel Wing Headwalls

July, 2020

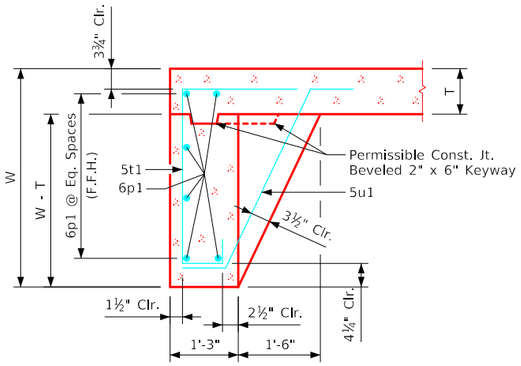
Dimension Table
15° Skew

PWH 15-1-20

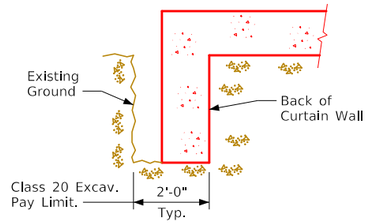
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-1-20 - THIS SHEET ISSUED 07-2020.



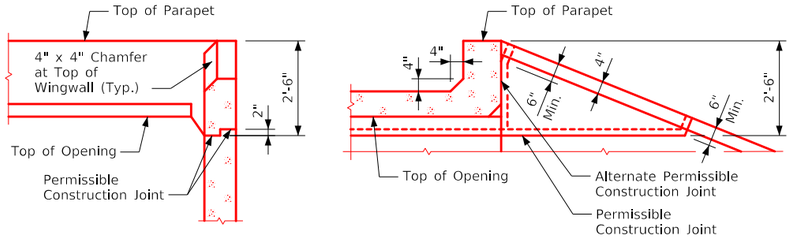
Section thru Parapet



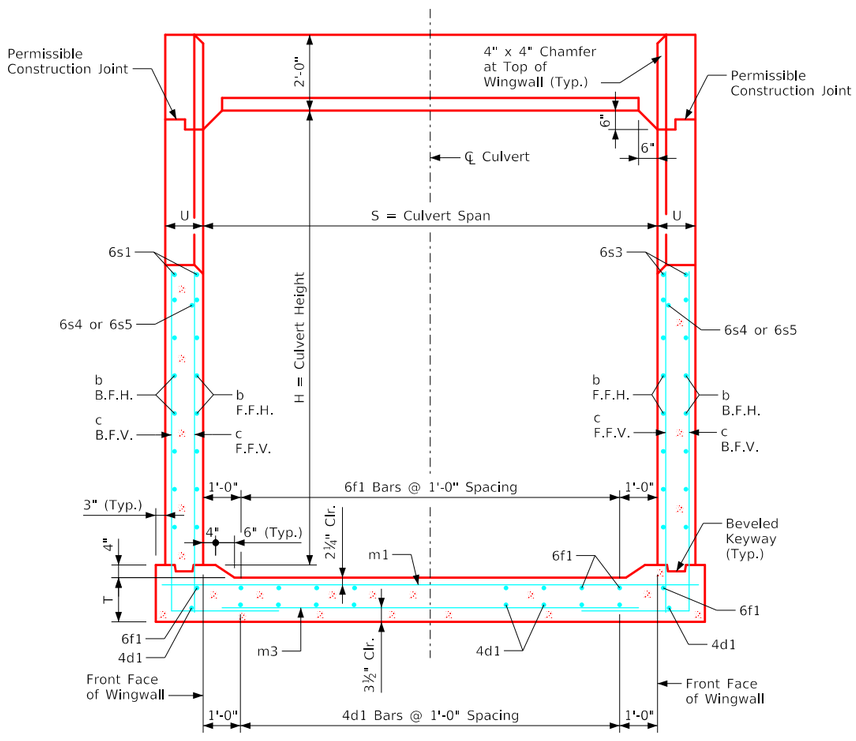
Section thru Curtain Wall



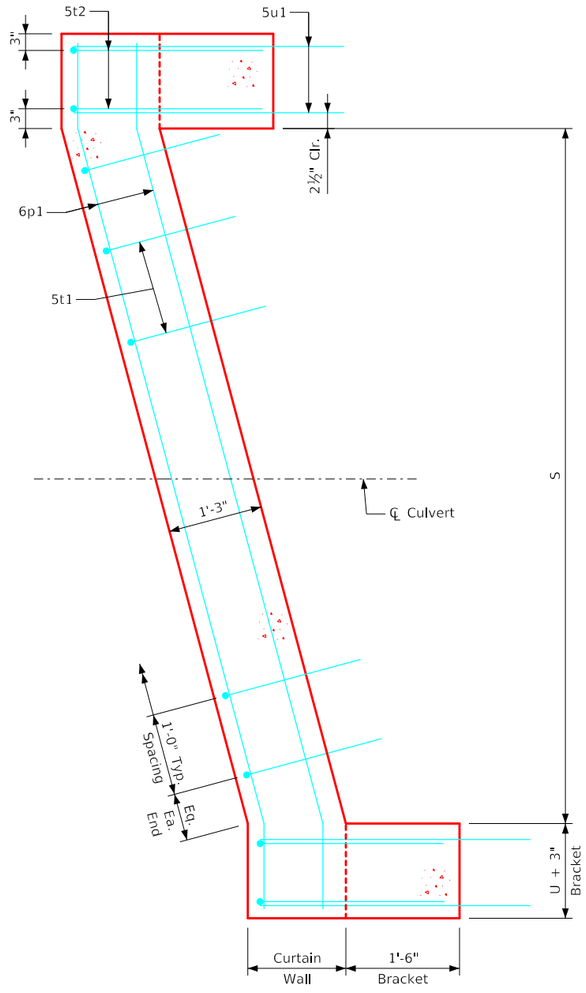
Curtain Wall
Class 20 Excavation



Top of Wingwall Details



Typical Cross Section - thru Headwall



Curtain Wall Detail - Plan View
(Apron is not shown)

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. For dimension table see Sheet PWH 15-1-20.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Cross Section Details
15° Skew

PWH 15-2-20

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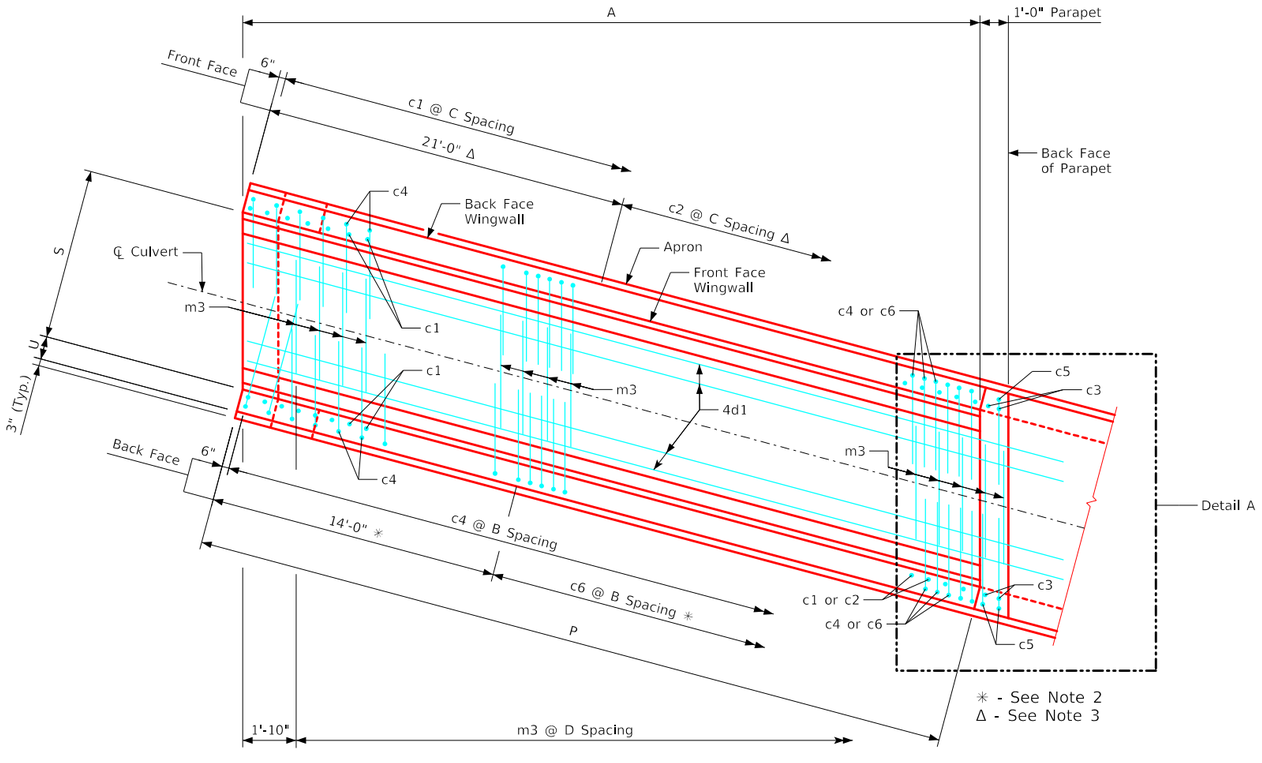
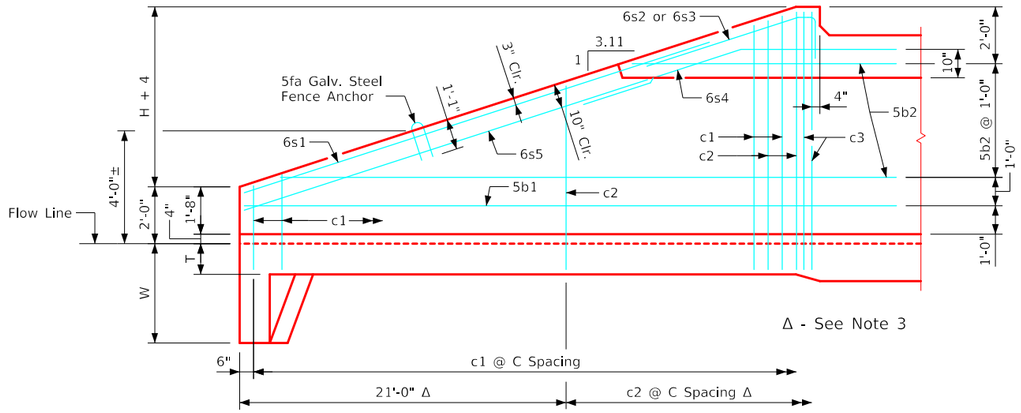
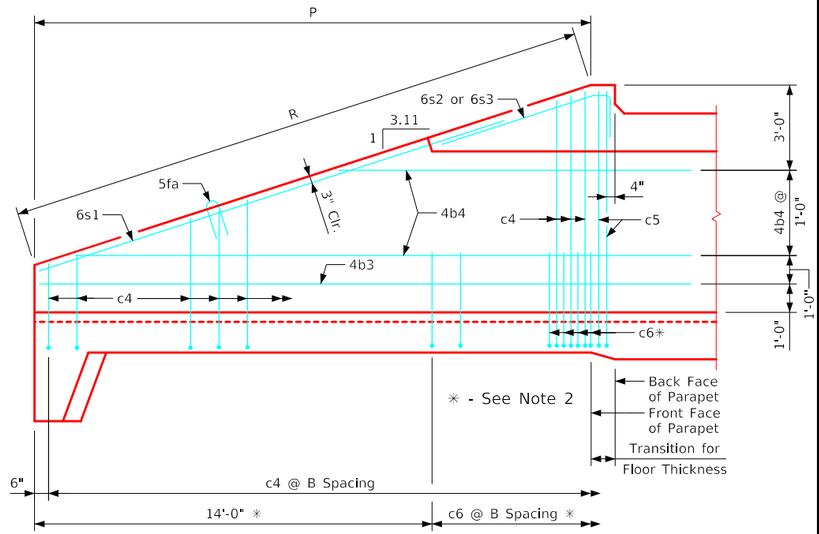


Plan View - Bottom Apron Reinforcing

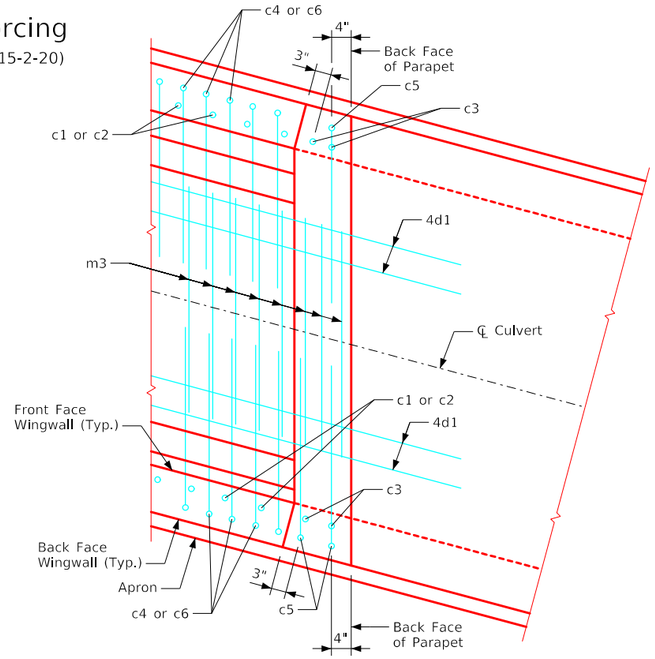
(Curtain Wall Reinforcing not shown, See Sheet PWH 15-2-20)



Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing



Detail A

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. Not applicable for 3' thru 5' height headwalls.
3. Not applicable for 3' thru 8' height headwalls.
4. For headwall dimensions and bar spacing see Sheet PWH 15-1-20.
5. Apron m3 bars are to be centered on ℄ culvert.
6. B.F.V. (c5) and F.F.V. (c3) bars are approximately 4" from the back of parapet for all headwalls.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations & Bottom Apron Reinforcing 15° Skew

PWH 15-3-20

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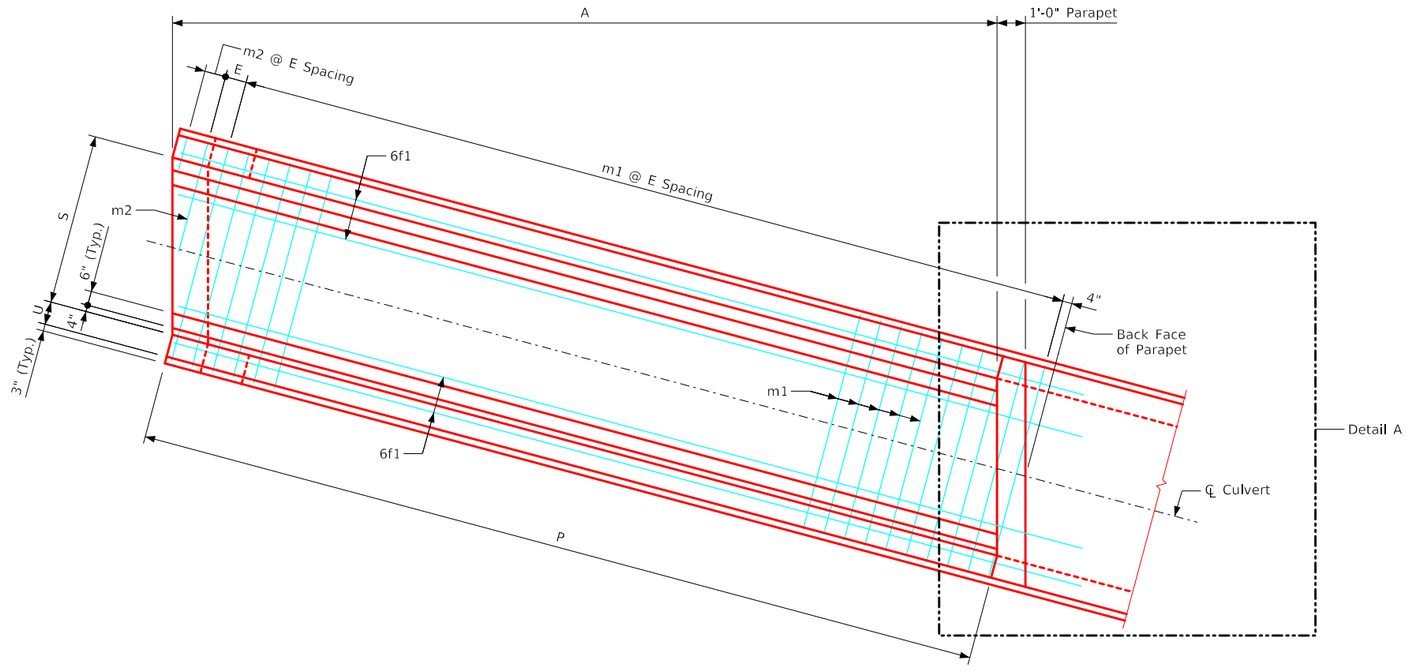
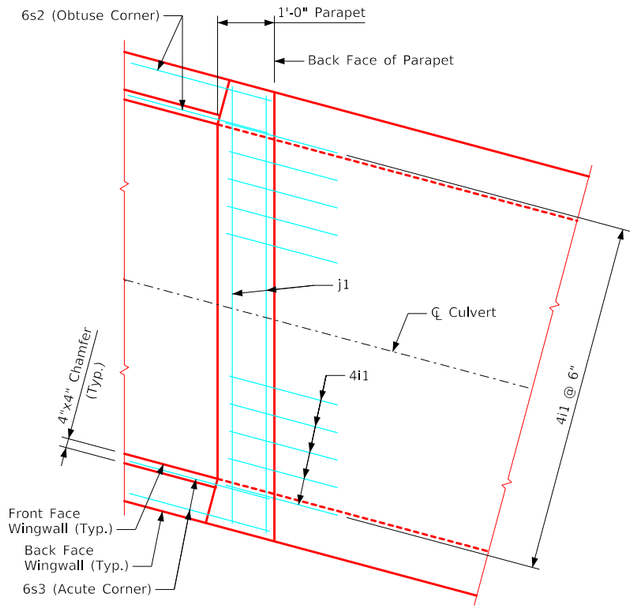


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. For headwall dimensions and bar spacing see Sheet PWH 15-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 15° Skew

PWH 15-4-20

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

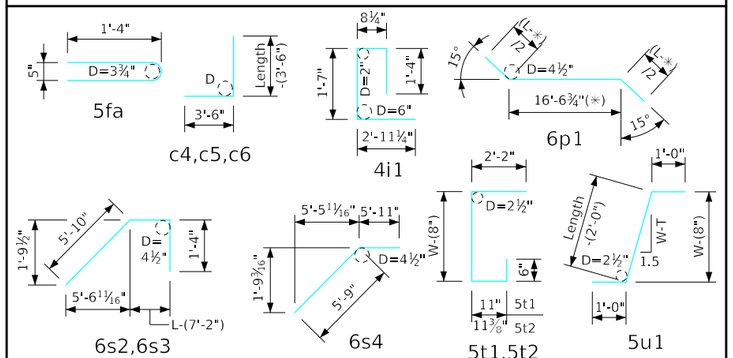
Location	Shape	16' x 14'				16' x 13'				16' x 12'				16' x 11'				16' x 10'				16' x 9'				16' x 8'				16' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	47'-10	105	5b1	2	44'-9	98	5b1	2	41'-7	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	26 Var.	2 Each 9'-2 to 46'-5	769	5b2	24 Var.	2 Each 9'-2 to 43'-4	667	5b2	22 Var.	2 Each 9'-2 to 40'-2	571	5b2	20 Var.	2 Each 9'-2 to 37'-1	482	5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212
Wingwall, B.F.H.		4b3	2	48'-0	67	4b3	2	44'-11	63	4b3	2	41'-9	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	24 Var.	2 Each 12'-5 to 46'-7	483	4b4	22 Var.	2 Each 12'-5 to 43'-6	417	4b4	20 Var.	2 Each 12'-5 to 40'-4	356	4b4	18 Var.	2 Each 12'-5 to 37'-3	299	4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124
Wingwall, F.F.V.		5c1	90 Var.	2 Each 2'-10 to 17'-0	931	5c1	82 Var.	2 Each 2'-10 to 15'-9	795	5c1	76 Var.	2 Each 2'-10 to 14'-9	697	5c1	70 Var.	2 Each 2'-10 to 13'-9	605	4c1	64 Var.	2 Each 2'-10 to 12'-10	335	4c1	58 Var.	2 Each 2'-10 to 11'-10	284	4c1	68 Var.	2 Each 2'-10 to 10'-10	310	4c1	60 Var.	2 Each 2'-10 to 9'-10	254
Wingwall, F.F.V.		5c2	48 Var.	2 Each 9'-5 to 16'-10	657	5c2	42 Var.	2 Each 9'-5 to 15'-11	555	5c2	36 Var.	2 Each 9'-5 to 14'-11	457	5c2	30 Var.	2 Each 9'-5 to 13'-11	365	4c2	24 Var.	2 Each 9'-5 to 13'-0	180	4c2	16 Var.	2 Each 9'-5 to 11'-8	113	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, F.F.V. (A)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, B.F.V.		6c4	90 Var.	2 Each 6'-6 to 20'-8	1836	6c4	82 Var.	2 Each 6'-6 to 19'-5	1596	6c4	76 Var.	2 Each 6'-6 to 18'-5	1422	5c4	70 Var.	2 Each 6'-6 to 17'-6	876	5c4	64 Var.	2 Each 6'-6 to 16'-6	768	5c4	58 Var.	2 Each 6'-6 to 15'-7	668	5c4	52 Var.	2 Each 6'-6 to 14'-7	572	5c4	46 Var.	2 Each 6'-6 to 13'-7	482
Wingwall, B.F.V. (O)		6c5	1	20'-9	31	6c5	1	19'-9	30	6c5	1	18'-9	28	5c5	1	17'-9	19	5c5	1	16'-9	17	5c5	1	15'-9	16	5c5	1	14'-9	15	5c5	1	13'-9	14
Wingwall, B.F.V. (A)		6c5	2	20'-9	62	6c5	2	19'-9	59	6c5	2	18'-9	56	5c5	2	17'-9	37	5c5	2	16'-9	35	5c5	2	15'-9	33	5c5	2	14'-9	31	5c5	2	13'-9	29
Wingwall, B.F.V.		7c6	62	9'-6	1204	6c6	56	8'-6	715	6c6	50	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
Apron, Longit., Bott.		4d1	17	47'-9	570	4d1	17	44'-8	535	4d1	17	41'-7	500	4d1	17	38'-5	436	4d1	17	35'-4	401	4d1	17	32'-3	366	4d1	17	29'-2	331	4d1	17	26'-0	295
Apron, Longit., Top		6f1	17	47'-9	1281	6f1	17	44'-8	1202	6f1	17	41'-7	1123	6f1	17	38'-5	981	6f1	17	35'-4	902	6f1	17	32'-3	823	6f1	17	29'-2	745	6f1	17	26'-0	664
Parapet, Vertical		4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145
Parapet, Horiz.		9j1	4	18'-5	250	9j1	4	18'-5	250	9j1	4	18'-3	248	9j1	4	18'-3	248	9j1	4	17'-11	244	9j1	4	17'-9	244	9j1	4	17'-11	244	9j1	4	17'-9	241
Apron, Trans., Top		5m1	86	18'-4	1644	5m1	80	18'-4	1530	5m1	74	18'-2	1402	5m1	68	18'-2	1288	5m1	61	17'-10	1135	5m1	55	17'-10	1023	5m1	49	17'-10	911	5m1	43	17'-8	792
Apron, Trans., Top		5m2	8 Var.	3'-9 to 16'-9	86	5m2	8 Var.	3'-3 to 16'-4	82	5m2	8 Var.	2'-10 to 15'-11	78	5m2	8 Var.	2'-5 to 15'-6	75	5m2	8 Var.	3'-9 to 16'-10	86	5m2	8 Var.	3'-4 to 16'-5	82	5m2	8 Var.	3'-0 to 16'-0	79	5m2	8 Var.	2'-6 to 15'-7	75
Apron, Trans., Bott.		6m3	85	16'-2	2064	5m3	79	15'-5	1270	5m3	73	15'-3	1161	6m3	34	16'-0	817	6m3	31	15'-8	729	5m3	28	14'-11	436	5m3	25	14'-11	389	5m3	22	14'-9	338
Curtain, Horiz.		6p1	7	18'-10	198	6p1	7	18'-10	198	6p1	6	18'-8	168	6p1	6	18'-8	168	6p1	6	18'-4	165	6p1	6	18'-4	165	6p1	6	18'-4	165	6p1	5	18'-2	136
Wing Slope, Both F.		6s1	4	43'-3	274	6s1	4	39'-11	240	6s1	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	7'-9	23	6s2	2	7'-9	23	6s2	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	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	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		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	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	40'-9	130	6s5	2	37'-6	113	6s5	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
Curtain, Vert.		5t1	17	8'-5	149	5t1	17	8'-2	145	5t1	17	7'-11	140	5t1	17	7'-8	136	5t1	17	7'-5	132	5t1	17	7'-2	127	5t1	17	6'-11	123	5t1	17	6'-8	118
Curtain, Vert. Ends		5t2	4	8'-5	35	5t2	4	8'-2	34	5t2	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	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23
Estimated Quantities One Headwall	Reinf. Steel	13,161 LB				10,924 LB				9877 LB				8000 LB				6831 LB				5849 LB				5182 LB				4513 LB			
	Concrete: Parapet Δ	2.2		82.1 CY		2.2		74.9 CY		2.1		65.6 CY		2.1		59.2 CY		2.0		49.4 CY		2.0		44.1 CY		2.0		38.8 CY		1.9		32.7 CY	
	Concrete: Wingwalls	31.7				27.8				22.3				19.1				13.4				11.2				9.1				6.5			
	Concrete: Apron ✳	48.2				44.9				41.2				38.0				34.0				30.9				27.7				24.3			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
15° Skew

PWH 15-5-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-5-20 S1 - THIS SHEET ISSUED 07-2020

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

Location	Shape	16' x 6' Bar	16' x 6' No.	16' x 6' Length	16' x 6' Wt.	16' x 5' Bar	16' x 5' No.	16' x 5' Length	16' x 5' Wt.	16' x 4' Bar	16' x 4' No.	16' x 4' Length	16' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-10 to 8'-11	204	4c1	34 Var.	2 Each 2'-10 to 8'-0	123	4c1	26 Var.	2 Each 2'-10 to 6'-8	82
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, F.F.V. (A)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-6 to 12'-8	400	6c4	44 Var.	2 Each 6'-6 to 11'-7	598	5c4	36 Var.	2 Each 6'-6 to 10'-8	322
Wingwall, B.F.V. (O)		5c5	1	12'-9	13	6c5	1	11'-9	18	5c5	1	10'-9	11
Wingwall, B.F.V. (A)		5c5	2	12'-9	27	6c5	2	11'-9	35	5c5	2	10'-9	22
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	17	22'-11	260	4d1	17	19'-10	225	4d1	17	16'-8	189
Apron, Longit., Top		6f1	17	22'-11	585	6f1	17	19'-10	506	6f1	17	16'-8	426
Parapet, Vertical		4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145
Parapet, Horiz..		9j1	4	17'-9	241	9j1	4	17'-9	241	9j1	4	17'-9	241
Apron, Trans., Top		5m1	36	17'-8	663	5m1	30	17'-8	553	5m1	24	17'-8	442
Apron, Trans., Top		5m2	9 Var.	2'-1 to 17'-0	90	5m2	8 Var.	3'-6 to 16'-7	84	5m2	8 Var.	3'-2 to 16'-3	81
Apron, Trans., Bott.		4m3	19	13'-11	177	4m3	16	14'-5	154	4m3	13	13'-11	121
Curtain, Horiz.		6p1	5	18'-2	136	6p1	5	18'-2	136	6p1	5	18'-2	136
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Curtain, Vert.		5t1	17	6'-5	114	5t1	17	6'-5	114	5t1	17	6'-5	114
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-5	23	5u1	4	5'-5	23	5u1	4	5'-5	23

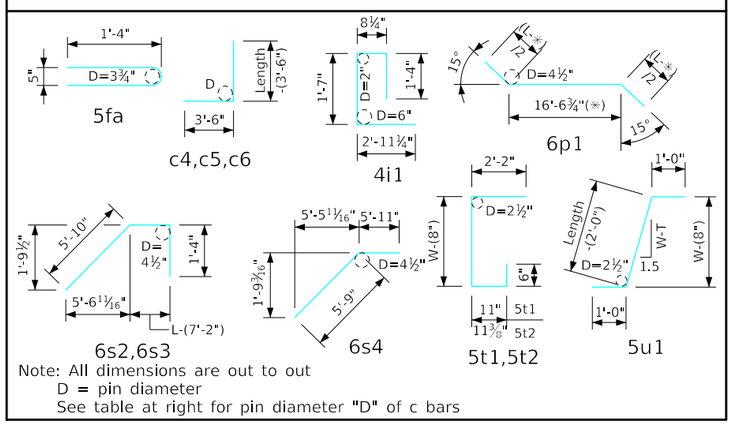
Estimated Quantities One Headwall			16' x 6'		16' x 5'		16' x 4'	
	Reinf. Steel		3801 LB		3455 LB		2750 LB	
	Concrete	Parapet Δ	1.9	28.1 CY	1.9	23.9 CY	1.9	19.8 CY
		Wingwalls	5.0		3.7		2.5	
		Apron ✳	21.2		18.3		15.4	

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 PWH 15-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
15° Skew

PWH 15-5-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-5-20 S2 - THIS SHEET ISSUED 07-2020.

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

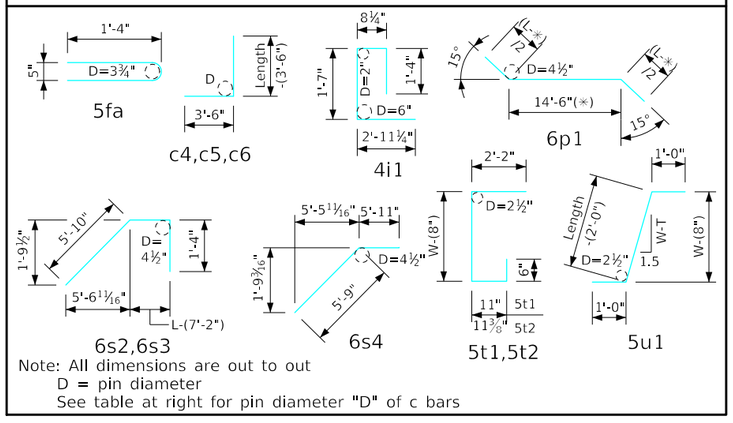
Location	Shape	14' x 14'				14' x 13'				14' x 12'				14' x 11'				14' x 10'				14' x 9'				14' x 8'				14' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	47'-10	105	5b1	2	44'-9	98	5b1	2	41'-7	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	26 Var.	2 Each 9'-2 to 46'-5	769	5b2	24 Var.	2 Each 9'-2 to 43'-4	667	5b2	22 Var.	2 Each 9'-2 to 40'-2	571	5b2	20 Var.	2 Each 9'-2 to 37'-1	482	5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212
Wingwall, B.F.H.		4b3	2	48'-0	67	4b3	2	44'-11	63	4b3	2	41'-9	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	24 Var.	2 Each 12'-5 to 46'-7	483	4b4	22 Var.	2 Each 12'-5 to 43'-6	417	4b4	20 Var.	2 Each 12'-5 to 40'-4	356	4b4	18 Var.	2 Each 12'-5 to 37'-3	299	4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124
Wingwall, F.F.V.		5c1	90 Var.	2 Each 2'-9 to 16'-11	923	5c1	82 Var.	2 Each 2'-9 to 15'-8	788	5c1	76 Var.	2 Each 2'-9 to 14'-8	690	5c1	70 Var.	2 Each 2'-9 to 13'-8	599	4c1	64 Var.	2 Each 2'-9 to 12'-9	331	4c1	58 Var.	2 Each 2'-9 to 11'-9	281	4c1	68 Var.	2 Each 2'-9 to 10'-9	307	4c1	60 Var.	2 Each 2'-9 to 9'-9	251
Wingwall, F.F.V.		5c2	48 Var.	2 Each 9'-4 to 16'-9	653	5c2	42 Var.	2 Each 9'-4 to 15'-10	551	5c2	36 Var.	2 Each 9'-4 to 14'-10	454	5c2	30 Var.	2 Each 9'-4 to 13'-10	362	4c2	24 Var.	2 Each 9'-4 to 12'-11	178	4c2	16 Var.	2 Each 9'-4 to 11'-7	112	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, F.F.V. (A)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, B.F.V.		6c4	90 Var.	2 Each 6'-5 to 20'-7	1825	6c4	82 Var.	2 Each 6'-5 to 19'-4	1586	6c4	76 Var.	2 Each 6'-5 to 18'-4	1413	5c4	70 Var.	2 Each 6'-5 to 17'-5	870	5c4	64 Var.	2 Each 6'-5 to 16'-5	762	5c4	58 Var.	2 Each 6'-5 to 15'-6	663	5c4	52 Var.	2 Each 6'-5 to 14'-6	567	5c4	46 Var.	2 Each 6'-5 to 13'-6	478
Wingwall, B.F.V. (O)		6c5	1	20'-8	31	6c5	1	19'-8	30	6c5	1	18'-8	28	5c5	1	17'-8	18	5c5	1	16'-8	17	5c5	1	15'-8	16	5c5	1	14'-8	15	5c5	1	13'-8	14
Wingwall, B.F.V. (A)		6c5	2	20'-8	62	6c5	2	19'-8	59	6c5	2	18'-8	56	5c5	2	17'-8	37	5c5	2	16'-8	35	5c5	2	15'-8	33	5c5	2	14'-8	31	5c5	2	13'-8	29
Wingwall, B.F.V.		7c6	62	9'-6	1204	6c6	56	8'-6	715	6c6	50	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
Apron, Longit., Bott.		4d1	15	47'-9	503	4d1	15	44'-8	472	4d1	15	41'-7	441	4d1	15	38'-5	385	4d1	15	35'-4	354	4d1	15	32'-3	323	4d1	15	29'-2	292	4d1	15	26'-0	261
Apron, Longit., Top		6f1	15	47'-9	1130	6f1	15	44'-8	1061	6f1	15	41'-7	991	6f1	15	38'-5	866	6f1	15	35'-4	796	6f1	15	32'-3	727	6f1	15	29'-2	657	6f1	15	26'-0	586
Parapet, Vertical		4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128
Parapet, Horiz.		9j1	4	16'-4	222	9j1	4	16'-4	222	9j1	4	16'-2	220	9j1	4	16'-2	220	9j1	4	15'-10	215	9j1	4	15'-10	215	9j1	4	15'-10	215	9j1	4	15'-8	213
Apron, Trans., Top		5m1	87	16'-4	1482	5m1	80	16'-4	1363	5m1	74	16'-2	1248	5m1	68	16'-2	1147	5m1	62	15'-10	1024	5m1	56	15'-10	925	5m1	49	15'-10	809	5m1	43	15'-8	703
Apron, Trans., Top		5m2	7 Var.	2'-9 to 13'-11	61	5m2	8 Var.	2'-3 to 15'-4	73	5m2	7 Var.	3'-8 to 14'-11	68	5m2	7 Var.	3'-4 to 14'-6	65	5m2	7 Var.	2'-9 to 13'-11	61	5m2	7 Var.	2'-4 to 13'-7	58	5m2	8 Var.	2'-0 to 15'-0	71	5m2	7 Var.	3'-4 to 14'-7	65
Apron, Trans., Bott.		6m3	85	14'-1	1798	6m3	79	14'-1	1671	5m3	73	13'-2	1002	6m3	34	13'-11	711	6m3	31	13'-7	632	5m3	28	12'-10	375	5m3	25	12'-10	335	5m3	22	12'-8	291
Curtain, Horiz.		6p1	7	16'-9	176	6p1	7	16'-9	176	6p1	6	16'-7	149	6p1	6	16'-7	149	6p1	6	16'-3	146	6p1	6	16'-3	146	6p1	6	16'-3	146	6p1	5	16'-1	121
Wing Slope, Both F.		6s1	4	43'-3	274	6s1	4	39'-11	240	6s1	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	7'-9	23	6s2	2	7'-9	23	6s2	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	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	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		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	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	40'-9	130	6s5	2	37'-6	113	6s5	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
Curtain, Vert.		5t1	15	8'-5	132	5t1	15	8'-2	128	5t1	15	7'-11	124	5t1	15	7'-8	120	5t1	15	7'-5	116	5t1	15	7'-2	112	5t1	15	6'-11	108	5t1	15	6'-8	104
Curtain, Vert. Ends		5t2	4	8'-5	35	5t2	4	8'-2	34	5t2	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	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23
Estimated Quantities One Headwall	Reinf. Steel	12,383 LB				10,840 LB				9264 LB				7481 LB				6352 LB				5438 LB				4803 LB				4174 LB			
	Concrete: Parapet Δ	2.0		74.7 CY		2.0		68.1 CY		2.0		59.4 CY		2.0		53.4 CY		1.8		44.1 CY		1.8		39.2 CY		1.8		34.5 CY		1.7		28.8 CY	
	Concrete: Wingwalls	31.7				27.8				22.3				19.1				13.4				11.2				9.1				6.5			
	Concrete: Apron ✳	41.0				38.3				35.1				32.3				28.9				26.2				23.6				20.6			

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.

(A) - Indicates bar located at acute corner.
(O) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
15° Skew

PWH 15-6-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-6-20 S1 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	14' x 6' Bar	14' x 6' No.	14' x 6' Length	14' x 6' Wt.	14' x 5' Bar	14' x 5' No.	14' x 5' Length	14' x 5' Wt.	14' x 4' Bar	14' x 4' No.	14' x 4' Length	14' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-9 to 8'-10	201	4c1	34 Var.	2 Each 2'-9 to 7'-11	121	4c1	26 Var.	2 Each 2'-9 to 6'-7	81
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, F.F.V. (A)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-5 to 12'-7	396	5c4	44 Var.	2 Each 6'-5 to 11'-6	411	5c4	36 Var.	2 Each 6'-5 to 10'-7	319
Wingwall, B.F.V. (O)		5c5	1	12'-8	13	5c5	1	11'-8	12	5c5	1	10'-8	11
Wingwall, B.F.V. (A)		5c5	2	12'-8	26	5c5	2	11'-8	24	5c5	2	10'-8	22
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	15	22'-11	230	4d1	15	19'-10	199	4d1	15	16'-8	167
Apron, Longit., Top		6f1	15	22'-11	516	6f1	15	19'-10	447	6f1	15	16'-8	376
Parapet, Vertical		4i1	29	6'-7	128	4i1	29	6'-7	128	4i1	29	6'-7	128
Parapet, Horiz.		9j1	4	15'-8	213	9j1	4	15'-8	213	9j1	4	15'-8	213
Apron, Trans., Top		5m1	25	15'-8	409	5m1	21	15'-8	343	5m1	17	15'-8	278
Apron, Trans., Top		5m2	5 Var.	2'-0 to 13'-2	40	5m2	4 Var.	4'-5 to 12'-10	36	5m2	4 Var.	4'-0 to 12'-5	34
Apron, Trans., Bott.		4m3	19	11'-10	150	4m3	16	11'-10	126	4m3	13	11'-10	103
Curtain, Horiz.		6p1	5	16'-1	121	6p1	5	16'-1	121	6p1	5	16'-1	121
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Curtain, Vert.		5t1	15	6'-5	100	5t1	15	6'-5	100	5t1	15	6'-5	100
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

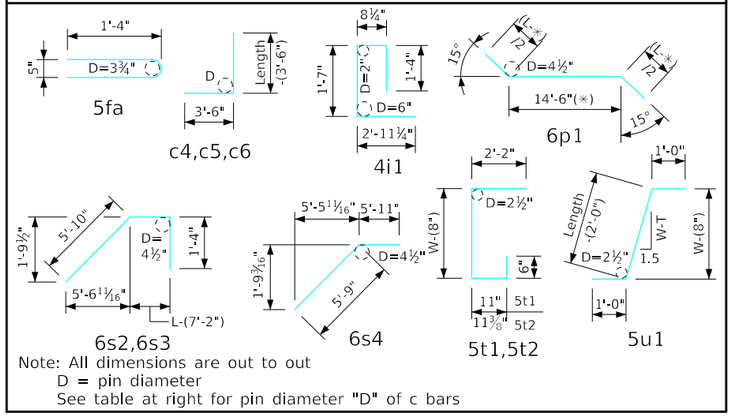
Estimated Quantities One Headwall	Reinf. Steel		14' x 6'	14' x 6'	14' x 5'	14' x 5'	14' x 4'	14' x 4'
	Concrete	Parapet Δ	1.7	3288 LB	1.7	2803 LB	1.7	2370 LB
		Wingwalls	5.0	24.7 CY	3.7	21.0 CY	2.5	17.4 CY
		Apron ✳	18.0		15.6		13.2	

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 PWH 15-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
15° Skew

PWH 15-6-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-6-20 S2 - THIS SHEET ISSUED 07-2020.

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.	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	41'-7	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 Var.	2 Each 9'-2 to 40'-2	571	5b2	20 Var.	2 Each 9'-2 to 37'-1	482	5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212
Wingwall, B.F.H.		4b3	2	41'-9	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 Var.	2 Each 12'-5 to 40'-4	356	4b4	18 Var.	2 Each 12'-5 to 37'-3	299	4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124
Wingwall, F.F.V.		5c1	76 Var.	2 Each 2'-8 to 14'-7	684	5c1	70 Var.	2 Each 2'-8 to 13'-7	593	4c1	64 Var.	2 Each 2'-8 to 12'-8	328	4c1	58 Var.	2 Each 2'-8 to 11'-8	278	4c1	68 Var.	2 Each 2'-8 to 10'-8	303	4c1	60 Var.	2 Each 2'-8 to 9'-8	247
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-3 to 14'-9	451	5c2	30 Var.	2 Each 9'-3 to 13'-9	360	4c2	24 Var.	2 Each 9'-3 to 12'-10	177	4c2	16 Var.	2 Each 9'-3 to 11'-6	111	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	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	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 Var.	2 Each 6'-4 to 18'-3	1403	5c4	70 Var.	2 Each 6'-4 to 17'-4	864	5c4	64 Var.	2 Each 6'-4 to 16'-4	757	5c4	58 Var.	2 Each 6'-4 to 15'-5	658	5c4	52 Var.	2 Each 6'-4 to 14'-5	563	5c4	46 Var.	2 Each 6'-4 to 13'-5	474
Wingwall, B.F.V. (O)		6c5	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	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'-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
Apron, Longit., Bott.		4d1	13	41'-7	382	4d1	13	38'-5	334	4d1	13	35'-4	307	4d1	13	32'-3	280	4d1	13	29'-2	253	4d1	13	26'-0	226
Apron, Longit., Top		6f1	13	41'-7	859	6f1	13	38'-5	750	6f1	13	35'-4	690	6f1	13	32'-3	630	6f1	13	29'-2	570	6f1	13	26'-0	508
Parapet, Vertical		4i1	25	6'-7	110	4i1	25	6'-7	110	4i1	25	6'-7	110	4i1	25	6'-7	110	4i1	25	6'-7	110	4i1	25	6'-7	110
Parapet, Horiz.		7j1	4	14'-1	115	7j1	4	14'-1	115	7j1	4	13'-9	112	7j1	4	13'-9	112	7j1	4	13'-9	112	7j1	4	13'-7	111
Apron, Trans., Top		5m1	50	14'-2	739	5m1	46	14'-2	680	5m1	42	13'-10	606	5m1	38	13'-10	548	5m1	33	13'-10	476	5m1	29	13'-8	413
Apron, Trans., Top		5m2	4 Var.	3'-7 to 12'-0	33	5m2	4 Var.	3'-3 to 11'-7	31	5m2	4 Var.	2'-8 to 11'-1	29	5m2	4 Var.	2'-3 to 10'-8	27	5m2	4 Var.	4'-8 to 13'-1	37	5m2	4 Var.	4'-3 to 12'-7	35
Apron, Trans., Bott.		5m3	73	11'-1	844	5m3	67	11'-1	775	6m3	31	11'-6	535	5m3	28	10'-9	314	5m3	25	10'-9	280	5m3	22	10'-7	243
Curtain, Horiz.		6p1	6	14'-7	131	6p1	6	14'-7	131	6p1	6	14'-3	128	6p1	6	14'-3	128	6p1	6	14'-3	128	6p1	5	14'-1	106
Wing Slope, Both F.		6s1	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	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	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	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	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
Curtain, Vert.		5t1	13	7'-11	107	5t1	13	7'-8	104	5t1	13	7'-5	101	5t1	13	7'-2	97	5t1	13	6'-11	94	5t1	13	6'-8	90
Curtain, Vert. Ends		5t2	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	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

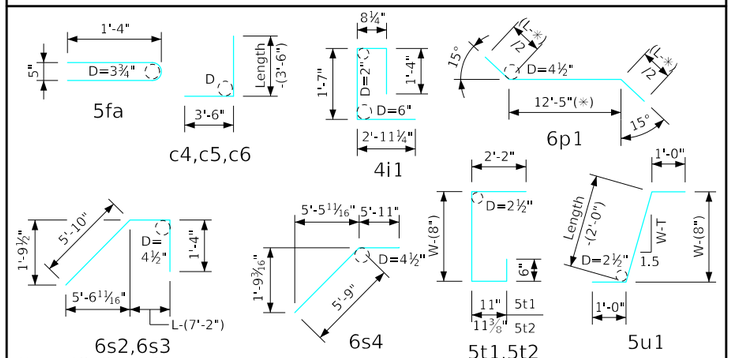
Estimated Quantities One Headwall			12' x 12'		12' x 11'		12' x 10'		12' x 9'		12' x 8'		12' x 7'	
Reinf. Steel			8191 LB		6704 LB		5487 LB		4666 LB		4093 LB		3533 LB	
Concrete	Parapet Δ		1.8	53.5 CY	1.8	48.0 CY	1.7	39.2 CY	1.7	34.8 CY	1.7	30.5 CY	1.6	25.3 CY
	Wingwalls		22.3		19.1		13.4		11.2		9.1		6.5	
	Apron ✳		29.4		27.1		24.1		21.9		19.7		17.2	

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
15° Skew

PWH 15-7-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-7-20 S1 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	12' x 6' Bar	12' x 6' No.	12' x 6' Length	12' x 6' Wt.	12' x 5' Bar	12' x 5' No.	12' x 5' Length	12' x 5' Wt.	12' x 4' Bar	12' x 4' No.	12' x 4' Length	12' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-8 to 8'-9	198	4c1	34 Var.	2 Each 2'-8 to 7'-10	119	4c1	26 Var.	2 Each 2'-8 to 6'-6	80
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (A)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-4 to 12'-6	393	5c4	44 Var.	2 Each 6'-4 to 11'-5	407	5c4	36 Var.	2 Each 6'-4 to 10'-6	316
Wingwall, B.F.V. (O)		5c5	1	12'-7	13	5c5	1	11'-7	12	5c5	1	10'-7	11
Wingwall, B.F.V. (A)		5c5	2	12'-7	26	5c5	2	11'-7	24	5c5	2	10'-7	22
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	13	22'-11	199	4d1	13	19'-10	172	4d1	13	16'-8	145
Apron, Longit., Top		6f1	13	22'-11	447	6f1	13	19'-10	387	6f1	13	16'-8	325
Parapet, Vertical		4i1	25	6'-7	110	4i1	25	6'-7	110	4i1	25	6'-7	110
Parapet, Horiz.		7j1	4	13'-7	111	7j1	4	13'-7	111	7j1	4	13'-7	111
Apron, Trans., Top		5m1	25	13'-8	356	5m1	21	13'-8	299	5m1	17	13'-8	242
Apron, Trans., Top		5m2	4 Var.	3'-9 to 12'-2	33	5m2	4 Var.	3'-5 to 11'-10	32	5m2	4 Var.	3'-0 to 11'-5	30
Apron, Trans., Bott.		4m3	19	9'-10	125	4m3	21	9'-10	138	4m3	13	9'-10	85
Curtain, Horiz.		6p1	5	14'-1	106	6p1	5	14'-1	106	6p1	5	14'-1	106
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Curtain, Vert.		5t1	13	6'-5	87	5t1	13	6'-5	87	5t1	13	6'-5	87
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

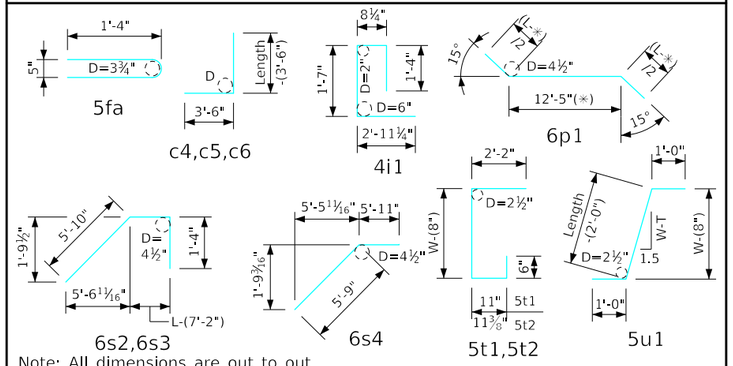
Estimated Quantities One Headwall			12' x 6'		12' x 5'		12' x 4'	
	Reinf. Steel		2949 LB		2526 LB		2085 LB	
	Concrete	Parapet Δ	1.6	21.6 CY	1.6	18.3 CY	1.6	15.1 CY
		Wingwalls	5.0		3.7		2.5	
		Apron ✳	15.0		13.0		11.0	

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.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 12'-0" Span 15° Skew

PWH 15-7-20

SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-7-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 15° 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	41'-7	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 Var.	2 Each 9'-2 to 40'-2	571	5b2	20 Var.	2 Each 9'-2 to 37'-1	482	5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212
Wingwall, B.F.H.		4b3	2	41'-9	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 Var.	2 Each 12'-5 to 40'-4	356	4b4	18 Var.	2 Each 12'-5 to 37'-3	299	4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124
Wingwall, F.F.V.		5c1	76 Var.	2 Each 2'-7 to 14'-6	677	5c1	70 Var.	2 Each 2'-7 to 13'-6	587	4c1	64 Var.	2 Each 2'-7 to 12'-7	324	4c1	58 Var.	2 Each 2'-7 to 11'-7	274	4c1	68 Var.	2 Each 2'-7 to 10'-7	299	4c1	60 Var.	2 Each 2'-7 to 9'-7	244
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-2 to 14'-8	447	5c2	30 Var.	2 Each 9'-2 to 13'-8	357	4c2	24 Var.	2 Each 9'-2 to 12'-9	176	4c2	16 Var.	2 Each 9'-2 to 11'-5	110	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	76 Var.	2 Each 6'-3 to 18'-2	1394	5c4	70 Var.	2 Each 6'-3 to 17'-3	858	5c4	64 Var.	2 Each 6'-3 to 16'-3	751	5c4	58 Var.	2 Each 6'-3 to 15'-4	653	5c4	52 Var.	2 Each 6'-3 to 14'-4	558	5c4	46 Var.	2 Each 6'-3 to 13'-4	470
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	2	18'-6	56	5c5	2	17'-6	37	5c5	2	16'-6	34	5c5	2	15'-6	32	5c5	2	14'-6	30	5c5	2	13'-6	28
Wingwall, B.F.V.		6c6	50	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
Apron, Longit., Bott.		4d1	11	41'-7	323	4d1	11	38'-5	282	4d1	11	35'-4	260	4d1	11	32'-3	237	4d1	11	29'-2	214	4d1	11	26'-0	191
Apron, Longit., Top		6f1	11	41'-7	727	6f1	11	38'-5	635	6f1	11	35'-4	584	6f1	11	32'-3	533	6f1	11	29'-2	482	6f1	11	26'-0	430
Parapet, Vertical		4i1	21	6'-7	92	4i1	21	6'-7	92	4i1	21	6'-7	92	4i1	21	6'-7	92	4i1	21	6'-7	92	4i1	21	6'-7	92
Parapet, Horiz.		7j1	4	12'-0	98	7j1	4	12'-0	98	7j1	4	11'-8	95	7j1	4	11'-8	95	7j1	4	11'-8	95	7j1	4	11'-6	94
Apron, Trans., Top		5m1	50	12'-2	634	5m1	46	12'-2	584	5m1	42	11'-10	518	5m1	38	11'-10	469	5m1	34	11'-10	420	5m1	30	11'-8	365
Apron, Trans., Top		5m2	4 Var.	2'-7 to 11'-0	28	5m2	4 Var.	2'-3 to 10'-7	27	5m2	3 Var.	4'-6 to 10'-1	23	5m2	3 Var.	4'-1 to 9'-8	22	5m2	3 Var.	3'-8 to 9'-3	20	5m2	3 Var.	3'-3 to 8'-10	19
Apron, Trans., Bott.		6m3	73	9'-10	1078	5m3	67	9'-0	629	6m3	31	9'-5	438	5m3	37	8'-8	334	5m3	25	8'-8	226	5m3	22	8'-6	195
Curtain, Horiz.		6p1	6	12'-6	113	6p1	6	12'-6	113	6p1	6	12'-2	110	6p1	6	12'-2	110	6p1	6	12'-2	110	6p1	5	12'-0	90
Wing Slope, Both F.		6s1	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	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	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	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	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
Curtain, Vert.		5t1	11	7'-11	91	5t1	11	7'-8	88	5t1	11	7'-5	85	5t1	11	7'-2	82	5t1	11	6'-11	79	5t1	11	6'-8	76
Curtain, Vert. Ends		5t2	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	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

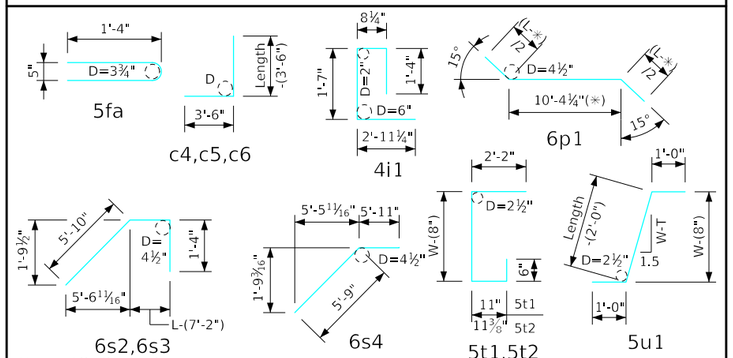
Estimated Quantities One Headwall			10' x 12'		10' x 11'		10' x 10'		10' x 9'		10' x 8'		10' x 7'	
Reinf. Steel			8035 LB		6206 LB		5062 LB		4383 LB		3762 LB		3236 LB	
Concrete	Parapet Δ	1.7	48.1 CY		1.7	43.1 CY	1.5	34.6 CY	1.5	30.6 CY	1.5	26.7 CY	1.4	22.0 CY
	Wingwalls	22.3			19.1		13.4		11.2		9.1		6.5	
	Apron ✳	24.1			22.3		19.7		17.9		16.1		14.1	

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 10'-0" Span 15° Skew

PWH 15-8-20

SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-8-20 S1 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-7 to 8'-8	195	4c1	34 Var.	2 Each 2'-7 to 7'-9	117	4c1	26 Var.	2 Each 2'-7 to 6'-5	78
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (A)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-3 to 12'-5	389	5c4	34 Var.	2 Each 6'-3 to 11'-5	313	5c4	26 Var.	2 Each 6'-3 to 10'-2	223
Wingwall, B.F.V. (O)		5c5	1	12'-6	13	5c5	1	11'-6	12	5c5	1	10'-6	11
Wingwall, B.F.V. (A)		5c5	2	12'-6	26	5c5	2	11'-6	24	5c5	2	10'-6	22
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	11	22'-11	168	4d1	11	19'-10	146	4d1	11	16'-8	122
Apron, Longit., Top		6f1	11	22'-11	379	6f1	11	19'-10	328	6f1	11	16'-8	275
Parapet, Vertical		4i1	21	6'-7	92	4i1	21	6'-7	92	4i1	21	6'-7	92
Parapet, Horiz.		7j1	4	11'-6	94	7j1	4	11'-6	94	7j1	4	11'-6	94
Apron, Trans., Top		5m1	26	11'-8	316	5m1	21	11'-8	256	5m1	17	11'-8	207
Apron, Trans., Top		5m2	3 Var.	2'-9 to 8'-5	17	5m2	4 Var.	2'-5 to 10'-10	28	5m2	4 Var.	2'-0 to 10'-5	26
Apron, Trans., Bott.		4m3	19	7'-9	98	4m3	16	7'-9	83	4m3	13	7'-9	67
Curtain, Horiz.		6p1	5	12'-0	90	6p1	5	12'-0	90	6p1	5	12'-0	90
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Curtain, Vert.		5t1	11	6'-5	74	5t1	11	6'-5	74	5t1	11	6'-5	74
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

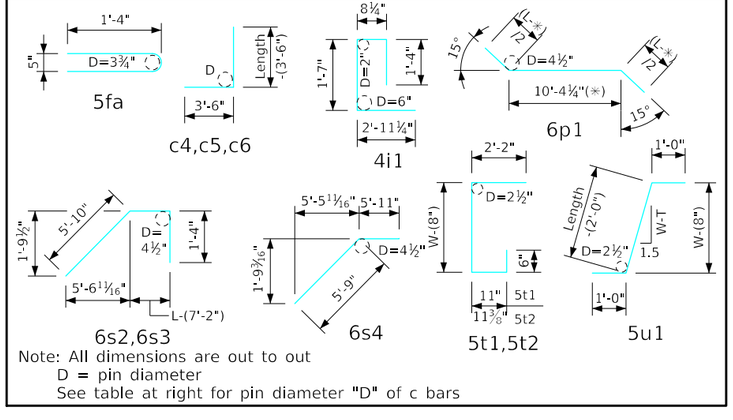
Estimated Quantities One Headwall			10' x 6'		10' x 5'		10' x 4'	
	Reinf. Steel		2696 LB		2179 LB		1796 LB	
	Concrete	Parapet Δ	1.4	18.7 CY	1.4	15.8 CY	1.4	13.0 CY
		Wingwalls	5.0		3.7		2.5	
		Apron ✳	12.3		10.7		9.1	

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
15° Skew

PWH 15-8-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-8-20 S2 - THIS SHEET ISSUED 07-2020.

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

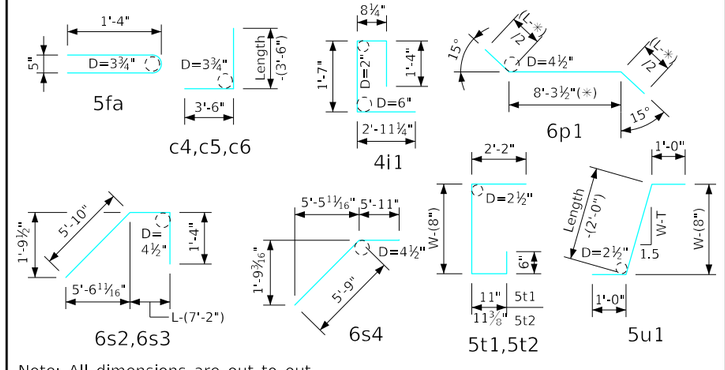
Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	35'-5	74	5b1	2	32'-4	67	5b1	2	29'-2	61	5b1	2	26'-1	54	5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212	5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	35'-6	47	4b3	2	32'-5	43	4b3	2	29'-3	39	4b3	2	26'-2	35	4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124	4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Wingwall, F.F.V.		4c1	64 Var.	2 Each 2'-5 to 12'-5	317	4c1	58 Var.	2 Each 2'-5 to 11'-5	268	4c1	68 Var.	2 Each 2'-5 to 10'-5	291	4c1	60 Var.	2 Each 2'-5 to 9'-5	237	4c1	52 Var.	2 Each 2'-5 to 8'-6	190	4c1	34 Var.	2 Each 2'-5 to 7'-7	114	4c1	26 Var.	2 Each 2'-5 to 6'-3	75
Wingwall, F.F.V.		4c2	24 Var.	2 Each 9'-0 to 12'-7	173	4c2	16 Var.	2 Each 9'-0 to 11'-3	108	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (A)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, B.F.V.		5c4	64 Var.	2 Each 6'-1 to 16'-1	740	5c4	58 Var.	2 Each 6'-1 to 15'-2	643	5c4	52 Var.	2 Each 6'-1 to 14'-2	549	5c4	46 Var.	2 Each 6'-1 to 13'-2	462	5c4	40 Var.	2 Each 6'-1 to 12'-3	382	5c4	34 Var.	2 Each 6'-1 to 11'-3	307	5c4	26 Var.	2 Each 6'-1 to 10'-0	218
Wingwall, B.F.V. (O)		5c5	1	16'-4	17	5c5	1	15'-4	16	5c5	1	14'-4	15	5c5	1	13'-4	14	5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11
Wingwall, B.F.V. (A)		5c5	2	16'-4	34	5c5	2	15'-4	32	5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22
Wingwall, B.F.V.		5c6	38	8'-6	337	5c6	30	8'-6	266	5c6	24	8'-6	213	5c6	18	8'-6	160	5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	9	35'-4	212	4d1	9	32'-3	194	4d1	9	29'-2	175	4d1	9	26'-0	156	4d1	9	22'-11	138	4d1	9	19'-10	119	4d1	9	16'-8	100
Apron, Longit., Top		6f1	9	35'-4	478	6f1	9	32'-3	436	6f1	9	29'-2	394	6f1	9	26'-0	351	6f1	9	22'-11	310	6f1	9	19'-10	268	6f1	9	16'-8	225
Parapet, Vertical		4i1	17	6'-7	75	4i1	17	6'-7	75	4i1	17	6'-7	75	4i1	17	6'-7	75	4i1	17	6'-7	75	4i1	17	6'-7	75	4i1	17	6'-7	75
Parapet, Horiz.		7j1	4	9'-7	78	7j1	4	9'-7	78	7j1	4	9'-7	78	7j1	4	9'-5	77	7j1	4	9'-5	77	7j1	4	9'-5	77	7j1	4	9'-5	77
Apron, Trans., Top		5m1	32	9'-10	328	5m1	29	9'-10	297	5m1	26	9'-10	267	5m1	23	9'-8	232	5m1	20	9'-8	202	5m1	16	9'-8	161	5m1	13	9'-8	131
Apron, Trans., Top		5m2	2 Var.	3'-6 to 7'-2	11	5m2	2 Var.	3'-1 to 6'-10	10	5m2	2 Var.	2'-8 to 6'-5	9	5m2	2 Var.	2'-3 to 5'-11	9	5m2	1	5'-6	6	5m2	2 Var.	5'-2 to 8'-10	15	5m2	2 Var.	4'-9 to 8'-6	14
Apron, Trans., Bott.		6m3	61	7'-5	680	5m3	55	6'-7	378	5m3	33	6'-7	227	5m3	22	6'-5	147	4m3	19	5'-8	72	4m3	16	5'-8	61	4m3	13	5'-8	49
Curtain, Horiz.		6p1	6	10'-1	91	6p1	6	10'-1	91	6p1	6	10'-1	91	6p1	5	9'-11	74	6p1	5	9'-11	74	6p1	5	9'-11	74	6p1	5	9'-11	74
Wing Slope, Both F.		6s1	4	30'-2	181	6s1	4	26'-11	162	6s1	4	23'-8	142	6s1	4	20'-5	123	6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	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	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	6s3	2	8'-0	24
Wing Slope, F.F.		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	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	27'-8	83	6s5	2	24'-5	73	6s5	2	21'-2	64	6s5	2	17'-11	54	6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Curtain, Vert.		5t1	9	7'-5	70	5t1	9	7'-2	67	5t1	9	6'-11	65	5t1	9	6'-8	63	5t1	9	6'-5	60	5t1	9	6'-5	60	5t1	9	6'-5	60
Curtain, Vert. Ends		5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel		4858 LB				4017 LB				3386 LB				2853 LB				2370 LB				1887 LB				1546 LB		
	Concrete Parapet Δ	1.4	29.6 CY			1.4	26.0 CY			1.4	22.6 CY			1.3	18.3 CY			1.3	15.5 CY			1.3	13.0 CY			1.3	10.7 CY		
	Concrete Wingwalls	13.4				11.2				9.1				6.5				5.0				3.7				2.5			
	Concrete Apron ✳	14.8				13.4				12.1				10.5				9.2				8.0				6.9			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
15° Skew

PWH 15-9-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-9-20 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	6' x 8'				6' x 7'				6' x 6'				6' x 5'				6' x 4'				6' x 3'			
		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	29'-2	61	5b1	2	26'-1	54	5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35	5b1	2	13'-8	29
Wingwall, F.F.H.		5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212	5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77	5b2	4 Var.	2 Each 9'-2 to 12'-3	45
Wingwall, B.F.H.		4b3	2	29'-3	39	4b3	2	26'-2	35	4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22	4b3	2	13'-9	18
Wingwall, B.F.H.		4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124	4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37	4b4	2	12'-4	16
Wingwall, F.F.V.		4c1	68 Var.	2 Each 2'-5 to 10'-5	291	4c1	60 Var.	2 Each 2'-5 to 9'-5	237	4c1	52 Var.	2 Each 2'-5 to 8'-6	190	4c1	34 Var.	2 Each 2'-5 to 7'-7	114	4c1	26 Var.	2 Each 2'-5 to 6'-3	75	4c1	20 Var.	2 Each 2'-5 to 5'-4	52
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (A)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, B.F.V.		5c4	52 Var.	2 Each 6'-1 to 14'-2	549	5c4	46 Var.	2 Each 6'-1 to 13'-2	462	5c4	40 Var.	2 Each 6'-1 to 12'-3	382	5c4	34 Var.	2 Each 6'-1 to 11'-3	307	5c4	26 Var.	2 Each 6'-1 to 10'-0	218	5c4	20 Var.	2 Each 6'-1 to 9'-0	157
Wingwall, B.F.V. (O)		5c5	1	14'-4	15	5c5	1	13'-4	14	5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11	5c5	1	9'-4	10
Wingwall, B.F.V. (A)		5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22	5c5	2	9'-4	19
Wingwall, B.F.V.		5c6	24	8'-6	213	5c6	18	8'-6	160	5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	7	29'-2	136	4d1	7	26'-0	122	4d1	7	22'-11	107	4d1	7	19'-10	93	4d1	7	16'-8	78	4d1	7	13'-7	64
Apron, Longit., Top		6f1	7	29'-2	307	6f1	7	26'-0	273	6f1	7	22'-11	241	6f1	7	19'-10	209	6f1	7	16'-8	175	6f1	7	13'-7	143
Parapet, Vertical		4i1	13	6'-7	57	4i1	13	6'-7	57	4i1	13	6'-7	57	4i1	13	6'-7	57	4i1	13	6'-7	57	4i1	13	6'-7	57
Parapet, Horiz.		7j1	4	7'-7	62	7j1	4	7'-4	60	7j1	4	7'-4	60	7j1	4	7'-4	60	7j1	4	7'-4	60	7j1	4	7'-4	60
Apron, Trans., Top		5m1	26	7'-10	212	5m1	23	7'-8	184	5m1	20	7'-8	160	5m1	17	7'-8	136	5m1	14	7'-8	112	5m1	11	7'-8	88
Apron, Trans., Top		5m2	1	5'-5	6	5m2	1	4'-11	5	5m2	1	4'-6	5	5m2	1	4'-2	4	5m2	1	3'-9	4	5m2	1	3'-4	3
Apron, Trans., Bott.		5m3	33	4'-6	155	5m3	22	4'-4	99	4m3	19	3'-7	45	4m3	16	3'-7	38	4m3	13	3'-7	31	4m3	10	3'-7	24
Curtain, Horiz.		6p1	6	8'-0	72	6p1	5	7'-10	59	6p1	5	7'-10	59	6p1	5	7'-10	59	6p1	5	7'-10	59	6p1	5	7'-10	59
Wing Slope, Both F.		6s1	4	23'-8	142	6s1	4	20'-5	123	6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64	6s1	4	7'-4	44
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	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	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	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	21'-2	64	6s5	2	17'-11	54	6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24	6s5	2	4'-10	15
Curtain, Vert.		5t1	7	6'-11	50	5t1	7	6'-8	49	5t1	7	6'-5	47	5t1	7	6'-5	47	5t1	7	6'-5	47	5t1	7	6'-5	47
Curtain, Vert. Ends		5t2	4	6'-11	29	5t2	4	6'-8	28	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

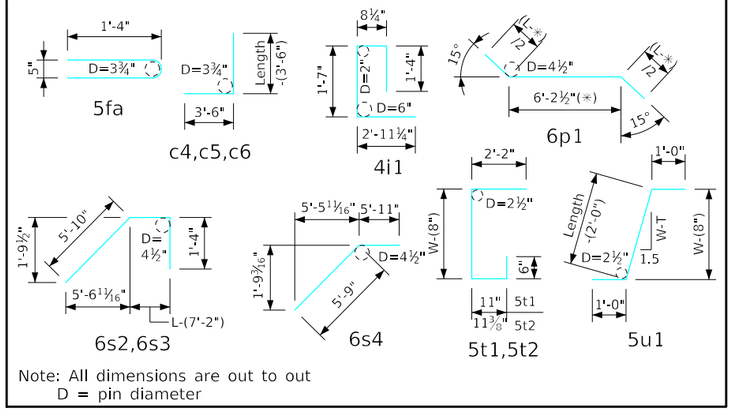
Estimated Quantities One Headwall																									
	Reinf. Steel		3062 LB			2577 LB				2137 LB				1680 LB				1364 LB				1104 LB			
	Concrete	Parapet Δ	1.2	20.3 CY		1.1	16.2 CY			1.1	13.7 CY			1.1	11.4 CY			1.1	9.2 CY			1.1	7.3 CY		
		Wingwalls	9.1			6.5				5.0				3.7				2.5				1.5			
		Apron ✳	10.0			8.6				7.6				6.6				5.6				4.7			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
6'-0" Span
15° Skew

PWH
15-10-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-10-20 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	5' x 6' Bar	5' x 6' No.	5' x 6' Length	5' x 6' Wt.	5' x 5' Bar	5' x 5' No.	5' x 5' Length	5' x 5' Wt.	5' x 4' Bar	5' x 4' No.	5' x 4' Length	5' x 4' Wt.	5' x 3' Bar	5' x 3' No.	5' x 3' Length	5' x 3' Wt.
Fence Anchor (Galv.)		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	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35	5b1	2	13'-8	29
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77	5b2	4 Var.	2 Each 9'-2 to 12'-3	45
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22	4b3	2	13'-9	18
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37	4b4	2	12'-4	16
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-5 to 8'-6	190	4c1	34 Var.	2 Each 2'-5 to 7'-7	114	4c1	26 Var.	2 Each 2'-5 to 6'-3	75	4c1	20 Var.	2 Each 2'-5 to 5'-4	52
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (A)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-1 to 12'-3	382	5c4	34 Var.	2 Each 6'-1 to 11'-3	307	5c4	26 Var.	2 Each 6'-1 to 10'-0	218	5c4	20 Var.	2 Each 6'-1 to 9'-0	157
Wingwall, B.F.V. (O)		5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11	5c5	1	9'-4	10
Wingwall, B.F.V. (A)		5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22	5c5	2	9'-4	19
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	6	22'-11	92	4d1	6	19'-10	79	4d1	6	16'-8	67	4d1	6	13'-7	54
Apron, Longit., Top		6f1	6	22'-11	207	6f1	6	19'-10	179	6f1	6	16'-8	150	6f1	6	13'-7	122
Parapet, Vertical		4i1	11	6'-7	48	4i1	11	6'-7	48	4i1	11	6'-7	48	4i1	11	6'-7	48
Parapet, Horiz.		7j1	4	6'-4	52	7j1	4	6'-4	52	7j1	4	6'-4	52	7j1	4	6'-4	52
Apron, Trans., Top		5m1	20	6'-8	139	5m1	17	6'-8	118	5m1	14	6'-8	97	5m1	11	6'-8	76
Apron, Trans., Top		5m2	1	4'-0	4	5m2	1	3'-8	4	5m2	1	3'-3	3	5m2	1	2'-10	3
Apron, Trans., Bott.		5m3	19	3'-4	66	4m3	16	2'-7	28	4m3	13	2'-7	22	4m3	10	2'-7	17
Curtain, Horiz.		6p1	5	6'-10	51	6p1	5	6'-10	51	6p1	5	6'-10	51	6p1	5	6'-10	51
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64	6s1	4	7'-4	44
Wing Slope, Both F. (O)		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	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		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	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24	6s5	2	4'-10	15
Curtain, Vert.		5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	6	6'-5	40
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

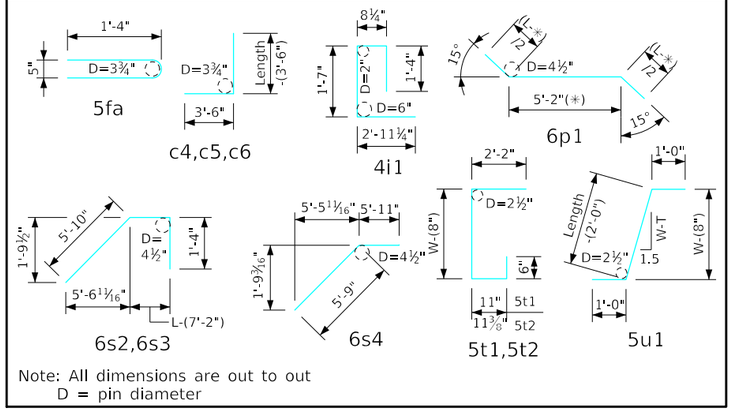
Estimated Quantities One Headwall																	
	Reinf. Steel		2055 LB			1576 LB			1271 LB			1022 LB					
	Concrete	Parapet Δ	1.0	12.7 CY		1.0	10.6 CY		1.0	8.5 CY		1.0	6.7 CY				
		Wingwalls	5.0			3.7			2.5			1.5					
		Apron ✳	6.7			5.9			5.0			4.2					

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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 - Single Reinforced Concrete Box Culverts

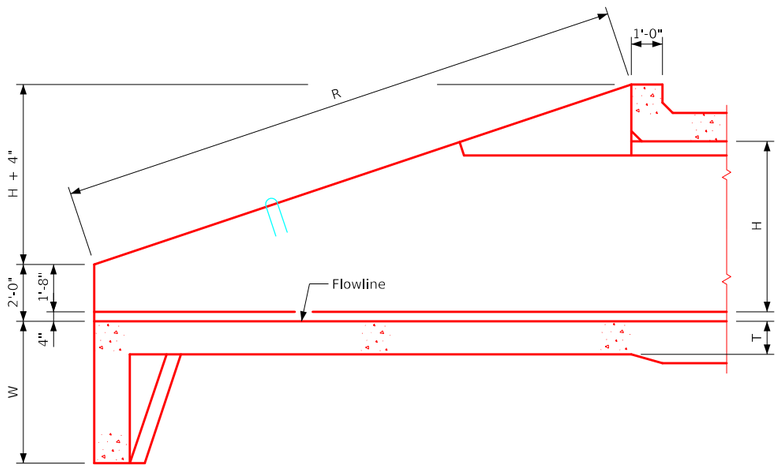
Parallel Wing Headwalls

July, 2020

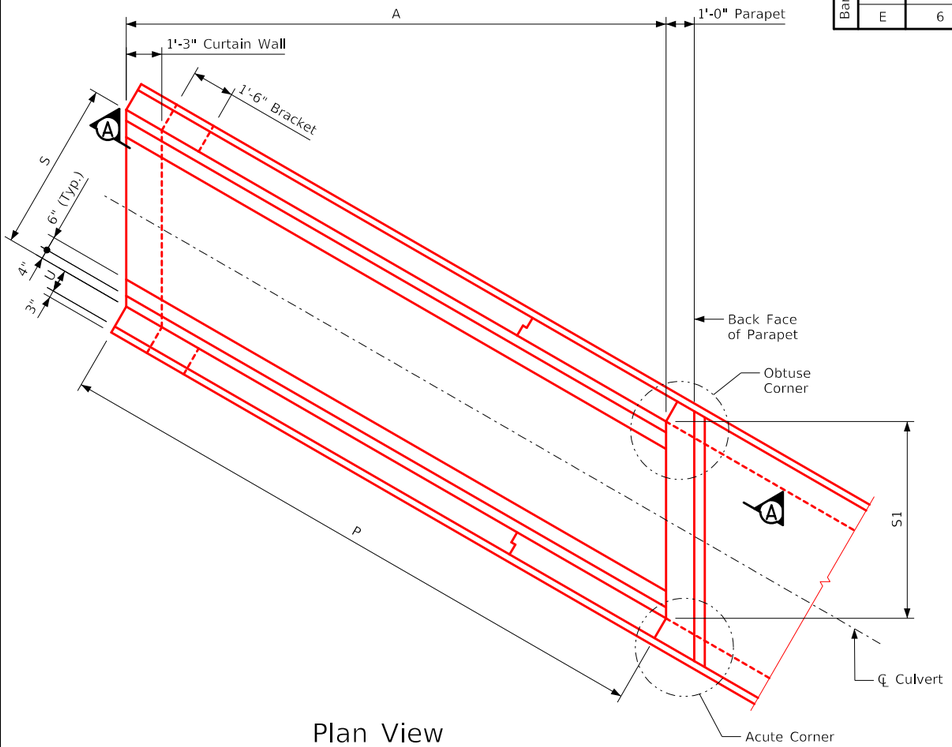
Quantity Tabulation
5'-0" Span
15° Skew

PWH
15-11-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 15-11-20 - THIS SHEET ISSUED 07-2020.



Elevation Section A-A



Plan View

Dimension Table

	S x H	16' x 14'	16' x 13'	16' x 12'	16' x 11'	16' x 10'	16' x 9'	16' x 8'	16' x 7'	16' x 6'	16' x 5'	16' x 4'	14' x 14'	14' x 13'	14' x 12'	14' x 11'	14' x 10'	14' x 9'	14' x 8'	14' x 7'	14' x 6'	S x H
Headwall Dimensions	A	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	A
	H	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	H
	P	49'-7⅞	46'-2¼	42'-8⅝	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	49'-7⅞	46'-2¼	42'-8⅝	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	P
	R	51'-8⅛	48'-0⅞	44'-5⅝	40'-10⅜	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	51'-8⅛	48'-0⅞	44'-5⅝	40'-10⅜	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	R
	S	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	S
	S1	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	18'-5¾	16'-2	16'-2	16'-2	16'-2	16'-2	16'-2	16'-2	16'-2	16'-2	S1
	T	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	T
	U	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	9	9	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	U
	W	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	C
	D	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	6	9	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	E

Dimension Table

	S x H	14' x 5'	14' x 4'	12' x 12'	12' x 11'	12' x 10'	12' x 9'	12' x 8'	12' x 7'	12' x 6'	12' x 5'	12' x 4'	10' x 12'	10' x 11'	10' x 10'	10' x 9'	10' x 8'	10' x 7'	10' x 6'	10' x 5'	10' x 4'	S x H
Headwall Dimensions	A	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	H	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	P	18'-5¾	15'-0⅛	42'-8⅝	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	42'-8⅝	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	P
	R	19'-2¾	15'-7½	44'-5⅝	40'-10⅜	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	44'-5⅝	40'-10⅜	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	R
	S	14'-0	14'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	S
	S1	16'-2	16'-2	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	S1
	T	1'-3	1'-3	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	T
	U	9	9	1'-0	1'-0	10	10	10	9	9	9	9	1'-0	1'-0	10	10	10	9	9	9	9	U
	W	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
Bar Spacing	B	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	1'-0	1'-0	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	9	1'-0	6	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	6	6	9	9	9	9	9	9	9	9	9	E

Dimension Table

	S x H	8' x 10'	8' x 9'	8' x 8'	8' x 7'	8' x 6'	8' x 5'	8' x 4'	6' x 8'	6' x 7'	6' x 6'	6' x 5'	6' x 4'	6' x 3'	5' x 6'	5' x 5'	5' x 4'	5' x 3'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	A
	H	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	8'-0	7'-0	6'-0	5'-0	4'-0	3'-0	6'-0	5'-0	4'-0	3'-0	H
	P	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	11'-6⅝	21'-11¼	18'-5¾	15'-0⅛	11'-6⅝	P
	R	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	12'-0¼	22'-10	19'-2¾	15'-7½	12'-0¼	R
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	5'-0	5'-0	5'-0	5'-0	S
	S1	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	6'-11⅛	6'-11⅛	6'-11⅛	6'-11⅛	6'-11⅛	6'-11⅛	5'-9¾	5'-9¾	5'-9¾	5'-9¾	S1
	T	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	T
	U	10	10	10	9	9	9	9	10	9	9	9	9	9	9	9	9	9	U
	W	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	4'-0	3'-9	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	C
	D	6	6	9	1'-0	1'-0	1'-0	1'-0	6	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	1'-0	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets PWH 30-2-20 thru 30-4-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

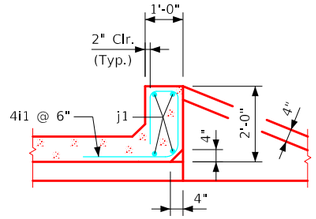
Parallel Wing Headwalls

July, 2020

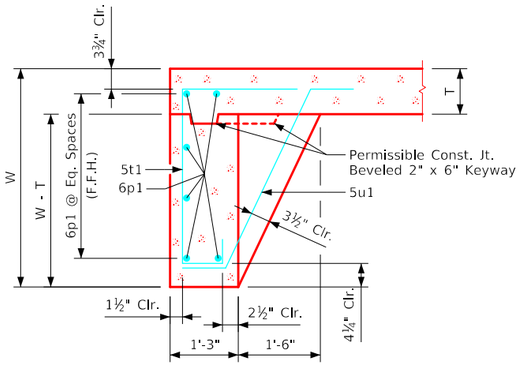
Dimension Table
30° Skew

PWH 30-1-20

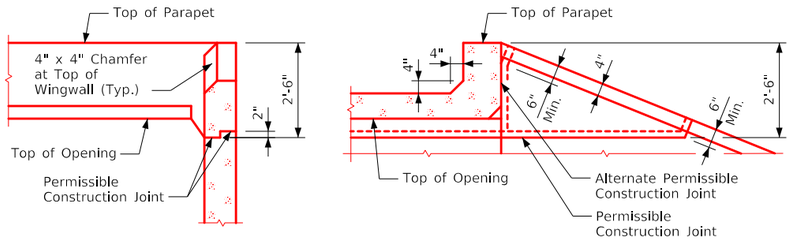
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-1-20 - THIS SHEET ISSUED 07-2020.



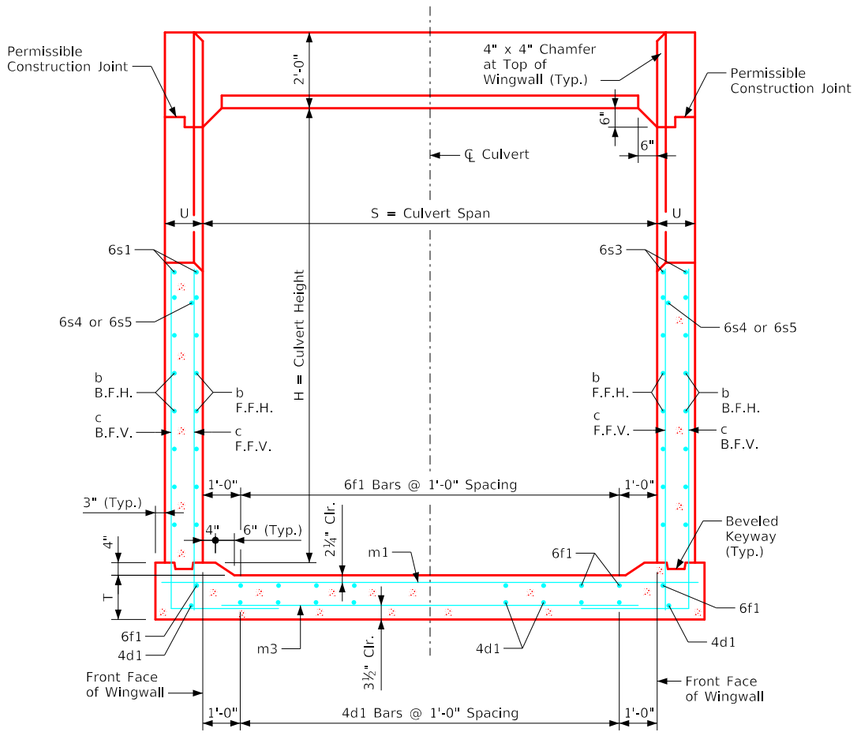
Section thru Parapet



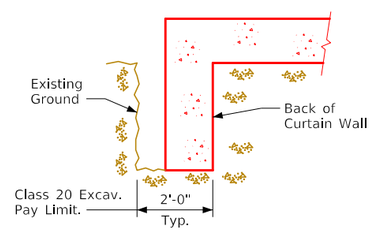
Section thru Curtain Wall



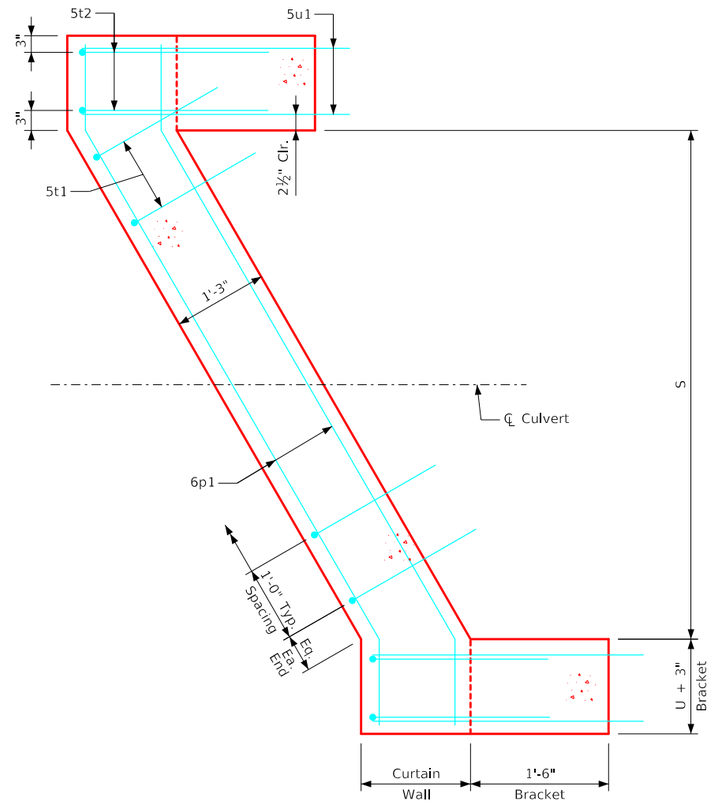
Top of Wingwall Details



Typical Cross Section - thru Headwall



Curtain Wall
Class 20 Excavation



Curtain Wall Detail - Plan View
(Apron is not shown)

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. For dimension table see Sheet PWH 30-1-20.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

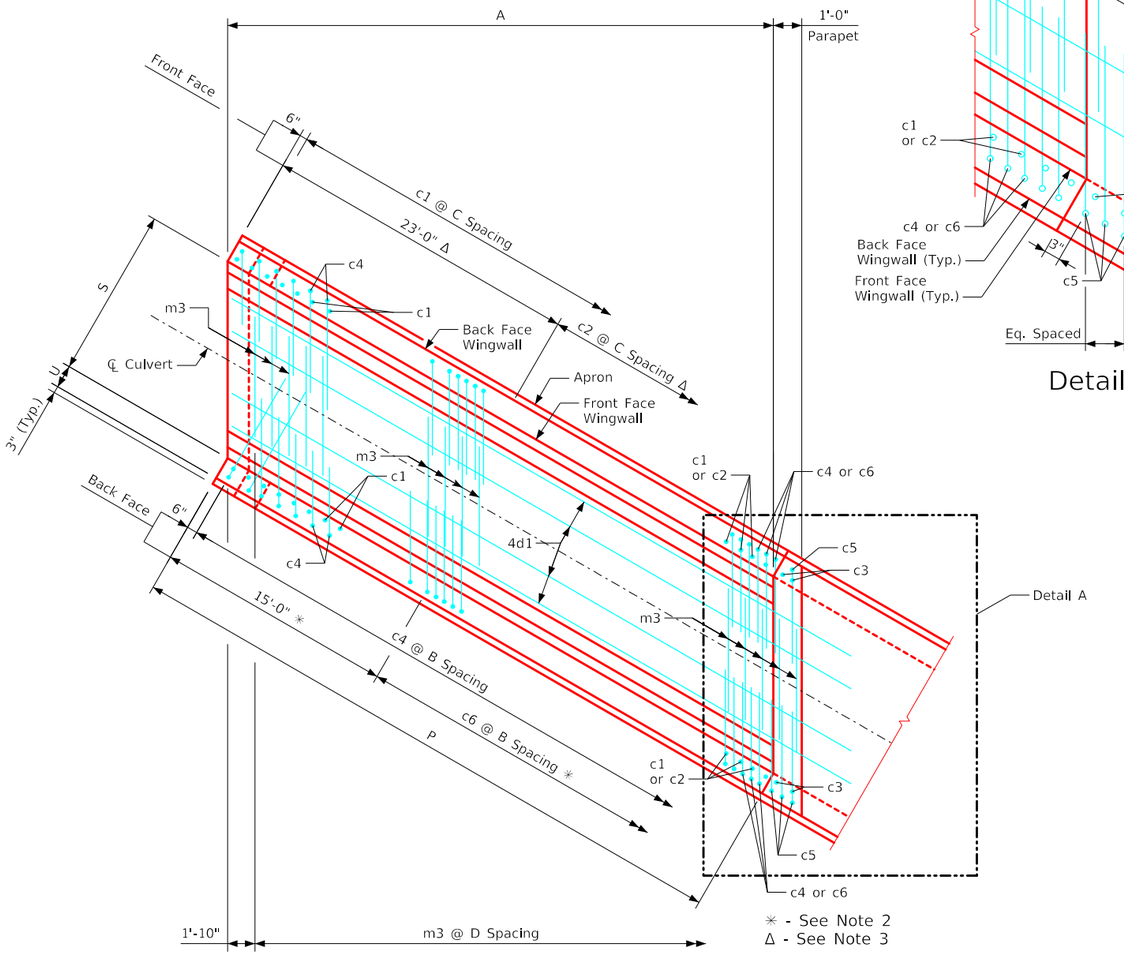
Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

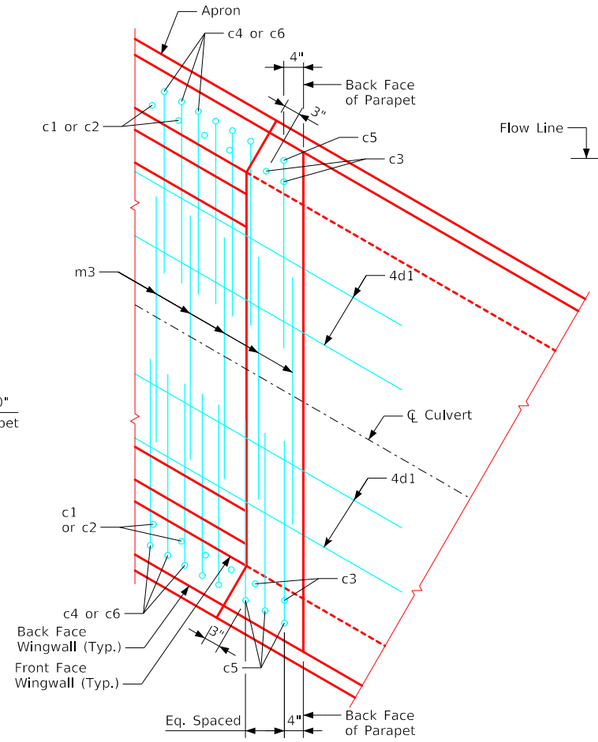
Cross Section Details
30° Skew

PWH 30-2-20

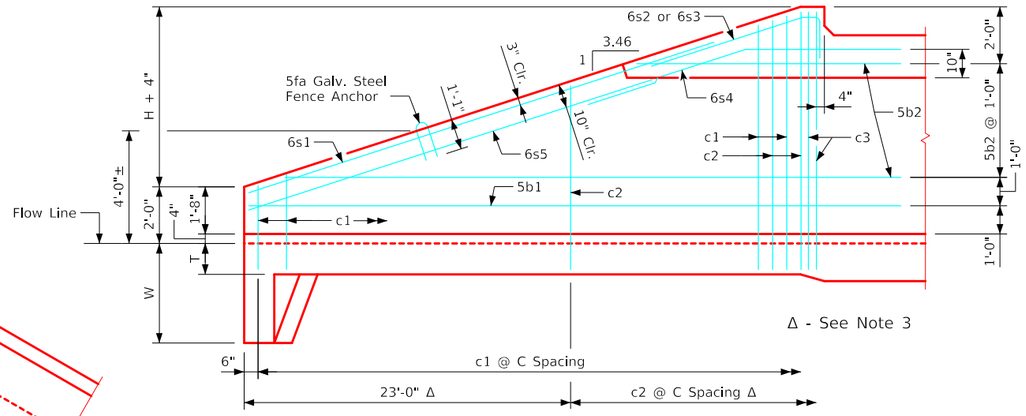


Plan View - Bottom Apron Reinforcing

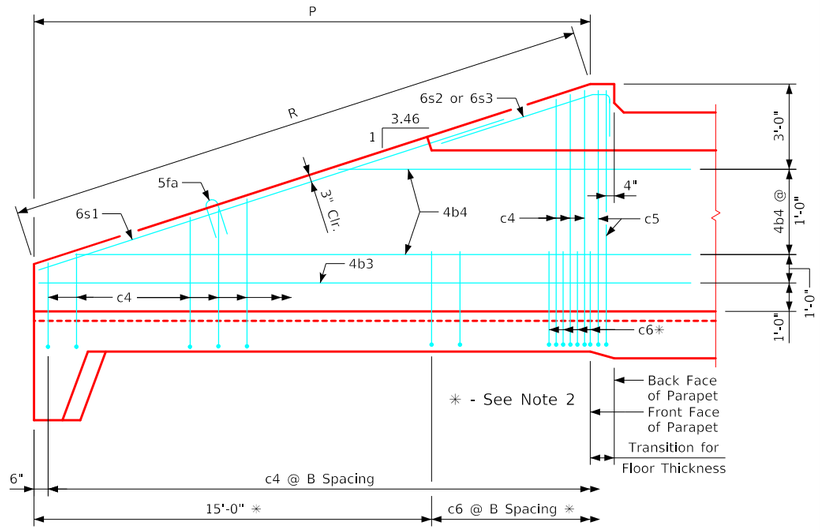
(Curtain Wall Reinforcing not shown, See Sheet PWH 30-2-20)



Detail A



Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. Not applicable for 3' thru 5' height headwalls.
3. Not applicable for 3' thru 8' height headwalls.
4. For headwall dimensions and bar spacing see Sheet PWH 30-1-20.
5. Apron m3 bars are to be centered on ℄ culvert.
6. B.F.V. (c5) and F.F.V. (c3) bars are approximately 4" from the back of parapet for all headwalls.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations & Bottom Apron Reinforcing 30° Skew

PWH 30-3-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-3-20 - THIS SHEET ISSUED 07-2020.

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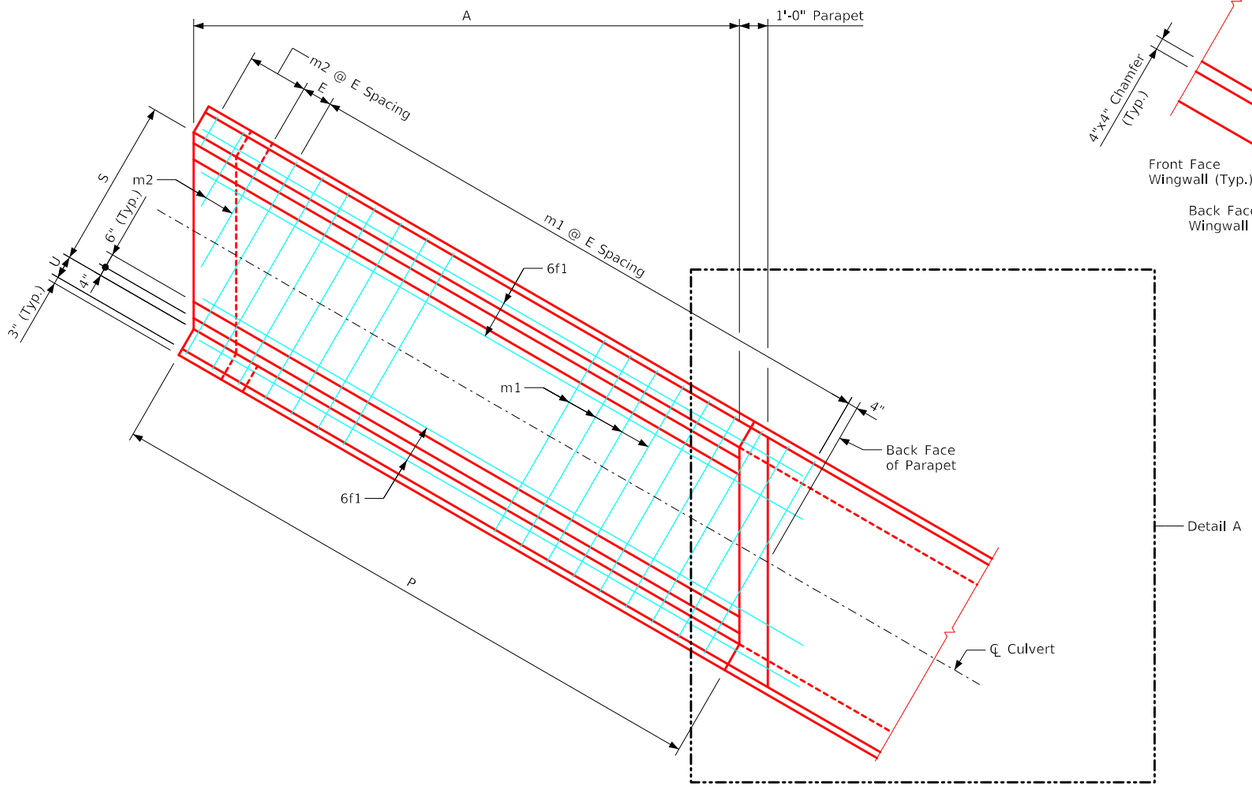
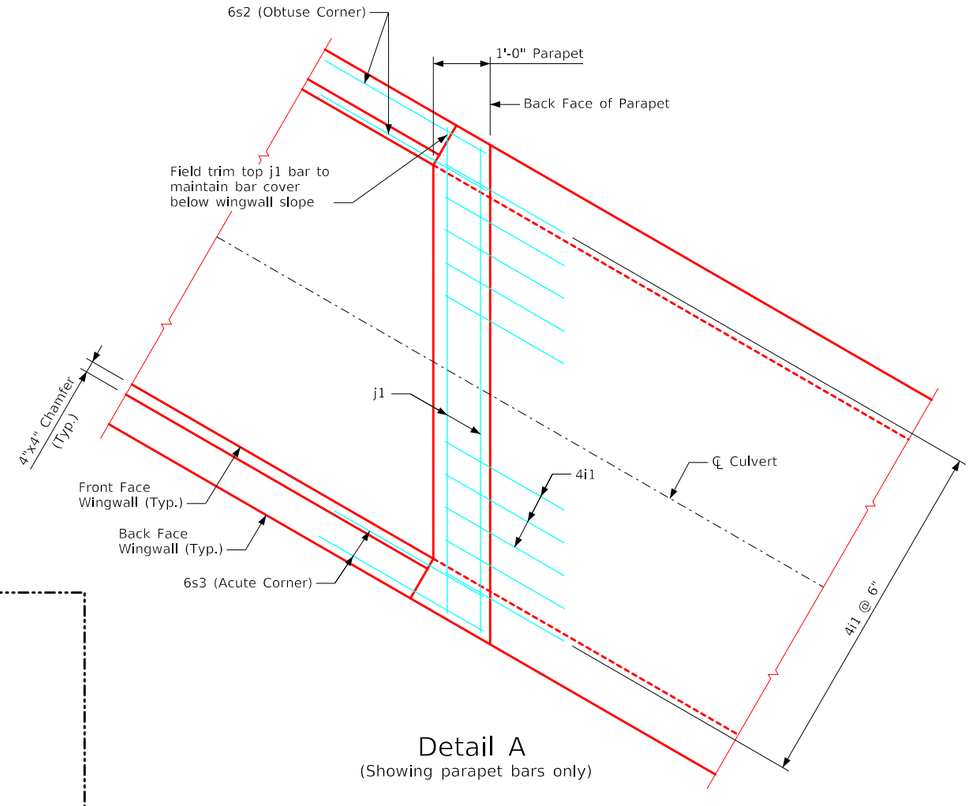


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. For headwall dimensions and bar spacing see Sheet PWH 30-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 30° Skew

PWH 30-4-20

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Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

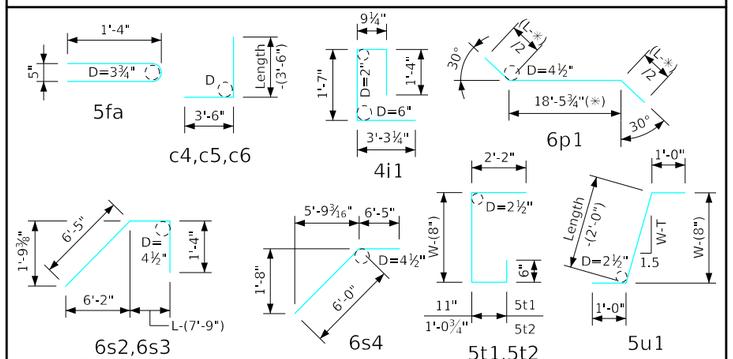
Location	Shape	16' x 14'				16' x 13'				16' x 12'				16' x 11'				16' x 10'				16' x 9'				16' x 8'				16' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	53'-2	116	5b1	2	49'-8	109	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	26 Var.	2 Each 10'-0 to 51'-7	855	5b2	24 Var.	2 Each 10'-0 to 48'-1	742	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	53'-6	75	4b3	2	50'-1	70	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	24 Var.	2 Each 13'-10 to 51'-11	540	4b4	22 Var.	2 Each 13'-10 to 48'-5	467	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
Wingwall, F.F.V.		5c1	100 Var.	2 Each 2'-10 to 17'-0	1034	5c1	92 Var.	2 Each 2'-10 to 15'-10	896	5c1	86 Var.	2 Each 2'-10 to 14'-11	796	5c1	78 Var.	2 Each 2'-10 to 13'-10	678	4c1	72 Var.	2 Each 2'-10 to 12'-11	379	4c1	64 Var.	2 Each 2'-10 to 11'-9	312	4c1	76 Var.	2 Each 2'-10 to 10'-10	347	4c1	68 Var.	2 Each 2'-10 to 10'-0	291
Wingwall, F.F.V.		5c2	54 Var.	2 Each 9'-4 to 16'-10	737	5c2	48 Var.	2 Each 9'-4 to 16'-0	634	5c2	40 Var.	2 Each 9'-4 to 14'-10	504	5c2	34 Var.	2 Each 9'-4 to 13'-11	412	4c2	26 Var.	2 Each 9'-4 to 12'-9	192	4c2	20 Var.	2 Each 9'-4 to 11'-11	142	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, F.F.V. (A)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, B.F.V.		6c4	100 Var.	2 Each 6'-6 to 20'-8	2040	6c4	92 Var.	2 Each 6'-6 to 19'-6	1796	6c4	86 Var.	2 Each 6'-6 to 18'-8	1625	6c4	78 Var.	2 Each 6'-6 to 17'-6	1406	6c4	72 Var.	2 Each 6'-6 to 16'-7	1248	5c4	64 Var.	2 Each 6'-6 to 15'-6	734	5c4	58 Var.	2 Each 6'-6 to 14'-7	638	5c4	50 Var.	2 Each 6'-6 to 13'-5	519
Wingwall, B.F.V. (O)		6c5	1	20'-9	31	6c5	1	19'-9	30	6c5	1	18'-9	28	6c5	1	17'-9	27	6c5	1	16'-9	25	5c5	1	15'-9	16	5c5	1	14'-9	15	5c5	1	13'-9	14
Wingwall, B.F.V. (A)		6c5	3	20'-9	93	6c5	3	19'-9	89	6c5	3	18'-9	84	6c5	3	17'-9	80	6c5	3	16'-9	75	5c5	3	15'-9	49	5c5	3	14'-9	46	5c5	3	13'-9	43
Wingwall, B.F.V.		7c6	70	9'-6	1359	6c6	64	8'-6	817	6c6	56	8'-6	715	6c6	50	8'-6	638	6c6	42	8'-6	536	5c6	36	8'-6	319	5c6	28	8'-6	248	5c6	22	8'-6	195
Apron, Longit., Bott.		4d1	17	53'-0	629	4d1	17	49'-7	591	4d1	17	46'-1	551	4d1	17	42'-7	511	4d1	17	39'-2	445	4d1	17	35'-8	405	4d1	17	32'-3	366	4d1	17	28'-9	326
Apron, Longit., Top		6f1	17	53'-0	1415	6f1	17	49'-7	1328	6f1	17	46'-1	1238	6f1	17	42'-7	1149	6f1	17	39'-2	1000	6f1	17	35'-8	911	6f1	17	32'-3	823	6f1	17	28'-9	734
Parapet, Vertical		4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154
Parapet, Horiz.		9j1	4	20'-7	280	9j1	4	20'-7	280	9j1	4	20'-4	277	9j1	4	20'-4	277	9j1	4	20'-0	272	9j1	4	20'-0	272	9j1	4	20'-0	272	9j1	4	19'-9	269
Apron, Trans., Top		6m1	92	18'-4	2533	6m1	85	18'-4	2341	6m1	78	18'-2	2128	5m1	71	18'-2	1345	5m1	64	17'-10	1190	5m1	57	17'-10	1060	5m1	50	17'-10	930	5m1	43	17'-8	792
Apron, Trans., Top		6m2	17 Var.	2'-8 to 16'-7	246	6m2	17 Var.	2'-9 to 16'-7	247	6m2	17 Var.	2'-9 to 16'-7	247	5m2	17 Var.	2'-9 to 16'-8	172	5m2	17 Var.	2'-8 to 16'-6	170	5m2	17 Var.	2'-9 to 16'-7	171	5m2	17 Var.	2'-10 to 16'-8	173	5m2	17 Var.	2'-9 to 16'-8	172
Apron, Trans., Bott.		6m3	85	18'-4	2341	6m3	79	18'-4	2175	5m3	73	17'-4	1320	6m3	34	18'-1	923	6m3	31	17'-9	826	5m3	28	16'-11	494	5m3	25	16'-11	441	5m3	22	16'-9	246
Curtain, Horiz.		6p1	7	20'-9	218	6p1	7	20'-9	218	6p1	6	20'-7	185	6p1	6	20'-7	185	6p1	6	20'-3	182	6p1	6	20'-3	182	6p1	6	20'-3	182	6p1	5	20'-1	151
Wing Slope, Both F.		6s1	4	47'-7	300	6s1	4	43'-11	278	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'-2	25	6s2	2	8'-2	25	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	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	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	45'-1	143	6s5	2	41'-6	132	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
Curtain, Vert.		5t1	19	8'-5	167	5t1	19	8'-2	162	5t1	19	7'-11	157	5t1	19	7'-8	152	5t1	19	7'-5	147	5t1	19	7'-2	142	5t1	19	6'-11	137	5t1	19	6'-8	132
Curtain, Vert. Ends		5t2	4	8'-7	36	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	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23
Estimated Quantities One Headwall	Reinf. Steel	15,538 LB				13,782 LB				11,800 LB				9676 LB				8178 LB				6520 LB				5764 LB				4876 LB			
	Concrete Parapet Δ	2.5				2.5				2.4				2.4				2.2				2.2				2.2				2.1			
	Concrete Wingwalls	35.4		91.6 CY		31.0		83.6 CY		24.8		73.2 CY		21.3		66.1 CY		15.0		55.1 CY		12.5		49.1 CY		10.2		43.3 CY		7.3		36.5 CY	
	Concrete Apron ✳	53.7				50.1				46.0				42.4				37.9				34.4				30.9				27.1			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
30° Skew

PWH 30-5-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-5-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	16' x 6' Bar	16' x 6' No.	16' x 6' Length	16' x 6' Wt.	16' x 5' Bar	16' x 5' No.	16' x 5' Length	16' x 5' Wt.	16' x 4' Bar	16' x 4' No.	16' x 4' Length	16' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-10 to 8'-11	228	4c1	36 Var.	2 Each 2'-10 to 7'-9	127	4c1	30 Var.	2 Each 2'-10 to 6'-10	97
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, F.F.V. (A)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-6 to 12'-7	438	6c4	48 Var.	2 Each 6'-6 to 11'-6	649	6c4	40 Var.	2 Each 6'-6 to 10'-8	516
Wingwall, B.F.V. (O)		5c5	1	12'-9	13	6c5	1	11'-9	18	6c5	1	10'-9	16
Wingwall, B.F.V. (A)		5c5	3	12'-9	40	6c5	3	11'-9	53	6c5	3	10'-9	48
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	17	25'-4	288	4d1	17	21'-10	248	4d1	17	18'-4	208
Apron, Longit., Top		6f1	17	25'-4	647	6f1	17	21'-10	557	6f1	17	18'-4	468
Parapet, Vertical		4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154
Parapet, Horiz.		9j1	4	19'-9	269	9j1	4	19'-9	269	9j1	4	19'-9	269
Apron, Trans., Top		5m1	36	17'-8	663	5m1	29	17'-8	534	5m1	22	17'-8	405
Apron, Trans., Top		5m2	18 Var.	2'-0 to 16'-8	175	5m2	18 Var.	2'-1 to 16'-9	177	5m2	18 Var.	2'-1 to 16'-10	178
Apron, Trans., Bott.		4m3	19	16'-0	203	4m3	16	16'-6	176	4m3	13	16'-6	143
Curtain, Horiz.		6p1	5	20'-1	151	6p1	5	20'-1	151	6p1	5	20'-1	151
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		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
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Curtain, Vert.		5t1	19	6'-5	127	5t1	19	6'-5	127	5t1	19	6'-5	127
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-5	23	5u1	4	5'-5	23	5u1	4	5'-5	23

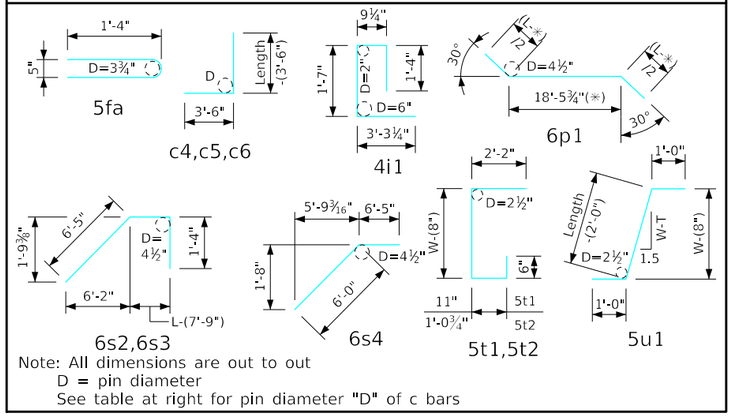
Estimated Quantities One Headwall	Reinf. Steel		16' x 6'		16' x 5'		16' x 4'	
	Concrete	Parapet Δ	2.1	4212 LB	2.1	3806 LB	2.1	3229 LB
		Wingwalls	5.6	31.3 CY	4.1	26.6 CY	2.8	22.1 CY
		Apron ✳	23.6		20.4		17.2	

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 PWH 30-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 16'-0" Span 30° Skew

PWH 30-5-20

SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-5-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

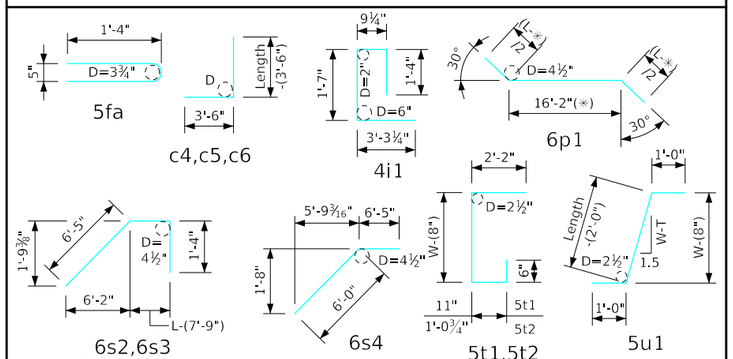
Location	Shape	14' x 14'				14' x 13'				14' x 12'				14' x 11'				14' x 10'				14' x 9'				14' x 8'				14' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	53'-2	116	5b1	2	49'-8	109	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	26 Var.	2 Each 10'-0 to 51'-7	855	5b2	24 Var.	2 Each 10'-0 to 48'-1	742	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	53'-6	75	4b3	2	50'-1	70	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	24 Var.	2 Each 13'-10 to 51'-11	540	4b4	22 Var.	2 Each 13'-10 to 48'-5	467	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
Wingwall, F.F.V.		5c1	100 Var.	2 Each 2'-9 to 16'-11	1026	5c1	92 Var.	2 Each 2'-9 to 15'-9	888	5c1	86 Var.	2 Each 2'-9 to 14'-10	789	5c1	78 Var.	2 Each 2'-9 to 13'-9	671	4c1	72 Var.	2 Each 2'-9 to 12'-10	375	4c1	64 Var.	2 Each 2'-9 to 11'-8	308	4c1	76 Var.	2 Each 2'-9 to 10'-9	343	4c1	68 Var.	2 Each 2'-9 to 9'-11	288
Wingwall, F.F.V.		5c2	54 Var.	2 Each 9'-3 to 16'-9	732	5c2	48 Var.	2 Each 9'-3 to 15'-11	630	5c2	40 Var.	2 Each 9'-3 to 14'-9	501	5c2	34 Var.	2 Each 9'-3 to 13'-10	409	4c2	26 Var.	2 Each 9'-3 to 12'-8	190	4c2	20 Var.	2 Each 9'-3 to 11'-10	141	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, F.F.V. (A)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, B.F.V.		6c4	100 Var.	2 Each 6'-5 to 20'-7	2028	6c4	92 Var.	2 Each 6'-5 to 19'-5	1785	6c4	86 Var.	2 Each 6'-5 to 18'-7	1615	5c4	78 Var.	2 Each 6'-5 to 17'-5	969	5c4	72 Var.	2 Each 6'-5 to 16'-6	860	5c4	64 Var.	2 Each 6'-5 to 15'-5	729	5c4	58 Var.	2 Each 6'-5 to 14'-6	633	5c4	50 Var.	2 Each 6'-5 to 13'-4	515
Wingwall, B.F.V. (O)		6c5	1	20'-8	31	6c5	1	19'-8	30	6c5	1	18'-8	28	5c5	1	17'-8	18	5c5	1	16'-8	17	5c5	1	15'-8	16	5c5	1	14'-8	15	5c5	1	13'-8	14
Wingwall, B.F.V. (A)		6c5	3	20'-8	93	6c5	3	19'-8	89	6c5	3	18'-8	84	5c5	3	17'-8	55	5c5	3	16'-8	52	5c5	3	15'-8	49	5c5	3	14'-8	46	5c5	3	13'-8	43
Wingwall, B.F.V.		7c6	70	9'-6	1359	6c6	64	8'-6	817	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
Apron, Longit., Bott.		4d1	15	53'-0	555	4d1	15	49'-7	521	4d1	15	46'-1	486	4d1	15	42'-7	451	4d1	15	39'-2	392	4d1	15	35'-8	357	4d1	15	32'-3	323	4d1	15	28'-9	288
Apron, Longit., Top		6f1	15	53'-0	1249	6f1	15	49'-7	1172	6f1	15	46'-1	1093	6f1	15	42'-7	1014	6f1	15	39'-2	882	6f1	15	35'-8	804	6f1	15	32'-3	727	6f1	15	28'-9	648
Parapet, Vertical		4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136
Parapet, Horiz.		9j1	4	18'-3	248	9j1	4	18'-3	248	9j1	4	18'-1	246	9j1	4	18'-1	246	9j1	4	17'-8	240	9j1	4	17'-8	240	9j1	4	17'-8	240	9j1	4	17'-6	238
Apron, Trans., Top		5m1	93	16'-4	1584	5m1	86	16'-4	1465	5m1	79	16'-2	1332	5m1	72	16'-2	1214	5m1	65	15'-10	1073	5m1	58	15'-10	958	5m1	51	15'-10	842	5m1	44	15'-8	719
Apron, Trans., Top		5m2	15 Var.	2'-7 to 14'-8	135	5m2	15 Var.	2'-7 to 14'-9	136	5m2	15 Var.	2'-7 to 14'-8	135	5m2	15 Var.	2'-8 to 14'-9	136	5m2	15 Var.	2'-6 to 14'-8	134	5m2	15 Var.	2'-7 to 14'-9	136	5m2	15 Var.	2'-8 to 14'-10	137	5m2	15 Var.	2'-8 to 14'-9	136
Apron, Trans., Bott.		6m3	85	16'-0	2043	6m3	79	16'-0	1899	5m3	73	15'-0	1142	6m3	45	15'-10	1070	6m3	31	15'-5	718	5m3	28	14'-8	428	5m3	25	14'-8	382	5m3	22	14'-5	331
Curtain, Horiz.		6p1	7	18'-6	195	6p1	7	18'-6	195	6p1	6	18'-4	165	6p1	6	18'-4	165	6p1	6	18'-0	162	6p1	6	18'-0	162	6p1	6	18'-0	162	6p1	5	17'-10	134
Wing Slope, Both F.		6s1	4	47'-7	300	6s1	4	43'-11	278	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'-2	25	6s2	2	8'-2	25	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	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	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	45'-1	143	6s5	2	41'-6	132	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
Curtain, Vert.		5t1	17	8'-5	149	5t1	17	8'-2	145	5t1	17	7'-11	140	5t1	17	7'-8	136	5t1	17	7'-5	132	5t1	17	7'-2	127	5t1	17	6'-11	123	5t1	17	6'-8	118
Curtain, Vert. Ends		5t2	4	8'-7	36	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	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23
Estimated Quantities One Headwall	Reinf. Steel	13,824 LB				12,180 LB				10,398 LB				8700 LB				7072 LB				6067 LB				5349 LB				4641 LB			
	Concrete Parapet Δ	2.3		83.4 CY		2.3		75.9 CY		2.2		66.1 CY		2.2		59.5 CY		2.0		49.2 CY		2.0		43.7 CY		2.0		38.4 CY		1.9		32.2 CY	
	Concrete Wingwalls	35.4				31.0				24.8				21.3				15.0				12.5				10.2				7.3			
	Concrete Apron ✳	45.7				42.6				39.1				36.0				32.2				29.2				26.2				23.0			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
30° Skew

PWH 30-6-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-6-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	14' x 6' Bar	14' x 6' No.	14' x 6' Length	14' x 6' Wt.	14' x 5' Bar	14' x 5' No.	14' x 5' Length	14' x 5' Wt.	14' x 4' Bar	14' x 4' No.	14' x 4' Length	14' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-9 to 8'-10	224	4c1	36 Var.	2 Each 2'-9 to 7'-8	125	4c1	30 Var.	2 Each 2'-9 to 6'-9	95
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, F.F.V. (A)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-5 to 12'-6	434	6c4	48 Var.	2 Each 6'-5 to 11'-5	643	5c4	40 Var.	2 Each 6'-5 to 10'-7	355
Wingwall, B.F.V. (O)		5c5	1	12'-8	13	6c5	1	11'-8	18	5c5	1	10'-8	11
Wingwall, B.F.V. (A)		5c5	3	12'-8	40	6c5	3	11'-8	53	5c5	3	10'-8	33
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	15	25'-4	254	4d1	15	21'-10	219	4d1	15	18'-4	184
Apron, Longit., Top		6f1	15	25'-4	571	6f1	15	21'-10	492	6f1	15	18'-4	413
Parapet, Vertical		4i1	29	7'-0	136	4i1	29	7'-0	136	4i1	29	7'-0	136
Parapet, Horiz.		9j1	4	17'-6	238	9j1	4	17'-6	238	9j1	4	17'-6	238
Apron, Trans., Top		5m1	37	15'-8	605	5m1	31	15'-8	507	5m1	24	15'-8	392
Apron, Trans., Top		5m2	15 Var.	2'-9 to 14'-10	138	5m2	14 Var.	2'-9 to 14'-0	122	5m2	15 Var.	2'-0 to 14'-1	126
Apron, Trans., Bott.		4m3	19	13'-8	173	4m3	16	14'-2	151	4m3	13	13'-8	119
Curtain, Horiz.		6p1	5	17'-10	134	6p1	5	17'-10	134	6p1	5	17'-10	134
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		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
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Curtain, Vert.		5t1	17	6'-5	114	5t1	17	6'-5	114	5t1	17	6'-5	114
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

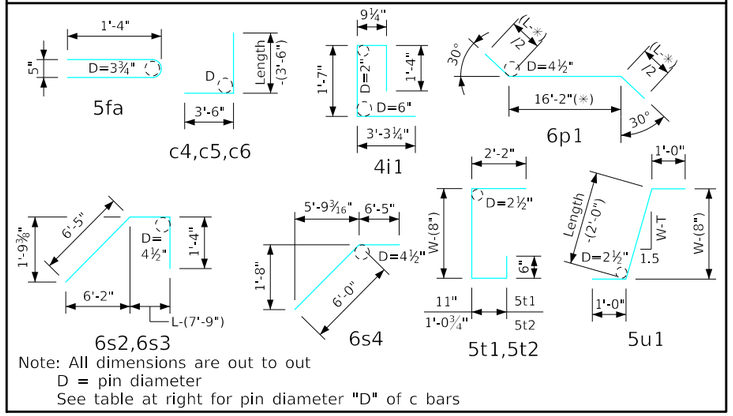
Estimated Quantities One Headwall			14' x 6'		14' x 5'		14' x 4'	
	Reinf. Steel		3889 LB		3517 LB		2798 LB	
	Concrete	Parapet Δ	1.9	27.6 CY	1.9	23.4 CY	1.9	19.4 CY
		Wingwalls	5.6		4.1		2.8	
		Apron ✳	20.1		17.4		14.7	

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.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"
7	5¼"

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
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7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
30° Skew

PWH 30-6-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-6-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° 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.	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
Wingwall, F.F.V.		5c1	86 Var.	2 Each 2'-8 to 14'-9	781	5c1	78 Var.	2 Each 2'-8 to 13'-8	664	4c1	72 Var.	2 Each 2'-8 to 12'-9	371	4c1	64 Var.	2 Each 2'-8 to 11'-7	305	4c1	76 Var.	2 Each 2'-8 to 10'-8	338	4c1	68 Var.	2 Each 2'-8 to 9'-10	284
Wingwall, F.F.V.		5c2	40 Var.	2 Each 9'-2 to 14'-8	497	5c2	34 Var.	2 Each 9'-2 to 13'-9	406	4c2	26 Var.	2 Each 9'-2 to 12'-7	189	4c2	20 Var.	2 Each 9'-2 to 11'-9	140	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	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	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	86 Var.	2 Each 6'-4 to 18'-6	1604	5c4	78 Var.	2 Each 6'-4 to 17'-4	963	5c4	72 Var.	2 Each 6'-4 to 16'-5	854	5c4	64 Var.	2 Each 6'-4 to 15'-4	723	5c4	58 Var.	2 Each 6'-4 to 14'-5	628	5c4	50 Var.	2 Each 6'-4 to 13'-3	511
Wingwall, B.F.V. (O)		6c5	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	3	18'-7	84	5c5	3	17'-7	55	5c5	3	16'-7	52	5c5	3	15'-7	49	5c5	3	14'-7	46	5c5	3	13'-7	43
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
Apron, Longit., Bott.		4d1	13	46'-1	421	4d1	13	42'-7	391	4d1	13	39'-2	340	4d1	13	35'-8	310	4d1	13	32'-3	280	4d1	13	28'-9	250
Apron, Longit., Top		6f1	13	46'-1	947	6f1	13	42'-7	879	6f1	13	39'-2	765	6f1	13	35'-8	696	6f1	13	32'-3	630	6f1	13	28'-9	561
Parapet, Vertical		4i1	25	7'-0	117	4i1	25	7'-0	117	4i1	25	7'-0	117	4i1	25	7'-0	117	4i1	25	7'-0	117	4i1	25	7'-0	117
Parapet, Horiz.		7j1	4	15'-9	129	7j1	4	15'-9	129	7j1	4	15'-4	125	7j1	4	15'-4	125	7j1	4	15'-4	125	7j1	4	15'-2	124
Apron, Trans., Top		5m1	80	14'-2	1182	5m1	73	14'-2	1079	5m1	66	13'-10	952	5m1	59	13'-10	851	5m1	52	13'-10	750	5m1	46	13'-8	656
Apron, Trans., Top		5m2	13 Var.	2'-5 to 12'-10	103	5m2	13 Var.	2'-6 to 12'-11	105	5m2	13 Var.	2'-5 to 12'-10	103	5m2	13 Var.	2'-6 to 12'-10	104	5m2	13 Var.	2'-6 to 12'-11	105	5m2	12 Var.	2'-6 to 12'-1	91
Apron, Trans., Bott.		5m3	73	12'-9	971	5m3	67	12'-9	891	6m3	31	13'-1	609	6m3	28	13'-1	550	5m3	25	12'-4	322	5m3	22	12'-2	279
Curtain, Horiz.		6p1	6	16'-0	144	6p1	6	16'-0	144	6p1	6	15'-8	141	6p1	6	15'-8	141	6p1	6	15'-8	141	6p1	5	15'-6	116
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
Curtain, Vert.		5t1	14	7'-11	116	5t1	14	7'-8	112	5t1	14	7'-5	108	5t1	14	7'-2	105	5t1	14	6'-11	101	5t1	14	6'-8	97
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'-5	27	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-9	24	5u1	4	5'-6	23

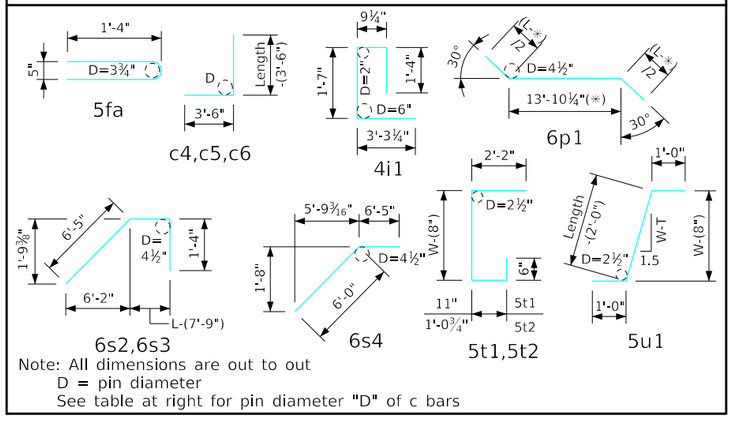
Estimated Quantities One Headwall																									
Reinf. Steel			9627 LB				7961 LB				6450 LB				5708 LB				4838 LB				4174 LB		
Concrete	Parapet Δ	2.0	59.5 CY			2.0	53.5 CY			1.9	43.8 CY			1.9	38.8 CY			1.9	34.0 CY			1.8	28.3 CY		
	Wingwalls	24.8				21.3				15.0				12.5				10.2				7.3			
	Apron ✳	32.7				30.2				26.9				24.4				21.9				19.2			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
30° Skew

PWH 30-7-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-7-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	12' x 6' Bar	12' x 6' No.	12' x 6' Length	12' x 6' Wt.	12' x 5' Bar	12' x 5' No.	12' x 5' Length	12' x 5' Wt.	12' x 4' Bar	12' x 4' No.	12' x 4' Length	12' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-8 to 8'-9	221	4c1	36 Var.	2 Each 2'-8 to 7'-7	123	4c1	30 Var.	2 Each 2'-8 to 6'-8	94
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (A)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-4 to 12'-5	430	5c4	48 Var.	2 Each 6'-4 to 11'-4	442	5c4	40 Var.	2 Each 6'-4 to 10'-6	351
Wingwall, B.F.V. (O)		5c5	1	12'-7	13	5c5	1	11'-7	12	5c5	1	10'-7	11
Wingwall, B.F.V. (A)		5c5	3	12'-7	39	5c5	3	11'-7	36	5c5	3	10'-7	33
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	13	25'-4	220	4d1	13	21'-10	190	4d1	13	18'-4	159
Apron, Longit., Top		6f1	13	25'-4	495	6f1	13	21'-10	426	6f1	13	18'-4	358
Parapet, Vertical		4i1	25	7'-0	117	4i1	25	7'-0	117	4i1	25	7'-0	117
Parapet, Horiz.		7j1	4	15'-2	124	7j1	4	15'-2	124	7j1	4	15'-2	124
Apron, Trans., Top		5m1	39	13'-8	556	5m1	32	13'-8	456	5m1	25	13'-8	356
Apron, Trans., Top		5m2	12 Var.	2'-7 to 12'-1	92	5m2	12 Var.	2'-8 to 12'-2	93	5m2	12 Var.	2'-8 to 12'-3	93
Apron, Trans., Bott.		4m3	19	11'-4	144	4m3	21	11'-4	159	4m3	13	11'-4	98
Curtain, Horiz.		6p1	5	15'-6	116	6p1	5	15'-6	116	6p1	5	15'-6	116
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		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
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Curtain, Vert.		5t1	14	6'-5	94	5t1	14	6'-5	94	5t1	14	6'-5	94
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

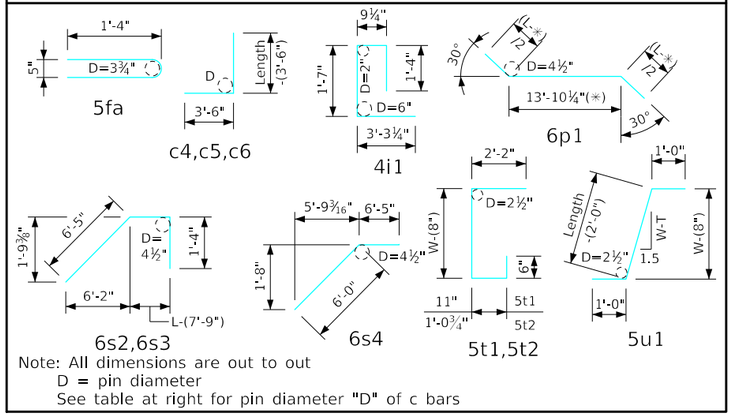
Estimated Quantities One Headwall			12' x 6'		12' x 5'		12' x 4'	
	Reinf. Steel		3476 LB		2953 LB		2450 LB	
	Concrete	Parapet Δ	1.8	24.1 CY	1.8	20.4 CY	1.8	16.9 CY
		Wingwalls	5.6		4.1		2.8	
		Apron ✳	16.7		14.5		12.3	

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 PWH 30-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 12'-0" Span 30° Skew

PWH 30-7-20

SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-7-20 S2 - THIS SHEET ISSUED 07-2020.

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
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
Apron, Longit., Bott.		4d1	11	46'-1	356	4d1	11	42'-7	331	4d1	11	39'-2	288	4d1	11	35'-8	262	4d1	11	32'-3	237	4d1	11	28'-9	211
Apron, Longit., Top		6f1	11	46'-1	801	6f1	11	42'-7	743	6f1	11	39'-2	647	6f1	11	35'-8	589	6f1	11	32'-3	533	6f1	11	28'-9	475
Parapet, Vertical		4i1	21	7'-0	98	4i1	21	7'-0	98	4i1	21	7'-0	98	4i1	21	7'-0	98	4i1	21	7'-0	98	4i1	21	7'-0	98
Parapet, Horiz.		7j1	4	13'-5	110	7j1	4	13'-5	110	7j1	4	13'-1	107	7j1	4	13'-1	107	7j1	4	13'-1	107	7j1	4	12'-10	105
Apron, Trans., Top		5m1	54	12'-2	685	5m1	50	12'-2	634	5m1	45	11'-10	555	5m1	41	11'-10	506	5m1	36	11'-10	444	5m1	31	11'-8	377
Apron, Trans., Top		5m2	7 Var.	3'-2 to 11'-0	52	5m2	7 Var.	2'-5 to 10'-2	46	5m2	7 Var.	2'-8 to 10'-6	48	5m2	6 Var.	3'-3 to 9'-8	40	5m2	7 Var.	2'-5 to 10'-2	46	5m2	7 Var.	2'-10 to 10'-7	49
Apron, Trans., Bott.		6m3	73	11'-2	1224	6m3	67	11'-2	1124	6m3	61	10'-10	993	6m3	55	10'-10	895	5m3	25	10'-0	261	5m3	22	9'-10	226
Curtain, Horiz.		6p1	6	13'-8	123	6p1	6	13'-8	123	6p1	6	13'-4	120	6p1	6	13'-4	120	6p1	6	13'-4	120	6p1	5	13'-2	99
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
Curtain, Vert.		5t1	12	7'-11	99	5t1	12	7'-8	96	5t1	12	7'-5	93	5t1	12	7'-2	90	5t1	12	6'-11	87	5t1	12	6'-8	83
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

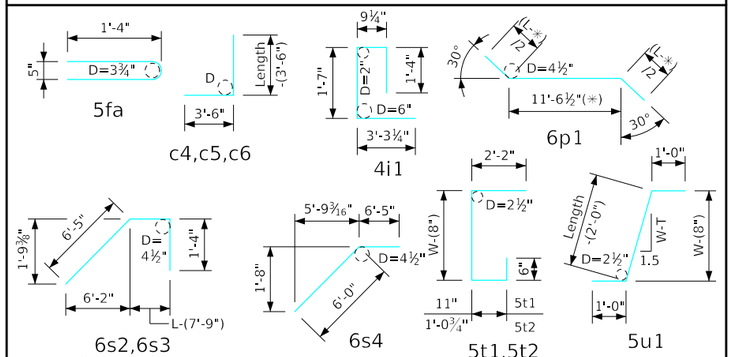
Estimated Quantities One Headwall		Reinf. Steel	9023 LB		7402 LB		6127 LB		5405 LB		4190 LB		3596 LB	
	Concrete	Parapet Δ	1.9	53.6 CY	1.9	48.0 CY	1.7	38.7 CY	1.7	34.2 CY	1.7	29.9 CY	1.6	24.6 CY
		Wingwalls	24.8		21.3		15.0		12.5		10.2		7.3	
		Apron ✳	26.9		24.8		22.0		20.0		18.0		15.7	

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
30° Skew

PWH 30-8-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-8-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-7 to 8'-8	218	4c1	36 Var.	2 Each 2'-7 to 7'-6	121	4c1	30 Var.	2 Each 2'-7 to 6'-7	92
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (A)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-3 to 12'-4	426	5c4	48 Var.	2 Each 6'-3 to 11'-3	438	5c4	30 Var.	2 Each 6'-3 to 10'-4	259
Wingwall, B.F.V. (O)		5c5	1	12'-6	13	5c5	1	11'-6	12	5c5	1	10'-6	11
Wingwall, B.F.V. (A)		5c5	3	12'-6	39	5c5	3	11'-6	36	5c5	3	10'-6	33
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	11	25'-4	186	4d1	11	21'-10	160	4d1	11	18'-4	135
Apron, Longit., Top		6f1	11	25'-4	419	6f1	11	21'-10	361	6f1	11	18'-4	303
Parapet, Vertical		4i1	21	7'-0	98	4i1	21	7'-0	98	4i1	21	7'-0	98
Parapet, Horiz.		7j1	4	12'-10	105	7j1	4	12'-10	105	7j1	4	12'-10	105
Apron, Trans., Top		5m1	27	11'-8	329	5m1	22	11'-8	268	5m1	17	11'-8	207
Apron, Trans., Top		5m2	7 Var.	2'-0 to 9'-10	43	5m2	7 Var.	2'-6 to 10'-4	47	5m2	7 Var.	3'-0 to 10'-10	50
Apron, Trans., Bott.		4m3	19	9'-1	115	4m3	16	9'-1	97	4m3	13	9'-1	79
Curtain, Horiz.		6p1	5	13'-2	99	6p1	5	13'-2	99	6p1	5	13'-2	99
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		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
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Curtain, Vert.		5t1	12	6'-5	80	5t1	12	6'-5	80	5t1	12	6'-5	80
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

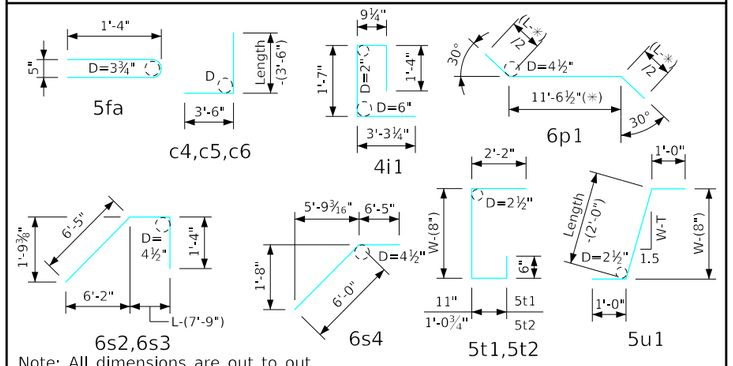
Estimated Quantities One Headwall	Reinf. Steel		10' x 6'		10' x 5'		10' x 4'	
	Concrete	Parapet Δ	1.6	2985 LB	1.6	2487 LB	1.6	1997 LB
		Wingwalls	5.6	20.9 CY	4.1	17.6 CY	2.8	14.5 CY
		Apron ✳	13.7		11.9		10.1	

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 PWH 30-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
30° Skew

PWH 30-8-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-8-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	39'-3	82	5b1	2	35'-10	75	5b1	2	32'-4	67	5b1	2	28'-11	60	5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		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	5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	39'-6	53	4b3	2	36'-1	48	4b3	2	32'-7	44	4b3	2	29'-1	39	4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		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	4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-5 to 12'-6	359	4c1	64 Var.	2 Each 2'-5 to 11'-4	294	4c1	76 Var.	2 Each 2'-5 to 10'-5	326	4c1	68 Var.	2 Each 2'-5 to 9'-7	273	4c1	58 Var.	2 Each 2'-5 to 8'-6	211	4c1	36 Var.	2 Each 2'-5 to 7'-4	117	4c1	30 Var.	2 Each 2'-5 to 6'-5	89
Wingwall, F.F.V.		4c2	26 Var.	2 Each 8'-11 to 12'-4	185	4c2	20 Var.	2 Each 8'-11 to 11'-6	136	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (A)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, B.F.V.		6c4	72 Var.	2 Each 6'-1 to 16'-2	1203	5c4	64 Var.	2 Each 6'-1 to 15'-1	706	5c4	58 Var.	2 Each 6'-1 to 14'-2	613	5c4	50 Var.	2 Each 6'-1 to 13'-0	498	5c4	44 Var.	2 Each 6'-1 to 12'-2	419	5c4	36 Var.	2 Each 6'-1 to 11'-0	321	5c4	30 Var.	2 Each 6'-1 to 10'-2	254
Wingwall, B.F.V. (O)		6c5	1	16'-4	25	5c5	1	15'-4	16	5c5	1	14'-4	15	5c5	1	13'-4	14	5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11
Wingwall, B.F.V. (A)		6c5	3	16'-4	74	5c5	3	15'-4	48	5c5	3	14'-4	45	5c5	3	13'-4	42	5c5	3	12'-4	39	5c5	3	11'-4	35	5c5	3	10'-4	32
Wingwall, B.F.V.		6c6	42	8'-6	536	5c6	36	8'-6	319	5c6	28	8'-6	248	5c6	22	8'-6	195	5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	9	39'-2	235	4d1	9	35'-8	214	4d1	9	32'-3	194	4d1	9	28'-9	173	4d1	9	25'-4	152	4d1	9	21'-10	131	4d1	9	18'-4	110
Apron, Longit., Top		6f1	9	39'-2	529	6f1	9	35'-8	482	6f1	9	32'-3	436	6f1	9	28'-9	389	6f1	9	25'-4	342	6f1	9	21'-10	295	6f1	9	18'-4	248
Parapet, Vertical		4i1	17	7'-0	79	4i1	17	7'-0	79	4i1	17	7'-0	79	4i1	17	7'-0	79	4i1	17	7'-0	79	4i1	17	7'-0	79	4i1	17	7'-0	79
Parapet, Horiz.		7j1	4	10'-9	88	7j1	4	10'-9	88	7j1	4	10'-9	88	7j1	4	10'-7	87	7j1	4	10'-7	87	7j1	4	10'-7	87	7j1	4	10'-7	87
Apron, Trans., Top		5m1	35	9'-10	359	5m1	31	9'-10	318	5m1	37	9'-10	379	5m1	24	9'-8	242	5m1	21	9'-8	212	5m1	17	9'-8	171	5m1	14	9'-8	141
Apron, Trans., Top		5m2	4 Var.	2'-2 to 7'-4	20	5m2	4 Var.	3'-1 to 8'-3	24	5m2	5 Var.	2'-8 to 7'-11	28	5m2	4 Var.	3'-1 to 8'-4	24	5m2	4 Var.	2'-4 to 7'-6	21	5m2	4 Var.	3'-3 to 8'-5	24	5m2	4 Var.	2'-5 to 7'-8	21
Apron, Trans., Bott.		6m3	61	8'-6	779	5m3	55	7'-9	445	5m3	33	7'-9	267	5m3	22	7'-6	172	4m3	19	6'-9	86	4m3	16	6'-9	72	4m3	13	6'-9	59
Curtain, Horiz.		6p1	6	11'-0	99	6p1	6	11'-0	99	6p1	6	11'-0	99	6p1	5	10'-10	81	6p1	5	10'-10	81	6p1	5	10'-10	81	6p1	5	10'-10	81
Wing Slope, Both F.		6s1	4	33'-2	199	6s1	4	29'-6	177	6s1	4	25'-11	156	6s1	4	22'-4	134	6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	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	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	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	30'-8	92	6s5	2	27'-1	81	6s5	2	23'-5	70	6s5	2	19'-10	60	6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Curtain, Vert.		5t1	10	7'-5	77	5t1	10	7'-2	75	5t1	10	6'-11	72	5t1	10	6'-8	70	5t1	10	6'-5	67	5t1	10	6'-5	67	5t1	10	6'-5	67
Curtain, Vert. Ends		5t2	4	7'-7	32	5t2	4	7'-4	31	5t2	4	7'-1	30	5t2	4	6'-10	29	5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

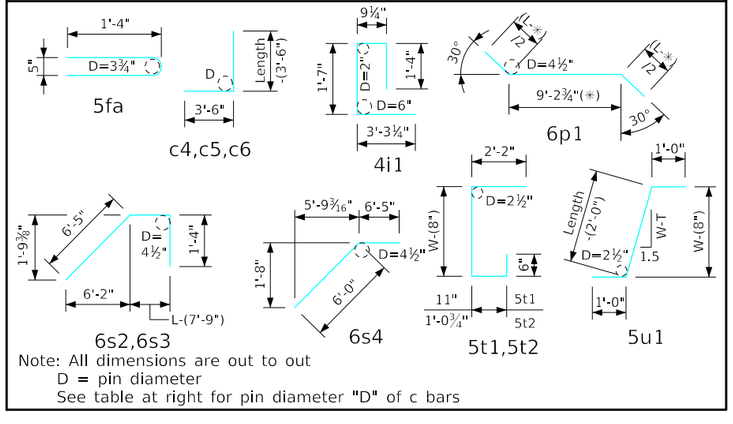
Estimated Quantities One Headwall			8' x 10'		8' x 9'		8' x 8'		8' x 7'		8' x 6'		8' x 5'		8' x 4'	
Reinf. Steel	Concrete	Parapet Δ	1.5	5981 LB	1.5	4500 LB	1.5	3879 LB	1.4	3175 LB	1.4	2624 LB	1.4	2055 LB	1.4	1725 LB
		Wingwalls	15.0	32.9 CY	12.5	28.9 CY	10.2	25.2 CY	7.3	20.4 CY	5.6	17.3 CY	4.1	14.5 CY	2.8	11.8 CY
		Apron ✳	16.4		14.9		13.5		11.7		10.3		9.0		7.6	

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
30° Skew

PWH 30-9-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-9-20 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

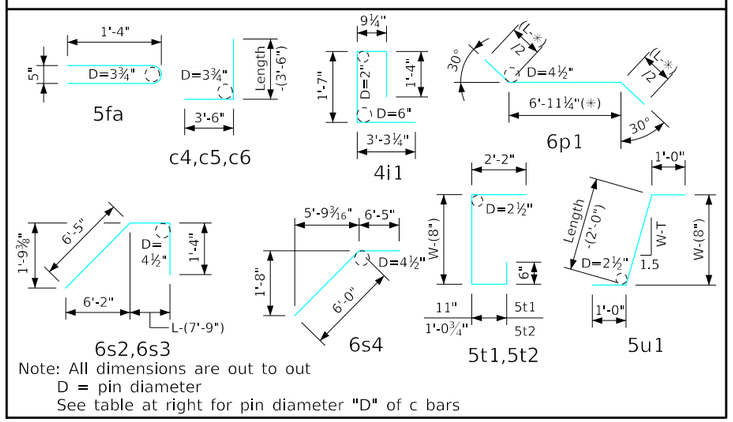
Location	Shape	6' x 8'				6' x 7'				6' x 6'				6' x 5'				6' x 4'				6' x 3'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	32'-4	67	5b1	2	28'-11	60	5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39	5b1	2	15'-0	31
Wingwall, F.F.H.		5b2	14 Var.	2 Each 10'-0 to 30'-9	298	5b2	12 Var.	2 Each 10'-0 to 27'-4	234	5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84	5b2	4 Var.	2 Each 10'-0 to 13'-5	49
Wingwall, B.F.H.		4b3	2	32'-7	44	4b3	2	29'-1	39	4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25	4b3	2	15'-3	20
Wingwall, B.F.H.		4b4	12 Var.	2 Each 13'-8 to 31'-0	179	4b4	10 Var.	2 Each 13'-7 to 27'-6	137	4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41	4b4	2	13'-8	18
Wingwall, F.F.V.		4c1	76 Var.	2 Each 2'-5 to 10'-5	326	4c1	68 Var.	2 Each 2'-5 to 9'-7	273	4c1	58 Var.	2 Each 2'-5 to 8'-6	211	4c1	36 Var.	2 Each 2'-5 to 7'-4	117	4c1	30 Var.	2 Each 2'-5 to 6'-5	89	4c1	24 Var.	2 Each 2'-5 to 5'-7	64
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (A)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, B.F.V.		5c4	58 Var.	2 Each 6'-1 to 14'-2	613	5c4	50 Var.	2 Each 6'-1 to 13'-0	498	5c4	44 Var.	2 Each 6'-1 to 12'-2	419	5c4	36 Var.	2 Each 6'-1 to 11'-0	321	5c4	30 Var.	2 Each 6'-1 to 10'-2	254	5c4	24 Var.	2 Each 6'-1 to 9'-3	192
Wingwall, B.F.V. (O)		5c5	1	14'-4	15	5c5	1	13'-4	14	5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11	5c5	1	9'-4	10
Wingwall, B.F.V. (A)		5c5	3	14'-4	45	5c5	3	13'-4	42	5c5	3	12'-4	39	5c5	3	11'-4	35	5c5	3	10'-4	32	5c5	3	9'-4	29
Wingwall, B.F.V.		5c6	28	8'-6	248	5c6	22	8'-6	195	5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	7	32'-3	151	4d1	7	28'-9	134	4d1	7	25'-4	118	4d1	7	21'-10	102	4d1	7	18'-4	86	4d1	7	14'-11	70
Apron, Longit., Top		6f1	7	32'-3	339	6f1	7	28'-9	302	6f1	7	25'-4	266	6f1	7	21'-10	230	6f1	7	18'-4	193	6f1	7	14'-11	157
Parapet, Vertical		4i1	13	7'-0	61	4i1	13	7'-0	61	4i1	13	7'-0	61	4i1	13	7'-0	61	4i1	13	7'-0	61	4i1	13	7'-0	61
Parapet, Horiz.		7j1	4	8'-5	69	7j1	4	8'-3	67	7j1	4	8'-3	67	7j1	4	8'-3	67	7j1	4	8'-3	67	7j1	4	8'-3	67
Apron, Trans., Top		5m1	28	7'-10	229	5m1	25	7'-8	200	5m1	21	7'-8	168	5m1	18	7'-8	144	5m1	14	7'-8	112	5m1	11	7'-8	88
Apron, Trans., Top		5m2	3 Var.	3'-0 to 6'-6	15	5m2	3 Var.	2'-1 to 5'-7	12	5m2	3 Var.	3'-0 to 6'-6	15	5m2	3 Var.	2'-3 to 5'-9	13	5m2	3 Var.	3'-2 to 6'-8	15	5m2	3 Var.	2'-4 to 5'-10	13
Apron, Trans., Bott.		5m3	49	5'-5	277	5m3	29	5'-3	159	5m3	25	5'-3	137	4m3	16	4'-5	47	4m3	13	4'-5	38	4m3	10	4'-5	30
Curtain, Horiz.		6p1	6	8'-9	79	6p1	5	8'-7	64	6p1	5	8'-7	64	6p1	5	8'-7	64	6p1	5	8'-7	64	6p1	5	8'-7	64
Wing Slope, Both F.		6s1	4	25'-11	156	6s1	4	22'-4	134	6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69	6s1	4	7'-11	48
Wing Slope, Both F. (O)		6s2	2	8'-4	25	6s2	2	8'-4	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	23'-5	70	6s5	2	19'-10	60	6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27	6s5	2	5'-5	16
Curtain, Vert.		5t1	7	6'-11	50	5t1	7	6'-8	49	5t1	7	6'-5	47	5t1	7	6'-5	47	5t1	7	6'-5	47	5t1	7	6'-5	47
Curtain, Vert. Ends		5t2	4	7'-1	30	5t2	4	6'-10	29	5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel		3507 LB				2906 LB				2440 LB				1823 LB				1515 LB				1233 LB		
	Concrete Parapet Δ	1.3				1.3				1.3				1.3				1.3				1.3			
	Concrete Wingwalls	10.2		22.6 CY		7.3		18.2 CY		5.6		15.3 CY		4.1		12.7 CY		2.8		10.4 CY		1.7		8.2 CY	
	Concrete Apron ✳	11.1				9.6				8.4				7.3				6.3				5.2			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
6'-0" Span
30° Skew

PWH
30-10-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-10-20 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	5' x 6'				5' x 5'				5' x 4'				5' x 3'			
		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
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39	5b1	2	15'-0	31
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84	5b2	4 Var.	2 Each 10'-0 to 13'-5	49
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25	4b3	2	15'-3	20
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41	4b4	2	13'-8	18
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-5 to 8'-6	211	4c1	36 Var.	2 Each 2'-5 to 7'-4	117	4c1	30 Var.	2 Each 2'-5 to 6'-5	89	4c1	24 Var.	2 Each 2'-5 to 5'-7	64
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (A)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-1 to 12'-2	419	5c4	36 Var.	2 Each 6'-1 to 11'-0	321	5c4	30 Var.	2 Each 6'-1 to 10'-2	254	5c4	24 Var.	2 Each 6'-1 to 9'-3	192
Wingwall, B.F.V. (O)		5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11	5c5	1	9'-4	10
Wingwall, B.F.V. (A)		5c5	3	12'-4	39	5c5	3	11'-4	35	5c5	3	10'-4	32	5c5	3	9'-4	29
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	6	25'-4	102	4d1	6	21'-10	88	4d1	6	18'-4	73	4d1	6	14'-11	60
Apron, Longit., Top		6f1	6	25'-4	228	6f1	6	21'-10	197	6f1	6	18'-4	165	6f1	6	14'-11	134
Parapet, Vertical		4i1	11	7'-0	51	4i1	11	7'-0	51	4i1	11	7'-0	51	4i1	11	7'-0	51
Parapet, Horiz.		7j1	4	7'-1	58	7j1	4	7'-1	58	7j1	4	7'-1	58	7j1	4	7'-1	58
Apron, Trans., Top		5m1	22	6'-8	153	5m1	18	6'-8	125	5m1	15	6'-8	104	5m1	11	6'-8	76
Apron, Trans., Top		5m2	2 Var.	2'-6 to 4'-3	7	5m2	2 Var.	3'-6 to 5'-3	9	5m2	2 Var.	2'-8 to 4'-5	7	5m2	2 Var.	3'-7 to 5'-4	9
Apron, Trans., Bott.		5m3	19	4'-1	81	4m3	16	3'-3	35	4m3	13	3'-3	28	4m3	10	3'-3	22
Curtain, Horiz.		6p1	5	7'-5	56	6p1	5	7'-5	56	6p1	5	7'-5	56	6p1	5	7'-5	56
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69	6s1	4	7'-11	48
Wing Slope, Both F. (O)		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
Wing Slope, F.F.		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	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27	6s5	2	5'-5	16
Curtain, Vert.		5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	6	6'-5	40	5t1	6	6'-5	40
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

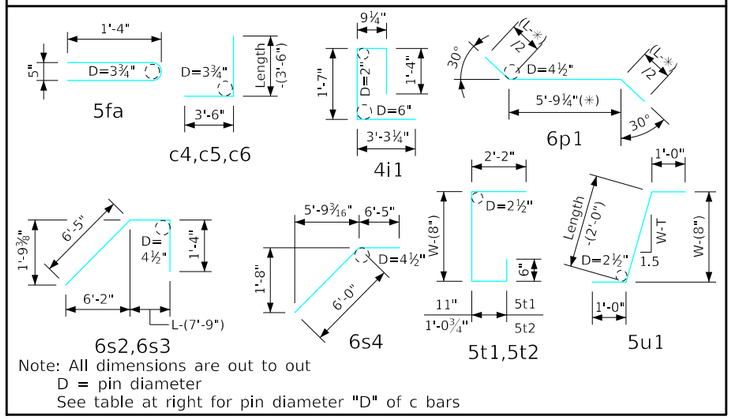
Estimated Quantities One Headwall																	
Reinf. Steel			2273 LB			1707 LB				1414 LB				1142 LB			
Concrete	Parapet Δ	1.2	14.3 CY			1.2	11.8 CY			1.2	9.6 CY			1.2	7.5 CY		
	Wingwalls	5.6				4.1				2.8				1.7			
	Apron ✳	7.5				6.5				5.6				4.6			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 30-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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 - Single Reinforced Concrete Box Culverts

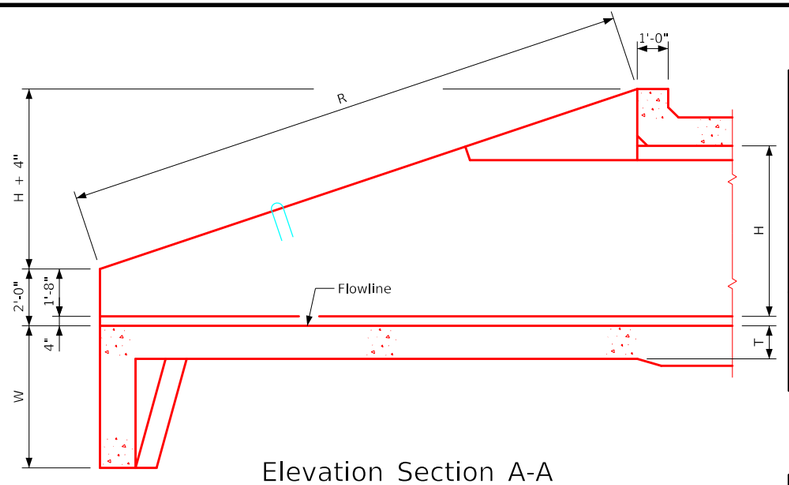
Parallel Wing Headwalls

July, 2020

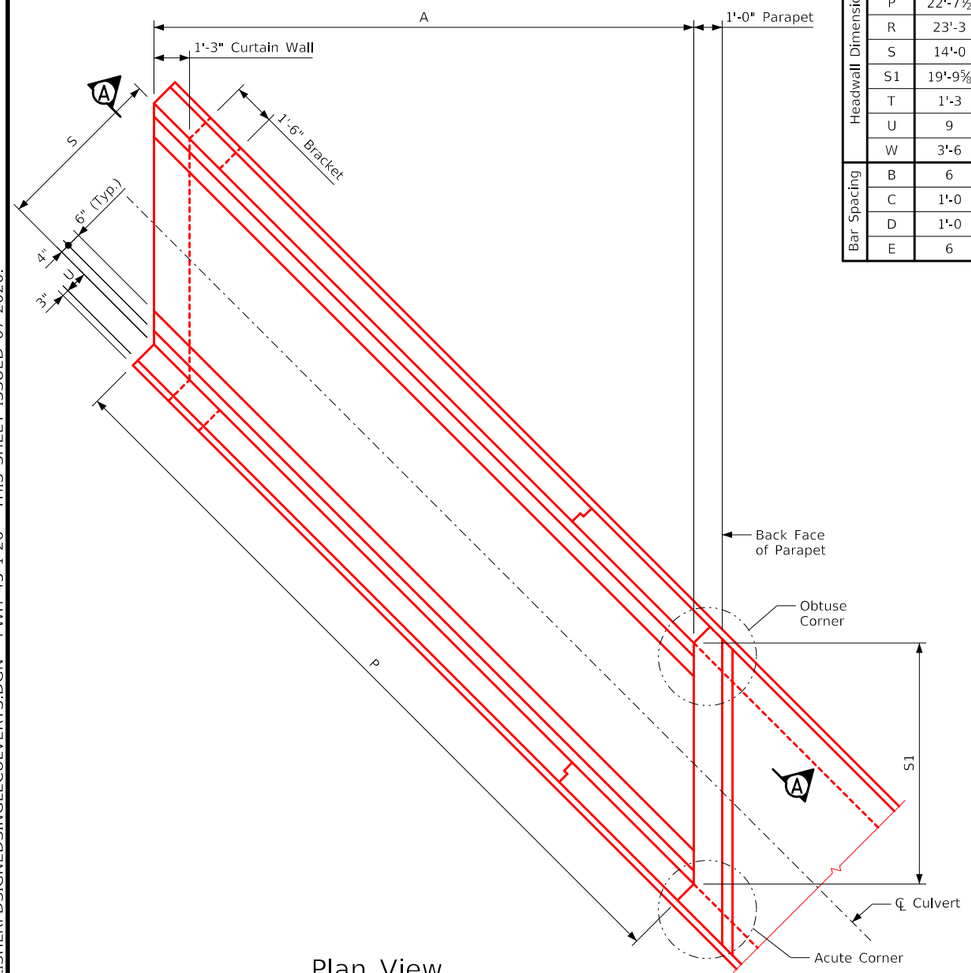
Quantity Tabulation
5'-0" Span
30° Skew

PWH
30-11-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 30-11-20 - THIS SHEET ISSUED 07-2020.



Elevation Section A-A



Plan View

Dimension Table

	S x H	16' x 14'	16' x 13'	16' x 12'	16' x 11'	16' x 10'	16' x 9'	16' x 8'	16' x 7'	16' x 6'	16' x 5'	16' x 4'	14' x 14'	14' x 13'	14' x 12'	14' x 11'	14' x 10'	14' x 9'	14' x 8'	14' x 7'	14' x 6'	S x H
Headwall Dimensions	A	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	43'-0	40'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	A
	H	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	14'-0	13'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	H
	P	60'-9¾	56'-6⅞	52'-3⅞	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	60'-9¾	56'-6⅞	52'-3⅞	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	P
	R	62'-5¾	58'-1⅜	53'-9⅛	49'-4¾	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	62'-5¾	58'-1⅜	53'-9⅛	49'-4¾	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	R
	S	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	16'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	14'-0	S
	S1	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	22'-7½	19'-9⅝	19'-9⅝	19'-9⅝	19'-9⅝	19'-9⅝	19'-9⅝	19'-9⅝	19'-9⅝	19'-9⅝	S1
	T	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-4	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	1'-3	T
	U	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	9	9	1'-1	1'-1	1'-0	1'-0	10	10	10	9	9	U
	W	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-6	5'-3	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	C
	D	6	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	E

Dimension Table

	S x H	14' x 5'	14' x 4'	12' x 12'	12' x 11'	12' x 10'	12' x 9'	12' x 8'	12' x 7'	12' x 6'	12' x 5'	12' x 4'	10' x 12'	10' x 11'	10' x 10'	10' x 9'	10' x 8'	10' x 7'	10' x 6'	10' x 5'	10' x 4'	S x H
Headwall Dimensions	A	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	H	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	P	22'-7½	18'-4⅝	52'-3⅞	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	52'-3⅞	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	P
	R	23'-3	18'-10⅝	53'-9⅛	49'-4¾	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	53'-9⅛	49'-4¾	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	R
	S	14'-0	14'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	S
	S1	19'-9⅝	19'-9⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	S1
	T	1'-3	1'-3	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	T
	U	9	9	1'-0	1'-0	10	10	10	9	9	9	9	1'-0	1'-0	10	10	10	9	9	9	9	U
	W	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
Bar Spacing	B	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	B
	C	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	1'-0	1'-0	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	E

Dimension Table

	S x H	8' x 10'	8' x 9'	8' x 8'	8' x 7'	8' x 6'	8' x 5'	8' x 4'	6' x 8'	6' x 7'	6' x 6'	6' x 5'	6' x 4'	6' x 3'	5' x 6'	5' x 5'	5' x 4'	5' x 3'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	A
	H	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	8'-0	7'-0	6'-0	5'-0	4'-0	3'-0	6'-0	5'-0	4'-0	3'-0	H
	P	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	14'-1¾	26'-10½	22'-7½	18'-4⅝	14'-1¾	P
	R	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	14'-6⅜	27'-7¼	23'-3	18'-10⅝	14'-6⅜	R
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	5'-0	5'-0	5'-0	5'-0	S
	S1	11'-3¾	11'-3¾	11'-3¾	11'-3¾	11'-3¾	11'-3¾	11'-3¾	8'-5⅞	8'-5⅞	8'-5⅞	8'-5⅞	8'-5⅞	8'-5⅞	7'-0⅞	7'-0⅞	7'-0⅞	7'-0⅞	S1
	T	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	T
	U	10	10	10	9	9	9	9	10	9	9	9	9	9	9	9	9	9	U
	W	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	4'-0	3'-9	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	W
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	9	1'-0	1'-0	1'-0	C
	D	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets PWH 45-2-20 thru 45-4-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Dimension Table
45° Skew

PWH 45-1-20

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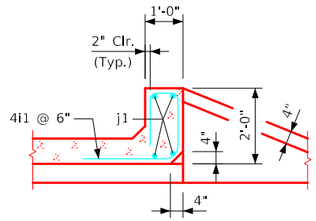
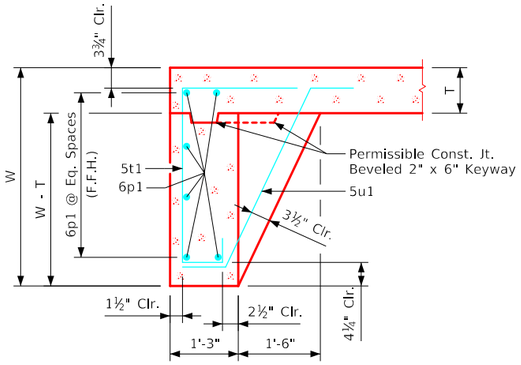
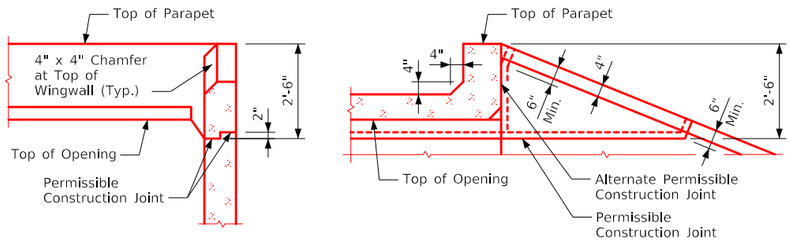


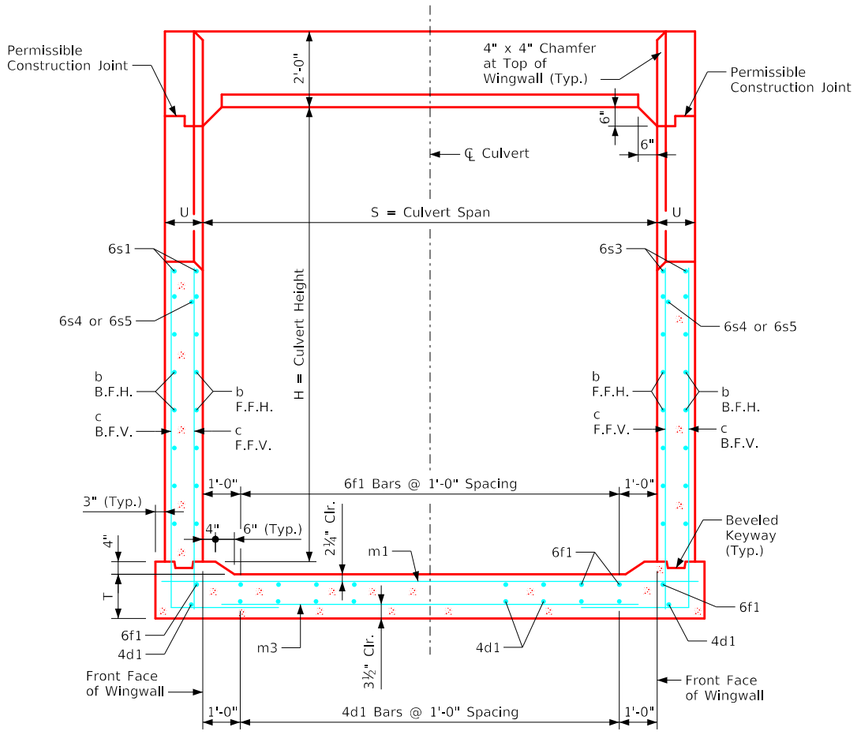
Section thru Parapet



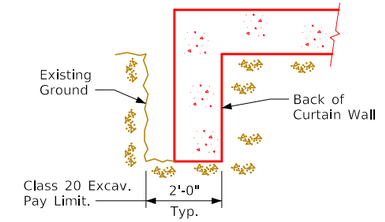
Section thru Curtain Wall



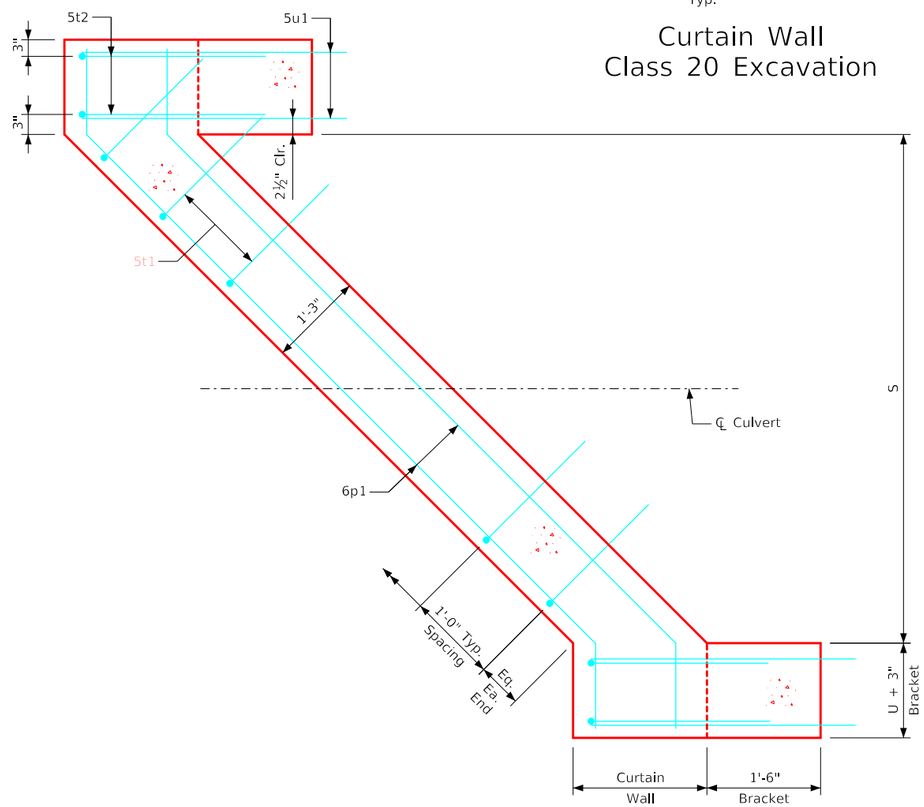
Top of Wingwall Details



Typical Cross Section - thru Headwall



Curtain Wall
Class 20 Excavation



Curtain Wall Detail - Plan View
(Apron is not shown)

Notes:

1. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
2. For dimension table see Sheet PWH 0-1-20.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Cross Section Details 45° Skew

PWH 45-2-20

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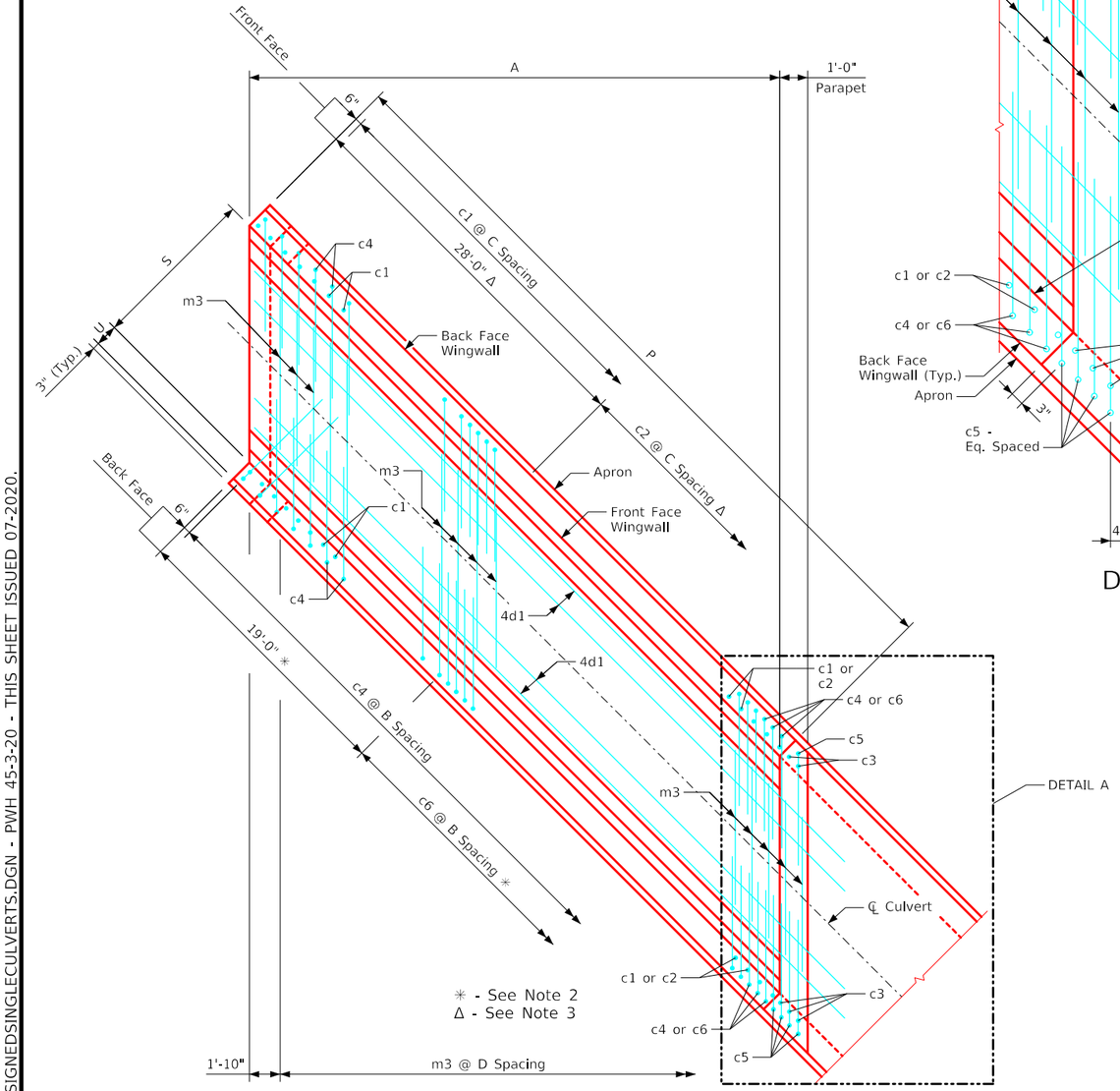
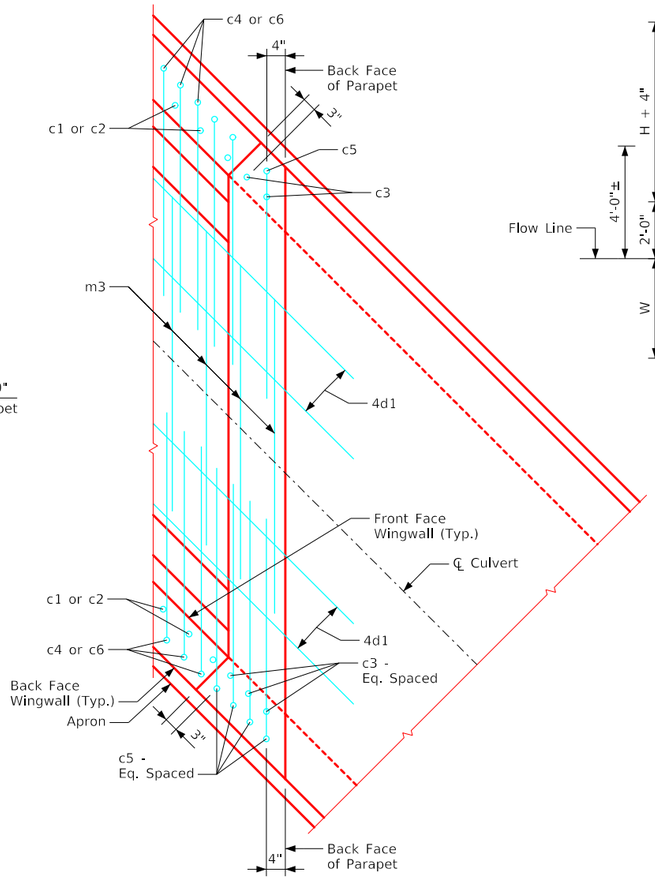
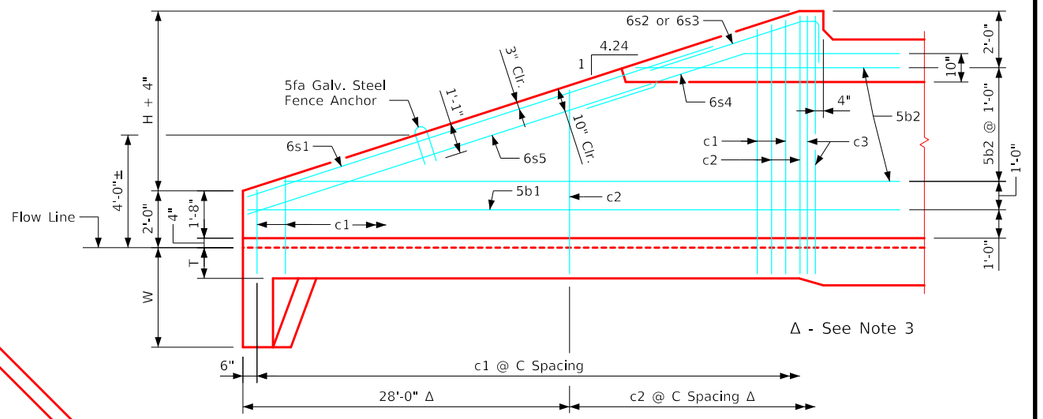


Plan View - Bottom Apron Reinforcing

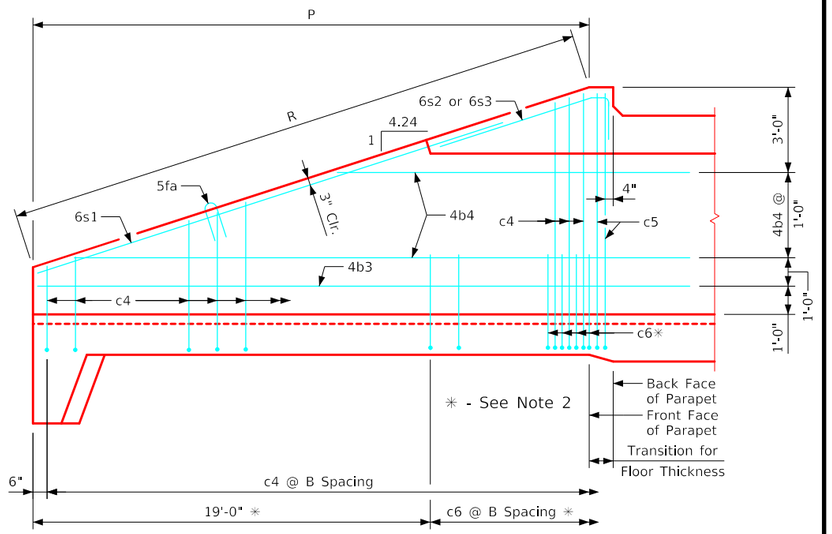
(Curtain Wall Reinforcing not shown, See Sheet PWH 45-2-20)



Detail A



Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. Not applicable for 3' thru 5' height headwalls.
3. Not applicable for 3' thru 8' height headwalls.
4. For headwall dimensions and bar spacing see Sheet PWH 0-1-20.
5. Apron m3 bars are to be centered on ℄ culvert.
6. B.F.V. (c5) and F.F.V. (c3) bars are approximately 4" from the back of parapet for all headwalls.

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IOWA DOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations & Bottom Apron Reinforcing 45° Skew

PWH 45-3-20

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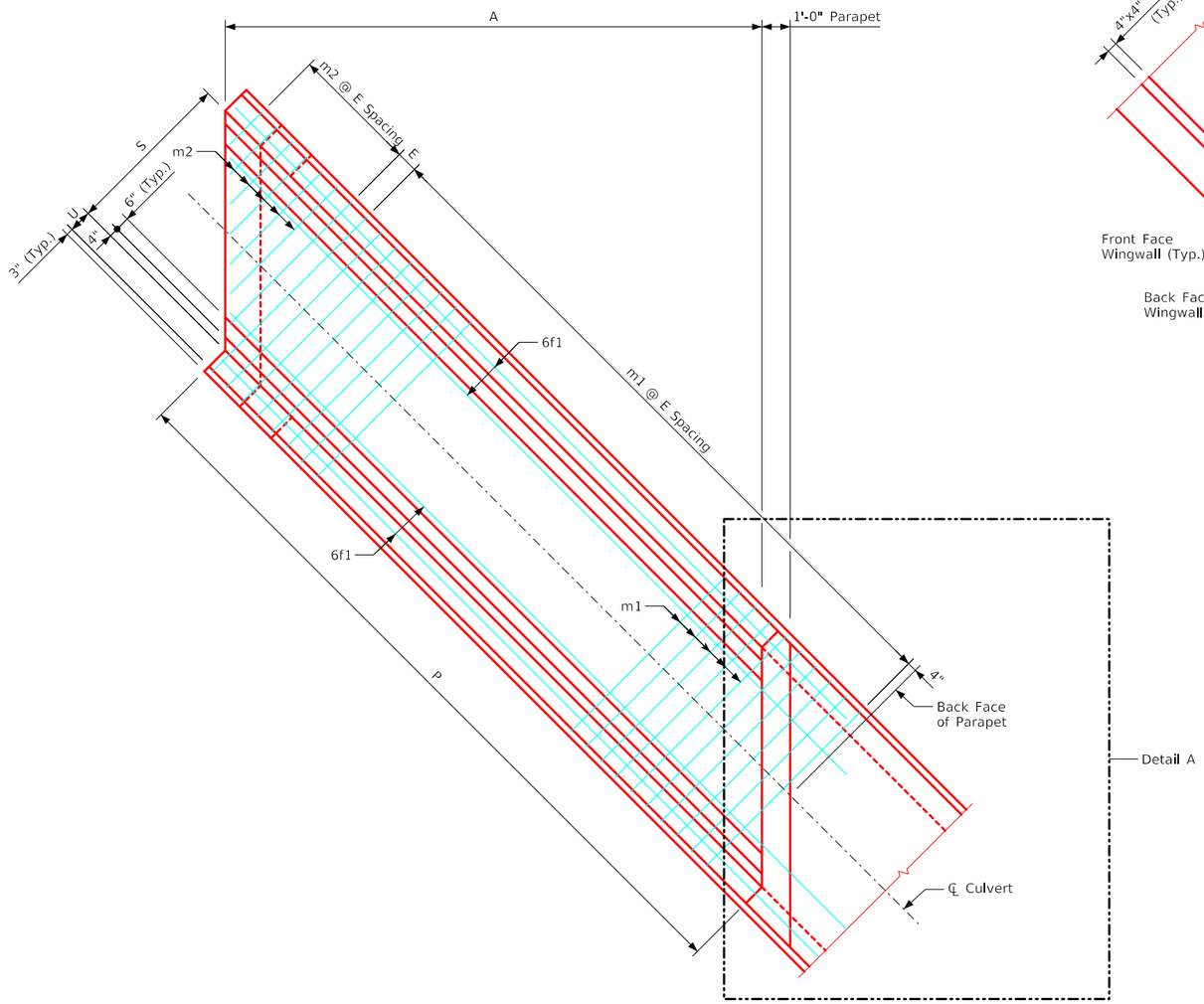
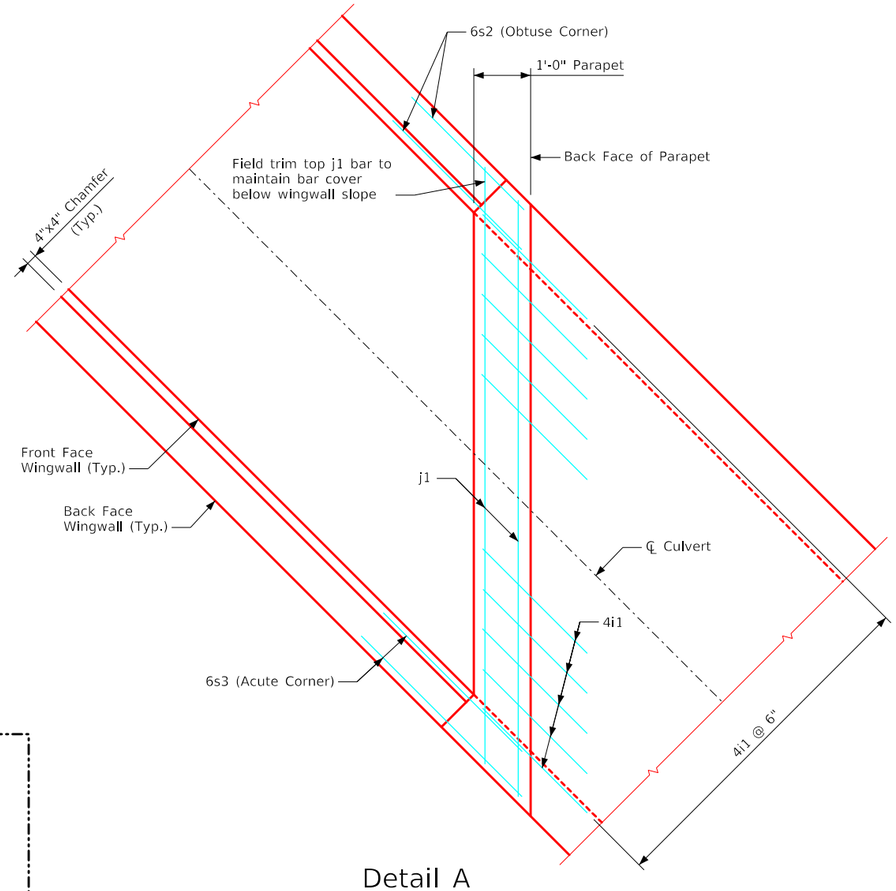


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. For headwall dimensions and bar spacing see Sheet PWH 45-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

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IOWADOT Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 45° Skew

PWH 45-4-20

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

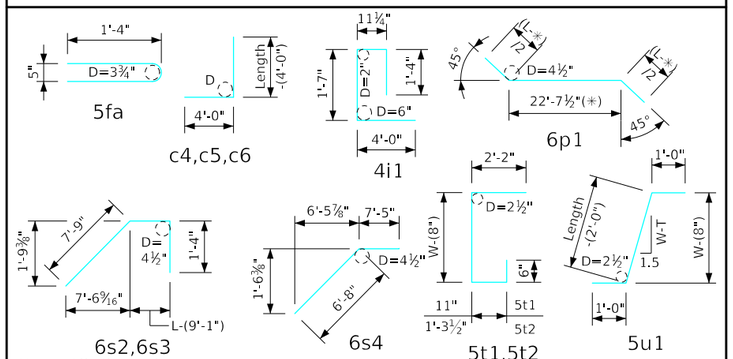
Location	Shape	16' x 14'				16' x 13'				16' x 12'				16' x 11'				16' x 10'				16' x 9'				16' x 8'				16' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	64'-8	140	5b1	2	60'-5	131	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	26 Var.	2 Each 11'-9 to 62'-8	1039	5b2	24 Var.	2 Each 11'-9 to 58'-5	903	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	65'-3	90	4b3	2	61'-1	85	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	24 Var.	2 Each 16'-8 to 63'-4	661	4b4	22 Var.	2 Each 16'-8 to 59'-1	573	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
Wingwall, F.F.V.		5c1	122 Var.	2 Each 2'-10 to 16'-11	1257	5c1	114 Var.	2 Each 2'-10 to 16'-0	1120	5c1	104 Var.	2 Each 2'-10 to 14'-10	958	5c1	96 Var.	2 Each 2'-10 to 13'-11	839	4c1	88 Var.	2 Each 2'-10 to 12'-11	463	4c1	80 Var.	2 Each 2'-10 to 12'-0	396	4c1	94 Var.	2 Each 2'-10 to 10'-11	432	4c1	82 Var.	2 Each 2'-10 to 9'-11	349
Wingwall, F.F.V.		5c2	66 Var.	2 Each 9'-3 to 16'-10	898	5c2	58 Var.	2 Each 9'-3 to 15'-11	761	5c2	50 Var.	2 Each 9'-3 to 14'-11	630	5c2	42 Var.	2 Each 9'-3 to 14'-0	509	4c2	32 Var.	2 Each 9'-3 to 12'-10	236	4c2	24 Var.	2 Each 9'-3 to 11'-11	170	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	17'-3	36	5c3	2	16'-3	34	5c3	2	15'-3	32	5c3	2	14'-3	30	4c3	2	13'-3	18	4c3	2	12'-3	16	4c3	2	11'-3	15	4c3	2	10'-3	14
Wingwall, F.F.V. (A)		5c3	3	17'-3	54	5c3	3	16'-3	51	5c3	3	15'-3	48	5c3	3	14'-3	45	4c3	3	13'-3	27	4c3	3	12'-3	25	4c3	3	11'-3	23	4c3	3	10'-3	21
Wingwall, B.F.V.		7c4	122 Var.	2 Each 7'-0 to 21'-2	3512	7c4	114 Var.	2 Each 7'-0 to 20'-2	3165	7c4	104 Var.	2 Each 7'-0 to 19'-0	2763	7c4	96 Var.	2 Each 7'-0 to 18'-1	2461	7c4	88 Var.	2 Each 7'-0 to 17'-1	2166	7c4	80 Var.	2 Each 7'-0 to 16'-2	1894	6c4	70 Var.	2 Each 7'-0 to 15'-0	1157	6c4	62 Var.	2 Each 7'-0 to 14'-1	982
Wingwall, B.F.V. (O)		7c5	1	21'-3	43	7c5	1	20'-3	41	7c5	1	19'-3	39	7c5	1	18'-3	37	7c5	1	17'-3	35	7c5	1	16'-3	33	6c5	1	15'-3	23	6c5	1	14'-3	21
Wingwall, B.F.V. (A)		7c5	4	21'-3	174	7c5	4	20'-3	166	7c5	4	19'-3	157	7c5	4	18'-3	149	7c5	4	17'-3	141	7c5	4	16'-3	133	6c5	4	15'-3	92	6c5	4	14'-3	86
Wingwall, B.F.V.		8c6	84	9'-6	2131	7c6	76	9'-0	1398	7c6	68	9'-0	1251	7c6	60	9'-0	1104	7c6	50	9'-0	920	7c6	42	9'-0	773	6c6	34	9'-0	460	6c6	26	9'-0	351
Apron, Longit., Bott.		4d1	17	64'-5	759	4d1	17	60'-2	711	4d1	17	55'-11	662	4d1	17	51'-8	614	4d1	17	47'-6	567	4d1	17	43'-3	519	4d1	17	39'-0	443	4d1	17	34'-9	395
Apron, Longit., Top		6f1	17	64'-5	1707	6f1	17	60'-2	1598	6f1	17	55'-11	1489	6f1	17	51'-8	1381	6f1	17	47'-6	1275	6f1	17	43'-3	1166	6f1	17	39'-0	996	6f1	17	34'-9	887
Parapet, Vertical		4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173
Parapet, Horiz.		10j1	4	25'-2	433	10j1	4	25'-2	433	10j1	4	24'-11	429	10j1	4	24'-11	429	10j1	4	24'-6	422	10j1	4	24'-6	422	10j1	4	24'-6	422	10j1	4	24'-3	417
Apron, Trans., Top		7m1	108	18'-4	4047	7m1	99	18'-4	3710	7m1	91	18'-2	3379	7m1	82	18'-2	3045	7m1	74	17'-10	2697	7m1	65	17'-10	2369	7m1	57	17'-10	2078	6m1	48	17'-8	1274
Apron, Trans., Top		7m2	30 Var.	2'-3 to 16'-9	583	7m2	30 Var.	2'-7 to 17'-1	603	7m2	30 Var.	2'-3 to 16'-9	583	7m2	30 Var.	2'-6 to 17'-0	598	7m2	30 Var.	2'-1 to 16'-7	572	7m2	30 Var.	2'-4 to 16'-10	588	7m2	30 Var.	2'-1 to 16'-7	572	6m2	30 Var.	2'-3 to 16'-9	428
Apron, Trans., Bott.		6m3	85	22'-2	2830	6m3	79	21'-11	2601	6m3	73	21'-8	2376	6m3	67	21'-8	2180	6m3	31	21'-3	989	5m3	28	20'-9	606	5m3	25	20'-5	532	5m3	22	20'-3	465
Curtain, Horiz.		6p1	7	24'-11	262	6p1	7	24'-11	262	6p1	6	24'-9	223	6p1	6	24'-9	223	6p1	6	24'-5	220	6p1	6	24'-5	220	6p1	6	24'-5	220	6p1	5	24'-3	182
Wing Slope, Both F.		6s1	4	57'-0	357	6s1	4	52'-8	331	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'-4	28	6s2	2	9'-4	28	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	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	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	54'-7	171	6s5	2	50'-2	158	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
Curtain, Vert.		5t1	23	8'-5	202	5t1	23	8'-2	196	5t1	23	7'-11	190	5t1	23	7'-8	184	5t1	23	7'-5	178	5t1	23	7'-2	172	5t1	23	6'-11	166	5t1	23	6'-8	160
Curtain, Vert. Ends		5t2	4	8'-10	37	5t2	4	8'-7	36	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	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23
Estimated Quantities One Headwall	Reinf. Steel	21,733 LB				19,376 LB				17,468 LB				15,836 LB				12,677 LB				11,033 LB				8946 LB				7163 LB			
	Concrete Parapet Δ	3.0				3.0				2.9				2.9				2.7				2.7				2.7				2.6			
	Concrete Wingwalls	43.4		112.1 CY		38.0		102.3 CY		30.4		89.5 CY		26.1		80.8 CY		18.4		67.5 CY		15.3		60.1 CY		12.5		53.0 CY		8.9		44.7 CY	
	Concrete Apron ✳	65.7				61.3				56.2				51.8				46.4				42.1				37.8				33.2			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
6	4½"
7	5¼"
8	6"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
45° Skew

PWH 45-5-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-5-20 S1 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	16' x 6' Bar	16' x 6' No.	16' x 6' Length	16' x 6' Wt.	16' x 5' Bar	16' x 5' No.	16' x 5' Length	16' x 5' Wt.	16' x 4' Bar	16' x 4' No.	16' x 4' Length	16' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-10 to 9'-0	285	4c1	46 Var.	2 Each 2'-10 to 8'-0	166	4c1	36 Var.	2 Each 2'-10 to 6'-10	116
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-3	12	4c3	2	8'-3	11	4c3	2	7'-3	10
Wingwall, F.F.V. (A)		4c3	3	9'-3	19	4c3	3	8'-3	17	4c3	3	7'-3	15
Wingwall, B.F.V.		6c4	54 Var.	2 Each 7'-0 to 13'-1	814	6c4	90 Var.	2 Each 7'-0 to 12'-2	1295	6c4	72 Var.	2 Each 7'-0 to 11'-1	978
Wingwall, B.F.V. (O)		6c5	1	13'-3	20	6c5	1	12'-3	18	6c5	1	11'-3	17
Wingwall, B.F.V. (A)		6c5	4	13'-3	80	6c5	4	12'-3	74	6c5	4	11'-3	68
Wingwall, B.F.V.		6c6	16	9'-0	216	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	17	30'-6	346	4d1	17	26'-3	298	4d1	17	22'-0	250
Apron, Longit., Top		6f1	17	30'-6	779	6f1	17	26'-3	670	6f1	17	22'-0	562
Parapet, Vertical		4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173
Parapet, Horiz.		10j1	4	24'-3	417	10j1	4	24'-3	417	10j1	4	24'-3	417
Apron, Trans., Top		6m1	40	17'-8	1061	6m1	31	17'-8	823	6m1	23	17'-8	610
Apron, Trans., Top		6m2	30 Var.	2'-0 to 16'-6	417	6m2	30 Var.	2'-3 to 16'-9	428	6m2	30 Var.	2'-0 to 16'-6	417
Apron, Trans., Bott.		5m3	19	20'-3	401	5m3	16	20'-3	338	5m3	13	20'-3	275
Curtain, Horiz.		6p1	5	24'-3	182	6p1	5	24'-3	182	6p1	5	24'-3	182
Wing Slope, Both F.		6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-8	29	6s2	2	9'-8	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
Wing Slope, F.F.		6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Curtain, Vert.		5t1	23	6'-5	154	5t1	23	6'-5	154	5t1	23	6'-5	154
Curtain, Vert. Ends		5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-5	23	5u1	4	5'-5	23	5u1	4	5'-5	23

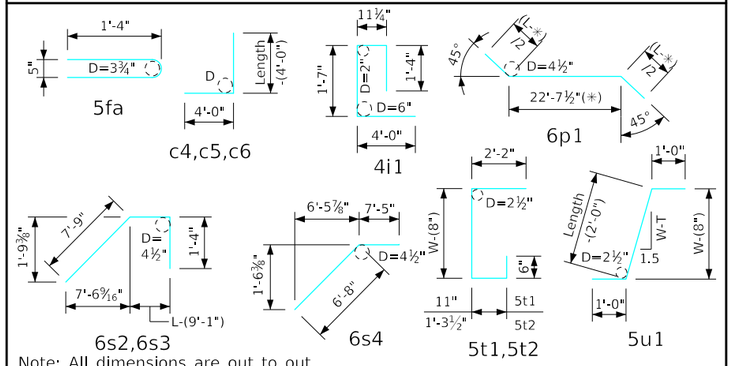
Estimated Quantities One Headwall			16' x 6'		16' x 5'		16' x 4'	
	Reinf. Steel		6165 LB		5701 LB		4743 LB	
	Concrete	Parapet Δ	2.6	38.3 CY	2.6	32.6 CY	2.6	27.0 CY
		Wingwalls	6.8		5.0		3.4	
		Apron ✳	28.9		25.0		21.0	

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.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
6	4½"
7	5¼"
8	6"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
16'-0" Span
45° Skew

PWH 45-5-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-5-20 S2 - THIS SHEET ISSUED 07-2020.

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

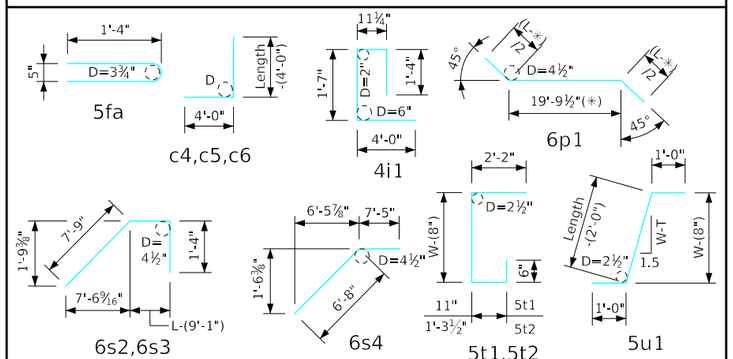
Location	Shape	14' x 14'				14' x 13'				14' x 12'				14' x 11'				14' x 10'				14' x 9'				14' x 8'				14' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	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	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	64'-8	140	5b1	2	60'-5	131	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	26 Var.	2 Each 11'-9 to 62'-8	1039	5b2	24 Var.	2 Each 11'-9 to 58'-5	903	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	65'-3	90	4b3	2	61'-1	85	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	24 Var.	2 Each 16'-8 to 63'-4	661	4b4	22 Var.	2 Each 16'-8 to 59'-1	573	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
Wingwall, F.F.V.		5c1	122 Var.	2 Each 2'-9 to 16'-10	1246	5c1	114 Var.	2 Each 2'-9 to 15'-11	1110	5c1	104 Var.	2 Each 2'-9 to 14'-9	949	5c1	96 Var.	2 Each 2'-9 to 13'-10	830	4c1	88 Var.	2 Each 2'-9 to 12'-10	458	4c1	80 Var.	2 Each 2'-9 to 11'-11	392	4c1	94 Var.	2 Each 2'-9 to 10'-10	426	4c1	82 Var.	2 Each 2'-9 to 9'-10	345
Wingwall, F.F.V.		5c2	66 Var.	2 Each 9'-2 to 16'-9	892	5c2	58 Var.	2 Each 9'-2 to 15'-10	756	5c2	50 Var.	2 Each 9'-2 to 14'-10	626	5c2	42 Var.	2 Each 9'-2 to 13'-11	506	4c2	32 Var.	2 Each 9'-2 to 12'-9	234	4c2	24 Var.	2 Each 9'-2 to 11'-10	168	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	17'-2	36	5c3	2	16'-2	34	5c3	2	15'-2	32	5c3	2	14'-2	30	4c3	2	13'-2	18	4c3	2	12'-2	16	4c3	2	11'-2	15	4c3	2	10'-2	14
Wingwall, F.F.V. (A)		5c3	3	17'-2	54	5c3	3	16'-2	51	5c3	3	15'-2	47	5c3	3	14'-2	44	4c3	3	13'-2	26	4c3	3	12'-2	24	4c3	3	11'-2	22	4c3	3	10'-2	20
Wingwall, B.F.V.		7c4	122 Var.	2 Each 6'-11 to 21'-1	3491	7c4	114 Var.	2 Each 6'-11 to 20'-1	3146	7c4	104 Var.	2 Each 6'-11 to 18'-11	2746	7c4	96 Var.	2 Each 6'-11 to 18'-0	2445	7c4	88 Var.	2 Each 6'-11 to 17'-0	2151	7c4	80 Var.	2 Each 6'-11 to 16'-1	1880	6c4	70 Var.	2 Each 6'-11 to 14'-11	1148	6c4	62 Var.	2 Each 6'-11 to 14'-0	974
Wingwall, B.F.V. (O)		7c5	1	21'-2	43	7c5	1	20'-2	41	7c5	1	19'-2	39	7c5	1	18'-2	37	7c5	1	17'-2	35	7c5	1	16'-2	33	6c5	1	15'-2	23	6c5	1	14'-2	21
Wingwall, B.F.V. (A)		7c5	4	21'-2	173	7c5	4	20'-2	165	7c5	4	19'-2	157	7c5	4	18'-2	149	7c5	4	17'-2	140	7c5	4	16'-2	132	6c5	4	15'-2	91	6c5	4	14'-2	85
Wingwall, B.F.V.		8c6	84	9'-6	2131	7c6	76	9'-0	1398	7c6	68	9'-0	1251	7c6	60	9'-0	1104	7c6	50	9'-0	920	7c6	42	9'-0	773	6c6	34	9'-0	460	6c6	26	9'-0	351
Apron, Longit., Bott.		4d1	15	64'-5	670	4d1	15	60'-2	627	4d1	15	55'-11	585	4d1	15	51'-8	542	4d1	15	47'-6	500	4d1	15	43'-3	458	4d1	15	39'-0	391	4d1	15	34'-9	348
Apron, Longit., Top		6f1	15	64'-5	1506	6f1	15	60'-2	1410	6f1	15	55'-11	1314	6f1	15	51'-8	1218	6f1	15	47'-6	1125	6f1	15	43'-3	1029	6f1	15	39'-0	879	6f1	15	34'-9	783
Parapet, Vertical		4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152
Parapet, Horiz.		10j1	4	22'-4	384	10j1	4	22'-4	384	10j1	4	22'-1	380	10j1	4	22'-1	380	10j1	4	21'-8	373	10j1	4	21'-8	373	10j1	4	21'-8	373	10j1	4	21'-5	369
Apron, Trans., Top		7m1	110	16'-4	3672	7m1	101	16'-4	3372	7m1	93	16'-2	3073	7m1	84	16'-2	2776	7m1	76	15'-10	2460	7m1	67	15'-10	2168	7m1	59	15'-10	1909	6m1	50	15'-8	1177
Apron, Trans., Top		7m2	26 Var.	2'-3 to 14'-9	452	7m2	26 Var.	2'-7 to 15'-1	469	7m2	26 Var.	2'-3 to 14'-9	452	7m2	26 Var.	2'-6 to 15'-0	465	7m2	26 Var.	2'-1 to 14'-7	443	7m2	26 Var.	2'-4 to 14'-10	456	7m2	26 Var.	2'-1 to 14'-7	443	6m2	26 Var.	2'-3 to 14'-9	332
Apron, Trans., Bott.		7m3	85	19'-11	3460	6m3	79	19'-1	2264	6m3	73	18'-11	2074	6m3	67	18'-11	1904	6m3	31	18'-5	858	5m3	28	17'-11	523	5m3	25	17'-8	461	5m3	22	17'-5	400
Curtain, Horiz.		6p1	7	22'-1	232	6p1	7	22'-1	232	6p1	6	21'-11	198	6p1	6	21'-11	198	6p1	6	21'-7	195	6p1	6	21'-7	195	6p1	6	21'-7	195	6p1	5	21'-5	161
Wing Slope, Both F.		6s1	4	57'-0	357	6s1	4	52'-8	331	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'-4	28	6s2	2	9'-4	28	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	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	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	54'-7	171	6s5	2	50'-2	158	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
Curtain, Vert.		5t1	20	8'-5	176	5t1	20	8'-2	170	5t1	20	7'-11	165	5t1	20	7'-8	160	5t1	20	7'-5	155	5t1	20	7'-2	149	5t1	20	6'-11	144	5t1	20	6'-8	139
Curtain, Vert. Ends		5t2	4	8'-10	37	5t2	4	8'-7	36	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	7'-1	30	5u1	4	6'-10	29	5u1	4	6'-8	28	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	6'-0	25	5u1	4	5'-9	24	5u1	4	5'-7	23
Estimated Quantities One Headwall	Reinf. Steel	21,402 LB				18,134 LB				16,326 LB				14,775 LB				11,821 LB				10,279 LB				8274 LB				6629 LB			
	Concrete Parapet Δ	2.8		102.1 CY		2.8		92.9 CY		2.7		80.9 CY		2.7		72.9 CY		2.5		60.3 CY		2.5		53.5 CY		2.5		47.1 CY		2.4		39.4 CY	
	Concrete Wingwalls	43.4				38.0				30.4				26.1				18.4				15.3				12.5				8.9			
	Concrete Apron ✳	55.9				52.1				47.8				44.1				39.4				35.7				32.1				28.1			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
6	4½"
7	5¼"
8	6"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
45° Skew

PWH 45-6-20
SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-6-20 S1 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	14' x 6' Bar	14' x 6' No.	14' x 6' Length	14' x 6' Wt.	14' x 5' Bar	14' x 5' No.	14' x 5' Length	14' x 5' Wt.	14' x 4' Bar	14' x 4' No.	14' x 4' Length	14' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-9 to 8'-11	281	4c1	46 Var.	2 Each 2'-9 to 7'-11	164	4c1	36 Var.	2 Each 2'-9 to 6'-9	114
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-2	12	4c3	2	8'-2	11	4c3	2	7'-2	10
Wingwall, F.F.V. (A)		4c3	3	9'-2	18	4c3	3	8'-2	16	4c3	3	7'-2	14
Wingwall, B.F.V.		6c4	54 Var.	2 Each 6'-11 to 13'-0	808	6c4	90 Var.	2 Each 6'-11 to 12'-1	1284	6c4	72 Var.	2 Each 6'-11 to 11'-0	969
Wingwall, B.F.V. (O)		6c5	1	13'-2	20	6c5	1	12'-2	18	6c5	1	11'-2	17
Wingwall, B.F.V. (A)		6c5	4	13'-2	79	6c5	4	12'-2	73	6c5	4	11'-2	67
Wingwall, B.F.V.		6c6	16	9'-0	216	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	15	30'-6	306	4d1	15	26'-3	263	4d1	15	22'-0	220
Apron, Longit., Top		6f1	15	30'-6	687	6f1	15	26'-3	591	6f1	15	22'-0	496
Parapet, Vertical		4i1	29	7'-10	152	4i1	29	7'-10	152	4i1	29	7'-10	152
Parapet, Horiz.		10j1	4	21'-5	369	10j1	4	21'-5	369	10j1	4	21'-5	369
Apron, Trans., Top		6m1	42	15'-8	988	6m1	33	15'-8	777	6m1	25	15'-8	588
Apron, Trans., Top		6m2	26 Var.	2'-0 to 14'-6	322	6m2	26 Var.	2'-3 to 14'-9	332	6m2	26 Var.	2'-0 to 14'-6	322
Apron, Trans., Bott.		5m3	19	17'-5	345	5m3	16	17'-5	291	5m3	13	17'-5	236
Curtain, Horiz.		6p1	5	21'-5	161	6p1	5	21'-5	161	6p1	5	21'-5	161
Wing Slope, Both F.		6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-8	29	6s2	2	9'-8	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
Wing Slope, F.F.		6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Curtain, Vert.		5t1	20	6'-5	134	5t1	20	6'-5	134	5t1	20	6'-5	134
Curtain, Vert. Ends		5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

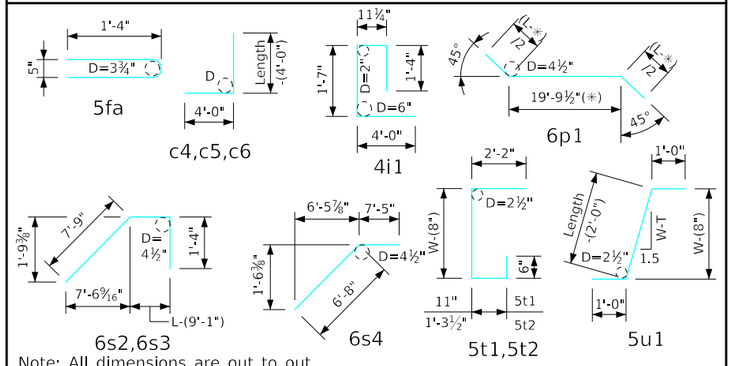
Estimated Quantities One Headwall			14' x 6'		14' x 5'		14' x 4'	
	Reinf. Steel		5686 LB		5272 LB		4367 LB	
	Concrete	Parapet Δ	2.4	33.7 CY	2.4	28.6 CY	2.4	23.7 CY
		Wingwalls	6.8		5.0		3.4	
		Apron ✳	24.5		21.2		17.9	

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

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

c Bar Pin Diameter	
Bar Size	D
6	4½"
7	5¼"
8	6"

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
14'-0" Span
45° Skew

PWH 45-6-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-6-20 S2 - THIS SHEET ISSUED 07-2020.

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

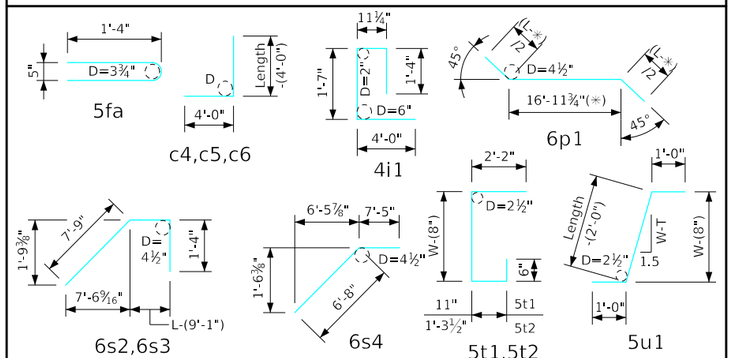
Location	Shape	12' x 12'				12' x 11'				12' x 10'				12' x 9'				12' x 8'				12' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	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
Wingwall, F.F.V.		5c1	104 Var.	2 Each 2'-8 to 14'-8	940	5c1	96 Var.	2 Each 2'-8 to 13'-9	822	4c1	88 Var.	2 Each 2'-8 to 12'-9	453	4c1	80 Var.	2 Each 2'-8 to 11'-10	387	4c1	94 Var.	2 Each 2'-8 to 10'-9	421	4c1	82 Var.	2 Each 2'-8 to 9'-9	340
Wingwall, F.F.V.		5c2	50 Var.	2 Each 9'-1 to 14'-9	621	5c2	42 Var.	2 Each 9'-1 to 13'-10	502	4c2	32 Var.	2 Each 9'-1 to 12'-8	232	4c2	24 Var.	2 Each 9'-1 to 11'-9	167	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	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	3	15'-1	47	5c3	3	14'-1	44	4c3	3	13'-1	26	4c3	3	12'-1	24	4c3	3	11'-1	22	4c3	3	10'-1	20
Wingwall, B.F.V.		6c4	104 Var.	2 Each 6'-10 to 18'-10	2005	5c4	96 Var.	2 Each 6'-10 to 17'-11	1239	5c4	88 Var.	2 Each 6'-10 to 16'-11	1090	5c4	80 Var.	2 Each 6'-10 to 16'-0	953	5c4	70 Var.	2 Each 6'-10 to 14'-10	791	5c4	62 Var.	2 Each 6'-10 to 13'-11	671
Wingwall, B.F.V. (O)		6c5	1	19'-1	29	5c5	1	18'-1	19	5c5	1	17'-1	18	5c5	1	16'-1	17	5c5	1	15'-1	16	5c5	1	14'-1	15
Wingwall, B.F.V. (A)		6c5	4	19'-1	115	5c5	4	18'-1	75	5c5	4	17'-1	71	5c5	4	16'-1	67	5c5	4	15'-1	63	5c5	4	14'-1	59
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
Apron, Longit., Bott.		4d1	13	55'-11	507	4d1	13	51'-8	470	4d1	13	47'-6	433	4d1	13	43'-3	397	4d1	13	39'-0	339	4d1	13	34'-9	302
Apron, Longit., Top		6f1	13	55'-11	1139	6f1	13	51'-8	1056	6f1	13	47'-6	975	6f1	13	43'-3	892	6f1	13	39'-0	762	6f1	13	34'-9	679
Parapet, Vertical		4i1	25	7'-10	131	4i1	25	7'-10	131	4i1	25	7'-10	131	4i1	25	7'-10	131	4i1	25	7'-10	131	4i1	25	7'-10	131
Parapet, Horiz.		9j1	4	19'-3	262	9j1	4	19'-3	262	9j1	4	18'-10	256	9j1	4	18'-10	256	9j1	4	18'-10	256	9j1	4	18'-7	253
Apron, Trans., Top		6m1	95	14'-2	2021	6m1	86	14'-2	1830	6m1	78	13'-10	1621	5m1	69	13'-10	996	5m1	61	13'-10	880	5m1	52	13'-8	741
Apron, Trans., Top		6m2	22 Var.	2'-3 to 12'-9	248	6m2	22 Var.	2'-6 to 13'-0	256	6m2	22 Var.	2'-1 to 12'-7	242	5m2	22 Var.	2'-4 to 12'-10	174	5m2	22 Var.	2'-1 to 12'-7	168	5m2	22 Var.	2'-3 to 12'-9	172
Apron, Trans., Bott.		6m3	73	16'-1	1763	5m3	67	15'-3	1066	6m3	31	15'-7	726	6m3	28	15'-7	655	6m3	25	15'-7	585	5m3	22	14'-7	335
Curtain, Horiz.		6p1	6	19'-1	172	6p1	6	19'-1	172	6p1	6	18'-9	169	6p1	6	18'-9	169	6p1	6	18'-9	169	6p1	5	18'-7	140
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
Curtain, Vert.		5t1	17	7'-11	140	5t1	17	7'-8	136	5t1	17	7'-5	132	5t1	17	7'-2	127	5t1	17	6'-11	123	5t1	17	6'-8	118
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'-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			13,175 LB				10,755 LB				8846 LB				7354 LB				6202 LB				5191 LB	
	Concrete: Parapet Δ		2.5	72.9 CY			2.5	65.5 CY			2.3	53.6 CY			2.3	47.4 CY			2.3	41.6 CY			2.2	34.6 CY	
	Concrete: Wingwalls		30.4				26.1				18.4				15.3				12.5				8.9		
	Concrete: Apron ✳		40.0				36.9				32.9				29.8				26.8				23.5		

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 12'-0" Span 45° Skew

PWH 45-7-20

SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-7-20 S1 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	12' x 6' Bar	12' x 6' No.	12' x 6' Length	12' x 6' Wt.	12' x 5' Bar	12' x 5' No.	12' x 5' Length	12' x 5' Wt.	12' x 4' Bar	12' x 4' No.	12' x 4' Length	12' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-8 to 8'-10	277	4c1	46 Var.	2 Each 2'-8 to 7'-10	161	4c1	36 Var.	2 Each 2'-8 to 6'-8	112
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (A)		4c3	3	9'-1	18	4c3	3	8'-1	16	4c3	3	7'-1	14
Wingwall, B.F.V.		5c4	54 Var.	2 Each 6'-10 to 12'-11	556	6c4	60 Var.	2 Each 6'-10 to 11'-11	845	6c4	48 Var.	2 Each 6'-10 to 10'-11	640
Wingwall, B.F.V. (O)		5c5	1	13'-1	14	6c5	1	12'-1	18	6c5	1	11'-1	17
Wingwall, B.F.V. (A)		5c5	4	13'-1	55	6c5	4	12'-1	73	6c5	4	11'-1	67
Wingwall, B.F.V.		5c6	16	9'-0	150	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	13	30'-6	265	4d1	13	26'-3	228	4d1	13	22'-0	191
Apron, Longit., Top		6f1	13	30'-6	596	6f1	13	26'-3	513	6f1	13	22'-0	430
Parapet, Vertical		4i1	25	7'-10	131	4i1	25	7'-10	131	4i1	25	7'-10	131
Parapet, Horiz.		9j1	4	18'-7	253	9j1	4	18'-7	253	9j1	4	18'-7	253
Apron, Trans., Top		5m1	44	13'-8	627	5m1	35	13'-8	499	5m1	27	13'-8	385
Apron, Trans., Top		5m2	22 Var.	2'-0 to 12'-6	166	5m2	22 Var.	2'-3 to 12'-9	172	5m2	22 Var.	2'-0 to 12'-6	166
Apron, Trans., Bott.		5m3	19	14'-7	289	5m3	16	14'-7	243	5m3	13	14'-7	198
Curtain, Horiz.		6p1	5	18'-7	140	6p1	5	18'-7	140	6p1	5	18'-7	140
Wing Slope, Both F.		6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-8	29	6s2	2	9'-8	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
Wing Slope, F.F.		6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Curtain, Vert.		5t1	17	6'-5	114	5t1	17	6'-5	114	5t1	17	6'-5	114
Curtain, Vert. Ends		5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

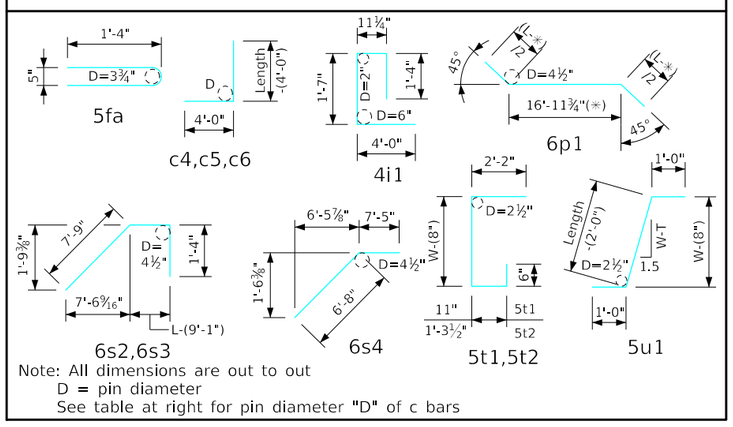
Estimated Quantities One Headwall			12' x 6'		12' x 5'		12' x 4'	
	Reinf. Steel		4451 LB		4053 LB		3365 LB	
	Concrete	Parapet Δ	2.2	29.5 CY	2.2	25.0 CY	2.2	20.6 CY
		Wingwalls	6.8		5.0		3.4	
		Apron ✳	20.5		17.8		15.0	

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

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
45° Skew

PWH 45-7-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-7-20 S2 - THIS SHEET ISSUED 07-2020.

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

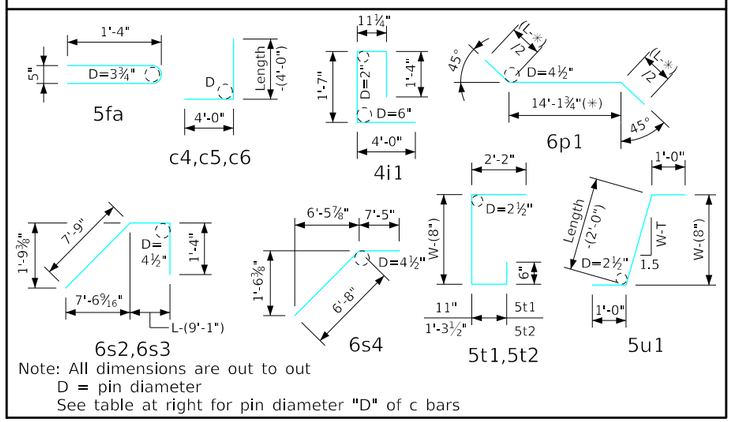
Location	Shape	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' x 7'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	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
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
Apron, Longit., Bott.		4d1	11	55'-11	429	4d1	11	51'-8	397	4d1	11	47'-6	367	4d1	11	43'-3	336	4d1	11	39'-0	287	4d1	11	34'-9	255
Apron, Longit., Top		6f1	11	55'-11	964	6f1	11	51'-8	894	6f1	11	47'-6	825	6f1	11	43'-3	755	6f1	11	39'-0	644	6f1	11	34'-9	574
Parapet, Vertical		4i1	21	7'-10	110	4i1	21	7'-10	110	4i1	21	7'-10	110	4i1	21	7'-10	110	4i1	21	7'-10	110	4i1	21	7'-10	110
Parapet, Horiz.		9j1	4	16'-6	224	9j1	4	16'-6	224	9j1	4	16'-0	218	9j1	4	16'-0	218	9j1	4	16'-0	218	9j1	4	15'-9	214
Apron, Trans., Top		6m1	97	12'-2	1773	6m1	88	12'-2	1608	6m1	80	11'-10	1422	5m1	71	11'-10	876	5m1	63	11'-10	778	5m1	54	11'-8	657
Apron, Trans., Top		6m2	18 Var.	2'-3 to 10'-9	176	6m2	18 Var.	2'-6 to 11'-0	182	6m2	18 Var.	2'-1 to 10'-7	171	5m2	18 Var.	2'-4 to 10'-10	124	5m2	18 Var.	2'-1 to 10'-7	119	5m2	18 Var.	2'-3 to 10'-9	122
Apron, Trans., Bott.		6m3	73	13'-3	1453	5m3	67	12'-5	868	5m3	61	12'-0	763	6m3	28	12'-9	536	6m3	25	12'-9	479	5m3	22	11'-9	270
Curtain, Horiz.		6p1	6	16'-3	146	6p1	6	16'-3	146	6p1	6	15'-11	143	6p1	6	15'-11	143	6p1	6	15'-11	143	6p1	5	15'-9	118
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
Curtain, Vert.		5t1	15	7'-11	124	5t1	15	7'-8	120	5t1	15	7'-5	116	5t1	15	7'-2	112	5t1	15	6'-11	108	5t1	15	6'-8	104
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			12,164 LB				9904 LB				8282 LB				6755 LB				5664 LB				4734 LB	
	Concrete Parapet Δ	2.3				2.3				2.1				2.1				2.1				2.0			
	Concrete Wingwalls	30.4		65.6 CY		26.1		58.7 CY		18.4		47.4 CY		15.3		41.8 CY		12.5		36.6 CY		8.9		30.1 CY	
	Concrete Apron ✳	32.9				30.3				26.9				24.4				22.0				19.2			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation 10'-0" Span 45° Skew

PWH 45-8-20

SHEET 1 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-8-20 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-7 to 8'-9	273	4c1	46 Var.	2 Each 2'-7 to 7'-9	159	4c1	36 Var.	2 Each 2'-7 to 6'-7	110
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (A)		4c3	3	9'-0	18	4c3	3	8'-0	16	4c3	3	7'-0	14
Wingwall, B.F.V.		5c4	54 Var.	2 Each 6'-9 to 12'-10	551	6c4	60 Var.	2 Each 6'-9 to 11'-10	837	6c4	48 Var.	2 Each 6'-9 to 10'-10	634
Wingwall, B.F.V. (O)		5c5	1	13'-0	14	6c5	1	12'-0	18	6c5	1	11'-0	17
Wingwall, B.F.V. (A)		5c5	4	13'-0	54	6c5	4	12'-0	72	6c5	4	11'-0	66
Wingwall, B.F.V.		5c6	16	9'-0	150	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	11	30'-6	224	4d1	11	26'-3	193	4d1	11	22'-0	162
Apron, Longit., Top		6f1	11	30'-6	504	6f1	11	26'-3	434	6f1	11	22'-0	363
Parapet, Vertical		4i1	21	7'-10	110	4i1	21	7'-10	110	4i1	21	7'-10	110
Parapet, Horiz.		9j1	4	15'-9	214	9j1	4	15'-9	214	9j1	4	15'-9	214
Apron, Trans., Top		5m1	46	11'-8	560	5m1	37	11'-8	450	5m1	29	11'-8	353
Apron, Trans., Top		5m2	18 Var.	2'-0 to 10'-6	117	5m2	18 Var.	2'-3 to 10'-9	122	5m2	18 Var.	2'-0 to 10'-6	117
Apron, Trans., Bott.		5m3	19	11'-9	233	5m3	16	11'-9	196	5m3	13	11'-9	159
Curtain, Horiz.		6p1	5	15'-9	118	6p1	5	15'-9	118	6p1	5	15'-9	118
Wing Slope, Both F.		6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-8	29	6s2	2	9'-8	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
Wing Slope, F.F.		6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Curtain, Vert.		5t1	15	6'-5	100	5t1	15	6'-5	100	5t1	15	6'-5	100
Curtain, Vert. Ends		5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

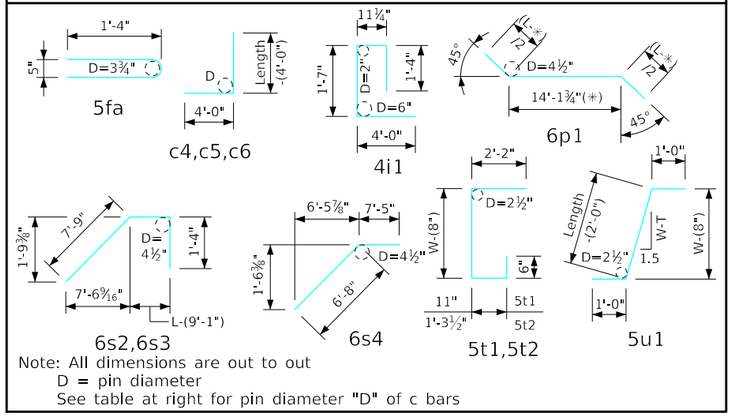
Estimated Quantities One Headwall	Reinf. Steel		10' x 6'		10' x 5'		10' x 4'	
	Concrete	Parapet Δ	2.0	25.6 CY	2.0	21.5 CY	2.0	17.7 CY
		Wingwalls	6.8		5.0		3.4	
		Apron ✳	16.8		14.5		12.3	

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.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
45° Skew

PWH 45-8-20
SHEET 2 OF 2

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-8-20 S2 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	47'-8	104	5b1	2	43'-5	96	5b1	2	39'-2	82	5b1	2	34'-11	73	5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		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	5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	48'-1	67	4b3	2	43'-10	62	4b3	2	39'-7	53	4b3	2	35'-3	47	4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		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	4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Wingwall, F.F.V.		4c1	88 Var.	2 Each 2'-5 to 12'-6	438	4c1	80 Var.	2 Each 2'-5 to 11'-7	374	4c1	94 Var.	2 Each 2'-5 to 10'-6	406	4c1	82 Var.	2 Each 2'-5 to 9'-6	326	4c1	72 Var.	2 Each 2'-5 to 8'-7	265	4c1	46 Var.	2 Each 2'-5 to 7'-7	154	4c1	36 Var.	2 Each 2'-5 to 6'-5	106
Wingwall, F.F.V.		4c2	32 Var.	2 Each 8'-10 to 12'-5	227	4c2	24 Var.	2 Each 8'-10 to 11'-6	163	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (A)		4c3	3	12'-10	26	4c3	3	11'-10	24	4c3	3	10'-10	22	4c3	3	9'-10	20	4c3	3	8'-10	18	4c3	3	7'-10	16	4c3	3	6'-10	14
Wingwall, B.F.V.		5c4	88 Var.	2 Each 6'-7 to 16'-8	1067	5c4	80 Var.	2 Each 6'-7 to 15'-9	932	5c4	70 Var.	2 Each 6'-7 to 14'-7	773	5c4	62 Var.	2 Each 6'-7 to 13'-8	655	5c4	54 Var.	2 Each 6'-7 to 12'-8	542	5c4	60 Var.	2 Each 6'-7 to 11'-8	571	5c4	48 Var.	2 Each 6'-7 to 10'-8	432
Wingwall, B.F.V. (O)		5c5	1	16'-10	18	5c5	1	15'-10	17	5c5	1	14'-10	15	5c5	1	13'-10	14	5c5	1	12'-10	13	5c5	1	11'-10	12	5c5	1	10'-10	11
Wingwall, B.F.V. (A)		5c5	4	16'-10	70	5c5	4	15'-10	66	5c5	4	14'-10	62	5c5	4	13'-10	58	5c5	4	12'-10	54	5c5	4	11'-10	49	5c5	4	10'-10	45
Wingwall, B.F.V.		6c6	50	9'-0	676	6c6	42	9'-0	568	5c6	34	9'-0	319	5c6	26	9'-0	244	5c6	16	9'-0	150	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	9	47'-6	300	4d1	9	43'-3	275	4d1	9	39'-0	234	4d1	9	34'-9	209	4d1	9	30'-6	183	4d1	9	26'-3	158	4d1	9	22'-0	132
Apron, Longit., Top		6f1	9	47'-6	675	6f1	9	43'-3	617	6f1	9	39'-0	527	6f1	9	34'-9	470	6f1	9	30'-6	412	6f1	9	26'-3	355	6f1	9	22'-0	297
Parapet, Vertical		4i1	17	7'-10	89	4i1	17	7'-10	89	4i1	17	7'-10	89	4i1	17	7'-10	89	4i1	17	7'-10	89	4i1	17	7'-10	89	4i1	17	7'-10	89
Parapet, Horiz.		9j1	4	13'-2	179	9j1	4	13'-2	179	9j1	4	13'-2	179	9j1	4	12'-11	176	9j1	4	12'-11	176	9j1	4	12'-11	176	9j1	4	12'-11	176
Apron, Trans., Top		5m1	82	9'-10	841	5m1	73	9'-10	749	5m1	65	9'-10	667	5m1	56	9'-8	565	5m1	48	9'-8	484	5m1	26	9'-8	262	5m1	21	9'-8	212
Apron, Trans., Top		5m2	14 Var.	2'-1 to 8'-7	78	5m2	14 Var.	2'-4 to 8'-10	82	5m2	14 Var.	2'-1 to 8'-7	78	5m2	14 Var.	2'-3 to 8'-9	80	5m2	14 Var.	2'-0 to 8'-6	77	5m2	10 Var.	2'-0 to 8'-9	56	5m2	9 Var.	2'-3 to 8'-3	49
Apron, Trans., Bott.		5m3	61	9'-2	583	5m3	55	9'-2	526	6m3	25	9'-11	372	5m3	22	8'-11	205	5m3	19	8'-11	177	5m3	16	8'-11	149	5m3	13	8'-11	121
Curtain, Horiz.		6p1	6	13'-1	118	6p1	6	13'-1	118	6p1	6	13'-1	118	6p1	5	12'-11	97	6p1	5	12'-11	97	6p1	5	12'-11	97	6p1	5	12'-11	97
Wing Slope, Both F.		6s1	4	39'-7	238	6s1	4	35'-3	212	6s1	4	30'-10	185	6s1	4	26'-6	159	6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-8	29	6s2	2	9'-8	29	6s2	2	9'-8	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	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	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	37'-2	112	6s5	2	32'-9	98	6s5	2	28'-5	85	6s5	2	24'-1	72	6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Curtain, Vert.		5t1	12	7'-5	93	5t1	12	7'-2	90	5t1	12	6'-11	87	5t1	12	6'-8	83	5t1	12	6'-5	80	5t1	12	6'-5	80	5t1	12	6'-5	80
Curtain, Vert. Ends		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	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

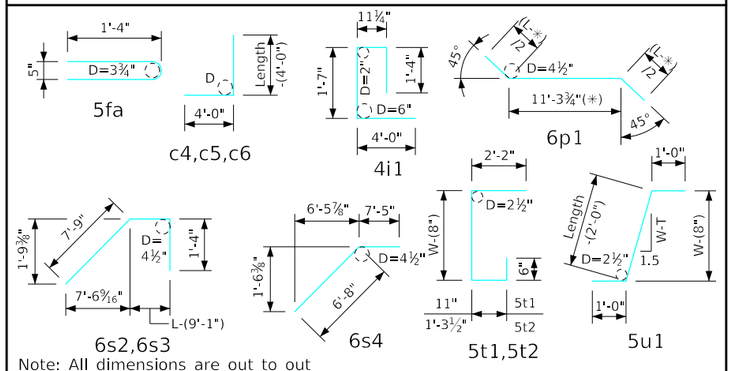
Estimated Quantities One Headwall	Reinf. Steel		7072 LB		6243 LB		5104 LB		4262 LB		3617 LB		2870 LB		2368 LB	
	Concrete	Parapet Δ	1.8	40.3 CY	1.8	35.4 CY	1.8	30.7 CY	1.7	24.9 CY	1.7	21.0 CY	1.7	17.6 CY	1.7	14.4 CY
		Wingwalls	18.4		15.3		12.5		8.9		6.8		5.0		3.4	
		Apron ✳	20.1		18.3		16.4		14.3		12.5		10.9		9.3	

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

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

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
45° Skew

PWH 45-9-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-9-20 - THIS SHEET ISSUED 07-2020.

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

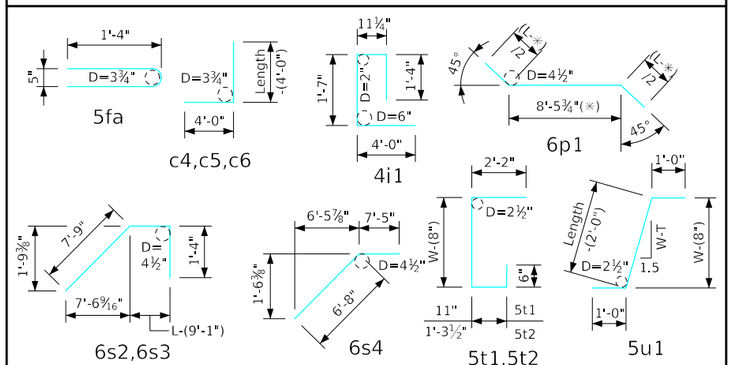
Location	Shape	6' x 8'				6' x 7'				6' x 6'				6' x 5'				6' x 4'				6' x 3'			
		Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	39'-2	82	5b1	2	34'-11	73	5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46	5b1	2	18'-0	38
Wingwall, F.F.H.		5b2	14 Var.	2 Each 11'-9 to 37'-3	358	5b2	12 Var.	2 Each 11'-9 to 33'-0	280	5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100	5b2	4 Var.	2 Each 11'-9 to 16'-0	58
Wingwall, B.F.H.		4b3	2	39'-7	53	4b3	2	35'-3	47	4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30	4b3	2	18'-3	24
Wingwall, B.F.H.		4b4	12 Var.	2 Each 16'-5 to 37'-7	216	4b4	10 Var.	2 Each 16'-4 to 33'-3	166	4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49	4b4	2	16'-4	22
Wingwall, F.F.V.		4c1	94 Var.	2 Each 2'-5 to 10'-6	406	4c1	82 Var.	2 Each 2'-5 to 9'-6	326	4c1	72 Var.	2 Each 2'-5 to 8'-7	265	4c1	46 Var.	2 Each 2'-5 to 7'-7	154	4c1	36 Var.	2 Each 2'-5 to 6'-5	106	4c1	28 Var.	2 Each 2'-5 to 5'-5	73
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (A)		4c3	3	10'-10	22	4c3	3	9'-10	20	4c3	3	8'-10	18	4c3	3	7'-10	16	4c3	3	6'-10	14	4c3	3	5'-10	12
Wingwall, B.F.V.		5c4	70 Var.	2 Each 6'-7 to 14'-7	773	5c4	62 Var.	2 Each 6'-7 to 13'-8	655	5c4	54 Var.	2 Each 6'-7 to 12'-8	542	5c4	46 Var.	2 Each 6'-7 to 11'-9	440	5c4	36 Var.	2 Each 6'-7 to 10'-7	322	5c4	28 Var.	2 Each 6'-7 to 9'-8	237
Wingwall, B.F.V. (O)		5c5	1	14'-10	15	5c5	1	13'-10	14	5c5	1	12'-10	13	5c5	1	11'-10	12	5c5	1	10'-10	11	5c5	1	9'-10	10
Wingwall, B.F.V. (A)		5c5	4	14'-10	62	5c5	4	13'-10	58	5c5	4	12'-10	54	5c5	4	11'-10	49	5c5	4	10'-10	45	5c5	4	9'-10	41
Wingwall, B.F.V.		5c6	34	9'-0	319	5c6	26	9'-0	244	5c6	16	9'-0	150	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	7	39'-0	182	4d1	7	34'-9	162	4d1	7	30'-6	143	4d1	7	26'-3	123	4d1	7	22'-0	103	4d1	7	17'-9	83
Apron, Longit., Top		6f1	7	39'-0	410	6f1	7	34'-9	365	6f1	7	30'-6	321	6f1	7	26'-3	276	6f1	7	22'-0	231	6f1	7	17'-9	187
Parapet, Vertical		4i1	13	7'-10	68	4i1	13	7'-10	68	4i1	13	7'-10	68	4i1	13	7'-10	68	4i1	13	7'-10	68	4i1	13	7'-10	68
Parapet, Horiz.		9j1	4	10'-4	141	9j1	4	10'-1	137	9j1	4	10'-1	137	9j1	4	10'-1	137	9j1	4	10'-1	137	9j1	4	10'-1	137
Apron, Trans., Top		5m1	34	7'-10	278	5m1	29	7'-8	232	5m1	25	7'-8	200	5m1	21	7'-8	168	5m1	17	7'-8	136	5m1	12	7'-8	96
Apron, Trans., Top		5m2	5 Var.	2'-1 to 6'-1	21	5m2	5 Var.	2'-9 to 6'-9	25	5m2	5 Var.	2'-6 to 6'-6	23	5m2	5 Var.	2'-3 to 6'-3	22	5m2	5 Var.	2'-0 to 6'-0	21	5m2	5 Var.	2'-9 to 6'-9	25
Apron, Trans., Bott.		5m3	49	6'-4	324	5m3	22	6'-1	140	5m3	19	6'-1	121	5m3	16	6'-1	102	5m3	13	6'-1	82	5m3	10	6'-1	63
Curtain, Horiz.		6p1	6	10'-3	92	6p1	5	10'-1	76	6p1	5	10'-1	76	6p1	5	10'-1	76	6p1	5	10'-1	76	6p1	5	10'-1	76
Wing Slope, Both F.		6s1	4	30'-10	185	6s1	4	26'-6	159	6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81	6s1	4	9'-1	55
Wing Slope, Both F. (O)		6s2	2	9'-7	29	6s2	2	9'-8	29	6s2	2	9'-8	29	6s2	2	9'-8	29	6s2	2	9'-8	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	28'-5	85	6s5	2	24'-1	72	6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33	6s5	2	6'-7	20
Curtain, Vert.		5t1	9	6'-11	65	5t1	9	6'-8	63	5t1	9	6'-5	60	5t1	9	6'-5	60	5t1	9	6'-5	60	5t1	9	6'-5	60
Curtain, Vert. Ends		5t2	4	7'-4	31	5t2	4	7'-1	30	5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel		4334 LB				3556 LB				2991 LB				2349 LB				1919 LB				1552 LB		
	Concrete Parapet Δ	1.6				1.5				1.5				1.5				1.5				1.5			
	Concrete Wingwalls	12.5		27.6 CY		8.9		22.1 CY		6.8		18.6 CY		5.0		15.5 CY		3.4		12.5 CY		2.1		9.9 CY	
	Concrete Apron ✳	13.5				11.7				10.3				9.0				7.6				6.3			

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.

(A) - Indicates bar located at acute corner.
(0) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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 - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
6'-0" Span
45° Skew

PWH
45-10-20

ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - PWH 45-10-20 - THIS SHEET ISSUED 07-2020.

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

Location	Shape	5' x 6'				5' x 5'				5' x 4'				5' x 3'			
		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
Wingwall, F.F.H.		5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46	5b1	2	18'-0	38
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100	5b2	4 Var.	2 Each 11'-9 to 16'-0	58
Wingwall, B.F.H.		4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30	4b3	2	18'-3	24
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49	4b4	2	16'-4	22
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-5 to 8'-7	265	4c1	46 Var.	2 Each 2'-5 to 7'-7	154	4c1	36 Var.	2 Each 2'-5 to 6'-5	106	4c1	28 Var.	2 Each 2'-5 to 5'-5	73
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9	4c3	2	5'-10	8
Wingwall, F.F.V. (A)		4c3	3	8'-10	18	4c3	3	7'-10	16	4c3	3	6'-10	14	4c3	3	5'-10	12
Wingwall, B.F.V.		5c4	54 Var.	2 Each 6'-7 to 12'-8	542	5c4	46 Var.	2 Each 6'-7 to 11'-9	440	5c4	36 Var.	2 Each 6'-7 to 10'-7	322	5c4	28 Var.	2 Each 6'-7 to 9'-8	237
Wingwall, B.F.V. (O)		5c5	1	12'-10	13	5c5	1	11'-10	12	5c5	1	10'-10	11	5c5	1	9'-10	10
Wingwall, B.F.V. (A)		5c5	4	12'-10	54	5c5	4	11'-10	49	5c5	4	10'-10	45	5c5	4	9'-10	41
Wingwall, B.F.V.		5c6	16	9'-0	150	c6	--	--	--	c6	--	--	--	c6	--	--	--
Apron, Longit., Bott.		4d1	6	30'-6	122	4d1	6	26'-3	105	4d1	6	22'-0	88	4d1	6	17'-9	71
Apron, Longit., Top		6f1	6	30'-6	275	6f1	6	26'-3	237	6f1	6	22'-0	198	6f1	6	17'-9	160
Parapet, Vertical		4i1	11	7'-10	58	4i1	11	7'-10	58	4i1	11	7'-10	58	4i1	11	7'-10	58
Parapet, Horiz.		9j1	4	8'-8	118	9j1	4	8'-8	118	9j1	4	8'-8	118	9j1	4	8'-8	118
Apron, Trans., Top		5m1	26	6'-8	181	5m1	21	6'-8	146	5m1	17	6'-8	118	5m1	13	6'-8	90
Apron, Trans., Top		5m2	4 Var.	2'-0 to 5'-0	15	5m2	4 Var.	2'-9 to 5'-9	18	5m2	4 Var.	2'-6 to 5'-6	17	5m2	4 Var.	2'-3 to 5'-3	16
Apron, Trans., Bott.		5m3	19	4'-8	92	5m3	16	4'-8	78	5m3	13	4'-8	63	5m3	10	4'-8	49
Curtain, Horiz.		6p1	5	8'-8	65	6p1	5	8'-8	65	6p1	5	8'-8	65	6p1	5	8'-8	65
Wing Slope, Both F.		6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81	6s1	4	9'-1	55
Wing Slope, Both F. (O)		6s2	2	9'-8	29	6s2	2	9'-8	29	6s2	2	9'-8	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
Wing Slope, F.F.		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	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33	6s5	2	6'-7	20
Curtain, Vert.		5t1	8	6'-5	54	5t1	8	6'-5	54	5t1	8	6'-5	54	5t1	8	6'-5	54
Curtain, Vert. Ends		5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22

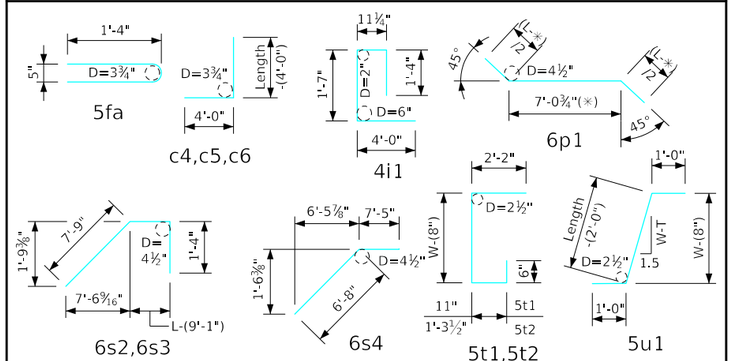
Estimated Quantities One Headwall																	
Reinf. Steel			2822 LB			2196 LB				1784 LB				1438 LB			
Concrete	Parapet Δ	1.4	17.4 CY			1.4	14.4 CY			1.4	11.6 CY			1.4	9.1 CY		
	Wingwalls	6.8				5.0				3.4				2.1			
	Apron ✳	9.2				8.0				6.8				5.6			

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.

(A) - Indicates bar located at acute corner.
(O) - Indicates bar located at obtuse corner.
Refer to Sheet PWH 45-1-20 for acute and obtuse corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter

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

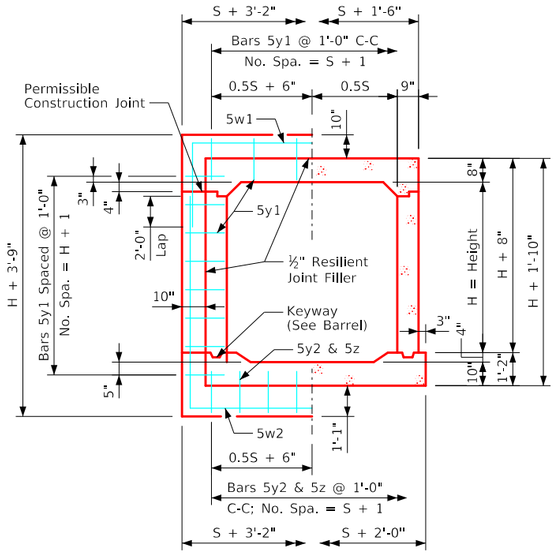
Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

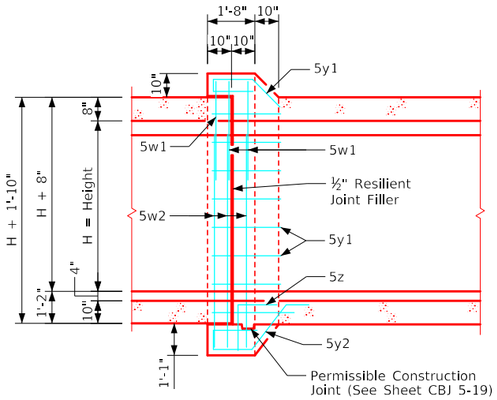
July, 2020

Quantity Tabulation
5'-0" Span
45° Skew

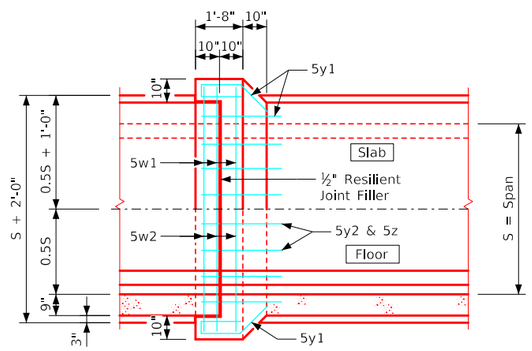
PWH
45-11-20



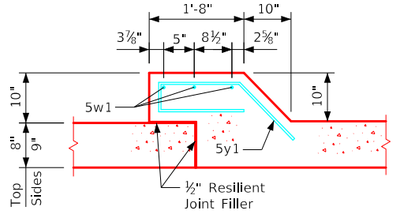
Joint Detail
Section thru Barrel



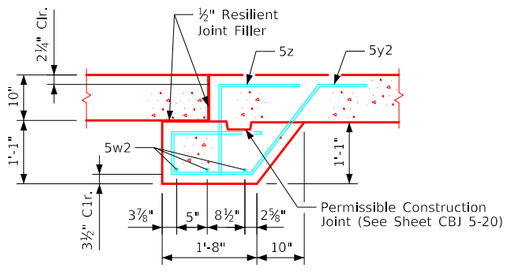
Longitudinal Section



Plan View



Top & Sides - Bars 5y1

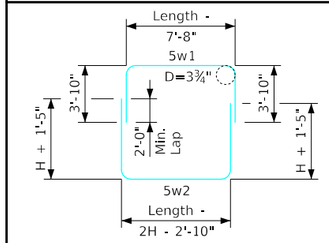


Bottom - Bars 5y2 & 5z

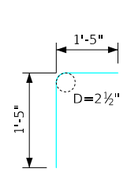
Estimate of Quantities - One Joint - 3', 4', & 5' Spans

Bill of Reinforcing Steel			3' x 3'			4' x 4'			5' x 3'			5' x 4'			5' x 5'			5' x 6'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
5w1	Slab & Walls		3	13'-4	42	3	14'-4	45	3	15'-4	48	3	15'-4	48	3	15'-4	48	3	15'-4	48
5w2	Floor & Walls		3	14'-6	45	3	17'-6	55	3	16'-6	52	3	18'-6	58	3	20'-6	64	3	22'-6	70
5y1	Top & Sides		15	4'-10	76	18	4'-10	91	17	4'-10	86	19	4'-10	96	21	4'-10	106	23	4'-10	116
5y2	Bottom		5	6'-2	32	6	6'-2	39	7	6'-2	45	7	6'-2	45	7	6'-2	45	7	6'-2	45
5z	Bottom & Floor		5	2'-10	15	6	2'-10	18	7	2'-10	21	7	2'-10	21	7	2'-10	21	7	2'-10	21
Total Weight (LB)					210			248			252			268			284			300
Total Concrete (CY)				1.5			1.8			1.8			1.9			2.0			2.2	

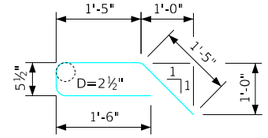
Bent Bar Details



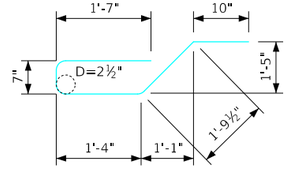
5w1 & 5w2



5z



5y1



5y2

Note:
All dimensions are out to out. D = pin diameter.

Concrete Placement

Barrel Size	Barrel Dimension			Bell Joint Quantities (CY)		
	A	B	C	Footing	Walls	Slab
3' x 3'	8	10	9	0.647	0.336	0.510
4' x 4'	8	10	9	0.730	0.462	0.573
5' x 3'	8	10	9	0.812	0.336	0.636
5' x 4'	8	10	9	0.812	0.462	0.636
5' x 5'	8	10	9	0.812	0.588	0.636
5' x 6'	8	10	9	0.812	0.714	0.636

Notes:

1. Dimensions and quantities shown are based on slab, floor, and wall thicknesses (A, B, and C, respectively). Values for these dimensions, under varying fill conditions, can be found on the RCB culvert barrel detail sheets.
2. Change lengths of bars 5w1, 5w2, 5z, and adjust reinforcing steel and concrete quantities accordingly for slab, wall, and floor thicknesses other than shown.
3. All bar lengths are estimated with a 2" clearance from concrete edge to outside of bar, except as noted.
4. Material and construction to be in accordance with the current Standard Specifications of I.D.O.T.
5. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
6. Barrel floor bars m1 & m9 are to be shortened 6" in length at bell joints.
7. Dimensions "A", "B" and "C" are in inches. "Length" dimensions in bar lists are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

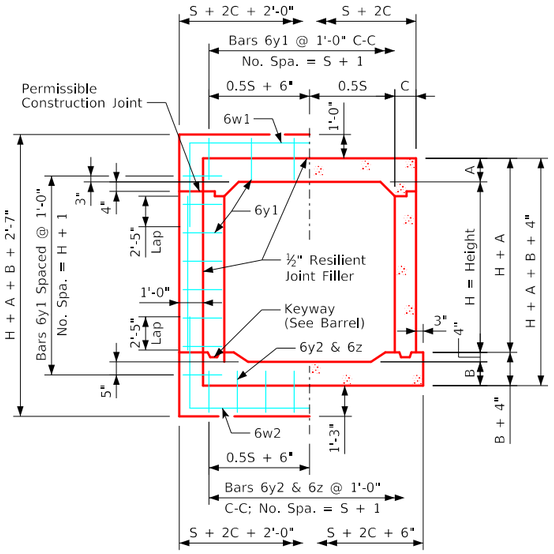
Single Reinforced Concrete Box Culverts

July, 2020

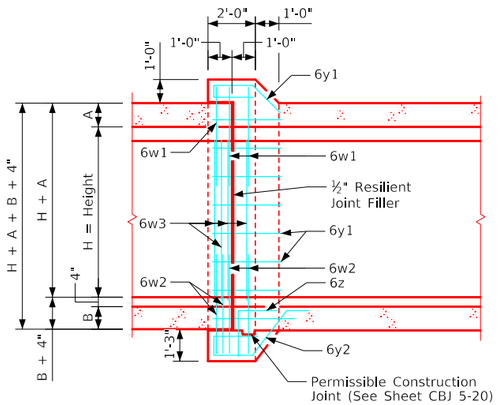
Culvert Bell Joints

3', 4', & 5' Spans

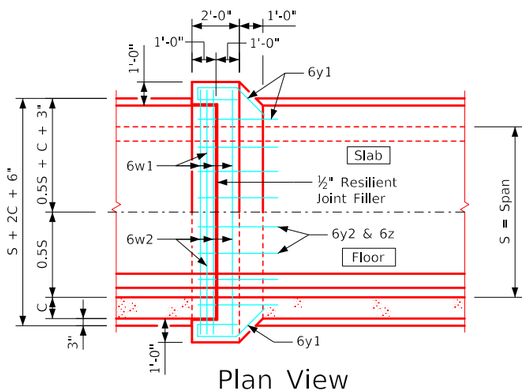
CBJ 1-20



Joint Detail
Section thru Barrel



Longitudinal Section



Plan View

Estimate of Quantities - One Joint - 6' Span

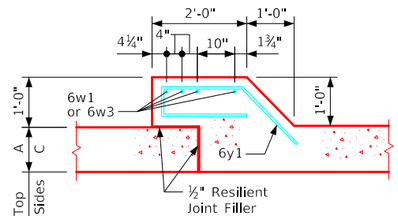
Bill of Reinforcing Steel			6' x 3'			6' x 4'			6' x 5'			6' x 6'			6' x 7'			6' x 8'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	18'-2	109	4	18'-2	109	4	18'-2	109	4	18'-2	109	4	18'-2	109	4	18'-3	110
6w2	Floor & Walls		4	18'-4	110	4	20'-4	122	4	22'-4	134	4	18'-6	111	4	18'-6	111	4	18'-7	112
6w3	Walls		--	--	--	--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90
6y1	Top & Sides		18	6'-2	167	20	6'-2	185	22	6'-2	204	24	6'-2	222	26	6'-2	241	28	6'-2	259
6y2	Bottom		8	7'-5	89	8	7'-5	89	8	7'-5	89	8	7'-5	89	8	7'-5	89	8	7'-5	89
6z	Bottom & Floor		8	3'-2	38	8	3'-2	38	8	3'-2	38	8	3'-2	38	8	3'-2	38	8	3'-2	38
Total Weight (LB)					513			543			574			635			666			698
Total Concrete (CY)				2.8			3.0			3.2			3.4			3.5			3.7	

Estimate of Quantities - One Joint - 8' Span

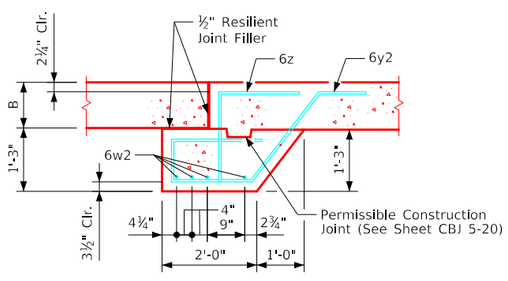
Bill of Reinforcing Steel			8' x 4'			8' x 5'			8' x 6'			8' x 7'			8' x 8'			8' x 9'			8' x 10'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	20'-2	121	4	20'-2	121	4	20'-2	121	4	20'-2	121	4	20'-3	122	4	20'-6	123	4	20'-8	124
6w2	Floor & Walls		4	22'-4	134	4	24'-4	146	4	20'-6	123	4	20'-6	123	4	20'-7	124	4	20'-10	125	4	21'-0	126
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114
6y1	Top & Sides		22	6'-2	204	24	6'-2	222	26	6'-2	241	28	6'-2	259	30	6'-2	278	32	6'-2	296	34	6'-2	315
6y2	Bottom		10	7'-8	115	10	7'-8	115	10	7'-8	115	10	7'-8	115	10	7'-8	115	10	7'-8	115	10	7'-8	115
6z	Bottom & Floor		10	3'-2	48	10	3'-2	48	10	3'-2	48	10	3'-2	48	10	3'-2	48	10	3'-2	48	10	3'-2	48
Total Weight (LB)					622			652			714			744			777			809			842
Total Concrete (CY)				3.5			3.7			3.8			4.0			4.2			4.4			4.7

Concrete Placement

Barrel Size	Barrel Dimension			Bell Joint Quantities (CY)		
	A	B	C	Footing	Walls	Slab
6' x 3'	8	10	9	1.285	0.486	1.038
6' x 4'	8	10	9	1.285	0.668	1.038
6' x 5'	8	10	9	1.285	0.850	1.038
6' x 6'	8	10	9	1.285	1.032	1.038
6' x 7'	8	10.5	9	1.292	1.214	1.038
6' x 8'	8	10.5	9.5	1.302	1.396	1.045
8' x 4'	10	12.5	9	1.551	0.668	1.250
8' x 5'	10	12.5	9	1.551	0.850	1.250
8' x 6'	10	12.5	9	1.551	1.032	1.250
8' x 7'	10	12.5	9	1.551	1.214	1.250
8' x 8'	10	12.5	9.5	1.561	1.396	1.258
8' x 9'	10	12.5	11	1.589	1.578	1.280
8' x 10'	10	12.5	12	1.608	1.760	1.296

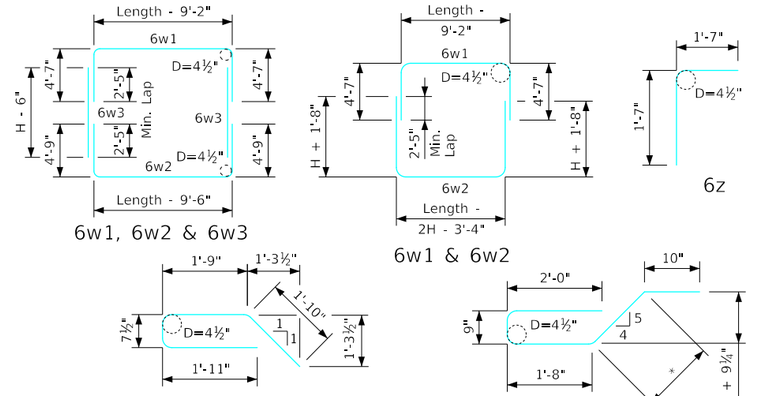


Top & Sides - Bars 6y1



Bottom - Bars 6y2 & 6z

Bent Bar Details



Note:
All dimensions are out to out. D = pin diameter.
* 1.3 times vertical dimension.

Notes:

1. Dimensions and quantities shown are based on slab, floor, and wall thicknesses (A, B, and C, respectively). Values for these dimensions, under varying fill conditions, can be found on the RCB culvert barrel detail sheets.
2. Change lengths of bars 6w1, 6w2, 6z, and adjust reinforcing steel and concrete quantities accordingly for slab, wall, and floor thicknesses other than shown.
3. All bar lengths are estimated with a 2" clearance from concrete edge to outside of bar, except as noted.
4. Material and construction to be in accordance with the current Standard Specifications of I.D.O.T.
5. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
6. Barrel floor bars m1 & m9 are to be shortened 6" in length at bell joints.
7. Dimensions "A", "B" and "C" are in inches. "Length" dimensions in bar lists are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

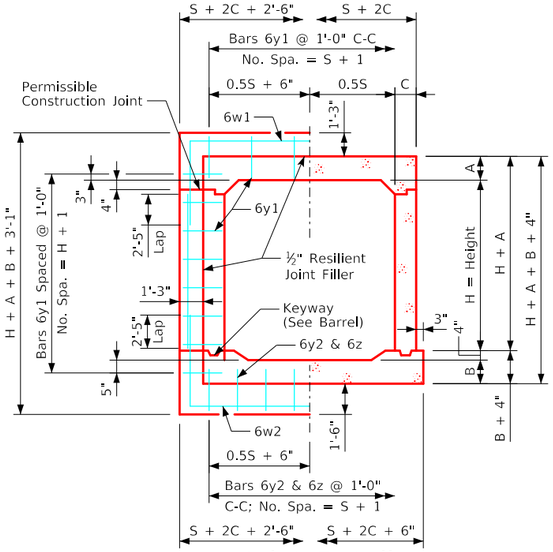
July, 2020

Culvert Bell Joints

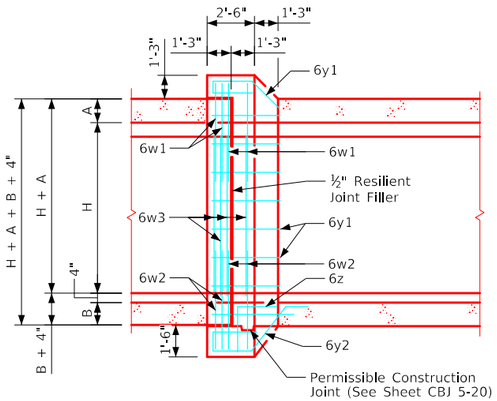
6' & 8' Spans

CBJ 2-20

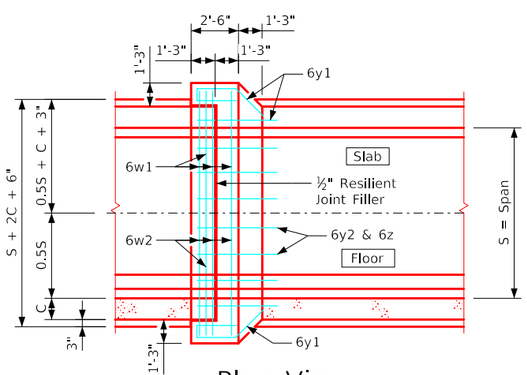
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - CBJ 2-20 - THIS SHEET ISSUED 07-2020.



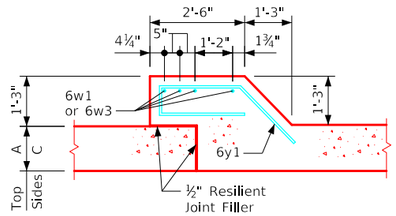
Joint Detail
Section thru Barrel



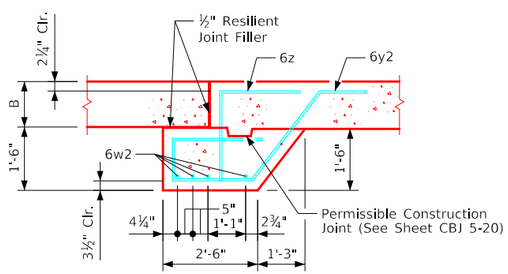
Longitudinal Section



Plan View



Top & Sides - Bars 6y1



Bottom - Bars 6y2 & 6z

Estimate of Quantities - One Joint - 10' Span

Bill of Reinforcing Steel			10' x 4'			10' x 5'			10' x 6'			10' x 7'			10' x 8'			10' x 9'			10' x 10'			10' x 11'			10' x 12'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	23'-10	143	4	23'-10	143	4	23'-10	143	4	23'-10	143	4	23'-11	144	4	24'-1	145	4	24'-4	146	4	24'-6	147	4	24'-9	149
6w2	Floor & Walls		4	26'-4	158	4	28'-4	170	4	24'-4	146	4	24'-4	146	4	24'-5	147	4	24'-7	148	4	24'-10	149	4	25'-0	150	4	25'-3	152
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114	8	10'-6	126	8	11'-6	138
6y1	Top & Sides		24	8'-0	288	26	8'-0	312	28	8'-0	336	30	8'-0	360	32	8'-0	385	34	8'-0	409	36	8'-0	433	38	8'-0	457	40	8'-0	481
6y2	Bottom		12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-7	173	12	9'-7	173	12	9'-7	173	12	9'-7	173	12	9'-7	173
6z	Bottom & Floor		12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71
Total Weight (LB)					831			867			933			969			1010			1048			1086			1124			1164
Total Concrete (CY)				6.2			6.5			6.8			7.1			7.4			7.8			8.1			8.5			8.8	

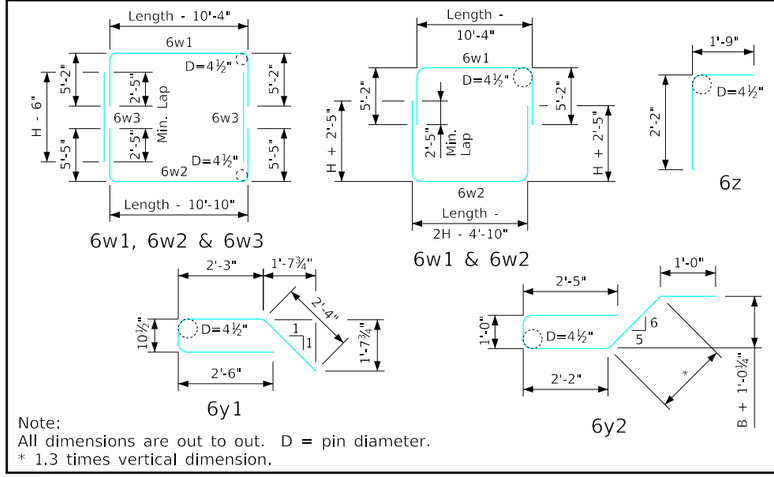
Estimate of Quantities - One Joint - 12' Span

Bill of Reinforcing Steel			12' x 4'			12' x 5'			12' x 6'			12' x 7'			12' x 8'			12' x 9'			12' x 10'			12' x 11'			12' x 12'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	26'-0	156	4	26'-0	156	4	25'-11	156	4	25'-11	156	4	25'-11	156	4	26'-1	157	4	26'-4	158	4	26'-7	160	4	26'-9	161
6w2	Floor & Walls		4	28'-6	171	4	30'-6	183	4	26'-5	159	4	26'-5	159	4	26'-5	159	4	26'-7	160	4	26'-10	161	4	27'-1	163	4	27'-3	164
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114	8	10'-6	126	8	11'-6	138
6y1	Top & Sides		26	8'-0	312	28	8'-0	336	30	8'-0	360	32	8'-0	385	34	8'-0	409	36	8'-0	433	38	8'-0	457	40	8'-0	481	42	8'-0	505
6y2	Bottom		14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207
6z	Bottom & Floor		14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82
Total Weight (LB)					928			964			1030			1067			1103			1141			1179			1219			1257
Total Concrete (CY)				7.0			7.3			7.6			7.9			8.1			8.5			8.8			9.2			9.6	

Concrete Placement

Barrel Size	Barrel Dimension			Bell Joint Quantities (CY)		
	A	B	C	Footing	Walls	Slab
10' x 4'	12.5	14.5	9	2.819	1.047	2.372
10' x 5'	12.5	14.5	9	2.819	1.332	2.372
10' x 6'	12.5	14.5	9	2.819	1.618	2.372
10' x 7'	12.5	14.5	9	2.819	1.903	2.372
10' x 8'	12.5	15	9.5	2.846	2.189	2.383
10' x 9'	12.5	15	10.5	2.874	2.474	2.407
10' x 10'	12.5	15	12	2.917	2.760	2.443
10' x 11'	12.5	15	13	2.946	3.045	2.467
10' x 12'	12.5	15	14.5	2.989	3.331	2.502
12' x 4'	14.5	17	10	3.251	1.047	2.728
12' x 5'	14.5	17	10	3.251	1.332	2.728
12' x 6'	14.5	17	9.5	3.237	1.618	2.717
12' x 7'	14.5	17	9.5	3.237	1.903	2.717
12' x 8'	14.5	17	9.5	3.237	2.189	2.717
12' x 9'	14.5	17	10.5	3.265	2.474	2.740
12' x 10'	14.5	17	12	3.308	2.760	2.776
12' x 11'	14.5	17.5	13.5	3.363	3.045	2.812
12' x 12'	14.5	17.5	14.5	3.392	3.331	2.835

Bent Bar Details



Note:
All dimensions are out to out. D = pin diameter.
* 1.3 times vertical dimension.

Notes:

1. Dimensions and quantities shown are based on slab, floor, and wall thicknesses (A, B, and C, respectively). Values for these dimensions, under varying fill conditions, can be found on the RCB culvert barrel detail sheets.
2. Change lengths of bars 6w1, 6w2, 6z, and adjust reinforcing steel and concrete quantities accordingly for slab, wall, and floor thicknesses other than shown.
3. All bar lengths are estimated with a 2" clearance from concrete edge to outside of bar, except as noted.
4. Material and construction to be in accordance with the current Standard Specifications of I.D.O.T.
5. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
6. Barrel floor bars m1 & m9 are to be shortened 6" in length at bell joints.
7. Dimensions "A", "B" and "C" are in inches. "Length" dimensions in bar lists are in feet and inches.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Bell Joints

10' & 12' Spans

CBJ 3-20

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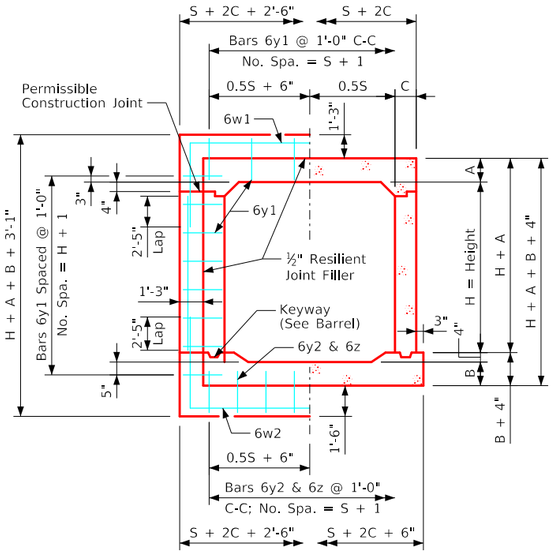
Estimate of Quantities - One Joint - 14' Spans

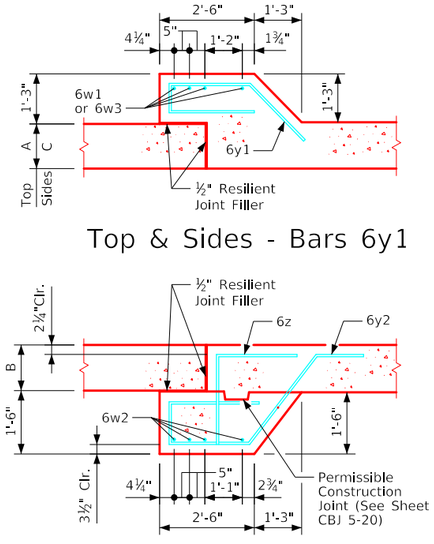
Bill of Reinforcing Steel			14' x 4'			14' x 5'			14' x 6'			14' x 7'			14' x 8'			14' x 9'			14' x 10'			14' x 11'			14' x 12'			14' x 13'			14' x 14'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	
6w1	Slab & Walls		4	27'-4	164	4	27'-4	164	4	27'-6	165	4	27'-6	165	4	27'-6	165	4	27'-6	165	4	27'-8	166	4	27'-10	167	4	28'-0	168	4	28'-2	169	4	28'-4	170
6w2	Floor & Walls		4	29'-8	178	4	31'-8	190	4	27'-10	167	4	27'-10	167	4	27'-10	167	4	27'-10	167	4	28'-0	168	4	28'-2	169	4	28'-4	170	4	28'-6	171	4	28'-8	172
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114	8	10'-6	126	8	11'-6	138	8	12'-6	150	8	13'-6	162
6y1	Top & Sides		28	8'-0	336	30	8'-0	360	32	8'-0	385	34	8'-0	409	36	8'-0	433	38	8'-0	457	40	8'-0	481	42	8'-0	505	44	8'-0	529	46	8'-0	553	48	8'-0	577
6y2	Bottom		16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224	16	9'-4	224
6z	Bottom & Floor		16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90	16	3'-9	90
Total Weight (LB)					992			1028			1097			1133			1169			1205			1243			1281			1319			1357			1395
Total Concrete (CY)				7.4			7.7			8.0			8.2			8.5			8.8			9.2			9.5			9.8			10.2			10.5	

Estimate of Quantities - One Joint - 16' Spans

Bill of Reinforcing Steel			16' x 4'			16' x 5'			16' x 6'			16' x 7'			16' x 8'			16' x 9'			16' x 10'			16' x 11'			16' x 12'			16' x 13'			16' x 14'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	
6w1	Slab & Walls		4	29'-5	177	4	29'-5	177	4	29'-7	178	4	29'-6	177	4	29'-6	177	4	29'-6	177	4	29'-8	178	4	29'-10	179	4	30'-0	180	4	30'-2	181	4	30'-4	182
6w2	Floor & Walls		4	31'-9	191	4	33'-9	203	4	29'-11	180	4	29'-10	179	4	29'-10	179	4	29'-10	179	4	30'-0	180	4	30'-2	181	4	30'-4	182	4	30'-6	183	4	30'-8	184
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114	8	10'-6	126	8	11'-6	138	8	12'-6	150	8	13'-6	162
6y1	Top & Sides		30	8'-0	360	32	8'-0	385	34	8'-0	409	36	8'-0	433	38	8'-0	457	40	8'-0	481	42	8'-0	505	44	8'-0	529	46	8'-0	553	48	8'-0	577	50	8'-0	601
6y2	Bottom		18	9'-4	252	18	9'-4	252	18	9'-5	255	18	9'-6	257	18	9'-6	257	18	9'-6	257	18	9'-6	257	18	9'-6	257	18	9'-6	257	18	9'-5	255	18	9'-5	255
6z	Bottom & Floor		18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101	18	3'-9	101
Total Weight (LB)					1081			1118			1189			1225			1261			1297			1335			1373			1411			1447			1485
Total Concrete (CY)				8.1			8.4			8.7			9.0			9.3			9.5			9.9			10.2			10.5			10.8			11.2	



Joint Detail
Section thru Barrel



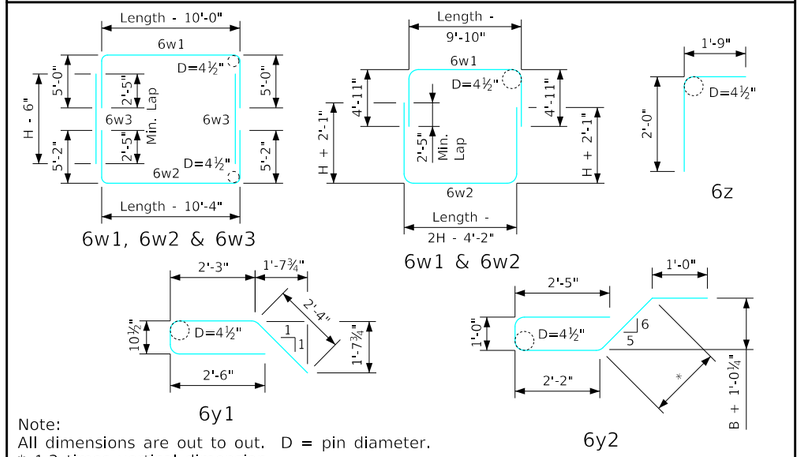
Top & Sides - Bars 6y1

Bottom - Bars 6y2 & 6z

Concrete Placement

Barrel Size	Barrel Dimension			Bell Joint Quantities (CY)		
	A	B	C	Footing	Walls	Slab
14' x 4'	10	12.5	9	3.459	1.047	2.883
14' x 5'	10	12.5	9	3.459	1.332	2.883
14' x 6'	10	12.5	9	3.459	1.618	2.883
14' x 7'	10	12.5	9	3.459	1.903	2.883
14' x 8'	10	12.5	9	3.459	2.189	2.883
14' x 9'	10	12.5	9	3.459	2.474	2.883
14' x 10'	10	12.5	10	3.487	2.760	2.907
14' x 11'	10	12.5	11	3.516	3.045	2.931
14' x 12'	10	12.5	12	3.544	3.331	2.954
14' x 13'	10	12.5	13	3.573	3.616	2.978
14' x 14'	10	12.5	14	3.602	3.902	3.002
16' x 4'	11	13	9.5	3.828	1.047	3.204
16' x 5'	11	13	9.5	3.828	1.332	3.204
16' x 6'	11	13.5	9.5	3.840	1.618	3.204
16' x 7'	12	14.5	9	3.849	1.903	3.216
16' x 8'	12	14.5	9	3.849	2.189	3.216
16' x 9'	12	14.5	9	3.849	2.474	3.216
16' x 10'	11.5	14.5	10	3.878	2.760	3.228
16' x 11'	11	14.5	11	3.907	3.045	3.240
16' x 12'	11	14	12	3.923	3.331	3.264
16' x 13'	11	13.5	13	3.940	3.616	3.288
16' x 14'	11	13.5	14	3.969	3.902	3.311

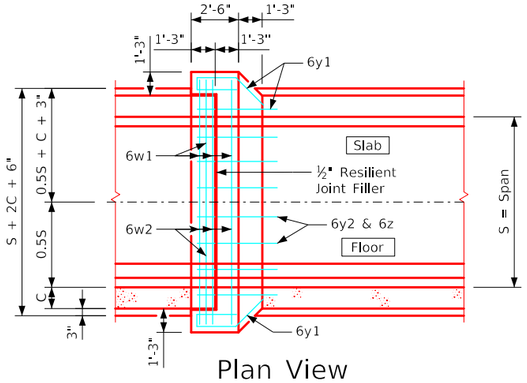
Bent Bar Details



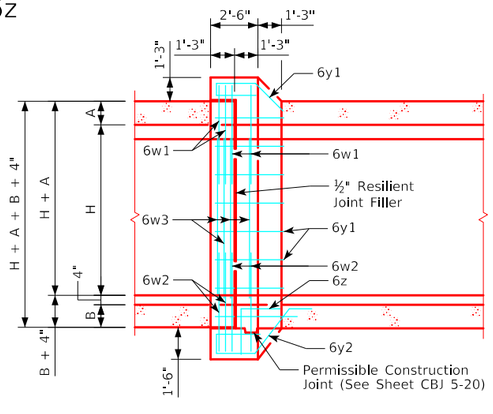
Note:
All dimensions are out to out. D = pin diameter.
* 1.3 times vertical dimension.

Notes:

1. Dimensions and quantities shown are based on slab, floor, and wall thicknesses (A, B, and C, respectively). Values for these dimensions, under varying fill conditions, can be found on the RCB culvert barrel detail sheets.
2. Change lengths of bars 6w1, 6w2, 6z, and adjust reinforcing steel and concrete quantities accordingly for slab, wall, and floor thicknesses other than shown.
3. All bar lengths are estimated with a 2" clearance from concrete edge to outside of bar, except as noted.
4. Material and construction to be in accordance with the current Standard Specifications of I.D.O.T.
5. See Sheet RCB G2-20 for General Notes, Specifications, and Design Stresses.
6. Barrel floor bars m1 & m9 are to be shortened 6" in length at bell joints.
7. Dimensions "A", "B" and "C" are in inches. "Length" dimensions in bar lists are in feet and inches.



Plan View



Longitudinal Section

IOWA DOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Bell Joints

14' & 16' Spans

CBJ 4-20

LATEST REVISION DATE

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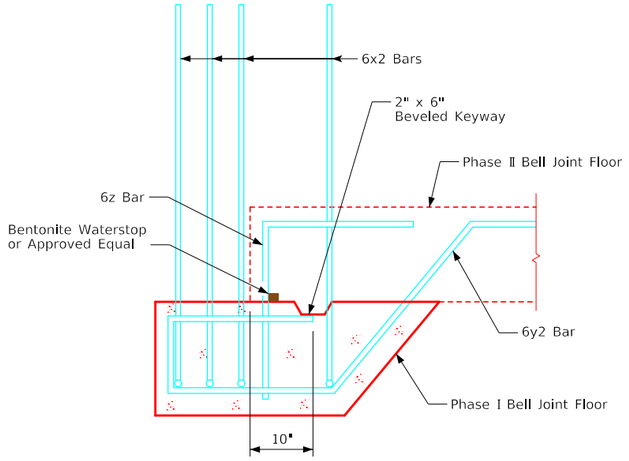
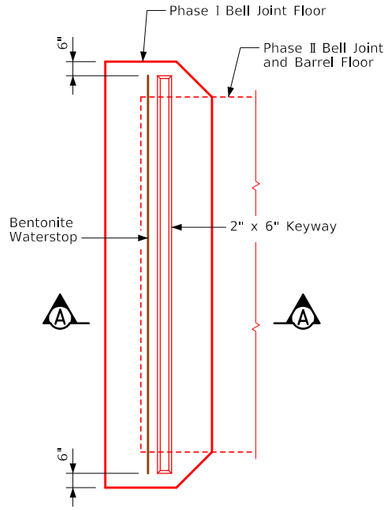


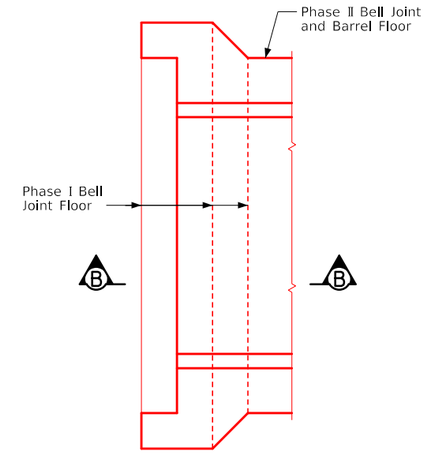
Section A-A

Bell Joint at Floor



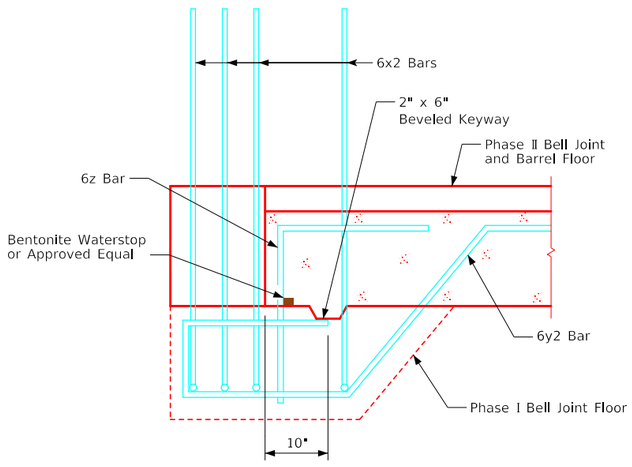
Plan View - Phase I

(Showing Phase I of floor bell joint construction)



Plan View - Phase II

(Showing Phase II of floor bell joint
and barrel floor construction)



Section B-B

Bell Joint at Floor

Notes:

1. The details shown on this sheet are an option for the contractor to construct the floor of the bell joint with a permissible construction joint as shown.
2. Reinforcing steel will be placed prior to placing the phase I concrete.
3. The cost of the waterstop is considered incidental to the project.
4. A 2" x 6" beveled keyway will be formed to the distance shown and location noted before placing the concrete.
5. For details and dimensions of the bell joint refer to the bell joint standard sheets.
6. Cost of waterstop considered incidental to the project.

LATEST REVISION DATE

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IOWADOT Highway Division

Standard Design

Single Reinforced Concrete Box Culverts

July, 2020

Culvert Bell Joints

All Spans

CBJ 5-20