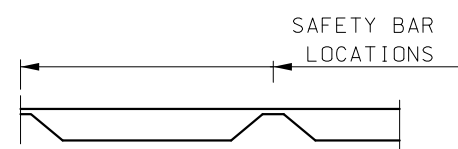
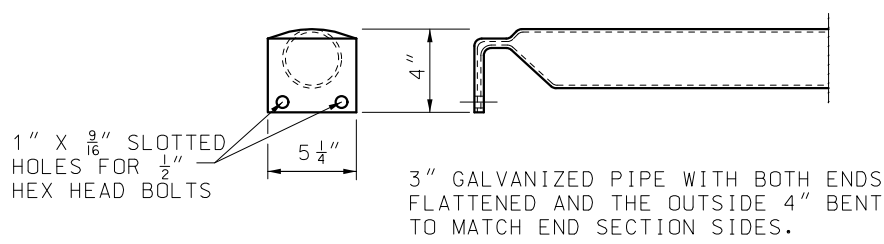


FRONT VIEW CIRCULAR PIPE

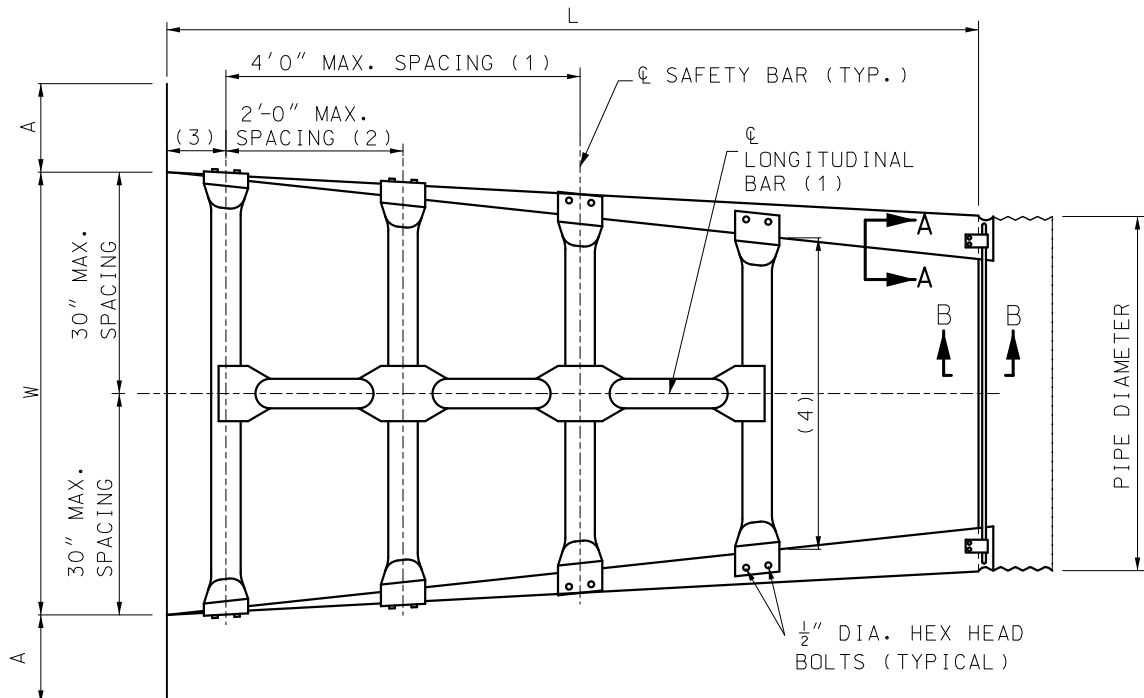
SIDE ELEVATION CIRCULAR SECTION



LONGITUDINAL BAR DETAIL



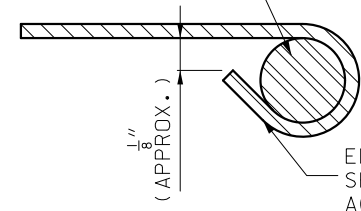
DETAIL OF SAFETY BAR



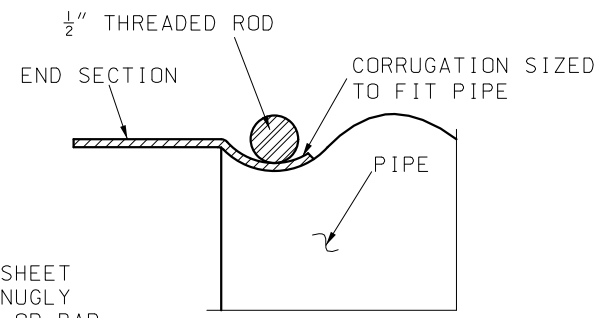
TOP VIEW CIRCULAR SECTION

LONGITUDINAL BAR, WHEN REQUIRED, SHALL BE WELDED TO SAFETY BARS TO FORM SINGLE GRATE STRUCTURE. LONGITUDINAL BAR IS NOT TO BE USED FOR PARALLEL DRAINAGE STRUCTURES.

MINIMUM 7/16" DIAMETER GALVANIZED STEEL ROD OR NO. 4 GALVANIZED REINFORCED BAR



SECTION A-A



SECTION B-B

- NOTES:
- (1) FOR CROSSROAD DRAINAGE STRUCTURES ONLY.
 - (2) FOR PARALLEL DRAINAGE STRUCTURES ONLY.
 - (3) 4" TO 6" MINIMUM
 - (4) SAFETY BARS SHALL BE PROVIDED UNTIL THE LATERAL SPAN OF THE OPENING IS LESS THAN OR EQUAL TO 30".

GENERAL NOTES:

END SECTIONS, INCLUDING ALL BOLTS, NUTS, RODS AND STRAPS, SHALL BE FABRICATED FROM GALVANIZED STEEL MEETING THE REQUIREMENTS OF SECTION 1020.

ALL BOLTS UNLESS OTHERWISE SHOWN SHALL BE ASTM A307 BOLTS.

WHEN REQUIRED, OPTIONAL TOE PLATE EXTENSION SHALL BE PUNCHED OR DRILLED AND BOLTED TO END SECTION TOE PLATE. STEEL FOR TOE PLATE EXTENSION SHALL BE SAME GAUGE AS END SECTION. DIMENSIONS SHALL BE OVERALL WIDTH LESS 6" BY 8" HIGH.

ATTACHMENT TO CIRCULAR PIPES 15" THROUGH 24" DIAMETER SHALL BE MADE WITH TYPE #1 STRAPS. ALL OTHER SIZES SHALL BE ATTACHED WITH TYPE #2 CONNECTORS.

SAFETY BARS AND LONGITUDINAL BARS SHALL BE FABRICATED FROM STEEL PIPE MEETING THE REQUIREMENTS OF ASTM A-53 SCHEDULE 40 SPECIFICATIONS. SAFETY BARS AND LONGITUDINAL BARS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH SECTION 1020 OF STANDARD SPECIFICATIONS.

INSTALLATION SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 725 AND 732 OF THE STANDARD SPECIFICATIONS.

SLOTTED HOLES FOR SAFETY BAR ATTACHMENT SHALL BE PROVIDED FOR ALL END SECTIONS.

MINOR VARIATIONS OF DETAIL WILL BE ACCEPTED TO PERMIT THE USE OF A MANUFACTURER'S STANDARD METHODS OF FABRICATION.

END SECTIONS FABRICATED FROM THICKER METAL THAN INDICATED WILL BE ACCEPTED.

ALL BOLTS SHALL BE 3/8" DIAMETER AND GALVANIZED, UNLESS OTHERWISE SHOWN.

SKIRT SECTION IS DEFINED AS THE FLARED PORTION OF THE END SECTION INCLUDING SIDE AND BOTTOM (CENTER) PANELS AND APRON.

SKIRT SECTION FOR 12" TROUGH 24" PIPES SHALL BE MADE IN ONE PIECE.

SKIRT SECTIONS FOR 30" AND LARGER PIPES MAY BE MADE FROM UP TO 2 SHEETS JOINED BY RIVETING OR BOLTING ON CENTERLINE.

SKIRT SECTIONS FROM 48" AND LARGER PIPES MAY BE MADE FROM UP TO 3 SHEETS JOINED BY RIVETING OR BOLTING EQUAL DISTANCE FROM CENTERLINE.

ALL 3 PIECE SKIRTS FOR 60" PIPES SHALL HAVE 0.109" THICK SIDES AND 0.138" THICK BOTTOM (CENTER) PANELS. WIDTH OF BOTTOM PANELS SHALL BE GREATER THAN 20% OF THE PIPE PERIPHERY CONNECTOR SECTION. CORNER PLATES AND TOE PLATES SHALL BE GALVANIZED AND OF THE SAME OR GREATER THICKNESS AS THE SKIRT.

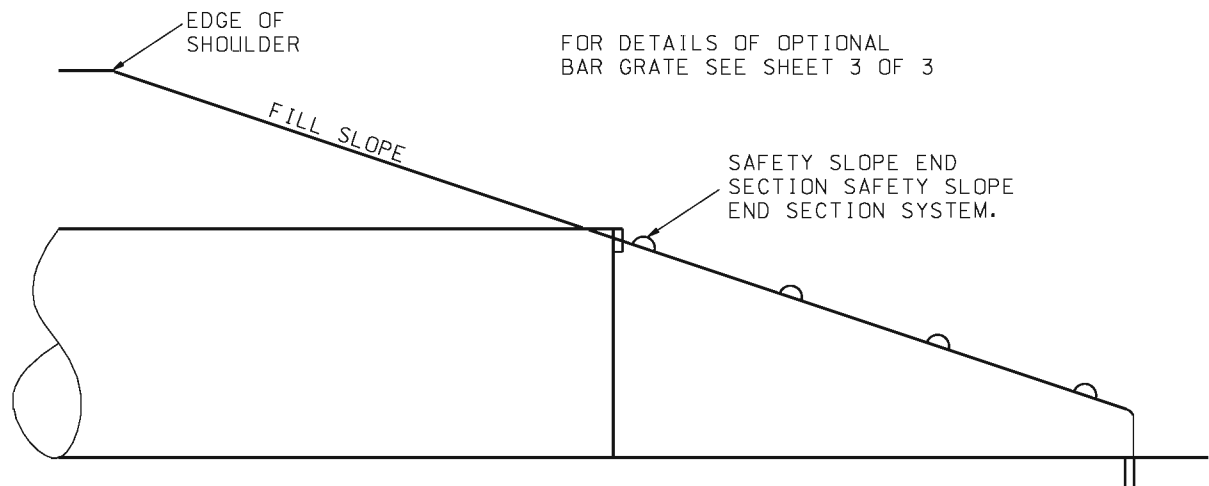
MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
 105 WEST CAPITOL
 JEFFERSON CITY, MO 65102
 1-888-ASK-MODOT (1-888-275-6636)

STATE OF MISSOURI
 TRAVIS D. KOESTNER
 NUMBER PE-30042
 PROFESSIONAL ENGINEER
 THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

SAFETY SLOPE END SECTION

| | | |
|----------------------------|----------------|-----------|
| DATE EFFECTIVE: 01/01/2021 | 732.10H | SHEET NO. |
| DATE PREPARED: 10/14/2020 | | 1 OF 3 |

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PIPE END DETAILS FOR DRAINAGE STRUCTURES
(SINGLE PIPE INSTALLATION)

NOTE:
SEE DRIVEWAY STANDARD PLANS FOR
BEVELED END SECTION REQUIREMENT.

FOR CONNECTION DETAILS, SEE 732.00
SHEET 3 OF 3.

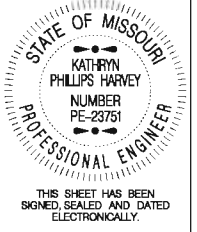
| METAL END SECTIONS FOR CIRCULAR PIPES | | | | | | | | | | | | |
|---------------------------------------|---------------------------------|----------------------------|----------------------|-----------|-----------|---------------|--------------|--------------|-------|--------------|-------|--------------|
| PIPE DIA. (IN.) | MIN. GAUGE ENDS (IN.) 4:1 & 6:1 | MIN. GAUGE ENDS (IN.) 10:1 | DIMENSIONS IN INCHES | | | | L DIMENSIONS | | | | | |
| | | | A 1" TOL. | H 1" TOL. | W 2" TOL. | OVERALL WIDTH | SLOPE | LENGTH (IN.) | SLOPE | LENGTH (IN.) | SLOPE | LENGTH (IN.) |
| 15 | 16 | 12 | 8 | 6 | 21 | 37 | 4:1 | 20 | 6:1 | 30 | 10:1 | 70 |
| 18 | 16 | 12 | 8 | 6 | 24 | 40 | 4:1 | 32 | 6:1 | 48 | 10:1 | 100 |
| 21 | 16 | 12 | 8 | 6 | 27 | 43 | 4:1 | 44 | 6:1 | 66 | 10:1 | 130 |
| 24 | 16 | 12 | 8 | 6 | 30 | 46 | 4:1 | 56 | 6:1 | 84 | 10:1 | 160 |
| 30 | 12 | | 12 | 9 | 36 | 60 | 4:1 | 80 | 6:1 | 120 | 10:1 | 220 |
| 36 | 12 | | 12 | 9 | 42 | 66 | 4:1 | 104 | 6:1 | 156 | 10:1 | 280 |
| 42 | 12 | | 16 | 12 | 48 | 80 | 4:1 | 128 | 6:1 | 192 | | |
| 48 | 12 | | 16 | 12 | 54 | 86 | 4:1 | 152 | 6:1 | 228 | | |
| 54 | 12 | | 16 | 12 | 60 | 92 | 4:1 | 176 | 6:1 | 264 | | |
| 60 | 12 | | 16 | 12 | 66 | 98 | 4:1 | 200 | 6:1 | 300 | | |



MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

SAFETY SLOPE END SECTION



THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

DATE EFFECTIVE: 06/01/2013
DATE PREPARED: 4/1/2013

732.10H

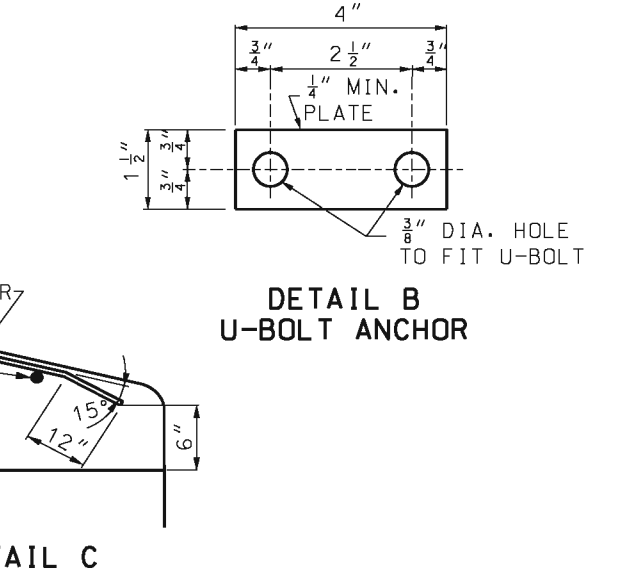
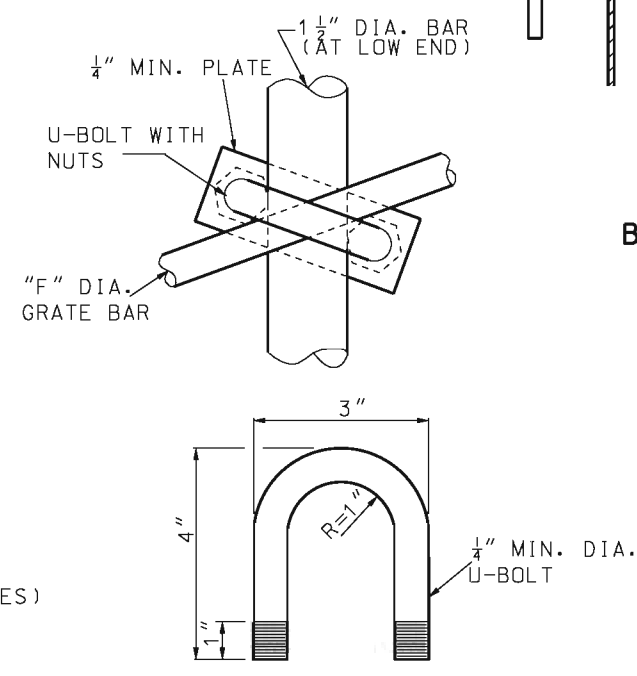
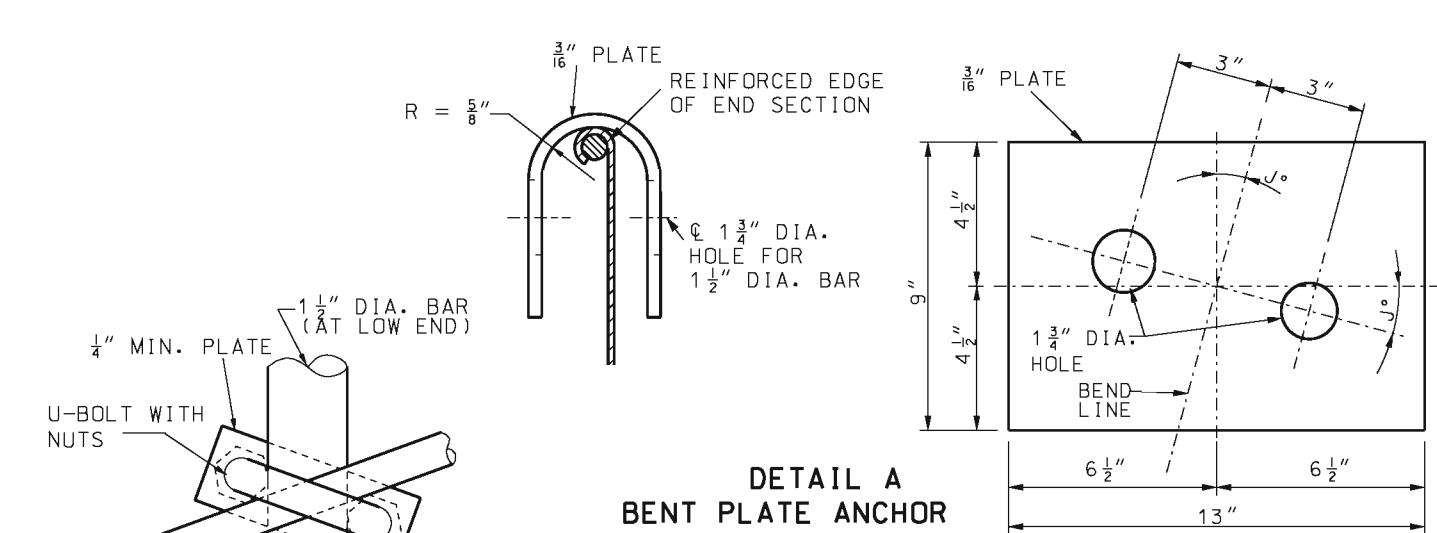
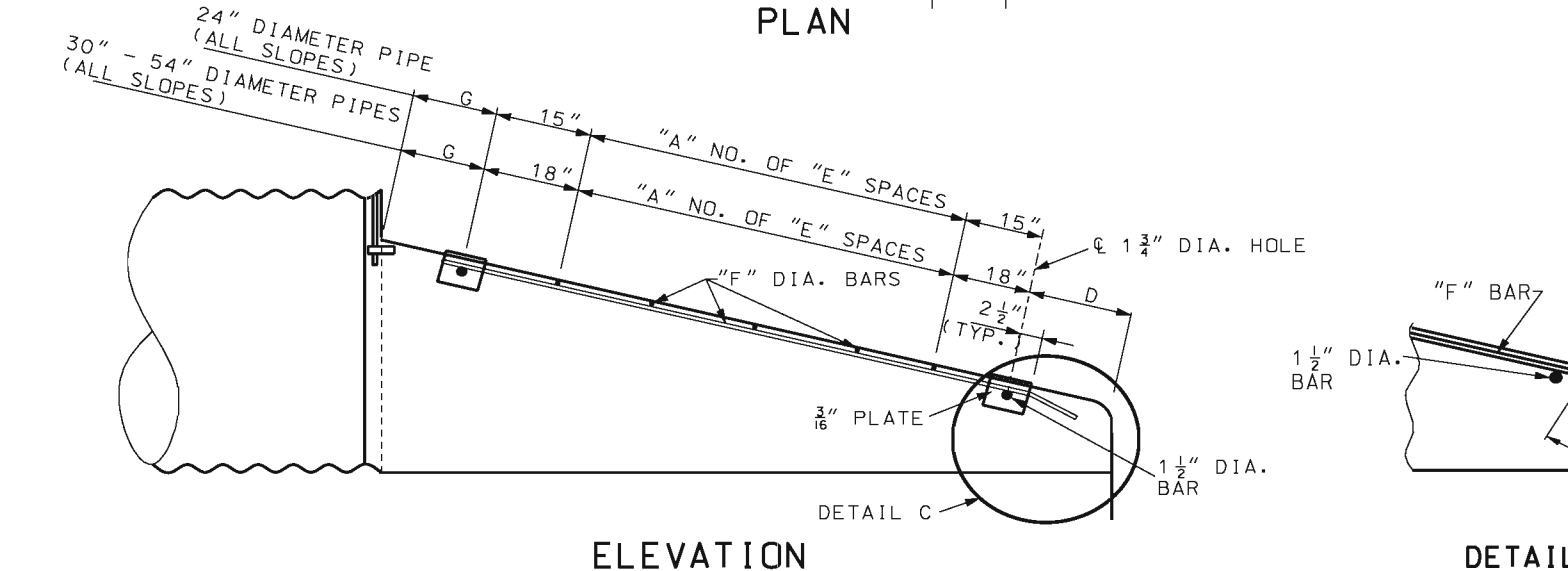
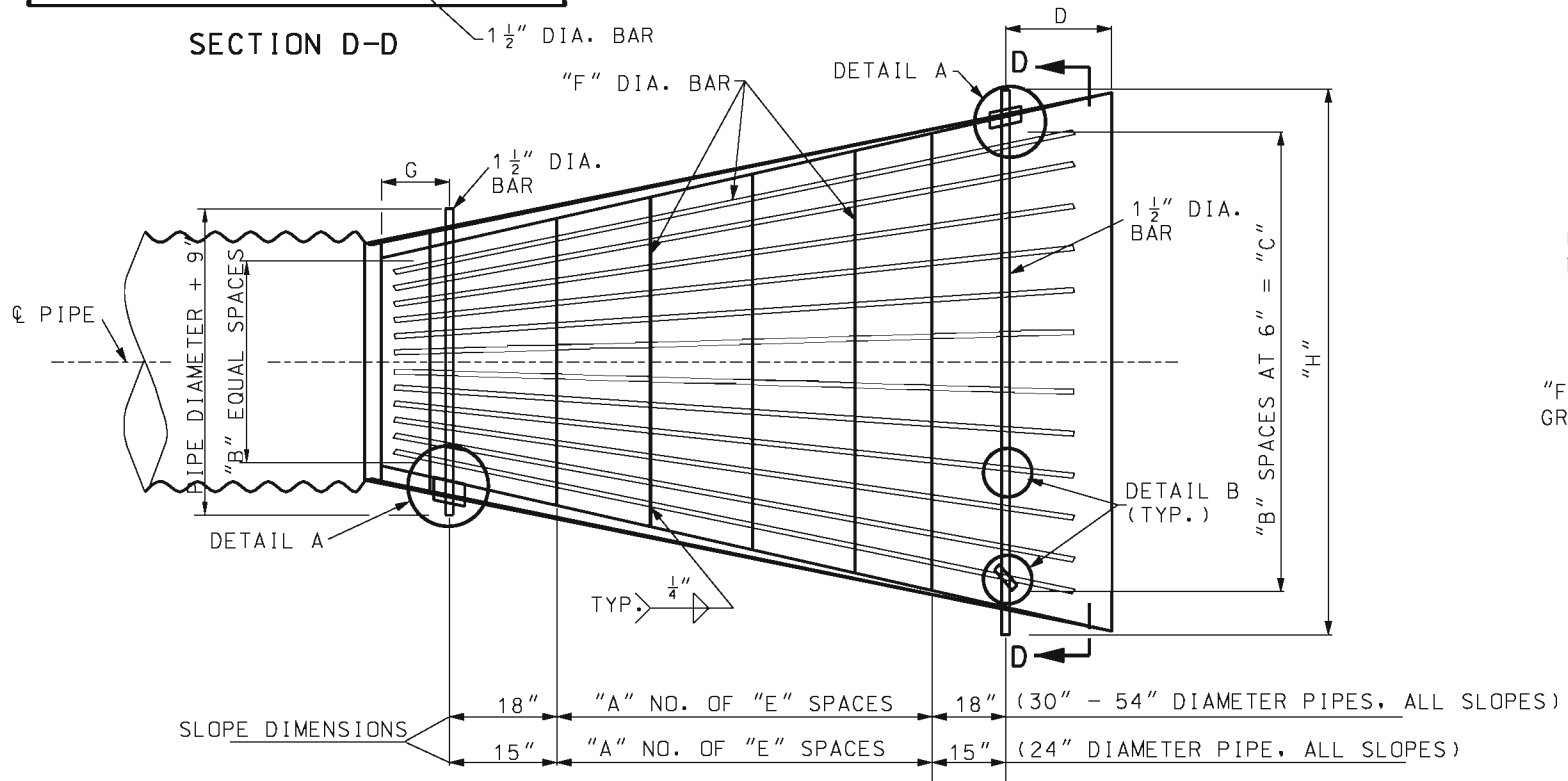
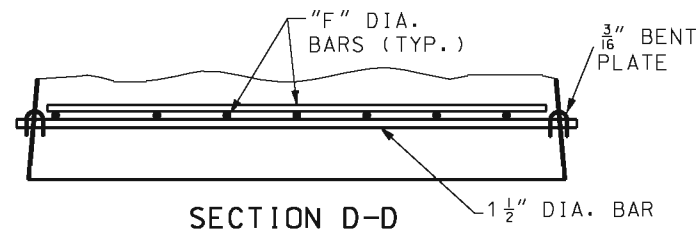
SHEET NO.
2 OF 3

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

BAR GRATE SYSTEM DATA

| DRAIN PIPE SIZE | 3:1 SLOPE | | | | | | | | | 4:1 SLOPE | | | | | | | | | 6:1 SLOPE | | | | | | | | |
|-----------------|-----------|---|-------|--------------------|-----|-------------------|--------------------|-------|-------|-----------|---|-------|--------------------|-----|-------------------|--------------------|-------|-----|-----------|---|-------|--------------------|-----|-------------------|-----|-------|-------|
| | A | B | C | D | E | "F" BARS | G | H | J | A | B | C | D | E | "F" BARS | G | H | J | A | B | C | D | E | "F" BARS | G | H | J |
| 15"* | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18"* | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21"* | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24" | 0 | 4 | 2'-0" | 6" | 15" | $\frac{5}{8}$ " | 8 $\frac{1}{4}$ " | 3'-3" | 18.4° | 0 | 4 | 2'-0" | 15 $\frac{3}{4}$ " | 15" | $\frac{5}{8}$ " | 12" | 3'-3" | 14° | 2 | 4 | 2'-0" | 13 $\frac{1}{8}$ " | 15" | $\frac{5}{8}$ " | 12" | 3'-3" | 9.5° |
| 30" | 0 | 5 | 2'-6" | 15 $\frac{1}{4}$ " | 18" | $\frac{5}{8}$ " | 12" | 3'-9" | 18.4° | 1 | 5 | 2'-6" | 16 $\frac{1}{2}$ " | 18" | $\frac{5}{8}$ " | 12" | 3'-9" | 14° | 3 | 5 | 2'-6" | 19 $\frac{5}{8}$ " | 18" | $\frac{5}{8}$ " | 12" | 3'-9" | 9.5° |
| 36" | 1 | 6 | 3'-0" | 16 $\frac{1}{4}$ " | 18" | $\frac{3}{4}$ " | 12" | 4'-3" | 18.4° | 2 | 6 | 3'-0" | 18" | 18" | $\frac{3}{4}$ " | 17 $\frac{1}{4}$ " | 4'-3" | 14° | 5 | 6 | 3'-0" | 20 $\frac{1}{8}$ " | 18" | $\frac{3}{4}$ " | 12" | 4'-3" | 9.5° |
| 42" | 2 | 7 | 3'-6" | 17 $\frac{1}{4}$ " | 18" | 1" | 12" | 4'-9" | 18.4° | 4 | 7 | 3'-6" | 12" | 18" | 1" | 12" | 4'-9" | 14° | 7 | 7 | 3'-6" | 11 $\frac{7}{8}$ " | 18" | 1" | 9" | 4'-9" | 10.1° |
| 48" | 3 | 8 | 4'-0" | 18" | 18" | 1" | 12 $\frac{5}{8}$ " | 5'-3" | 18.4° | 5 | 8 | 4'-0" | 18" | 18" | 1" | 12 $\frac{5}{8}$ " | 5'-3" | 14° | 7 | 8 | 4'-0" | 13" | 18" | 1" | 9" | 5'-3" | 11.9° |
| 54" | 4 | 9 | 4'-6" | 18" | 18" | 1 $\frac{1}{8}$ " | 13 $\frac{3}{8}$ " | 5'-9" | 18.4° | 6 | 9 | 4'-6" | 18" | 18" | 1 $\frac{1}{8}$ " | 19 $\frac{3}{8}$ " | 5'-9" | 14° | 7 | 9 | 4'-6" | 14 $\frac{1}{4}$ " | 18" | 1 $\frac{1}{8}$ " | 9" | 5'-9" | 13.7° |

* BAR GRATE SYSTEM IS NOT REQUIRED FOR DRAIN PIPE DIAMETER OF 21" OR LESS, FOR SINGLE PIPE INSTALLATIONS.



GENERAL NOTES:

ALL STEEL MATERIAL FOR BAR GRATE SYSTEM SHALL BE IN ACCORDANCE WITH ASTM A575 GRADE 1020 STEEL.

ALL MATERIAL IN GRATE SYSTEM SHALL BE GALVANIZED.

GALVANIZING SHALL BE DONE IN ACCORDANCE WITH ASTM A123.

ALL MATERIALS, FABRICATION AND INSTALLATION OF OPTIONAL BAR GRATE SYSTEM USED IN LIEU OF SAFETY BAR SYSTEM SHALL BE INCLUDED IN CONTRACT UNIT PRICE BID FOR END SECTION (SAFETY SLOPE).

| | | |
|---|--|---|
| | MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION 105 WEST CAPITOL JEFFERSON CITY, MO 65102 1-888-ASK-MODOT (1-888-275-6636) | |
| | | OPTIONAL BAR GRATE SYSTEM FOR SAFETY SLOPE END SECTION |
| DATE EFFECTIVE: 06/01/2013 DATE PREPARED: 4/1/2013 | 732.10H | SHEET NO. 3 OF 3 |

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.