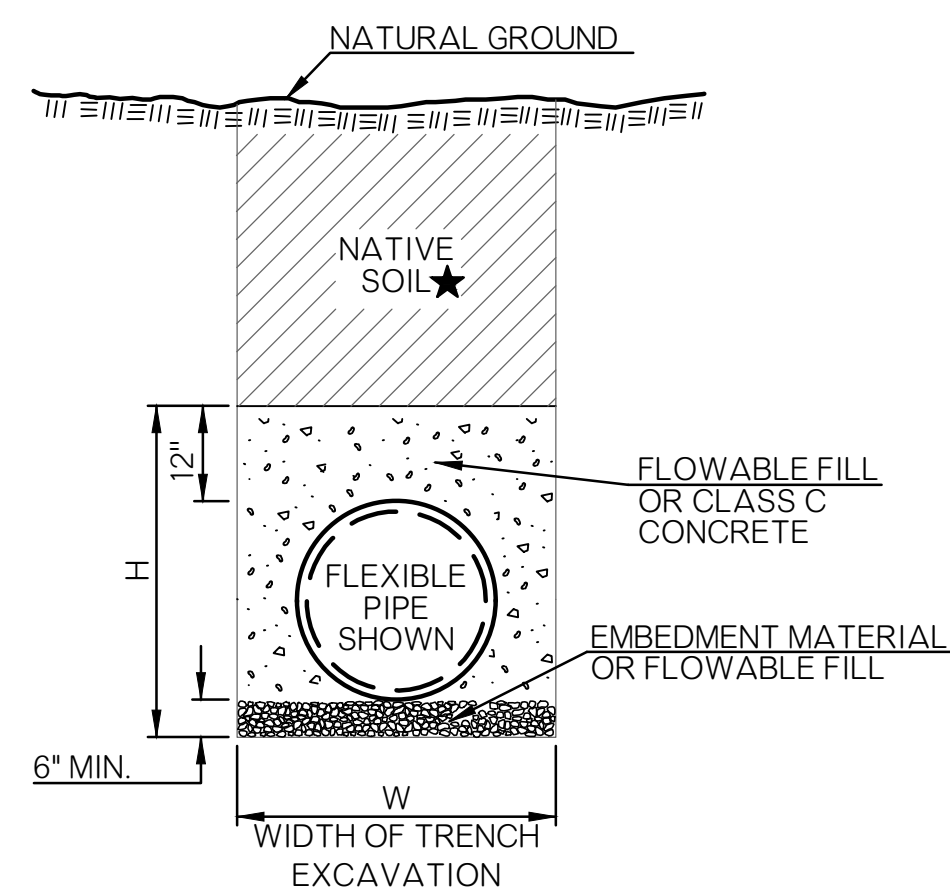
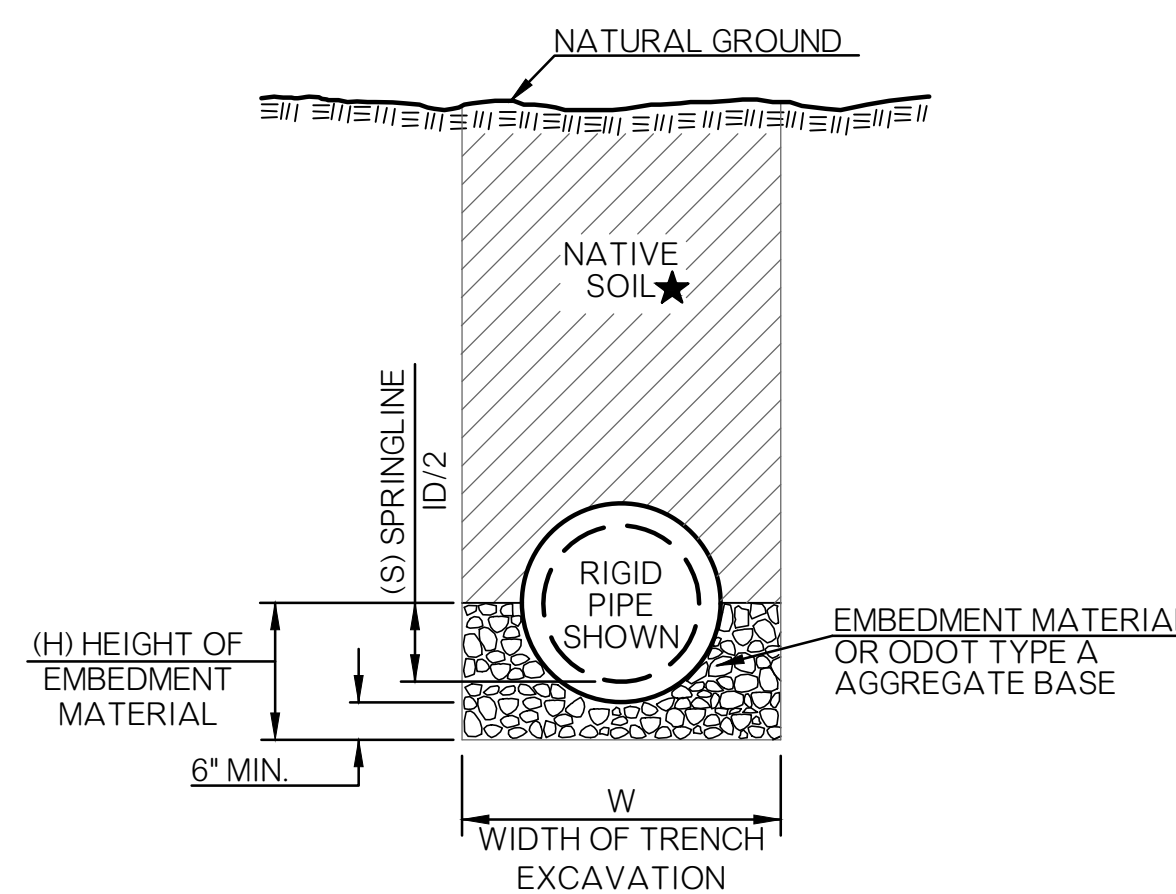


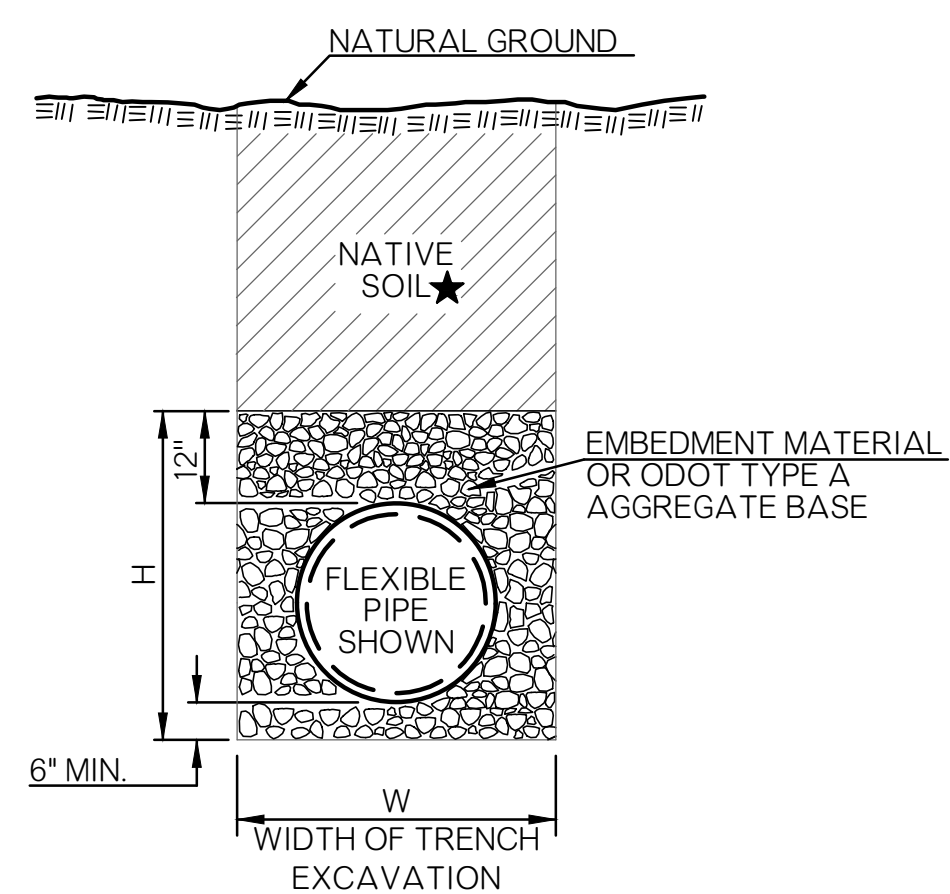
CLASS A BEDDING RIGID PIPES



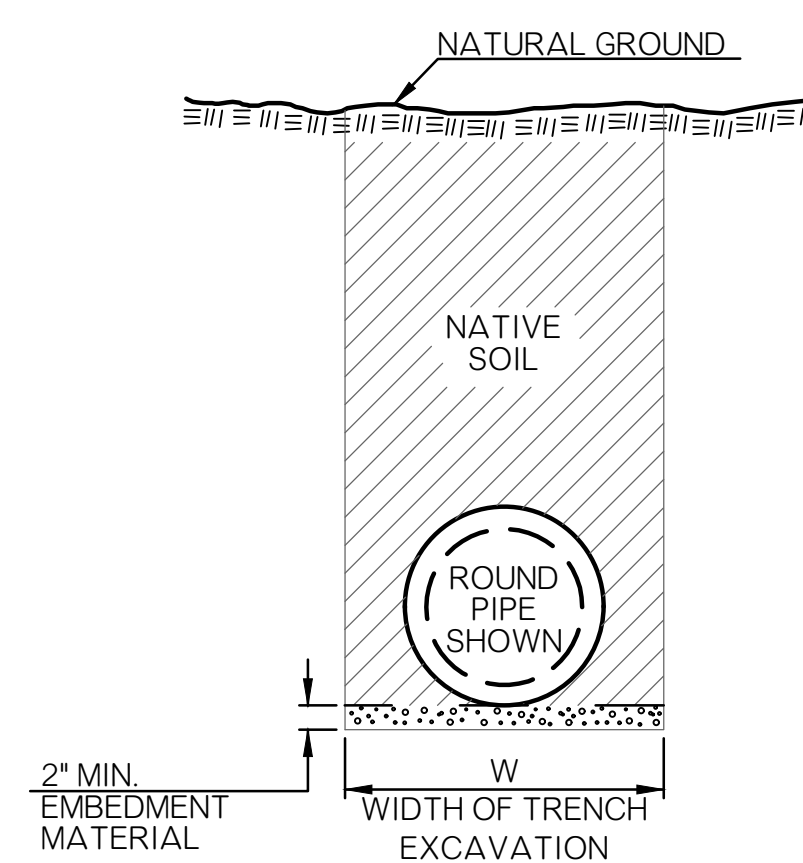
CLASS A BEDDING FLEXIBLE PIPES



CLASS B BEDDING RIGID PIPES

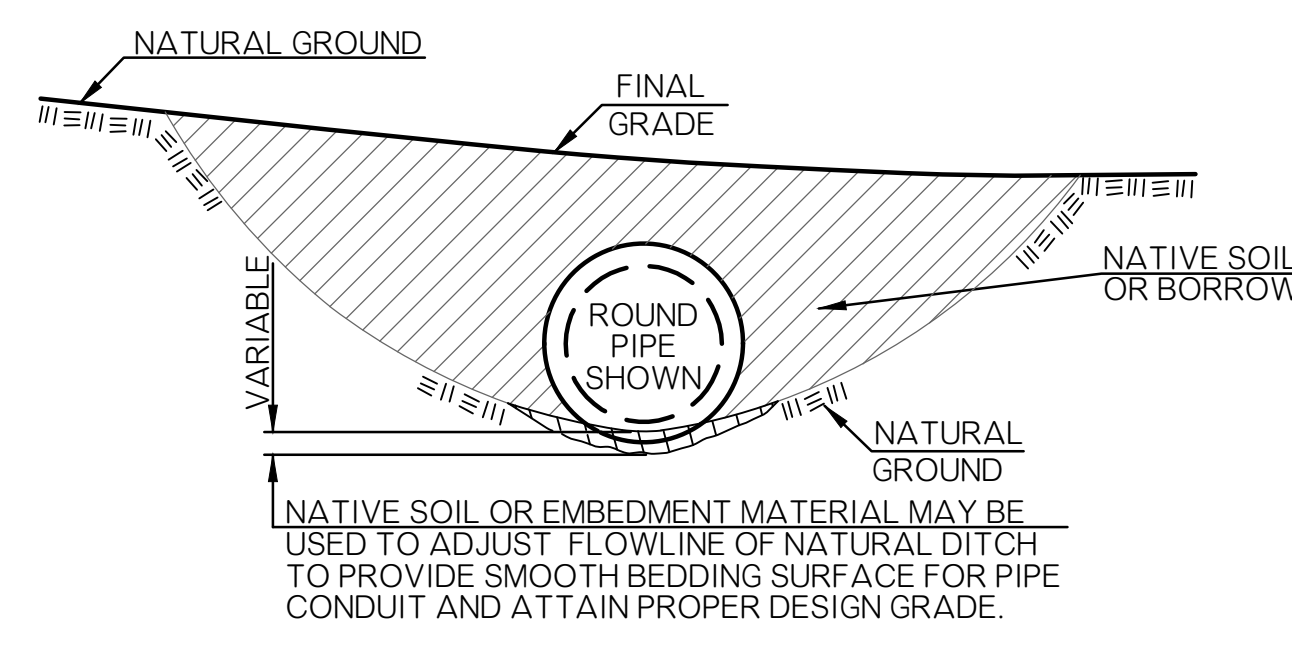


CLASS B BEDDING FLEXIBLE PIPES



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							
TYPE OF PIPE	■ 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.

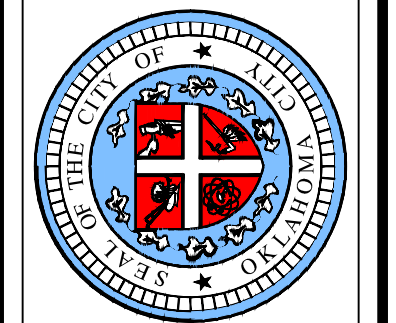
■ WHEN THERE IS ANY POSSIBILITY OF THE PAVEMENT BEING WIDENED DURING THE LIFE OF THE DRAINAGE STRUCTURE, THE BEDDING SHALL MEET THE 'UNDER PAVING SECTION' CRITERIA FOR THE FULL EXTENT OF ANY ANTICIPATED EXPANSION TO THE FACILITY.

▲ 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: 6/22/2023
ERIC J. WENGER, P.E.
CITY ENGINEER
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

PIPE BEDDING AND BACKFILL

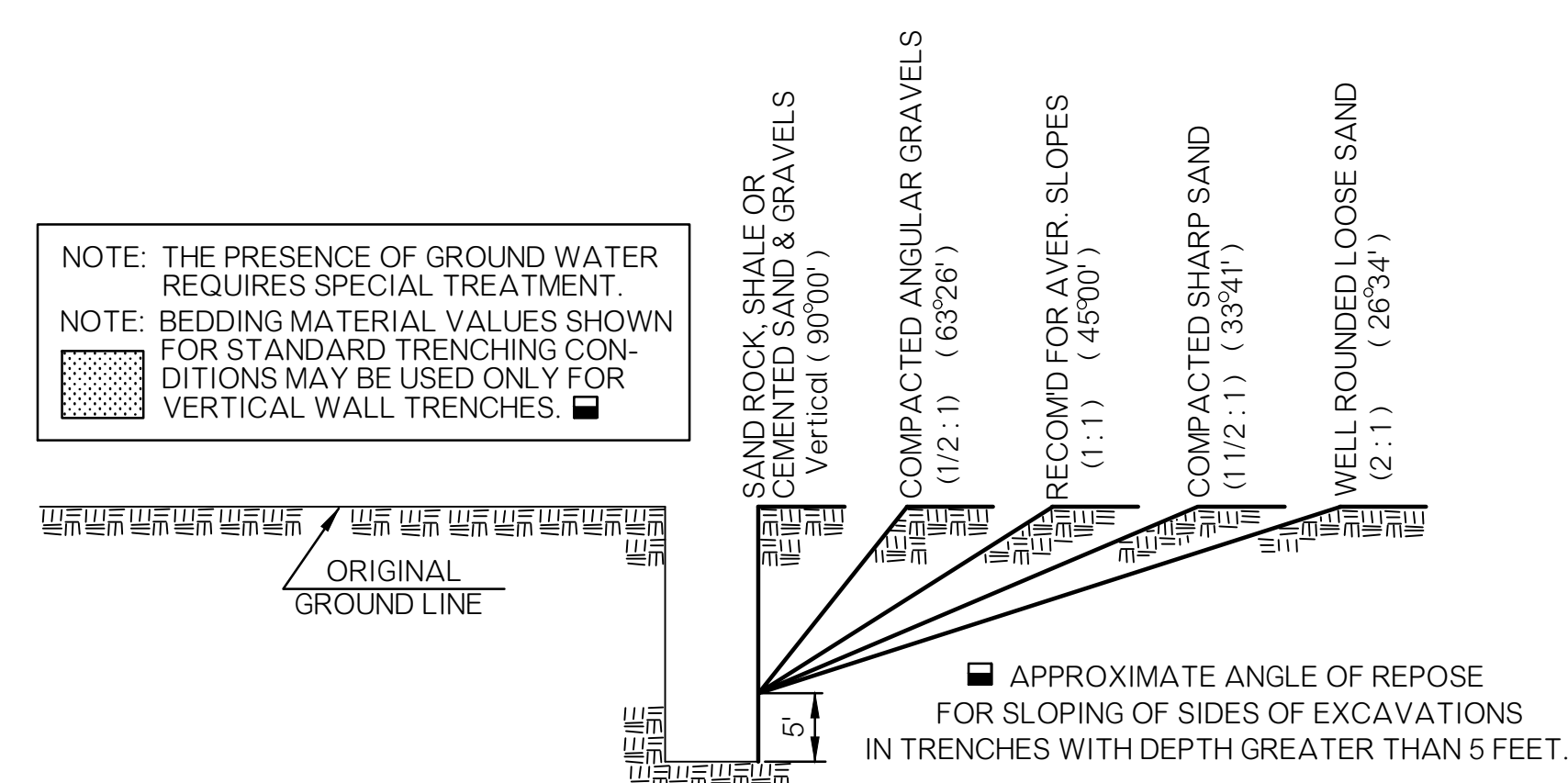
Detail Number
D-1000

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	9.00	0.448	19.36	1.050	27.81	1.436	0.113
66	3.29	0.583	9.75	0.512	20.81	1.183	30.03	1.630	0.122	

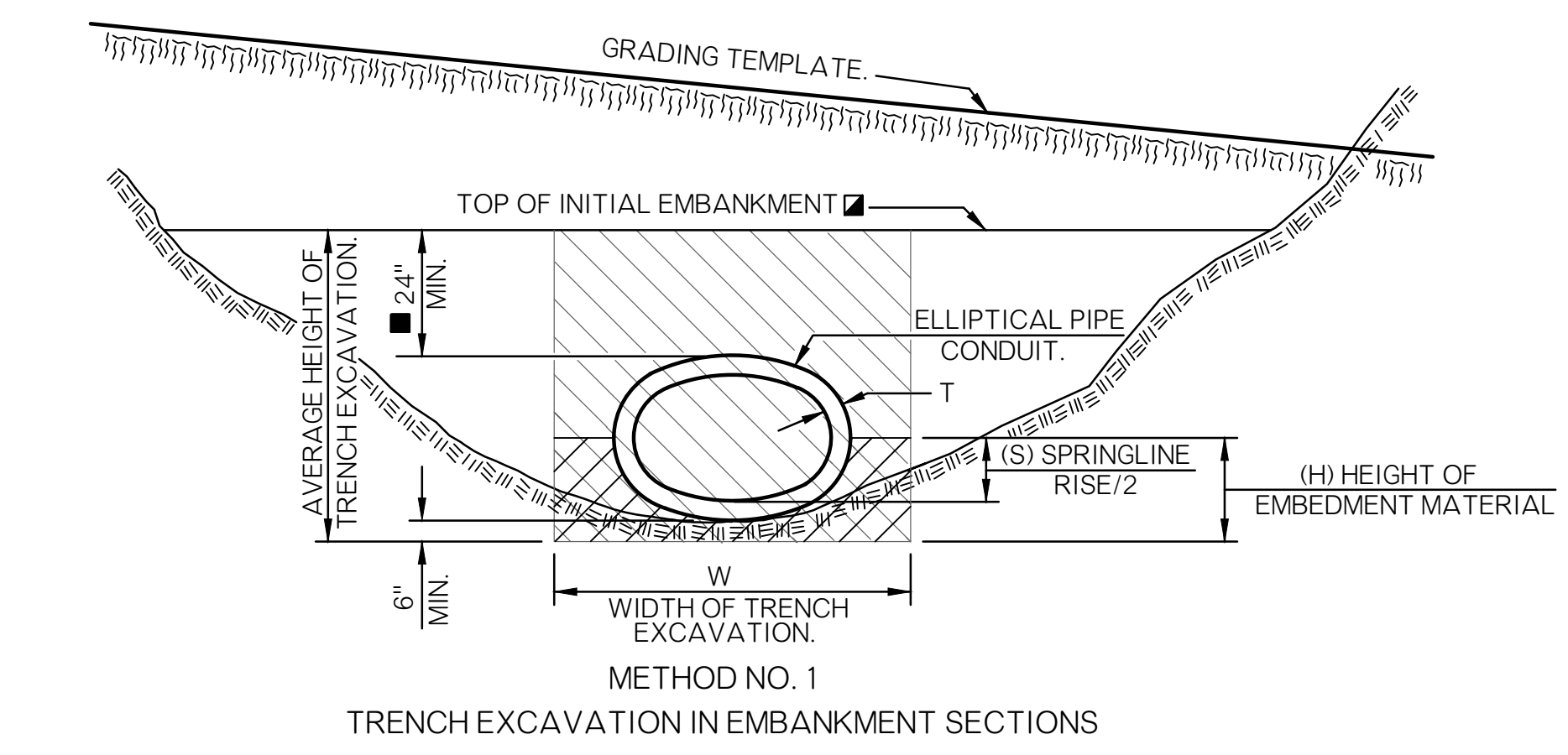
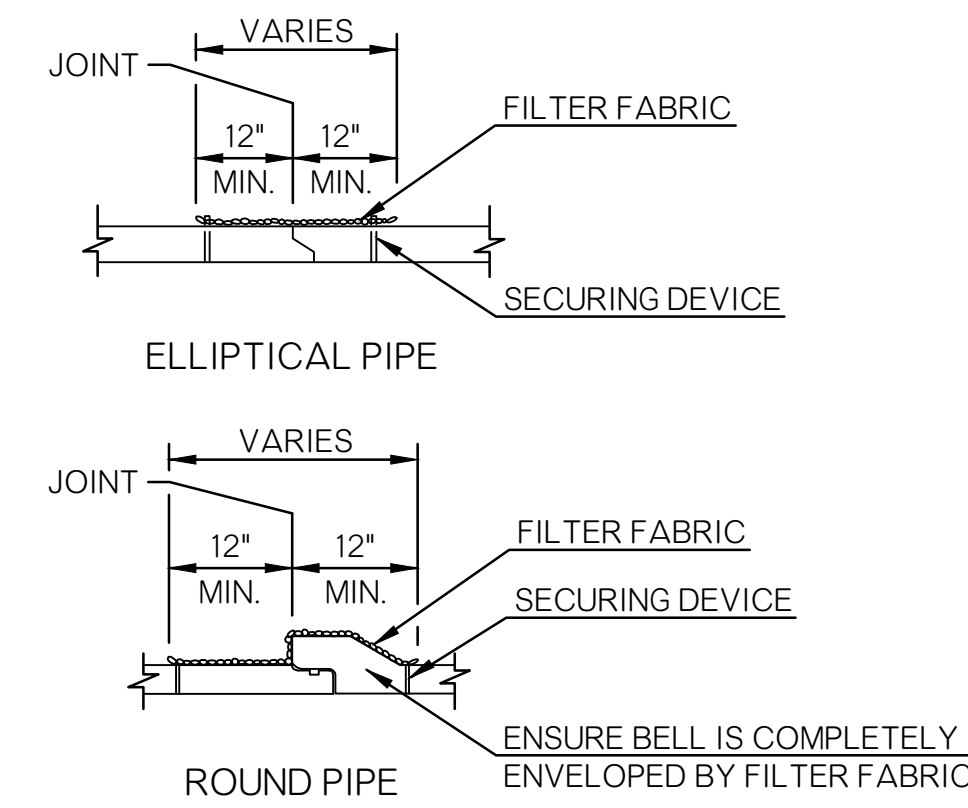
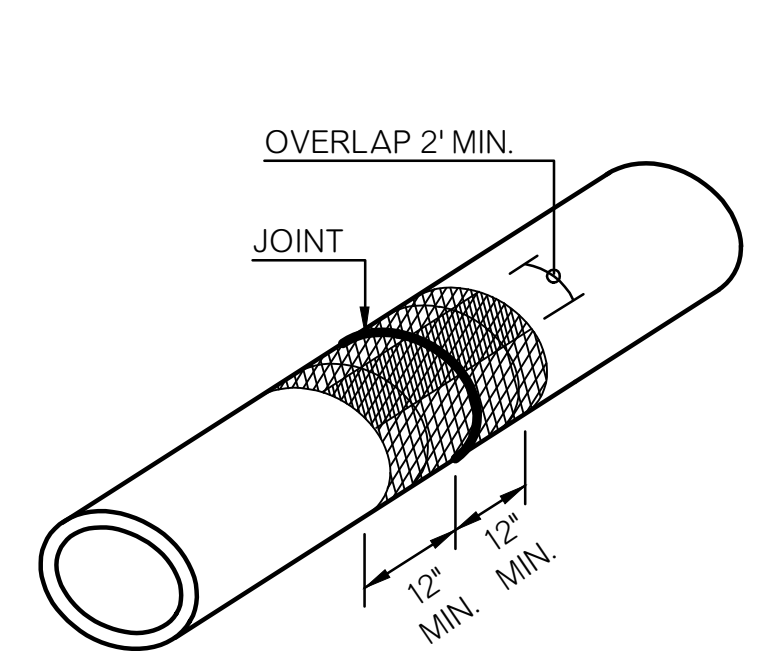
NOTE: TRENCH WIDTHS BASED UPON MINIMUM VALUES PER OKC SPEC 212. TO CALCULATE ADDITIONAL EMBEDMENT MATERIAL, MULTIPLY THE ADDITIONAL WIDTH (FT) BY THE CORRESPONDING HEIGHT (FT) AND DIVIDE BY 27 TO FIND THE ADDITIONAL CY/LF VALUES.

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

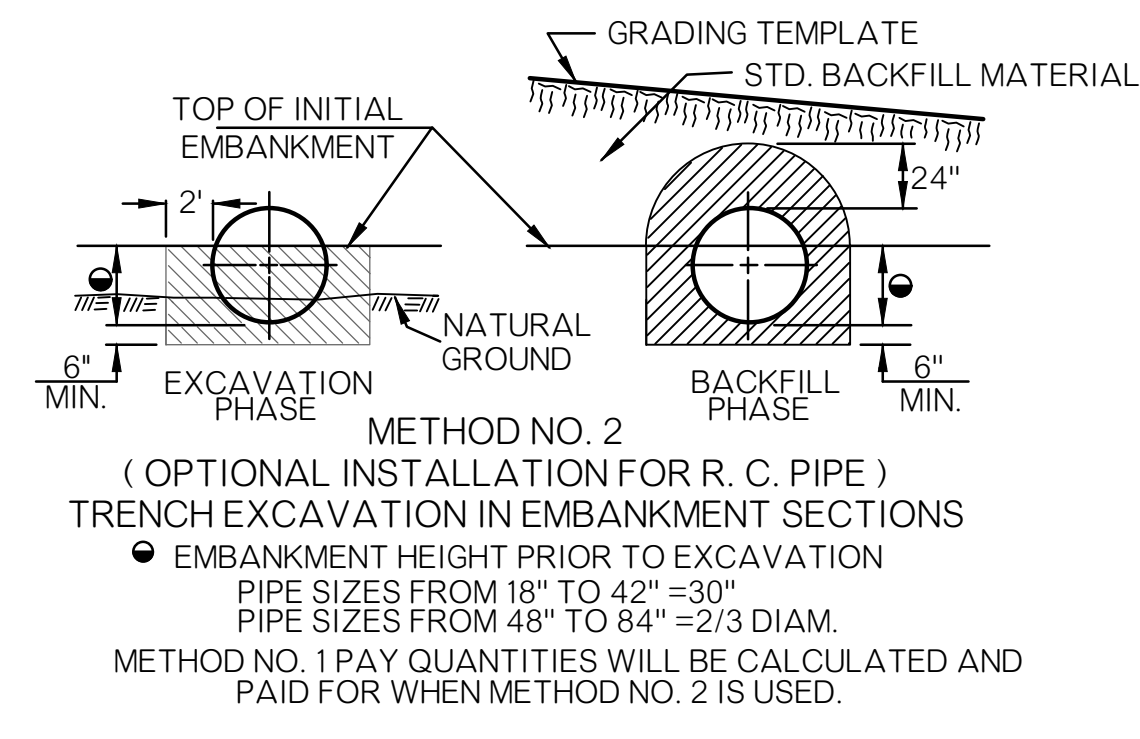
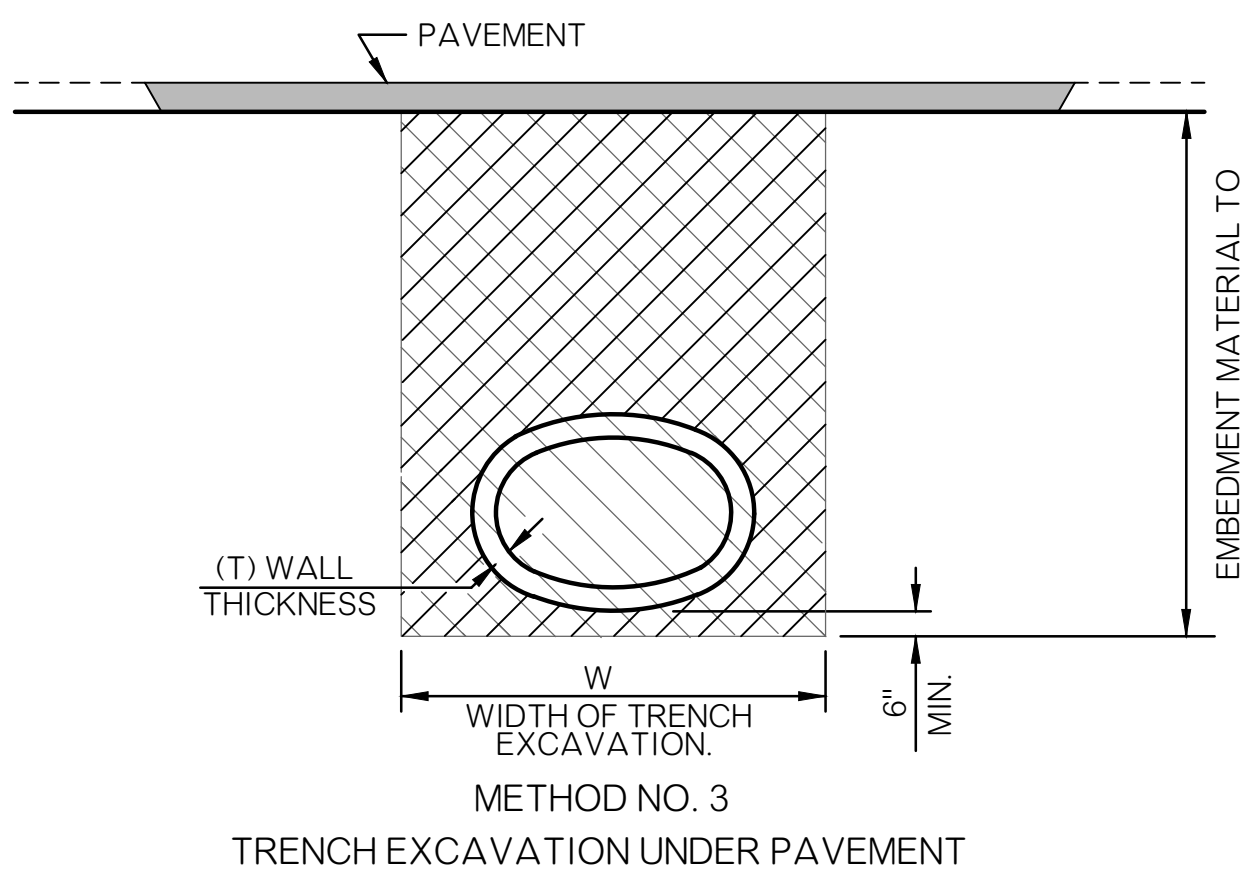
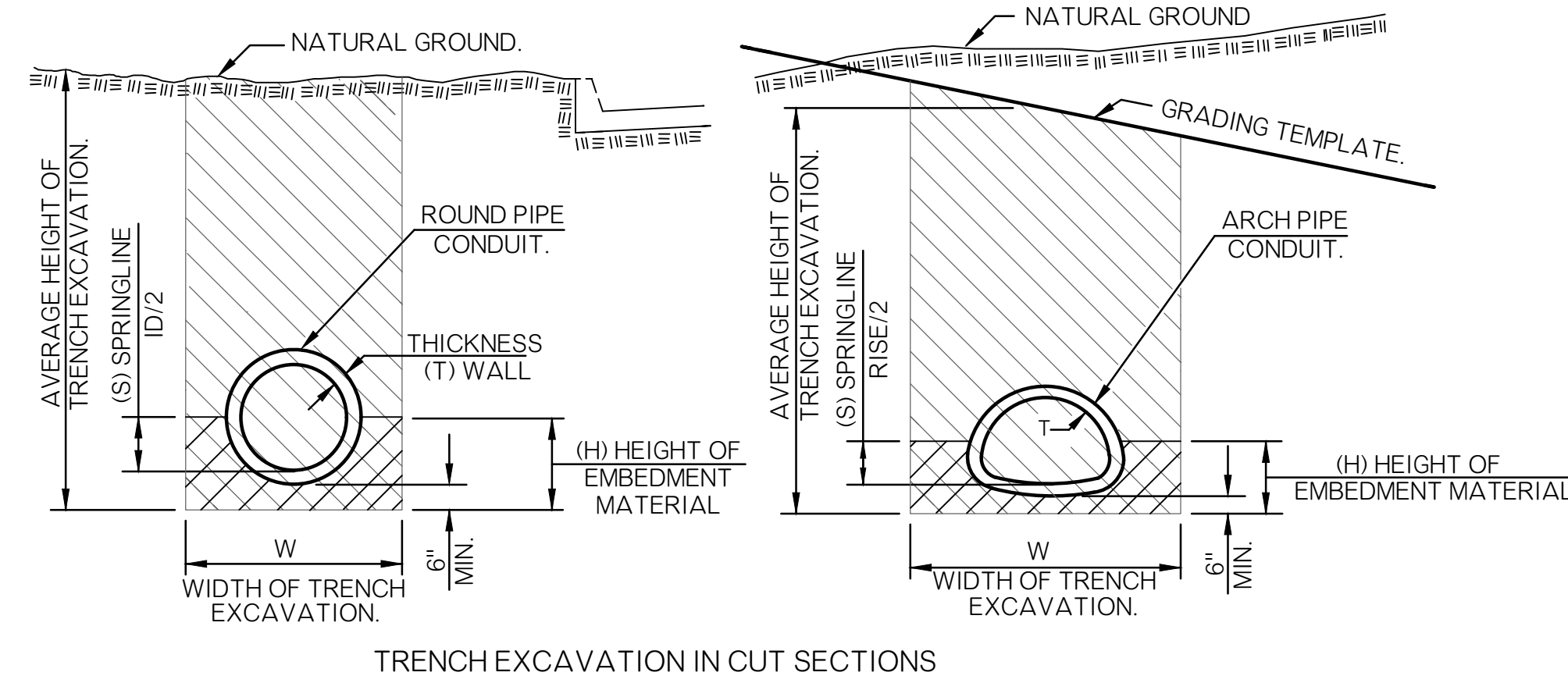
NOTE: THE PRESENCE OF GROUND WATER REQUIRES SPECIAL TREATMENT.
NOTE: BEDDING MATERIAL VALUES SHOWN FOR STANDARD TRENCHING CONDITIONS MAY BE USED ONLY FOR VERTICAL WALL TRENCHES. ■



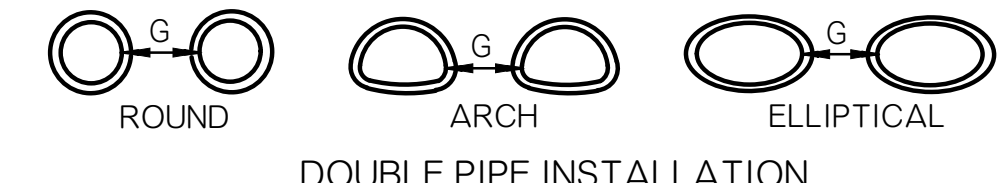
■ OPTIONAL TRENCHES WITH DEPTH GREATER THAN 5.0 FEET
EXCAVATION AND BEDDING MATERIAL WILL BE MEASURED AND PAID FOR AS IF SHEETING & SHORING WAS USED. (SPECIAL TRENCHING=STD. WIDTH TRENCH+12")



■ 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"	



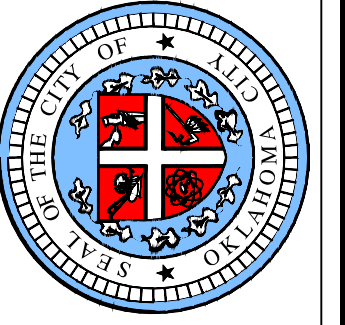
GENERAL NOTES

- 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]
ERIC J. WENGER, P.E.
CITY ENGINEER
DATE: 6/22/2023
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

RIGID PIPE INSTALLATION DETAILS

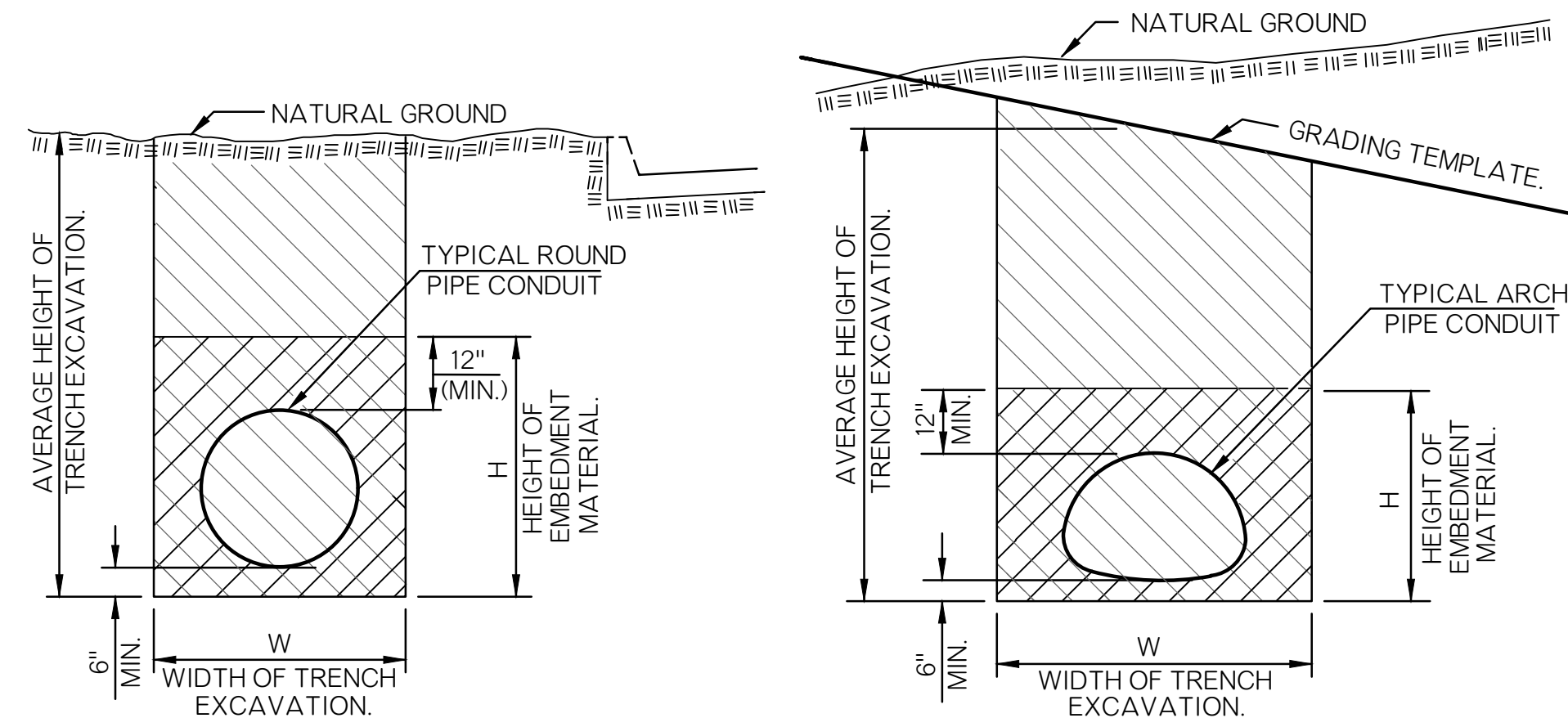
Detail Number
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TABLE OF TRENCHING AND EMBEDMENT MATERIAL QUANTITIES

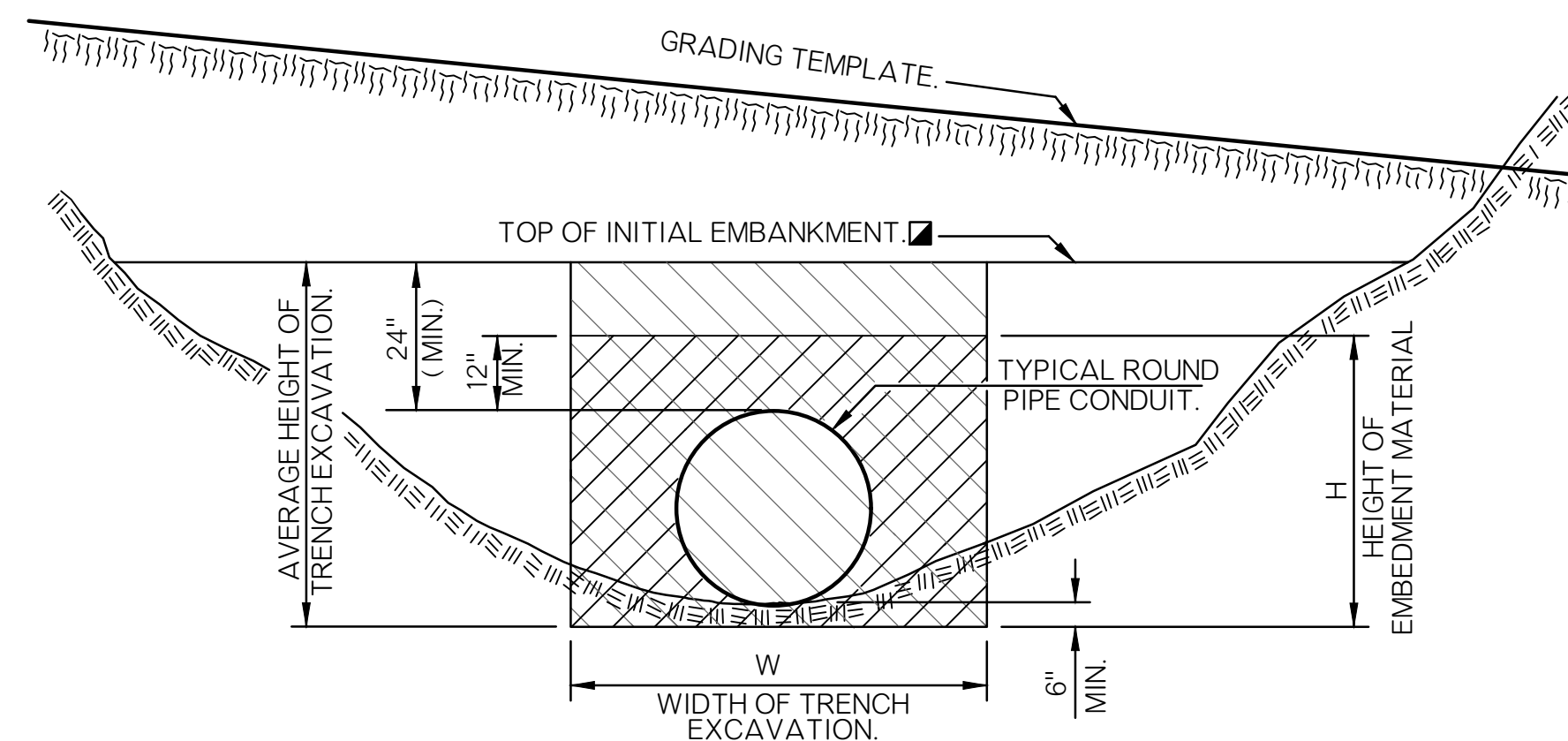
	PIPE DIAM. OR DESIGN EQUIV.	SINGLE PIPE INSTALLATION		DOUBLE PIPE INSTALLATION		TRIPLE PIPE INSTALLATION		CLEAR SPACE BETWEEN PIPES	
		H	W	W	W	W	W		
	IN.	FT.	FT.	FT.	FT.	FT.	FT.	INCHES	
ROUND PIPE	18	3.17	3.25	0.30	6.10	0.55	9.00	0.81	14
	24	3.67	4.00	0.41	7.70	0.77	11.40	1.14	17
	30	4.25	4.50	0.49	9.30	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
METAL ARCH PIPE	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.)	MINIMUM METAL PIPE GAGE REQUIREMENT
	POLYETH. ROUND	EQUIV. METAL ARCH		
18	21 x 15	15	10	14
24	28 x 20	20	10	14
30	35 x 24	25	10	14
36	42 x 29	30	10	14
42	49 x 33	35	10	12
48	57 x 38	40	10	12
54	64 x 43	45	N/A	12
60	71 x 47	50	N/A	10
66	77 x 52	55	N/A	10



TRENCH EXCAVATION IN CUT SECTIONS

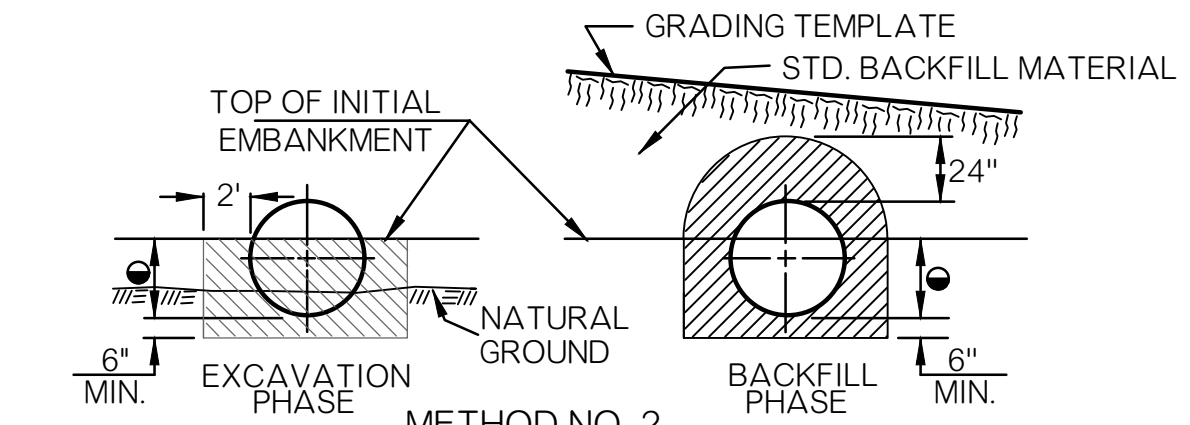


TRENCH EXCAVATION IN EMBANKMENT SECTIONS

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

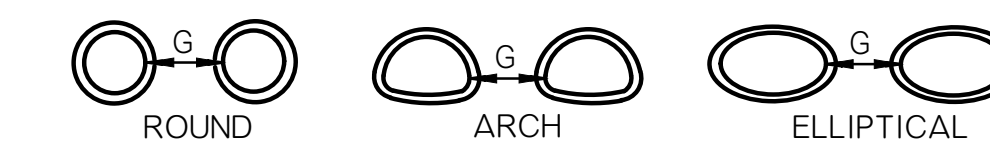
LIMITS OF EMBEDMENT MATERIAL. QUANTITIES FOR BEDDING MATERIAL DO NOT INCLUDE THE SPACE WITHIN AND BOUNDED BY THE OUTER SURFACE OF THE PIPE CONDUIT.

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

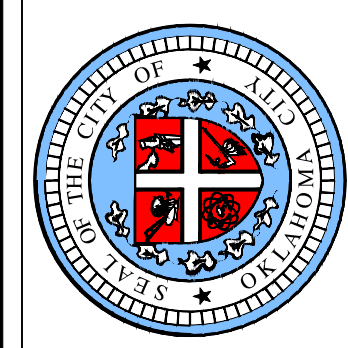
GENERAL NOTES

- 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%

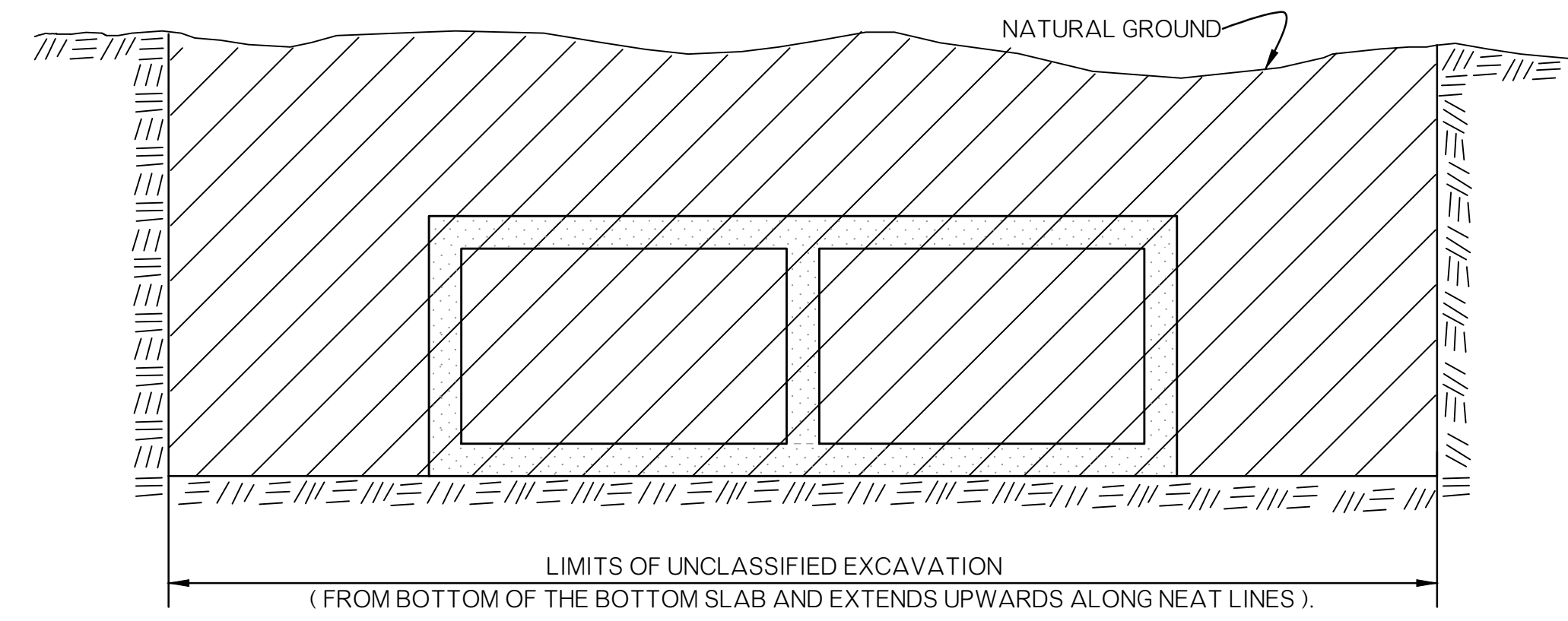
The City of Oklahoma City Public Works Department Engineering Division



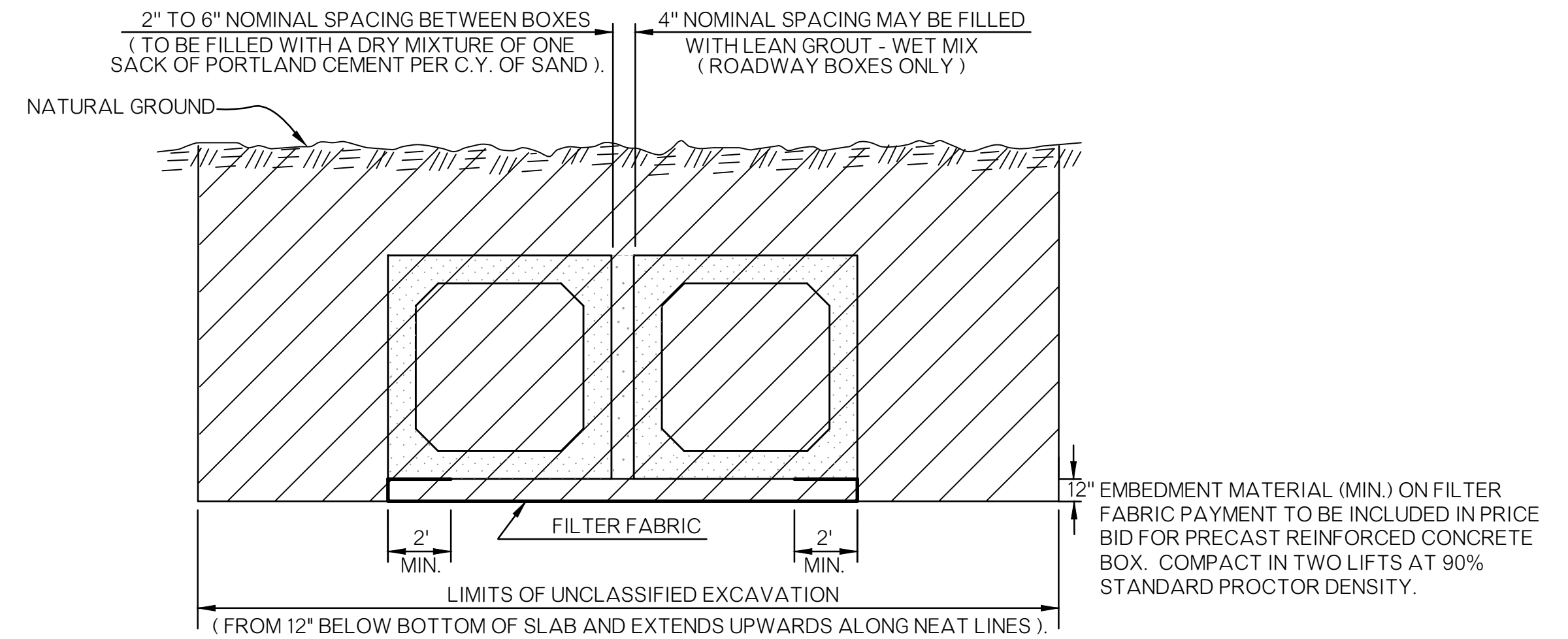
APPROVED BY: DATE: 6/22/2023
 ERIC J. WENGER, P.E. CITY ENGINEER
 DRAWN: OKC-PW-SRB
 DATE: 3/9/2023

FLEXIBLE PIPE INSTALLATION DETAILS

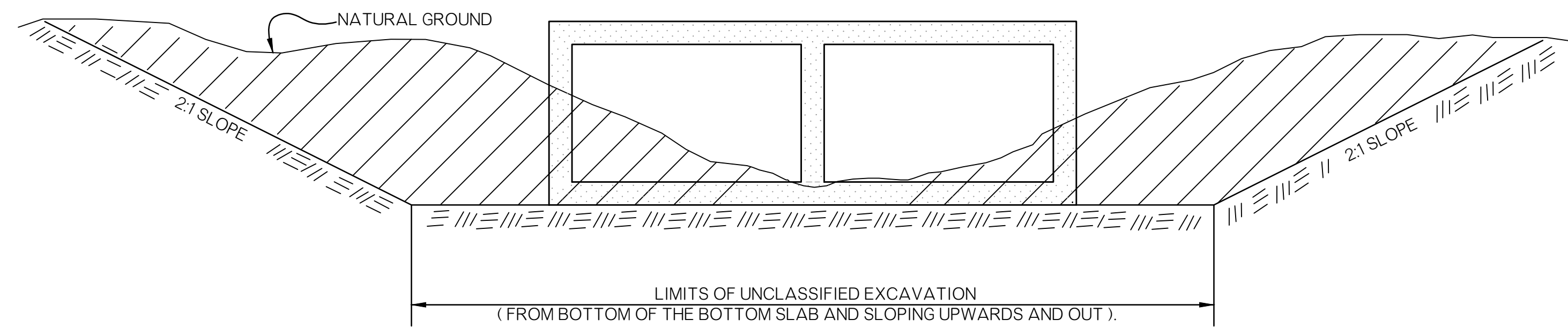
Detail Number D-1002



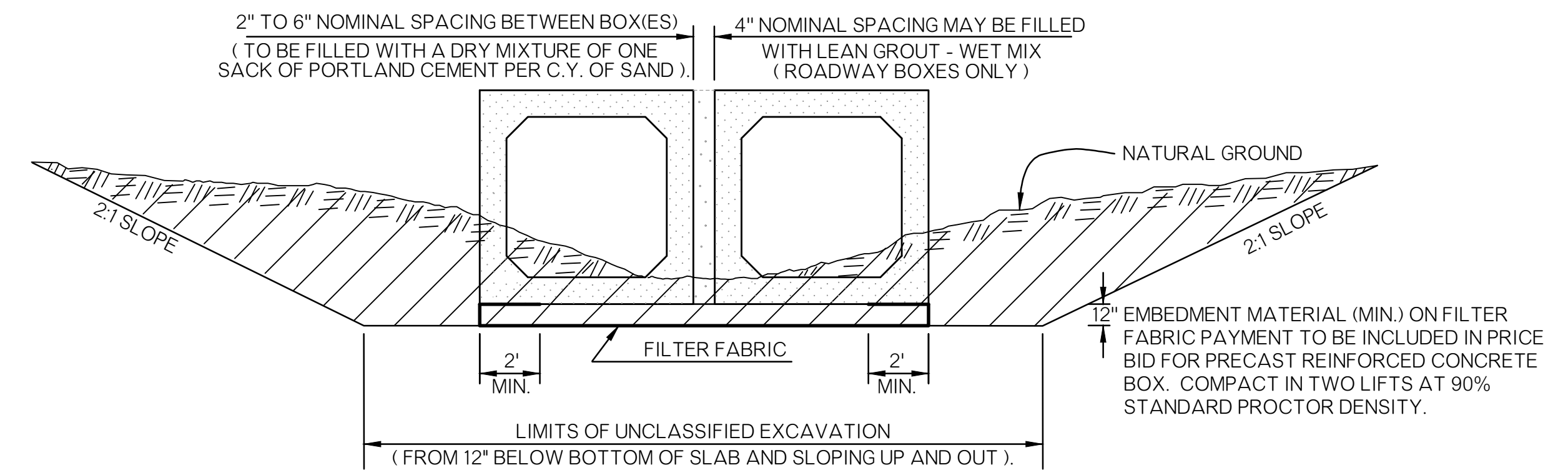
REQUIREMENTS FOR UNCLASSIFIED EXCAVATION OF R.C.B. STORM SEWERS



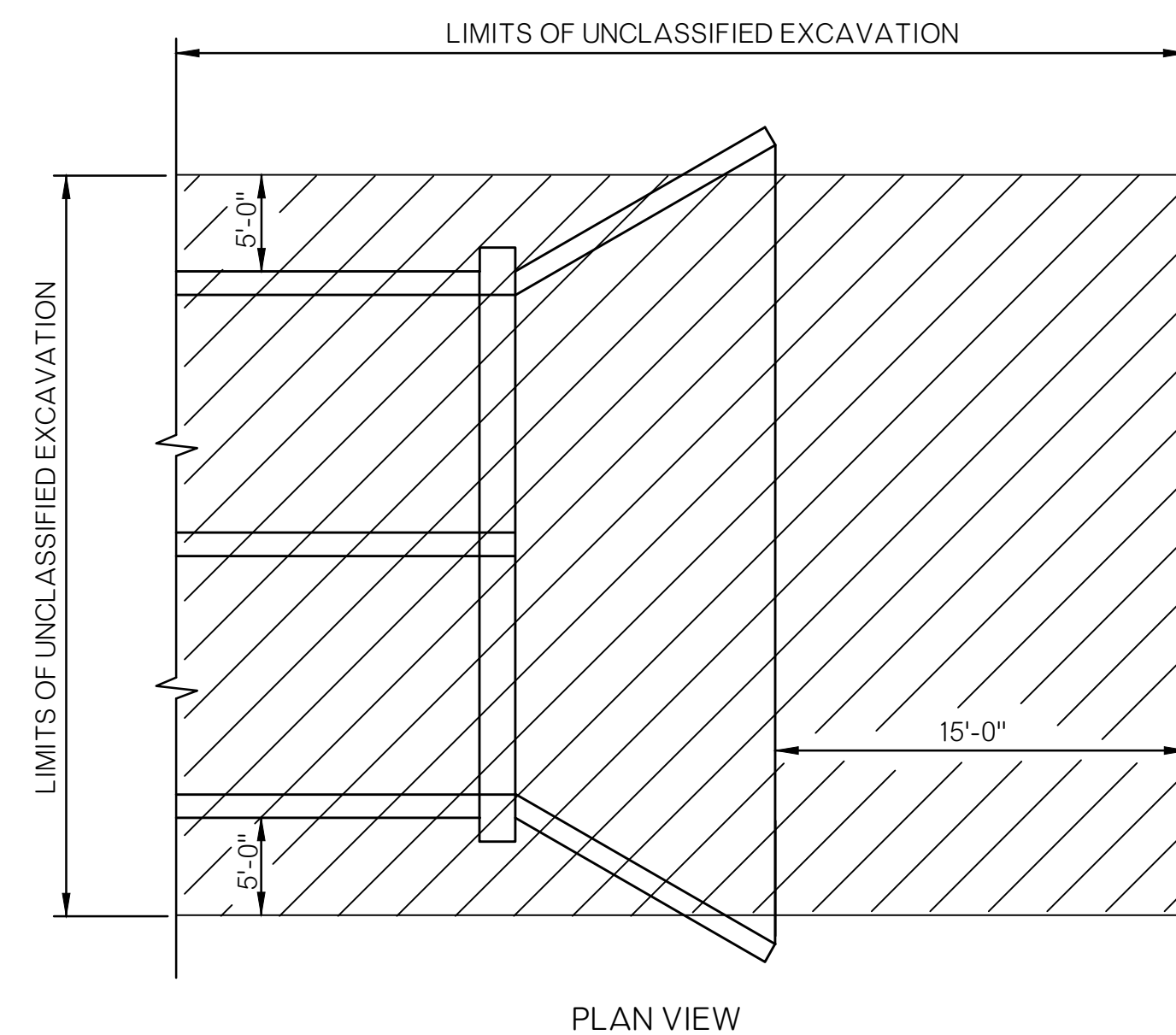
REQUIREMENTS FOR EXCAVATION OF PRECAST R.C.B. STORM SEWERS



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

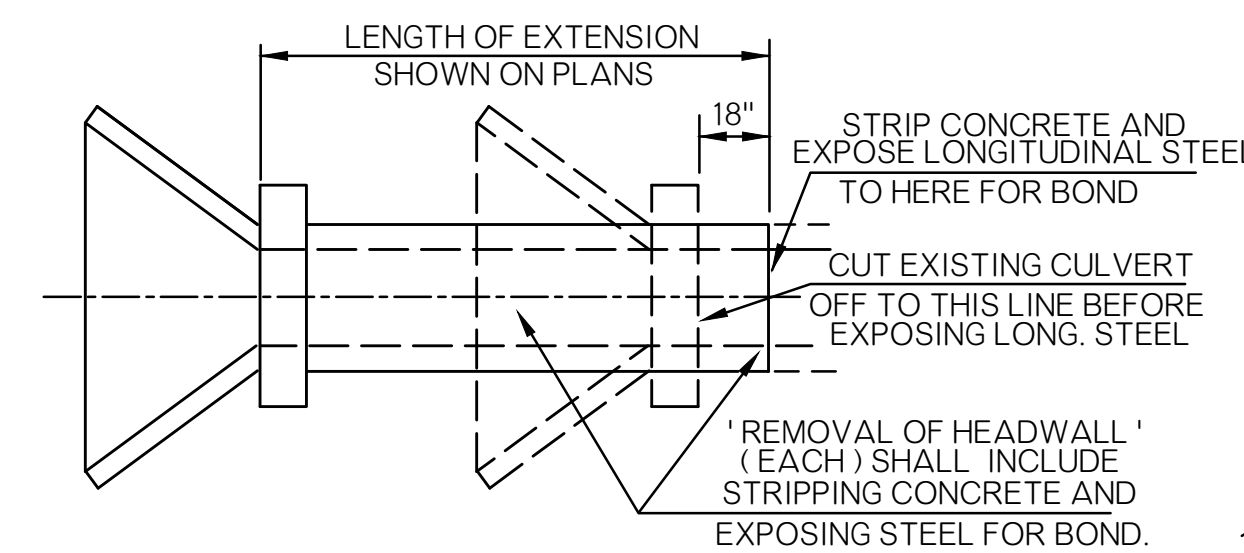


REQUIREMENTS FOR EXCAVATION OF PRECAST R.C.B. CULVERTS OF ROADWAY AND BRIDGE CLASSIFICATION

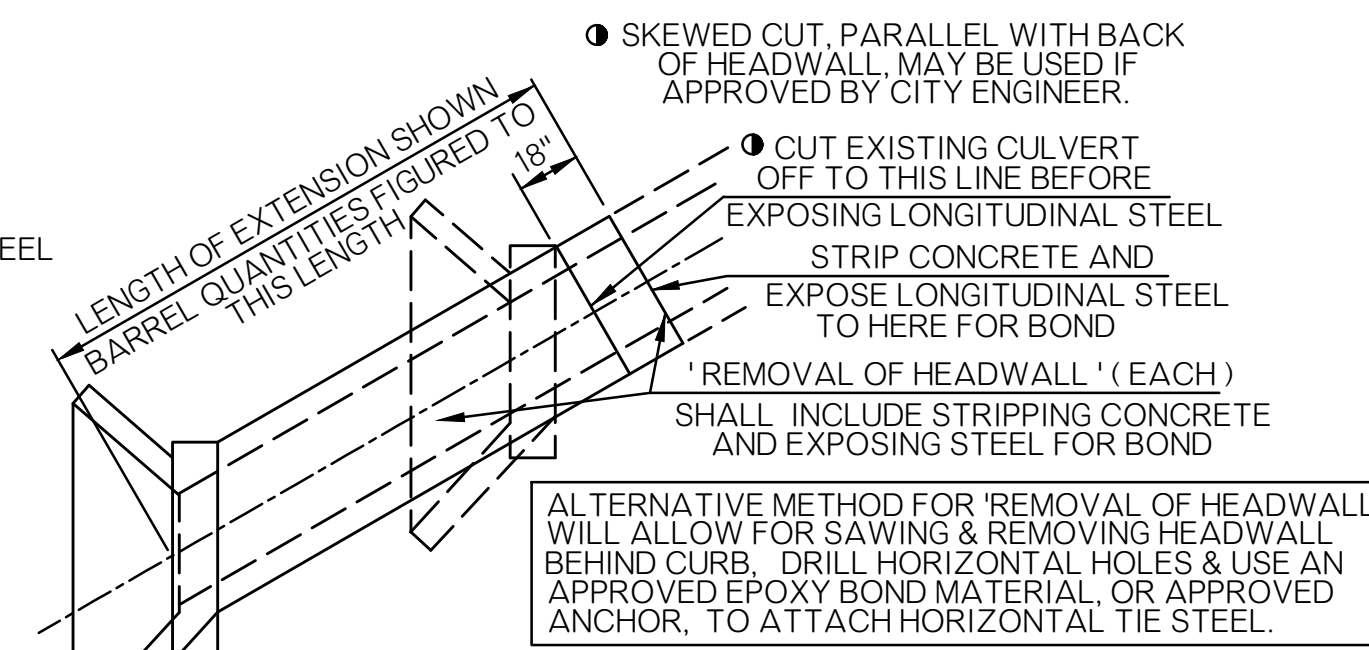


PLAN VIEW

LIMITS OF UNCLASSIFIED EXCAVATION



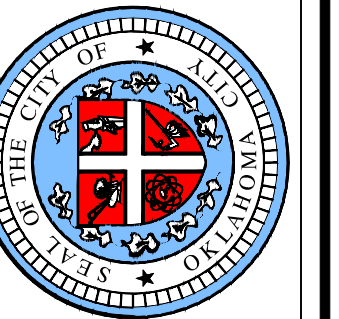
ALTERNATE METHOD FOR EXTENDING 0° SKEWED BOXES



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.



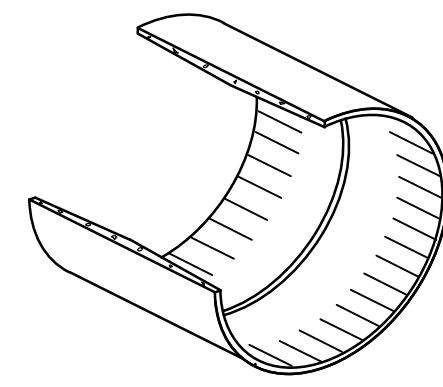
APPROVED BY: DATE: 6/22/2023
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CITY ENGINEER

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

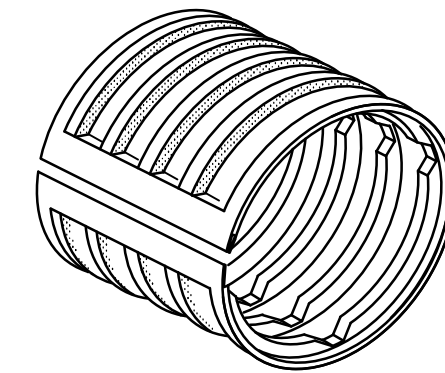
**REINFORCED CONCRETE BOX
INSTALLATION DETAILS**

Detail Number

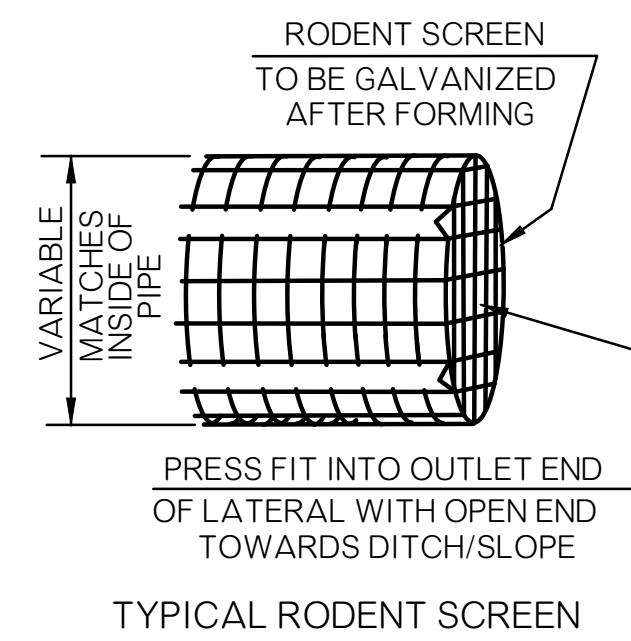
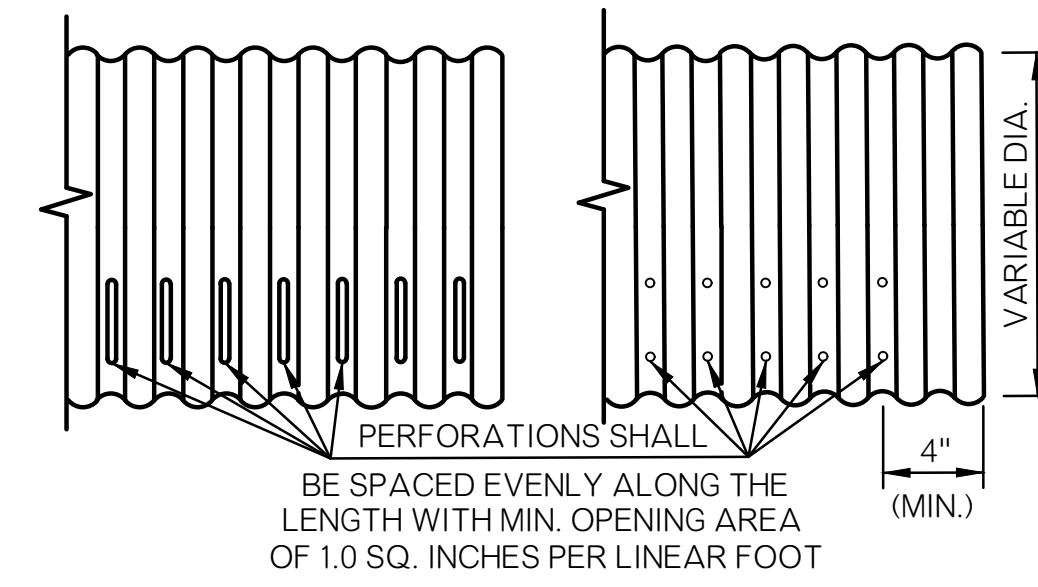
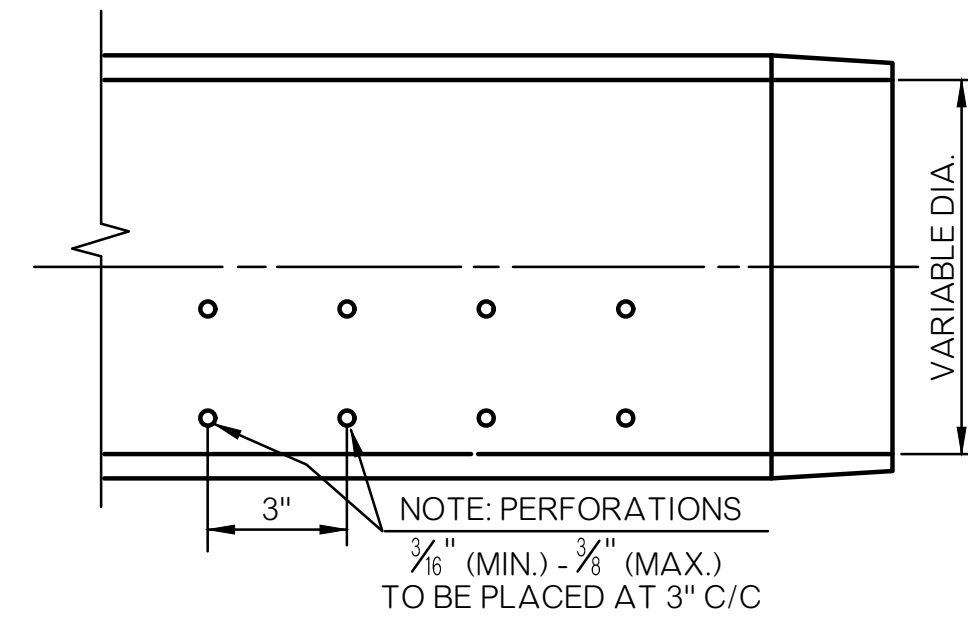
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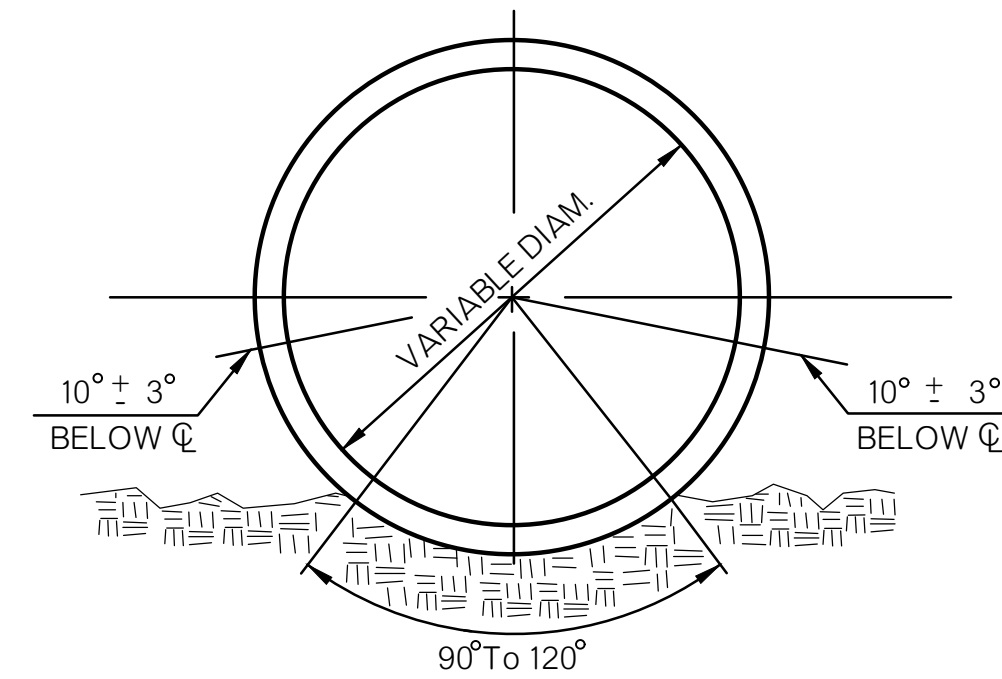
TYPICAL COUPLING FOR PVC PIPE UNDERDRAIN
1/4 SECTION REMOVED



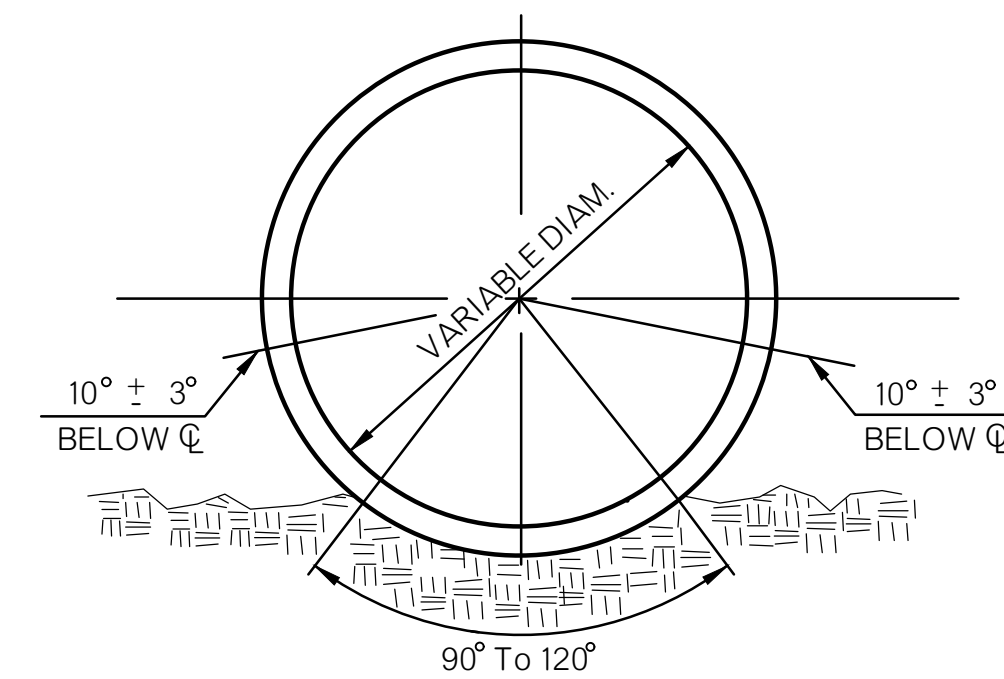
TYPICAL CORRUGATED COUPLING OR AN APPROVED EQUAL



TYPICAL RODENT SCREEN



POLYVINYL (PVC) PIPE UNDERDRAIN



CORRUGATED POLYETHYLENE PIPE UNDERDRAIN

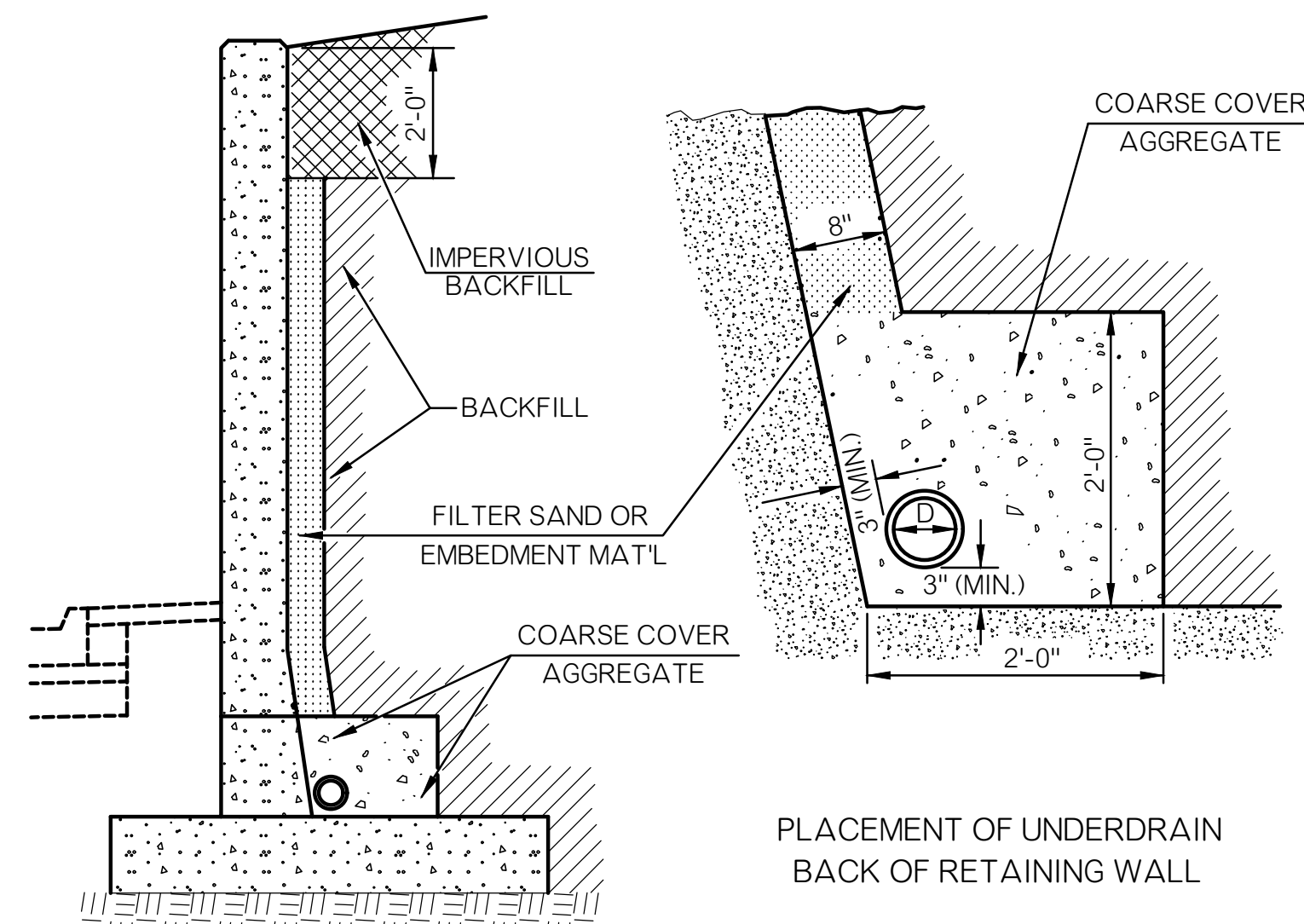
INSTALLATION TECHNIQUE: (12" DIAMETER OR SMALLER)

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.

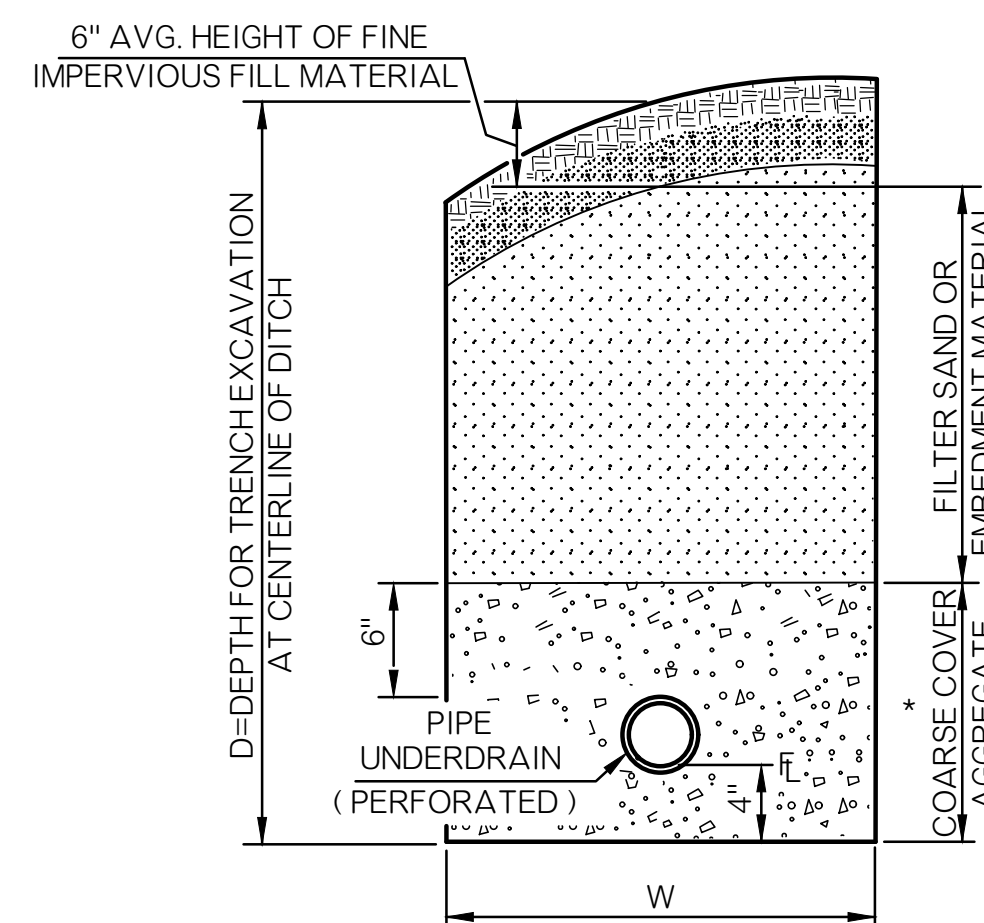
NON-PERFORATED PIPE UNDERDRAIN, WHEN INSTALLED IN A TRENCH, SHALL BE BEDDED IN A 4" LAYER CONSISTING OF COARSE AGGREGATE COVER MATERIAL OR A 50-50 MIX OF COARSE AGGREGATE COVER MATERIAL AND FILTER SAND. THE REMAINING BACKFILL MAY BE NATIVE SOIL REMOVED IN THE TRENCHING OPERATION. FILTER SAND OR BACKFILL 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.

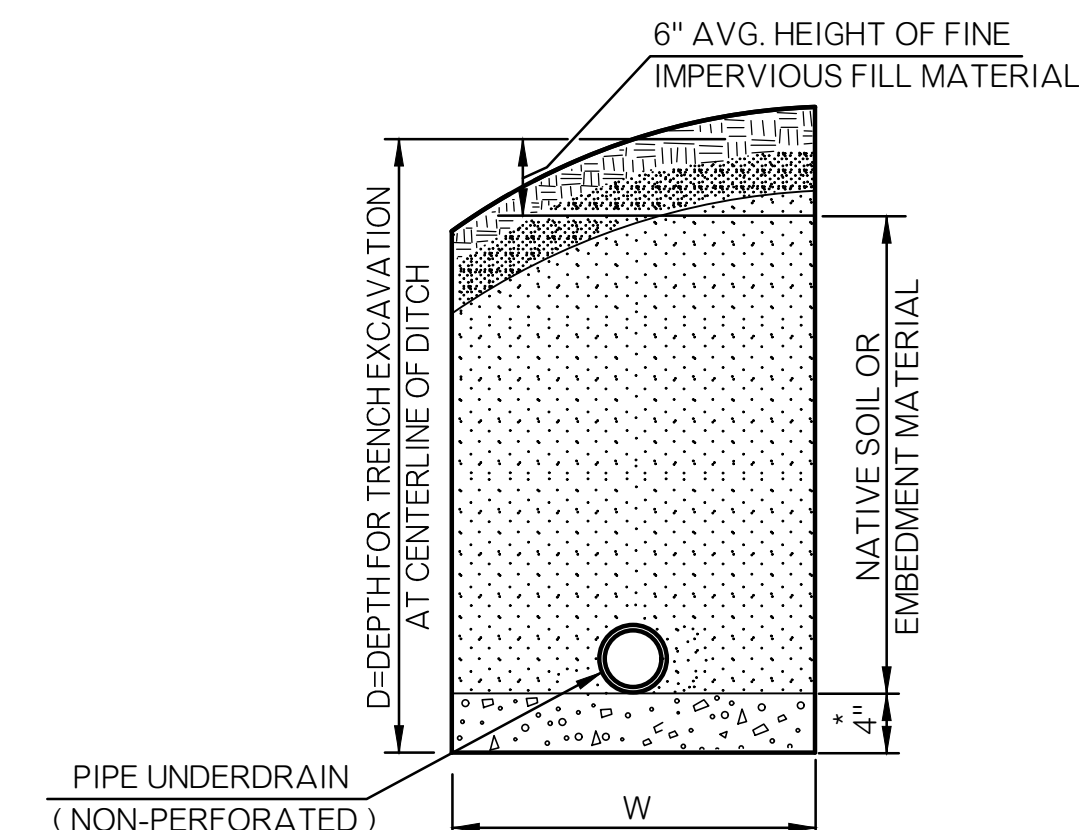


PLACEMENT OF UNDERDRAIN BACK OF RETAINING WALL



DETAIL TRENCH EXCAVATION PERFORATED PIPE UNDERDRAIN INSTALLATIONS

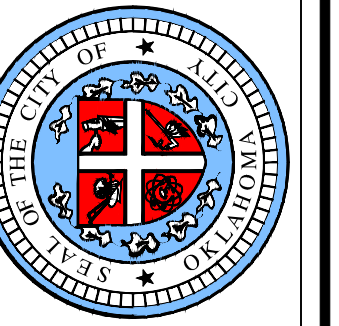
* PIPE UNDERDRAIN COVER MATERIAL



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%



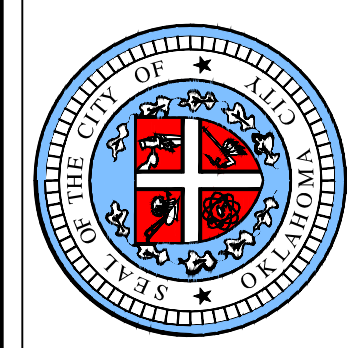
APPROVED BY: DATE: 6/22/2023
ERIC J. WENGER, P.E.
CITY ENGINEER

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

**PIPE UNDERDRAIN INSTALLATION
DETAILS**

Detail Number

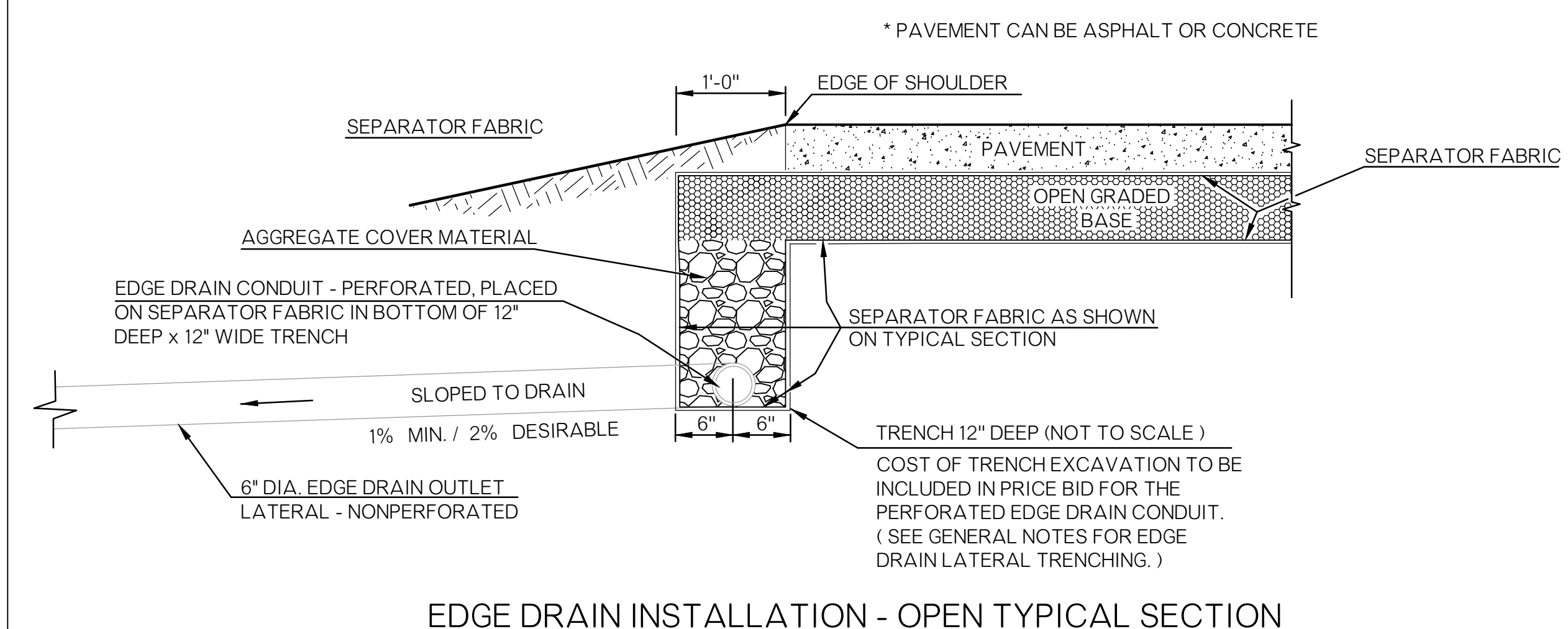
D-1004



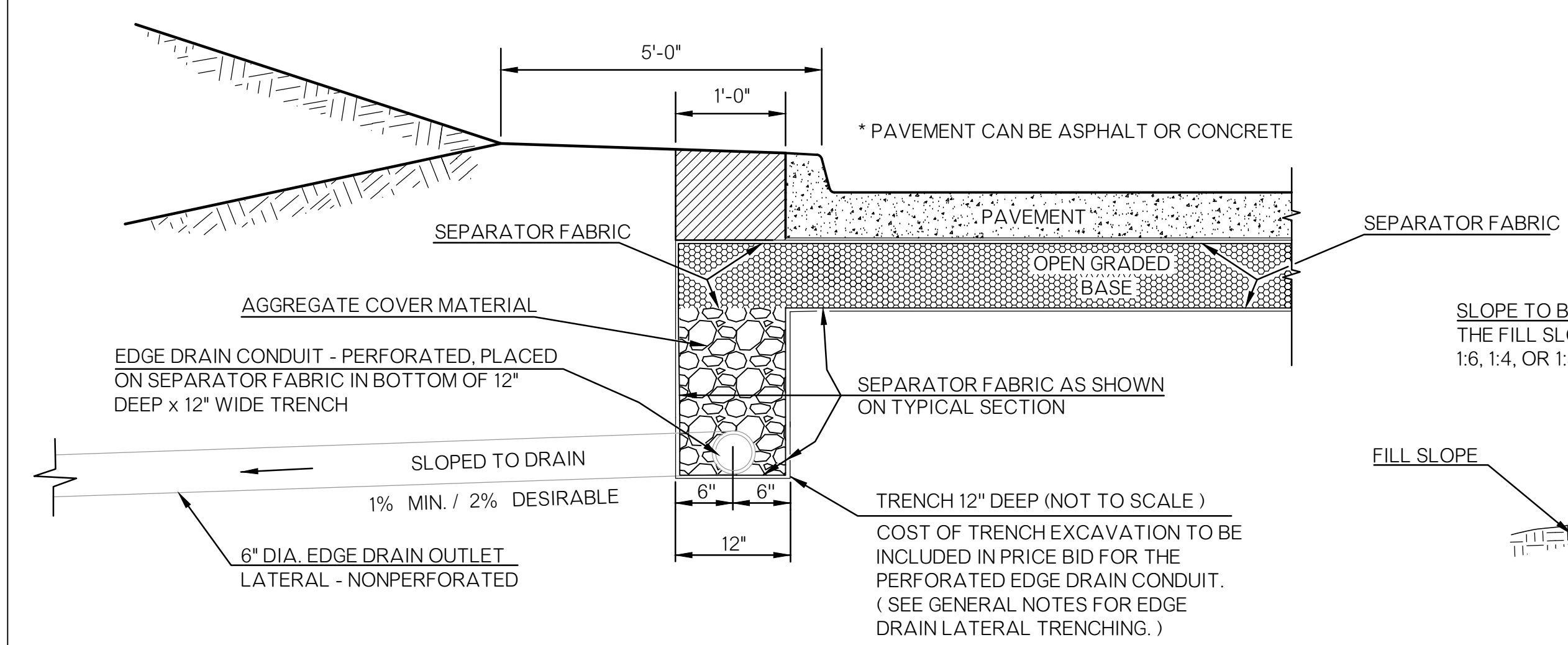
APPROVED BY: *[Signature]* DATE: 6/22/2023
ERIC J. WENGER, P.E.
CITY ENGINEER
DRAWN: OKC-PW-SRB
DATE: 3/9/2023

**PAVEMENT EDGE DRAIN
DETAILS**

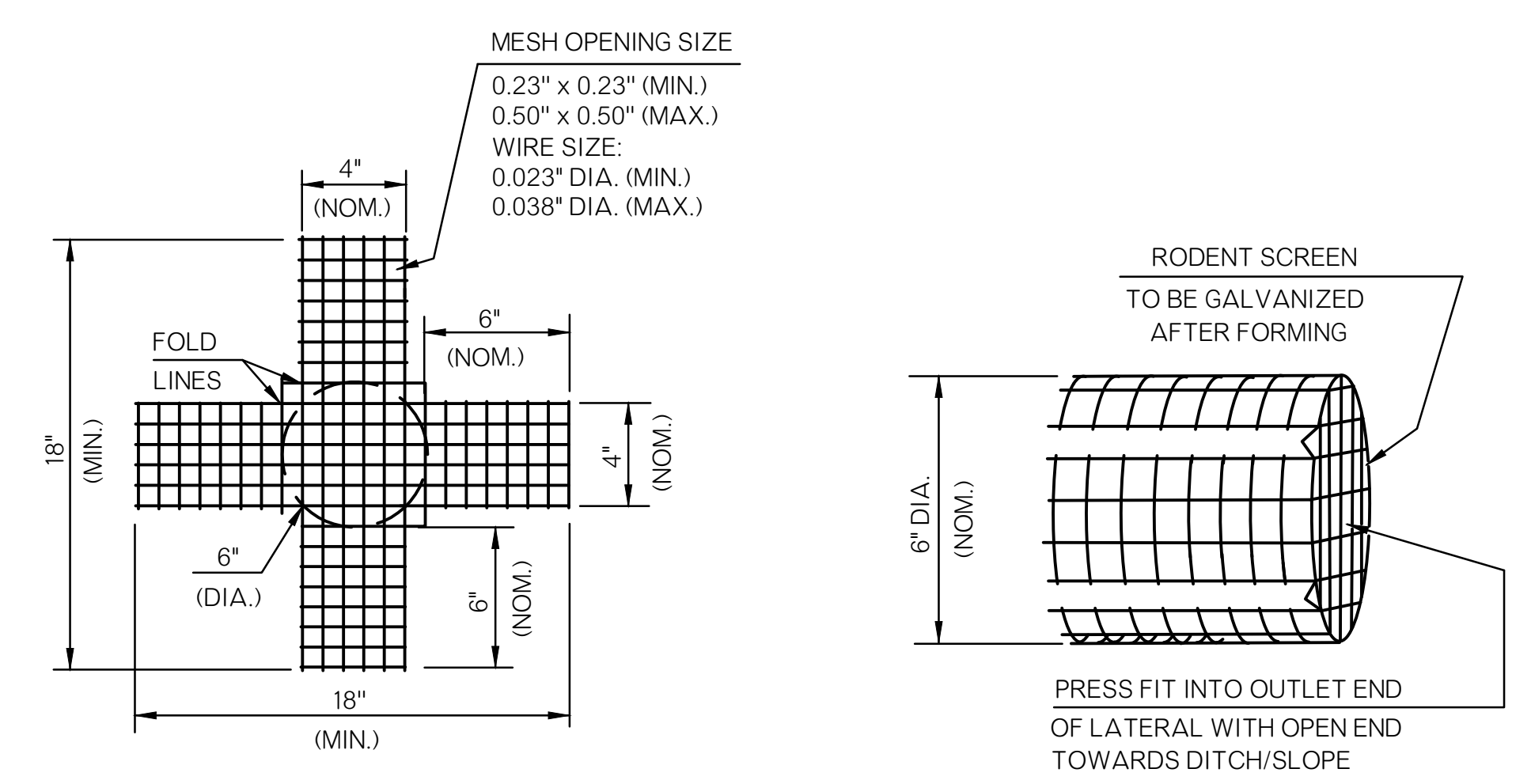
Detail Number
D-1005



EDGE DRAIN INSTALLATION - OPEN TYPICAL SECTION

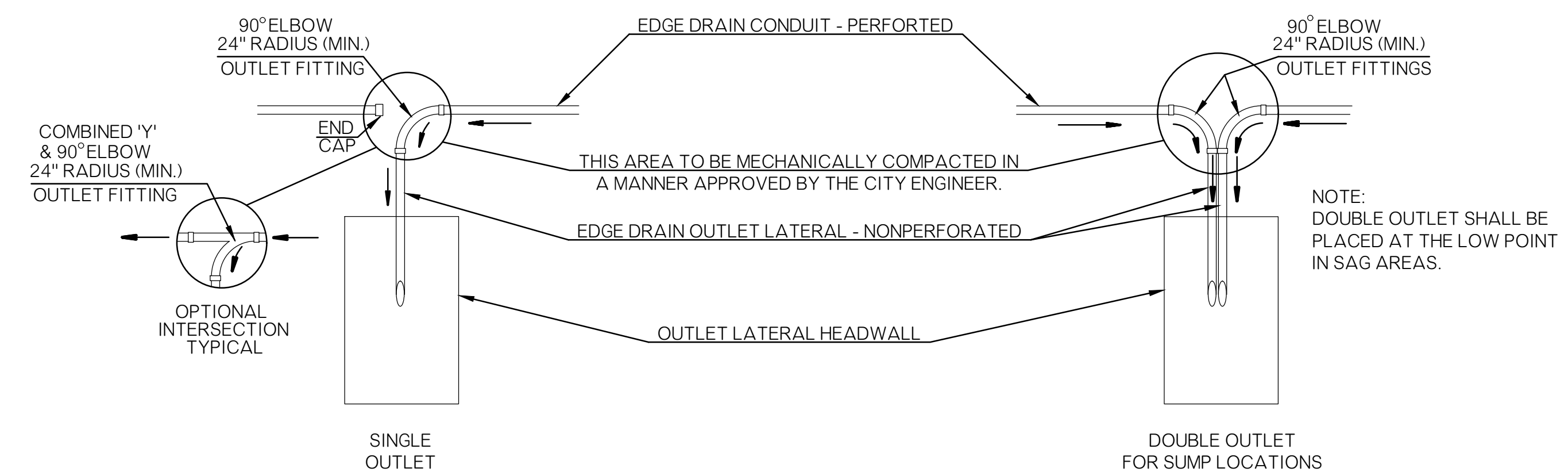


EDGE DRAIN INSTALLATION - CURBED TYPICAL SECTION

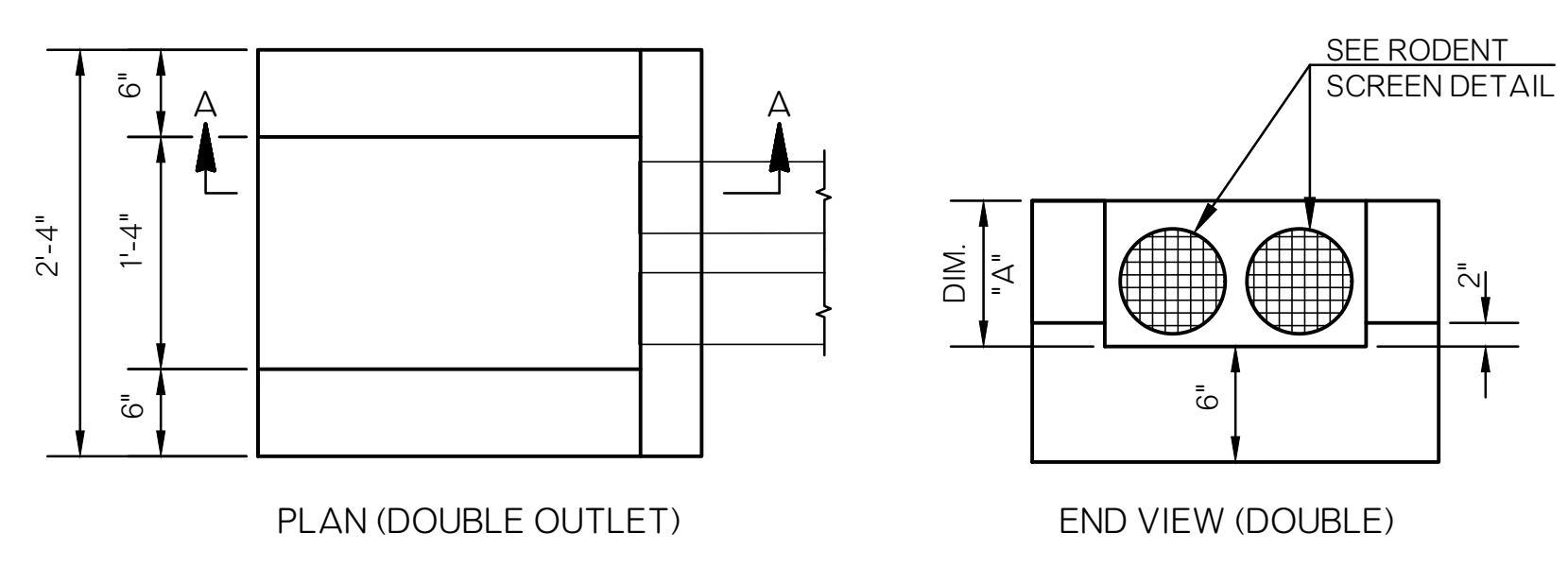
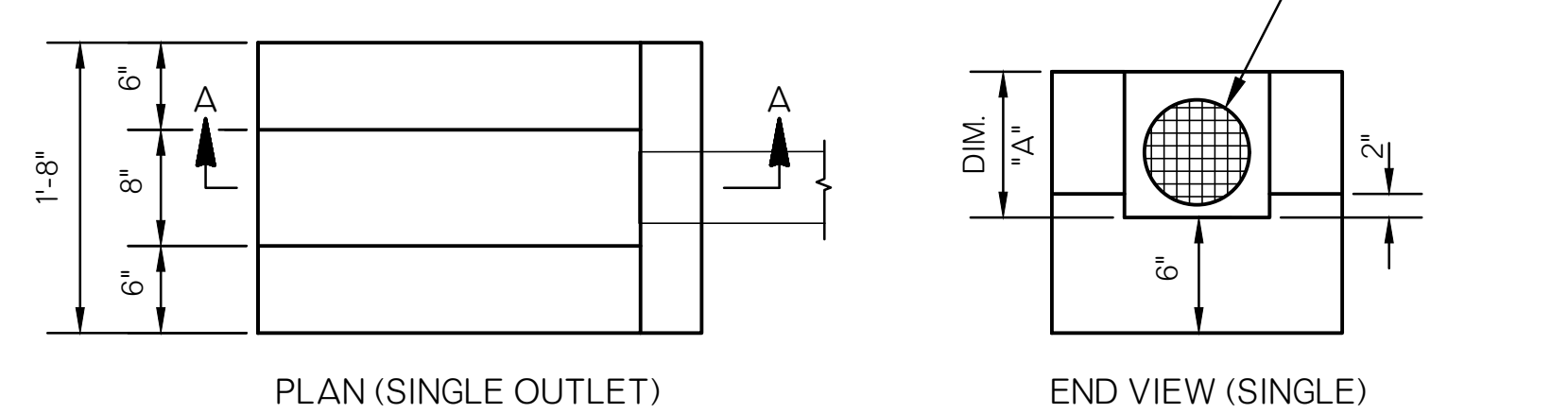
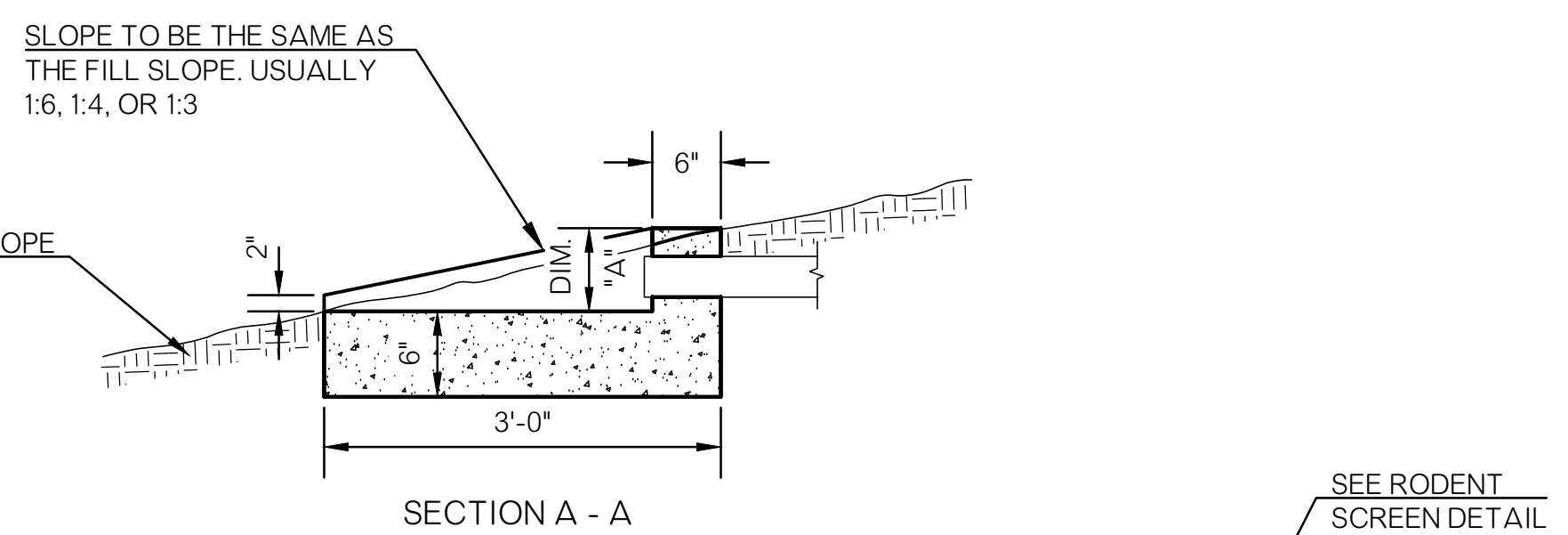


RODENT SCREEN DETAIL

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.

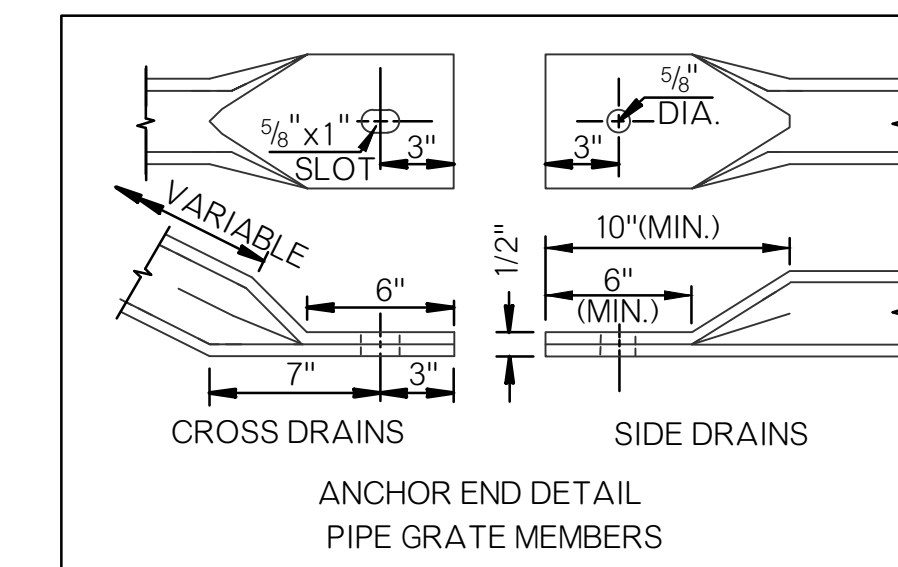
OUTLET LATERAL HEADWALL SCHEDULE			
FILL SLOPE	DIM. "A"	CLASS A CONCRETE QUALITY	
		SINGLE OUTLET	DOUBLE OUTLET
1 : 3	1'-0"	0.18 C.Y.	0.23 C.Y.
1 : 4	9 1/2"	0.17 C.Y.	0.21 C.Y.
1 : 6	7"	0.16 C.Y.	0.19 C.Y.

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)		
A4	15"	2				36"	NONE		
	18"	2				36"	NONE		
	(18")		22 x 13	1	21 x 15	2	14 x 23	1	42"
B4	21"	2				42"	NONE		
	24"	2				45"	NONE		
	(24")		28 x 18	2			19 x 30	2	48"
			36 x 22	3			22 x 34	2	54"
					35 x 24	3	35 x 24	3	54"
C4	30"	5				50"	NONE		
	(30")		43 x 26	3			42 x 29	3	64"
							29 x 45	3	64"
			51 x 31	4			34 x 53	4	72"
					49 x 33	4	49 x 33	4	70"
D4	36"	4				60"	1 @ 18'-9"		
	42"	5				66"	1 @ 20'-9"		
	(42")		58 x 36	4	57 x 38	5	38 x 60	5	78"
E4	48"	6				92"	2 @ 20'-6"		
	(48")		73 x 45	6	71 x 47	6	48 x 76	6	96"

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

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.	H-BARS	H-BARS	S-BARS	STEEL LENGTH
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"	

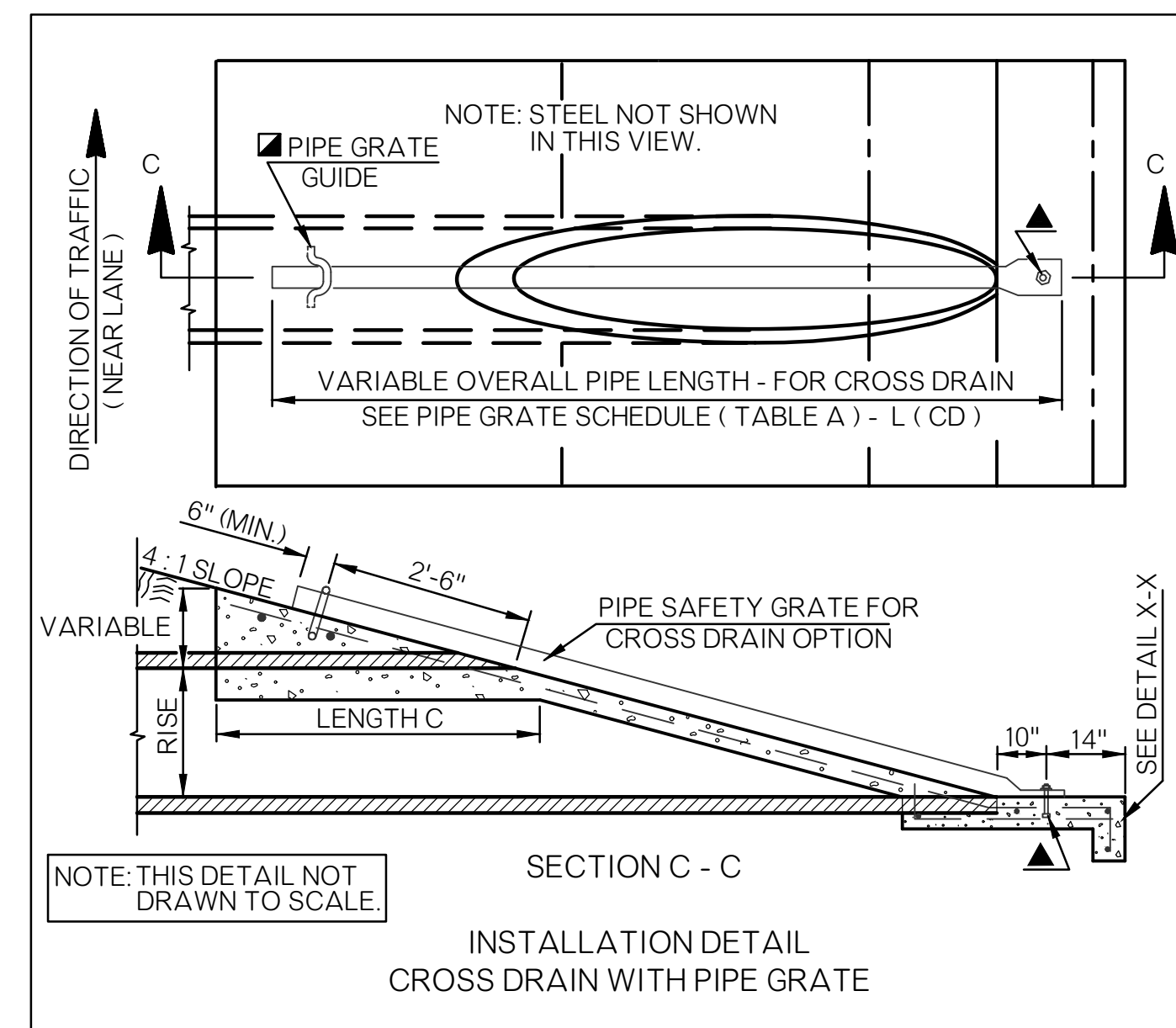
Ⓡ ROUND SHAPE CULVERT OPTIONS
 Ⓜ ARCH SHAPE CULVERT OPTIONS
 Ⓢ HORIZONTAL ELLIPSE SHAPE CULVERT OPTIONS



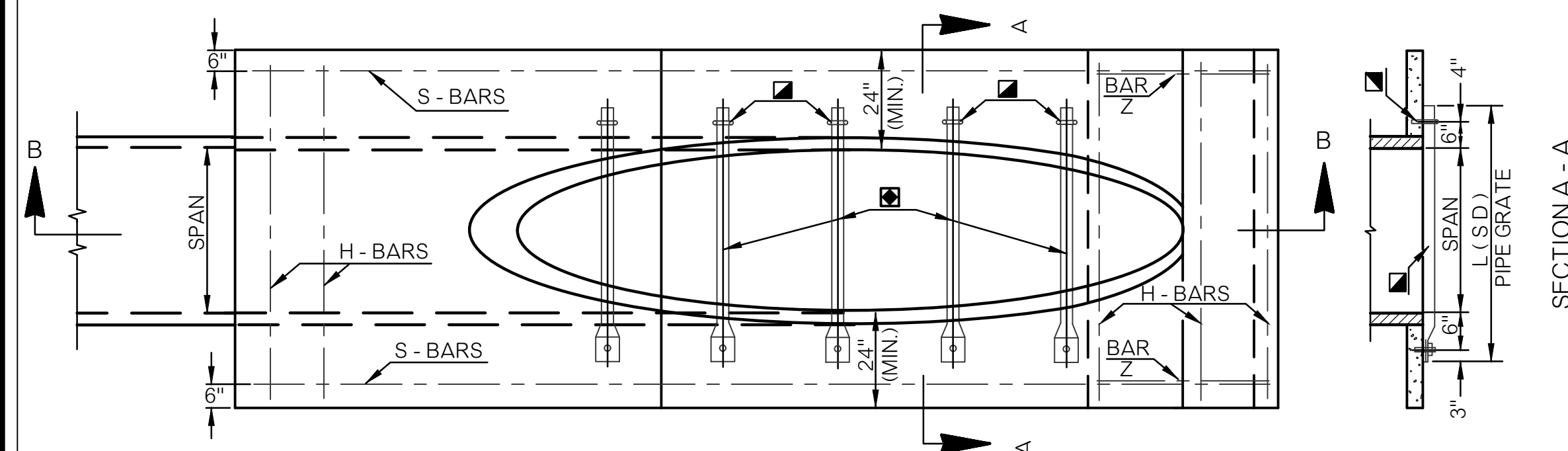
GENERAL NOTES

- 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".

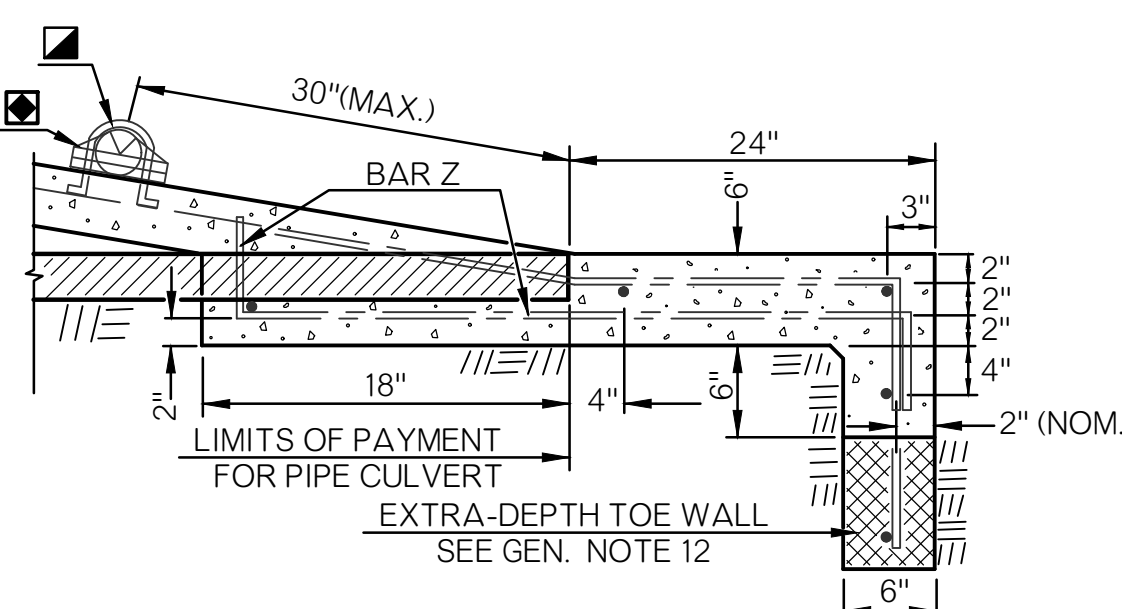
PRECAST CULVERT END TREATMENTS OR OTHER ALTERNATIVE DESIGNS MAY BE USED IF APPROPRIATE DRAWINGS ARE SUBMITTED TO AND APPROVED BY THE CITY ENGINEER.



SECTION C - C
 INSTALLATION DETAIL
 CROSS DRAIN WITH PIPE GRATE

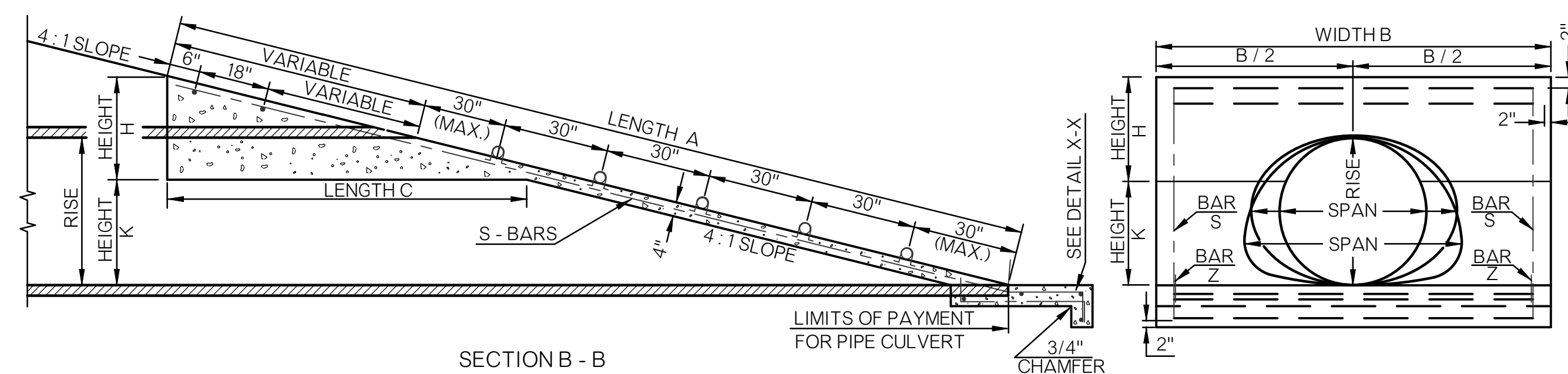


SECTION A - A

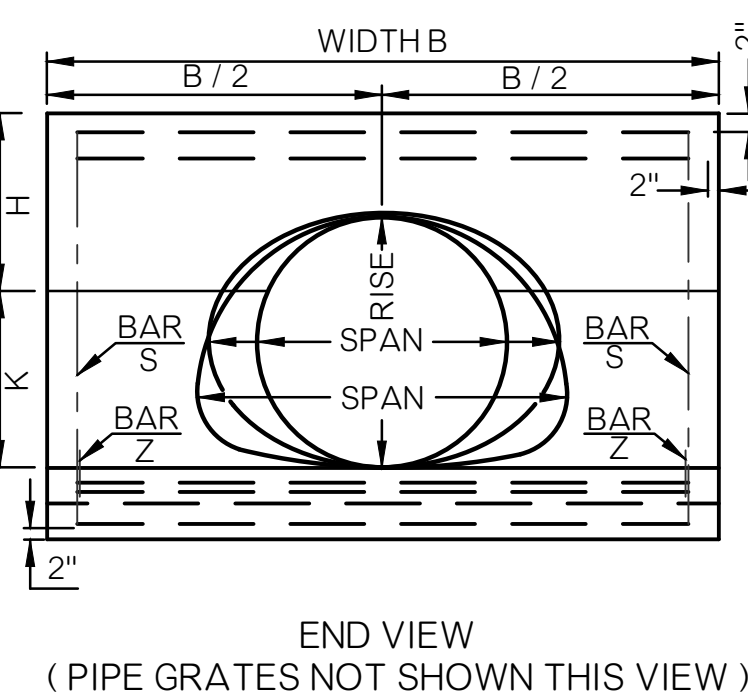


DETAIL X - X

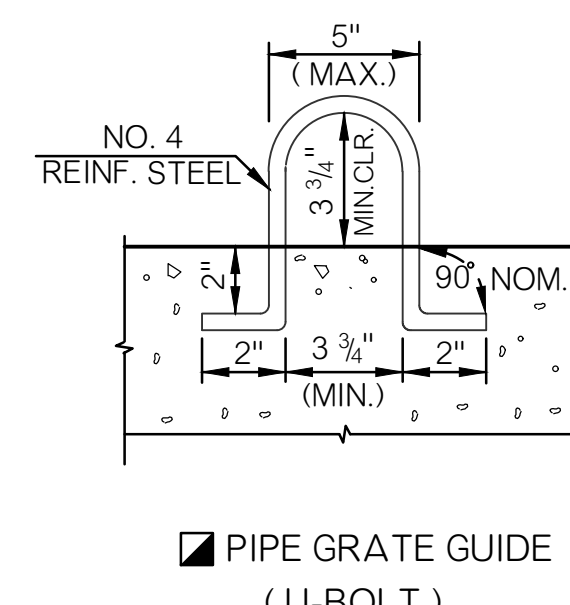
TYPICAL ABBREVIATIONS
 RS - ROUND SIDE DRAIN
 RC - ROUND CROSS DRAIN
 AS - ARCH SIDE DRAIN
 AC - ARCH CROSS DRAIN
 GR - GRATED
 NG - NON-GRATED



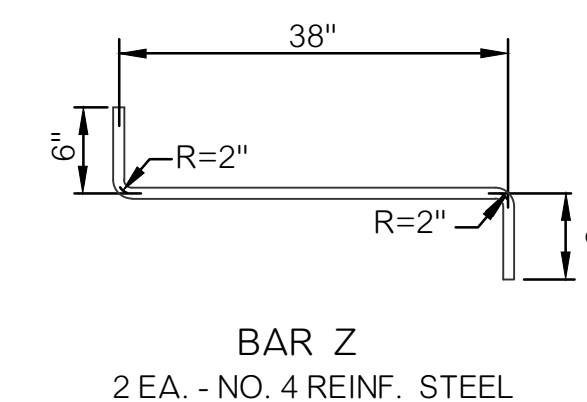
SECTION B - B
 INSTALLATION DETAIL
 SIDE DRAIN WITH PIPE GRATES



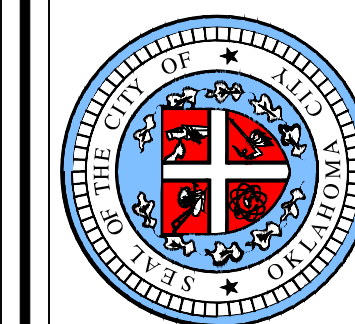
END VIEW
 (PIPE GRATES NOT SHOWN THIS VIEW)



PIPE GRATE GUIDE
 (U-BOLT)



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



APPROVED BY: *[Signature]* DATE: 6/22/2023
 ERIC J. WENGER, P.E.
 CITY ENGINEER

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

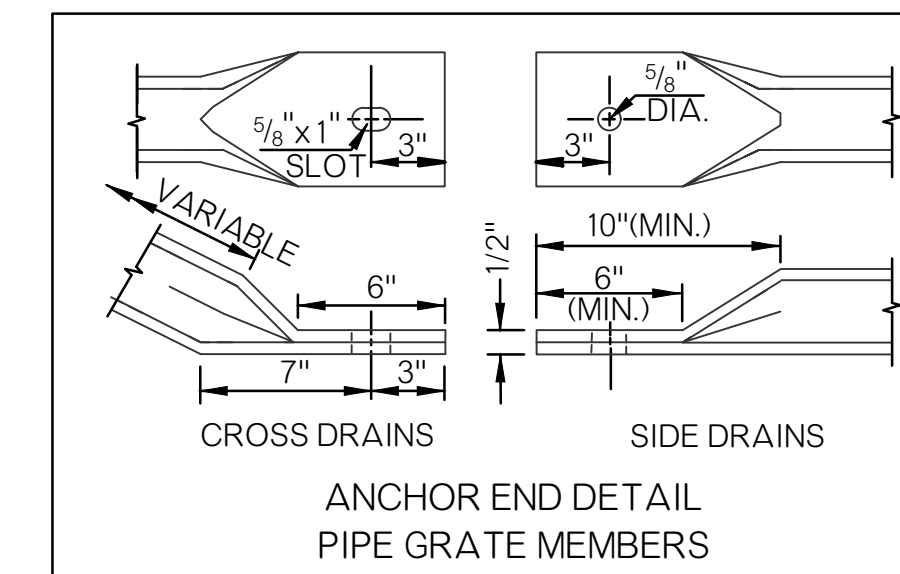
**CULVERT END TREATMENT
 SINGLE PIPE DETAILS**

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)	CROSS DRAIN GRATES L (CD)	G				
AA4	15"					5'-2"	NONE	12				
	18"					5'-8"	NONE	12				
	(18")	22 x 13	1	21 x 15	2	21 x 15	2	14 x 23	1	6'-6"	NONE	12
		26 x 15	2	24 x 18	2	24 x 18	2				7'-0"	NONE
BB4	21"					6'-2"	NONE	12				
	24"					6'-8"	NONE	12				
	(24")	28 x 18	2	28 x 20	2	28 x 20	2	19 x 30	2	7'-8"	NONE	12
		36 x 22	3	35 x 24	3	35 x 24	3	22 x 34	2	8'-6"	2 @ 12'-6"	12
CC4	30"					7'-10"	NONE	15				
	(30")	43 x 26	3	42 x 29	3	42 x 29	3	29 x 45	3	10'-0"	2 @ 13'-6"	15
		51 x 31	4	49 x 33	4	49 x 33	4	34 x 53	4	10'-4"	2 @ 14'-3"	15
										11'-8"	2 @ 15'-3"	18
DD4	36"					9'-8"	2 @ 16'-6"	18				
	42"					10'-4"	2 @ 18'-9"	21				
	(42")	58 x 36	4	57 x 38	5	57 x 38	5	38 x 60	5	13'-4"	2 @ 17'-3"	21
		65 x 40	5	64 x 43	5	64 x 43	5			14'-2"	4 @ 18'-0"	21
EE4	48"					11'-8"	2 @ 20'-9"	24				
	(48")					15'-0"	4 @ 19'-0"	24				
						15'-9"	4 @ 20'-6"	24				
						16'-5"	4 @ 20'-9"	26				

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

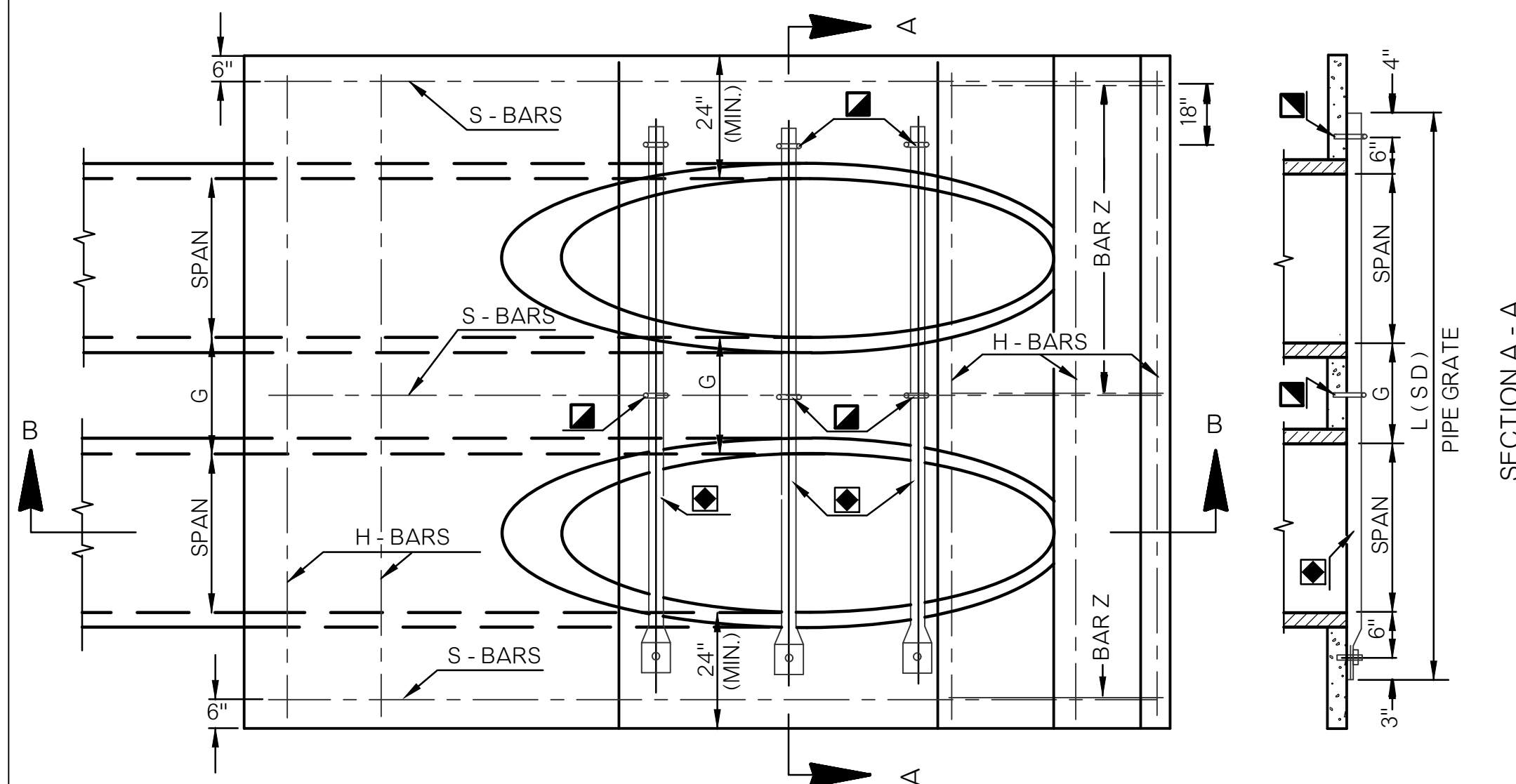
DOUBLE PIPE INSTALLATION - 4 TO 1 SAFETY SLOPE												
TABLE B - SCHEDULE OF DIMENSIONS FOR C. E. T. TYPES												
C.E.T. TYPE	LENGTH A	WIDTH BB	WIDTH BB	LENGTH C	HEIGHT H	HEIGHT K	CONC. C.Y.	CONC. C.Y.	STEEL LENGTH			
									H-BARS	H-BARS	S-BARS	
AA4	10'-4"	8'-0"	9'-4"	5'-8"	21"	9"	2.45	2.90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

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

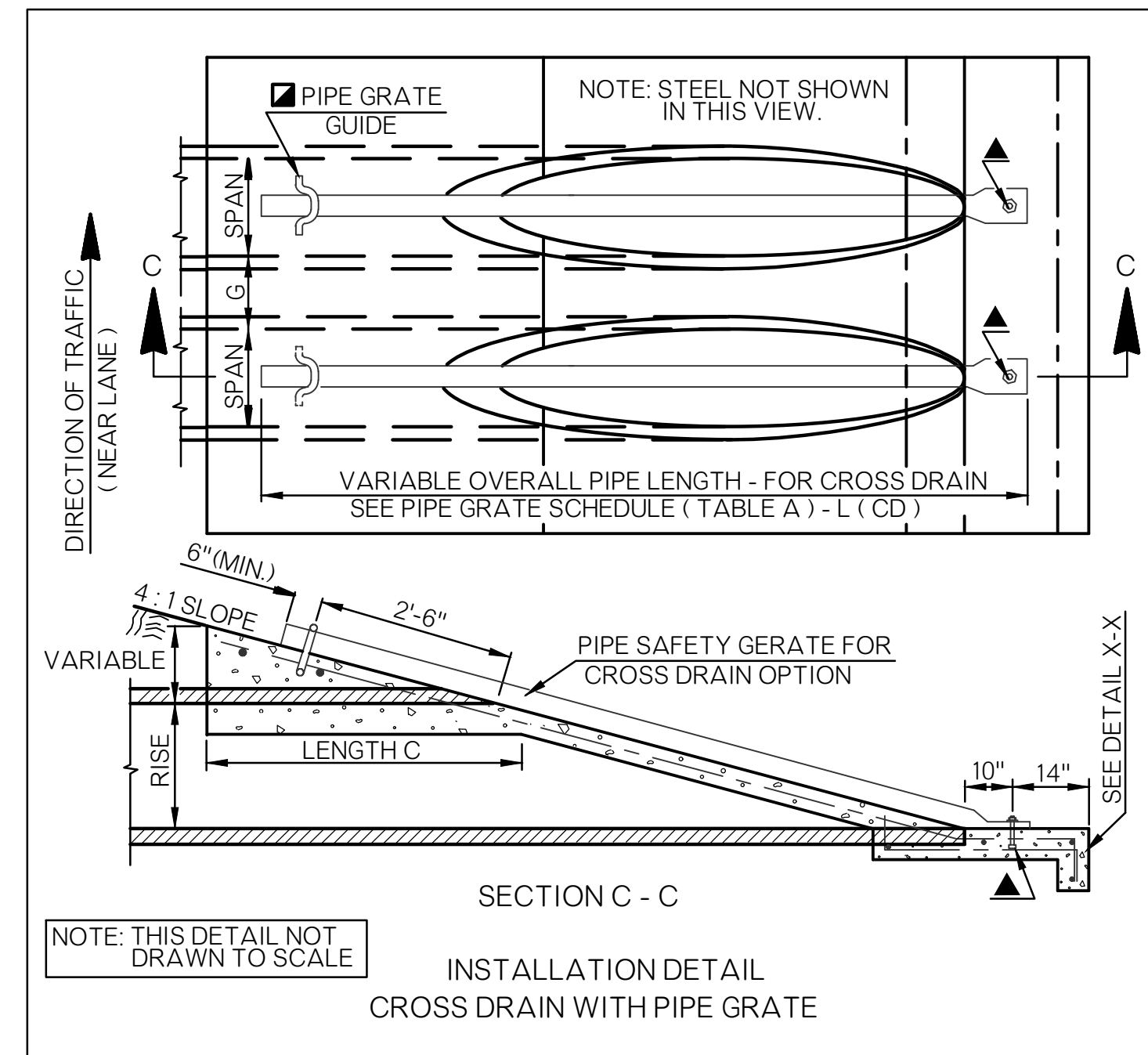


ANCHOR END DETAIL
PIPE GRATE MEMBERS

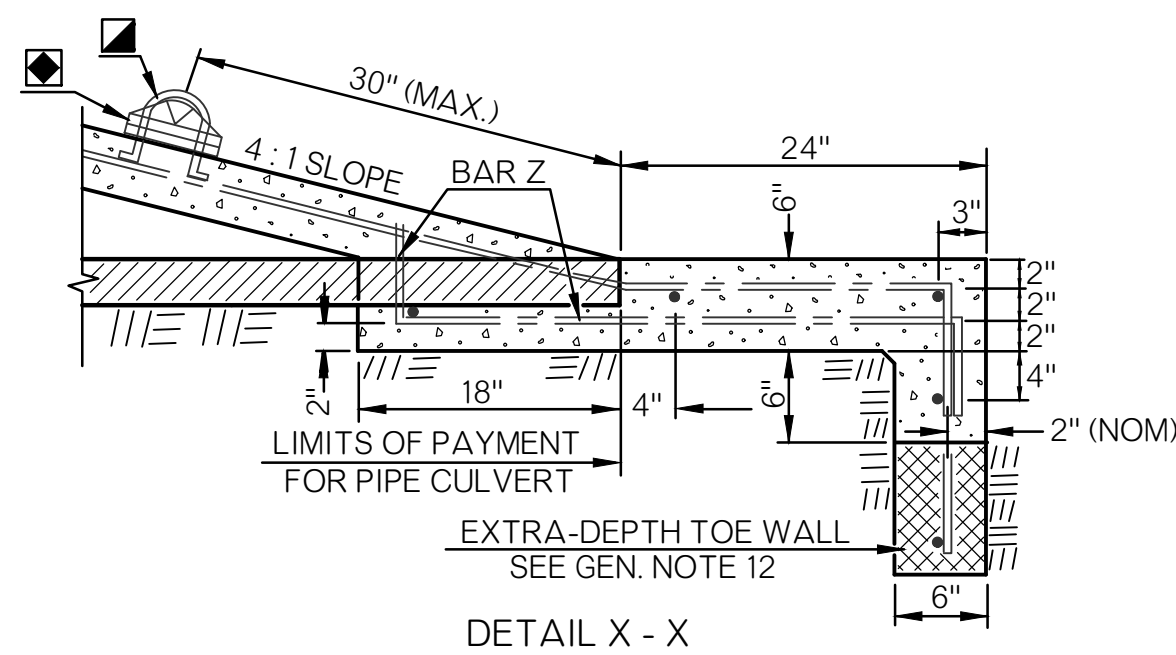
- GENERAL NOTES
- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
 - QUANTITIES SHOWN IN TABLE A ARE FOR ONE END ONLY. CLASS A CONCRETE SHALL CONFORM TO THE MINIMUM REQUIREMENTS OF THE OKC STANDARD SPECIFICATIONS 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:
 - ALL SIDE DRAIN AND MULTIPLE PIPE INSTALLATIONS WITHIN THE CLEAR ZONE.
 - ALL CROSS DRAIN INSTALLATIONS WITH A CULVERT SPAN OF 30" OR MORE.
 - 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.



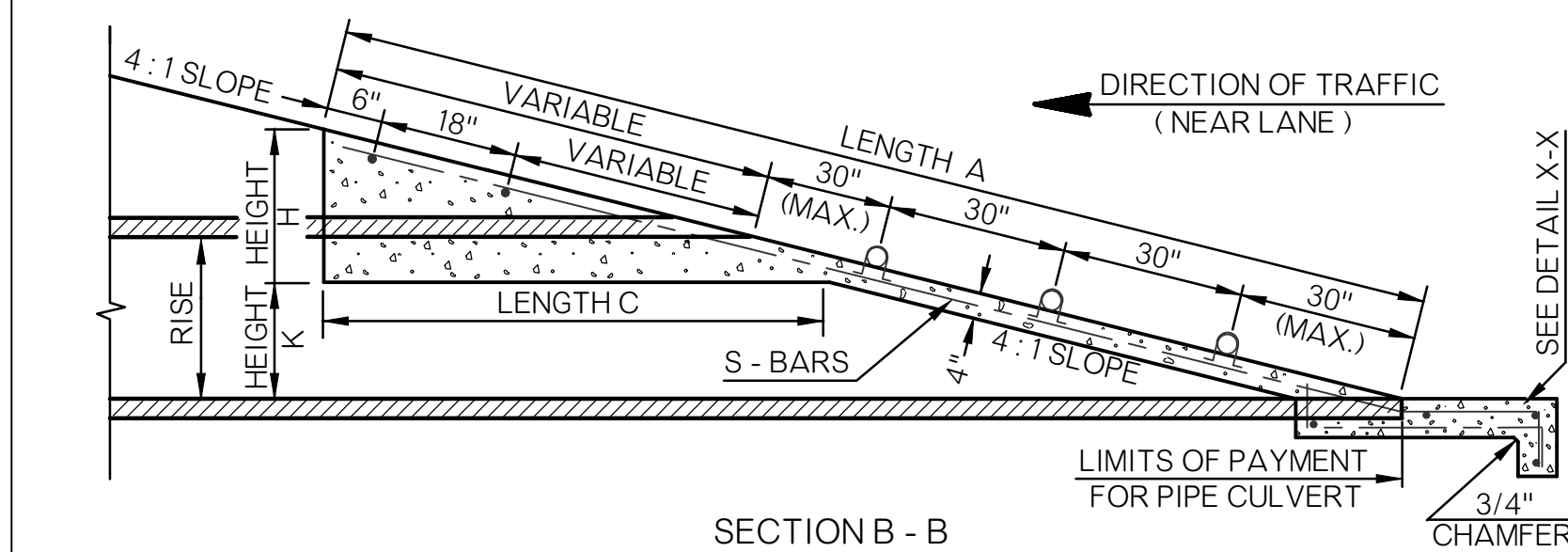
SECTION A - A
PIPE GRATE



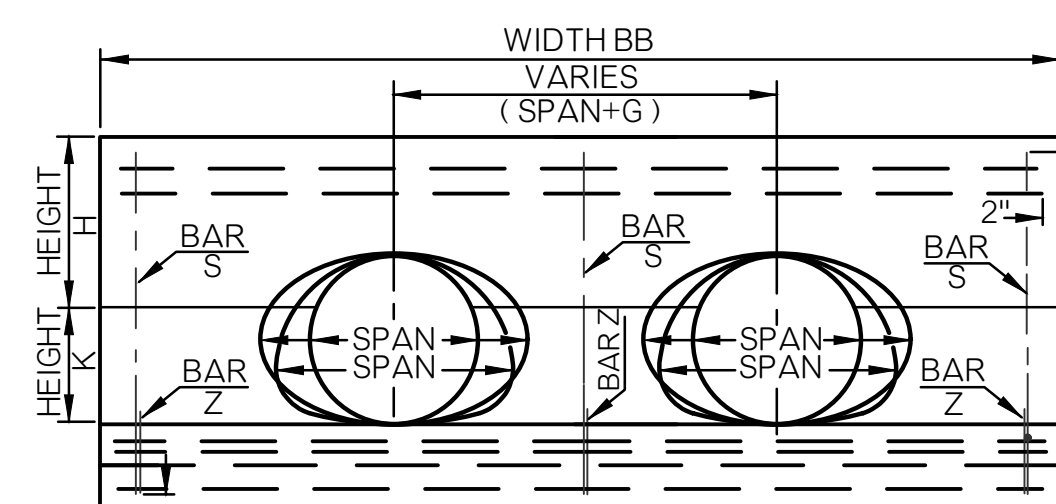
SECTION C - C
INSTALLATION DETAIL
CROSS DRAIN WITH PIPE GRATE



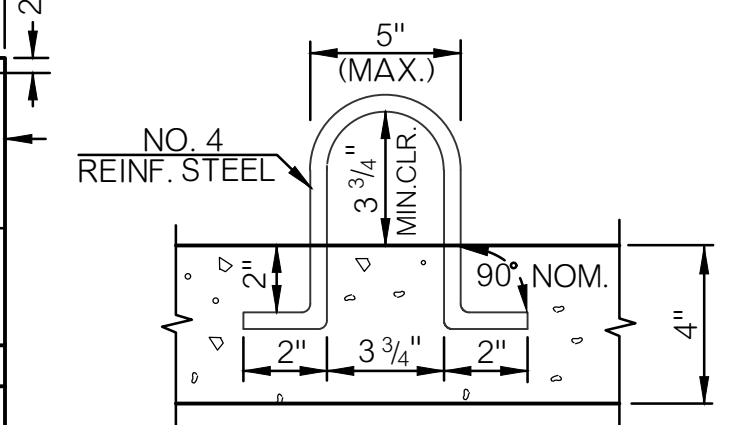
DETAIL X - X



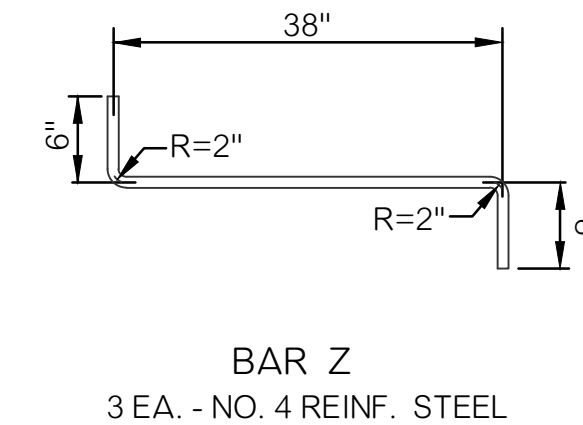
SECTION B - B
INSTALLATION DETAIL
SIDE DRAIN WITH PIPE GRATES



END VIEW
(PIPE GRATES NOT SHOWN THIS VIEW)



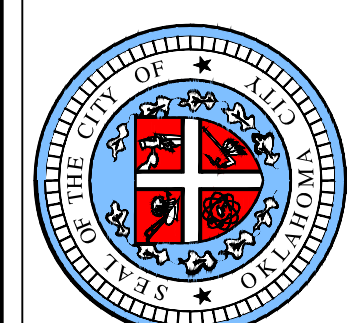
PIPE GRATE GUIDE
(U-BOLT)



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

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

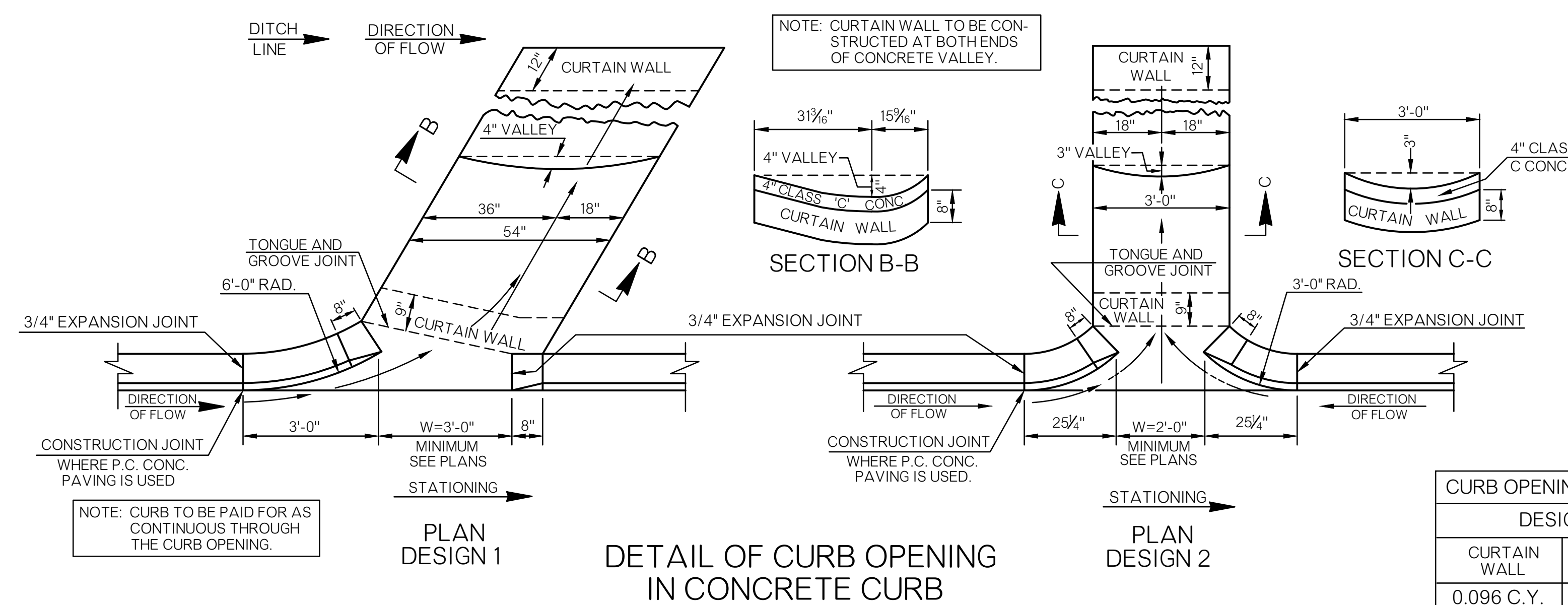
The City of
Oklahoma City
 Public Works Department
 Engineering Division



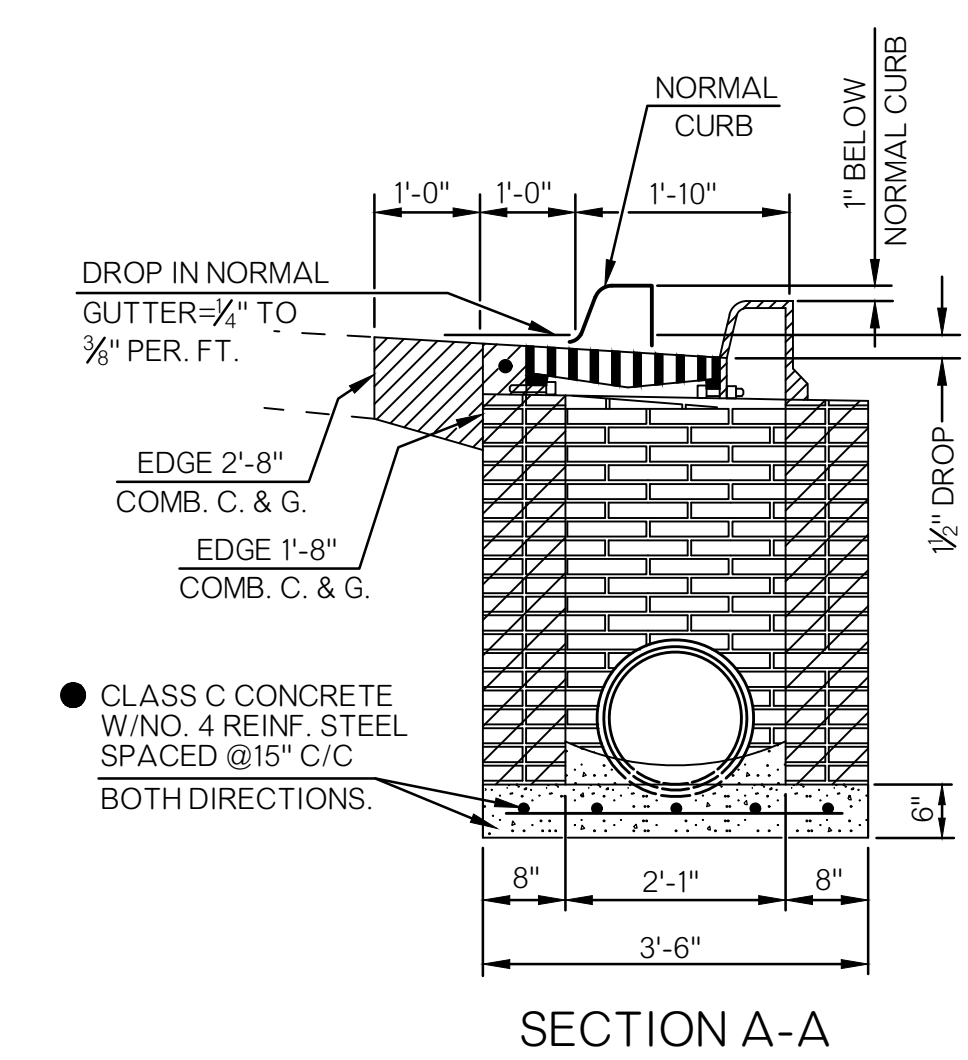
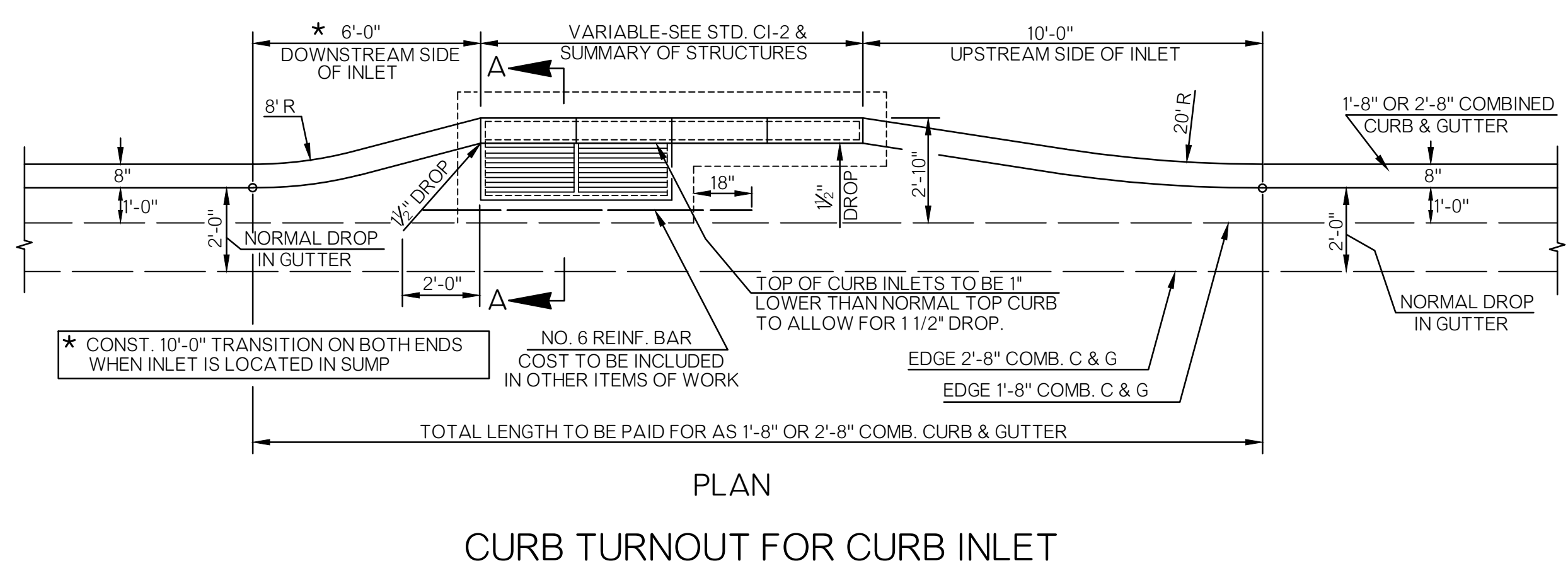
APPROVED BY: *[Signature]* DATE: 6/22/2023
 ERIC J. WENGER, P.E.
 CITY ENGINEER
 DRAWN: OKC-PW-SRB
 DATE: 3/9/2023

**CULVERT END TREATMENT
 DOUBLE PIPE DETAILS**

Detail Number
 D-1007

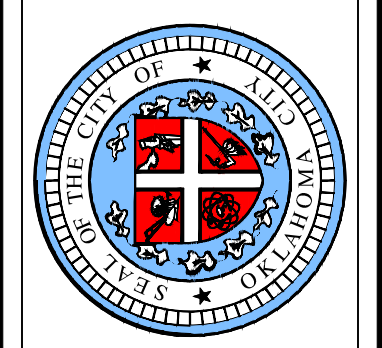


CURB OPENING - CLASS C CONCRETE QUANTITIES			
DESIGN 1		DESIGN 2	
CURTAIN WALL	PER FOOT OF FLUME	CURTAIN WALL	PER FOOT OF FLUME
0.096 C.Y.	0.048 C.Y.	0.074 C.Y.	0.037 C.Y.



- GENERAL NOTES
- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE OKC STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC IMPROVEMENTS.
 - 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: 6/22/2023
ERIC J. WENGER, P.E.
CITY ENGINEER

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

**STORM SEWER CONSTRUCTION
DETAILS**

Detail Number
D-1008