

PRECAST CONCRETE PIPE

WHY PROVIDE GUIDELINES?

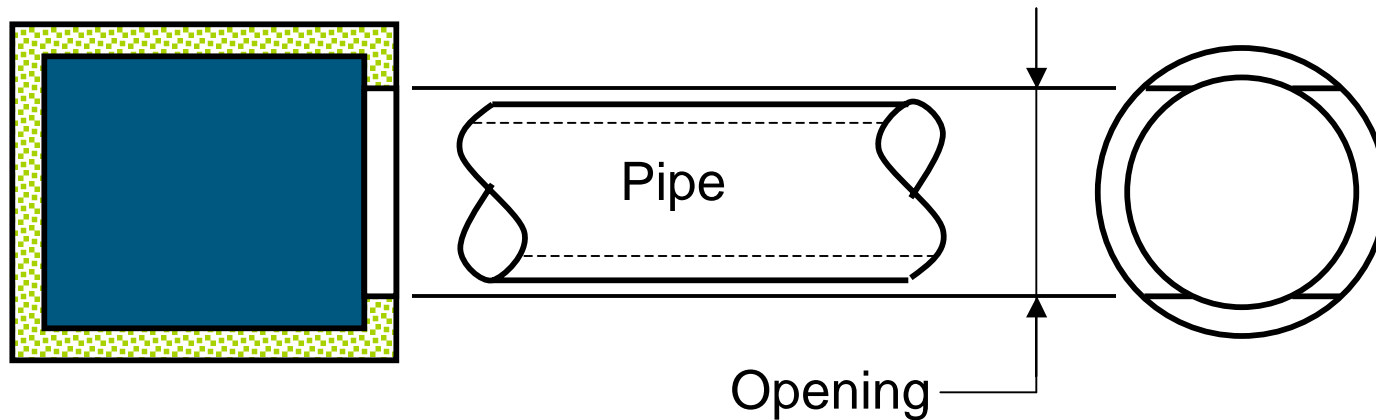
- Past problems.
- Was tedious to keep track of variables.
- Was easy to make mistakes.
- Wanted a design tool to reduce problems.

TOPICS

- Minimum Structure Size.
- Maximum Angle into Rectangular Structures.
- Minimum Angle between Pipes entering Round Structures.
- Minimum Pipe Depth.

MINIMUM STRUCTURE SIZE

- The precast opening is typically 6 inches larger than the pipe's outside diameter.



MINIMUM STRUCTURE SIZE

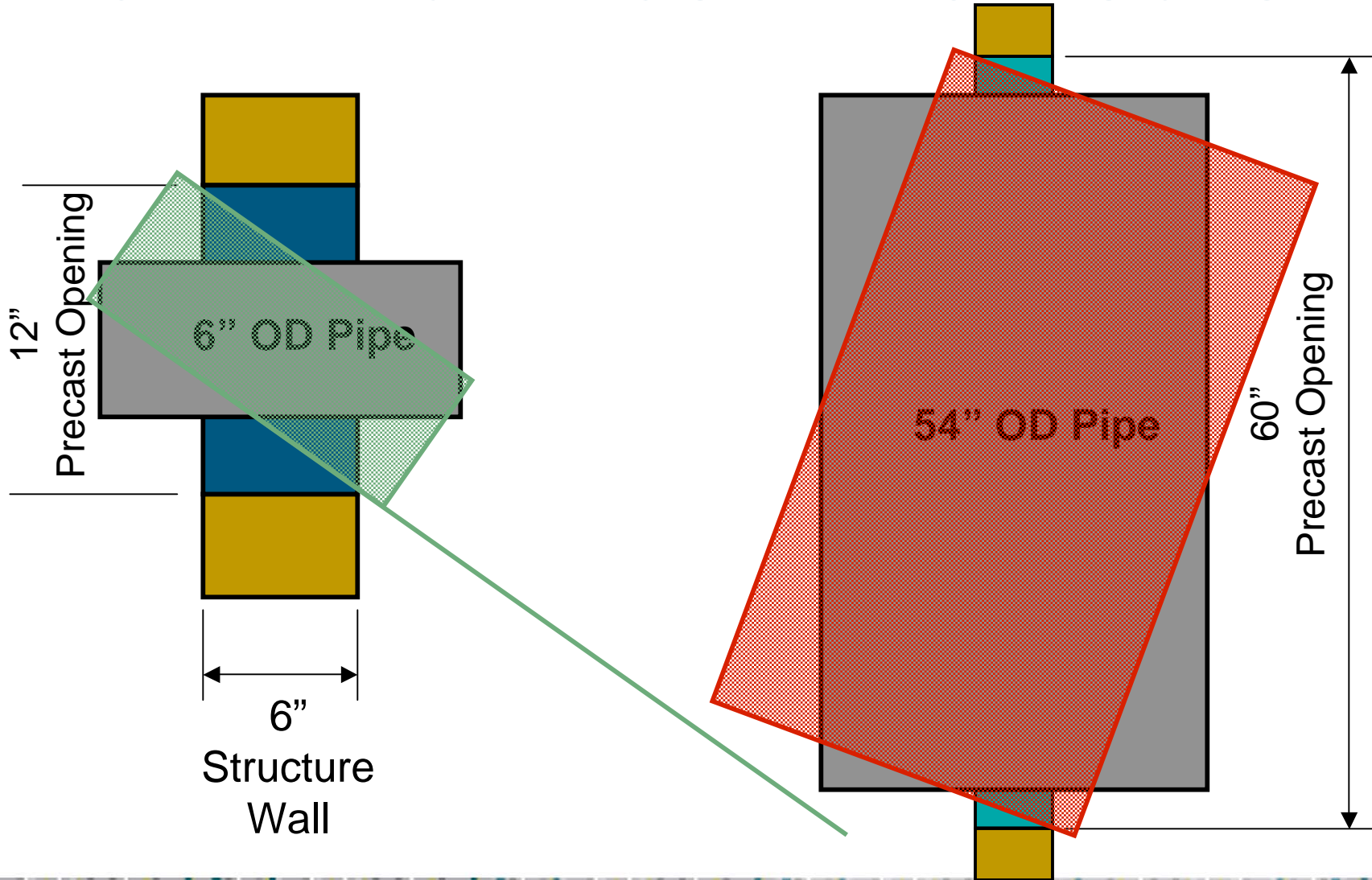
Table 4-2
of
Storm Drain Handbook
August 2000

Values based on
Openings for Concrete Pipe

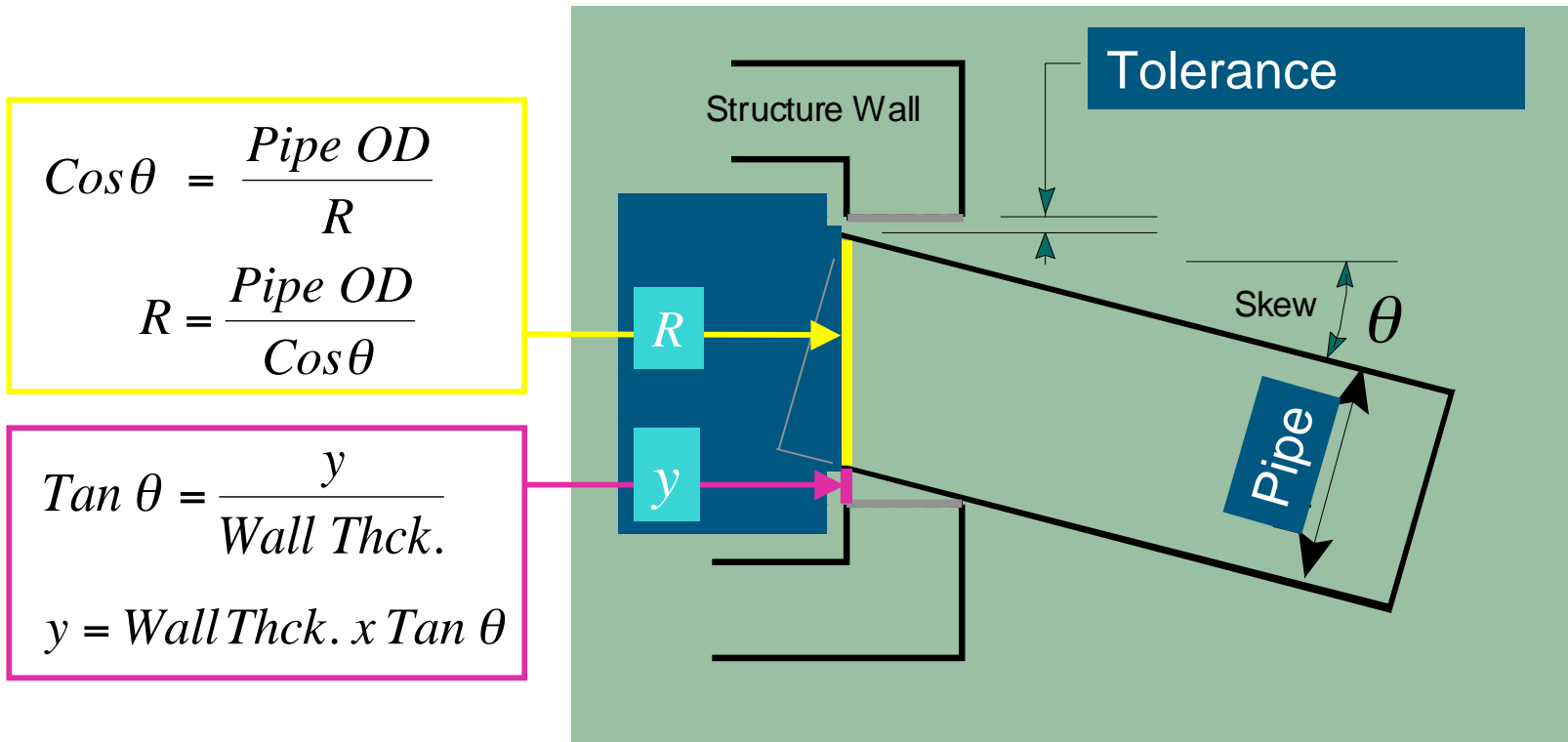
Minimum Dimensions For Structures		
Pipe Size	Rectangular	Round
	Side Dimension	Diameter
30 in.	3'-6"	4 ft
36 in.	4 ft	5 ft
42 in.	5 ft	6 ft
48 in.	6 ft	6 ft
54 in.	6 ft	8 ft
60 in.	7 ft	8 ft
66 in.	7 ft	8 ft
72 in.	8 ft	8 ft
78 in.	9 ft	10 ft.

Maximum Angle (Skew) into a Rectangular Structure

MAXIMUM ANGLE (SKEW) INTO A RECTANGULAR STRUCTURE



MAXIMUM ANGLE (SKEW) INTO A RECTANGULAR STRUCTURE



$$\text{Tolerance} = \text{Precast Opening} - R - y$$

MAXIMUM ANGLE (SKEW) INTO A RECTANGULAR STRUCTURE

Example:

Given: 24" Concrete Pipe at 17 degree skew
Structure Wall Thickness = 8"

A 24" concrete pipe has a 30" outside diameter and a 36" precast opening.

$$\begin{aligned}\text{Tolerance} &= \text{Precast Opening} - R - y \\ &= 36'' - (30''/\text{Cos } 17^\circ) - 8'' \times \text{Tan } 17^\circ \\ &= 2.2''\end{aligned}$$

MAXIMUM ANGLE (SKEW) INTO A RECTANGULAR STRUCTURE

Table 4-3	Pipe Size							
	18"	24"	30"	36"	42"	48"	54"	60"
Max Skew	19°	17°	16°	16°	15°	14°	14°	13°

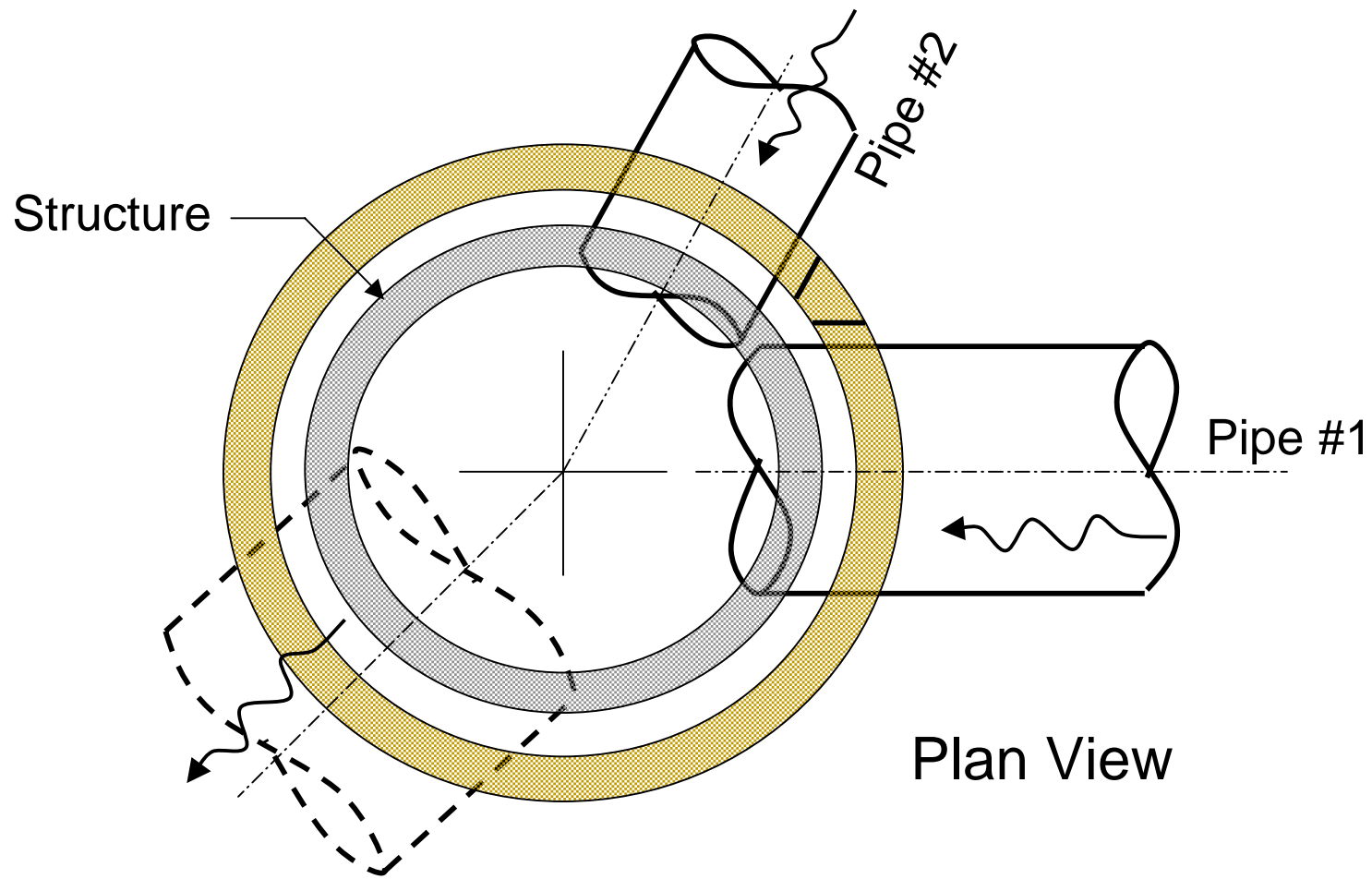
Table 4-3 of
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**Use Round Structure or Rearrange Pipes
if these Angles are Exceeded.**

Values are based on 2 inches of construction tolerance,
structures with 8-inch walls and concrete pipe dimensions.

Minimum Angle Between Pipes Entering Round Structures

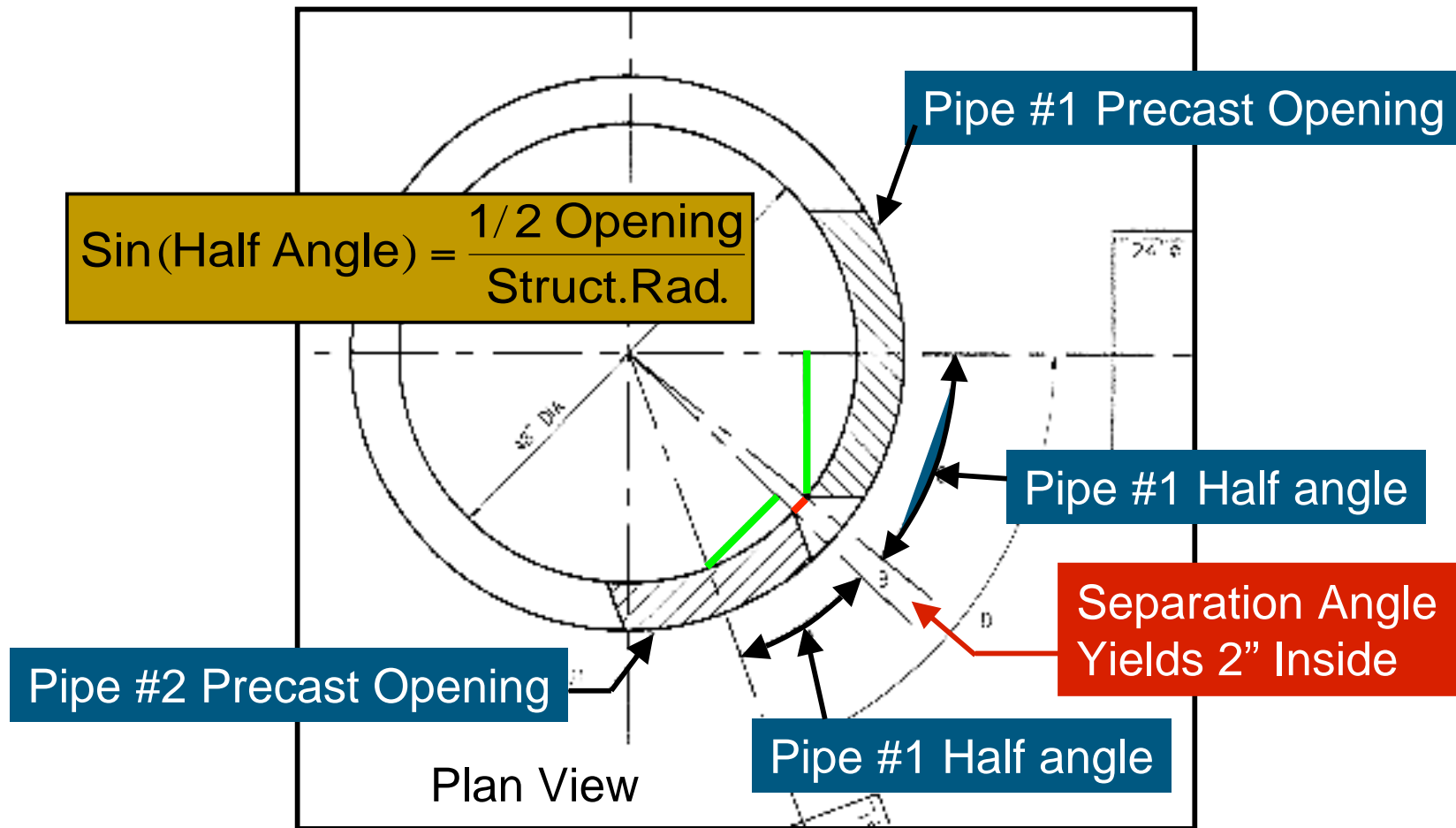
MINIMUM ANGLE BETWEEN PIPES ENTERING ROUND STRUCTURE



MINIMUM ANGLE BETWEEN PIPES ENTERING ROUND STRUCTURE



HALF ANGLE DIAGRAM



MINIMUM ANGLE BETWEEN PIPES ENTERING ROUND STRUCTURE

**Table 4-6
of
Storm Drain
Handbook**

Read Notes!

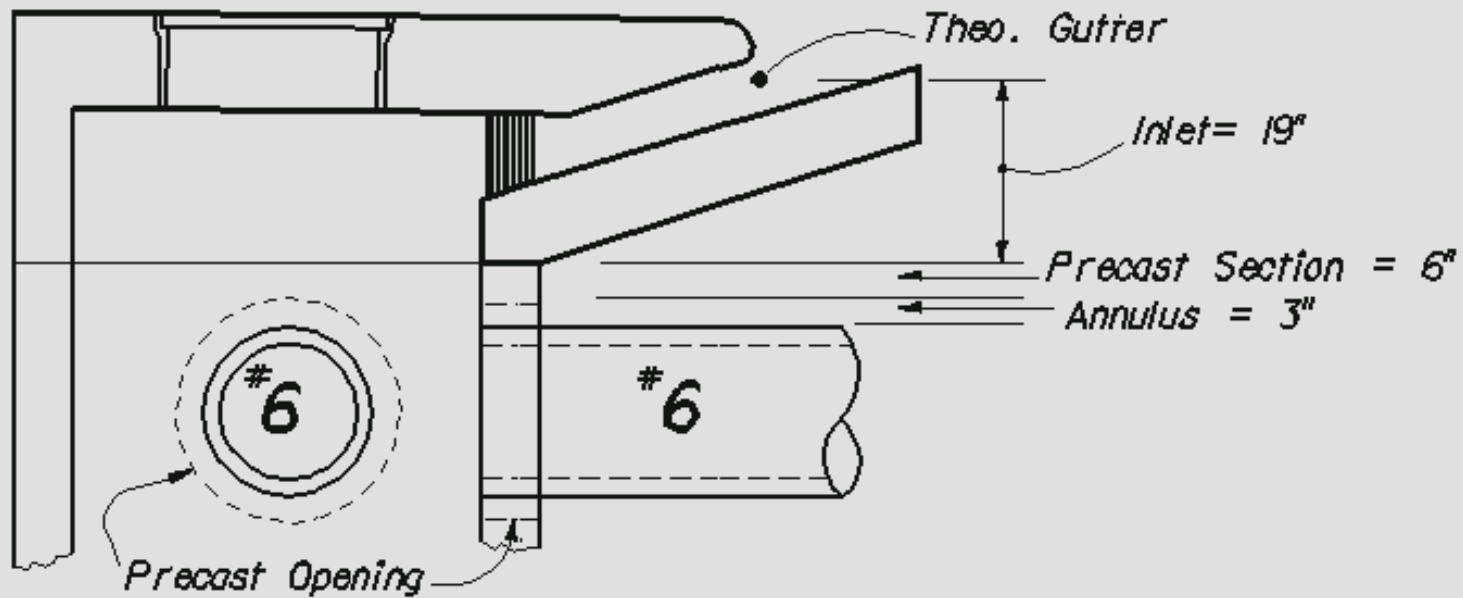
RECOMMENDED MINIMUM ANGLE (in Degree								
IN ROUND (Alt.								
PIPE SIZE	18"		24"		30"		36"	
		A D.		A D.		A D.		A D.
18"	31	10'	34	10'	37	10'	40	10'
	39	8'	43	8'	47	8'	51	8'
	52	6'	58	6'	63	6'	70	6'
	64	5'	71	5'	78	5'	87	5'
	82	4'	90	4'	105	4'		
24"			37	10'	40	10'	43	10'
			46	8'	50	8'	54	8'
			63	6'	69	6'	75	6'
			78	5'	85	5'	94	5'
			102	4'	114	4'		

Partial View

MINIMUM DEPTH

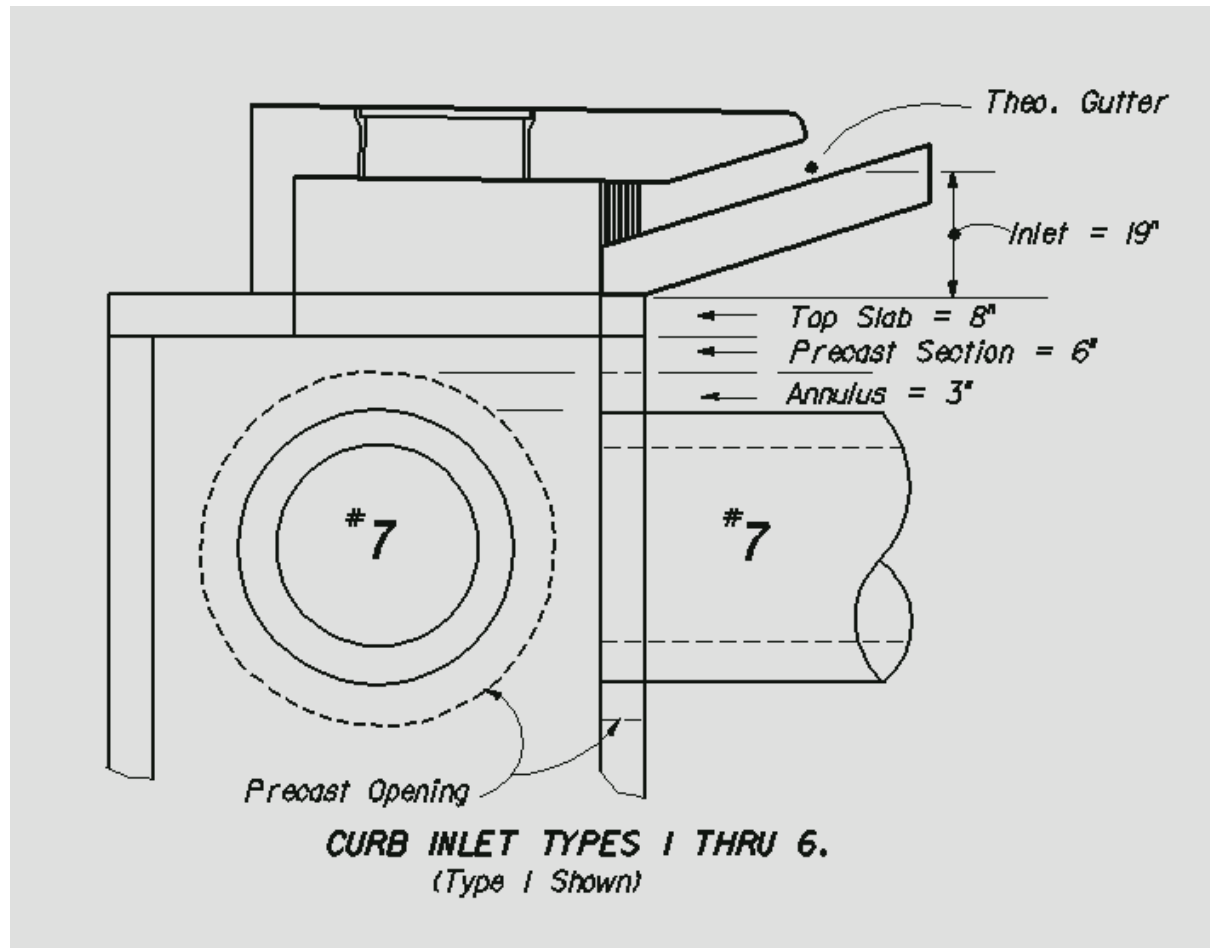
- Minimum Cover Requirements of Index 205.
- Strive to maintain a 6-inch precast section above the pipe opening while avoiding Grates, Inlet Tops and Top Slabs.

MINIMUM DEPTH

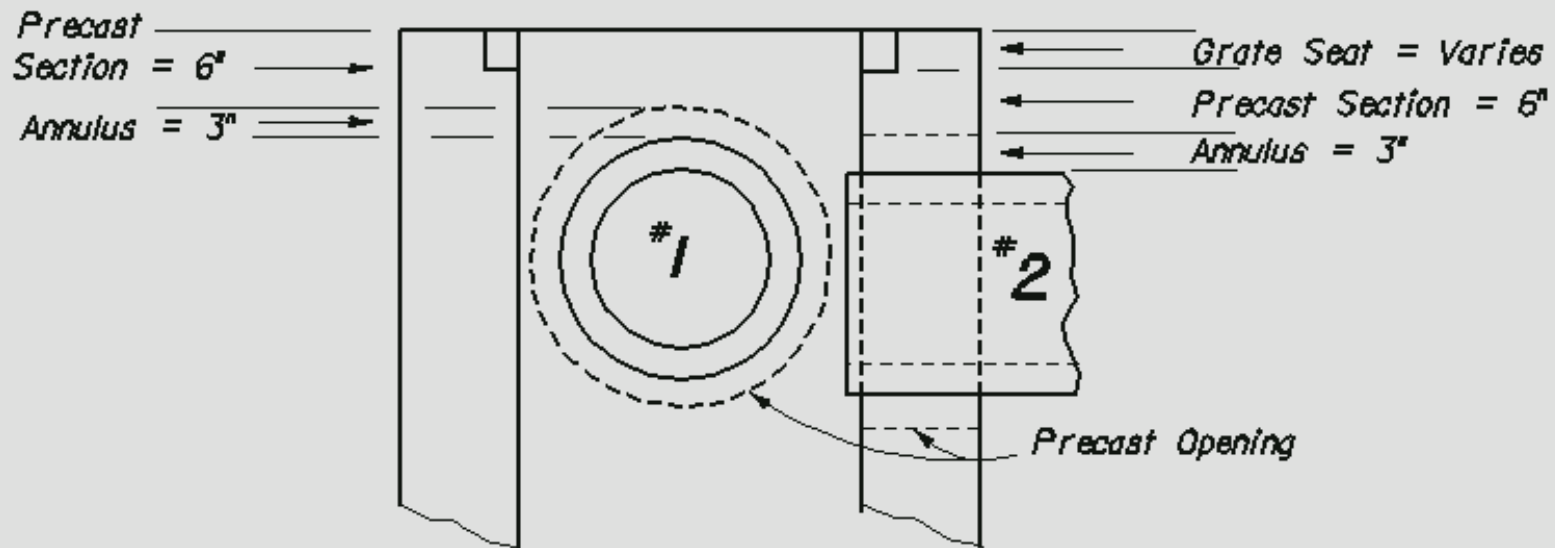


CURB INLET TYPES 1 THRU 6.
(Type 1 Shown)

MINIMUM DEPTH

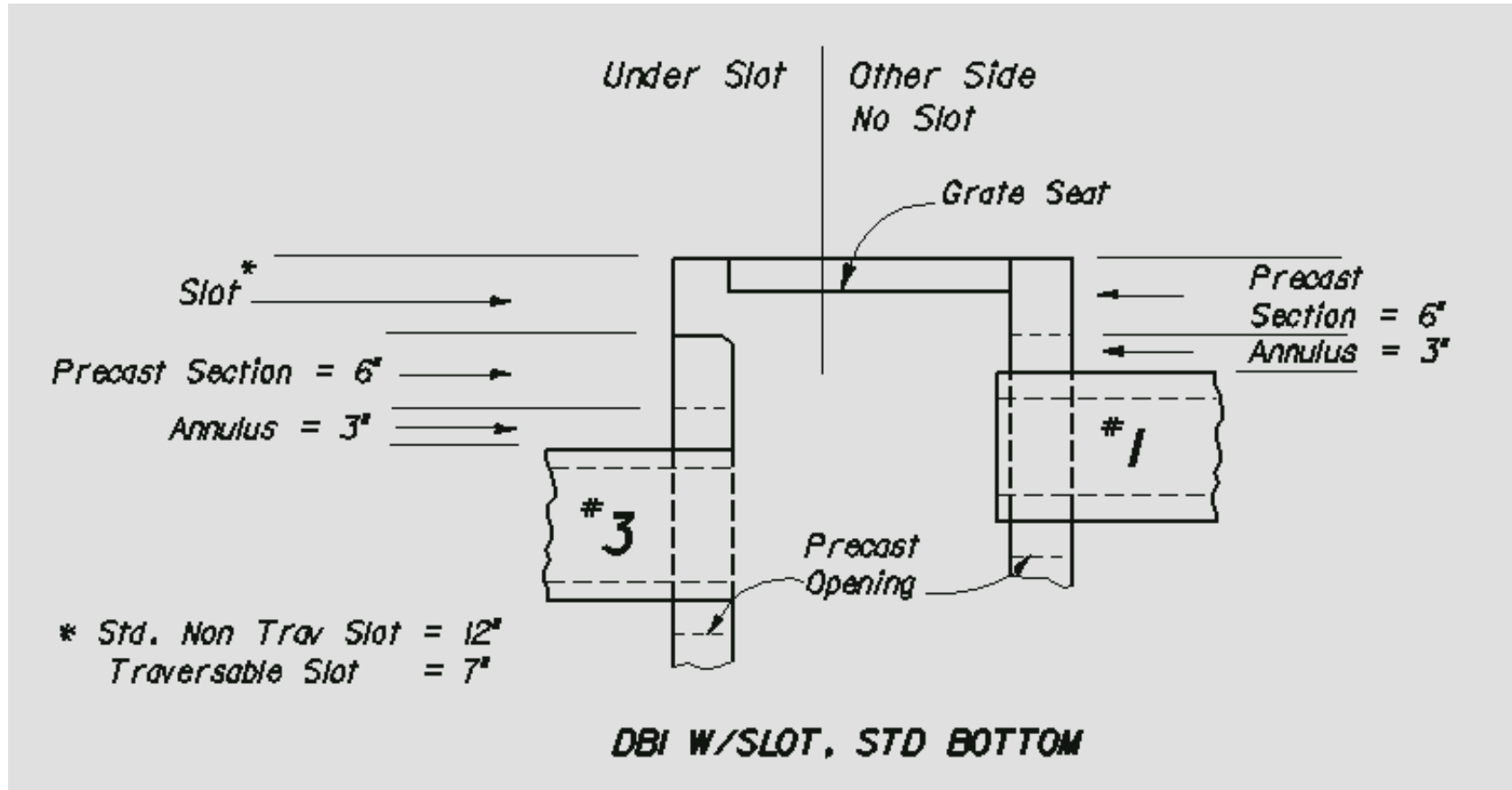


MINIMUM DEPTH

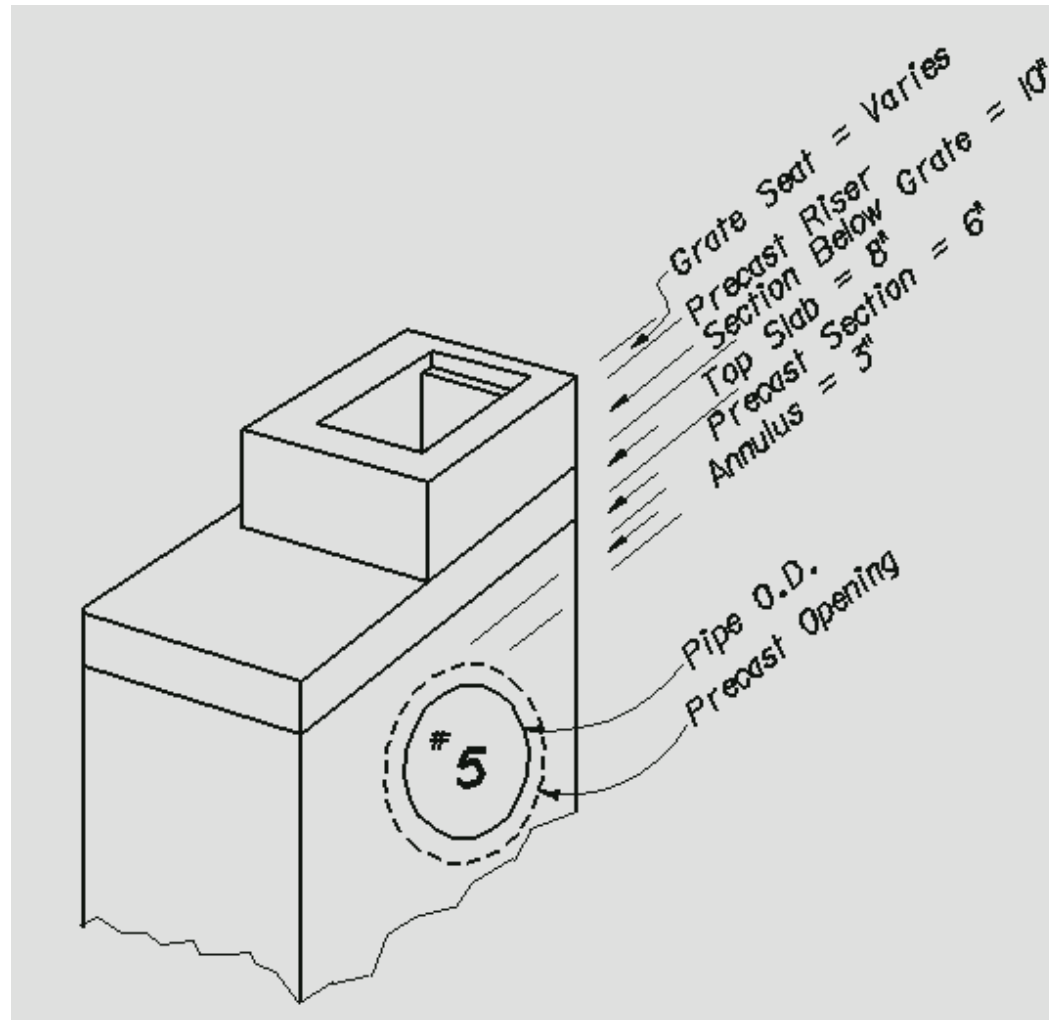


DBI, W/O SLOTS, STD BOTTOM

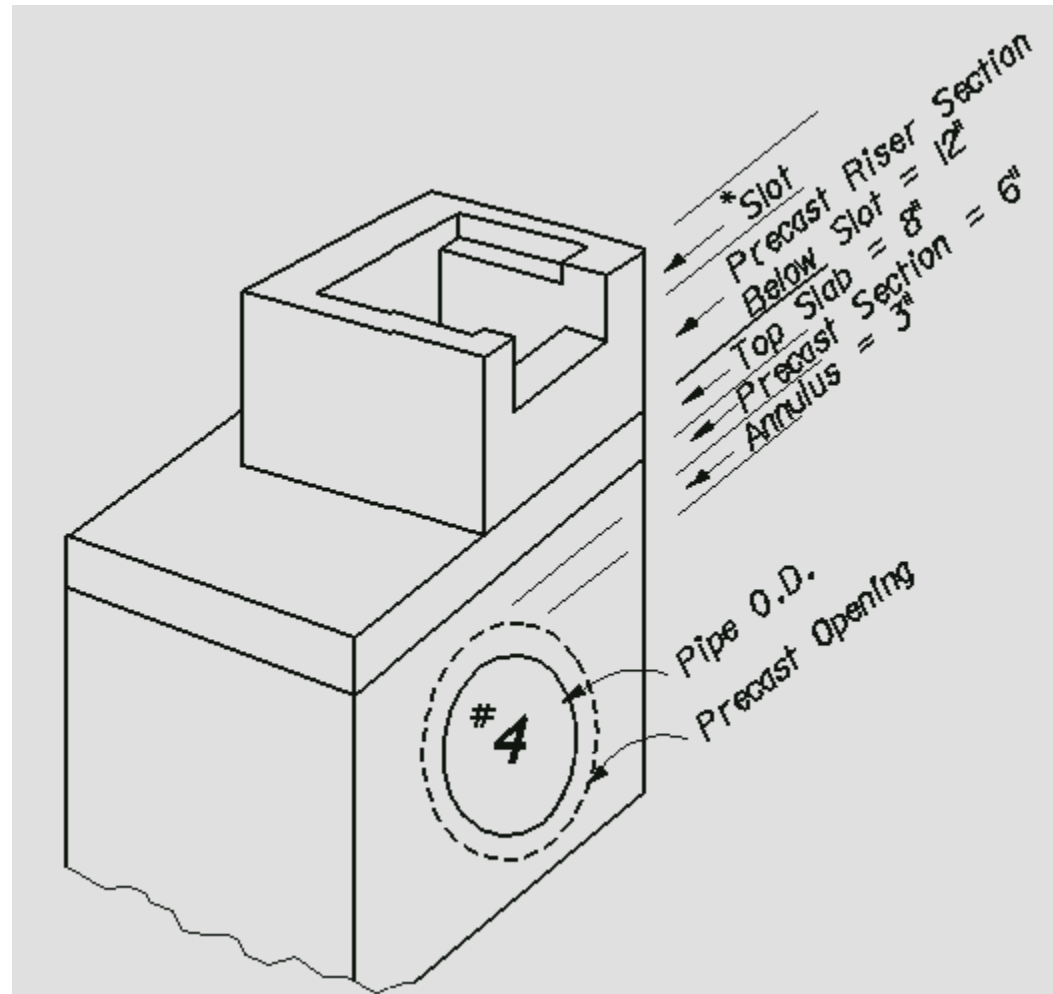
MINIMUM DEPTH



MINIMUM DEPTH



MINIMUM DEPTH



MINIMUM DEPTH

File =	inletclr.123	PIPE REFERENCE LOCATION															
VARIABLE	DISTANCE inches	UNDER GRATE						UNDER SLOT			RISER W/ SLOT J BOTTOM			RISER W/O SLOT J BOTTOM			
		1	2A	2B	2C	2F	2S	3B	3T	3NT	4B	4T	4NT	5A	5B	5C	5F
GRate seat depth Type A	4		4											4			
GRate seat depth Type B, G, J & V(G, J, & V reduc	5			5											5		
GRate seat depth C, D, E, & H	2				2											2	
GRate seat depth F, 3-5/16 rounded down to 3	3					3											3
GRate depth Type S	5.5						5.5										
Traversable slot depth	7							7			7						
Standard non traversable slot depth	12								12			12					
Type B Slot	14							14			14						
Type 1 thru 6 Inlet depth	19																
Barrier Wall Inlet (Index 218) Depth	24																
Minimum precast RISER section (No Slots)	10												10	10	10	10	
Minium precast RISER section Below Slots	12										12	12	12				
Type G Haunch	23																
Top slab thickness	8										8	8	8	8	8	8	8
Minimum precast Concrete Section above pipe o	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Pipe opening	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Distance from Grate to Top of Pipe (INCHES)		9	13	14	11	12	15	23	16	21	43	36	41	31	32	29	30
Total Distance from Grate* to Top of Pipe (FEET)		0.8	1.1	1.2	0.9	1	1.2	1.9	1.3	1.8	3.6	3	3.4	2.6	2.7	2.4	2.5

MINIMUM DEPTH

Table 4-4 of Storm Drain Handbook (partial view)

INLET TYPE	SLOT TYPE	PIPE LOCATION		RECOMMENDED MIN. DISTANCE (Ft.) FROM GRATE (INLET) ELEVATION TO PIPE FLOW LINE											
				15" Pipe	18" Pipe	24" Pipe	30" Pipe	36" Pipe	42" Pipe	48" Pipe	54" Pipe	60" Pipe			
Type A		Short	2'-0"	2.2 (1)	2.5 (1)	4.8 (5)	5.4 (5)	5.9 (5)	6.5 (5)	7.0 (5)	7.5 (5)	8.1 (5)			
		Long	3'-1"	2.5 (2)	2.8 (2)	4.8 (5)	5.4 (5)	5.9 (5)	6.5 (5)	7.0 (5)	7.5 (5)	8.1 (5)			
Type C (Note 3)	None	Short	2'-0"	2.2 (1)	2.5 (1)	4.7 (5)	5.2 (5)	5.8 (5)	6.3 (5)	6.8 (5)	7.4 (5)	7.9 (5)			
		Long	3'-1"	2.4 (2)	2.6 (2)	4.7 (5)	5.2 (5)	5.8 (5)	6.3 (5)	6.8 (5)	7.4 (5)	7.9 (5)			
	Travers	Short	No Slot	2.2 (1)	2.5 (1)	5.3 (4)	5.8 (4)	6.3 (4)	6.9 (4)	7.4 (4)	8.0 (4)	8.5 (4)			
		Short	Under Slot	2.8 (3)	3.0 (3)	5.3 (4)	5.8 (4)	6.3 (4)	6.9 (4)	7.4 (4)	8.0 (4)	8.5 (4)			
		Long		2.8 (2)	2.6 (2)	5.3 (4)	5.8 (4)	6.3 (4)	6.9 (4)	7.4 (4)	8.0 (4)	8.5 (4)			
	Non-Travs 12" Std	Short	No Slot	2.2 (1)	2.5 (1)	5.7 (4)	6.2 (4)	6.8 (4)	7.3 (4)	7.8 (4)	8.4 (4)	8.9 (4)			
		Short	Under Slot	3.2 (3)	3.5 (3)	5.7 (4)	6.2 (4)	6.8 (4)	7.3 (4)	7.8 (4)	8.4 (4)	8.9 (4)			
		Long		2.4 (2)	2.6 (2)	5.7 (4)	6.2 (4)	6.8 (4)	7.3 (4)	7.8 (4)	8.4 (4)	8.9 (4)			

*** **Read Notes** ***

Inlet Types B & G were not included due to planned design changes.

FUTURE CHANGES TO THE ROADWAY & TRAFFIC DESIGN STANDARDS

- **Index 220: Inlet Type S; Recommended Max pipe in long wall should be 30", not 36"**
- **Index 221: Inlet Type V; Recommended Max pipe in long wall should be 30", not 36"**
- **Index 230: Inlet Type A; Recommended Max pipe in long wall should be 18", not 24"**

FUTURE CHANGES TO THE ROADWAY & TRAFFIC DESIGN STANDARDS

- **Index 232: Inlet Type C; Recommended Max pipe in long wall should be 18", not 24"**
- **Index 232: Inlet Type E; Recommended Max pipe in long wall should be 36", not 42"**
- **Index 234: Inlet Type J; Recommended Max pipe in long wall should be 30", not 36"**