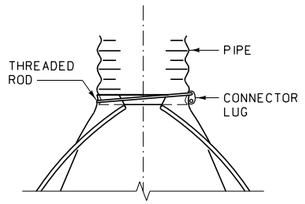
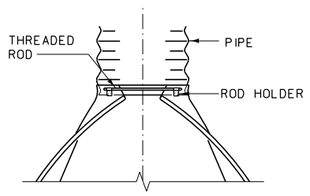
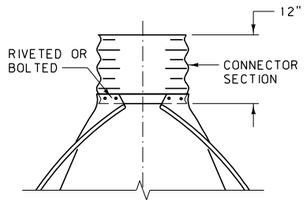
## CONNECTIONS




TYPE 1




TYPE 2




TYPE 3

NOTES:

PROVIDE TOE PLATE WHEN SPECIFIED.

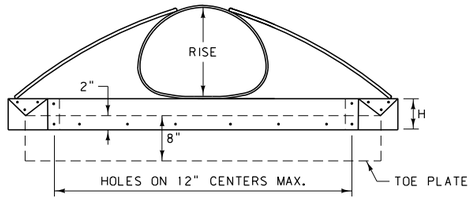
GALVANIZE ALL PARTS IN ACCORDANCE WITH AASHTO M 36.

PAINT ANY AREAS WHERE GALVANIZING IS BROKEN OR METAL IS BARE WITH ONE COAT OF ZINC CHROMATE PRIME AND TWO COATS OF ALUMINUM PAINT.

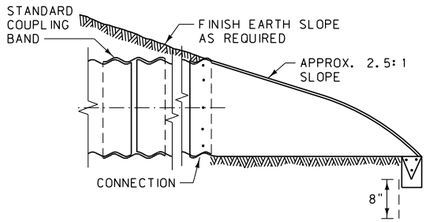
MINOR VARIATIONS IN DESIGN MAY BE ACCEPTABLE ON APPROVAL OF THE ENGINEER.

SEAMS OR JOINTS LENGTHWISE OF THE APRON ARE ACCEPTABLE IF SECURELY BOLTED OR WELDED AND PAINTED AS PROVIDED ABOVE.

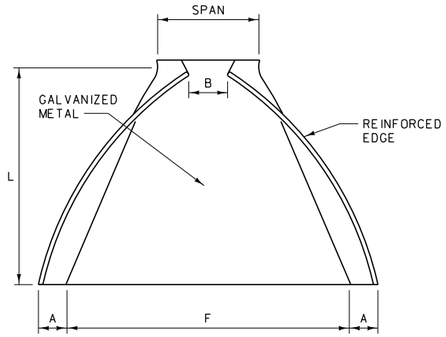
## ARCH PIPE




ELEVATION



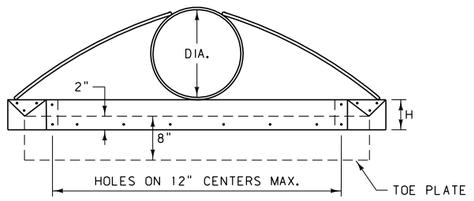

TYPICAL CROSS-SECTION
(ILLUSTRATED WITH TYPE 3 CONNECTION)



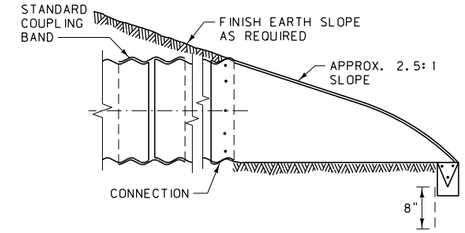

PLAN

| 3" x 1" CORR. SPAN x RISE | MINIMUM THICKNESS | 2⅔"x ½" CORR. SPAN x RISE | MINIMUM THICKNESS | DIMENSIONS A 1" TOL. | B MAX. | H 1" TOL. | L 1½" TOL. | F 2" TOL. | TYPE CONNECTOR |
|---|---|---|---|---|---|---|---|---|---|
| | | 17" x 13" | 0.064" | 7" | 9" | 6" | 19" | 30" | 2 |
| | | 21" x 15" | 0.064" | 7" | 10" | 6" | 23" | 30" | 2 |
| | | 24" x 18" | 0.064" | 8" | 12" | 6" | 28" | 42" | 2 |
| | | 28" x 20" | 0.064" | 9" | 14" | 6" | 32" | 48" | 2 |
| | | 35" x 24" | 0.079" | 10" | 16" | 6" | 39" | 60" | 2 |
| 40" x 31" | 0.079" | 42" x 29" | 0.079" | 12" | 18" | 8" | 46" | 75" | 3 |
| 46" x 36" | 0.109" | 49" x 33" | 0.109" | 13" | 21" | 9" | 53" | 85" | 3 |
| 53" x 41" | 0.109" | 57" x 38" | 0.109" | 18" | 26" | 12" | 63" | 90" | 3 |
| 60" x 46" | 0.109" | 64" x 43" | 0.109" | 18" | 30" | 12" | 70" | 102" | 3 |
| 66" x 51" | 0.109" | 71" x 47" | 0.109" | 18" | 33" | 12" | 77" | 114" | 3 |
| 73" x 55" | 0.109" | 77" x 52" | 0.109" | 18" | 36" | 12" | 77" | 126" | 3 |
| 81" x 59" | 0.109" | 83" x 57" | 0.109" | 18" | 36" | 12" | 77" | 138" | 3 |

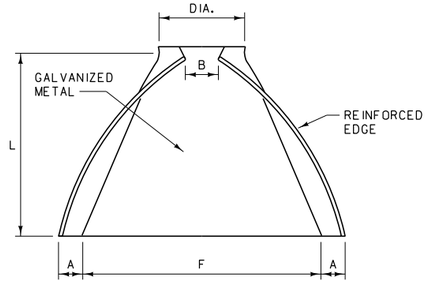
## ROUND PIPE




ELEVATION




TYPICAL CROSS-SECTION
(ILLUSTRATED WITH TYPE 3 CONNECTION)




PLAN

| PIPE DIA. | MINIMUM THICKNESS | DIMENSIONS A 1" TOL. | B MAX. | H 1" TOL. | L 1½" TOL. | F 2" TOL. | TYPE CONNECTOR |
|---|---|---|---|---|---|---|---|
| 12" | 0.064" | 6" | 6" | 6" | 21" | 24" | 1 |
| 15" | 0.064" | 7" | 8" | 6" | 26" | 30" | 1 |
| 18" | 0.064" | 8" | 10" | 6" | 31" | 36" | 1 |
| 21" | 0.064" | 9" | 12" | 6" | 36" | 42" | 1 |
| 24" | 0.064" | 10" | 13" | 6" | 41" | 48" | 1 |
| 30" | 0.079" | 12" | 16" | 8" | 51" | 60" | 2 |
| 36" | 0.079" | 14" | 19" | 9" | 60" | 72" | 2 |
| 42" | 0.109" | 16" | 22" | 11" | 69" | 84" | 3 |
| 48" | 0.109" | 18" | 27" | 12" | 78" | 90" | 3 |
| 54" | 0.109" | 18" | 30" | 12" | 84" | 102" | 3 |
| 60" | 0.109" | 18" | 33" | 12" | 87" | 114" | 3 |
| 66" | 0.109" | 18" | 36" | 12" | 87" | 120" | 3 |
| 72" | 0.109" | 18" | 39" | 12" | 87" | 126" | 3 |
| 78" | 0.109" | 18" | 42" | 12" | 87" | 132" | 3 |
| 84" | 0.109" | 18" | 45" | 12" | 87" | 138" | 3 |

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603, 709

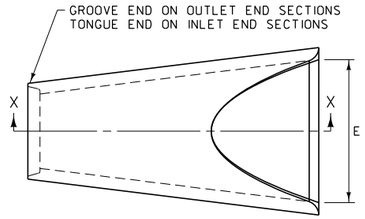
DWG. NO. 603-02

CMP FLARED END TERMINAL SECTION (FETS)

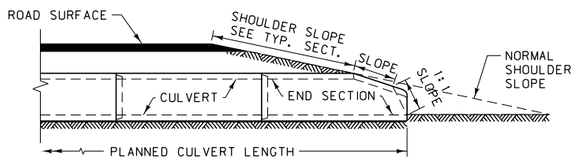
EFFECTIVE: FEBRUARY 2005

MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION

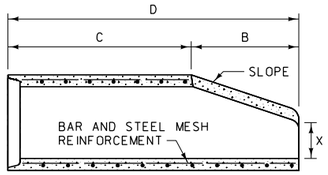
## TYPE "A"



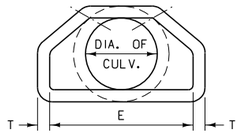

PLAN




SLOPE DETAIL




SECTION X-X



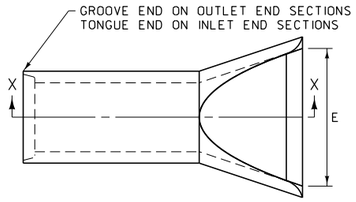

END VIEW

| TYPE "A" | | | | | | | |
|---|---|---|---|---|---|---|---|
| DIA. | SLOPE | X | B | C | D | E | T * |
| 12" | 2.4:1 | 4" | 2'-0" | 4'-0" | 6'-0" | 2'-0" | 2" |
| 15" | 2.4:1 | 6" | 2'-3" | 3'-9" | 6'-0" | 2'-6" | 2¼" |
| 18" | 2.3:1 | 9" | 2'-3" | 3'-9" | 6'-0" | 3'-0" | 2½" |
| 24" | 2.5:1 | 9½" | 3'-7½" | 2'-4½" | 6'-0" | 4'-0" | 3" |
| 30" | 2.5:1 | 1'-0" | 4'-6" | 1'-6" | 6'-0" | 5'-0" | 3½" |
| 36" | 2.5:1 | 1'-3" | 5'-3" | 2'-11" | 8'-2" | 6'-0" | 4" |
| 42" | 2.5:1 | 1'-9" | 5'-3" | 2'-11" | 8'-2" | 6'-6" | 4½" |
| 48" | 2.5:1 | 2'-0" | 6'-0" | 2'-2" | 8'-2" | 7'-0" | 5" |
| 54" | 2.0:1 | 2'-3" | 5'-5" | 2'-9½" | 8'-2½" | 7'-6" | 5½" |

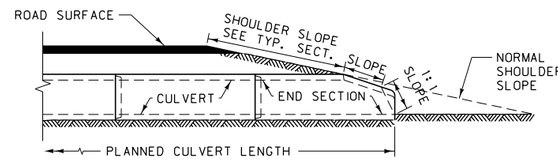
* WALL "B" THICKNESS

TOLERANCES IN THE ADJACENT TABLES MAY NOT VARY MORE THAN ±1.5% FOR THE DIMENSIONS SHOWN. OTHERWISE THEY MUST CONFORM TO AASHTO M 170.

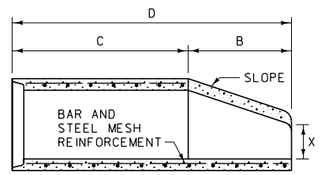
## TYPE "B"



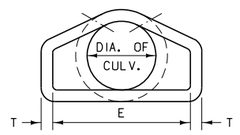

PLAN




SLOPE DETAIL




SECTION X-X

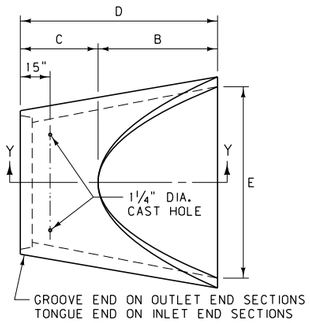



END VIEW

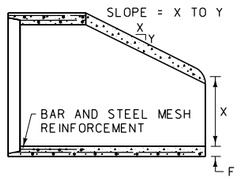
| TYPE "B" | | | | | | | |
|---|---|---|---|---|---|---|---|
| DIA. | SLOPE | X | B | C | D | E | T * |
| 12" | 2.4:1 | 4" | 2'-0" | 4'-0" | 6'-0" | 2'-0" | 2" |
| 15" | 2.4:1 | 6" | 2'-3" | 3'-9" | 6'-0" | 2'-6" | 2¼" |
| 18" | 2.3:1 | 9" | 2'-3" | 3'-9" | 6'-0" | 3'-0" | 2½" |
| 24" | 2.5:1 | 9½" | 3'-7½" | 2'-4½" | 6'-0" | 4'-0" | 3" |
| 30" | 2.5:1 | 1'-0" | 4'-6" | 1'-6" | 6'-0" | 5'-0" | 3½" |
| 36" | 2.5:1 | 1'-3" | 5'-3" | 2'-11" | 8'-2" | 6'-0" | 4" |
| 42" | 2.5:1 | 1'-9" | 5'-3" | 2'-11" | 8'-2" | 6'-6" | 4½" |
| 48" | 2.5:1 | 2'-0" | 6'-0" | 2'-2" | 8'-2" | 7'-0" | 5" |
| 54" | 2.0:1 | 2'-3" | 5'-5" | 2'-9½" | 8'-2½" | 7'-6" | 5½" |

* WALL "B" THICKNESS

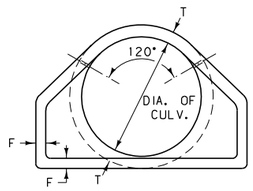
## LARGE DIAMETER PIPE




PLAN



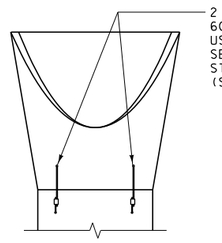

SECTION Y-Y




END VIEW

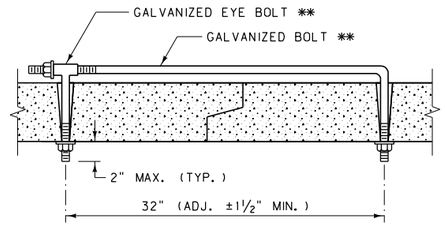
| LARGE DIAMETER CULVERT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DIA. | SLOPE | T * | X | B | C | D | E | F |
| 60" | 1.9:1 | 6" | 2'-11" | 5'-0" | 3'-3" | 8'-3" | 8'-0" | 5" |
| 66" | 1.7:1 | 6½" | 2'-6" | 6'-0" | 2'-3" | 8'-3" | 8'-6" | 5½" |
| 72" | 1.9:1 | 7" | 3'-0" | 6'-6" | 1'-9" | 8'-3" | 9'-0" | 6" |
| 78" | 1.8:1 | 7½" | 3'-0" | 7'-6" | 1'-9" | 9'-3" | 9'-6" | 6½" |
| 84" | 1.5:1 | 8" | 3'-0" | 7'-6½" | 1'-9" | 9'-3½" | 10'-0" | 6½" |
| 90" | 1.5:1 | 8½" | 3'-5" | 7'-3½" | 2'-0" | 9'-3½" | 11'-0" | 6½" |

* WALL "B" THICKNESS



TIE BOLT CONNECTION

2 TIE BOLTS EACH AT 60° TO THE VERTICAL, USED TO TIE END SECTION TO ADJACENT STRAIGHT SECTION. (SEE TIE BOLT DETAIL.)




** ¾" FOR 12" TO 54" DIA. RCP
1" FOR 60" TO 84" DIA. RCP

TIE BOLT DETAIL
(TWO PER END SECTION)

TIE BOLTS: USE TWO TIE BOLTS ON ALL FLARED END SECTIONS, ONE ON EACH SIDE AT 60° TO THE VERTICAL. GALVANIZE ALL PARTS. SEE TIE BOLT DETAIL.

CONSTRUCTION: CONSTRUCT ACCORDING TO CLASS III, AASHTO M 170, AS FAR AS DESIGN WILL PERMIT.

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603, 708

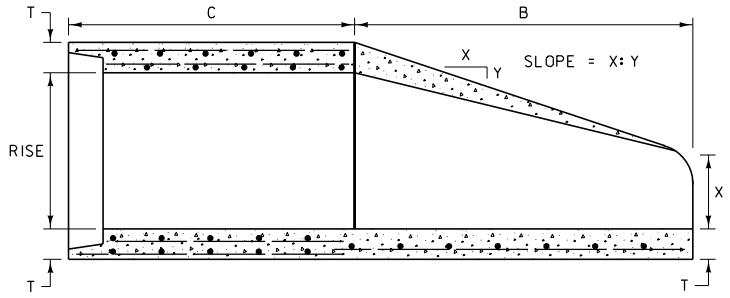
DWG. NO. 603-08

PREFABRICATED RCP FLARED END TERMINAL SECTION (FETS)

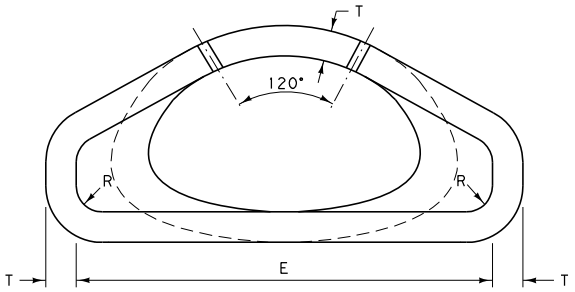
--REVISED-- January 2008

EFFECTIVE: FEBRUARY 2005

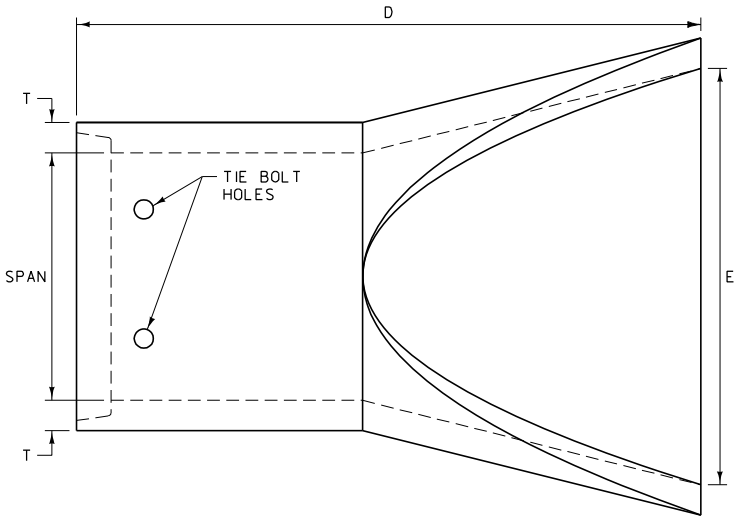
MONTANA DEPARTMENT OF TRANSPORTATION
serving you with pride



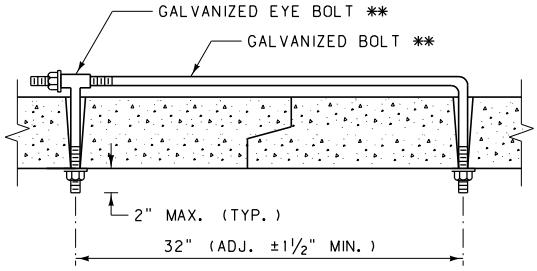

LONGITUDINAL SECTION




END VIEW




PLAN VIEW




** ¾" FOR 18" TO 54" EQUIV. SIZE
1" FOR 60" TO 72" EQUIV. SIZE

TIE BOLT DETAIL
(TWO PER END SECTION)

TIE BOLTS: USE TIE BOLTS ON ALL FLARED END SECTIONS, ONE ON EACH SIDE AT 60° TO THE VERTICAL. GALVANIZE ALL PARTS. SEE TIE BOLT DETAIL.

CONSTRUCTION: CONSTRUCT ACCORDING TO CLASS A-III, AASHTO M 206, AS FAR AS DESIGN WILL PERMIT.

| EQUIV. SIZE | SPAN | RISE | T * | X | B | C | D | E | R | SLOPE |
|---|---|---|---|---|---|---|---|---|---|---|
| 18" | 22" | 13½" | 2½" | 7" | 27" | 45" | 72" | 36" | 3" | 3:1 |
| 24" | 28½" | 18" | 3½" | 8½" | 39" | 33" | 72" | 48" | 3" | 3:1 |
| 30" | 36¼" | 22½" | 4" | 9½" | 50" | 46" | 96" | 60" | 3" | 3:1 |
| 36" | 43¾" | 26⅝" | 4½" | 11⅛" | 60" | 36" | 96" | 72" | 6" | 3:1 |
| 42" | 51⅛" | 31⅝" | 4½" | 15 13/16" | 60" | 36" | 96" | 78" | 6" | 3:1 |
| 48" | 58½" | 36" | 5" | 21" | 60" | 36" | 96" | 84" | 6" | 3:1 |
| 54" | 65" | 40" | 5½" | 25½" | 60" | 36" | 96" | 90" | 6" | 3:1 |
| 60" | 73" | 45" | 6" | 31" | 60" | 36" | 96" | 96" | 6" | 3:1 |
| 72" | 88" | 54" | 7" | 31" | 60" | 36" | 96" | 120" | 6" | 2:1 |
| 84" | 102" | 62" | 8" | 21½" | 84" | 24" | 108" | 144" | 6" | 2:1 |

* WALL "B" THICKNESS

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603

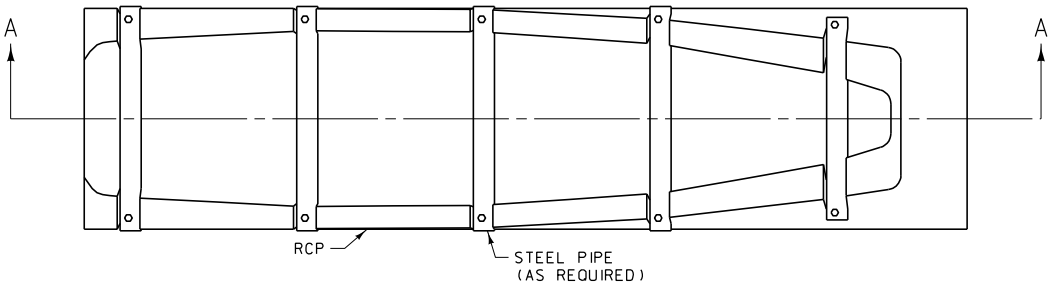
DWG. NO. 603-10

PREFABRICATED RCP ARCH FLARED END TERMINAL SECTION (FETS)

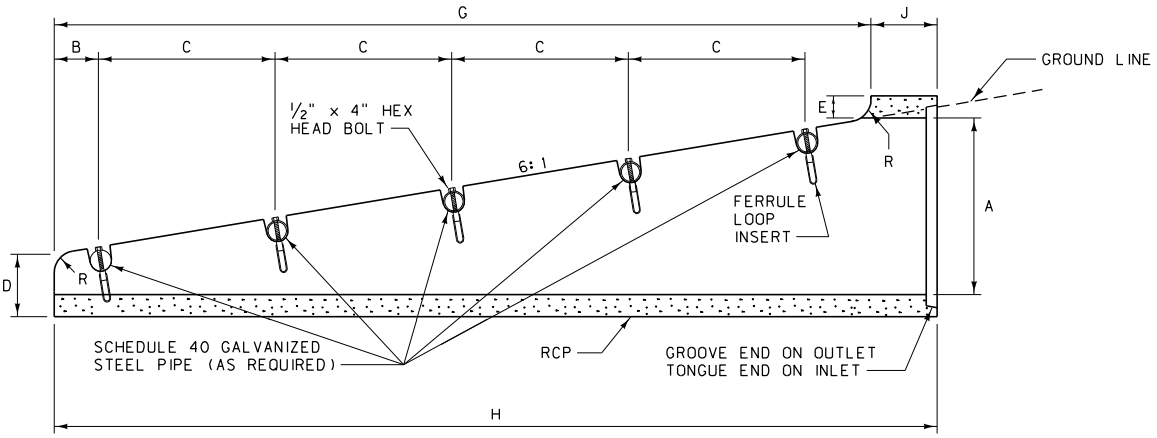
EFFECTIVE: FEBRUARY 2005

MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION

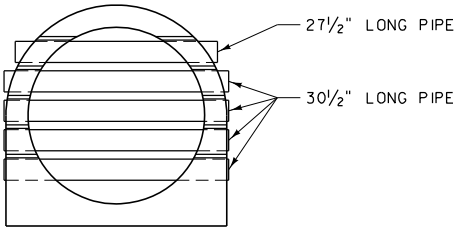
| ROAD APPROACH CULVERT END TREATMENT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| QUANTITIES (FOR ESTIMATING ONLY) | | | | | | | | | | |
| DIA. A RCP | H PIPE LENGTH | F-64½" x 4⅛" FERRULE LOOP INSERT (EACH) | LENGTH 2½" DIA. SCHEDULE 40 GALV. PIPE | DIMENSIONS (FT.) | | | | | | |
| | | | | B | C | D | E | G | R | J |
| 15" | 4.75' | ~ | ~ | ~ | ~ | 0.69 | 0.27 | 4.0 | 0.25 | 0.75 |
| 18" | 6.5' | ~ | ~ | ~ | ~ | 0.71 | 0.25 | 5.75 | 0.25 | 0.75 |
| 24" | 10.0' | 10 | 12.5' | 0.5 | 2.0 | 0.75 | 0.21 | 9.25 | 0.25 | 0.75 |



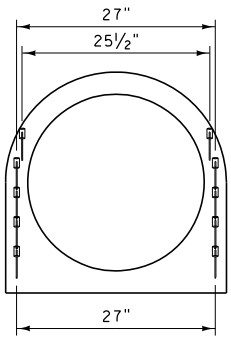

PLAN VIEW




SECTION A-A



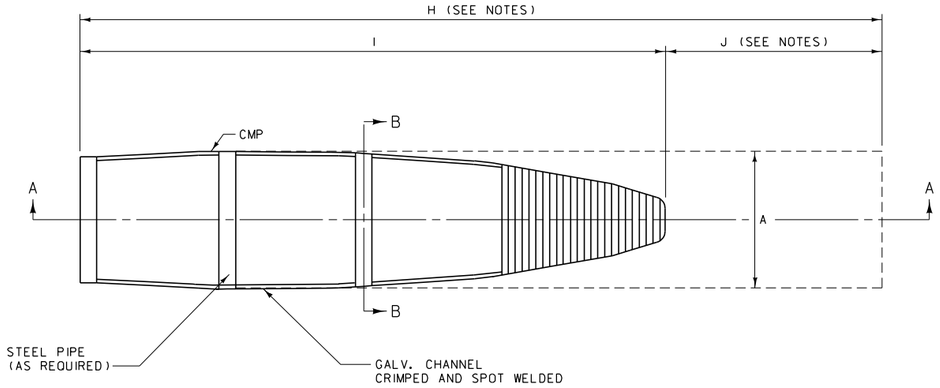

END VIEW



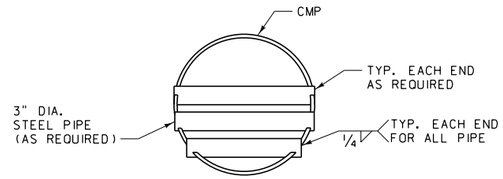

VIEW OF INSERTS

NOTE:
PAINT ALL NON-GALVANIZED PARTS
IN ACCORDANCE WITH SECTION 710
OF THE STANDARD SPECIFICATIONS.

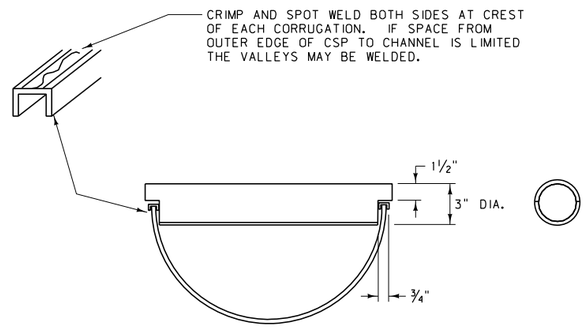
| DETAILED DRAWING | |
|---|---|
| REFERENCE STANDARD SPEC. SECTION 603, 710 | DWG. NO. 603-12 |
| RCP ROAD APPROACH CULVERT END TREATMENT (RACET) | |
| EFFECTIVE: FEBRUARY 2005 | |
| MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION | |



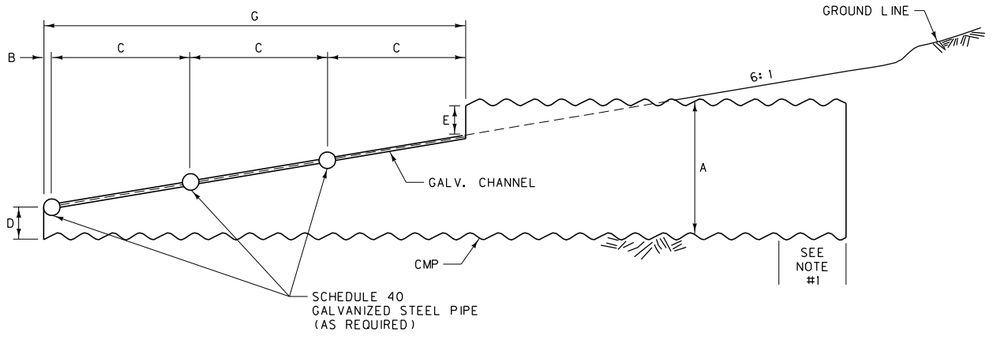

PLAN VIEW




END VIEW




SECTION B-B




SECTION A-A

ILLUSTRATED WITH 24"
CMP (30" CMP UTILIZES
FOUR GALV. STEEL PIPES)

| ROAD APPROACH CULVERT END TREATMENT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| QUANTITIES (FOR ESTIMATING ONLY) | | | | | | | | | | |
| DIA. A CMP | H PIPE LENGTH | 3/4" x 3/8" x 1/8" GALV. CHANNEL | LENGTH 3" DIA SCHEDULE 40 GALV. PIPE | DIMENSIONS (FT.) | | | | | | |
| | | | | B | C | D | E | G | I | J |
| 15" | 7.0' | 10' | ~ | ~ | ~ | 0.20 | 0.20 | 5.0 | 6.0 | 1.0 |
| 18" | 8.0' | 10' | ~ | ~ | ~ | 0.33 | 0.33 | 5.0 | 7.0 | 1.0 |
| 24" | 10.0' | 12' | 6.0' | 0.15 | 1.95 | 0.50 | 0.50 | 6.0 | 9.0 | 1.0 |
| 30" | 12.5' | 16' | 10.0' | 0.20 | 1.95 | 0.60 | 0.60 | 8.0 | 11.5 | 1.0 |

NOTES:

1) PIPE TO HAVE ANNULAR CORRUGATION OR REROLLED ENDS. USE ONLY APPROVED COUPLING BAND PER STANDARD SPECIFICATION 709.02 CMP. FOR RCP END TREATMENT, SEE DTL. DWG. NO. 603-26 FOR CONNECTION.

2) THE TWO 3/4" CHANNELS MAY BE ELIMINATED FROM THE CULVERT END TREATMENT IF:

   A. THE CULVERT IS FABRICATED WITH 12 GAGE (0.109" THICK) MATERIAL.

   B. HALF CIRCLE NOTCHES ARE CUT IN THE CULVERT FOR THE STEEL PIPE WITH CONTINUOUS WELD OF THE PERIPHERY IN CONTACT PROVIDED.

   C. ALL WELDS AND OTHER NON-GALVANIZED PARTS ARE PAINTED IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 710.

3) CONNECTIONS MADE PER DTL. DWG. NO. 603-26 REQUIRE PIPE LENGTHS H AND J TO BE INCREASED BY 3".

DETAILED DRAWING

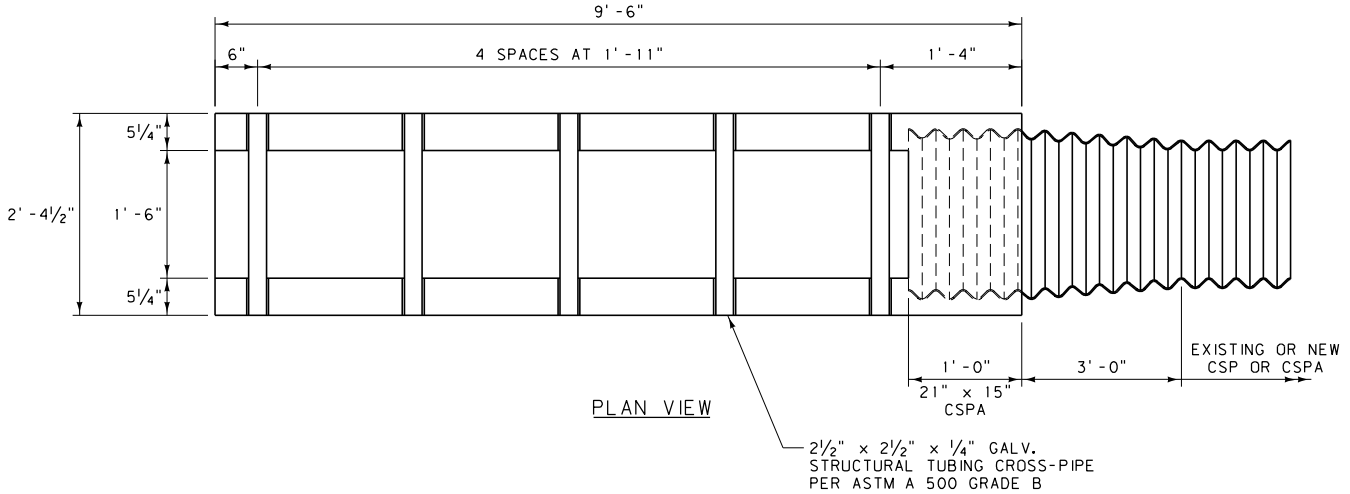
REFERENCE STANDARD SPEC. SECTION 603, 709, 710

DWG. NO. 603-14

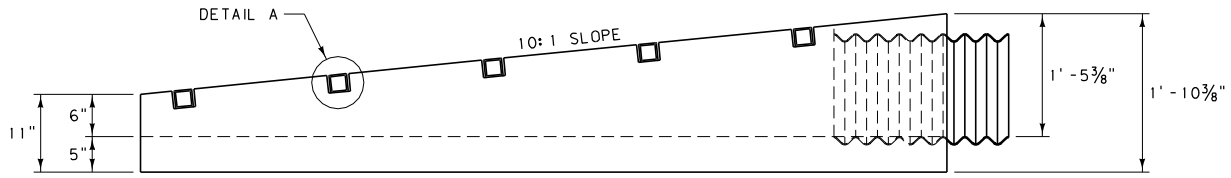
CMP ROAD APPROACH CULVERT END TREATMENT (RACET)

EFFECTIVE: FEBRUARY 2005

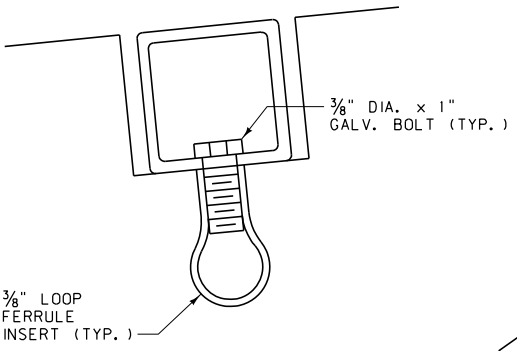
MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION



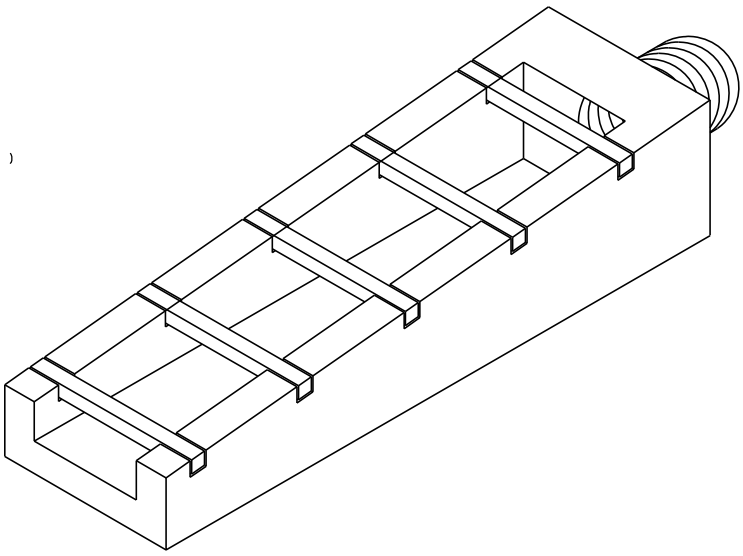

PLAN VIEW




ELEVATION

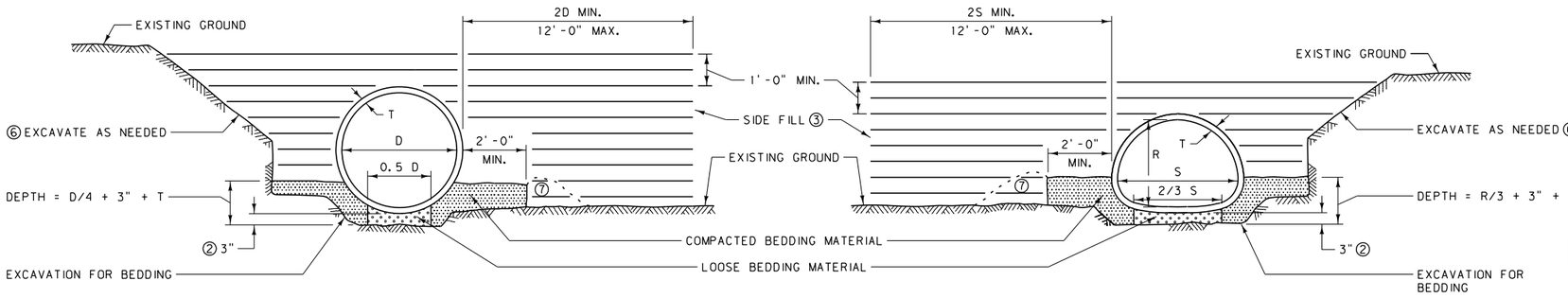



DETAIL A

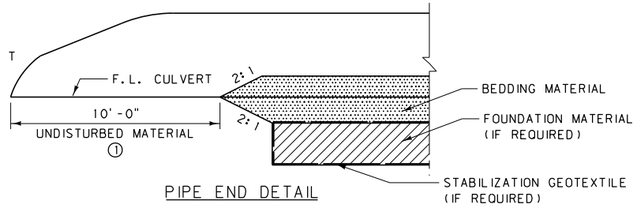


NOTE:
PAINT ALL EXPOSED METAL PARTS WITH ONE COAT OF ZINC RICH PAINT AND TWO COATS OF ALUMINUM PAINT ACCORDING TO STANDARD SPECIFICATION SECTION 710.

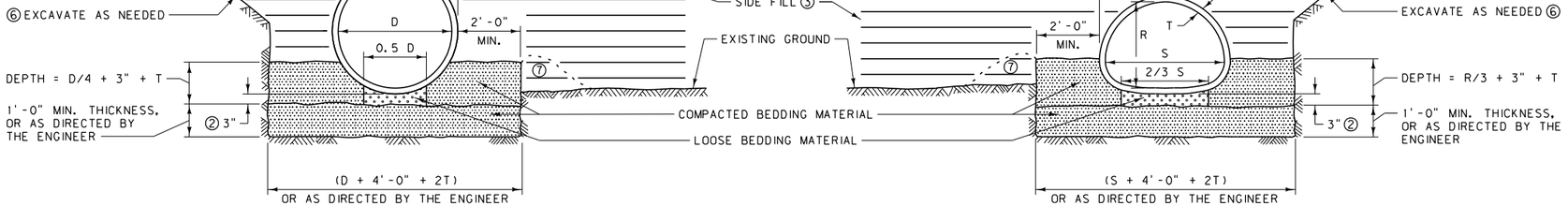
| DETAILED DRAWING | |
|---|---|
| REFERENCE STANDARD SPEC. SECTION 603, 708, 710 | DWG. NO. 603-17 |
| PRECAST MEDIAN U-TURN CROSS DRAIN AND CONC. BEVELED END | |
| EFFECTIVE: FEBRUARY 2005 | |
| MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION | |



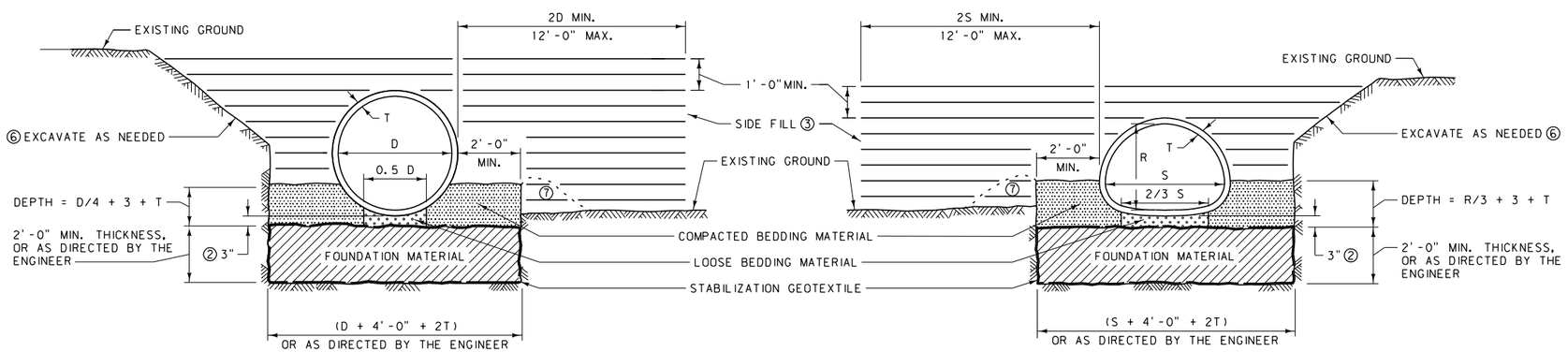

1-STANDARD BEDDING INSTALLATION




PIPE END DETAIL




2-ROCK




3-FOUNDATION STABILIZATION

NOTES:

① DO NOT EXTEND BEDDING MATERIAL TO THE END OF THE PIPE. LEAVE 10' OF UNDISTURBED MATERIAL AT EACH END UNLESS OTHERWISE NOTED IN PLANS. SEE PIPE END DETAIL.

② PLACE LOOSE BEDDING MATERIAL UNIFORMLY IN THE BOTTOM OF THE TRENCH AND SHAPE TO FIT BOTTOM OF PIPE. THE MINIMUM THICKNESS BEFORE PLACING PIPE IS 3". 42" AND 48" RCP IRR. REQUIRE 4" DEPTH OF LOOSE BEDDING MATERIAL TO ACCOMODATE BELL THICKNESS. AFTER LAYING CULVERT, COMPACT BEDDING MATERIAL AT HAUNCHES AND SIDES OF PIPE.

③ COMPACT SIDE FILL IN 6" LOOSE LAYERS TO DENSITY SPECIFIED FOR ADJACENT EMBANKMENT. SEE SECTION 203.03.3 OF THE STANDARD SPECIFICATIONS FOR THE DENSITY REQUIREMENTS.

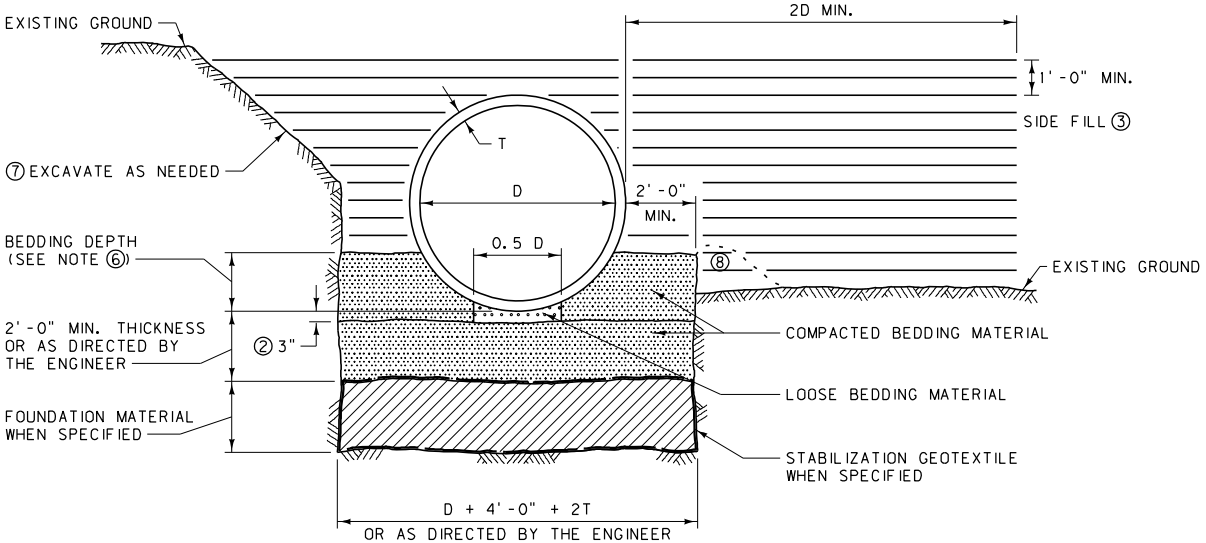
④ SEE SECTION 701.04 OF THE STANDARD SPECIFICATIONS FOR BEDDING AND FOUNDATION MATERIAL REQUIREMENTS.

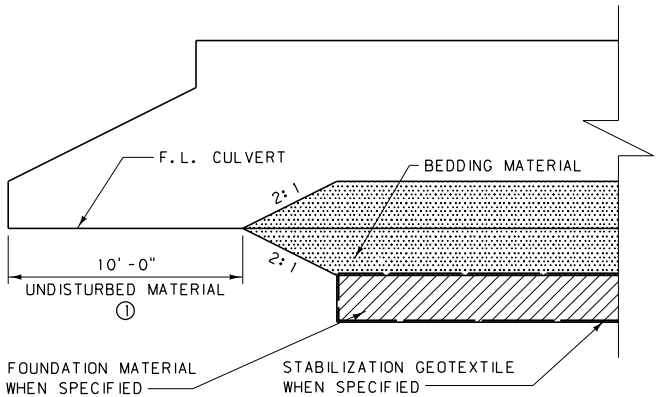
⑤ DIMENSIONS D, S AND R ARE INSIDE PIPE DIAMETER, SPAN AND RISE. DIMENSION T IS THE CULVERT SHELL THICKNESS FOR CONCRETE OR CORRUGATION WIDTH FOR METAL. CORRUGATION WIDTHS ARE TYPICALLY ½" FOR 48" EQUIVALENT SIZE METAL CULVERTS AND SMALLER.

⑥ EXCAVATE A SUFFICIENT AMOUNT TO PROVIDE A SAFE WORKING ENVIRONMENT AND TO ALLOW ACHIEVEMENT OF ALL CULVERT INSTALLATION AND COMPACTION REQUIREMENTS. SLOPE, BENCH OR PROVIDE SHORING FOR ALL EXCAVATIONS IN ACCORDANCE WITH THE U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION.

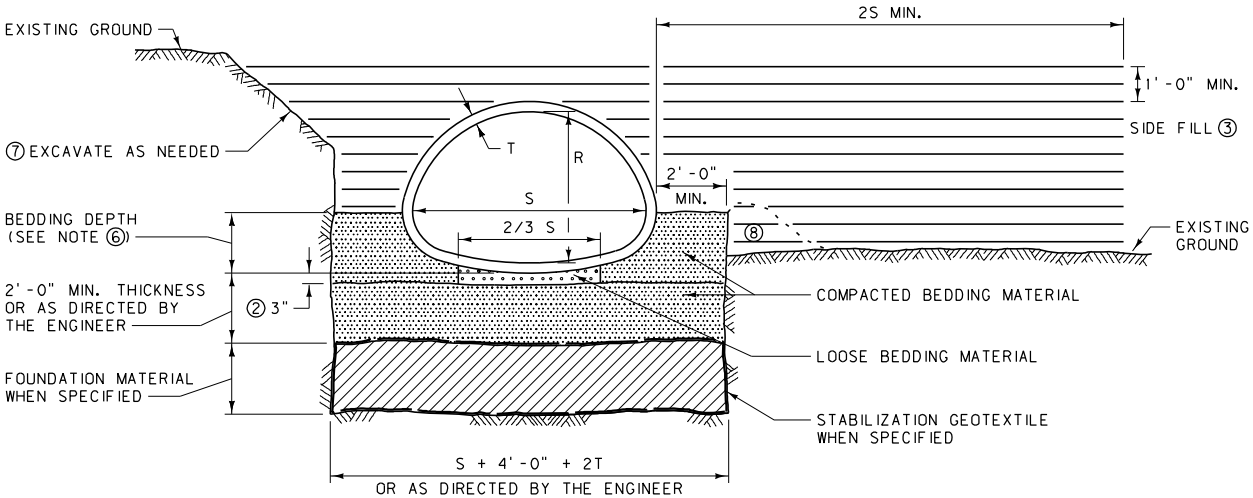
⑦ BUILD BERM WITH FILL MATERIAL AS NEEDED TO CONTAIN THE BEDDING MATERIAL TO THE PROPER DEPTH.

| DETAILED DRAWING | |
|---|---|
| REFERENCE STANDARD SPEC. SECTION 207, 603, 701 | DWG. NO. 603-18 |
| BEDDING FOR MAINLINE & PUBLIC APPROACH CULVERTS 48" EQUIVALENT & SMALLER | |
| --REVISED-- January 2008 | EFFECTIVE: APRIL 2006 |
| | MONTANA DEPARTMENT OF TRANSPORTATION serving you with pride |




## PIPE END DETAIL




NOTES:

① DO NOT EXTEND BEDDING MATERIAL TO THE END OF THE PIPE. LEAVE 10' OF UNDISTURBED MATERIAL AT EACH END UNLESS OTHERWISE NOTED IN PLANS. SEE PIPE END DETAIL.

② PLACE LOOSE BEDDING MATERIAL UNIFORMLY IN THE BOTTOM OF THE TRENCH AND SHAPE TO FIT BOTTOM OF PIPE. THE MINIMUM THICKNESS BEFORE PLACING PIPE IS 3". RCP IRR. REQUIRE GREATER THAN 3" OF LOOSE BEDDING MATERIAL TO ACCOMODATE BELL THICKNESS. AFTER LAYING CULVERT, COMPACT BEDDING MATERIAL AT HAUNCHES AND SIDES OF PIPE.

③ COMPACT SIDE FILL IN 6" LOOSE LAYERS TO DENSITY SPECIFIED FOR ADJACENT EMBANKMENT. SEE SECTION 203.03.3 OF THE STANDARD SPECIFICATIONS FOR THE DENSITY REQUIREMENTS.

④ SEE SECTION 701.04 OF THE STANDARD SPECIFICATIONS FOR BEDDING AND FOUNDATION MATERIAL REQUIREMENTS.

⑤ DIMENSIONS D, S, AND R ARE THE INSIDE PIPE DIAMETER, SPAN, AND RISE. DIMENSION T IS THE CULVERT SHELL THICKNESS FOR CONCRETE OR CORRUGATION WIDTH FOR METAL.

⑥ THE BEDDING DEPTH FOR CONCRETE PIPE IS D/4 + T OR R/3 + T. THE BEDDING DEPTH FOR METAL PIPE IS "X" + T. SEE DTL. DWG. NO. 603-32 AND 603-34 FOR "X" DIMENSIONS OF METAL PIPES.

⑦ EXCAVATE A SUFFICIENT AMOUNT TO PROVIDE A SAFE WORKING ENVIRONMENT AND TO ALLOW ACHIEVEMENT OF ALL CULVERT INSTALLATION AND COMPACTION REQUIREMENTS. SLOPE, BENCH OR PROVIDE SHORING FOR ALL EXCAVATIONS IN ACCORDANCE WITH THE U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION.

⑧ BUILD BERM WITH FILL MATERIAL AS NEEDED TO CONTAIN THE BEDDING MATERIAL TO THE PROPER DEPTH.

DETAILED DRAWING

| REFERENCE STANDARD SPEC. SECTION 207, 603, 701 | DWG. NO. 603-19 |
|---|---|

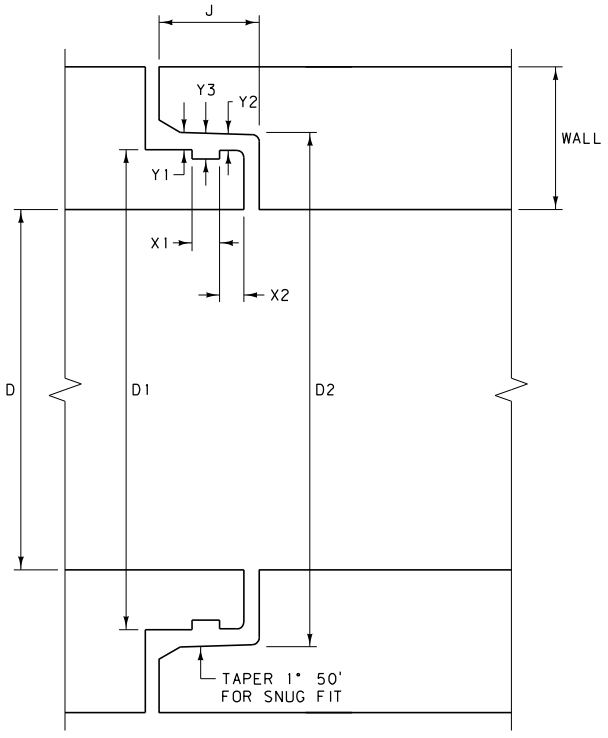
# BEDDING FOR CULVERTS 54" EQUIVALENT & LARGER

| --REVISED-- | EFFECTIVE: APRIL 2006 |
|---|---|
| January 2008 | MONTANA DEPARTMENT OF TRANSPORTATION |

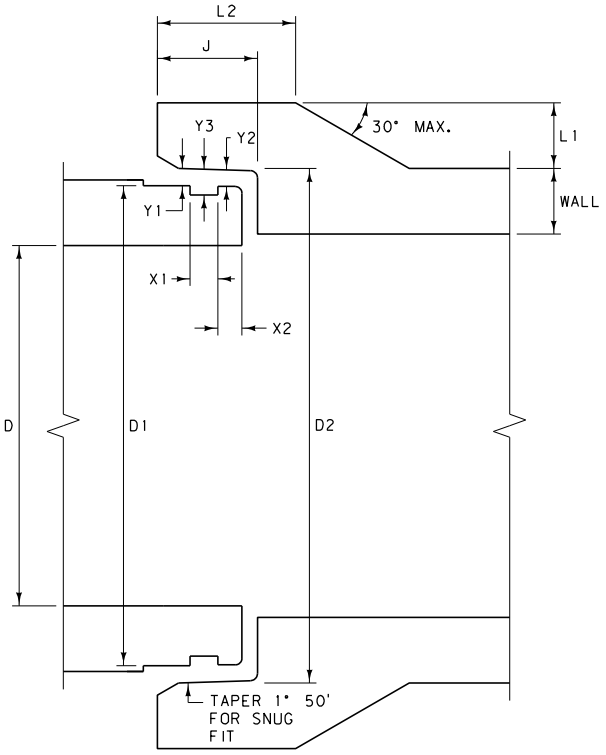
serving you with pride

| DIA. D | APPROX. DIA. GASKET MATL. NOT STRETCHED | LENGTH OF JOINT J | D1 | D2 | L2 (MIN.) | L1 (WALL "B") | L1 (WALL "C") | X1 | X2 | Y1 | Y2 | Y3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12" | 21/32" | 3 5/8" | 15.223" | 15.331" | 5" | 2" | ~ | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 15" | 21/32" | 3 5/8" | 18.723" | 18.831" | 4 3/4" | 2 3/16" | ~ | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 18" | 21/32" | 3 5/8" | 22.098" | 22.206" | 5" | 2 3/8" | ~ | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 21" | 21/32" | 3 7/8" | 25.600" | 25.724" | 5 1/4" | 2 9/16" | ~ | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 24" | 21/32" | 3 7/8" | 28.975" | 29.099" | 5 1/2" | 2 3/4" | 2" | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 27" | 21/32" | 4" | 32.476" | 32.608" | 5 1/2" | 2 3/4" | 2" | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 30" | 21/32" | 4" | 35.976" | 36.108" | 5 1/2" | 2 3/4" | 2" | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 33" | 21/32" | 4 1/8" | 39.476" | 39.616" | 5 3/4" | 2 7/8" | 2 1/8" | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 36" | 21/32" | 4 1/8" | 42.976" | 43.116" | 6" | 3 1/8" | 2 3/8" | 1" | 7/8" | 0.062" | 0.090" | 0.313" |
| 42" | 3/4" | 4 5/8" | 50.183" | 50.183" | 6 3/4" | 3 3/4" | 3" | 1 3/16" | 1" | 0.067" | 0.129" | 0.376" |
| 48" | 3/4" | 4 3/4" | 57.023" | 57.193" | 7 1/4" | 4 1/8" | 3 3/8" | 1 3/16" | 1" | 0.067" | 0.129" | 0.376" |
| 54" | 3/4" | 5" | 63.007" | 63.192" | 7 1/2" | 3 5/8" | 2 7/8" | 1 3/16" | 1" | 0.067" | 0.129" | 0.376" |
| 60" | 3/4" | 5" | 69.007" | 69.192" | 7 1/2" | 3 1/8" | 2 3/8" | 1 3/16" | 1" | 0.067" | 0.129" | 0.376" |
| 66" | 13/16" | 5" | 75.007" | 75.192" | 7 1/2" | 2 3/4" | 2" | 1 3/16" | 1" | 0.067" | 0.129" | 0.376" |
| 72" | 13/16" | 5 1/4" | 79.250" | 79.400" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |
| 78" | 13/16" | 5 1/4" | 86.250" | 86.400" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |
| 84" | 13/16" | 5 1/4" | 91.500" | 91.650" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |
| 90" | 13/16" | 5 1/4" | 97.750" | 97.900" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |
| 96" | 13/16" | 5 1/4" | 104.250" | 104.400" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |
| 102" | 13/16" | 5 1/4" | 110.750" | 110.900" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |
| 108" | 13/16" | 5 1/4" | 117.250" | 117.400" | ~ | ~ | ~ | 1 3/16" | 1 1/4" | 0.093" | 0.190" | 0.376" |

72" DIA. PIPES AND LARGER




66" DIA. PIPES AND SMALLER




NOTES:

TYPICAL FOR STORM DRAIN AND IRRIGATION APPLICATIONS (FOR HEADS UP TO 20 FEET).

USE RUBBER GASKETS THAT MEET THE REQUIREMENTS OF STANDARD SPECIFICATION 707.02.1.

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603, 707, 708

DWG. NO. 603-22

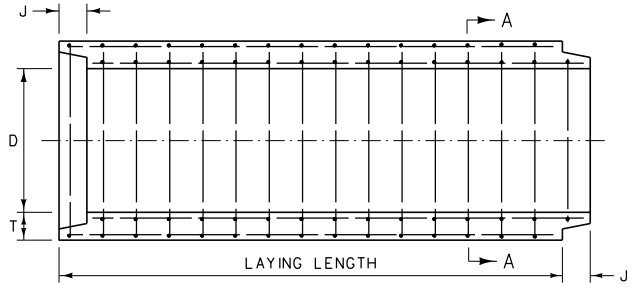
# WATER TIGHT JOINT FOR REINFORCED CONCRETE PIPE

EFFECTIVE: FEBRUARY 2005

MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION

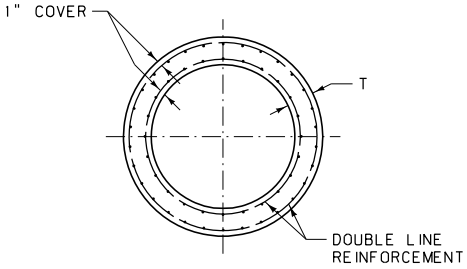
| DIA. D | XSEC. WATER AREA (SQ. FT.) | WT. PER L.F. OF PIPE (LB.) | T * MIN. WALL THICKNESS | J LENGTH OF JOINT | A (NOMINAL) = D2 - D1 / 2 | D1 | D2 | D3 | D4 |
|---|---|---|---|---|---|---|---|---|---|
| 12" | 0.79 | 92 | 2" | 1 3/4" | 3/16" | 13 1/4" | 13 5/8" | 13 7/8" | 14 1/4" |
| 15" | 1.23 | 127 | 2 1/4" | 2" | 3/16" | 16 1/2" | 16 7/8" | 17 1/4" | 17 5/8" |
| 18" | 1.77 | 168 | 2 1/2" | 2 1/4" | 3/16" | 19 5/8" | 20" | 20 3/8" | 20 3/4" |
| 21" | 2.40 | 214 | 2 3/4" | 2 1/2" | 3/16" | 22 7/8" | 23 1/4" | 23 3/4" | 24 1/8" |
| 24" | 3.14 | 265 | 3" | 2 3/4" | 3/16" | 26" | 26 3/8" | 27" | 27 3/8" |
| 27" | 3.98 | 322 | 3 1/4" | 3" | 3/16" | 29 1/4" | 29 5/8" | 30 1/4" | 30 5/8" |
| 30" | 4.91 | 384 | 3 1/2" | 3 1/4" | 3/16" | 32 3/8" | 32 3/4" | 33 1/2" | 33 7/8" |
| 33" | 5.94 | 452 | 3 3/4" | 3 1/2" | 1/4" | 35 1/2" | 36" | 36 3/4" | 37 1/4" |
| 36" | 7.07 | 524 | 4" | 3 3/4" | 1/4" | 38 3/4" | 39 1/4" | 40" | 40 1/2" |
| 42" | 9.62 | 685 | 4 1/2" | 4" | 1/4" | 45 1/8" | 45 3/8" | 46 1/2" | 47" |
| 48" | 12.57 | 867 | 5" | 4 1/4" | 1/4" | 51 1/2" | 52" | 53" | 53 1/2" |
| 54" | 15.90 | 1070 | 5 1/2" | 4 1/2" | 1/4" | 57 7/8" | 58 3/8" | 59 3/8" | 59 7/8" |
| 60" | 19.63 | 1296 | 6" | 5" | 1/4" | 64 1/4" | 64 3/4" | 66" | 66 1/2" |
| 66" | 23.76 | 1542 | 6 1/2" | 5 1/2" | 1/4" | 70 5/8" | 71 1/8" | 72 1/2" | 73" |
| 72" | 28.27 | 1810 | 7" | 6" | 1/4" | 77" | 77 1/2" | 79" | 79 1/2" |
| 78" | 33.18 | 2098 | 7 1/2" | 6 1/2" | 1/4" | 83 3/8" | 83 7/8" | 85 5/8" | 86 1/3" |
| 84" | 38.48 | 2410 | 8" | 7" | 1/4" | 89 3/4" | 90 1/4" | 92 1/8" | 92 5/8" |
| 90" | 44.18 | 2740 | 8 1/2" | 7" | 1/4" | 95 3/4" | 96 1/4" | 98 1/8" | 98 5/8" |
| 96" | 50.27 | 2950 | 9" | 7" | 1/4" | 102 1/8" | 102 5/8" | 104 1/2" | 105" |
| 102" | 56.75 | 3075 | 9 1/2" | 7 1/2" | 1/4" | 109" | 109 1/2" | 111 1/2" | 112" |
| 108" | 63.62 | 3870 | 10" | 7 1/2" | 1/4" | 115 1/2" | 116" | 118" | 118 1/2" |

* WALL "B" THICKNESS

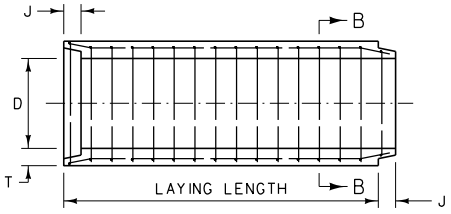



TYPICAL LONGITUDINAL SECTION

36" DIAMETER PIPES AND LARGER

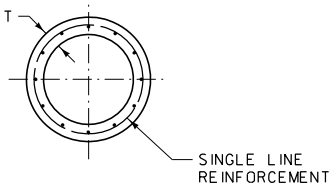



SECTION A-A

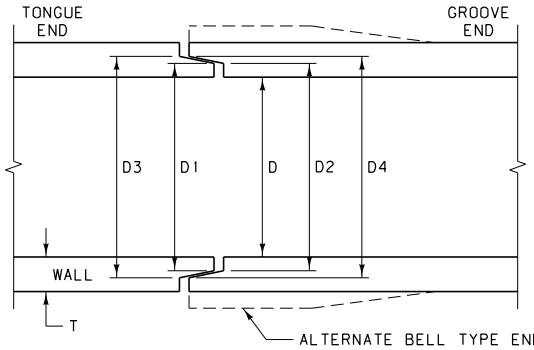



TYPICAL LONGITUDINAL SECTION

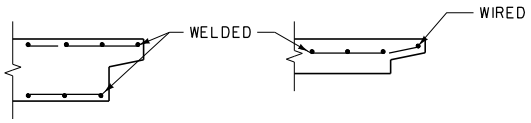
33" DIAMETER PIPES AND SMALLER




SECTION B-B




JOINT DETAIL




REINFORCING AT ENDS OF PIPE

NOTES:

TOLERANCES IN DIMENSIONS IN ACCORDANCE WITH AASHTO M 170.

TYPICAL FOR DRAINAGE APPLICATIONS.

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603, 708

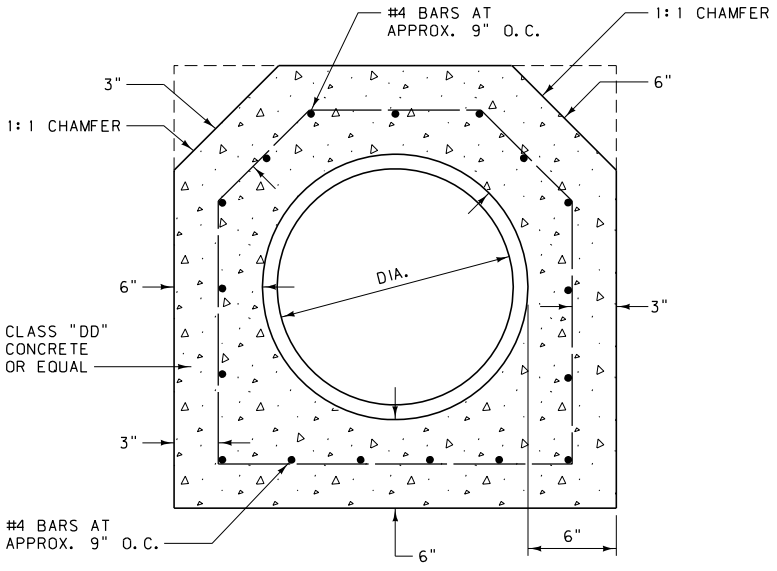
DWG. NO. 603-24

REINFORCED CONCRETE PIPE JOINT

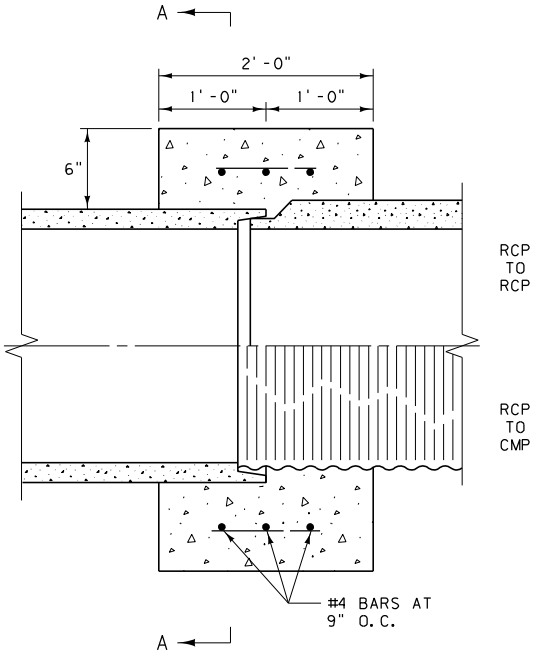
EFFECTIVE: FEBRUARY 2005

MDT serving you with pride

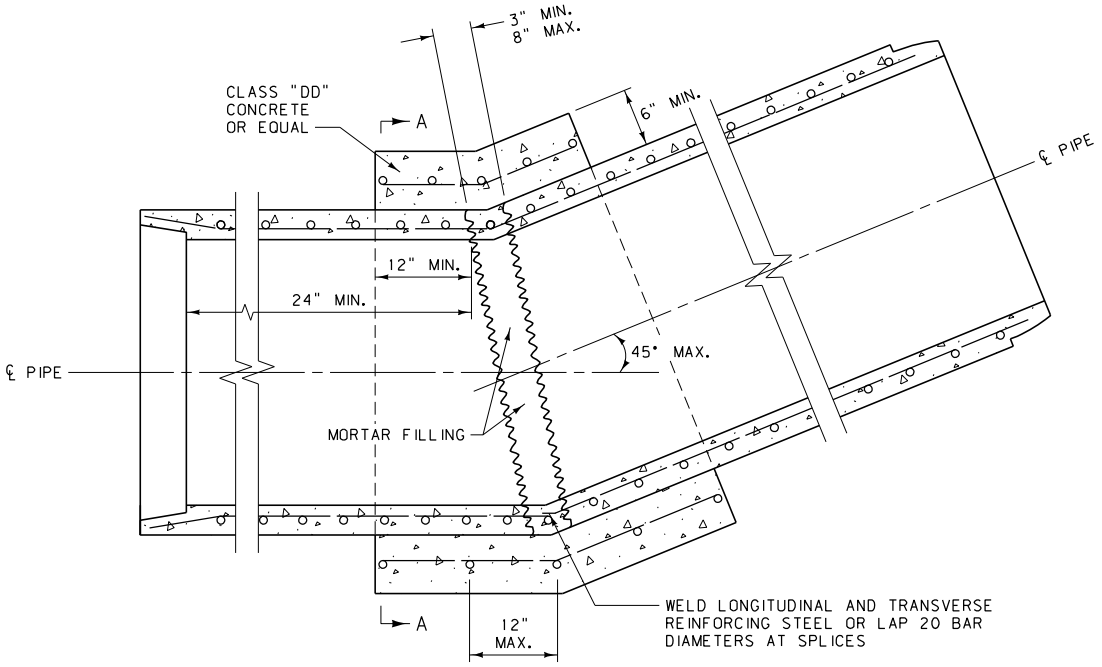
MONTANA DEPARTMENT OF TRANSPORTATION




SECTION A-A

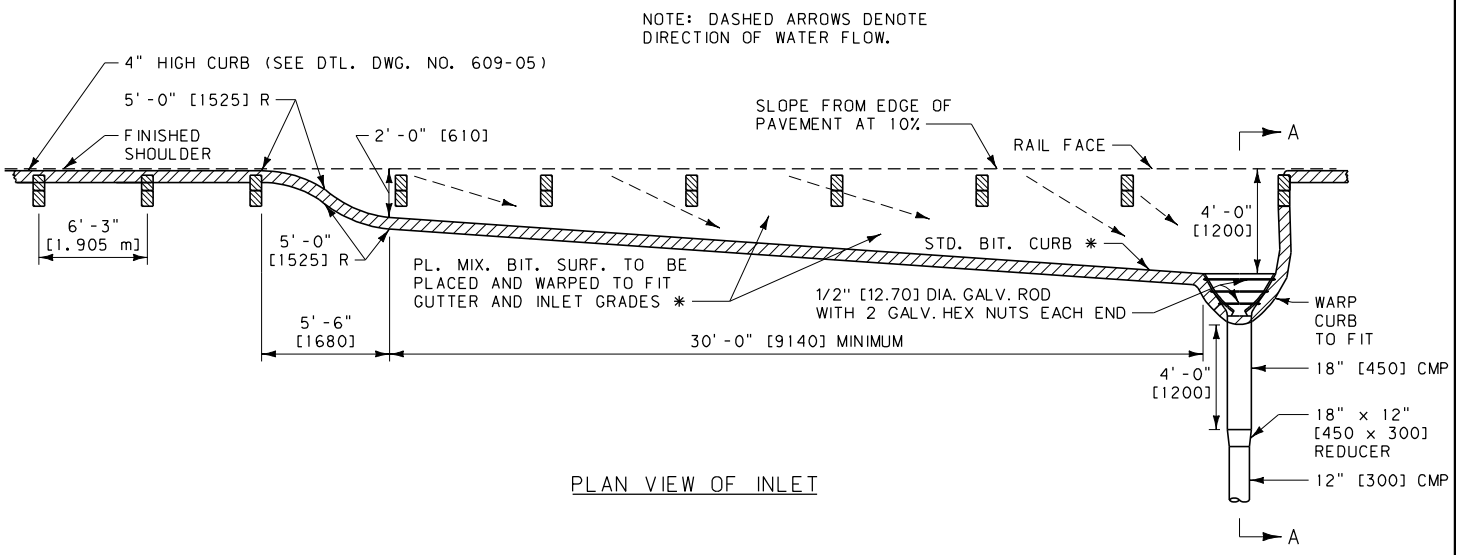



CONNECTION DETAILS

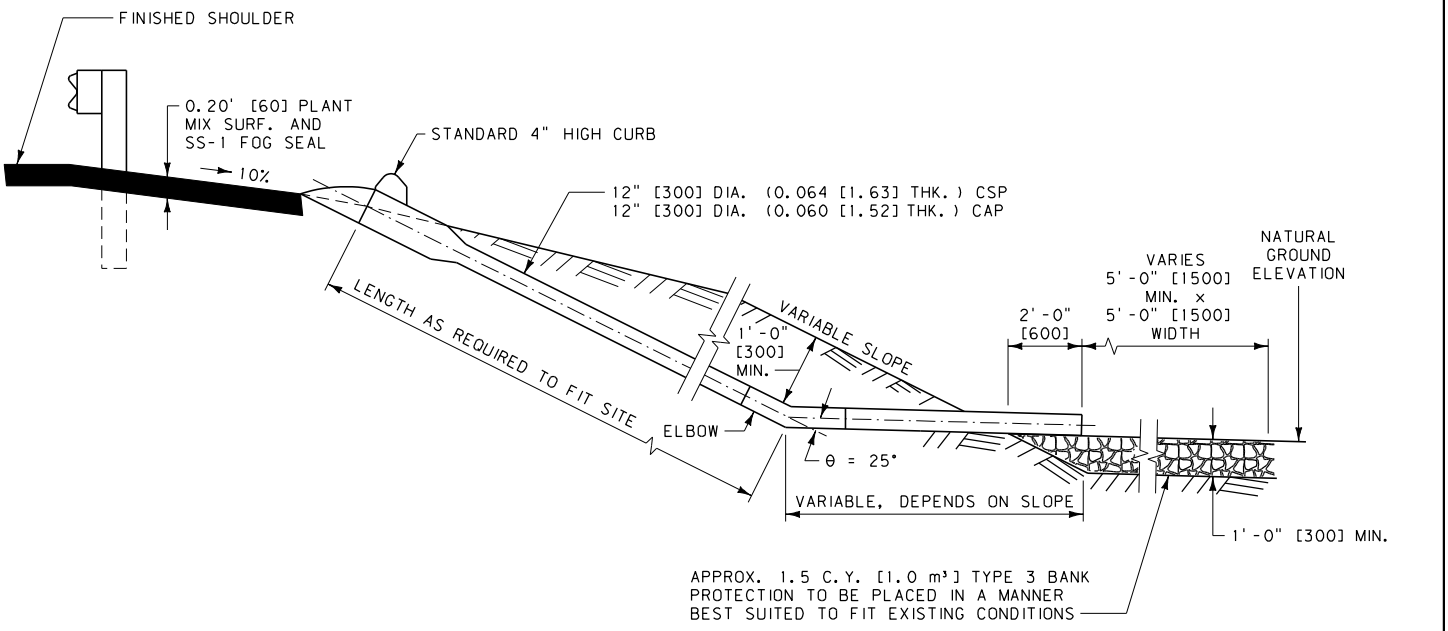



TYPICAL FIELD CAST CONCRETE BEND

| DETAILED DRAWING | |
|---|---|
| REFERENCE<br>STANDARD SPEC.<br>SECTION 603, 708 | DWG. NO.<br>603-26 |
| TYPICAL FIELD CAST<br>CONCRETE CONNECTIONS | |
| EFFECTIVE: FEBRUARY 2005 | |
| serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION | |




PLAN VIEW OF INLET




OUTLET DETAIL

SECTION A-A

NOTES:

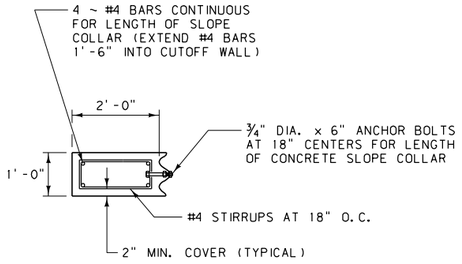
CORRUGATION MAY BE EITHER ANNULAR OR HELICAL.
BEND ON ELBOW (θ) IS AS SHOWN UNLESS OTHERWISE SPECIFIED IN THE PLANS OR BY THE PROJECT MANAGER.

* INCLUDED WITH ROADWAY QUANTITIES.

*UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.*

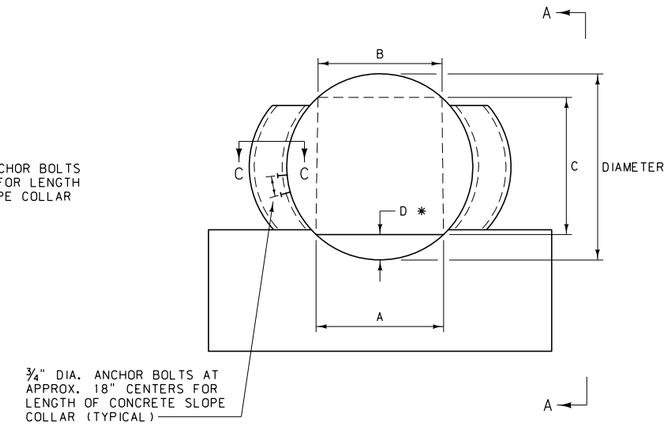
| DETAILED DRAWING | |
|---|---|
| REFERENCE STANDARD SPEC. SECTION 603 | DWG. NO. 603-28 |
| EMBANKMENT PROTECTOR | |
| --REVISED-- MAY 2011 | EFFECTIVE: FEBRUARY 2005 |

MONTANA DEPARTMENT OF TRANSPORTATION

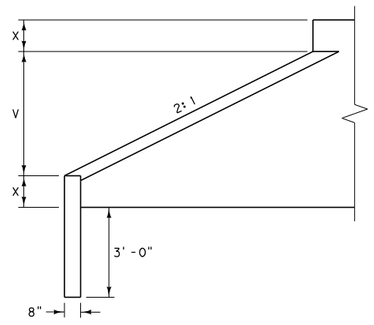



NOTE:
SEE DTL. DWG. NO. 552-00
FOR ANCHOR BOLT DETAILS.

SECTION C-C




ELEVATION




SECTION A-A

NOTES:

DESIGNATE THESE STRUCTURES, IN PLANS AND PROPOSAL, AS "VEHICULAR UNDERPASS." CONFORM MATERIALS, INSTALLATION, AND OTHER PROVISIONS TO THE STANDARD SPECIFICATIONS. USE THE TERM "VEHICULAR UNDERPASS," REGARDLESS OF THE USE OR PURPOSE OF THE STRUCTURE.

PROVIDE END TREATMENT FOR ALL VEHICULAR UNDERPASSES INCLUDING CUTOFF WALLS, BACKFILL RETAINING WALLS AND CONCRETE SLOPE COLLARS.

PROVIDE SURFACING FOR THE INSIDE OF THE STRUCTURE, CROSS-SLOPED TO ALLOW A DRAINAGE COURSE ALONG ONE SIDE.

FOR PLATE THICKNESS SEE ROAD DESIGN MANUAL FILL HEIGHT TABLES.

USE CLASS "DD" CONCRETE OR EQUAL.

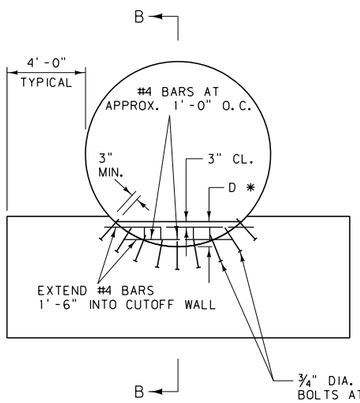
SEE DTL. DWG. NO. 552-08 FOR QUANTITIES.

| DEPTH OF SURFACING * | | |
|---|---|---|
| MATERIAL | ALTERNATE "A" | ALTERNATE "B" |
| PL. MIX SURF. | — | 0.20' |
| CRUSHED AGGREGATE COURSE | BAL. | BAL. |

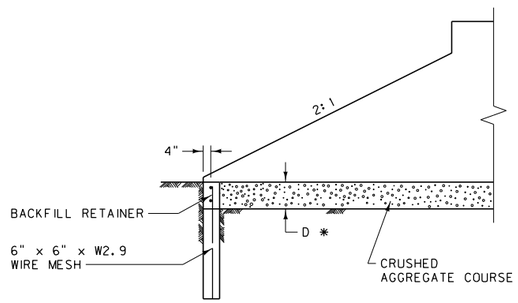
| DIAMETER | A | B | C | V | X | * D | BACKFILL RETAINER (C.Y.) | CONCRETE COLLAR (C.Y.) |
|---|---|---|---|---|---|---|---|---|
| 96" | 4' | 4' | 6.9' | 4.0' | 2.0' | 0.5' | 0.04 | 0.66 |
| 120" | 7' | 7' | 7.1' | 5.0' | 2.5' | 1.4' | 0.17 | 0.82 |
| 150" | 10' | 8' | 8.6' | 6.25' | 3.13' | 2.5' | 0.43 | 1.08 |
| 162" | 10' | 8' | 10.0' | 6.75' | 3.38' | 2.2' | 0.38 | 1.16 |
| 186" | 12' | 10' | 10.8' | 7.75' | 3.88' | 2.9' | 0.59 | 1.34 |
| 192" | 12' | 10' | 11.5' | 8.0' | 4.0' | 2.7' | 0.55 | 1.38 |
| 204" | 12' | 10' | 12.9' | 8.5' | 4.25' | 2.5' | 0.51 | 1.46 |
| 216" | 12' | 10' | 14.2' | 9.0' | 4.50' | 2.3' | 0.47 | 1.54 |
| 228" | 16' | 12' | 12.5' | 9.5' | 4.75' | 4.4' | 1.23 | 1.72 |
| 240" | 16' | 12' | 14.0' | 10.0' | 5.0' | 4.0' | 1.10 | 1.72 |

| SURFACING QUANTITIES PER LINEAR FOOT FOR DEPTH "D" * | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALTERNATE "A" | ALTERNATE "B" | | | | | |
| | C.Y. SURFACING | TONS SURFACING | | C.Y. SURFACING | TONS BIT. MATL. | | |
| DIAMETER | CRUSHED AGGREGATE COURSE | COVER MATERIAL | PLANT MIX | CRUSHED AGGREGATE COURSE | PLANT MIX | PRIME | SEAL |
| 96" | 0.054 | 0.0056 | 0.052 | 0.027 | 0.0031 | 0.0005 | 0.0007 |
| 120" | 0.255 | 0.0097 | 0.097 | 0.205 | 0.0058 | 0.0009 | 0.0012 |
| 150" | 0.647 | 0.0139 | 0.141 | 0.574 | 0.0084 | 0.0014 | 0.0017 |
| 162" | 0.563 | 0.0139 | 0.140 | 0.489 | 0.0084 | 0.0014 | 0.0017 |
| 186" | 0.882 | 0.0167 | 0.169 | 0.794 | 0.0102 | 0.0017 | 0.0020 |
| 192" | 0.830 | 0.0167 | 0.168 | 0.744 | 0.0101 | 0.0016 | 0.0020 |
| 204" | 0.769 | 0.0167 | 0.169 | 0.680 | 0.0102 | 0.0016 | 0.0020 |
| 216" | 0.702 | 0.0167 | 0.168 | 0.615 | 0.0101 | 0.0016 | 0.0020 |
| 228" | 1.842 | 0.0222 | 0.227 | 1.725 | 0.0136 | 0.0022 | 0.0026 |
| 240" | 1.656 | 0.0222 | 0.226 | 1.539 | 0.0136 | 0.0022 | 0.0026 |

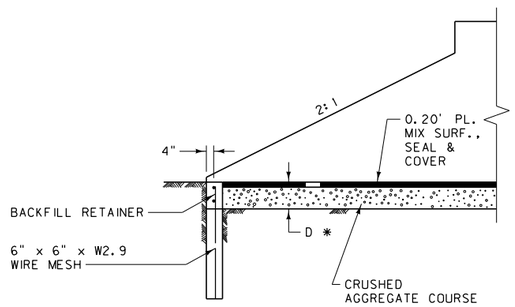
## BACKFILL RETAINER & CUTOFF WALL DETAIL




ELEVATION



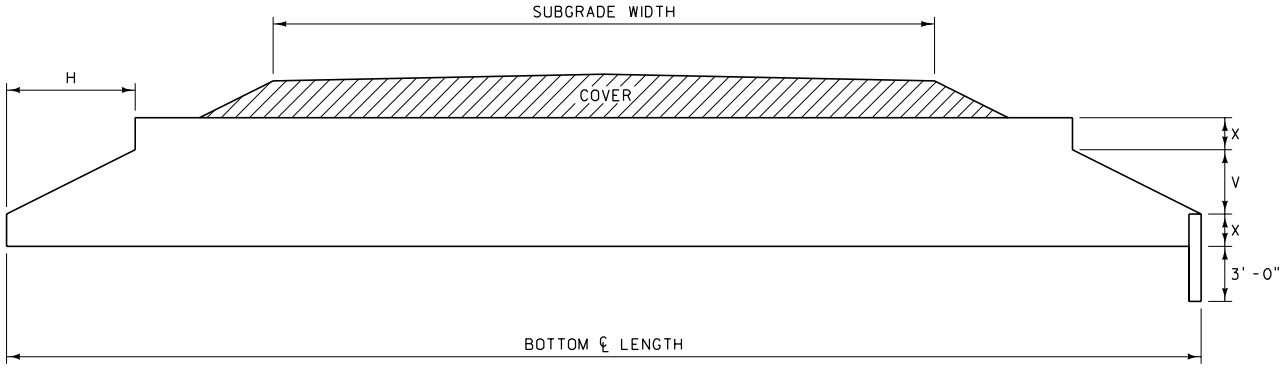

SECTION B-B
(ALTERNATE "A")

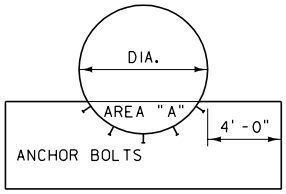



SECTION B-B
(ALTERNATE "B")

NOTE:
INCLUDE CONCRETE COLLAR
WHEN SPECIFIED.

| DETAILED DRAWING | |
|---|---|
| REFERENCE STANDARD SPEC. SECTION 552.603 | DWG. NO. 603-30 |
| VEHICULAR UNDERPASS AND BACKFILL RETAINER & CUTOFF WALL DETAIL | |
| --REVISED-- January 2008 | EFFECTIVE: FEBRUARY 2005 |
| | MONTANA DEPARTMENT OF TRANSPORTATION (MDT serving you with pride) |




NOTE:
FOR DETAILS COVERING CUTOFF WALLS
SEE DTL. DWG. NO. 552-00.

| DIA. | X (FT. ) | V (FT. ) | H (FT. ) FOR BEVELS: | | AREA "A" (SQ. FT. ) * |
|---|---|---|---|---|---|
| | | | 1.5:1 | 2:1 | |
| CSP 3" x 1" OR 5" x 1" CORRUGATIONS | | | | | |
| 54" | 1.125 | 2.250 | 3.375 | 4.500 | 3.31 |
| 60" | 1.250 | 2.500 | 3.750 | 5.000 | 4.06 |
| 66" | 1.375 | 2.750 | 4.125 | 5.500 | 4.89 |
| 72" | 1.500 | 3.000 | 4.500 | 6.000 | 5.79 |
| 78" | 1.625 | 3.250 | 4.875 | 6.500 | 6.77 |
| 84" | 1.750 | 3.500 | 5.250 | 7.000 | 7.83 |
| 90" | 1.875 | 3.750 | 5.625 | 7.500 | 8.97 |
| 96" | 2.000 | 4.000 | 6.000 | 8.000 | 10.18 |
| 102" | 2.125 | 4.250 | 6.375 | 8.500 | 11.47 |
| 108" | 2.250 | 4.500 | 6.750 | 9.000 | 12.83 |
| 114" | 2.375 | 4.750 | 7.125 | 9.500 | 14.27 |
| 120" | 2.500 | 5.000 | 7.500 | 10.000 | 15.79 |

| DIA. | X (FT. ) | V (FT. ) | H (FT. ) FOR BEVELS: | | AREA "A" (SQ. FT. ) * |
|---|---|---|---|---|---|
| | | | 1.5:1 | 2:1 | |
| SSPP 6" x 2" CORRUGATIONS | | | | | |
| 10'-6" | 2.625 | 5.250 | 7.875 | 10.500 | 17.39 |
| 11'-0" | 2.750 | 5.500 | 8.250 | 11.000 | 19.06 |
| 11'-6" | 2.875 | 5.750 | 8.625 | 11.500 | 20.81 |
| 12'-0" | 3.000 | 6.000 | 9.000 | 12.000 | 22.64 |
| 12'-6" | 3.125 | 6.250 | 9.375 | 12.500 | 24.54 |
| 13'-0" | 3.250 | 6.500 | 9.750 | 13.000 | 26.52 |
| 13'-6" | 3.375 | 6.750 | 10.125 | 13.500 | 28.58 |
| 14'-0" | 3.500 | 7.000 | 10.500 | 14.000 | 30.71 |
| 14'-6" | 3.625 | 7.250 | 10.875 | 14.500 | 32.92 |
| 15'-0" | 3.750 | 7.500 | 11.250 | 15.000 | 35.21 |
| 15'-6" | 3.875 | 7.750 | 11.625 | 15.500 | 37.57 |
| 16'-0" | 4.000 | 8.000 | 12.000 | 16.000 | 40.01 |
| 16'-6" | 4.125 | 8.250 | 12.375 | 16.500 | 42.53 |
| 17'-0" | 4.250 | 8.500 | 12.750 | 17.000 | 45.12 |
| 17'-6" | 4.375 | 8.750 | 13.125 | 17.500 | 47.79 |
| 18'-0" | 4.500 | 9.000 | 13.500 | 18.000 | 50.54 |
| 19'-0" | 4.750 | 9.500 | 14.250 | 19.000 | 56.26 |
| 20'-0" | 5.000 | 10.000 | 15.000 | 20.000 | 62.29 |
| 21'-0" | 5.250 | 10.500 | 15.750 | 21.000 | 68.63 |

* AREA "A" IS TO THE MIDDLE OF THE CORRUGATIONS.

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603

DWG. NO. 603-32

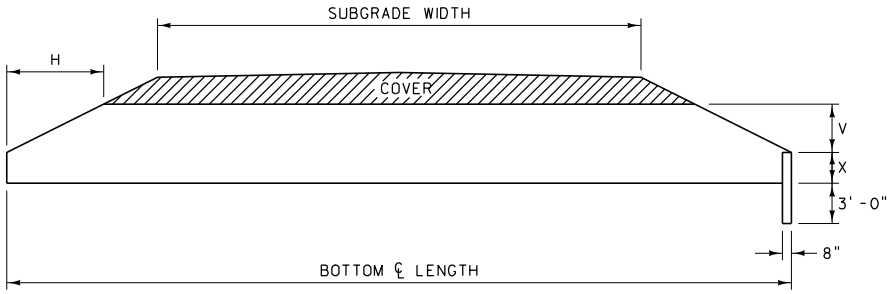
# STEP BEVEL FOR CIRCULAR METAL CULVERT

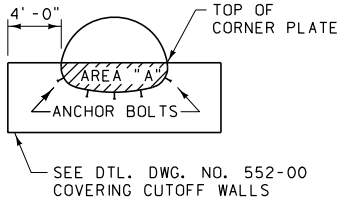
--REVISED--
May 2009

EFFECTIVE: APRIL 2006

MDT serving you with pride

MONTANA DEPARTMENT OF TRANSPORTATION




| SPAN | RISE | EQUIV. DIA. | X (FT.) | V (FT.) | H (FT.) FOR BEVELS: | | | AREA "A" (SQ. FT.) |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1.5:1 | 2:1 | 2.5:1 | |
| SSPPA 6" x 2" CORRUGATIONS WITH 18" CORNER RADIUS | | | | | | | | |
| 6'-1" | 4'-7" | 66" | 2.3 | 2.3 | 3.4 | 4.6 | 5.7 | 12.8 |
| 6'-9" | 4'-11" | 72" | 2.4 | 2.5 | 3.8 | 5.0 | 6.3 | 14.8 |
| 7'-3" | 5'-3" | 78" | 2.1 | 3.2 | 4.7 | 6.3 | 7.9 | 14.1 |
| 7'-11" | 5'-7" | 84" | 2.3 | 3.3 | 4.9 | 6.6 | 8.2 | 16.8 |
| 8'-7" | 5'-11" | 90" | 2.3 | 3.6 | 5.4 | 7.2 | 9.0 | 18.0 |
| 9'-4" | 6'-3" | 96" | 2.5 | 3.8 | 5.6 | 7.5 | 9.4 | 21.0 |
| 9'-9" | 6'-7" | 102" | 2.2 | 4.4 | 6.6 | 8.8 | 11.0 | 19.8 |
| 10'-8" | 6'-11" | 108" | 2.8 | 4.1 | 6.2 | 8.2 | 10.3 | 26.6 |
| 11'-5" | 7'-3" | 114" | 2.8 | 4.5 | 6.7 | 8.9 | 11.1 | 27.9 |
| 11'-10" | 7'-7" | 120" | 2.5 | 5.1 | 7.6 | 10.2 | 13.6 | 26.4 |
| 12'-6" | 7'-11" | 126" | 2.7 | 5.2 | 7.8 | 10.4 | 13.0 | 30.0 |
| 12'-10" | 8'-4" | 132" | 2.3 | 6.0 | 8.9 | 11.9 | 14.9 | 26.9 |
| SSPPA 6" x 2" CORRUGATIONS WITH 31" CORNER RADIUS | | | | | | | | |
| 13'-3" | 9'-4" | ~ | 3.9 | 5.5 | 8.2 | 10.9 | 13.6 | 45.7 |
| 13'-6" | 9'-6" | ~ | 3.8 | 5.7 | 8.6 | 11.5 | 14.3 | 45.7 |
| 14'-0" | 9'-8" | 144" | 4.0 | 5.7 | 8.5 | 11.4 | 14.2 | 49.1 |
| 14'-3" | 9'-10" | ~ | 3.8 | 6.1 | 9.1 | 12.1 | 15.2 | 47.6 |
| 14'-5" | 10'-0" | ~ | 3.7 | 6.3 | 9.5 | 12.7 | 15.9 | 47.4 |
| 14'-11" | 10'-2" | ~ | 4.0 | 6.2 | 9.3 | 12.4 | 15.5 | 52.4 |
| 15'-4" | 10'-4" | 156" | 4.3 | 6.0 | 9.1 | 12.1 | 15.1 | 57.6 |
| 15'-7" | 10'-6" | ~ | 4.1 | 6.4 | 9.6 | 12.8 | 16.1 | 55.9 |
| 15'-10" | 10'-8" | ~ | 3.9 | 6.8 | 10.2 | 13.6 | 17.0 | 54.2 |
| 16'-3" | 10'-10" | ~ | 4.3 | 6.5 | 9.8 | 13.1 | 16.4 | 61.1 |
| 16'-6" | 11'-0" | 168" | 4.1 | 6.9 | 10.4 | 13.9 | 17.3 | 59.4 |
| 17'-0" | 11'-2" | ~ | 4.4 | 6.8 | 10.2 | 13.6 | 17.0 | 64.7 |
| 17'-2" | 11'-4" | ~ | 4.3 | 7.1 | 10.6 | 14.1 | 17.6 | 64.6 |
| 17'-5" | 11'-6" | ~ | 4.1 | 7.4 | 11.2 | 14.9 | 18.6 | 62.6 |
| 17'-11" | 11'-8" | 180" | 4.3 | 7.4 | 11.1 | 14.8 | 18.5 | 66.6 |
| 18'-1" | 11'-10" | ~ | 4.2 | 7.7 | 11.5 | 15.3 | 19.2 | 66.4 |
| 18'-7" | 12'-0" | ~ | 4.5 | 7.5 | 11.3 | 15.0 | 18.8 | 72.2 |
| 18'-9" | 12'-2" | ~ | 4.3 | 7.9 | 11.8 | 15.8 | 19.7 | 70.1 |
| 19'-3" | 12'-4" | 192" | 4.6 | 7.7 | 11.6 | 15.5 | 19.4 | 76.3 |
| 19'-6" | 12'-6" | ~ | 4.4 | 8.1 | 12.2 | 16.3 | 20.3 | 74.1 |
| 19'-8" | 12'-8" | ~ | 4.3 | 8.4 | 12.6 | 16.8 | 21.0 | 73.7 |
| 19'-11" | 12'-10" | ~ | 4.1 | 8.8 | 13.2 | 17.6 | 22.0 | 71.3 |
| 20'-5" | 13'-0" | 204" | 4.4 | 8.6 | 12.9 | 17.3 | 21.6 | 77.6 |
| 20'-7" | 13'-2" | ~ | 4.3 | 8.9 | 13.4 | 17.8 | 22.3 | 77.2 |

| SPAN | RISE | EQUIV. DIA. | X (FT.) | V (FT.) | H (FT.) FOR BEVELS: | | | AREA "A" (SQ. FT.) |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1.5:1 | 2:1 | 2.5:1 | |
| CSPA 3" x 1" CORRUGATIONS (SEE NOTE ⊗) | | | | | | | | |
| 60" | 46" | 54" | 1.7 | 2.3 | 3.5 | 4.7 | 5.8 | 7.1 |
| 66" | 51" | 60" | 1.9 | 2.6 | 3.9 | 5.2 | 6.5 | 8.7 |
| 73" | 55" | 66" | 2.1 | 2.8 | 4.1 | 5.5 | 6.9 | 10.7 |
| 81" | 59" | 72" | 2.0 | 3.2 | 4.8 | 6.5 | 8.1 | 11.1 |
| 87" | 63" | 78" | 2.1 | 3.5 | 5.2 | 6.9 | 8.6 | 13.2 |
| 95" | 67" | 84" | 2.3 | 3.7 | 5.5 | 7.3 | 9.2 | 15.3 |
| 103" | 71" | 90" | 2.5 | 3.9 | 5.8 | 7.7 | 9.6 | 17.8 |
| 112" | 75" | 96" | 2.6 | 4.1 | 6.1 | 8.1 | 10.2 | 20.2 |
| 117" | 79" | 102" | 2.8 | 4.3 | 6.4 | 8.5 | 10.7 | 23.1 |
| 128" | 83" | 108" | 3.0 | 4.5 | 6.7 | 8.9 | 11.2 | 25.9 |
| 137" | 87" | 114" | 3.1 | 4.7 | 7.0 | 9.4 | 11.7 | 29.0 |
| 142" | 91" | 120" | 3.3 | 4.9 | 7.3 | 9.7 | 12.2 | 32.2 |
| CSPA 2⅔" x ½" CORRUGATIONS (SEE NOTE ⊗) | | | | | | | | |
| 57" | 38" | 48" | 1.1 | 2.1 | 3.1 | 4.2 | 5.2 | 4.5 |
| 64" | 43" | 54" | 1.2 | 2.4 | 3.5 | 4.7 | 5.9 | 5.6 |
| 71" | 47" | 60" | 1.4 | 2.6 | 3.8 | 5.1 | 6.4 | 6.9 |
| 77" | 52" | 66" | 1.5 | 2.8 | 4.3 | 5.7 | 7.1 | 8.2 |
| 83" | 57" | 72" | 1.6 | 3.1 | 4.7 | 6.3 | 7.8 | 9.6 |

NOTES:

BEVEL TO TOP OF CORNER PLATE.

PIPE ENDS ARE SQUARE (PERPENDICULAR TO CENTERLINE OF PIPE) AND FILL SLOPES ARE WARPED TO ACCOMMODATE THE SQUARE ENDS UNLESS SPECIFIED OTHERWISE ON PLANS.

⊗ TABULATED VALUES BASED ON NOMINAL PIPE DIMENSIONS. IN PLACE DIMENSIONS SUBJECT TO TOLERANCES LISTED IN CURRENT AASHTO M 36 AND M 196.

DETAILED DRAWING

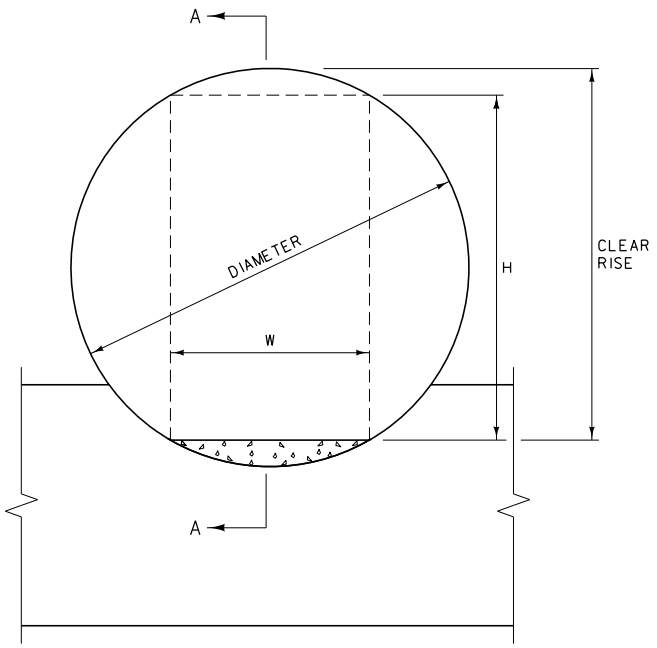
REFERENCE STANDARD SPEC. SECTION 603

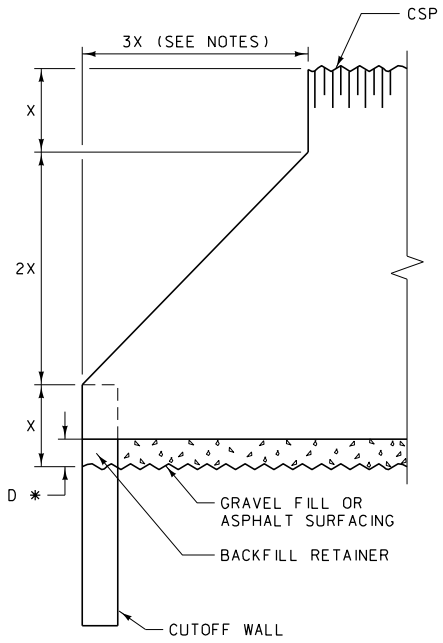
DWG. NO. 603-34

# BEVEL ON ARCH METAL CULVERT

EFFECTIVE: FEBRUARY 2005

MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION




SECTION A-A

| DIAMETER | X | * D | CLEAR RISE | H | W | BACKFILL RETAINER (CUBIC YARDS) |
|---|---|---|---|---|---|---|
| 84" | 21.0" | 0.50' | 6.5' | 6.0' | 3.6' | 0.1 |
| 90" | 22.5" | 0.75' | 6.75' | 6.0' | 4.5' | 0.1 |
| 96" | 24.0" | 0.83' | 7.17' | 6.34' | 4.9' | 0.1 |

| | SURFACING QUANTITIES PER LINEAR FOOT FOR DEPTH "D" * | | | | |
|---|---|---|---|---|---|
| | FULL DEPTH GRAVEL | 0.20' PMS AND REMAINING DEPTH GRAVEL | | | |
| | C.Y. SURF. | TONS SURF. | C.Y. SURF. | TONS BIT. MATERIAL | |
| DIAMETER | CR. TOP SURF. | PLANT MIX | CR. TOP SURF. | PLANT MIX | PRIME |
| 84" | 0.045 | 0.046 | 0.021 | 0.0028 | 0.0004 |
| 90" | 0.085 | 0.060 | 0.054 | 0.0036 | 0.0006 |
| 96" | 0.102 | 0.066 | 0.068 | 0.0040 | 0.0006 |

NOTES:

UNLESS OTHERWISE SPECIFIED, INSTALL STOCKPASSES WITH CUTOFF WALLS AND BACKFILL RETAINERS AT EACH END, GRAVEL FILL AND BEDDING MATERIAL.

WHEN SPECIFIED, INSTALL COMBINATION STOCKPASSES AND DRAINS WITH CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS, CONCRETE EDGE PROTECTION AT THE INLET END, RANDOM RIPRPAP AT THE OUTLET END, BEDDING MATERIAL AND ASPHALT SURFACING; CROSS SLOPE ASPHALT SURFACING TO ALLOW DRAINAGE COURSE ALONG ONE SIDE. (SEE DTL. DWG. NO. 613-14 AND 613-06.)

UNLESS OTHERWISE SPECIFIED, STEP BEVEL PIPE ENDS AT A 1.5:1 SLOPE.

THE MINIMUM THICKNESS FOR CORRUGATED STEEL PIPE STOCKPASS IS 0.079". (SEE FILL HEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.)

SEE DTL. DWG. NO. 552-00, 603-30 AND 603-18.

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 603

DWG. NO. 603-36

# CORRUGATED STEEL PIPE STOCKPASS

EFFECTIVE: FEBRUARY 2005

MDT serving you with pride — MONTANA DEPARTMENT OF TRANSPORTATION