

**DOUBLE PIPE INSTALLATION - 4 TO 1 SAFETY SLOPE**

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

C. E. T. TYPE	ROUND		REINF. CONC. ARCH PIPE		STEEL ARCH PIPE		ALUMINUM ARCH PIPE		REINF. CONC. ELLIPTICAL PIPE		SIDE DRAIN GRATES	CROSS DRAIN GRATES	G	
	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES				
AA4	15"	2									5'-2"	NONE	12	
	18"	2									5'-8"	NONE	12	
	(18")			22 x 13 1/2	1	21 x 15	2	21 x 15	2	14 x 23	1	6'-6"	NONE	12
				26 x 15 1/2	2							7'-0"	NONE	12
BB4	21"	2									6'-2"	NONE	12	
	24"	2									6'-8"	NONE	12	
	(24")			28 1/2 x 18	2	28 x 20	2	28 x 20	2	19 x 30	2	7'-8"	NONE	12
				36 1/4 x 22 1/2	3					22 x 34	2	8'-6"	2 @ 12'-0"	12
CC4	30"	5									9'-2"	2 @ 12'-6"	15	
	(30")			43 3/8 x 26 3/8	3	42 x 29	3	42 x 29	3			10'-0"	2 @ 14'-3"	15
										29 x 45	3	10'-4"	2 @ 14'-3"	15
												11'-8"	2 @ 15'-3"	18
DD4	36"	4									11'-3"	2 @ 15'-9"	18	
	42"	5									11'-3"	2 @ 15'-9"	18	
	(42")			58 1/2 x 36	4	57 x 38	5	57 x 38	5	38 x 60	5	14'-2"	4 @ 19'-0"	21
				65 x 40	5							14'-2"	4 @ 19'-0"	21
EE4	48"	6									11'-8"	2 @ 20'-9"	24	
	(48")											15'-0"	4 @ 20'-6"	24
												15'-9"	4 @ 20'-6"	24
												16'-5"	4 @ 20'-9"	26

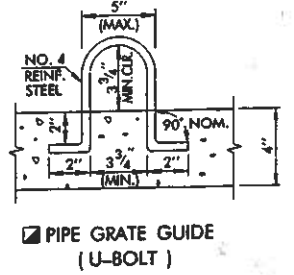
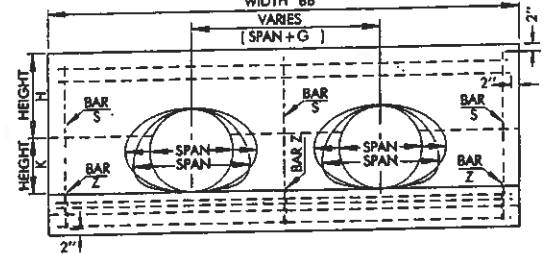
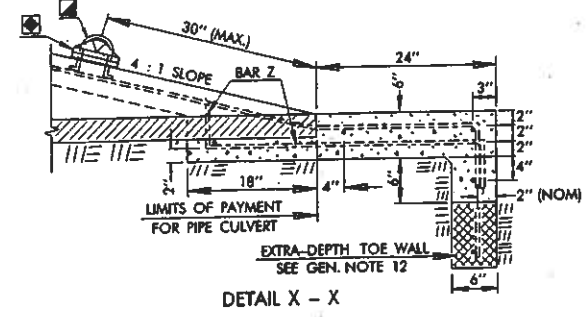
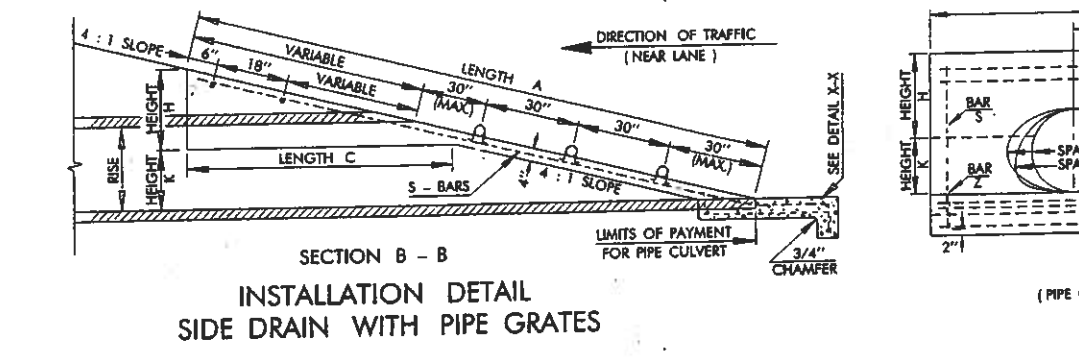
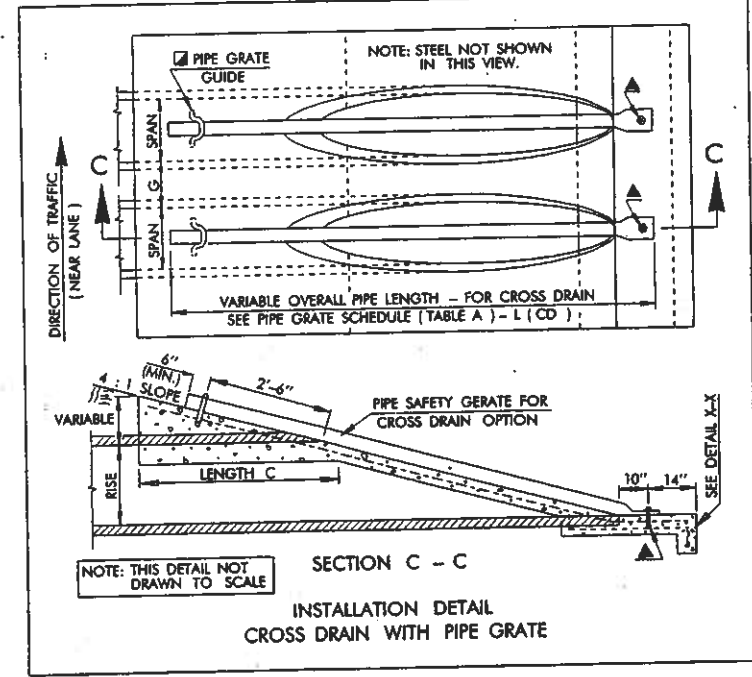
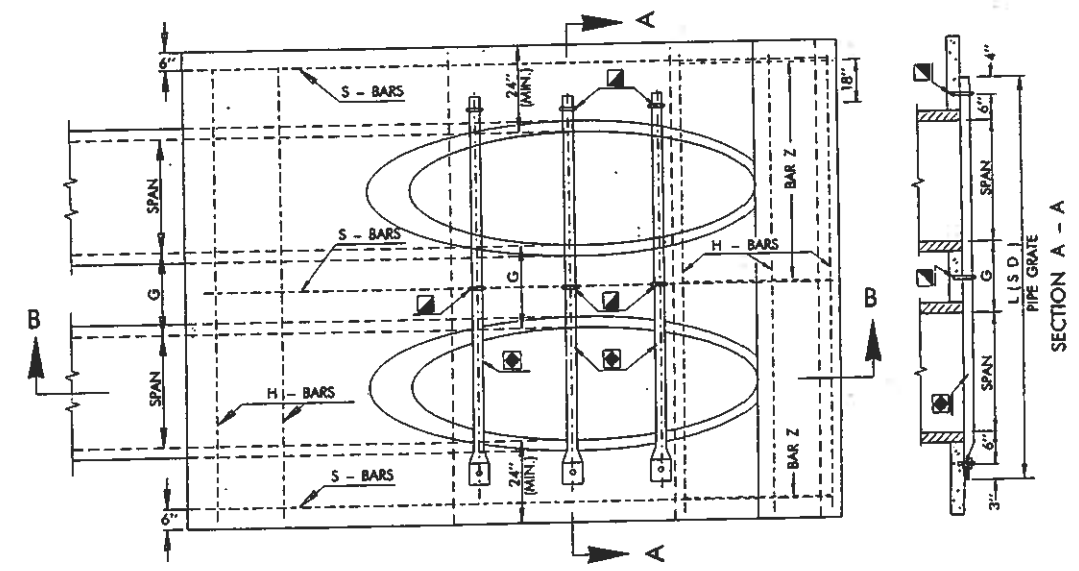
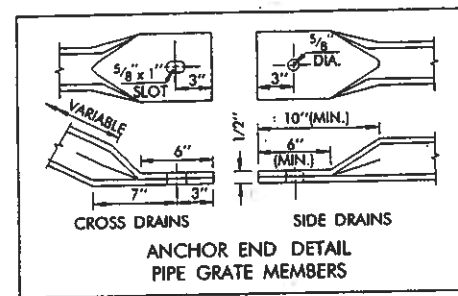
Ⓜ NUMBER OF HORIZONTAL PIPE GRATES FOR SIDE DRAIN OPTIONS.      Ⓞ DIMENSIONS SHOWN AS RISE BY SPAN.

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**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



**TYPICAL ABBREVIATIONS**

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

**BASIS OF PAYMENT**

ITEM NO.	ITEM	UNIT
613.04(CC)	Ⓜ CULVERT END TREATMENT	EA.

- Ⓜ SPECIFY TYPE OF END TREATMENT (EXAMPLE: TYPE BB4 CULVERT END TREATMENT)
- Ⓜ C. E. T. ORIENTATION AND SAFETY GRATE REQUIREMENTS SHALL BE SPECIFIED ON THE SUMMARY OF DRAINAGE STRUCTURES. (SEE TYPICAL ABBREVIATIONS)

APPROVED BY ROADWAY ENGINEER *C.M. Sankowski* DATE 9/1/99

**OKLAHOMA DEPT. OF TRANSPORTATION  
ROADWAY STANDARD (ENGLISH)  
CULVERT END TREATMENT  
DOUBLE PIPE INSTALLATION  
4 TO 1 SAFETY SLOPE**

1999 SPECIFICATIONS      CET4D-2      OOE      R-80CE

- GENERAL NOTES**
- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE 1999 ENGLISH STANDARD SPECIFICATIONS.
  - QUANTITIES SHOWN IN TABLE A ARE FOR ONE END ONLY. CLASS A CONCRETE SHALL CONFORM TO THE MINIMUM REQUIREMENTS OF SECTION 509 OF THE 1999 ENGLISH STANDARD SPECIFICATIONS.
  - TYPES AA4 THROUGH EE4 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 ENGINEER.