

VARIABLE DIMENSION FOR ALL CURB CASTINGS

	A	B	C
6" CURB FACE	7"	11 3/8"	8 1/4"
8" CURB FACE	9"	13 3/8"	10 1/4"

BAR LIST & QUANTITIES FOR DOUBLE GRATE & CURB INLET

SIZE OF LEAD	H (MIN.)	F (MIN.)	CLASS A CONC. C.Y.	REINF. STL. LBS.
18"	2'-8 1/2"	2.57 FT.	1.02	137
24"	3'-3"	3.11 FT.	1.18	147
30"	3'-9 1/2"	3.66 FT.	1.34	180

LEAD	PER ADDITIONAL FOOT OF DEPTH		BARS A (MIN.)	
	CONC. C.Y.	CONC. C.Y.	SIZE	#
18"	0.295	19.0	1/2" ϕ x (H+8")	14
18"			1/2" ϕ x (H+8")	14
18"			1/2" ϕ x (H+8")	14

LEAD	BARS B		BARS C		BARS D (MIN.)	
	SIZE	#	SIZE	#	SIZE	#
18"	1/2" ϕ x 5'-6"	14	1/2" ϕ x 2'-9"	16	1/2" ϕ x (H+4")	14
18"	1/2" ϕ x 5'-6"	14	1/2" ϕ x 2'-9"	16	1/2" ϕ x (H+4")	14
18"	1/2" ϕ x 5'-6"	18	1/2" ϕ x 2'-9"	20	1/2" ϕ x (H+4")	14

□ HORIZONTAL BARS ARE APPROXIMATELY 12" CENTERS. WHEN ADDITIONAL BARS ARE REQUIRED DUE TO INCREASE OF DEPTH OF INLET 22.5 LBS OF REINFORCING STEEL IS TO BE ADDED FOR EACH SET OF BARS.

NOTE: ALL COST OF 4 X 4 M 13.8 #BM SUPPORTS FOR GRATE FRAME TO BE INCLUDED IN THE PRICE OF BID FOR INLET FRAMES AND GRATES.

QUANTITIES OF ANGLE IRON FOR CURB INLETS

INLET #	# PIECES	LENGTH OF 3" x 3"
2-0		
2-1	1	5' - 1 5/8"
2-2	1	10' - 6 1/8"
2-3	1	15' - 10 5/8"
2-4	2	10' - 6 1/8"

BRICK OPTION IN PLACE OF CONCRETE
 HOLD INSIDE DIMENSION GIVEN FOR CONCRETE
 6" P.C. CONCRETE FLOOR & 8" BRICK WALLS

MIN. QUANTITIES REQ'D.	2-0	2-1	2-2	2-3	2-4
BRICK (1/2" JOINTS)	445	725	995	1250	1495
1 : 2 MORTAR C.Y.	0.32	0.53	0.72	0.95	1.09
3500 CONCRETE C.Y.	0.4	0.60	0.80	1.00	1.20

GENERAL NOTES:

CASTING SHALL CONFORM TO THE A.S.T.M. SPECIFICATIONS FOR GRAY-IRON CASTINGS, SERIAL DESIGNATION A-48-29.

NO WORDING OR MARKING OF ANY KIND OTHER THAN THOSE SHOWN ON THE PLANS WILL BE PERMITTED ON THESE CASTINGS.

ALL BOLT REQUIREMENTS FOR THESE STRUCTURES WILL BE MACHINE BOLTS.

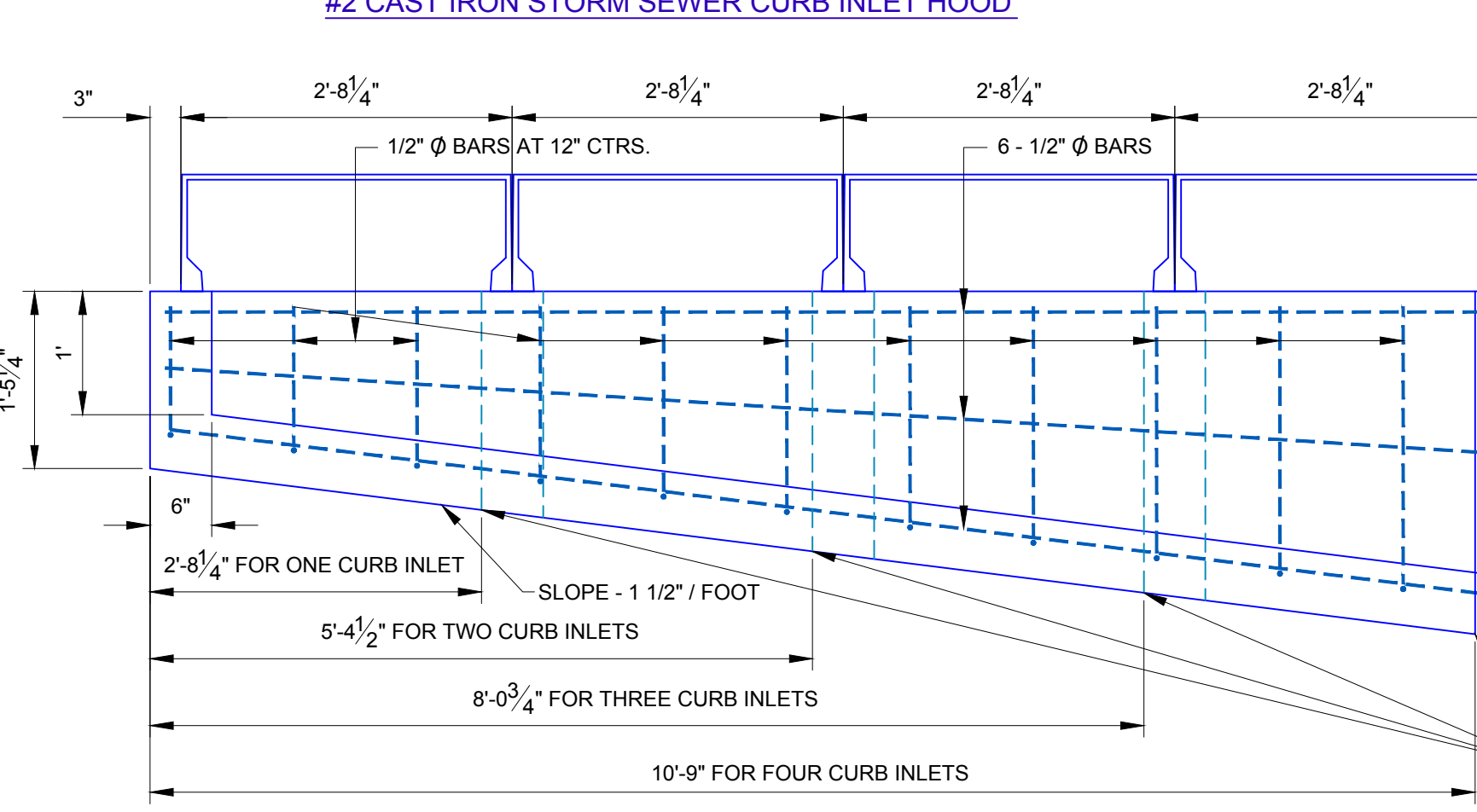
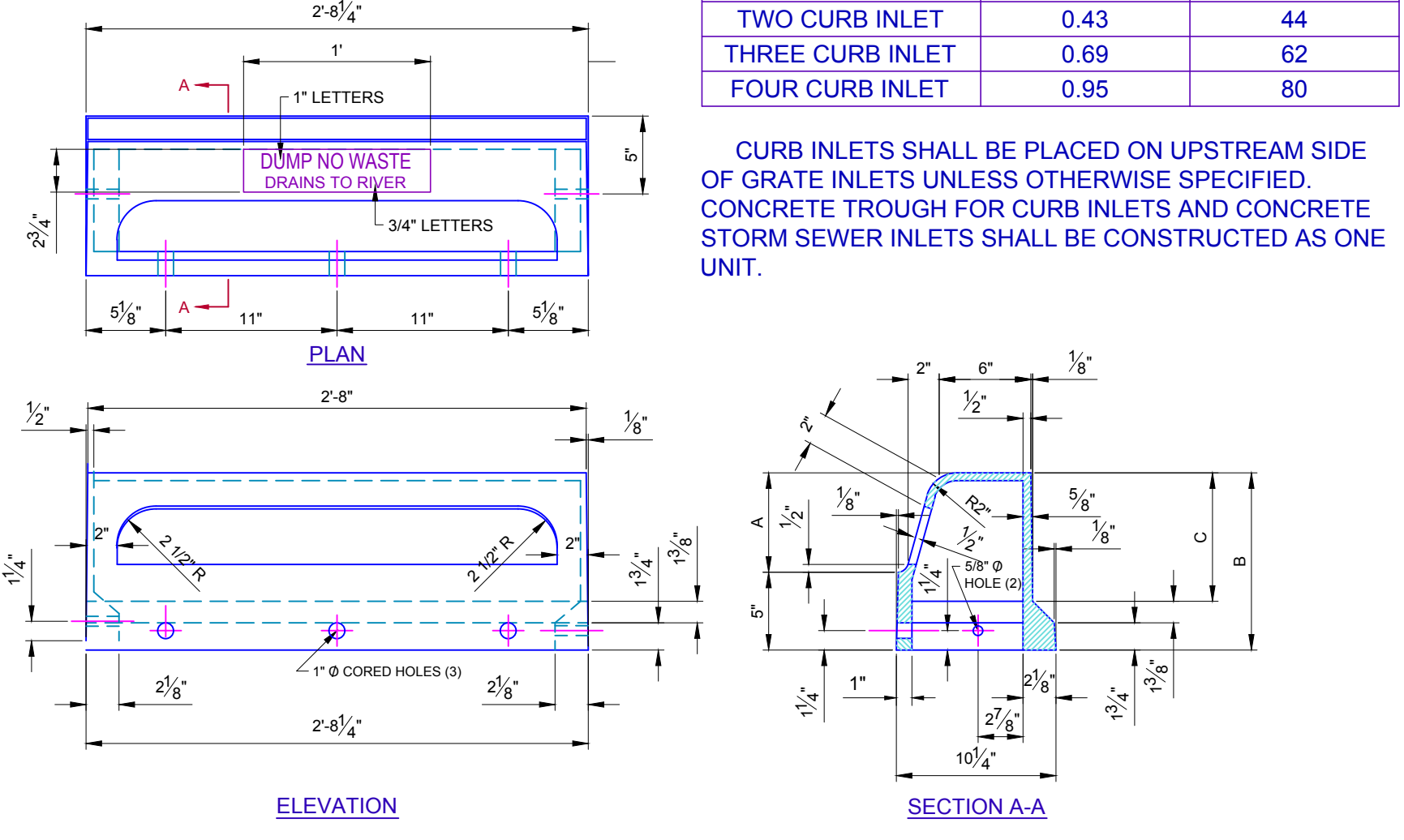
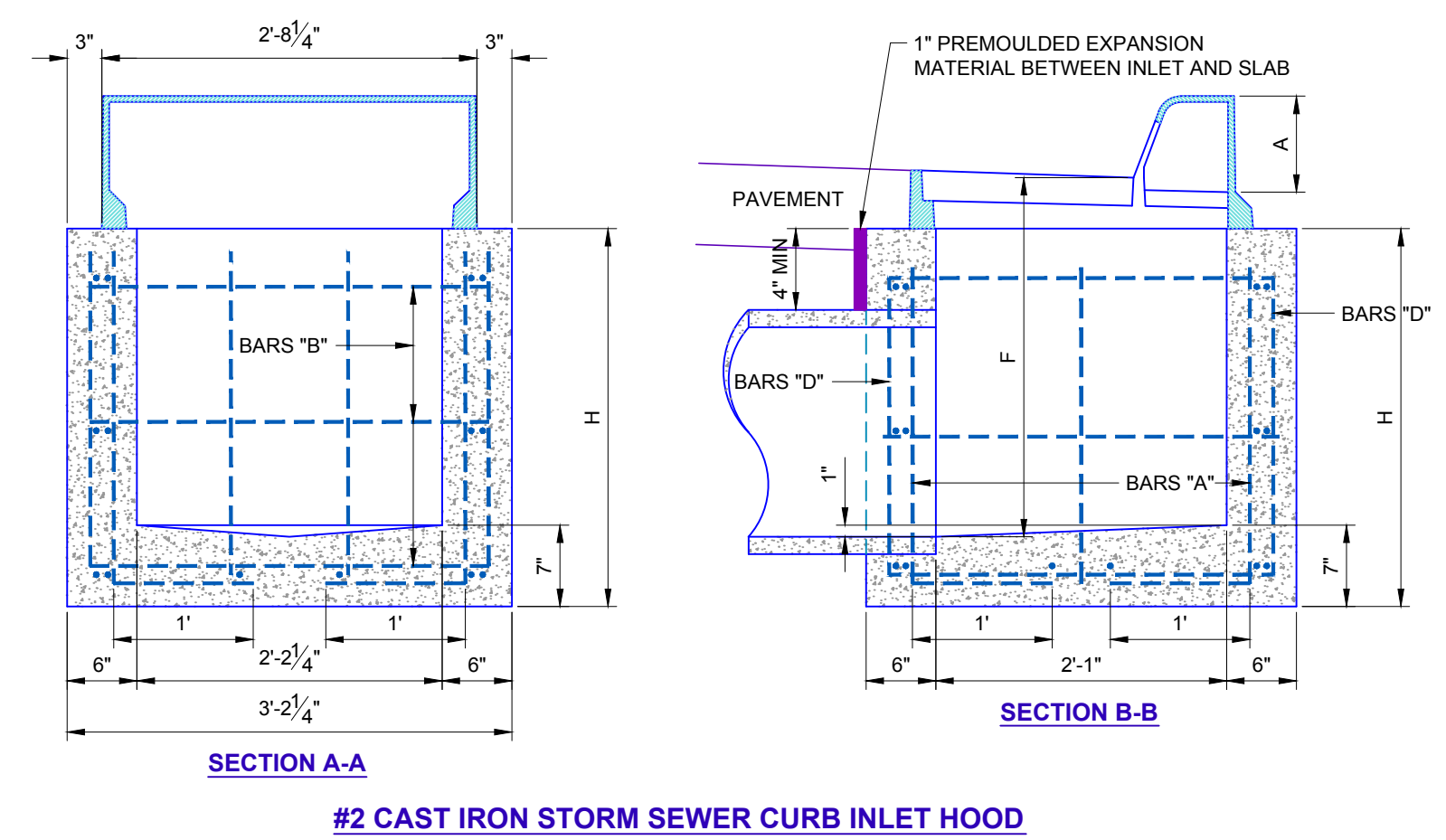
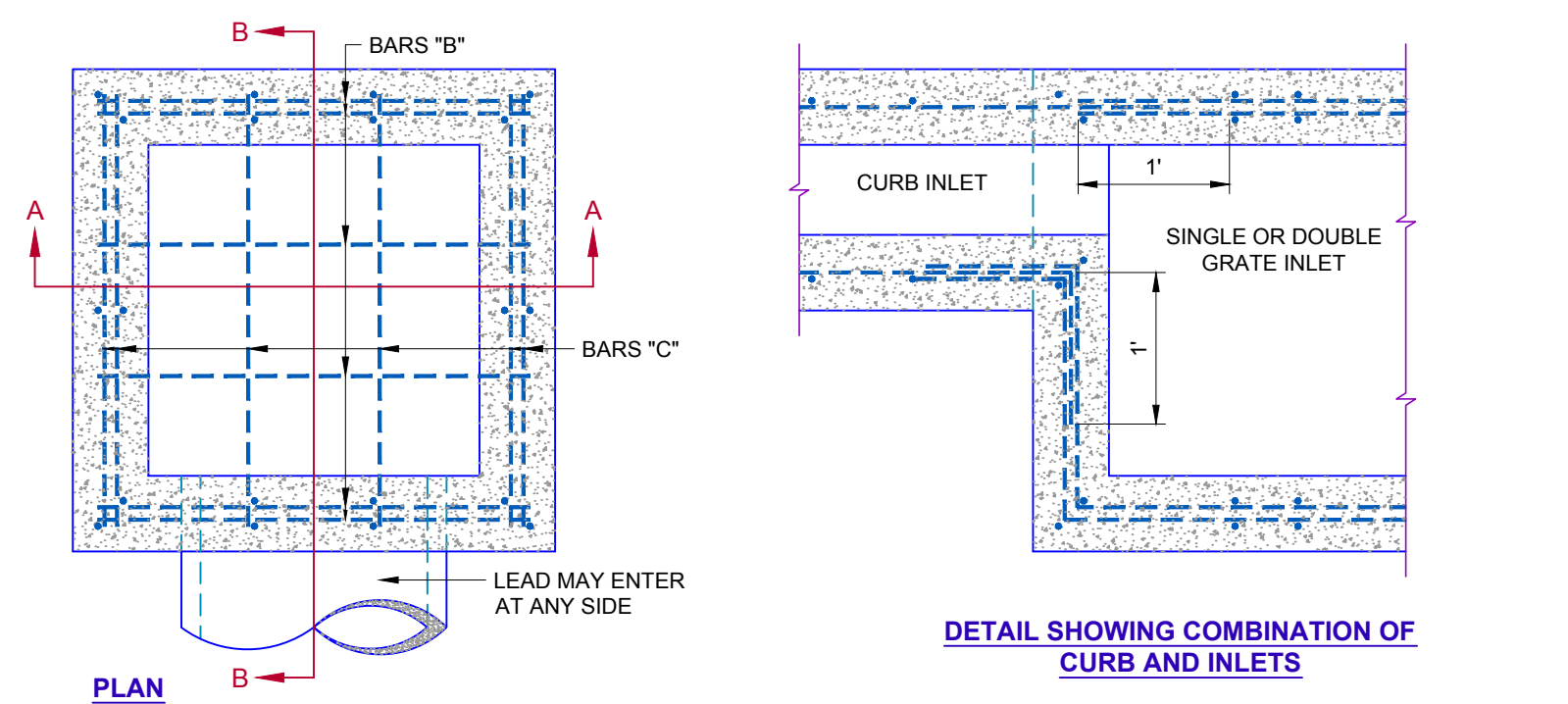
QUANTITIES FOR CURB INLETS

	CLASS A CONC.	STEEL
ONE CURB INLET	0.20	26
TWO CURB INLET	0.43	44
THREE CURB INLET	0.69	62
FOUR CURB INLET	0.95	80

CURB INLETS SHALL BE PLACED ON UPSTREAM SIDE OF GRATE INLETS UNLESS OTHERWISE SPECIFIED. CONCRETE TROUGH FOR CURB INLETS AND CONCRETE STORM SEWER INLETS SHALL BE CONSTRUCTED AS ONE UNIT.

CAST IRON INLET NUMBER

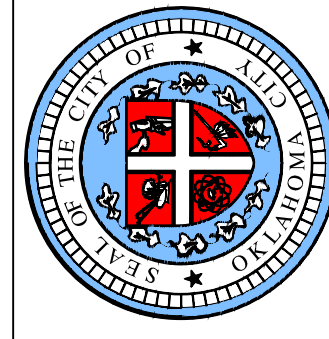
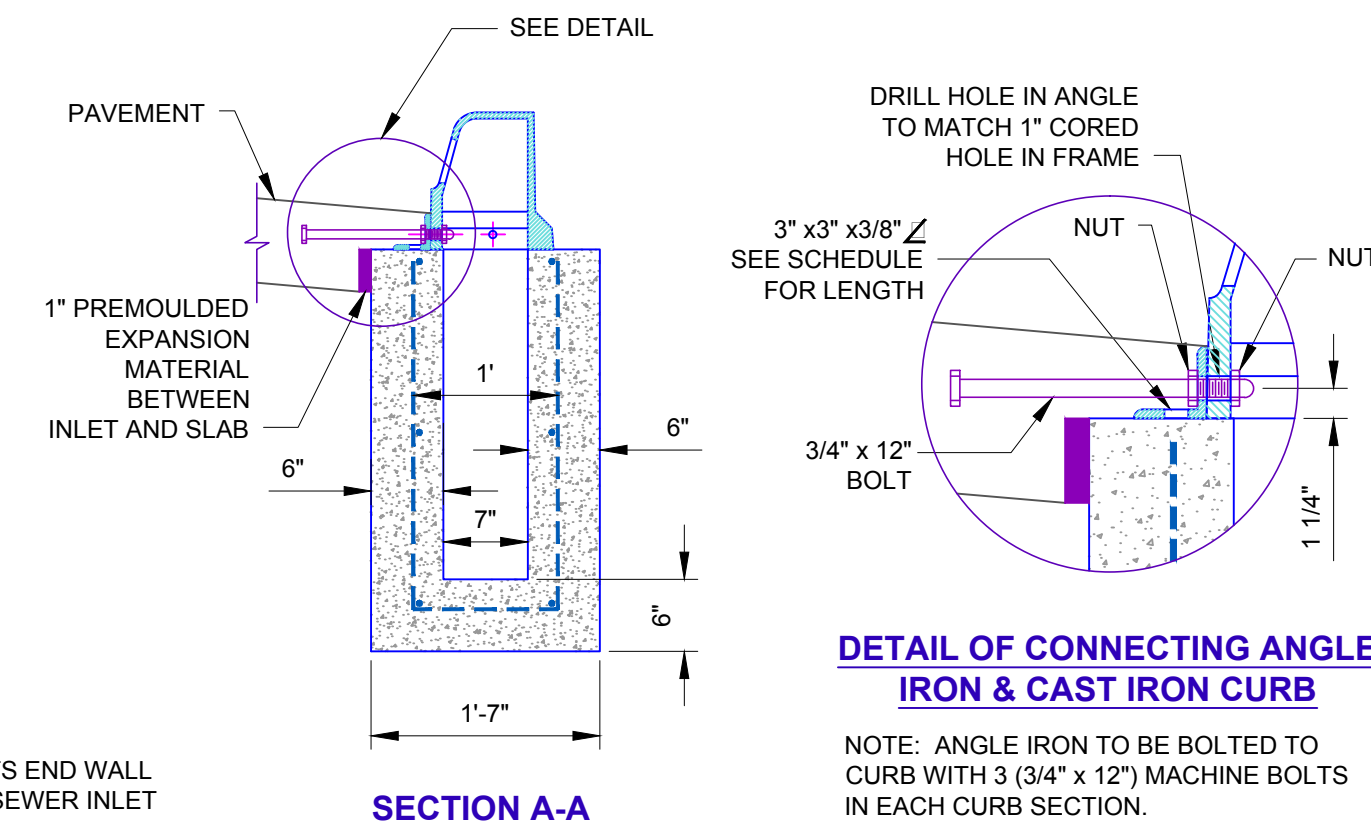
#	#1 INLET	TYPE B GRATE	#2 INLET
2-0	2	2	
2-1	2	2	2
2-2	2	2	4
2-3	2	2	6
2-4	2	2	8



BAR LIST AND QUANTITIES FOR SINGLE GRATE AND CURB INLETS

SIZE OF LEAD	H (MIN.)	F (MIN.)	CLASS A CONC. C.Y.	REINF. STL. LBS.	PER ADDITIONAL FOOT OF DEPTH	BARS A (MIN.)	BARS B	BARS C	BARS D (MIN.)				
					CONC. C.Y.	SIZE	SIZE	SIZE	SIZE				
15"	2'-3 1/4"	2.14 FT.	0.54	86	0.20	1/2" ϕ x (H+8")	10	1/2" ϕ x 2'-10"	14				
18"	2'-6 1/2"	2.14 FT.	0.59	90						1/2" ϕ x 2'-10"	14	1/2" ϕ x 2'-9"	14
24"	3'-1"	2.95 FT.	0.70	97						1/2" ϕ x (H+8")	10	1/2" ϕ x 2'-10"	14

□ HORIZONTAL BARS ARE APPROXIMATELY 12" CENTERS WHEN ADDITIONAL BARS ARE REQUIRED DUE TO INCREASE OF DEPTH OF INLET. 15.2 LBS. OF REINFORCING STEEL IS TO BE ADDED FOR EACH ADDITIONAL SET OF BARS.



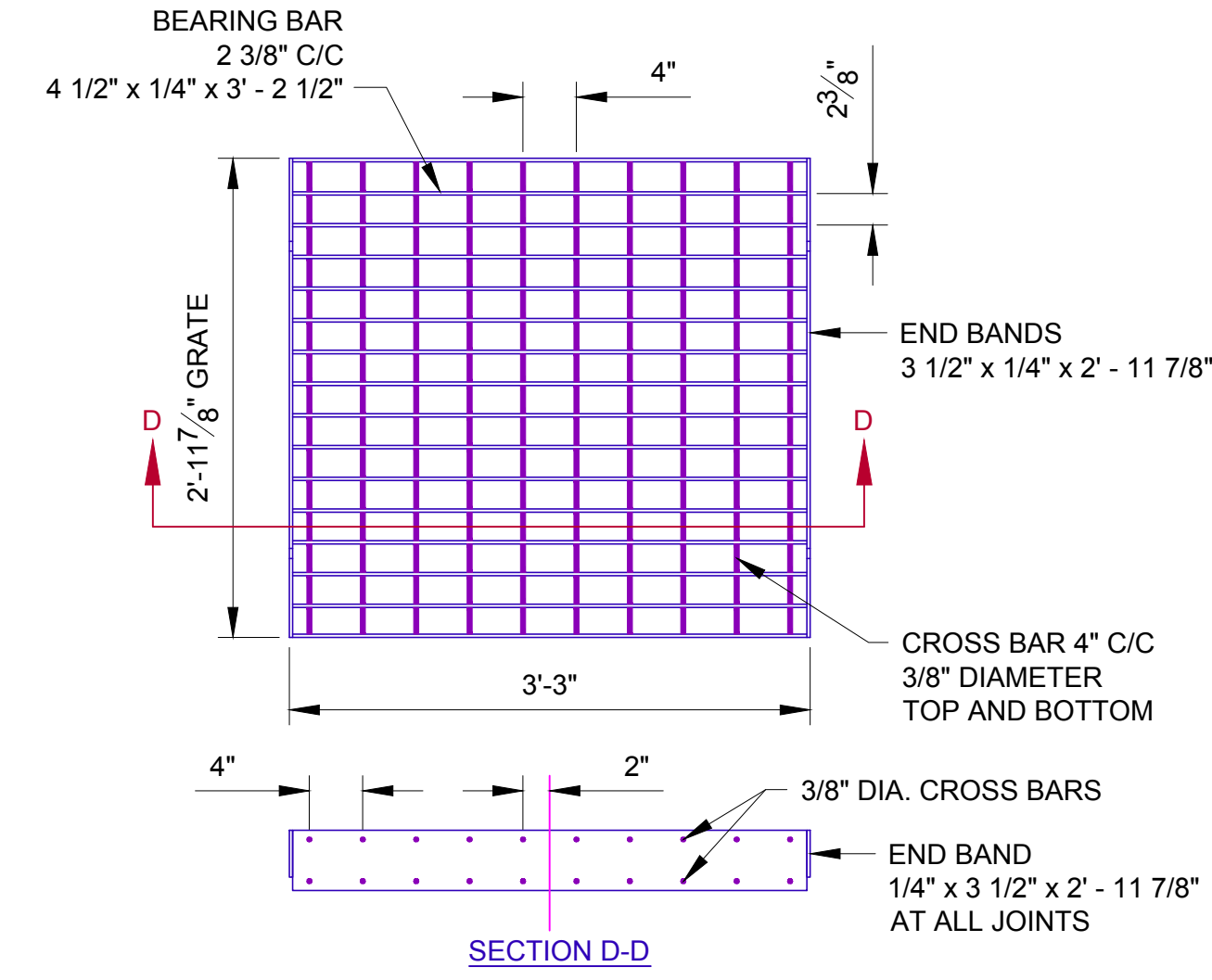
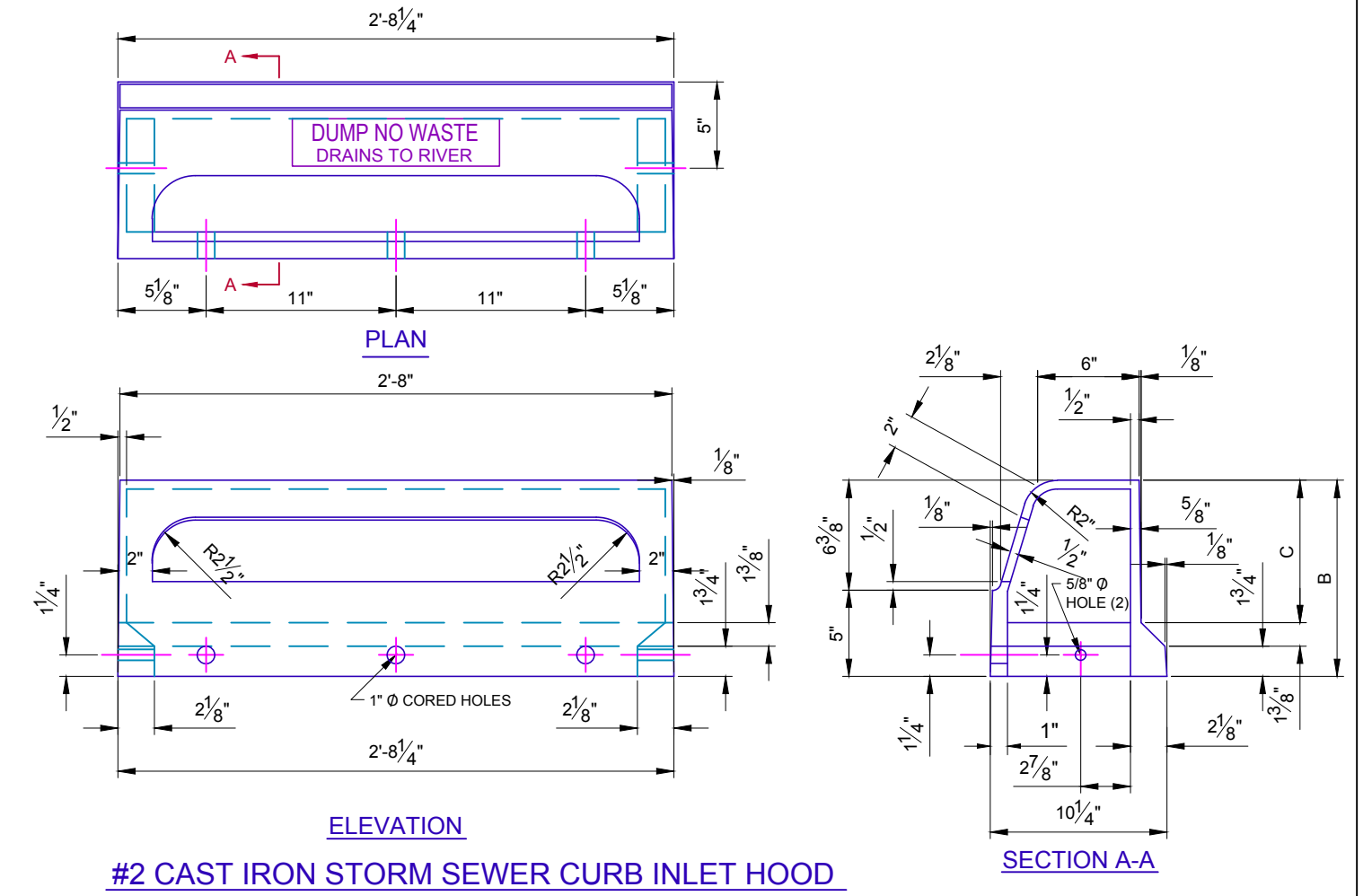
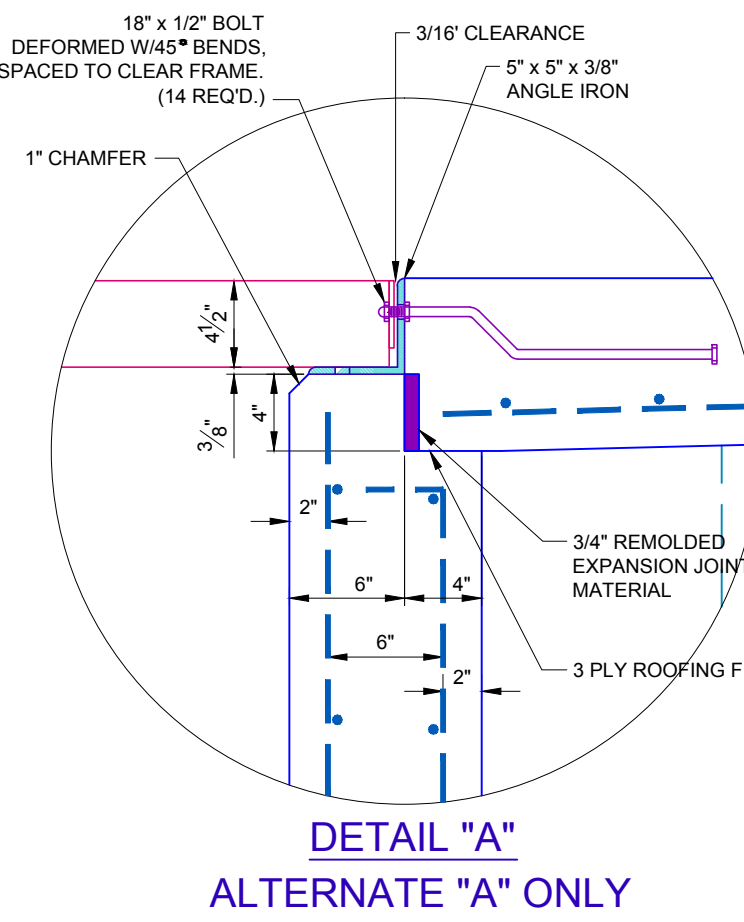
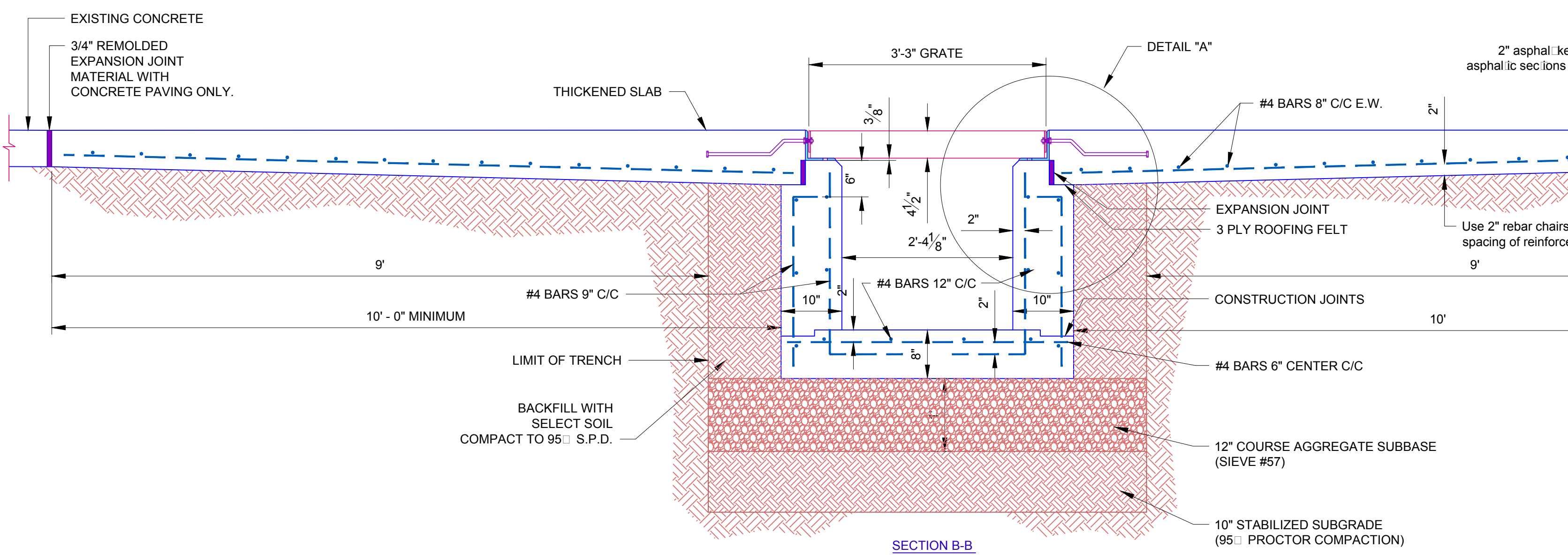
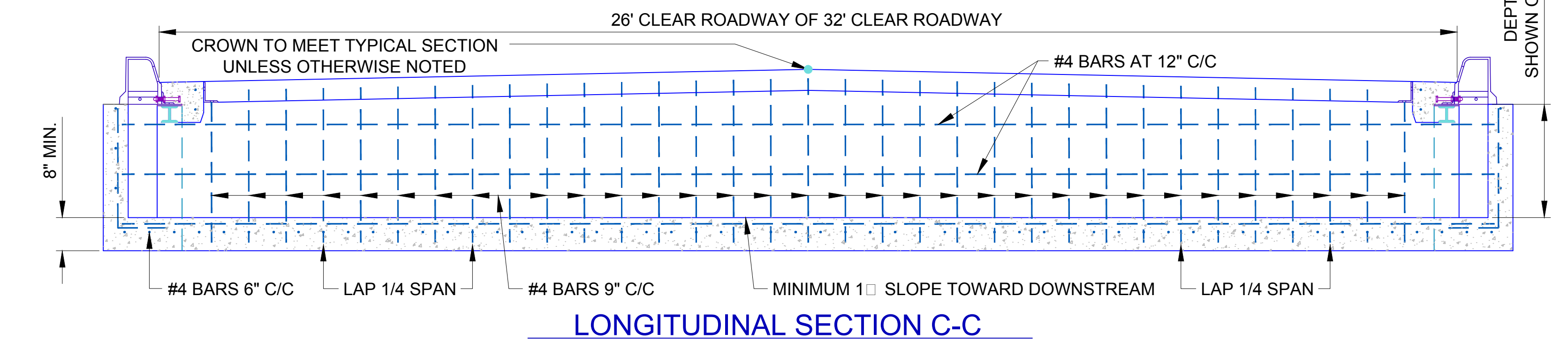
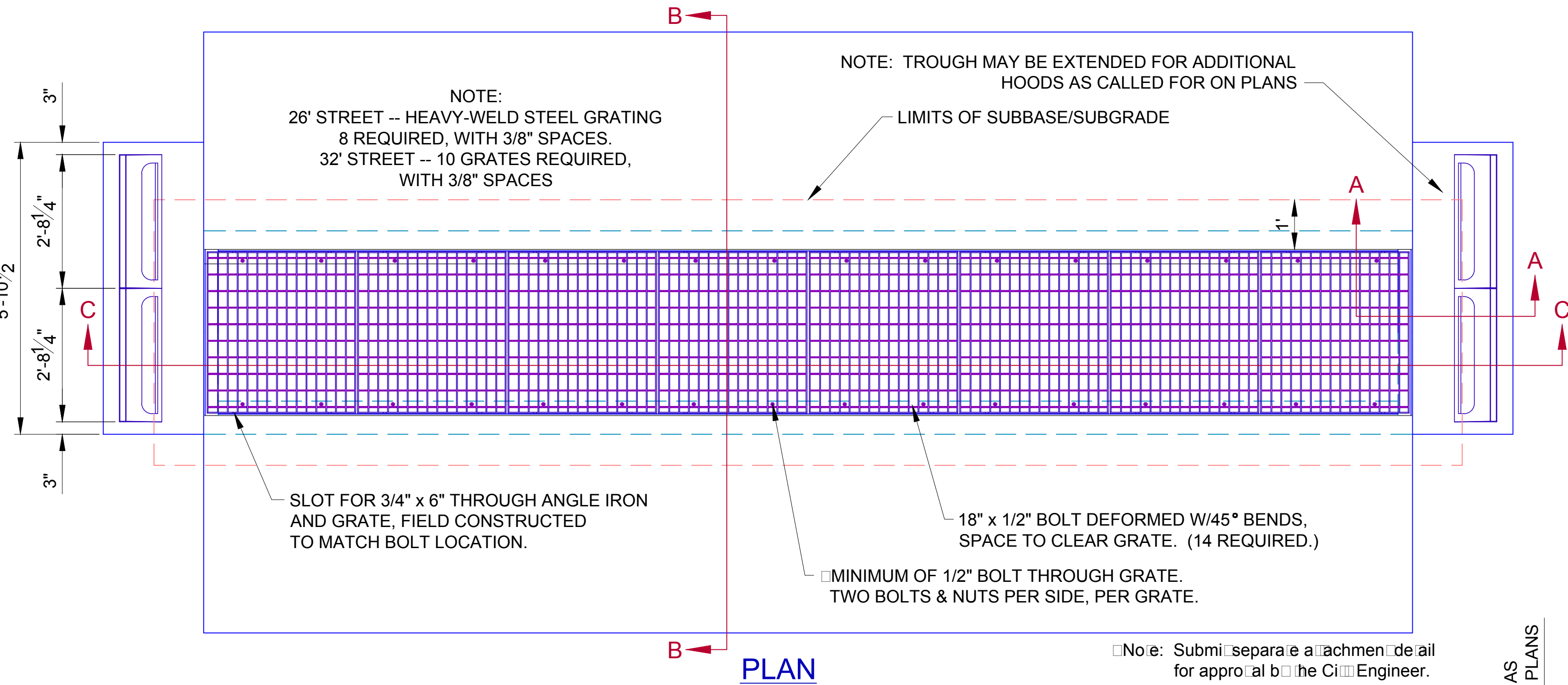
APPROVED BY: DATE: 01-30-13
 CITY ENGINEER
 DRAWN: VSC
 DATE: 01-30-13

**STANDARD STORM SEWER INLETS
 DESIGN 2 INLET WITH
 CAST STEEL HOODS**

QUANTITIES OF ANGLE IRON FOR CURB INLETS		
# OF CAST HOODS	# OF PIECES	LENGTH OF 3" x 3" \angle
2 - 0	1	5' - 1 5/8"
2 - 1	1	10' - 6 1/8"
2 - 2	1	15' - 10 5/8"
2 - 3	2	10' - 6 1/8"

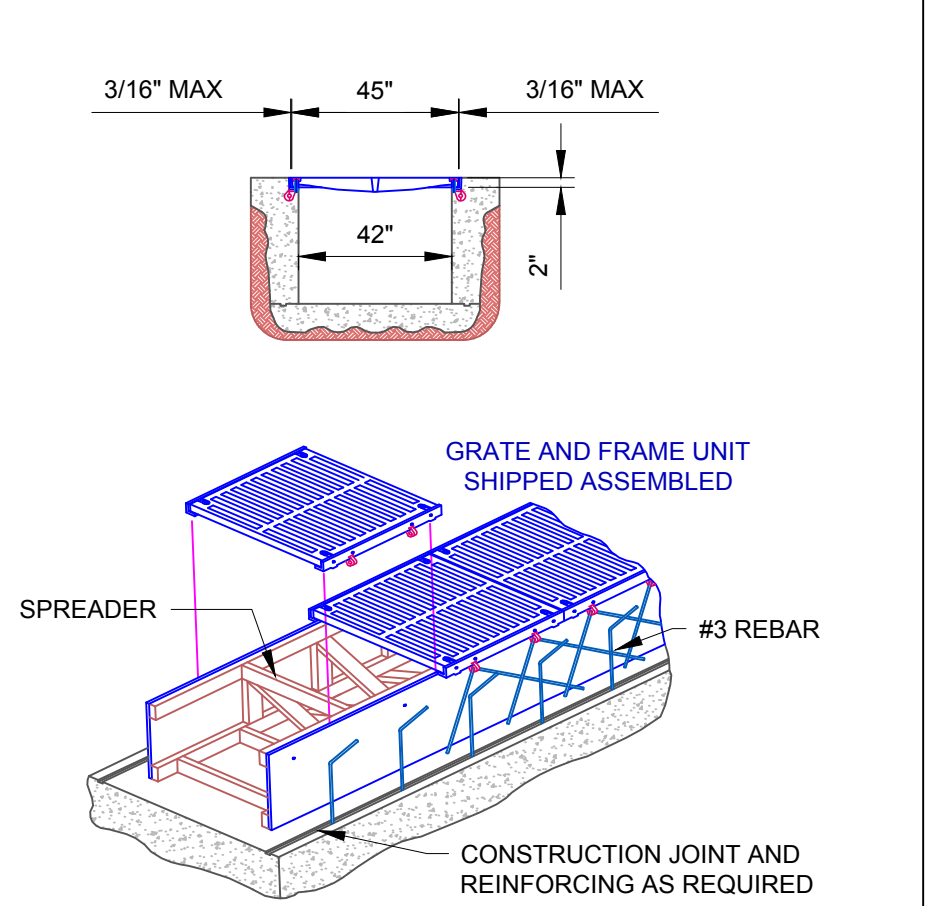
VARIABLE DIMENSION FOR ALL CURB CASTINGS			
	A	B	C
6" CURB FACE	7"	11 3/8"	8 1/4"
8" CURB FACE	9"	13 3/8"	10 1/4"

STREET WIDTH	IKG GRATE	
	SUMP	ON GRADE (NOT IN SUMP)
26'	112	67
32'	140	84



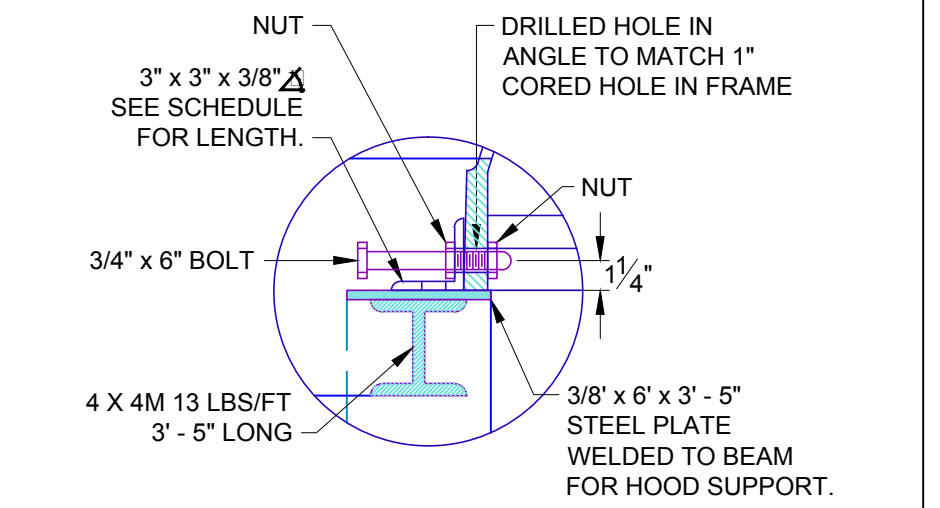
16 BEARING BARS 4 1/2" X 1/4" X 3' - 2 1/2" LONG SPACED AT 2 3/8" C/C. OVERALL DIMENSIONS 3' - 3" X 2' - 11 7/8" ARRANGED WITH 4 1/2" X 1/4" BEARING BARS 3' - 2 1/2" LONG WITH END BANDING 3 1/2" 1/4" END BANDS 2' - 11 7/8" LONG & 3/8" CROSS BARS TOP AND BOTTOM, 4" C/C SPACED AS SHOWN.

IKG INDUSTRIES IRVING HEAVY - WELD GALVANIZED STEEL GRATING TYPE HE ALTERNATE "A" ONLY

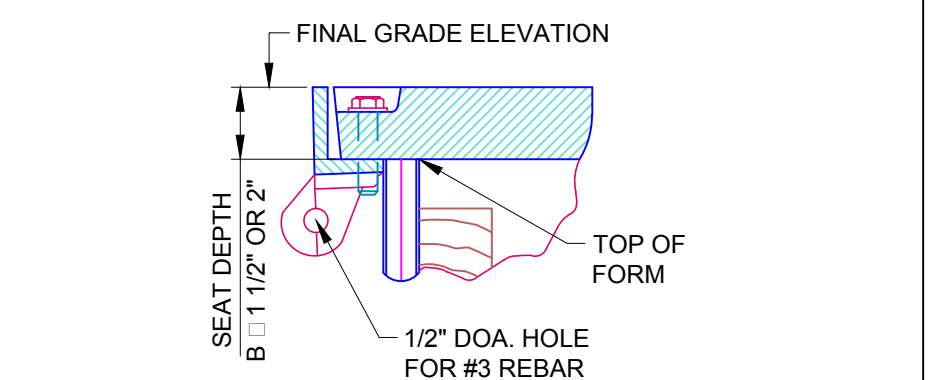


NEENAH FOUNDRY -- Type R-4999-NX w/ Type C Frame OR APPROVED EQUIVALENT

ALTERNATE "B" ONLY
To be installed as per manufacturer's specifications.

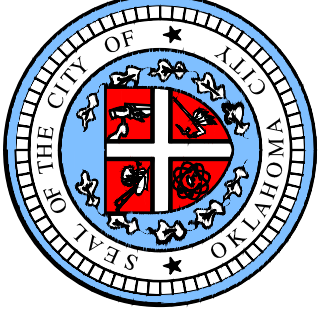


DETAIL "B"
ALTERNATE "A" ONLY
NOTE: ANGLE IRON TO BE BOLTED TO CURB WITH 3(3/4" x 6") MACHINE BOLTS IN EACH CURB SECTION



For dimensions char: see 102-a06

ALTERNATE "B" ONLY



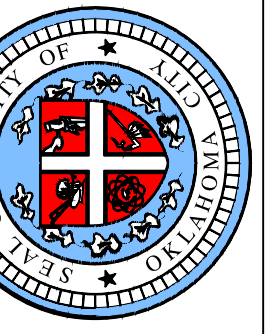
APPROVED BY: ERIC J. WENGER, P.E. CITY ENGINEER

DATE: 01-31-13

DRAWN: VSC

DATE: 01-31-13

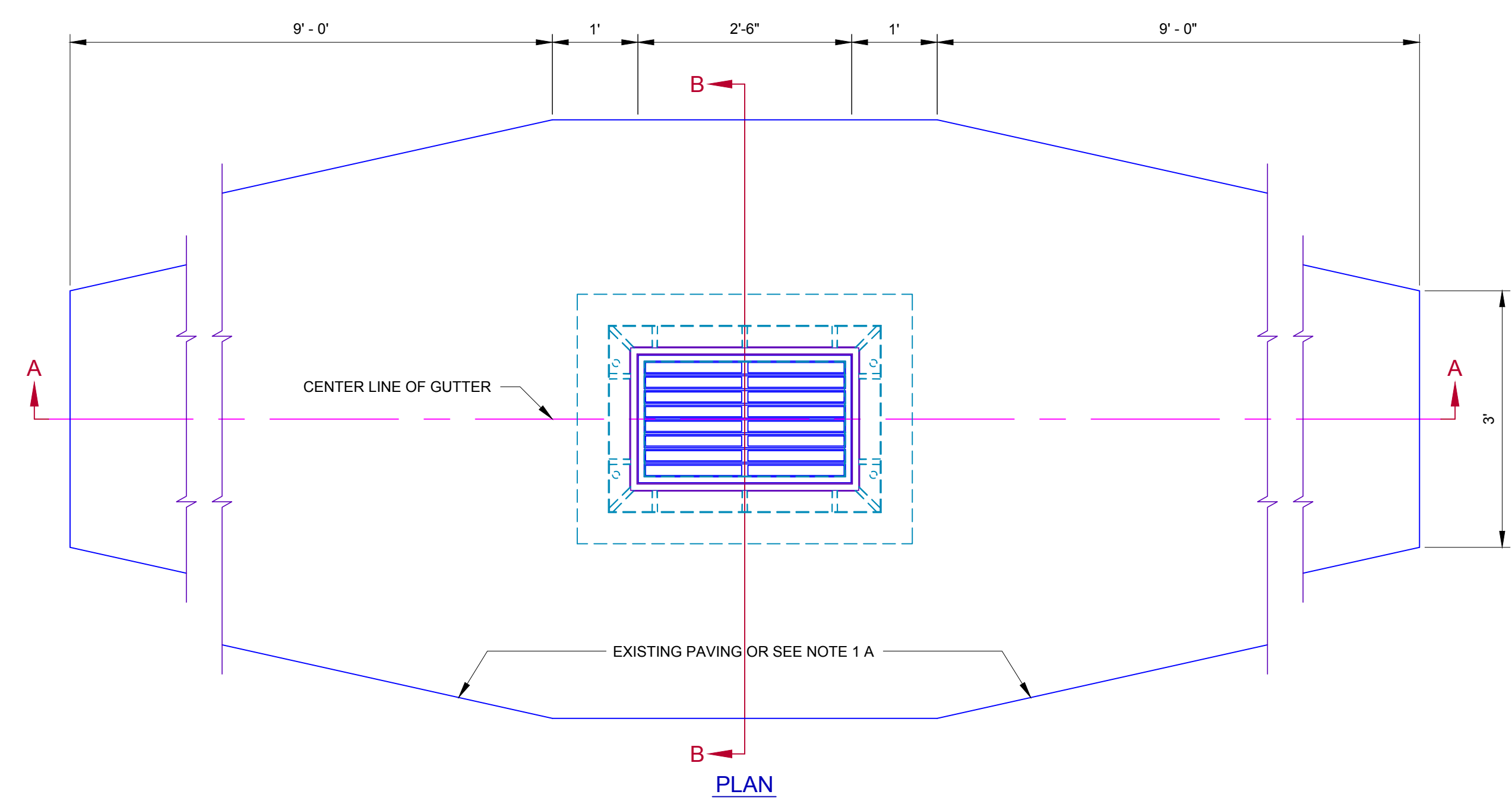
GRADED STREET INLET DETAIL



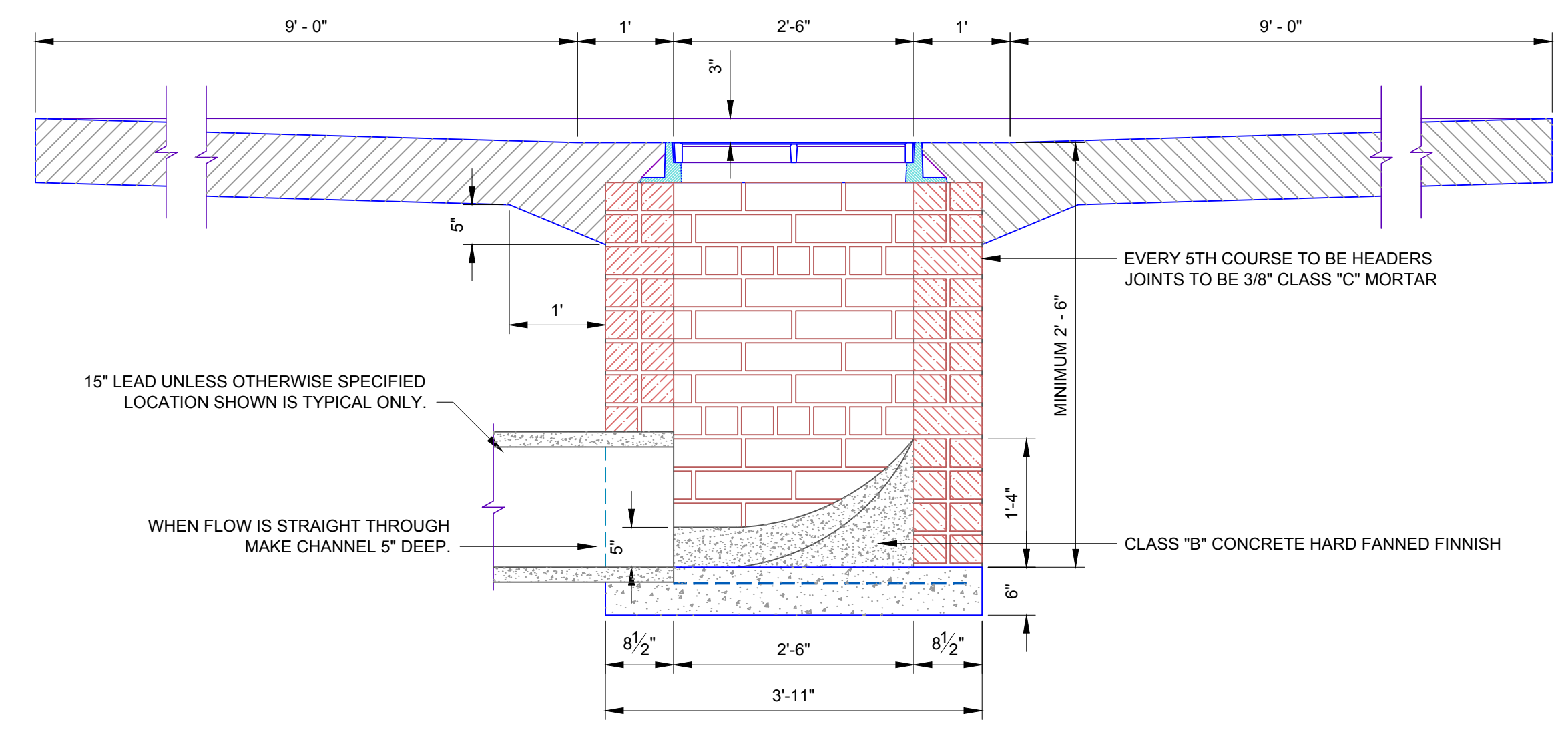
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ERIC J. WENGER, P.E.
CITY ENGINEER
DRAWN: VSC
DATE: 01-31-13

**STANDARD INLET DETAILS
DESIGN # 5 (SINGLE GRATING)
AND BOX TYPE INLET**

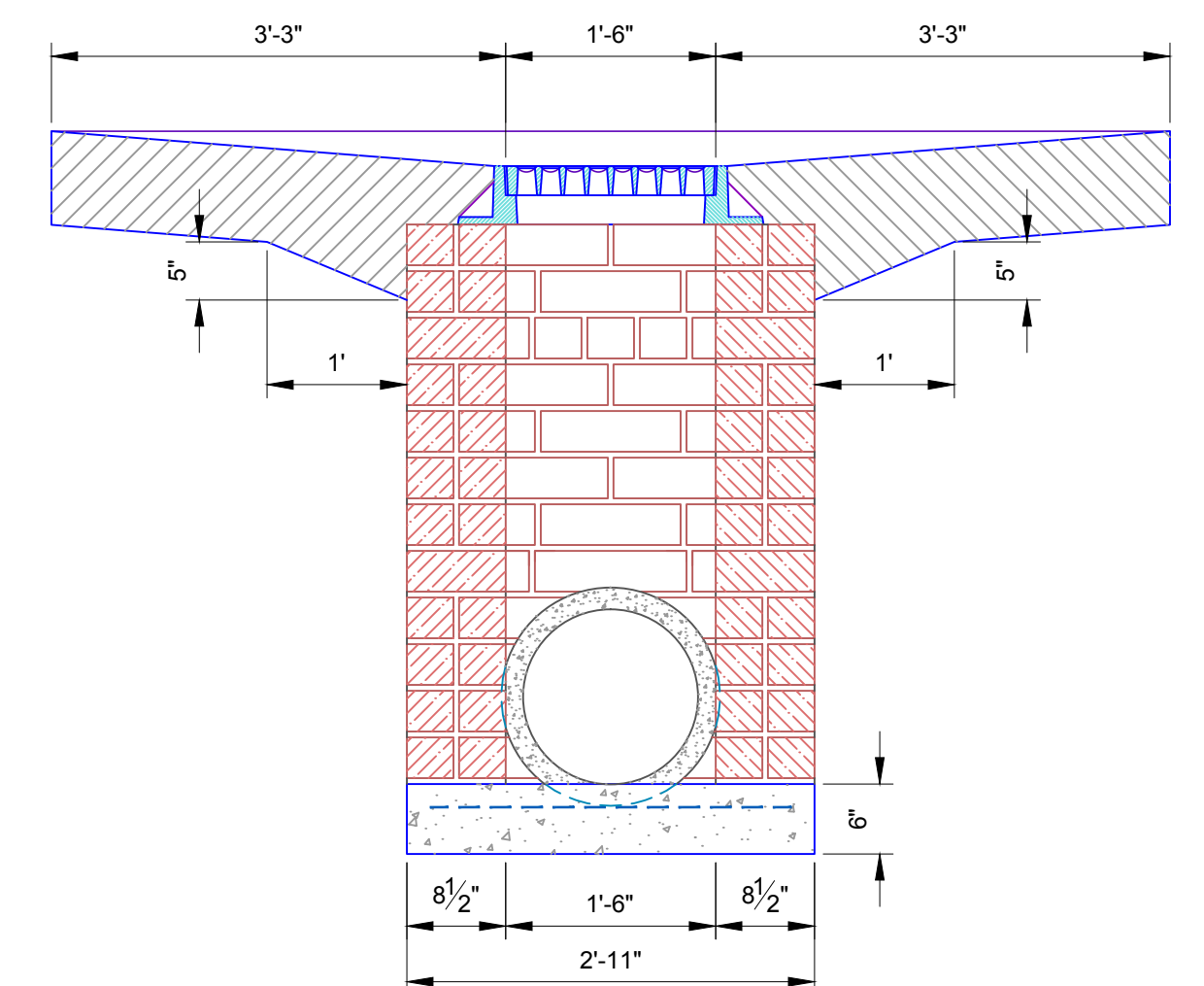
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PLAN



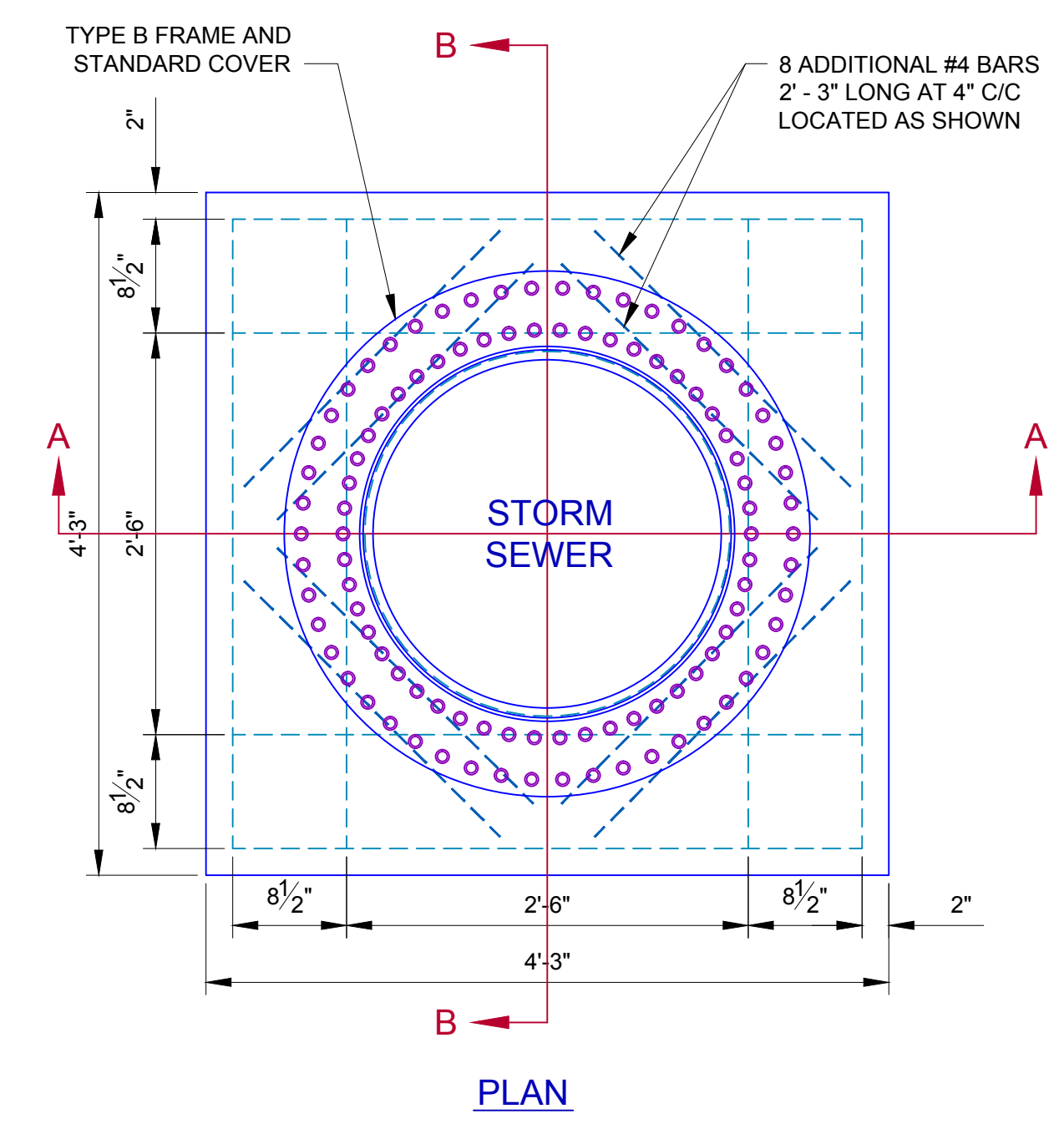
SECTION A-A



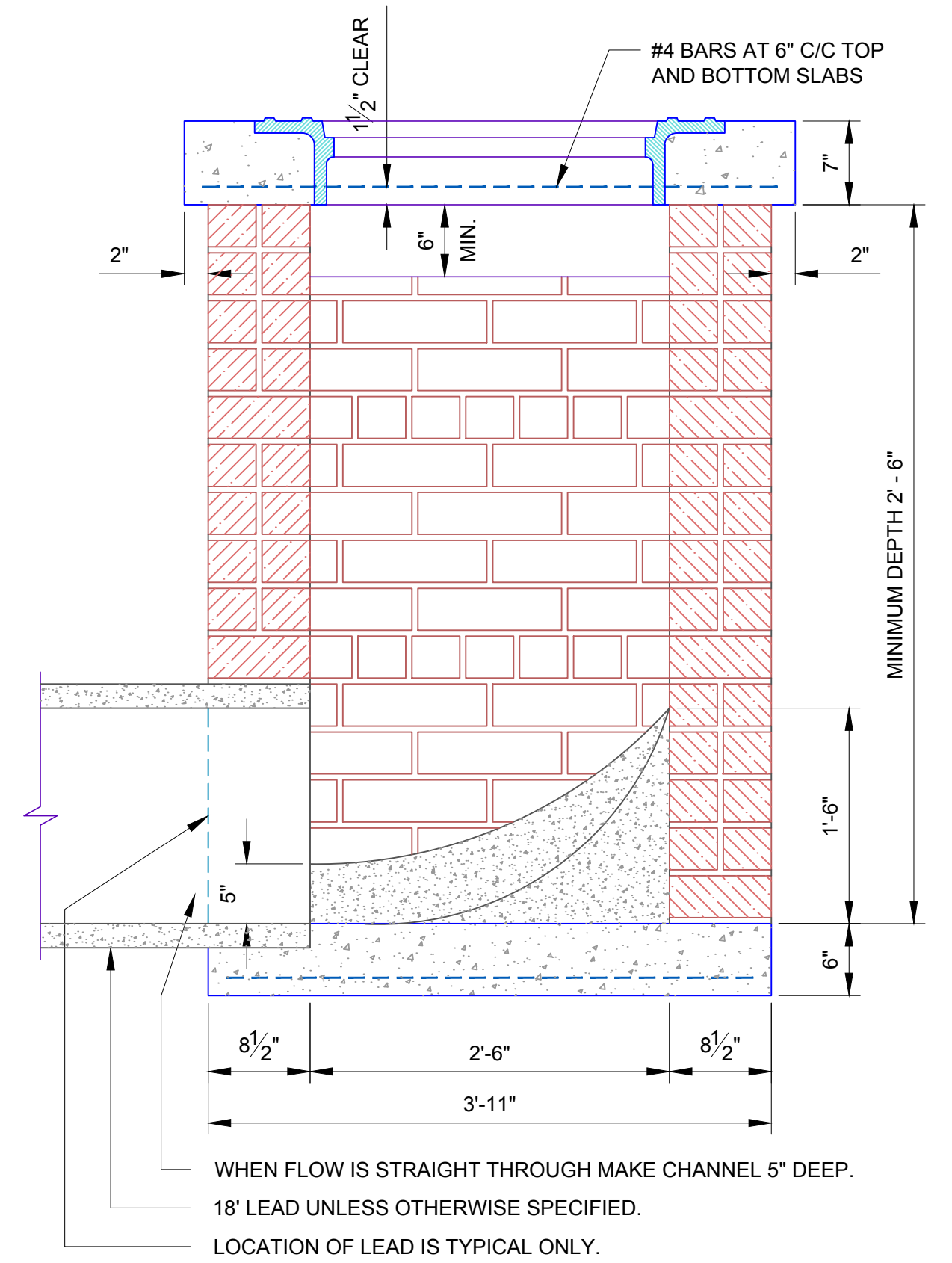
SECTION B-B

- GENERAL NOTES:
1. WHEN INLET IS BUILT IN NEW PAVEMENT, THE PAVEMENT SHALL BE MONOLITHIC WITH NEW PAVEMENT AND CONFORM TO PLANS AND SPECIFICATIONS THEREOF.
 2. CAST IRON STEPS SHALL BE PLACED IN ALL INLETS 3' OR MORE IN DEPTH IN CONFORMITY WITH STANDARD SPECIFICATIONS.
 3. THE GRATING TO BE USED IN THIS STRUCTURE WILL BE SHOWN ON THE PLANS OR DESIGNATED IN SPECIAL PROVISIONS.
 4. THIS STRUCTURE WILL BE DESIGNED ON PLANS AS INLET NUMBER 5.
 5. BASIS OF PAYMENT FOR INLETS WILL BE FOR A LUMP SUM AS DETAILED OR UPON THE FOLLOWING ITEMS AS DESIGNATED IN THE PROPOSAL:
CUBIC FEET BRICK MASONRY
EACH TYPE "C" INLET FRAME & TYPE "A" GRATING
CUBIC YARDS TYPE "B" CONCRETE INLET BOTTOMS

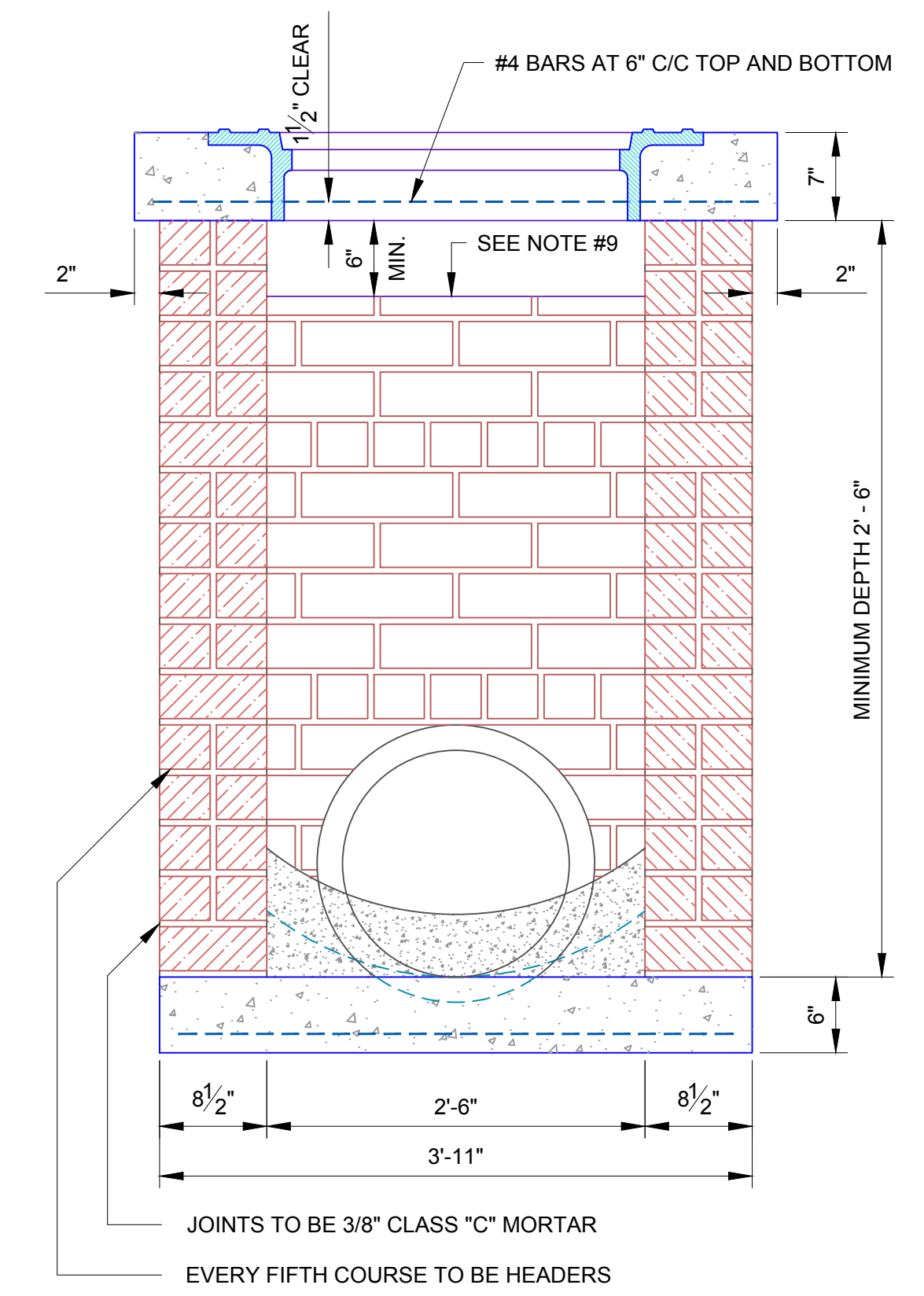
STORM SEWER INLET
DESIGN # 5 - SINGLE GRATING



PLAN



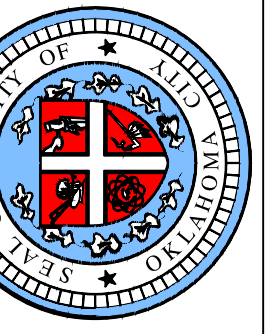
SECTION A-A



SECTION B-B

- GENERAL NOTES
1. THIS TYPE INLET IS STANDARD FOR UNPAVED STREETS AND UNDEVELOPED AREAS.
 2. TOP SLAB MAY BE CAST IN PLACE MORTAR OR PRE-CAST AND SET IN MORTAR.
 3. CONCRETE SHALL BE 3,500 LBS. PER SQUARE INCH.
 4. BASIS OF PAYMENT SHALL BE LUMP SUM OR AS DESIGNED IN THE PROPOSAL.
 5. REINFORCING STEEL IN TOP TO BE #4 BARS 4' - 0" LONG, IN BOTTOM TO BE 3' - 8" LONG, AT 6" ON CENTERS EACH WAY.
 6. OPENINGS MAY BE OMITTED ON 1, 2, OR 3 SIDES.
 7. OKLAHOMA CITY STANDARD TYPE B FRAME STANDARD COVER SHALL BE INSTALLED IN TOP SLAB.
 8. ALL DIMENSIONS SHOWN ARE MINIMUM DIMENSIONS AND MAY VARY ACCORDING TO THE PLANS.
 9. INLET WEIR ELEVATION TO BE CONSTRUCTED TO THE ELEVATION SHOWN IN THE PLANS OR BE A MINIMUM OF 1.0' BELOW EXISTING GROUND LINE.

BOX TYPE INLET

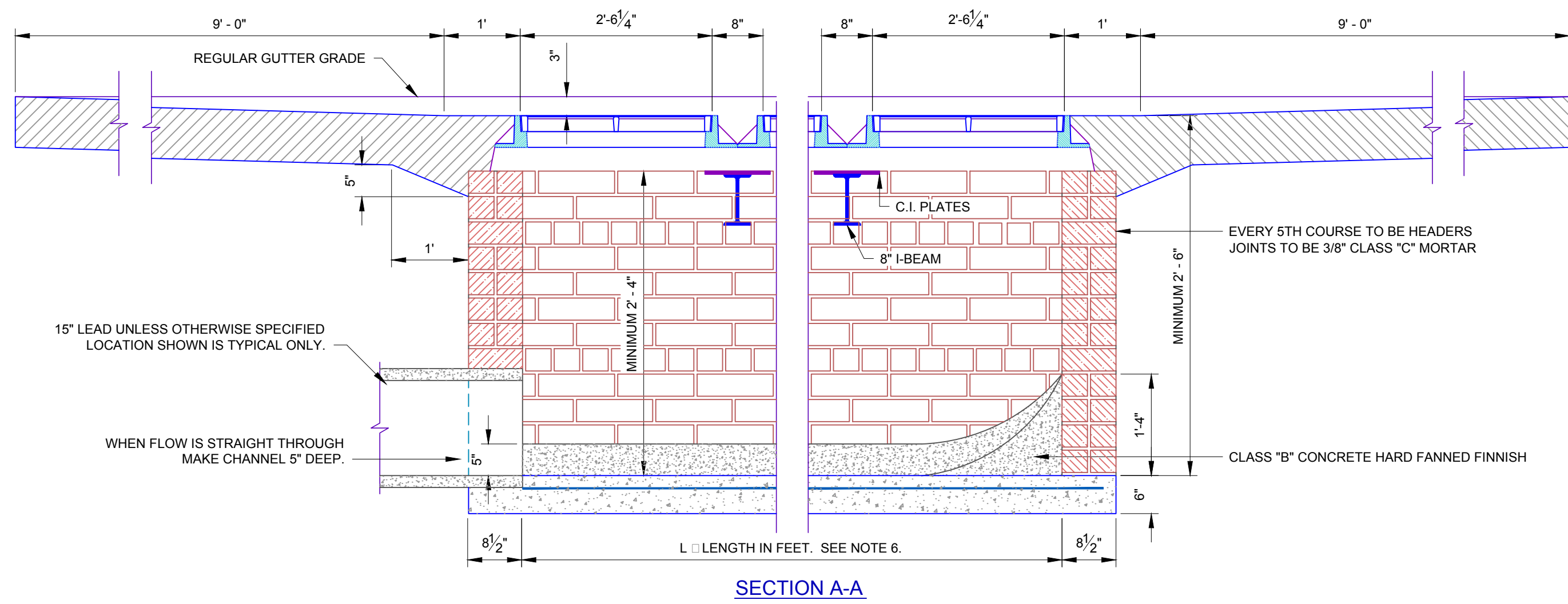
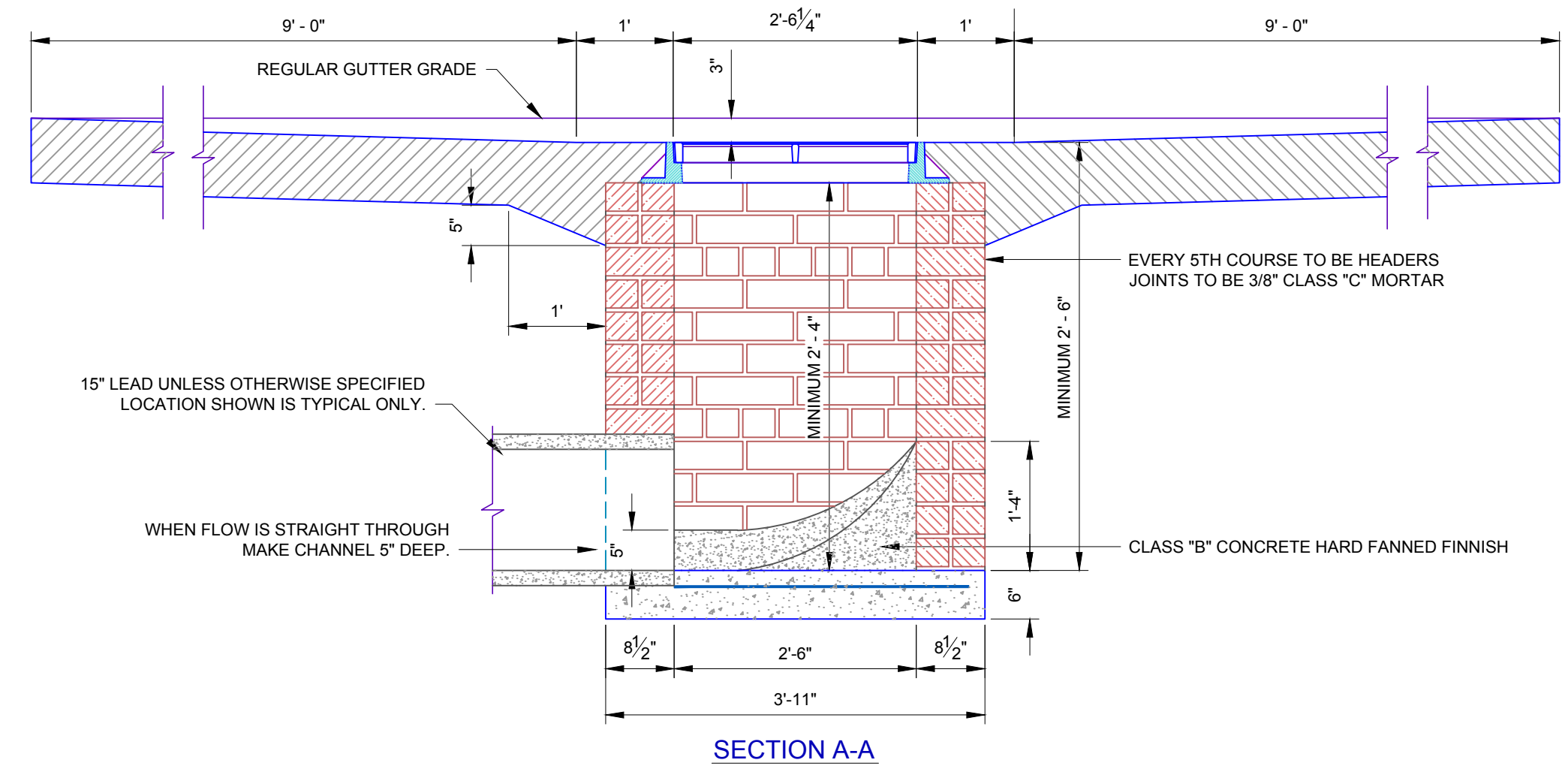
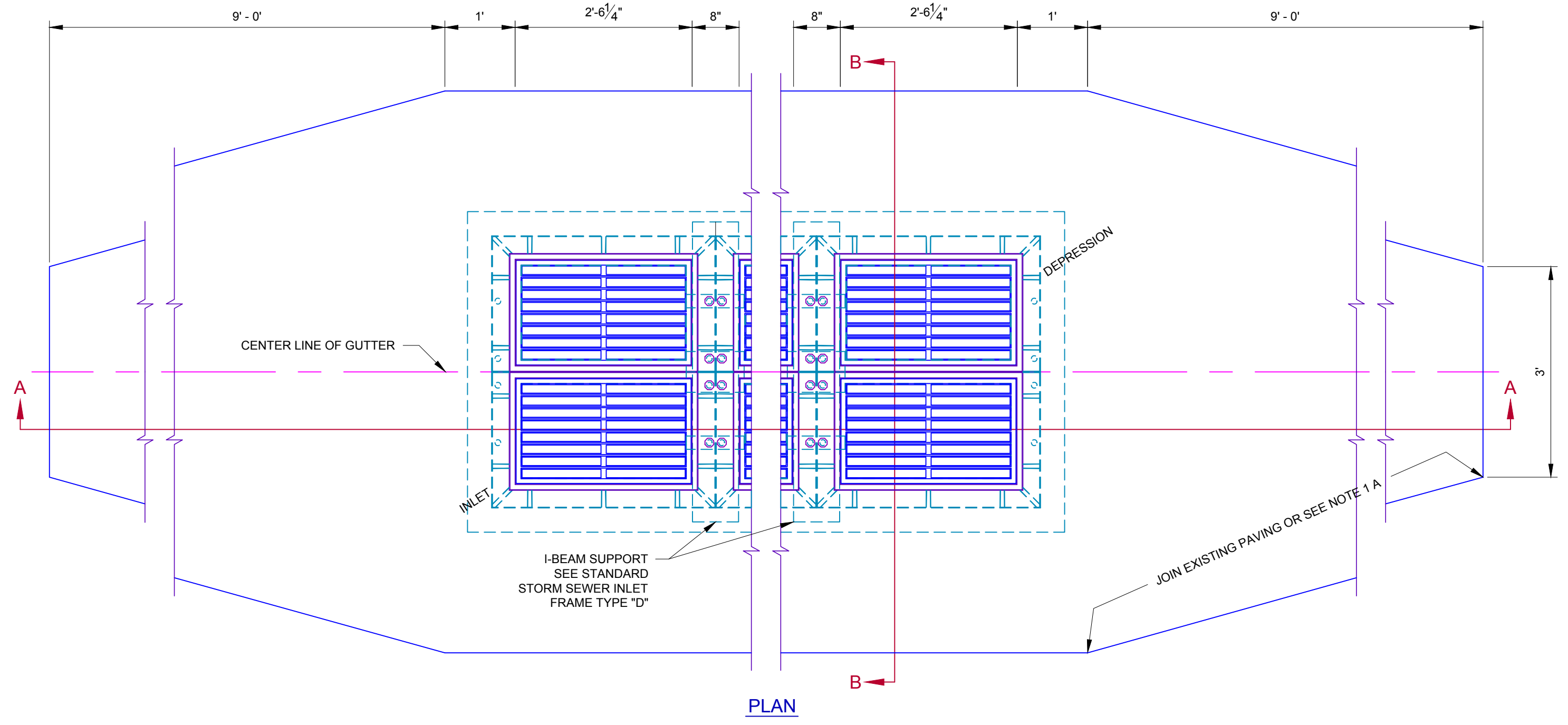
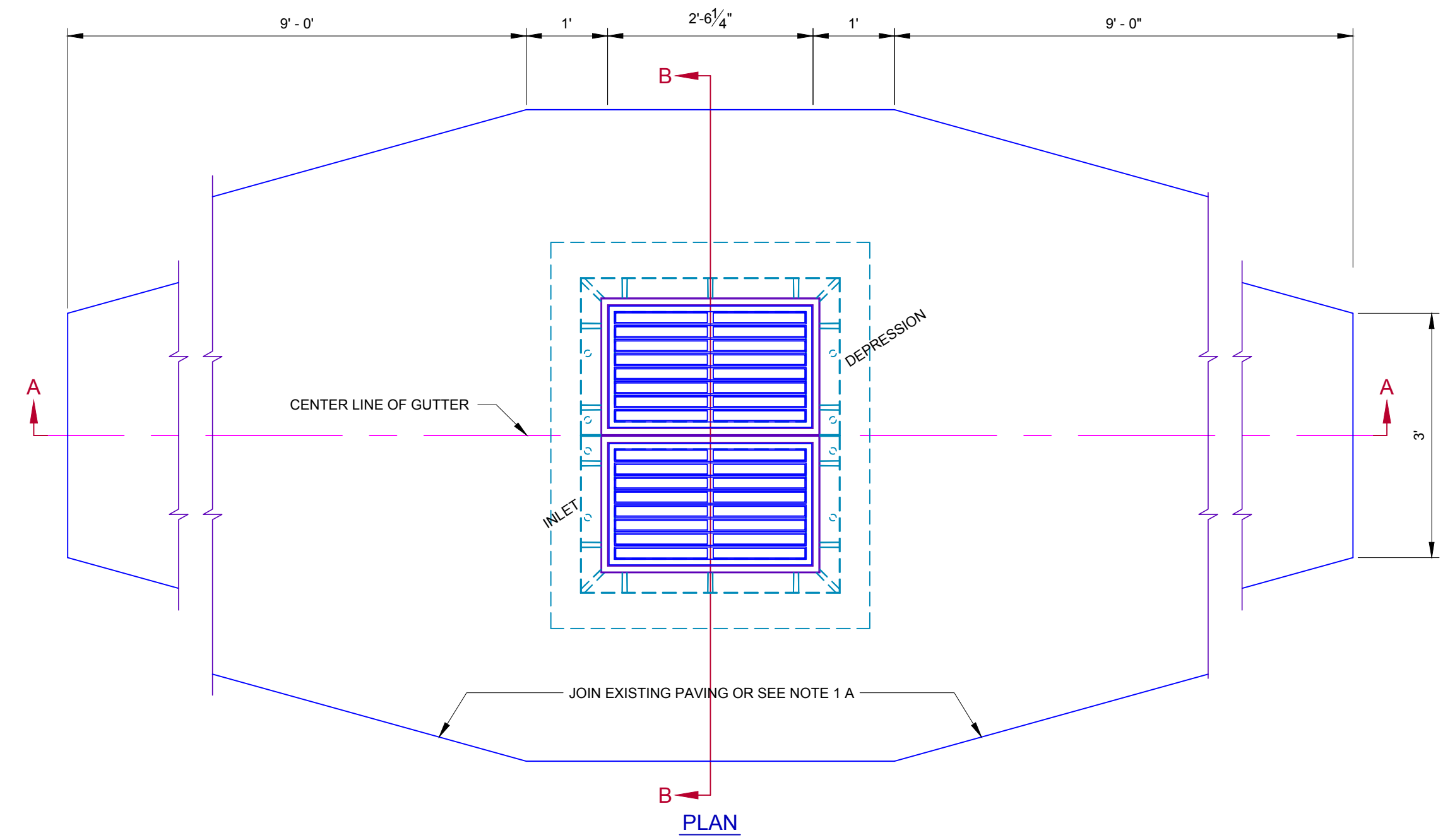


APPROVED BY: DATE: 01-31-13
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: VSC
DATE: 01-31-13

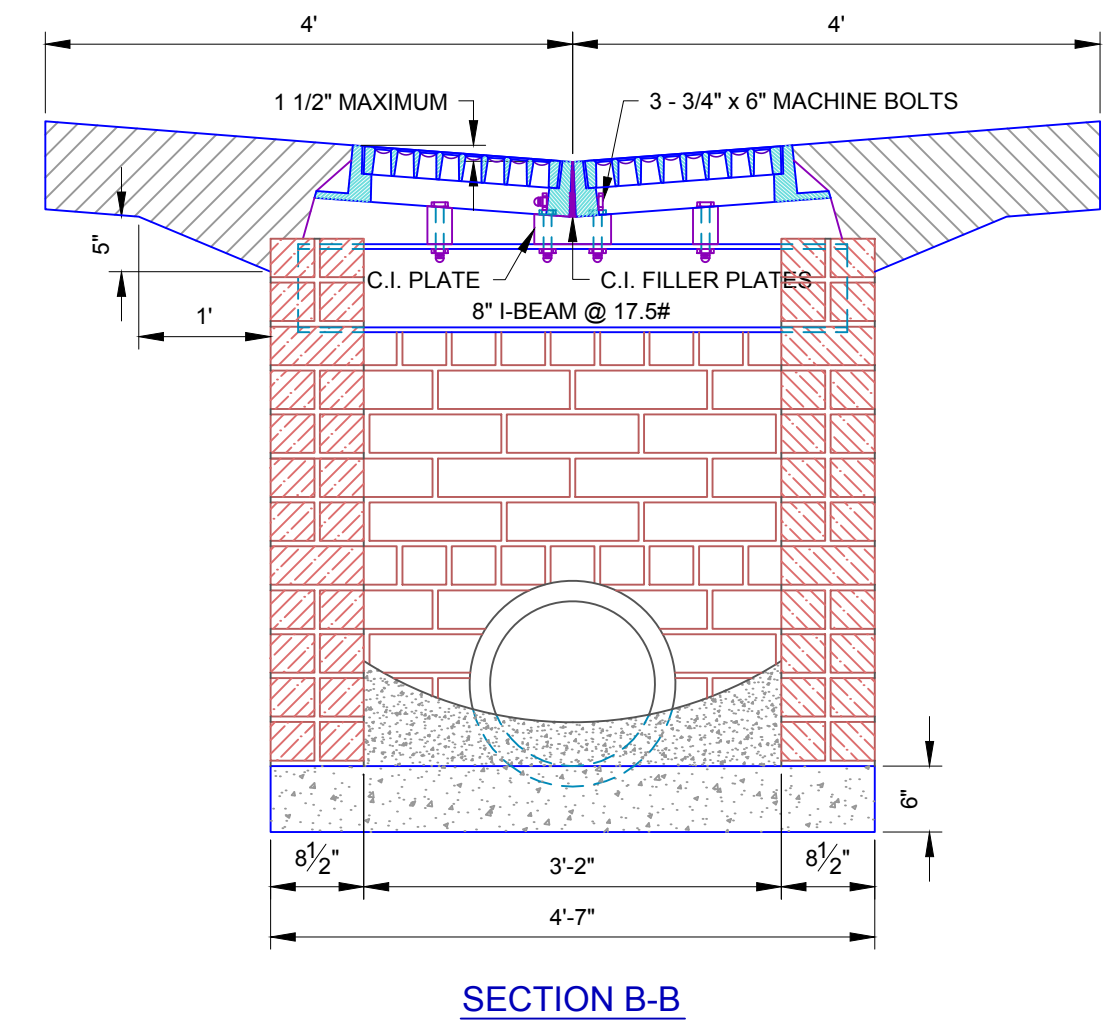
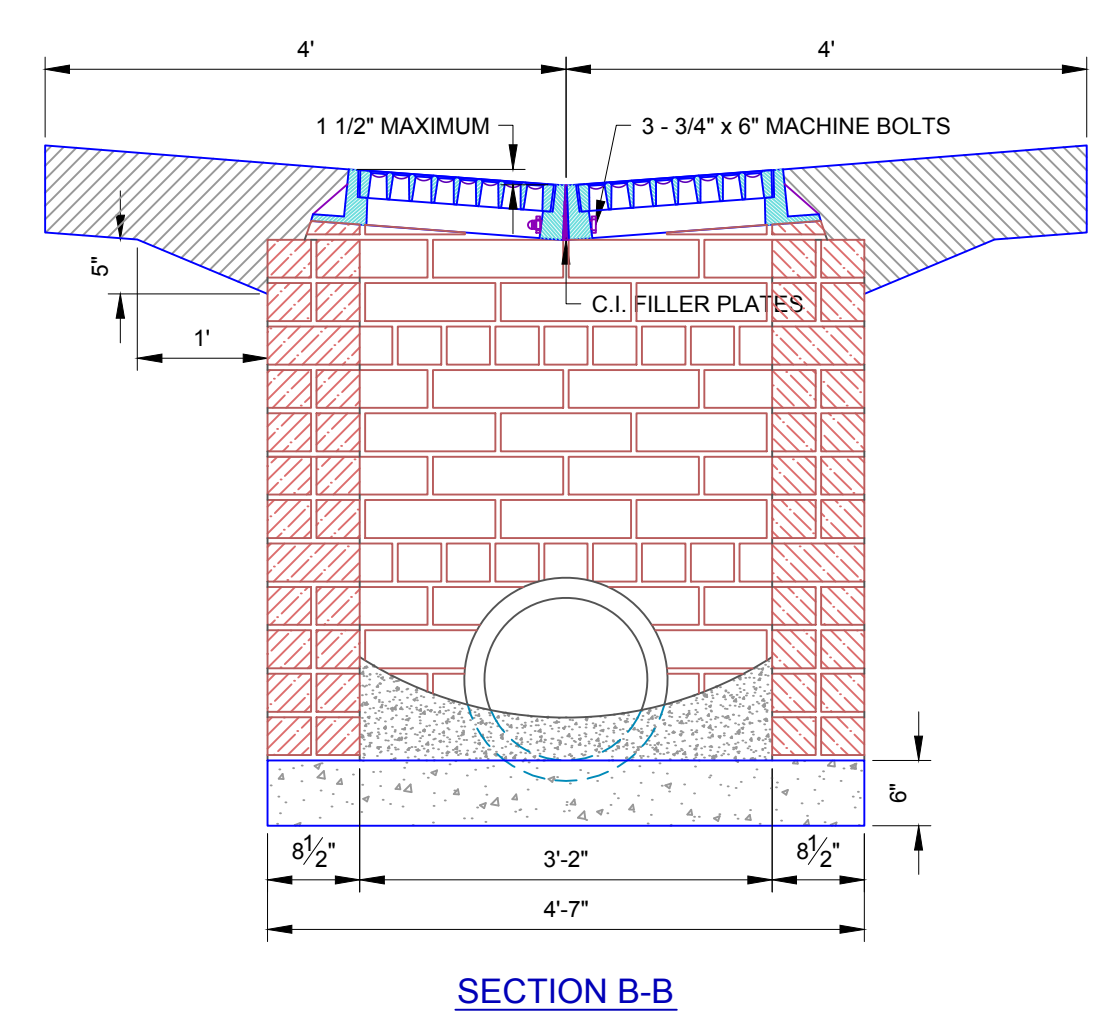
**STANDARD INLETS
DESIGN #6 & DESIGN #7**

Drawing Number
D-105



**STORM SEWER INLET
DESIGN #6 (DOUBLE GRATINGS)**

**STORM SEWER INLET
DESIGN #7 (MULTIPLE GRATINGS)**



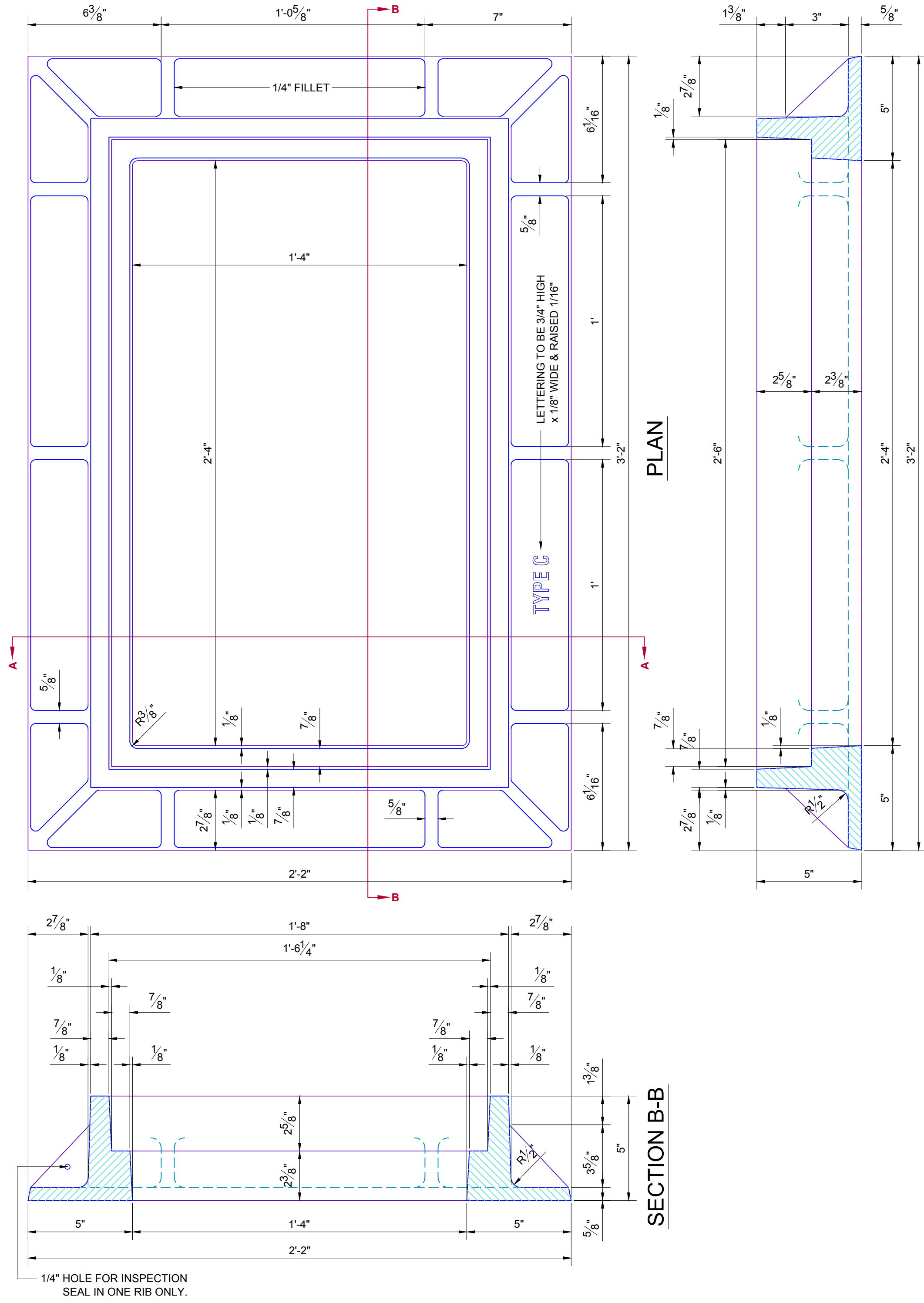
GENERAL NOTES:

1. A. WHEN INLET IS BUILT IN NEW PAVEMENT, THE PAVEMENT SHALL BE MONOLITHIC WITH NEW PAVEMENT AND CONFORM TO PLANS AND SPECIFICATIONS THEREOF.
1. B. WHEN INLET IS BUILT IN EXISTING PAVEMENT THE TYPES OF INLET PAVEMENT SHALL CONFORM TO THAT OF THE ADJACENT SLAB UNLESS OTHERWISE PROVIDED IN SPECIAL PROVISIONS.
2. CAST IRON STEPS SHALL BE PLACED IN ALL INLETS 3' OR MORE IN DEPTH IN CONFORMITY WITH STANDARD SPECIFICATIONS.
3. THE GRATING TO BE USED IN THIS STRUCTURE WILL BE SHOWN ON THE PLANS OR DESIGNATED IN SPECIAL PROVISIONS.
4. THIS STRUCTURE WILL BE DESIGNATED ON PLANS AS INLET NUMBER 6.
5. BASIS OF PAYMENT FOR INLETS WILL BE FOR A LUMP SUM INCLUDING REMOVAL AND REPLACEMENT OF EXISTING PAVEMENT.

GENERAL NOTES:

1. A. WHEN INLET IS BUILT IN NEW PAVEMENT, THE PAVEMENT SHALL BE MONOLITHIC WITH NEW PAVEMENT AND CONFORM TO PLANS AND SPECIFICATIONS THEREOF.
1. B. WHEN INLET IS BUILT IN EXISTING PAVEMENT THE TYPES OF INLET PAVEMENT SHALL CONFORM TO THAT OF THE ADJACENT SLAB UNLESS OTHERWISE PROVIDED IN SPECIAL PROVISIONS.
2. CAST IRON STEPS SHALL BE PLACED IN ALL INLETS 3' OR MORE IN DEPTH IN CONFORMITY WITH STANDARD SPECIFICATIONS.
3. THE GRATING TO BE USED IN THIS STRUCTURE WILL BE SHOWN ON THE PLANS OR DESIGNATED IN SPECIAL PROVISIONS.
4. THIS STRUCTURE WILL BE DESIGNATED ON PLANS AS INLET NUMBER 7-X (IN WHICH X = NUMBER OF DOUBLE GRATING).
5. BASIS OF PAYMENT FOR INLETS WILL BE FOR A LUMP SUM INCLUDING REMOVAL AND REPLACEMENT OF EXISTING PAVEMENT.
6. L = (3.18 N) - 0.66 IN WHICH N = THE NUMBER OF DOUBLE GRATINGS.

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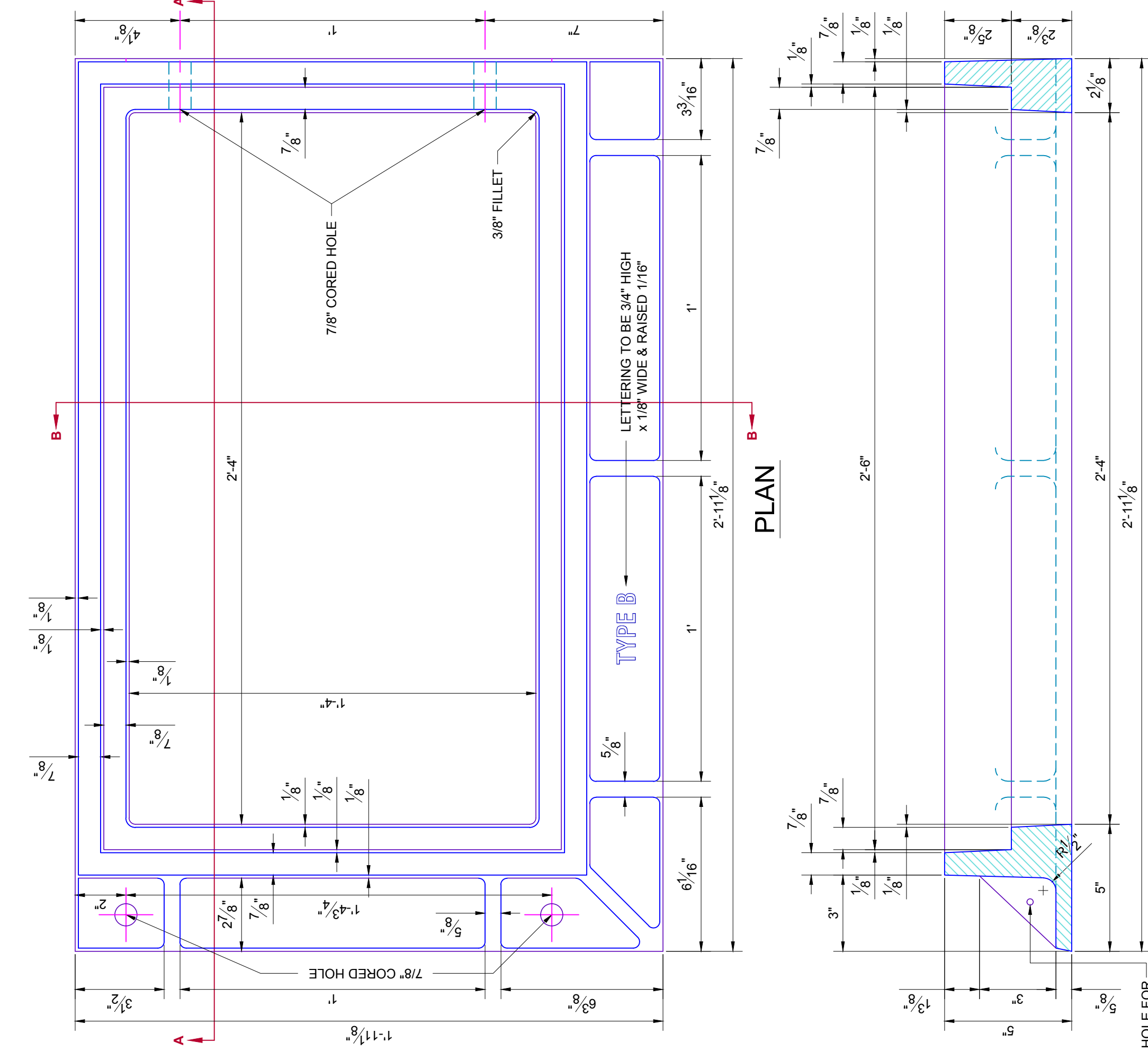
STORM SEWER INLET FRAME
INLET DESIGN #5

GENERAL NOTES:
1. CASTINGS SHALL CONFORM TO THE A.S.T.M. SPECIFICATION FOR GRAY IRON CASTINGS SERIAL DESIGN A-48-28.
2. NO WORDING OR MARKINGS OF ANY KIND OTHER THAN THOSE SHOWN ON THE PLANS WILL BE PERMITTED ON THESE CASTINGS.

CASTING WEIGHTS

THE AVERAGE WEIGHT OF CASTINGS FURNISHED WILL NOT BE LESS THAN 98% OF WEIGHTS SHOWN BELOW. WEIGHTS OF INDIVIDUAL CASTINGS SHALL NOT BE LESS THAN 95% OF WEIGHTS SHOWN BELOW.

- TYPE "A" FRAME ONLY 205 LBS.
- TYPE "B" FRAME ONLY 195 LBS.
- TYPE "C" FRAME ONLY 210 LBS.
- TYPE "A" GRATE ONLY 145 LBS.



STORM SEWER INLET FRAME
TYPE "B" FOR INLET DESIGN #2

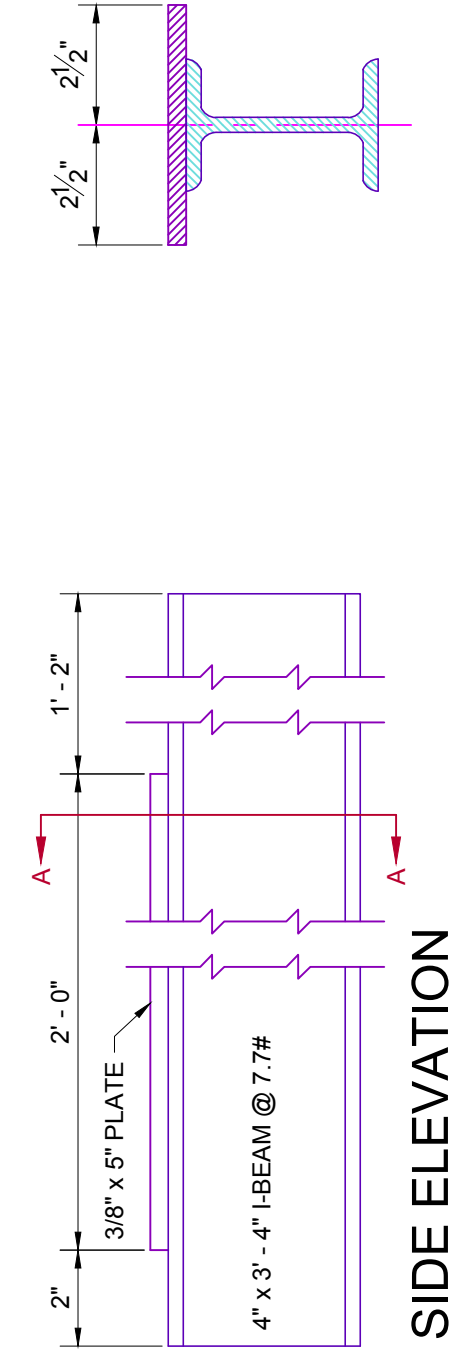
GENERAL NOTES:

1. CASTINGS SHALL CONFORM TO THE A.S.T.M. SPECIFICATIONS FOR GRAY IRON CASTINGS SERIAL DESIGN A-48-28.
2. NO WORDING OR MARKINGS OF ANY KIND OTHER THAN THOSE SHOWN ON THE PLANS WILL BE PERMITTED ON THESE CASTINGS.
3. MAKE ONE FRAME AS SHOWN AND ONE REVERSED FOR EACH PAIR OF DOUBLE FRAMES.
4. PLATES ON I-BEAM SUPPORTS SHALL BE SPOT WELDED TO THE I-BEAM AT FOUR PLACES ON EACH SIDE OF FLANGE.
5. WHEN BUILT ON A CURVE, INLET DESIGN #2 REQUIRES 1 - 3/4" x 5" MACHINE BOLT WITH NUT, 1 - 3/4" x 6 1/2" MACHINE BOLT WITH NUT, AND 1 - 3/8" x 5" PLATE.
6. WHEN BUILT ON A CURVE, INLET #3 REQUIRES THE DOUBLE FRAME AND IN ADDITION REQUIRES THE I-BEAM SUPPORT WITH 10" PLATE. THE NUMBER OF THESE SUPPORTS IS ONE LESS THAN THE NUMBER OF DOUBLE FRAMES SPECIFIED. FOUR 3/4" x 1 3/4" MACHINE BOLTS WITH NUTS ARE REQUIRED FOR EACH OF THESE SUPPORTS.

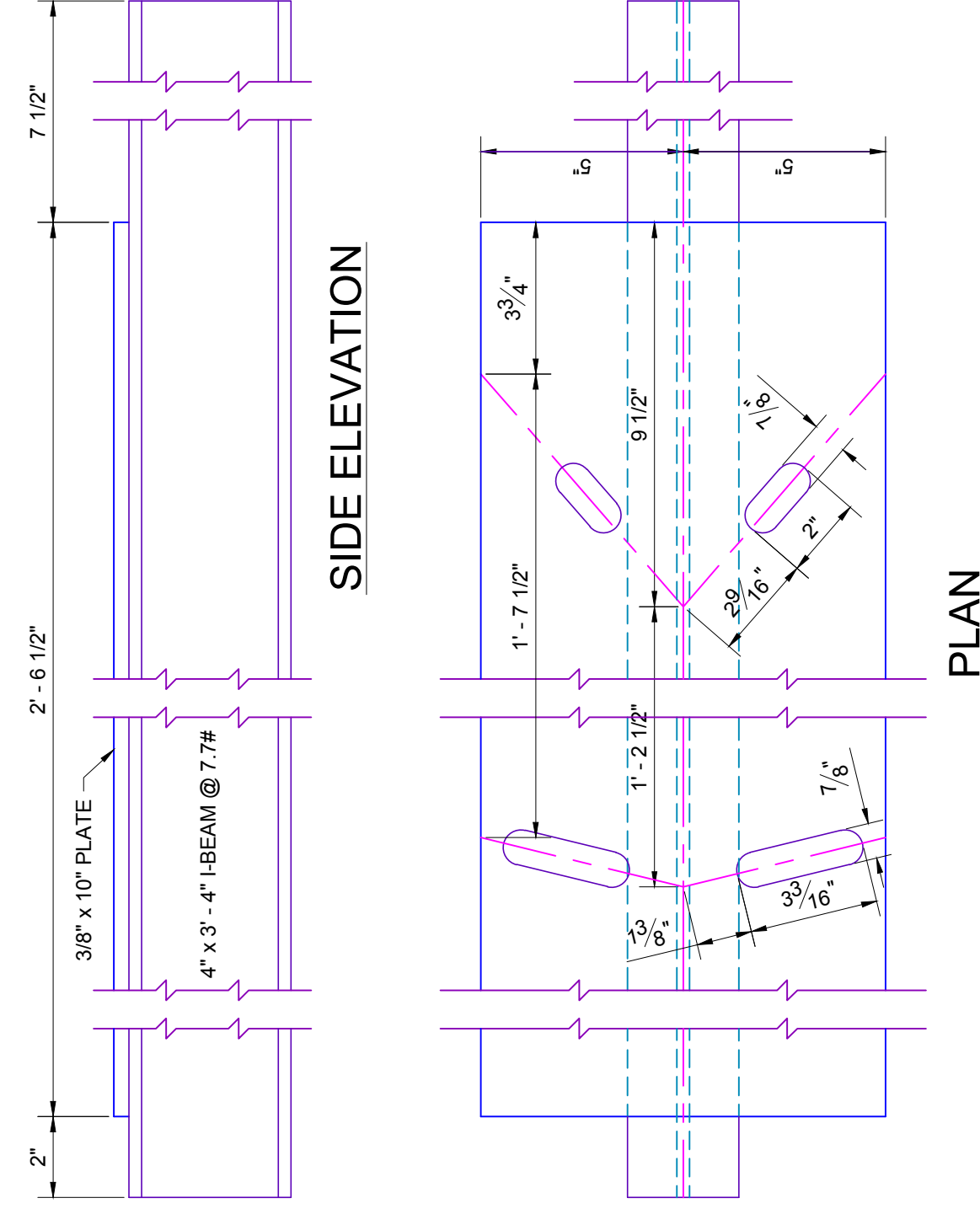
CASTING WEIGHTS

THE AVERAGE WEIGHT OF CASTINGS FURNISHED WILL NOT BE LESS THAN 98% OF WEIGHTS SHOWN BELOW. WEIGHTS OF INDIVIDUAL CASTINGS SHALL NOT BE LESS THAN 95% OF WEIGHTS SHOWN BELOW.

- TYPE "A" FRAME ONLY 205 LBS.
- TYPE "B" FRAME ONLY 195 LBS.
- TYPE "C" FRAME ONLY 210 LBS.
- TYPE "A" GRATE ONLY 145 LBS.



I-BEAM SUPPORT
FOR USE ON CURVED CURBS



I-BEAM SUPPORT
FOR INLET DESIGN #3 ONLY

STANDARD INLET FRAME
DETAIL FOR DESIGN #2 & #5

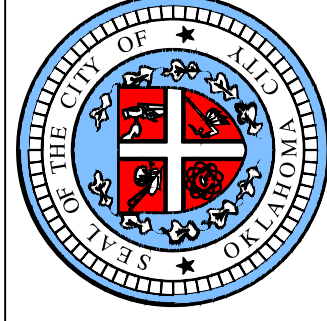
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D-106

APPROVED BY:
ERIC J. WENGER, P.E.
CITY ENGINEER

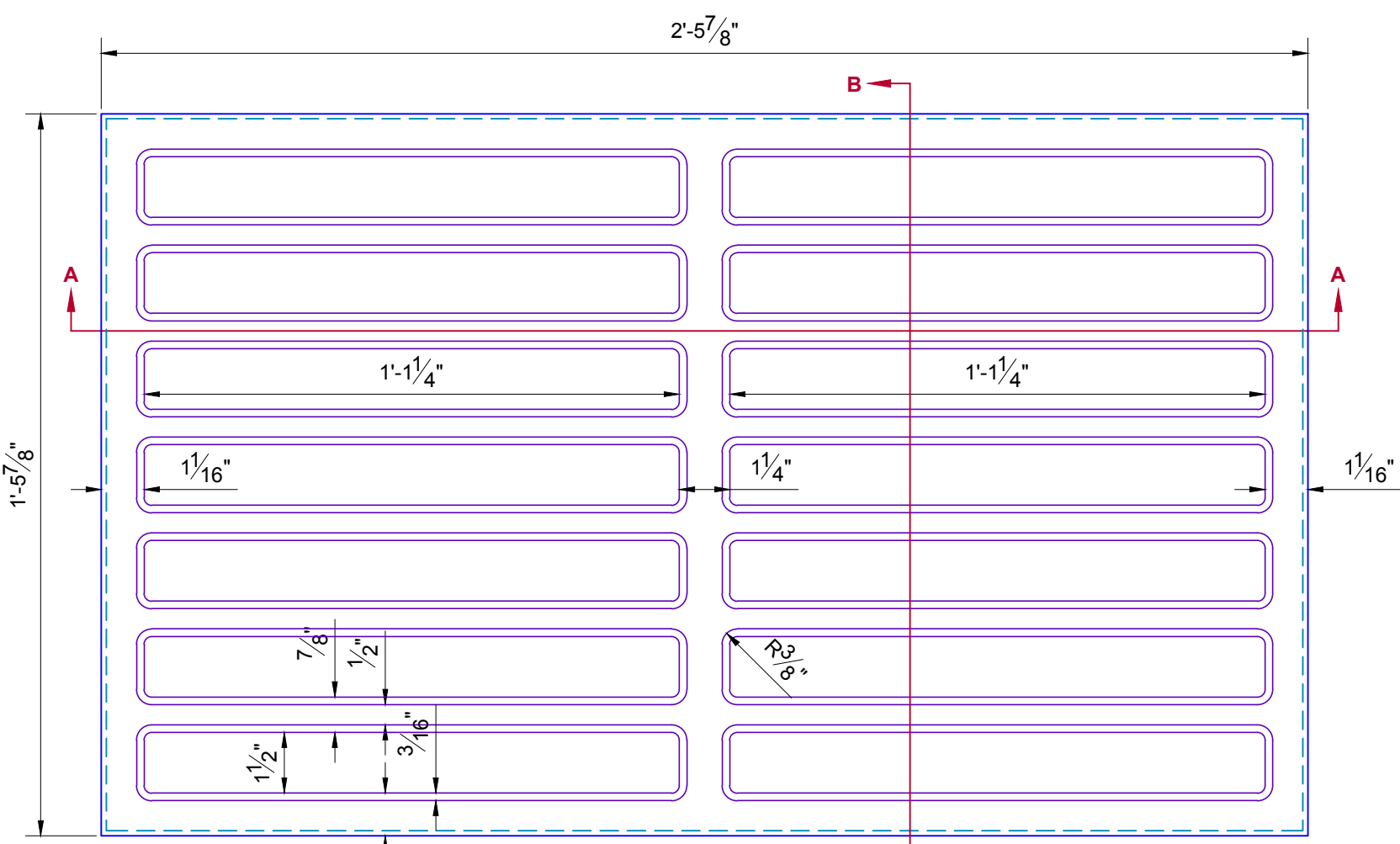
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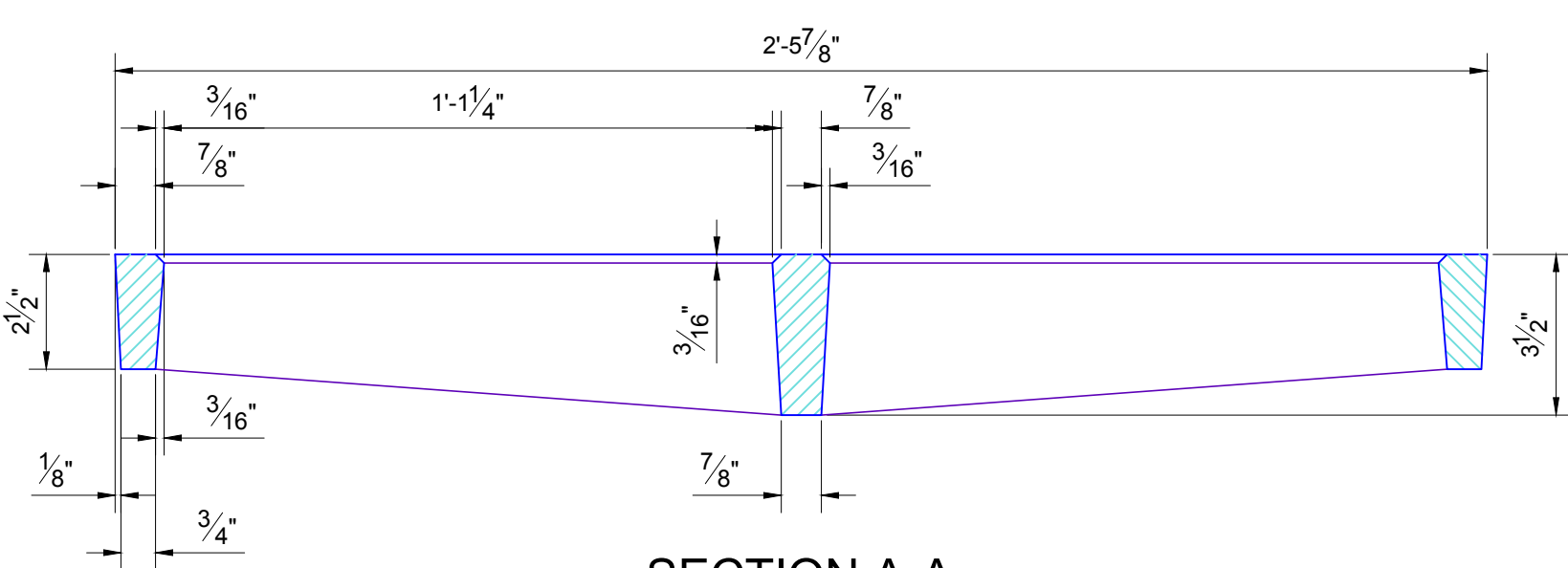
DATE: 01-31-13



The City of
Oklahoma City
Public Works Department
Engineering Division



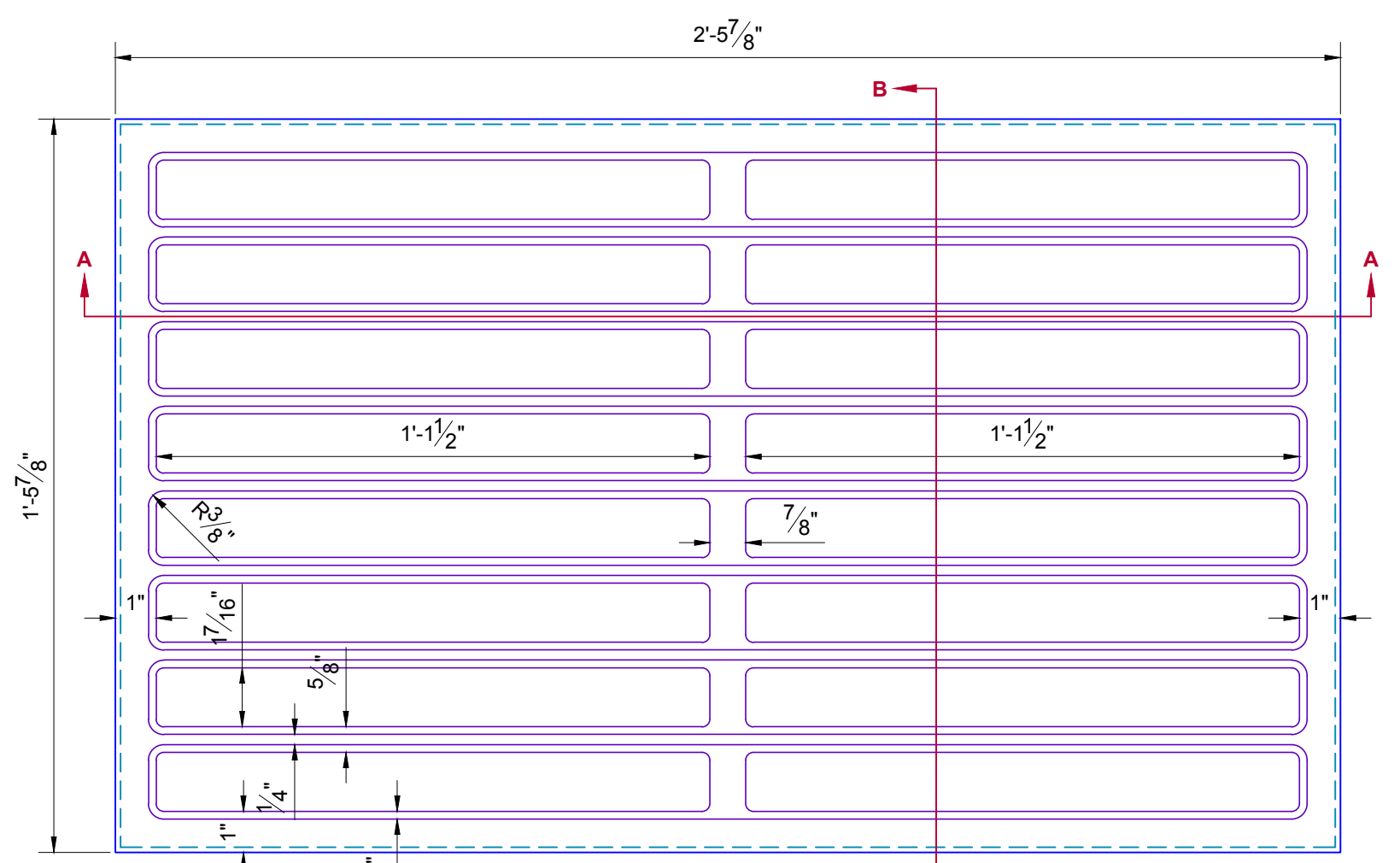
PLAN



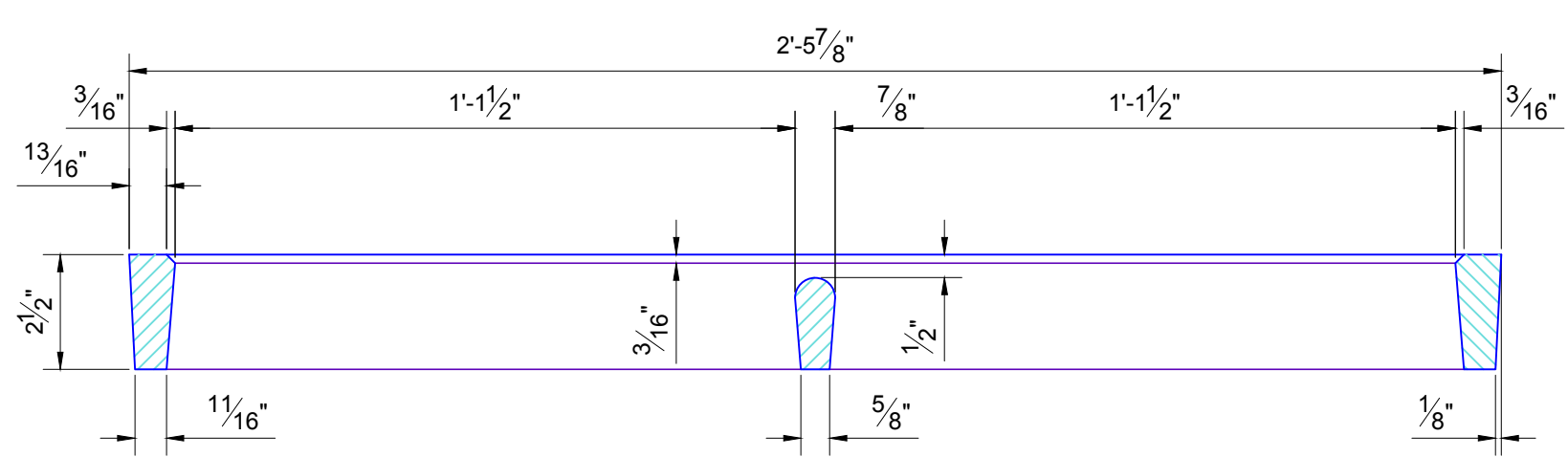
SECTION A-A

STORM SEWER INLET GRATING

DETAIL OF TYPE "A" GRATING



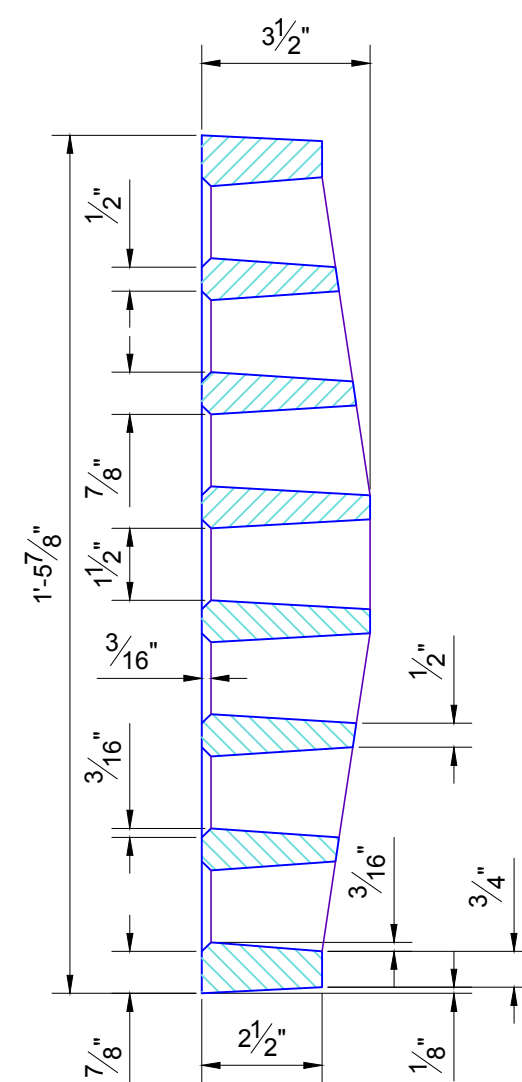
PLAN



SECTION A-A

STORM SEWER INLET GRATING

DETAIL OF TYPE "B" GRATING



SECTION B-B

CASTING WEIGHTS

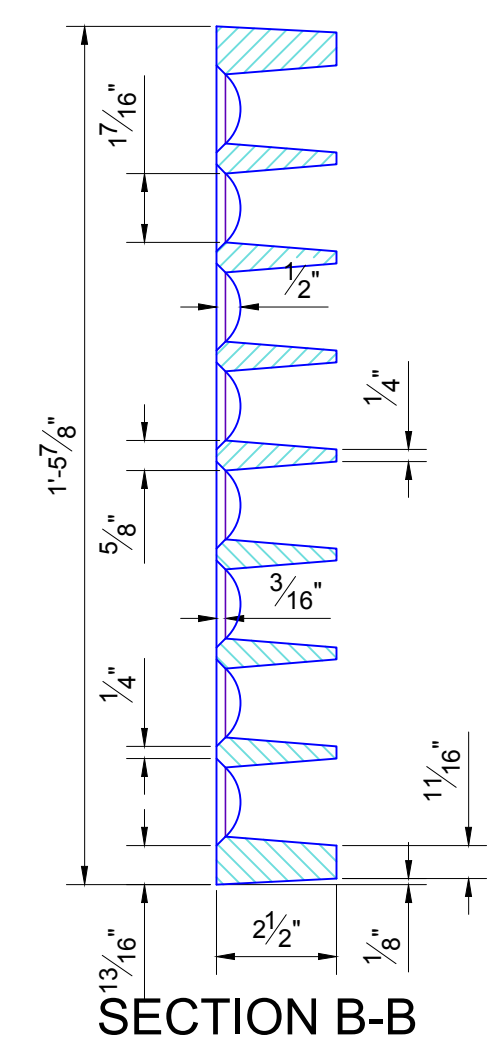
THE AVERAGE WEIGHT OF CASTINGS FURNISHED WILL NOT BE LESS THAN 98% OF WEIGHTS SHOWN BELOW.

WEIGHTS OF INDIVIDUAL CASTINGS SHALL NOT BE LESS THAN 95% OF WEIGHTS SHOWN BELOW.

- TYPE A FRAMES ONLY 250 LBS.
- TYPE B FRAMES ONLY 195 LBS.
- TYPE C FRAMES ONLY 210 LBS.
- TYPE A GRATES ONLY 145 LBS.

NOTE

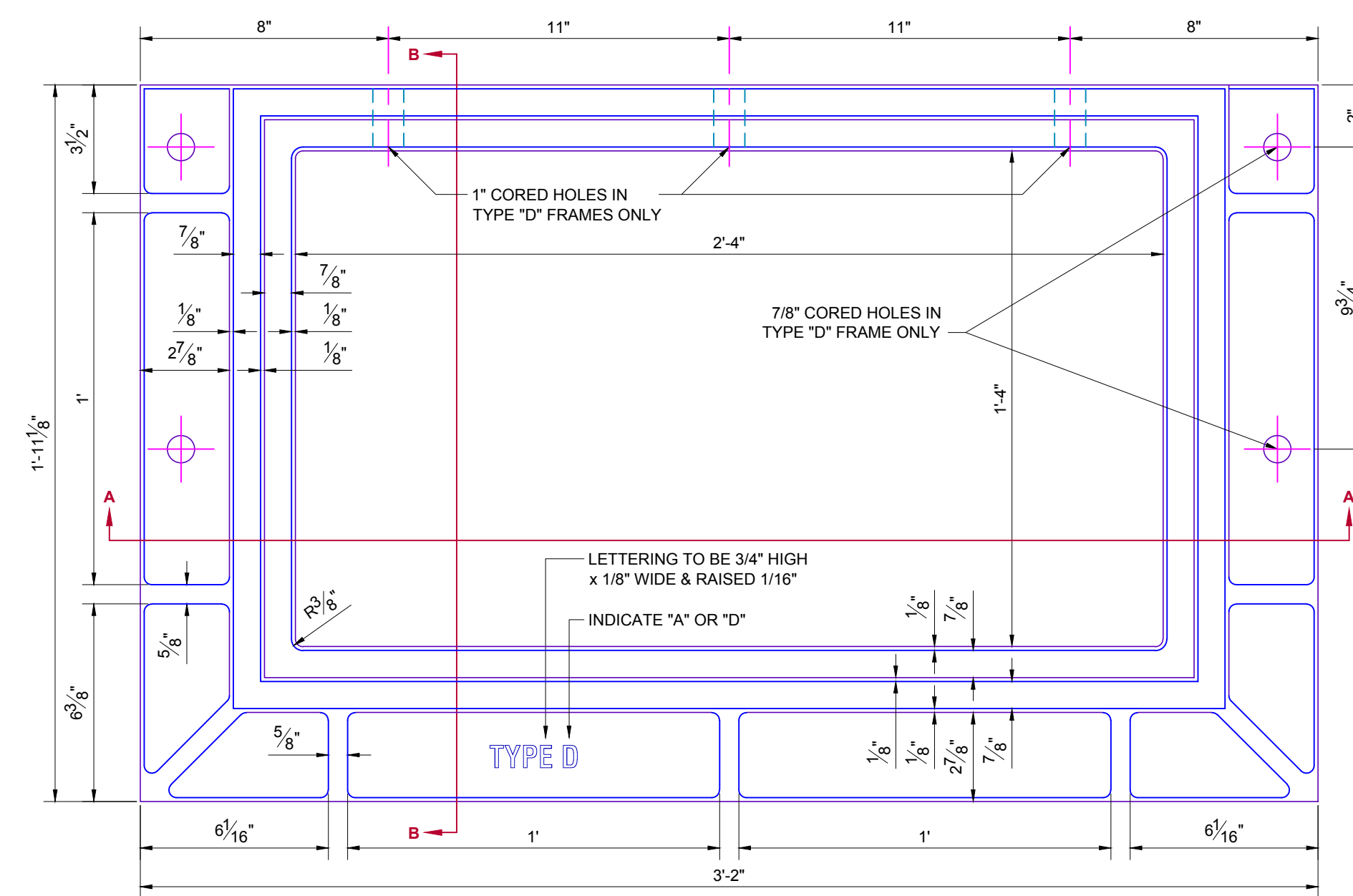
GRATING SHALL CONFORM TO THE A.S.T.M. SPECIFICATIONS FOR GRAY IRON CASTINGS SERIAL DESIGNATION A-48-29.



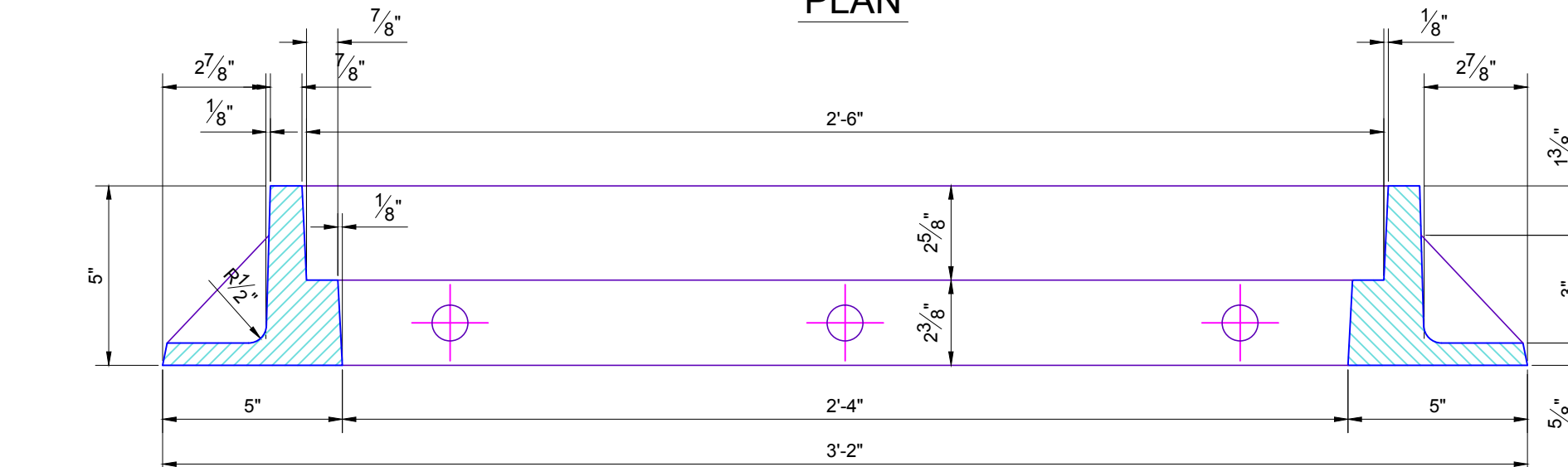
SECTION B-B

NOTE

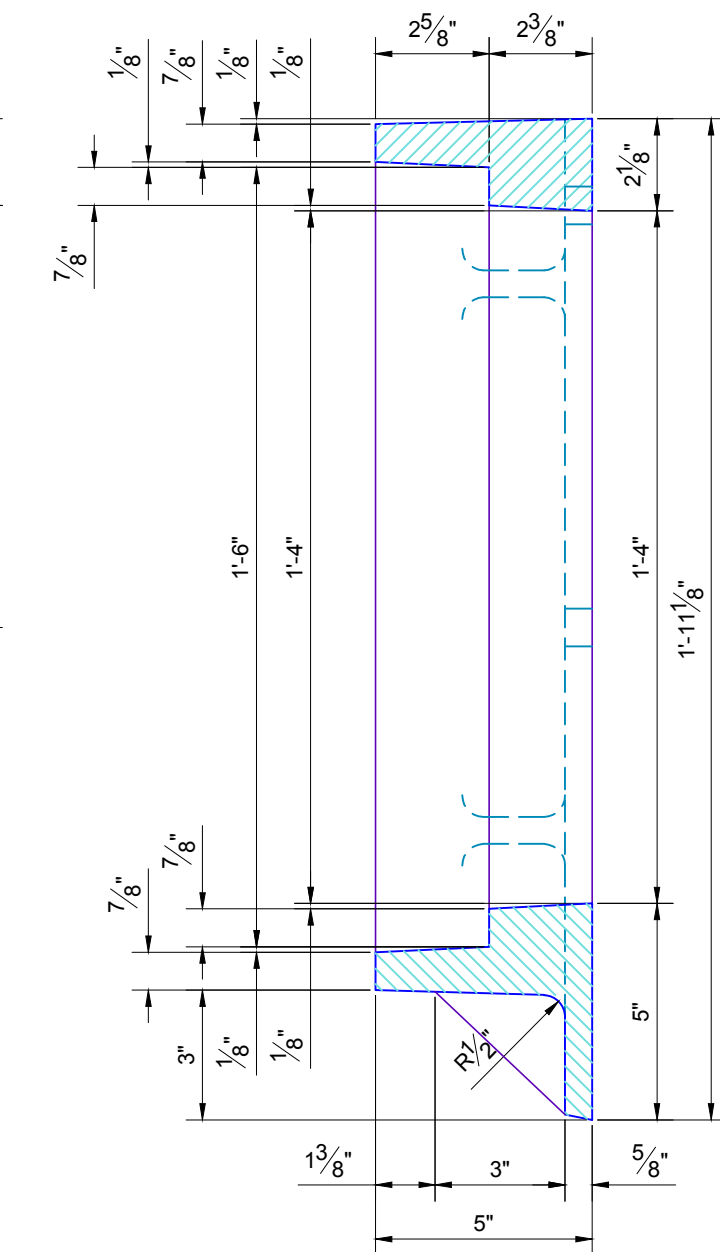
GRATING SHALL CONFORM TO THE A.S.T.M. SPECIFICATIONS FOR STEEL CASTINGS SERIAL DESIGNATION A-27-24. CASTINGS SHALL BE CL "B" HARD STEEL.



PLAN



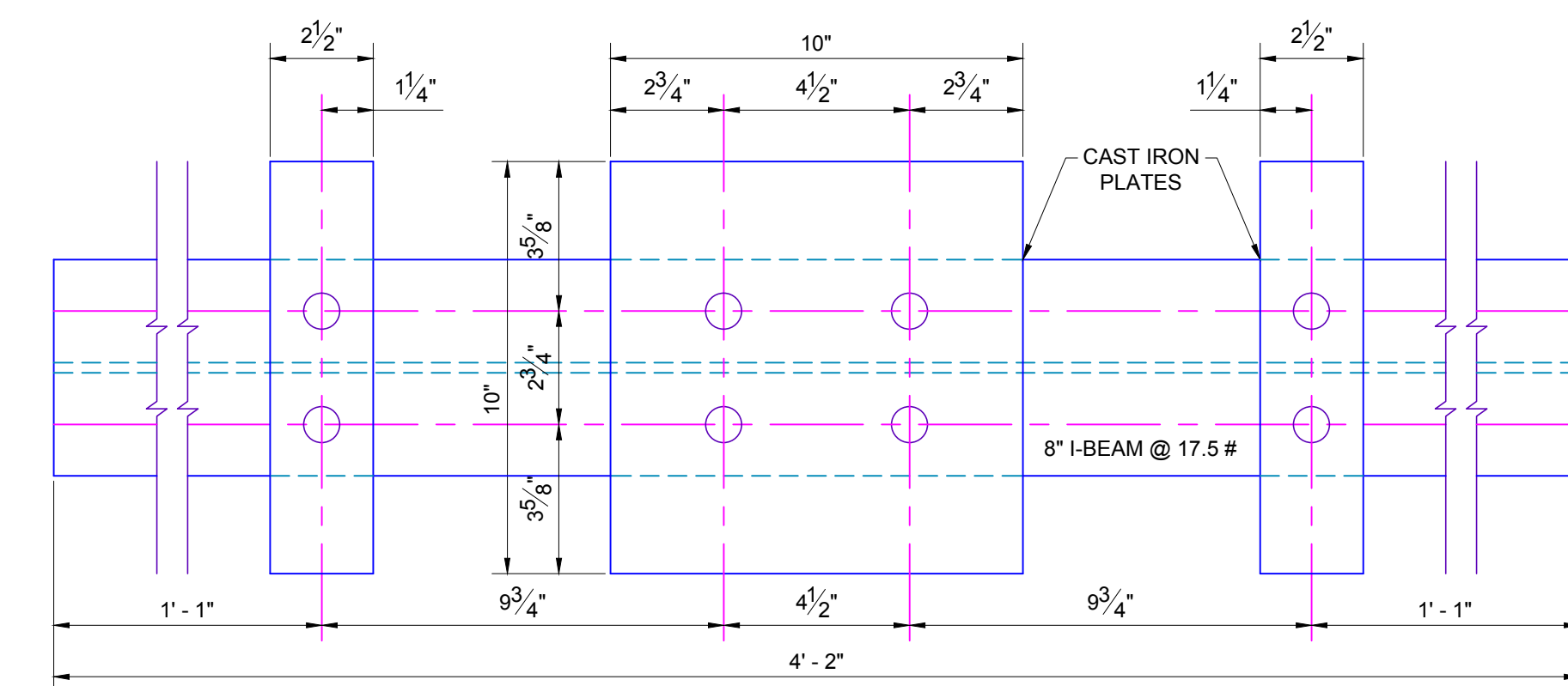
SECTION A-A



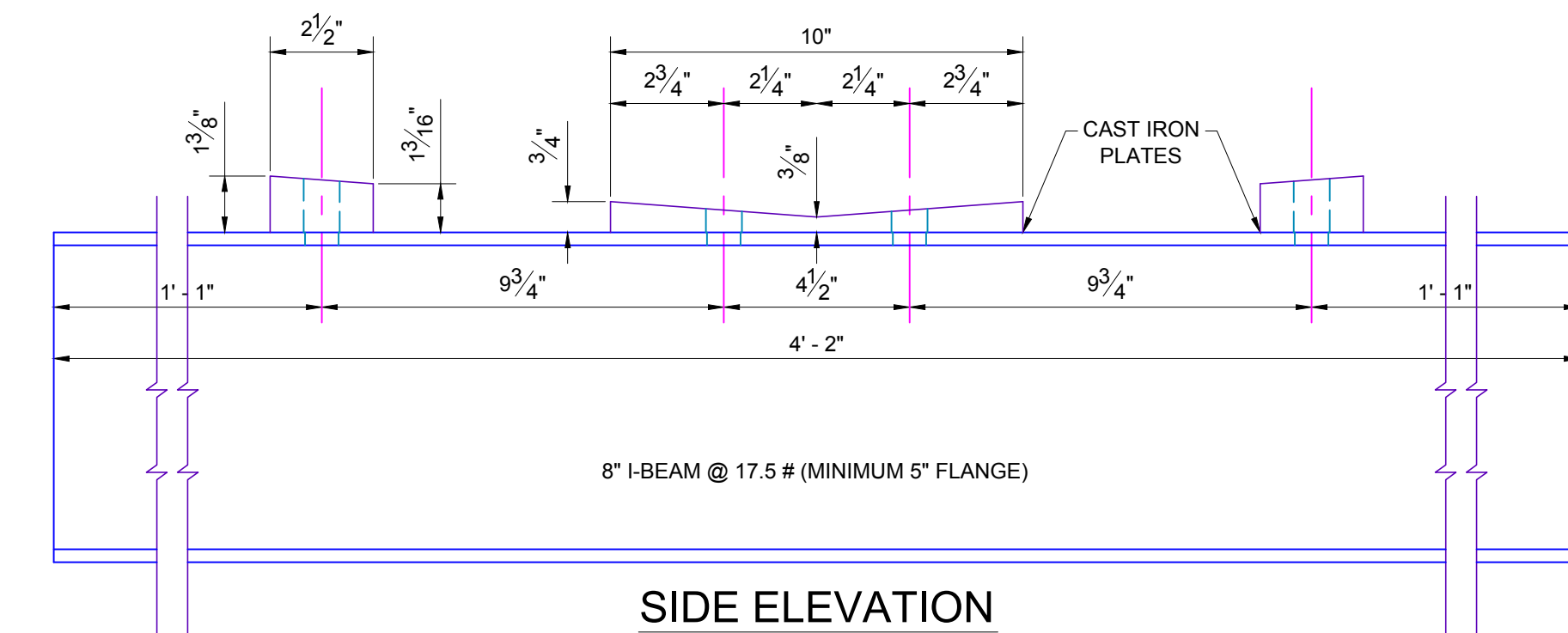
SECTION B-B

STORM SEWER INLET FRAME

TYPE "D" & TYPE "A"



PLAN

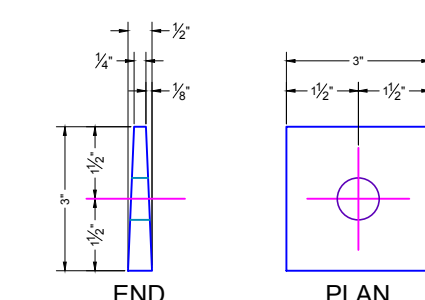


8" I-BEAM @ 17.5 # (MINIMUM 5" FLANGE)

SIDE ELEVATION

DETAILS OF I-BEAM SUPPORT

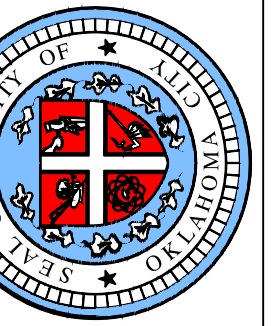
FOR INLET #7 ONLY

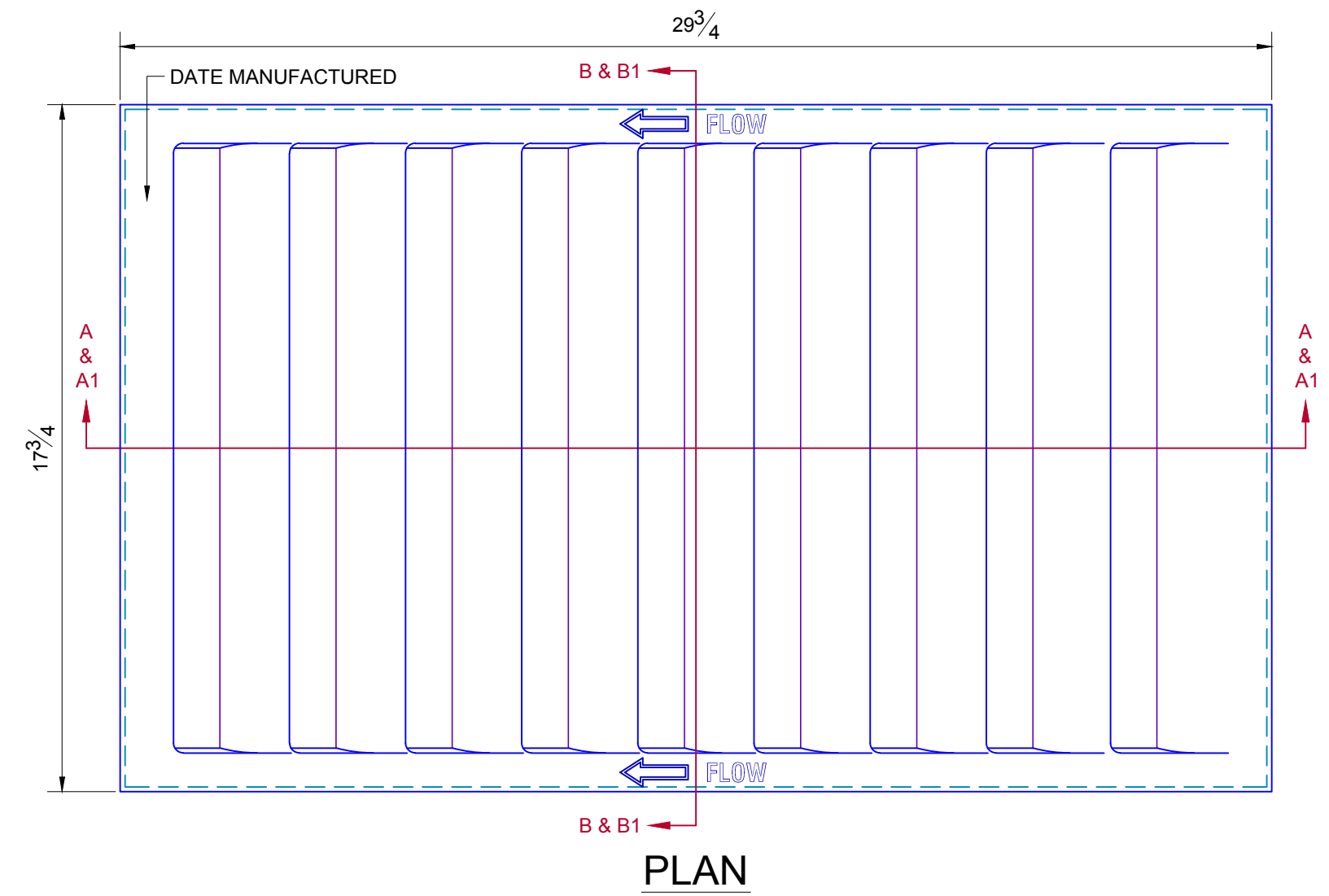


CAST IRON FILLER PLATE FOR USE ON TYPE "D" FRAMES

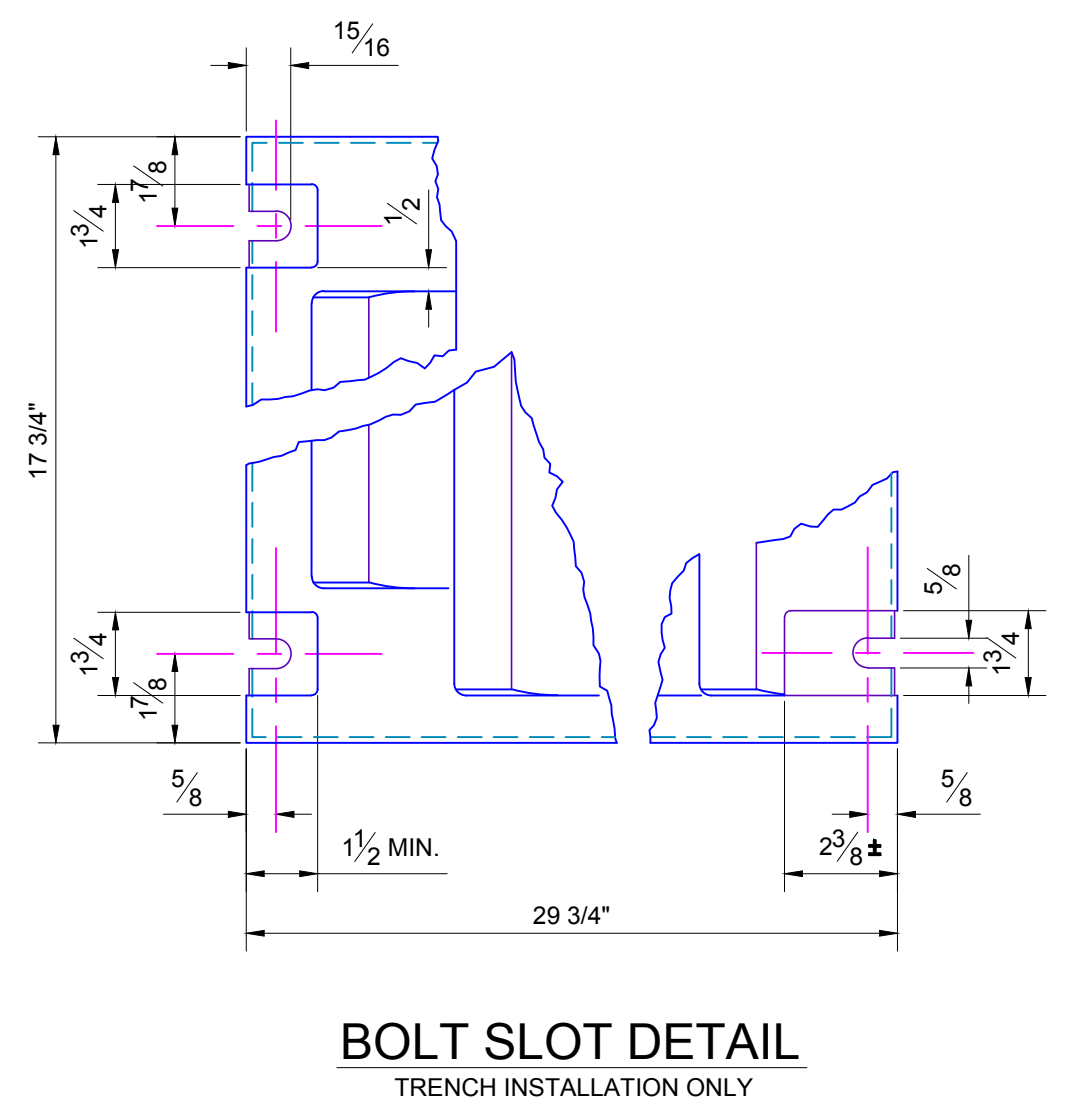
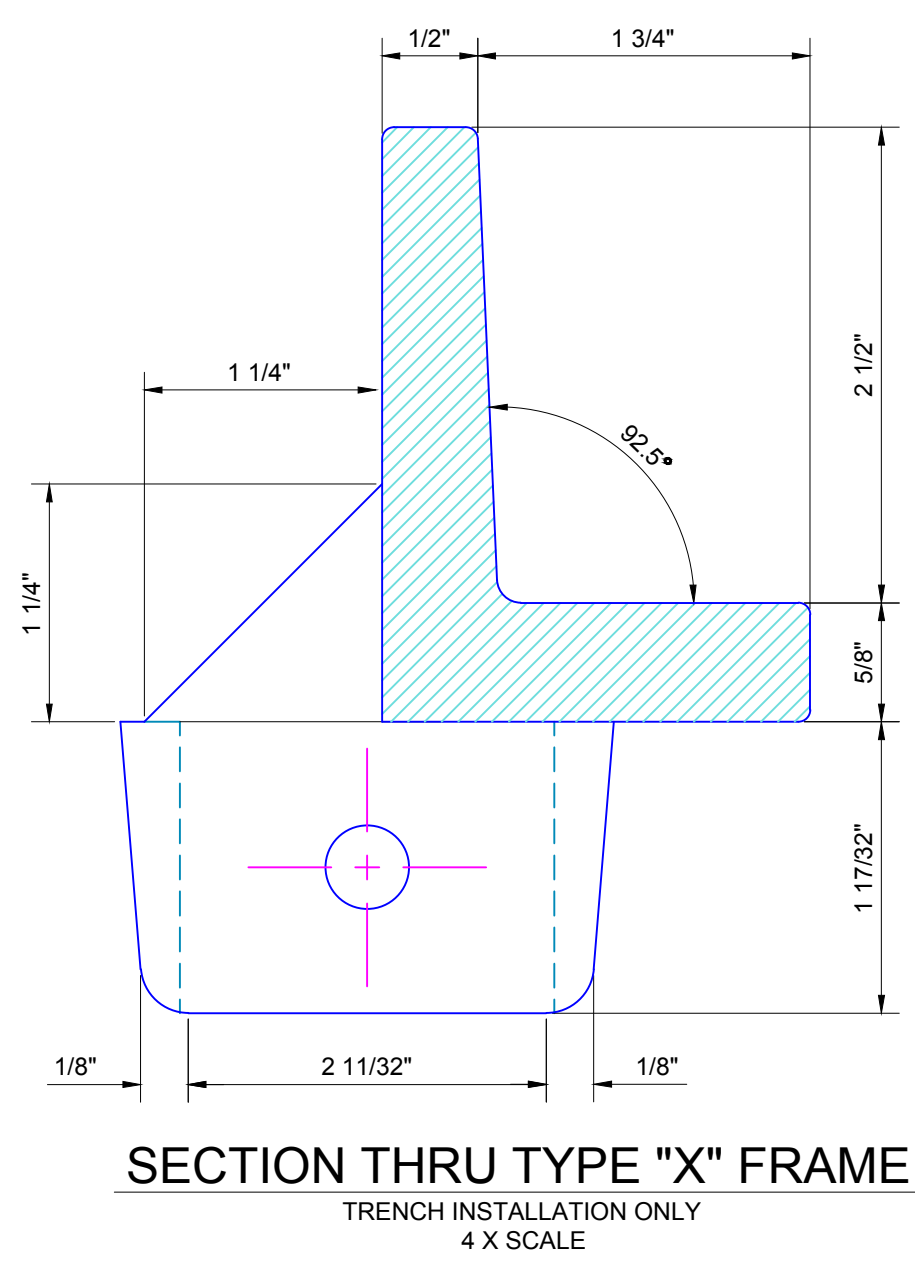
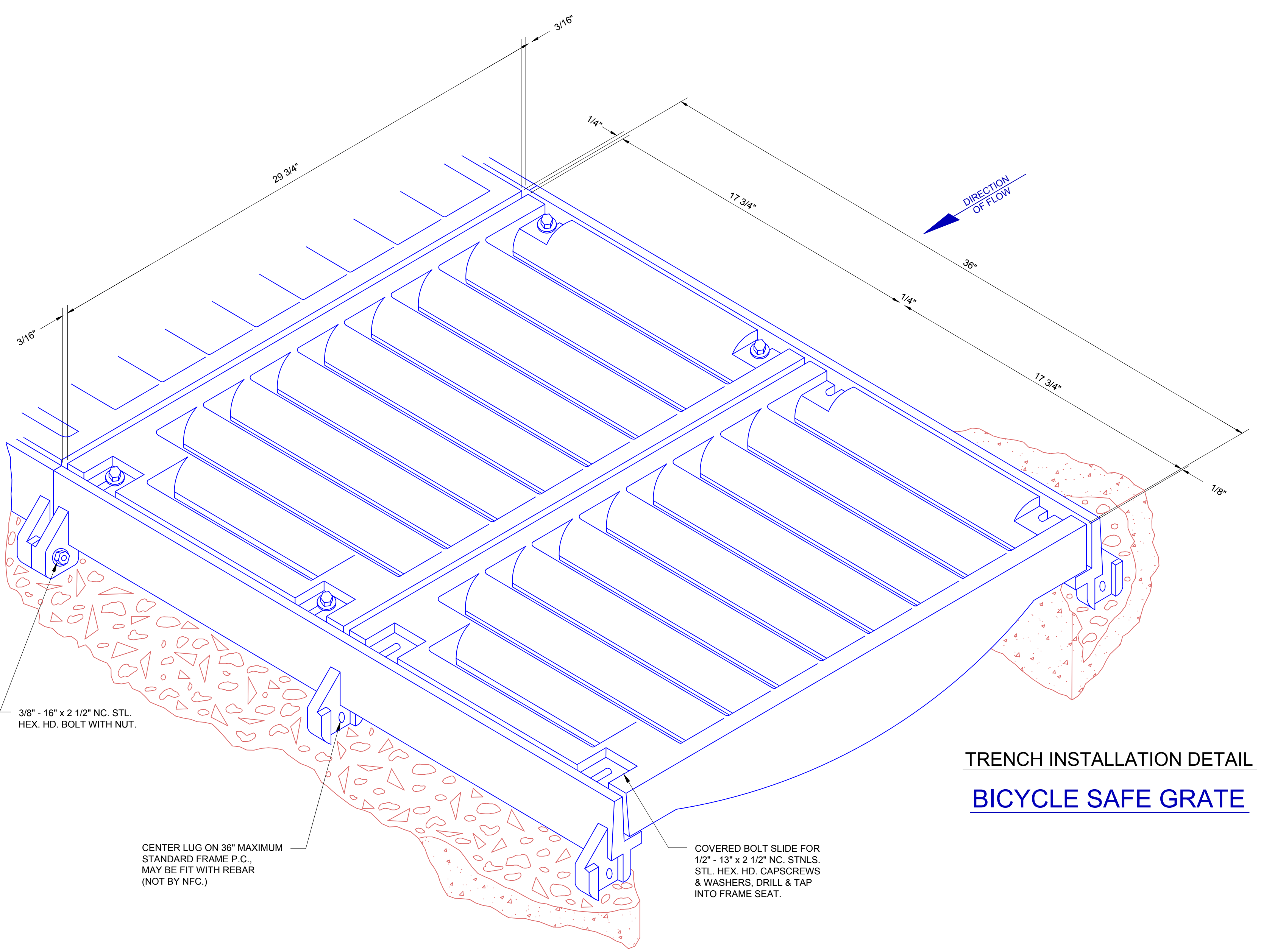
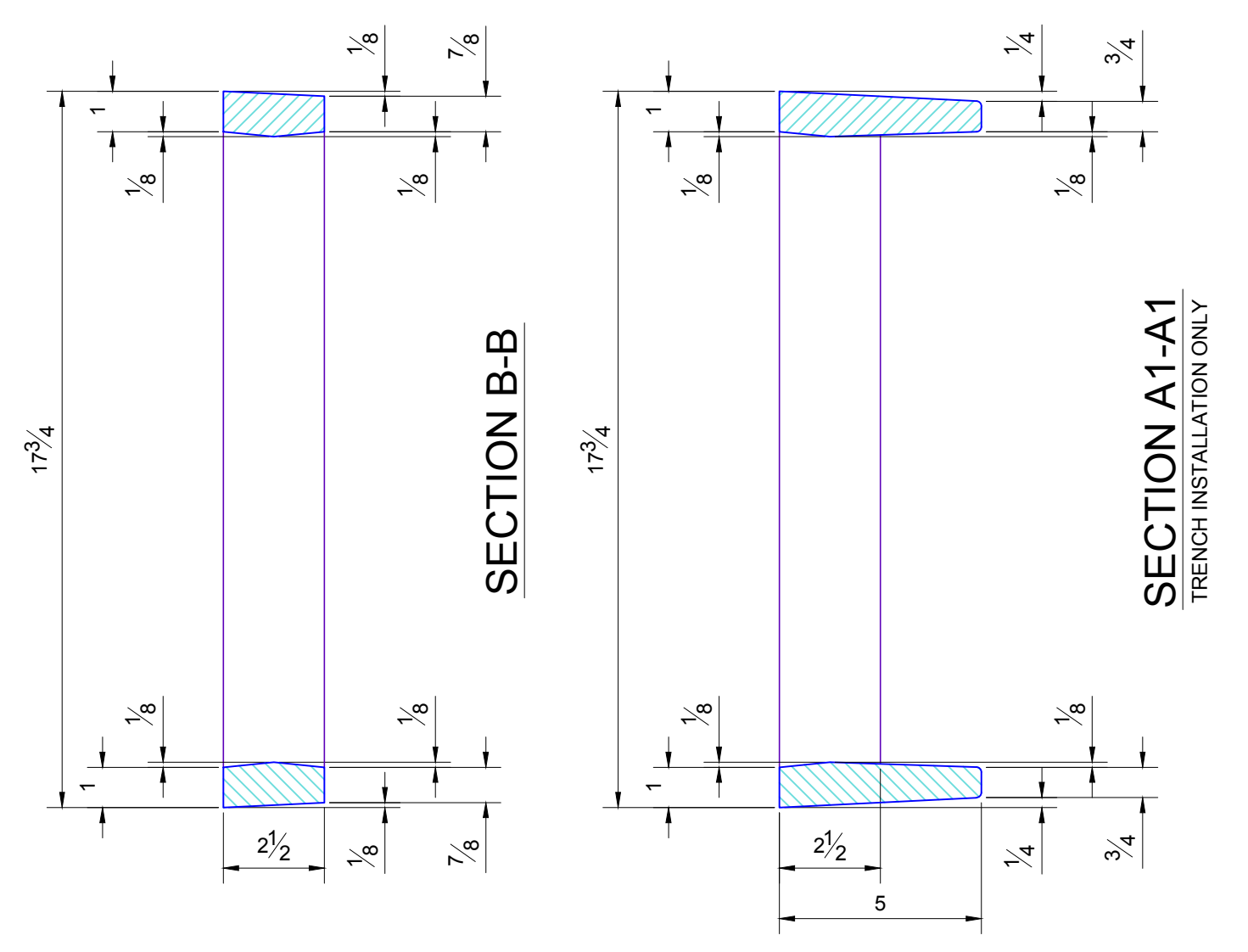
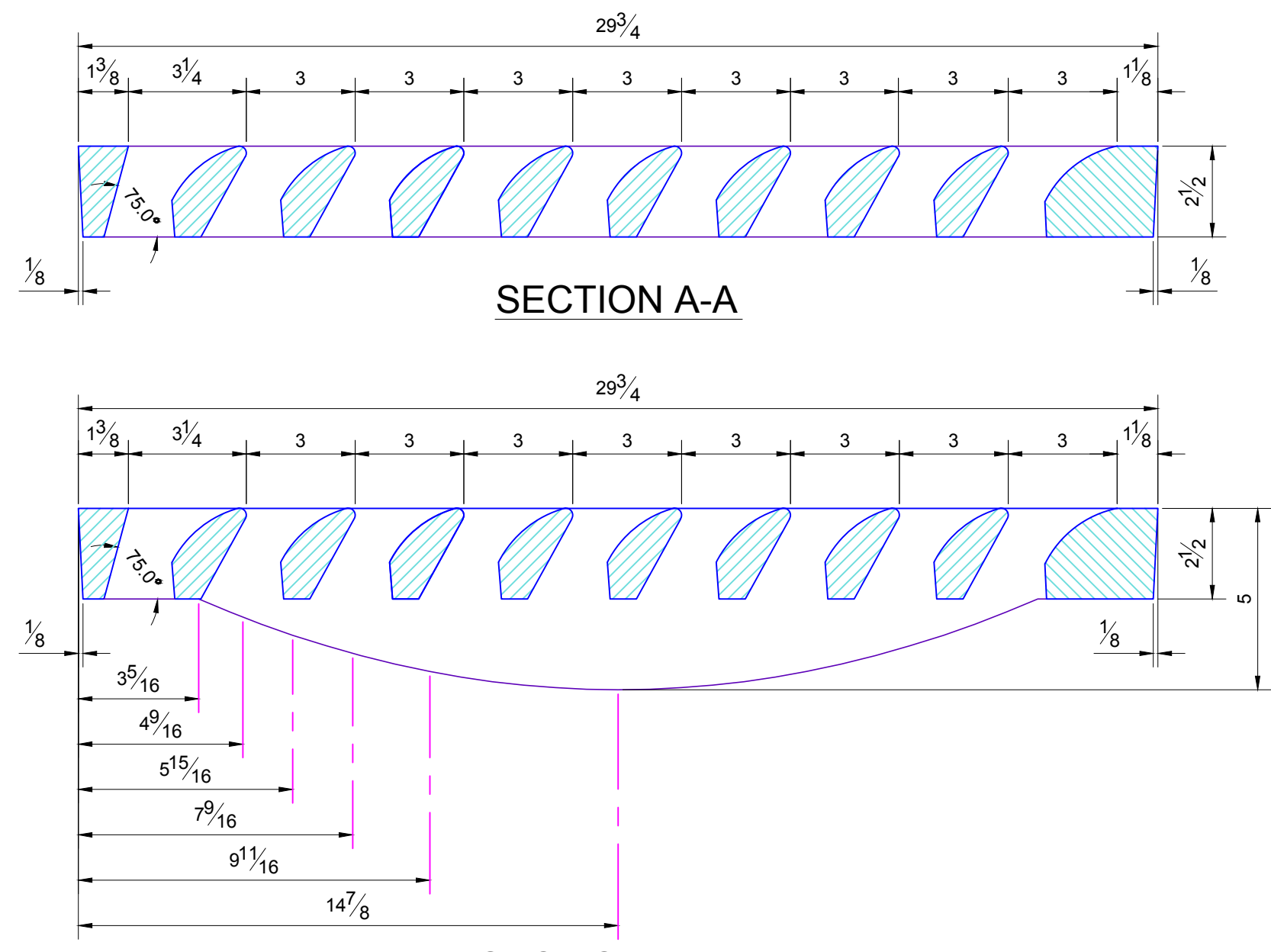
GENERAL NOTES

1. CASTINGS SHALL CONFORM TO THE A.S.T.M. SPECIFICATIONS FOR GRAY IRON CASTINGS SERIAL DESIGNATION A-48-29.
2. NO WELDING OR MARKINGS OF ANY KIND OTHER THAN THOSE SHOWN ON THE PLANS WILL BE PERMITTED ON THESE CASTINGS.
3. TYPE "A" FRAMES DO NOT REQUIRE APERTURNANCES OF ANY KIND.
4. TYPE "D" FRAMES REQUIRE THREE 3/4" x 6" MACHINE BOLTS WITH NUTS AND THREE CAST IRON FILLER PLATES WITH EACH DOUBLE FRAME.
5. THE NUMBER OF I-BEAM SUPPORTS REQUIRED FOR INLET DESIGN #7 IS ONE LESS THAN THE NUMBER OF DOUBLE FRAMES SPECIFIED. FOUR 3/4" x 2 1/2" AND FOUR 3/4" x 3 1/2" MACHINE BOLTS WITH NUTS ARE REQUIRED FOR EACH I-BEAM SUPPORT.
6. TYPE "A" GRATE IS FOR INLET DESIGN #1. TYPE "D" GRATE IS FOR INLET DESIGN #6 & 7.



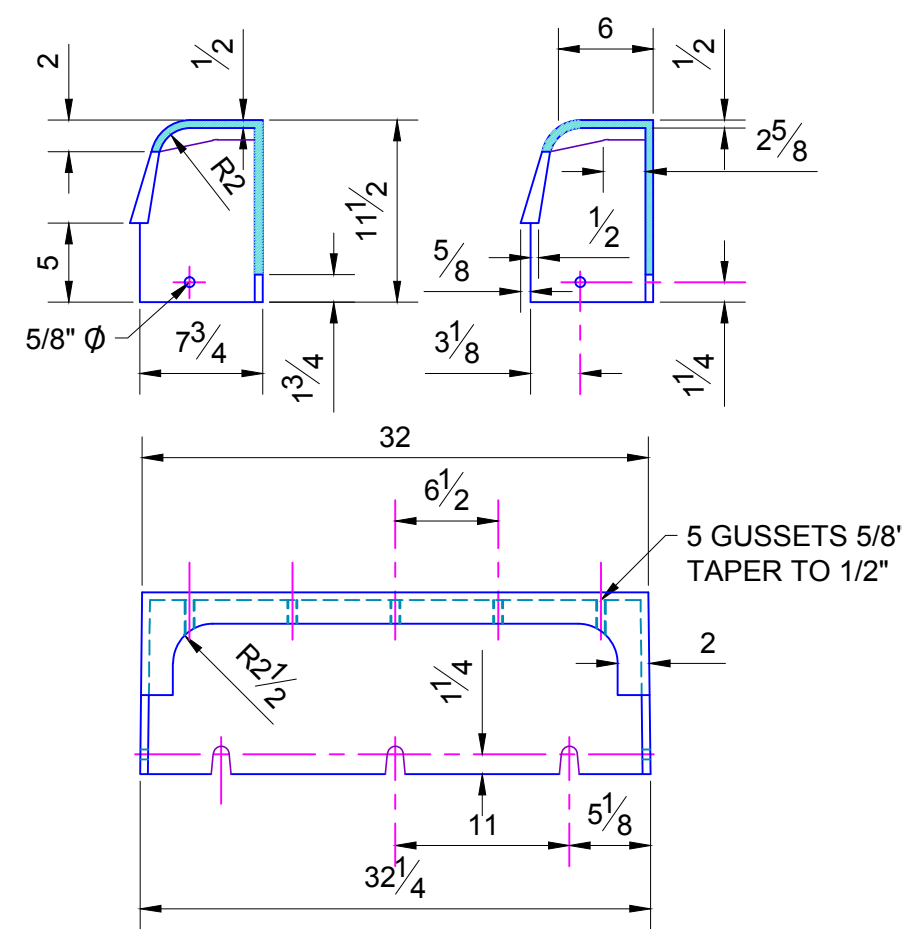


BICYCLE SAFE GRATE



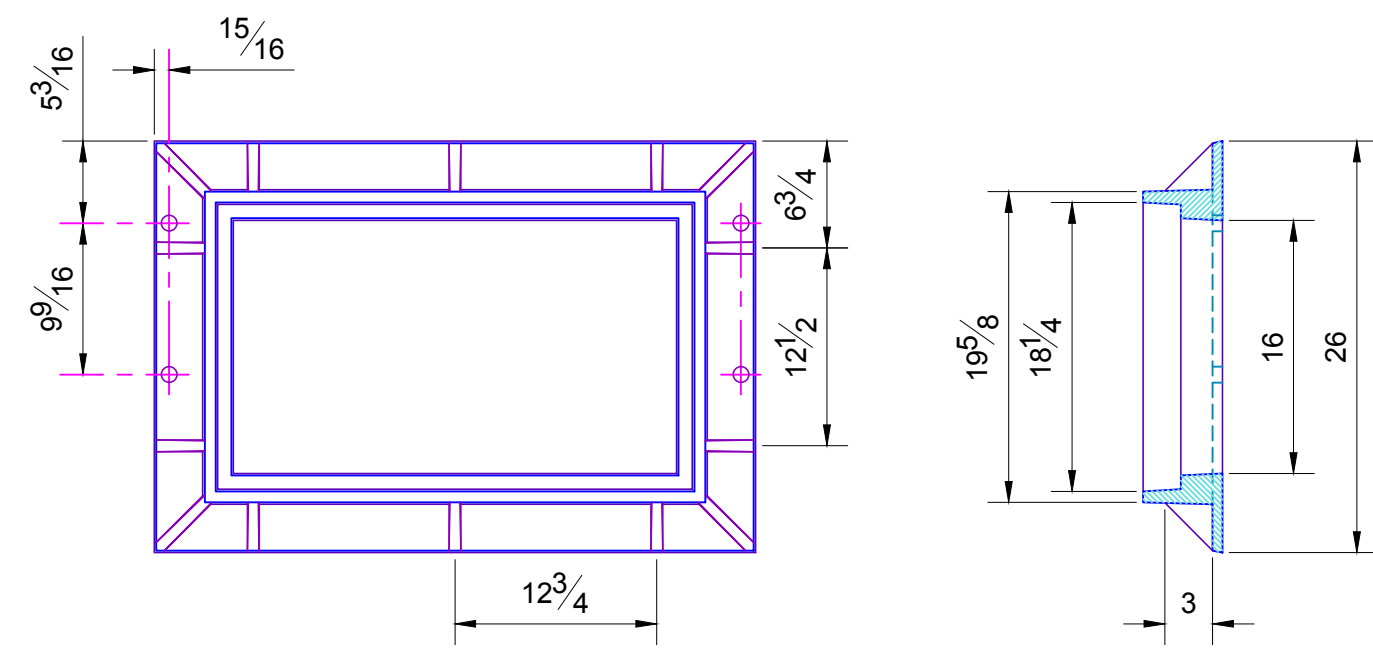
- NOTES:
1. ALL CONSTRUCTION METHODS & MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE CURRENT SPECIFICATIONS.
 2. SHARP EDGES RESULTING FROM FABRICATION SHALL BE DULLED BY ANY ACCEPTABLE METHOD FOR SAFETY IN HANDLING.
 3. GRATES SHALL BE INSTALLED IN FRAME WITH FLOW ARROW POINTING DOWNSTREAM OR TOWARD THE LOW POINT IN A SUMP.
 4. CAST GRATES SHALL BE OF DUCTILE IRON CONTAINING THE REQUIREMENTS OF ASTM A-536, GRADE 65-45-12, OR OF GRAY IRON CONFORMING TO THE REQUIREMENTS OF AASHTO M-105 (OR ASTM - A-480, CASE 35B.)
 5. FERROUS CASTINGS SHALL BE OF UNIFORM QUALITY, FREE OF BLOWHOLES, POROSITY, HARDSPOTS, SHRINKAGE DISTORTION OR OTHER DEFECTS.
 6. CASTINGS SHALL BE SMOOTH & WELL CLEANED BY SHOT BLASTING OR OTHER APPROVED CLEANING.
 7. ALL CASTINGS SHALL BE MANUFACTURED TRUE TO PATTERN. COMPONENT PARTS SHALL FIT TOGETHER IN A SATISFACTORY MANNER.
 8. ALL LETTERING SHALL BE RECESSED 1/16". REFERENCE NF-29927M NF-21808, & ORIGINAL REFERENCE 2669.

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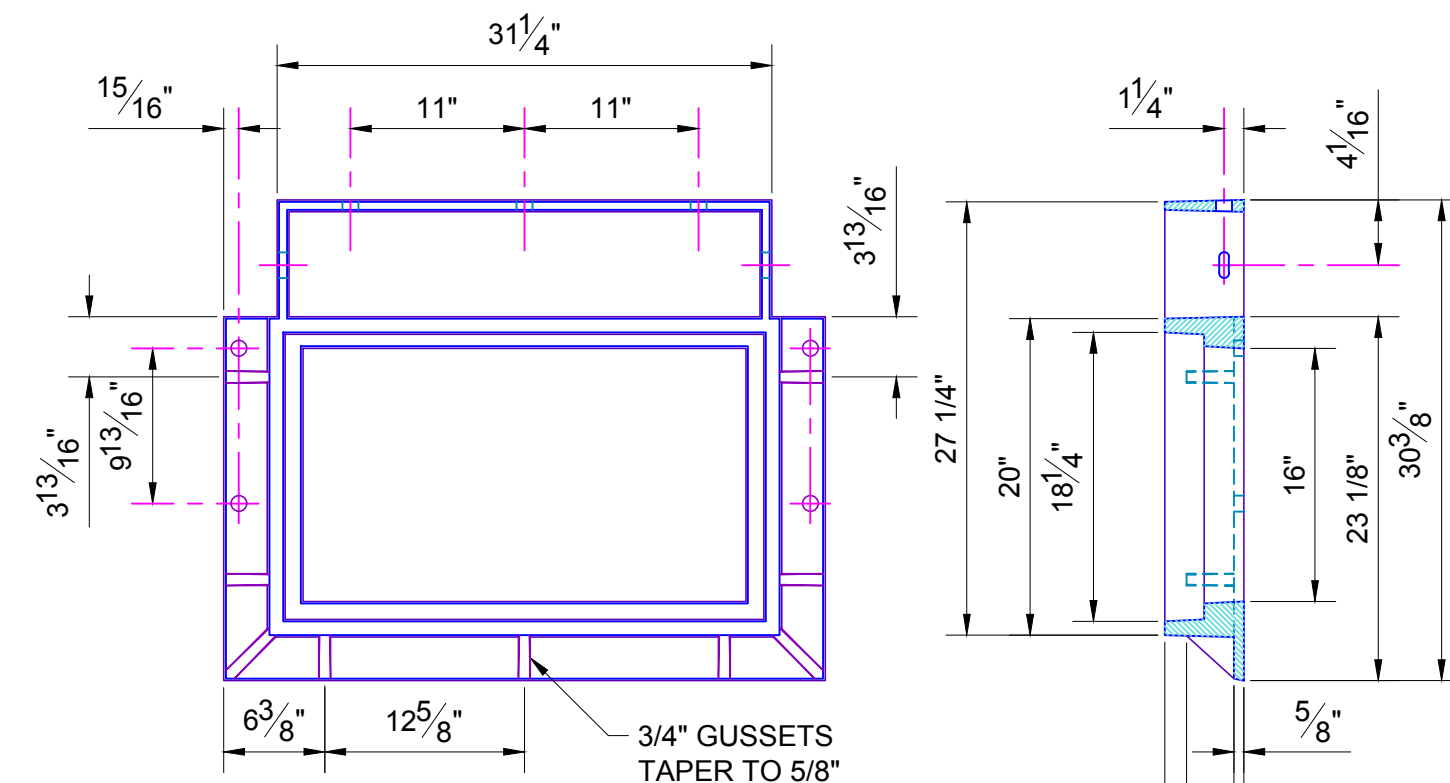
- NOTES:
 1. MATERIAL: CAST GRAY IRON, ASTM A-48, CLASS 35B
 2. FINISH: NO PAINT
 3. WEIGHT: 105 LBS.

BARRIER CURB 11 1/2"



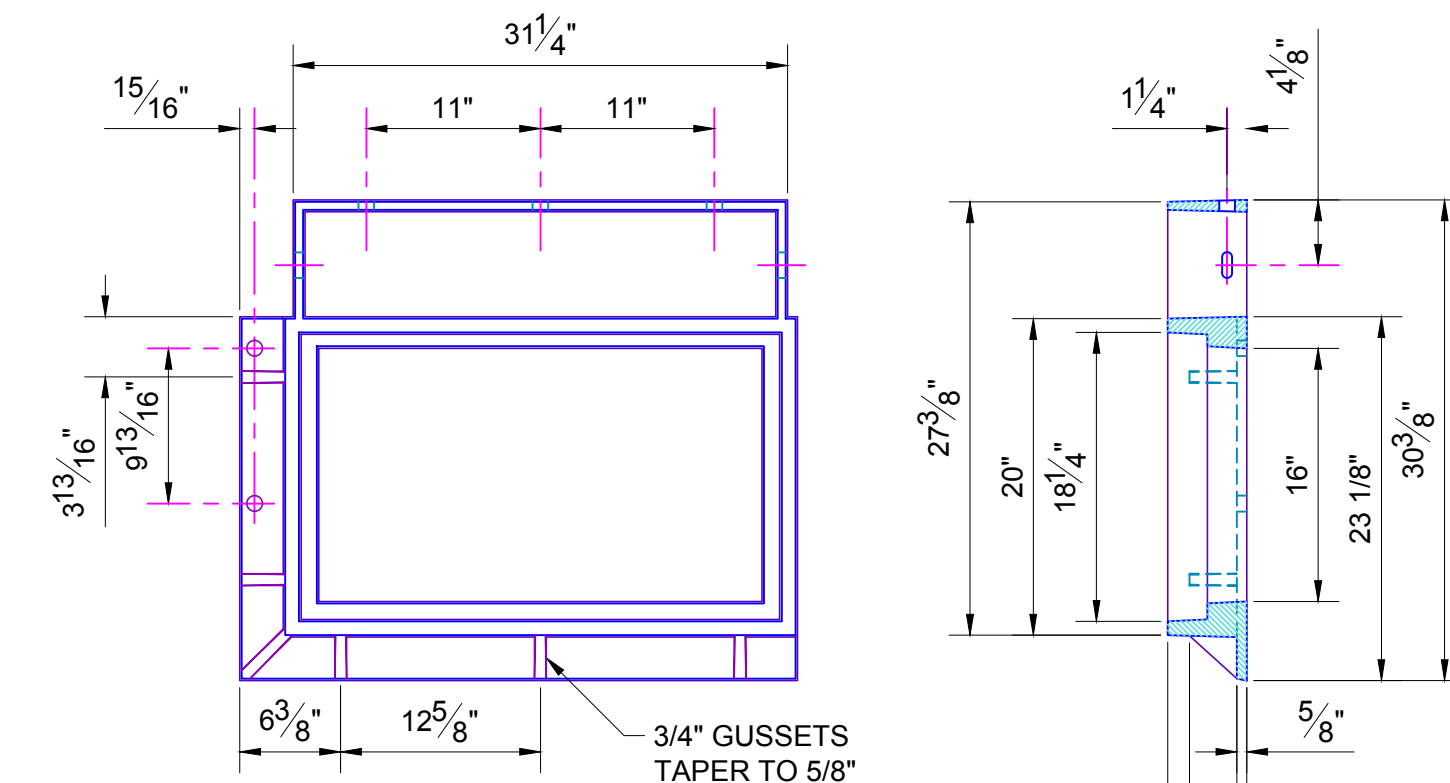
- NOTES:
 1. TOTAL OPEN AREA OF GRATE IN 216 SQUARE INCHES.
 2. MATERIAL: CAST GRAY IRON, ASTM A48-94A, CLASS 35B.
 3. FINISH: NO PAINT
 4. WEIGHT: 242 LBS.

CATCH BASIN INLET FRAME



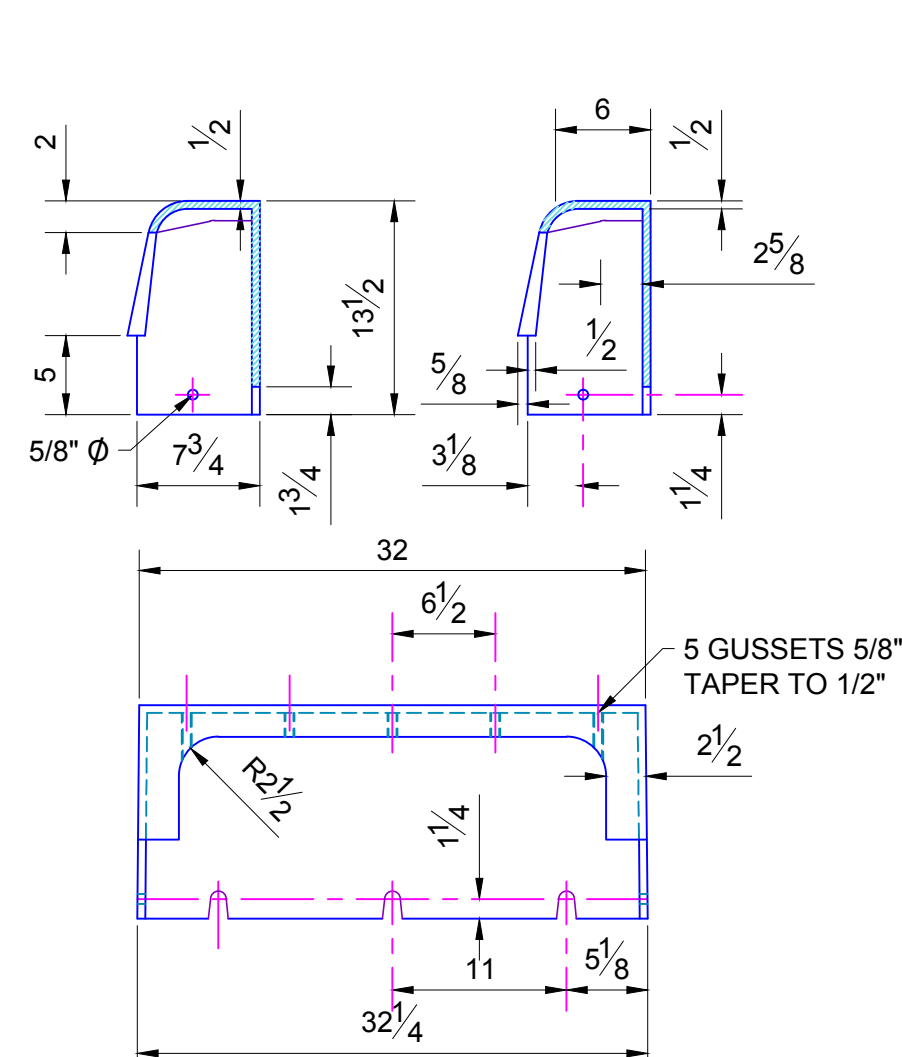
- NOTES:
 1. TOTAL OPEN AREA OF GRATE IN 216 SQUARE INCHES.
 2. MATERIAL: CAST GRAY IRON, ASTM A48, CLASS 35B.
 3. FINISH: NO PAINT
 4. WEIGHT: 295 LBS.

INLET CURB FRAME



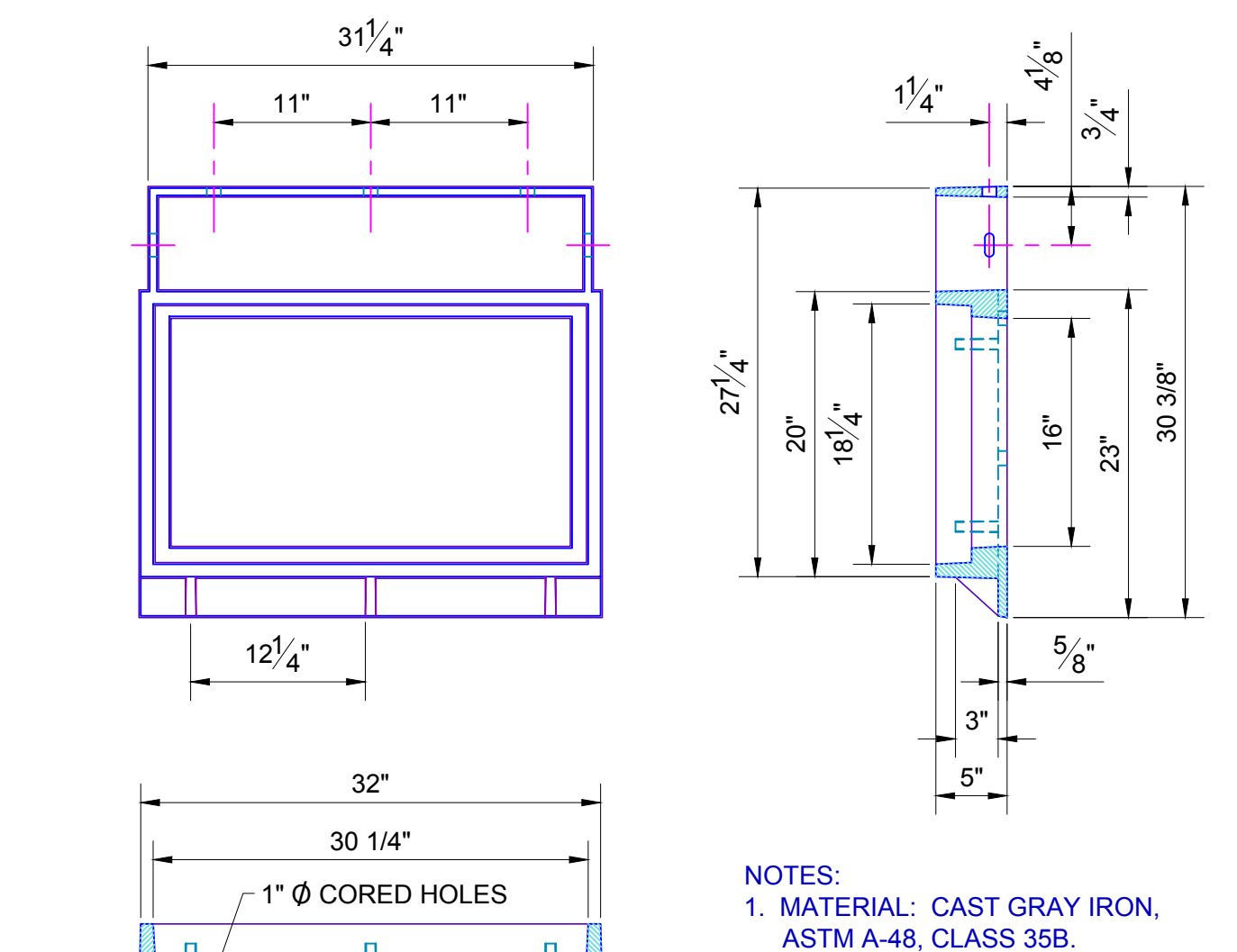
- NOTES:
 1. TOTAL OPEN AREA OF GRATE IN 216 SQUARE INCHES.
 2. MATERIAL: CAST GRAY IRON, ASTM A48, CLASS 35B.
 3. FINISH: NO PAINT
 4. WEIGHT: 278 LBS.

INLET CURB FRAME FOR MULTIPLE INLET



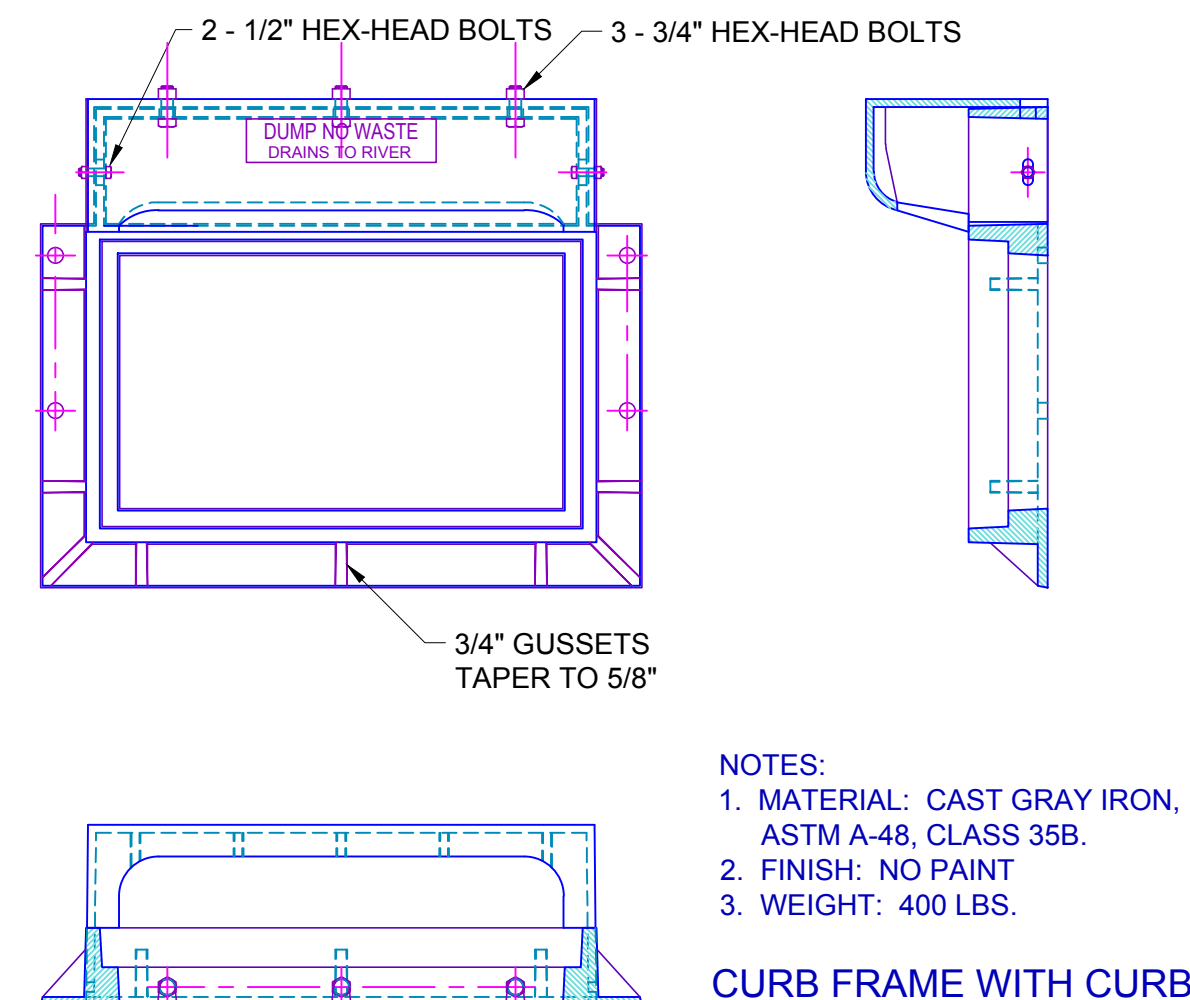
- NOTES:
 1. MATERIAL: CAST GRAY IRON, ASTM A-48, CLASS 35B
 2. FINISH: NO PAINT
 3. WEIGHT: 112 LBS.

BARRIER CURB 13 1/2"



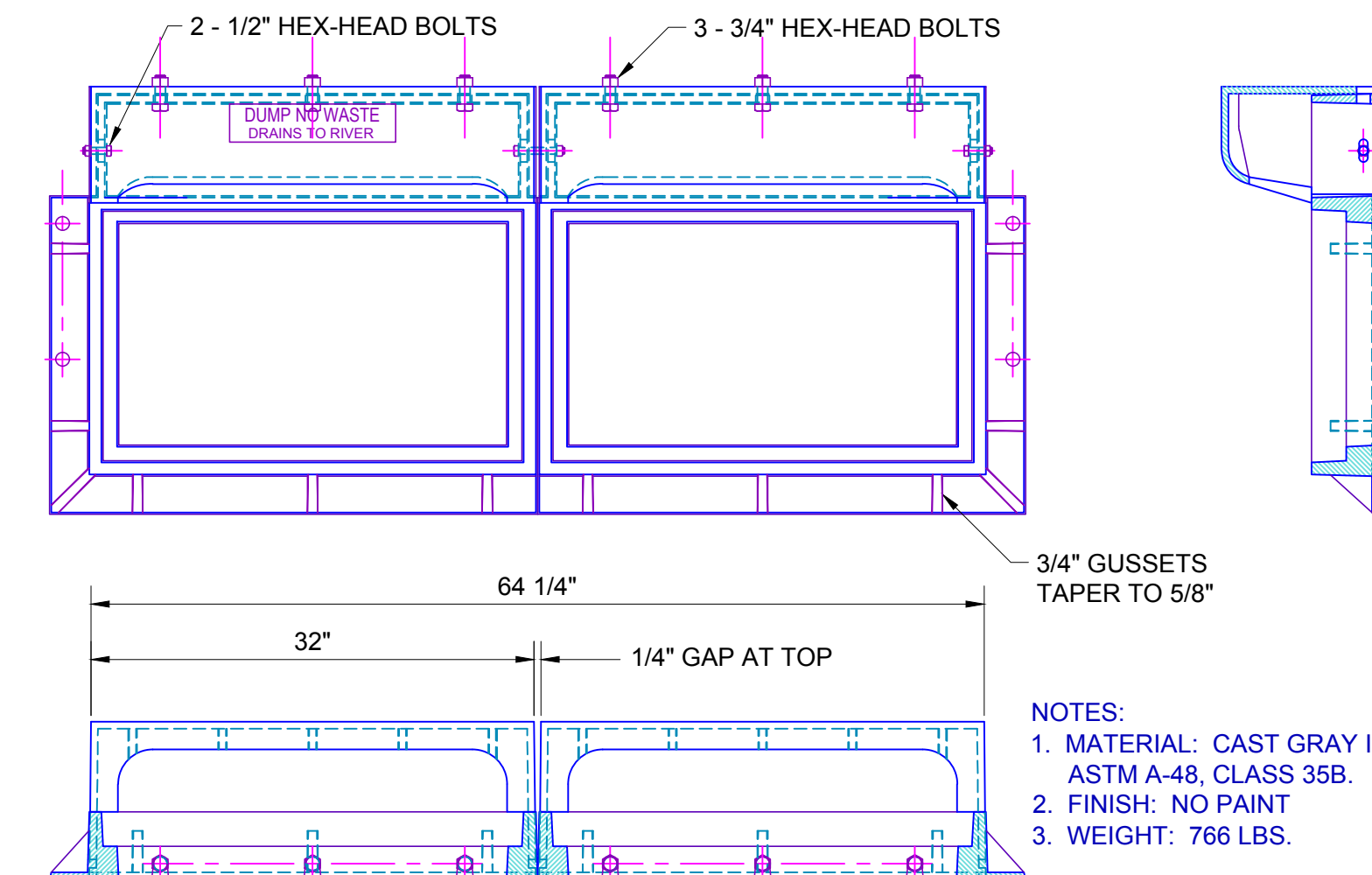
- NOTES:
 1. MATERIAL: CAST GRAY IRON, ASTM A-48, CLASS 35B.
 2. FINISH: NO PAINT
 3. WEIGHT: 261 LBS.

INLET CURB FRAME FOR MULTIPAL INLET



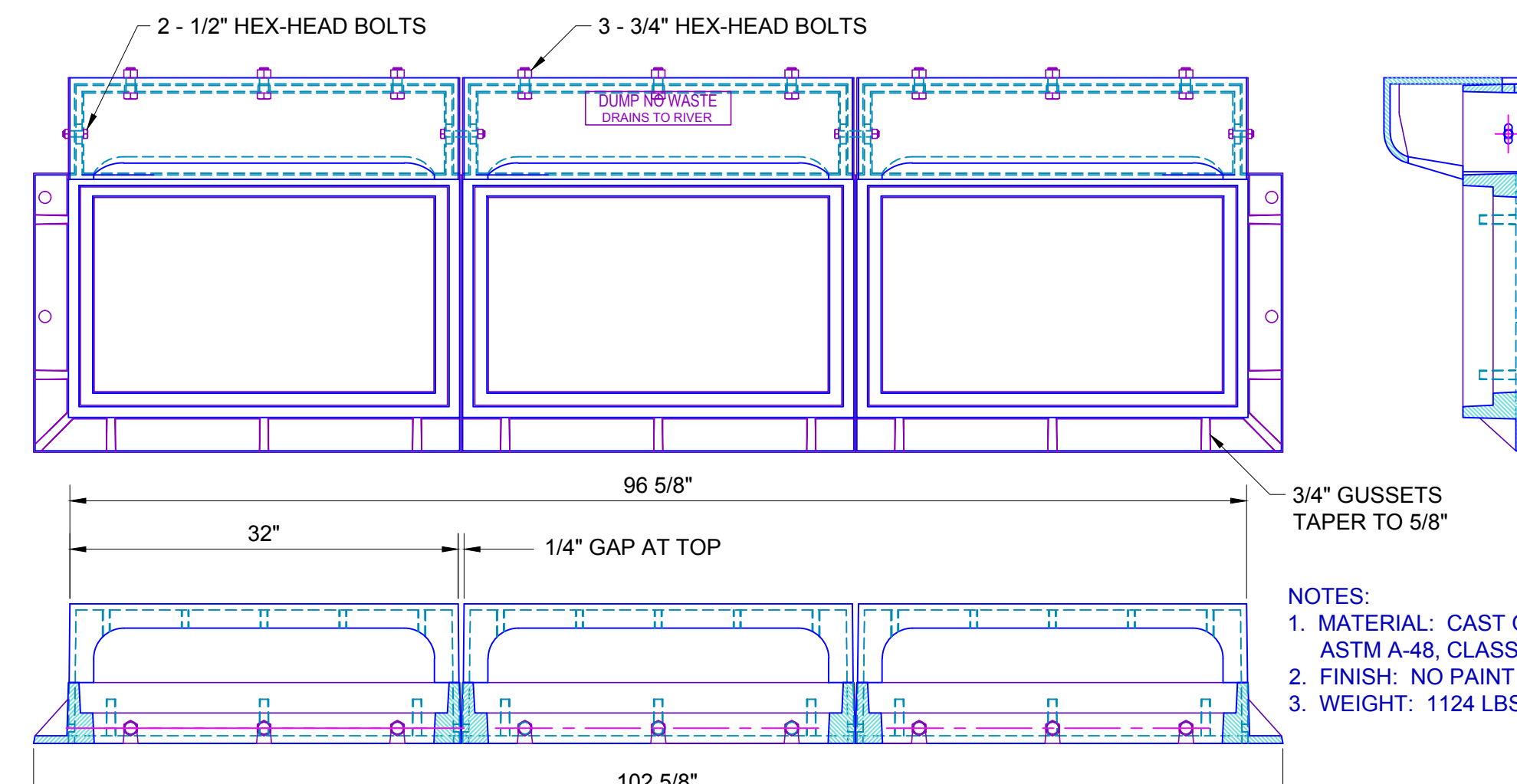
- NOTES:
 1. MATERIAL: CAST GRAY IRON, ASTM A-48, CLASS 35B.
 2. FINISH: NO PAINT
 3. WEIGHT: 400 LBS.

CURB FRAME WITH CURB



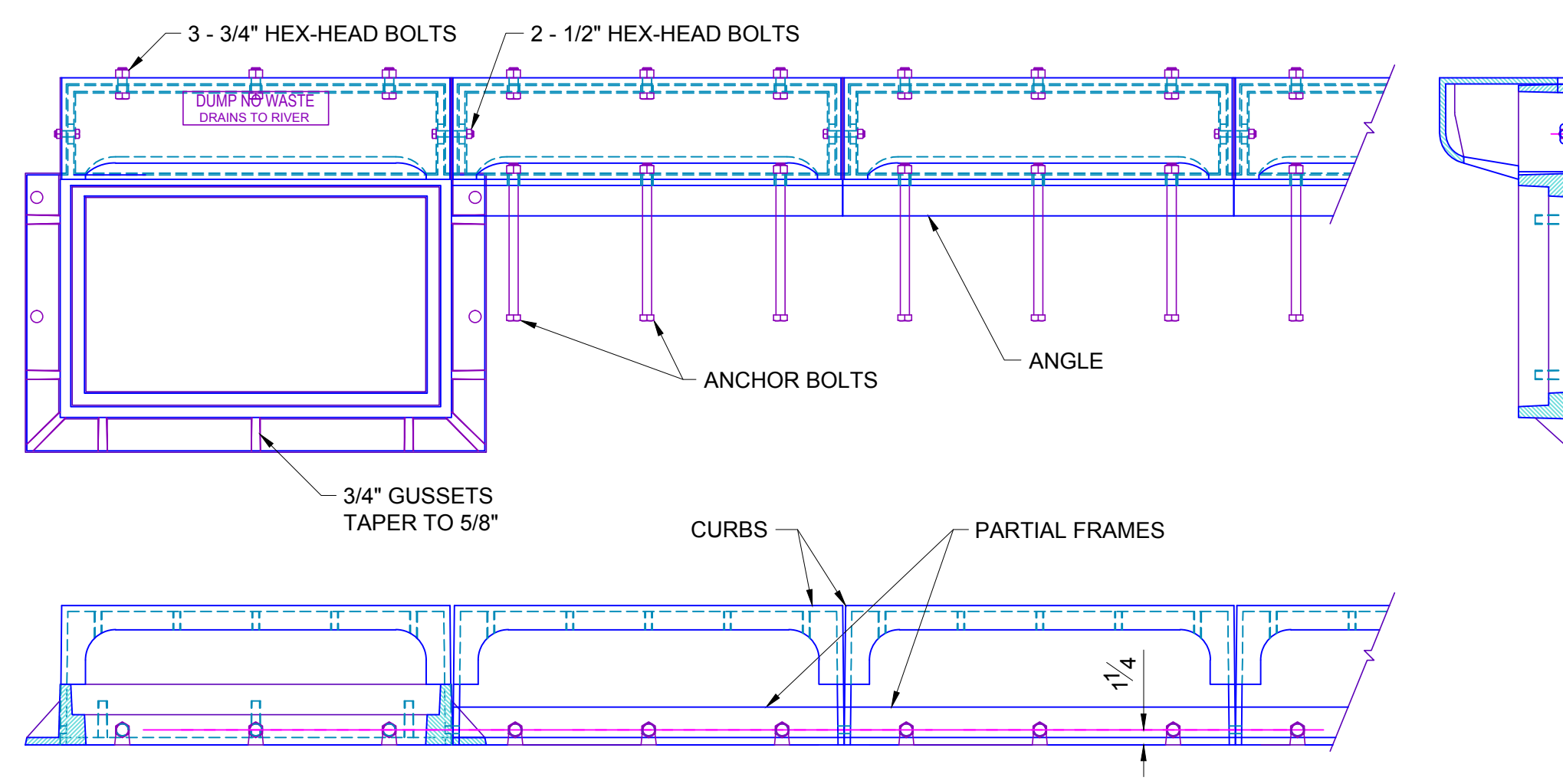
- NOTES:
 1. MATERIAL: CAST GRAY IRON, ASTM A-48, CLASS 35B.
 2. FINISH: NO PAINT
 3. WEIGHT: 766 LBS.

DOUBLE INLET CURB FRAME



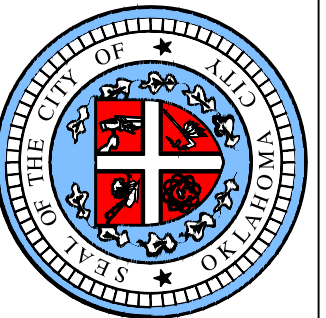
- NOTES:
 1. MATERIAL: CAST GRAY IRON, ASTM A-48, CLASS 35B.
 2. FINISH: NO PAINT
 3. WEIGHT: 1124 LBS.

CATCH BASIN INLET FRAME



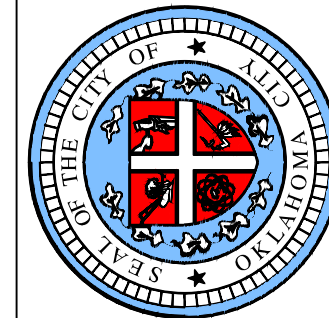
ONE CURB FRAME WITH MULTIPLE CURB INLETS

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APPROVED BY: DATE: 02-01-13
 ERIC J. WENGER, P.E.
 CITY ENGINEER
 DRAWN: VSC
 DATE: 02-01-13

**CURB / CATCH BASIN
 INLET FRAME DETAILS**

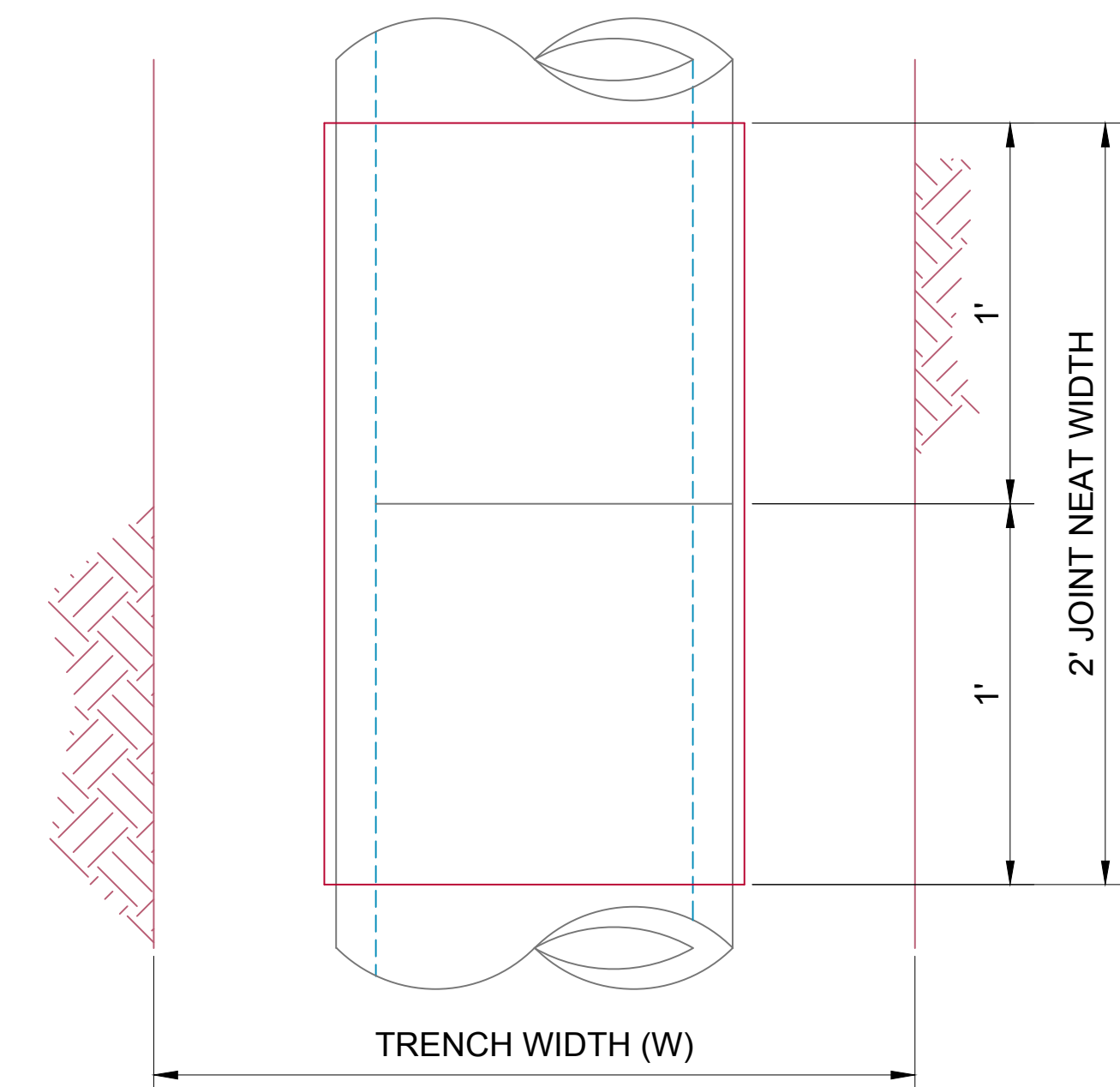
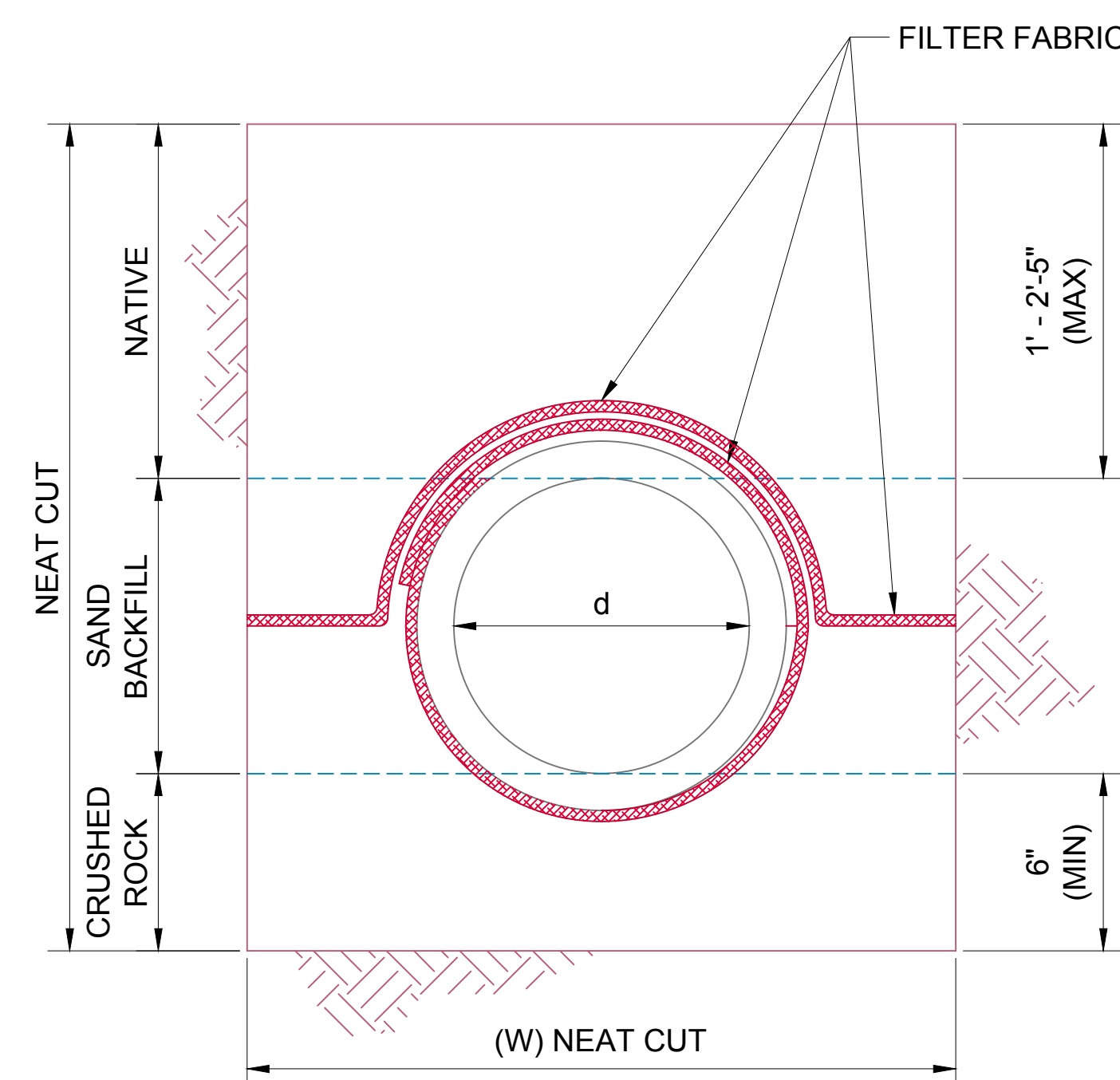
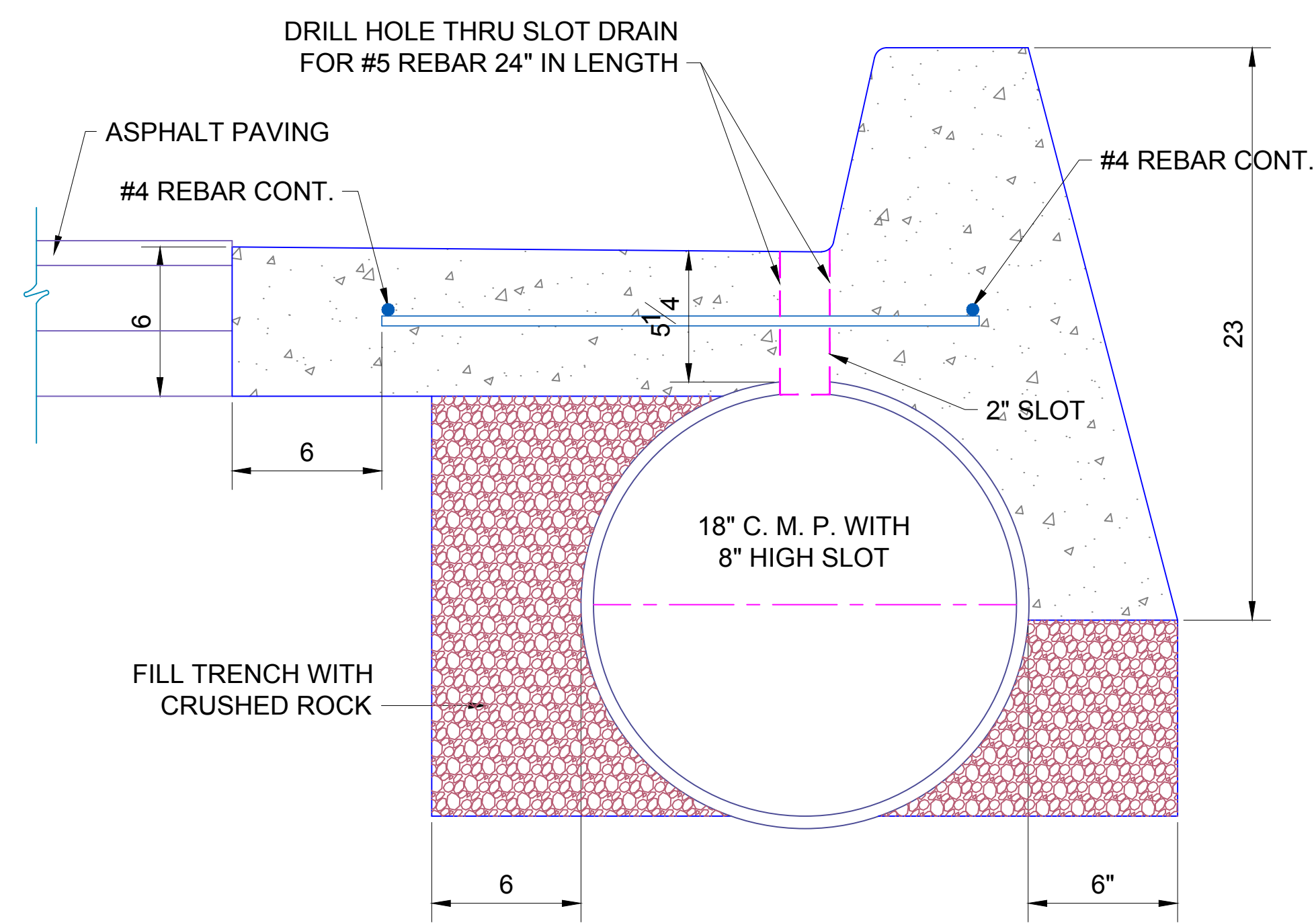
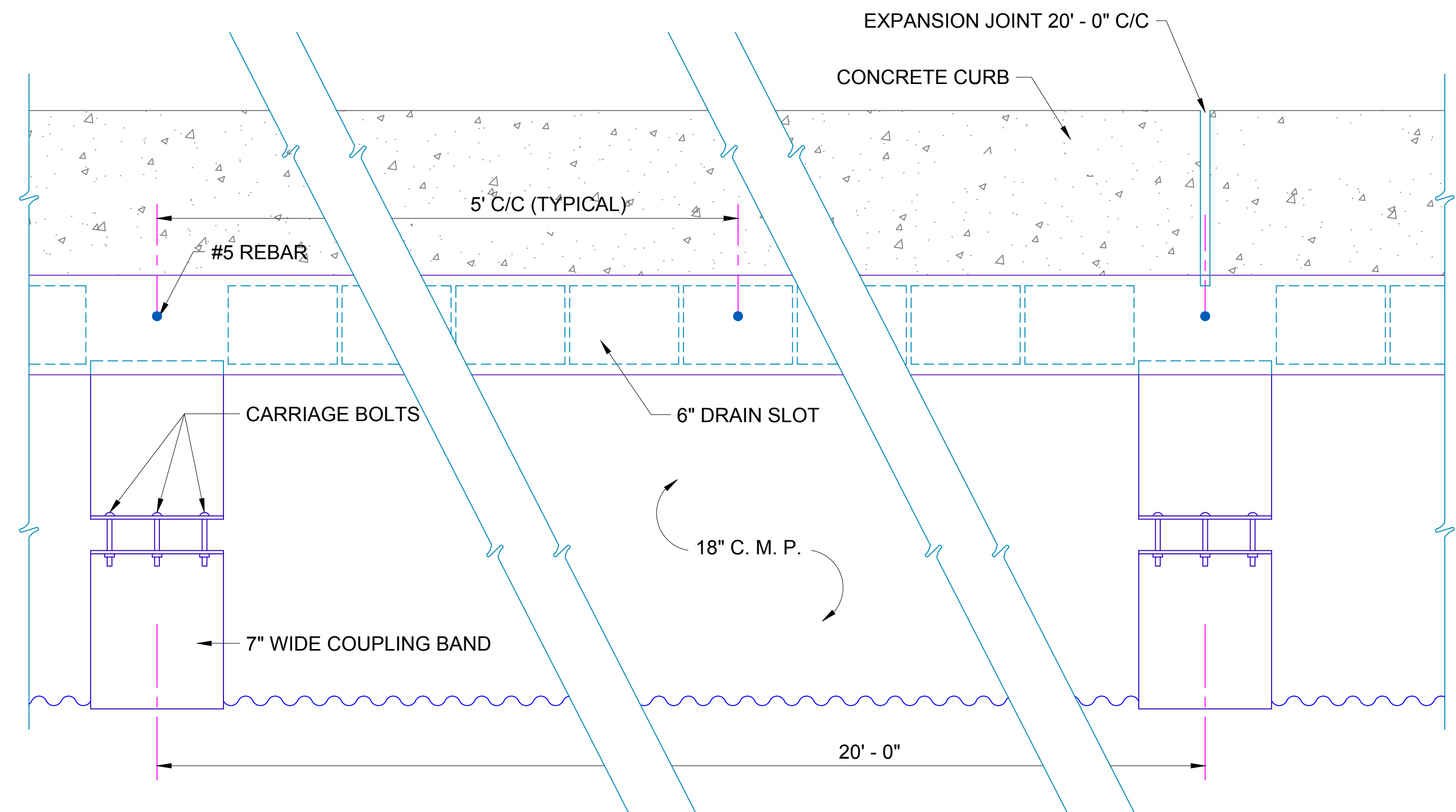
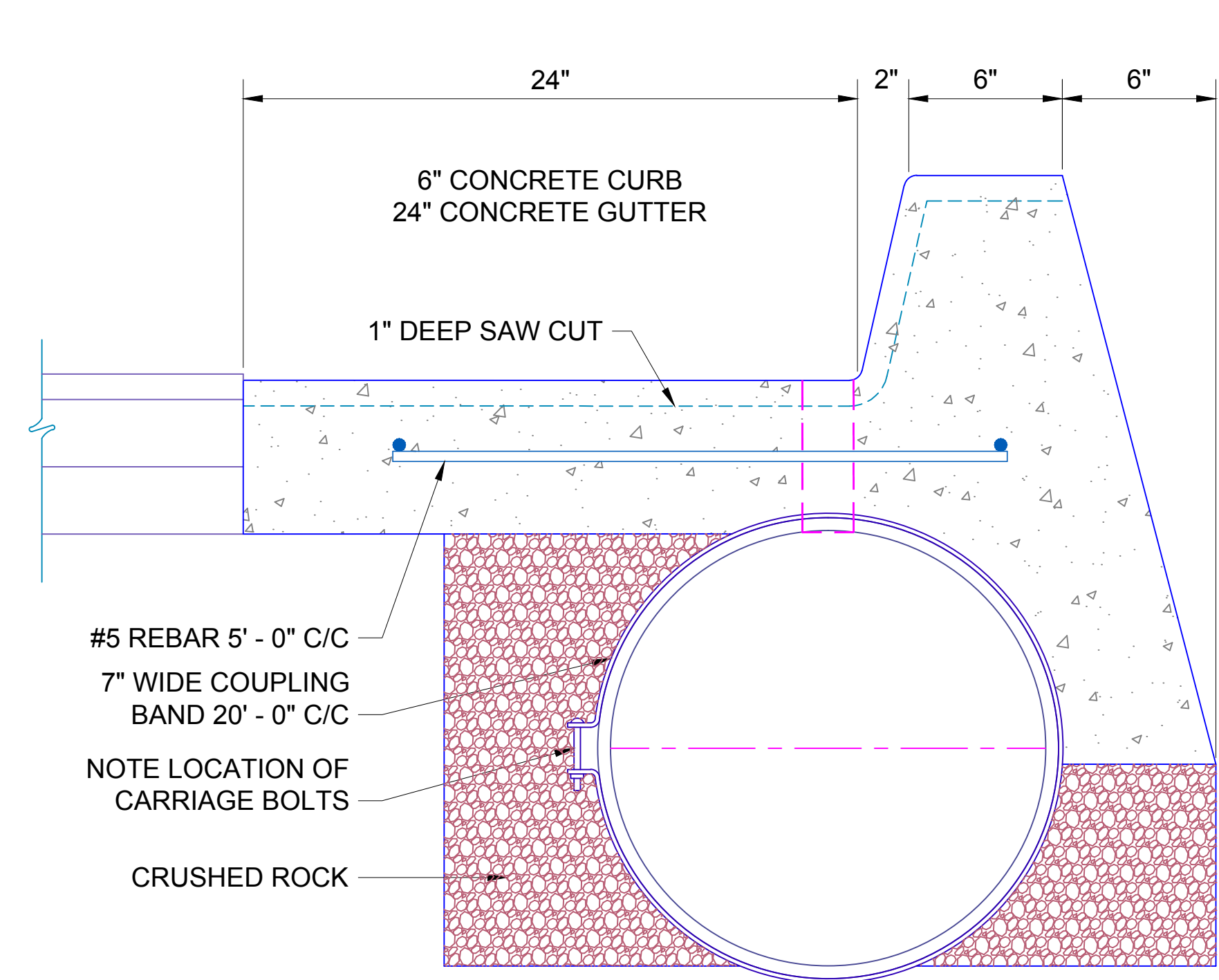


APPROVED BY: DATE: 02-01-13
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: VSC
DATE: 02-01-13

**SLOTTED DRAIN INLET &
TRENCH WIDTH PIPE WARPING
FOR STORM SEWER**

Drawing Number
D-110



SECTION

PLAN VIEW

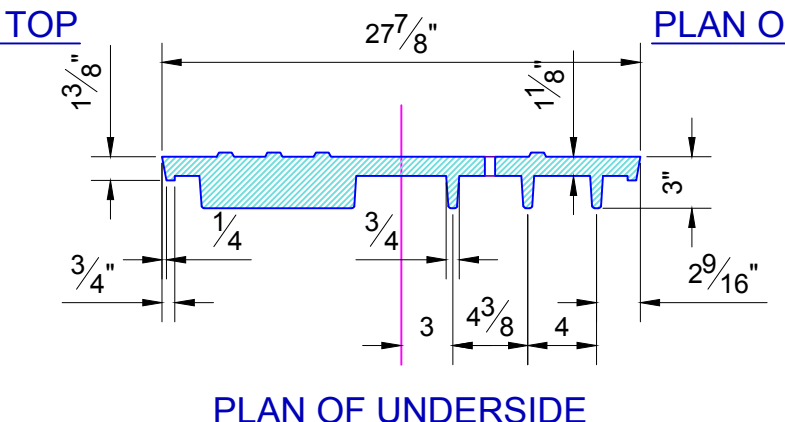
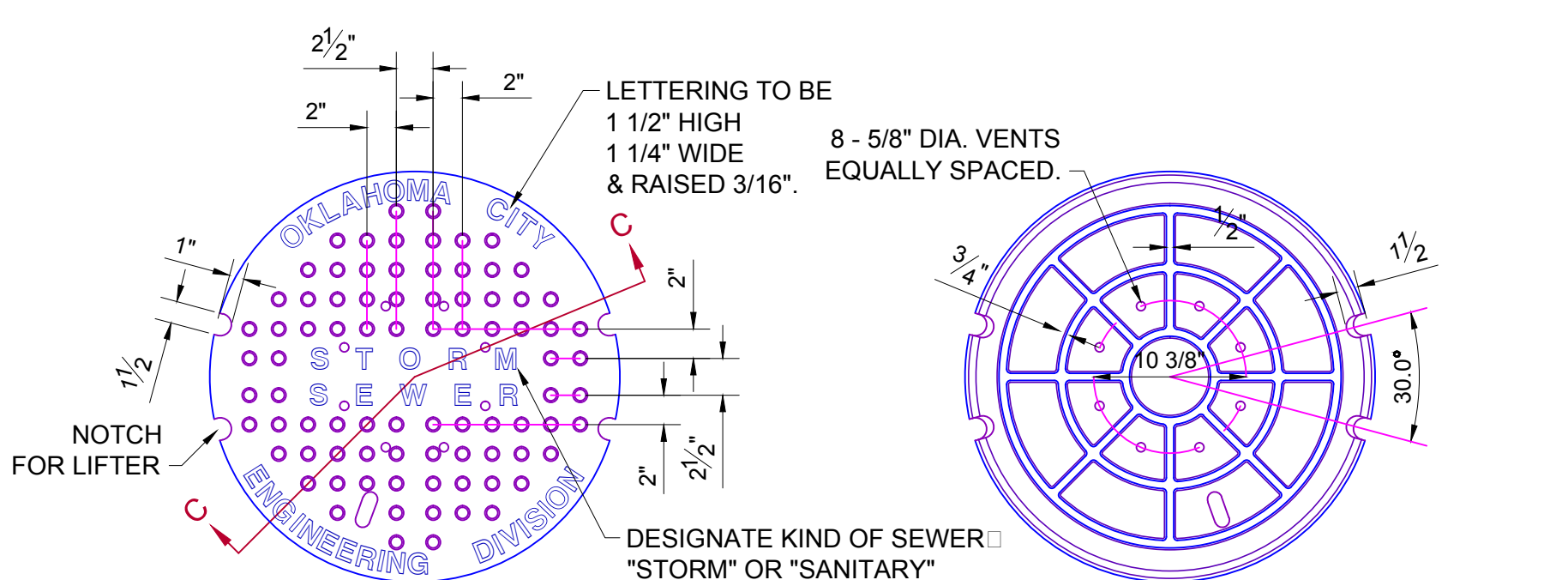
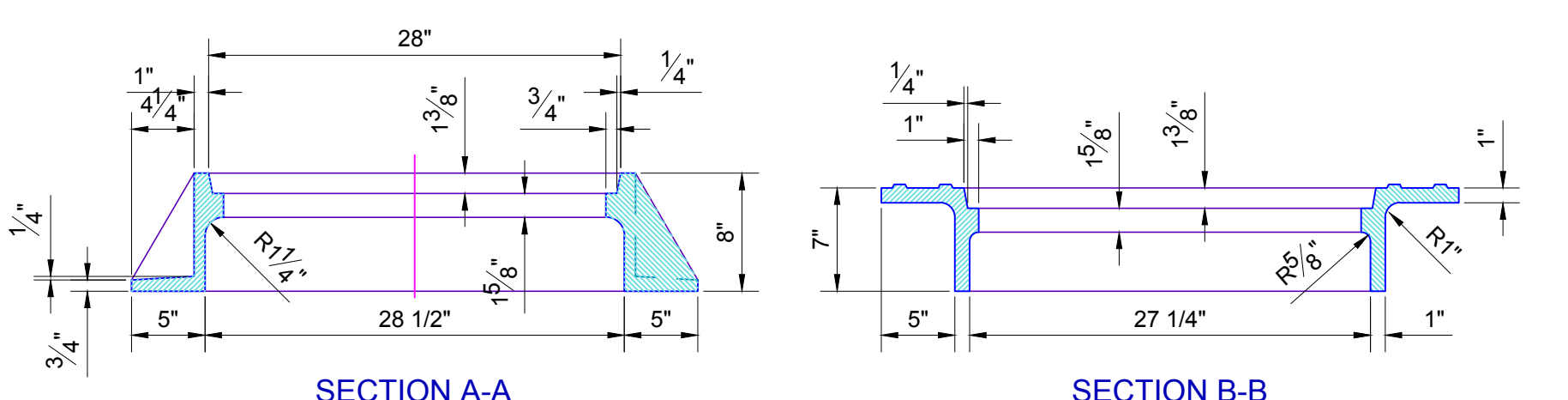
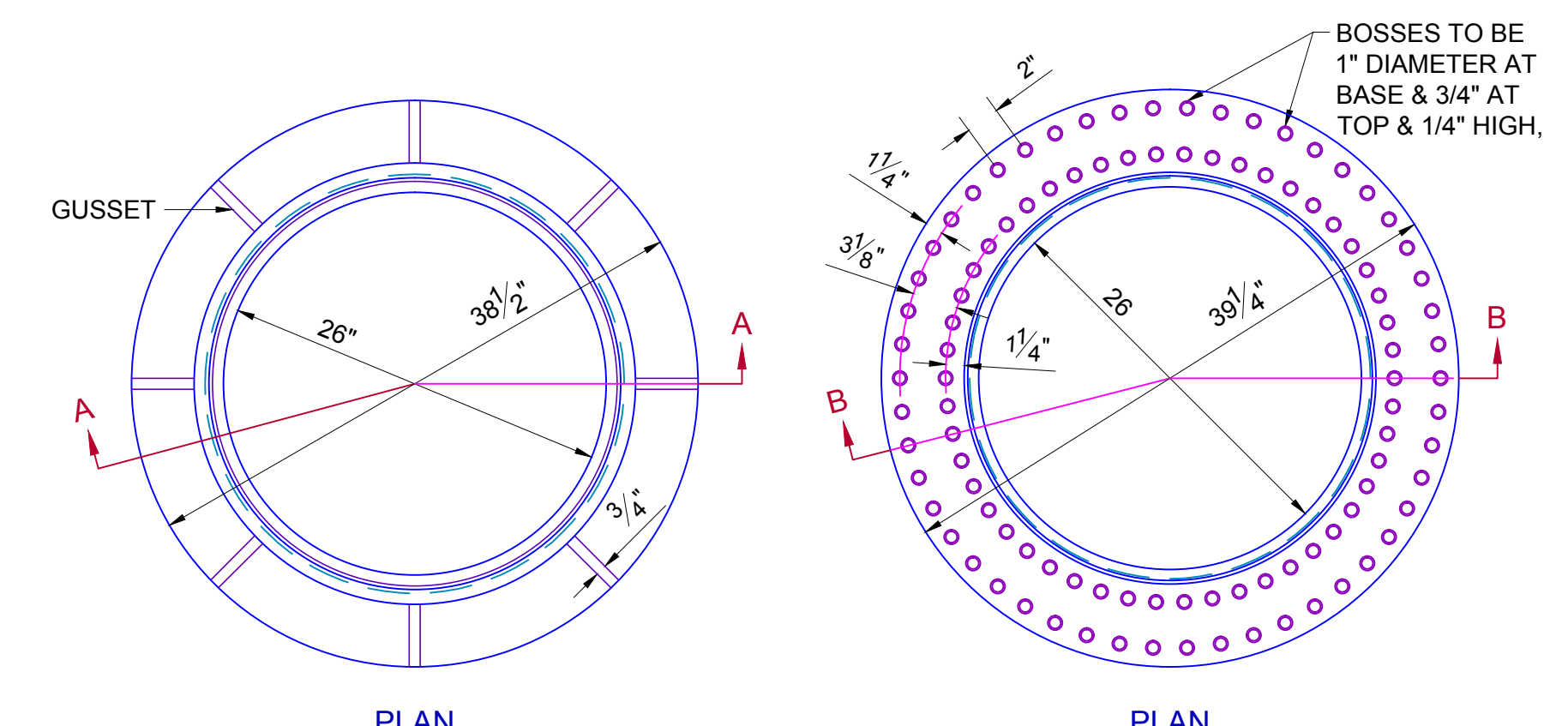
General Notes

- Quantities for sand backfill and crushed rock will be paid for as "Neat Cut" Dimensions.
- Excess sand backfill and crushed rock quantities above scheduled quantities shall be considered waste and the cost shall be borne by the contractor.
- Native Backfill over the sand backfill shall be compacted to applicable specifications whether under paving sections, developed areas or unimproved areas.

Construction Notes

- Width of trench shall conform to minimum widths noted for diameter of pipe.
- Filter Fabric shall be placed between crushed rock and sand backfill to prevent migration of sand into bedding.
- Wrapped joints shall be a minimum of one foot (1') either side of the joint.
- Wrapped joints shall be double wrapped sufficient to prevent slippage of wrap material as crushed rock is placed in trench.
- Wrapped joints shall be double wrapped from top of pipe to the spring line or two foot minimum.
- Wrapped joints shall be wrapped the entire circumference of the pipe and double wrapped as noted.

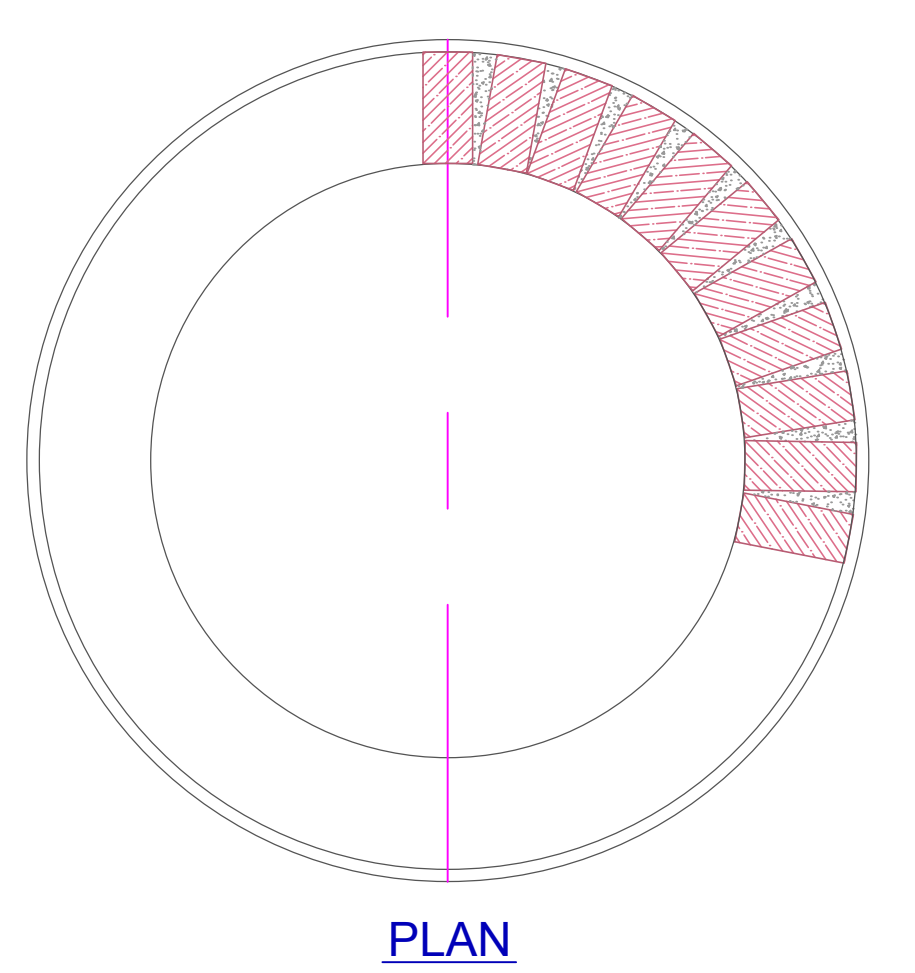
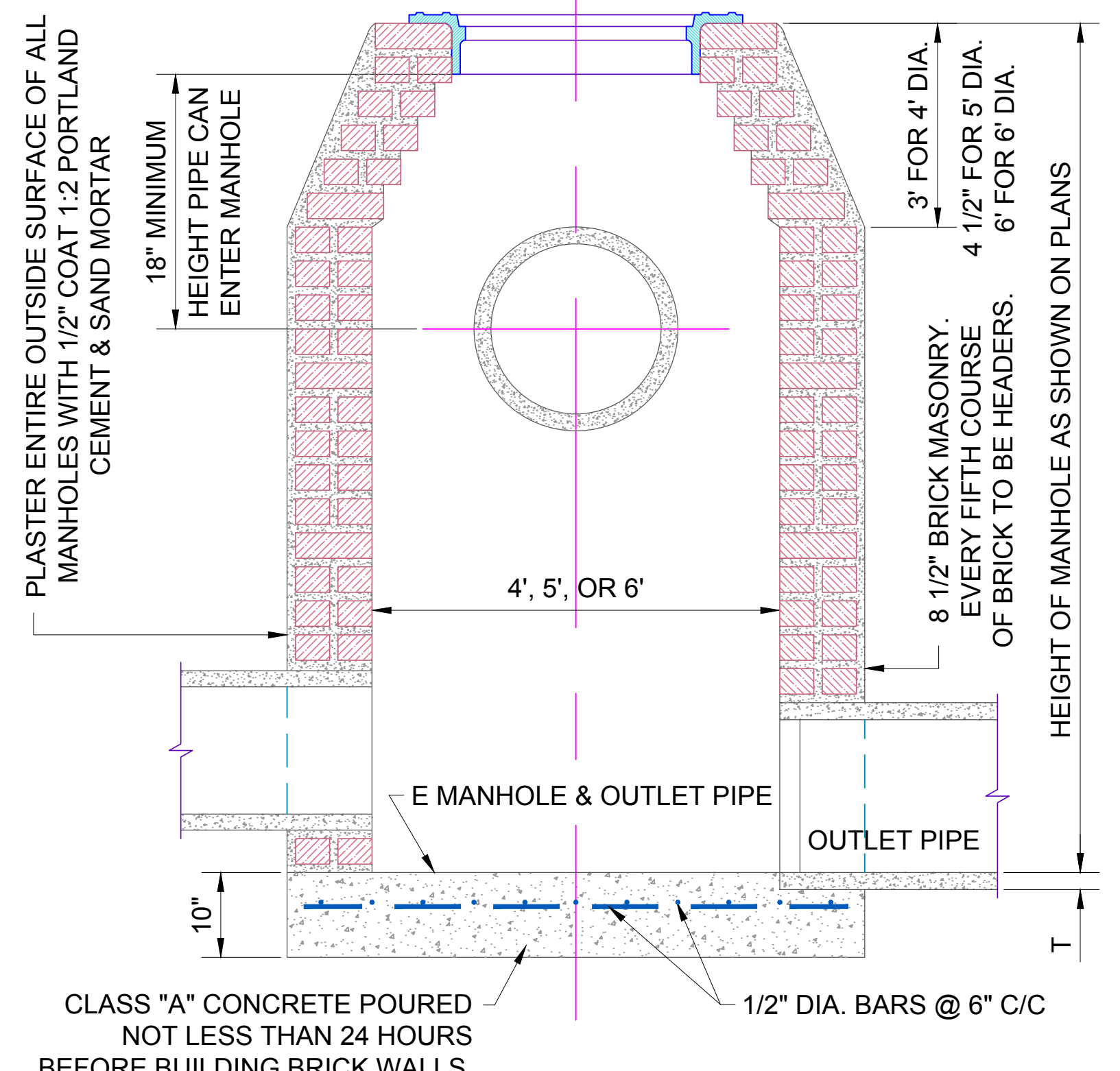
Pipe Diameter and Minimum Trench Width																				
Diameter (in.)	6	8	10	12	15	18	21	24	27	30	33	36	42	48	54	60	66	72	78	84
Trench Width (ft.)	2.00	2.00	2.00	2.00	2.63	2.92	3.21	3.50	4.29	4.58	4.63	4.92	5.50	6.08	6.67	7.25	7.83	8.42	9.00	9.58



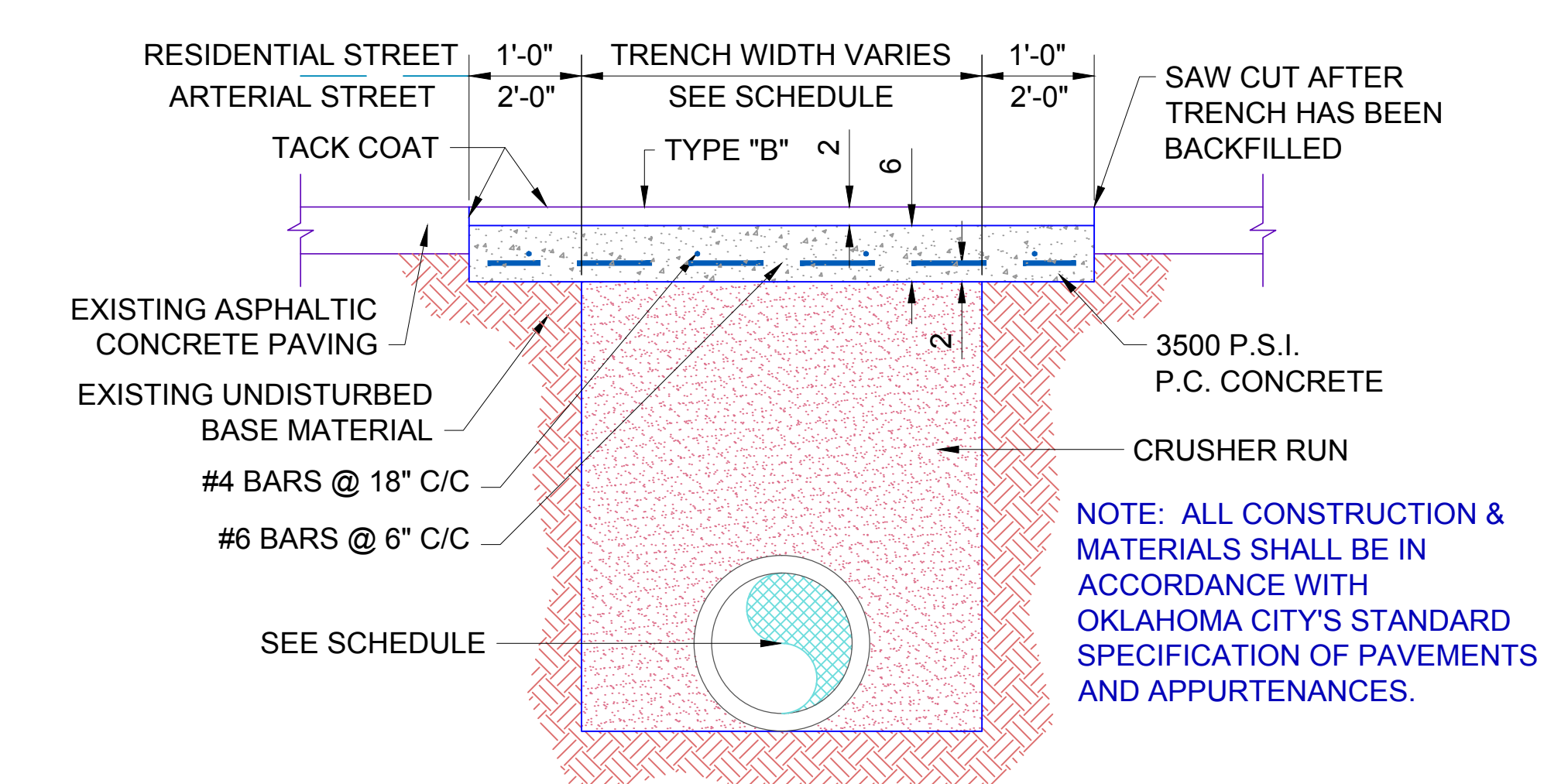
- GENERAL NOTES:**
1. CASTINGS TO CONFORM TO THE A.S.T.M. SPECIFICATIONS FOR GRAY IRON CASTINGS, SERIAL DESIGNATION A 48-28.
 2. WHEN EACH COVER IS PLACED IN ANY POSITION IN ITS ASSOCIATED FRAME, THE SIDE PLAY IN ANY DIRECTION SHALL NOT EXCEED 1/8".
 3. TYPE A FRAMES SHALL BE USED ON PAVED STREETS AND ALLEYS.
 4. TYPE A FRAMES SHALL BE USED ON UNPAVED STREETS AND ALLEYS.
 5. NO WORDING OF MARKINGS OF ANY KIND OTHER THAN THOSE SHOWN ON THIS STANDARD WILL BE PERMITTED ON THESE CASTINGS.
 6. THE AVERAGE WEIGHT OF CASTINGS WILL NOT BE LESS THAN 98% OF WEIGHTS SHOWN.
 7. REVERSIBLE FRAME AND COVER D-204, MAY BE USED IN LIEU OF FRAME AND COVER SHOWN ON D-201.

CASTING WEIGHTS

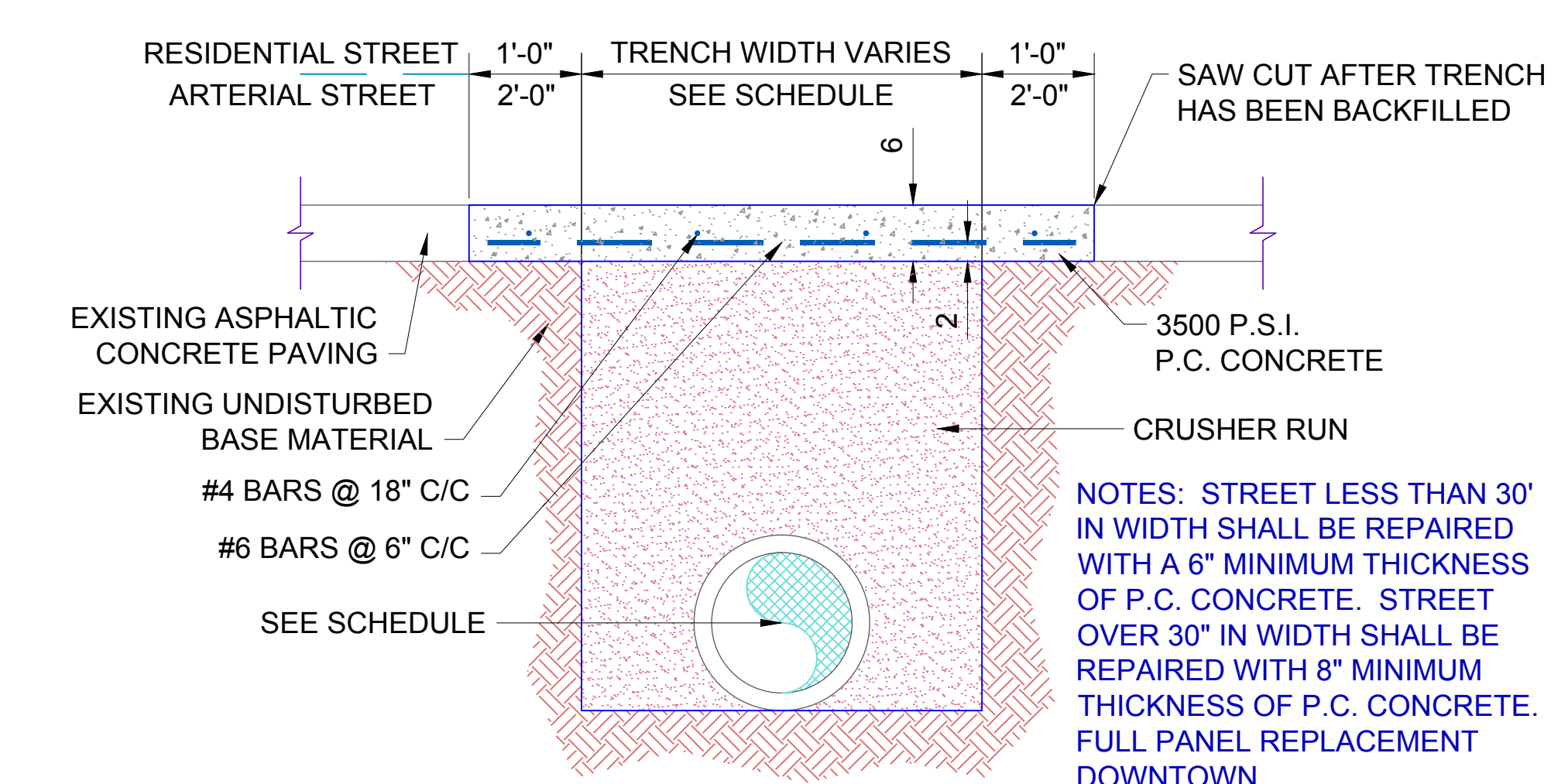
"A" RING ONLY	347 LBS.
"B" RING ONLY	392 LBS.
COVER ONLY	251 LBS.
TOTAL TYPE "A"	598 LBS.
TOTAL TYPE "B"	643 LBS.



DETAIL OF STANDARD MASONRY MANHOLE



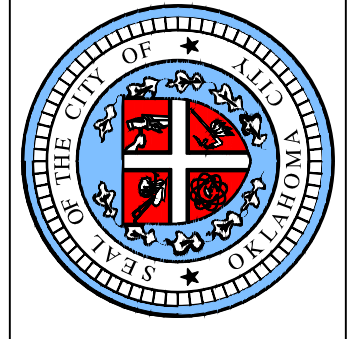
TYPICAL PERMANENT REPAIR SECTION FOR ASPHALT CONCRETE PAVING

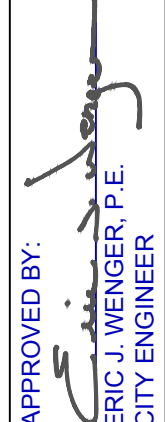


TYPICAL PERMANENT REPAIR SECTION FOR P.C. CONCRETE PAVING

	TRENCH WIDTH SCHEDULE				
PIPE SIZE I.D.	12" OR LESS	15" TO 21"	24" TO 30"	33" TO 54"	60" & OVER
TRENCH WIDTH (W/O SHORING)	24"	O.D. + 12"	O.D. + 18"	O.D. + 15"	O.D. + 15"
TRENCH WIDTH (W/ SHORING)	36"	O.D. + 24"	O.D. + 30"	O.D. + 30"	O.D. + 36"

The City of
Oklahoma City
Public Works Department
Engineering Division



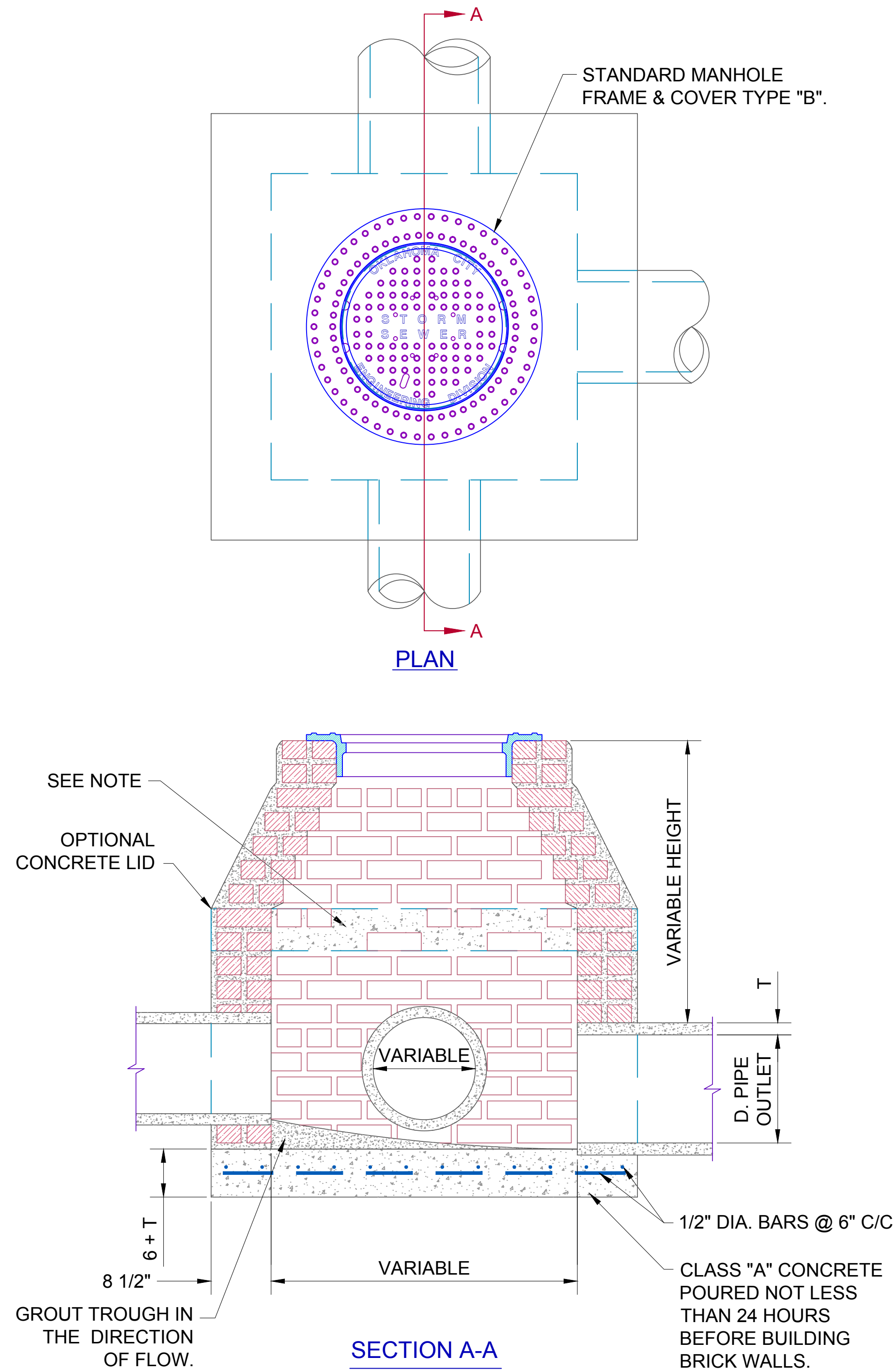
APPROVED BY:  DATE: 05-02-13
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: VSC DATE: 05-02-13

STANDARD MASONRY MANHOLE

Drawing Number
D-201

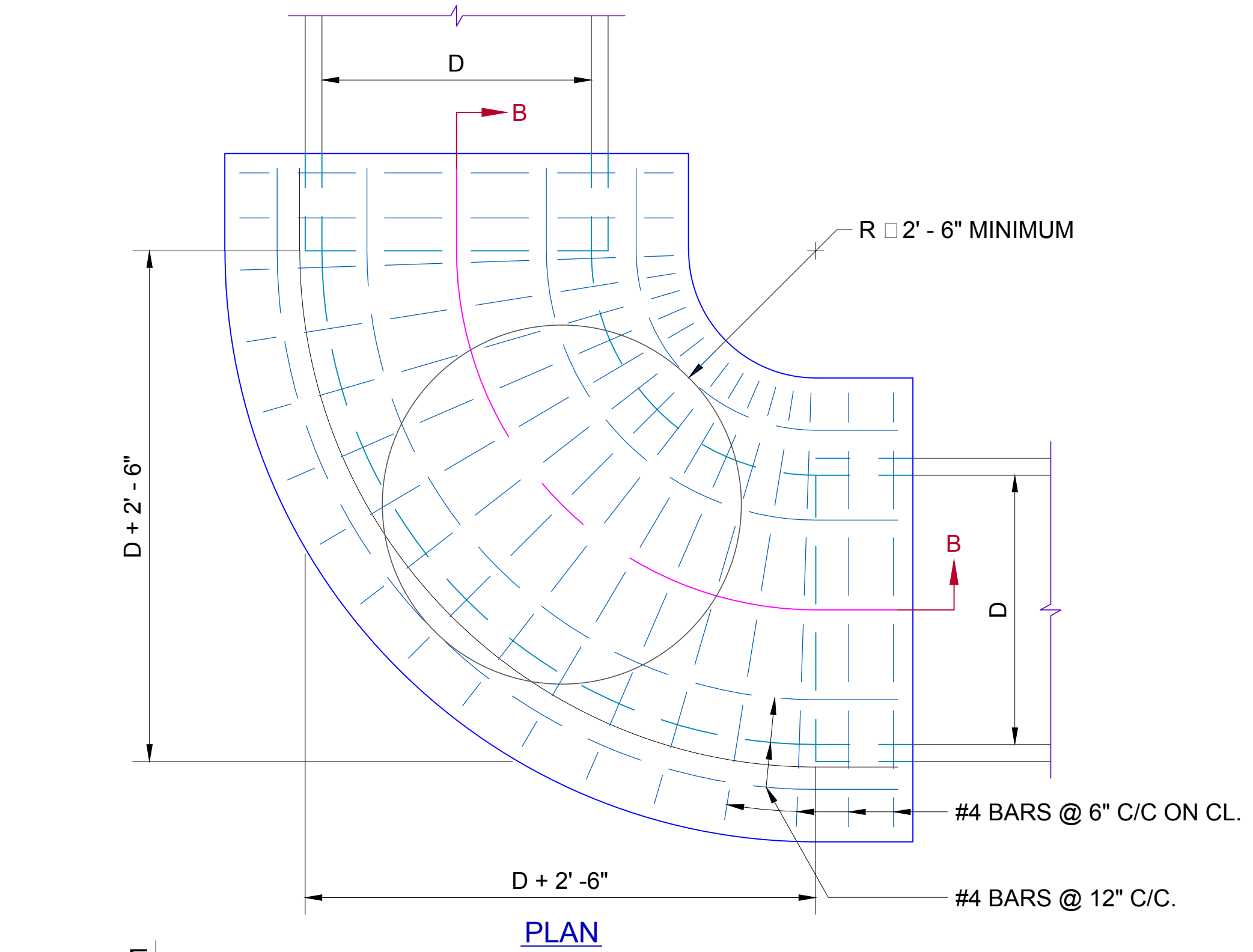
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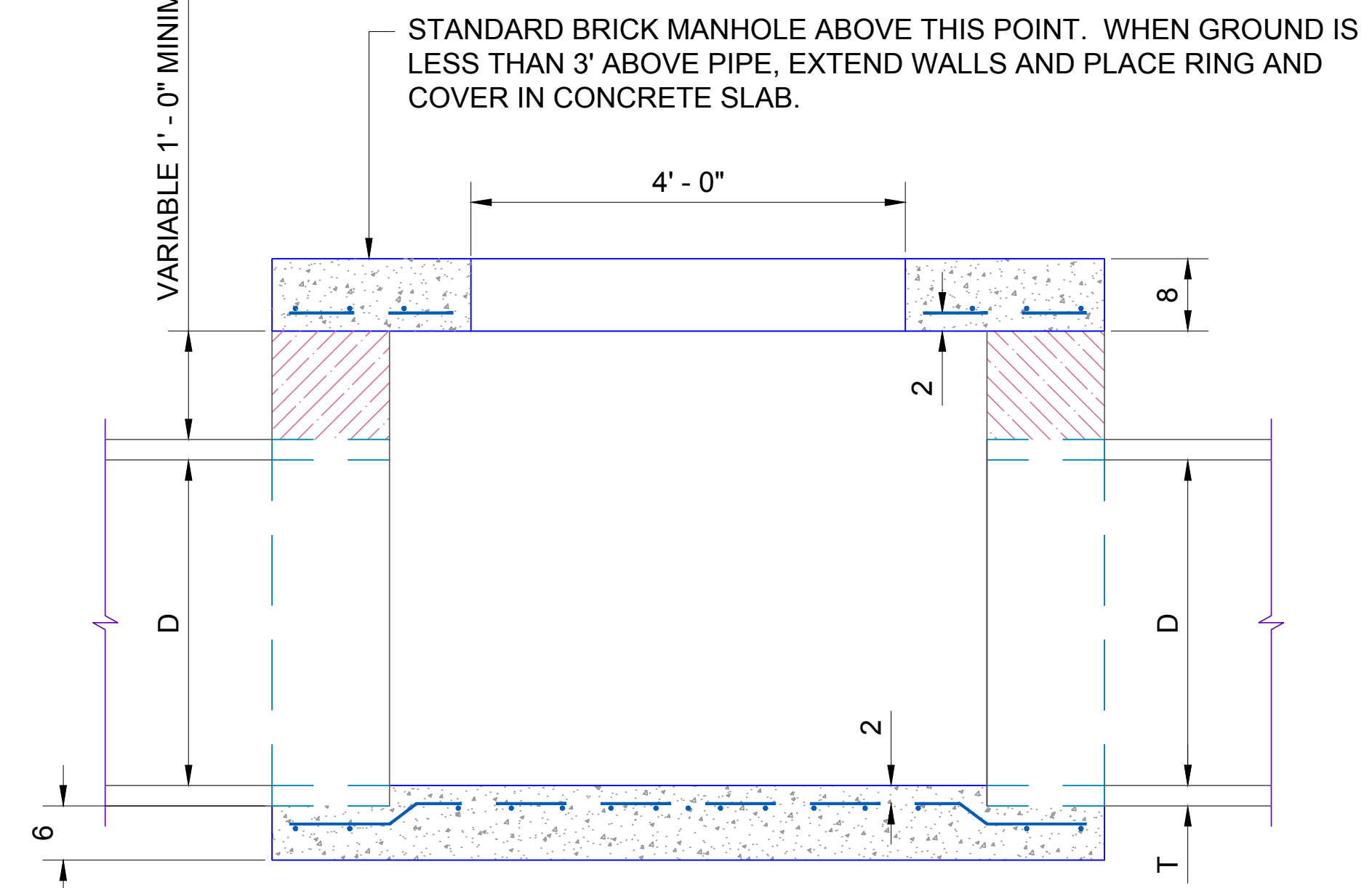
DETAIL OF MASONRY JUNCTION BOX

NOTE:

1. ALL CONSTRUCTION AND MATERIAL SHALL BE IN ACCORDANCE WITH THE OKLAHOMA CITY STANDARDS SPECIFICATIONS.
2. ALL CONCRETE SHALL BE CLASS "A" CONCRETE 3500 P.S.I. AND POURED NOT LESS THAN 24 HOURS BEFORE BUILDING BRICK WALLS.
3. OPTIONAL CONCRETE LID WITH STANDARD MANHOLE FRAME AND COVER MAY BE USED IN LIEU OF BRICK CONE FOR SHALLOW BOXES OF PAVED AREAS IF CALLED FOR IN THE PLANS OR APPROVED BY THE ENGINEER. CONCRETE LID SHALL BE 7" THICK WITH #4 BARS AT 6" C/C EACH WAY. EIGHT ADDITIONAL #4 BARS SHALL BE PLACED AT 45° UNDER MANHOLE FRAME.
4. RADIUS JUNCTION BOX WILL BE USED FOR PIPE DIAMETER 36" AND ABOVE.



PLAN



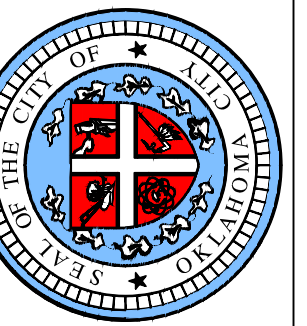
SECTION B-B

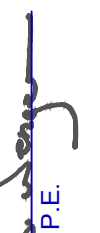
DETAIL OF MASONRY RADIUS JUNCTION BOX

NOTE:

1. ALL CONSTRUCTION AND MATERIAL SHALL BE IN ACCORDANCE WITH THE OKLAHOMA CITY STANDARDS SPECIFICATIONS.
2. ALL CONCRETE SHALL BE CLASS "A" CONCRETE 3500 P.S.I. AND POURED NOT LESS THAN 24 HOURS BEFORE BUILDING BRICK WALLS.
3. RADIUS JUNCTION BOX WILL BE USED FOR PIPE DIAMETER 36" AND ABOVE.

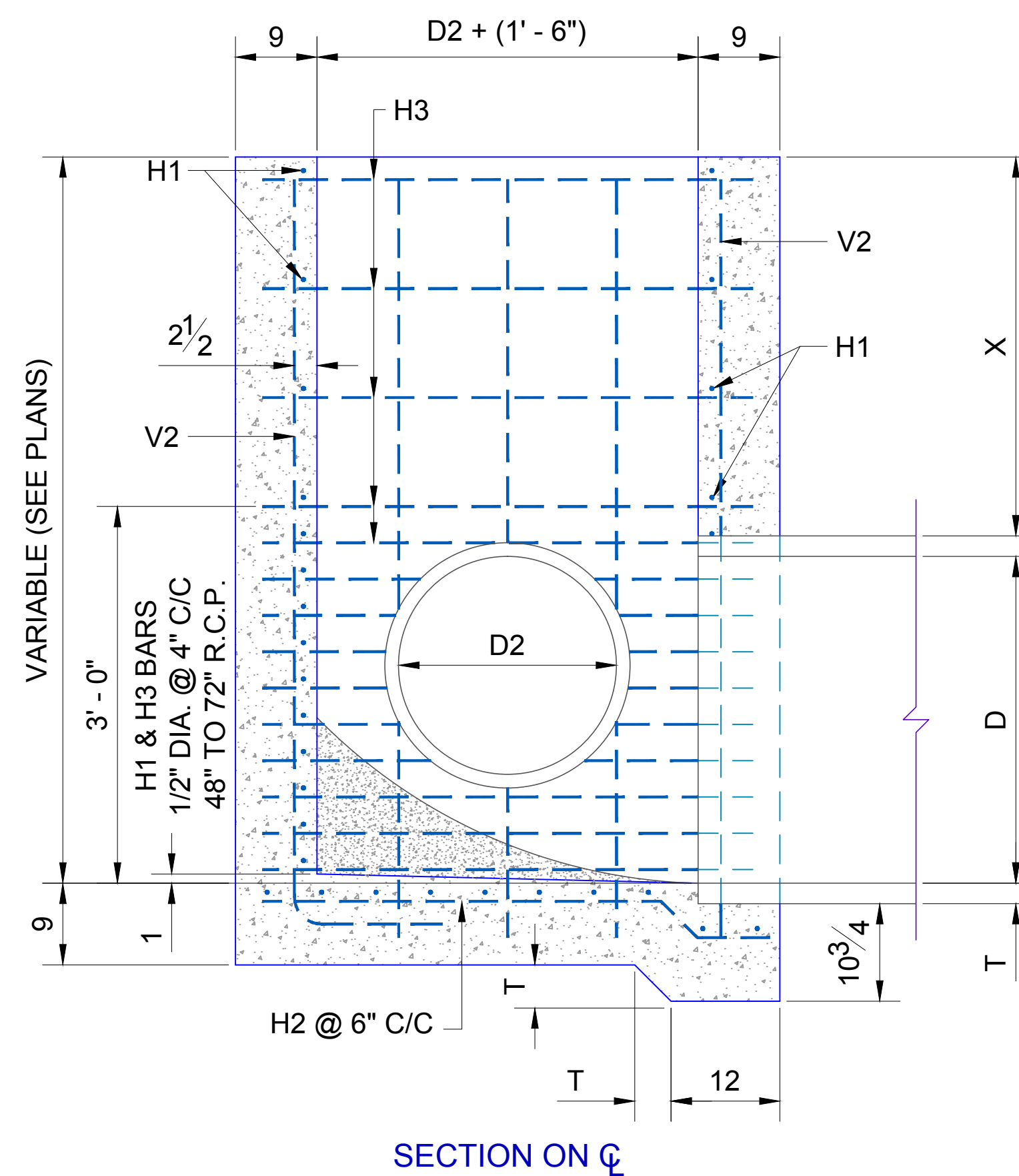
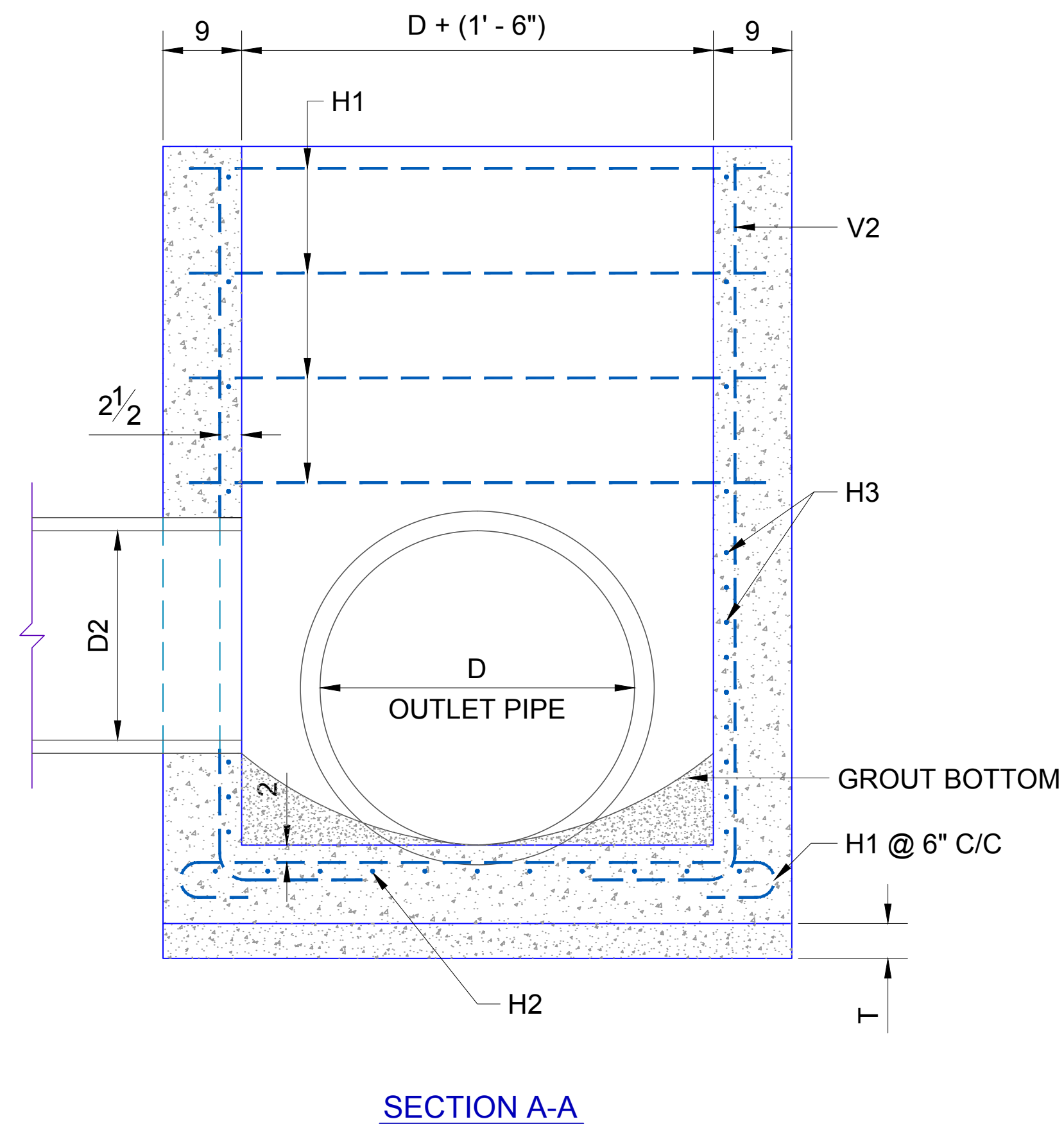
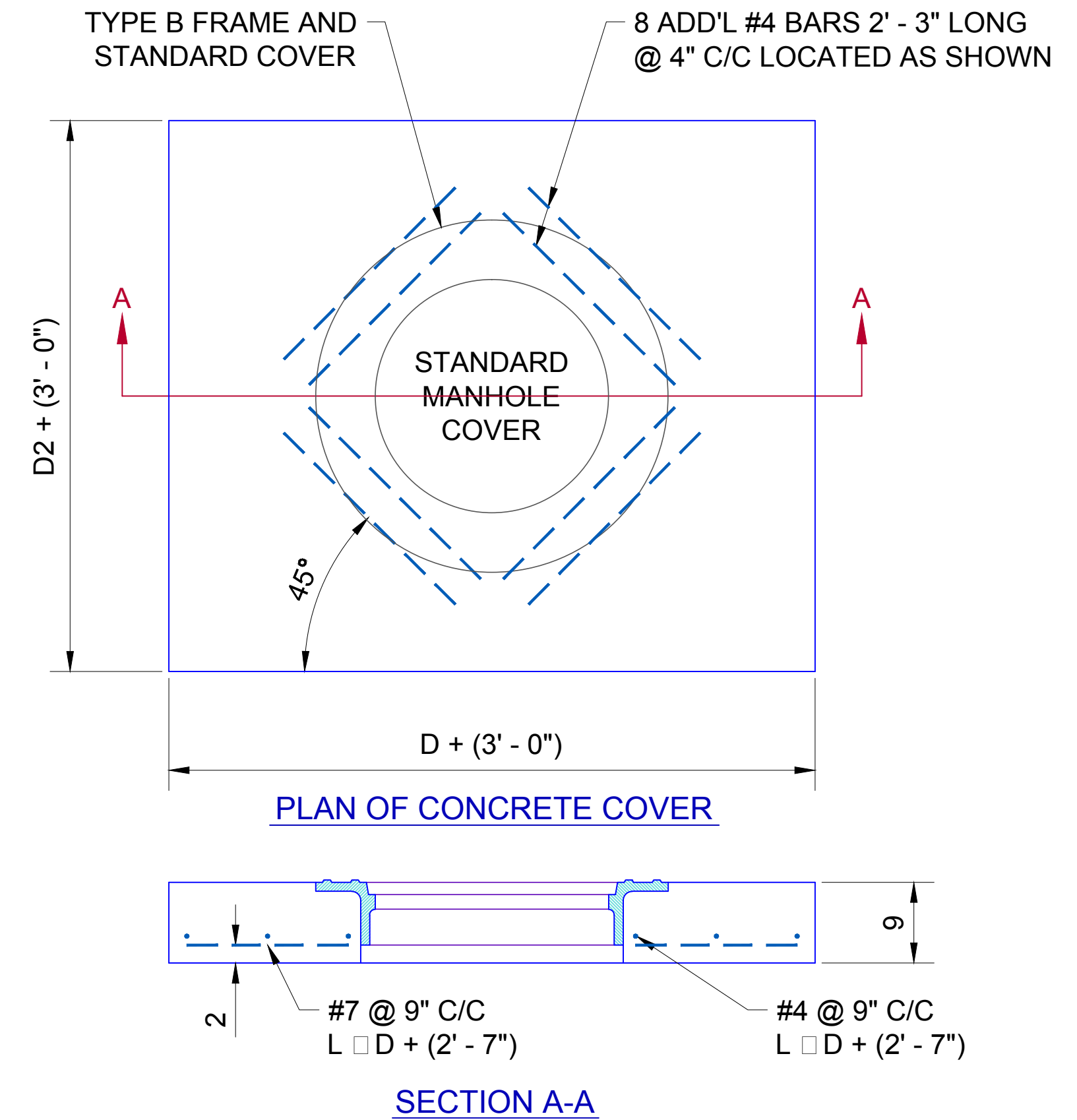
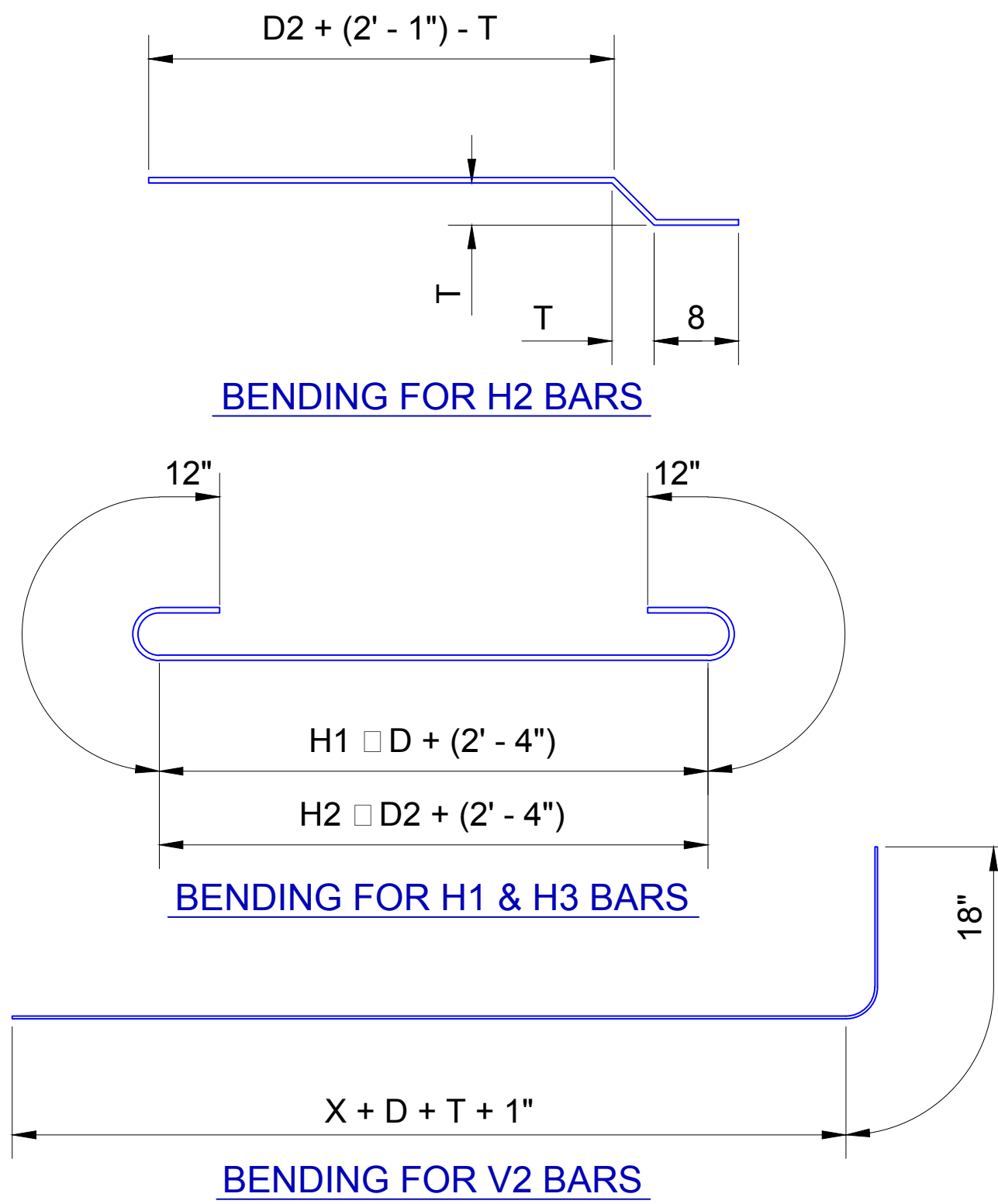
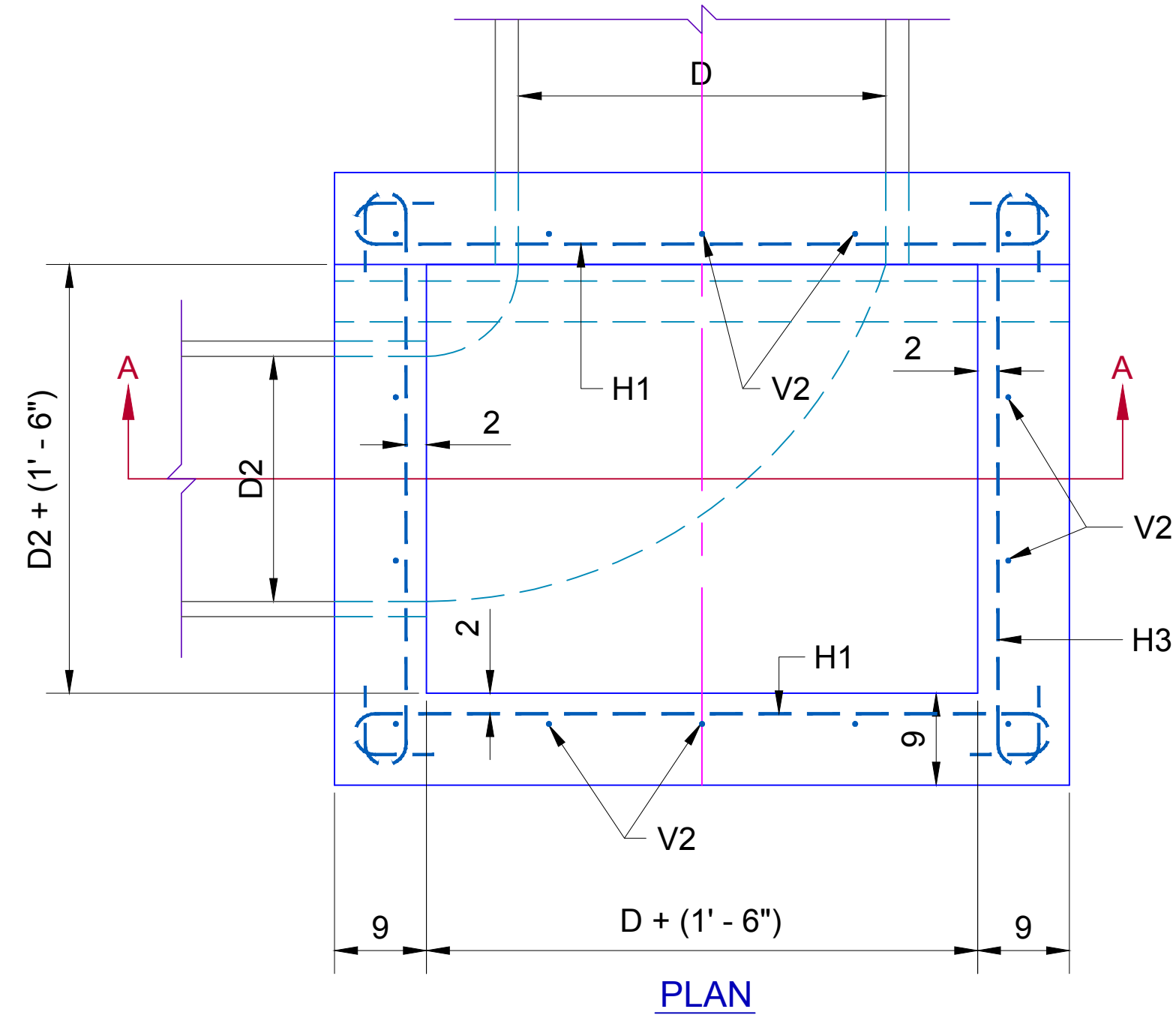
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APPROVED BY:  DATE: 05-02-13
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: VSC
DATE: 05-02-13

**STANDARD MASONRY
JUNCTION BOX
& RADIUS JUNCTION BOX**



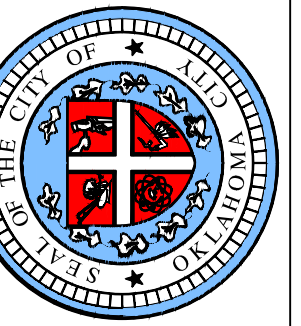
GENERAL NOTES:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH OKLAHOMA CITY STANDARD SPECIFICATIONS.
2. ALL EXPOSED CONCRETE SURFACES SHALL HAVE A CARBORUNDUM FINISH.
3. ALL EXPOSED CONCRETE SURFACES SHALL HAVE A 3/4" CHAMFER
4. ALL REINFORCED STEEL SHALL BE 1/2" DIAMETER, EXCEPT AS NOTED. ALL HORIZONTAL BARS SHALL BE SPACED AS SHOWN. (18" MAXIMUM)
5. MAXIMUM DEPTHS OF BOXES FOR 48" TO 72" R.C.P. SHALL BE AS FOLLOWS:
48" - 18" 54" - 16" 60" - 12" 72" - 10".
6. REINFORCED CONCRETE PIPE SHALL CONFORM TO THE REQUIREMENTS OF A.A.S.H.T.O. M-170 (ASTM C-78) CLASS III UNLESS OTHERWISE DESIGNATED.
7. WALL THICKNESS (DIMENSION "T") OF PIPES SHOWN, ARE FROM "WALL B" COLUMN OF A.A.S.H.T.O. TABLES.

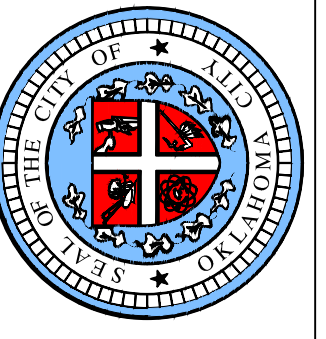
D	36"	42"	48"	54"	60"	66"	72"
T	4"	4 1/2"	5"	5 1/2"	6"	6 1/2"	7"

8. DIMENTION D2 IS THE DIAMETER OF THE LARGEST PIPE ENTERING THE JUNCTION BOX THROUGH THE SIDE.
9. DIMENTION "X" DEPENDS ON THE DEPTHS AS CALLED FOR IN THE PLANS.

**JUNCTION BOX 36" TO 72"
REINFORCED CONCRETE PIPE**



**STANDARD REINFORCED CONCRETE
JUNCTION BOX FOR 36" TO 72"
REINFORCED CONCRETE PIPE**



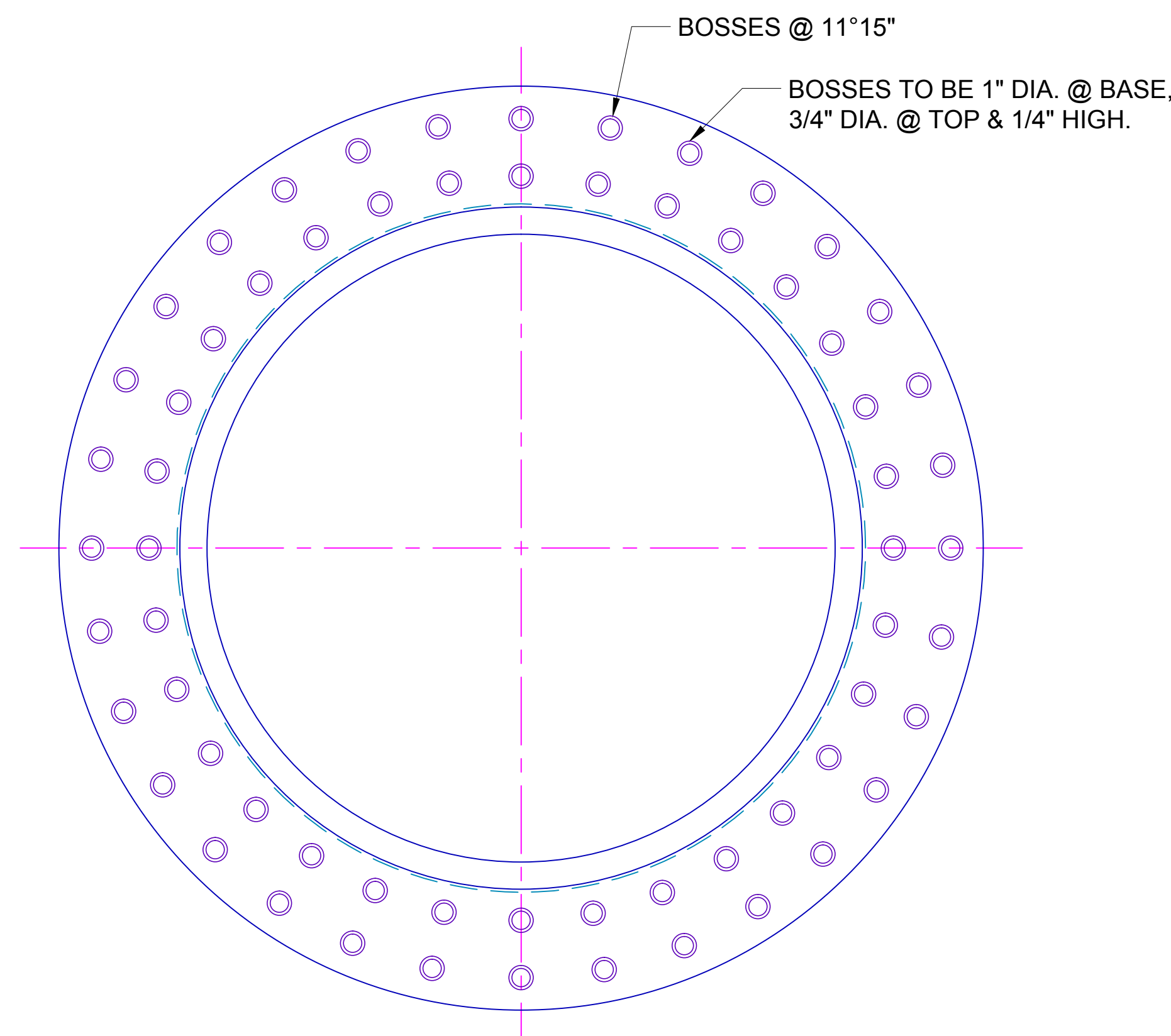
APPROVED BY: DATE: 05-02-13
 ERIC J. WENGER, P.E.
 CITY ENGINEER

DRAWN: VSC

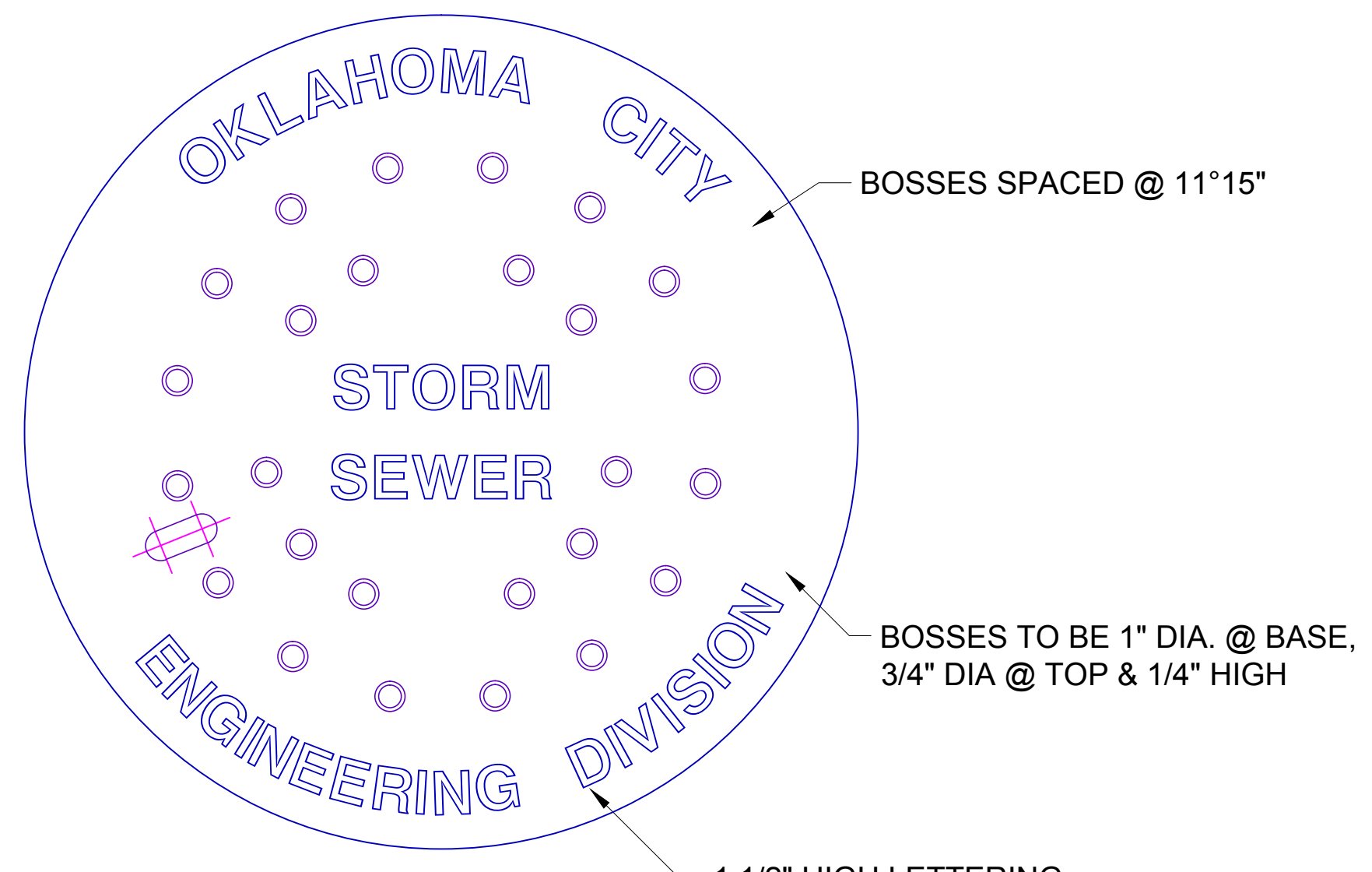
DATE: 05-02-13

**STANDARD MANHOLE
 REVERSIBLE FRAME & COVER**

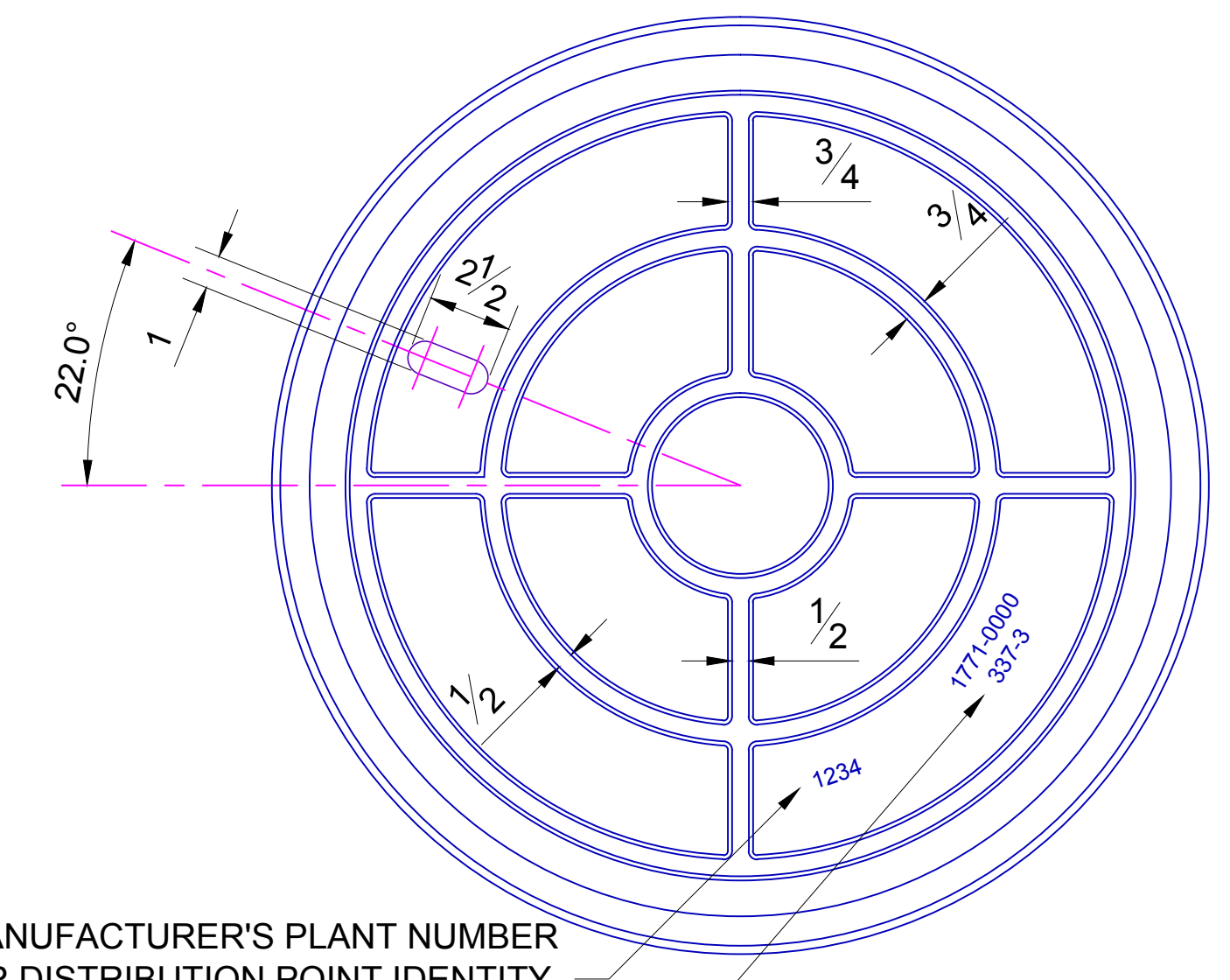
Drawing Number
 D-204



PLAN



PLAN

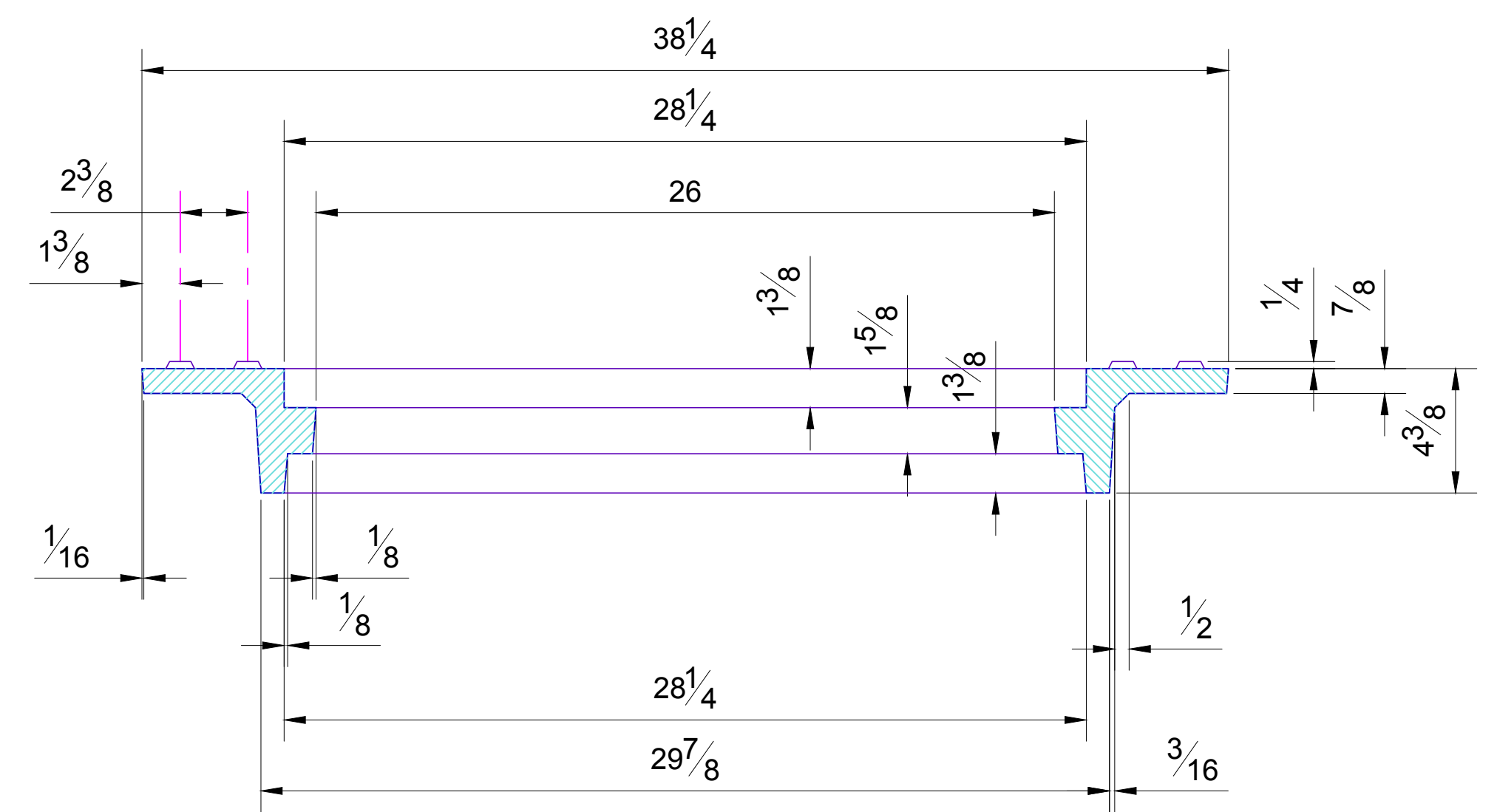


PLAN OF UNDERSIDE

MANUFACTURER'S PLANT NUMBER
 OR DISTRIBUTION POINT IDENTITY.
 MANUFACTURER'S PART NUMBER
 & HEAT NUMBER OR OTHER
 AGREED UPON IDENTITY.

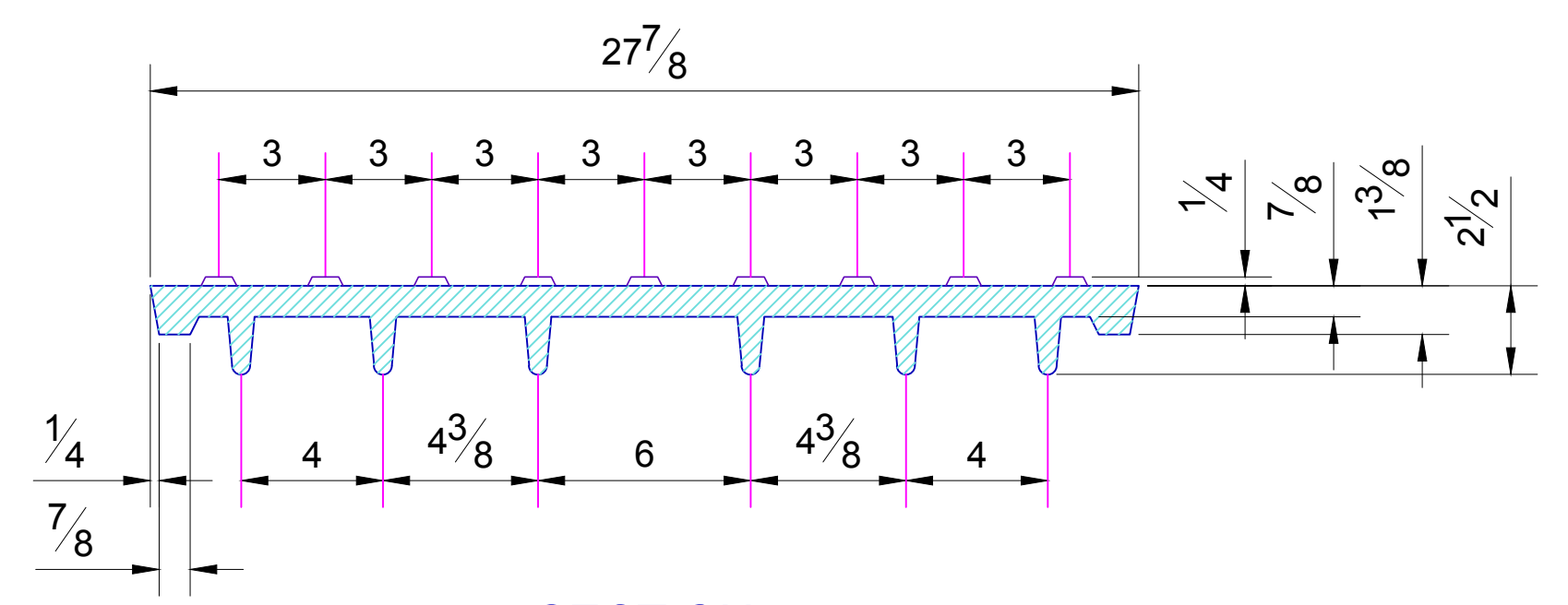
GENERAL NOTES:

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CURRENT SPECIFICATIONS.
2. SHARP EDGES RESULTING FROM FABRICATION SHALL BE DULLED BY ANY ACCEPTABLE METHOD FOR SAFETY IN HANDLING.
3. COVERS SHALL BE GRAY IRON CONFORMING TO THE REQUIREMENTS OF ASHTO M-105 CLASS 35B OR ASTM A-48-76 CLASS 35B OR ASTM A-48-76 CLASS 30B.
4. FERROUS CASTINGS SHALL BE OF UNIFORM QUALITY, FREE OF BLOWHOLES, POROSITY HARDSPOTS, SHRINKAGE DISTORTION OR OTHER DEFECTS. THEY SHALL BE SMOOTH AND WELL CLEANED BY SHOT BLASTING OR OTHER APPROVED CLEANING METHOD.
5. ALL CASTINGS SHALL BE MANUFACTURED TRUE TO PATTERN. COMPONENT PARTS SHALL FIT TOGETHER IN A SATISFACTORY MANNER.
6. WHERE INDICATED, MACHINED SURFACES SHALL BE FURNISHED.
7. WEIGHTS ARE APPROXIMATE AND AVERAGE. DEVIATION FROM THE FOLLOWING WEIGHTS SHALL NOT EXCEED 5% PLUS OR MINUS:
 FRAME 235 L.B. COVERS 195 L.B.
8. CASTING SHALL BE UNPAINTED.



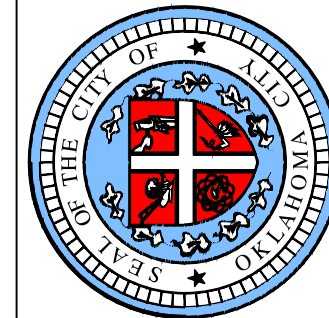
SECTION

REVERSIBLE MANHOLE FRAME



SECTION

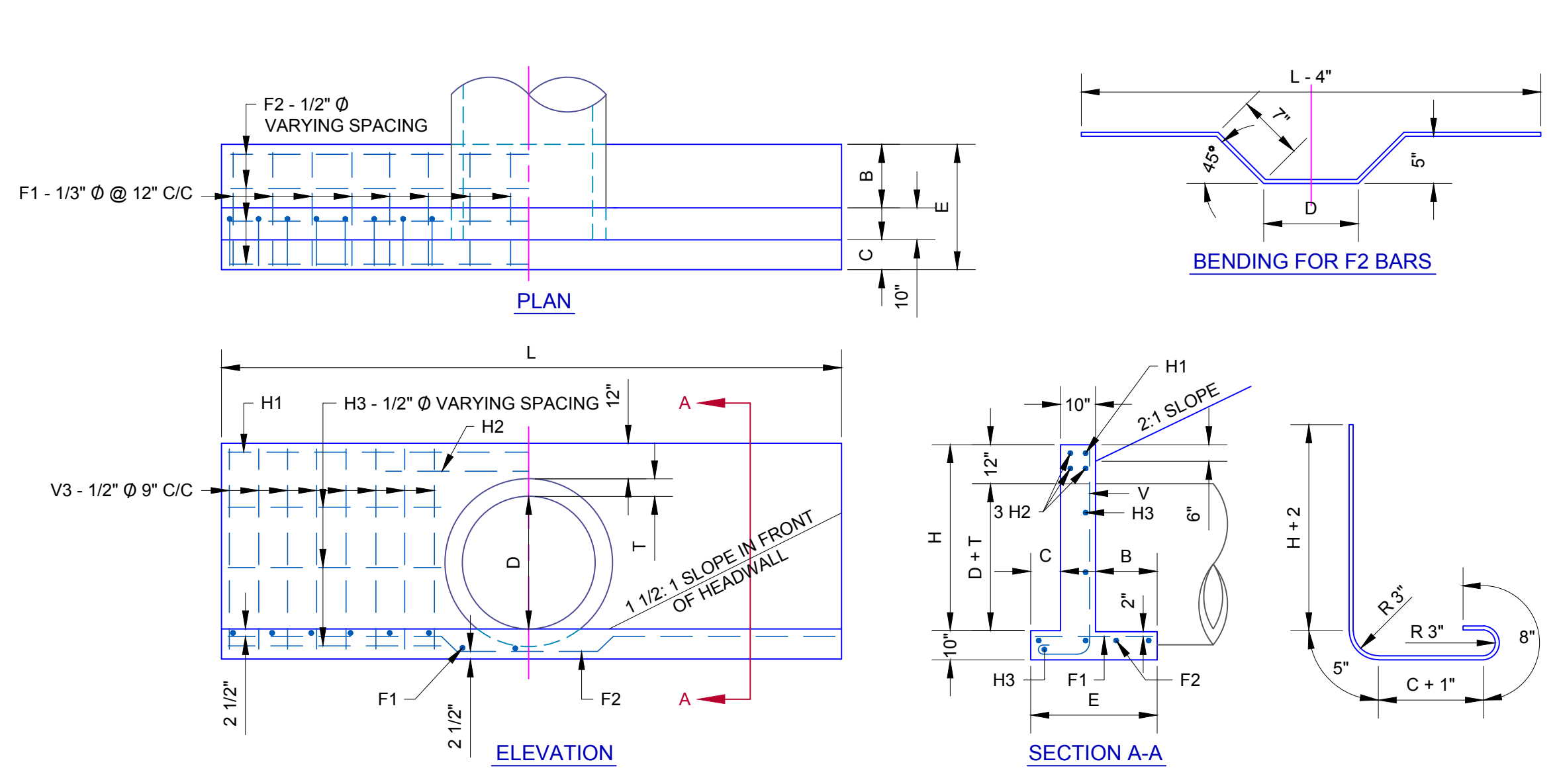
STANDARD MANHOLE COVER



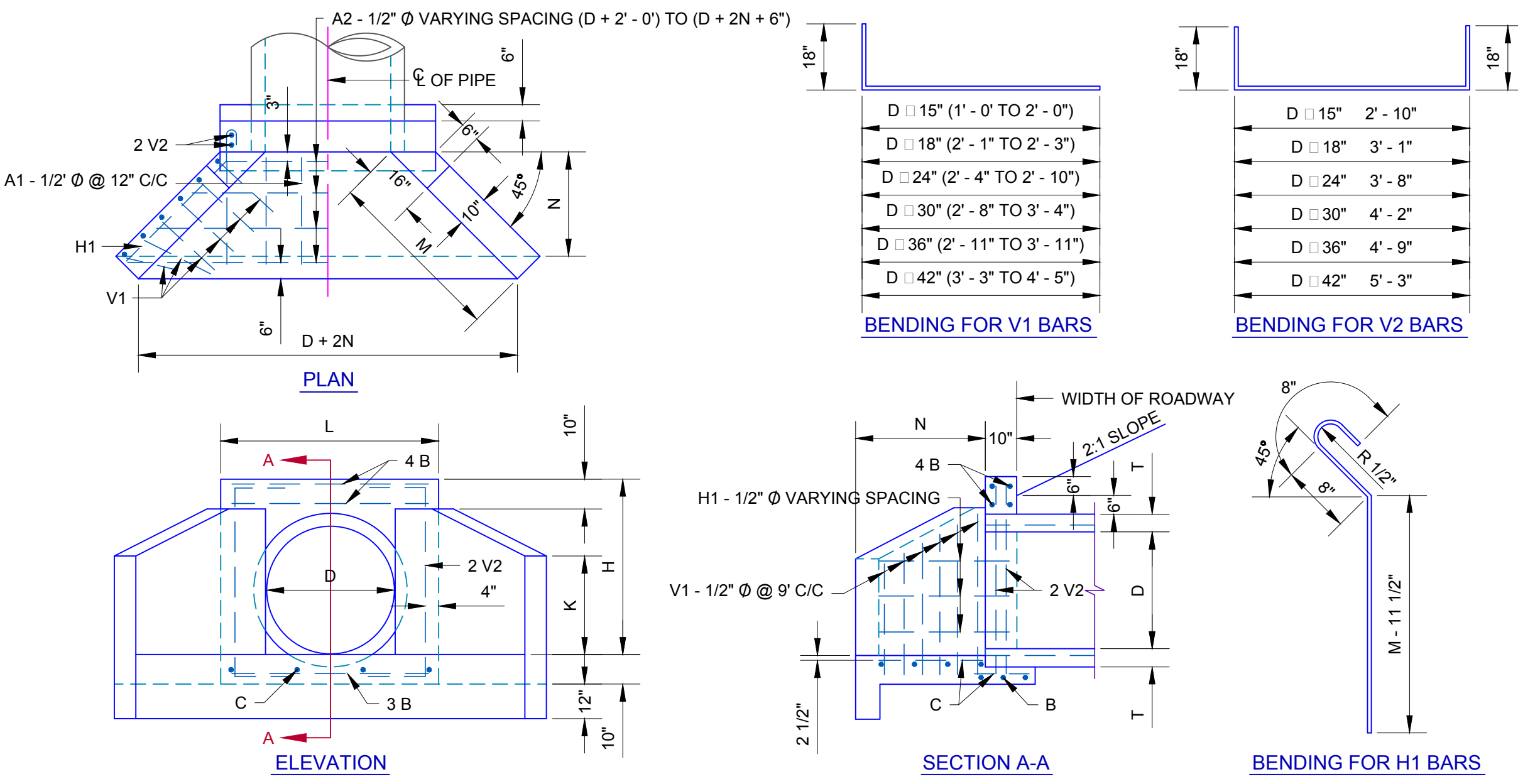
APPROVED BY: DATE: 02-06-13
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: VSC
DATE: 02-06-13

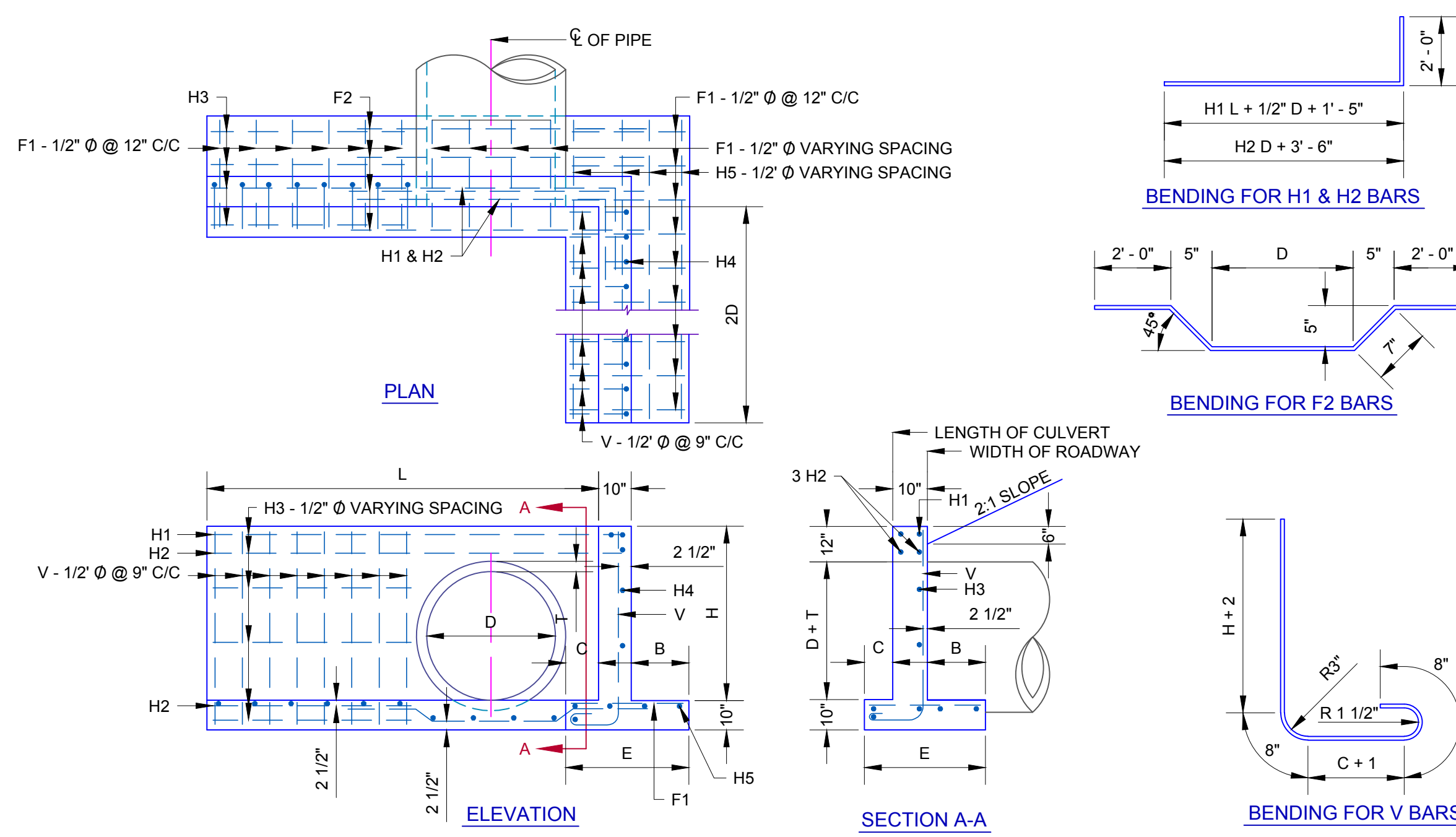
**CAST IN PLACE CONCRETE
HEADWALLS FOR 15" TO 42"
REINFORCED CONCRETE PIPES**



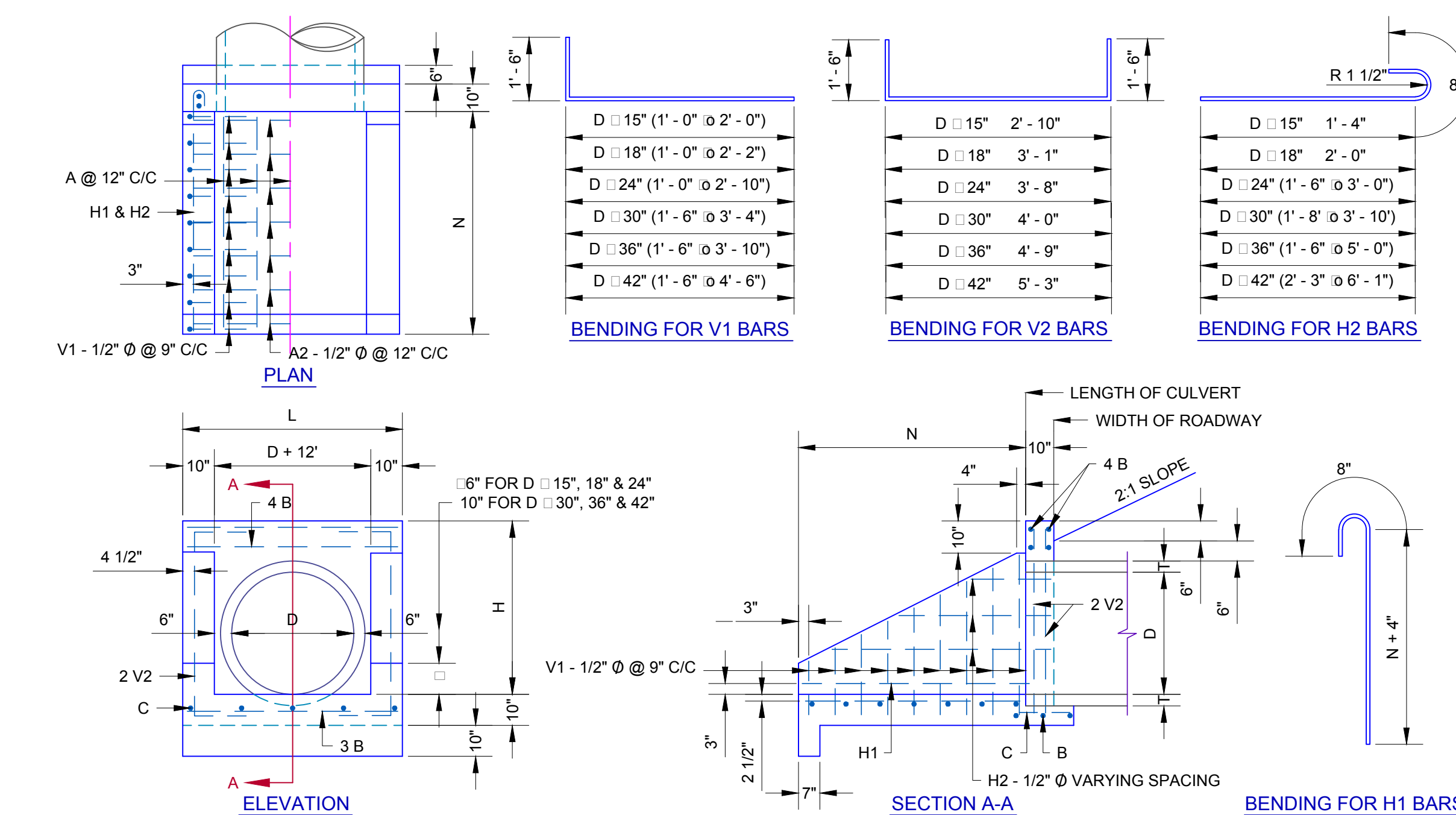
DIMENSIONS & QUANTITIES FOR STRAIGHT HEADWALLS												FOR ONE HEADWALL									
DIMENSIONS												REINFORCING STEEL		QUANTITIES							
D	AREA SQ FT	T	H	L	E	B	C	F1 - 1/2" Ø	F2 - 1/2" Ø	H1 - 1/2" Ø	H2 - 1/2" Ø	H3 - 1/2" Ø	V - 1/2" Ø	CLASS "A" CONC C.Y.	REINF. STEEL LBS						
15"	1.23	2 1/2"	2'-5 1/2"	6'-0"	2'-2"	10"	6"	6	1'-10"	3	6'-0"	1	5'-8"	3	5'-3"	4	2'-0"	6	4'-3"	.78	56
18"	1.77	2 1/2"	2'-8 1/2"	7'-0"	2'-3"	11"	6"	8	1'-11"	3	7'-0"	1	6'-8"	3	5'-6"	4	2'-4"	8	4'-6"	.98	70
24"	3.14	3"	3'-3"	9'-0"	2'-7"	1'-3"	6"	10	2'-3"	3	9'-0"	1	8'-8"	3	6'-0"	4	3'-1"	10	5'-1"	1.46	95
30"	4.91	3 1/2"	3'-9 1/2"	11'-0"	2'-10"	1'-4"	8"	12	2'-6"	3	11'-0"	1	10'-8"	3	6'-6"	6	3'-9"	12	5'-9"	2.00	122
36"	7.07	4"	4'-4"	14'-0"	3'-1"	1'-7"	8"	14	2'-9"	4	14'-0"	1	13'-8"	3	7'-0"	6	5'-0"	14	6'-4"	2.85	170
42"	9.62	4 1/2"	4'-10 1/2"	16'-0"	3'-4"	1'-8"	10"	16	3'-0"	4	16'-0"	1	15'-8"	3	7'-6"	6	5'-8"	16	7'-0"	3.58	198



DIMENSIONS & QUANTITIES FOR HEADWALLS WITH 45° WINGS												FOR ONE HEADWALL											
DIMENSIONS												REINFORCING STEEL		QUANTITIES									
D	AREA SQ FT	T	H	L	M	N	A1 - 1/2" Ø	A2 - 1/2" Ø	B - 1/2" Ø	C - 1/2" Ø	H1 - 1/2" Ø	V1 - 1/2" Ø	V2 - 1/2" Ø	CLASS "A" CONC C.Y.	REINF. STEEL LBS								
15"	1.23	2 1/4"	2'-5 1/4"	1'-5"	3'-7"	1'-9"	1'-3"	4	1'-0"	2	3'-9" AV.	7	3'-3"	3	1'-6"	4	2'-1"	4	3'-5" AV.	4	5'-10"	.74	57
18"	1.77	2 1/2"	2'-8 1/2"	1'-7"	3'-10"	2'-1 1/2"	1'-6"	4	1'-2"	2	4'-3" AV.	7	3'-6"	3	1'-6"	4	2'-6"	4	3'-8" AV.	4	6'-1"	.91	61
24"	3.14	3"	3'-3"	1'-10 1/2"	4'-4"	2'-10"	2'-0"	5	1'-8"	3	5'-3" AV.	7	4'-0"	3	1'-6"	6	3'-2"	6	4'-1" AV.	4	6'-8"	1.37	85
30"	4.91	3 1/2"	3'-9 1/2"	2'-2"	4'-10"	3'-6 1/2"	2'-6"	5	2'-2"	3	6'-3" AV.	7	4'-6"	4	1'-6"	6	3'-11"	8	4'-6" AV.	4	7'-2"	1.77	104
36"	7.07	4"	4'-4"	2'-5 1/2"	5'-4"	4'-3"	3'-0"	6	2'-8"	4	7'-3" AV.	7	5'-0"	4	1'-6"	6	4'-7"	10	4'-11" AV.	4	7'-9"	2.29	130
42"	9.62	4 1/2"	4'-10 1/2"	2'-9"	5'-10"	4'-1 1/2"	3'-6"	6	3'-2"	4	8'-3" AV.	7	5'-6"	4	1'-6"	6	5'-4"	12	5'-4" AV.	4	8'-3"	2.89	151



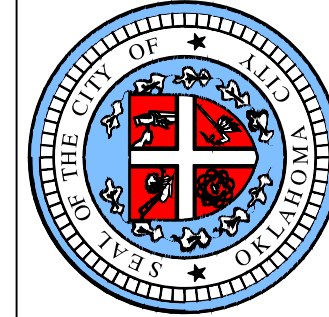
DIMENSIONS & QUANTITIES FOR HEADWALLS WITH 90° WINGS												FOR ONE HEADWALL													
DIMENSIONS												REINFORCING STEEL		QUANTITIES											
D	AREA SQ FT	T	H	L	E	B	C	F1 - 1/2" Ø	F2 - 1/2" Ø	H1 - 1/2" Ø	H2 - 1/2" Ø	H3 - 1/2" Ø	H4 - 1/2" Ø	H5 - 1/2" Ø	V - 1/2" Ø	CLASS "A" CONC C.Y.	REINF. STEEL LBS								
15"	1.23	2 1/4"	2'-5 1/4"	3'-0"	2'-2"	10"	6"	10	1'-10"	3	6'-5"	1	7'-0"	3	6'-9"	5	2'-0"	2	3'-0"	4	3'-10"	7	2'-0"	1.09	84
18"	1.77	2 1/2"	2'-8 1/2"	3'-6"	2'-3"	11"	6"	10	1'-11"	3	6'-8"	1	7'-8"	3	7'-0"	5	2'-4"	2	3'-6"	4	4'-5"	9	2'-4"	1.32	97
24"	3.14	3"	3'-3"	4'-6"	2'-7"	1'-3"	6"	14	2'-3"	3	7'-2"	1	8'-11"	3	7'-6"	6	3'-1"	3	4'-6"	4	5'-9"	11	3'-1"	1.94	131
30"	4.91	3 1/2"	3'-9 1/4"	5'-6"	2'-10"	1'-4"	8"	16	2'-6"	3	7'-8"	1	10'-2"	3	8'-0"	6	3'-9"	3	5'-6"	4	6'-10"	14	3'-9"	2.59	163
36"	7.07	4"	4'-4"	7'-0"	3'-1"	1'-7"	8"	16	2'-9"	4	8'-2"	1	11'-11"	3	8'-6"	7	5'-0"	4	6'-8"	4	8'-1"	17	5'-0"	3.47	216
42"	9.62	4 1/2"	4'-10 1/4"	8'-0"	3'-4"	1'-8"	10"	19	3'-0"	4	8'-8"	1	13'-2"	3	9'-0"	7	5'-8"	4	7'-6"	4	9'-2"	19	5'-8"	4.32	252



DIMENSIONS & QUANTITIES FOR HEADWALLS WITH U-TYPE WINGS												FOR ONE HEADWALL											
DIMENSIONS												REINFORCING STEEL		QUANTITIES									
D	AREA SQ FT	T	H	L	N	A1 - 1/2" Ø	A2 - 1/2" Ø	B - 1/2" Ø	C - 1/2" Ø	H1 - 1/2" Ø	H2 - 1/2" Ø	V1 - 1/2" Ø	V2 - 1/2" Ø	CLASS "A" CONC C.Y.	REINF. STEEL LBS								
15"	1.23	2 1/4"	2'-5 1/4"	3'-11"	6'-6"	3	2'-2"	3	3'-7"	7	3'-7"	3	1'-6"	2	3'-6"	2	2'-0"	8	3'-0" AV.	4	5'-10"	.95	71
18"	1.77	2 1/4"	2'-8 1/4"	3'-1"	3'-1"	3	2'-9"	4	3'-10"	7	3'-10"	3	1'-6"	2	4'-1"	2	2'-8"	8	3'-1" AV.	4	6'-1"	1.15	79
24"	3.14	3"	3'-3"	4'-2"	4'-2"	4	3'-10"	5	4'-4"	7	4'-4"	4	1'-6"	2	5'-2"	4	2'-11" AV.	12	3'-5" AV.	4	6'-8"	1.60	109
30"	4.91	3 1/4"	3'-9 1/4"	4'-3"	4'-3"	4	2'-6"	5	4'-10"	7	4'-10"	4	1'-6"	2	5'-3"	4	3'-5" AV.	12	3'-11" AV.	4	7'-2"	1.91	120
36"	7.07	4"	4'-4"	5'-4"	5'-4"	5	2'-9"	6	5'-4"	7	5'-4"	5	1'-6"	2	6'-4"	6	3'-11" AV.	14	4'-2" AV.	4	7'-9"	2.48	152
42"	9.62	4 1/4"	4'-10 1/4"	6'-5"	6'-5"	5	3'-0"	7	5'-10"	7	5'-10"	5	1'-6"	2	7'-5"	6	4'-10" AV.	18	4'-6" AV.	4	8'-3"	3.12	186

GENERAL NOTES:

- ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH OKLAHOMA CITY STANDARD SPECIFICATIONS.
- ALL EXPOSED CONCRETE SURFACES SHALL HAVE A CARBORUNDUM FINISH.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" CHAMFER.
- ALL REINFORCED STEEL SHALL CONFORM TO ASTM SPEC. A-305-49.



APPROVED BY: DATE: 02-06-13
ERIC J. WENGER, P.E.
CITY ENGINEER

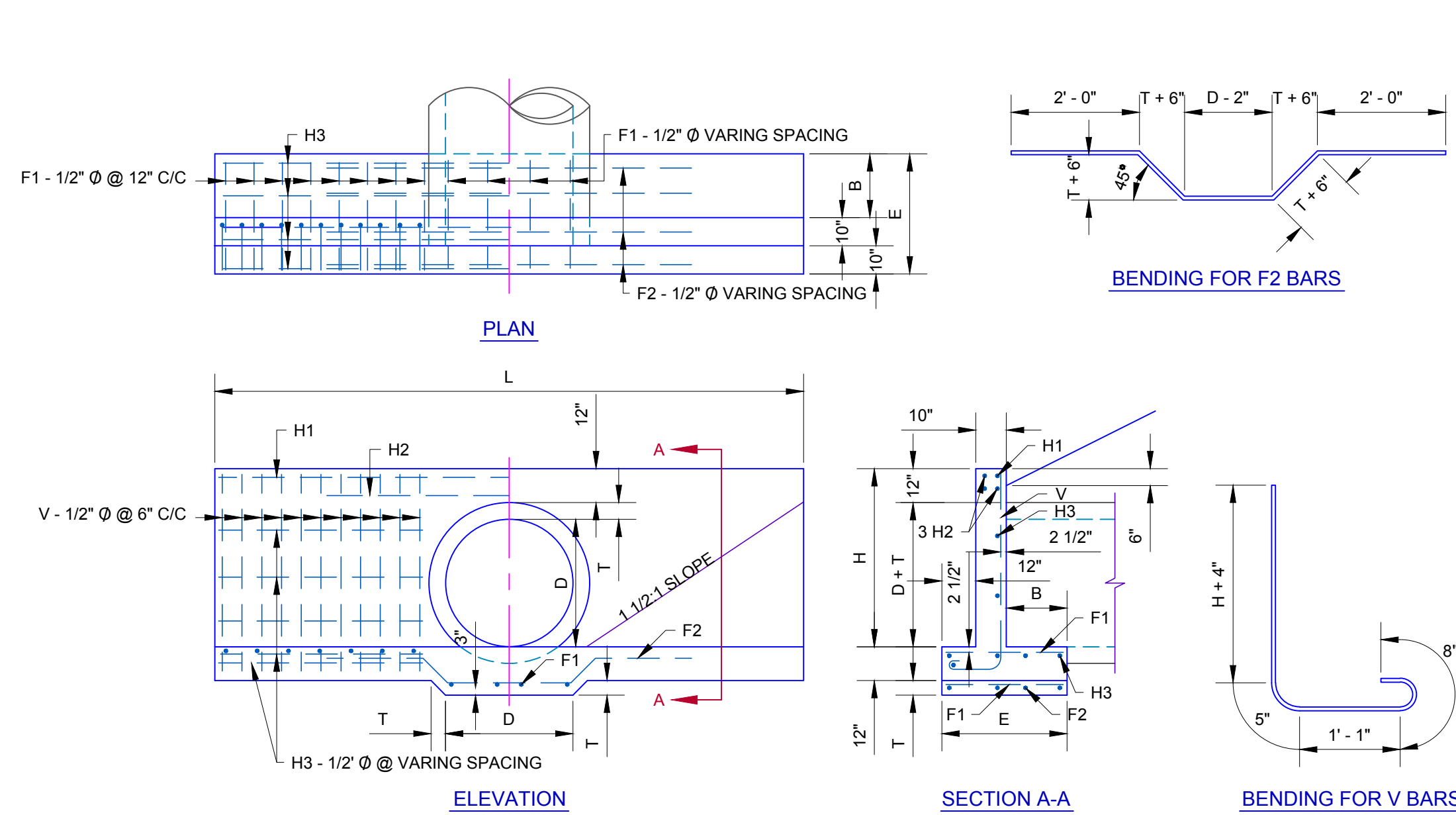
DRAWN: VSC

DATE: 02-06-13

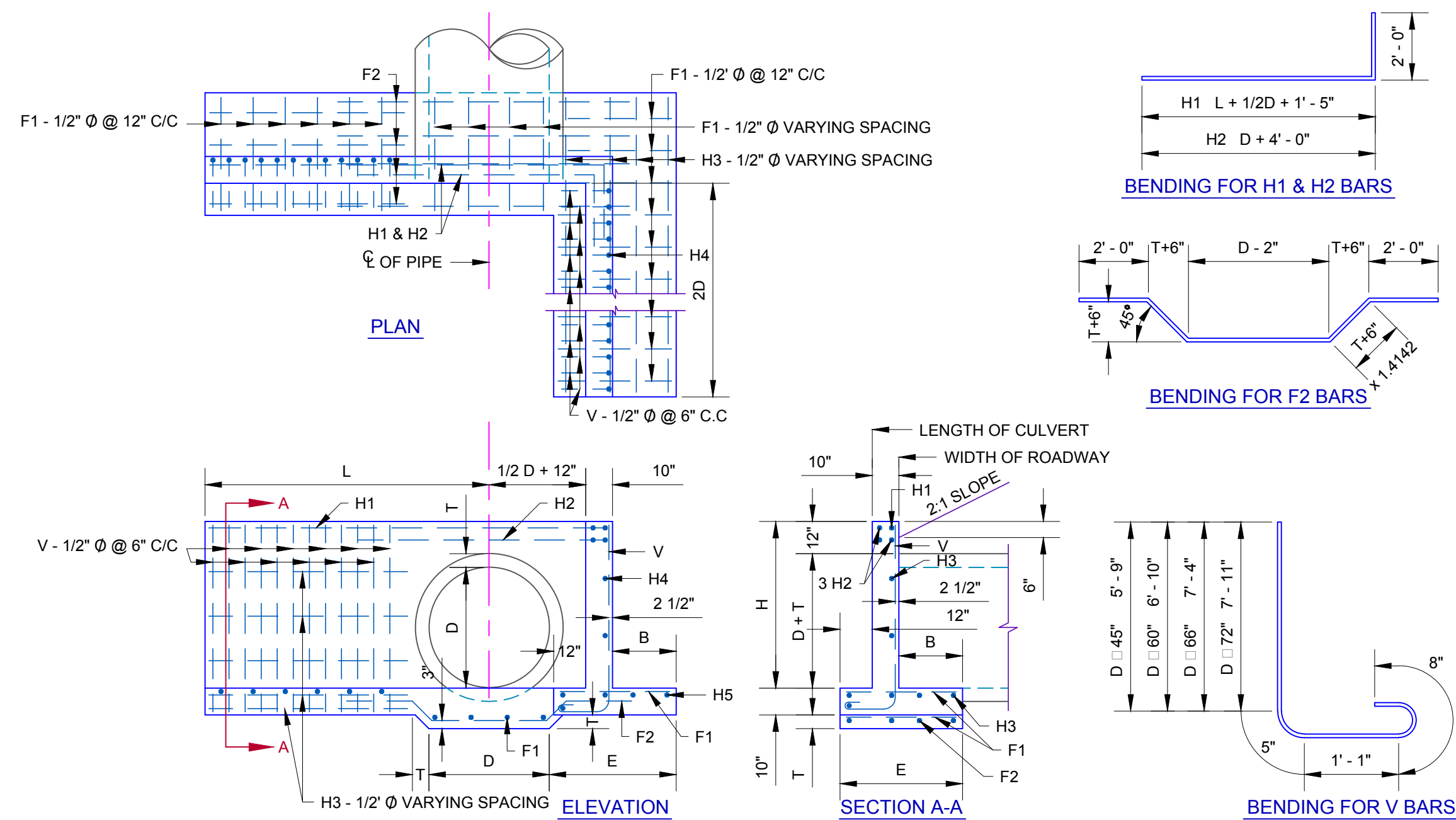
**CAST-IN-PLACE CONCRETE HEADWALLS
FOR 48" TO 72"
REINFORCED CONCRETE PIPE**

Drawing Number

D-407

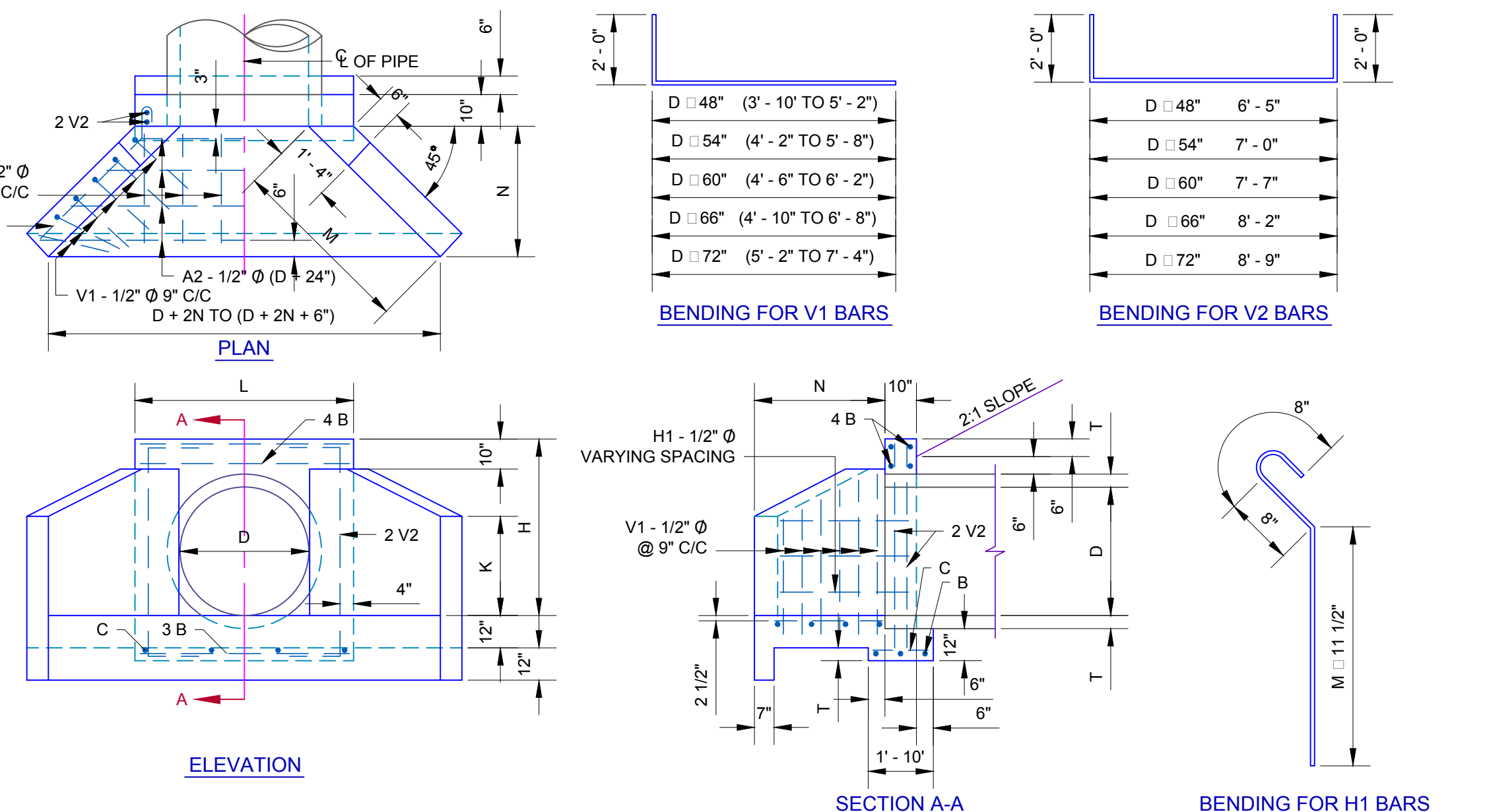


DIMENSIONS & QUANTITIES FOR STRAIGHT HEADWALLS											FOR ONE HEADWALL									
D	AREA SQ. FT.	DIMENSIONS					REINFORCING STEEL					QUANTITIES								
		T	H	L	E	B	F1 - 1/2" Ø #	F2 - 1/2" Ø #	H1 - 1/2" Ø #	H2 - 1/2" Ø #	H3 - 1/2" Ø #	V - 1/2" Ø #	CLASS "A" CONC. C.Y.	REINF. STEEL LBS.						
48"	12.57	5"	5'-5"	18'-0"	3'-9"	1'-11"	18	3'-5"	4	10'-5"	1	17'-8"	3	8'-0"	14	6'-5"	28	7'-11"	5.14	305
54"	15.90	5 1/2"	5'-11 1/2"	20'-0"	4'-0"	2'-2"	20	3'-8"	4	11'-0"	1	19'-8"	3	8'-6"	16	7'-1"	30	8'-6"	6.19	355
60"	19.63	6"	6'-6"	22'-0"	4'-3"	2'-5"	24	3'-11"	5	11'-8"	1	21'-8"	3	9'-0"	18	7'-10"	32	9'-0"	7.34	421
66"	23.76	6 1/2"	7'-0 1/2"	24'-0"	4'-6"	2'-8"	25	4'-2"	5	12'-3"	1	23'-8"	3	9'-6"	18	8'-6"	36	9'-6"	8.58	476
72"	28.27	7"	7'-7"	26'-0"	4'-10"	3'-0"	27	4'-6"	5	12'-10"	1	25'-8"	3	10'-0"	18	9'-3"	38	10'-1"	10.01	529



DIMENSIONS & QUANTITIES FOR HEADWALLS WITH 45° WINGS											FOR ONE HEADWALL												
D	AREA SQ. FT.	DIMENSIONS						REINFORCING STEEL					QUANTITIES										
		T	H	K	L	M	N	A1 - 1/2" Ø #	A - 1/2" Ø #	B - 1/2" Ø #	C - 1/2" Ø #	H1 - 1/2" Ø #	V1 - 1/2" Ø #	V - 1/2" Ø #	CLASS "A" CONC. C.Y.	REINF. STEEL LBS.							
48"	12.57	5"	5'-5"	3'-2"	6'-4"	5'-3 1/2"	3'-9"	7	3'-5"	4	9'-0" AV.	7	6'-0"	5	1'-6"	8	5'-8"	12	6'-6" AV.	4	10'-5"	3.81	184
54"	15.90	5 1/2"	5'-11 1/2"	3'-6"	6'-10"	5'-10 1/2"	4'-2"	7	3'-10"	5	9'-11" AV.	7	6'-6"	5	1'-6"	8	6'-3"	14	6'-11" AV.	4	11'-0"	4.54	214
60"	19.63	6"	6'-6"	3'-10"	7'-4"	6'-5 1/2"	4'-7"	8	4'-3"	5	10'-10" AV.	7	7'-0"	6	1'-6"	10	6'-10"	16	7'-4" AV.	4	11'-7"	5.33	253
66"	23.76	6 1/2"	7'-0 1/2"	4'-2"	7'-10"	7'-1"	5'-0"	8	4'-8"	5	11'-9" AV.	7	7'-6"	6	1'-6"	10	7'-5"	18	7'-9" AV.	4	12'-2"	6.20	281
72"	28.27	7"	7'-7"	2'-5 1/2"	8'-4"	7'-9 1/2"	5'-6"	9	5'-2"	6	12'-9" AV.	7	8'-0"	6	1'-6"	10	8'-2"	20	8'-3" AV.	4	12'-9"	7.22	325

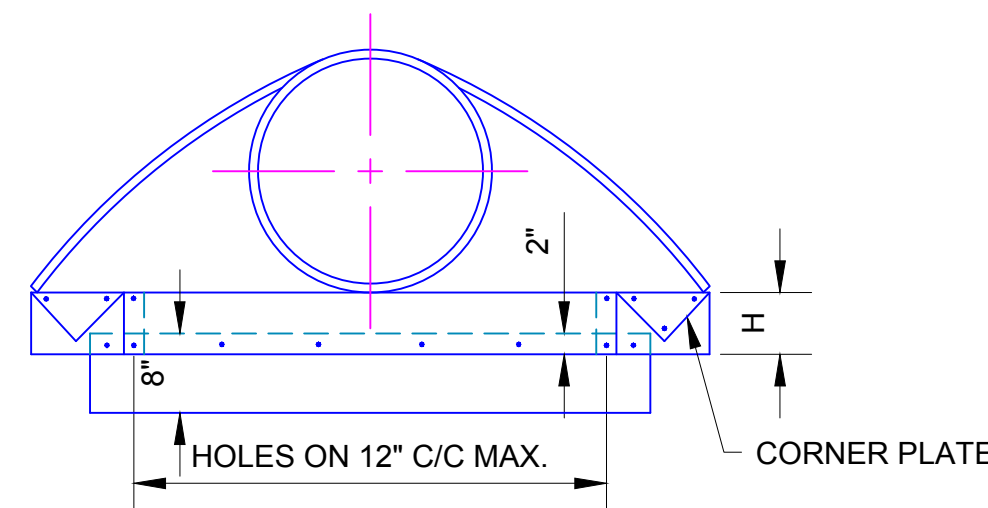
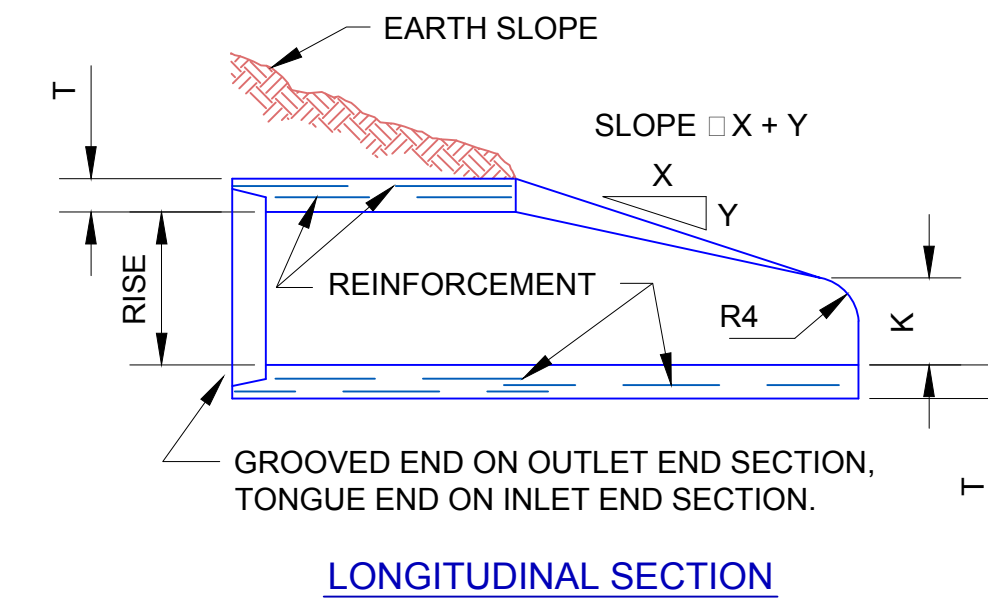
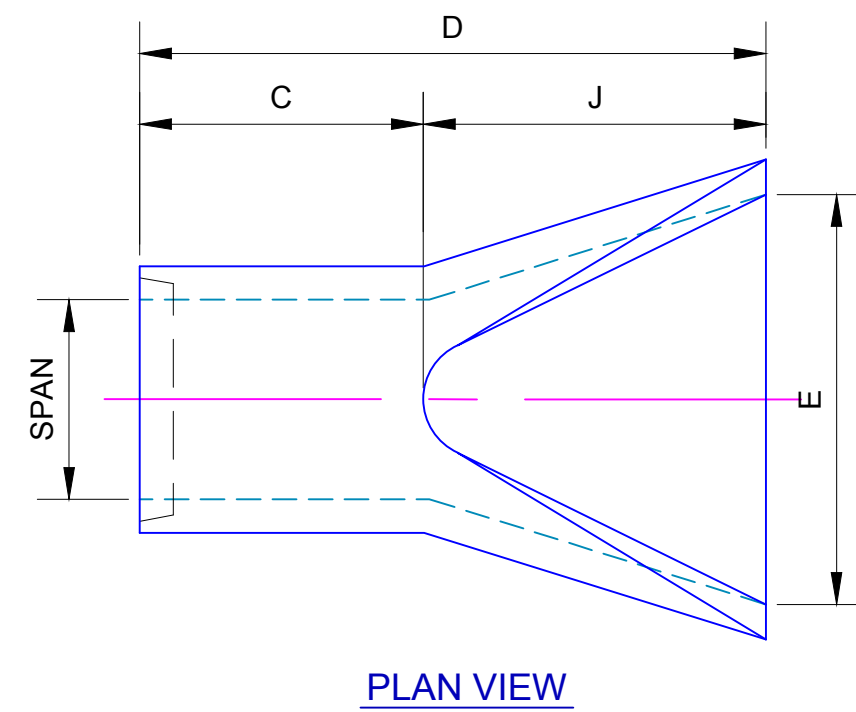
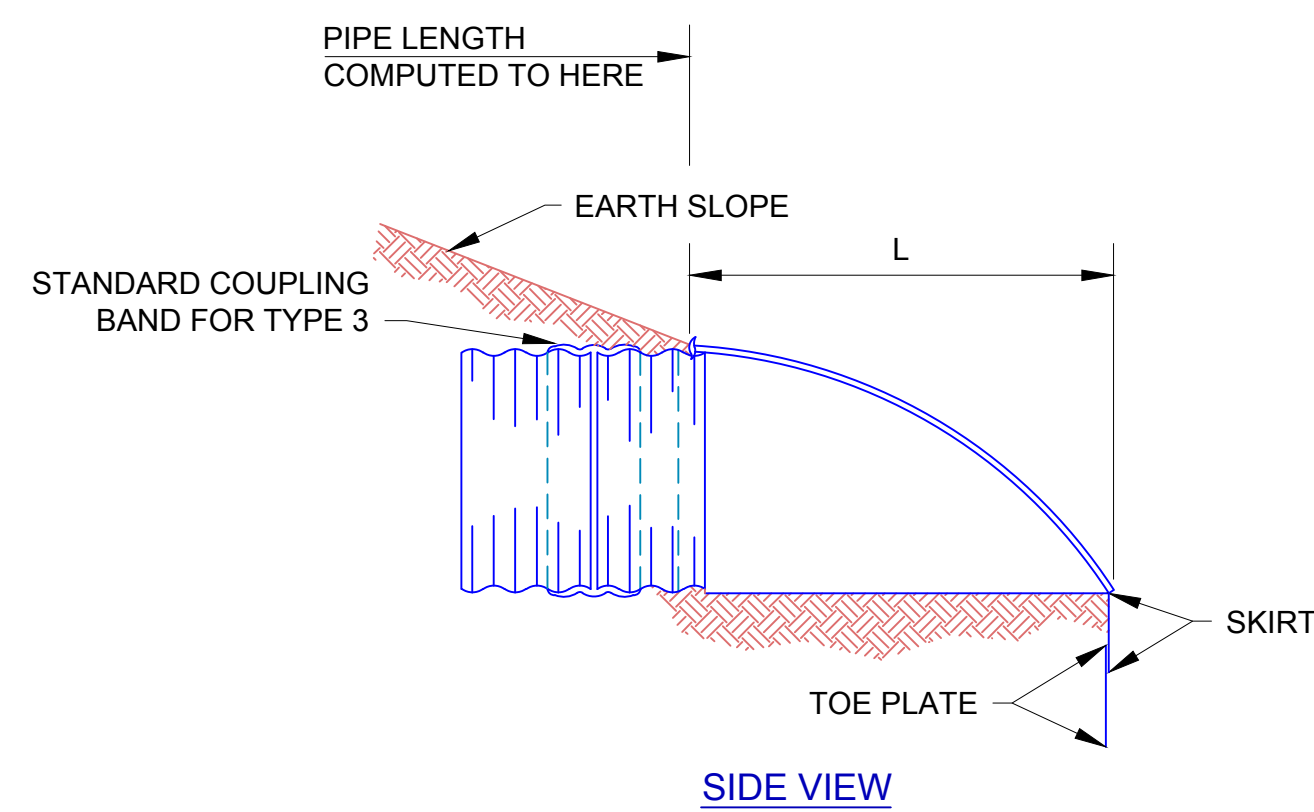
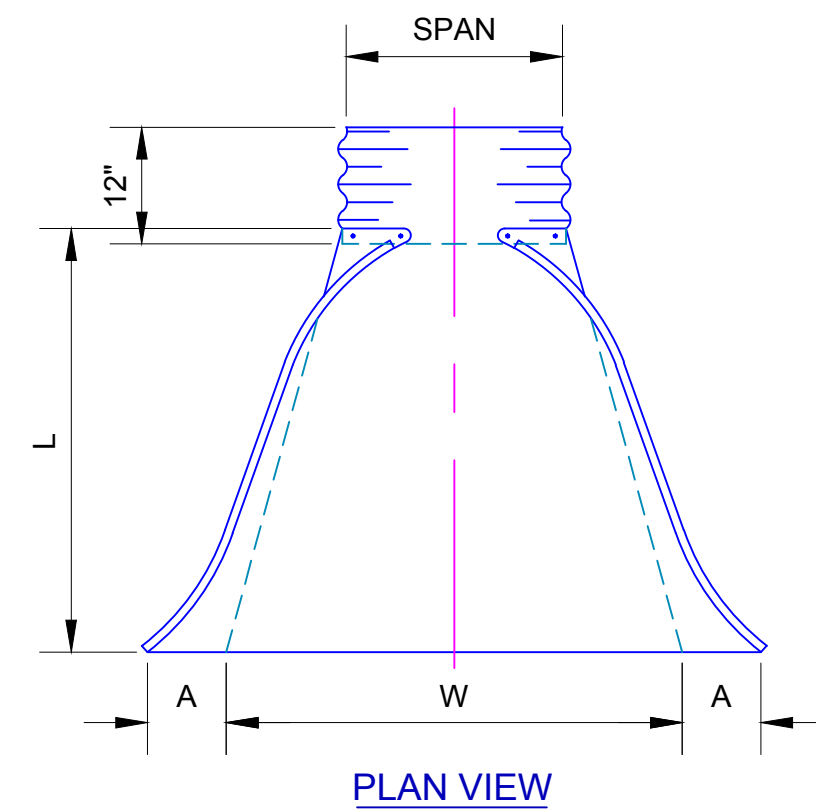
DIMENSIONS & QUANTITIES FOR HEADWALLS WITH 90° WINGS											FOR ONE HEADWALL															
D	AREA SQ. FT.	DIMENSIONS					REINFORCING STEEL					QUANTITIES														
		T	H	L	E	B	F1 - 1/2" Ø #	F2 - 1/2" Ø #	H1 - 1/2" Ø #	H2 - 1/2" Ø #	H3 - 1/2" Ø #	H4 - 1/2" Ø #	H5 - 1/2" Ø #	V - 1/2" Ø #	CLASS "A" CONC. C.Y.	REINF. STEEL LBS.										
48"	12.57	5"	5'-0"	9'-0"	3'-9"	1'-11"	22	3'-5"	4	10'-5"	1	14'-0"	3	10'-0"	7	6'-5"	4	8'-6"	4	10'-5"	18	5'-8"	4	10'-5"	4.56	234
54"	15.90	5 1/2"	5'-11 1/2"	10'-0"	4'-0"	2'-2"	24	3'-8"	4	11'-0"	1	15'-8"	3	10'-6"	8	7'-1"	4	9'-6"	5	11'-8"	33	8'-6"	7.39	410		
60"	19.63	6"	6'-6"	11'-0"	4'-3"	2'-5"	26	3'-11"	5	11'-8"	1	16'-11"	3	11'-0"	9	7'-10"	5	10'-6"	5	12'-11"	36	9'-0"	8.75	482		
66"	23.76	6 1/2"	7'-0 1/4"	12'-0"	4'-6"	2'-8"	30	4'-2"	5	12'-3"	1	18'-2"	3	11'-6"	9	8'-6"	5	11'-6"	5	14'-2"	40	9'-6"	10.23	551		
72"	28.27	7"	7'-7"	13'-0"	4'-10"	3'-0"	31	4'-6"	5	12'-10"	1	19'-5"	3	12'-0"	9	9'-3"	5	12'-6"	5	15'-6"	43	10'-1"	11.95	612		



DIMENSIONS & QUANTITIES FOR HEADWALLS WITH U-TYPE WINGS											FOR ONE HEADWALL												
D	AREA SQ. FT.	DIMENSIONS					REINFORCING STEEL					QUANTITIES											
		T	H	L	N	A1 - 1/2" Ø #	A2 - 1/2" Ø #	B - 1/2" Ø #	C - 1/2" Ø #	H1 - 1/2" Ø #	H2 - 1/2" Ø #	V1 - 1/2" Ø #	V2 - 1/2" Ø #	CLASS "A" CONC. C.Y.	REINF. STEEL LBS.								
48"	12.57	5"	5'-5"	7'-8"	6'-6"	7	6'-2"	7	7'-4"	7	7'-4"	7	1'-6"	4	4'-10" AV.	18	5'-8"	4	10'-5"	4	10'-5"	4.56	234
54"	15.90	5 1/2"	5'-11 1/2"	8'-2"	3'-1"	7	7'-3"	8	7'-10"	7	7'-10"	7	1'-6"	4	8'-7"	6	4'-11" AV.	20	5'-10" AV.	4	11'-0"	5.49	270
60"	19.63	6"	6'-6"	8'-8"	4'-2"	8	8'-4"	9	8'-4"	7	8'-4"	7	1'-6"	4	9'-8"	6	6'-0" AV.	24	6'-2" AV.	4	11'-7"	6.50	321
66"	23.76	6 1/2"	7'-0 1/2"	9'-2"	4'-3"	8	8'-5"	10	8'-10"	7	8'-10"	8	1'-6"	4	10'-9"	8	6'-1" AV.	26	6'-5" AV.	4	12'-2"	7.58	364
72"	28.27	7"	7'-7"	5'-4"	9'-8"	9	10'-6"	11	9'-4"	7	9'-4"	8	1'-6"	4	11'-10"	8	7'-2" AV.	30	6'-9" AV.	4	12'-9"	8.75	423

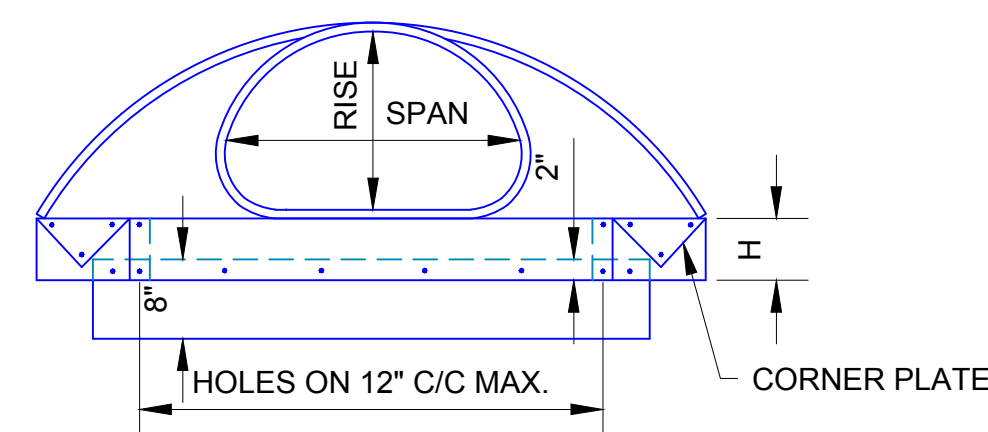
GENERAL NOTES:

- ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH OKLAHOMA CITY STANDARD SPECIFICATIONS.
- ALL EXPOSED CONCRETE SURFACES SHALL HAVE A CARBORUNDUM FINISH.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" CHAMFER.
- ALL REINFORCED STEEL SHALL CONFORM TO AASHTO M-179 (ASTM C-76)
- MINIMUM DEPTH OF FILL OVER CULVERTS SHALL BE 1'-0".
- WALL THICKNESS (DIMENSION "T" OF PIPES SHOWN, ARE TAKEN FROM "WALL B" COLUMN OF ASTM AND AASHTO TABLES.



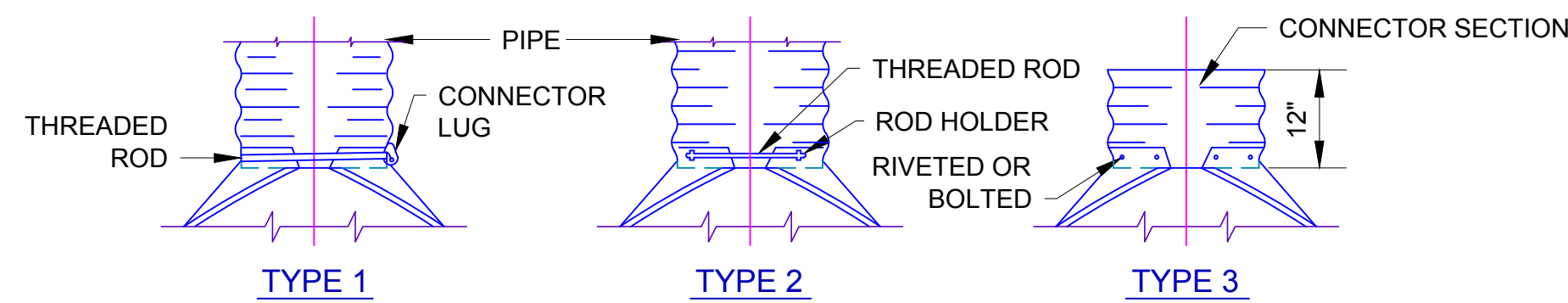
END VIEW
ROUND METAL PIPE END SECTION

DIMENSIONS OF END SECTION FOR ROUND METAL PIPE								
SPAN	GA.	A ± 1	B (MAX.)	H ± 1	L ± 1/2	W ± 2	APPROX. SLOPE	SPAN
IN.	IN.	IN.	IN.	IN.	IN.	IN.		IN.
18	16	8	10	6	31	36	2 1/2 : 1	1
24	16	10	13	6	41	48	2 1/2 : 1	1
30	14	12	16	8	51	60	2 1/2 : 1	1
36	14	14	19	9	60	72	2 1/2 : 1	2
42	12	16	22	11	69	84	2 1/2 : 1	2
48	12	18	27	12	78	90	2 1/4 : 1	2

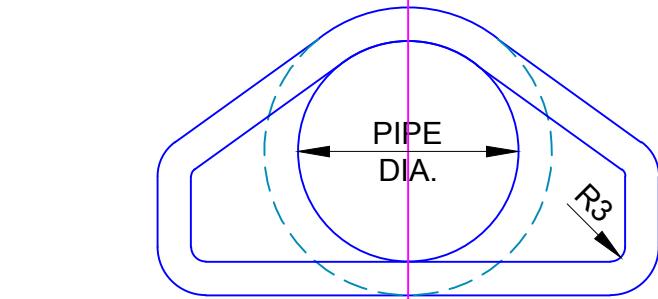


END VIEW
ARCH METAL PIPE END SECTION

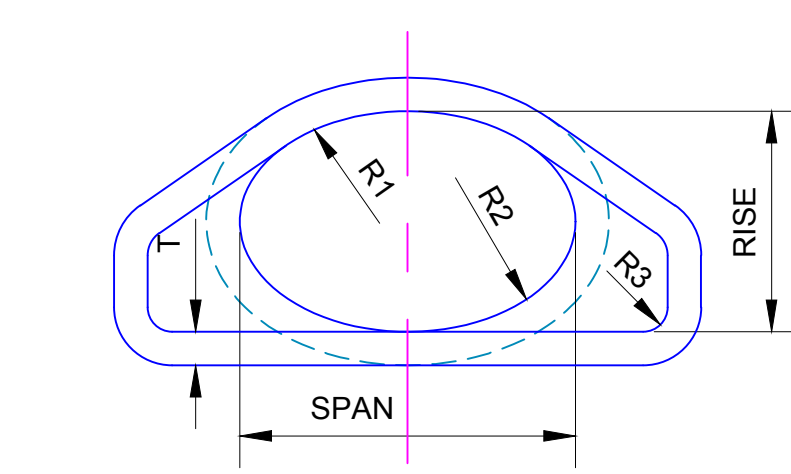
DIMENSIONS OF END SECTION FOR METAL PIPE ARCH									
SPAN	RISE	GA.	A ± 1	B (MAX.)	H ± 1	L ± 1/2	W ± 2	APPROX. SLOPE	SPAN
IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.		IN.
22	13	16	7	10	6	23	36	2 1/2 : 1	1
29	18	16	9	14	6	32	48	2 1/2 : 1	1
43	22	14	10	16	8	39	60	2 1/2 : 1	1
36	27	14	12	18	8	46	75	2 1/2 : 1	1
50	31	12	13	21	9	53	85	2 1/2 : 1	2
58	36	12	18	26	12	63	90	2 1/4 : 1	2
65	40	12	18	30	12	70	102	2 1/2 : 1	2
72	44	12	18	33	12	77	114	2 1/4 : 1	3



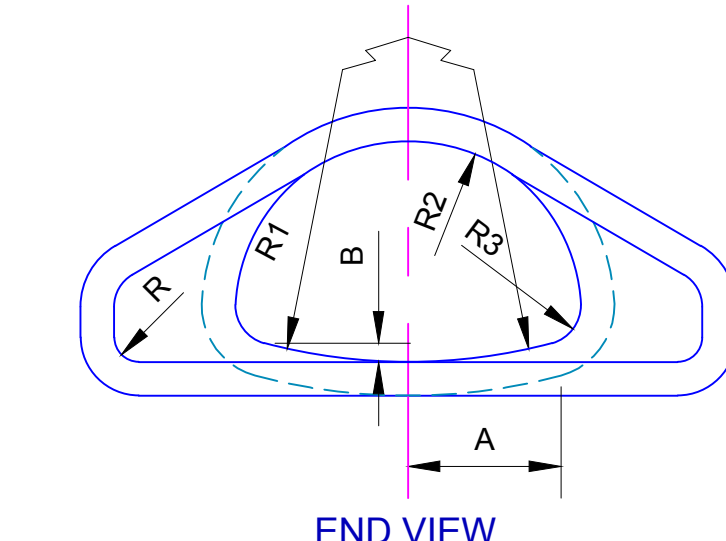
TYPICAL METAL END SECTION CONNECTIONS



END VIEW
ARCH METAL PIPE END SECTION



END VIEW
ELLIPTICAL CONCRETE PIPE END SECTION



END VIEW
ARCH CONCRETE PIPE END SECTION

DIMENSIONS OF PRECAST END SECTION FOR PIPES										
SPAN	K	J	C	D	E	T	R3	R4	R5	SLOPE
IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	
18	9	27	46	73	36	2 1/2	3	3	6	3 TO 1
24	8 1/2	43 1/2	30	73 1/2	48	3	3	3	7	3 TO 1
30	12	54	19 3/4	73 3/4	60	3 1/2	3	3	8	3 TO 1
36	15	63	34 3/4	73 3/4	72	4	3	3	10 1/2	3 TO 1
42	21	63	35	98	78	4 1/2	3	3	10 1/2	3 TO 1
48	24	72	26	98	84	5	6	6	14	3 TO 1

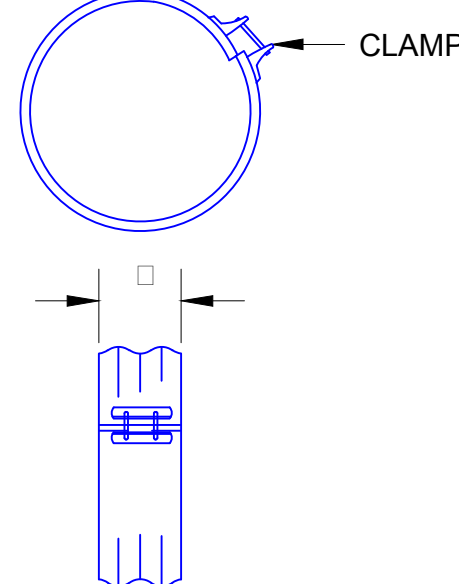
DIMENSIONS OF PRE-CAST END SECTIONS FOR ELLIPTICAL PIPES													
SPAN	RISE	R1	R2	R3	R4	R5	T	K	J	C	D	E	SLOPE
IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	
23	14	6	20	3	3		2 3/4	8	27	45	72	36	3 TO 1
30	19	8 1/4	26 1/4	3	3	7	3 1/4	8 1/2	39	33	72	48	3 TO 1
34	22	9 1/4	29 17/32	3	3	8	3 1/2	9	46	26	72	54	3 TO 1
38	24	10 1/4	32 3/4	3	3	9	3 3/4	9 1/2	54	18	72	60	3 TO 1
42	27	11 7/16	36 3/16	3	3	10 1/2	3 3/4	10 3/8	57	15	72	66	3 TO 1
45	29	12 1/4	39 1/4	3	3	12	4 1/2	11 1/4	60	36	96	72	3 TO 1
49	32	13 9/16	42 21/32	3	3	12 1/2	4 3/4	12	60	36	96	75	3 TO 1
53	34	14 3/4	46	6	6	13	5	15 3/4	60	36	96	78	3 TO 1
60	38	16 1/2	51 3/4	6	6	14	5 1/2	21	60	36	96	84	3 TO 1
68	43	18 21/32	58 13/32	6	6	16	6	25 1/2	60	36	96	90	3 TO 1

DIMENSIONS OF PRE-CAST END SECTION FOR ARCH-PIPES																
SPAN	RISE	A	B	R	R1	R2	R3	R4	R5	T	K	J	C	D	E	SLOPE
IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	
28 1/2	18	10 7/8	3 3/4	3	40 11/16	14 3/4	4 5/8	3	7	3 1/2	8 1/2	39	33	72	48	3 TO 1
36 1/4	22 1/2	13 5/8	3 13/16	3	51	18 3/4	6 1/8	3	8	4	9 1/2	50	46	96	60	3 TO 1
43 3/4	26 5/8	17 1/8	4 1/8	6	62	22 1/2	6 1/2	3	10 1/2	4 1/2	11 1/8	60	36	96	72	3 TO 1
51 1/8	31 1/16	20	5 1/16	6	73	26 1/4	7 3/4	3	12 1/2	4 1/2	15 13/16	60	36	96	78	3 TO 1
58 1/2	36	22 3/4	6	6	84	30	8 7/8	3	14	5	21	60	36	96	84	3 TO 1
65	40	25	6 3/4	6	92 1/2	33 1/2	10	6	16	5 1/2	25 1/2	60	36	96	90	3 TO 1
73	45	28 1/2	7 1/2	6	105	37 1/2	11 1/16	6		6	31	60	36	96	96	3 TO 1

GENERAL NOTES FOR METAL END SECTIONS:

- WHEN PREFABRICATED END SECTIONS ARE OPTIONAL, THEY SHALL BE OF THE SAME MATERIALS AS THAT OF THE PIPE, WHICH THEY ARE INSTALLED.
- FOR MATERIAL OF ALUMINUM ALLOY END SECTION, SEE SUBSECTION 726.65 OF THE CURRENT OKLAHOMA STANDARD SPECIFICATIONS.
- FOR MATERIALS OF GALVANIZED METAL END SECTION, SEE SUBSECTION 726.17 OF THE CURRENT OKLAHOMA STANDARD SPECIFICATIONS.
- CONNECTOR SECTION, CORNER PLATE AND TOE PLATE TO BE OF THE SAME GAGE & MATERIAL AS THE SKIRT AND SHALL BE INCLUDED IN THE BID FOR END SECTION.
- TOE PLATES WILL BE REQUIRED FOR ALL METAL END SECTIONS UNLESS SOLID ROCK IS ENCOUNTERED. HOLES IN TOE PLATE ARE TO BE PUNCHED TO MATCH HOLES IN SKIRT LIP. 3/8" BOLTS TO BE FURNISHED. LENGTH TO TOE PLATES FOR ROUND PIPE SECTION IS W + 10" TO 12" TO 30" DIAMETER PIPE, W + 22" FOR 36" TO 48" DIAMETER PIPE. LENGTH OF TOE PLATES FOR ARCH PIPE END SECTION IS W + 10" FOR A RISE OF 11" TO 27" AND W + 18 FOR A RISE OF 31" TO 44".
- IF TYPE 3 END SECTION IS USED AS OPTIONAL PIPE, THE LENGTH OF PIPE IS TO BE REDUCED BY 12" FOR EACH END SECTION.
- ANY STRUCTURAL EXCAVATION REQUIRED FOR INSTALLATION OF PREFABRICATED END SECTIONS SHALL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF WORK.

NOTE: COUPLING BAND CLAMP SHALL CLEAR HORIZONTAL LINE



STANDARD COUPLING BAND
7" FOR UP TO 36" DIAMETER, 12" FOR 36" DIAMETER AND UP.

BASIS OF PAYMENT FOR METAL END SECTIONS:

- GALVANIZED METAL END SECTION - ROUND EA.
- GALVANIZED METAL END SECTION - ARCH EA.

WHEN USED AS OPTIONAL END SECTION BETWEEN METAL, ALUMINUM ALLOY & CONCRETE, THE BASIS OF PAYMENT SHALL BE:

- SP. PREFABRICATED CULVERT END SECTION - ROUND EA.
- SP. PREFABRICATED CULVERT END SECTION - ARCH EA.

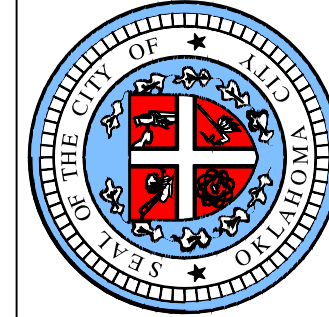
GENERAL NOTES FOR PRECAST END SECTIONS:

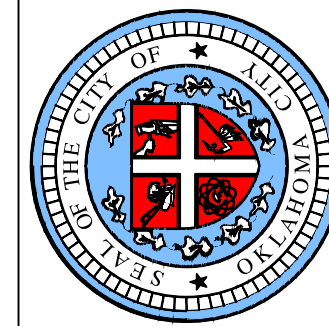
- WHEN PREFABRICATED END SECTIONS ARE OPTIONAL, THEY SHALL BE OF THE SAME MATERIALS AS THAT OF THE PIPE, WHICH THEY ARE INSTALLED.
- DIMENSIONS SHOWN FOR PREFABRICATED END SECTIONS ARE SUBJECT TO MANUFACTURERS TOLERANCES.
- ANY STRUCTURAL EXCAVATION REQUIRED FOR INSTALLATION OF PREFABRICATED END SECTIONS SHALL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF WORK.

BASIS OF PAYMENT FOR PRECAST END SECTIONS:

- PRECAST CONCRETE CULVERT END SECTION - ROUNDED EA.
- PRECAST CONCRETE CULVERT END SECTION - ELLIPTICAL EA.
- PRECAST CONCRETE CULVERT END SECTION - ARCH EA.

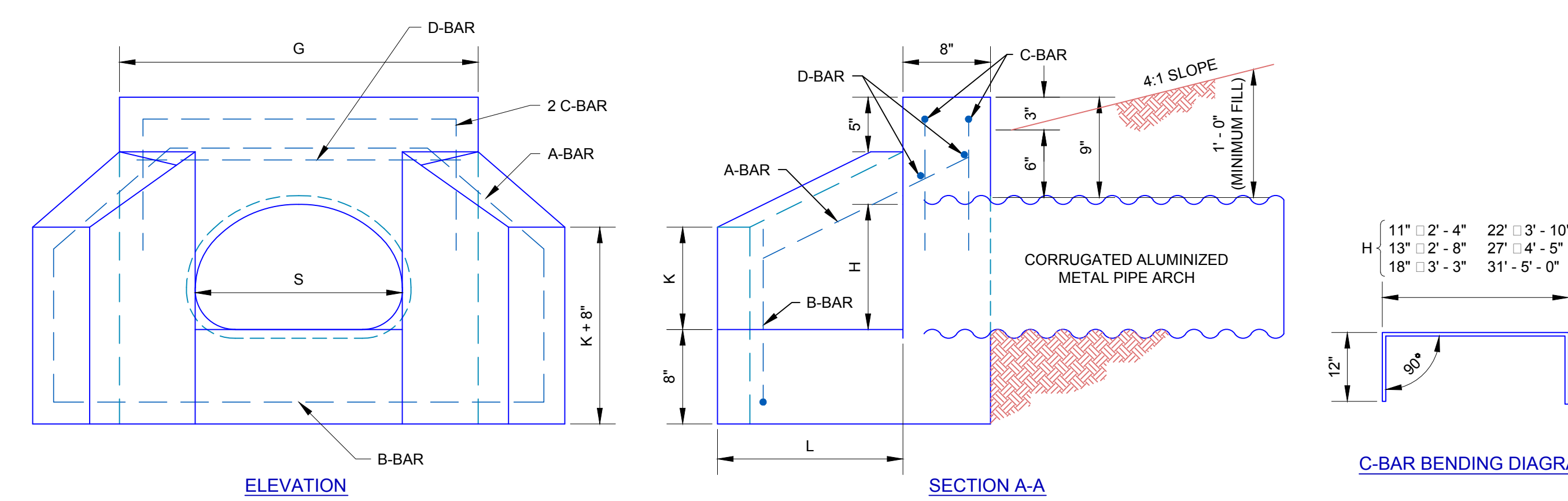
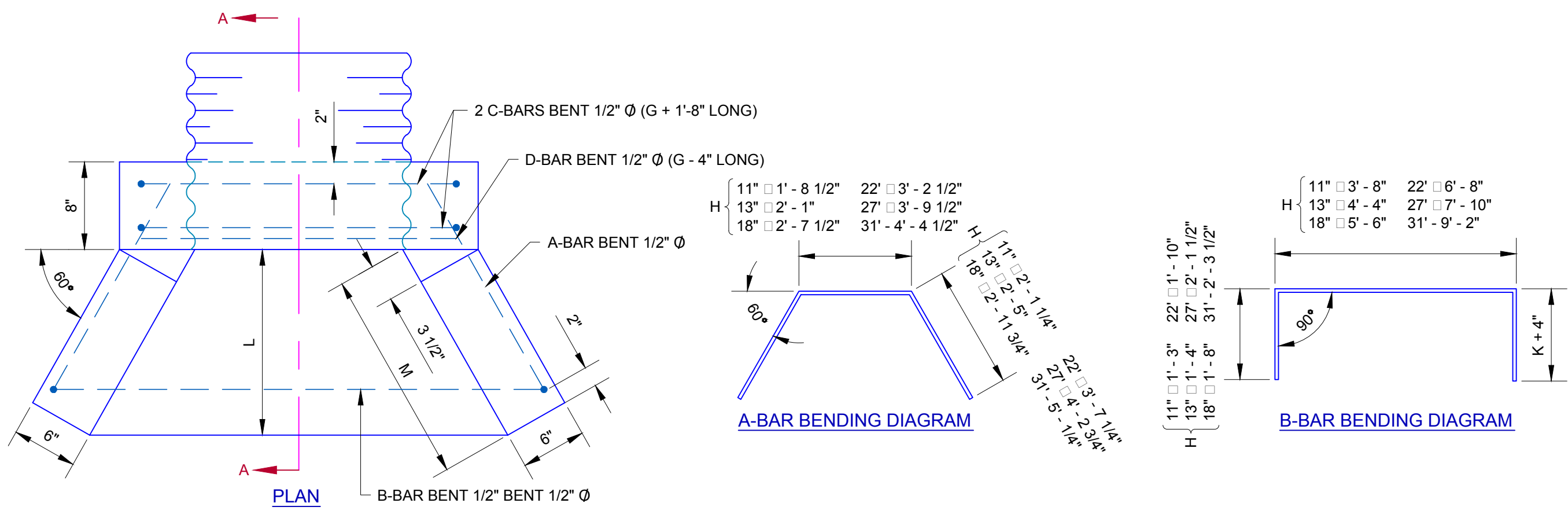
IF ELLIPTICAL CONCRETE IS USED, THE ELLIPTICAL CONCRETE END SECTION SHALL BE USED.





APPROVED BY: DATE: 02-06-13
ERIC J. MENGER, P.E.
CITY ENGINEER
DRAWN: VSC
DATE: 02-06-13

**CAST-IN-PLACE CONCRETE
HEADWALLS FOR ELLIPTICAL
OR ARCH PIPE**



DIMENSIONS AND QUANTITIES FOR STEEL FOR METAL PIPE ARCH

S	H	A-BARS			B-BARS			C-BARS			D-BARS						
		FORM #	SIZE	LENGTH	FORM #	SIZE	LENGTH	FORM #	SIZE	LENGTH	FORM #	SIZE	LENGTH				
18"	11"	BENT	1	1/2" Ø	5'-11"	BENT	1	1/2" Ø	6'-2"	BENT	2	1/2" Ø	4'-4"	STR.	1	1/2" Ø	2'-4"
22"	13"	BENT	1	1/2" Ø	6'-11"	BENT	1	1/2" Ø	7'-0"	BENT	2	1/2" Ø	4'-8"	STR.	1	1/2" Ø	2'-8"
29"	18"	BENT	1	1/2" Ø	8'-7"	BENT	1	1/2" Ø	8'-10"	BENT	2	1/2" Ø	5'-3"	STR.	1	1/2" Ø	3'-3"
36"	22"	BENT	1	1/2" Ø	10'-5"	BENT	1	1/2" Ø	10'-4"	BENT	2	1/2" Ø	5'-10"	STR.	1	1/2" Ø	3'-10"
43"	27"	BENT	1	1/2" Ø	12'-3"	BENT	1	1/2" Ø	12'-1"	BENT	2	1/2" Ø	6'-5"	STR.	1	1/2" Ø	4'-5"
50"	31"	BENT	1	1/2" Ø	14'-5"	BENT	1	1/2" Ø	13'-9"	BENT	2	1/2" Ø	7'-0"	STR.	1	1/2" Ø	5'-0"

DIMENSIONS FOR CONCRETE

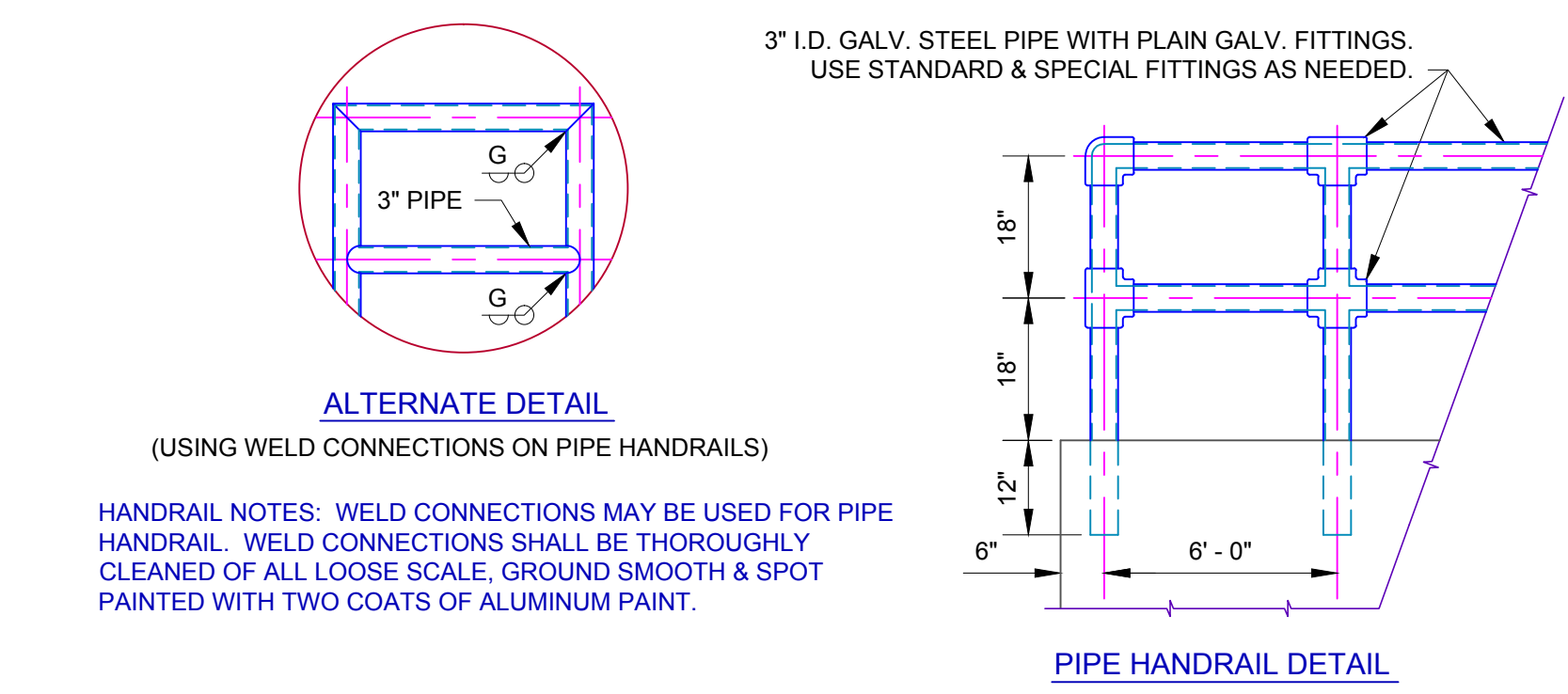
S	H	AREA SQ. FT.	K	G	L	M
18"	11"	1.2	11"	2'-8"	1'-7"	1'-10"
22"	13"	1.8	1'-0"	3'-0"	1'-10"	2'-1 1/2"
29"	18"	3.1	1'-4"	3'-7"	2'-4"	2'-8 1/2"
36"	22"	4.9	1'-6"	4'-2"	2'-10"	3'-3 1/2"
43"	27"	7.1	1'-9 1/2"	4'-9"	3'-4 1/2"	3'-11"
50"	31"	9.6	1'-11 1/2"	5'-4"	4'-12"	4'-8"

QUANTITIES FOR TWO END WALLS

H	CLASS "A" CONC. C.Y.	REINFORCING STEEL LBS.
11"	0.66	31
13"	0.82	35
18"	1.23	42
22"	1.66	49
27"	2.23	56
31"	2.92	63

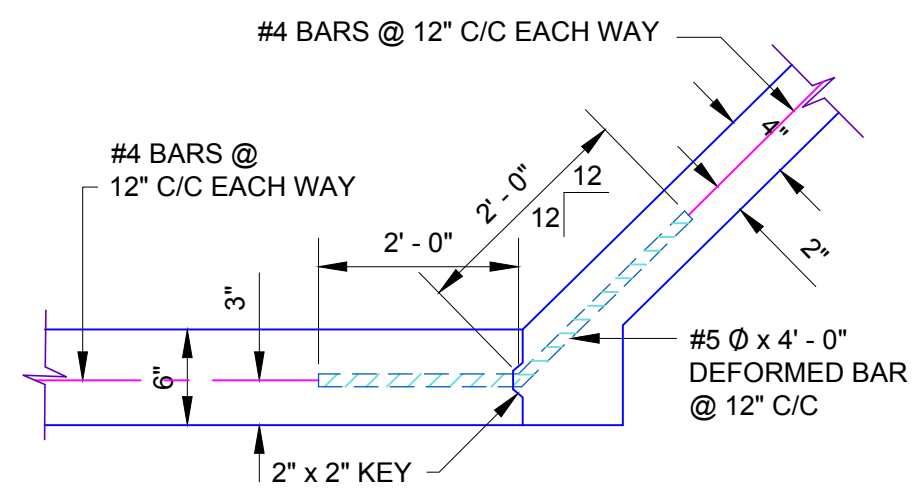
DIMENSIONS & QUANTITIES FOR CAST-IN-PLACE 45° HEADWALLS [FOR ONE HEADWALL]

DIMENSIONS									REINFORCING STEEL						* QUANTITY									
W	H	AREA SQ. FT.	T	H	K	L	M	N	A1 - 1/2" Ø #	A2 - 1/2" Ø #	B - 1/2" Ø #	C - 1/2" Ø #	H1 - 1/2" Ø #	V1 - 1/2" Ø #	V2 - 1/2" Ø #	CLASS "A" CONC. CU. YD.	REINFORCED STEEL LBS.							
30"	19"	3.3	3 1/4"	2'-10 1/4"	1'-4"	4'-10 1/4"	2'-6"	1'-9"	5	1'-5"	3	5'-8" A	7	4'-6 1/2"	4	1'-6"	8	2'-10 1/2"	12	3'-8" A	4	6'-4"	1.27	104
38"	24"	5.1	3 3/4"	3'-3 3/4"	1'-10"	5'-6 1/4"	3'-1"	2'-1 1/2"	6	1'-10"	3	6'-9" A	7	5'-2 1/4"	4	1'-6"	12	3'-5 1/2"	16	4'-2" A	4	6'-10"	1.87	140
42"	27"	6.3	3 3/4"	3'-6 3/4"	2'-0"	5'-10 1/4"	3'-5"	2'-4 1/2"	6	2'-1"	3	7'-1" A	7	5'-6 1/4"	4	1'-6"	12	3'-9 1/2"	16	4'-4 1/2" A	4	7'-1"	2.09	149
45"	29"	7.4	4 1/2"	3'-9 1/2"	2'-2"	6'-1 1/4"	3'-8"	2'-7 1/8"	7	2'-3"	4	7'-9" A	7	5'-9 1/4"	4	1'-6"	12	4'-1/2"	16	4'-6 1/4" A	4	7'-3"	2.38	163
53"	34"	10.2	5"	4'-3"	2'-6"	6'-9 1/4"	4'-3"	3'-0"	7	2'-8"	4	8'-8" A	7	6'-5 1/4"	5	1'-6"	12	4'-7 1/2"	20	4'-11 1/2" A	4	7'-9"	3.01	195



GENERAL NOTES

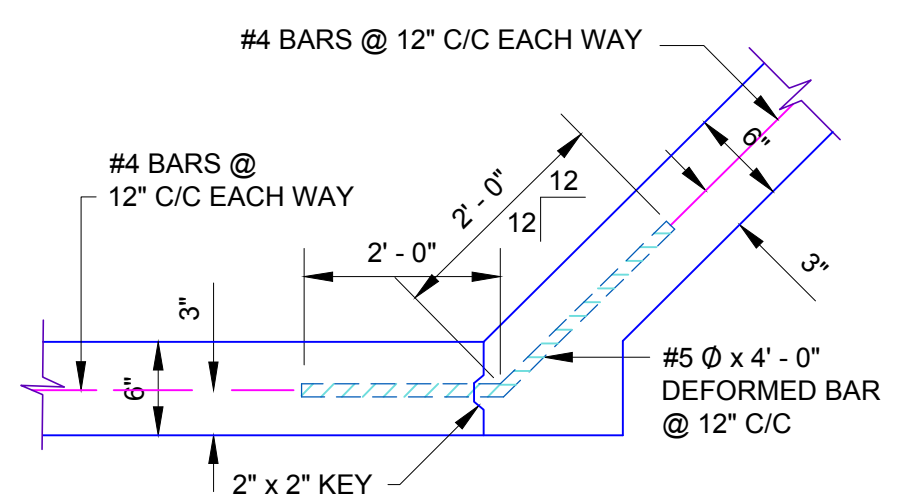
- All construction shall be in accordance with the latest edition of the Oklahoma City Specifications.
- All Exposed Concrete Edges shall have a 3/4" Chamfer.
- All Exposed Concrete Surfaces shall have a Carborundum Finish.
- Minimum depth of fill over Culvert shall be 1'-0".



LONGITUDINAL CONSTRUCTION JOINT

FOR 6" BOTTOM & 4" SIDE WALLS
4" WALLS FOR DEPTH OF 0' TO 5'
WALL DETAIL "A"

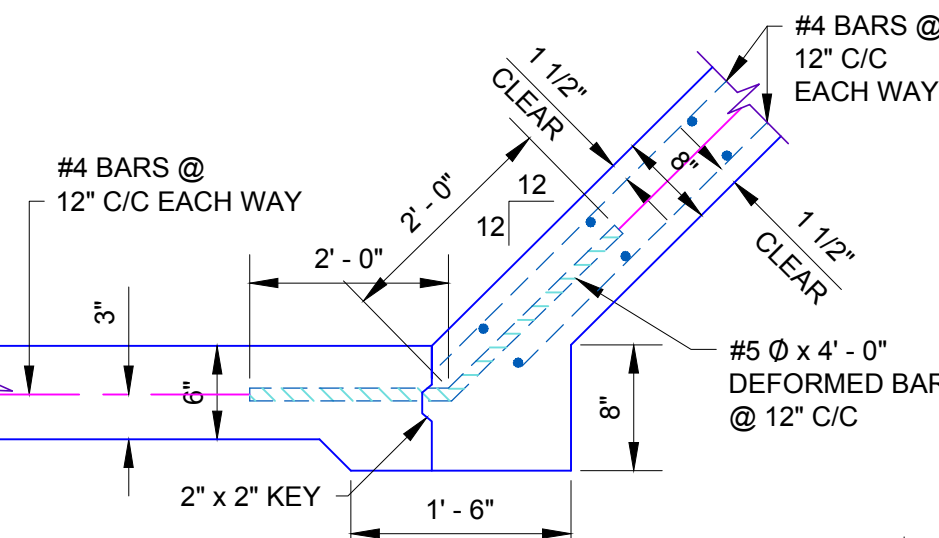
CONCRETE CHANNEL LINER JOINT DETAIL



LONGITUDINAL CONSTRUCTION JOINT

FOR 6" BOTTOM & 4" SIDE WALLS
6" WALLS FOR DEPTH OF 0' TO 5'
WALL DETAIL "B"

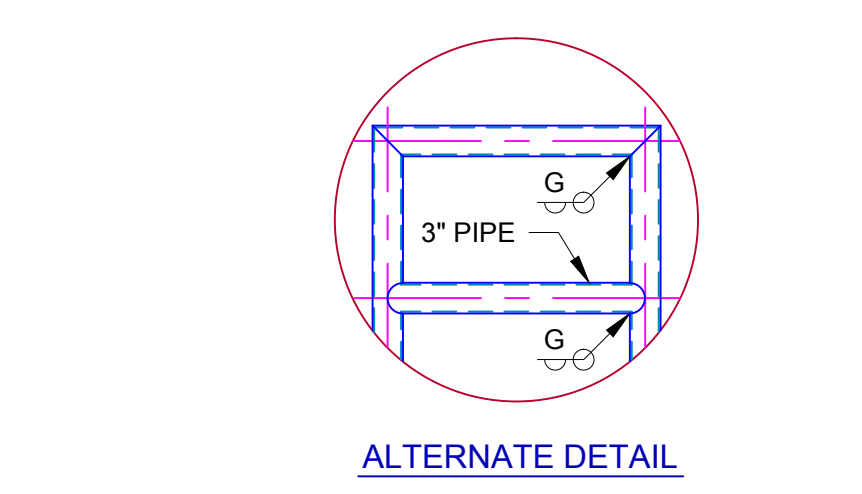
CONCRETE CHANNEL LINER JOINT DETAIL



LONGITUDINAL CONSTRUCTION JOINT

FOR 6" BOTTOM & 6" SIDE WALLS
8" WALLS FOR 2/3 THE WALL HEIGHT ABOVE 5'
WALL DETAIL "C"

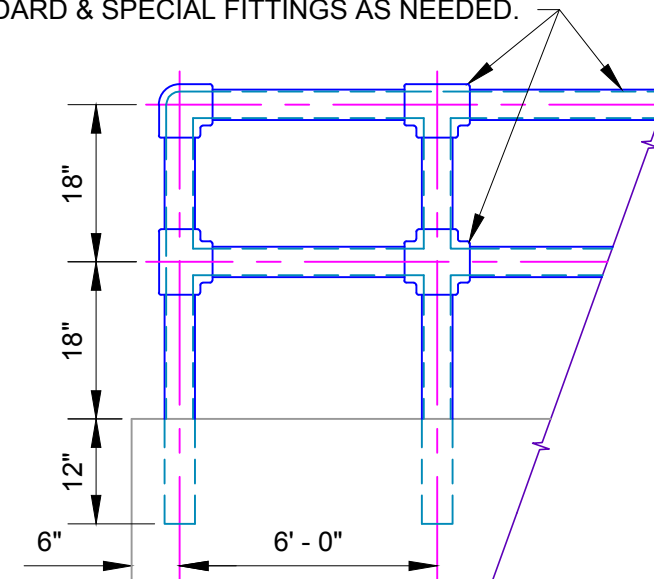
CONCRETE CHANNEL LINER JOINT DETAIL



ALTERNATE DETAIL

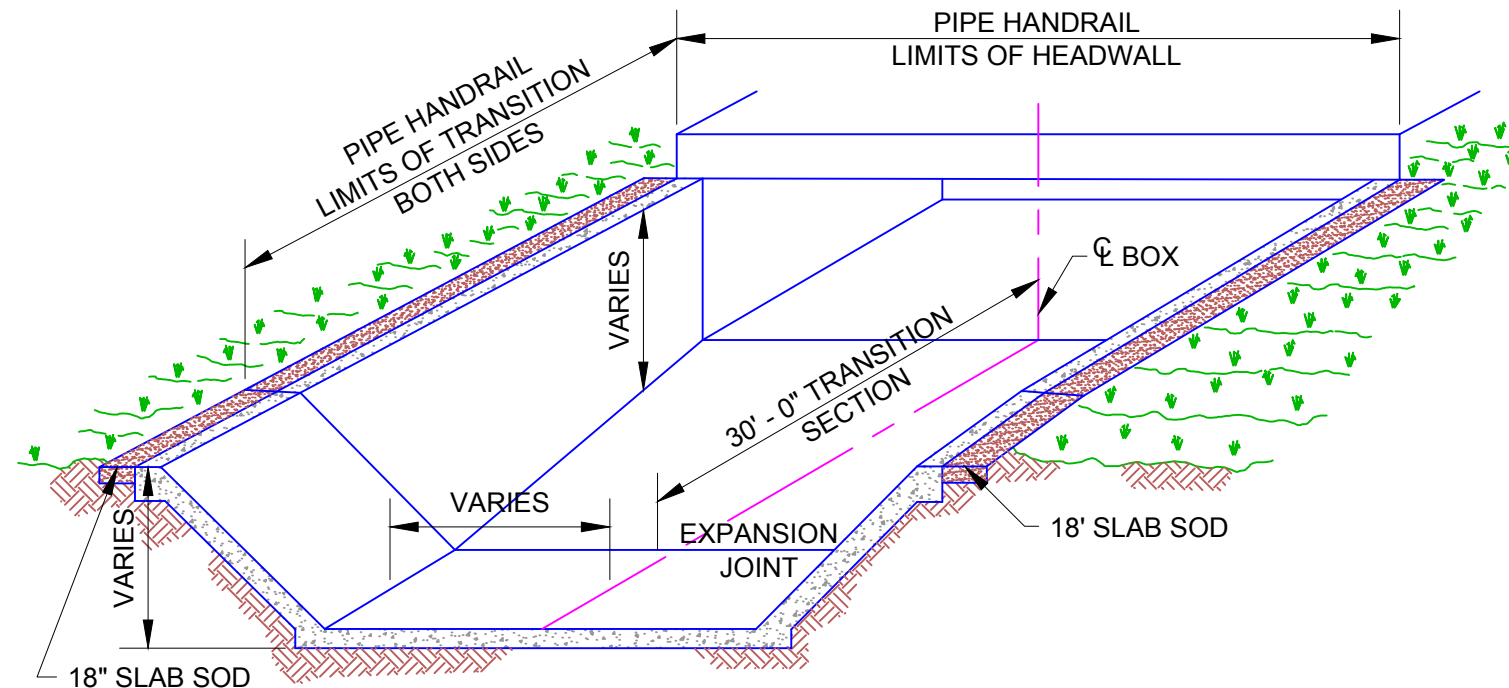
(USING WELD CONNECTIONS ON PIPE HANDRAILS)

3" I.D. GALV. STEEL PIPE WITH PLAIN GALV. FITTINGS.
USE STANDARD & SPECIAL FITTINGS AS NEEDED.

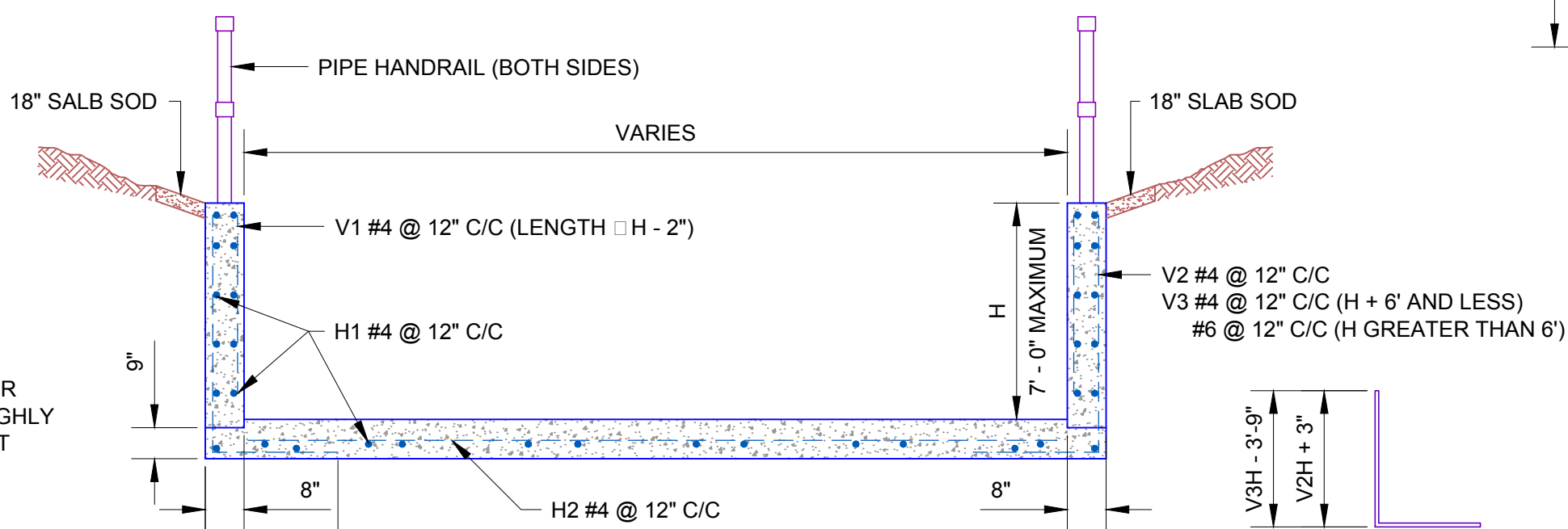


PIPE HANDRAIL DETAIL

HANDRAIL NOTES: WELD CONNECTIONS MAY BE USED FOR
PIPE HANDRAIL. WELD CONNECTIONS SHALL BE THOROUGHLY
CLEANED OF ALL LOOSE SCALE, GROUND SMOOTH & SPOT
POINTED WITH TWO COATS OF ALUMINUM PAINT.

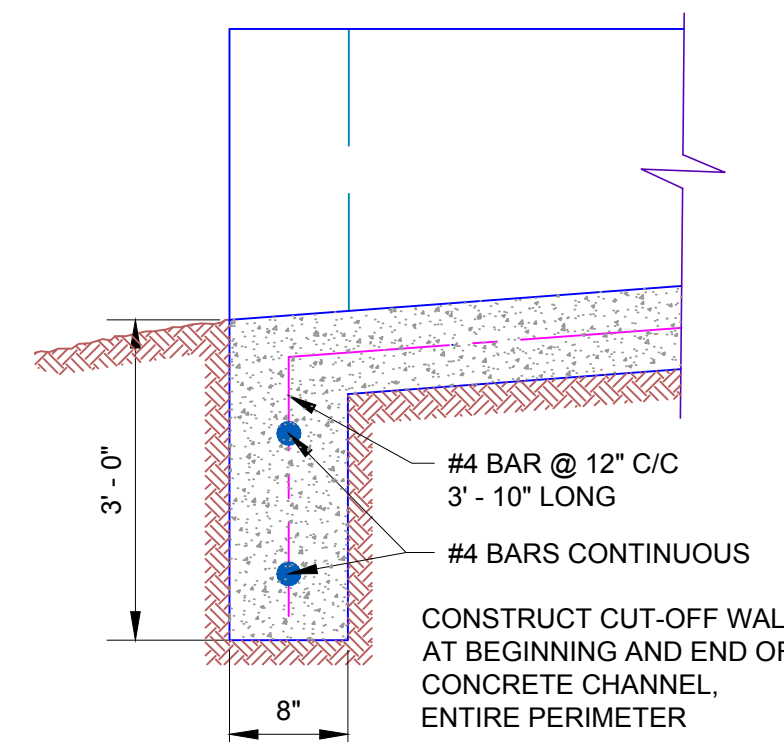


CONCRETE CHANNEL LINER JOINT DETAIL



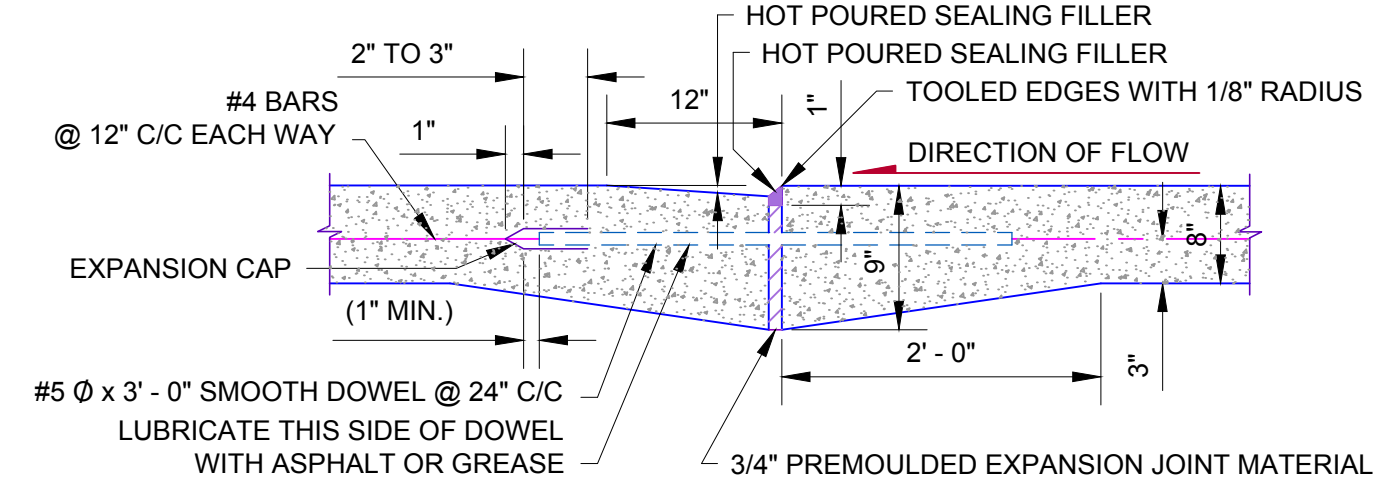
CONCRETE CHANNEL LINER JOINT DETAIL

BAR BENDING DIAGRAM



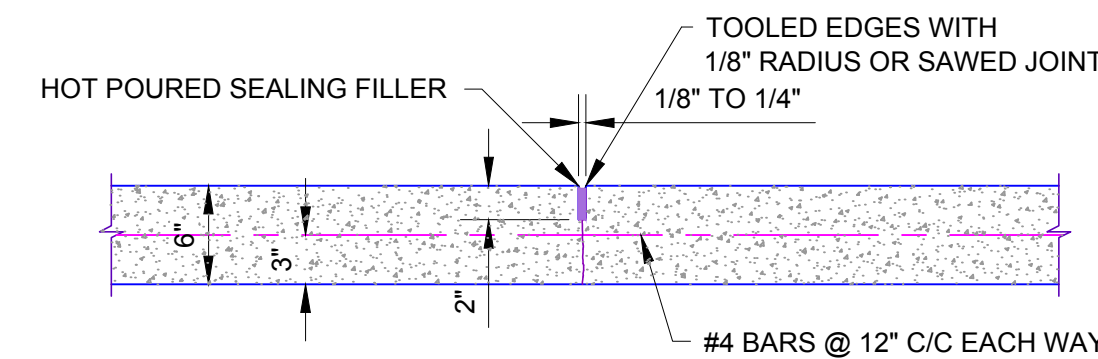
CUT-OFF WALL DETAIL

TYPICAL #4 BAR
(FOR CUT-OFF WALL)



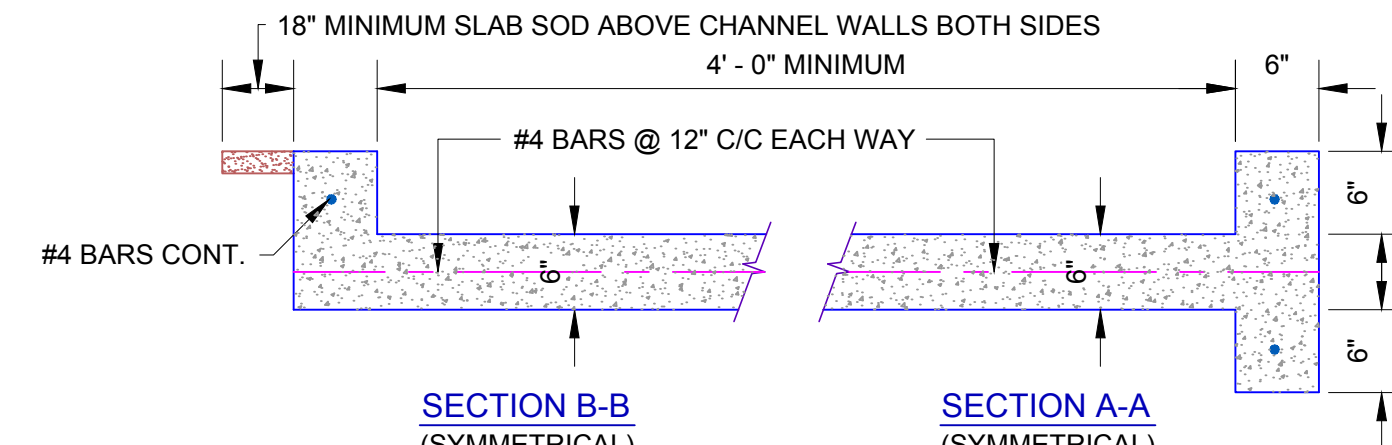
TYPICAL TRANSVERSE EXPANSION JOINT

SPACED AT 100 FOOT C/C MAXIMUM



CONTRACTION JOINT

SPACED AT 20 FOOT C/C
(ALSO USE JOINT LONGITUDINALLY AT CENTERLINE OF CHANNEL
FOR BOTTOM WIDTHS OF 12 FOOT AND OVER)

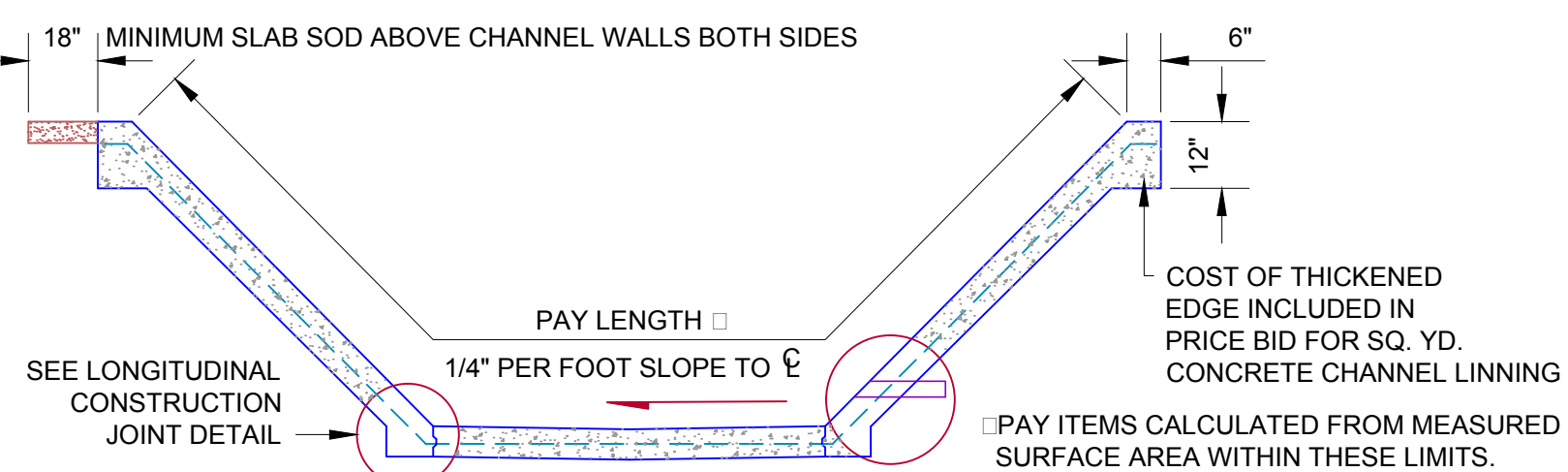


SECTION B-B
(SYMMETRICAL)

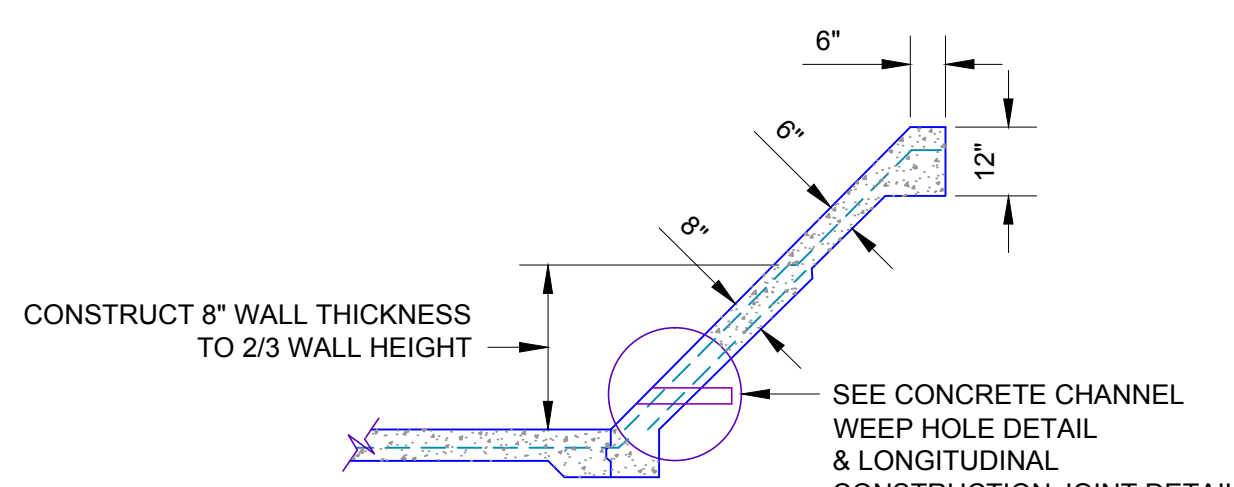
SECTION A-A
(SYMMETRICAL)

CONSTRUCTION JOINT

SPACED AT 20 FOOT C/C
(ALSO USE JOINT LONGITUDINALLY AT CENTERLINE OF CHANNEL
FOR BOTTOMS OF 12 FOOT AND OVER)

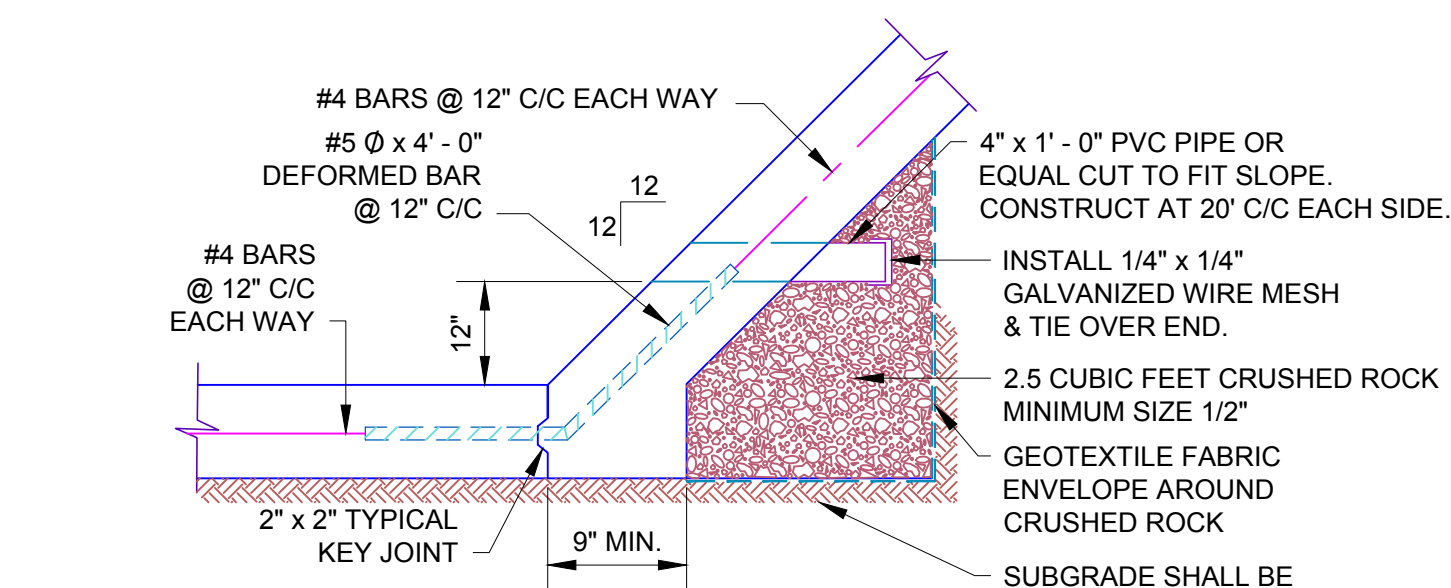


TYPICAL CONCRETE CHANNEL LINER DETAIL

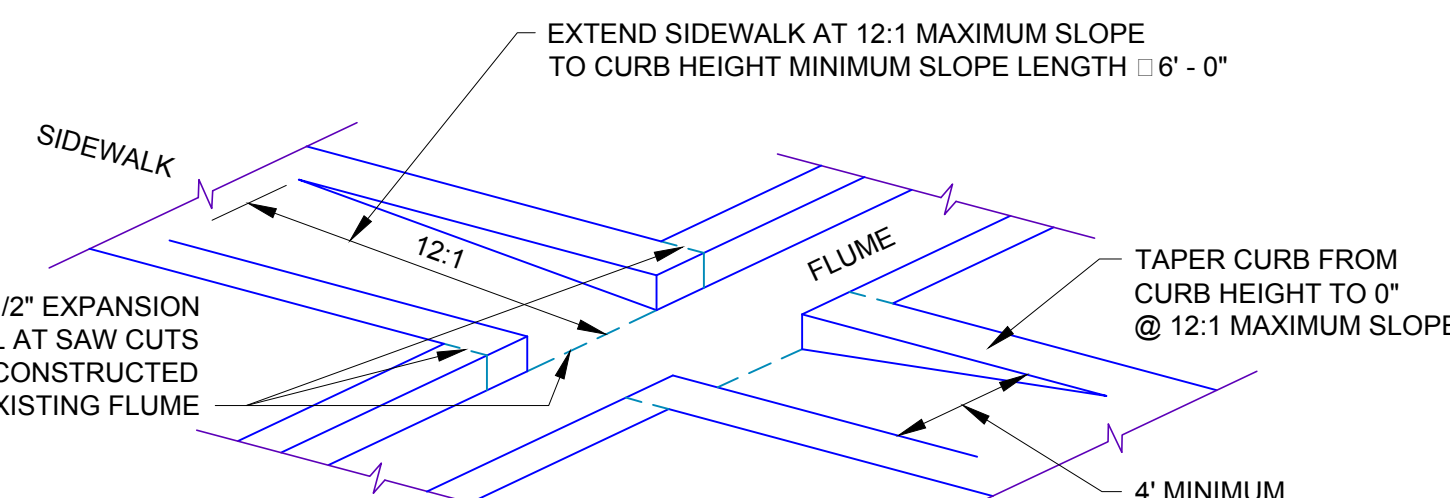


CONCRETE CHANNEL LINER JOINT DETAIL

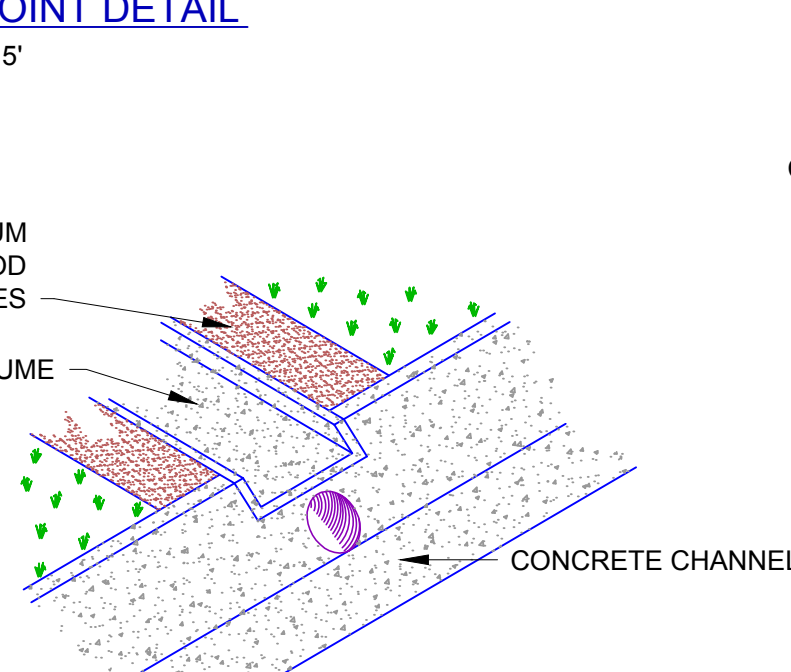
FOR WALL HEIGHT ABOVE 5'



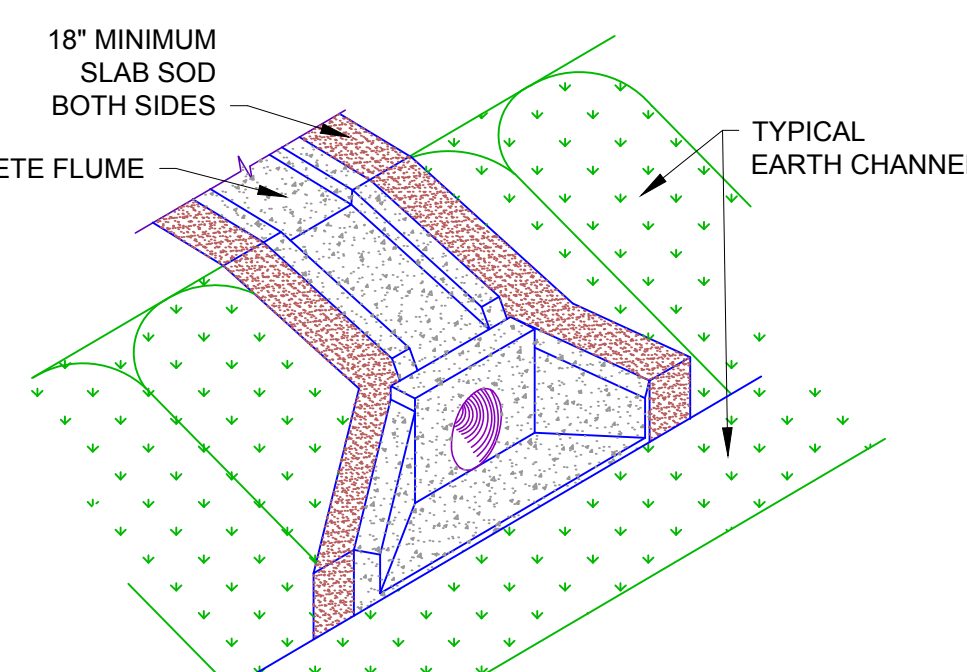
CONCRETE CHANNEL WEEP HOLE DETAIL



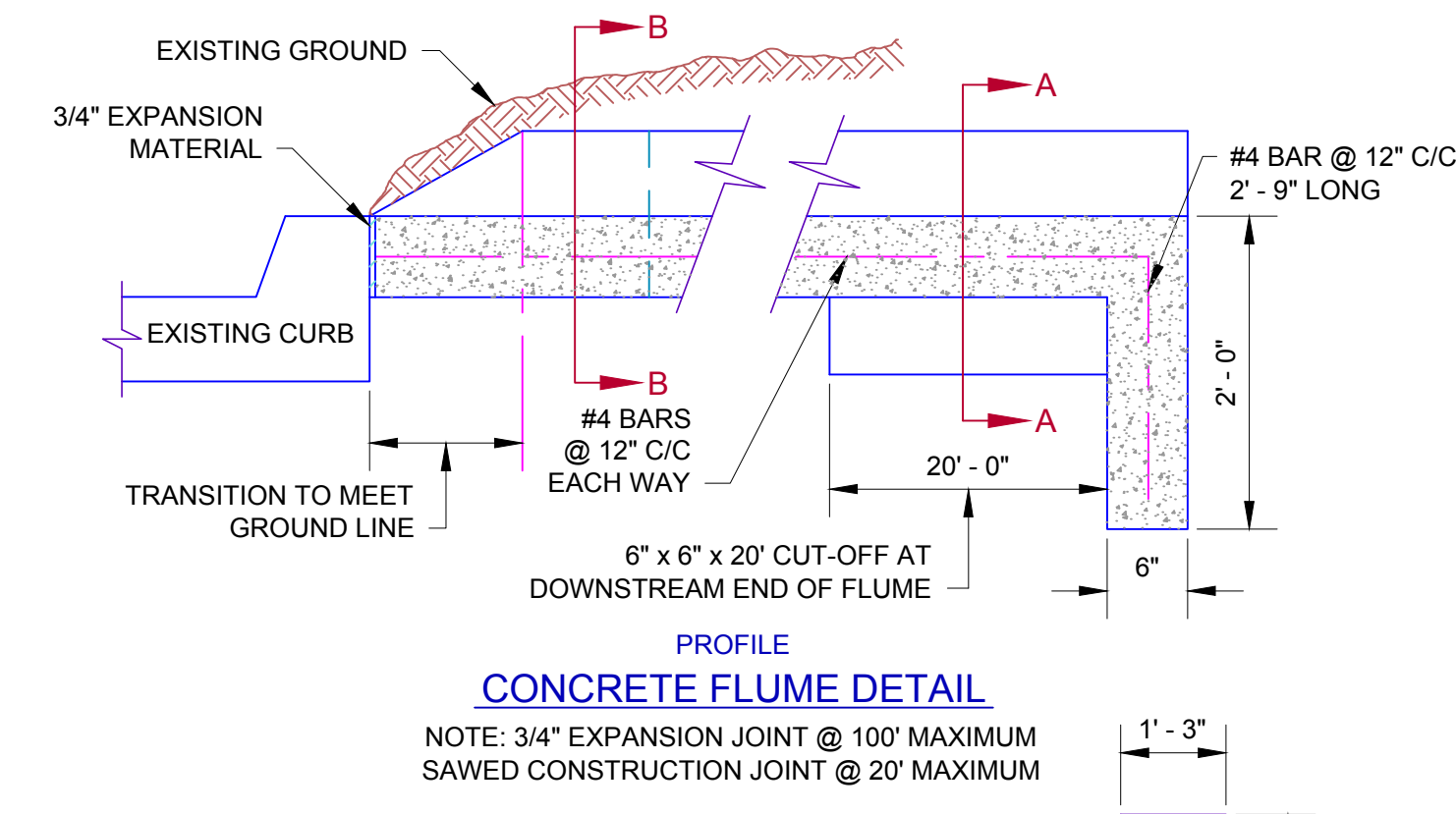
SIDEWALK RAMP AT FLUME CROSSING



TYPICAL FLUME DETAIL
CONCRETE CHANNEL



TYPICAL FLUME DETAIL
EARTH CHANNEL



PROFILE
CONCRETE FLUME DETAIL

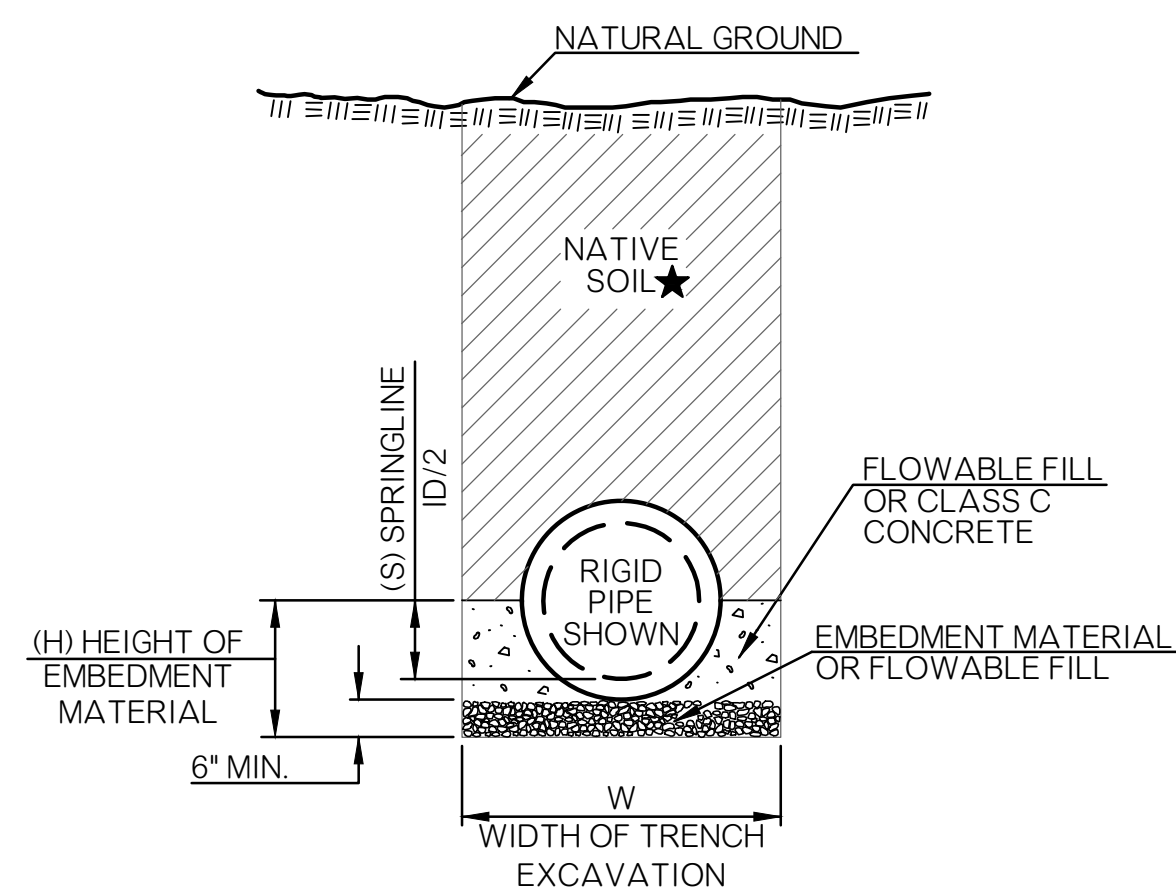
NOTE: 3/4" EXPANSION JOINT @ 100' MAXIMUM
SAWED CONSTRUCTION JOINT @ 20' MAXIMUM

TYPICAL #4 BAR
(FOR CONCRETE FLUME)

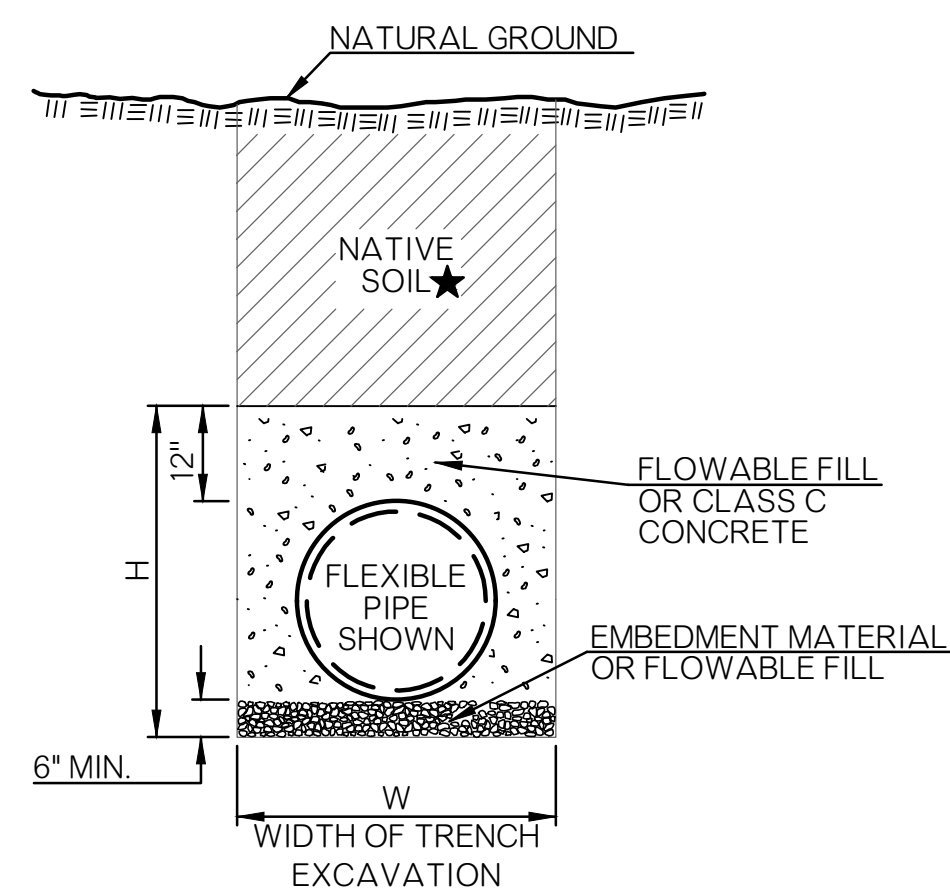
OKLAHOMA CITY
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

STANDARD CHANNEL LINER & FLUME DETAILS

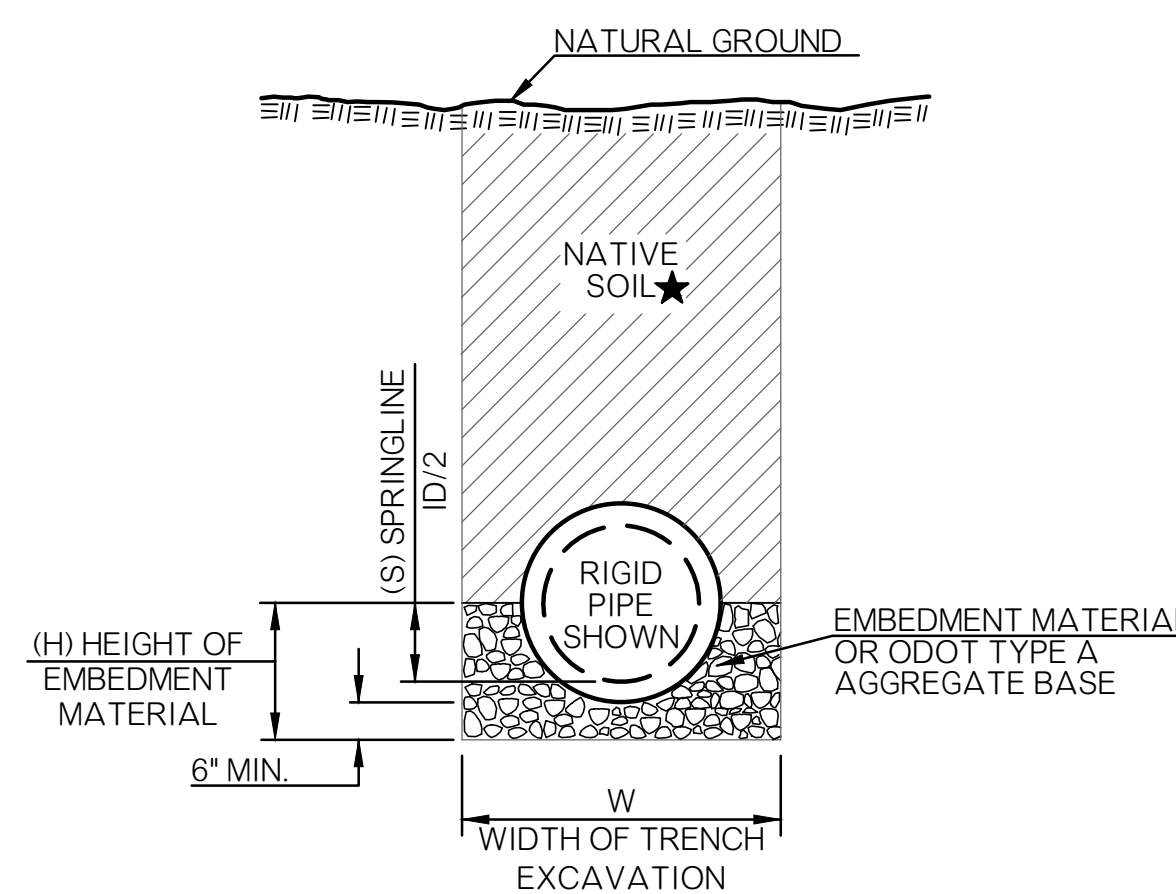
APPROVED BY: DATE: 7-11-01
DRAWN: V.S.C. DATE: 06/27/01 DWG. NO. D-501



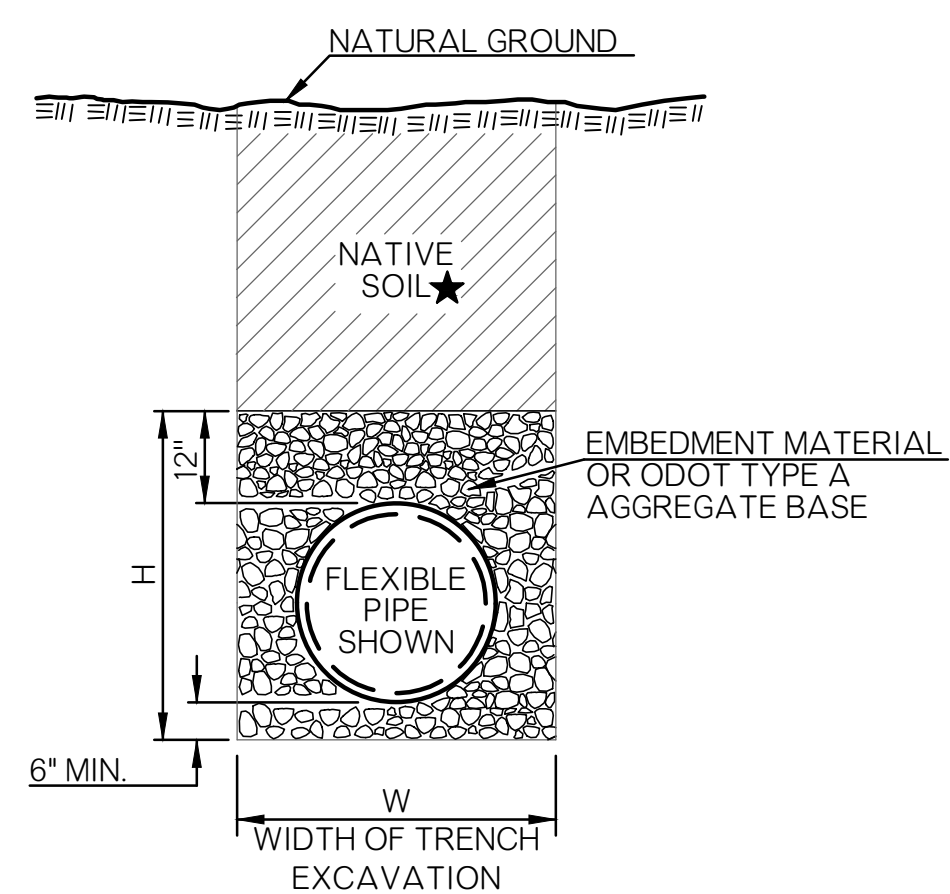
CLASS A BEDDING RIGID PIPES



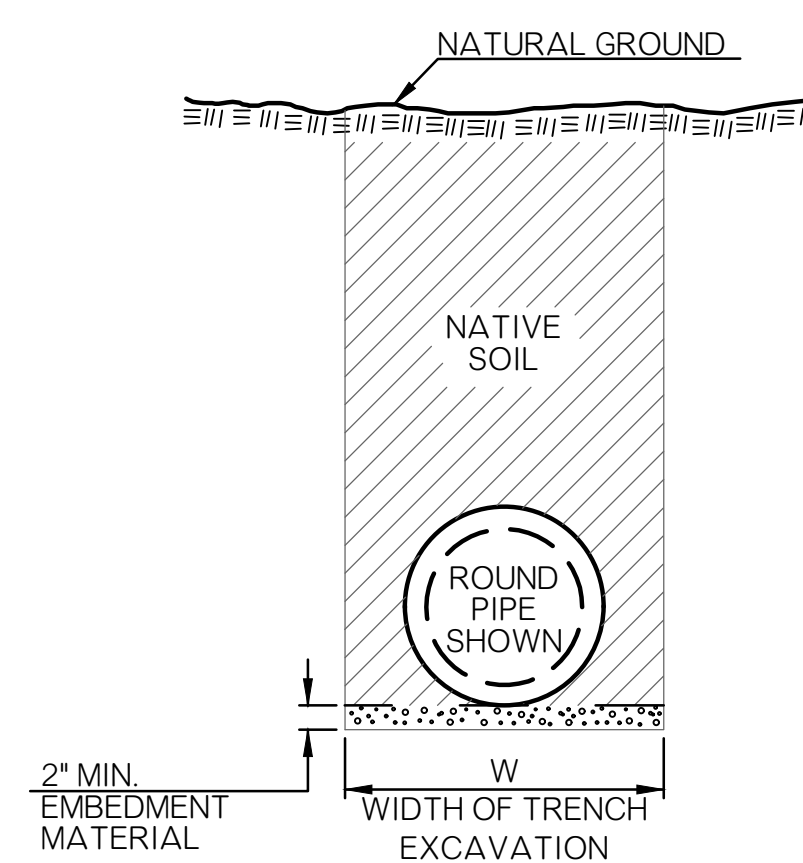
CLASS A BEDDING FLEXIBLE PIPES



CLASS B BEDDING RIGID PIPES

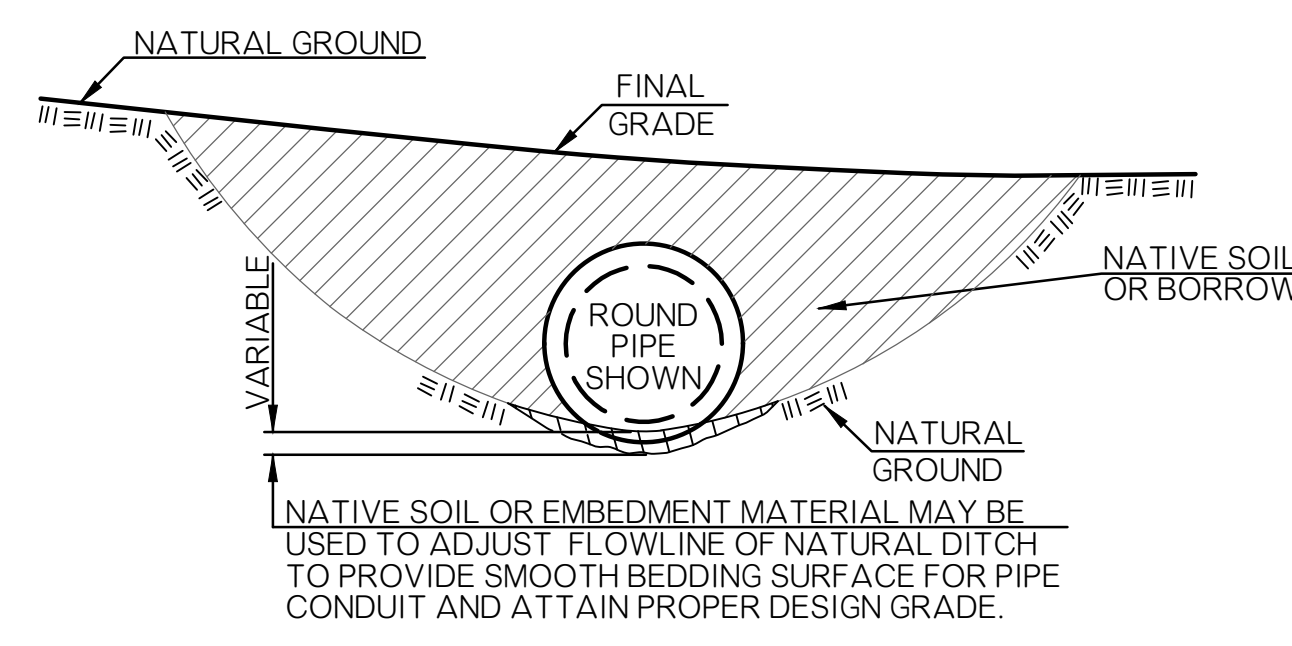


CLASS B BEDDING FLEXIBLE PIPES



CLASS C BEDDING ALTERNATE 1

NOTE: DETAIL THE SAME FOR RIGID & FLEXIBLE PIPES.



CLASS C BEDDING ALTERNATE 2

NOTE: DETAIL THE SAME FOR RIGID & FLEXIBLE PIPES.

PIPE BEDDING CLASS/DESIGN TABLE	■ UNDER PAVING				OUTSIDE PAVING		
	CROSS DRAIN (NHS OR ADT > 6000 VPD)	CROSS DRAIN (OTHER)	STORM SEWER (NHS OR ADT > 6000 VPD)	STORM SEWER (OTHER)	CROSS DRAIN	SIDE DRAIN	STORM SEWER
REINFORCED CONCRETE PIPE	B	B	B	B	B	C	B
CORRUGATED GALV. STEEL PIPE (CGSP)	NA	B	NA	B	B	C	B
MILL (POLYMER) PRECOATED CGSP	NA	B	NA	B	B	C	B
CORRUGATED GALV. STRUCT. PLATE	NA	B	NA	B	B	C	B
ALUMINIZED (ALUMINUM COATED) TYPE II CSP	NA	B	NA	B	B	C	B
CORRUGATED POLYETHYLENE / PVC	NA	A/B	NA	A/B	B	B	B
POLYVINYL CHLORIDE (SC 40/80 PVC)	NA	NA	NA	NA	NA	NA	NA
POLYPROPYLENE PIPE (PP) ▲	B	B	B	B	B	C	B

NOTE: CLASS A BEDDING NEEDS APPROVAL BY THE CITY ENGINEER.

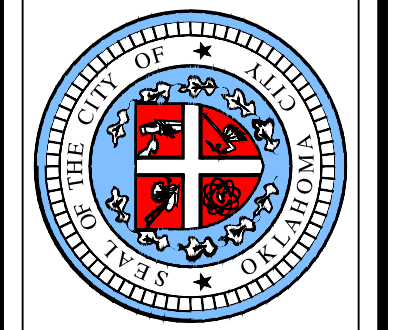
■ WHEN THERE IS ANY POSSIBILITY OF THE PAVEMENT BEING WIDENED DURING THE LIFE OF THE DRAINAGE STRUCTURE, THE BEDDING SHALL MEET THE 'UNDER PAVING SECTION' CRITERIA FOR THE FULL EXTENT OF ANY ANTICIPATED EXPANSION TO THE FACILITY.

▲ BACKFILL WITH A MINIMUM OF TWO (2) FEET OF APPROVED BACKFILL MATERIAL.

GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKLAHOMA STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- NATIVE SOIL FOR BACKFILL TO BE COMPACTED IN ACCORDANCE WITH SECTION 212 OF THE OKC STANDARD SPECIFICATIONS.
- A BETTER CLASS OF BEDDING MAY BY SUBSTITUTED FOR THE NEXT LOWER CLASS. EXAMPLE: CLASS A STANDARD BEDDING CAN BE USED IN LIEU OF CLASS B STANDARD BEDDING.
- FOR TRENCH WIDTH (W), BEDDING HEIGHT (H), PIPE DATA, MULTIPLE PIPE SPACING & BEDDING DATA, SEE ROADWAY STANDARDS D-1001 & D-1002.
- DATA TABLE WILL DISPLAY 'NA' WHEN PIPE MATERIALS ARE NOT ALLOWED.
- STANDARD BEDDING CLASS C MATERIAL(S) (ALTERNATE 1) WILL BE CONSIDERED AS INCIDENTAL AND NOT BE PAID FOR SEPARATELY. COST FOR BORROW OR FILL MATERIAL, NEEDED FOR ALTERNATE 2, WILL BE INCLUDED IN THE PRICE OF THE PIPE.
- PIPE MATERIAL(S)/PRODUCT(S) NOT SHOWN IN THE PIPE BEDDING TABLE WILL BE EVALUATED AND APPROVED ON A CASE BY CASE BASIS.
- ALL TEMPORARY PIPES SHALL HAVE CLASS C BEDDING UNLESS OTHERWISE SHOWN IN THE PLANS.
- BEDDING MATERIAL TYPE B AND C SHALL BE PLACED IN 6" LAYERS AND COMPACTED TO THE SPECIFIED DENSITY USING HAND OPERATED EQUIPMENT ONLY.
- ★ WHEN PIPE INSTALLATION IS UNDER PAVING, IN LIEU OF BACKFILLING WITH NATIVE SOIL, PLACE BEDDING MATERIAL ALL THE WAY TO TOP OF TRENCH.
- THE USE OF AN ALTERNATE PIPE AND ITS CORRESPONDING BEDDING MATERIAL WILL BE ACCEPTABLE PROVIDED THE CRITERIA IN THE DESIGN TABLE IS MET.
- POLYPROPYLENE PIPE SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321.

The City of
Oklahoma City
Public Works Department
Engineering Division



APPROVED BY: DATE: 09/12/2023
ERIC J. WENGER, P.E.
CITY ENGINEER
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

PIPE BEDDING AND BACKFILL

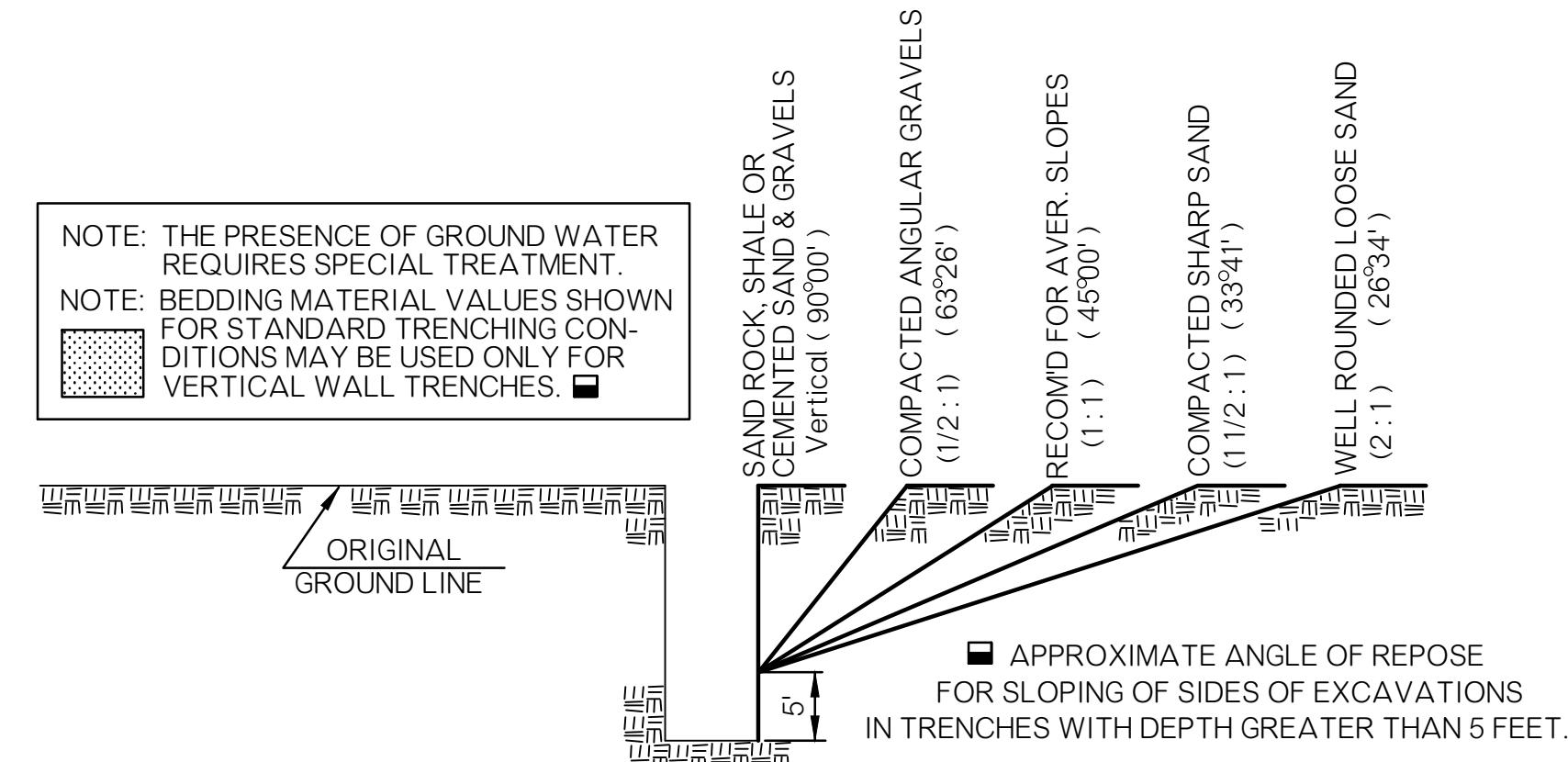
Detail Number
D-1000

TABLE OF TRENCHING AND EMBEDMENT MATERIAL QUANTITIES										
CONCRETE / METAL	PIPE DIAM. OR DESIGN EQUIV.	H	T	SINGLE PIPE		DOUBLE PIPE		TRIPLE PIPE		SPECIAL TRENCHING SINGLE, DOUBLE & TRIPLE PIPE OPTIONS W+12"
				STANDARD TRENCHING	EMBEDMENT MATERIAL	STANDARD TRENCHING	EMBEDMENT MATERIAL	STANDARD TRENCHING	EMBEDMENT MATERIAL	
	IN.	FT.	FT.	FT.	C.Y./L.F.	FT.	C.Y./L.F.	FT.	C.Y./L.F.	C.Y./L.F.
ROUND PIPE	18	1.46	0.208	3.25	0.122	5.67	0.199	8.17	0.281	0.054
	24	1.75	0.250	4.00	0.168	7.00	0.272	10.00	0.375	0.065
	30	2.04	0.292	4.50	0.202	8.33	0.353	12.08	0.499	0.076
	36	2.33	0.333	5.25	0.258	10.67	0.531	15.17	0.724	0.086
	42	2.63	0.375	6.25	0.345	12.00	0.641	17.25	0.889	0.097
	48	2.92	0.417	7.00	0.416	13.33	0.760	19.33	1.069	0.108
ARCH PIPE	54	3.21	0.458	8.00	0.524	14.67	0.890	21.42	1.265	0.119
	60	3.50	0.500	9.00	0.643	17.00	1.157	24.50	1.605	0.130
	66	3.79	0.542	9.75	0.739	18.33	1.313	26.58	1.842	0.140
	18	1.27	0.208	3.25	0.099	6.33	0.190	9.17	0.269	0.047
	24	1.50	0.250	4.00	0.130	7.75	0.245	11.13	0.341	0.056
	30	1.73	0.292	4.50	0.145	10.13	0.363	14.16	0.478	0.064
ELLIPTICAL PIPE	36	1.94	0.333	5.25	0.177	11.67	0.437	16.53	0.586	0.072
	42	2.18	0.375	6.25	0.232	13.17	0.518	18.83	0.703	0.081
	48	2.42	0.417	7.00	0.272	15.71	0.697	22.21	0.924	0.090
	54	2.63	0.458	8.00	0.342	17.05	0.786	24.28	1.053	0.097
	60	2.88	0.500	9.00	0.413	18.69	0.900	26.81	1.219	0.106
	66	3.04	0.542	9.75	0.512	20.81	1.183	30.03	1.630	0.122

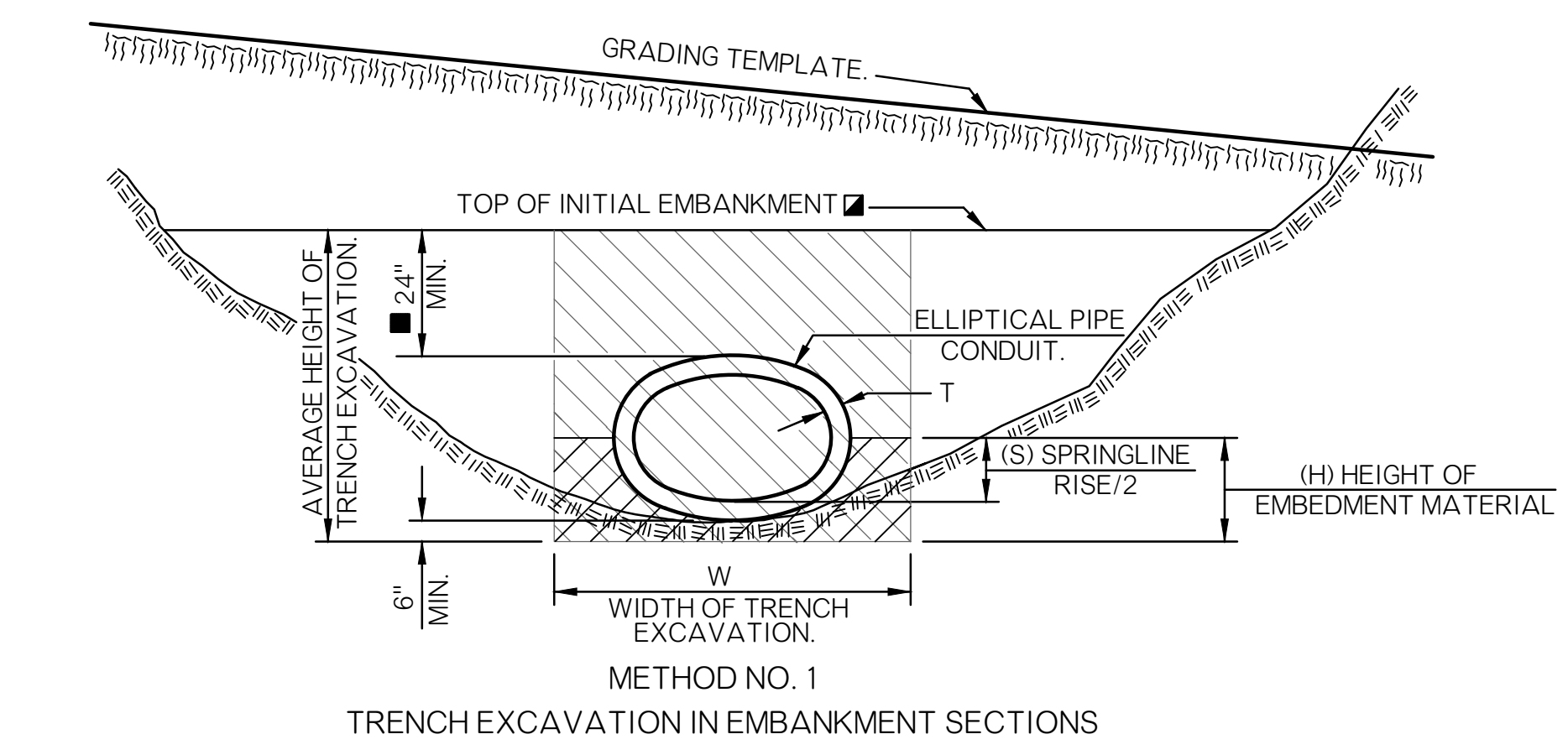
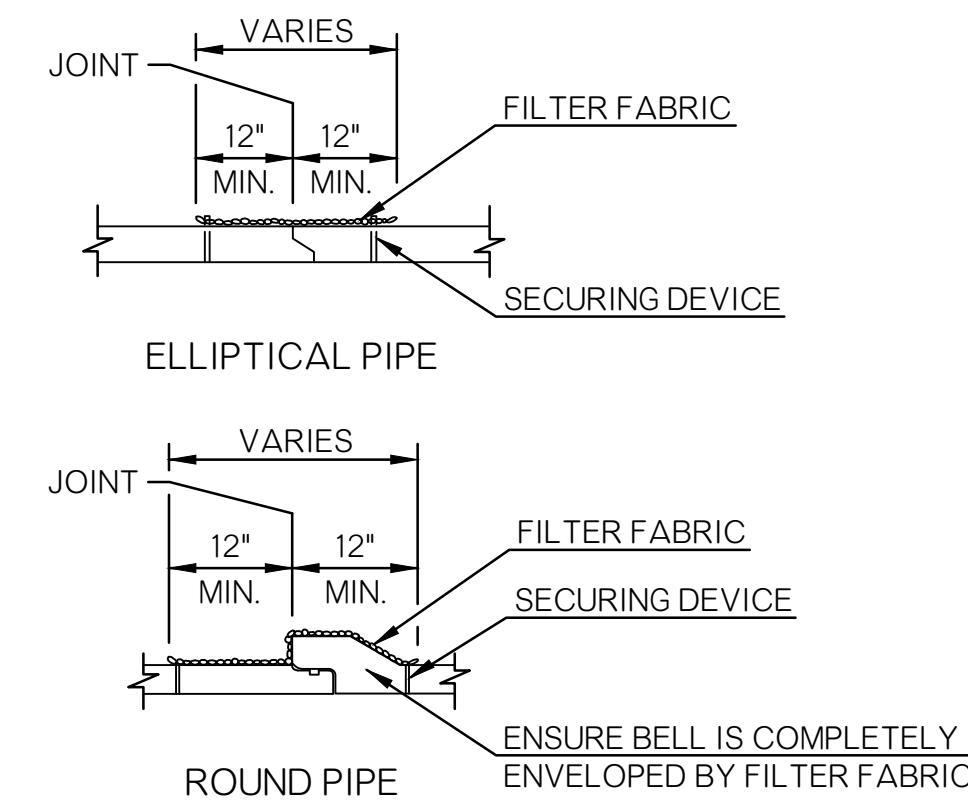
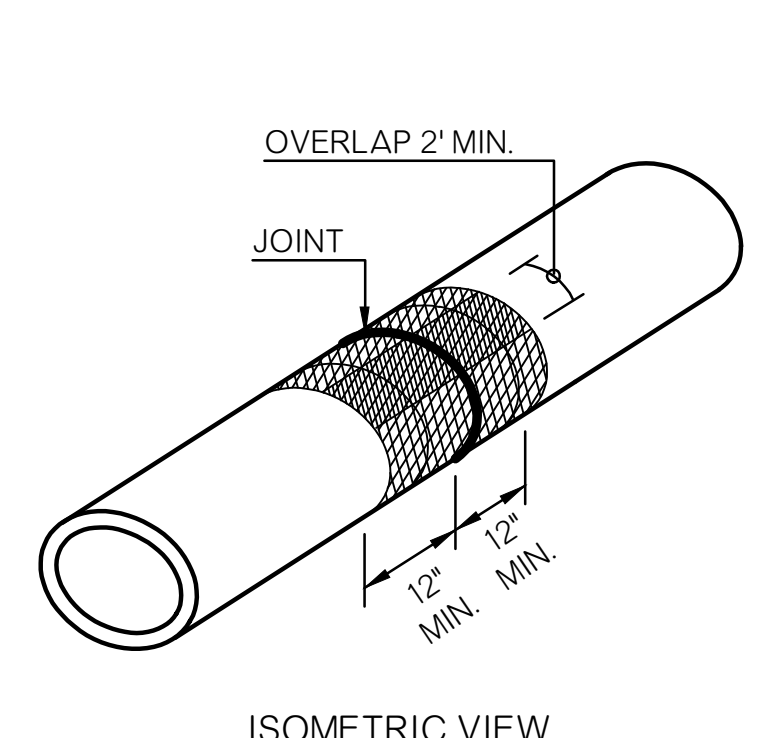
NOTE: TRENCH WIDTHS BASED UPON MINIMUM VALUES PER OKC SPEC 212. TO CALCULATE ADDITIONAL EMBEDMENT MATERIAL, MULTIPLY THE ADDITIONAL WIDTH (FT) BY THE CORRESPONDING HEIGHT (FT) AND DIVIDE BY 27 TO FIND THE ADDITIONAL CY/LF VALUES.

■ BEDDING MATERIAL VALUES SHOWN FOR STANDARD TRENCHING CONDITIONS MAY BE USED ONLY FOR VERTICAL WALL TRENCHES. ■

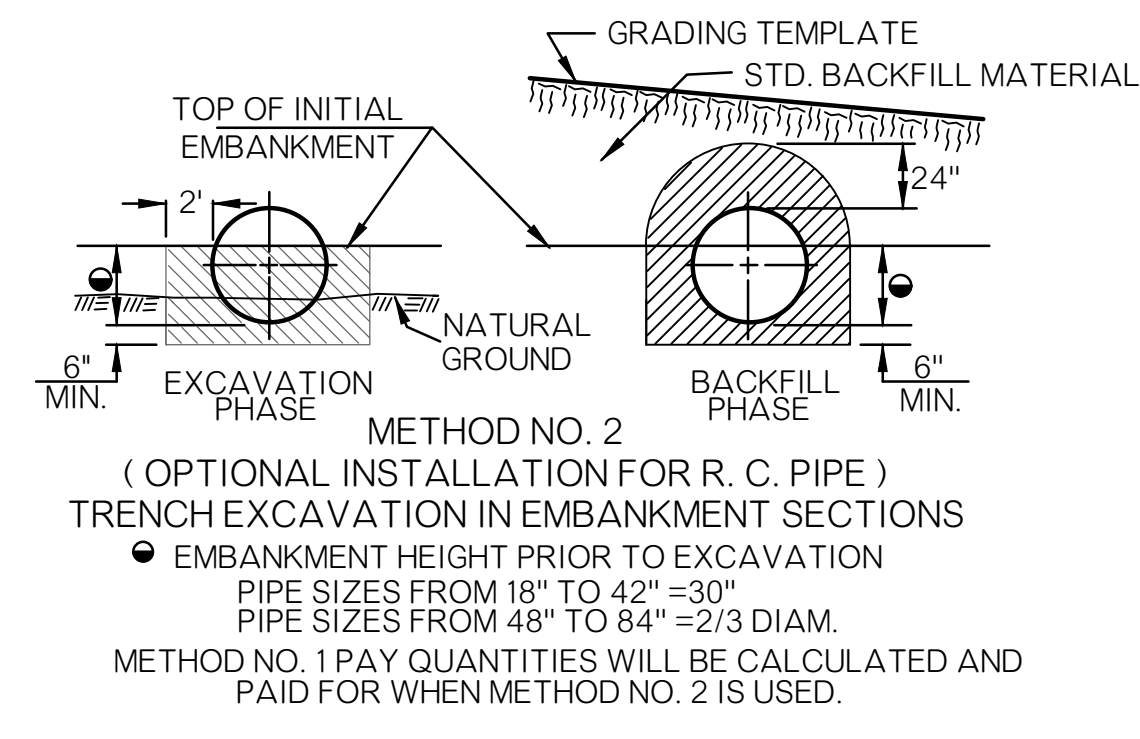
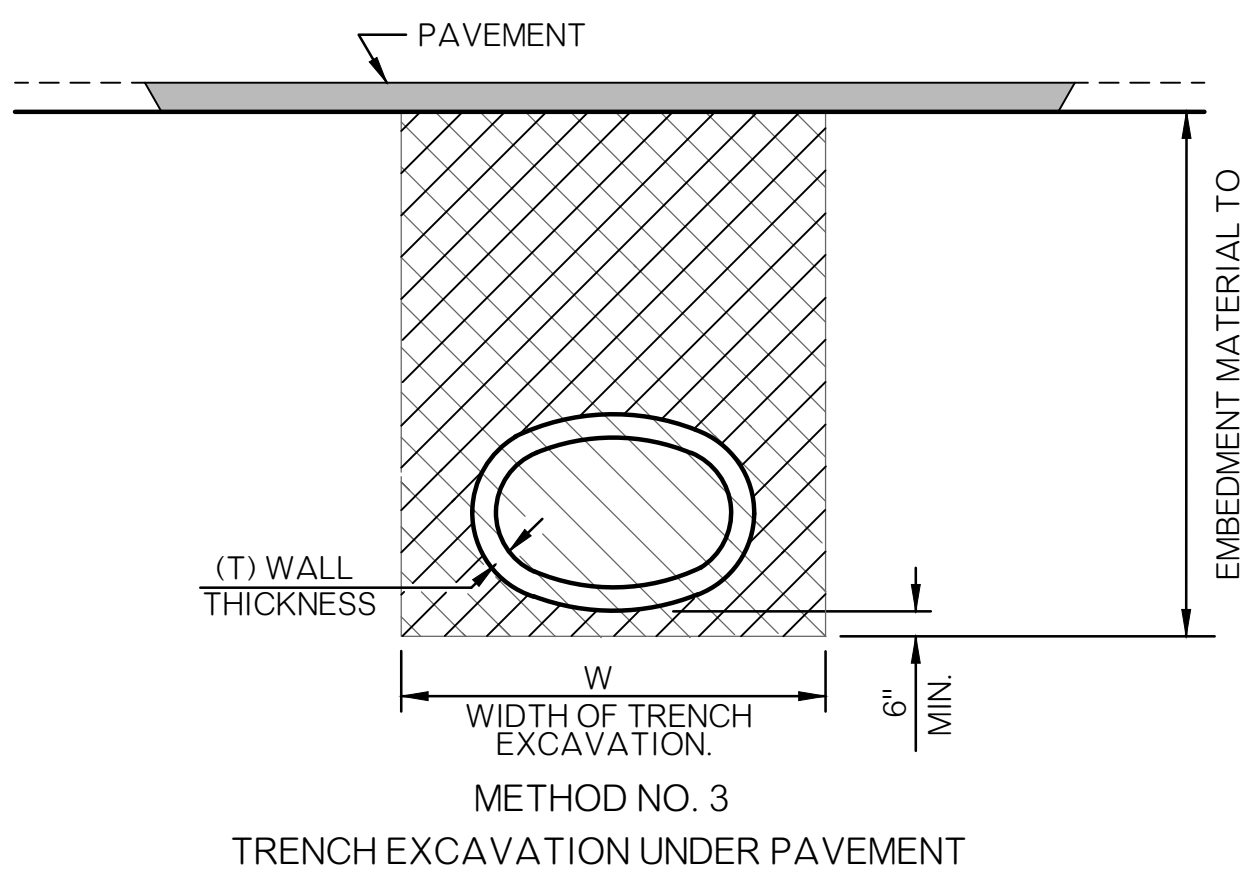
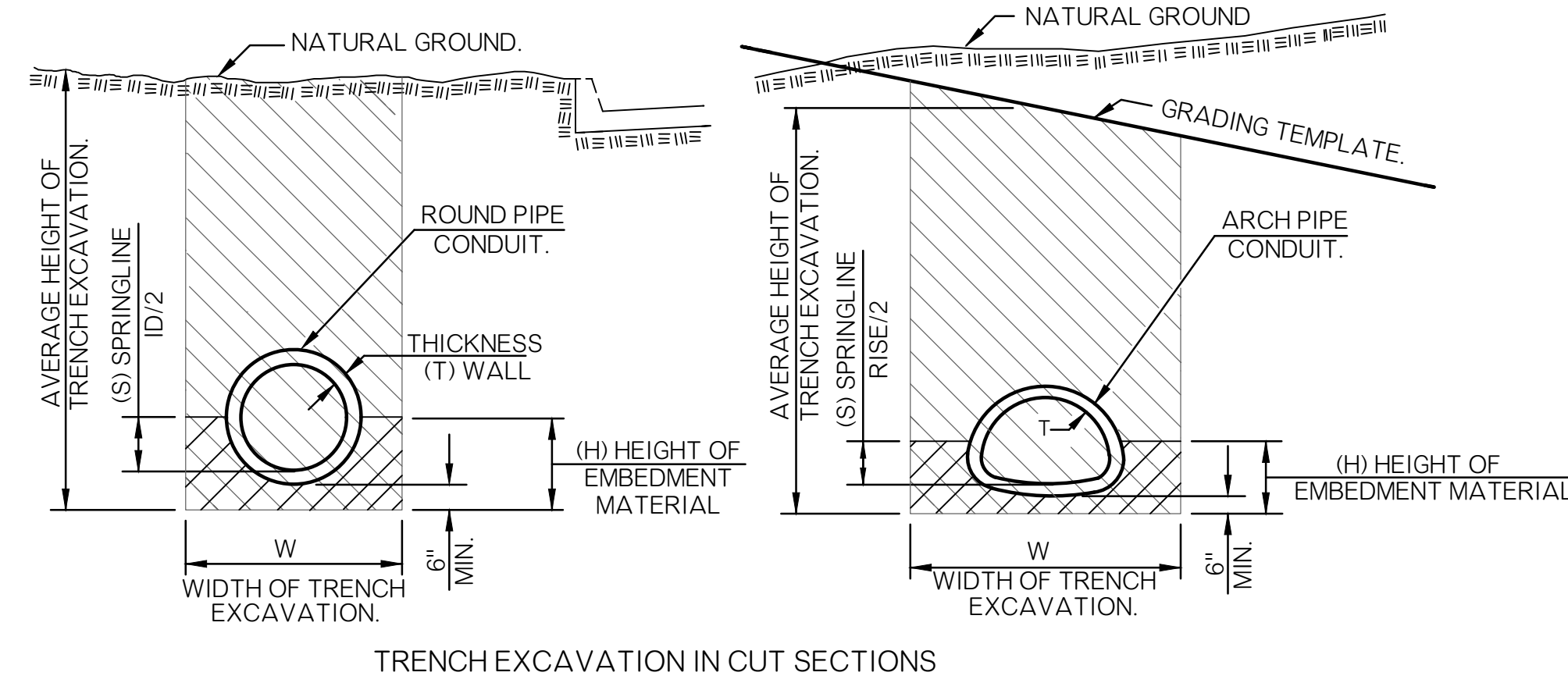
NOTE: THE PRESENCE OF GROUND WATER REQUIRES SPECIAL TREATMENT.
NOTE: BEDDING MATERIAL VALUES SHOWN FOR STANDARD TRENCHING CONDITIONS MAY BE USED ONLY FOR VERTICAL WALL TRENCHES. ■



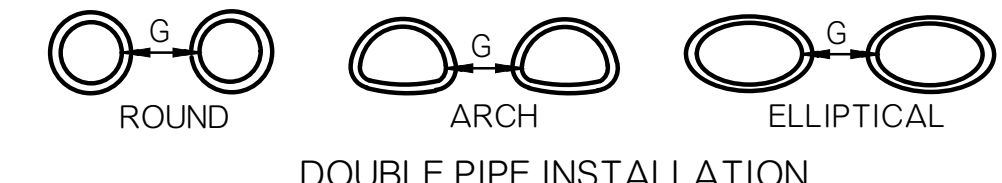
■ OPTIONAL TRENCHES WITH DEPTH GREATER THAN 5.0 FEET EXCAVATION AND BEDDING MATERIAL WILL BE MEASURED AND PAID FOR AS IF SHEETING & SHORING WAS USED. (SPECIAL TRENCHING=STD. WIDTH TRENCH+12")



■ LIMITS OF EMBEDMENT MATERIAL. QUANTITIES FOR BEDDING MATERIAL DO NOT INCLUDE THE SPACE WITHIN AND BOUNDED BY THE OUTER SURFACE OF THE PIPE CONDUIT. ■ LIMITS OF TRENCH EXCAVATION.



FOR DIAM. OR SPAN	CONDUIT SHAPE			DIST. G
	ROUND	ARCH	ELLIPTICAL	
UP TO 24"	UP TO 36"	UP TO 36"	12"	
25" TO 72"	37" TO 108"	37" TO 108"	D/2"	
OVER 73"	OVER 108"	OVER 108"	D/3"	



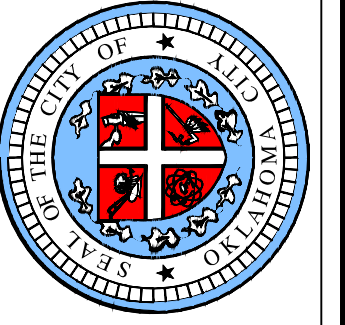
GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL CONFORM TO THE OKC STANDARD SPECIFICATION FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- TRENCH EXCAVATION AND BEDDING MATERIAL WILL NOT BE REQUIRED FOR PIPE INSTALLATIONS OF SIDE DRAINS UNLESS OTHERWISE NOTED ON THE PLANS.
- SPECIAL TRENCHING CONDITIONS ARE THOSE AS DEFINED BY O.S.H.A. REGULATIONS, TITLE 29 CFR CHAPTER XVII, PART 1926.650, 1926.651 & 1926.652, SO DEFINED WILL APPLY UNTIL THEY ARE IN CONFLICT WITH CURRENT SPECIFICATIONS. FOR TRENCH DEPTHS OVER FIVE FEET, WHERE O.S.H.A. REGULATIONS FOR SPECIAL TRENCHING ARE APPLIED, QUANTITIES AND DIMENSIONS FOR SPECIAL TRENCHING WILL BE USED FOR COMPUTING QUANTITIES. SEE TABLE OF TRENCHING DIMENSIONS AND EMBEDMENT MATERIAL QUANTITIES.
- NORMAL BACKFILLING OPERATIONS FOR REINFORCED CONCRETE PIPE (RCP) SHALL CONFORM TO THE OKC STANDARD SPECIFICATION (ASTM C1479). IN NO CASE SHALL A PIPE INSTALLATION SUBJECT TO SUDDEN FLOW DEVELOPMENT BE LEFT WITHOUT SUFFICIENT BACKFILL TO RESTRAIN THE CONDUIT MAY BE USED TO AUGMENT OR REPLACE THIS IMMEDIATE BACKFILL REQUIREMENT.
- ANY EXCESS EXCAVATION NOT USED FOR BACKFILL WILL BECOME THE PROPERTY OF THE CONTRACTOR AND DISPOSED OF, BY HIM, IN A MANNER APPROVED BY THE CITY ENGINEER.
- EMBEDMENT QUANTITIES FOR RCP ARE BASED ON ASTM C76 DESIGNATION CLASS III (WALL B).
- THIS METHOD PRODUCES A GUARANTEED NEGATIVE PROJECTION CONDITION. THE ONLY EXCEPTION TO THIS IS FOR INSTALLATION OF SHALLOWLY COVERED SIDE DRAINS OF LESS THAN 10.0 FEET OF DEPTH, INCLUDING SURFACING.
- LIFT THICKNESS AND COMPACTION REQUIREMENTS SHALL CONFORM TO THE OKC STANDARD SPECIFICATIONS. PER OKC SPEC 215, EMBEDMENT MATERIAL SHALL BE COMPACTED IN 6" LIFTS TO A MINIMUM 95% STANDARD PROCTOR DENSITY.
- WHEN REQUIRED, THE SIDES OF THE TRENCHES SHALL BE SHEETED AND SHORED OR OTHERWISE SUPPORTED WHEN THE TRENCH IS MORE THAN 5.0 FEET IN DEPTH. IN LIEU OF SHEETING, THE SIDES OF THE TRENCH ABOVE THE 5.0 FOOT LEVEL MAY BE SLOPED TO PRECLUDE COLLAPSE, SEE OPTIONAL TRENCHES DETAIL THIS SHEET.
- PROPER COMPACTION OF BACKFILL REQUIRES A VERTICAL WALLED TRENCH TO 24 INCHES ABOVE TOP OF PIPE, REGARDLESS OF EXCAVATION ABOVE THAT ELEVATION.
- ELLIPTICAL PIPE DIMENSIONS CONFORM TO AASHTO M 207, AS DESIGNATED RISE BY SPAN.
- EMBEDMENT MATERIAL OR ODOT TYPE A AGGREGATE BASE AS DEFINED AND REQUIRED TO TOP OF TRENCH UNDER PAVEMENT.

TABLE OF EQUIVALENT PIPES			
EQ. DIAM.	REINF. CONC. ARCH PIPE	STEEL ARCH PIPE	REINF. CONC. ELLIPTICAL PIPE
IN.	INCHES	INCHES	INCHES
18	22 X 13	21 X 15	14 X 23
24	28 X 18	28 X 20	19 X 30
27			22 X 34
30	36 X 22	35 X 24	24 X 38
36	43 X 26	42 X 29	29 X 45
42	51 X 31	49 X 33	34 X 53
48	58 X 36	57 X 38	38 X 60
54	65 X 40	64 X 43	43 X 68
60	73 X 45	71 X 47	48 X 76
66		77 X 52	53 X 83

CLASS B EMBEDMENT MATERIAL GRADATION	
Sieve Size	Percent Passing
1 1/2"	100%
3/4"	40-100%
3/8"	30-75%
#4	25-60%
#10	20-43%
#40	8-26%
#200	4-12%

The City of Oklahoma City Public Works Department Engineering Division



APPROVED BY: [Signature] DATE: 09/12/2023
ERIC J. WENGER, P.E. CITY ENGINEER
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

RIGID PIPE INSTALLATION DETAILS

Detail Number D-1001

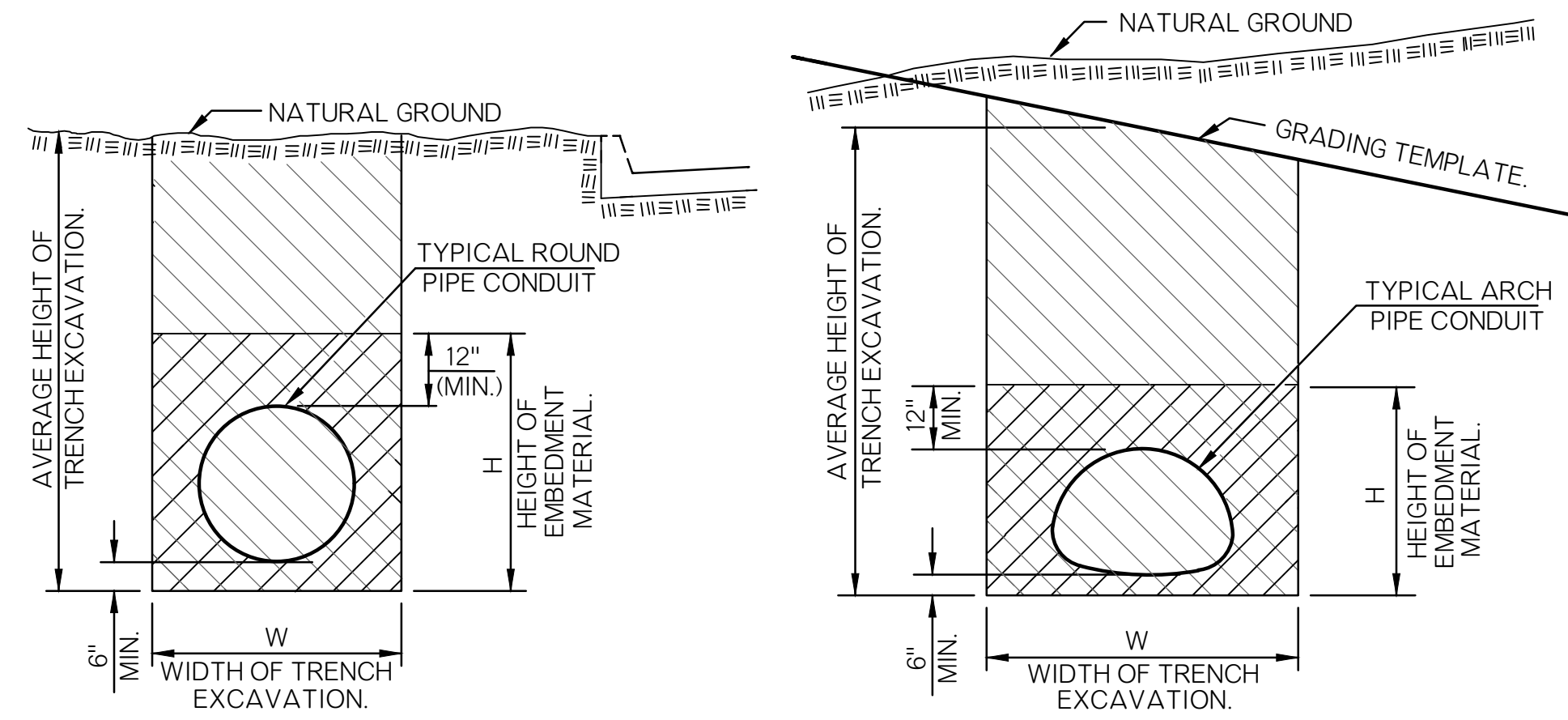
TABLE OF TRENCHING AND EMBEDMENT MATERIAL QUANTITIES

PIPE DIA. OR DESIGN EQUIV.	H	SINGLE PIPE INSTALLATION		DOUBLE PIPE INSTALLATION		TRIPLE PIPE INSTALLATION		CLEAR SPACE BETWEEN PIPES
		W	EMBEDMENT MATERIAL	W	EMBEDMENT MATERIAL	W	EMBEDMENT MATERIAL	
IN.	FT.	FT.	C.Y./L.F.	FT.	C.Y./L.F.	FT.	C.Y./L.F.	INCHES
18	3.17	3.25	0.30	6.10	0.55	9.00	0.81	14
24	3.67	4.00	0.41	7.70	0.77	11.40	1.14	17
30	4.25	4.50	0.49	9.30	1.02	13.80	1.51	20
36	4.75	5.25	0.62	10.80	1.29	16.20	1.93	23
42	5.25	6.25	0.81	13.20	1.75	19.30	2.53	26
48	5.75	7.00	0.97	14.75	2.09	21.70	3.05	29
54	6.25	8.00	1.20	15.30	2.23	22.70	3.29	32
60	6.75	9.00	1.45	17.60	2.80	25.90	4.07	35
66	7.25	9.75	1.66	18.80	3.12	27.70	4.55	38
18	2.97	3.25	0.30	6.20	0.56	9.20	0.84	14
24	3.39	4.00	0.41	7.83	0.81	11.67	1.20	17
30	3.72	4.50	0.45	10.20	1.07	14.87	1.55	20
36	4.14	5.25	0.56	11.75	1.32	17.25	1.92	23
42	4.47	6.25	0.71	13.33	1.55	19.66	2.27	26
48	4.89	7.00	0.84	15.35	1.92	22.60	2.80	29
54	5.31	8.00	1.03	17.58	2.37	25.66	3.41	32
60	5.64	9.00	1.21	18.92	2.61	27.84	3.80	35
66	6.06	9.75	1.38	20.65	3.01	30.40	4.39	38

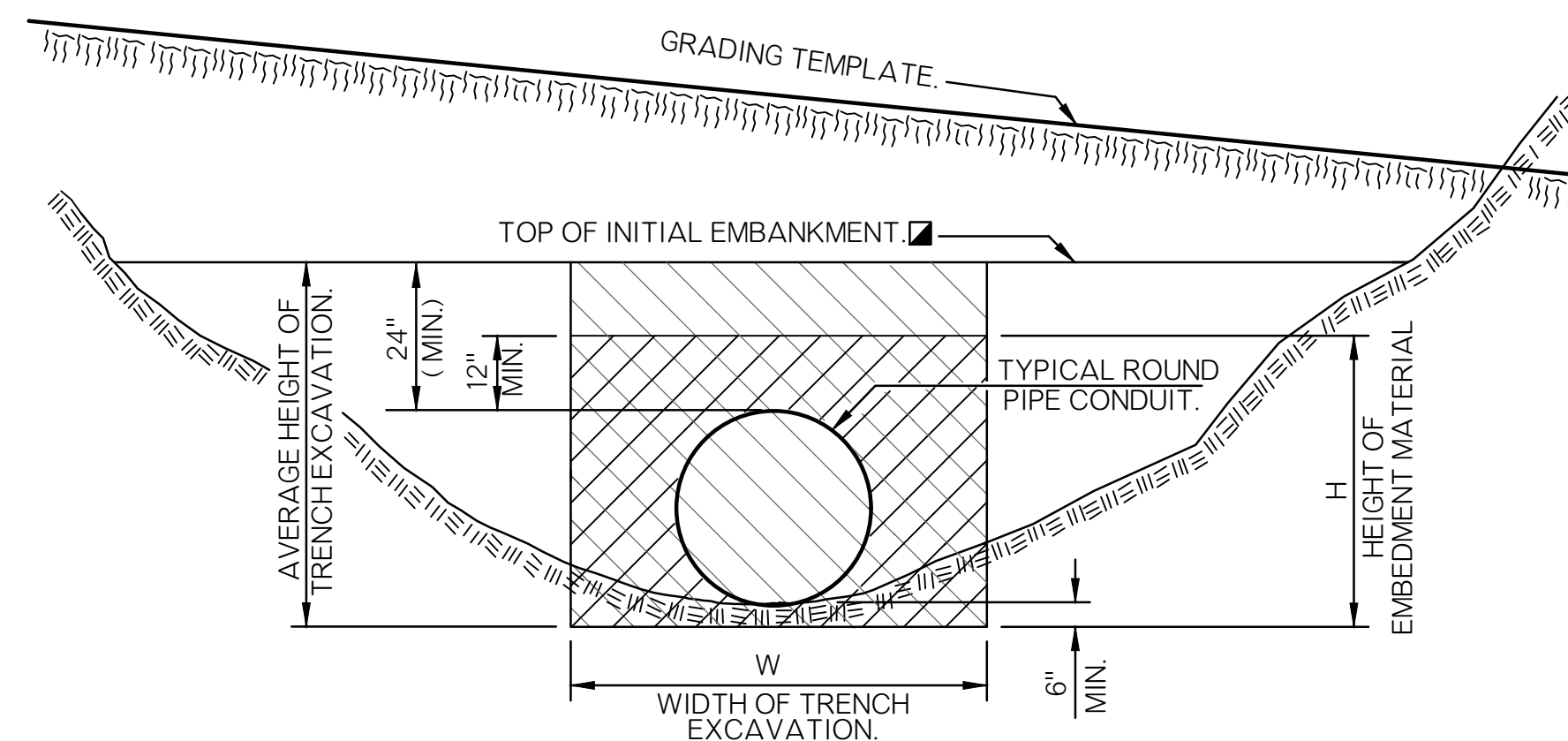
NOTE: TRENCH WIDTHS BASED UPON MINIMUM VALUES PER OKC SPEC 212. TO CALCULATE ADDITIONAL EMBEDMENT MATERIAL, MULTIPLY THE ADDITIONAL WIDTH (FT) BY THE CORRESPONDING HEIGHT (FT) AND DIVIDE BY 27 TO FIND THE ADDITIONAL CY/LF VALUES.

TABLE OF FILL HEIGHTS

PIPE SIZE (IN.)	MINIMUM COVER OVER TOP OF PIPE (BUOYANCY) (IN.)	MAXIMUM COVER (FT.)	
		POLYETHYLENE	UNDER PAVEMENT
18	15	10	14
24	20	10	14
30	25	10	14
36	30	10	14
42	35	10	12
48	40	10	12
54	45	N/A	12
60	50	N/A	10
66	55	N/A	10



TRENCH EXCAVATION IN CUT SECTIONS

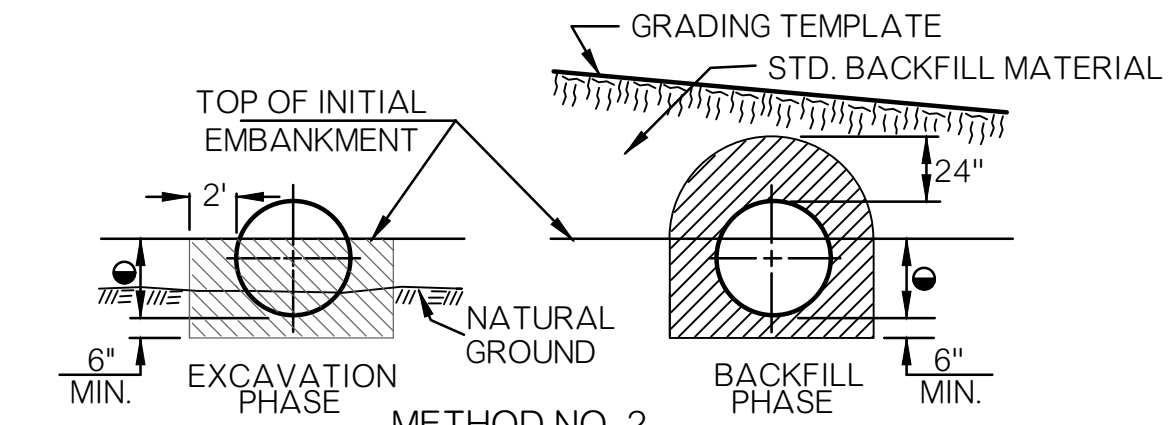


TRENCH EXCAVATION IN EMBANKMENT SECTIONS

TO BE COMPACTED IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.

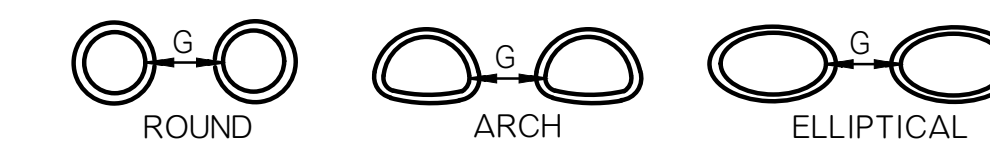
LIMITS OF EMBEDMENT MATERIAL. QUANTITIES FOR BEDDING MATERIAL DO NOT INCLUDE THE SPACE WITHIN AND BOUNDED BY THE OUTER SURFACE OF THE PIPE CONDUIT.

LIMITS OF TRENCH EXCAVATION.



METHOD NO. 2 (OPTIONAL INSTALLATION FOR R. C. PIPE) TRENCH EXCAVATION IN EMBANKMENT SECTIONS
 EMBANKMENT HEIGHT PRIOR TO EXCAVATION
 PIPE SIZES FROM 18" TO 42" = 30"
 PIPE SIZES FROM 48" TO 84" = 2/3 DIAM.
 METHOD NO. 1 PAY QUANTITIES WILL BE CALCULATED AND PAID FOR WHEN METHOD NO. 2 IS USED.

FOR DIAM. OR SPAN	CONDUIT SHAPE			DIST. G
	ROUND	ARCH UP TO 36"	ELLIPTICAL UP TO 36"	
UP TO 24"	12"	12"	12"	
25" TO 72"	D/2"	D/2"	D/2"	
37" TO 108"	D/3"	D/3"	D/3"	
OVER 73"	OVER 108"	OVER 108"	36"	



DOUBLE PIPE INSTALLATION

GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- TRENCH EXCAVATION & EMBEDMENT MATERIAL WILL NOT BE REQUIRED FOR PIPE INSTALLATIONS ON SIDE DRAINS UNLESS OTHERWISE SPECIFIED ON THE PLANS.
- TRENCH EXCAVATION WILL BE PAID FOR ON PIPE UNDERDRAIN. SEE DETAIL NUMBER D-1004.
- TRENCHING REQUIREMENTS FOR DEPTHS OVER 5 FEET SHALL BE IN ACCORDANCE WITH, & DEFINED BY, O.S.H.A. REGS., TITLE 29 CFR, STANDARDS 1926.650, 1926.651 & 1926.652.
- NORMAL BACKFILLING OPERATIONS FOR FLEXIBLE SHALL CONFORM TO THE OKC STANDARD SPECIFICATION (ASTM D2321-THERMOPLASTICS, AASHTO SECTION 26 CORRUGATED STEEL PIPE). IN NO CASE SHALL A PIPE INSTALLATION SUBJECT TO SUDDEN FLOW DEVELOPMENT BE LEFT WITHOUT SUFFICIENT BACKFILL TO RESTRAIN THE CONDUIT AND PREVENT JOINT SEPARATION AND/OR PIPING SCOUR. PHYSICALLY RESTRAINING THE CONDUIT MAY BE USED TO AUGMENT OR REPLACE THIS IMMEDIATE BACKFILL REQUIREMENT.
- ANY EXCESS EXCAVATION NOT USED FOR BACKFILL WILL BECOME THE PROPERTY OF THE CONTRACTOR AND DISPOSED OF, BY HIM, IN A MANNER APPROVED BY THE CITY ENGINEER.
- INSTALLATION OF THERMOPLASTIC AND CORRUGATED STEEL PIPE SHALL CONFORM TO ASTM D2321 AND AASHTO SECTION 26, RESPECTIVELY. ALL FLEXIBLE PIPE INSTALLATIONS SHALL CONFORM TO THE OKC STANDARD SPECIFICATION.
- LIFT THICKNESS AND COMPACTION REQUIREMENTS SHALL CONFORM TO OKC STANDARD SPECIFICATIONS. PER OKC SPEC 215, EMBEDMENT MATERIAL SHALL BE COMPACTED IN 6" LIFTS TO A MINIMUM 95% STANDARD PROCTOR DENSITY.
- JOINTS IN METAL PIPES SHALL CONFORM TO SECTION 26.4.2.4 OF AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES. IF A WATERTIGHT JOINT IS SPECIFIED ON THE PLANS, A 12" WIDE BY 3/4" THICK NEOPRENE SLEAVE GASKET MEETING ASTM D-1056 REQUIREMENT SHALL BE USED.
- EMBEDMENT MATERIAL QUANTITIES ARE BASED ON THE TRENCH WIDTH (W), TRENCH HEIGHT (H) AND EFFECTIVE DIAMETER (D) OF ROUND CORRUGATED POLYETHYLENE PIPE MEETING THE REQUIREMENTS OF AASHTO M 294 (18"-60").
- EMBEDMENT MATERIAL OR ODOT TYPE A AGGREGATE BASE AS DEFINED AND REQUIRED TO TOP OF TRENCH UNDER PAVEMENT.

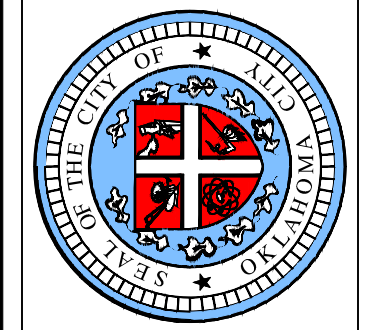
TABLE OF EQUIVALENT PIPES

EQ. DIAM.	REINF. CONC. ARCH PIPE	STEEL ARCH PIPE	REINF. CONC. ELLIPTICAL PIPE
18	22 X 13	21 X 15	14 X 23
24	28 X 18	28 X 20	19 X 30
27			22 X 34
30	36 X 22	35 X 24	24 X 38
36	43 X 26	42 X 29	29 X 45
42	51 X 31	49 X 33	34 X 53
48	58 X 36	57 X 38	38 X 60
54	65 X 40	64 X 43	43 X 68
60	73 X 45	71 X 47	48 X 76
66		77 X 52	53 X 83

CLASS B EMBEDMENT MATERIAL GRADATION

Sieve Size	Percent Passing
1 1/2"	100%
3/4"	40-100%
3/8"	30-75%
#4	25-60%
#10	20-43%
#40	8-26%
#200	4-12%

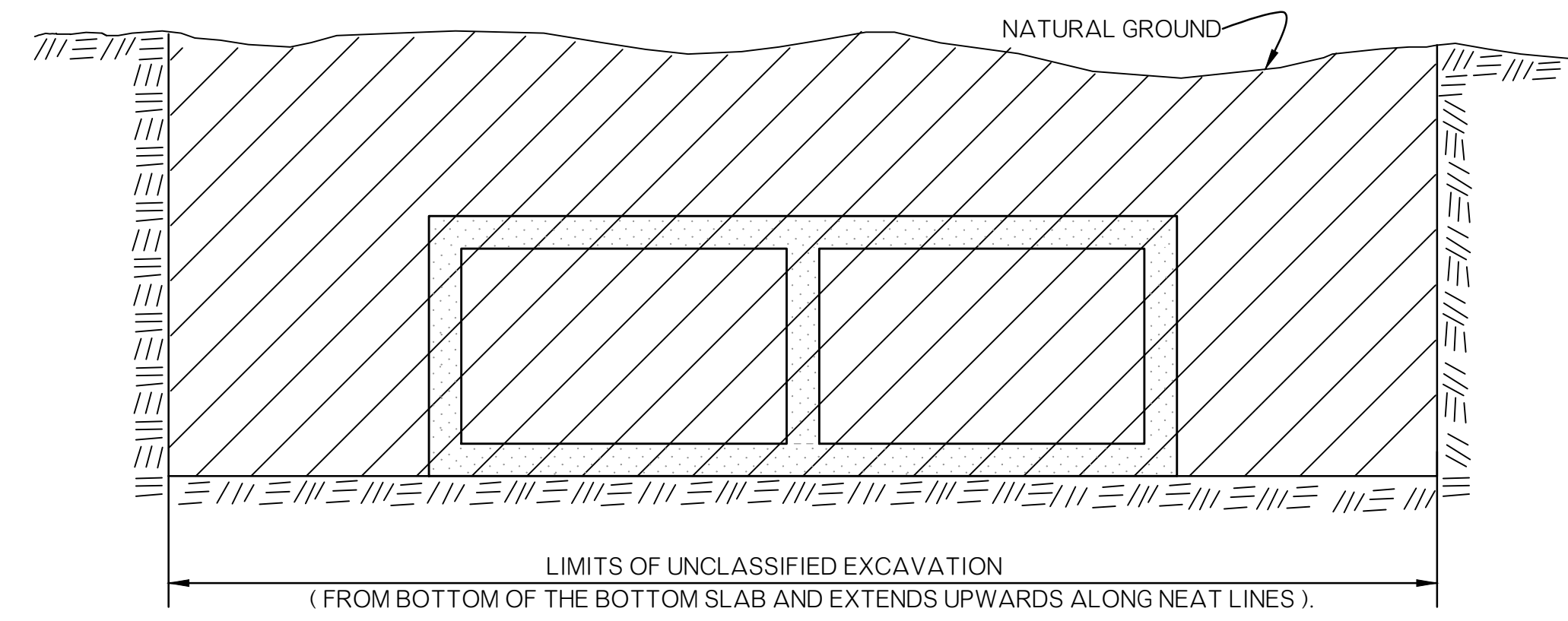
The City of Oklahoma City Public Works Department Engineering Division



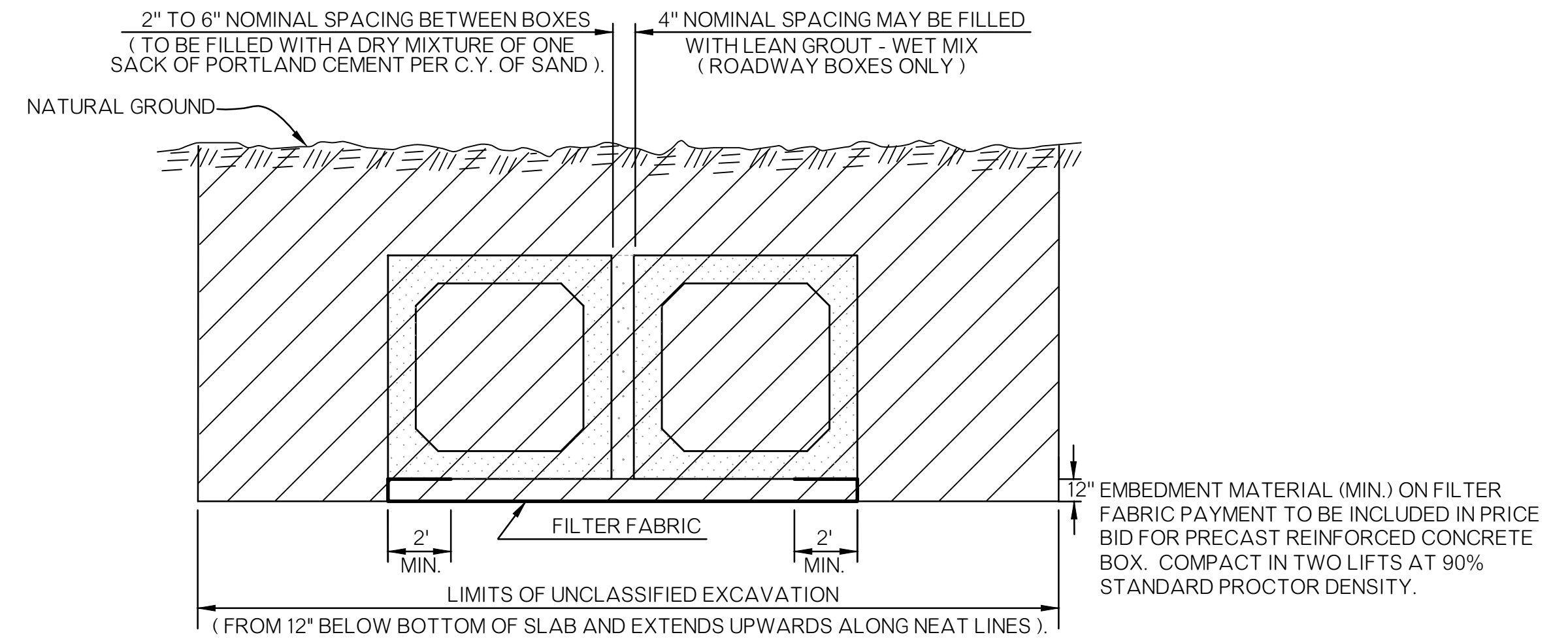
APPROVED BY: *[Signature]* DATE: 08/12/2023
 ERIC J. WENGER, P.E. CITY ENGINEER
 DRAWN: OKC-PW-SRB
 DATE: 3/9/2023

FLEXIBLE PIPE INSTALLATION DETAILS

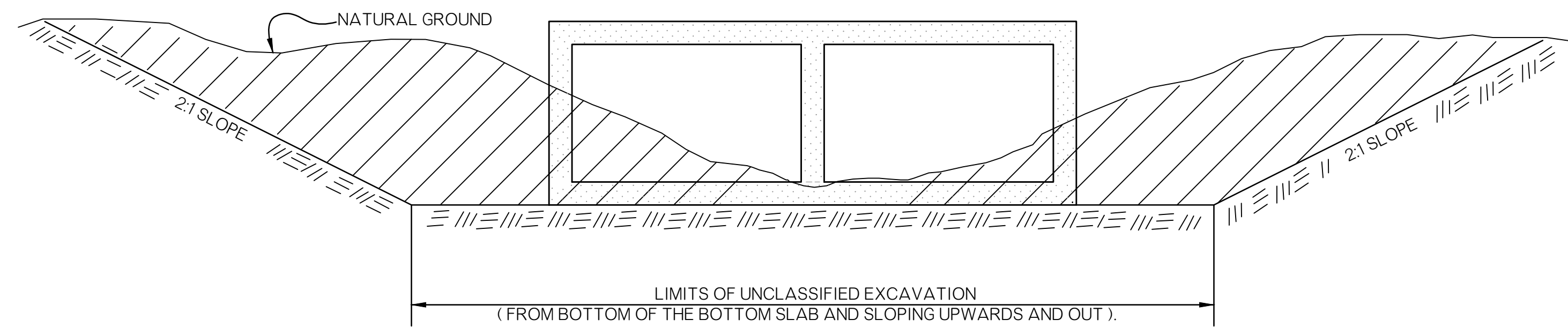
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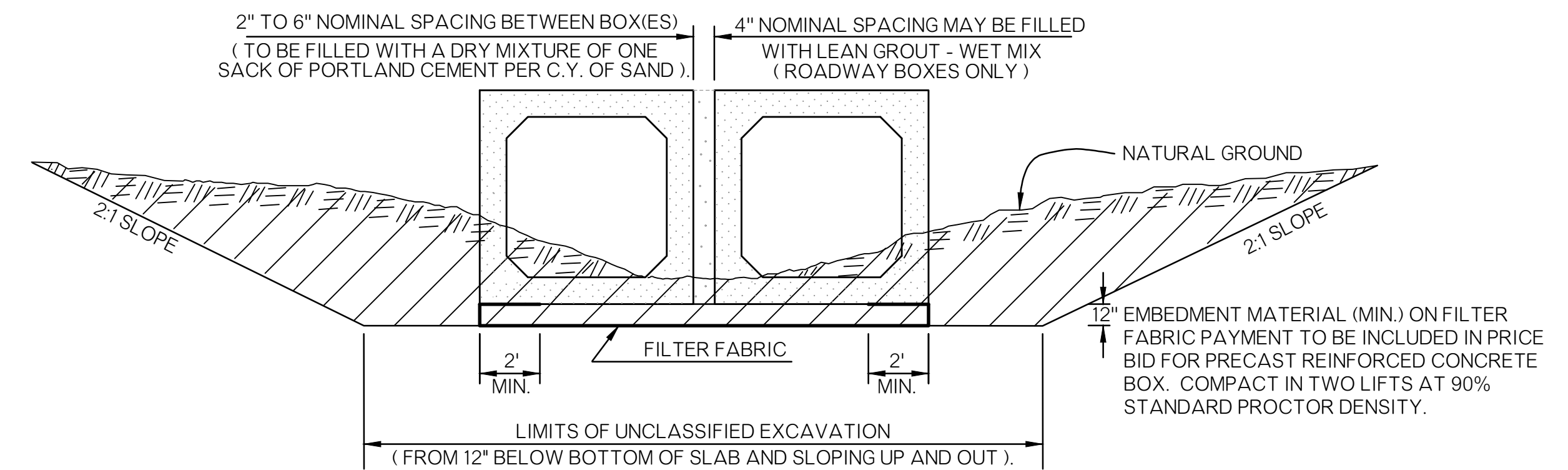
REQUIREMENTS FOR UNCLASSIFIED EXCAVATION OF R.C.B. STORM SEWERS



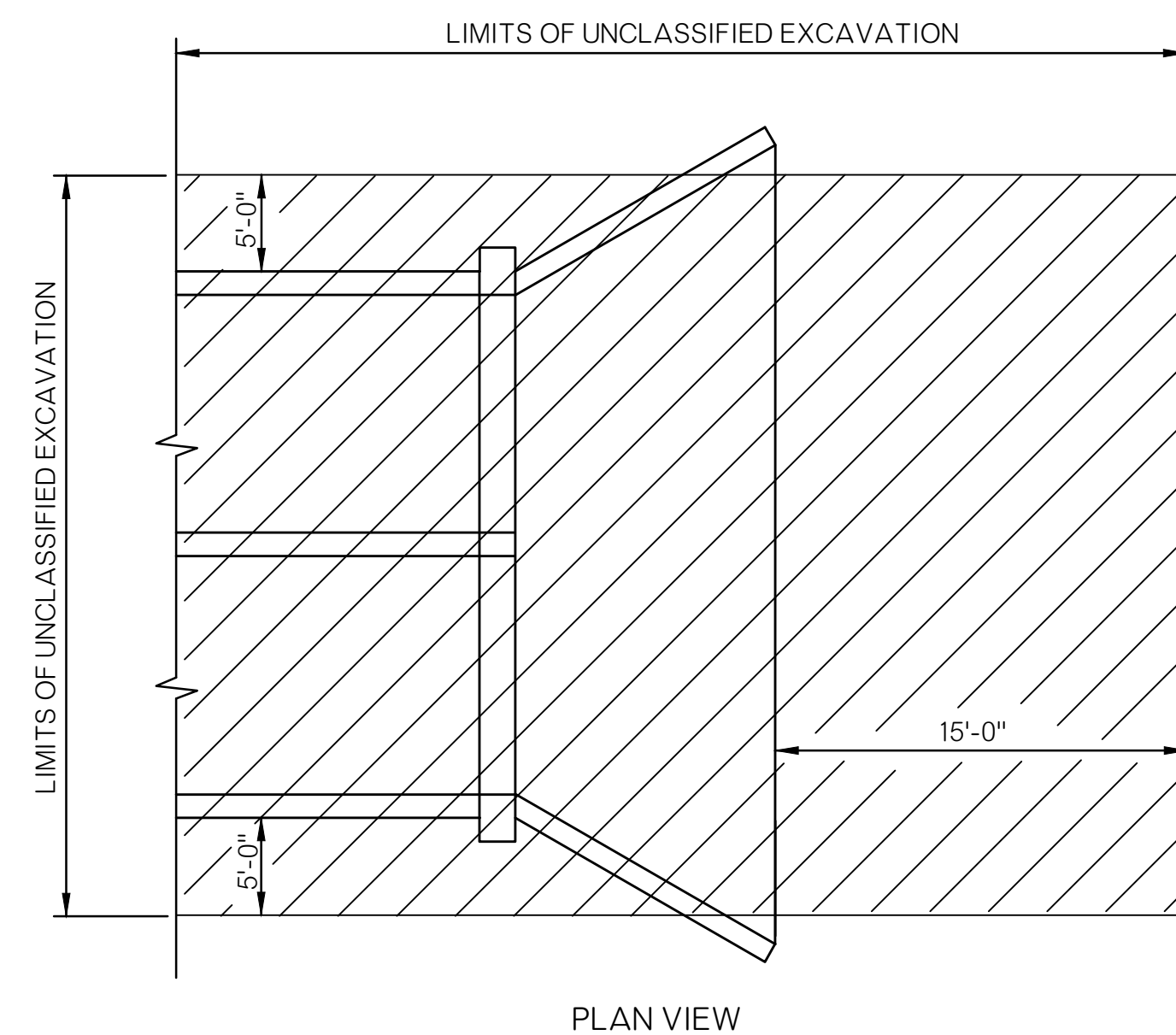
REQUIREMENTS FOR EXCAVATION OF PRECAST R.C.B. STORM SEWERS



REQUIREMENTS FOR UNCLASSIFIED EXCAVATION OF R.C.B. CULVERTS OF ROADWAY AND BRIDGE CLASSIFICATION

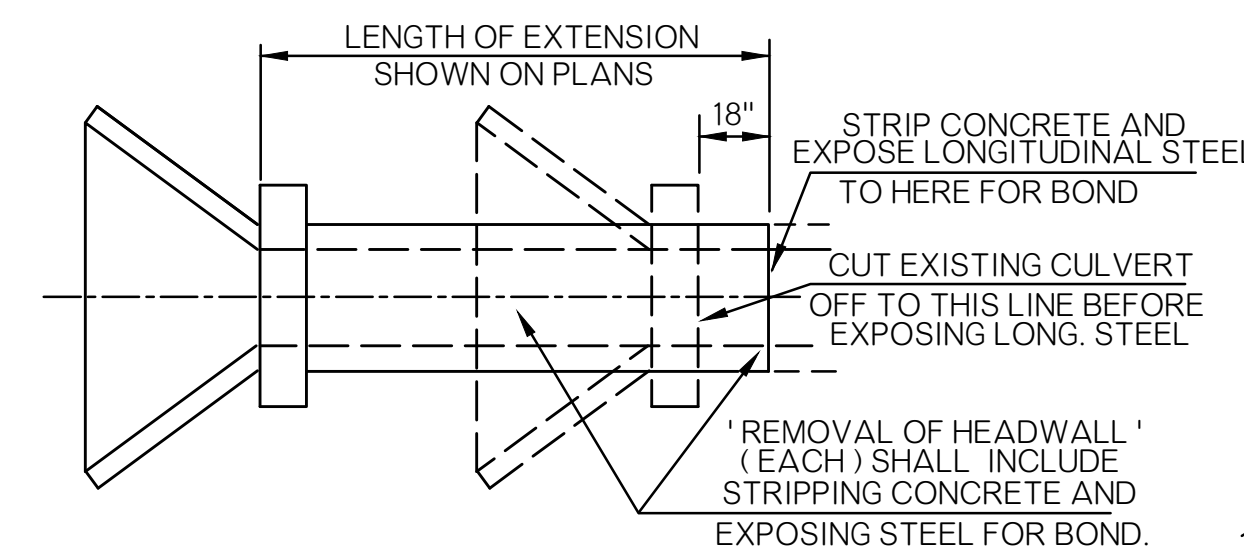


REQUIREMENTS FOR EXCAVATION OF PRECAST R.C.B. CULVERTS OF ROADWAY AND BRIDGE CLASSIFICATION

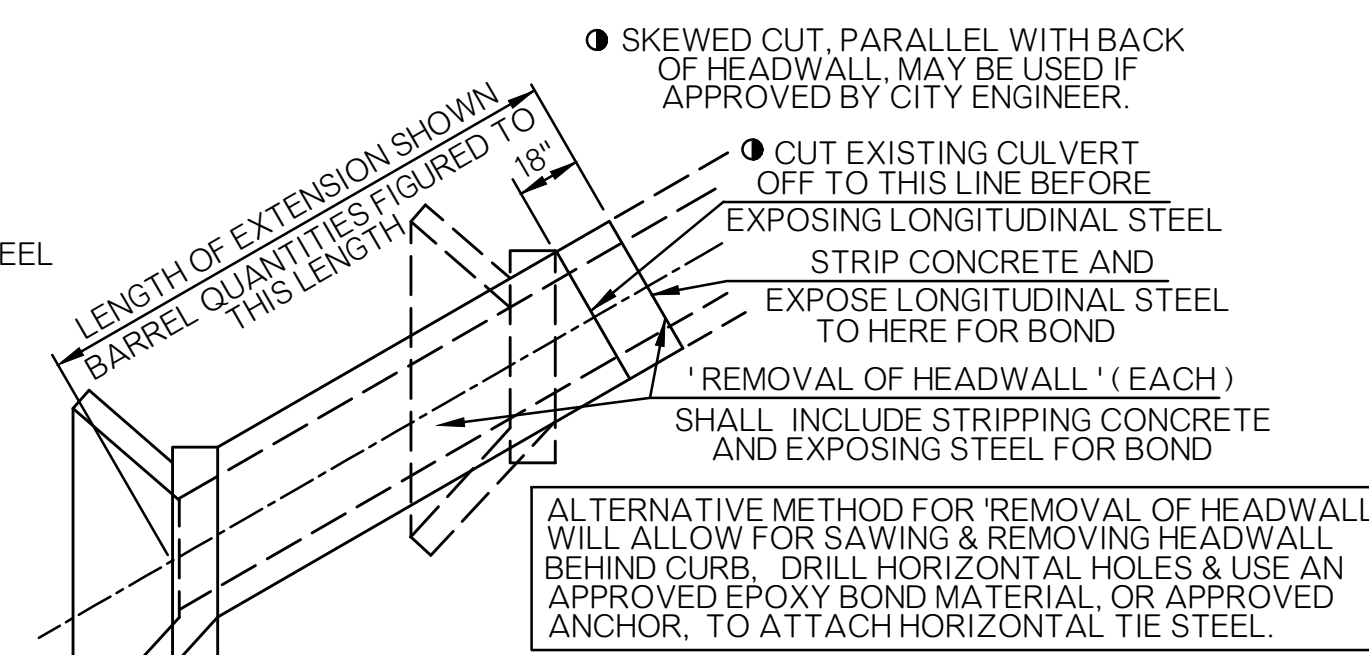


PLAN VIEW

LIMITS OF UNCLASSIFIED EXCAVATION



ALTERNATE METHOD FOR EXTENDING 0° SKEWED BOXES

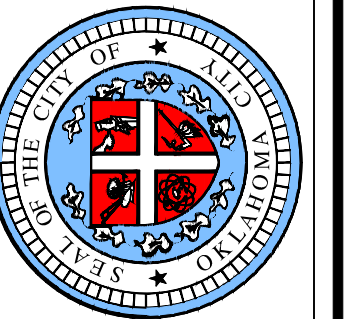


ALTERNATE METHOD FOR EXTENDING NON-0° SKEWED BOXES

EMBEDMENT MATERIAL GRADATION	
Sieve Size	Percent Passing
1 1/4"	100%
3/4"	40-100%
3/8"	30-75%
#4	25-60%
#10	20-43%
#40	8-26%
#200	4-12%

ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL CONFORM TO THE OKC STANDARD SPECIFICATION FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
*THE INSTALLATION OF REINFORCED BOX CULVERTS SHALL CONFORM TO OKC STANDARD SPECIFICATION AND ASTM C1675.

The City of
Oklahoma City
Public Works Department
Engineering Division



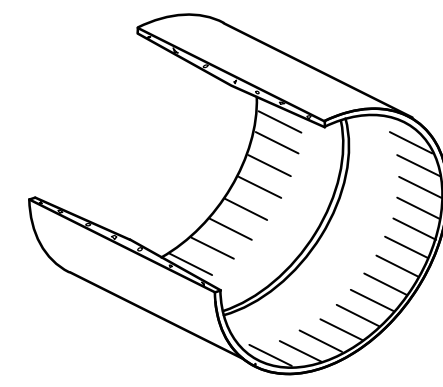
APPROVED BY: DATE: 08/12/2023
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: OKC-PW-SRB
DATE: 3/9/2023

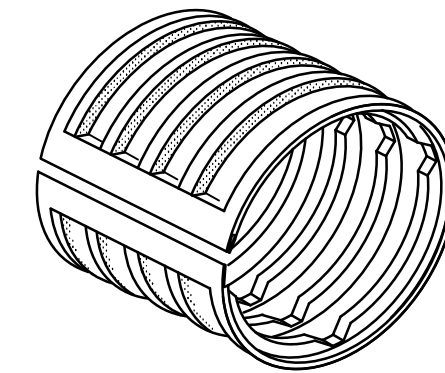
**REINFORCED CONCRETE BOX
INSTALLATION DETAILS**

Detail Number

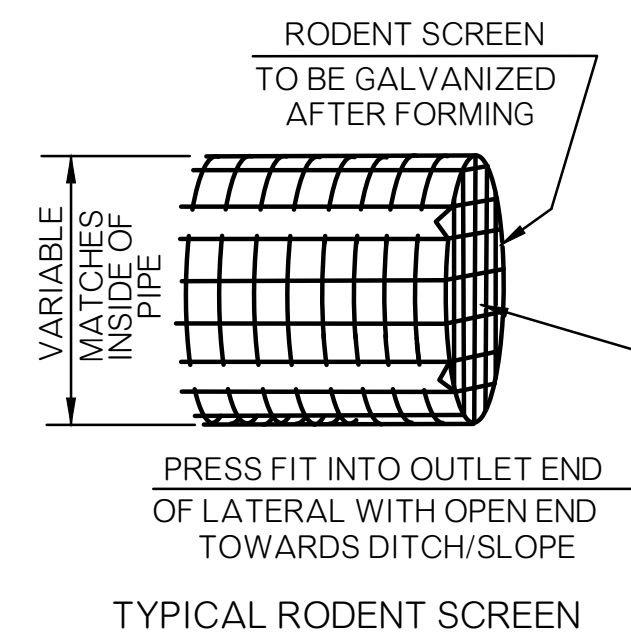
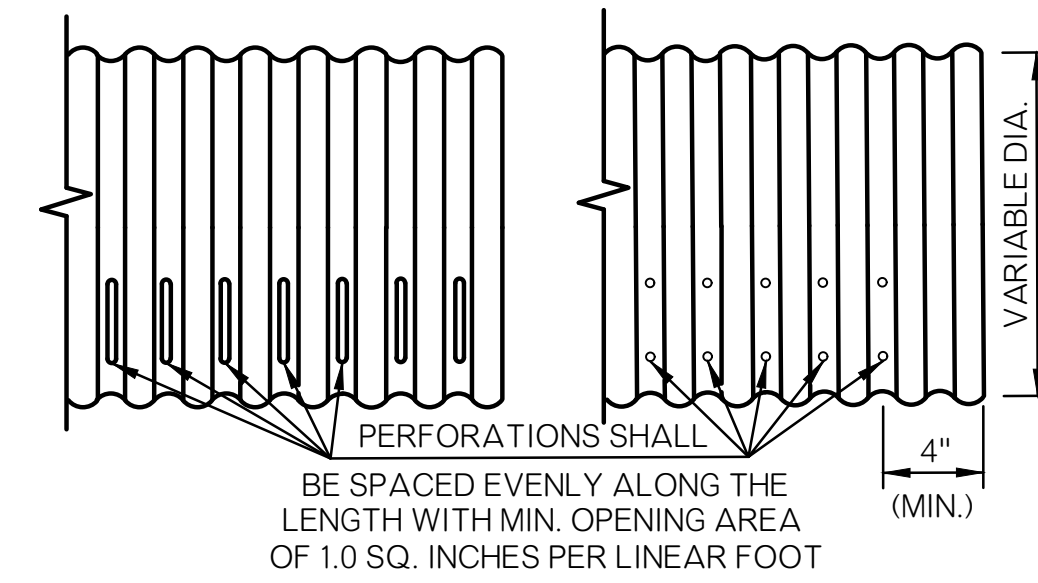
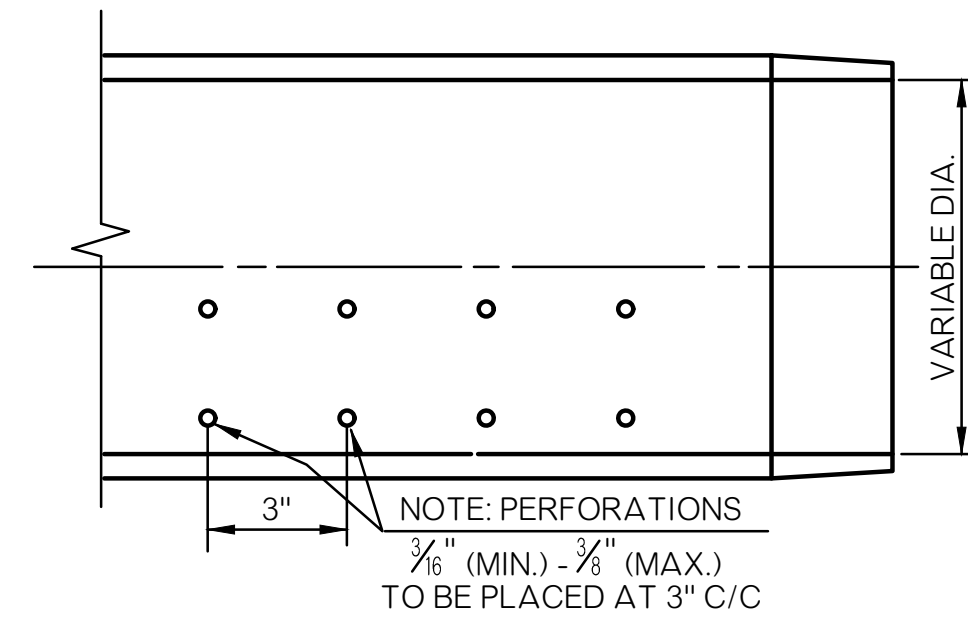
D-1003



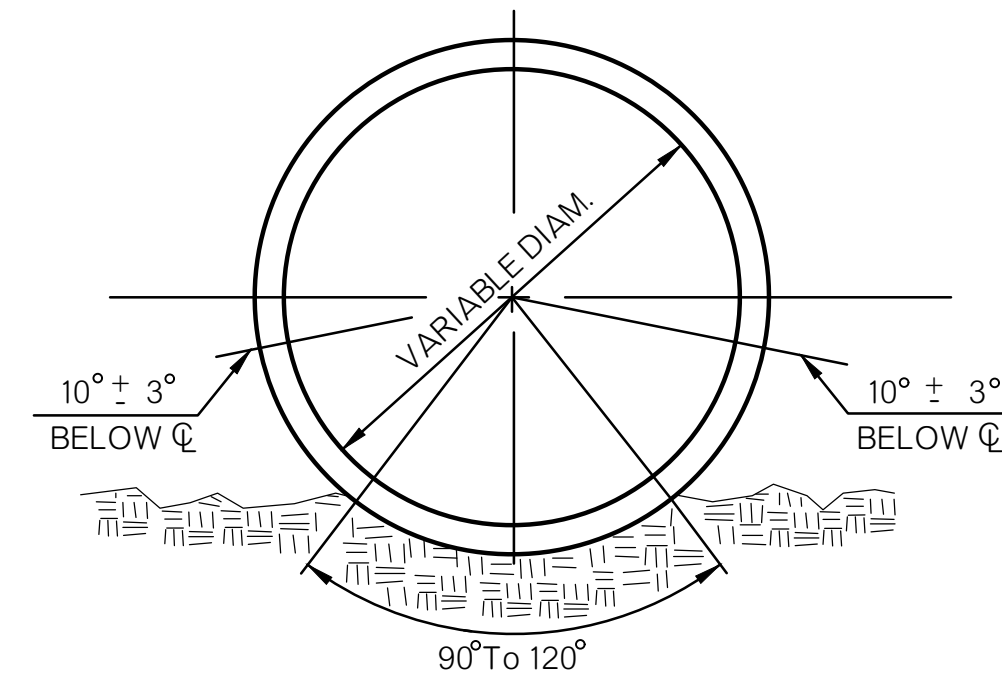
TYPICAL COUPLING FOR PVC PIPE UNDERDRAIN
1/4 SECTION REMOVED



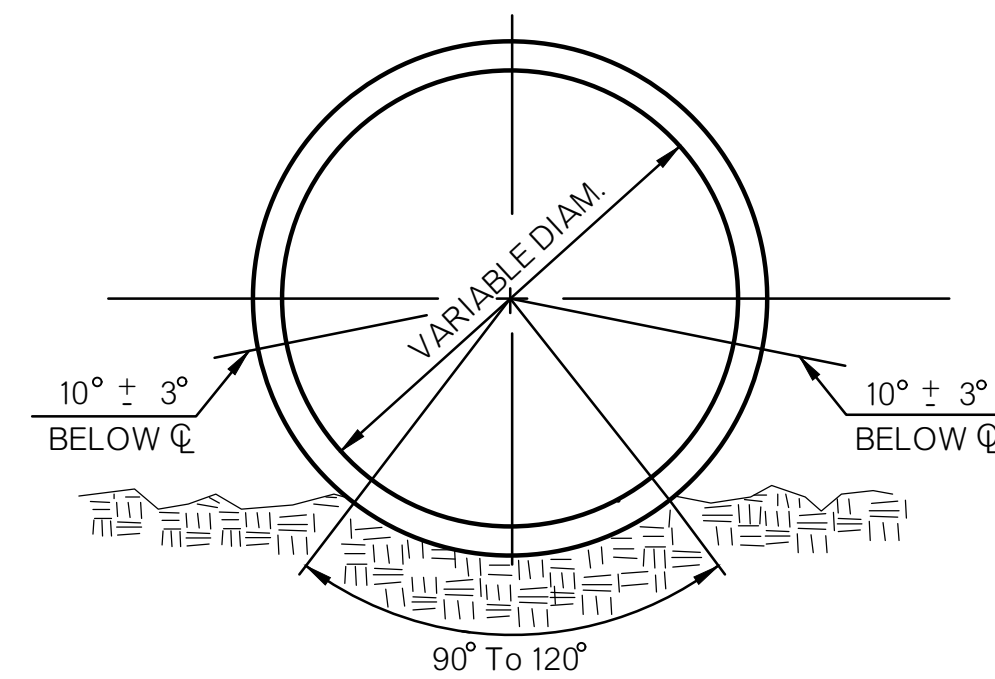
TYPICAL CORRUGATED COUPLING OR AN APPROVED EQUAL



TYPICAL RODENT SCREEN



POLYVINYL (PVC) PIPE UNDERDRAIN



CORRUGATED POLYETHYLENE PIPE UNDERDRAIN

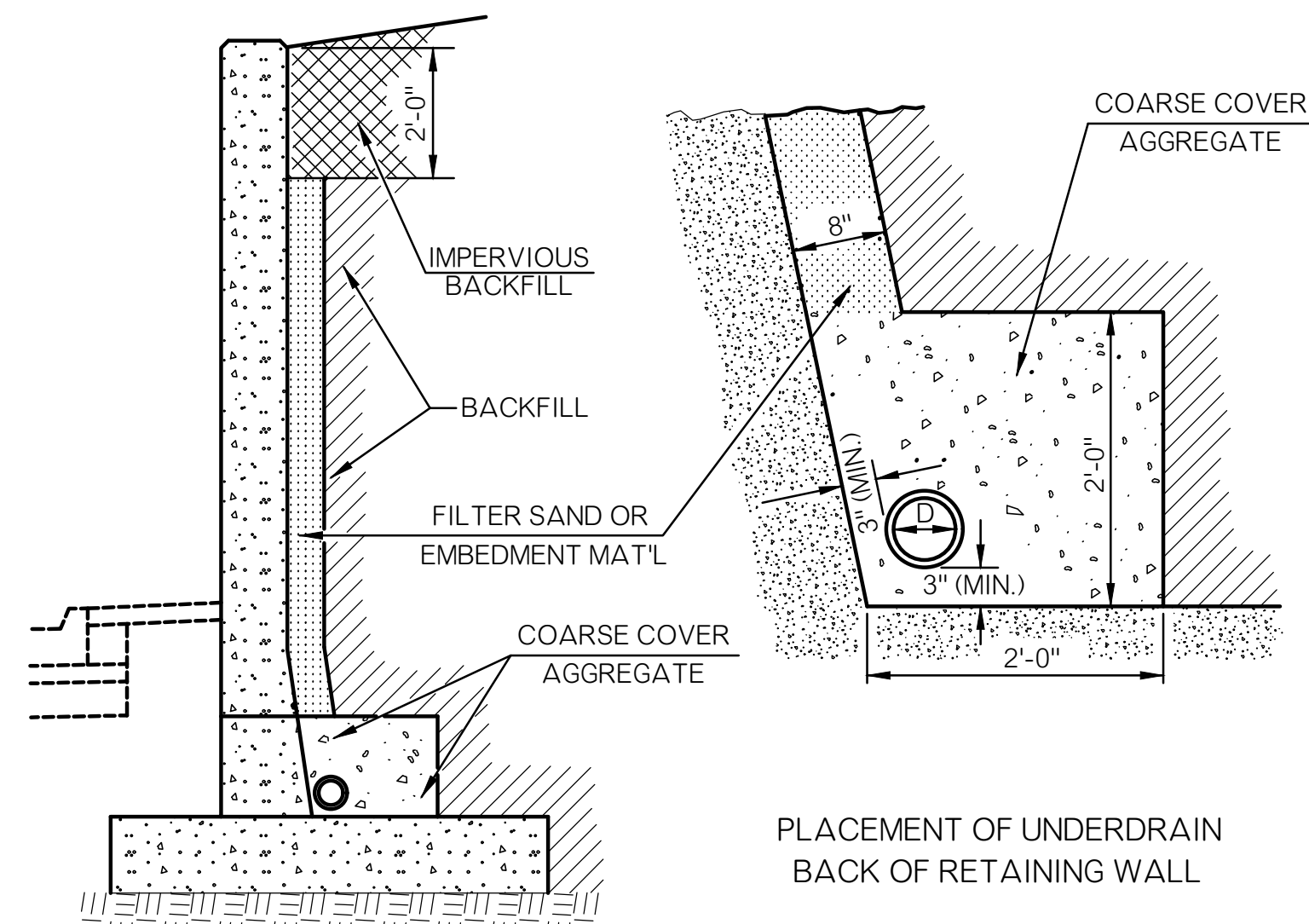
INSTALLATION TECHNIQUE: (12" DIAMETER OR SMALLER)

PERFORATED PIPE UNDERDRAIN, WHEN INSTALLED IN A TRENCH, SHALL BE BEDDED ON 4" OF COARSE AGGREGATE COVER MATERIAL. THE INSTALLED PIPE SHALL THEN BE CAREFULLY BACKFILLED WITH THE REMAINING COARSE AGGREGATE COVER MATERIAL TO 6" ABOVE THE TOP OF THE PIPE. FILTER SAND SHALL BE INSTALLED TO APPROXIMATELY 6" BELOW THE ORIGINAL NATURAL GROUND AS APPROVED BY THE CITY ENGINEER. ALL MATERIAL REQUIRED TO BE INCLUDED IN PRICE BID PER LINEAR FEET OF PIPE UNDERDRAIN.

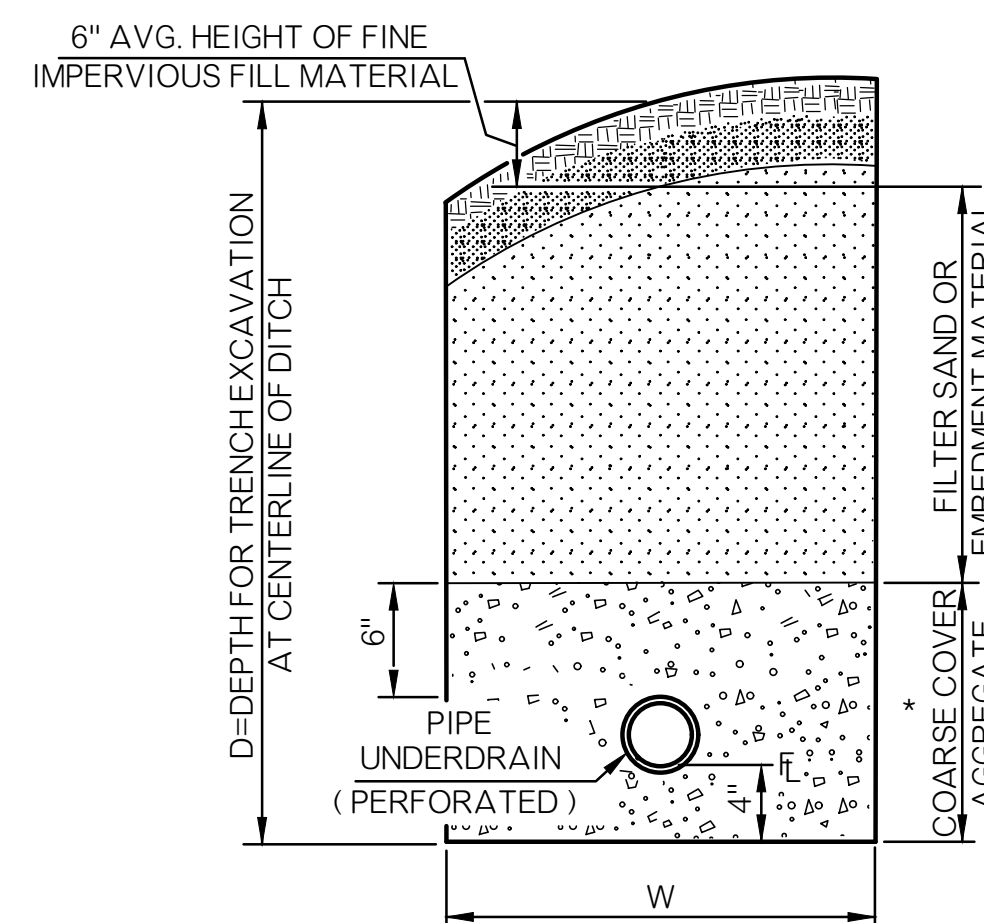
NON-PERFORATED PIPE UNDERDRAIN, WHEN INSTALLED IN A TRENCH, SHALL BE BEDDED IN A 4" LAYER CONSISTING OF COARSE AGGREGATE COVER MATERIAL OR A 50-50 MIX OF COARSE AGGREGATE COVER MATERIAL AND FILTER SAND. THE REMAINING BACKFILL MAY BE NATIVE SOIL REMOVED IN THE TRENCHING OPERATION. FILTER SAND OR BACKFILLED REQUIRED BY THE CITY ENGINEER. COST TO BE INCLUDED IN OTHER ITEMS OF WORK. SEE GENERAL NOTE NUMBERS 5 & 6.

GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- THE EXTENT, LOCATION AND DEPTH OF DRAINS MAY BE ADJUSTED BY THE CITY ENGINEER TO SUIT CONDITIONS FOUND DURING CONSTRUCTION.
- COST OF ALL FITTINGS TO BE INCLUDED IN THE PRICE BID PER LINEAR FOOT OF PIPE UNDERDRAIN.
- FOR PIPE UNDERDRAIN OF UP TO 12" IN DIAMETER, W = 24" WITHOUT SHEETING AND SHORING; W = 36" WHEN SHEETING AND SHORING IS USED. SEE STANDARD PIPE INSTALLATION, DETAIL D-1001, FOR SHEETING & SHORING NOTES.
- FOR PIPE UNDERDRAIN LARGER THAN 12" IN DIAMETER, SEE STANDARD PIPE INSTALLATION, DETAIL D-1001, FOR ADDITIONAL TRENCH EXCAVATION DETAILS.
- MATERIALS SHOWN HERE ARE TYPICAL ONLY AND ARE NOT THE ONLY CHOICE FOR SUBSURFACE DRAINAGE PURPOSES.
- OUTLET OPENING SHALL HAVE INSTALLED A REMOVABLE RODENT SCREEN HAVING A WIRE MESH DESIGN & 0.23" TO 0.50" (NOM.) SQUARE OPENINGS. SCREEN MATERIAL MAY BE STAINLESS STEEL OR GALVANIZED WITH WIRE THICKNESS OF BETWEEN 0.023" & 0.038". AFTER SHAPING AND FABRICATION. RODENT SCREEN DESIGN SHALL BE APPROVED BY THE CITY ENGINEER.
- THE FINAL SECTION OF THE OUTLET LATERAL CONDUIT SHALL BE NON-PERFORATED, SCHEDULE 40 OR TYPE S HIGH DENSITY POLYETHYLENE AND A MINIMUM 20'-0" IN LENGTH, INCLUDING COUPLINGS.
- FOR DETAILS OF OUTLET LATERAL HEADWALL, SEE DETAIL NUMBER D-1005.
- COARSE COVER AGGREGATE MATERIAL SHALL MEET THE REQUIREMENTS OF THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS, AGGREGATE NO. 57. COST OF AGGREGATE COVER MATERIAL TO BE INCLUDED IN PRICE BID FOR EDGE DRAIN CONDUIT - PERFORATED.

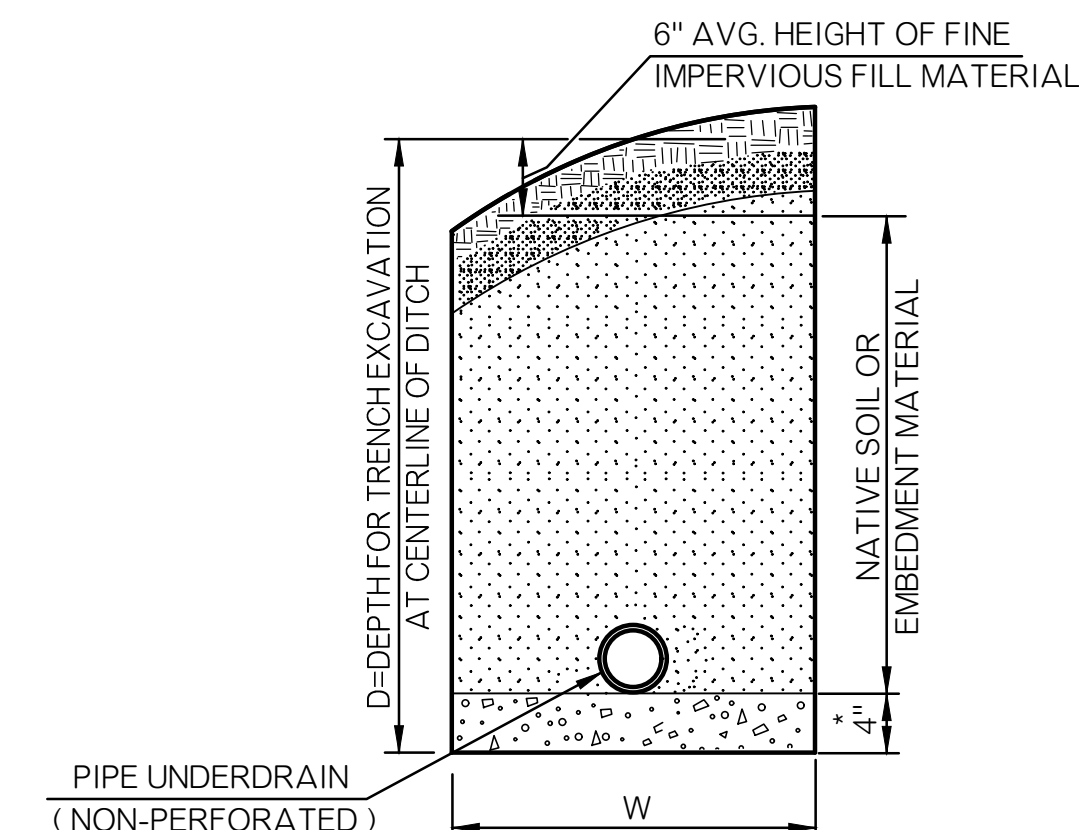


PLACEMENT OF UNDERDRAIN BACK OF RETAINING WALL



DETAIL TRENCH EXCAVATION PERFORATED PIPE UNDERDRAIN INSTALLATIONS

* PIPE UNDERDRAIN COVER MATERIAL

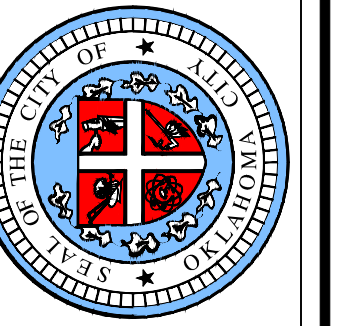


DETAIL TRENCH EXCAVATION NON-PERFORATED PIPE UNDERDRAIN INSTALLATIONS

* PIPE UNDERDRAIN COVER MATERIAL

CLASS B EMBEDMENT MATERIAL GRADATION	
Sieve Size	Percent Passing
1 1/2"	100%
3/4"	40-100%
3/8"	30-75%
#4	25-60%
#10	20-43%
#40	8-26%
#200	4-12%

The City of
Oklahoma City
Public Works Department
Engineering Division

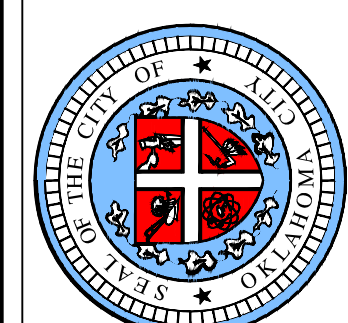


APPROVED BY: DATE: 09/12/2023
ERIC J. WENGER, P.E.
CITY ENGINEER
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

**PIPE UNDERDRAIN INSTALLATION
DETAILS**

Detail Number

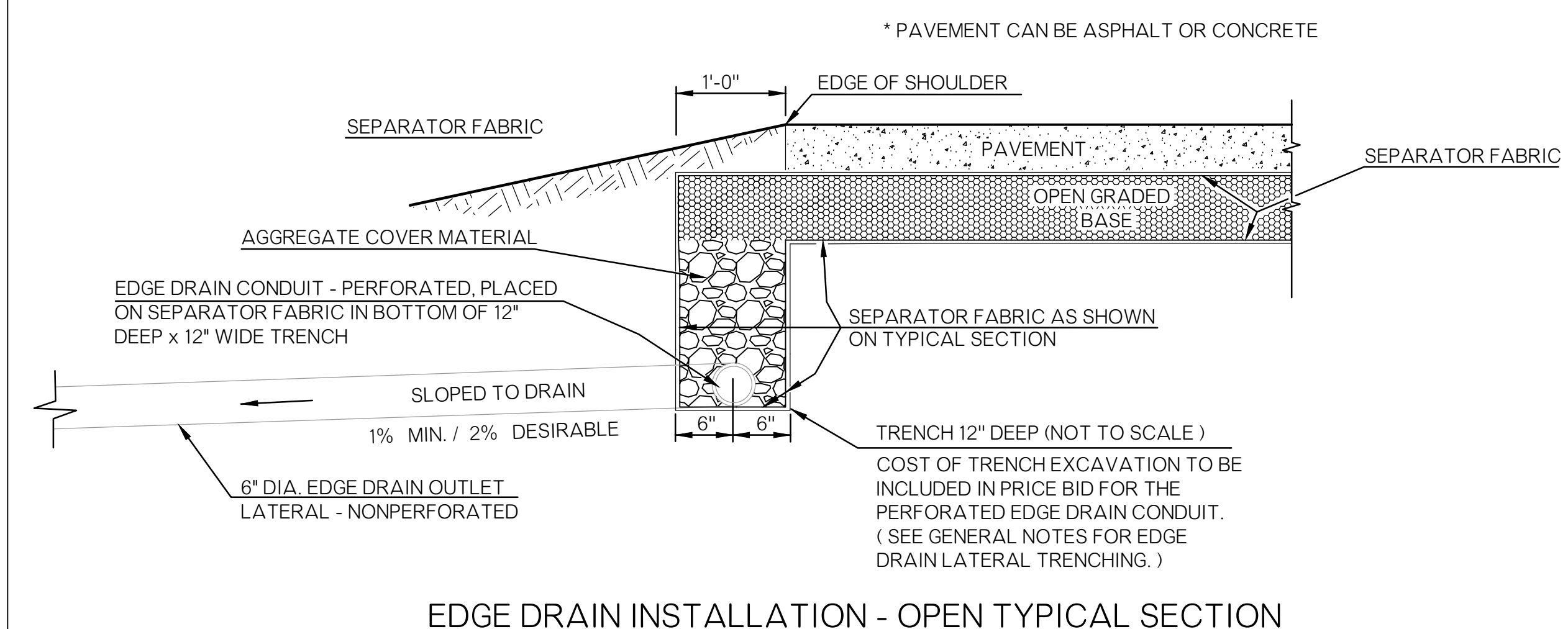
D-1004



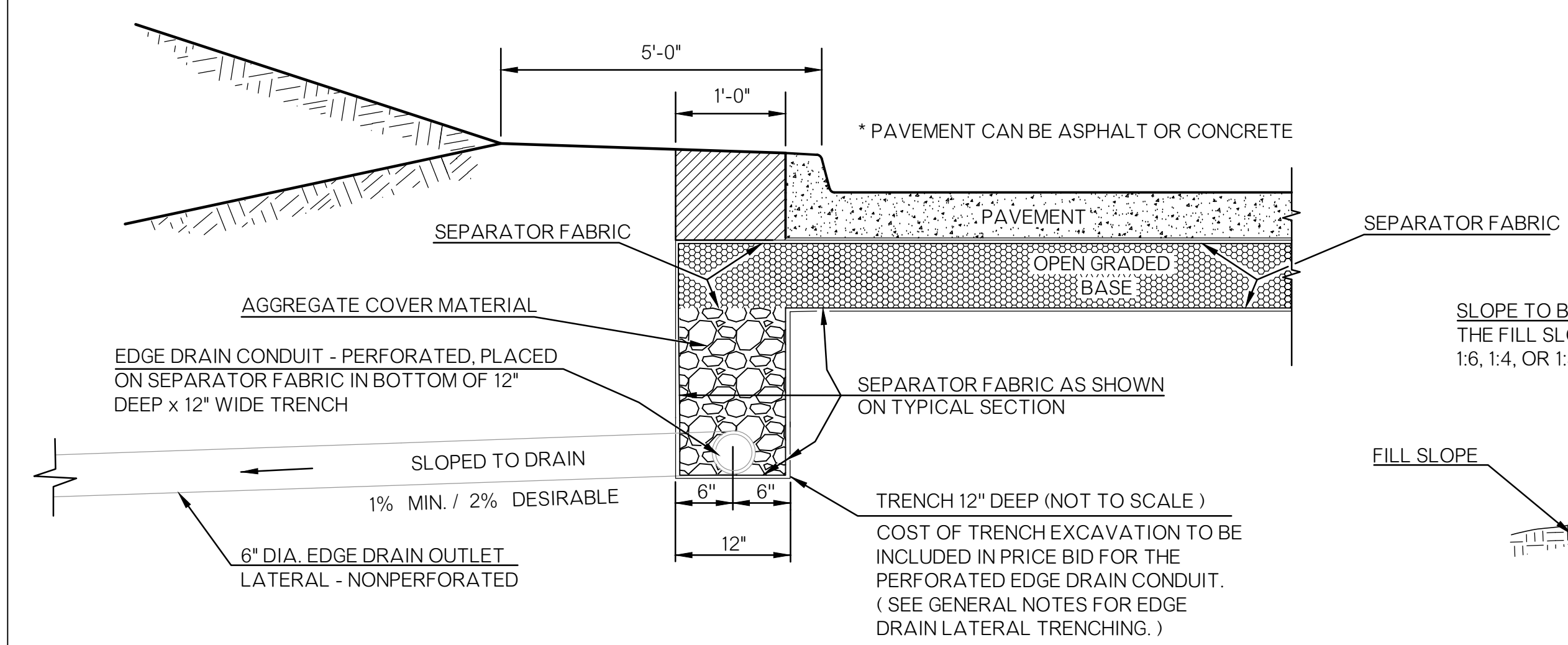
APPROVED BY: *[Signature]* DATE: 09/12/2023
ERIC J. WENGER, P.E.
CITY ENGINEER
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

**PAVEMENT EDGE DRAIN
DETAILS**

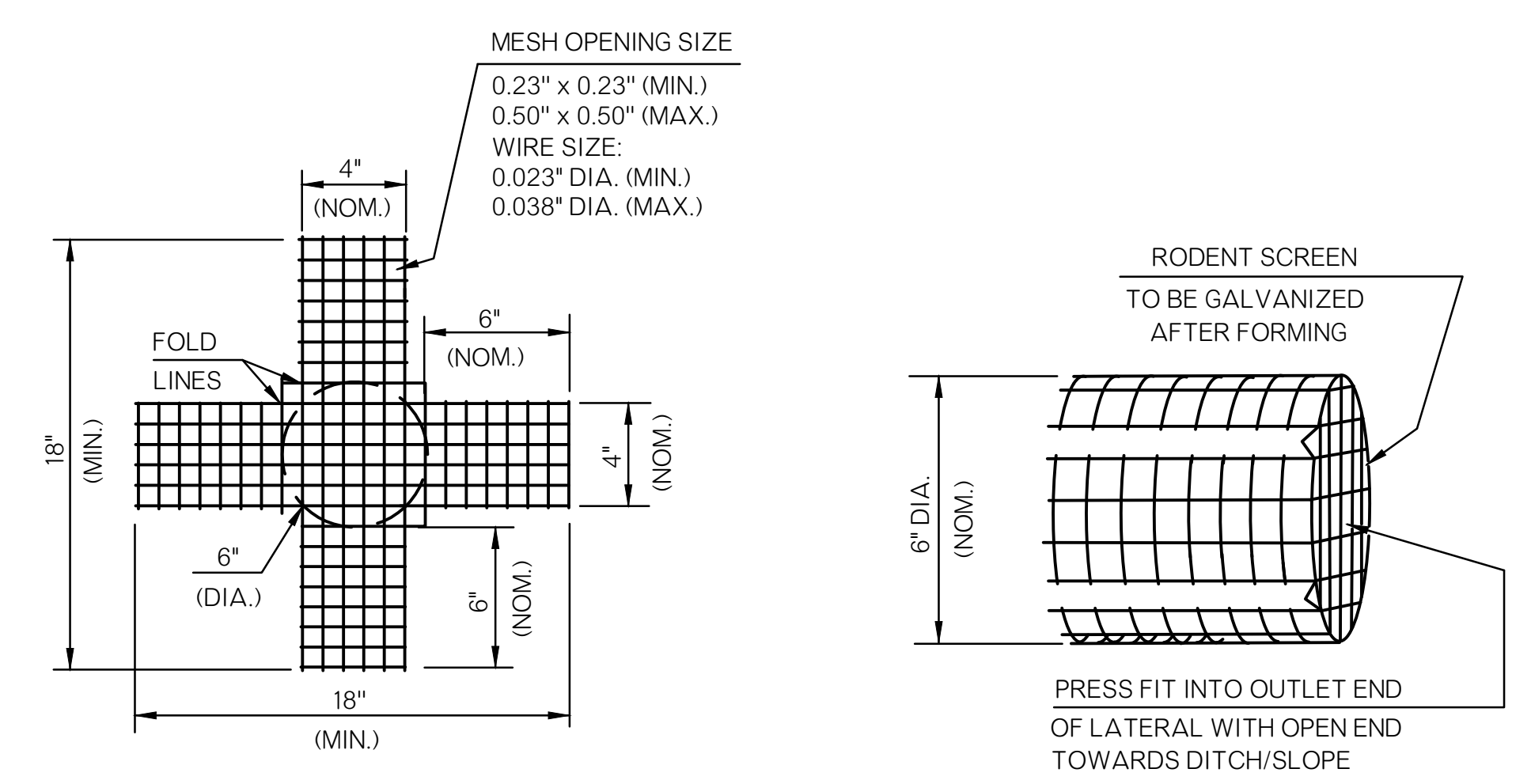
Detail Number
D-1005



EDGE DRAIN INSTALLATION - OPEN TYPICAL SECTION

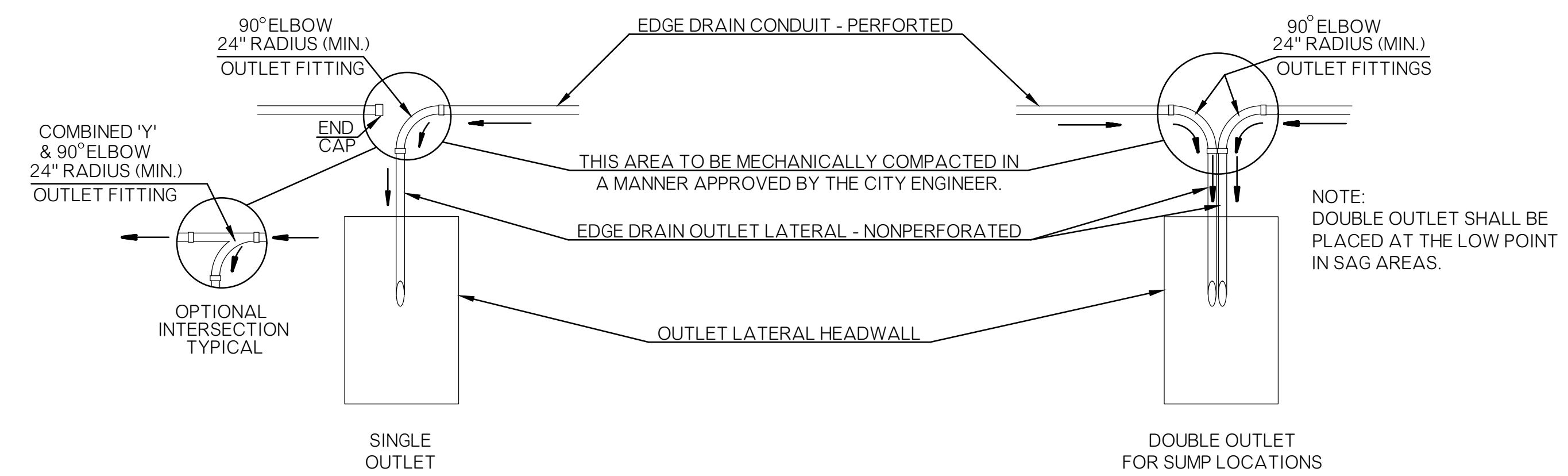


EDGE DRAIN INSTALLATION - CURBED TYPICAL SECTION

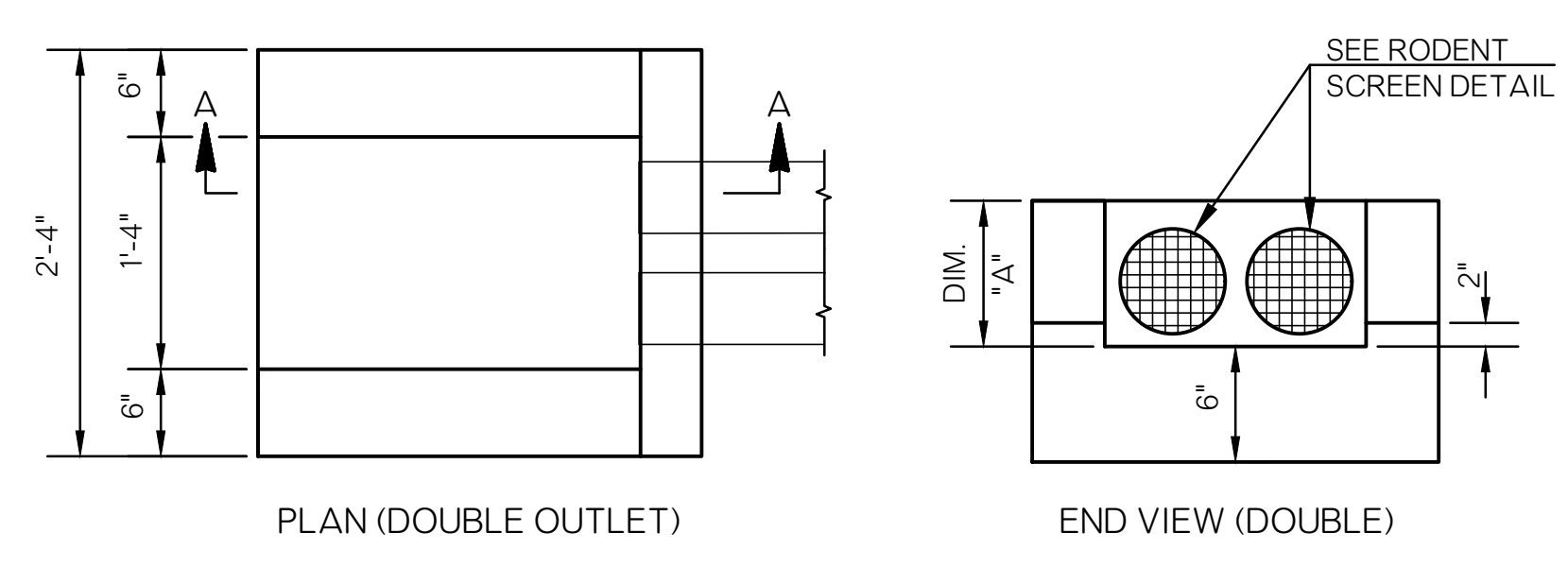
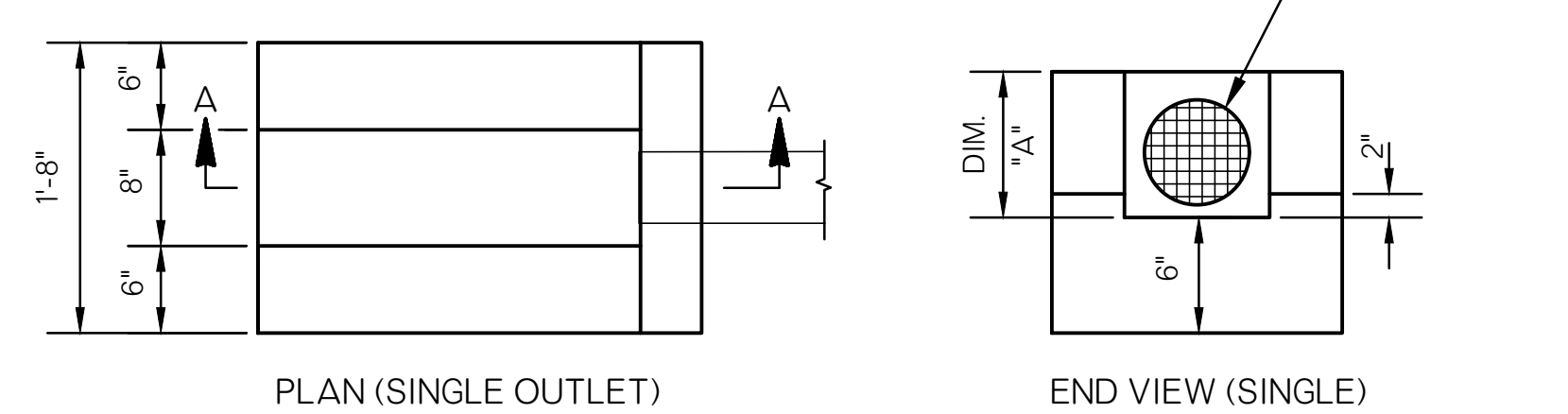
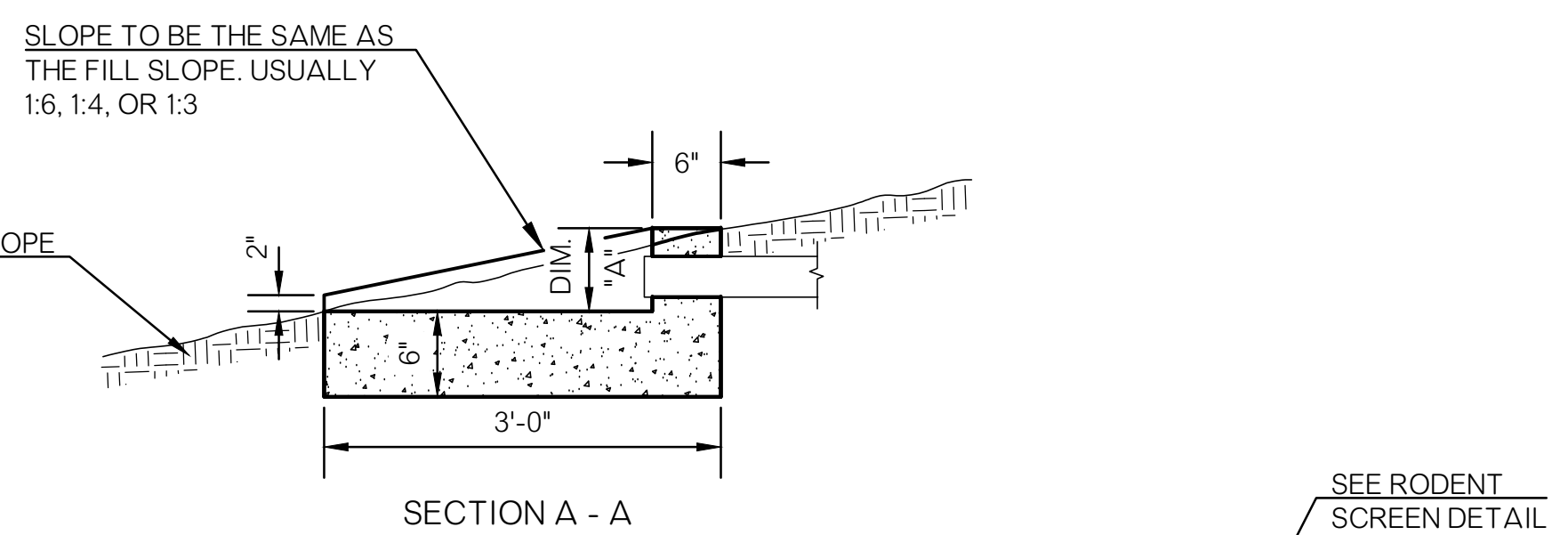


RODENT SCREEN DETAIL

THIS RODENT SCREEN DETAIL IS TYPICAL ONLY AND OTHER DESIGN LAYOUT PATTERNS MAY BE ALLOWED IF APPROVED BY THE CITY ENGINEER. NO TOLERANCE SHALL BE ALLOWED ON MATERIAL SPECIFICATIONS. RODENT SCREEN DIMENSIONS WILL CHANGE PROPORTIONATELY FOR ALTERNATE SIZE OUTLET LATERAL CONDUIT.



OUTLET LATERAL CONNECTIONS - PLAN



OUTLET LATERAL HEADWALL

NOTE: OPENING FOR LATERAL PIPE WILL VARY IN SIZE AND SHAPE, DEPENDING ON THE SIZE OF THE OUTLET LATERAL PIPE AND THE SLOPE OF THE STRUCTURE. THE OUTLET LATERAL PIPE SHALL BE CUT TO CONFORM TO THE TOP SURFACE OF THE OUTLET HEADWALL.

GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- INSTALLATION OF OUTLET LATERAL PIPES SHOULD BE SCHEDULED CONCURRENT WITH THE INSTALLATION OF PAVEMENT EDGE DRAIN.
- PAVEMENT EDGE DRAIN CONDUIT SHALL NOT BE LEFT IN PLACE LONGER THAN 48 HOURS WITHOUT BEING CONNECTED TO OUTLET LATERAL PIPES.
- OUTLET ELBOWS (90°) SHALL BE USED WHEN PIPE EDGE DRAIN SLOPE EXCEEDS TWO (2) PERCENT.
- CONNECTION OF THE OUTLET LATERAL PIPE TO THE OUTLET FITTING SHALL BE DONE IN A MANNER APPROVED BY THE CITY ENGINEER. COST OF ALL CAPS, FITTINGS, LATERAL PIPE, BONDING MATERIALS, RODENT SCREENS, TRENCHING, AND BACKFILLING NEEDED TO INSTALL OUTLET LATERAL PIPE SHALL BE INCLUDED IN THE PRICE BID FOR EDGE DRAIN OUTLET LATERAL (NON-PERFORATED).
- EDGE DRAINS AND OUTLET LATERALS SHALL BE LOCATED ON LOW SIDE OF SUPER ELEVATED SECTIONS AT CURVES. OUTLET LATERALS ARE TO BE PLACED AT 300' INTERVALS ON GRADE OR AS APPROVED BY THE CITY ENGINEER.
- PRICE BID FOR OUTLET LATERAL HEADWALL INCLUDES SURFACE PREPARATION, CLASS A CONCRETE, LABOR AND ANY INCIDENTALS NECESSARY FOR CONSTRUCTION.
- CLASS A CONCRETE SHALL MEET REQUIREMENTS OF THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- AGGREGATE COVER MATERIAL SHALL MEET THE REQUIREMENTS OF THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS, AGGREGATE NO. 57. COST OF AGGREGATE COVER MATERIAL TO BE INCLUDED IN PRICE BID FOR EDGE DRAIN CONDUIT - PERFORATED.
- DETAILS ON THIS SHEET ARE BASED ON 6" DIA. EDGE DRAIN CONDUIT. THE CONTRACTOR SHALL MAKE ALL NECESSARY ADJUSTMENTS TO ACCOMMODATE OTHER SIZE EDGE DRAINS.

OUTLET LATERAL HEADWALL SCHEDULE			
FILL SLOPE	DIM. "A"	CLASS A CONCRETE QUALITY	
		SINGLE OUTLET	DOUBLE OUTLET
1 : 3	1'-0"	0.18 C.Y.	0.23 C.Y.
1 : 4	9 1/2"	0.17 C.Y.	0.21 C.Y.
1 : 6	7"	0.16 C.Y.	0.19 C.Y.

SINGLE PIPE INSTALLATION - 4 TO 1 SAFETY SLOPE

TABLE A - SCHEDULE OF PIPE SAFETY GRATES - AASHTO DESIGNATED PIPE SIZES

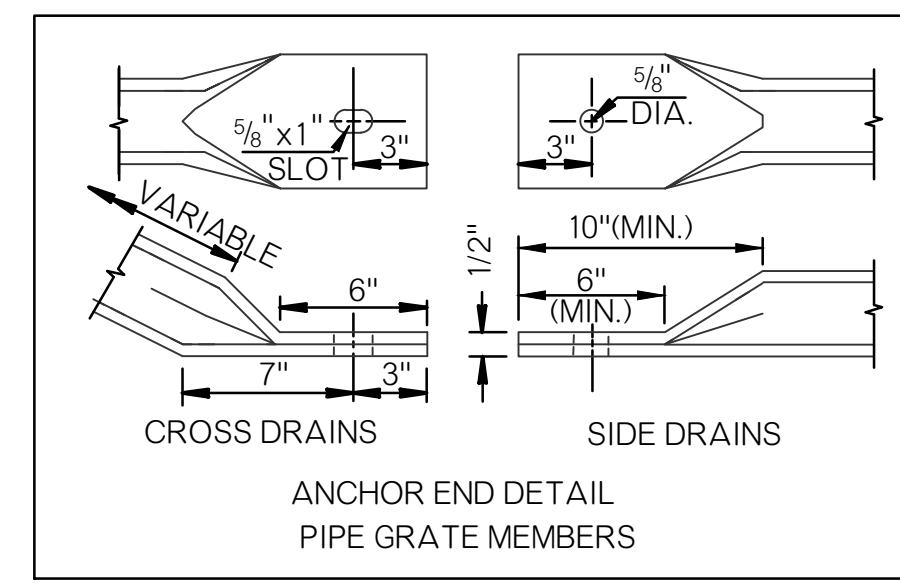
C. E. T. TYPE	ROUND INCHES	REINF. CONC. ARCH PIPE INCHES	STEEL ARCH PIPE INCHES	ALUMINUM ARCH PIPE INCHES	REINF. CONC. ELLIPTICAL PIPE INCHES	SIDE DRAIN GRATES L (SD)	CROSS DRAIN GRATES L (CD)	
								NUMBER OF HORIZONTAL PIPE GRATES FOR SIDE DRAIN OPTIONS
A4	15"					36"	NONE	
	18"					36"	NONE	
	(18")	22 x 13	1	21 x 15	2	14 x 23	1	42"
		26 x 15	2					45"
B4	21"					45"	NONE	
	24"					45"	NONE	
	(24")	28 x 18	2	28 x 20	2	19 x 30	2	48"
		36 x 22	3					48"
C4	30"	43 x 26	3	42 x 29	3	29 x 45	3	54"
		51 x 31	4					54"
	(30")			49 x 33	4	49 x 33	4	57"
						34 x 53	4	70"
D4	36"					54"	1 @ 13'-6"	
	42"					60"	1 @ 14'-3"	
	(42")	58 x 36	4	57 x 38	5	38 x 60	5	70"
		65 x 40	5					70"
E4	48"					66"	1 @ 15'-3"	
						72"	1 @ 15'-9"	
	(48")	73 x 45	6	71 x 47	6	43 x 68	5	72"
						48 x 76	6	92"

SINGLE PIPE INSTALLATION - 4 TO 1 SAFETY SLOPE

TABLE B - SCHEDULE OF DIMENSIONS FOR C. E. T. TYPES

C.E.T. TYPE	LENGTH A	WIDTH B	WIDTH B	LENGTH C	HEIGHT H	HEIGHT K	CONC. C.Y.	CONC. C.Y.	STEEL LENGTH		
									R-H-BARS	A-E-H-BARS	S-BARS
A4	10'-4"	5'-6"	6'-2"	5'-8"	21"	9"	1.70	2.00	5'-2"	5'-10"	12'-4"
B4	12'-4"	6'-0"	7'-2"	6'-0"	22"	14"	2.00	2.60	5'-8"	6'-10"	15'-4"
C4	15'-9"	6'-6"	8'-5"	7'-4"	26"	20"	2.85	3.95	6'-2"	8'-1"	19'-6"
D4	19'-3"	7'-6"	9'-6"	8'-0"	28"	27"	3.50	5.05	7'-2"	9'-2"	21'-6"
E4	20'-8"	8'-0"	10'-4"	8'-8"	30"	30"	4.05	5.75	7'-8"	10'-0"	23'-4"

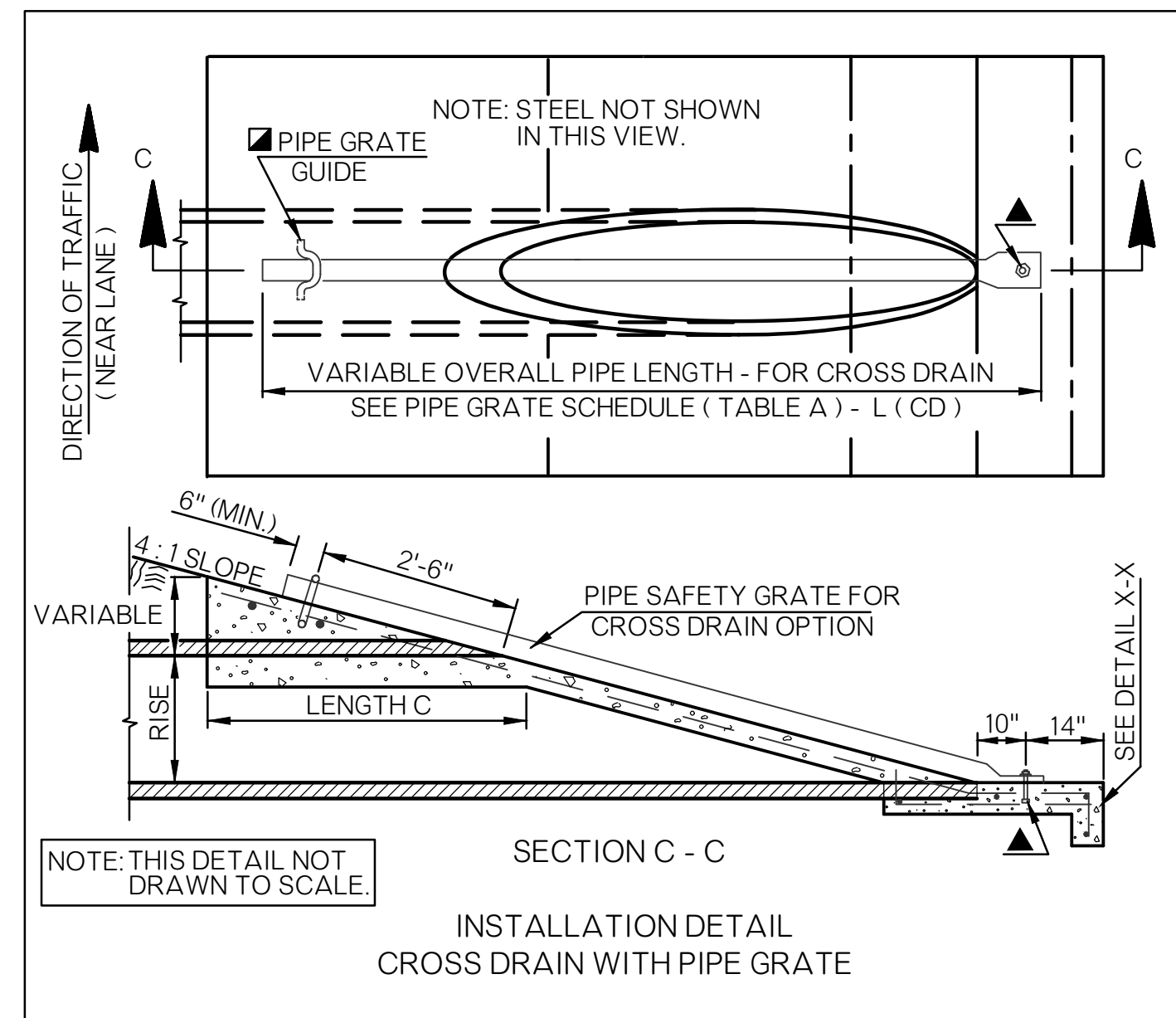
(R) ROUND SHAPE CULVERT OPTIONS
 (A) ARCH SHAPE CULVERT OPTIONS
 (E) HORIZONTAL ELLIPSE SHAPE CULVERT OPTIONS



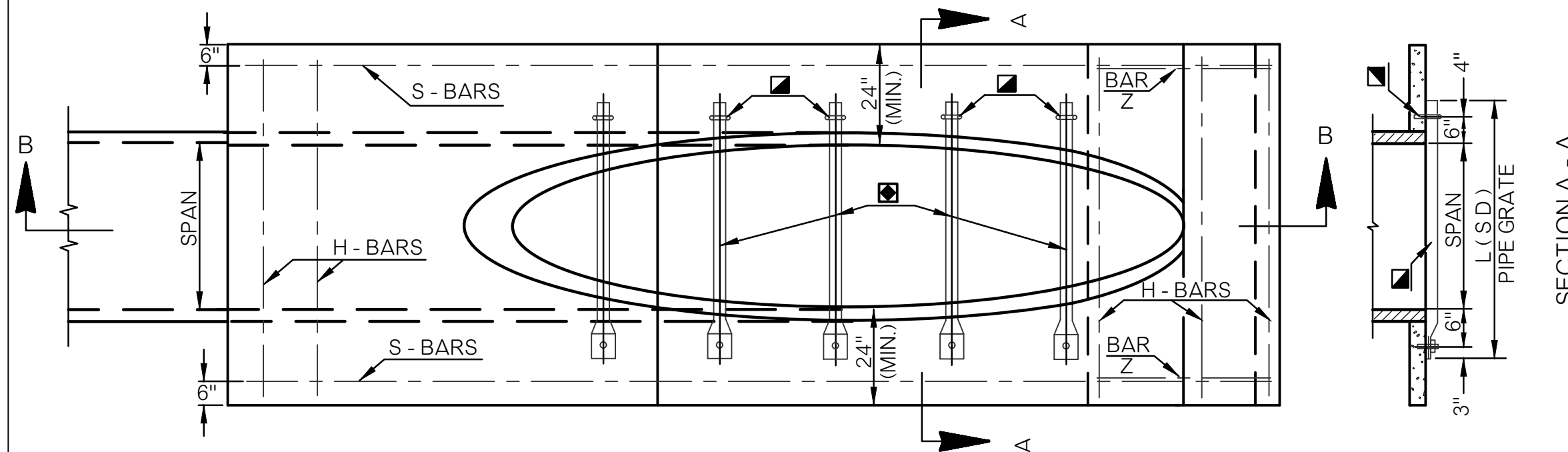
GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- QUANTITIES SHOWN IN TABLE A ARE FOR ONE END ONLY. CLASS A CONCRETE SHALL CONFORM TO THE MINIMUM REQUIREMENTS OF THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
- TYPES A4 THROUGH E4 END SECTIONS, AS SHOWN IN TABLE A, MAY BE USED WITH ANY AASHTO DESIGNATED METAL, ALUMINUM & CONCRETE PIPE SIZES, AS SHOWN IN TABLE B. END SECTION QUANTITIES ARE BASED ON METAL PIPE DIMENSIONS, NO PIPE WALL THICKNESS AND SMALLEST LISTED CULVERT ROUND OR ARCH PIPE WITHIN TYPE.
- SLOPED END OF CULVERT PIPE SHALL BE SHOP CUT. TWO COATS OF COLD GALVANIZATION WILL BE APPLIED TO CUT EDGES OF STEEL CULVERT PIPE. COST OF CUTTING AND GALVANIZING IS INCLUDED IN THE PRICE BID FOR PIPE CULVERT.
- ALL SIZES OF CULVERT PIPE WILL BE CUT ON 4 TO 1 SLOPE.
- PIPE FOR SAFETY GRATES SHALL BE 3" x 7.58 LBS./FT. STANDARD WEIGHT STEEL PIPE, SCHEDULE 40. IT SHALL BE FURNISHED GALVANIZED, PLAIN END AND SHALL MEET THE MINIMUM REQUIREMENTS OF ASTM A-53 (HYDROSTATIC TESTS MAY BE WAIVED) OR ASTM F 1083. COST OF GRATES TO BE INCLUDED IN PRICE BID FOR THE C.E.T.
- ANY GALVANIZED AREA(S) OF METAL PIPE DISTRESSED DURING THE POST FABRICATION AND/OR HANDLING PROCESS SHALL BE COATED WITH AN APPROVED ZINC RICH PAINT.
- REINFORCING STEEL AND PIPE GRATE GUIDES SHALL BE NO. 4 DEFORMED BARS. COST OF STEEL SHALL BE INCLUDED IN PRICE BID FOR THE CULV. END TREATMENT.
- CRITERIA FOR USE OF PIPE SAFETY GRATE MEMBERS:
 (A) ALL SIDE DRAIN AND MULTIPLE PIPE INSTALLATIONS WITHIN THE CLEAR ZONE.
 (B) ALL CROSS DRAIN INSTALLATIONS WITH A CULVERT SPAN OF 30" OR
 (C) ALL INSTALLATIONS OUTSIDE THE CLEAR ZONE WHERE HAZARD POTENTIAL IS HIGH BASED ON TRAFFIC DIRECTION, SPEED, VOLUME AND SIZE OF CULVERT.
 NOTE: ANALYZE HYDRAULIC PERFORMANCE AT VARYING DEGREES OF CLOGGING AND APPLY RISK ASSESSMENT BEFORE USING GRATES.
- PIPE GRATE MEMBERS ARE NOT SHOWN IN END VIEW.
- ANCHOR END OF PIPE GRATE MEMBERS SHALL BE HELD IN PLACE WITH A 1/2" x 5 1/2" GALVANIZED BOLT, NUT AND WASHER, THREADS, 1 3/4" (NOM.) SHALL REMAIN EXPOSED FOR INSTALLING GRATE, WASHER AND NUT. ALL BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM A-307 WITH COST TO BE INCLUDED IN THE PRICE BID FOR THE CULVERT END TREATMENT.
- FOR TOTAL QUANTITY OF EXTRA DEPTH TOE WALL, MULTIPLY WIDTH B TIMES 0.0185 FOR EACH FOOT OF DEPTH OF TOE WALL REQUIRED. PAYMENT TO BE INCLUDED IN PRICE BID FOR THE CULVERT END TREATMENT.
- LONGITUDINAL PIPE SAFETY GRATES FOR CROSS DRAIN INSTALLATIONS ARE NOT NECESSARY OR REQUIRED FOR OPEN TRENCH/DITCH SPANS LESS THAN 30".

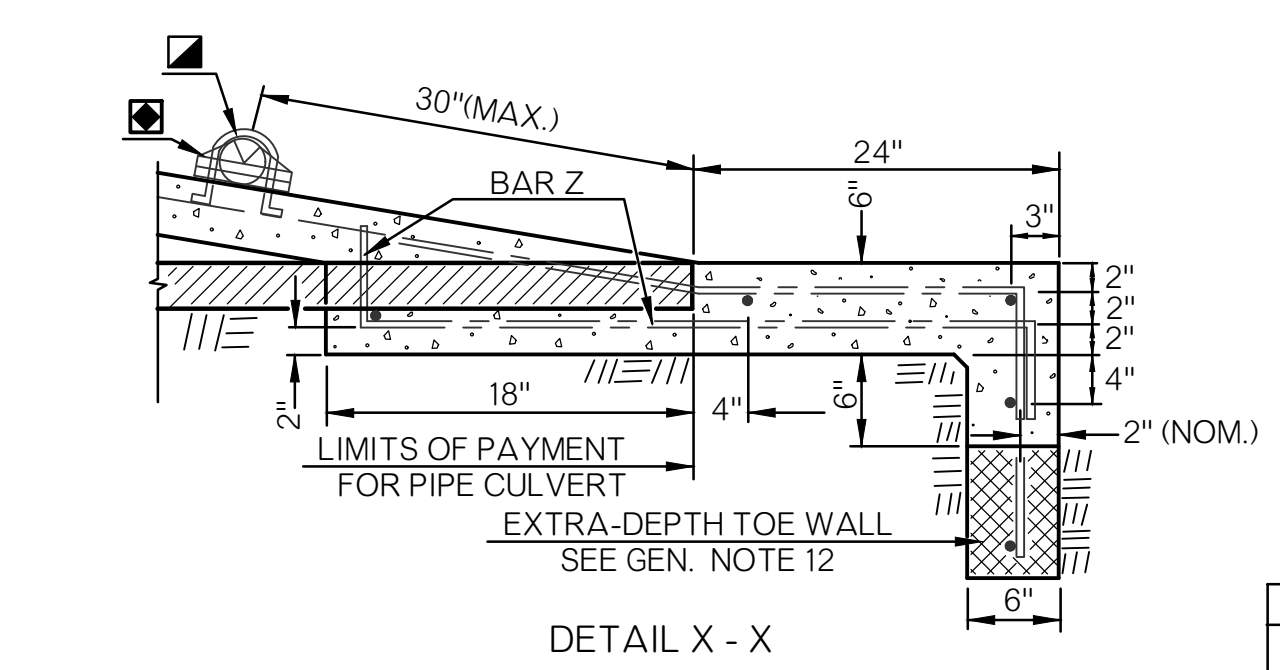
PRECAST CULVERT END TREATMENTS OR OTHER ALTERNATIVE DESIGNS MAY BE USED IF APPROPRIATE DRAWINGS ARE SUBMITTED TO AND APPROVED BY THE CITY ENGINEER.



SECTION C - C
 INSTALLATION DETAIL
 CROSS DRAIN WITH PIPE GRATE

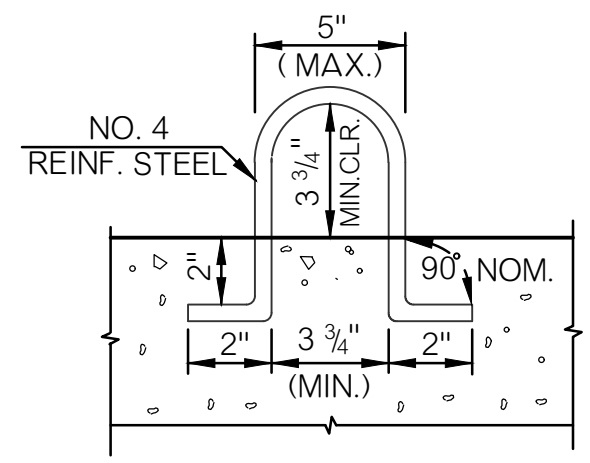


SECTION B - B
 INSTALLATION DETAIL
 SIDE DRAIN WITH PIPE GRATES



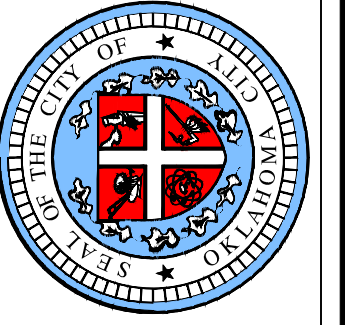
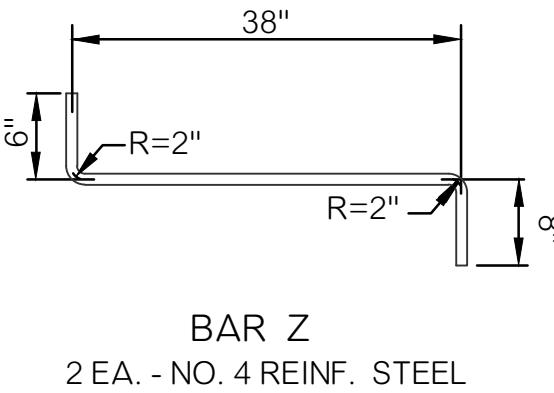
DETAIL X - X

TYPICAL ABBREVIATIONS
 RS - ROUND SIDE DRAIN
 RC - ROUND CROSS DRAIN
 AS - ARCH SIDE DRAIN
 AC - ARCH CROSS DRAIN
 GR - GRATED
 NG - NON-GRATED



END VIEW
 (PIPE GRATES NOT SHOWN THIS VIEW)

PIPE GRATE GUIDE
 (U-BOLT)



APPROVED BY: *[Signature]* DATE: 09/12/2023
 ERIC J. WENGER, P.E.
 CITY ENGINEER
 DRAWN: OKC-PW-SRB
 DATE: 3/9/2023

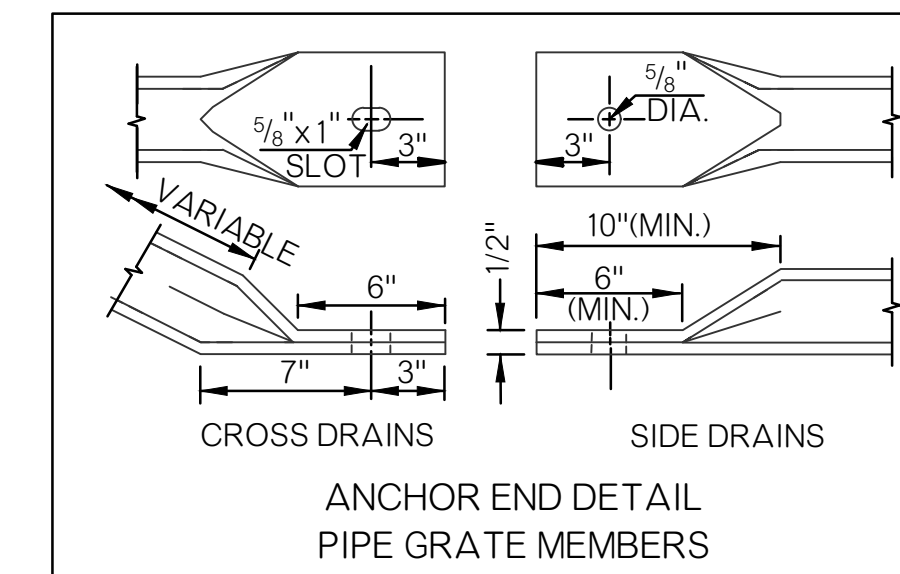
**CULVERT END TREATMENT
 SINGLE PIPE DETAILS**

DOUBLE PIPE INSTALLATION - 4 TO 1 SAFETY SLOPE										
TABLE A - SCHEDULE OF PIPE SAFETY GRATES - AASHTO DESIGNATED PIPE SIZES										
C. E. T. TYPE	ROUND INCHES	REINF. CONC. ARCH PIPE INCHES	STEEL ARCH PIPE INCHES	ALUMINUM ARCH PIPE INCHES	REINF. CONC. ELLIPTICAL PIPE INCHES	SIDE DRAIN GRATES L (SD) INCHES	CROSS DRAIN GRATES L (CD) INCHES	G		
AA4	15"	2				5'-2"	NONE	12		
	18"	2				5'-8"	NONE	12		
	(18")		22 x 13	1	21 x 15	2	21 x 15	2	14 x 23	1
			26 x 15	2	24 x 18	2	24 x 18	2		
BB4	21"	2				6'-2"	NONE	12		
	24"	2				6'-8"	NONE	12		
	(24")		28 x 18	2	28 x 20	2	28 x 20	2	19 x 30	2
			36 x 22	3	35 x 24	3	35 x 24	3	22 x 34	2
CC4	30"	5				7'-10"	NONE	15		
	(30")		43 x 26	3	42 x 29	3	42 x 29	3	29 x 45	3
			51 x 31	4	49 x 33	4	49 x 33	4	34 x 53	4
	42"	5				9'-2"	2 @ 12'-6"	15		
DD4	36"	4				10'-0"	2 @ 13'-6"	15		
	(42")		58 x 36	4	57 x 38	5	57 x 38	5	38 x 60	5
			65 x 40	5	64 x 43	5	64 x 43	5	43 x 68	5
	48"	6				11'-8"	2 @ 20'-9"	24		
EE4	(48")		73 x 45	6	71 x 47	6	71 x 47	6	48 x 76	6

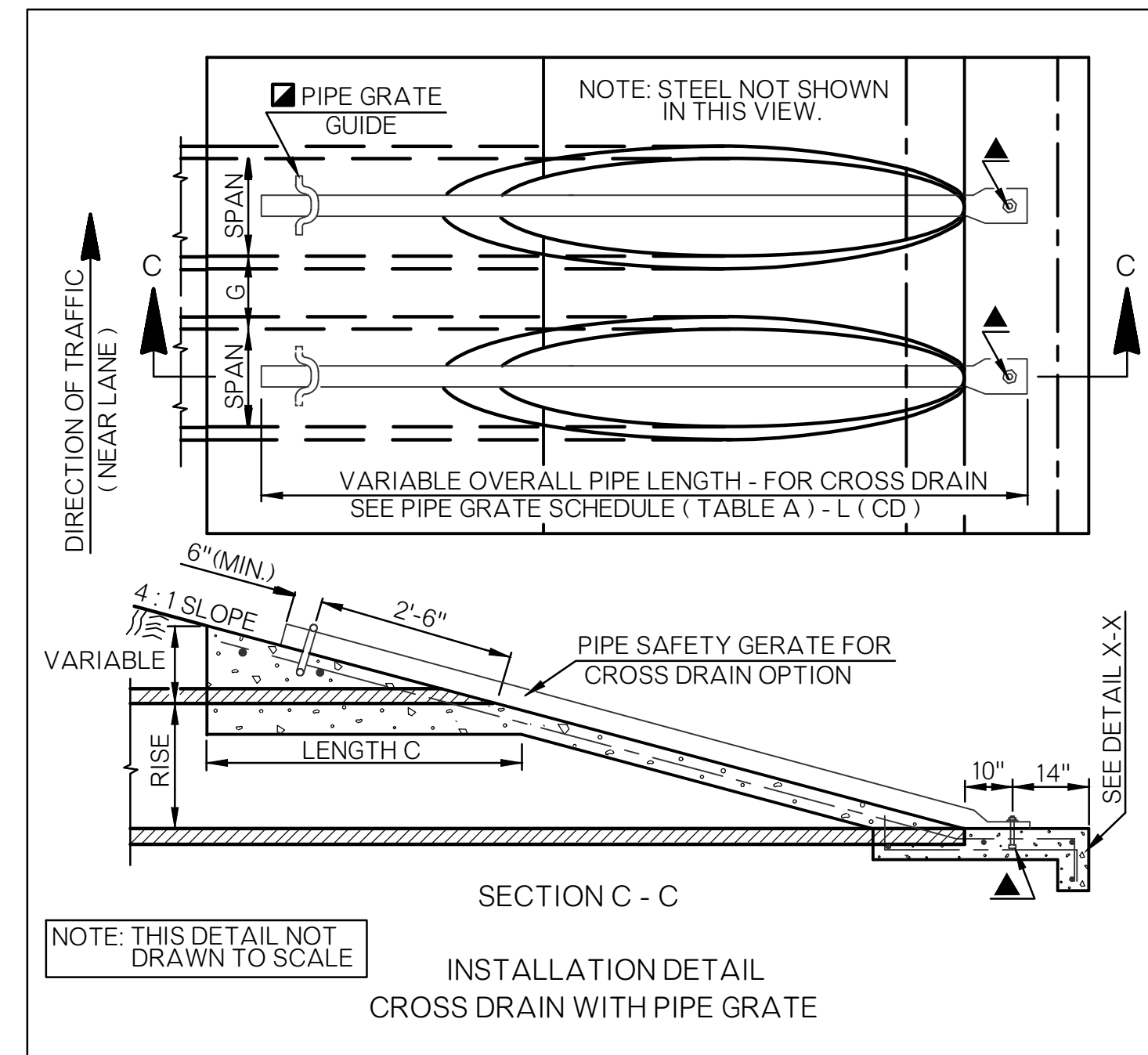
◆ NUMBER OF HORIZONTAL PIPE GRATES FOR SIDE DRAIN OPTIONS. ● DIMENSIONS SHOWN AS RISE BY SPAN.

DOUBLE PIPE INSTALLATION - 4 TO 1 SAFETY SLOPE									
TABLE B - SCHEDULE OF DIMENSIONS FOR C. E. T. TYPES									
C.E.T. TYPE	LENGTH A	WIDTH BB	WIDTH BB	LENGTH C	HEIGHT H	HEIGHT K	CONC. C.Y.	CONC. C.Y.	STEEL LENGTH
AA4	10'-4"	8'-0"	9'-4"	5'-8"	21"	9"	2.45	2.90	7'-8" H-BARS 9'-0" H-BARS 12'-4" S-BARS
BB4	12'-4"	9'-0"	11'-0"	6'-0"	22"	14"	2.95	3.75	8'-8" H-BARS 10'-8" H-BARS 15'-4" S-BARS
CC4	15'-9"	10'-4"	14'-0"	7'-4"	26"	20"	4.45	5.75	10'-0" H-BARS 13'-8" H-BARS 19'-6" S-BARS
DD4	19'-3"	12'-9"	16'-6"	8'-0"	28"	27"	6.00	8.00	12'-5" H-BARS 16'-2" H-BARS 21'-6" S-BARS
EE4	20'-8"	14'-0"	18'-0"	8'-8"	30"	30"	7.35	9.30	13'-8" H-BARS 17'-8" H-BARS 23'-4" S-BARS

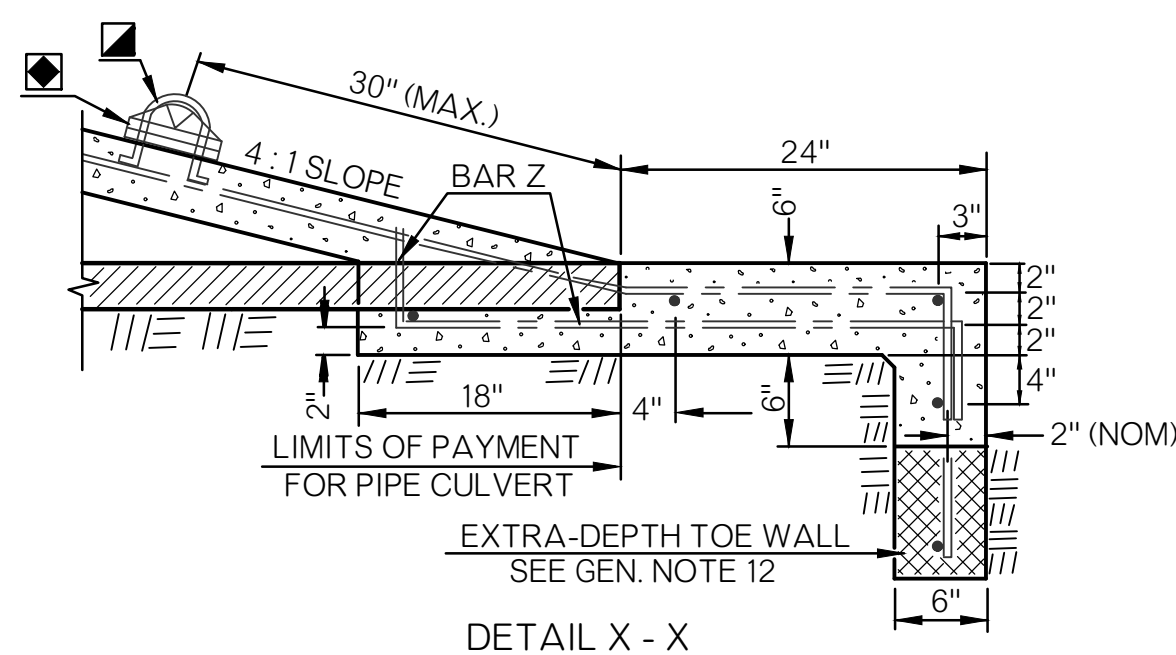
Ⓡ ROUND SHAPE CULVERT OPTIONS
 ⓐ ARCH SHAPE CULVERT OPTIONS
 ⓔ HORIZONTAL ELLIPSE SHAPE CULVERT OPTIONS



ANCHOR END DETAIL
PIPE GRATE MEMBERS

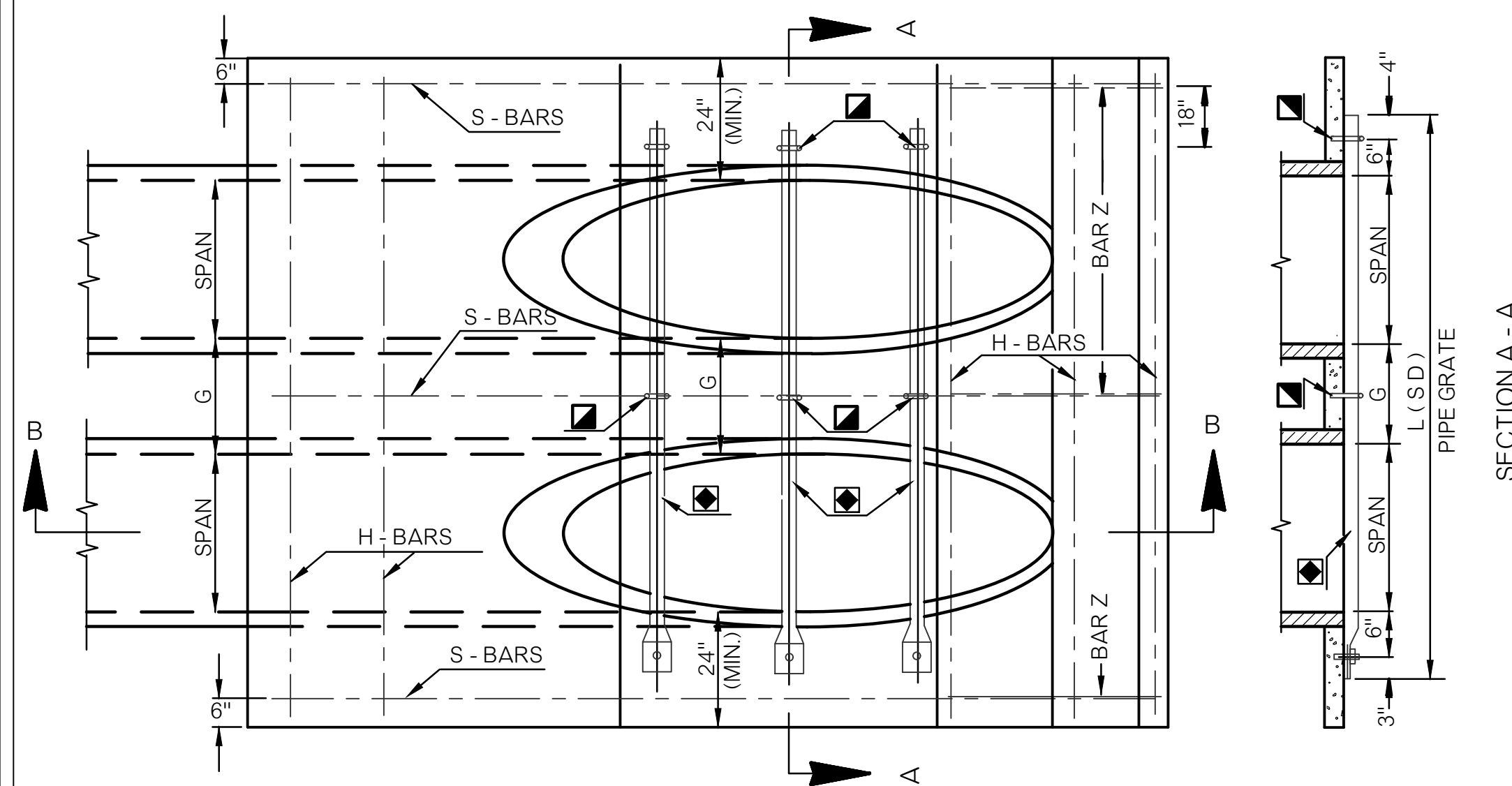


INSTALLATION DETAIL
CROSS DRAIN WITH PIPE GRATE

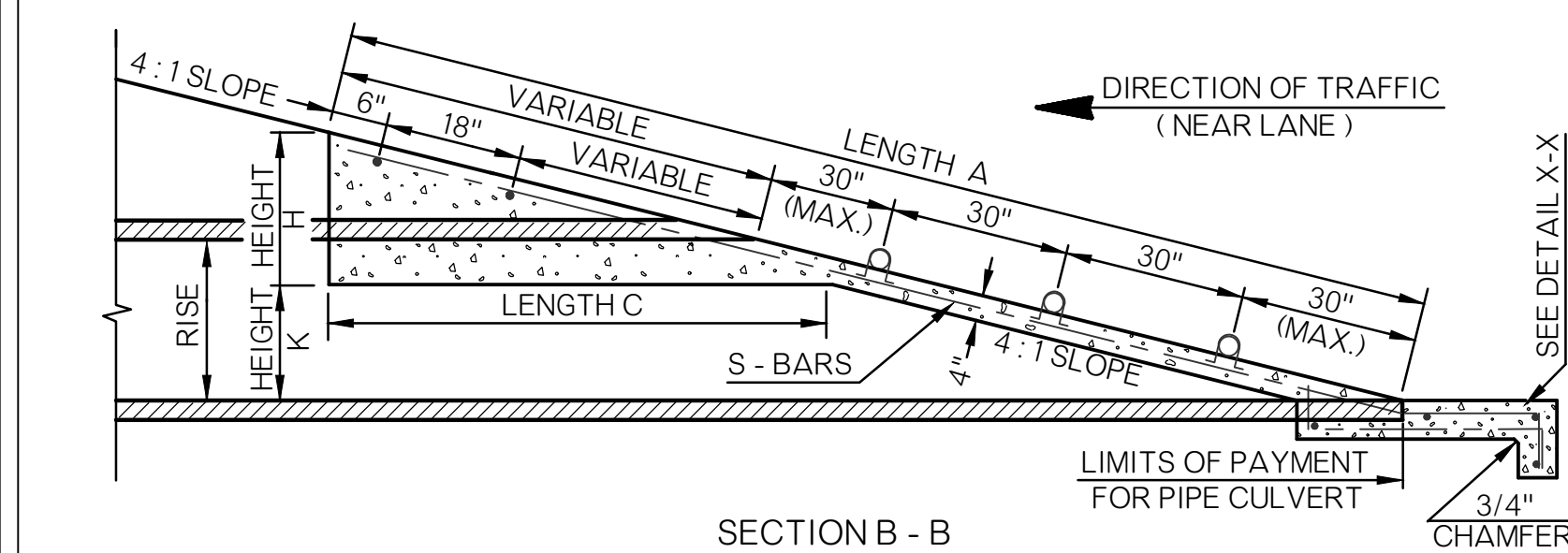


DETAIL X - X

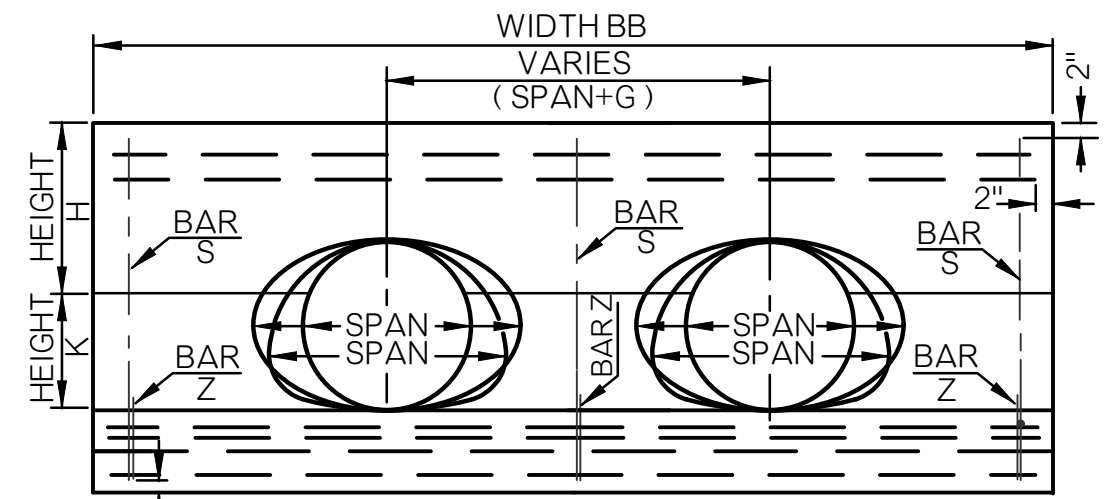
TYPICAL ABBREVIATIONS
 RS - ROUND SIDE DRAIN
 RC - ROUND CROSS DRAIN
 AS - ARCH SIDE DRAIN
 AC - ARCH CROSS DRAIN
 GR - GRATED
 NG - NON-GRATED



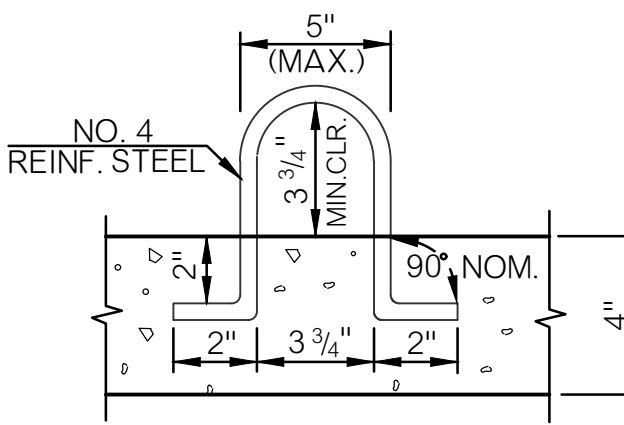
SECTION A - A



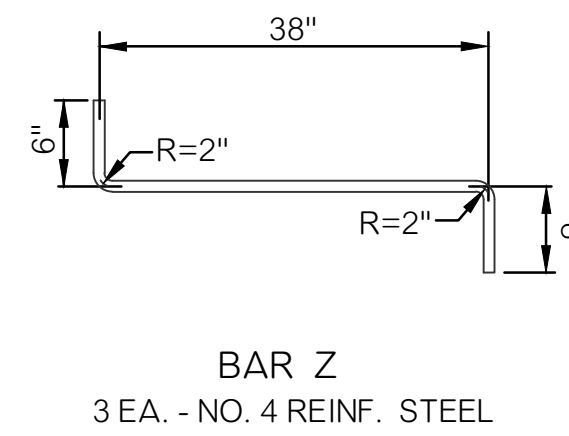
SECTION B - B
INSTALLATION DETAIL
SIDE DRAIN WITH PIPE GRATES



END VIEW
(PIPE GRATES NOT SHOWN THIS VIEW)



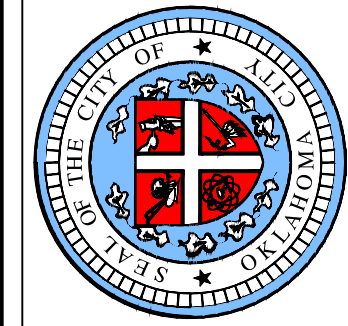
PIPE GRATE GUIDE
(U-BOLT)



BAR Z
3 EA. - NO. 4 REINF. STEEL

- GENERAL NOTES
- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
 - QUANTITIES SHOWN IN TABLE A ARE FOR ONE END ONLY. CLASS A CONCRETE SHALL CONFORM TO THE MINIMUM REQUIREMENTS OF THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
 - TYPES A4 THROUGH E4 END SECTIONS, AS SHOWN IN TABLE A, MAY BE USED WITH ANY AASHTO DESIGNATED METAL, ALUMINUM & CONCRETE PIPE SIZES, AS SHOWN IN TABLE B. END SECTION QUANTITIES ARE BASED ON METAL PIPE DIMENSIONS, NO PIPE WALL THICKNESS AND SMALLEST LISTED ROUND OR ARCH CULVERT PIPE WITHIN TYPE.
 - SLOPED END OF CULVERT PIPE SHALL BE SHOP CUT. TWO COATS OF COLD GALVANIZATION WILL BE APPLIED TO CUT EDGES OF STEEL CULVERT PIPE. COST OF CUTTING AND GALVANIZING IS INCLUDED IN THE PRICE BID FOR PIPE CULVERT.
 - ALL SIZES OF CULVERT PIPE WILL BE CUT ON 4 TO 1 SLOPE.
 - PIPE FOR SAFETY GRATES SHALL BE 3" x 7.58 LBS./FT. STANDARD WEIGHT STEEL PIPE, SCHEDULE 40. IT SHALL BE FURNISHED GALVANIZED, PLAIN END AND SHALL MEET THE MINIMUM REQUIREMENTS OF ASTM A-53 (HYDROSTATIC TESTS MAY BE WAIVED) OR ASTM F 1083. COST OF GRATES TO BE INCLUDED IN PRICE BID FOR THE C.E.T.
 - ANY GALVANIZED AREA(S) OF METAL PIPE DISTRESSED DURING THE POST FABRICATION AND/OR HANDLING PROCESS SHALL BE COATED WITH AN APPROVED ZINC RICH PAINT.
 - REINFORCING STEEL AND PIPE GRATE GUIDES SHALL BE NO. 4 DEFORMED BARS. COST OF STEEL SHALL BE INCLUDED IN PRICE BID FOR THE CULV. END TREATMENT.
 - CRITERIA FOR USE OF PIPE SAFETY GRATE MEMBERS:
 (A) ALL SIDE DRAIN AND MULTIPLE PIPE INSTALLATIONS WITHIN THE CLEAR ZONE.
 (B) ALL CROSS DRAIN INSTALLATIONS WITH A CULVERT SPAN OF 30" OR
 (C) ALL INSTALLATIONS OUTSIDE THE CLEAR ZONE WHERE HAZARD POTENTIAL IS HIGH BASED ON TRAFFIC DIRECTION, SPEED, VOLUME AND SIZE OF CULVERT.
 NOTE: ANALYZE HYDRAULIC PERFORMANCE AT VARYING DEGREES OF CLOGGING AND APPLY RISK ASSESSMENT BEFORE USING GRATES.
 - PIPE GRATE MEMBERS ARE NOT SHOWN IN END VIEW.
 - ANCHOR END OF PIPE GRATE MEMBERS SHALL BE HELD IN PLACE WITH A 1/2" x 5 1/2" GALVANIZED BOLT, NUT AND WASHER. THREADS, 1 3/4" (NOM.) SHALL REMAIN EXPOSED FOR INSTALLING GRATE, WASHER AND NUT. ALL BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM A-307 WITH COST TO BE INCLUDED IN THE PRICE BID FOR THE CULVERT END TREATMENT.
 - FOR TOTAL QUANTITY OF EXTRA DEPTH TOE WALL, MULTIPLY WIDTH BB TIMES 0.0185 FOR EACH FOOT OF DEPTH OF TOE WALL REQUIRED. PAYMENT TO BE INCLUDED IN PRICE BID FOR THE CULVERT END TREATMENT.
 - LONGITUDINAL PIPE SAFETY GRATES FOR CROSS DRAIN INSTALLATIONS ARE NOT NECESSARY OR REQUIRED FOR OPEN TRENCH/DITCH SPANS LESS THAN 30".
- PRECAST CULVERT END TREATMENTS OR OTHER ALTERNATIVE DESIGNS MAY BE USED IF APPROPRIATE DRAWINGS ARE SUBMITTED TO AND APPROVED BY THE CITY ENGINEER.

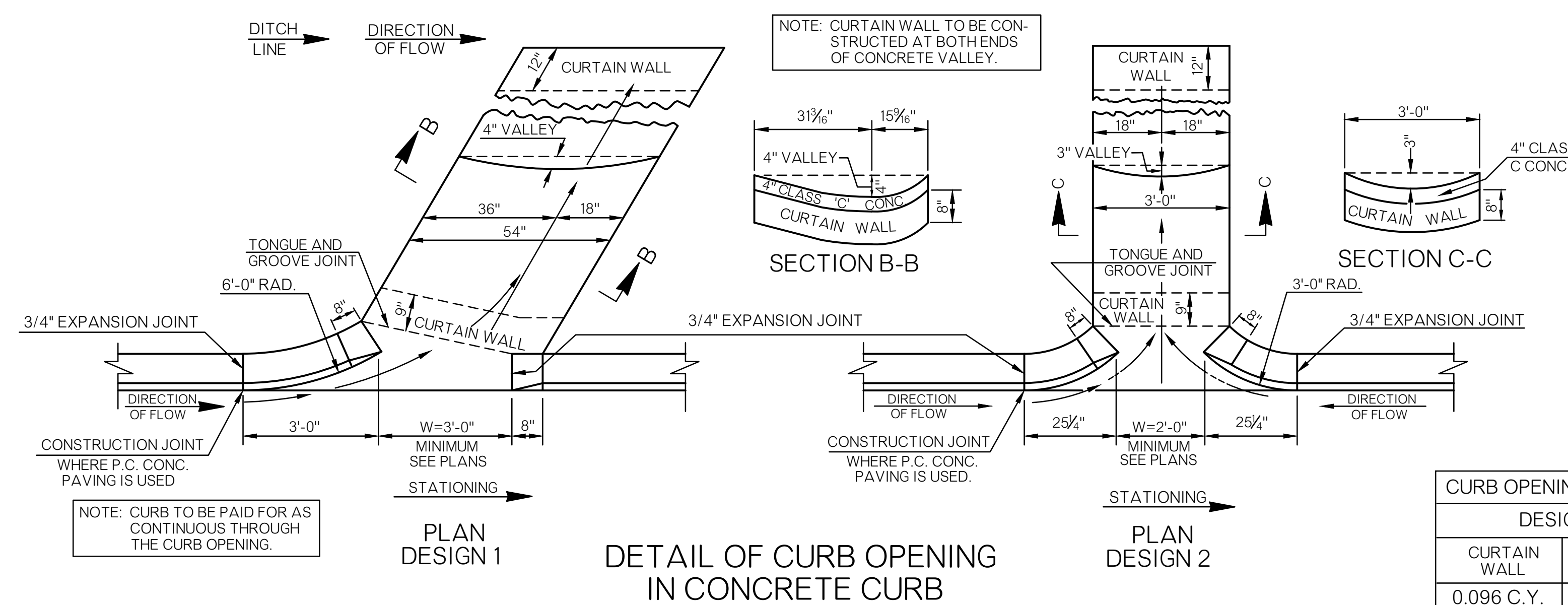
The City of
Oklahoma City
 Public Works Department
 Engineering Division



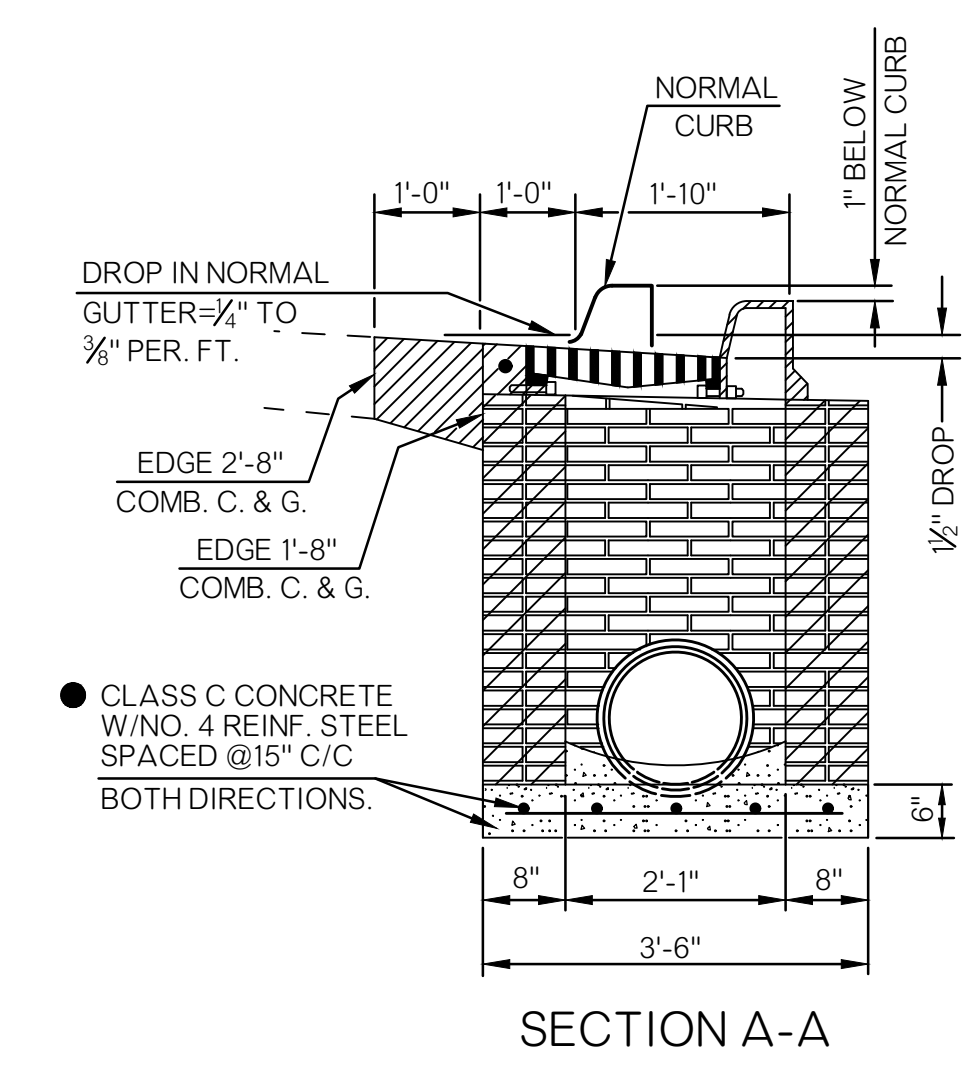
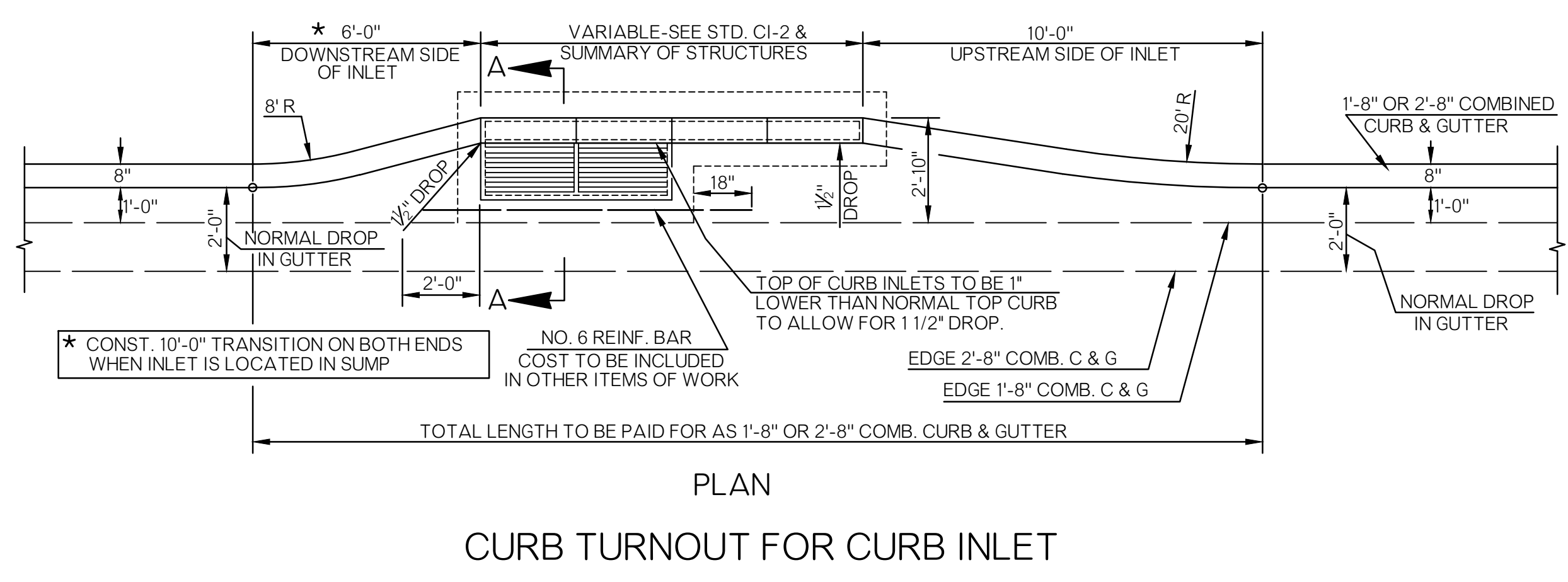
APPROVED BY: *[Signature]* DATE: 09/12/2023
 ERIC J. WENGER, P.E.
 CITY ENGINEER
 DRAWN: OKC-PW-SRB
 DATE: 3/9/2023

**CULVERT END TREATMENT
 DOUBLE PIPE DETAILS**

Detail Number
 D-1007

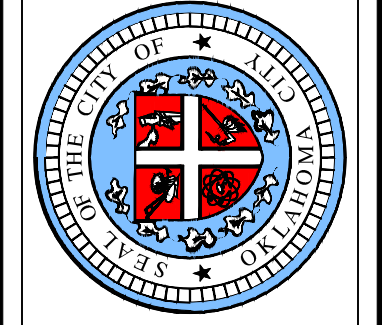


CURB OPENING - CLASS C CONCRETE QUANTITIES			
DESIGN 1		DESIGN 2	
CURTAIN WALL	PER FOOT OF FLUME	CURTAIN WALL	PER FOOT OF FLUME
0.096 C.Y.	0.048 C.Y.	0.074 C.Y.	0.037 C.Y.



- GENERAL NOTES
1. ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
 2. INLET STRUCTURES MAY BE SUPPLIED AS PRECAST UNITS IF PROPOSED PRECAST DESIGN IS SUBMITTED TO THE CITY ENGINEER AND APPROVED FOR USE.

The City of
Oklahoma City
Public Works Department
Engineering Division



APPROVED BY: DATE: 09/12/2023
ERIC J. WENGER, P.E.
CITY ENGINEER

DRAWN: OKC-PW-SRB
DATE: 3/9/2023

**STORM SEWER CONSTRUCTION
DETAILS**

Detail Number
D-1008