

SINGLE PIPE INSTALLATION – 1 TO 4 SAFETY SLOPE										
TABLE A – SCHEDULE OF PIPE SAFETY GRATES – AASHTO DESIGNATED PIPE SIZES (METRIC)										
C. E. T. DESIGN	EQUIV. ROUND DIAMETER	REINF. CONC. ROUND	REINF. CONC. ARCH PIPE	STEEL ARCH PIPE	ALUMINUM ARCH PIPE	REINF. CONC. ELLIPTICAL PIPE	SIDE DRAIN GRATES	CROSS DRAIN GRATES		
TYPE	mm	in.	mm	mm x mm	mm x mm	mm x mm	L (SD) mm	L (CD) mm		
A4	450	18	450	2				950	NONE	
	450	18			560 x 345	2		1060	NONE	
	450	18				510 x 380	2	1010	NONE	
	450	18					365 x 575	1	1075	
B4	525	21			660 x 395	2		1160	NONE	
	600	24	600	3				1100	NONE	
	600	24			725 x 460	2		1225	NONE	
	600	24				680 x 500	2	1180	NONE	
C4	675	27						490 x 770	2	1 @ 3245
	750	30	750	3				550 x 865	2	1 @ 3495
	750	30			920 x 570	3		1250	NONE	
	750	30						1420	1 @ 3575	
D4	800	32						610 x 960	3	1 @ 3740
	825	33						910 x 660	3	1 @ 3945
	900	36	900	4				670 x 1055	3	1 @ 3990
	900	36			1110 x 675	3		1400	1 @ 4935	
E4	900	36						1610	1 @ 4010	
	900	36						1530	1 @ 4275	
	900	36						1650	1 @ 4235	
	1000	39						730 x 1150	3	1 @ 4605
	1050	42	1050	5				1550	1 @ 5555	
	1050	42			1300 x 795	4		1530	1 @ 4500	
	1050	42						855 x 1345	4	1 @ 4750
	1200	48	1200	6				1700	1 @ 6175	
	1200	48			1485 x 915	4		1985	1 @ 5000	
	1200	48						1890	1 @ 5225	
	1200	48						975 x 1535	5	2 @ 5245

⊗ NUMBER OF HORIZONTAL PIPE GRATES FOR SIDE DRAIN OPTIONS

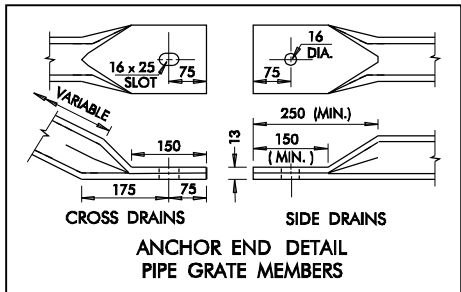
Ⓢ DIMENSIONS SHOWN AS RISE BY SPAN

SINGLE PIPE INSTALLATION – 1 TO 4 SAFETY SLOPE										
TABLE B – SCHEDULE OF DIMENSIONS FOR C. E. T. TYPES (METRIC)										
C.E.T. TYPE	LENGTH A	WIDTH B	WIDTH C	HEIGHT H	HEIGHT K	CONC.	CONC.	STEEL LENGTH		
								H-BARS	H-BARS	S-BARS
A4	3.10	1.675	1.875	1.70	525	225	1.29	1.51	1.575	1.775
B4	3.70	1.825	2.180	1.80	550	350	1.47	1.93	1.725	2.080
C4	4.75	1.980	2.560	2.20	650	500	2.06	2.98	1.885	2.460
D4	5.65	2.285	2.840	2.40	700	675	2.67	3.80	2.185	2.740
E4	6.20	2.435	3.145	2.60	750	750	2.87	4.53	2.335	3.045

Ⓡ ROUND SHAPE CULVERT OPTIONS

Ⓐ ARCH SHAPE CULVERT OPTIONS

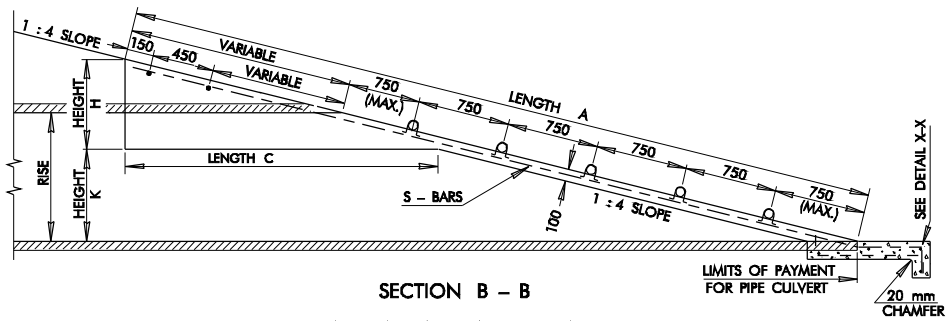
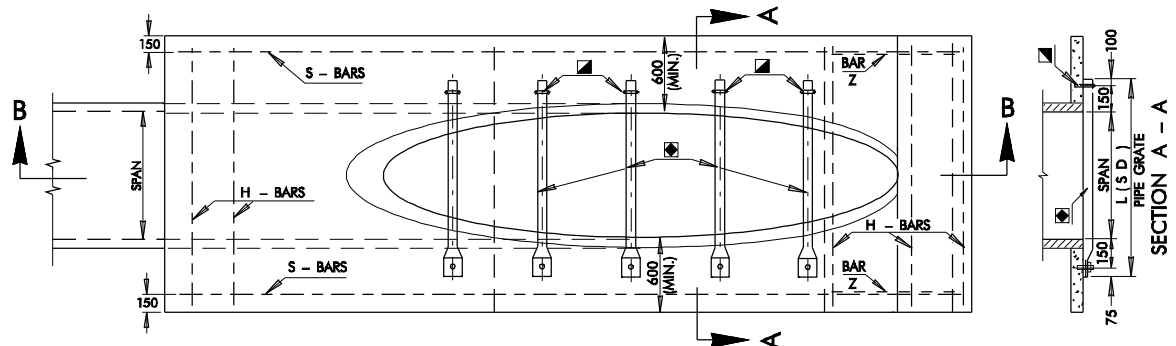
ⓔ HORIZONTAL ELLIPSE SHAPE CULVERT OPTIONS



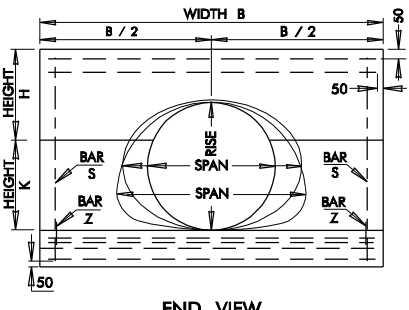
GENERAL NOTES

- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE 1999 METRIC 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 METRIC STANDARD SPECIFICATIONS.
- TYPES A4 THROUGH E4 END SECTIONS, AS SHOWN IN TABLE B, MAY BE USED WITH ANY AASHTO DESIGNATED METAL, ALUMINUM & CONCRETE PIPE SIZES, AS SHOWN IN TABLE A. END SECTION QUANTITIES ARE BASED ON METAL PIPE DIMENSIONS, ZERO 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 1 TO 4 SLOPE.
- PIPE FOR SAFETY GRATES SHALL BE 75 mm x 3.43 kg 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. 13M 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 CLEARZONE.
 - (B) ALL CROSS DRAIN INSTALLATIONS WITH A CULVERT SPAN OF 750 mm 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 NUMBER M14 x 140 mm GALVANIZED BOLT, NUT AND WASHER. THREADS, 45 mm(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 0.061 FOR EACH METER 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 750 mm.

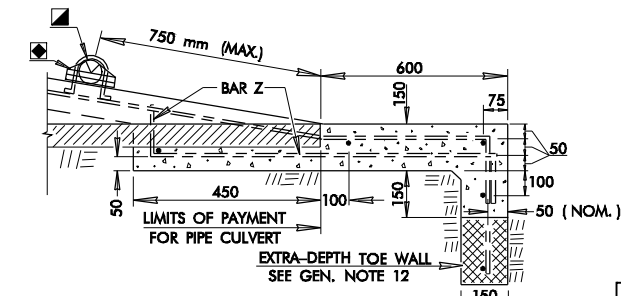
PRECAST CULVERT END TREATMENTS OR OTHER ALTERNATIVE DESIGNS MAY BE USED IF APPROPRIATE DRAWINGS ARE SUBMITTED TO AND APPROVED BY THE ENGINEER.



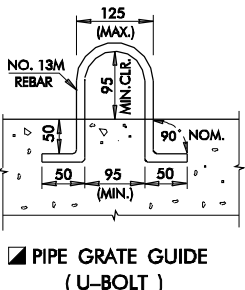
SECTION B – B
INSTALLATION DETAIL
SIDE DRAIN WITH PIPE GRATES



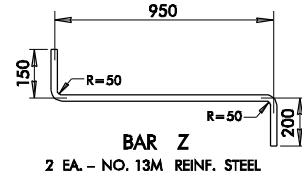
END VIEW
(PIPE GRATES NOT SHOWN THIS VIEW)



DETAIL X – X



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



BASIS OF PAYMENT		
ITEM NO.	ITEM	UNIT
613.06(CC)	CULVERT END TREATMENT	EACH

- SPECIFY TYPE OF END TREATMENT (EXAMPLE: TYPE B4 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		DATE
OKLAHOMA DEPT. OF TRANSPORTATION ROADWAY STANDARD (METRIC) CULVERT END TREATMENT SINGLE PIPE INSTALLATION 1 TO 4 SAFETY SLOPE		
1999 SPECIFICATIONS	CET4S-2	00M
ALL DIMENSIONS ON THIS SHEET IN MILLIMETERS UNLESS OTHERWISE NOTED.		R-80AM