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## ORIGINATION FORM

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### Proposed Revisions to a Standard Plans Index (Please provide all information — Incomplete forms will be returned)

**Contact Information:**

Date: November 1, 2019

Originator: Rick Jenkins

Phone: (850) 414-4355

Email: Rick.Jenkins@dot.state.fl.us

**Standard Plans:**

Index Number: 425-001

Sheet Number (s): ALL

Index Title: Supplementary Details for Manholes and Inlets

**Summary of the changes:**

Reorganized Index, Added additional Sheets.

Sheet 1: General Notes and Overview

Sheet 2: Manhole Frames and Tops

Sheet 3: Inlet Locking Grates, Subgrade and Base Temporary Drains, and Pipe to Structure Filter Fabric Wrap

Sheet 4: Drainage Structure Inlet, Sump Bottom, Wall Reinforcement Splice Details, and Typical Slab to Wall Details

Sheet 5: Construction Joints and Minimum Box Riser Segment Dimensions

Sheet 6: Skewed Pipe in Rectangular Structures

Sheet 7: Miscellaneous Pipe Connection Details

**Commentary / Background:**

Changed Title. Reorganized Details and Sheets to declutter Index. Moved information from detail callouts to Notes in order to decrease clutter of the drawing. Design notes moved to SPI. Removed dimension "H" from SEGMENTS FOR SLAB TO WALL DOWEL CONSTRUCTION JOINTS OR MONOLITHIC CAST to clarify that the values in Table 3 are for RISER SEGMENTS OTHER THAN DOWEL. Slab to Wall details from 425-010 added to Index. (Continued)

**Other Affected Offices / Documents:** (Provide name of person contacted)

Yes	No	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other Standard Plans – Index 425-010, Jennifer Green
<input type="checkbox"/>	<input type="checkbox"/>	FDOT Design Manual –
<input type="checkbox"/>	<input type="checkbox"/>	Basis of Estimates Manual –
<input type="checkbox"/>	<input type="checkbox"/>	Standard Specifications –
<input type="checkbox"/>	<input type="checkbox"/>	Approved Product List –
<input type="checkbox"/>	<input type="checkbox"/>	Construction –
<input type="checkbox"/>	<input type="checkbox"/>	Maintenance –

**Origination Package Includes:**

(Email or hand deliver package to Rick Jenkins)

Yes	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Redline Mark-ups
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Proposed Standard Plan Instruction (SPI)
<input type="checkbox"/>	<input type="checkbox"/>	Revised SPI
<input type="checkbox"/>	<input type="checkbox"/>	Other Support Documents

**Implementation:**

- Design Bulletin (Interim)
- DCE Memo
- Program Mgmt. Bulletin
- FY-Standard Plans (Next Release)

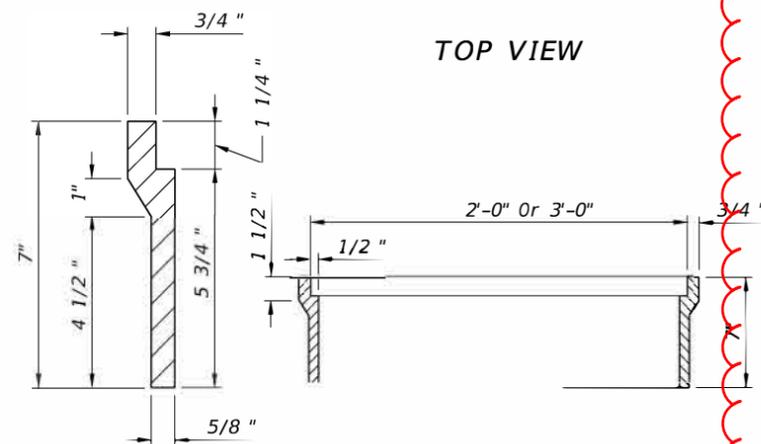
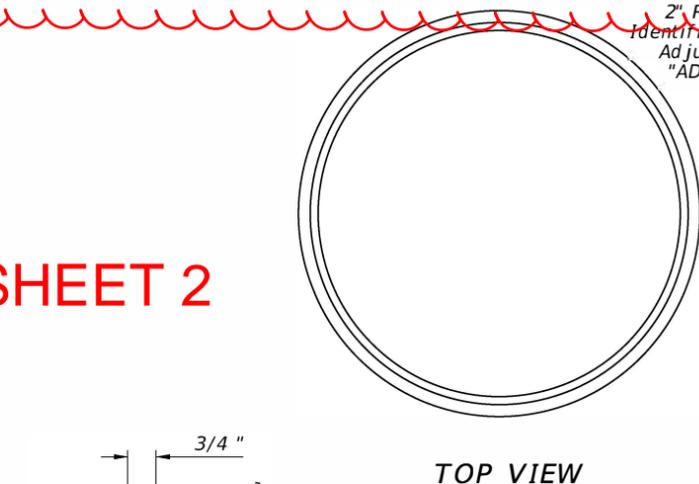
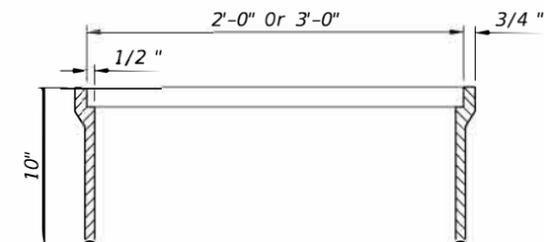
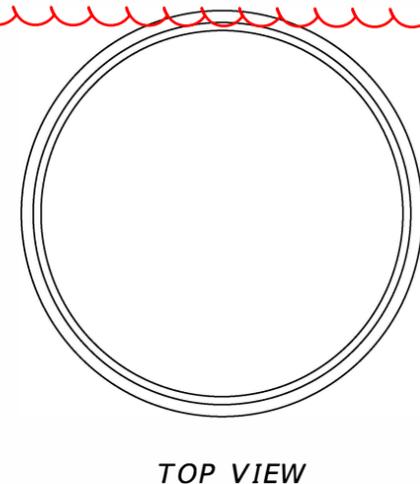
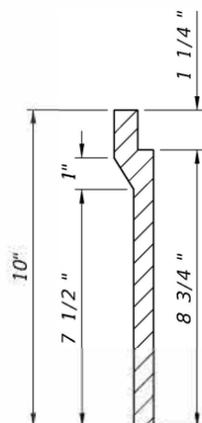
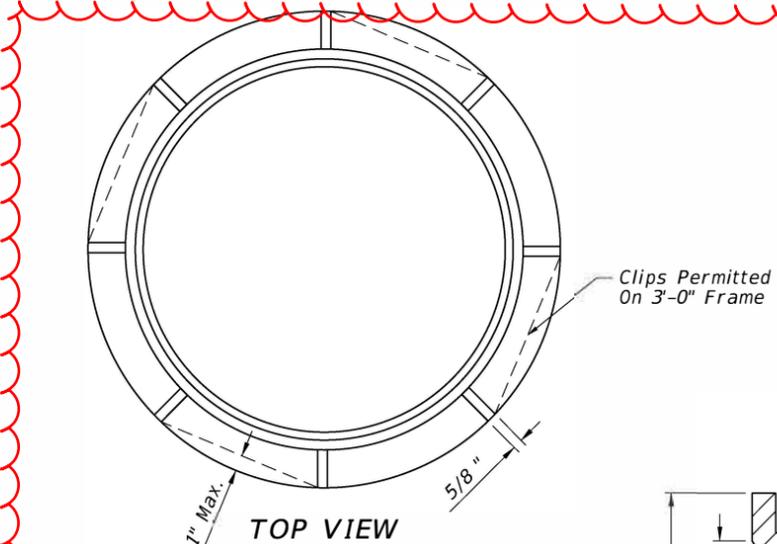
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Contact the Roadway Design Office for assistance in completing this form

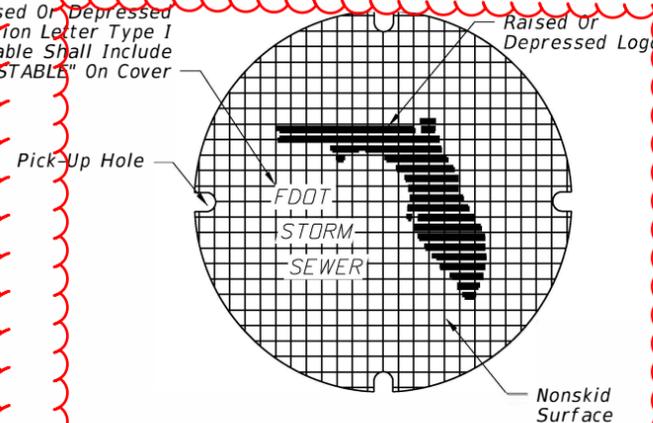
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NEW SHEET  
GENERAL NOTES AND OVERVIEW

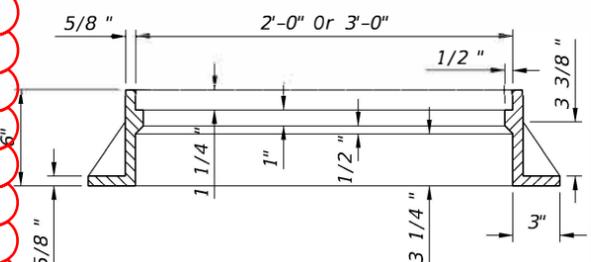
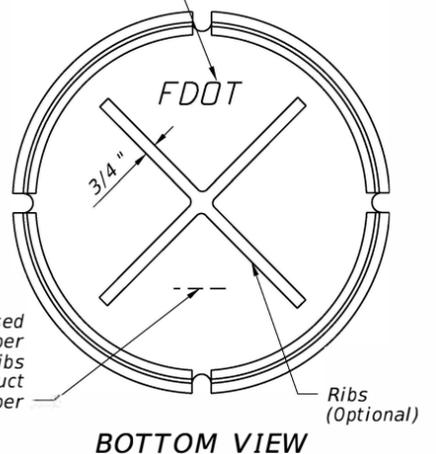
# SHEET 2



2" Raised Or Depressed Identification Letter Type I Adjustable Shall Include "ADJUSTABLE" On Cover



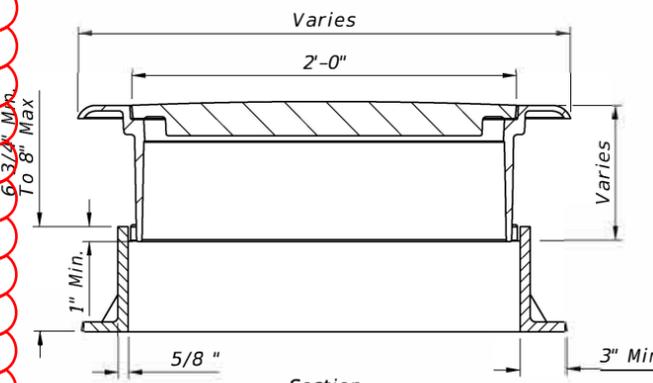
2" Raised Or Depressed Identification Letter



SECTION For Manholes TYPE I

WALL SECTION For Curb Inlets Types 1, 2, 3, & 4 TYPE II

WALL SECTION For Curb Inlets Types 7 & 8 TYPE III



Section

Frame Type	WEIGHT OF CASTINGS (lb)					
	2' OPENING		3' OPENING			
	Frame	Cover (Std.)	Frame	2-Piece Cover		
			Inside	Outside	Total	
I *	155	190	220	190	220	410
II	145	190	255	190	220	410
III	90	190	180	190	220	410

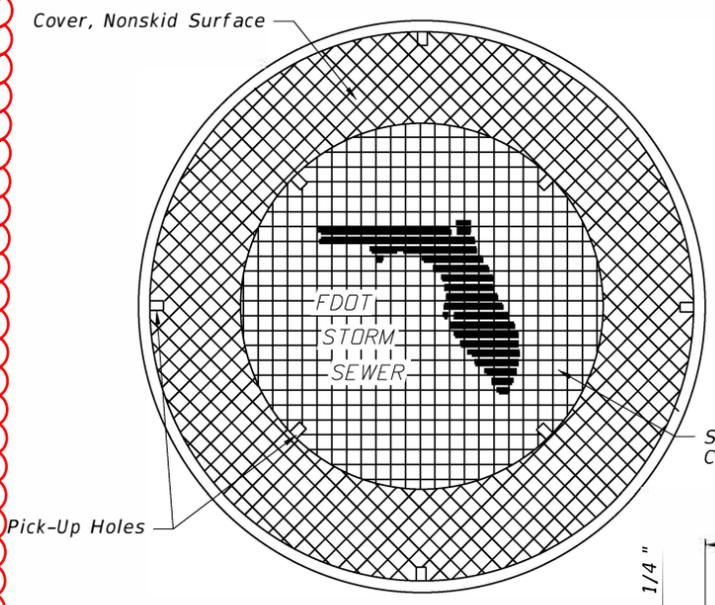
\* Includes Type I Adjustable

NOTES (FRAMES, AND COVER)

- The standard cover is to be used for all frames Types I, II, III and the 2-piece cover, and is the replacement cover for all previous frames with 1 1/2" deep seats (traffic type). The 185 lb. cover (nontraffic type), 1984 Roadway and Traffic Design Standards Index 201 is the replacement cover for existing frames with 1/2" deep seats. Installation of frame with 1/2" deep seats is not permitted.
- Use the 2'-0" cover, unless the 2-piece cover is called for in the plans, except at inlets and manholes with sump bottoms use the 2-piece cover when the sump depth exceeds 2', unless otherwise noted.

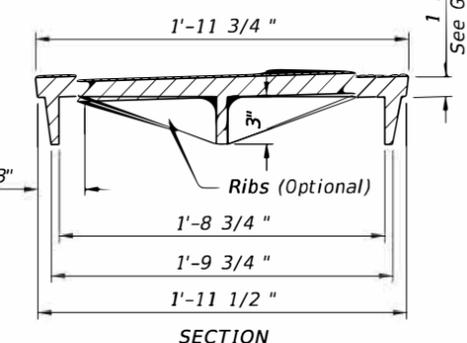
DESIGNER NOTE:

Consider using the 2-piece cover where depths exceed 5' and manual entry may be required for cleaning. Clearly note the requirement for a 2-piece cover on the Drainage Structure sheets in the plans.

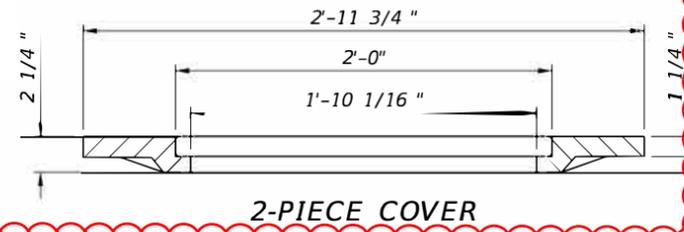


For Use With Types I, II And III Frames With 3'-0" Opening

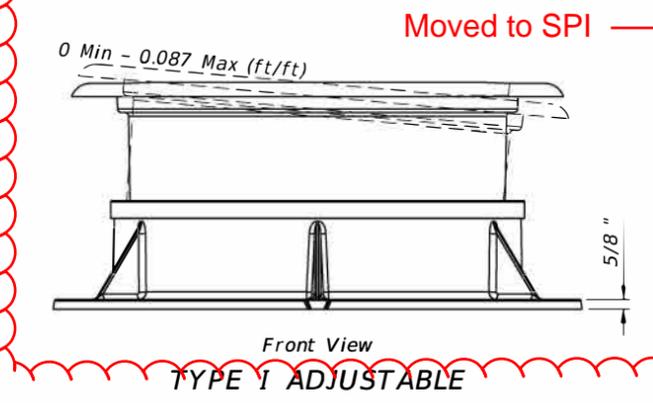
# SHEET 1



COVER FOR ALL FRAMES 1-PIECE COVER



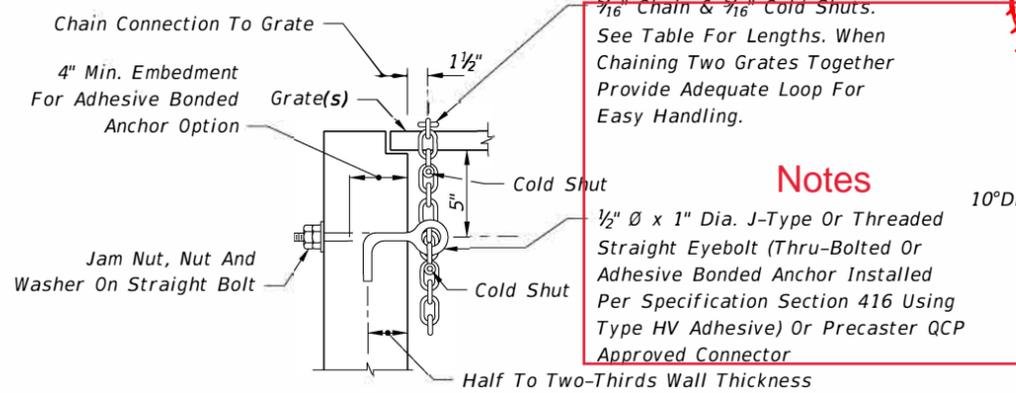
2-PIECE COVER



Moved to SPI

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LAST REVISION	DESCRIPTION:
11/01/17	11/01/20



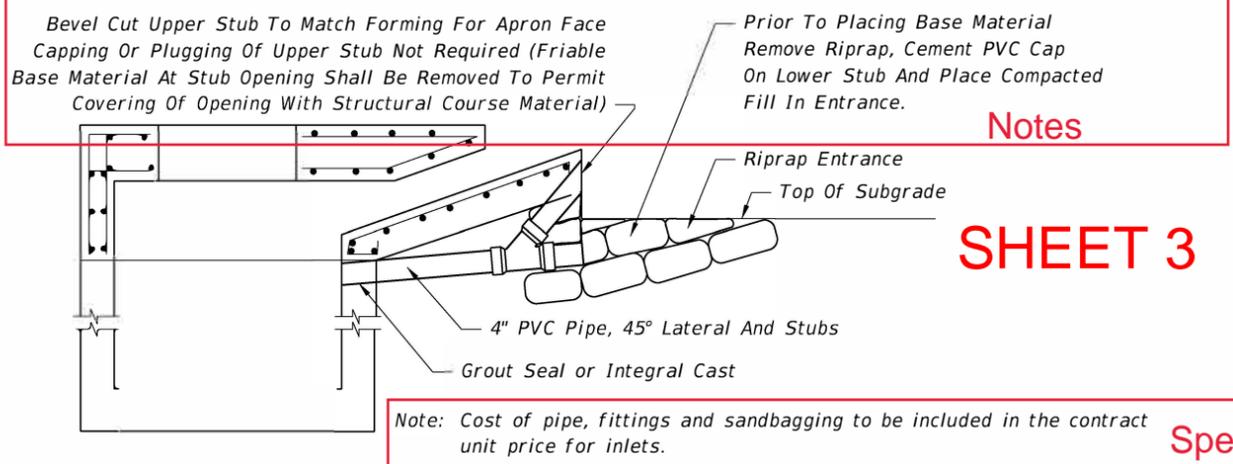
**Notes**  
 1/16" Chain & 1/16" Cold Shuts. See Table For Lengths. When Chaining Two Grates Together Provide Adequate Loop For Easy Handling.  
 1/2" Ø x 1" Dia. J-Type Or Threaded Straight Eyebolt (Thru-Bolted Or Adhesive Bonded Anchor Installed Per Specification Section 416 Using Type HV Adhesive) Or Precaster QCP Approved Connector  
 Half To Two-Thirds Wall Thickness

**NOTE:** When Alternate "G" grate is specified, the chain, bolt, nuts, washer and cold shuts shall be galvanized in accordance with Section 425 of the Standard Specifications.

Cost of eyebolt and chain to be included in the contract unit price for inlets. **Specs**

EYEBOLT AND CHAIN REQUIREMENTS				
Index Number	Inlet Type	Eye-Bolts	Length Of Chain	Handling & Remarks
425-030	1	1	4'-0"	Slide & Spin
	2	1	4'-0"	Slide & Spin
	3	2	2 @ 4'-0"	Slide & Spin
	4	2	2 @ 4'-0"	Slide & Spin
	5	2	2 @ 4'-0"	Slide & Spin
425-031	N/A	1	3'-8"	Slide Or Slide & Spin
425-032	N/A	1	4'-0"	Slide & Spin
425-040	S	1	4'-0"	Slide & Spin
425-041	V	1	4'-0"	Slide & Spin
425-050	A	1	3'-0"	Slide
425-051	B	1	5'-0"	Slide & Spin
	C	1	2'-6"	Slide & Spin
	D	1	2'-6"	Slide & Spin
	E	2	2 @ 2'-6"	Slide & Spin
425-052	H	2	2 @ 2'-6"	Flip Ctr. Grate and Slide & Spin Single Free Grate
			1 or 2 @ 1'-6"	Center Grate(s) Chained To One End Grate
425-053	F	1	3'-6"	Flip Or Slide & Spin
	G	1	6'-0"	Slide
425-054			2'-0"	Lifting Loop
	J	1	4'-0"	Slide & Spin

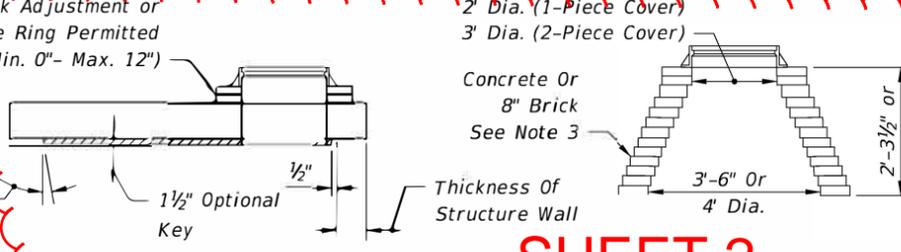
**EYEBOLT AND CHAIN FOR LOCKING GRATES TO INLETS**



**Notes**  
 Note: Cost of pipe, fittings and sandbagging to be included in the contract unit price for inlets. **Spec**

**TEMPORARY DRAINS FOR SUBGRADE AND BASE**

LAST REVISION	DESCRIPTION:
11/01/17	
11/01/20	



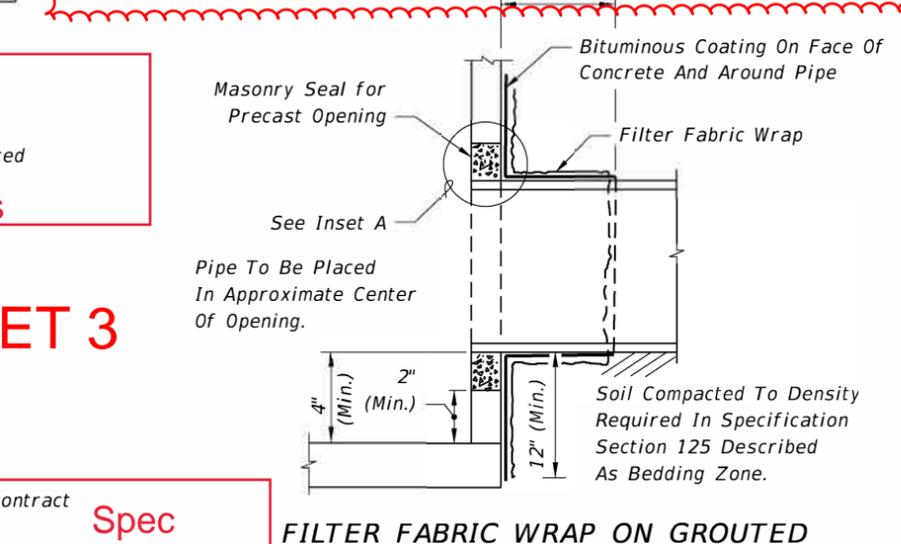
**SECTION TYPE 7**  
**SECTION TYPE 8**

**MANHOLE TOPS**

- NOTES (TOPS) UPDATED NOTES**
- Manhole top Type 7 slabs shall be of Class II concrete. Concrete as specified in ASTM C478 may be used for precast units; see General Note 3.
  - Manhole top Type 7 slabs may be of cast-in-place or precast construction. The optional key is for precast tops and in lieu of dowels. Frame and slab openings are to be omitted when top is used over a junction box.
  - Manhole top Type 8 may be of cast-in-place or precast concrete construction or brick construction. For concrete construction, the concrete and steel reinforcement shall be the same as the supporting wall unit. An eccentric cone may be used.
  - Manhole tops shall be secured to structures by optional construction joints as shown on Sheet 3.
  - Frames can be adjusted a maximum 12" height with brick or precast ASTM C478 grade rings.
  - Substitution of manhole top Type 8 for manhole top Type 7 is allowed provided that minimum dimensions shown above are not reduced.
  - Substitution of Manhole top Type 7 for Type 8 is allowed if the minimum thickness (h) above pipe opening cannot be maintained with manhole top Type 8.

**DESIGN NOTES SPI**

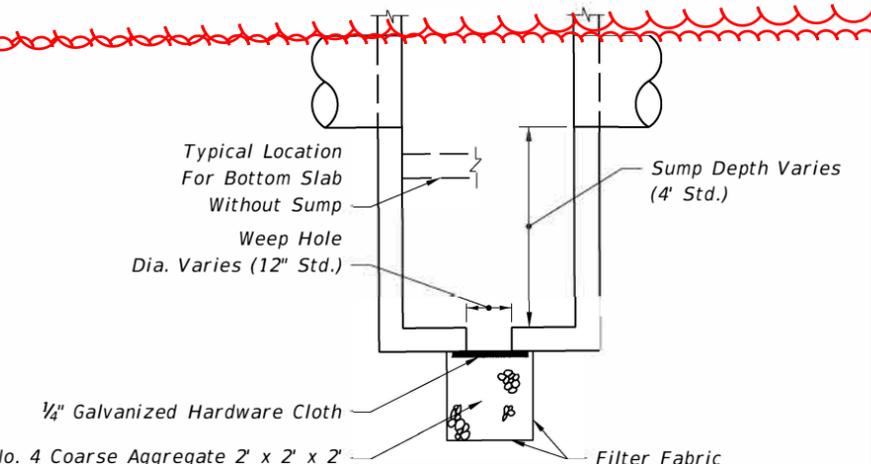
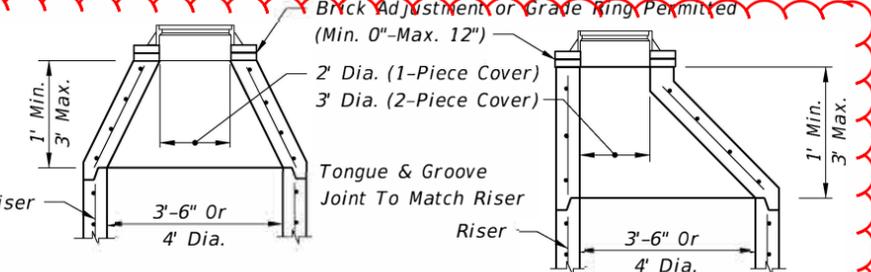
- Manhole top Type 8 should be specified in the plans when depths shown above can be maintained.



**FILTER FABRIC WRAP ON GROUTED PIPE TO STRUCTURE JOINT**

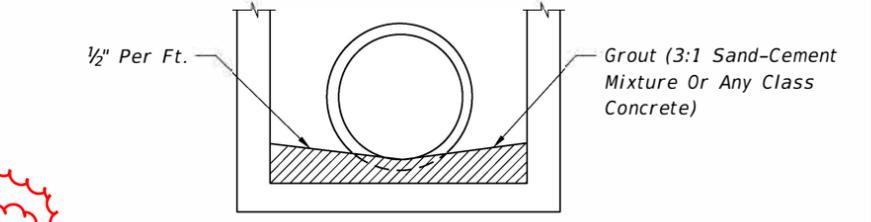
**SHEET 2**

**BRICK OR CONCRETE PRECAST CONCENTRIC CONE PRECAST ECCENTRIC CONE TYPE 8**

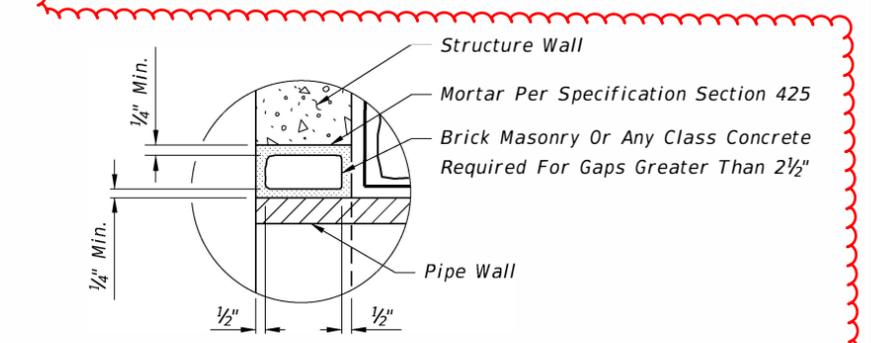


**NOTE:** Sump bottom appropriate for all manhole and inlet types. Sumps are to be constructed in inlet and manholes connected to French Drains unless excluded in the plans. At other locations, sump is to be constructed only where called for in the plans. Weep holes to be constructed in sump bottom only where called for in the plans. Cost of sump bottom and weep hole to be included in the contract unit price for inlet or manhole.

**SUMP BOTTOM SPI**



**FOR ALL STRUCTURES UNLESS EXCLUDED BY SPECIAL DETAIL ALL PIPE TYPES DRAINAGE STRUCTURE INVERT**



**INSET A**

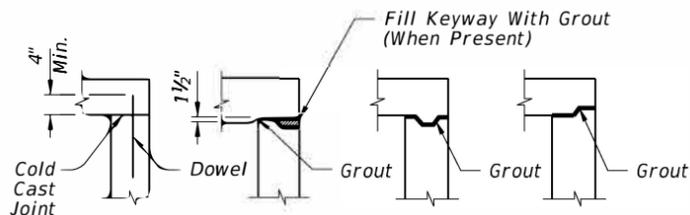
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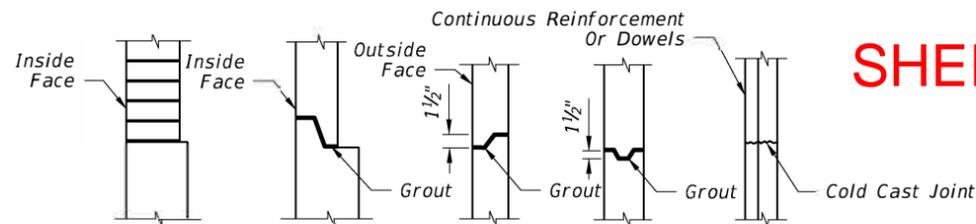
FY 2019-20 STANDARD PLANS

**SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS**

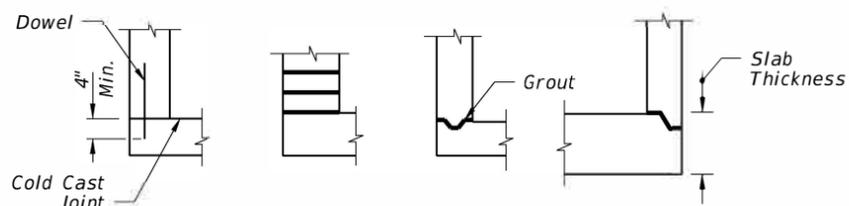
INDEX 425-001 SHEET 2 of 5



TOP SLABS TO WALLS



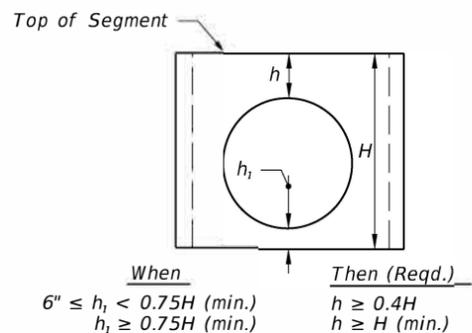
WALL JOINTS



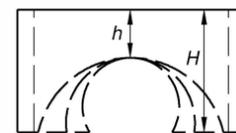
BOTTOM SLABS TO WALLS

1. One or more types of joints may be used in a single structure, except brick wall structure. Brick wall construction is permitted on circular units only.
2. All grouted joints are to have a maximum thickness of 1".
3. Keyways are to be a minimum of 1 1/2" deep.
4. Joint dowels are to be #4 bars, 12" long with a minimum of 6 bars per joint approximately evenly spaced for circular structures or at maximum 12" spacing for rectangular structures. Bars may be either Adhesive Bonded Dowels in accordance with Specification Section 416, or placed approximately 6" into fresh concrete leaving the remainder to extend into the secondary cast. Welded wire reinforcement may be substituted for the dowel bar in accordance with the equivalent steel area table on Sheet 4.
5. Minimum cover on dowel reinforcing bars is 2" to outside face of structure.
6. Joints between wall segments and between wall segments and top or bottom slabs may be sealed either by preformed plastic gasket material using the procedures given in Section 430 of the Specifications or by non-shrink grout, in accordance with Section 934 of the Specifications.
7. Insert products approved by the Engineer may be used in lieu of dowel embedment.

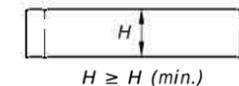
OPTIONAL CONSTRUCTION JOINTS



SEPARATE RISER SEGMENTS WITH CONSTRUCTION JOINTS OTHER THAN DOWEL OPTION

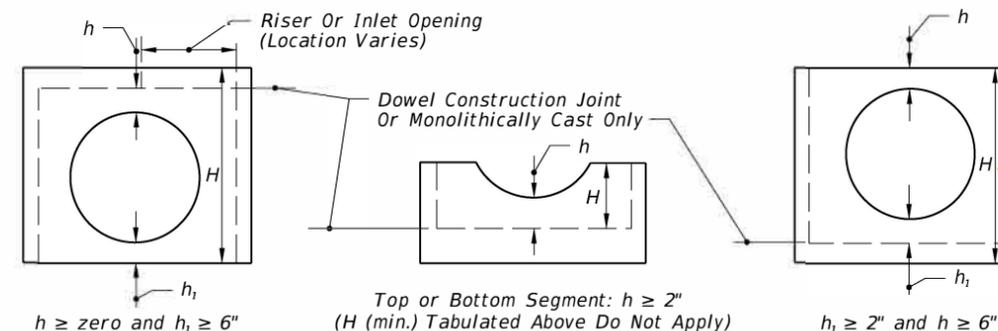


Segments may be inverted. Opening for pipe shall be the pipe OD plus 6" (± 2" tolerance). If h can not be attained, then a top or bottom slab must be attached to the segment as shown below.



Minimum Value For H	
H (min.)	Box Or Riser Diameter
1'-0"	3'-6" & 4'-0"
1'-6"	5'-0" & 6'-0"
2'-0"	>6'-0"

SHEET 6



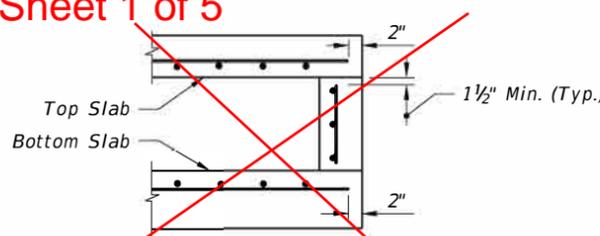
SEGMENTS FOR SLAB TO WALL DOWEL CONSTRUCTION JOINTS OR MONOLITHICALLY CAST SEGMENTS

NOTE: h may be less than 6" when approved by the Engineer, but not for inlet segments at finish grade elevation.

COMPARATIVE SIDE VIEWS

MINIMUM DIMENSIONS FOR BOX AND RISER SEGMENTS

Replace with "Typical Slab to Wall Detail" from Index 425-010, Sheet 1 of 5



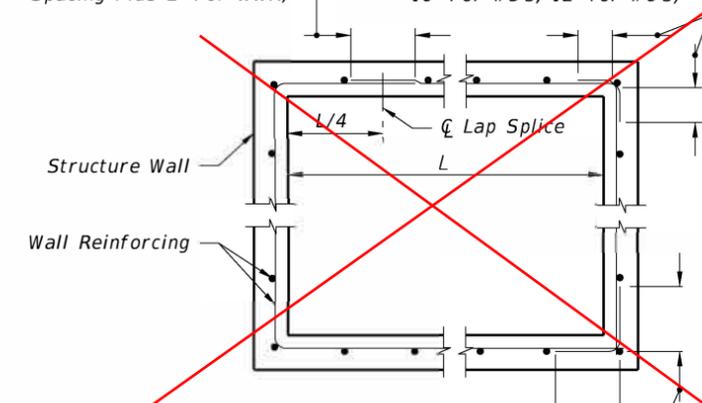
(NOTE: NOT APPLICABLE AROUND MANHOLE AND RISER OPENINGS)

REBAR STRAIGHT END EMBEDMENT FOR TOP AND BOTTOM SLABS

SHEET 4

Replace with Detail from Index 425-010, Sheet 5 of 5

- Option 1) Lap Splice: At Quarter Point (30 Bar Diameters Or Vertical Wire Spacing Plus 2" For WWR)
- Option 2) Lap Splice: Standard 90° Hooks At Corners (8" For #4's, 10" For #5's, 12" for #6's)



- Option 3) Lap Splice: Corner Spliced Bar (30 Bar Diameters, But Not Less Than Two Vertical Wire Spacings Plus 2" For WWR)

WALL REINFORCING SPLICE DETAILS

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LAST REVISION 11/01/17	DESCRIPTION: 11/01/20	FDOT	FY 2019-20 STANDARD PLANS	SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS	INDEX 425-001	SHEET 3 of 5
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EXAMPLE TABLE OF EQUIVALENT STEEL AREA

SCHEDULE	GRADE 60 REINFORCING BAR		EQUIVALENT GRADE 40 REINFORCING BAR		EQUIVALENT 65 KSI SMOOTH WELDED WIRE REINFORCEMENT		EQUIVALENT 70 KSI DEFORMED WELDED WIRE REINFORCEMENT	
	Bar Size & Spacing	Steel Area (in <sup>2</sup> /ft)	Bar Size & Spacing	Min. Steel Area (in <sup>2</sup> /ft)	Style Designation	Min. Steel Area (in <sup>2</sup> /ft)	Style Designation	Min. Steel Area (in <sup>2</sup> /ft)
A	#3 @ 6 1/2" Ctrs. #4 @ 12" Ctrs.	0.20	#3 @ 4 1/2" Ctrs. #4 @ 8" Ctrs. #5 @ 12" Ctrs.	0.30	3"x3"-W4.6xW4.6 4"x4"-W6.2xW6.2 6"x6"-W11.1xW11.1	0.1846	3"x3"-D4.3xD4.3 4"x4"-D5.7xD5.7 6"x6"-D8.6xD8.6	0.1714
B	#3 @ 5 1/2" Ctrs. #4 @ 10" Ctrs.	0.24	#3 @ 3 1/2" Ctrs. #4 @ 6 1/2" Ctrs. #5 @ 10" Ctrs.	0.36	3"x3"-W5.5xW5.5 4"x4"-W7.4xW7.4 6"x6"-W11.1xW11.1	0.2215	3"x3"-D5.1xD5.1 4"x4"-D6.9xD6.9 6"x6"-D10.3xD10.3	0.2057
Special 1	#3 @ 5" Ctrs. #4 @ 9" Ctrs.	0.267	#3 @ 3" Ctrs. #4 @ 6" Ctrs. #5 @ 9" Ctrs.	0.40	3"x3"-W6.2xW6.2 4"x4"-W8.2xW8.2 6"x6"-W12.3xW12.3	0.2465	3"x3"-D5.7xD5.7 4"x4"-D7.6xD7.6 6"x6"-D11.4xD11.4	0.2289
C	#3 @ 3 1/2" Ctrs. #4 @ 6 1/2" Ctrs. #5 @ 10" Ctrs.	0.37	#4 @ 4" Ctrs. #5 @ 6 1/2" Ctrs. #6 @ 9 1/2" Ctrs.	0.555	3"x3"-W8.5xW8.5 4"x4"-W11.4xW11.4 6"x6"-W17.1xW17.1	0.3415	3"x3"-D7.9xD7.9 4"x4"-D10.6xD10.6 6"x6"-D15.9xD15.9	0.3171
D	#4 @ 4 1/2" Ctrs. #5 @ 7" Ctrs. #6 @ 10" Ctrs.	0.53	#4 @ 3" Ctrs. #5 @ 4 1/2" Ctrs. #6 @ 6 1/2" Ctrs.	0.795	3"x3"-W12.2xW12.2 4"x4"-W16.3xW16.3 6"x6"-W24.5xW24.5	0.4892	3"x3"-D11.4xD11.4 4"x4"-D15.1xD15.1 6"x6"-D22.7xD22.7	0.4543
E	#4 @ 3" Ctrs. #5 @ 5" Ctrs. #6 @ 7" Ctrs.	0.73	#5 @ 3 1/2" Ctrs. #6 @ 4 1/2" Ctrs. #7 @ 6 1/2" Ctrs.	1.095	3"x3"-W16.8xW16.8 4"x4"-W22.5xW22.5 6"x6"-W33.7xW33.7	0.6738	3"x3"-D15.6xD15.6 4"x4"-D20.9xD20.9 6"x6"-D31.3xD31.3	0.6257
F	#5 @ 3 1/2" Ctrs. #6 @ 5" Ctrs. #7 @ 7" Ctrs.	1.06	#6 @ 3" Ctrs. #7 @ 4 1/2" Ctrs. #8 @ 6" Ctrs.	1.59	3"x3"-W24.5xW24.5 4"x4"-W32.6xW32.6 6"x6"-W48.9xW48.9	0.9785	3"x3"-D22.7xD22.7 4"x4"-D30.3xD30.3 6"x6"-D45.4xD45.4	0.9086
Special 2	#5 @ 3" Ctrs. #6 @ 4" Ctrs. #7 @ 5 1/2" Ctrs.	1.24	#7 @ 4" Ctrs. #8 @ 5" Ctrs.	1.86	3"x3"-W28.6xW28.6 4"x4"-W38.2xW38.2 6"x6"-W57.2xW57.2	1.1446	3"x3"-D26.6xD26.6 4"x4"-D35.4xD35.4 6"x6"-D53.1xD53.1	1.0629
G	#6 @ 3 1/2" Ctrs. #7 @ 5" Ctrs.	1.46	#7 @ 3" Ctrs. #8 @ 4" Ctrs.	2.19	3"x3"-W33.7xW33.7 4"x4"-W44.9xW44.9	1.3477	3"x3"-D31.3xD31.3 4"x4"-D41.7xD41.7	1.2514

NOTES FOR PRECAST OPTIONS AND EQUIVALENT REINFORCEMENT SUBSTITUTION

- Details for optional precast inlet construction up to depths of 15' are shown on the inlet indexes.
- When precast units are used in conjunction with Alt. "B" Structure Bottoms, Index 425-010, the interior dimensions of an Alt. "B" Bottom can be adjusted to reflect these inlet interior dimensions.
- Concrete which meets the requirements of ASTM C478 or Class IV must be used for precast structures constructed with 6" wall or slab thickness.
- Reinforcement can be either deformed bar reinforcement or welded wire reinforcement. Bar reinforcement other than 60 ksi may be used, however only two grades are recognized; Grade 40 and Grade 60. Smooth welded wire reinforcement, will be recognized as having a design strength of 65 ksi and deformed welded wire reinforcement will be recognized as having a design strength of 70 ksi. The area of reinforcement required may be adjusted in accordance with the Equivalent Steel Area Table provided. For bars and spacings not given, the steel area required can be determined by the following equations:

$$\text{Grade 40 Steel Area} = A_{s40} = \frac{60}{40} \times A_{s60}$$

$$\text{Smooth Welded Wire Reinforcement Steel Area} = A_{s65} = \frac{60}{65} \times A_{s60}$$

$$\text{Deformed Welded Wire Reinforcement Steel Area} = A_{s70} = \frac{60}{70} \times A_{s60}$$

When a reduced area of reinforcement is provided, any maximum bar spacing shown must also be reduced as determined by the following equations, unless otherwise shown:

$$\begin{aligned} \text{Max. Grade 40 Bar Spacing} &= \text{Grade 60 Bar Spacing} \\ \text{Max. Smooth Welded Wire Spacing} &= \text{Grade 60 Bar Spacing} \times 0.86 \\ \text{Max. Deformed Welded Wire Spacing} &= \text{Grade 60 Bar Spacing} \times 0.74 \end{aligned}$$

When an increased area of reinforcing is provided, then the maximum bar spacing may be increased by the squared ratio of increased steel area, but not to exceed 12":

$$\text{Max. Bar Spacing Provided} \leq \text{Max. Bar Spacing Required} \times \left( \frac{\text{Steel Area Provided}}{\text{Min. Steel Area Required}} \right)^2$$

In no case will reinforcement with wires smaller than W3.1 or D4.0, or spacings greater than 8" be permitted. Bar reinforcement shall show the minimum yield designation grade mark or either the number 60 or one (1) grade mark line to be acceptable at the higher value. Maximum bar spacing shall not be greater than two (2) times the slab thickness with a maximum spacing of 12" or three (3) times the wall thickness, with a maximum spacing of 18" for vertical bars and 12" for horizontal bars. Wires smaller than W3.1 or D4.0 are permitted in the walls of ASTM C 478 round structure bottoms and round risers.

- Fiber-reinforced concrete may be substituted for conventional steel reinforcement in accordance with the Structures Design Guidelines. Shop drawings corresponding to an approved fiber-reinforced concrete mix design must be submitted for approval to the State Drainage Engineer.

UPDATED NOTES

SHEET 5

GENERAL NOTES

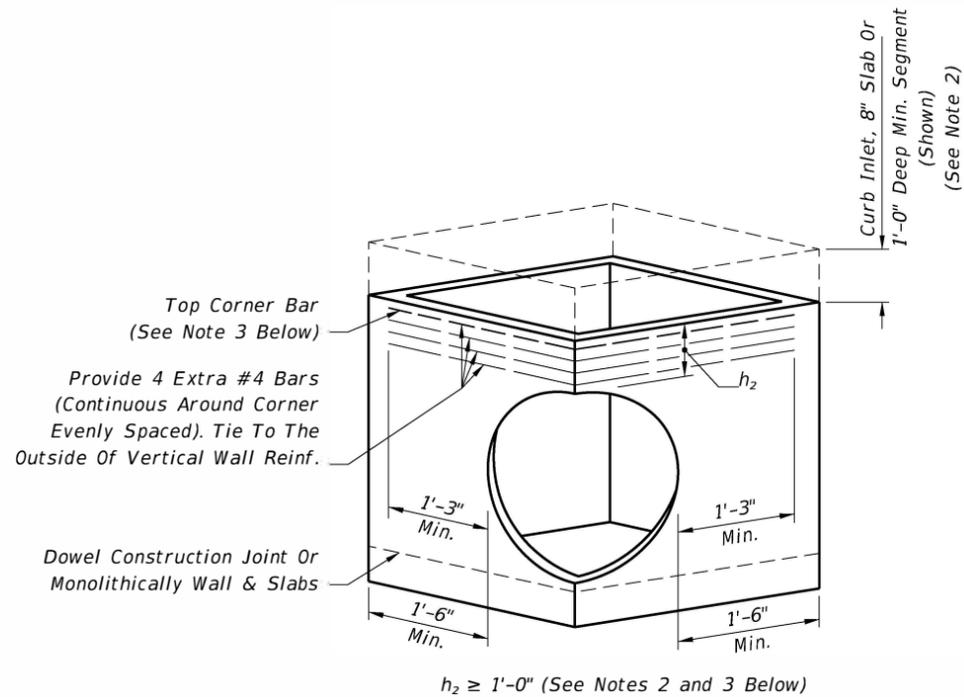
- For square or rectangular precast drainage structures, using either deformed or smooth WWR meeting the requirements of Specification Section 931, WWR shall be continuous around the box and lapped in accordance with Option 1 or 3 as shown in the Wall Reinforcing Splice Details.
- Horizontal steel in the walls of rectangular structures shall be lap spliced in accordance with Option 1, 2 or 3 as shown in the Wall Reinforcing Splice Details.
- Welding of splices and laps is permitted. The requirements and restrictions placed on welding in AASHTO M259 shall apply.
- Rebar straight end embedment of peripheral reinforcement may be used in lieu of ACI standard hooks for top and bottom slabs except when hooks are specifically called for in the plans or standard drawings.
- Concrete as specified in ASTM C478, (4000 psi) may be used in lieu of Class II concrete in precast items manufactured in plants which meet the requirements in accordance with Specification Section 449.
- Precast opening for pipe shall be the pipe OD plus 6" (± 2" tolerance). Mortar used to seal the pipe into the opening will be of such a mix that shrinkage will not cause leakage into or out of the structure. Dry-pack mortar may be used in lieu of brick and mortar construction to seal openings less than 2 1/2" wide.
- For pay item purposes, the height used to determine if a drainage structure is greater than 10 feet shall be computed using:
  - the elevation of the top of the manhole lid,
  - the grate elevation or the theoretical gutter grade elevation of an inlet, or
  - the outside top elevation of a junction box less the flow line elevation of the lowest pipe or to top of sump floor.

**MOVE TO SHEET 1**

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## Corrected Reference to Skew

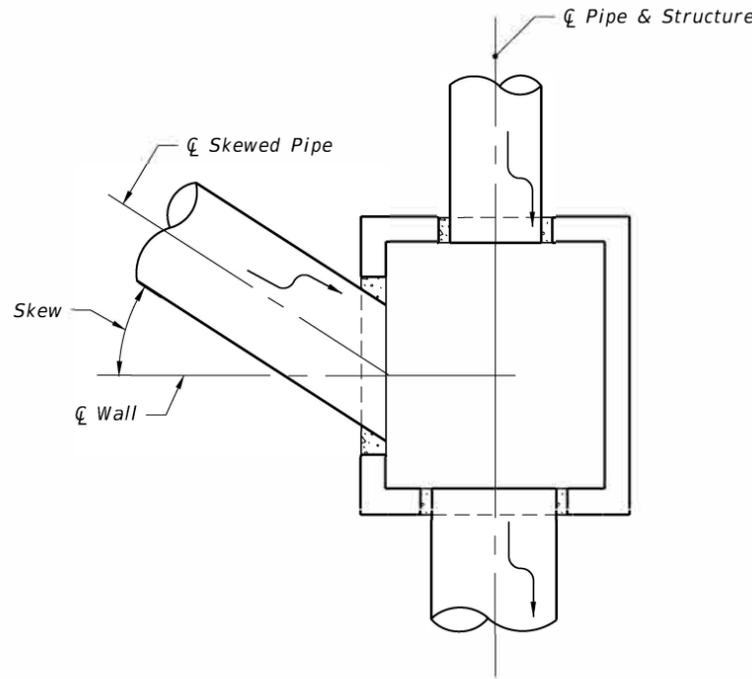


DESIGNER NOTE: Use only when round structures are not practical, engineer of record approval required.

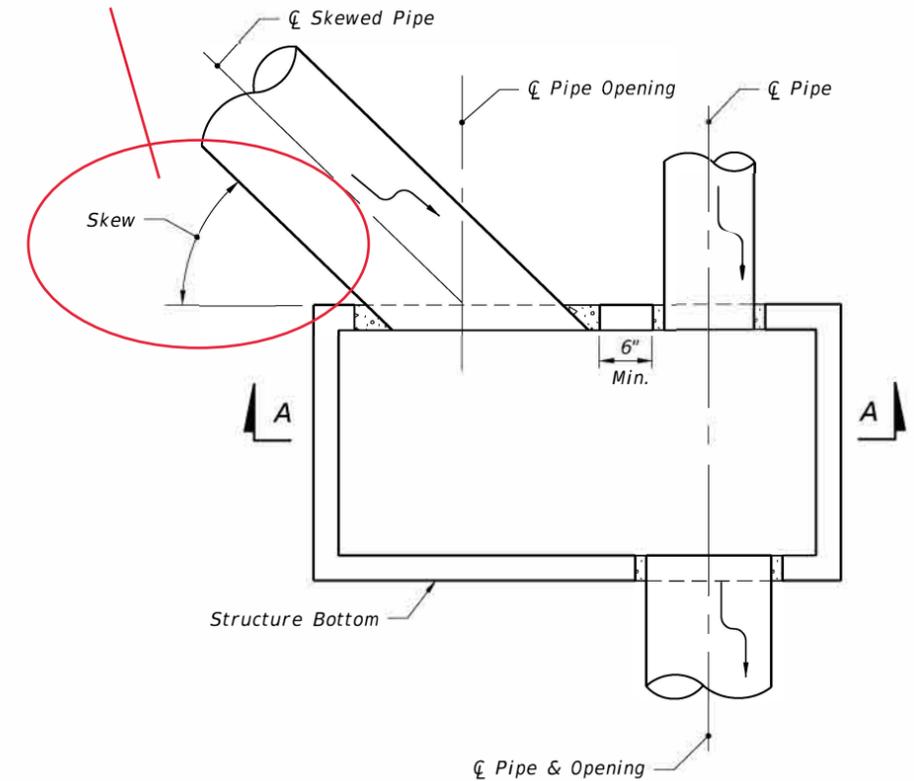
### PICTORIAL VIEW

- NOTE:
1. Submit Shop Drawings of corner openings for approval by the Engineer of Record.
  2.  $h_2$  may be less than 1'-0" when a minimum 1'-0" deep segment, 8" slab or curb inlet is provided above the corner opening.
  3. For inlet segments at finish grade elevation substitute a #8 Bar for the top corner bar when 1'-0" ≤  $h_2$  < 2'-0".

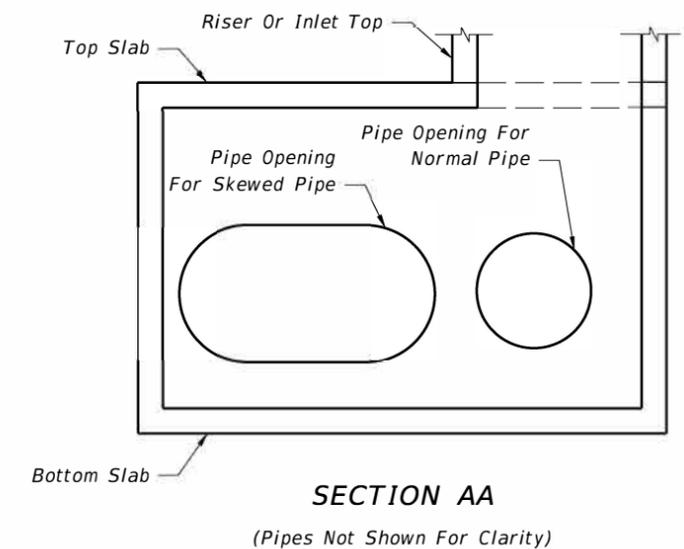
### RECTANGULAR SEGMENT WITH PIPE OPENING AT CORNER



PLAN VIEW FOR SKEWS ≤ 45°  
(Not Centered)



PLAN VIEW FOR SKEWS > 45°  
(Not Centered)



### SECTION AA

(Pipes Not Shown For Clarity)

DETAILS FOR SKEWED PIPES IN  
RECTANGULAR STRUCTURES

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Table 6-4.2 in the Drainage Design Guide.

**TABLE 3-MINIMUM STRUCTURE SIZES FOR SINGLE PIPE CONNECTION PER SIDE**

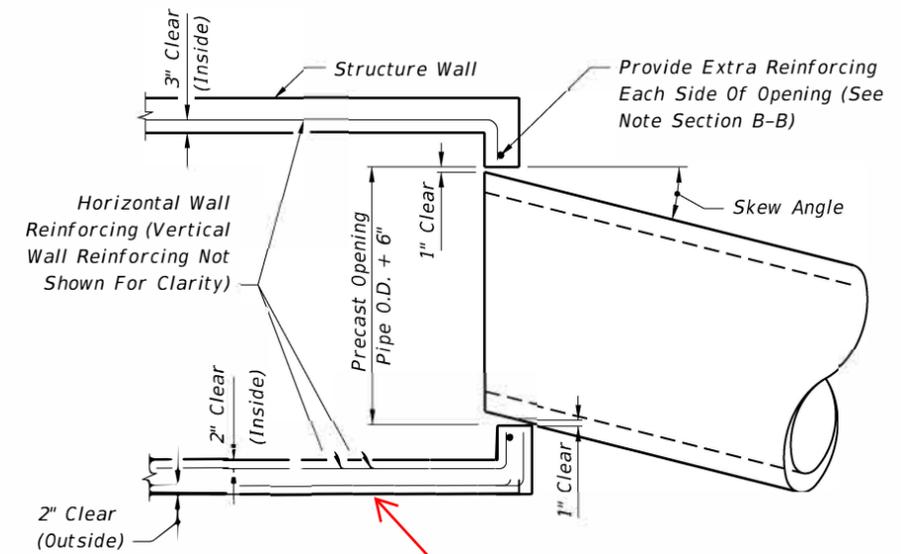
PIPE SIZE	RECTANGULAR		ROUND	
	Side Dimension (L)		Diameter (D)	
	Single Pipe Per Side	Note Number	Single Pipe or $\theta=180^\circ$	2 to 4 Pipes $\theta=90^\circ$
18"	3'-6"		3'-6"	4'-0"
24"	3'-6"		3'-6"	5'-0"
30"	3'-6"/4'-0"	2	4'-0"	6'-0"
36"	4'-0"/5'-0"	3	5'-0"	7'-0"
42"	5'-0"		6'-0"	7'-0"
48"	6'-0"		6'-0"	8'-0"
54"	6'-0"		7'-0"	10'-0"
60"	7'-0"		7'-0"	10'-0"
66"	7'-0"/8'-0"	4	8'-0"	12'-0"
72"	8'-0"		8'-0"	12'-0"
78"	9'-0"		10'-0"	12'-0"
84"	9'-0"		12'-0"	N/A

- TABLE 3 NOTES:**
- For Round Structures sizes with variable angles between pipes and variable pipe sizes, refer to the FDOT Storm Drain Handbook.
  - For 3'-6" Precast Square Structure Bottoms, 30" Pipes with similar invert elevations are not permitted in adjacent walls. Use 4'-0" Side Dimensions when 30" pipe openings are required on adjacent walls and the difference in flow lines is less than 3'-0".
  - For 4'-0" Precast Square Structure Bottoms, 36" Pipes with similar invert elevations are not permitted in adjacent walls. Use 5'-0" Side Dimensions when 36" pipe openings are required on adjacent walls and the difference in flow lines is less than 3'-0".
  - For 7'-0" Precast Square Structure Bottoms, 66" Pipes with similar invert elevations are not permitted in adjacent walls. Use 8'-0" Side Dimensions when 66" pipe openings are required on adjacent walls and the difference in flow lines is less than 4'-0".

**TABLE 4-MINIMUM SIZES FOR MULTIPLE PIPE CONNECTIONS FOR RECTANGULAR STRUCTURE BOTTOMS**

PIPE SIZE	PIPE SPACING (S)	MINIMUM WALL LENGTH (L) FOR NUMBER OF PARALLEL PIPES		
		2	3	4
18"	2'-10"	6'-0"	8'-6"	11'-0"
24"	3'-5"	6'-6"	10'-0"	13'-6"
30"	4'-3"	8'-0"	12'-6"	16'-6"
36"	5'-1"	9'-6"	14'-6"	19'-6"
42"	6'-0"	11'-0"	17'-0"	-
48"	6'-9"	12'-6"	19'-0"	-
54"	7'-8"	14'-0"	-	-
60"	8'-6"	15'-0"	-	-
66"	9'-0"	16'-6"	-	-
72"	10'-0"	18'-0"	-	-
78"	10'-9"	19'-0"	-	-
84"	11'-8"	20'-6"	-	-

- TABLE 4 NOTES:**
- Minimum wall lengths based on precast structures, using concrete pipe with maximum skew angles per Table 5.
  - Wall lengths exceeding 20'-0" require special designs.

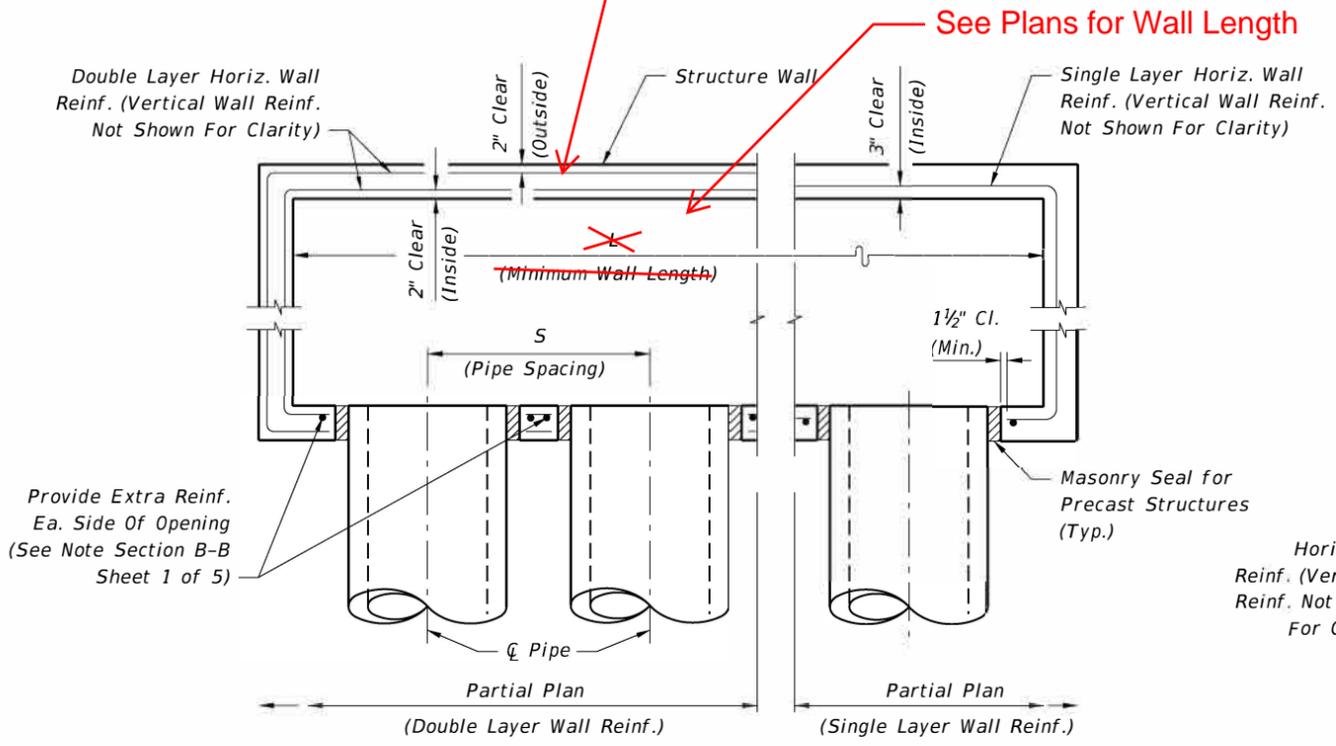


**TABLE 5 - MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS**

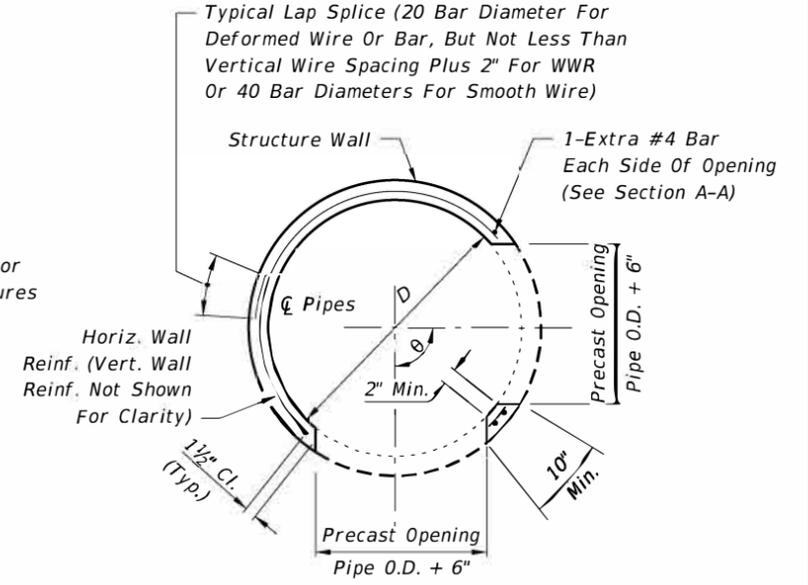
WALL THICKNESS	PIPE SIZE												
	18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	
MAXIMUM SKEW ANGLE	8"	19°	17°	16°	16°	15°	14°	14°	13°	13°	13°	12°	12°
	6"	21°	20°	18°	17°	17°	16°	15°	15°	14°	14°	13°	13°

**TABLE 5 NOTES:**  
 These values are based on 2" clearance for precast structures. Larger skews are possible for Cast-In-Place Structures or elliptical pipe openings when approved by the Engineer.

**MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS PLAN VIEW**



**MULTIPLE PARALLEL PIPE CONNECTIONS DETAIL PLAN VIEW**



**PRECAST ROUND STRUCTURES WITH MULTIPLE PIPE CONNECTIONS**

~~STRUCTURE SIZES FOR PIPE CONNECTIONS~~

**MISCELLANEOUS PIPE CONNECTION DETAILS**

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**GENERAL NOTES:**

1. Use a 1-piece cover, unless the 2-piece cover is called for in the Plans, except at inlets and manholes with sump bottoms. Use the 2-piece cover when the sump depth exceeds 2', unless otherwise noted.
2. Include "Adjustable" on the cover for Type I manhole adjustable frames.
3. For square or rectangular precast drainage structures, use either deformed or smooth WWR meeting the requirements of Specification 931. WWR must be continuous around the box and lapped in accordance with Option 1 or 3 as shown in the Wall Reinforcing Splice Details.
4. Lap splice horizontal steel in the walls of rectangular structures in accordance with Option 1, 2 or 3 as shown in the Wall Reinforcing Splice Details.
5. Welding of splices and laps is permitted. Use AASHTO M259 requirements and restrictions on welds.
6. Rebar straight end embedment of peripheral reinforcement may be used in lieu of ACI standard hooks for top and bottom slabs, except when hooks are specifically called for in the Plans.
7. Precast opening for pipe must be the pipe OD plus 6" ( $\pm 2"$  tolerance). Use mortar to seal the pipe into the opening of such a mix that shrinkage will not cause leakage into or out of the structure. Dry-pack mortar may be used to seal openings less than 2½" wide.

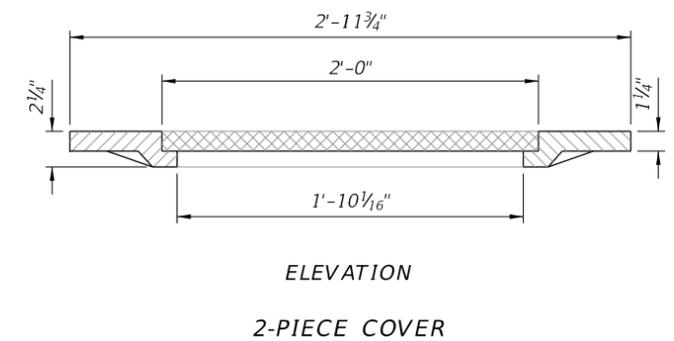
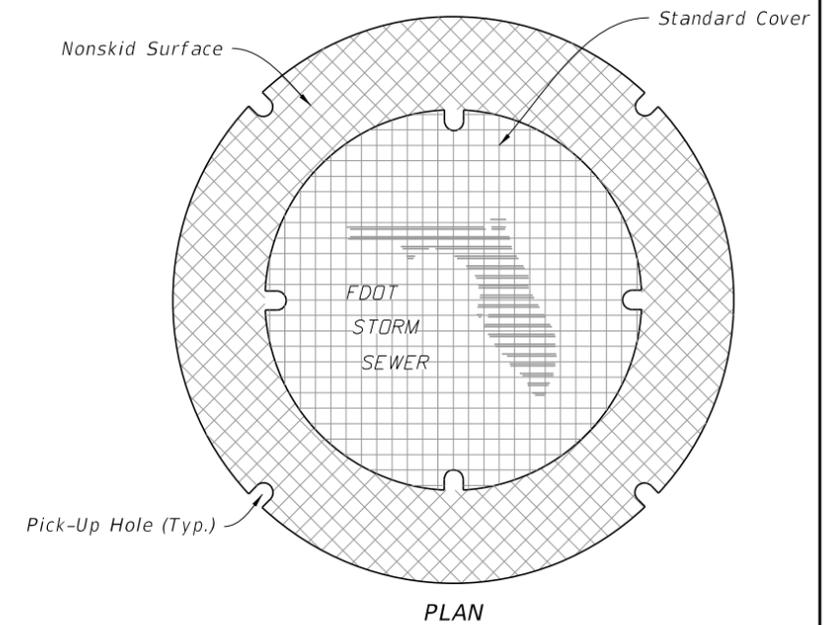
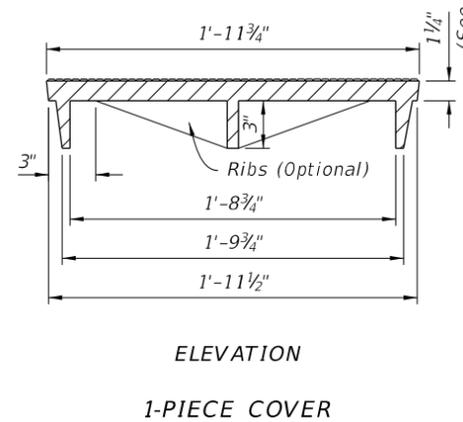
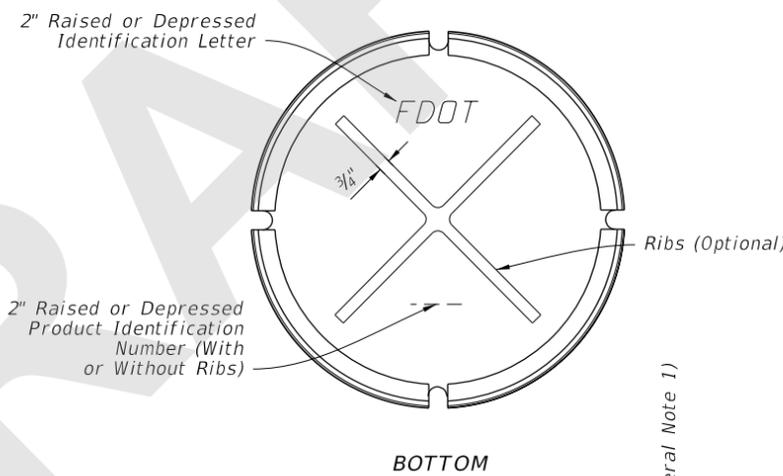
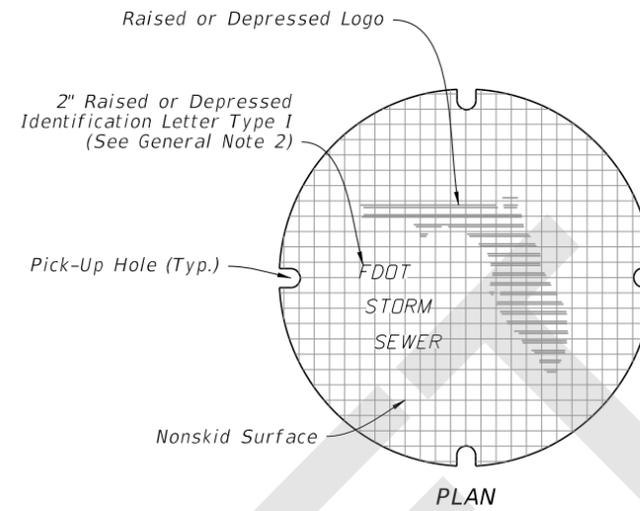
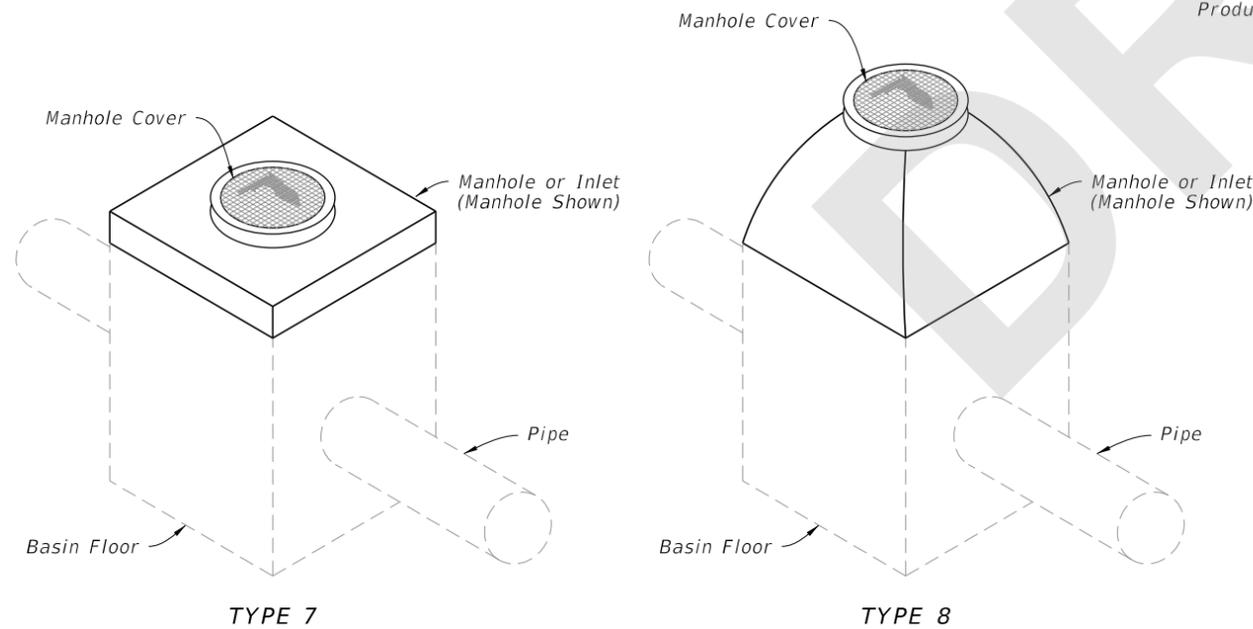


TABLE OF CONTENTS:	
Sheet	Description
1	General Notes, Contents, Manhole Top Overview, and Manhole Covers
2	Manhole Frames and Manhole Tops
3	Inlet Locking Grates, Subgrade and Base Temporary Drains, and Pipe to Structure Filter Fabric Wrap
4	Drainage Structure Invert, Sump Bottom, Wall Reinforcing Splice Details, and Typical Slab to Wall Details
5	Precast Option and Equivalent Reinforcement substitution
6	Construction Joints and Minimum Box Riser Segment Dimensions
7	Skewed Pipe in Rectangular Structures
8	Miscellaneous Pipe Connection Details



MANHOLE COVERS

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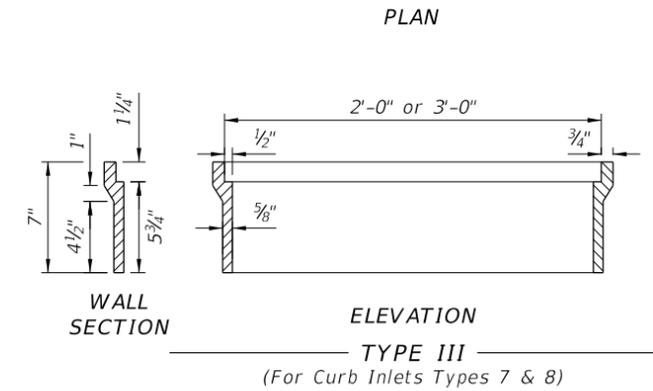
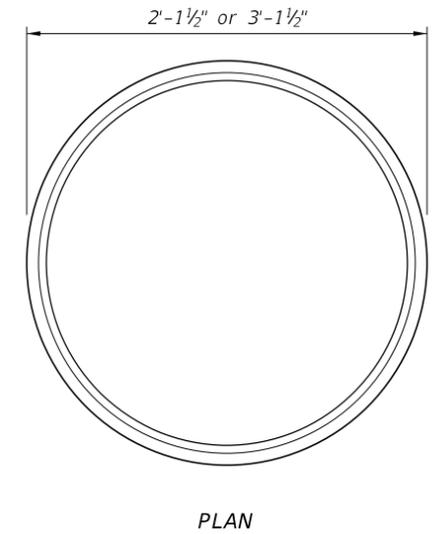
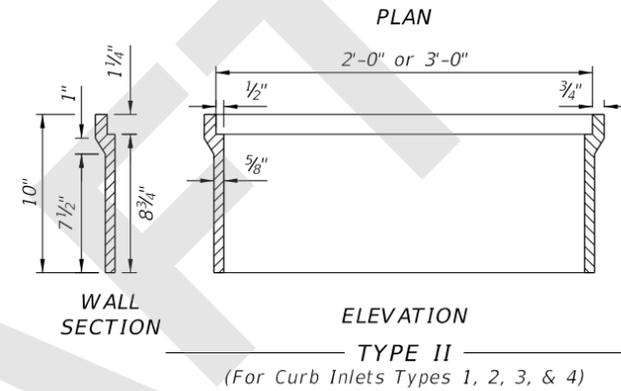
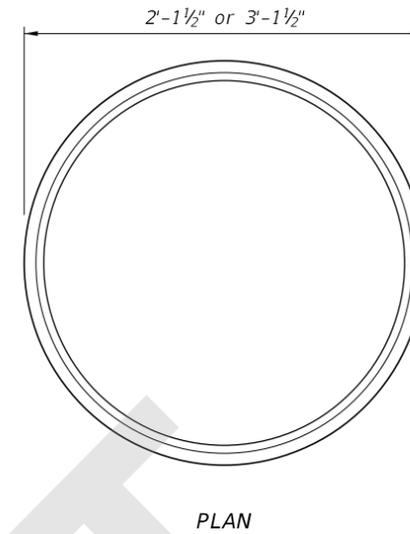
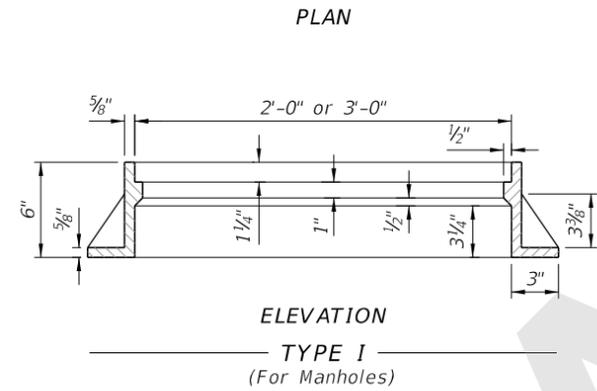
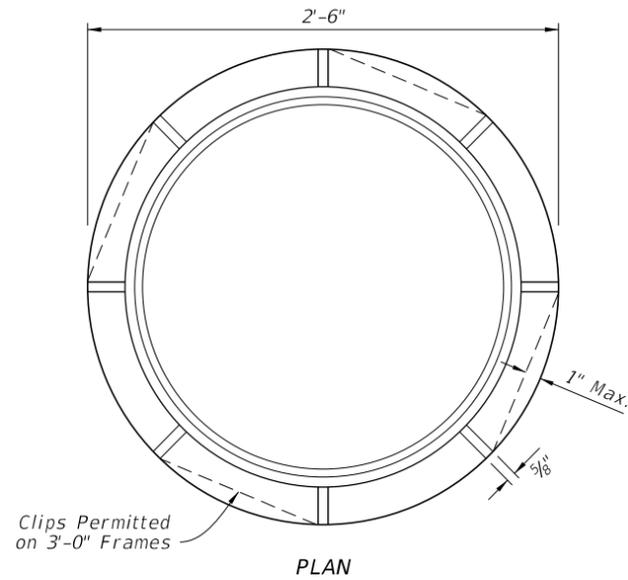
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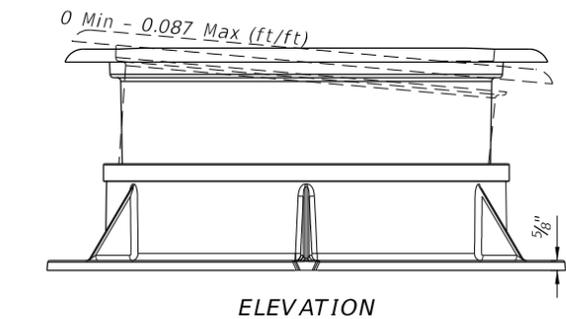
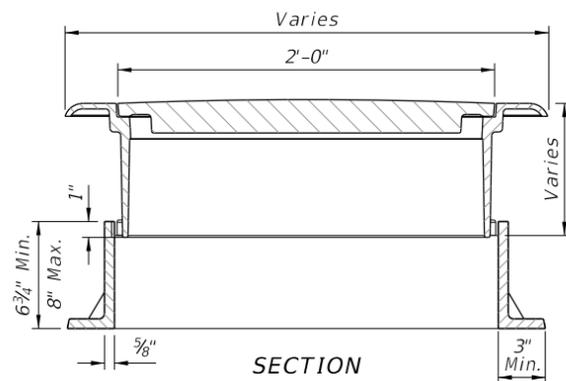
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Frame Type	2'-0" OPENING		3'-0" OPENING			
	Frame	Cover (Std.)	Frame	2-Piece Cover Inside	2-Piece Cover Outside	Total
I	155	190	220	190	220	410
II	145	190	255	190	220	410
III	90	190	180	190	220	410

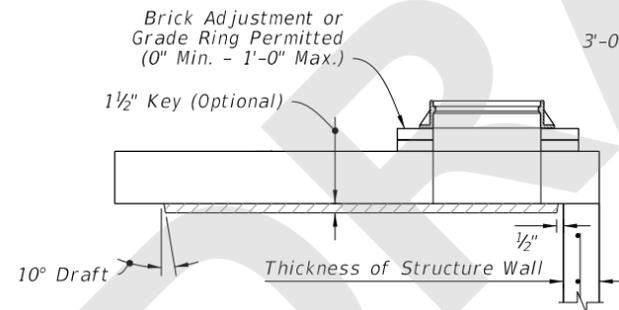
**NOTE:**  
Frame Type I in Table 1, includes Adjustable frames.



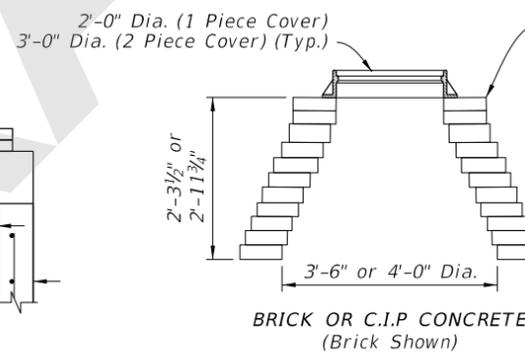
**MANHOLE FRAMES**



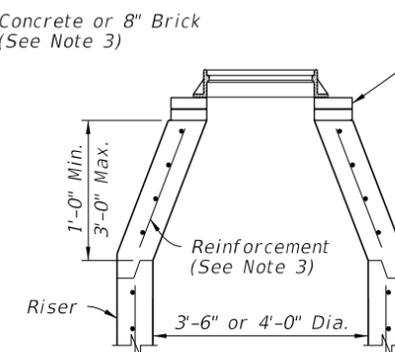
TYPE I ADJUSTABLE FRAME



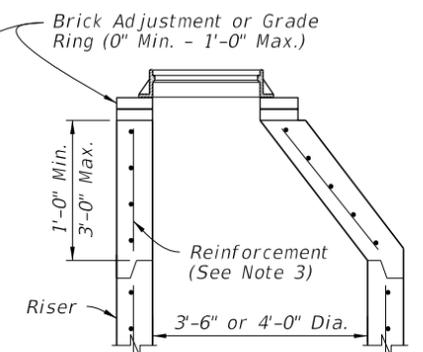
TYPE 7



BRICK OR C.I.P. CONCRETE (Brick Shown)



PRECAST CONCENTRIC CONE



PRECAST ECCENTRIC CONE

TYPE 8

**NOTES:**

1. Use Class II concrete for Manhole top Type 7 slabs, see General Note 6.
2. Manhole top Type 7 slabs may be of cast-in-place or precast construction. The optional key is for precast tops and in lieu of dowels. Omit frame and slab openings when top is used over a junction box.
3. Manhole top Type 8 may be of cast-in-place, precast concrete construction, or brick construction. For concrete construction, use the same concrete and steel reinforcement as the supporting wall unit. An eccentric cone may be used.
4. Use optional construction joints as shown on Sheet 6 to secure manhole tops to structures.
5. Frames may be adjusted to a maximum 12" height with brick or precast ASTM C478 grade rings.
6. Manhole top Type 8 may be substituted for a Type 7, if the minimum dimensions are not reduced.
7. Manhole top Type 7 may be substituted for Type 8, if the minimum thickness (h) above pipe opening cannot be maintained with Type 8.

**MANHOLE TOPS**

**MANHOLE FRAMES AND MANHOLE TOPS**

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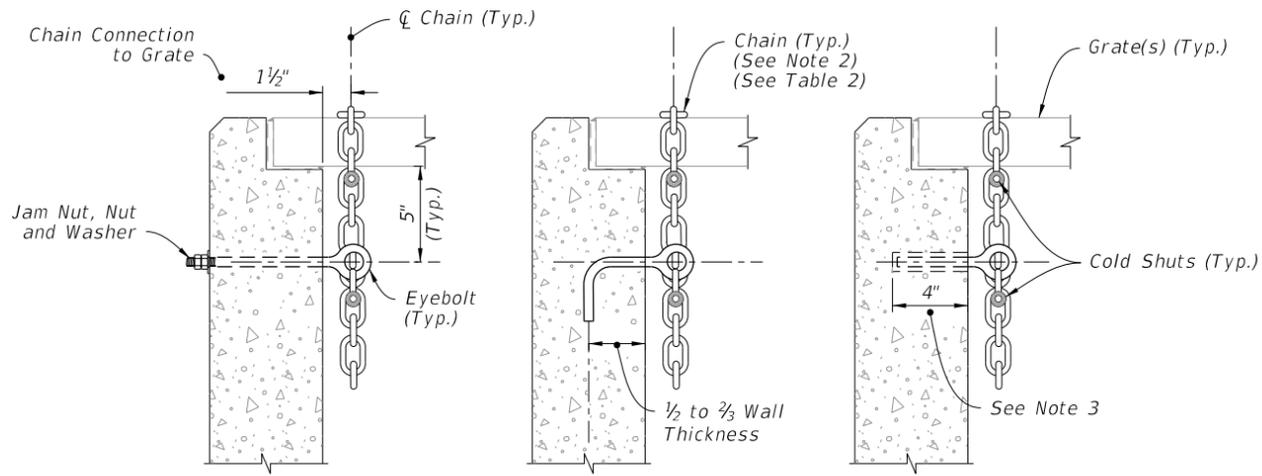


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THRU-BOLT

J-TYPE

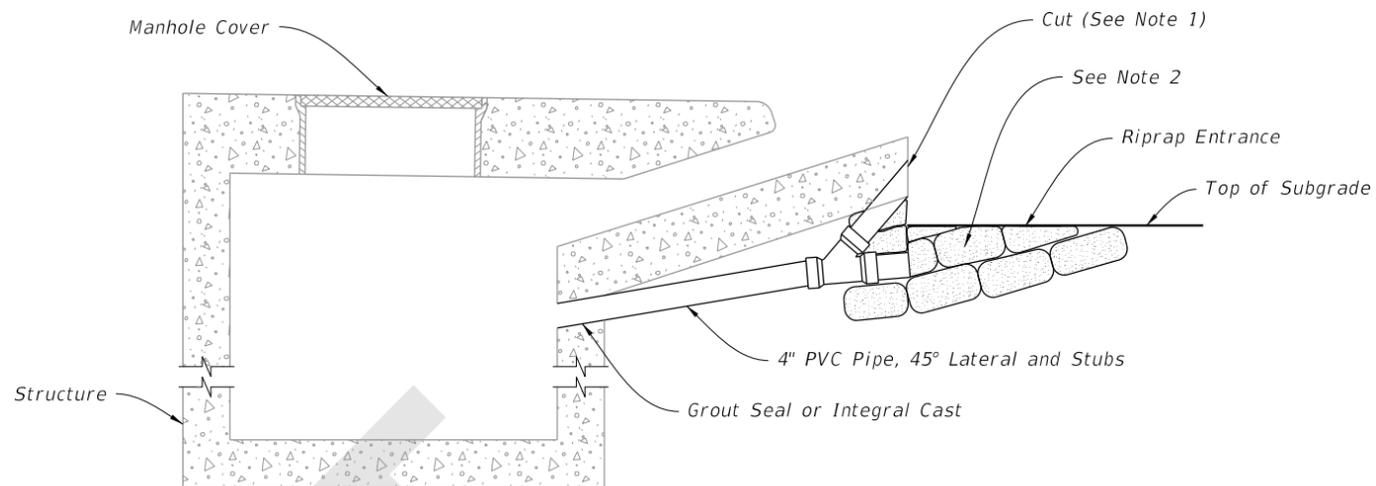
ADHESIVE BONDED ANCHOR

**NOTES:**

1. Install either a 1/2" Ø x 1" Diameter Threaded Straight (Thru-Bolt), a J-Type, or an adhesive Bonded Anchor Eyebolt.
2. Install a 3/16" Chain and 3/16" Cold Shuts. When chaining two grates together provide adequate loop for easy handling.
3. Install adhesive bonded anchor option with a minimum of 4" embedment, and in accordance with Specification 416.

**TABLE 2  
EYEBOLT AND CHAIN REQUIREMENTS**

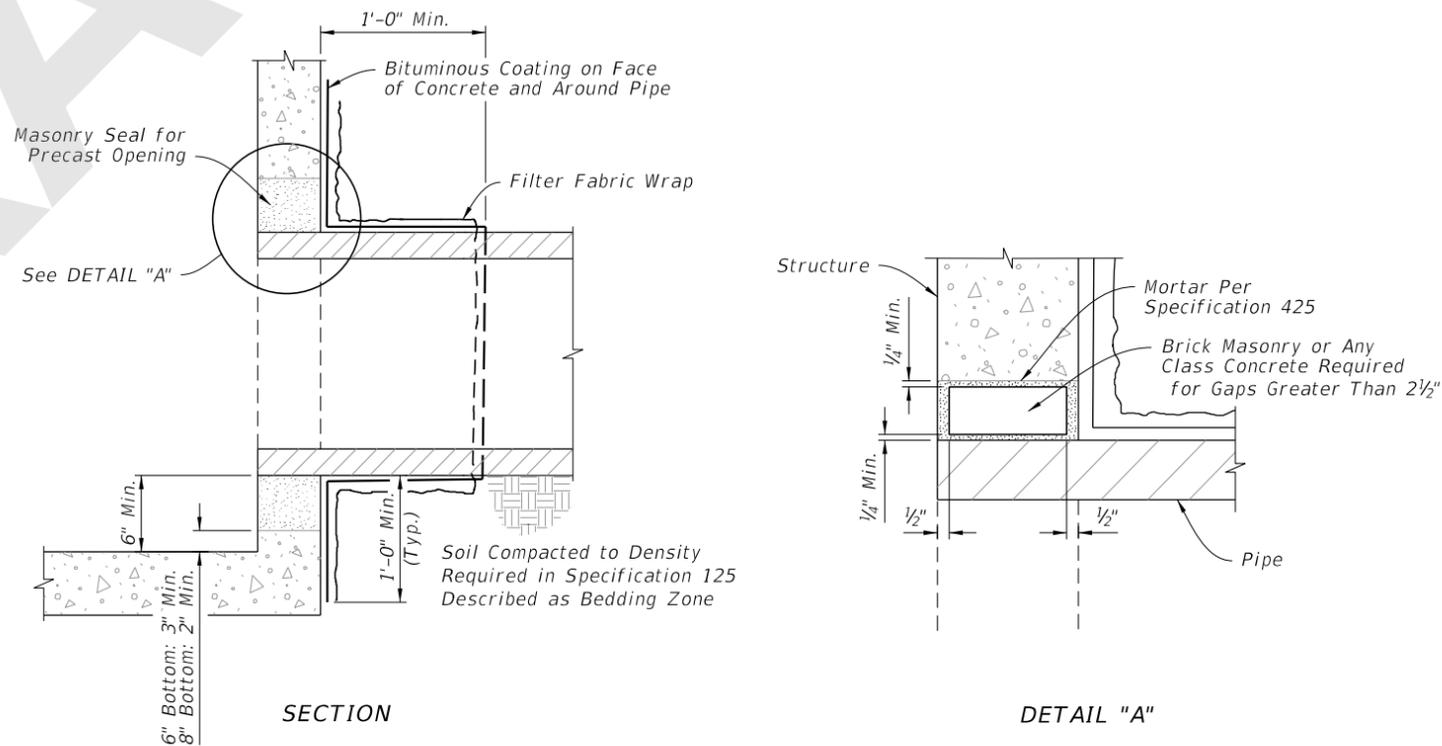
Index Number	Inlet Type	Eye-Bolts	Length of Chain	Handling & Remarks
425-030	1	1	4'-0"	Slide & Spin
	2	1	4'-0"	Slide & Spin
	3	2	2 @ 4'-0"	Slide & Spin
	4	2	2 @ 4'-0"	Slide & Spin
	5	2	2 @ 4'-0"	Slide & Spin
425-031	N/A	1	3'-8"	Slide or Slide & Spin
425-032	N/A	1	4'-0"	Slide & Spin
425-040	S	1	4'-0"	Slide & Spin
425-041	V	1	4'-0"	Slide & Spin
425-050	A	1	3'-0"	Slide
425-051	B	1	5'-0"	Slide & Spin
	C	1	2'-6"	Slide & Spin
	D	1	2'-6"	Slide & Spin
	E	2	2 @ 2'-6"	Slide & Spin
425-052	H	2	2 @ 2'-6"	Flip Ctr. Grate and Slide & Spin Single Free Grate
			1 or 2 @ 1'-6"	Center Grate(s) Chained to One End Grate
	F	1	3'-6"	Flip or Slide & Spin
425-053	G	1	6'-0"	Slide
			2'-0"	Lifting Loop
425-054	J	1	4'-0"	Slide & Spin



**NOTES:**

1. Bevel cut upper stub to match forming for apron face. Capping or plugging of upper stub is not required. Remove friable base material at stub opening to permit covering of opening with structural course material.
2. Remove riprap, cement PVC cap on lower stub, and place compacted fill in entrance prior to placing base material.

**SUBGRADE AND BASE TEMPORARY DRAINS**



**LOCKING GRATES TO INLETS**

**PIPE TO STRUCTURE FILTER FABRIC WRAP**

**LOCKING GRATES, SUBGRADE AND BASE TEMPORARY DRAINS, AND PIPE TO STRUCTURE FILTER FABRIC WRAP**

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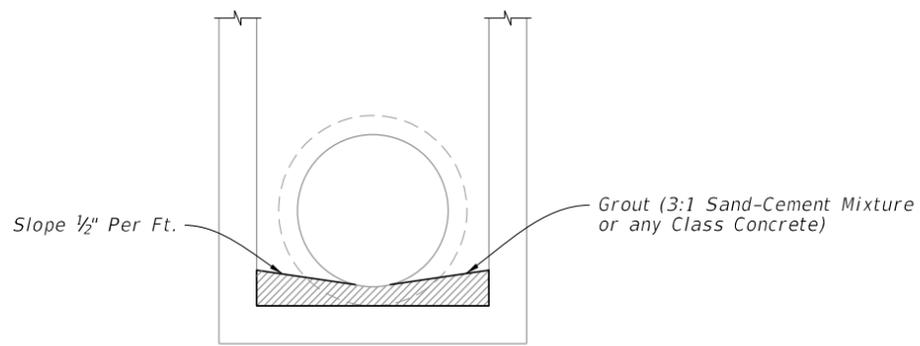


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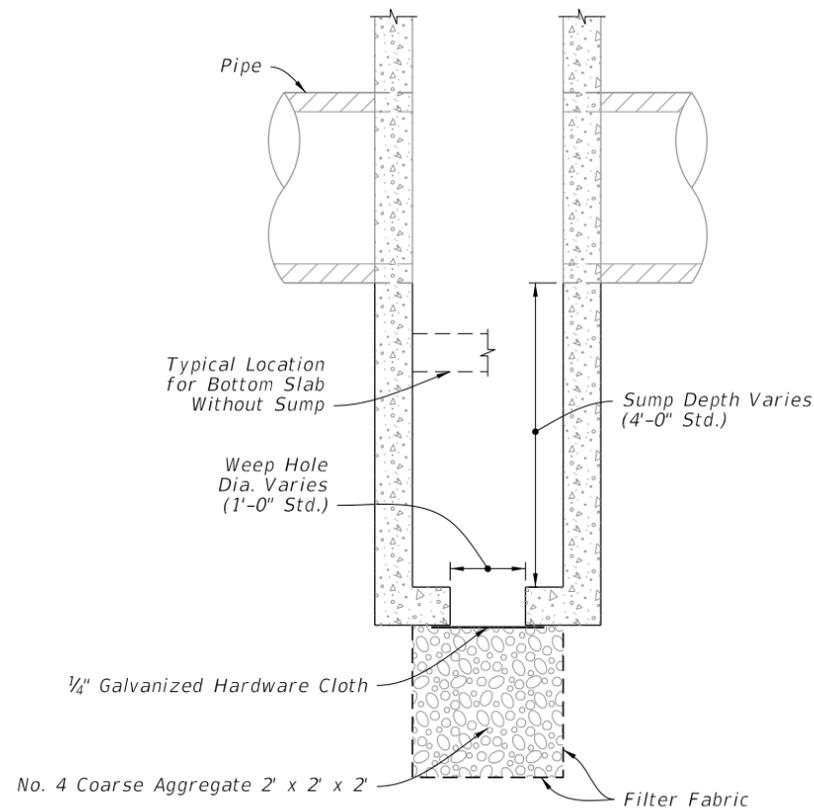
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NOTE: For all structures unless excluded by special detail.

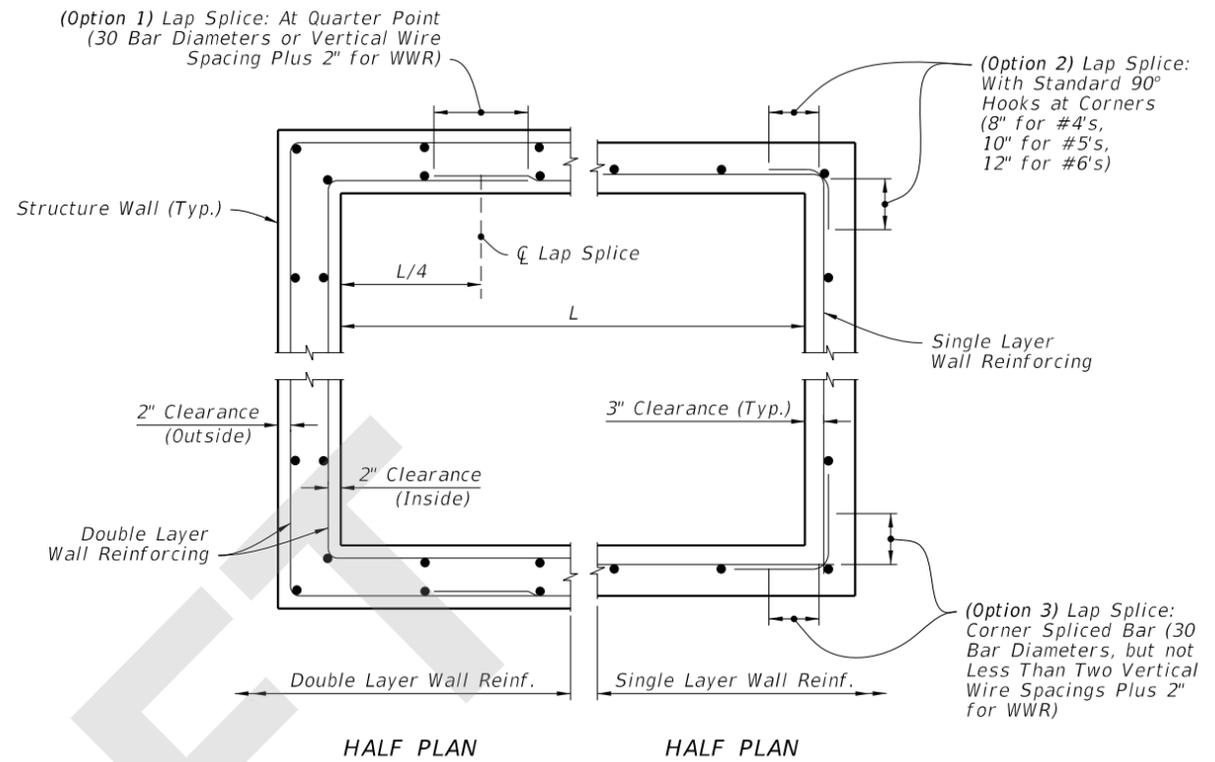
**DRAINAGE STRUCTURE INVERT**



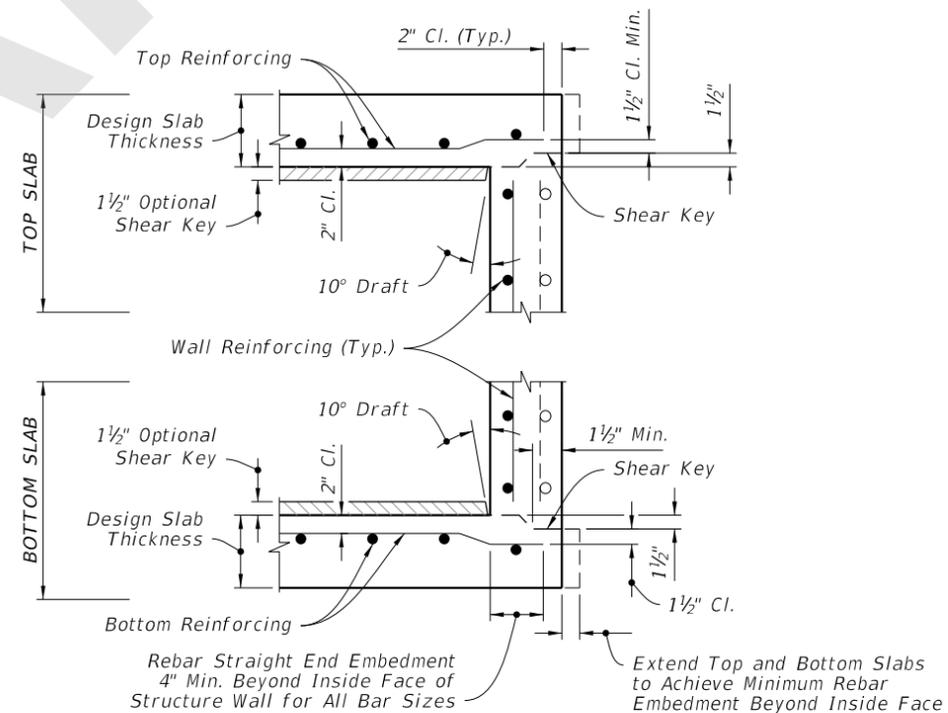
**NOTES:**

1. Construct sumps in inlets and manholes connecting to French Drains unless excluded in the Plans.
2. Construct sumps only where called for in the Plans at all other locations.
3. Construct weep holes in sump bottom only where called for in the Plans.

**SUMP BOTTOM**



**WALL REINFORCING SPLICE DETAILS**



**NOTES:**

1. See Sheet 6 for optional construction joints.
2. Bend bars as required to maintain cover.

**TYPICAL SLAB TO WALL DETAILS  
(PRECAST STRUCTURE SHOWN)**

**DRAINAGE STRUCTURE INVERT, SUMP BOTTOM, WALL REINFORCING SPLICE DETAILS, AND TYPICAL SLAB TO WALL DETAILS**

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**EXAMPLE TABLE OF EQUIVALENT STEEL AREA**

SCHEDULE	GRADE 60 REINFORCING BAR		EQUIVALENT GRADE 40 REINFORCING BAR		EQUIVALENT 65 KSI SMOOTH WELDED WIRE REINFORCEMENT		EQUIVALENT 70 KSI DEFORMED WELDED WIRE REINFORCEMENT	
	Bar Size & Spacing	Steel Area (in <sup>2</sup> /ft)	Bar Size & Spacing	Steel Area (in <sup>2</sup> /ft)	Style Designation	Steel Area (in <sup>2</sup> /ft)	Style Designation	Steel Area (in <sup>2</sup> /ft)
A	#3 @ 6½" Ctrs. #4 @ 12" Ctrs.	0.20	#3 @ 4½" Ctrs. #4 @ 8" Ctrs. #5 @ 12" Ctrs.	0.30	3"x3"-W4.6xW4.6 4"x4"-W6.2xW6.2 6"x6"-W9.2xW9.2	0.1846	3"x3"-D4.3xD4.3 4"x4"-D5.7xD5.7 6"x6"-D8.6xD8.6	0.1714
B	#3 @ 5½" Ctrs. #4 @ 10" Ctrs.	0.24	#3 @ 3½" Ctrs. #4 @ 6½" Ctrs. #5 @ 10" Ctrs.	0.36	3"x3"-W5.5xW5.5 4"x4"-W7.4xW7.4 6"x6"-W11.1xW11.1	0.2215	3"x3"-D5.1xD5.1 4"x4"-D6.9xD6.9 6"x6"-D10.3xD10.3	0.2057
Special 1	#3 @ 5" Ctrs. #4 @ 9" Ctrs.	0.267	#3 @ 3" Ctrs. #4 @ 6" Ctrs. #5 @ 9" Ctrs.	0.40	3"x3"-W6.2xW6.2 4"x4"-W8.2xW8.2 6"x6"-W12.3xW12.3	0.2465	3"x3"-D5.7xD5.7 4"x4"-D7.6xD7.6 6"x6"-D11.4xD11.4	0.2289
C	#3 @ 3½" Ctrs. #4 @ 6½" Ctrs. #5 @ 10" Ctrs.	0.37	#4 @ 4" Ctrs. #5 @ 6½" Ctrs. #6 @ 9½" Ctrs.	0.555	3"x3"-W8.5xW8.5 4"x4"-W11.4xW11.4 6"x6"-W17.1xW17.1	0.3415	3"x3"-D7.9xD7.9 4"x4"-D10.6xD10.6 6"x6"-D15.9xD15.9	0.3171
D	#4 @ 4½" Ctrs. #5 @ 7" Ctrs. #6 @ 10" Ctrs.	0.53	#4 @ 3" Ctrs. #5 @ 4½" Ctrs. #6 @ 6½" Ctrs.	0.795	3"x3"-W12.2xW12.2 4"x4"-W16.3xW16.3 6"x6"-W24.5xW24.5	0.4892	3"x3"-D11.4xD11.4 4"x4"-D15.1xD15.1 6"x6"-D22.7xD22.7	0.4543
E	#4 @ 3" Ctrs. #5 @ 5" Ctrs. #6 @ 7" Ctrs.	0.73	#5 @ 3½" Ctrs. #6 @ 4½" Ctrs. #7 @ 6½" Ctrs.	1.095	3"x3"-W16.8xW16.8 4"x4"-W22.5xW22.5 6"x6"-W33.7xW33.7	0.6738	3"x3"-D15.6xD15.6 4"x4"-D20.9xD20.9 6"x6"-D31.3xD31.3	0.6257
F	#5 @ 3½" Ctrs. #6 @ 5" Ctrs. #7 @ 7" Ctrs.	1.06	#6 @ 3" Ctrs. #7 @ 4½" Ctrs. #8 @ 6" Ctrs.	1.59	3"x3"-W24.5xW24.5 4"x4"-W32.6xW32.6 6"x6"-W48.9xW48.9	0.9785	3"x3"-D22.7xD22.7 4"x4"-D30.3xD30.3 6"x6"-D45.4xD45.4	0.9086
Special 2	#5 @ 3" Ctrs. #6 @ 4" Ctrs. #7 @ 5½" Ctrs.	1.24	#7 @ 4" Ctrs. #8 @ 5" Ctrs.	1.86	3"x3"-W28.6xW28.6 4"x4"-W38.2xW38.2 6"x6"-W57.2xW57.2	1.1446	3"x3"-D26.6xD26.6 4"x4"-D35.4xD35.4 6"x6"-D53.1xD53.1	1.0629
G	#6 @ 3½" Ctrs. #7 @ 5" Ctrs.	1.46	#7 @ 3" Ctrs. #8 @ 4" Ctrs.	2.19	3"x3"-W33.7xW33.7 4"x4"-W44.9xW44.9	1.3477	3"x3"-D31.3xD31.3 4"x4"-D41.7xD41.7	1.2514

**NOTES:**

1. See inlet indexes for optional precast inlet construction details up to depths of 15'.
2. Interior dimensions of an Alt. "B" Bottom may be adjusted to reflect these inlet interior dimensions when precast units are used in conjunction with Alt. "B" Structure Bottoms, Index 425-010.
3. Use concrete meeting the requirements of ASTM C478 or Class IV for precast structures with 6" wall or slab thickness.
4. Reinforcement may be deformed bar reinforcement or welded wire reinforcement. Bar reinforcement other than 60 ksi may be used, however only two grades are recognized: Grade 40 and Grade 60. Smooth welded wire reinforcement will be recognized as having a design strength of 65 ksi and deformed welded wire reinforcement will be recognized as having a design strength of 70 ksi. The area of reinforcement required may be adjusted in accordance with the Equivalent Steel Area Table provided. Use the following equations to determine the steel area and spacing for bars not otherwise specified:

Grade 40 Steel Area =  $As_{40} = 60/40 \times As_{60}$

Smooth Welded Wire Reinforcement Steel Area =  $As_{65} = 60/65 \times As_{60}$

Deformed Welded Wire Reinforcement Steel Area =  $As_{70} = 60/70 \times As_{60}$

When a reduced area of reinforcement is provided, any maximum bar spacing shown must also be reduced as determined by the following equations, unless otherwise shown:

Max. Grade 40 Bar Spacing = Grade 60 Bar Spacing

Max. Smooth Welded Wire Spacing = Grade 60 Bar Spacing x 0.86

Max. Deformed Welded Wire Spacing = Grade 60 Bar Spacing x 0.74

When an increased area of reinforcing is provided, the maximum bar spacing may be increased by the squared ration of increased steel area, but not to exceed 12":

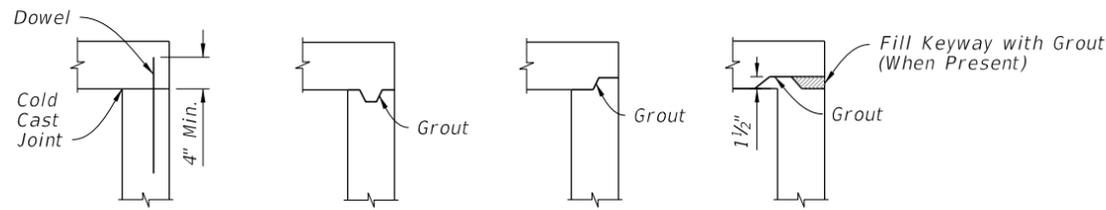
Max. Bar Spacing Provided  $\leq$  Max. Bar Spacing Required  $\times \left( \frac{\text{Steel Area Provided}}{\text{Min. Steel Area Required}} \right)^2$

Use wire no smaller than than W3.1 or D4.0, or larger and with spacing 8" or less. Use bar reinforcement displaying the minimum yield designation grade mark, or either the number 60 or one (1) grade mark line to be acceptable at the higher value. Use maximum bar spacing no greater than two (2) times the slab thickness with a maximum spacing of 12" or three (3) times the wall thickness, with a maximum spacing of 18" for vertical bars and 12" for horizontal bars. Wires smaller than W3.1 or D4.0 may be used in the walls of ASTM C 478 round structure bottoms and round risers.

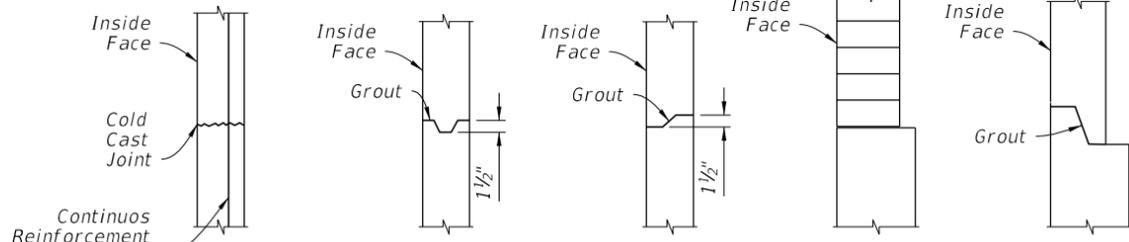
5. Fiber-reinforced concrete may be substituted for conventional steel reinforcement in accordance with the Structures Design Guidelines. Submit shop drawings corresponding to an approved fiber-reinforced concrete mix design for approval to the State Drainage Engineer.

**PRECAST OPTION AND EQUIVALENT REINFORCEMENT SUBSTITUTION**

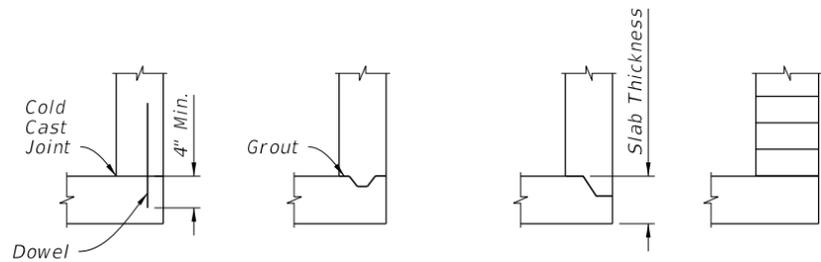
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TOP SLABS TO WALL JOINTS



WALL JOINTS

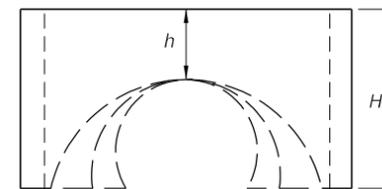
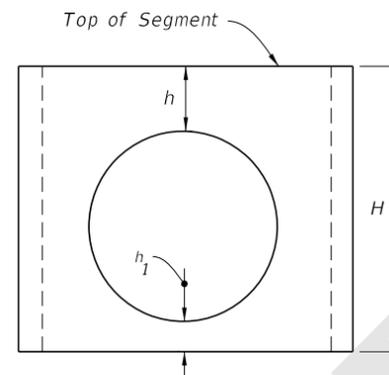


BOTTOM SLAB TO WALL JOINTS

**NOTES:**

1. One or more types of joints may be used in a single structure, except brick wall structure. Brick wall construction is permitted on circular units only.
2. All grouted joints are to have a maximum thickness of 1".
3. Keyways are to be a minimum of 1 1/2" deep.
4. Joint dowels are to be #4 bars, 12" long with a minimum of 6 bars per joint approximately evenly spaced for circular structures or at maximum 12" spacing for rectangular structures. Bars may be either Adhesive Bonded Dowels in accordance with Specification 416, or placed approximately 6" into fresh concrete leaving the remainder to extend into the secondary cast. Welded wire reinforcement may be substituted for the dowel bar in accordance with the equivalent steel area table on Sheet 5.
5. Minimum cover on dowel reinforcing bars is 2" to outside face of structure.
6. Seal joints between wall segments and between wall segments and top or bottom slabs with preformed plastic gasket material in accordance with Specification 430 or non-shrink grout in accordance with Specification 934.
7. Insert products approved by the Engineer may be used in lieu of dowel embedment.

CONSTRUCTION JOINT OPTIONS



$H (\text{Min.}) \leq h \leq 0.4H$



$H \geq H \text{ Min.}$

**NOTES:**

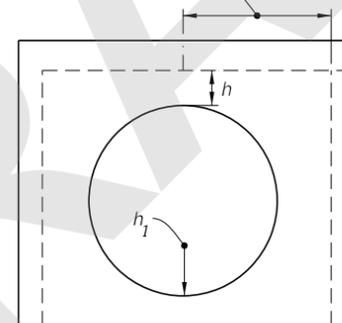
1. Segments may be inverted. Opening for pipe is the pipe OD plus 6" ( $\pm 2"$  tolerance).
2. If  $h$  can not be attained, then a top or bottom slab must be attached to the segment as shown below.

When  $6" \leq h_1 < 0.75H (\text{Min.})$   
 $h_1 \geq 0.75H (\text{Min.})$

Then (Reqd.)  
 $h \geq 0.4H$   
 $h \geq H (\text{Min.})$

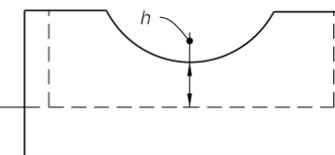
RISER SEGMENTS OTHER THAN DOWEL

Riser or Inlet Opening (Location Varies)



$h \geq \text{zero and } h_1 \geq 6"$

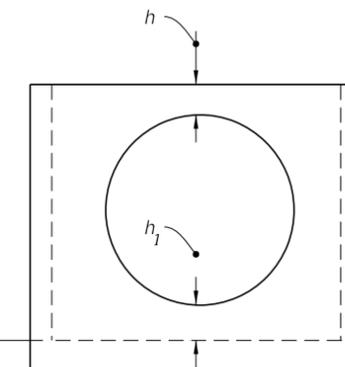
See Note 2



Top or Bottom Segment:  
 $h \geq 2"$

See Note 2

See Note 2



$h_1 \geq 2" \text{ and } h \geq 6"$

**NOTES:**

1.  $h$  may be less than 6" when approved by the Engineer, but not for inlet segments at finish grade elevation.
2. Dowel construction joint or monolithic cast only.

SEGMENTS FOR SLAB TO WALL DOWEL CONSTRUCTION JOINTS OR MONOLITHIC CAST

MINIMUM BOX AND RISER SEGMENT DIMENSIONS

CONSTRUCTION JOINT OPTIONS AND MINIMUM BOX AND RISER SEGMENT DIMENSIONS

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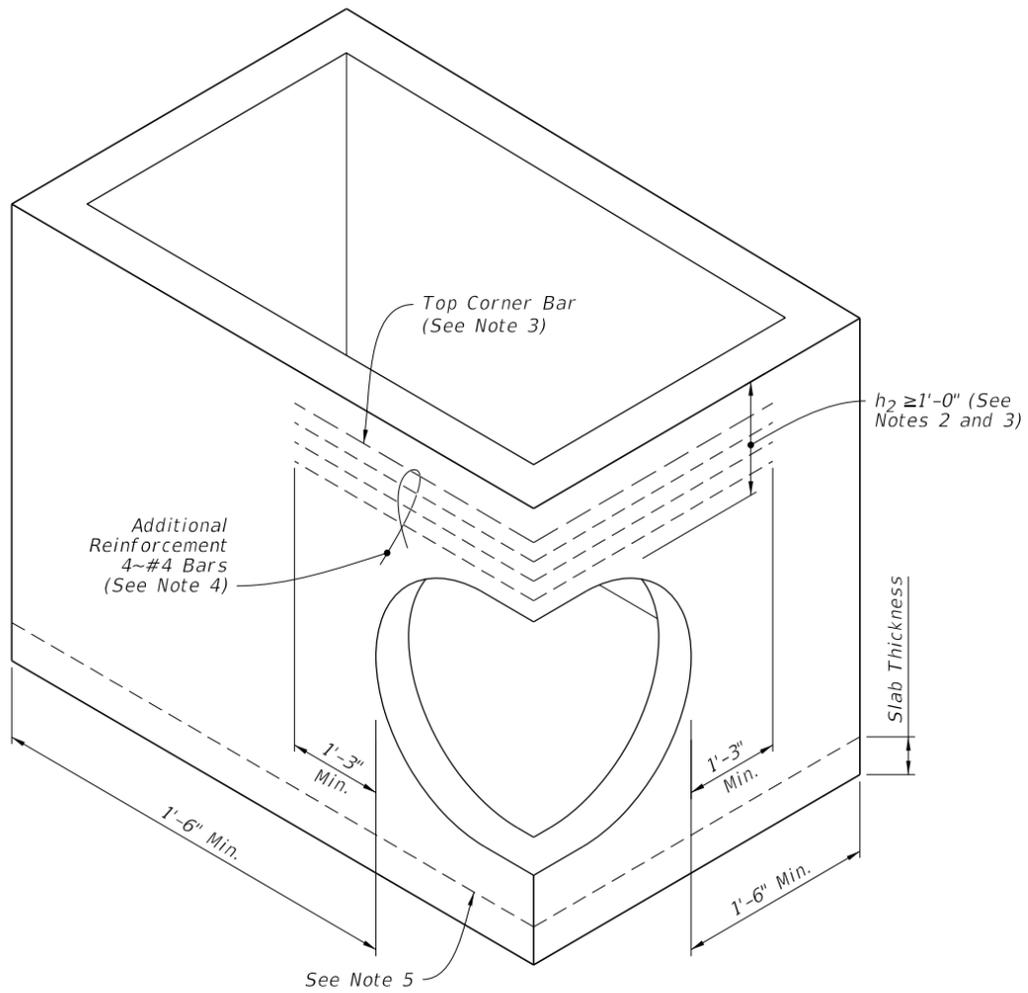


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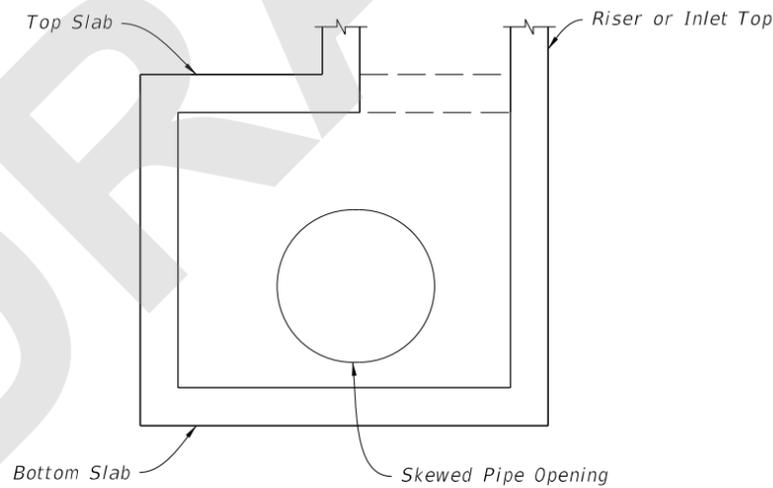
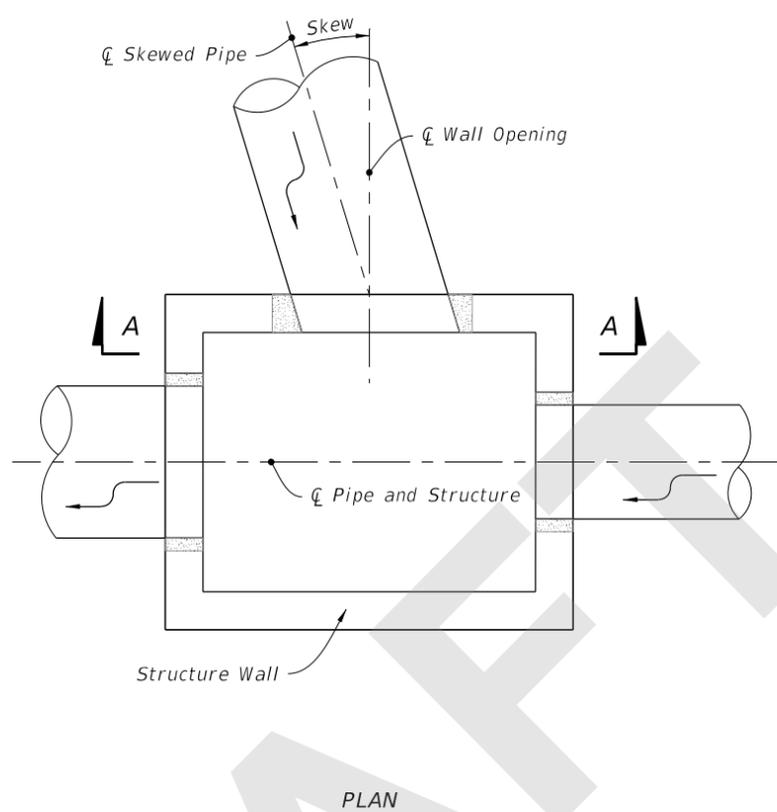
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**NOTES:**

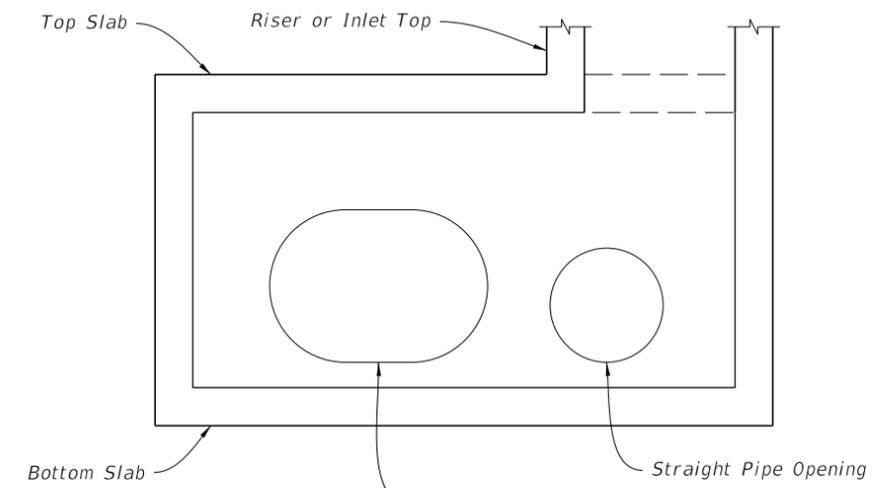
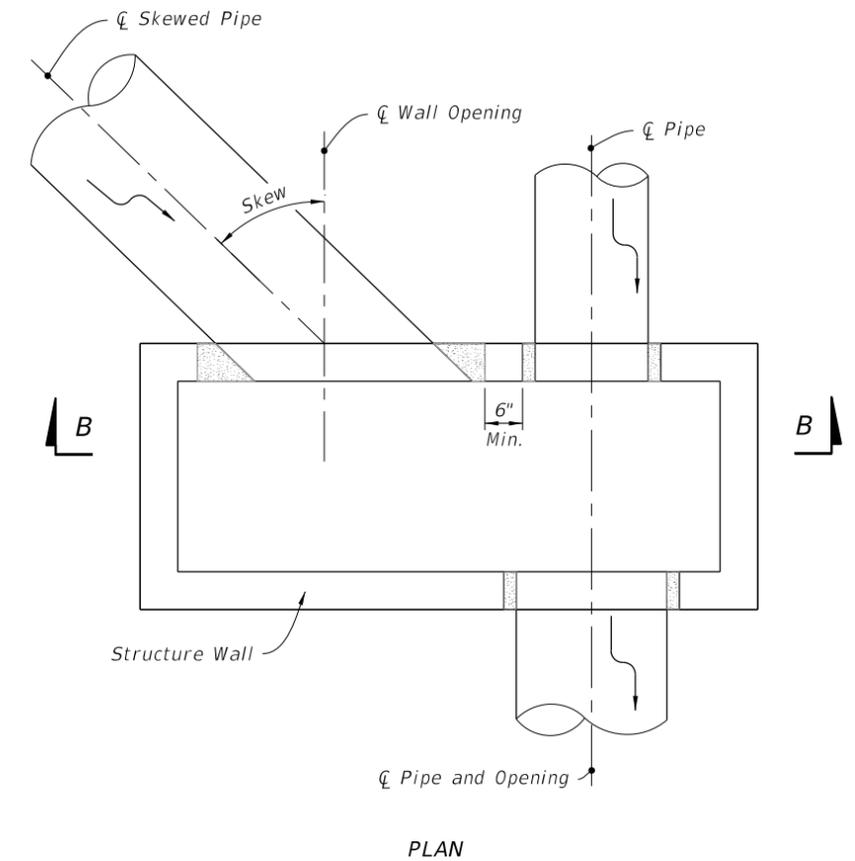
1. Submit Shop Drawings of corner openings for approval by the Engineer.
2.  $h_2$  may be less than 1'-0" when a minimum 1'-0" deep segment, 8" slab or curb inlet is provided above the corner opening.
3. For inlet segments at finish grade elevation, substitute a #8 Bar for the top corner bar when  $1'-0" \leq h_2 < 2'-0"$ .
4. Install bars continuously around corner and evenly spaced. Tie additional reinforcement to the outside of vertical wall reinforcement.
5. Dowel construction joint or monolithically cast wall and slabs.

PIPE OPENING AT CORNER



SECTION A-A

SKEWS  $\leq 45^\circ$   
(Not Centered)



SECTION B-B

SKEWS  $> 45^\circ$   
(Not Centered)

SKewed PIPE IN RECTANGULAR STRUCTURES

**SKewed PIPE IN RECTANGULAR STRUCTURES**

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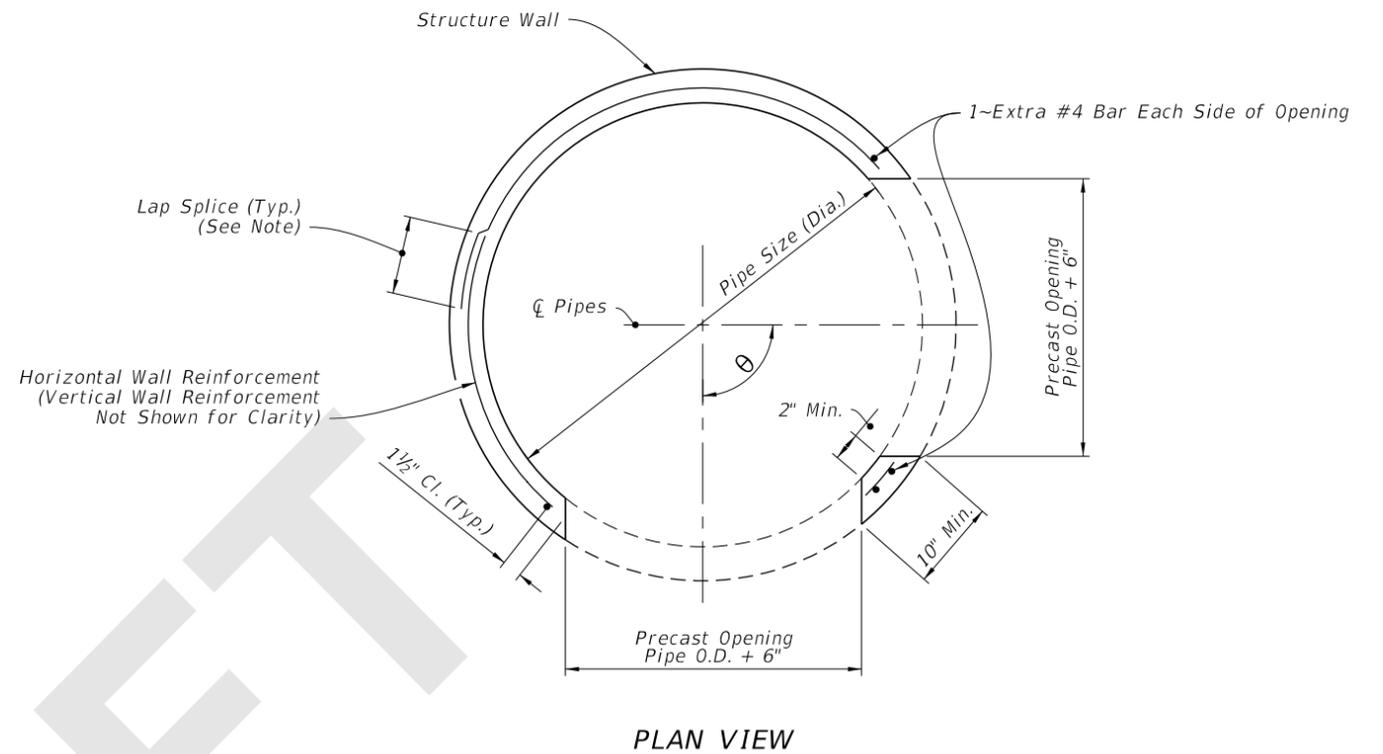
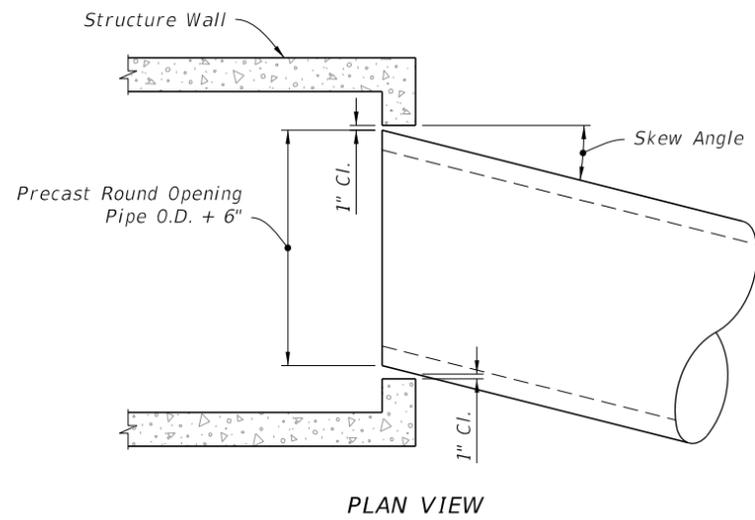


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**TABLE 4 - MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS**

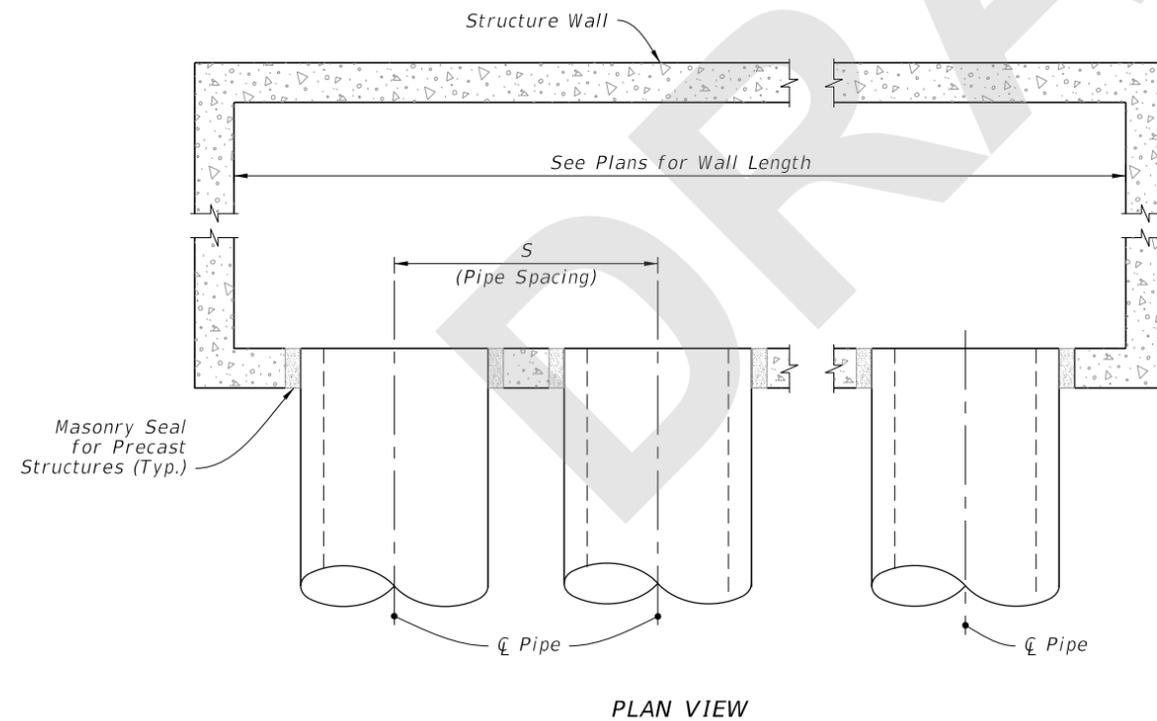
	WALL THICKNESS	PIPE SIZE												
		18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	
MAXIMUM SKEW ANGLE	8"	19°	17°	16°	16°	15°	14°	14°	13°	13°	13°	12°	12°	
	6"	21°	20°	18°	17°	17°	16°	15°	15°	14°	14°	13°	13°	

**NOTE:**  
 These values are based on 2" clearance for precast structures. Larger skews are possible for Cast-In-Place Structures or elliptical pipe openings when approved by the Engineer.

**NOTE:**  
 Lap splice: 20 bar diameter for deformed wire or bar, but not less than vertical wire spacing plus 2" for WWR or 40 bar diameters for smooth wire.

MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS

MULTIPLE PIPE CONNECTIONS - PRECAST ROUND STRUCTURES



**TABLE 5 - MINIMUM SIZES FOR MULTIPLE PARALLEL PIPE CONNECTIONS**

PIPE SIZE	PIPE SPACING (S)
18"	2'-10"
24"	3'-5"
30"	4'-3"
36"	5'-1"
42"	6'-0"
48"	6'-9"
54"	7'-8"
60"	8'-6"
66"	9'-0"
72"	10'-0"
78"	10'-9"
84"	11'-8"

MULTIPLE PARALLEL PIPE CONNECTIONS - RECTANGULAR STRUCTURES

MISCELLANEOUS PIPE CONNECTION DETAILS

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