

SECTION ALONG CL OF CULVERT

HYDRAULIC DATA

DRAINAGE AREA = 1.3 square miles

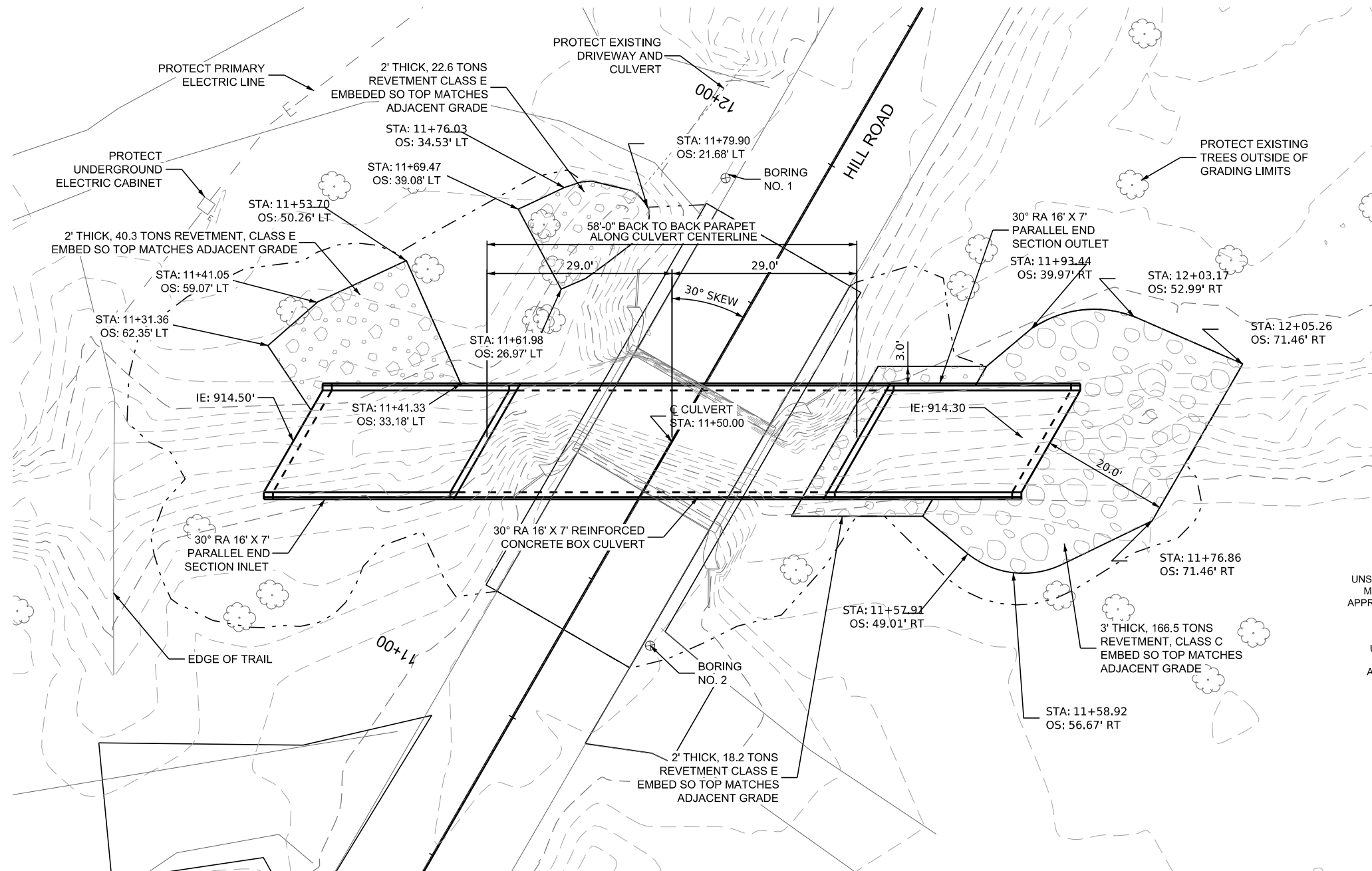
Q25 = 981 cfs  
 Q25 HWE = 924.63  
 Q50 = 1,251 cfs  
 Q50 HWE = 925.38  
 Q100 = 1,552 cfs  
 Q100 HWE = 926.07  
 Q500 = 2,357 cfs  
 Q500 HWE = 927.66  
 LOW ROADWAY = 924.77  
 STREAM SLOPE = 35.45 FT./MI.

NOTE: HIGH WATER ELEVATIONS ASSUMED LOW STAGE (910.50) OF THE VOLGA RIVER

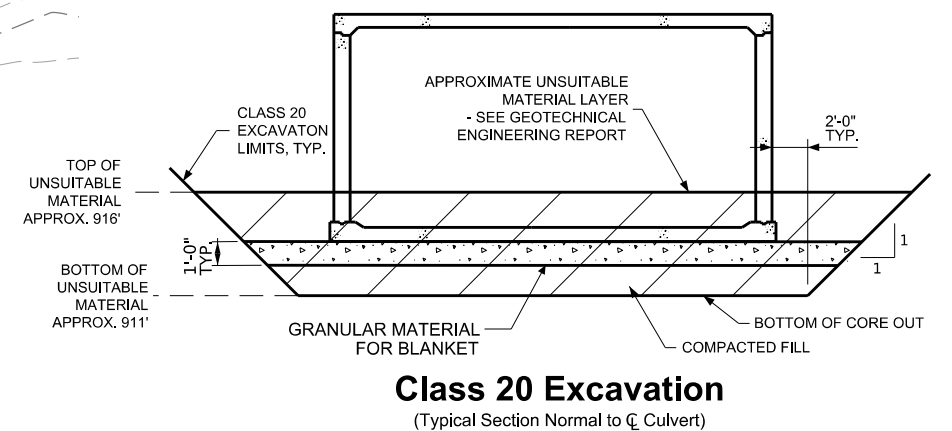
Q100 HIGH WATER ELEVATION = 926.1'

CULVERT NOTES:

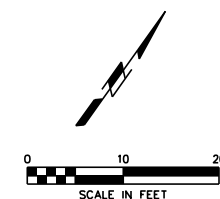
1. BASIS OF DESIGN IS IOWA DOT CAST IN PLACE SINGLE REINFORCED CONCRETE BOX CULVERT STANDARDS.
2. CULVERT MAY BE CAST IN PLACE OR PRECAST SUBJECT TO APPROVED SUBMITTALS. THE SUBMITTED CULVERT SHALL MEET THE STRUCTURAL LOADING, HYDRAULIC CAPACITY, AND DIMENSIONS AS SHOWN ON THE PLANS. CONTRACTOR SHALL ALLOW TEN WORKING DAYS FOR THE ENGINEER TO REVIEW.
3. REFER TO IOWA DOT SINGLE REINFORCED CONCRETE BOX CULVERT STANDARDS RCB G1-20, RCB G2-20, RCB G3-20, RCB 16-7-20, PWH 30-1-20, PWH 30-2-20, PWH 30-3-20, PWH 30-4-20, AND PWH 30-5-20 IF CAST IN PLACE OPTION IS CHOSEN.
4. REFER TO IOWA DOT LRFD PRECAST CULVERT STANDARDS PRCB G1-20, PRCB G2-20, PRCB 16-20, PES 7-20-T3, PES 8-20-T3, PES 9-20-T3, PES 10-20-T3, AND PES 11-20 IF PRECAST OPTION IS CHOSEN.
5. THE CONTRACTOR WILL BE PAID BY THE RCB BARREL AND RCB END SECTION BID ITEMS REGARDLESS OF WHETHER THE CAST IN PLACE OR PRECAST OPTION IS CHOSEN. NO ADDITIONAL PAYMENT WILL BE MADE IN EITHER CASE.
6. CONTRACTOR TO ATTEMPT TO REMOVE EXISTING BRIDGE PILES COMPLETELY, IF PILES CANNOT BE REMOVED, CUT AND REMOVE TOP OF PILING TO 2' MIN. BELOW BASE OF PROPOSED CULVERT CORE OUT. REMOVAL OF PILING SHALL BE CONSIDERED INCIDENTAL TO THE REMOVAL OF EXISTING BRIDGE ITEM.
7. GRADING AND REVEMENT LAYOUT SHALL BE APPROPRIATELY MODIFIED TO ACCOUNT FOR SELECTED END SECTION LENGTH. INTENT SHOWN IN THESE PLANS SHALL BE MAINTAINED.



SITUATION PLAN



Class 20 Excavation  
(Typical Section Normal to CL Culvert)



DESIGN FOR  
**SINGLE 16' X 7' X 58'**  
**REINFORCED CONCRETE BOX CULVERT**

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NO.	REVISION DESCRIPTION	APPROVED	DATE



# Single Reinforced Concrete Box Culvert Standards

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CBJ 5-20	Culvert Bell Joints, All Spans

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

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Standard Design <b>Single Reinforced Concrete Box Culverts</b> July, 2020
		Index of Sheets
		RCB G1-20

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# Single Reinforced Concrete Box Culvert Standards

## General Notes:

- The RCB culvert sections are designed for HL-93 live load and earth fills of varying heights.
- Vertical earth pressure,  $EV=0.120$  kcf.  
Horizontal earth pressure,  $EH_{max} = 0.060$  kcf max,  $EH_{min} = 0.030$  kcf.
- 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.
- 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.
- The clear distance from face of concrete to near edge or end of reinforcing bar to be 2" unless otherwise noted.
- Except for dowel bars 5r1 in slab, longitudinal reinforcing is not to extend thru the construction joints.
- Floor of barrel is to be finished smooth. Sides of footing are to be formed to insure correct line and grade.
- The permissible construction joint at the top of the walls may be lowered at the Contractor's option with Engineer's approval.
- 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.
- 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.
- 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"
  - All construction joints shall be formed with a beveled keyway except at bell joints.
  - All beveled keyways shall be centered.
  - 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.
  - 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.
  - 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.
  - All dimensions are in feet and inches unless otherwise noted or shown.
  - See current Standard Specifications regarding concrete form removal.
  - 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

- 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.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Standard Design <b>Single Reinforced Concrete Box Culverts</b> July, 2020	
		General Notes & Specifications	RCB G2-20

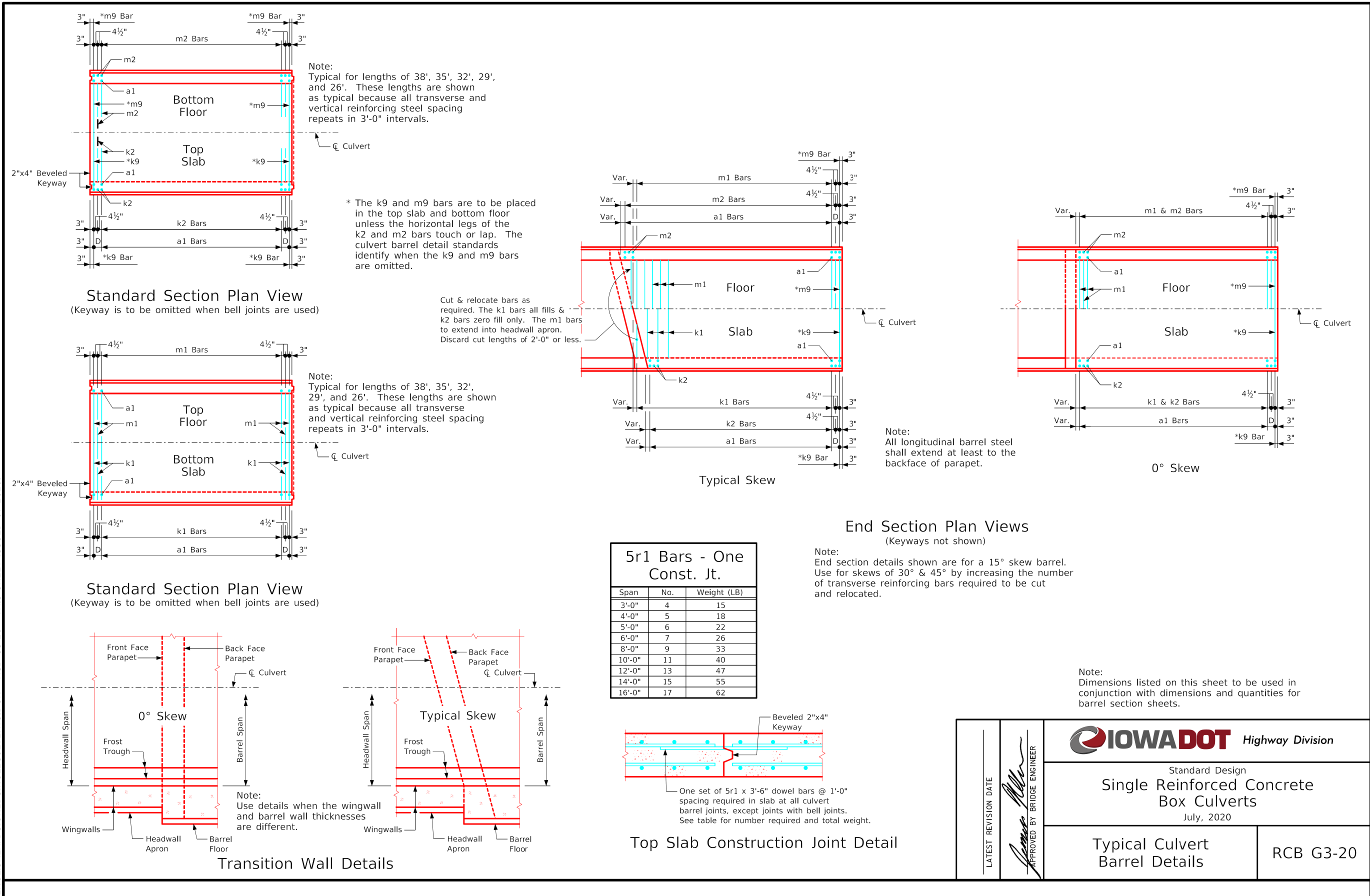
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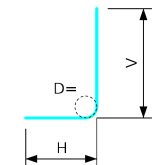
LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	<b>IOWA DOT Highway Division</b>	
		Standard Design <b>Single Reinforced Concrete Box Culverts</b> July, 2020	
		Typical Culvert Barrel Details	RCB G3-20

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

Fill		Dimensions						Bar List																								Quantities																	
								a1			b1			e1			e2			f1			f2			k1			k2			k9			m1			m2			m9			Concrete (CY/FT)				Steel (LB/FT)	
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	12	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

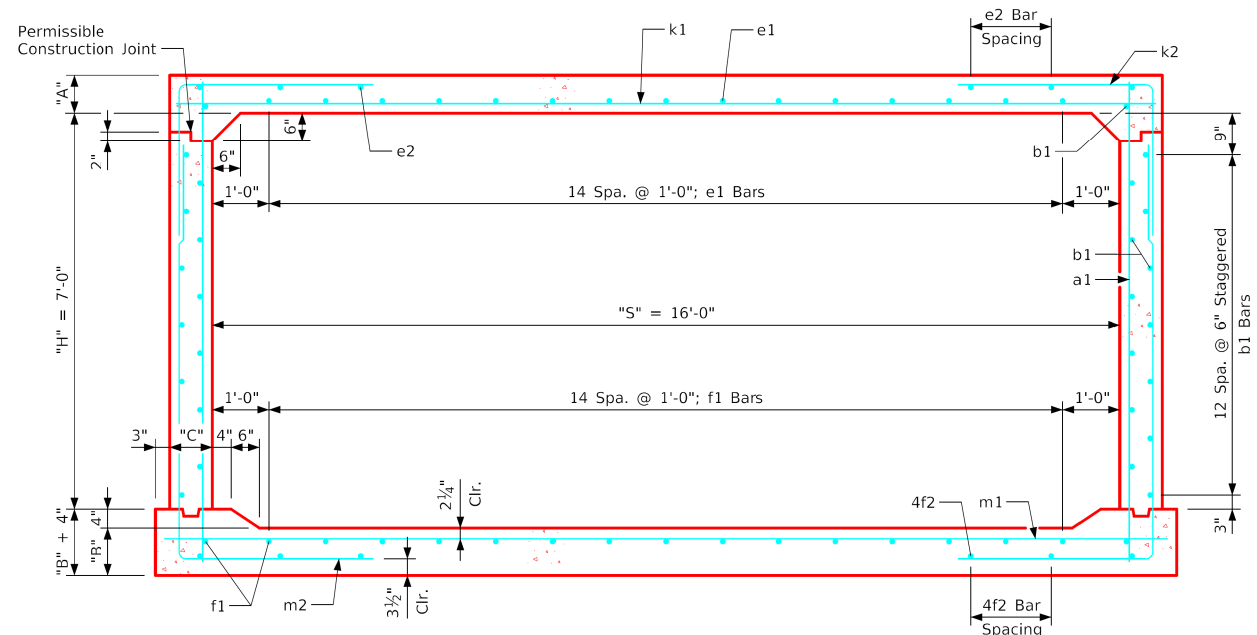
#### Bent Bar Detail

Bars	D
5	3 3/4"
6	4 1/2"
7	5 1/4"
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	Standard Design <b>Single Reinforced Concrete Box Culverts</b> July, 2020
Culvert Barrel Details 16' x 7' Barrel Sections		<b>RCB 16-7-20</b>

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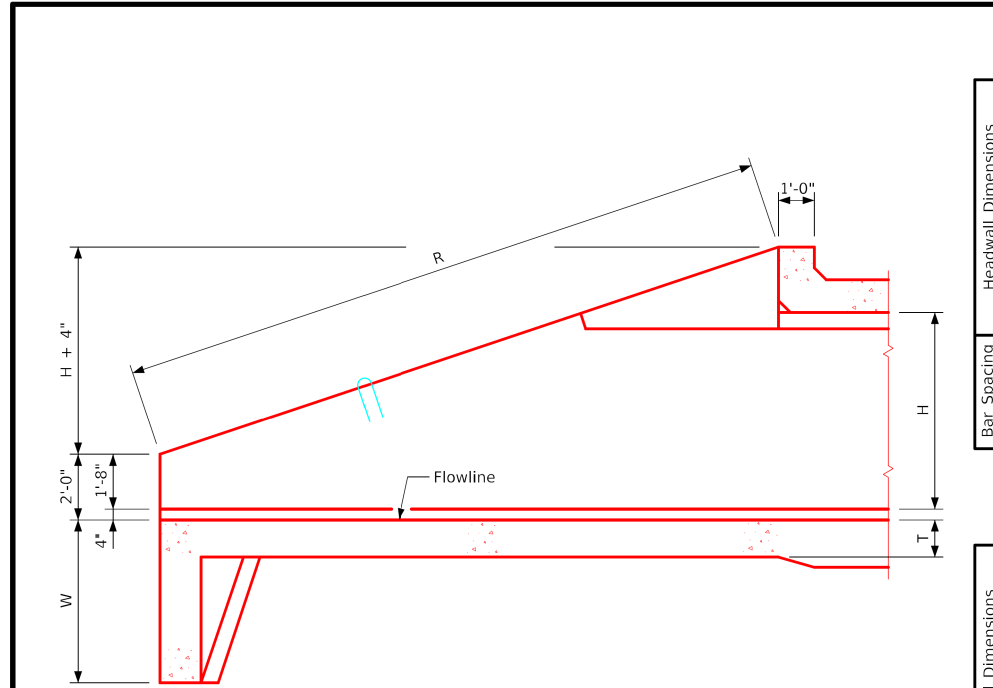
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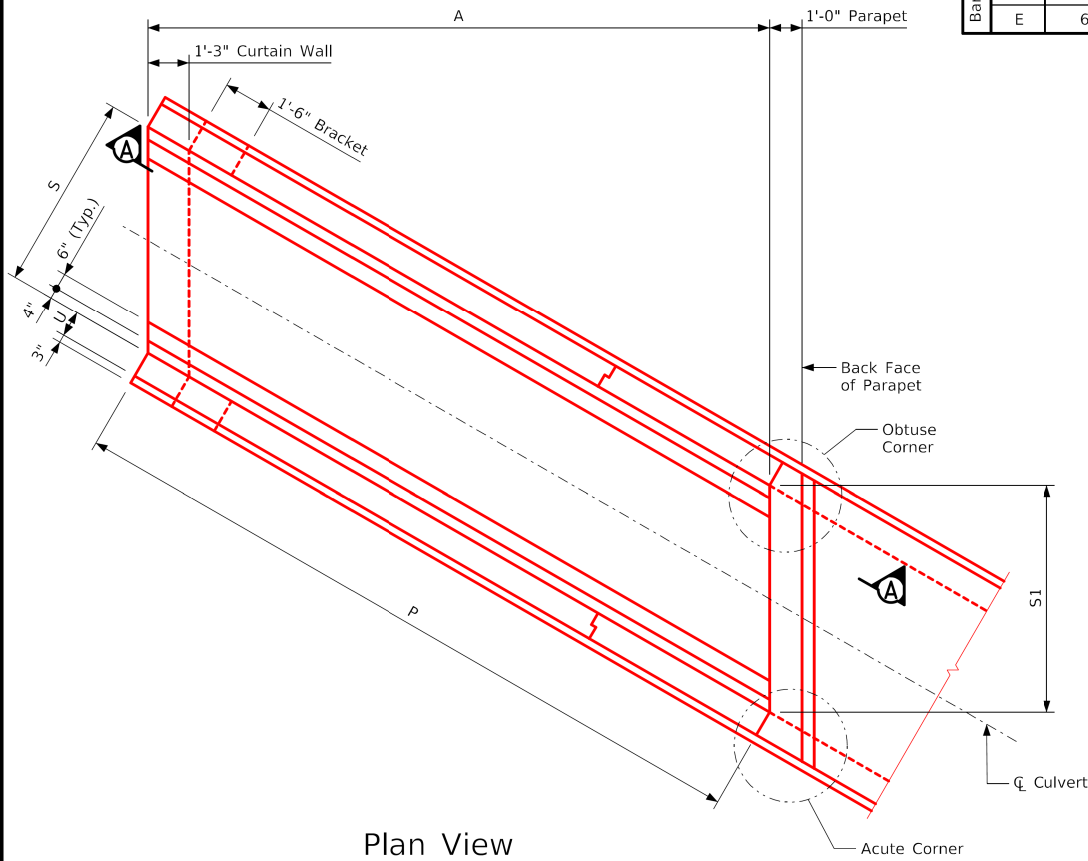
NO.	REVISION DESCRIPTION	APPROVED	DATE

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Elevation Section A-A



Plan View

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
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'-7 7/8	46'-2 1/4	42'-8 3/8	39'-3 3/8	35'-9 1/2	32'-4	28'-10 3/8	25'-4 7/8	21'-11 1/4	18'-5 3/4	15'-0 3/8	49'-7 7/8	46'-2 1/4	42'-8 3/8	39'-3 3/8	35'-9 1/2	32'-4	28'-10 3/8	25'-4 7/8	21'-11 1/4	P
R	51'-8 1/8	48'-0 7/8	44'-5 5/8	40'-10 3/8	37'-3 3/8	33'-7 7/8	30'-0 1/2	26'-5 1/4	22'-10	19'-2 3/4	15'-7 1/2	51'-8 1/8	48'-0 7/8	44'-5 5/8	40'-10 3/8	37'-3 3/8	33'-7 7/8	30'-0 1/2	26'-5 1/4	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'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	18'-5 3/4	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
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	9	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

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
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'-5 3/4	15'-0 3/8	42'-8 3/8	39'-3 3/8	35'-9 1/2	32'-4	28'-10 3/8	25'-4 7/8	21'-11 1/4	18'-5 3/4	15'-0 3/8	42'-8 3/8	39'-3 3/8	35'-9 1/2	32'-4	28'-10 3/8	25'-4 7/8	21'-11 1/4	18'-5 3/4	15'-0 3/8	P
R	19'-2 3/4	15'-7 1/2	44'-5 5/8	40'-10 3/8	37'-3 3/8	33'-7 7/8	30'-0 1/2	26'-5 1/4	22'-10	19'-2 3/4	15'-7 1/2	44'-5 5/8	40'-10 3/8	37'-3 3/8	33'-7 7/8	30'-0 1/2	26'-5 1/4	22'-10	19'-2 3/4	15'-7 1/2	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'-10 1/4	13'-10 1/4	13'-10 1/4	13'-10 1/4	13'-10 1/4	13'-10 1/4	13'-10 1/4	13'-10 1/4	13'-10 1/4	11'-6 3/8	11'-6 3/8	11'-6 3/8	11'-6 3/8	11'-6 3/8	11'-6 3/8	11'-6 3/8	11'-6 3/8	11'-6 3/8	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
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	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	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

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
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'-9 1/2	32'-4	28'-10 3/8	25'-4 7/8	21'-11 1/4	18'-5 3/4	15'-0 3/8	28'-10 3/8	25'-4 7/8	21'-11 1/4	18'-5 3/4	15'-0 3/8	11'-6 3/8	21'-11 1/4	18'-5 3/4	15'-0 3/8	11'-6 3/8	P
R	37'-3 3/8	33'-7 7/8	30'-0 1/2	26'-5 1/4	22'-10	19'-2 3/4	15'-7 1/2	30'-0 1/2	26'-5 1/4	22'-10	19'-2 3/4	15'-7 1/2	12'-0 1/4	22'-10	19'-2 3/4	15'-7 1/2	12'-0 1/4	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'-2 7/8	9'-2 7/8	9'-2 7/8	9'-2 7/8	9'-2 7/8	9'-2 7/8	9'-2 7/8	6'-11 1/8	6'-11 1/8	6'-11 1/8	6'-11 1/8	6'-11 1/8	6'-11 1/8	5'-9 3/4	5'-9 3/4	5'-9 3/4	5'-9 3/4	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
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:

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

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	<b>IOWA DOT Highway Division</b> Standard Design - Single Reinforced Concrete Box Culverts <b>Parallel Wing Headwalls</b> July, 2020	
		Dimension Table 30° Skew	PWH 30-1-20

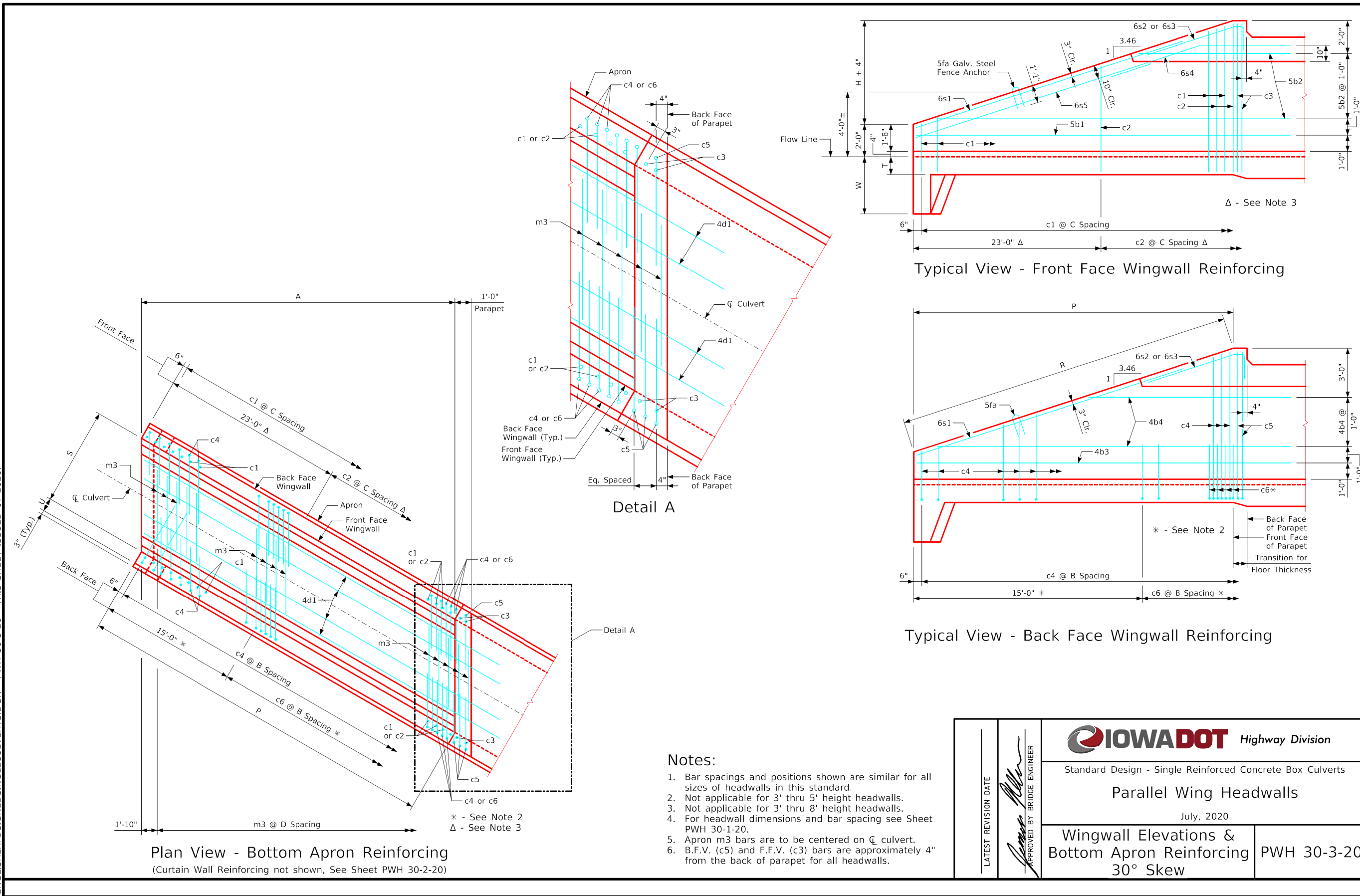
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NO.	REVISION DESCRIPTION	APPROVED	DATE



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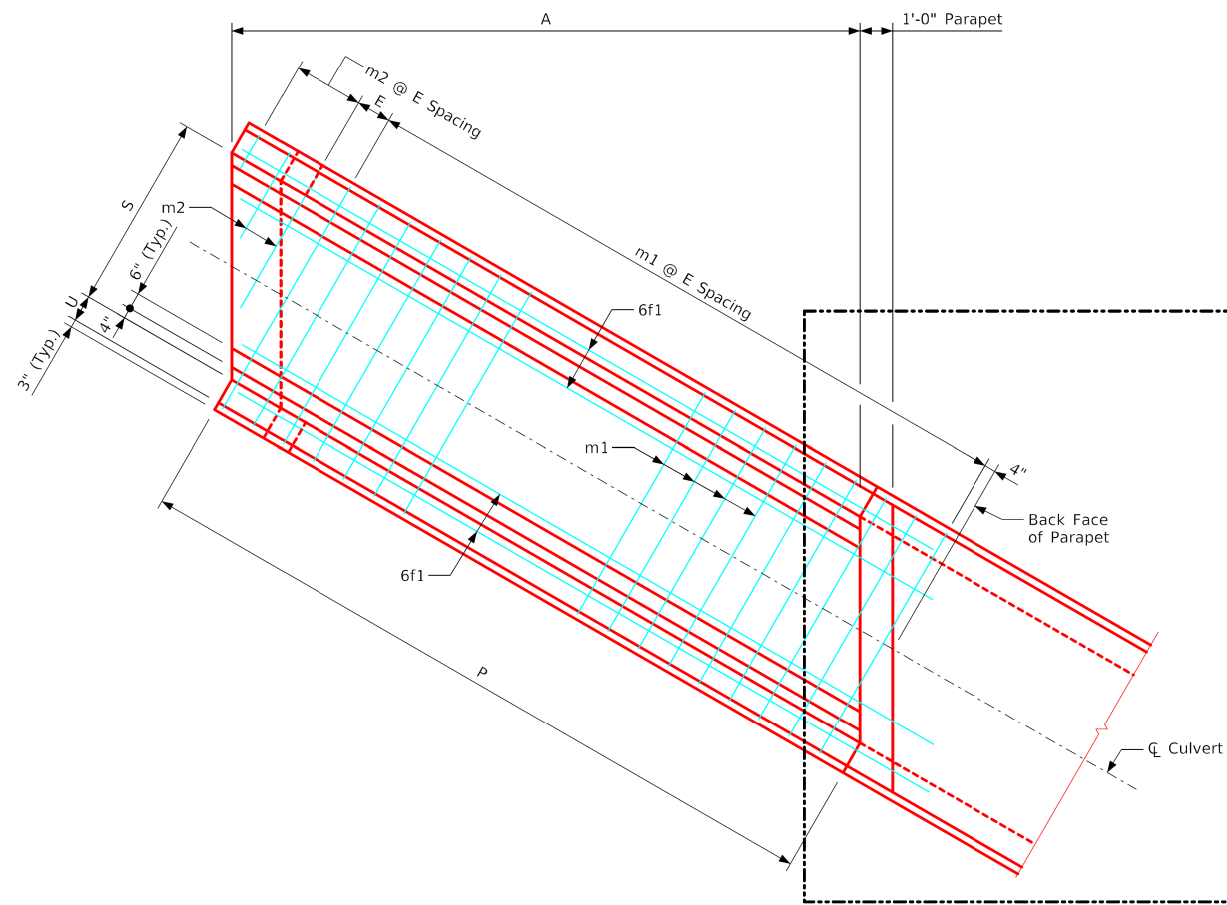
- Notes:**
1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
  2. Not applicable for 3' thru 5' height headwalls.
  3. Not applicable for 3' thru 8' height headwalls.
  4. For headwall dimensions and bar spacing see Sheet PWH 30-1-20.
  5. Apron m3 bars are to be centered on  $\phi$  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	<b>IOWA DOT Highway Division</b>	
		Standard Design - Single Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls	
		July, 2020	
		Wingwall Elevations & Bottom Apron Reinforcing	PWH 30-3-20 30° Skew

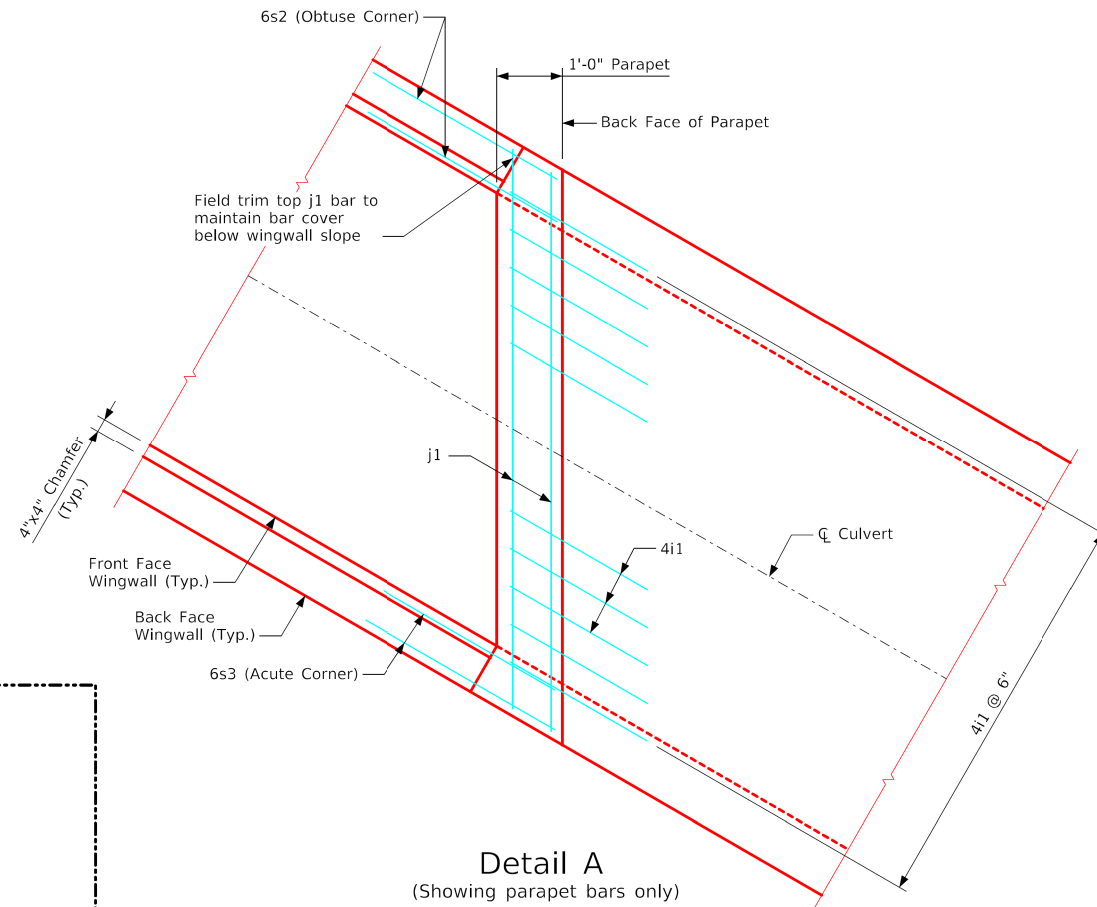
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NO.	REVISION DESCRIPTION	APPROVED	DATE





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		
	Standard Design - Single Reinforced Concrete Box Culverts <b>Parallel Wing Headwalls</b> July, 2020	
	Parapet Reinforcing & Top Apron Reinforcing 30° Skew	PWH 30-4-20

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NO.	REVISION DESCRIPTION	APPROVED	DATE

### 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	579	4c1	64 Var.	2 Each 2'-10 to 11'-9	492	4c1	56 Var.	2 Each 2'-10 to 10'-10	415	4c1	48 Var.	2 Each 2'-10 to 9'-0	347									
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				9,676 LB				8,178 LB				6,520 LB				5,764 LB				4,876 LB										
	Concrete	Parapet Δ	2.5					2.5					2.4					2.4					2.2					2.2					2.1								
		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		
	Apron *	53.7					50.1					46.0					42.4					37.9					34.4					30.9					27.1				

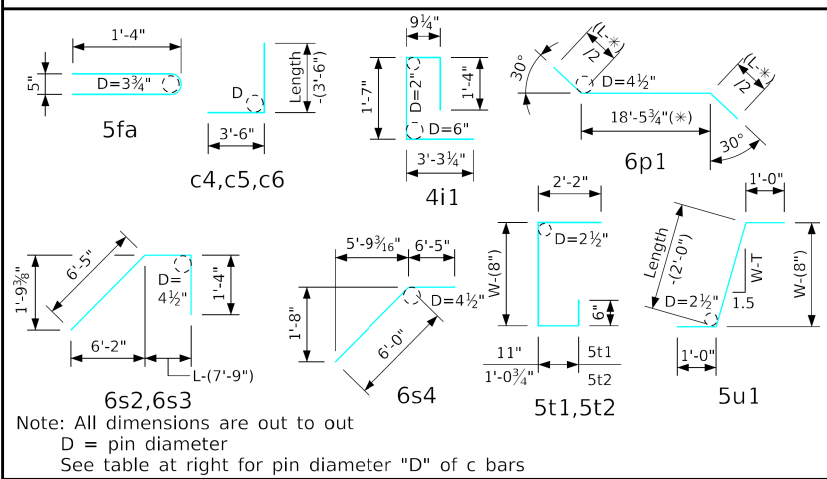
Δ Includes top of wingwall quantities.

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

#### Bent Bar Details



c Bar Pin Diameter	
Bar Size	D
5	3 3/8"
6	4 1/2"
7	5 1/2"

#### Headwall Notes:

- This headwall is based on a 3:1 slope normal to centerline of roadway.
- The sides of the apron are to be formed to ensure correct line and grade.
- All apron reinforcing steel is to be supported by bar chairs at intervals of not more than 3'-0" in either direction as outlined in the Standard Specifications.
- Clear distance from face of concrete to near reinforcing bar is to be 2" unless otherwise noted or shown. Clearance to the bottom ends of vertical bars shall be 3 inches.
- Concrete quantities are estimated from back of parapet.
- Horizontal tails of bars "b" & "s" estimated to extend 2'-5" beyond back of parapet (into end of barrel). Longitudinal bars "4d1" and "6f1" estimated to project into end section of barrel a minimum of 2'-5" beyond back of parapet. The "length" column reflects total number of feet necessary to meet these requirements.
- Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Standard Design - Single Reinforced Concrete Box Culverts <b>Parallel Wing Headwalls</b> July, 2020	
		Quantity Tabulation 16'-0" Span 30° Skew	PWH 30-5-20 SHEET 1 OF 2

NO.	REVISION DESCRIPTION	APPROVED	DATE