

| SINGLE PIPE INSTALLATION – 1 TO 6 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 | mm x mm | mm x mm | mm | mm |
| A6 | 450 | 18 | 450 | 3 | | | | | 950 | NONE |
| | 450 | 18 | | | 560 x 345 | 2 | | | 1060 | NONE |
| | 450 | 18 | | | | | 510 x 380 | 2 | 510 x 380 | 2 |
| | 450 | 18 | | | | | | | 1010 | NONE |
| B6 | 525 | 21 | | | 660 x 395 | 2 | | | 1075 | NONE |
| | 600 | 24 | 600 | 4 | | | | | 1160 | NONE |
| | 600 | 24 | | | 725 x 460 | 3 | | | 1100 | NONE |
| | 600 | 24 | | | | | 680 x 500 | 3 | 680 x 500 | 3 |
| C6 | 600 | 24 | | | | | | | 1225 | NONE |
| | 600 | 24 | | | | | | | 1180 | NONE |
| | 675 | 27 | | | | | | | 490 x 770 | 3 |
| | 750 | 30 | 750 | 5 | | | | | 1270 | 1 @ 4870 |
| D6 | 750 | 30 | | | 920 x 570 | 4 | | | 1365 | 1 @ 5235 |
| | 750 | 30 | | | | | | | 1250 | NONE |
| | 800 | 32 | | | | | 910 x 660 | 5 | 910 x 660 | 5 |
| | 825 | 33 | | | | | | | 1420 | 1 @ 5360 |
| E6 | 900 | 36 | 900 | 7 | | | | | 610 x 960 | 4 |
| | 900 | 36 | | | 1110 x 675 | 5 | | | 1460 | 1 @ 5600 |
| | 900 | 36 | | | | | 1030 x 740 | 5 | 1030 x 740 | 5 |
| | 900 | 36 | | | | | | | 1410 | 1 @ 5920 |
| E6 | 1000 | 39 | | | | | | | 730 x 1150 | 5 |
| | 1050 | 42 | 1050 | 8 | | | | | 1650 | 1 @ 6330 |
| | 1050 | 42 | | | 1300 x 795 | 6 | | | 1650 | 1 @ 6940 |
| | 1050 | 42 | | | | | | | 1550 | 1 @ 8275 |
| E6 | 1200 | 48 | 1200 | 9 | | | | | 1530 | 1 @ 8725 |
| | 1200 | 48 | | | 1485 x 915 | 7 | | | 855 x 1345 | 7 |
| | 1200 | 48 | | | | | 1390 x 970 | 7 | 1390 x 970 | 7 |
| | 1200 | 48 | | | | | | | 1700 | 1 @ 7090 |
| E6 | 1200 | 48 | | | | | | | 1985 | 1 @ 9190 |
| | 1200 | 48 | | | | | | | 1890 | 1 @ 7790 |
| | 1200 | 48 | | | | | 975 x 1535 | 7 | 2035 | 2 @ 7820 |
| | 1200 | 48 | | | | | | | | |

⊙ NUMBER OF HORIZONTAL PIPE GRATES FOR SIDE DRAIN OPTIONS

⊙ DIMENSIONS SHOWN AS RISE BY SPAN

SINGLE PIPE INSTALLATION – 1 TO 6 SAFETY SLOPE

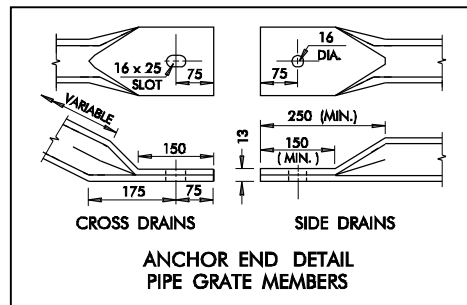
TABLE B – SCHEDULE OF DIMENSIONS FOR C. E. T. TYPES (METRIC)

| C.E.T. TYPE | LENGTH A | WIDTH B | WIDTH B | LENGTH C | HEIGHT H | HEIGHT K | R CONC. | A/E CONC. | STEEL LENGTH | | |
|-------------|----------|---------|---------|----------|----------|----------|---------|-----------|--------------|------------|--------|
| | | | | | | | | | R H-BARS | A/E H-BARS | S-BARS |
| A 6 | 4.55 | 1.675 | 1.875 | 2.55 | 525 | 225 | 1.76 | 2.08 | 1.575 | 1.775 | 5.24 |
| B 6 | 5.45 | 1.825 | 2.180 | 2.70 | 550 | 350 | 2.02 | 2.67 | 1.725 | 2.080 | 6.14 |
| C 6 | 7.00 | 1.980 | 2.560 | 3.30 | 650 | 500 | 2.89 | 4.21 | 1.980 | 2.460 | 6.98 |
| D 6 | 8.35 | 2.285 | 2.840 | 3.60 | 700 | 675 | 3.78 | 5.40 | 2.185 | 2.740 | 8.84 |
| E 6 | 9.10 | 2.435 | 3.145 | 3.90 | 750 | 750 | 4.05 | 6.44 | 2.335 | 3.045 | 9.74 |

(R) ROUND SHAPE CULVERT OPTIONS (VALUES & DIMENSIONS)

(A) ARCH SHAPE CULVERT OPTIONS (VALUES & DIMENSIONS)

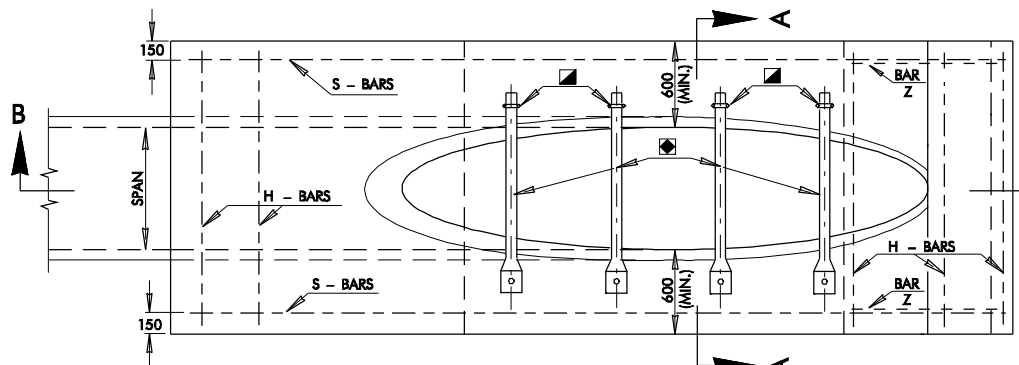
(E) HORIZONTAL ELLIPSE SHAPE CULVERT OPTIONS (VALUES & DIMENSIONS)



GENERAL NOTES

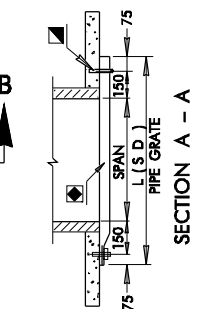
- ALL CONSTRUCTION AND MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE 1999 METRIC STANDARD SPECIFICATIONS.
- QUANTITIES SHOWN IN TABLE A ARE FOR ONE END ONLY. CLASS A CONCRETE SHALL CONFORM TO THE MINIMUM REQUIREMENTS OF SECTION 509 OF THE 1999 METRIC STANDARD SPECIFICATIONS.
- TYPES A6 THROUGH E6 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 6 SLOPE.
- PIPE FOR SAFETY GRATES SHALL BE 75 mm x 3.44 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, IN METERS, TIMES 0.152 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 METRIC DESIGNS MAY BE USED IF APPROPRIATE METRIC DRAWINGS ARE SUBMITTED TO AND APPROVED BY THE ENGINEER.

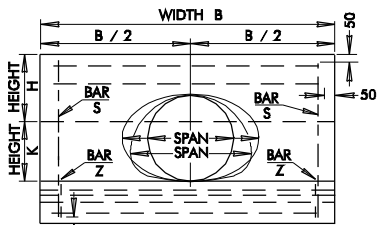


SECTION B – B

INSTALLATION DETAIL
SIDE DRAIN WITH PIPE GRATES

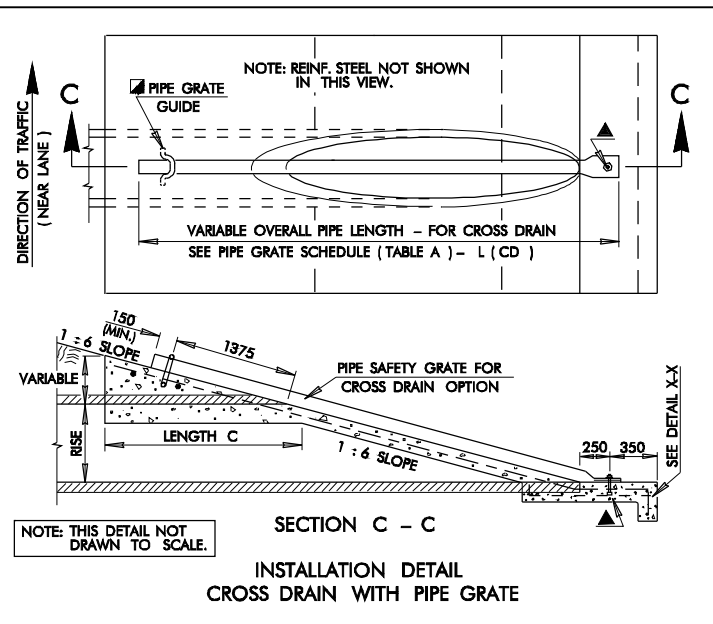


SECTION A – A



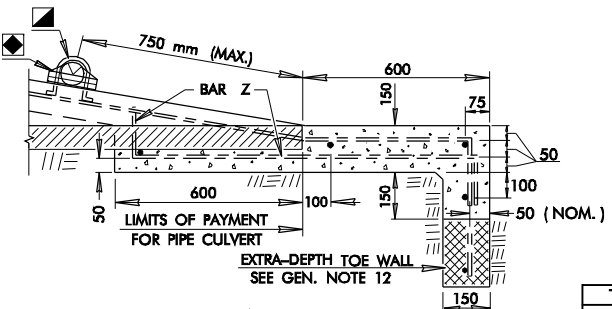
END VIEW

(PIPE GRATES NOT SHOWN THIS VIEW)

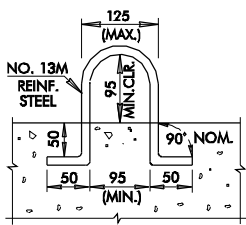


SECTION C – C

INSTALLATION DETAIL
CROSS DRAIN WITH PIPE GRATE

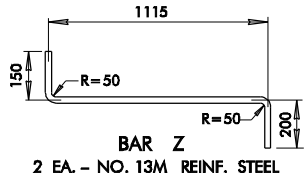


DETAIL X – X



PIPE GRATE GUIDE
(U-BOLT)

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



BAR Z
2 EA. – NO. 13M REINF. STEEL

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

- SPECIFY TYPE OF END TREATMENT (EXAMPLE: TYPE B6 CULVERT END TREATMENT – NG)
- 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 6 SAFETY SLOPE

1999 SPECIFICATIONS

CET6S-2

00M

ALL DIMENSIONS ON THIS SHEET IN MILLIMETERS UNLESS OTHERWISE NOTED.

R-80BM