

# Index 430-030

## Straight Concrete Endwalls - Single and Multiple Pipe

**ORIGINATION**

**Date:** May 7, 2018

**Name:** Rick Jenkins

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**Email:** [Rick.Jenkins@dot.state.fl.us](mailto:Rick.Jenkins@dot.state.fl.us)

**COMMENTARY**

Added Sheets and Reorganized Index. Moved payment and specification information to Specifications.  
 Sheet 1: General Notes and overall view.

Sheet 2: Concrete Endwall Details from old Sheet 1. Added Sta./Offset Location.

Sheet 3: Quantities Tables from old Sheet 2. Elliptical Concrete and Elliptical/ Arched Corrugated Metal Pipe combined into one table.

Sheet 4: Spacing for Multiple Pipes Details from old Sheet 1.

**COMMENTS AND RESPONSES**

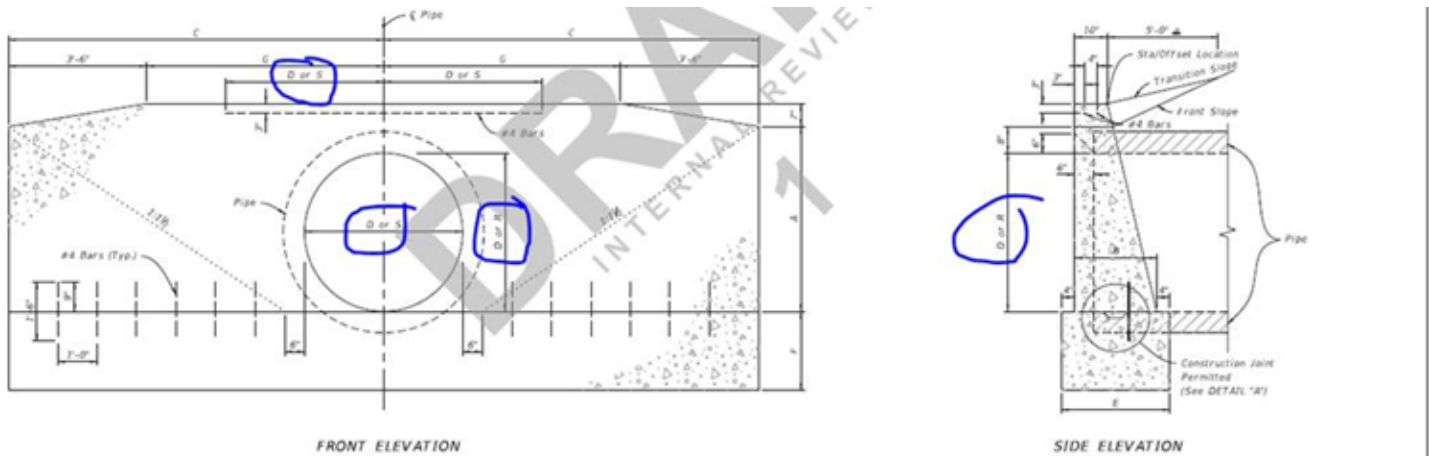
**BLACK** = Industry Review Comments    **RED** = Standard Plans Response

**Name:** Erin Yao

**Date:** August 8, 2019

**COMMENT:**

Sheet 2:



REVISION DESCRIPTION:	FY 2020-21 STANDARD PLANS	STRAIGHT CONCRETE ENDWALLS SINGLE AND MULTIPLE PIPE	INDEX 430-030	SHEET 2 of 4
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Sheet 3:

Match drawing S and R

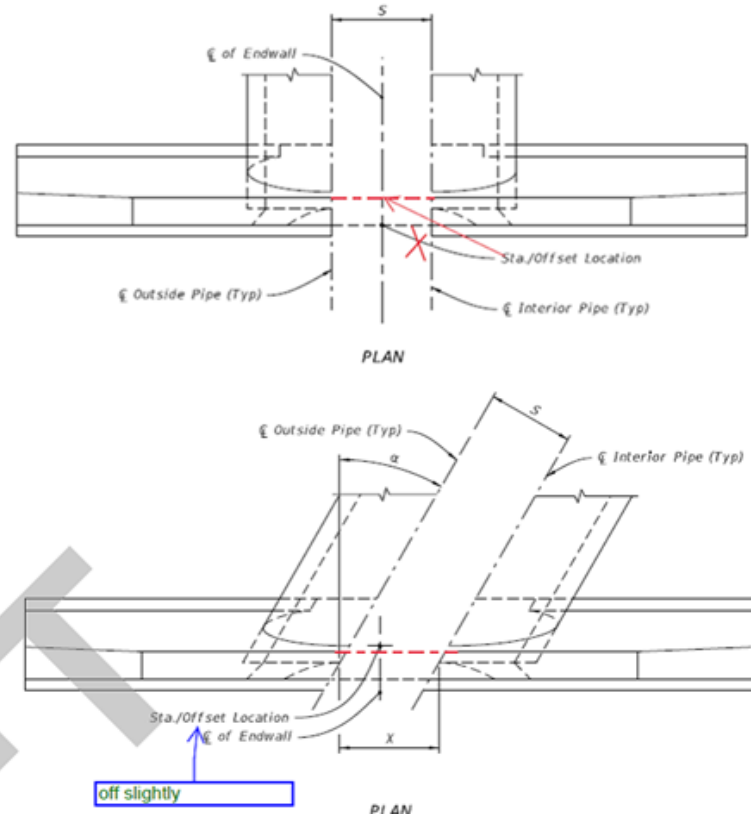
21"	2.41	4.82	7.23	9.64	2-0"	1-4"	3-0"	2-0"	1-4"	1-6"	2-2"	2-2"	2-2"	2-8"	4-0"	2.29	2.81	2.93	3.01	3.17	3.52	3.58	3.71	4		
24"	3.14	6.28	9.42	12.56	2-8"	1-4"	3-0"	2-0"	1-4"	2-0"	2-2"	2-2"	2-2"	2-8"	4-0"	3.14	4.28	4.31	4.43	4.67	5.20	5.27	5.49	5		
30"	4.91	9.82	14.73	19.64	2-2"	1-6"	4-0"	2-2"	1-6"	2-0"	4-2"	4-2"	4-2"	4-2"	6-0"	4.64	6.23	6.60	6.85	7.25	7.34	7.65	8			
36"	7.07	14.14	21.21	28.28	2-8"	1-4"	3-0"	2-0"	1-4"	2-0"	3-11"	3-11"	3-11"	3-11"	6-0"	6.48	8.43	8.50	8.73	9.23	10.38	10.52	10.98	11		
42"	9.62	19.24	28.86	38.48	4-2"	1-10"	6-0"	2-2"	1-6"	2-0"	6-0"	6-0"	6-0"	6-0"	6-11"	8-0"	8.38	10.85	10.94	11.21	11.82	13.34	13.51	14.11	12	
48"	12.57	25.14	37.71	50.28	4-8"	2-1"	9-6"	2-2"	1-6"	2-0"	6-0"	6-0"	6-0"	6-0"	7-10"	9-2"	8.38	10.85	10.94	11.21	11.82	13.34	13.51	14.11	13	
54"	15.90	31.80	47.70	63.60	5-2"	2-0"	10-0"	2-2"	2-2"	2-0"	7-8"	7-8"	7-8"	7-8"	7-11"	8-10"	10-10"	11-77	15.35	15.48	15.90	16.83	18.93	19.18	20.04	14

Span	Rise	Opening Area (SF)		Dimensions													Class I Concrete (CY)											
		Number of Pipes	d	A B C E F G S													Single						Double					
				0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°									
12"	11"	1.1	2.2	3.3	4.4	1-9"	1-9"	3-10"	1-10"	1-2"	0-4"	2-6"	2-6"	2-7"	2-7"	3-6"	1-6	1.47	1.49	1.52	1.60	1.78	1.80	1.88	2.04			
21"	15"	1.6	3.2	4.8	6.4	1-11"	1-2"	4-2"	1-10"	1-2"	0-2"	2-10"	2-11"	1-2"	4-0"	1-3	1.69	1.70	1.75	1.84	2.04	2.06	2.15	2.32				
24"	20"	2.8	5.6	8.4	11.2	2-4"	1-3"	3-2"	1-11"	1-2"	1-4"	3-5"	2-5"	3-4"	3-11"	4-10"	1.8	2.36	2.37	2.39	2.53	2.83	2.89	3.06				
30"	24"	3.3	6.6	9.9	13.2	2-8"	1-2"	3-11"	2-5"	1-4"	2-5"	4-0"	4-0"	4-2"	3-11"	5-6"	2.14	1.93	1.95	1.74	1.32	1.77	1.91	2.09				
36"	30"	5.9	11.8	17.7	23.6	3-1"	1-5"	6-10"	2-1"	1-5"	4-10"	4-9"	4-9"	4-11"	5-6"	6-9"	3.13	4.66	4.69	4.20	4.45	4.99	5.06	5.30				
42"	36"	8.4	16.8	25.2	33.6	3-5"	2-6"	7-8"	2-2"	1-6"	4-2"	3-6"	3-6"	4-6"	5-6"	6-9"	3.83	5.00	5.04	5.18	5.48	6.16	6.24	6.52				
48"	42"	10.8	21.6	32.4	43.2	3-10"	1-2"	8-9"	2-2"	1-2"	3-10"	6-4"	6-4"	6-5"	7-10"	8-10"	4.82	6.11	6.36	6.53	6.91	7.74	7.84	8.18				
54"	48"	13.2	26.4	39.6	52.8	4-2"	1-4"	9-6"	2-4"	1-8"	6-10"	7-11"	7-11"	7-11"	8-10"	10-0"	5.48	7.64	7.70	7.91	8.37	9.40	9.52	9.94				
72"	42"	16.8	33.6	50.4	67.2	1-10"	10-4"	2-6"	2-0"	6-10"	7-10"	7-10"	8-11"	9-11"	11-1"	7-80	10.15	10.23	10.31	11.12	12.49	12.83	13.22	14.43				
18"	12"	1.3	2.6	3.9	5.2	1-4"	1-2"	3-2"	1-10"	1-2"	0-2"	2-10"	2-11"	1-2"	4-0"	1-3	1.45	1.46	1.51	1.60	1.80	1.82	1.91	2.09				
24"	18"	1.8	3.6	5.4	7.2	1-10"	1-2"	4-2"	1-11"	1-2"	0-2"	2-10"	2-11"	1-2"	4-0"	1-3	1.82	1.83	1.89	2.01	2.20	2.22	2.31	2.50				
30"	18"	3.3	6.6	9.9	13.2	2-5"	1-4"	5-10"	2-4"	1-4"	10-9"	6-2"	4-2"	6-6"	4-10"	10-11"	1.89	2.55	2.57	2.65	2.82	3.22	3.27	3.43				
36"	24"	5.1	10.2	15.3	20.4	2-8"	1-5"	6-3"	2-1"	1-5"	12-9"	5-2"	3-2"	5-6"	10-10"	10-4"	2.64	3.55	3.58	3.69	3.93	4.48	4.54	4.77				
42"	30"	7.4	14.8	22.2	29.6	3-1"	1-6"	7-6"	2-2"	0-2"	10-9"	4-5"	3-5"	5-6"	10-11"	8-6"	3.32	4.48	4.52	4.65	4.96	5.64	5.72	6.00				
54"	36"	10.2	20.4	30.6	40.8	3-4"	2-2"	7-11"	2-2"	0-2"	10-9"	4-5"	3-5"	5-6"	10-11"	8-6"	4.24	5.76	5.81	6.00	6.39	7.29	7.40	7.76				
60"	36"	12.9	25.8	38.7	51.6	3-10"	1-2"	8-9"	2-4"	1-8"	10-9"	5-2"	3-2"	5-6"	11-2"	5-22	7.16	7.23	7.46	7.96	9.10	9.24	9.70	10.71				
66"	42"	16.8	33.6	50.4	67.2	1-10"	10-4"	2-6"	2-0"	6-10"	7-10"	7-10"	8-11"	9-11"	11-1"	7-80	10.15	10.23	10.31	11.12	12.49	12.83	13.22	14.43				
72"	48"	20.5	41.0	61.5	82.0	4-8"	2-1"	10-4"	2-2"	2-0"	10-9"	5-2"	3-2"	5-6"	10-11"	11-3"	13-9"	8.66	11.74	11.83	12.22	13.02	14.82	15.04	15.77			
84"	54"	24.6	49.6	74.4	99.2	5-1"	2-0"	11-7"	2-2"	2-6"	10-9"	5-2"	3-2"	5-6"	10-11"	12-3"	15-0"	12.50	16.98	16.98	17.67	18.83	21.47	21.78	22.86			
91"	58"	29.5	59.0	88.5	118.0	5-6"	2-10"	12-6"	2-6"	2-10"	10-9"	5-2"	3-2"	5-6"	11-3"	11-9"	13-1"	16-4"	16.46	22.26	22.46	23.16	24.65	28.05	28.46	29.85		

- NOTES:
- Dimension X is calculated as:  $X = S \cdot \sec \alpha$ .
  - Select tabular quantities using skew values as follows:
- |                  |                     |
|------------------|---------------------|
| End Skew to P/pe | Use Tabulated Value |
| 0° to 5°         | 0°                  |
| 6° to 15°        | 15°                 |
| 16° to 30°       | 30°                 |
| 31° or Over      | 45°                 |

LAST REVISION 11/01/19	DESCRIPTION	FDOT	FY 2020-21 STANDARD PLANS	STRAIGHT CONCRETE END SINGLE AND MULTIPLE PI
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Sheet 4:



**RESPONSE:**

Date: August 8, 2019

Sheet 2: Okay as is. Updated table to match.

Sheet 3: Updated table to match detail.

Sheet 4: Updated

**Name:** FHWA

**Date:** September 24, 2019

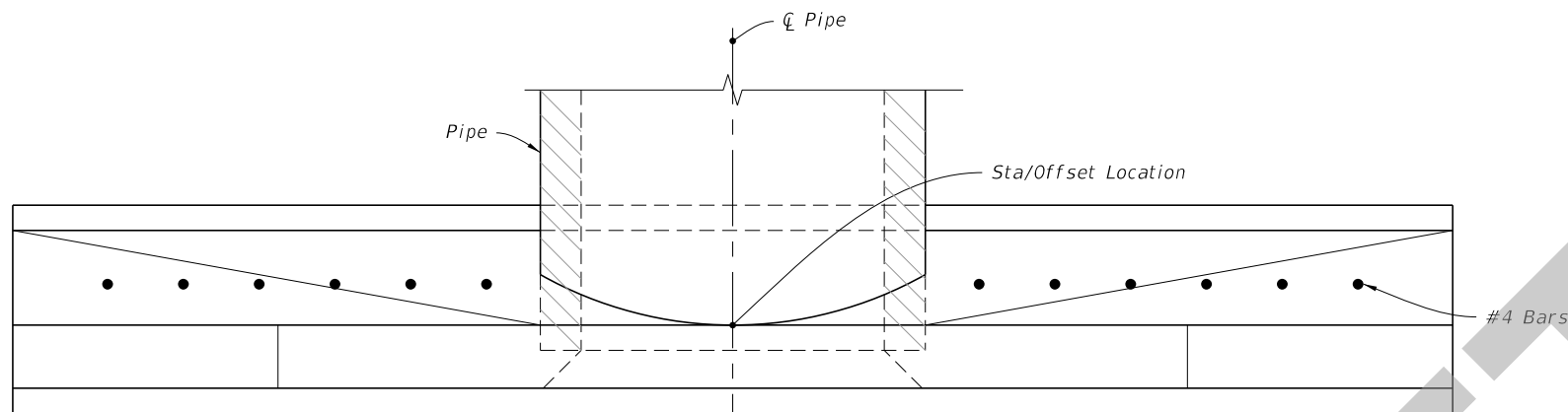
**COMMENT:**

Sheet 2: Detail "A" - Seems that 4" wide is out to out dimension of the joint but in the field may cause problem if interpreted that 4" is the base dimension. Recommend marking the 4" with dimension arrow.

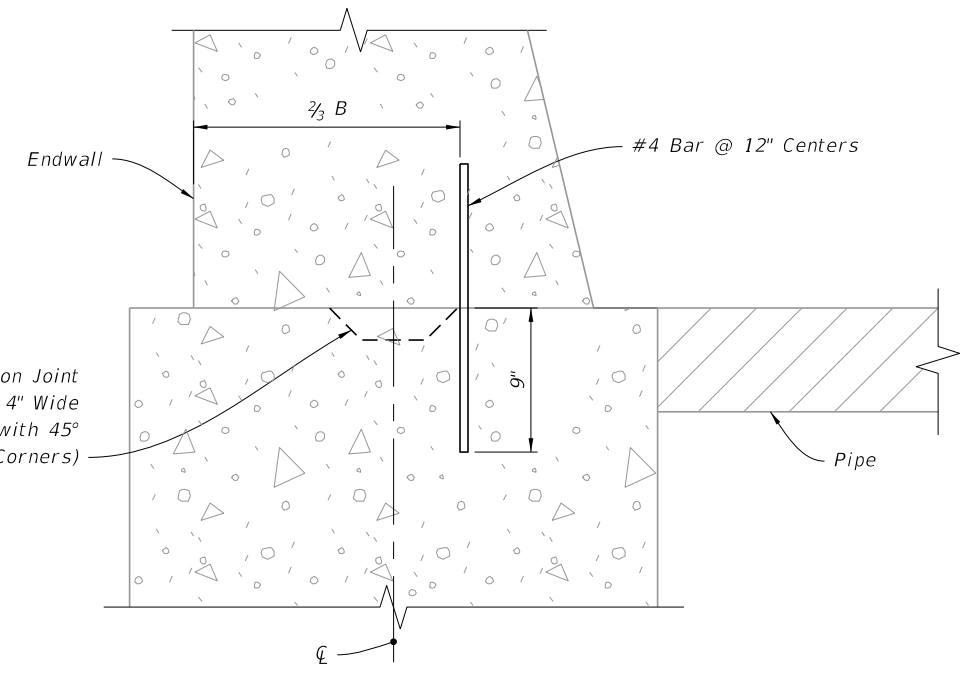
**RESPONSE:**

Date: September 26, 2019

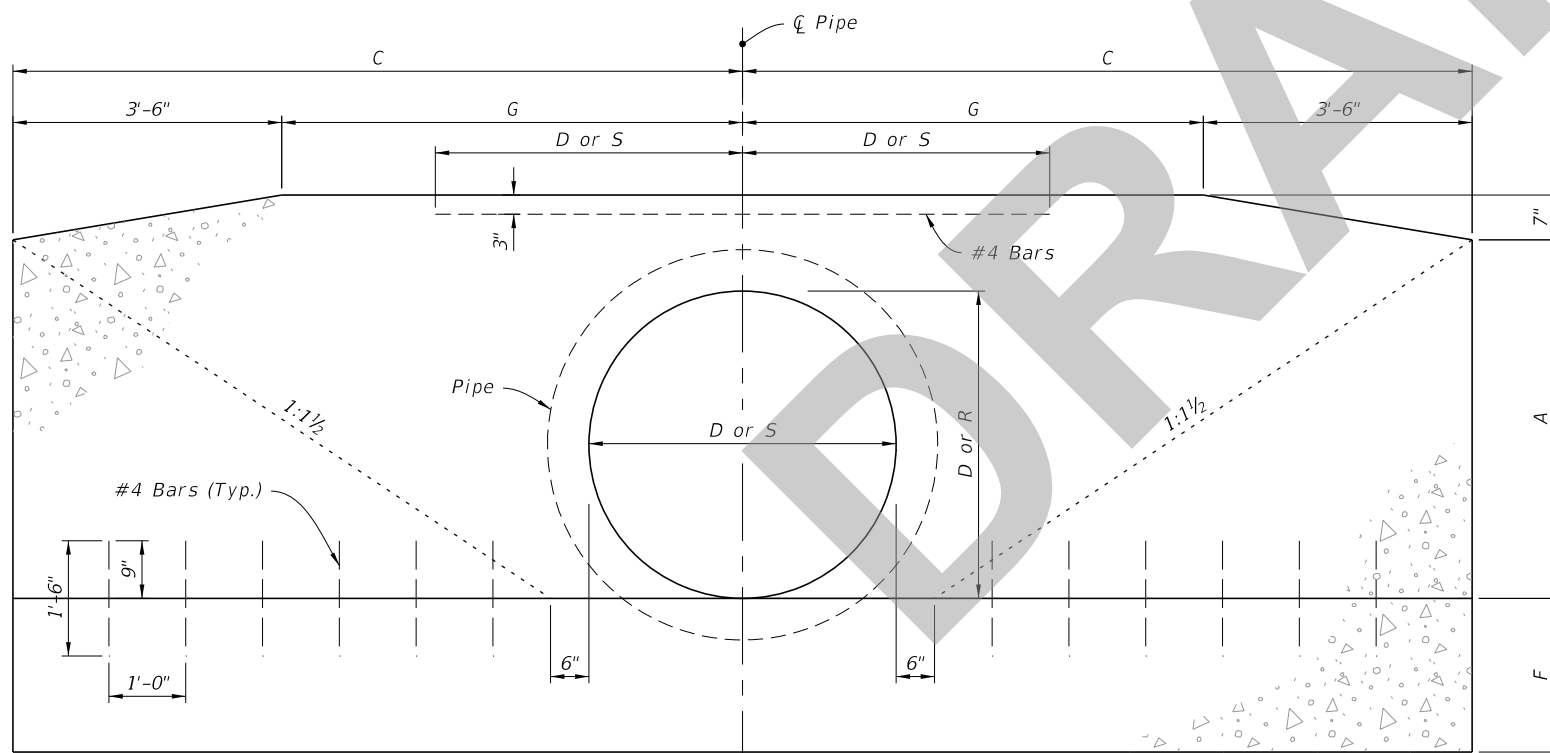
The 4" dimension is meant for the bottom of the construction joint. We will clarify with the note.



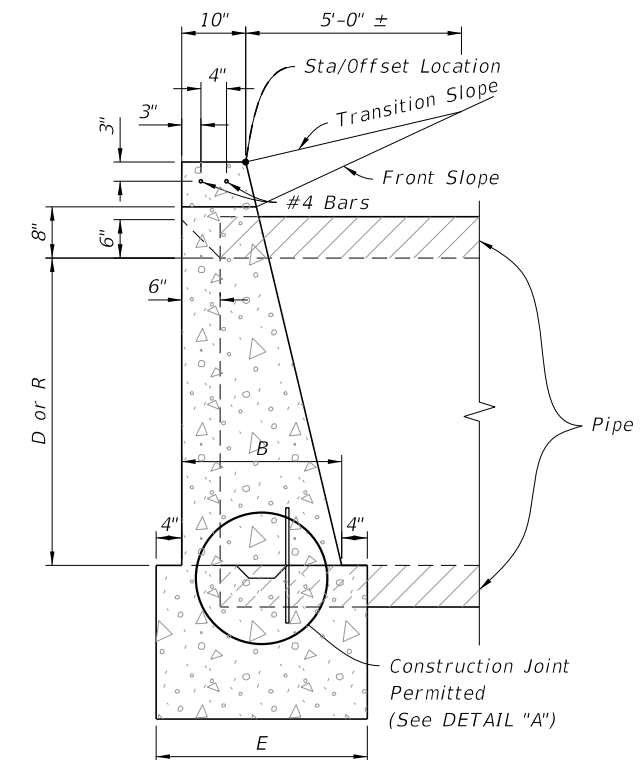
PLAN



DETAIL "A"



FRONT ELEVATION



SIDE ELEVATION

9/25/2019 1:36:56 PM

LAST REVISION 11/01/19	DESCRIPTION:
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FY 2020-21  
STANDARD PLANS

STRAIGHT CONCRETE ENDWALLS  
SINGLE AND MULTIPLE PIPE

INDEX  
430-030

SHEET  
2 of 4

CONCRETE ENDWALL DETAILS

ROUND CONCRETE AND CORRUGATED METAL PIPE																														
Pipe	Dia. D	Opening Area (SF)				Dimensions											Class I Concrete (CY)												D	
		Number Of Pipes				A	B	C	E	F	G	Y	X				Single 0°	Double				Triple				Quadruple				
		1	2	3	4								0°	15°	30°	45°		0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°		45°
Concrete	15"	1.23	2.46	3.69	4.92	1'-11"	1'-2"	4'-0"	1'-10"	1'-2"	0'-6"	2'-7"	2'-7"	2'-8"	3'-0"	3'-8"	1.23	1.59	1.60	1.65	1.74	1.94	1.96	2.05	2.23	2.30	2.34	2.47	2.74	15"
	18"	1.77	3.54	5.31	7.08	2'-2"	1'-3"	4'-6"	1'-11"	1'-3"	1'-0"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.56	1.99	2.01	2.06	2.17	2.43	2.46	2.56	2.79	2.86	2.91	3.06	3.40	18"
	21"	2.41	4.82	7.23	9.64	2'-5"	1'-4"	5'-0"	2'-0"	1'-4"	1'-6"	3'-2"	3'-2"	3'-2"	3'-3"	3'-8"	1.97													21"
	24"	3.14	6.28	9.42	12.56	2'-8"	1'-4"	5'-6"	2'-0"	1'-4"	2'-0"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	2.24	2.82	2.84	2.91	3.06	3.39	3.43	3.57	3.87	3.97	4.03	4.24	4.69	24"
	27"	3.98	7.96	11.94	15.92	2'-11"	1'-5"	6'-0"	2'-1"	1'-5"	2'-6"	3'-10"	3'-10"	4'-0"	4'-5"	5'-5"	2.73													27"
	30"	4.91	9.82	14.73	19.64	3'-2"	1'-6"	6'-6"	2'-2"	1'-6"	3'-0"	4'-3"	4'-3"	4'-5"	4'-11"	6'-0"	3.26	4.13	4.16	4.26	4.49	4.98	5.04	5.25	5.69	5.84	5.93	6.24	6.91	30"
	36"	7.07	14.14	21.21	28.28	3'-8"	1'-8"	7'-6"	2'-4"	1'-8"	4'-0"	5'-1"	5'-1"	5'-3"	5'-10"	7'-2"	4.53	5.73	5.77	5.92	6.23	6.92	7.00	7.29	7.91	8.13	8.26	8.69	9.62	36"
	42"	9.62	19.24	28.86	38.48	4'-2"	1'-10"	8'-6"	2'-6"	2'-0"	5'-0"	6'-0"	6'-0"	6'-3"	6'-11"	8'-6"	6.33	8.11	8.17	8.39	8.85	9.90	10.02	10.45	11.38	11.68	11.87	12.51	13.89	42"
48"	12.57	25.14	37.71	50.28	4'-8"	2'-1"	9'-6"	2'-9"	2'-0"	6'-0"	6'-9"	6'-9"	7'-0"	7'-10"	9'-7"	8.15	10.40	10.48	10.75	11.33	12.64	12.80	13.34	14.50	14.89	15.13	15.93	17.68	48"	
54"	15.90	31.80	47.70	63.60	5'-2"	2'-6"	10'-6"	3'-2"	2'-3"	7'-0"	7'-8"	7'-8"	7'-11"	8'-10"	10'-10"	11.71	15.23	15.35	15.78	16.69	18.77	19.02	19.86	21.69	22.29	22.66	23.93	26.67	54"	
Corrugated Metal	15"	1.23	2.46	3.69	4.92	1'-11"	1'-2"	4'-0"	1'-10"	1'-2"	0'-6"	2'-7"	2'-7"	2'-8"	3'-0"	3'-8"	1.24	1.62	1.63	1.68	1.78	1.99	2.02	2.11	2.30	2.37	2.41	2.75	2.84	15"
	18"	1.77	3.54	5.31	7.08	2'-2"	1'-3"	4'-6"	1'-11"	1'-3"	1'-0"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.59	2.04	2.06	2.11	2.23	2.51	2.54	2.65	2.89	2.96	3.01	3.17	3.53	18"
	21"	2.41	4.82	7.23	9.64	2'-5"	1'-4"	5'-0"	2'-0"	1'-4"	1'-6"	3'-2"	3'-2"	3'-2"	3'-3"	4'-6"														21"
	24"	3.14	6.28	9.42	12.56	2'-8"	1'-4"	5'-6"	2'-0"	1'-4"	2'-0"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	2.29	2.91	2.93	3.01	3.17	3.52	3.56	3.71	4.03	4.14	4.20	4.43	4.91	24"
	27"	3.98	7.96	11.94	15.92	2'-11"	1'-5"	6'-0"	2'-1"	1'-5"	2'-6"	3'-10"	3'-10"	4'-0"	4'-5"	5'-5"														27"
	30"	4.91	9.82	14.73	19.64	3'-2"	1'-6"	6'-6"	2'-2"	1'-6"	3'-0"	4'-3"	4'-3"	4'-5"	4'-11"	6'-0"	3.34	4.28	4.31	4.43	4.67	5.20	5.27	5.49	5.97	6.13	6.23	6.56	7.29	30"
	36"	7.07	14.14	21.21	28.28	3'-8"	1'-8"	7'-6"	2'-4"	1'-8"	4'-0"	5'-1"	5'-1"	5'-3"	5'-10"	7'-2"	4.64	5.95	6.00	6.15	6.49	7.25	7.34	7.65	8.33	8.57	8.71	9.18	10.20	36"
	42"	9.62	19.24	28.86	38.48	4'-2"	1'-10"	8'-6"	2'-6"	2'-0"	5'-0"	6'-0"	6'-0"	6'-3"	6'-11"	8'-6"	6.49	8.43	8.50	8.73	9.23	10.38	10.52	10.98	11.99	12.32	12.52	13.22	14.73	42"
48"	12.57	25.14	37.71	50.28	4'-8"	2'-1"	9'-6"	2'-9"	2'-0"	6'-0"	6'-9"	6'-9"	7'-0"	7'-10"	9'-7"	8.38	10.85	10.94	11.23	11.87	13.34	13.51	14.11	15.39	15.82	16.08	16.97	18.90	48"	
54"	15.90	31.80	47.70	63.60	5'-2"	2'-6"	10'-6"	3'-2"	2'-3"	7'-0"	7'-8"	7'-8"	7'-11"	8'-10"	10'-10"	11.77	15.35	15.48	15.90	16.83	18.93	19.18	20.04	21.89	22.51	22.89	24.17	26.96	54"	

ELLIPTICAL CONCRETE AND CORRUGATED METAL PIPE																																	
Pipe	Span S	Rise R	Opening Area (SF)				Dimensions											Class I Concrete (CY)												Span	Rise	Approx. Equiv. Round	
			Number Of Pipes				A	B	C	E	F	G	Y	X				Single 0°	Double				Triple				Quadruple						
			1	2	3	4								0°	15°	30°	45°		0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°				45°
Concrete	17"	13"	1.1	2.2	3.3	4.4	1'-9"	1'-2"	3'-10"	1'-10"	1'-2"	0'-4"	2'-6"	2'-6"	2'-7"	2'-11"	3'-6"	1.16	1.47	1.48	1.52	1.60	1.78	1.80	1.88	2.04	2.09	2.12	2.23	2.48	17"	13"	15"
	21"	15"	1.6	3.2	4.8	6.4	1'-11"	1'-2"	4'-3"	1'-10"	1'-2"	0'-9"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.33	1.69	1.70	1.75	1.84	2.04	2.06	2.15	2.33	2.40	2.44	2.57	2.84	21"	15"	18"
	28"	20"	2.8	5.6	8.4	11.2	2'-4"	1'-3"	5'-2"	1'-11"	1'-3"	1'-8"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	1.78	2.31	2.33	2.39	2.53	2.83	2.87	2.99	3.26	3.36	3.42	3.60	4.01	28"	20"	24"
	35"	24"	4.3	8.6	12.9	17.2	2'-8"	1'-4"	5'-11 1/2"	2'-0"	1'-4"	2'-5 1/2"	4'-0"	4'-0"	4'-2"	4'-7"	5'-8"	2.34	3.03	3.05	3.14	3.32	3.72	3.77	3.93	4.29	4.40	4.47	4.72	5.25	35"	24"	30"
	42"	29"	5.9	11.8	17.7	23.6	3'-1"	1'-5"	6'-10 1/2"	2'-1"	1'-5"	3'-4 1/2"	4'-9"	4'-9"	4'-11"	5'-6"	6'-9"	3.13	4.06	4.09	4.20	4.45	4.99	5.06	5.28	5.76	5.93	6.03	6.36	7.09	42"	29"	36"
	49"	33"	8.4	16.8	25.2	33.6	3'-5"	1'-6"	7'-8"	2'-2"	1'-6"	4'-2"	5'-6"	5'-6"	5'-8"	6'-4"	7'-9"	3.83	5.00	5.04	5.18	5.48	6.16	6.24	6.52	7.12	7.32	7.44	7.86	8.76	49"	33"	42"
	57"	38"	10.6	21.2	31.8	42.4	3'-10"	1'-7"	8'-7 1/2"	2'-3"	1'-7"	5'-1 1/2"	6'-4"	6'-4"	6'-7"	7'-4"	8'-11"	4.87	6.31	6.36	6.53	6.91	7.74	7.84	8.18	8.93	9.18	9.33	9.85	10.96	57"	38"	48"
	64"	43"	13.2	26.4	39.6	52.8	4'-3"	1'-8"	9'-6 1/2"	2'-4"	1'-8"	6'-0 1/2"	7'-1"	7'-1"	7'-4"	8'-2"	10'-0"	5.88	7.64	7.70	7.91	8.37	9.40	9.52	9.94	10.86	11.15	11.33	11.97	13.33	64"	43"	54"
71"	47"	16.9	33.8	50.7	67.6	4'-7"	1'-10"	10'-4"	2'-6"	2'-0"	6'-10"	7'-10"	7'-10"	8'-1"	9'-1"	11'-1"	7.80	10.15	10.23	10.51	11.12	12.49	12.65	13.22	14.43	14.85	15.10	15.94	17.77	71"	47"	60"	
Corrugated Metal	18"	12"	1.3	2.6	3.9	5.2	1'-8"	1'-2"	3'-9"	1'-10"	1'-2"	0'-3"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.09	1.45	1.46	1.51	1.60	1.80	1.82	1.91	2.09	2.16	2.20	2.33	2.60	12"	18"	15"
	23"	14"	1.8	3.6	5.4	7.2	1'-10"	1'-3"	4'-2 1/2"	1'-11"	1'-3"	8 1/2"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	1.36	1.82	1.84	1.89	2.01	2.29	2.32	2.43	2.68	2.75	2.80	2.97	3.33	14"	23"	18"
	30"	19"	3.3	6.6	9.9	13.2	2'-3"	1'-4"	5'-1 1/2"	2'-0"	1'-4"	1'-7 1/2"	4'-2"	4'-2"	4'-4"	4'-10"	5'-11"	1.89	2.55	2.57	2.65	2.82	3.22	3.27	3.43	3.77	3.88	3.95	4.19	4.70	19"	30"	24"
	38"	24"	5.1	10.2	15.3	20.4	2'-8"	1'-5"	6'-3"	2'-1"	1'-5"	2'-9"	5'-2"	5'-2"	5'-4"	6'-0"	7'-4"	2.64	3.55	3.58	3.69	3.93	4.48	4.54	4.77	5.24	5.39	5.49	5.82	6.53	24"	38"	30"
	45"	29"	7.4	14.8	22.2	29.6	3'-1"	1'-6"	7'-0"	2'-2"	1'-6"	3'-6"	6'-0"	6'-0"	6'-3"	6'-11"	8'-6"	3.32	4.48	4.52	4.66	4.96	5.64	5.72	6.00	6.60	6.80	6.92	7.34	8.24	29"	45"	36"
	53"	34"	10.2	20.4	30.6	40.8	3'-6"	1'-7"	7'-11 1/2"	2'-3"	1'-7"	4'-5 1/2"	7'-1"	7'-1"	7'-4"	8'-2"	10'-0"	4.24	5.76	5.81	6.00	6.39	7.29	7.40	7.76	8.55	8.81	8.97	9.52	10.70	34"	53"	42"
	60"	38"	12.9	25.8	38.7	51.6	3'-10"	1'-8"	8'-9"	2'-4"	1'-8"	5'-3"	7'-11"	7'-11"	8'-2"	9'-2"	11'-2"	5.22	7.16	7.23	7.46	7.96	9.10	9.24	9.70	10.71	11.05	11.25	11.95	13.46	38"	60"	48"
	68"	43"	16.6	33.2	49.8	66.4	4'-3"	1'-10"	9'-8 1/2"	2'-6"	1'-10"	6'-2 1/2"	8'-10"	8'-10"	9'-2"	10'-2"	12'-6"	6.63	9.01	9.09	9.38	10.00	11.39	11.56	12.13	13.36	13.77	14.02	14.88	16.73	43"	68"	54"
76"	48"	20.5	41.0	61.5	82.0	4'-8"	2'-1"	10'-8"	2'-9"	2'-0"	7'-2"	9'-9"	9'-9"	10'-1"	11'-3"	13'-9"	8.66	11.74	11.85	12.22	13.02	14.82	15.04	15.77	17.37	17.91	18.23	19.34	21.74	48"	76"	60"	
83"	53"	24.8	49.6	74.4	99.2	5'-1"	2'-6"	11'-7"	3'-2"	2'-6"	8'-1"	10'-7"	10'-7"	10'-11"	12'-3"	15'-0"	12.50	16.98	16.98	17.67	18.83	21.47	21.78	22.86	25.18	25.97	26.44	28.06	31.55	53"	83"	66"	
91"	58"	29.5	59.0	88.5	118.0	5'-6"	2'-10"	12'-6 1/2"	3'-6"	2'-10"	9'-0 1/2"	11'-4"	11'-4"	11'-9"	13'-1"	16'-0"	16.46	22.26	22.46	23.16	24.66	28.05	28.46	29.85	32.85	33.85	34.46	36.55	41.05	58"	91"	72"	

**NOTES:**

- Dimension X is calculated as:  $X = S \cdot \sec \alpha$ .
- Select tabular quantities using skew values as follows:  

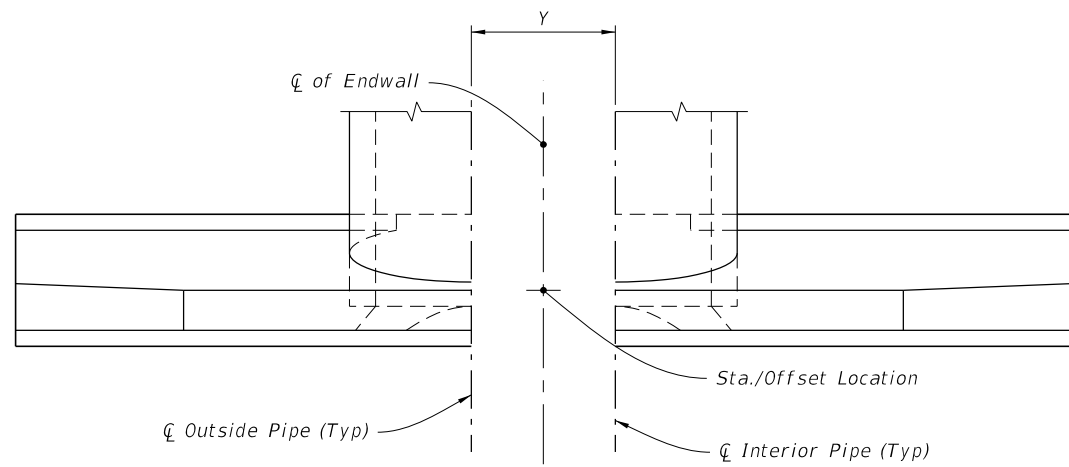
End Skew to Pipe	Use Tabulated Value
0° to 5°	0°
6° to 15°	15°
16° to 30°	30°
31° or Over	45°

8/12/2019 1:19:15 PM

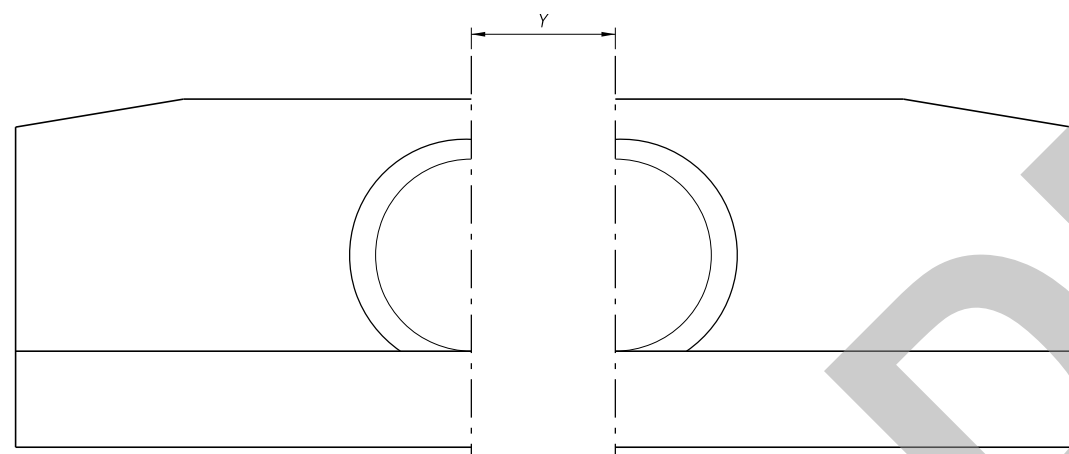
**CONCRETE AND METAL PIPE TABLES**

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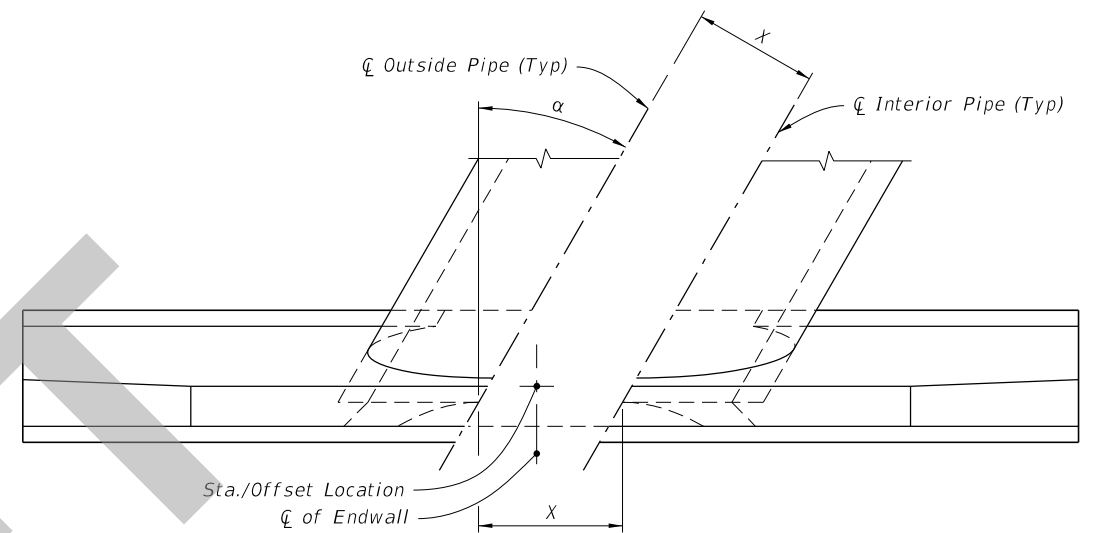


PLAN

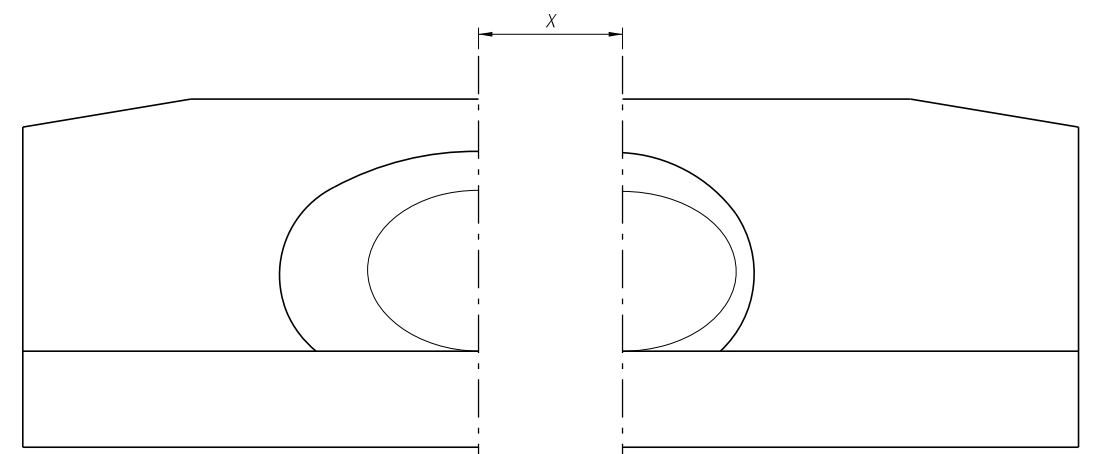


FRONT ELEVATION

NORMAL PIPE



PLAN



FRONT ELEVATION

SKewed PIPE

(Multiple Pipe Shown, Single Pipe Similar)

LEGEND:

- α Pipe Skew Angle
- S Center to Center between pipes
- X Center to Center along front of Headwall

SPACING FOR MULTIPLE PIPES

LAST REVISION 11/01/19	REVISION	DESCRIPTION:
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FY 2020-21  
STANDARD PLANS

STRAIGHT CONCRETE ENDWALLS  
SINGLE AND MULTIPLE PIPE

INDEX  
430-030

SHEET  
4 of 4