

PART 3

STORM DRAINS

Abbreviations and Symbols

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Abbreviations and symbols for storm drains

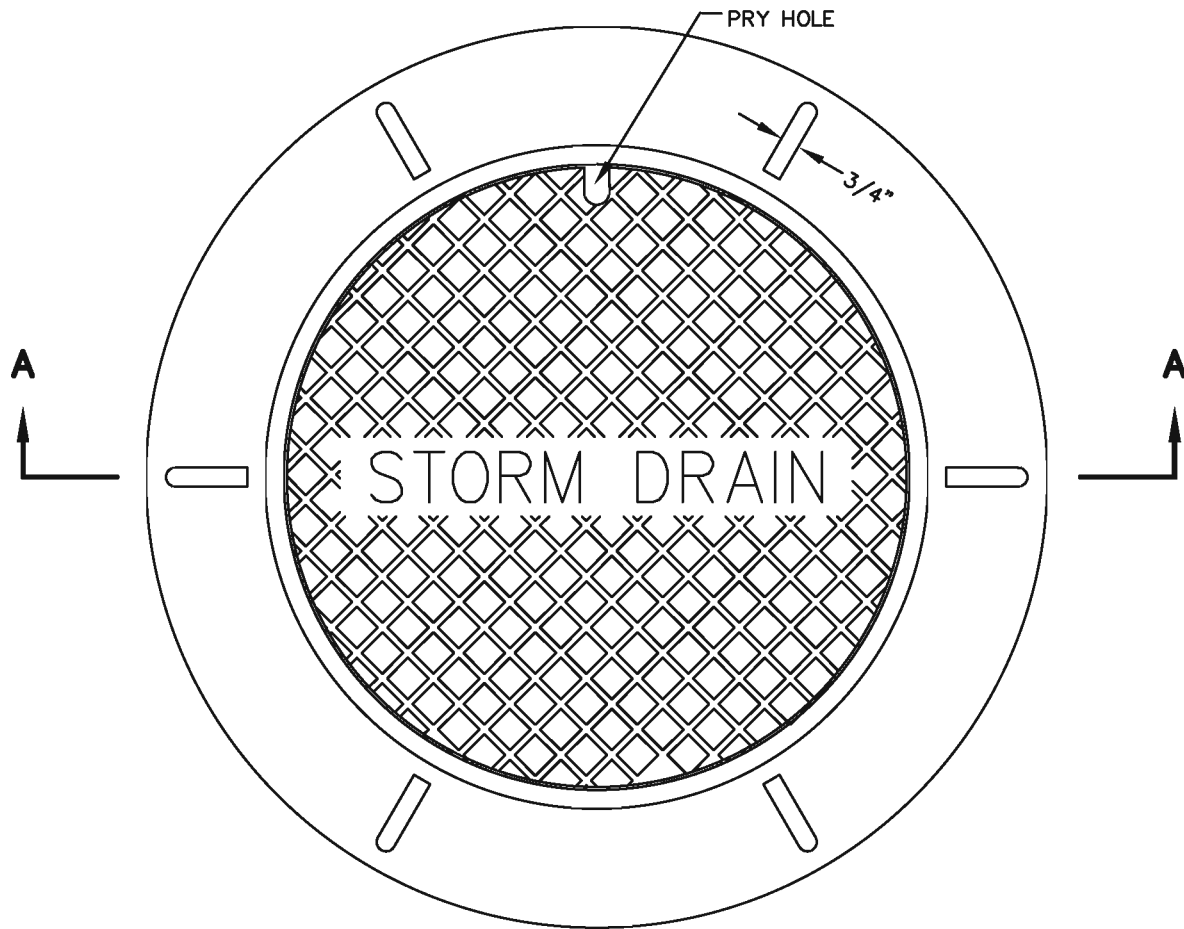
1. LETTERING SIZE: 100 Leroy minimum except for line type and other background information. Use 120 Leroy for new work installation.
2. LETTERING STYLE: Capital letters preferred.
3. EXISTING IMPROVEMENTS: Shown in light shaded dashed line.
4. NEW IMPROVEMENTS: Shown in solid continuous line.

SYMBOLS	DEFINITIONS	SYMBOLS	DEFINITIONS
	CENTER LINE		CURB & GUTTER
	CONSTRUCTION CENTER LINE		SIDEWALK
	PROPERTY OR R/W LINE		RAILROAD TRACKS
	EASEMENT LINE		GUARD RAIL
	MONUMENT LINE		OPEN DITCH, CANAL
	FENCE		CULVERT
	CONTOUR LINE CONTOUR ELEVATION		SECTION CORNER
	BANK SLOPES		SOIL BORING
	STORM DRAIN LINE		MONUMENT
	WATER LINE		BENCH MARK
	GAS LINE		SIGN
	TELEPHONE CABLE		POWER POLE
	ELECTRIC CABLE		TELEPHONE POLE
	SANITARY SEWER LINE		DECIDUOUS TREE
	ASPHALT PAVING		CONIFEROUS TREE
	FIRE HYDRANT		P.I.
	WATER VALVE		P.C. OR P.T.
	WATER METER		
	MANHOLE		
	CATCH BASIN		
	CLEAN OUT BOX		
	POLE & ANCHOR		
	STREET LIGHT		
	UNDISTURBED EARTH		
	STRUCTURE		
			<u>PROFILE</u> GROUND PROFILE
			CULVERT
			P.V.I.
			P.V.C. OR P.V.T.
			GROUNDWATER ELEVATION

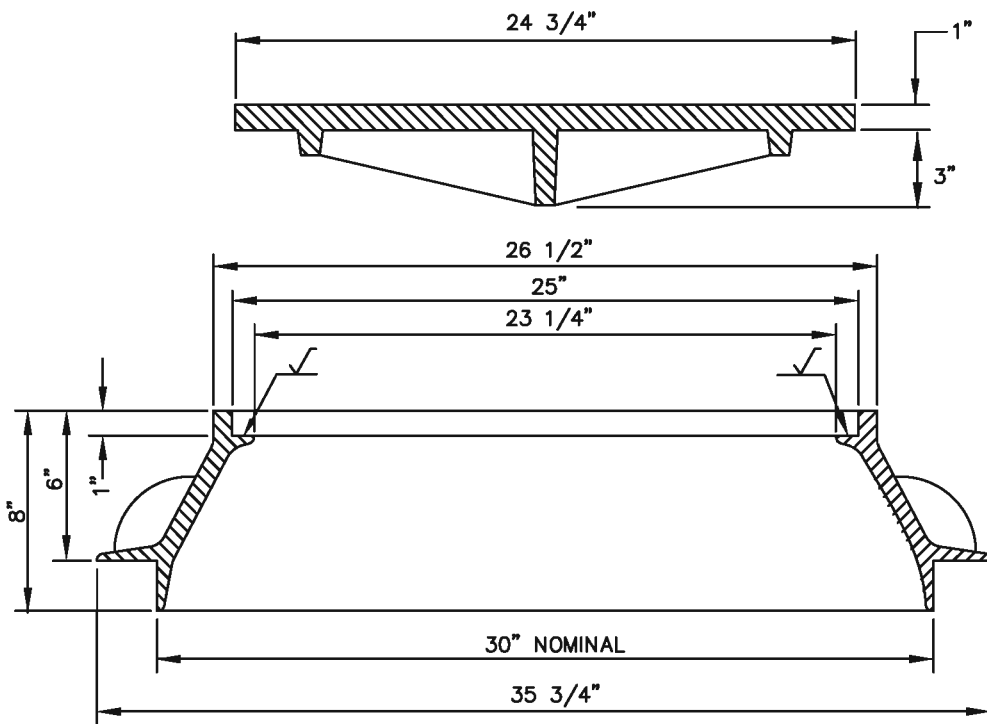
Abbreviations and symbols for storm drains

30" Frame and cover – type A

1. CASTINGS: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. INSCRIPTIONS: Cast the words "STORM DRAIN" on the cover flush with the surface finish.
4. HEAT NUMBER: Place foundry and heat number on the inside of the frame and on the bottom of the cover.
5. FIT: \surd designates machined surface. Give the frame and cover a machine finish so the cover will not rock.
6. LOCKING: Provide covers for manholes located in easements, rights-of-way, alleys, parking lots, and all other places except paved streets, with allen socket set screw locking devices. Drill and tap two holes to a depth of 1 inch at 90 degrees to pry hole and install 3/4 x 3/4 inch allen socket set screws.
7. CLEANOUT STRUCTURE: See Plan No. 330.
8. MANHOLE STRUCTURES: See Plan No. 341.



TYPE A



SECTION A-A

30" Frame and cover

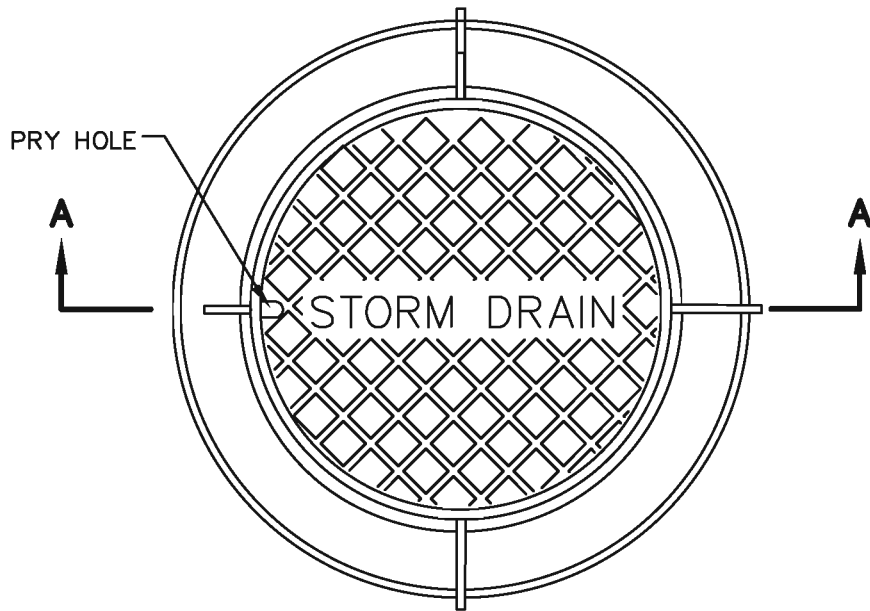
Plan No.

302

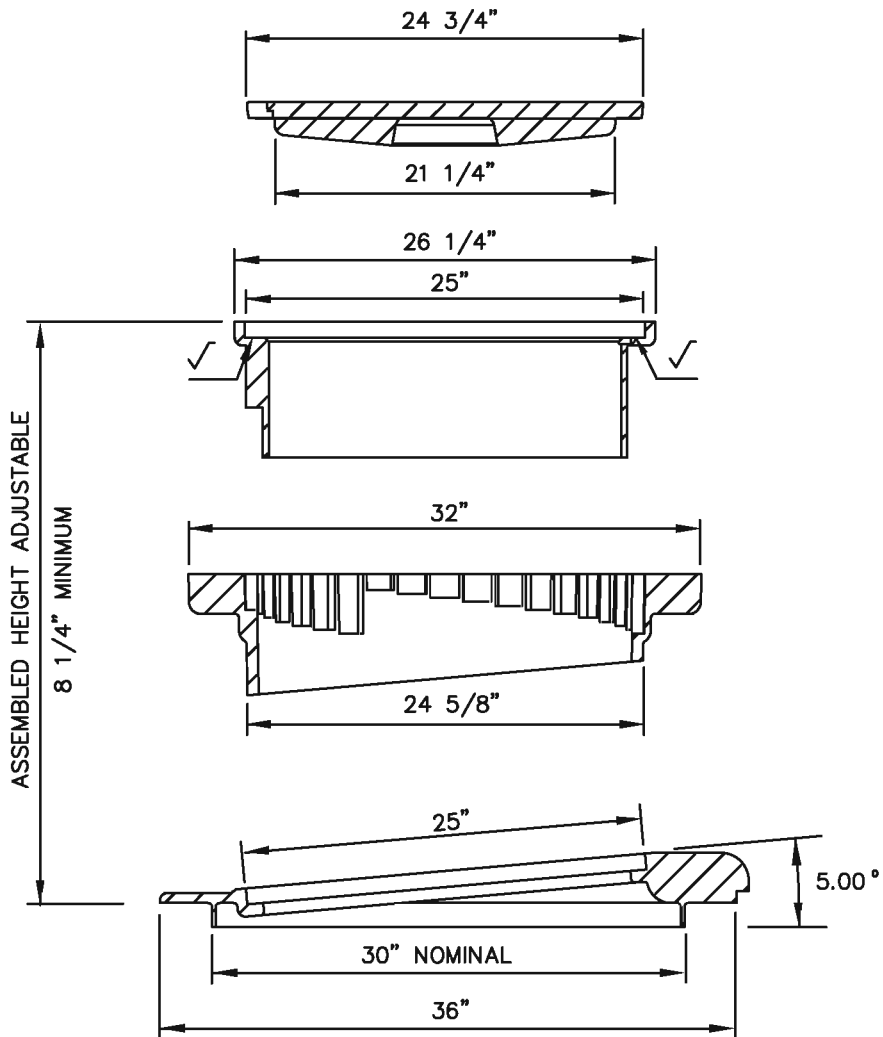
Drawing 1 of 2

30" Frame and cover – type B

1. CASTINGS: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. INSCRIPTIONS: Cast the words "STORM DRAIN" on the cover flush with the surface finish.
4. HEAT NUMBER: Place foundry and heat number on the inside of the frame and on the bottom of the cover.
5. FIT: \surd designates machined surface. Give the frame and cover a machine finish so the cover will not rock.
6. LOCKING: Provide covers for manholes located in easements, rights-of-way, alleys, parking lots, and all other places except paved streets, with allen socket set screw locking devices. Drill and tap two holes to a depth of 1 inch at 90 degrees to pry hole and install 3/4 x 3/4 inch allen socket set screws.
7. CLEANOUT STRUCTURE: See Plan No. 330.
8. MANHOLE STRUCTURES: See Plan No. 341.



TYPE B



SECTION A-A

30" Frame and cover

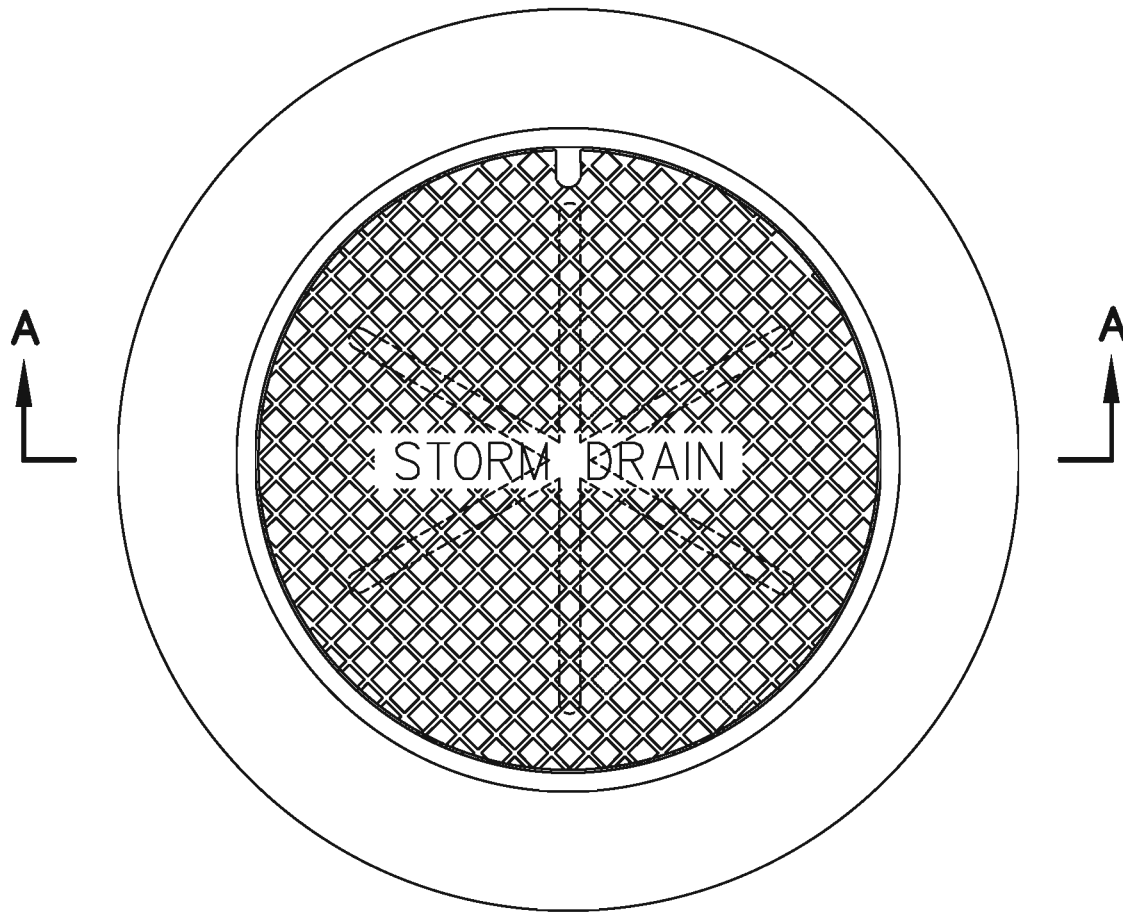
Plan No.

302

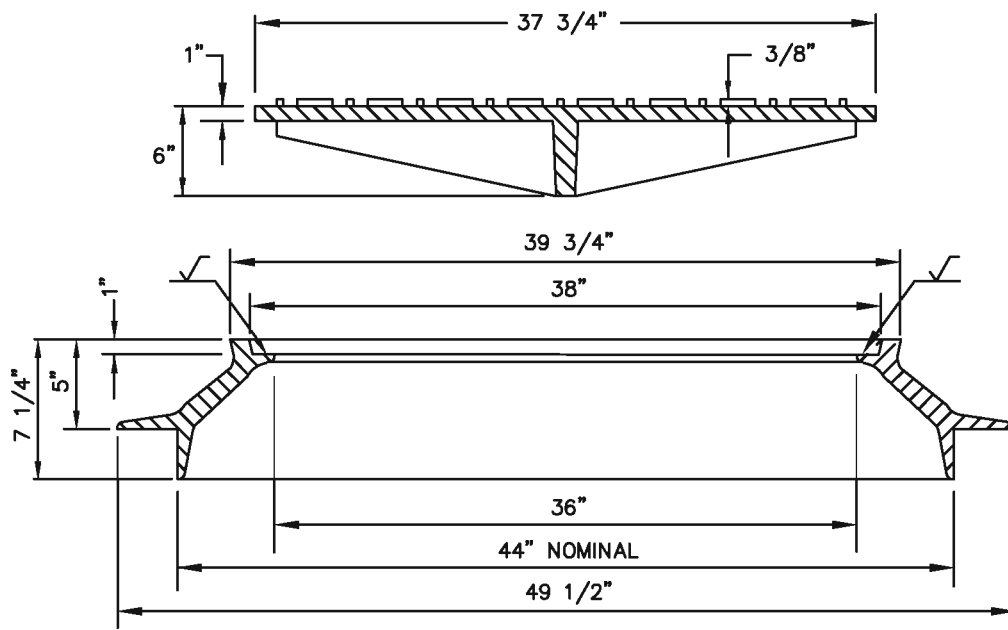
Drawing 2 of 2

44" Frame and cover

1. CASTINGS: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. INSCRIPTIONS: Cast the words "STORM DRAIN" on the cover flush with the surface finish.
4. HEAT NUMBER: Place foundry and heat number on the inside of the frame and on the bottom of the cover.
5. FIT: \surd designates machined surface. Give the frame and cover a machine finish so the cover will not rock.
6. LOCKING: Provide covers for manholes located in easements, rights-of-way, alleys, parking lots, and all other places except paved streets, with allen socket set screw locking devices. Drill and tap two holes to a depth of 1 inch at 90 degrees to pry hole and install 3/4 x 3/4 inch allen socket set screws.
7. CLEANOUT STRUCTURE: See Plan No. 330.
8. MANHOLE STRUCTURES: See Plan No. 341.



PLAN



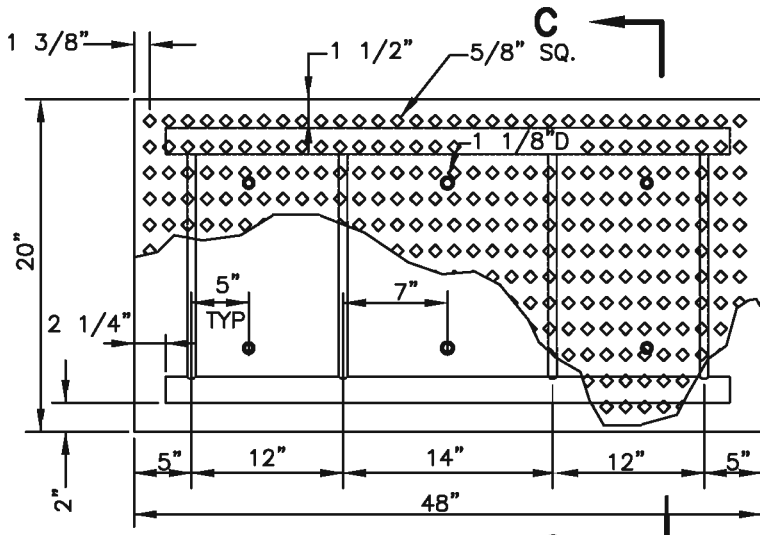
SECTION A-A

44" Frame and cover

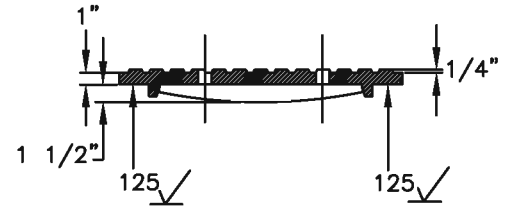
Plan No.
303

48" Cover and frame

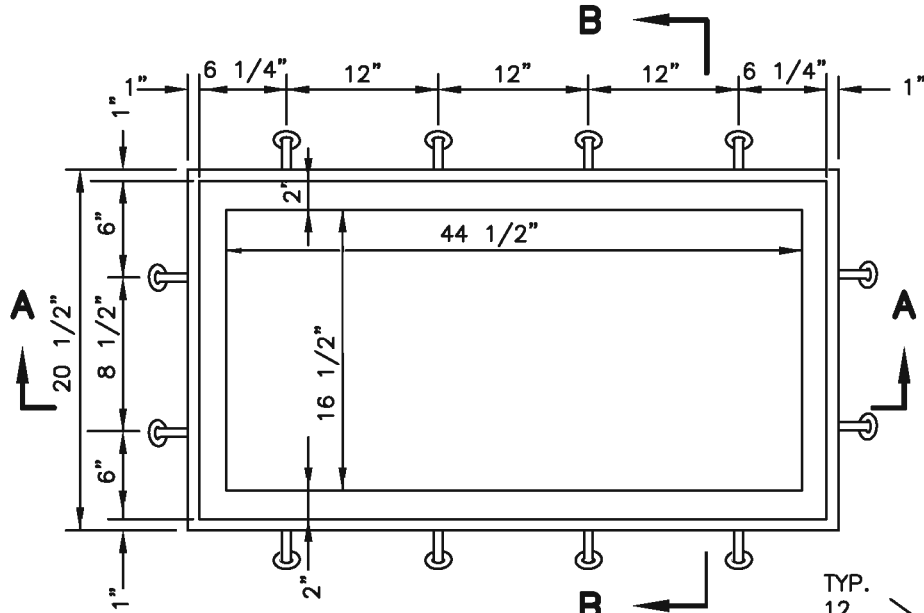
1. CASTINGS: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. CONCRETE BOX: See Plan No. 331.
4. HEAT NUMBER: Place foundry and heat number on the inside of the frame and on the bottom of the cover.



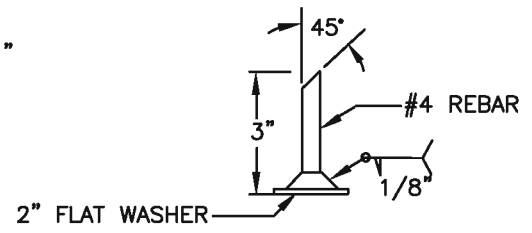
PLAN OF COVER



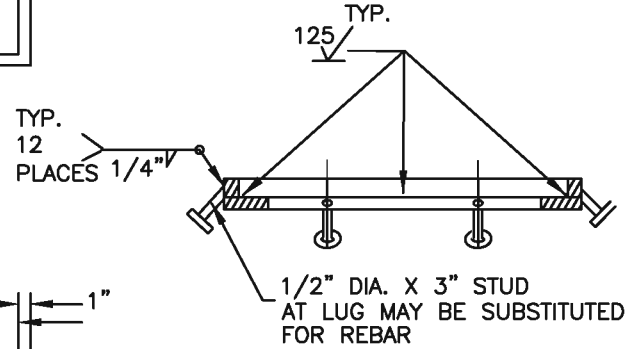
SECTION C-C



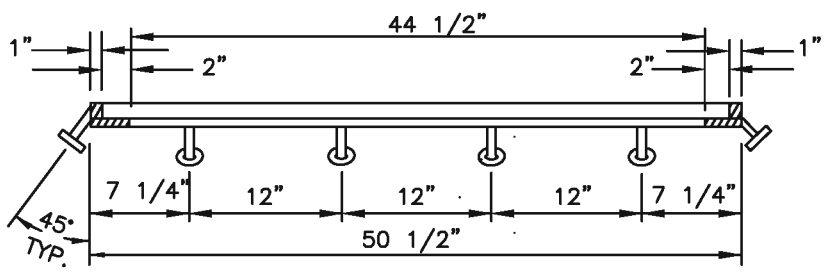
PLAN OF FRAME



DETAIL 1



SECTION B-B



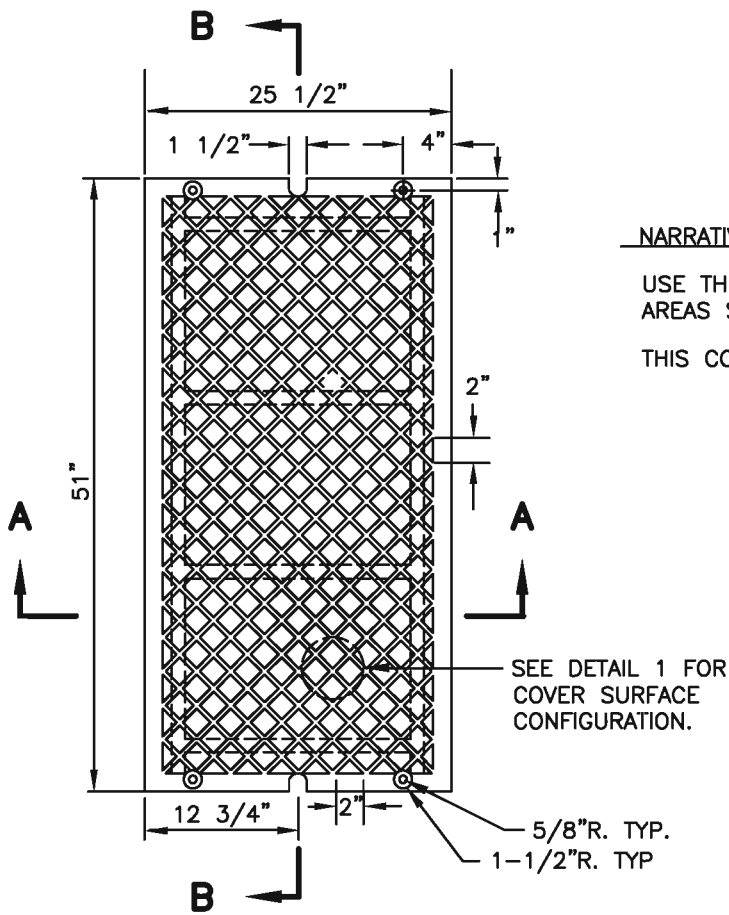
SECTION A-A

48" Cover and frame

Plan No.
304

51" Cover and frame - cover

1. CASTINGS: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. PRE-DRILL: Drill and tap covers at factory to match frames. Keep covers and frames bolted together prior to and during installation.
4. ACCESSORIES: Stainless steel bolts, washers, and accessories required. See APWA Section 05 05 23.
5. CONCRETE BOX: See Plan No. 332.
6. HEAT NUMBER: Place foundry and heat number on the inside of the frame and on the bottom of the cover.



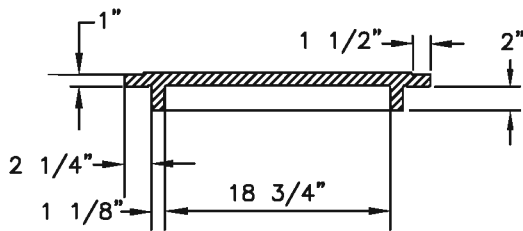
NARRATIVE

USE THIS FRAME AND COVER IN ROADWAYS AND OTHER AREAS SUBJECT TO HEAVY LOADINGS

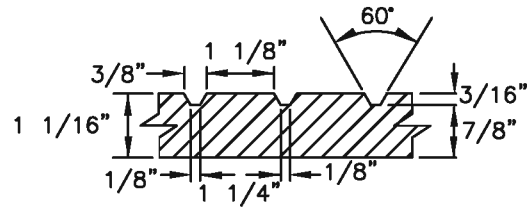
THIS COVER FITS TYPE A, B, C, AND D FRAMES

SEE DETAIL 1 FOR COVER SURFACE CONFIGURATION.

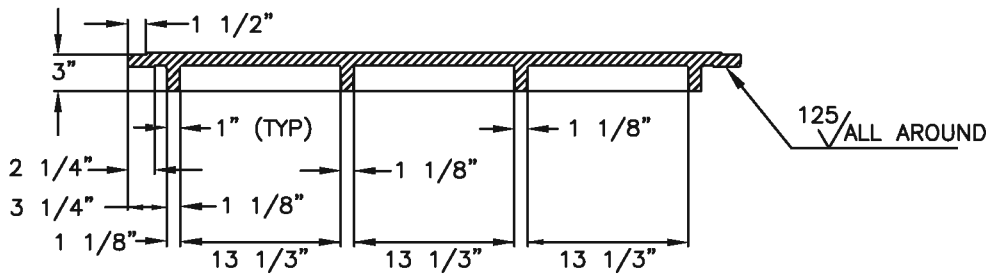
COVER PLAN VIEW



SECTION A-A



DETAIL 1



SECTION B-B

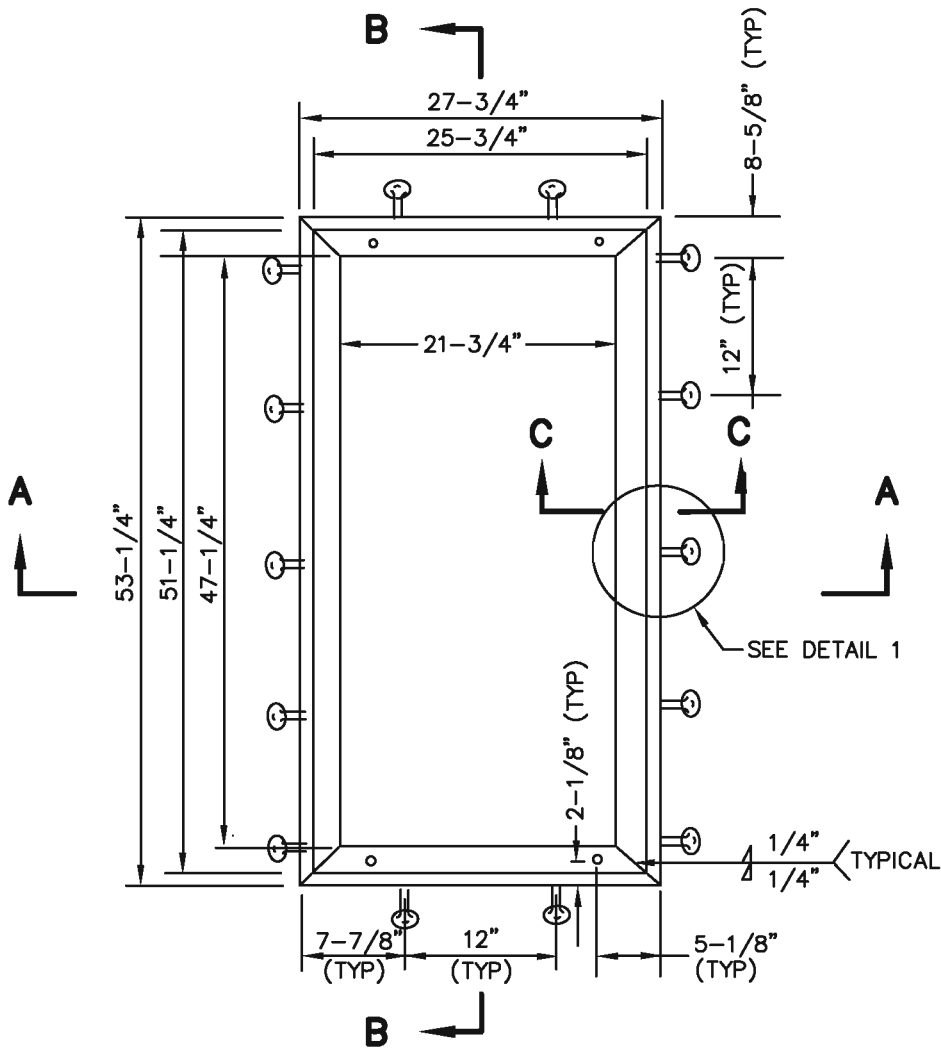
51" Cover and frame - cover

Plan No.

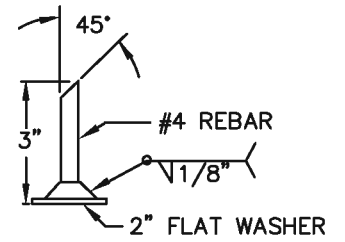
305

51" Cover and frame - type A frame

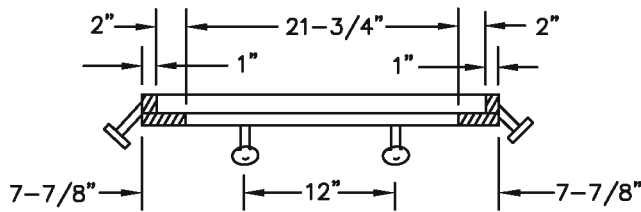
1. NARRATIVE: Use this frame and cover in roadways and other areas subject to heavy loadings. This cover fits Type A, B, C and D frames.
2. FRAME: ASTM A 36 steel, or ASTM A 48 grey iron class 35 minimum.
3. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
4. PRE-DRILL: Drill and tap covers at factory to match frames. Keep covers and frames bolted together prior to and during installation.
5. CONCRETE BOX: See Plan No. 332.



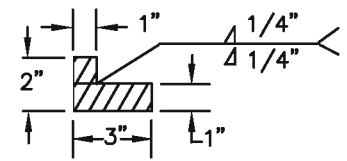
PLAN - TYPE A FRAME



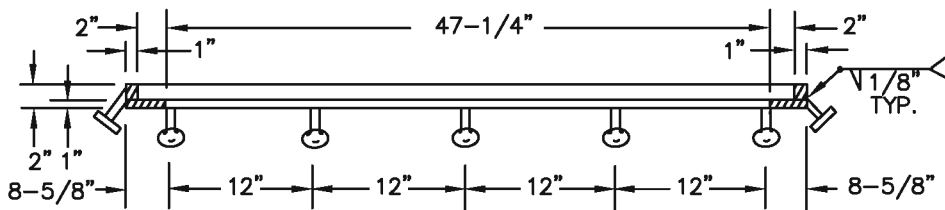
DETAIL 1



SECTION A-A



**SECTION C-C
TYP**



SECTION B-B

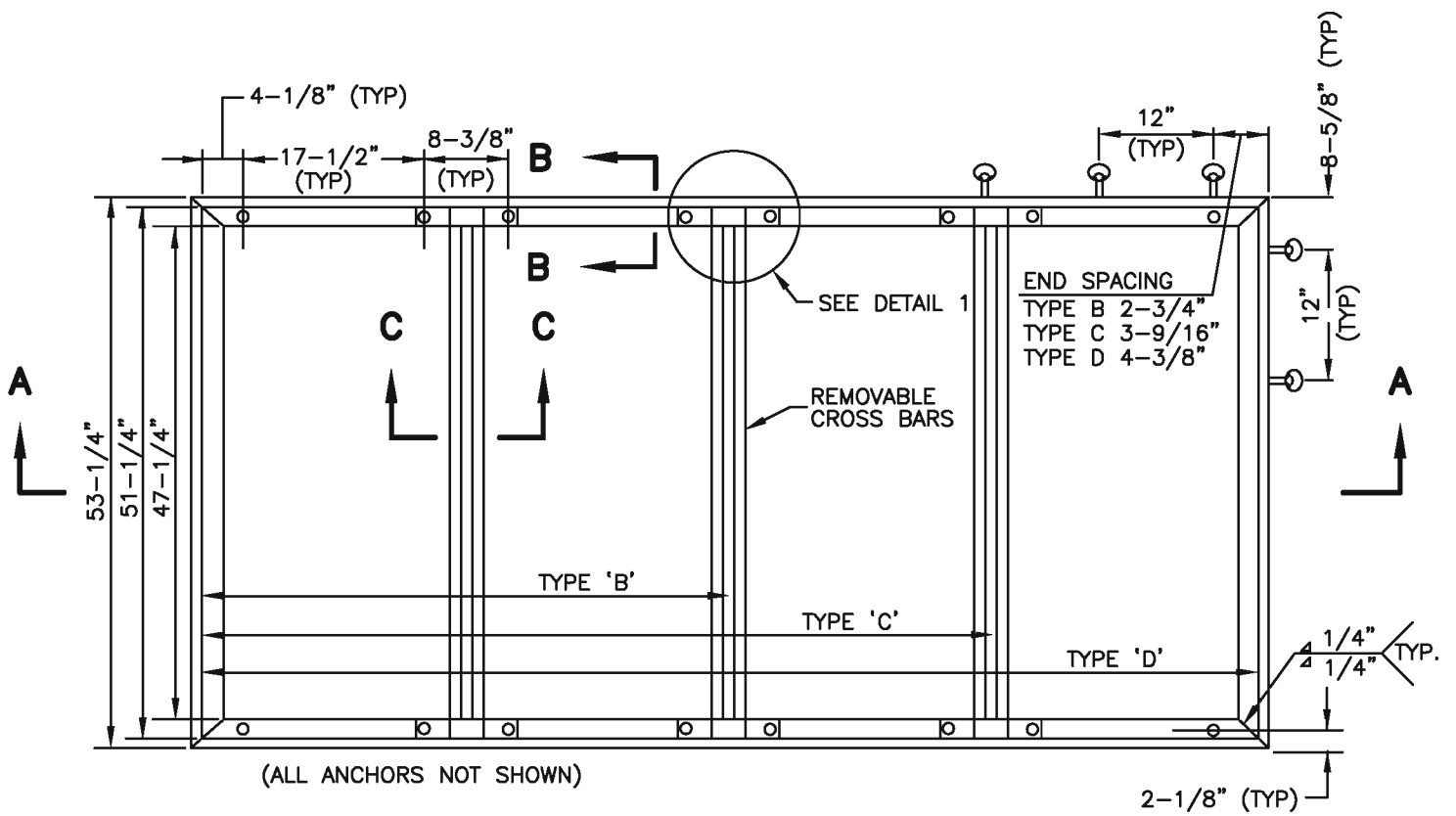
51" Cover and frame - type A frame

Plan No.

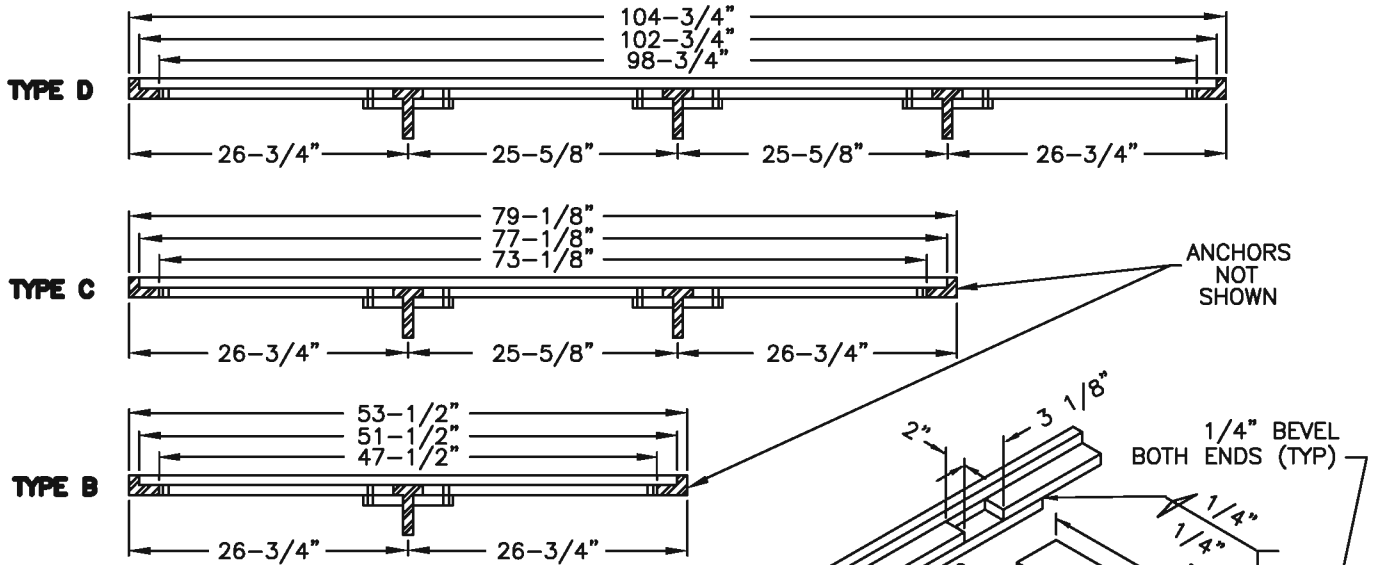
305

51" Cover and frame - type 'B', 'C', or 'D' frame

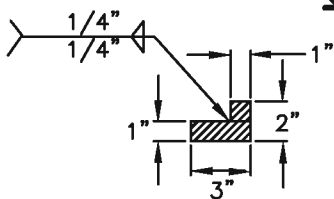
1. FRAME: ASTM A 36 steel, or ASTM A 48 grey iron class 35 minimum.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. PRE-DRILL: Drill and tap covers at factory to match frames. Keep covers and frames bolted together prior to and during installation.
4. CONCRETE BOX: See Plan No. 332.



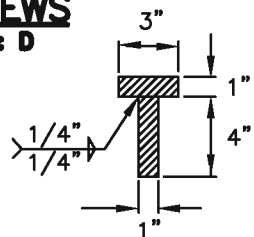
PLAN - TYPE B, C, AND D FRAMES



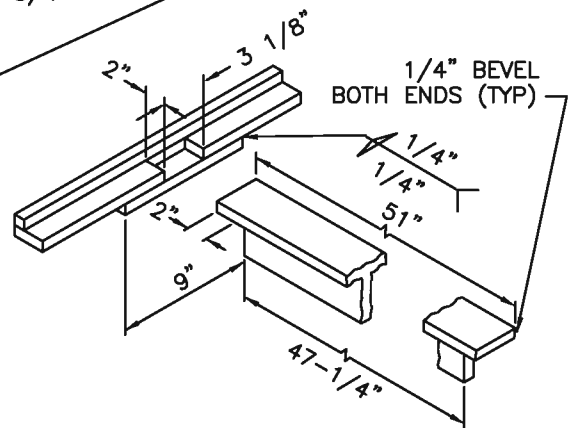
**SECTION VIEWS
TYPES B, C & D**



SECTION B-B



SECTION C-C



DETAIL 1

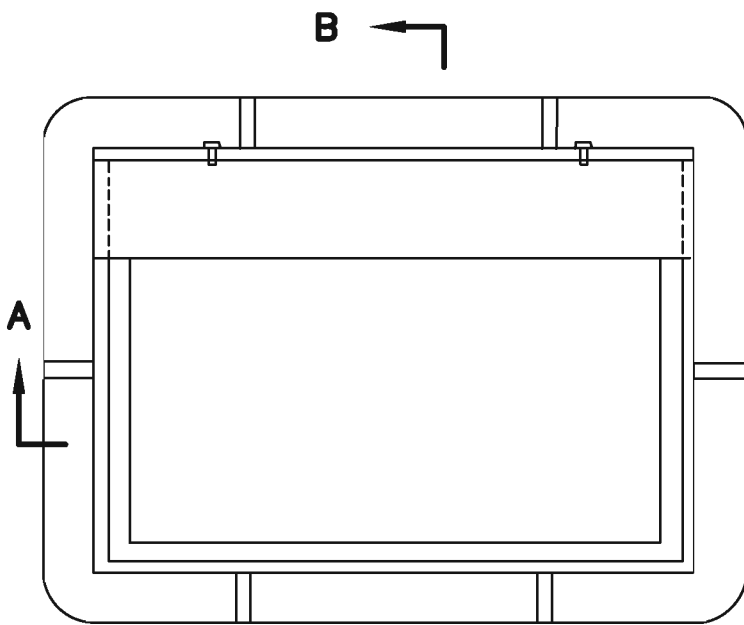
51" Cover and frame - type 'B', 'C', or 'D' frame

Plan No.

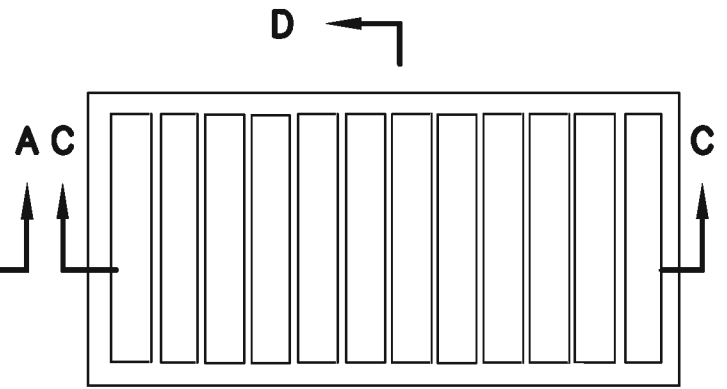
305

35 1/2" Grate and frame with adjustable curb box

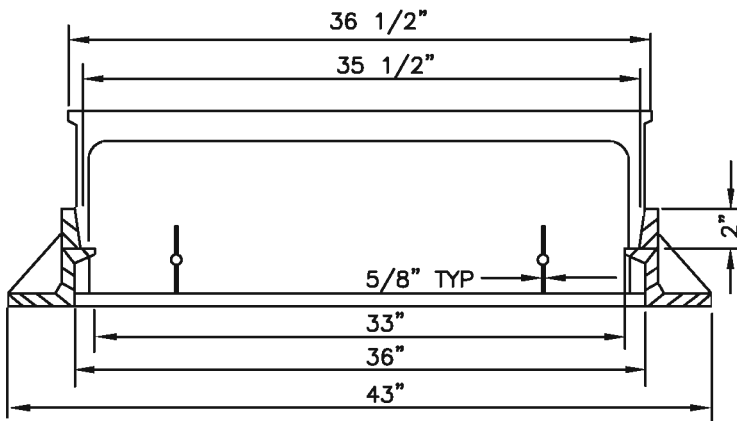
1. CASTING: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. INLET BOX: See Plan No. 315.



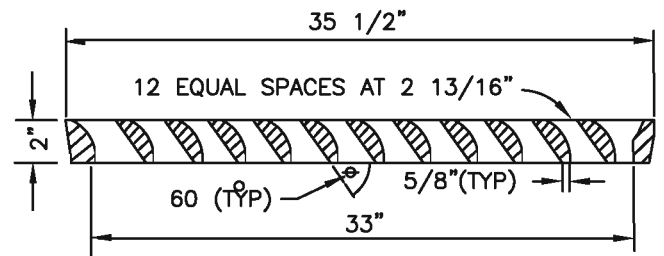
B ←
PLAN



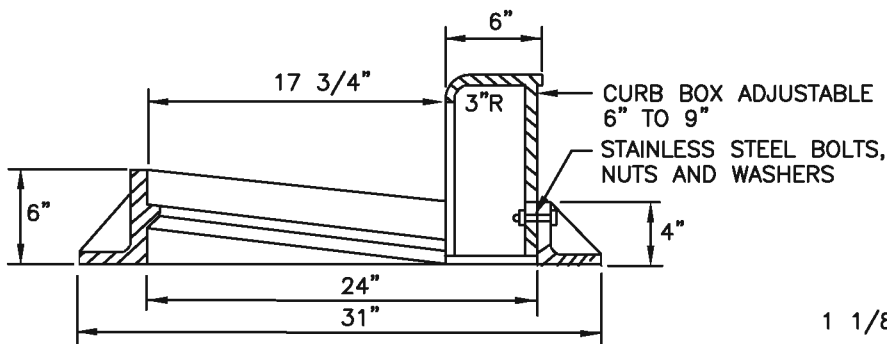
D ←
PLAN



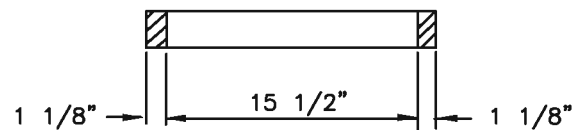
SECTION A-A



SECTION C-C



SECTION B-B



SECTION D-D

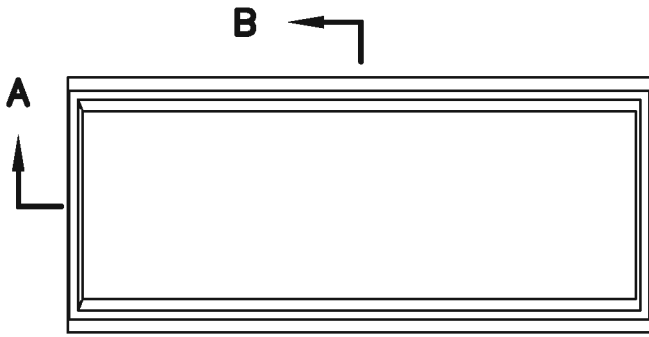
35 1/2" Grate and frame with adjustable curb box

Plan No.
308

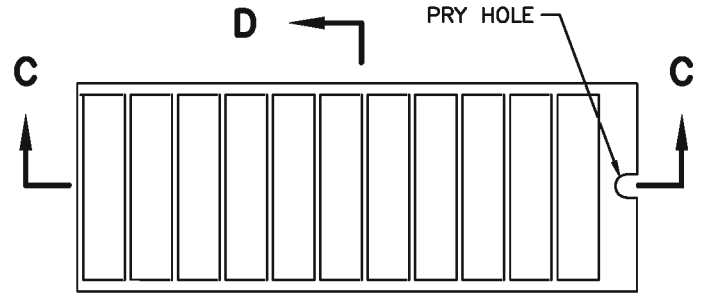
47 3/4" Grate and frame

1. CASTING: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. INLET BOX: See Plan No. 331.

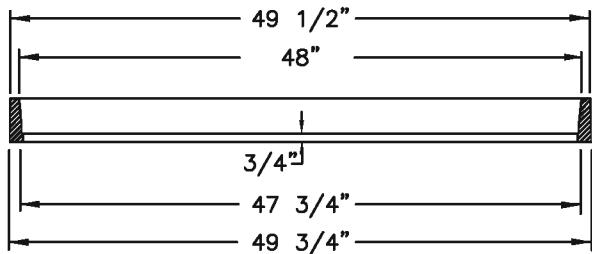
VANE GRATE



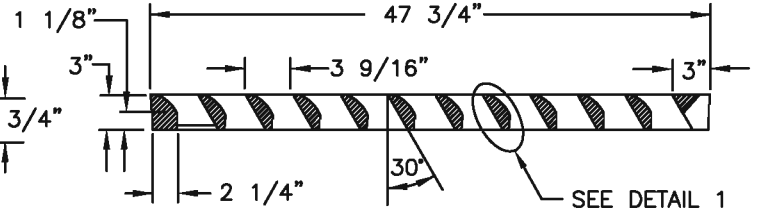
FRAME



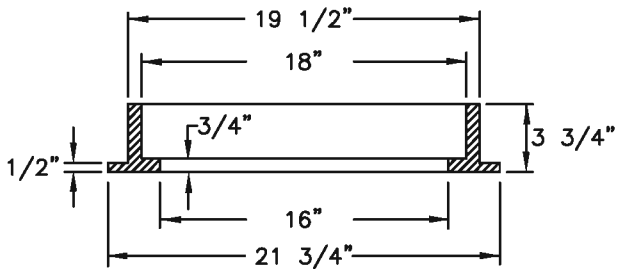
GRATE



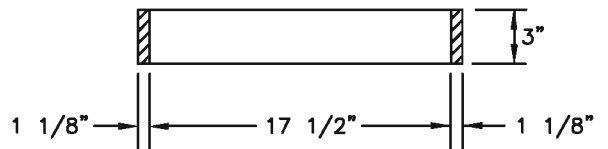
SECTION A-A



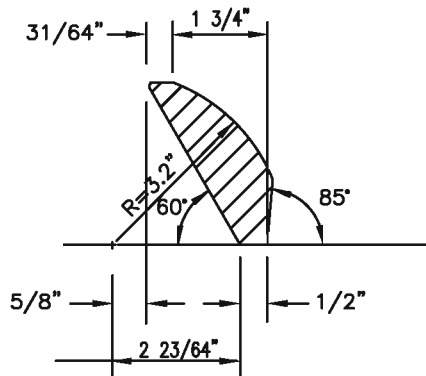
SECTION C-C



SECTION B-B



SECTION D-D



DETAIL 1

47 3/4" Grate and frame

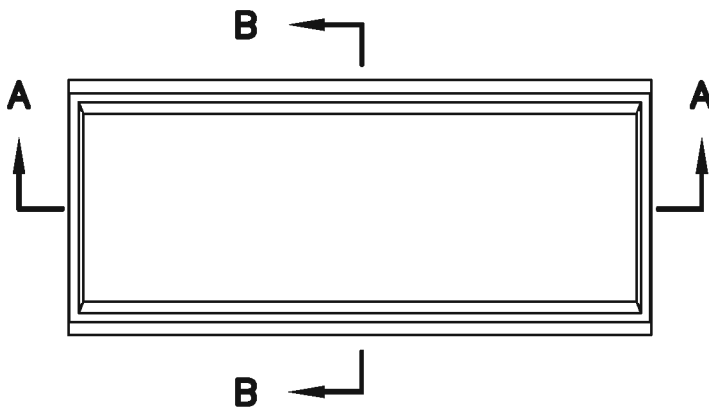
Plan No.

309

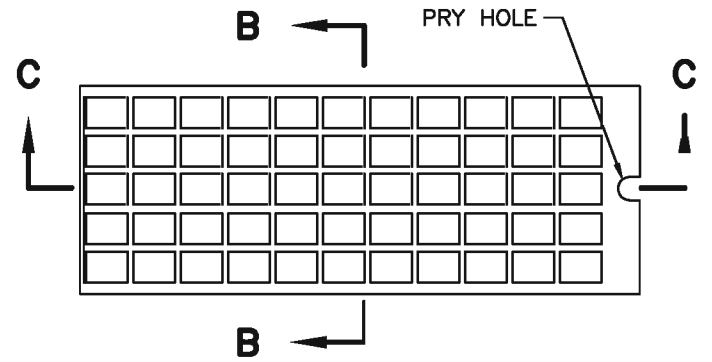
47 3/4" Grate and frame

1. CASTING: Grey iron class 35 minimum per ASTM A 48.
2. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
3. INLET BOX: See Plan No. 331.

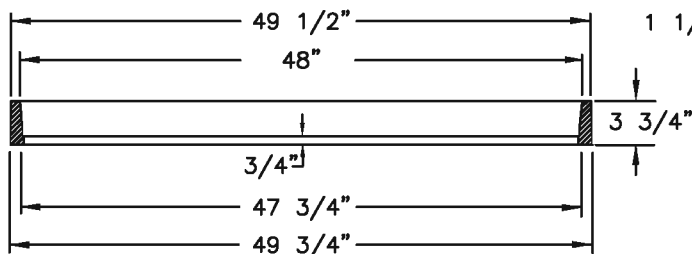
GRID GRATE



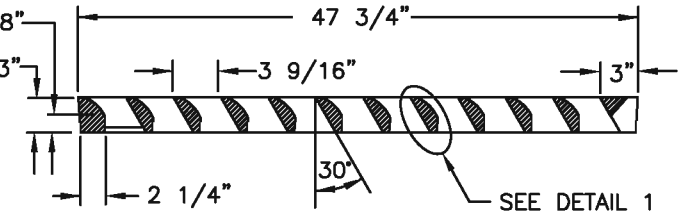
FRAME



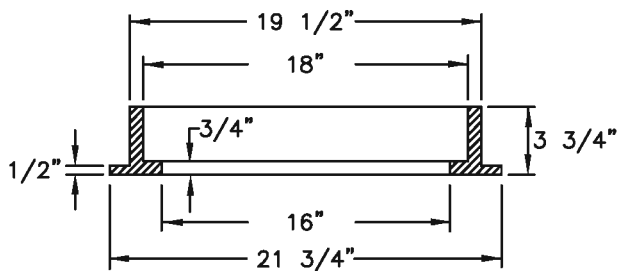
GRATE



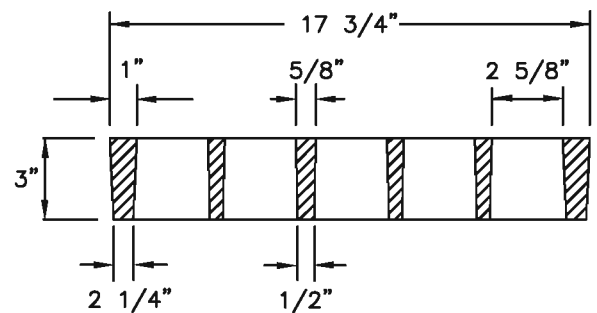
SECTION A-A



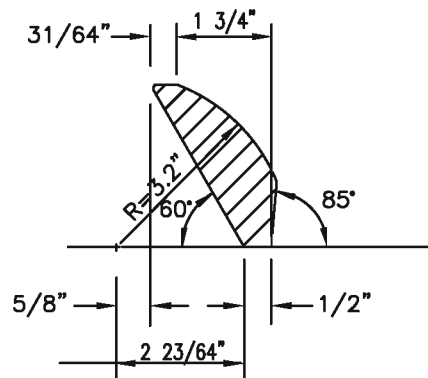
SECTION C-C



SECTION B-B



SECTION D-D



DETAIL 1

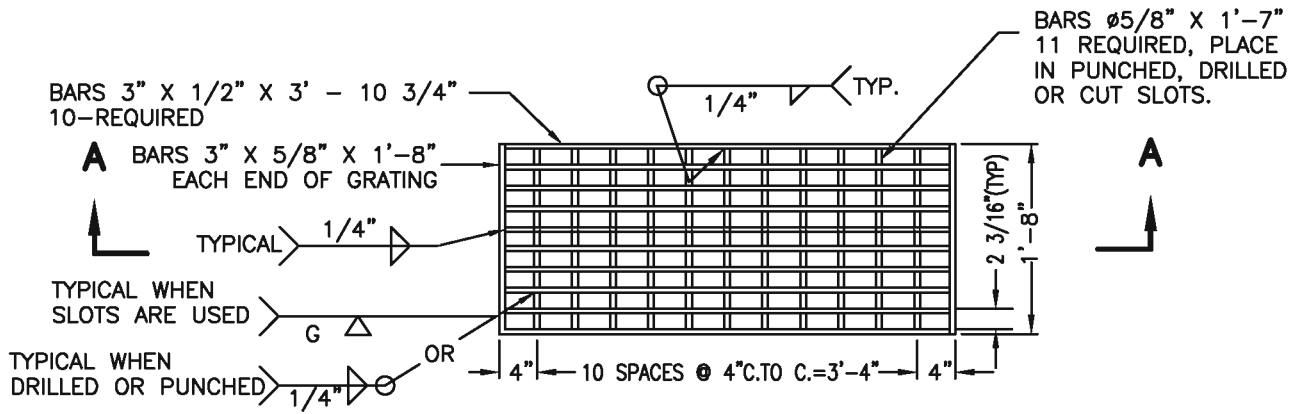
47 3/4" Grate and frame

Plan No.

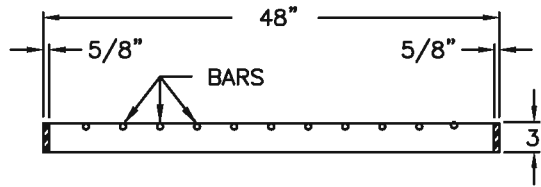
309

48" Grate and frame

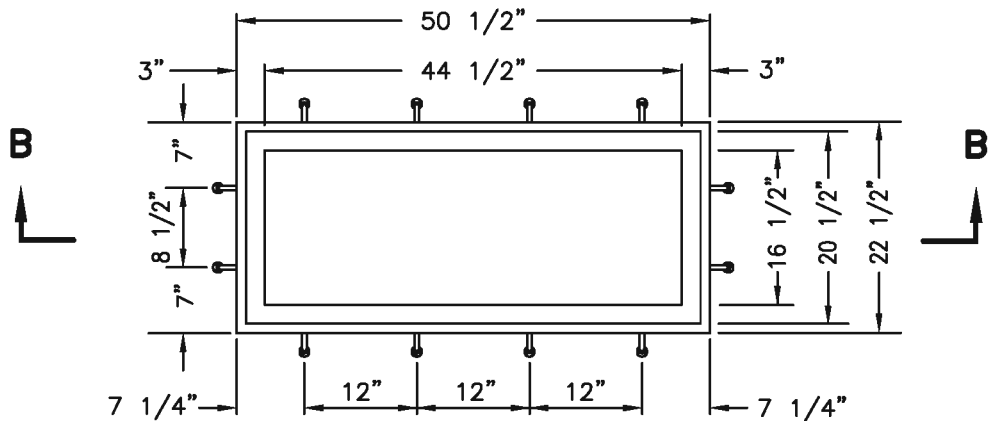
1. CAST IRON FRAMES: Grey iron class 35 minimum per ASTM A 48. Cast frame and lugs as one solid, complete unit.
2. STEEL FRAMES: Studs may be welded to the frame. Use ASTM A 36 steel.
3. COATINGS: Except machined surfaces, coat all metal parts with asphaltum paint.
4. INLET BOX: See Plan No. 331.



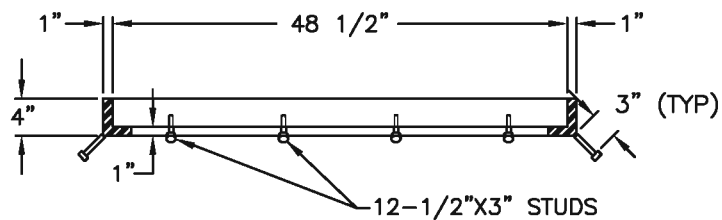
GRATE



SECTION A-A



FRAME



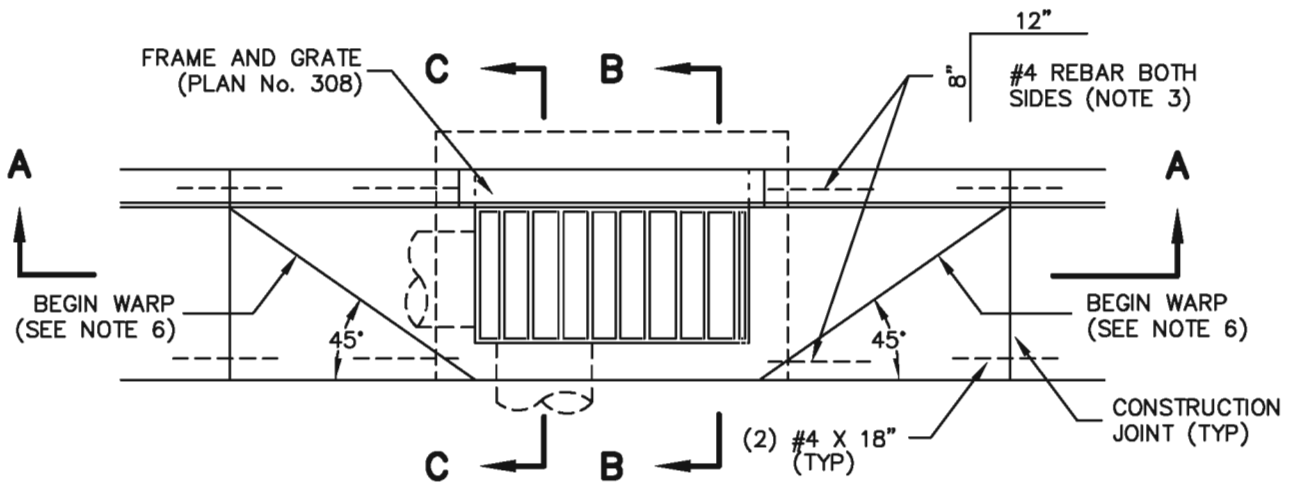
SECTION B-B

48" Grate and frame

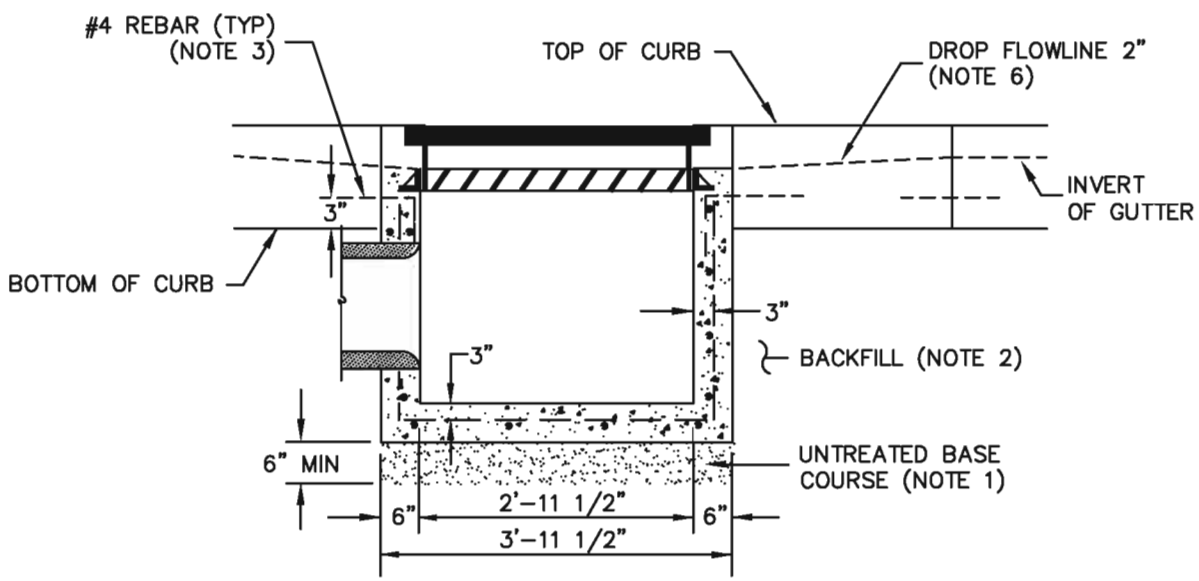
Plan No.
310

Catch basin

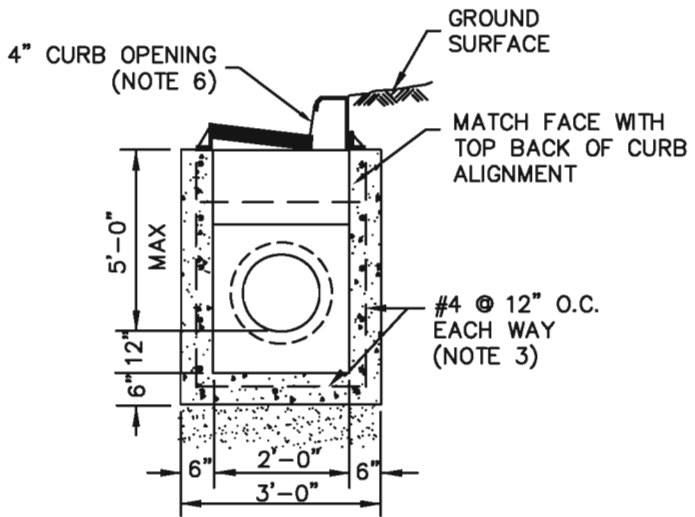
1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23 on all sides of basin. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10 Cure per APWA Section 03 39 00.
5. PIPE LATERALS: The drawing shows alternate connections to the catch basin. Refer to construction drawings for connection locations.
6. CURB FACE OPENING: Make opening at least 4 inches high. Provide at least a 2 inch drop between the "begin warp" line in the gutter flow-line and the top of the grate at the curb face opening.



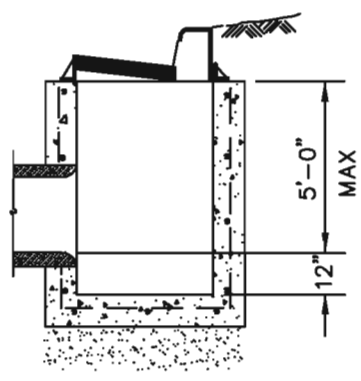
TYPE A - CURB INLET WITH SINGLE GRATE



SECTION A-A



SECTION B-B



SECTION C-C

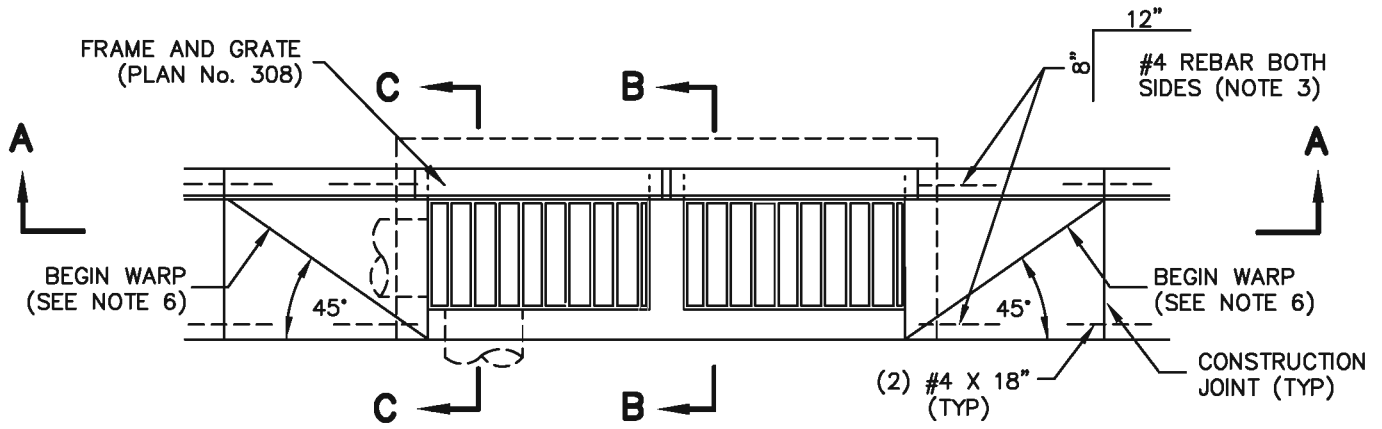
Catch basin

Plan No.

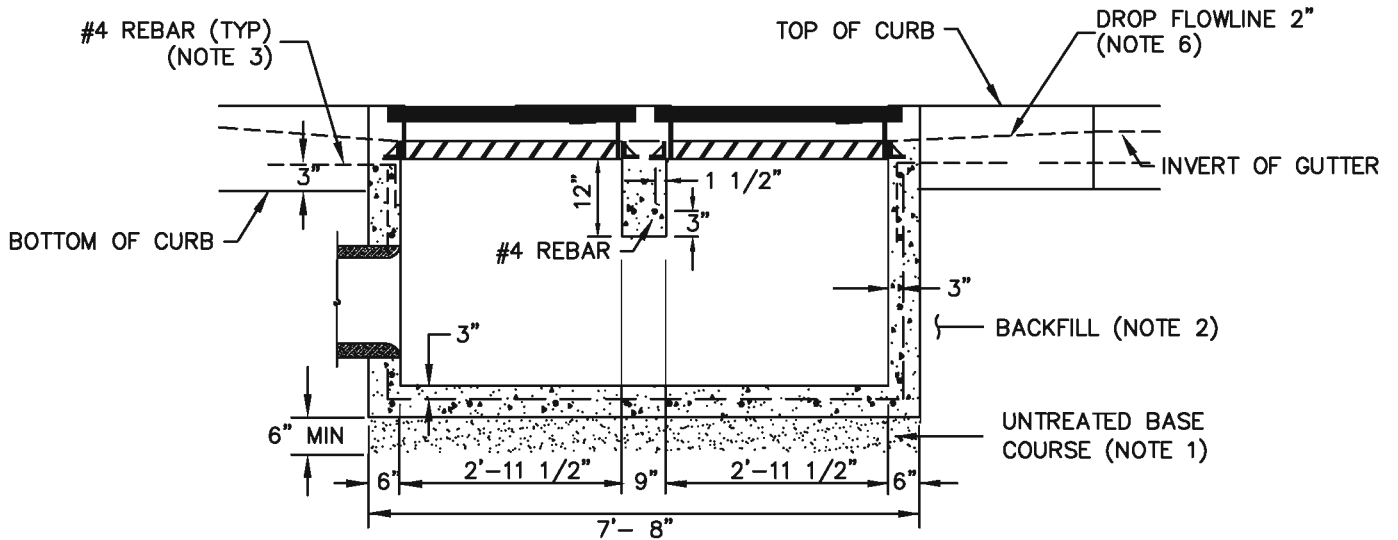
315

Catch basin

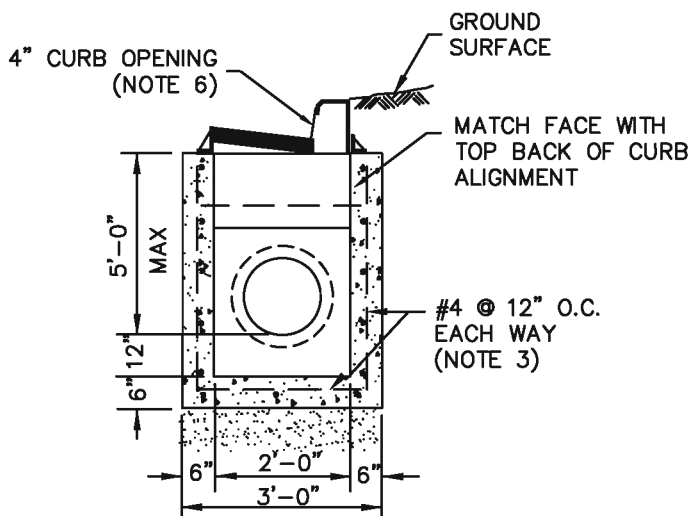
1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23 on all sides of basin. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. PIPE LATERALS: The drawing shows alternate connections to the catch basin. Refer to construction drawings for connection locations.
6. CURB FACE OPENING: Make opening at least 4 inches high. Provide at least a 2 inch drop between the "begin warp" line in the gutter flow-line and the top of the grate at the curb face opening.



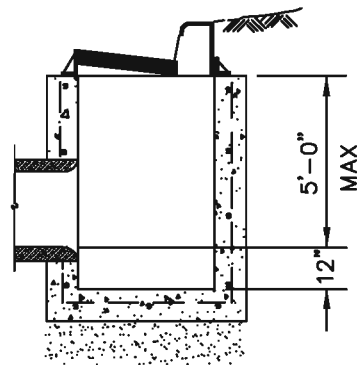
TYPE B - CURB INLET WITH DOUBLE GRATE



SECTION A-A



SECTION B-B



SECTION C-C

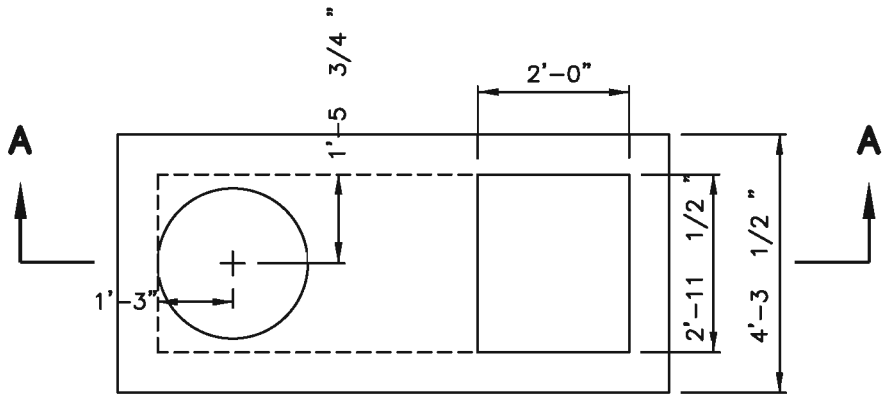
Catch basin

Plan No.

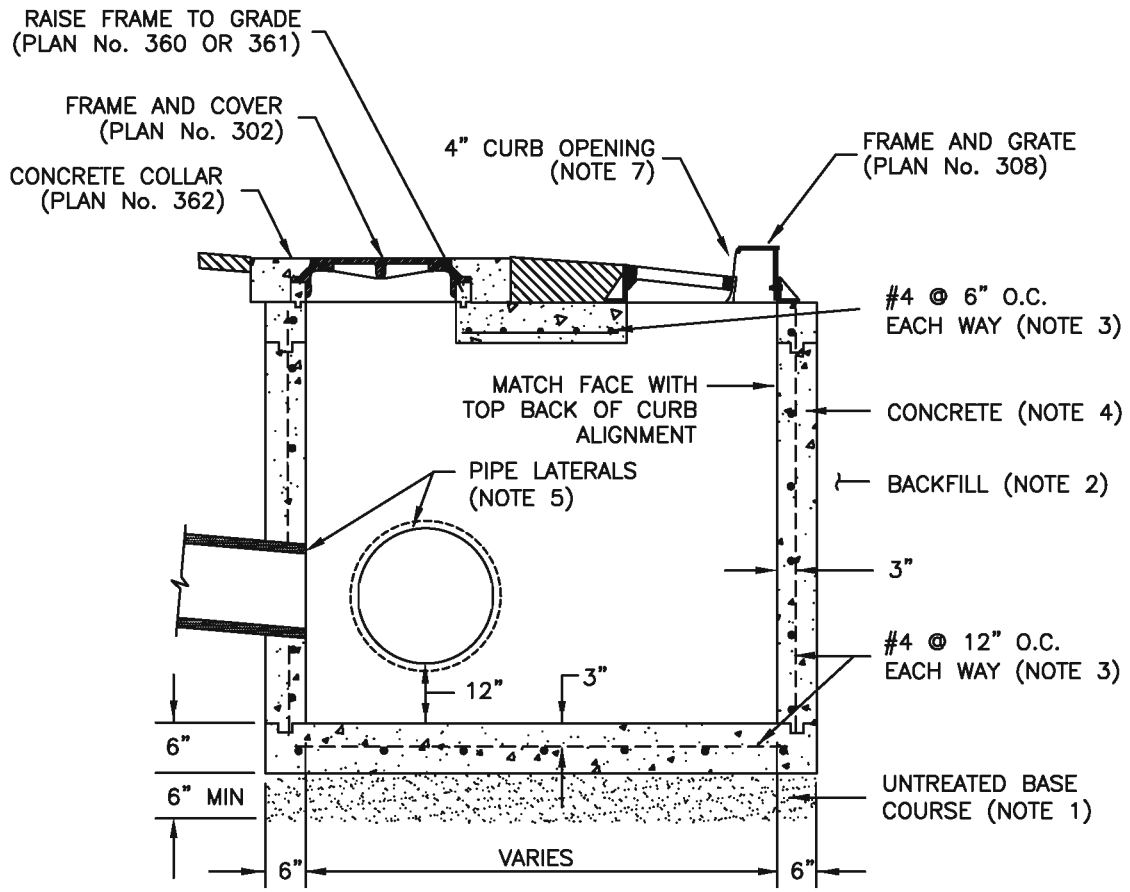
315

Combination inlet / cleanout box

1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23 on all sides of basin. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. PIPE LATERALS: The drawing shows alternate connections to the catch basin. Refer to construction drawings for connection locations.
6. LADDER RUNGS: Provide plastic coated steel ladder rungs in boxes over 6 feet deep. Place bottom rung 6 inches above top of pipe.
7. CURB FACE OPENING: Make opening at least 4 inches high. Provide at least a 2 inch drop from the concrete gutter flow-line to the top of the grate at the curb face opening.



PLAN



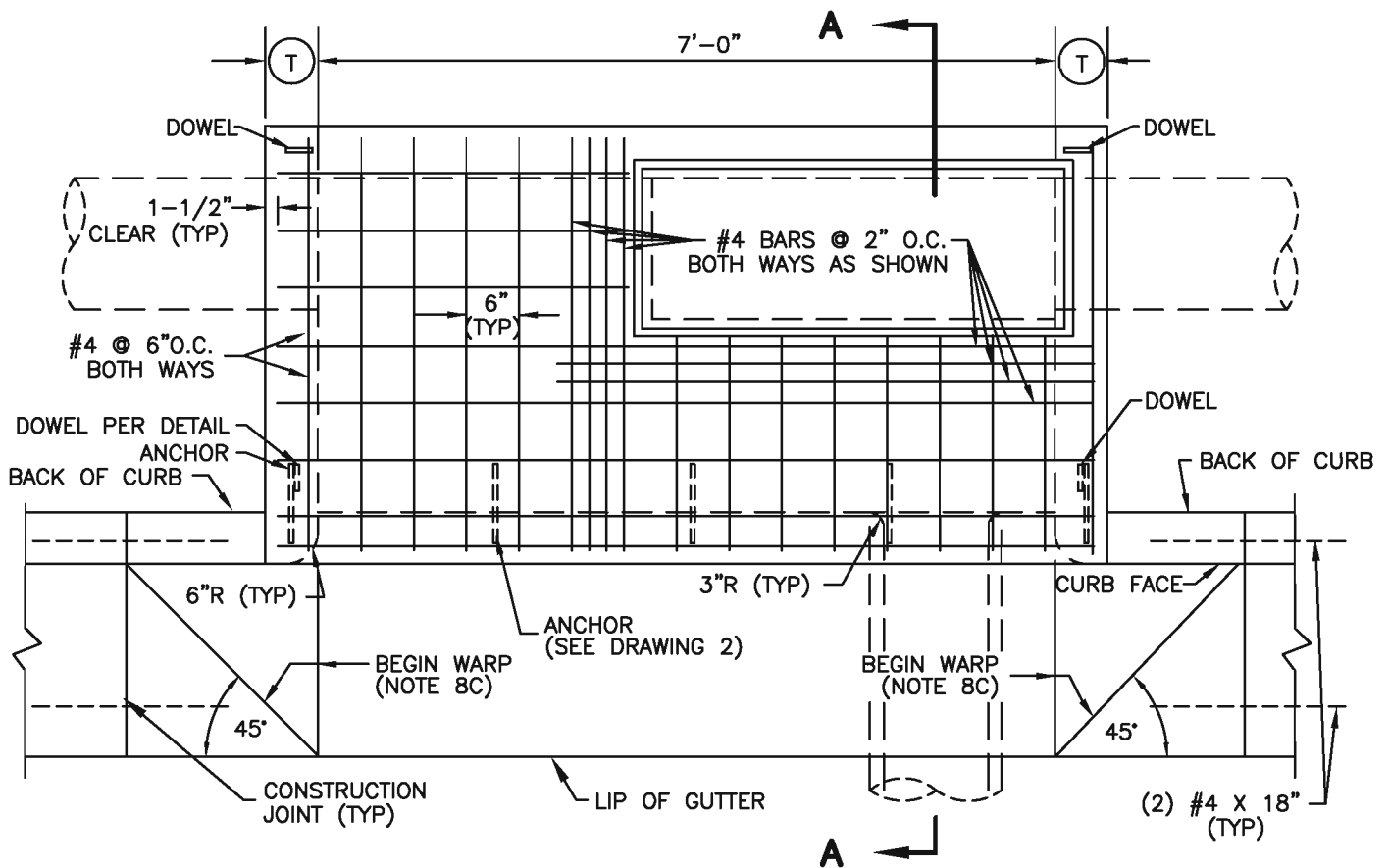
SECTION A-A

Combination inlet/cleanout box

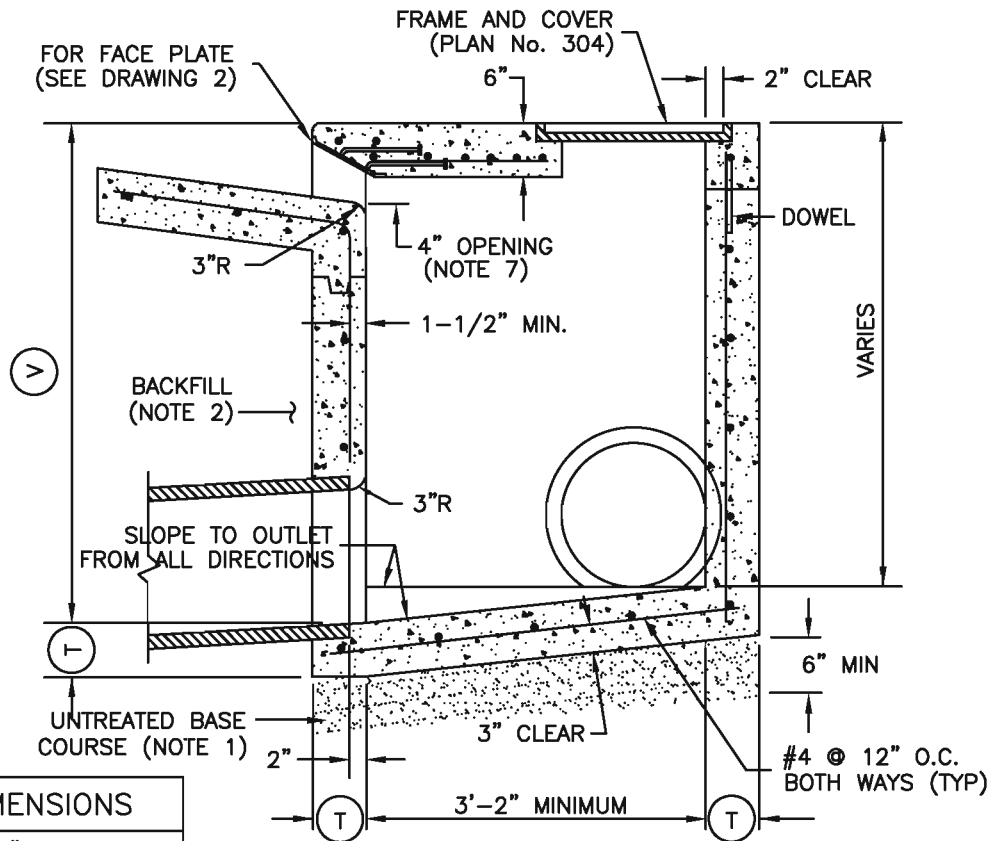
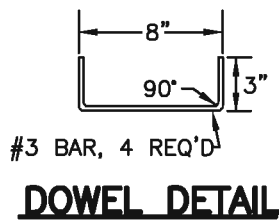
Plan No.
316

Curb inlet / outlet

1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23 on all sides of basin. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. PIPE LATERALS: The drawing shows alternate connections to the catch basin. Refer to construction drawings for connection locations.
6. FRAME AND COVER: Grey iron class 30 minimum per ASTM A 48. Coat all metal parts with asphaltum paint.
7. LADDER RUNGS: Provide plastic coated steel ladder rungs in boxes over 4 feet deep.
 - A. If $V = 3$ feet or less, place one step above the floor of the basin.
 - B. If $V = 3$ feet or more, place steps at 12 inch intervals from the floor of the basin with the top step at least 12 inches below the top of the manhole.
8. INSTALLATION:
 - A. Locate connector pipe at the downstream end of the basin unless specifically noted otherwise on the construction drawings. Trim pipe to the final shape and length before placement of concrete.
 - B. Make smooth curves at sill and sidewall at the gutter opening. Provide all exposed edges and corners with 1/2 inch radius edge finish. Match grade, slope, color and finish of adjacent curb and walkways.
 - C. Make curb opening at least 4 inches high. Provide at least a 2 inch drop from the concrete gutter flow-line to the top of the grate at the curb face opening.



PLAN



SECTION A-A

TABLE OF DIMENSIONS	
Ⓣ	= 6" IF V = 4'-0" OR LESS
Ⓣ	= 8" IF V = 4'-1" TO 8'-0"
Ⓣ	= 10" IF V = 8'-1" OR MORE

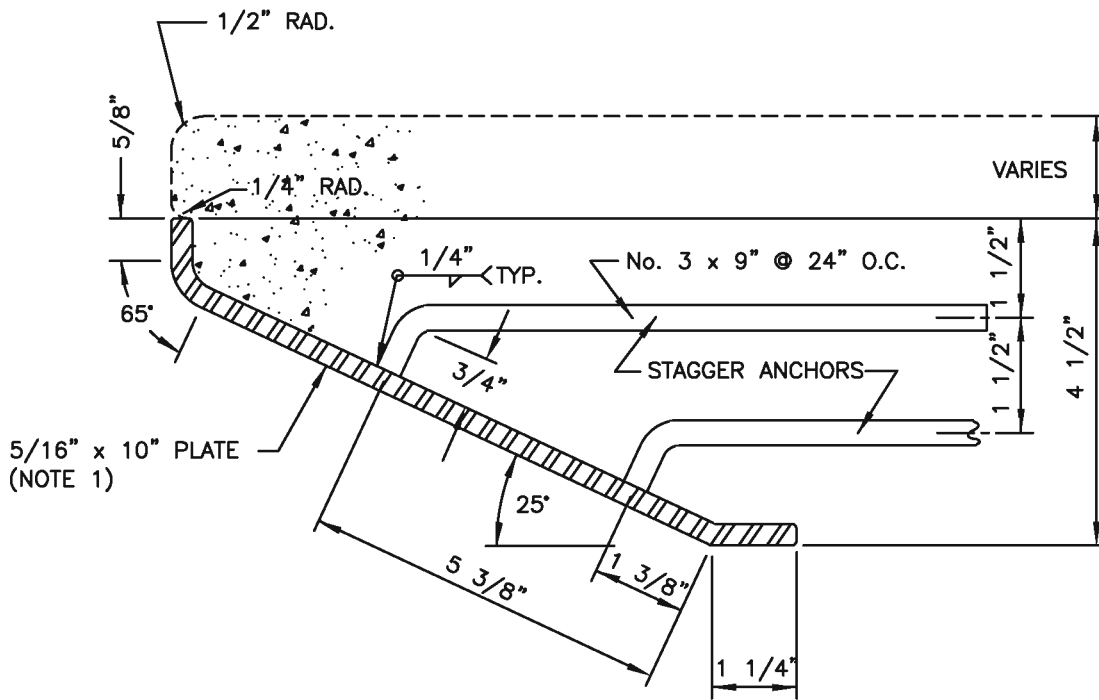
Curb inlet / outlet

Plan No.

317

Curb inlet / outlet

1. STEEL: ASTM A 36 hot dip galvanize after fabrication.

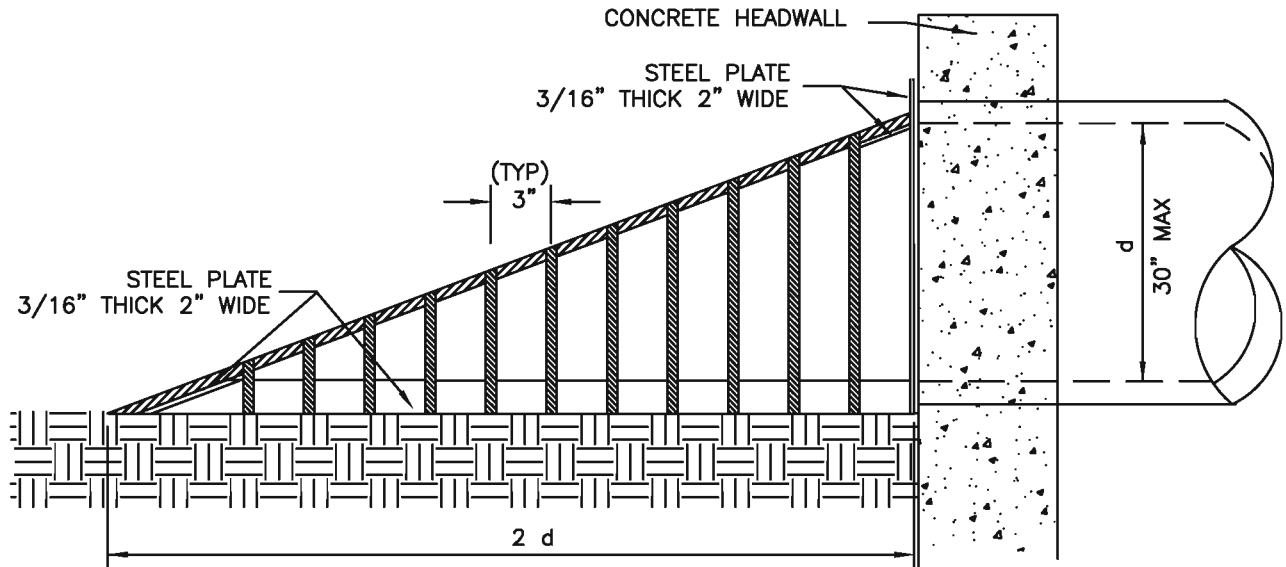
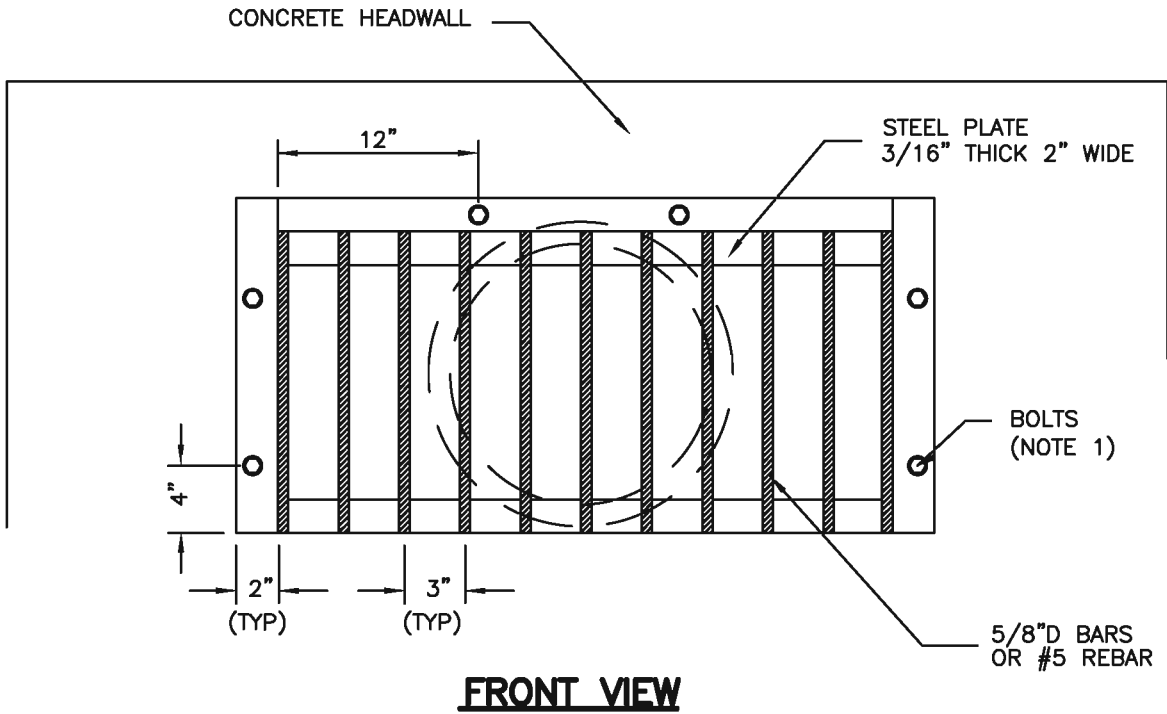


FACE PLATE DETAIL

Curb inlet / outlet

Debris grate inlet

1. BOLTS: Use 1/2 inch stainless steel bolts and 1/8 inch stainless steel washers.
2. STEEL: ASTM A 36 steel.
3. JOINTS: All joints to be welded.
4. COATING: Coat all metal parts with asphaltum paint.

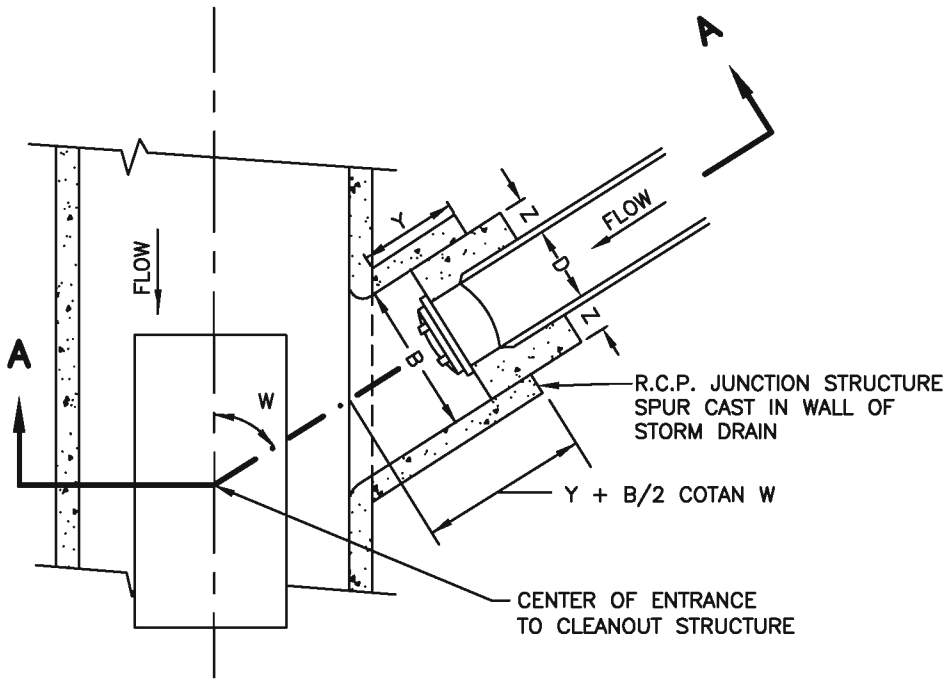


Debris grate inlet

Plan No.
320

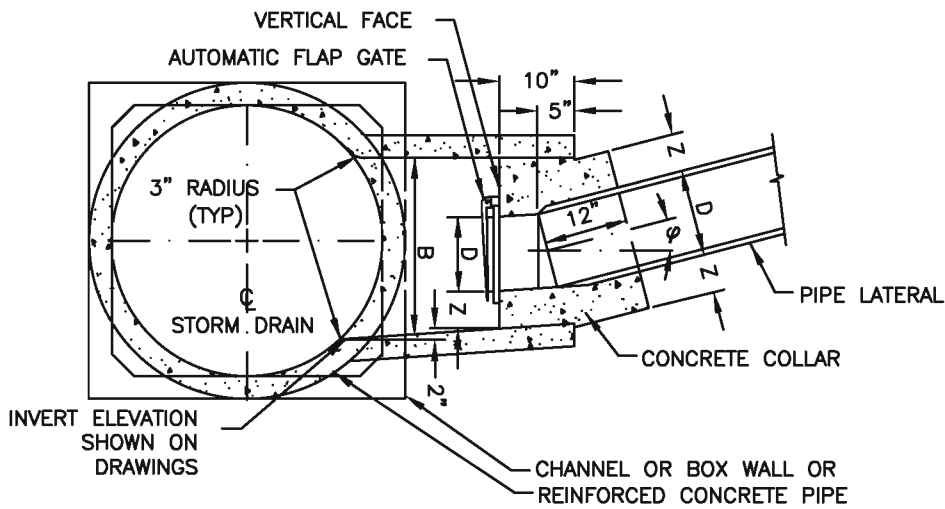
Automatic flap gate (pressurized storm drains)

1. BACKFILL: Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
2. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
3. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
4. INSTALLATION:
 - A. Mount the automatic flap gate on a concrete collar poured in the end of a junction spur.
 - B. Use nickel copper alloy mounting bolts and embed bolts 5 inches into the collar.
 - C. Provide flap gate designed for 20 feet of seating head unless specified otherwise in the Contract Documents.
 - D. The 'Y' dimension is measured at the top of the junction structure spur for trapezoidal reinforced concrete channel.
 - E. Flap gate may be either spigot back or flat back unless specified in the Contract Documents.



PLAN VIEW

TABLE OF DIMENSIONS			
D In.	B In.	Z In.	Y In.
4	16	5.0	2.0
6	18	5.0	2.0
8	20	5.0	3.0
10	22	5.0	3.0
12	24	5.0	4.0
15	27	5.0	4.0
18	33	5.0	4.0
21	39	5.0	4.0
24	42	5.0	4.0
30	51	6.0	4.5
36	60	6.0	5.0
42	72	7.0	6.0
48	81	7.0	6.5
54	87	7.0	7.0
60	96	8.0	8.0
66	108	8.0	8.5
72	114	8.0	9.0
78	126	9.0	9.5
84	138	9.0	10.5
90	144	9.0	11.0



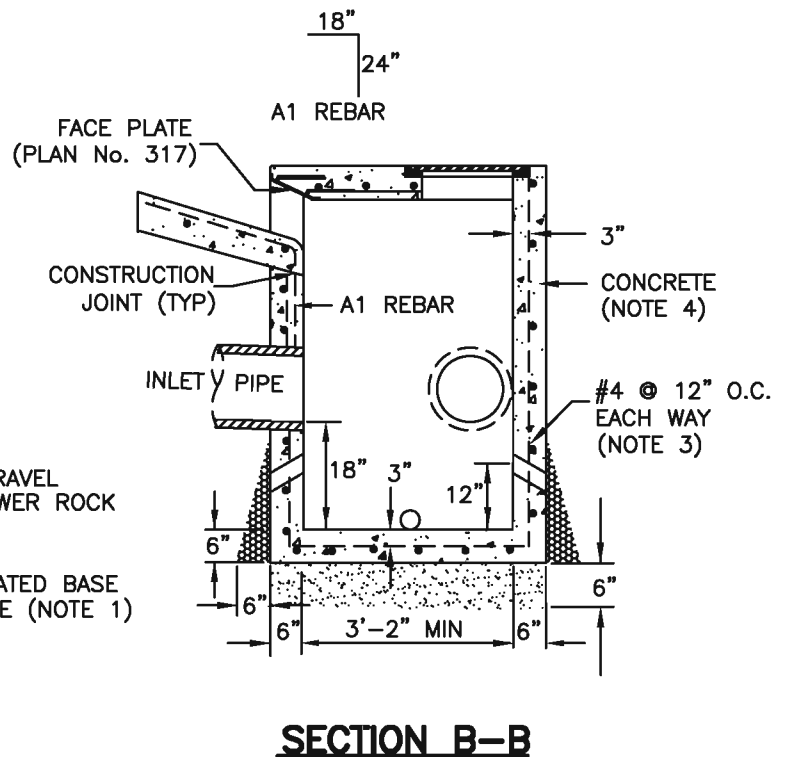
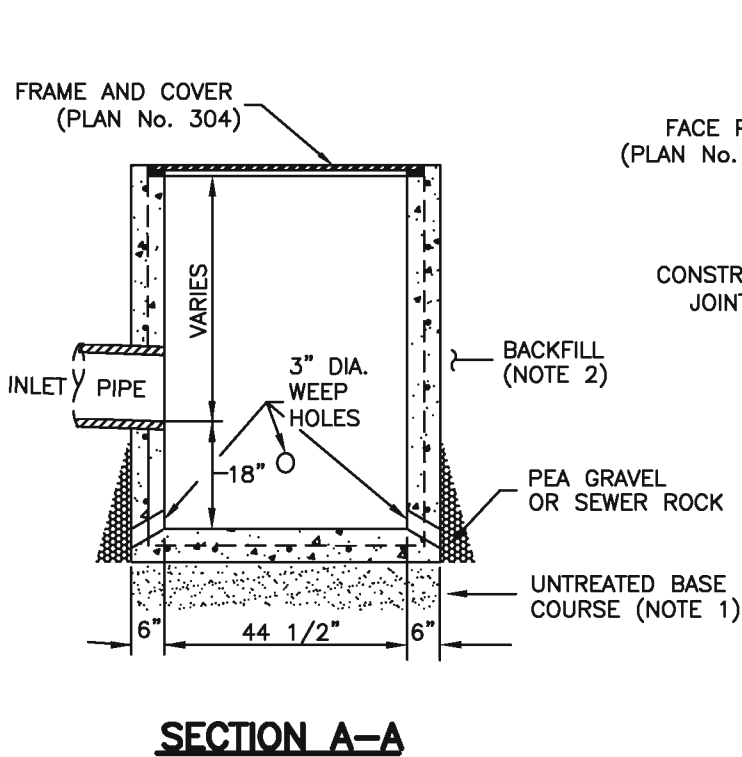
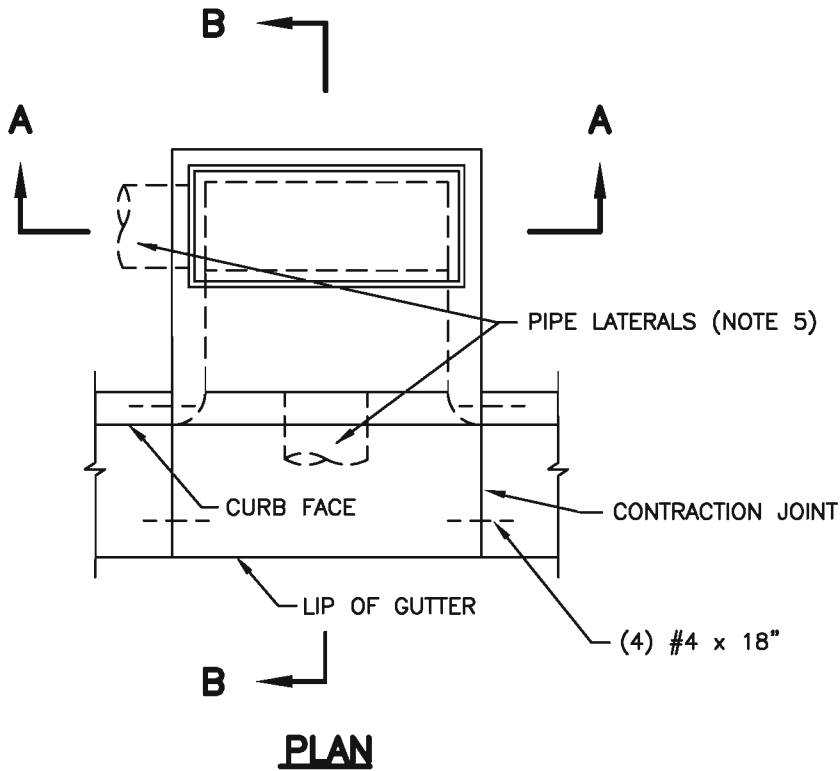
SECTION A-A

Automatic flap gate (pressurized storm drains)

Plan No.
321

Curb outlet

1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23 on all sides of basin. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements. Center steel in walls and slabs with a minimum cover of 2 inches. Keep steel 2 inches clear around pipe and lid opening.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. PIPE LATERALS: The drawing shows alternate connections to the curb outlet. Refer to construction drawings for connection locations or refer to field location of existing piping when engineering connection to existing piping.

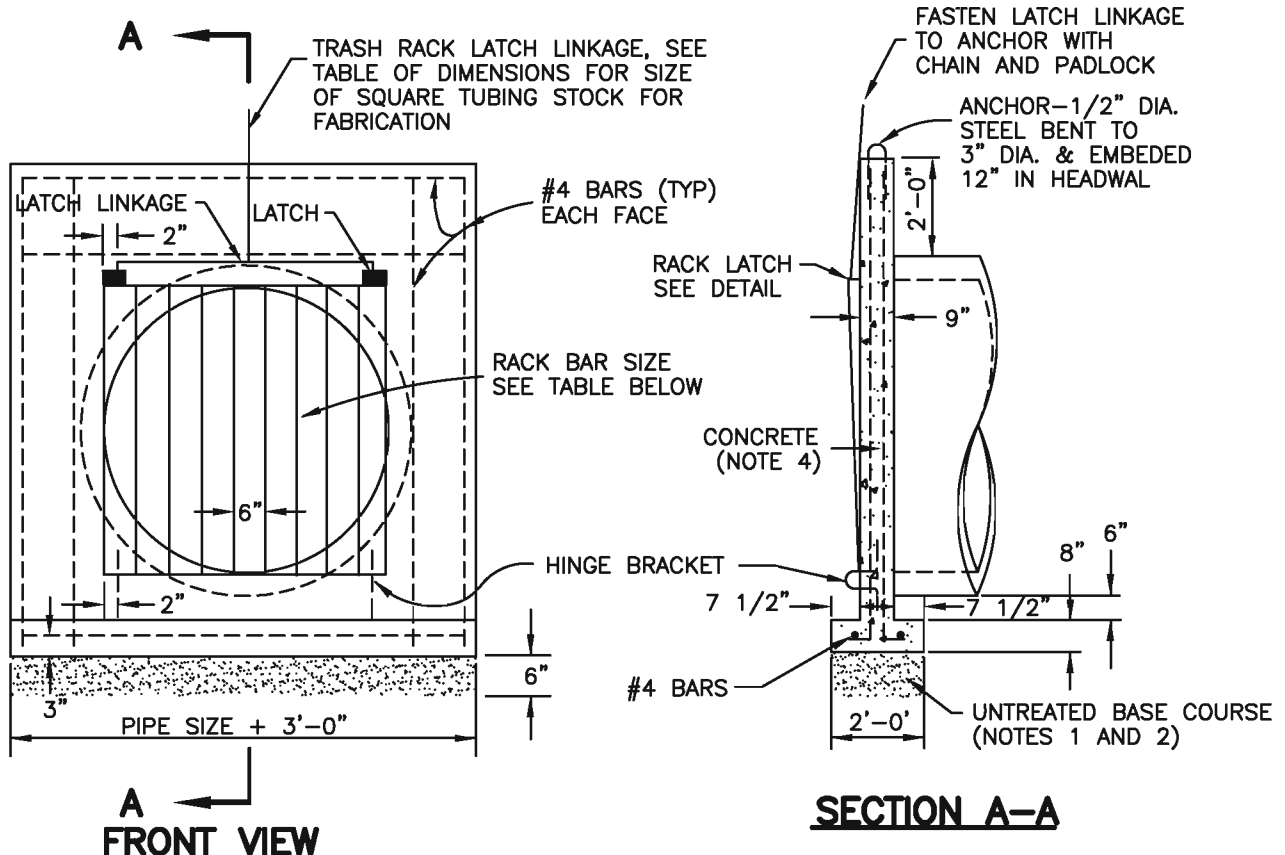


Curb outlet

Plan No.
322

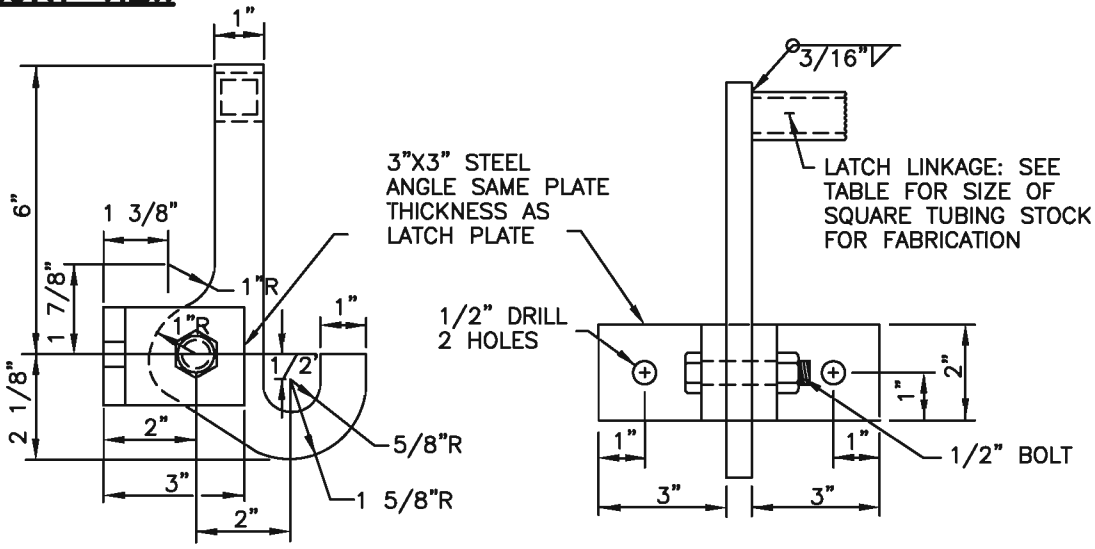
Pipe outfall access control rack

1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements. Weld rack with reinforcing steel or round bars of equal.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. STEEL: ASTM A 36.
6. INSTALLATION: Provide room to lay rack flat downstream.
 - A. Fasten latch bracket to headwall with 1/2" x 6" stainless steel bolts and hex nuts or 1/2" stainless steel expansion bolts.
 - B. When rack is in the closed position, the bottom rack bar must be tight against the top of the hinge bracket so that the rack cannot be lifted off of the latch.
 - C. Fabricate hinge bracket from #4 rebar.



FRONT VIEW

SECTION A-A



LEFT LATCH DETAIL (TYPICAL)

TABLE OF DIMENSIONS							
PIPE SIZE	RACK BAR SIZE	LATCH PLATE THICKNESS	LATCH LINKAGE SIZE	PIPE SIZE	RACK BAR SIZE	LATCH PLATE THICKNESS	LATCH LINKAGE SIZE
18"	#4	1/4"	1", .095" THICK	42"	#7	1/2"	1", .133" THICK
21"	"	"	"	48"	"	"	"
24"	#5	"	"	54"	#8	"	"
27"	"	3/8"	"	60"	"	"	"
30"	#6	"	"	66"	"	"	"
33"	"	"	1", .133" THICK	72"	"	"	"
36"	#7	"	"	84"	"	"	"

Cleanout box

1. **UNTREATED BASE COURSE:** Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.

2. **BACKFILL:** Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.

3. **REINFORCEMENT:** ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements. Center steel in walls and slabs with a minimum cover of 2 inches. Keep steel 2 inches clear around pipe and lid opening. A1 bars required at all corners, vertical and horizontal. A1 bars connecting two walls must match wall bar size and spacing. A1 bars connecting walls to top and bottom slabs must match slab steel size and spacing.

4. **CONCRETE:** Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.

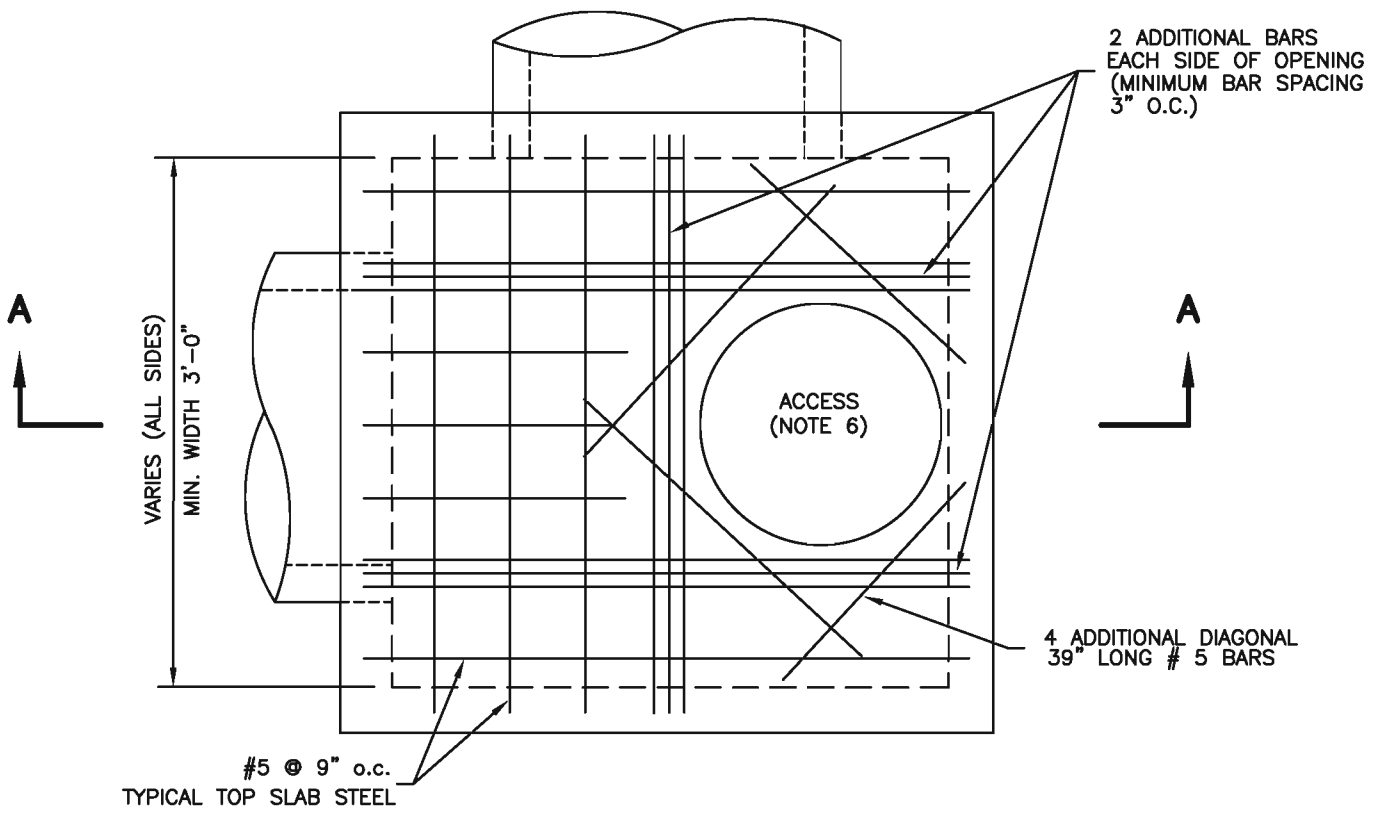
5. **PIPE LATERALS:** Refer to Drawings for connection locations.

6. **ACCESS:** Eccentric access is shown. Prior to construction, verify if concentric access is required. Adjust reinforcement accordingly.

7. **LADDER RUNGS:** Plastic. Required in boxes greater than 6 feet deep with eccentric access. Align rungs with location of access opening. Rungs not required in boxes with concentric access.

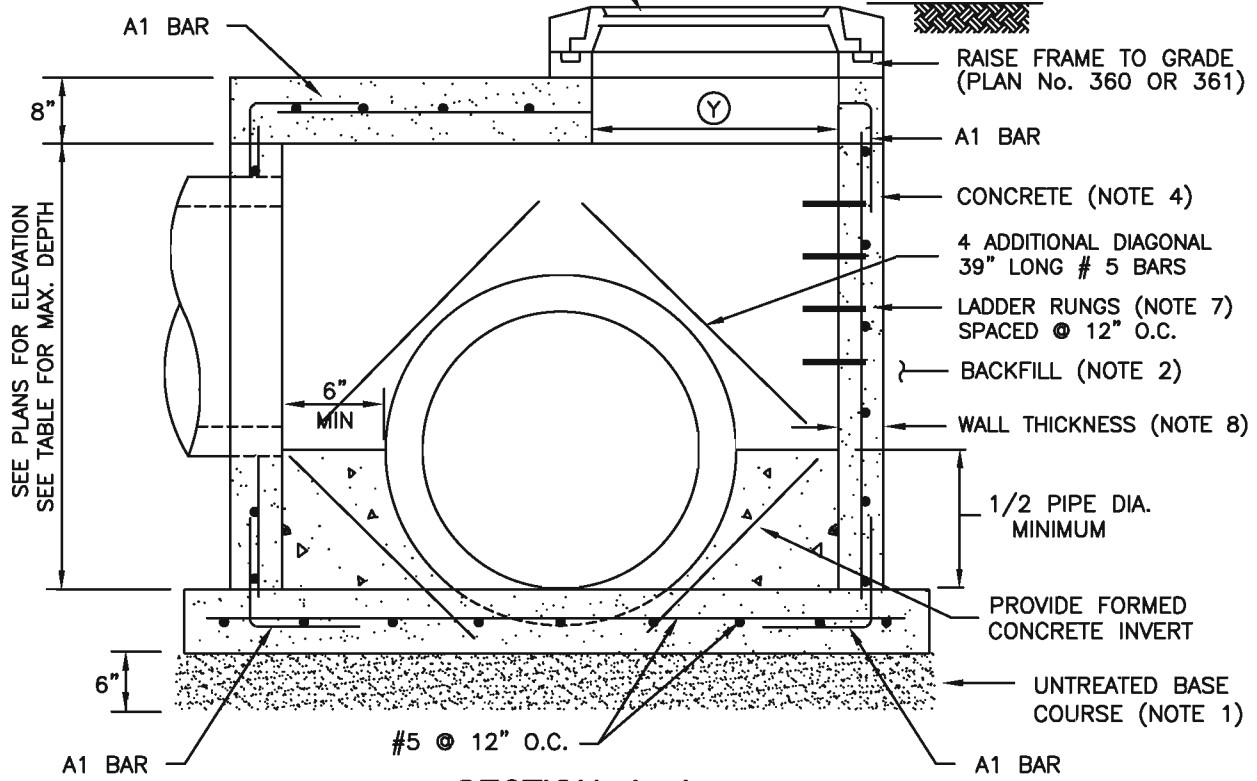
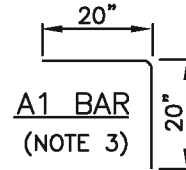
8. **WALL THICKNESS AND WALL STEEL**

Low Water Table				
Max. Box Width	6 feet	8 feet	8 feet	9 feet
Max. Box Depth	6 feet	8 feet	12 feet	12 feet
Wall Thickness	8 inches	8 inches	12 inches	12 inches
Wall Curtain Steel	#5 @ 12"	#5 @ 6"	#5 @ 6"	#7 @ 9"
Modifications for High Water Table				
Wall Thickness	8 inches	10 inches	16 inches	12 inches
Wall Curtain Steel	#5 @ 9"	#5 @ 6"	#5 @ 6"	#6 @ 6"



BASE WITHOUT SUMP

DIMENSION	LARGEST PIPE DIAMETER	SEE PLAN No.
Y = 30"	< 24"	302
Y = 44"	24"+	303



SECTION A-A

Cleanout box

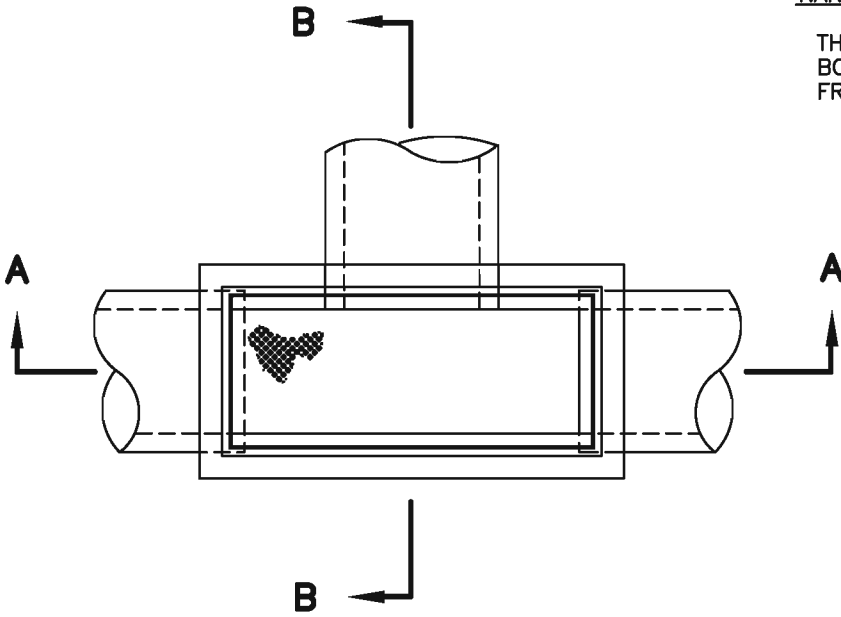
Plan No.
330

Cleanout box

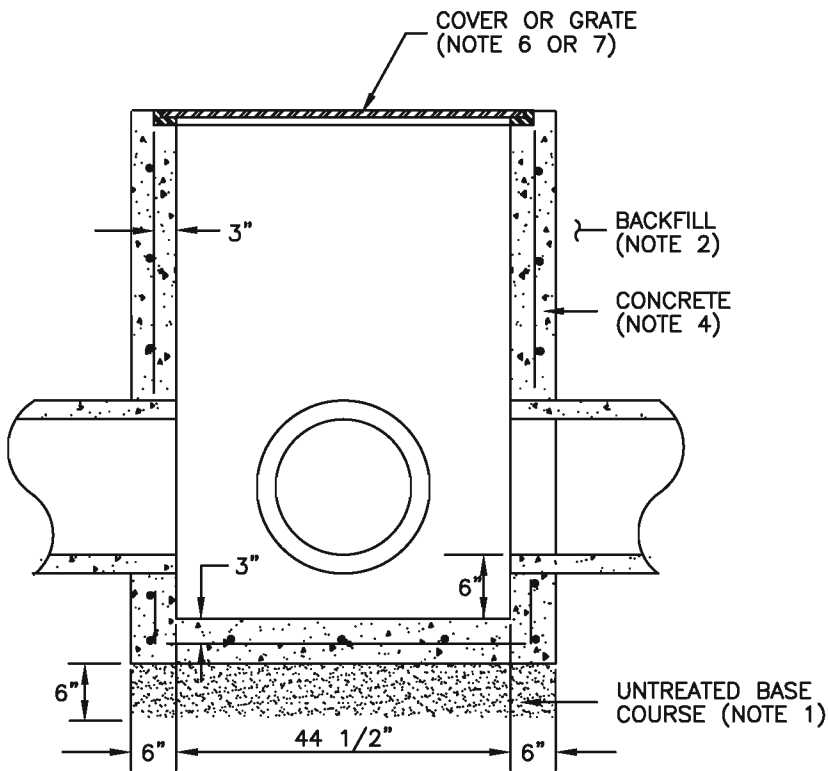
1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. PIPE LATERALS: The drawing shows alternate connections to the curb outlet. Refer to Construction Drawings for connection locations.
6. COVER AND FRAME: See Plan No. 304. Adjust concrete dimensions at frame accordingly.
7. GRATE AND FRAME: See Plan No. 309 or 310. Adjust concrete dimensions at frame accordingly.

NARRATIVE

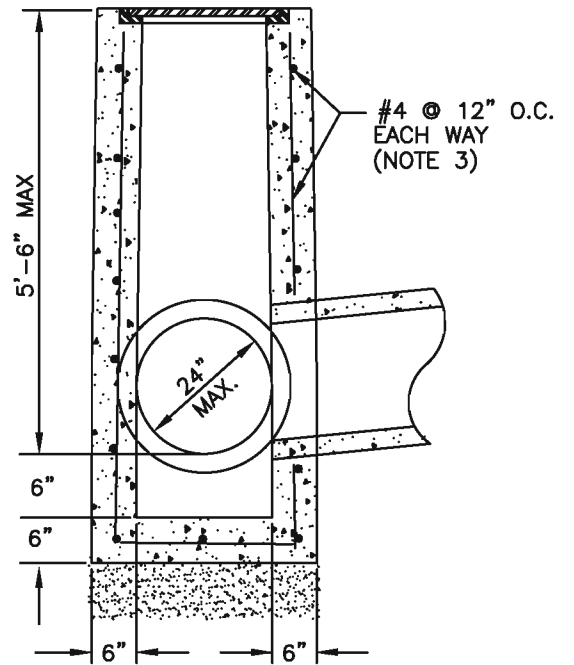
THIS CONCRETE BOX MAY BE USED AS A CLEANOUT BOX OR AN INLET BOX. INSTALL THE APPROPRIATE FRAME AND COVER, OR FRAME AND GRATE.



PLAN VIEW



SECTION A-A



SECTION B-B

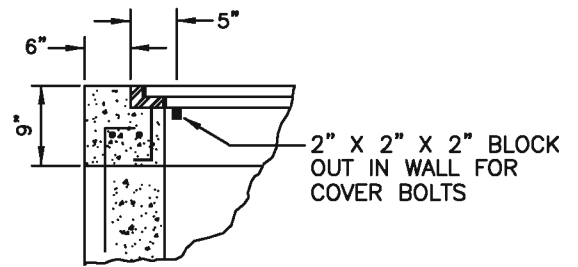
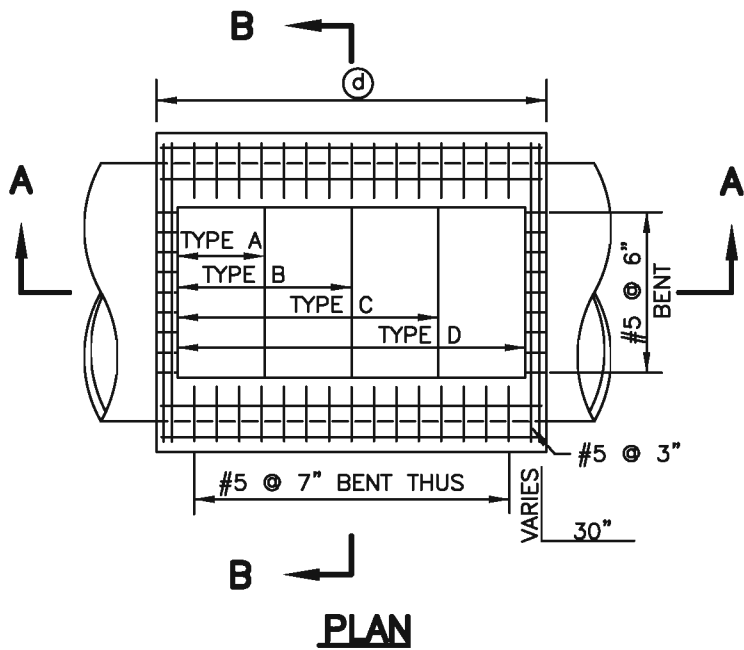
Cleanout box

Plan No.

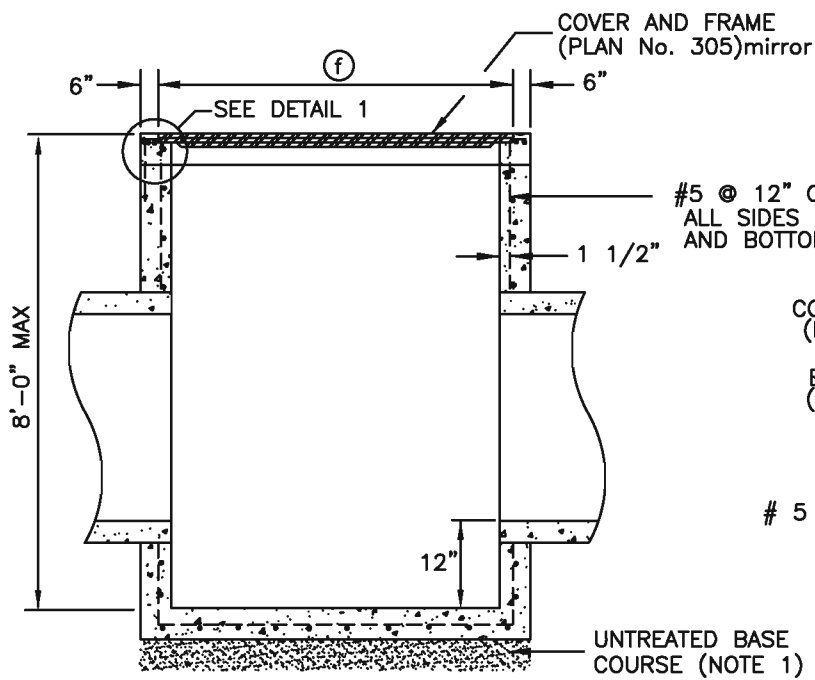
331

Cast in-place manhole

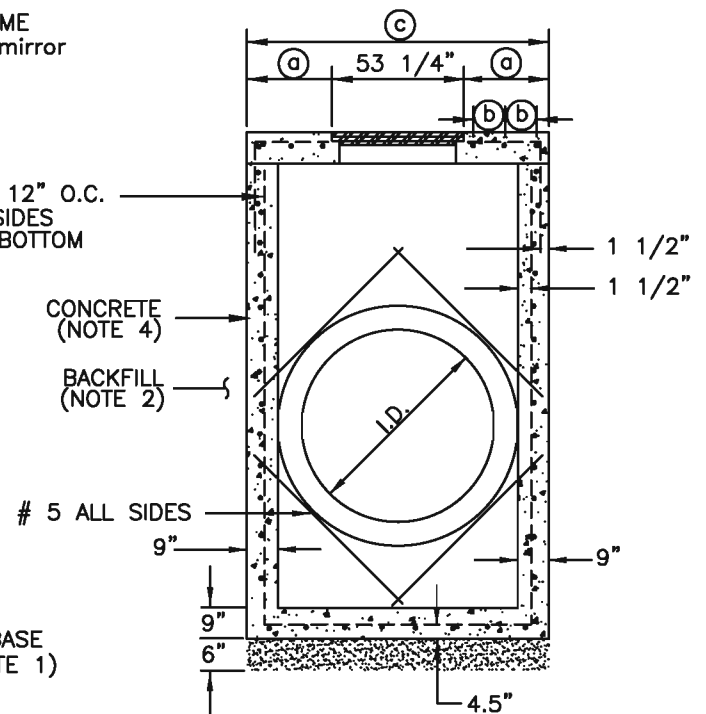
1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23 on all sides of manhole. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
4. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
5. COVER AND FRAME: See Plan No. 305. Adjust concrete dimensions at frame accordingly.



DETAIL 1



SECTION A-A



SECTION B-B

TABLE OF DIMENSIONS				
PIPE I.D.	(a)	(b)	(c)	(d) (f)
<48	6"	0	65-1/4"	SEE TABLE OF MAN- HOLE COVERS
48	6"	0	65-1/4"	
54	15-5/8"	5-1/2"	84-1/2"	
60	19-1/8"	7	91-1/2"	
66	22-5/8"	9	98-1/2"	

TABLE OF MANHOLE COVERS		
TYPE	(d)	(f)
A	39-3/4"	27-3/4"
B	65-1/4"	53-1/4"
C	90-3/4"	78-3/4"
D	116-1/4"	104-1/4"

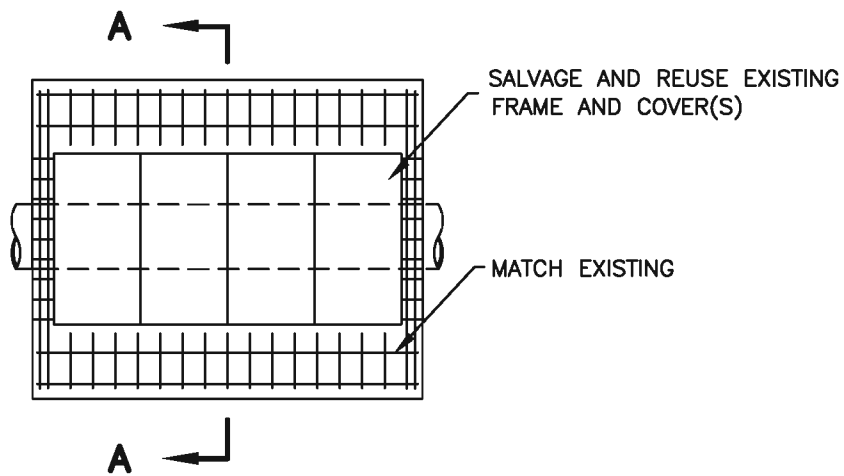
Cast-in-place manhole

Plan No.

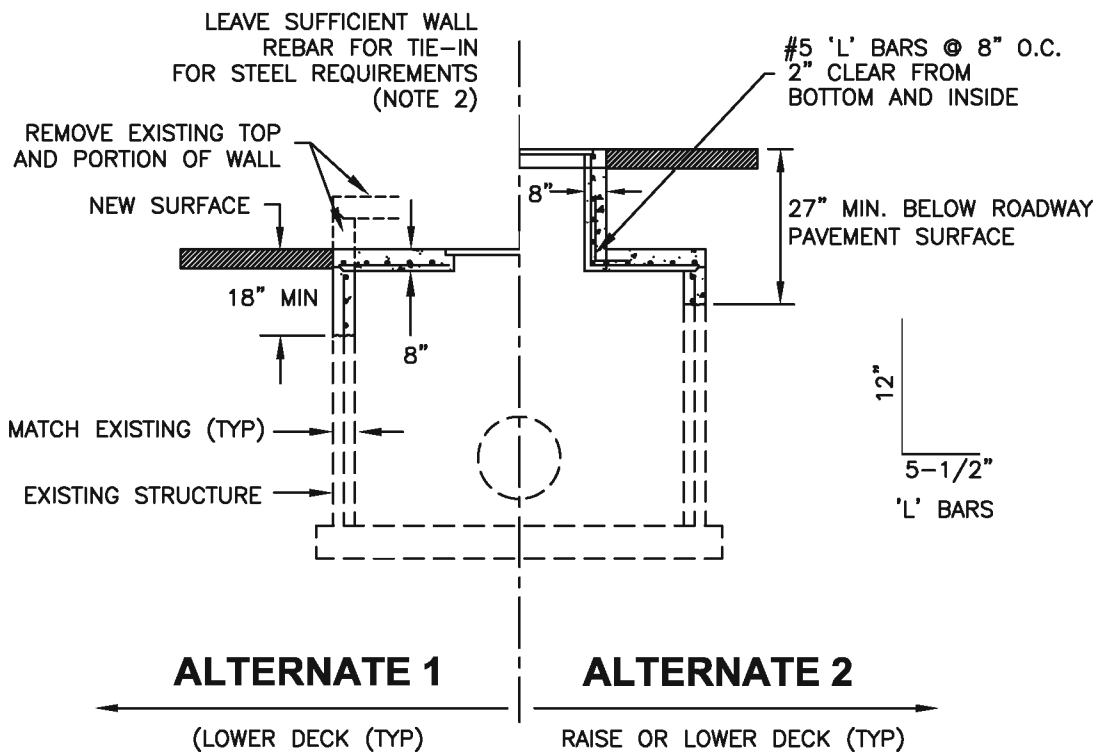
332

Adjust reinforced concrete deck to grade

1. BACKFILL: Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
2. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
3. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
4. COVER AND FRAME: For storm drain application see Plan No. 305. Adjust concrete dimensions at frame accordingly.



PLAN



NOTE : FIELD MEASURE AND VERIFY DIMENSIONS OF EACH STRUCTURE PRIOR TO CONSTRUCTION OF DECK LID

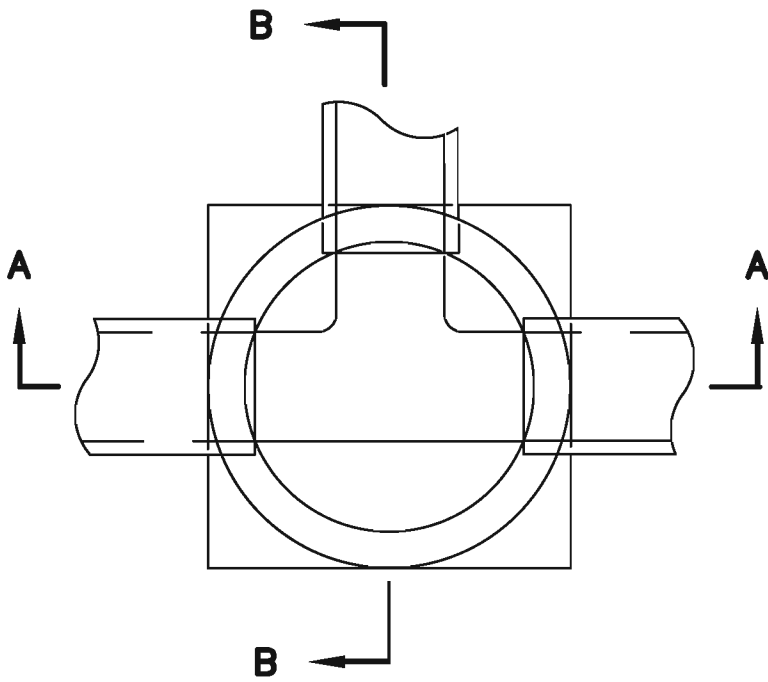
SECTION A-A

Adjust reinforced concrete deck to grade

Plan No.
335

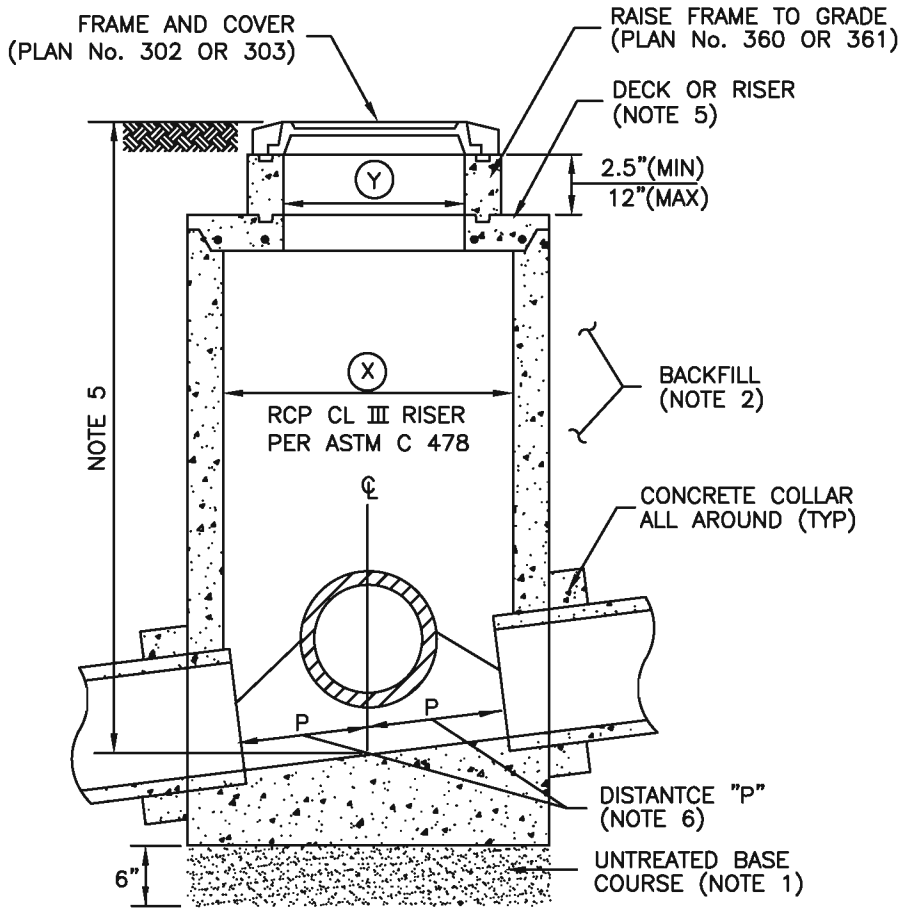
Precast manhole

1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
4. STATIONING AND ELEVATIONS:
 - A. Stations of manholes shown on the Drawings apply to the centerline of the shaft.
 - B. Elevations shown at the shaft's center refer to the prolonged (or extended) invert grade of the pipe.
 - C. Inlet pipe elevation applies to a point of intersection of the inlet pipe invert to the manhole wall.
5. CONCRETE DECK OR REDUCING RISER: When depth of manhole from pipe invert to finish grade exceeds 6'-7", use an ASTM C 478 reducing riser cone.
6. DISTANCE "P": "P" varies as per size of pipes, such that the horizontal inside diameter of the pipe intersects the inside face of the riser.
7. JOINTS: Place flexible gasket-type sealant in all manhole joints.
8. BASE OF MANHOLE: Pour in one continuous operation.
9. FINISH: Provide smooth and neat finishes on interior of cones, shafts, and rings. Imperfect moldings or honeycombs will not be accepted.

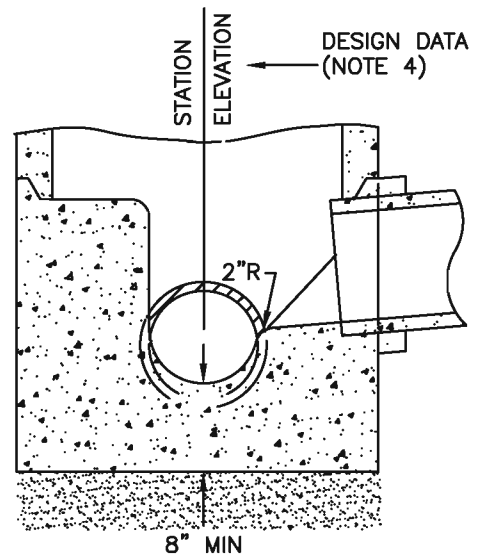


CAST-IN-PLACE BASE

TABLE OF DIMENSIONS	
MANHOLE TYPE	DIMENSION
A	(X) = 48" (Y) = 30"
B	(X) = 60" (Y) = 44"
C	(X) = 60" (Y) = 30"



SECTION A-A



SECTION B-B

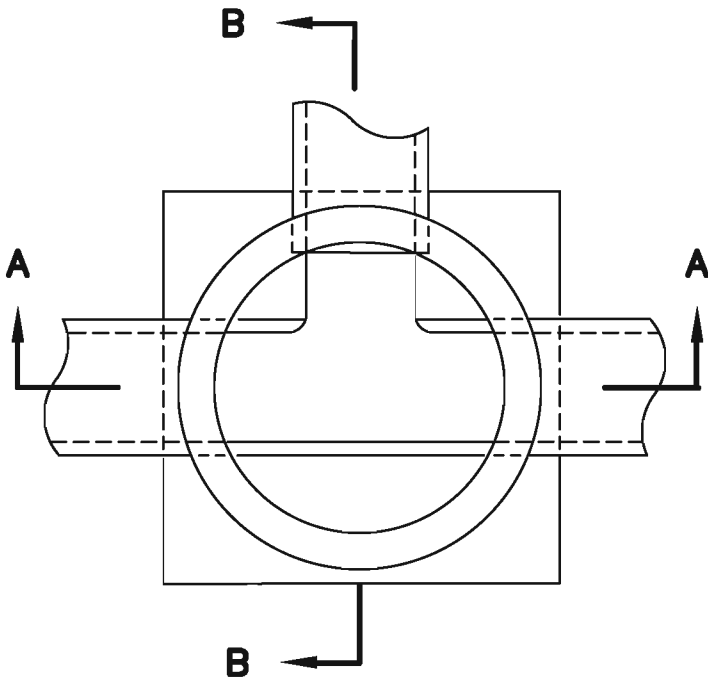
Precast manhole

Plan No.

341

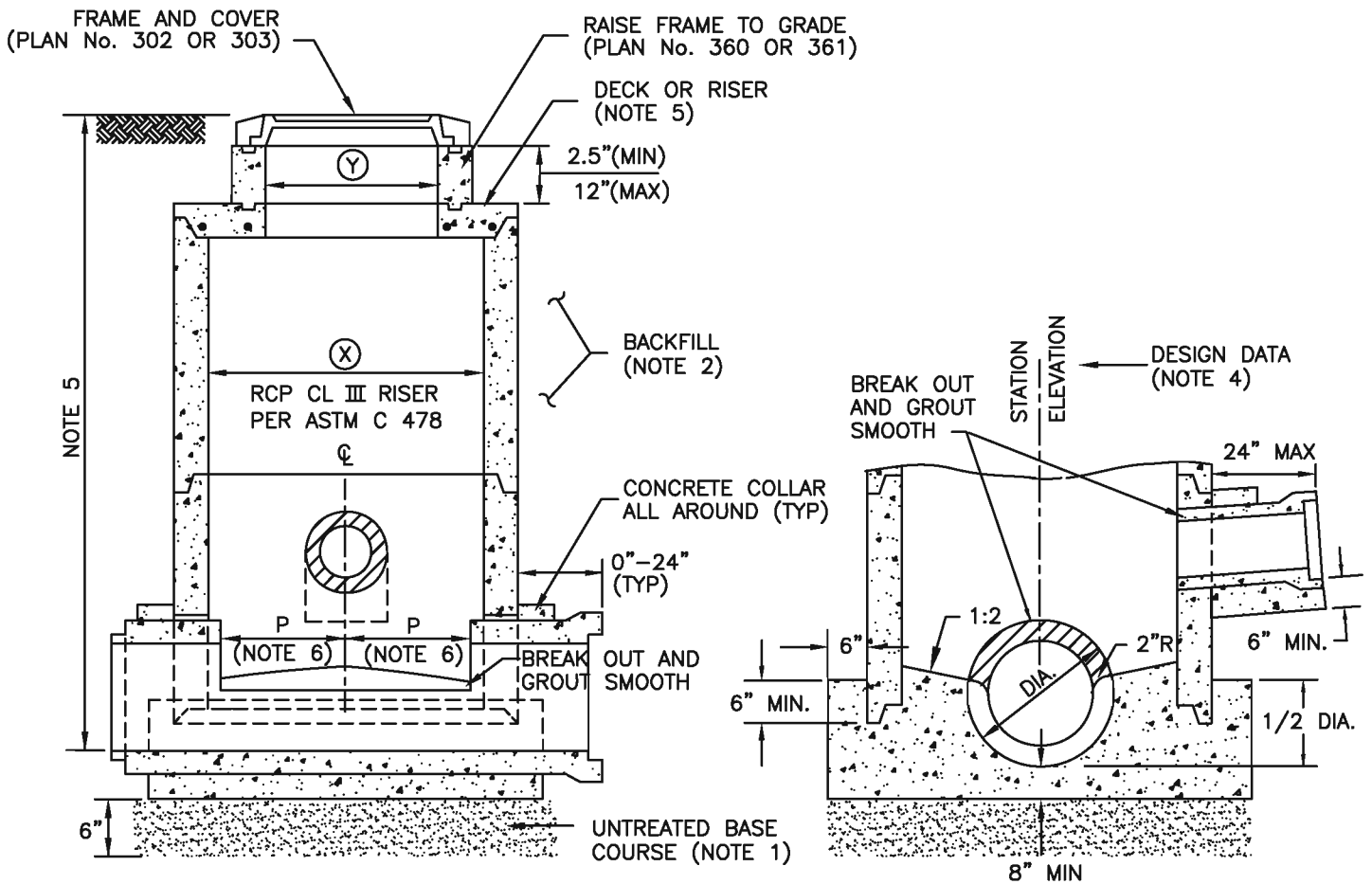
Precast manhole

1. UNTREATED BASE COURSE: Provide material specified in APWA Section 32 11 23.
 - A. Do not use gravel as a substitute for untreated base course without ENGINEER's permission.
 - B. Place material per APWA Section 31 23 23.
 - C. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness before compaction is 8 inches when using riding compaction equipment or 6 inches when using hand held compaction equipment.
2. BACKFILL: Provide and place per APWA Section 31 23 23. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.
3. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
4. STATIONING AND ELEVATIONS:
 - A. Stations of manholes shown on the Drawings apply to the centerline of the shaft.
 - B. Elevations shown at the shaft's center refer to the prolonged (or extended) invert grade of the pipe.
 - C. Inlet pipe elevation applies to a point of intersection of the inlet pipe invert to the manhole wall.
5. CONCRETE DECK OR REDUCING RISER: When depth of manhole from pipe invert to finish grade exceeds 6'-7", use a reducing riser section.
6. DISTANCE "P": "P" varies as per size of pipes, such that the horizontal inside diameter of the pipe intersects the inside face of the riser.
7. JOINTS: Place flexible gasket-type sealant in all manhole joints.
8. BASE OF MANHOLE: Pour in one continuous operation.
9. FINISH: Provide smooth and neat finishes on interior of cones, shafts, and rings. Imperfect moldings or honeycombs will not be accepted.



PIPE PASS-THROUGH BASE

TABLE OF DIMENSIONS	
MANHOLE TYPE	DIMENSION
A	(X) = 48" (Y) = 30"
B	(X) = 60" (Y) = 44"
C	(X) = 60" (Y) = 30"



SECTION A-A

SECTION B-B

Precast manhole

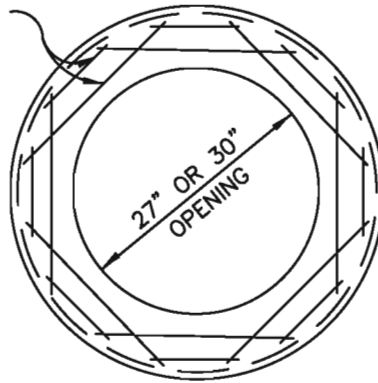
Plan No.

341

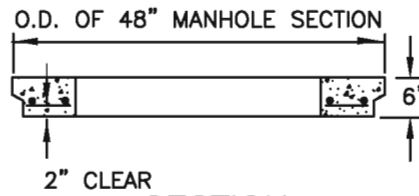
Concrete Deck

1. REINFORCEMENT: ASTM A 615, grade 60, deformed steel. See APWA Section 03 20 00 requirements.
2. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.

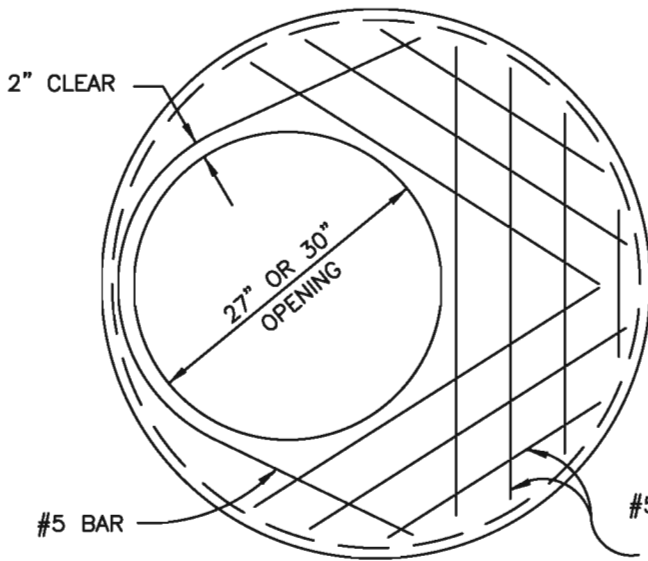
#5 BARS @ 6" O.C.
BOTH DIRECTIONS BOTTOM FACE



48" DECK PLAN

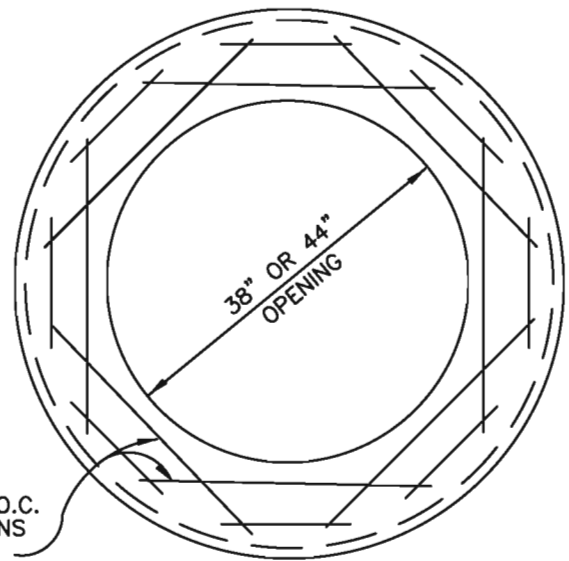


SECTION

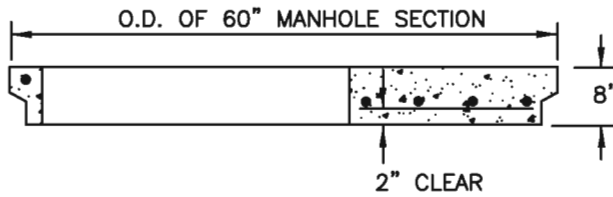


60" DECK PLAN

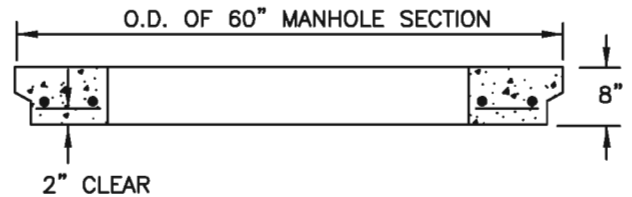
#5 BARS @ 6" O.C.
BOTH DIRECTIONS
BOTTOM FACE



60" DECK PLAN



SECTION



SECTION

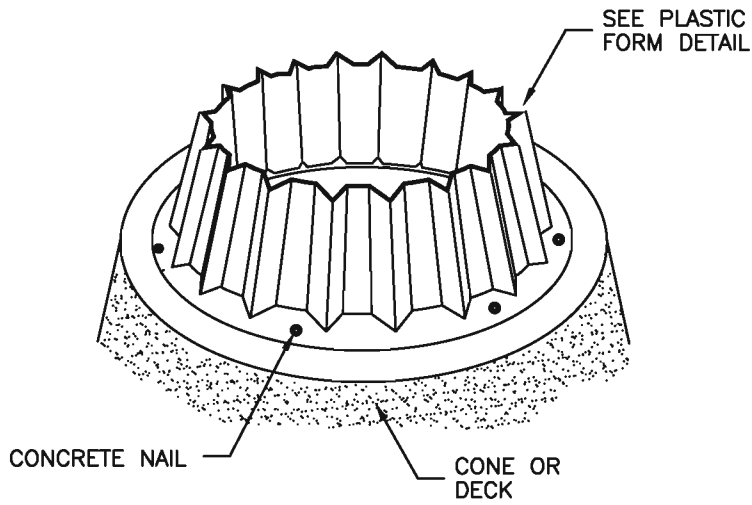
Concrete deck

Plan No.

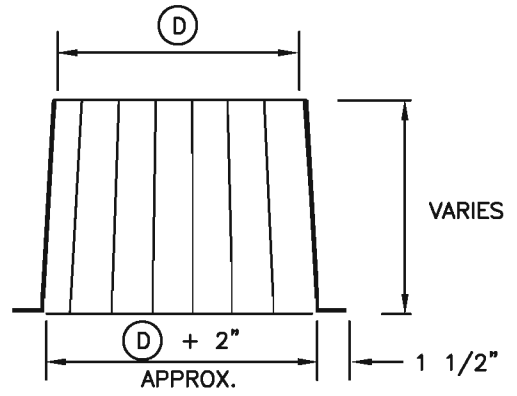
345

Raise frame to grade – plastic form

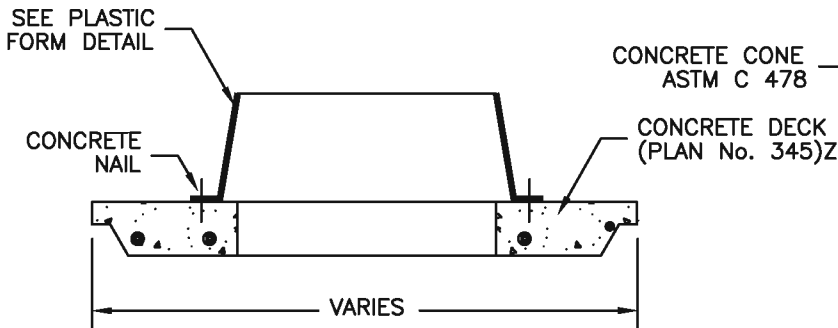
1. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.



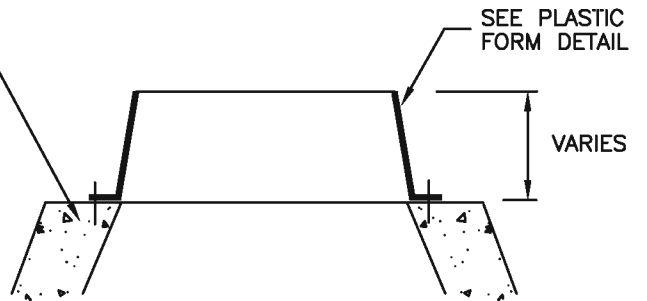
PLASTIC FORM OBLIQUE



PLASTIC FORM DETAIL



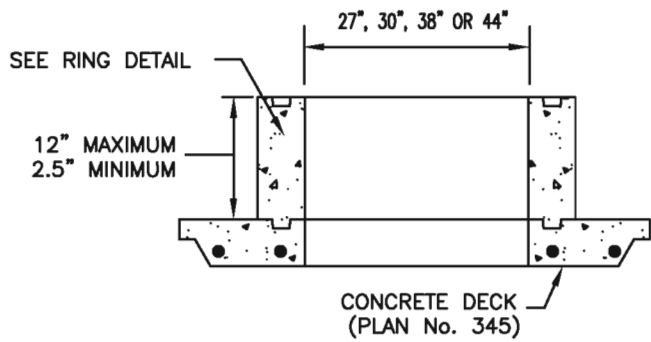
DECK SECTION



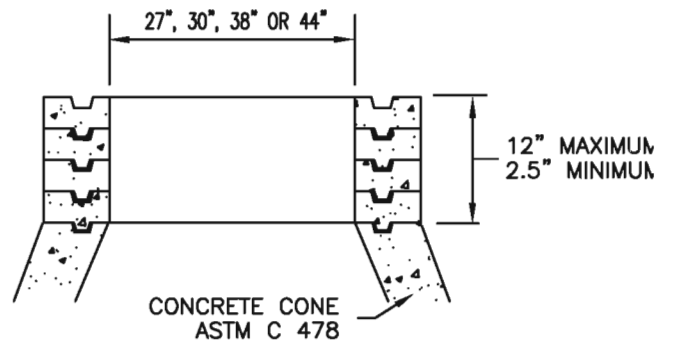
CONE SECTION

Raise frame to grade – grade ring

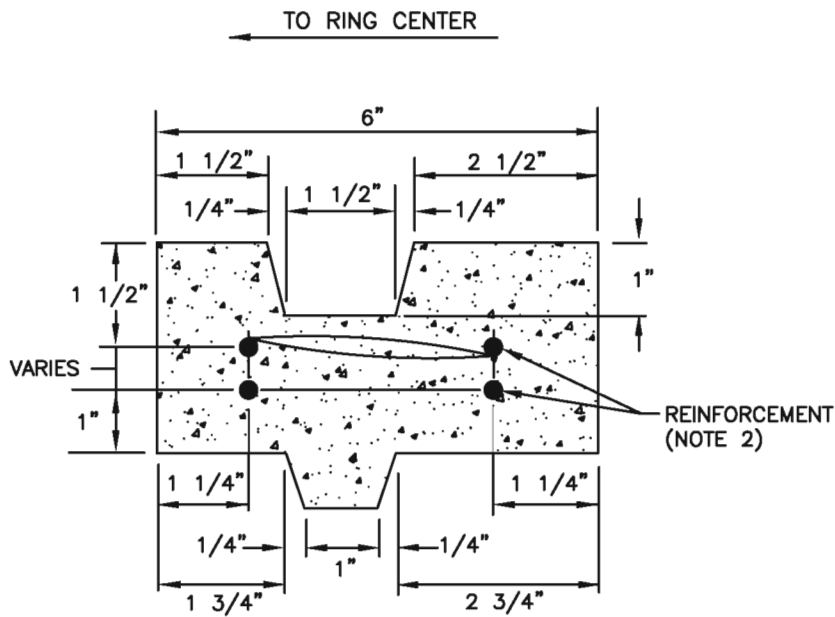
1. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
2. REINFORCEMENT: ASTM A 615, grade 60 steel per APWA Section 03 20 00.
 - A. 2 1/2" High Rings: Provide two 1/4" diameter steel hoops tied with No. 14 AWS gage wire, 8" on center.
 - B. 6" and 8" High Rings: Provide four 1/4" diameter steel hoops, tied with No. 14 AWS gage wire, 8" on center.
3. JOINTS: Seat rings with a compressible gasket for non-pressurized applications.



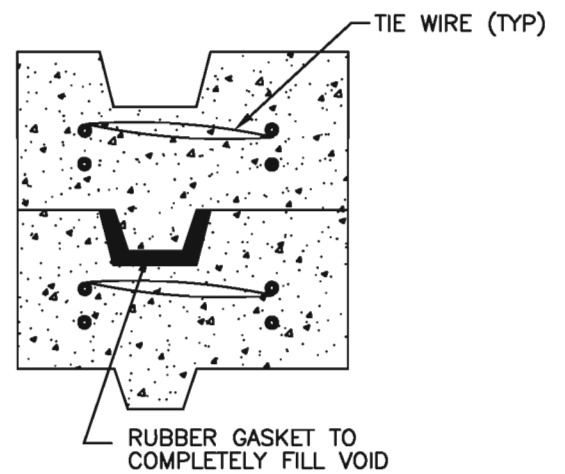
DECK SECTION



CONE SECTION



RING DETAIL



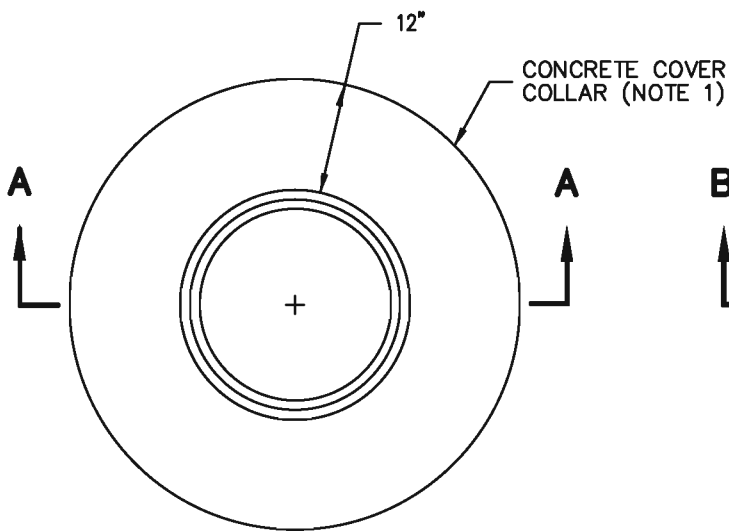
GASKET DETAIL

Raise frame to grade - grade ring

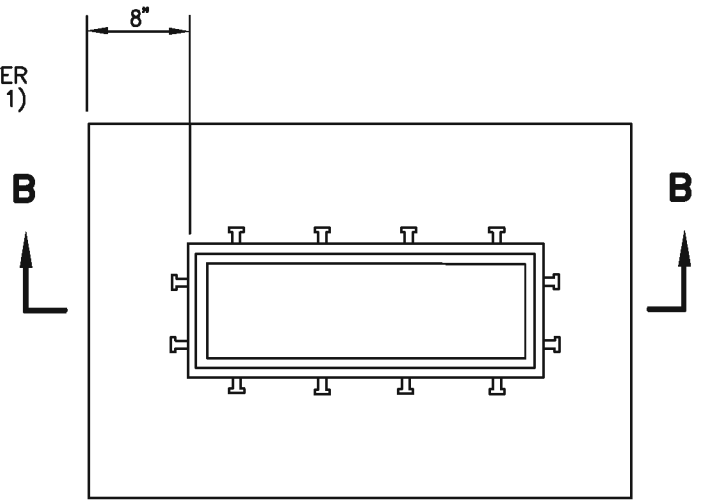
Plan No.
361

Cover collar for storm drains

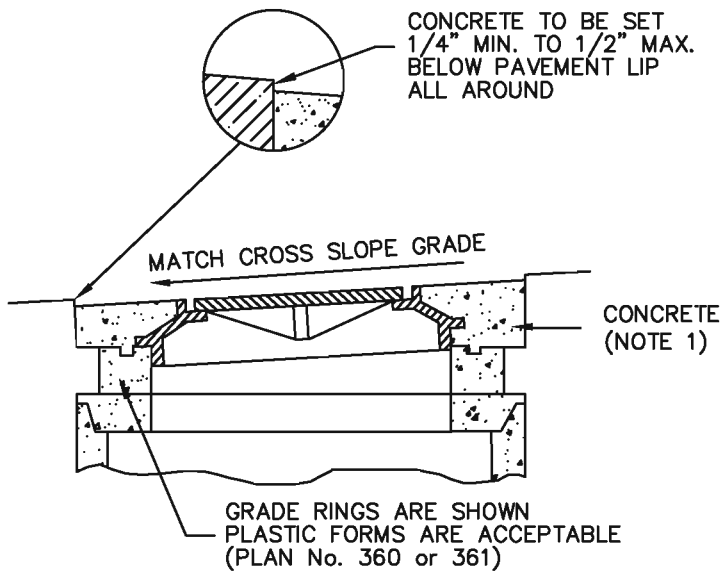
1. CONCRETE: Class 4000 per APWA Section 03 30 04. Place concrete per APWA Section 03 30 10. Cure per APWA Section 03 39 00.
2. JOINTS: Provide a neat straight joint between existing and new asphalt concrete surfaces. Provide concentric circle or straight edge cut. Clean edges of all dirt, oil and loose debris.



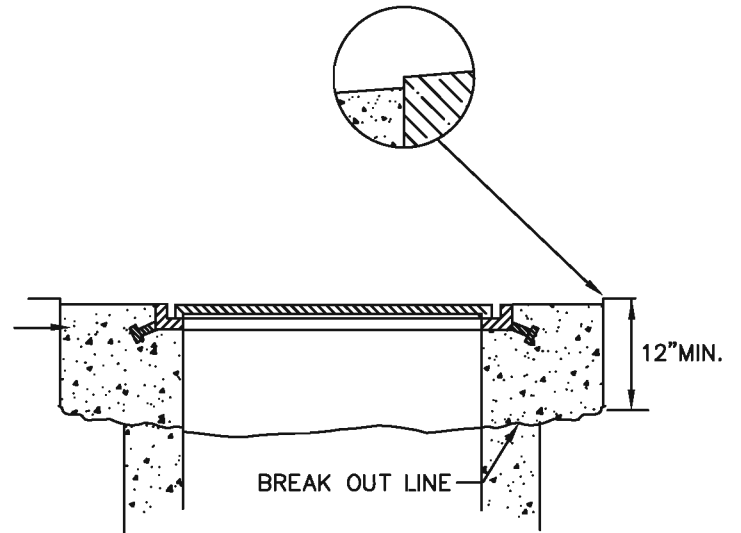
PLAN



PLAN



SECTION A-A



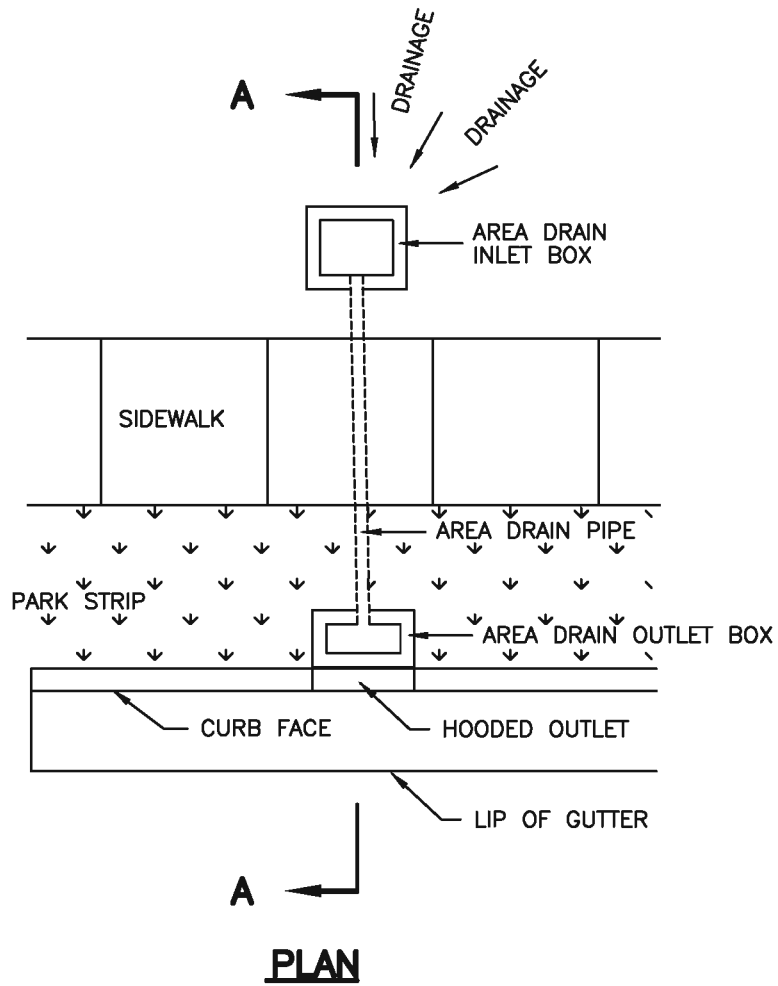
SECTION B-B

Cover collar for storm drains

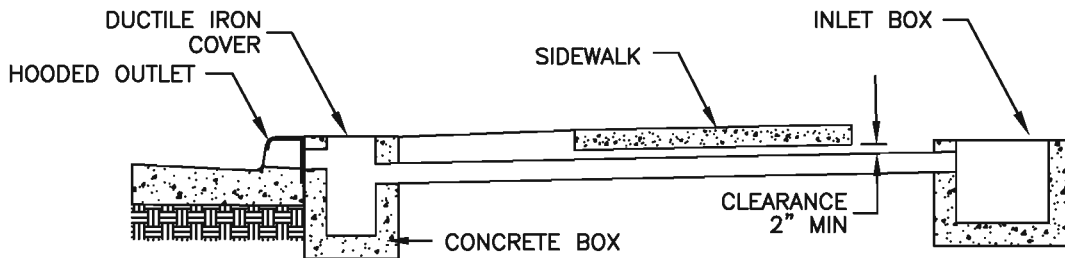
Plan No.
362

Area drain pipe

1. BACKFILL: Provide and place per APWA Section 33 05 20. Compact per APWA Section 31 23 26 to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction.



PLAN



SECTION A-A

Area drain pipe

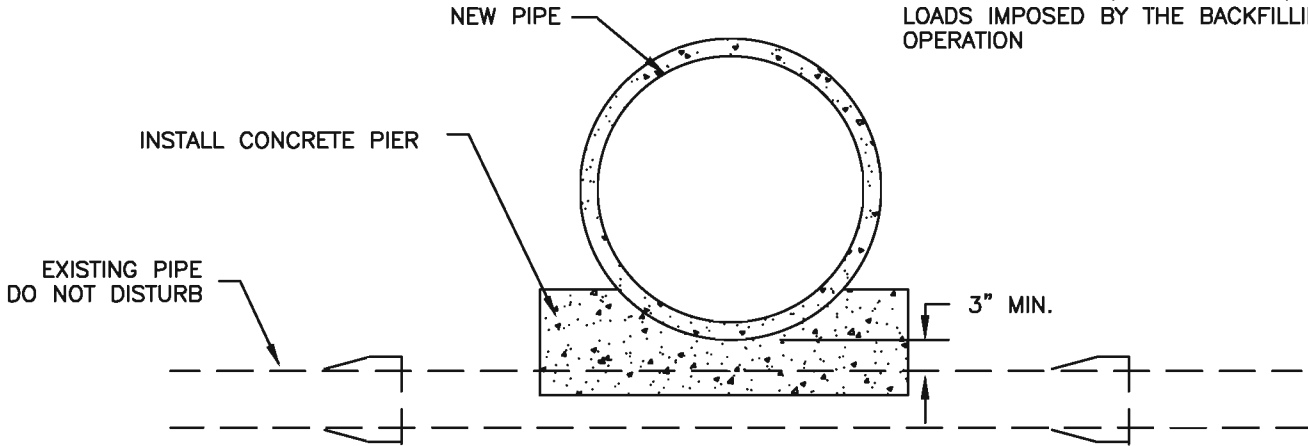
Plan No.
372

Concrete pier

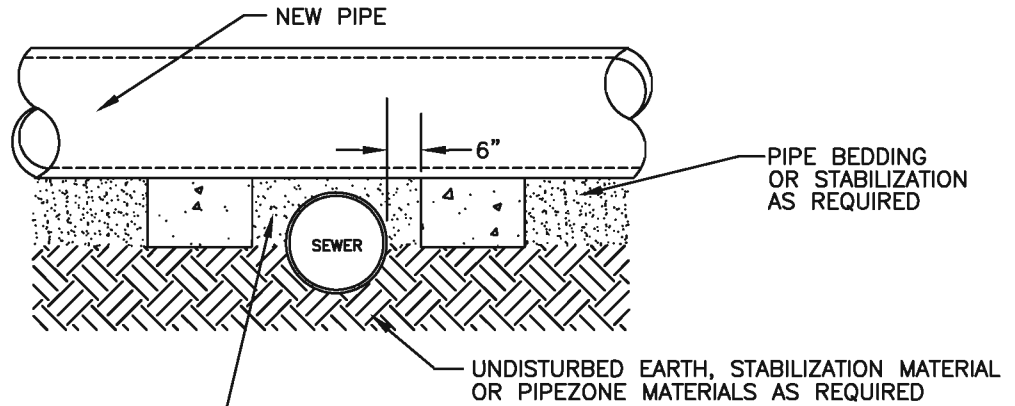
1. BACKFILL: Install and compact all backfill material per APWA Section 33 05 20.
2. CONCRETE: Class 4000 per APWA Section 03 30 04.

NARRATIVE

USE CAUTION WHEN CROSSING OVER BURIED PIPELINE. THE PURPOSE FOR PROVIDING THE PIERS SHOWN IN THIS DRAWING IS TO PROTECT THE UNDERLYING PIPELINE FROM CURRENT AND FUTURE LOADS IMPOSED BY THE BACKFILLING OPERATION

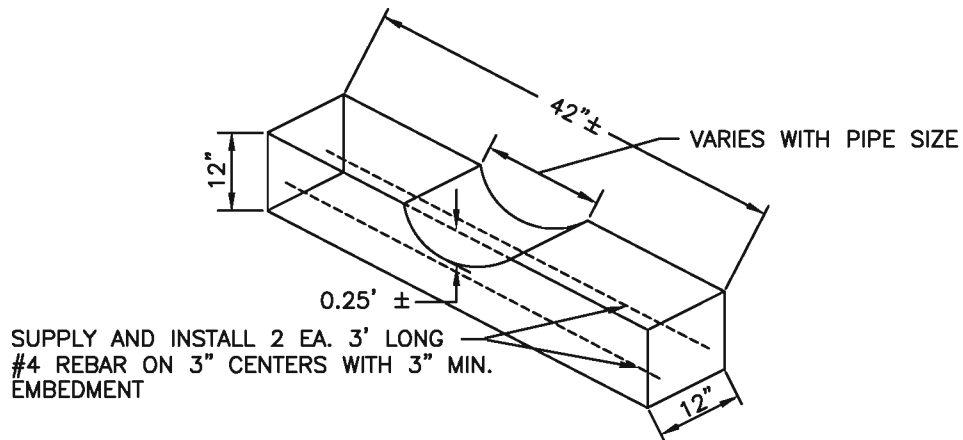


CONCRETE PIER DETAILS



FILL VOID OVER SEWER PIPE WITH SAND. MINIMIZE COMPACTION ENOUGH TO ALLOW FURTHER COMPRESSION OF THE SAND FILL MATERIAL THROUGH TIME

SECTION A-A



OBLIQUE

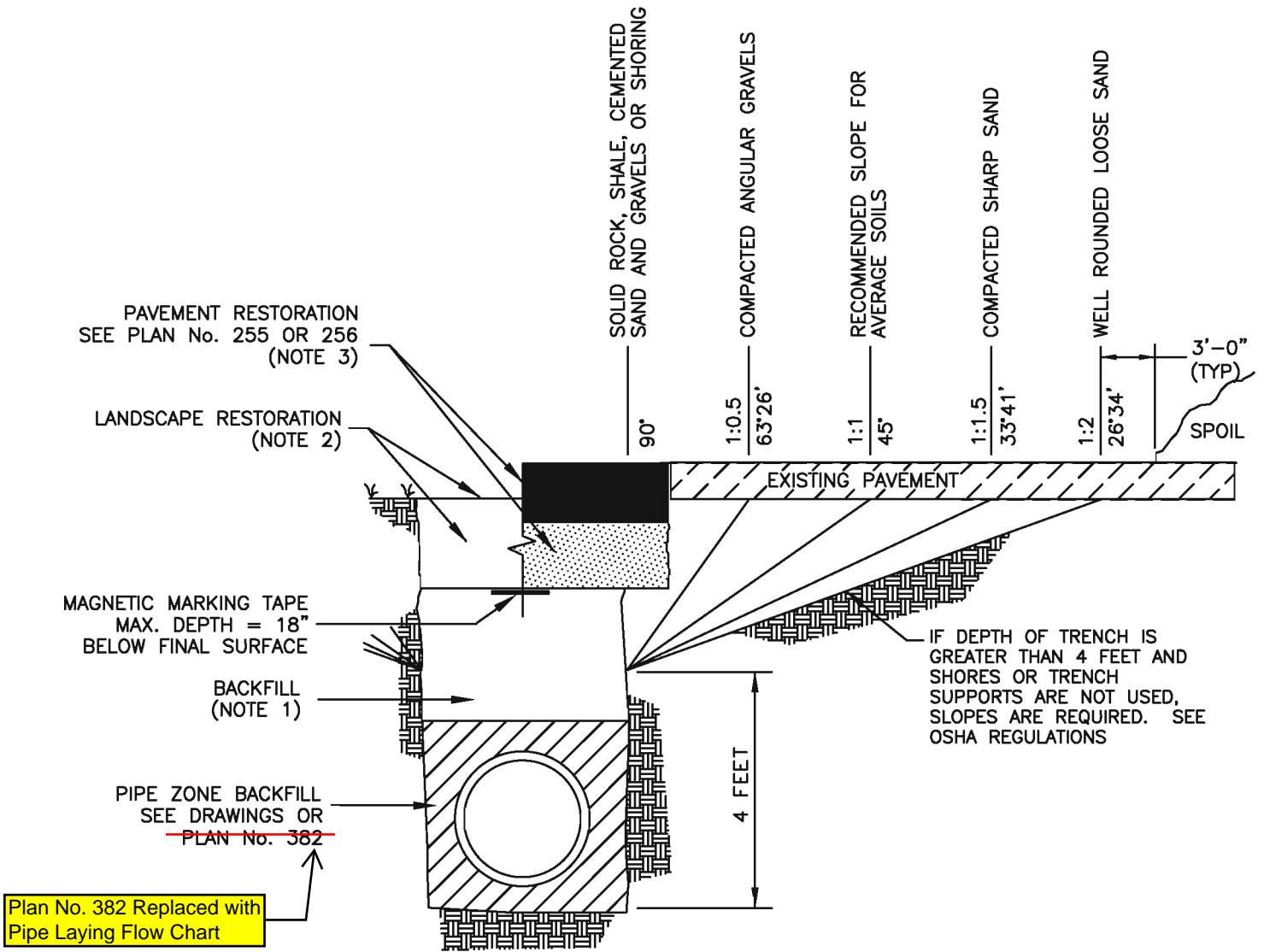
Concrete pier

Plan No.

373

Trench backfill

1. BACKFILL: Above the pipe zone.
 - A. Granular Fill. Limit maximum particle size to 6 inches. Place fill per APWA Section 33 05 20. Compact to a modified proctor density of 95 percent or greater. Maximum lift thickness is 8 inches before compaction. Do not use clay without ENGINEER's review and acceptance. Water jetting is NOT allowed in backfilling operation.
 - B. Flowable Fill. Provide and place controlled low strength material per APWA Section 31 05 15. Cure the fill before placing surface restorations.
2. LANDSCAPED RESTORATION: Provide landscaped surfaces with topsoil. Rake to match existing grade. Replace vegetation to match pre-construction conditions. See APWA Section 32 92 00 or APWA Section 32 93 13 requirements.
3. PAVEMENT RESTORATION: Do not install asphalt or concrete surfacing until trench compaction is accepted by ENGINEER.
4. PEA GRAVEL: Pea gravel is not allowed in any part of the trench.



SECTION

Trench backfill

Plan No.
381

EXCAVATE TRENCH
WIDTH OF TRENCH = OD OF PIPE + 18"

IS FOUNDATION SOIL SUITABLE?
IF SOIL IS TOO WET
TO COMPACT TO A
FIRM AND UNYIELDING
STATE, IT IS NOT SUITABLE

YES

NO

EXCAVATE TRENCH TO ALLOW FOR A
MINIMUM OF 6" BEDDING MATERIAL

COMPACT FOUNDATION TO A FIRM
AND UNYIELDING STATE

BRING TRENCH TO PIPE GRADE
USING APPROVED BACKFILL
MATERIAL (SEE GEN. NOTES), IN
LOOSE 8" MAXIMUM LIFTS AND THEN
COMPACTED TO 95% STANDARD
PROCTOR

TEST BEDDING MATERIAL EVERY 200
LF TO 95% STANDARD PROCTOR

LAY PIPE, SUPPORT ENTIRE LENGTH,
SHAPE TRENCH TO PIPE
(PROVIDE BELL HOLES IF PRESENT)

OVER EXCAVATE TRENCH A MIN OF
12", MAY REQUIRE MORE
DEPENDING ON CONDITIONS

DEWATER TRENCH

INSTALL FILTER FABRIC IN SUCH A
WAY AS TO COVER THE SIDES AND
FOUNDATION OF TRENCH

BRING TRENCH TO SUB GRADE
USING CLEAN GRAVEL OR COBBLE,
CLASS 5 SEWER ROCK (1" MINUS)
MIN

INSTALL FILTER FABRIC ON TOP OF
CLEAN GRAVEL OR COBBLE

BACKFILL TO THE SPRING LINE OF
THE PIPE WITH APPROVED BACKFILL
MATERIAL (SEE GEN. NOTES), 8" MAX
LIFTS

HAND COMPACT MATERIAL UNDER
PIPE HAUNCHES BY SHOVEL
SLICING THE ENTIRE LENGTH OF
THE PIPE, AVOID LIFTING THE PIPE

PLACE INITIAL BACKFILL USING
GRADE 3/4 UNTREATED BASE COURSE,
IN LOOSE 8" MAX LIFTS, AND THEN
COMPACT TO 95% STANDARD
PROCTOR

TEST INITIAL BACKFILL MATERIAL
EVERY 200 LF TO 95% STANDARD
PROCTOR

PLACE FINAL BACKFILL WITH
GRANULAR BACKFILL BORROW

GEN. NOTES:

GRADATION DOCUMENTATION,
CLASSIFICATION AND PROCTORS SHALL BE
PROVIDED TO CITY ENGINEER FOR
APPROVAL PRIOR TO PLACEMENT OF
MATERIAL. GRADATION SHALL MEET 100%
PASSING 3/4" SIEVE, AND LESS THAN 12%
PASSING THE #200 SIEVE (CLAY).

ADDITIONAL FILTER FABRIC MAY BE
REQUIRED BY CITY ENGINEER AT THE
INTERFACE OF THE INITIAL AND FINAL
BACKFILL, IF THE MATERIALS DIFFER
SIGNIFICANTLY IN GRADATION (PEA GRAVEL
TO PIT RUN)

ANY VARIANCE FROM THIS FLOW CHART
MUST BE APPROVED IN WRITING BY CITY
ENGINEER

