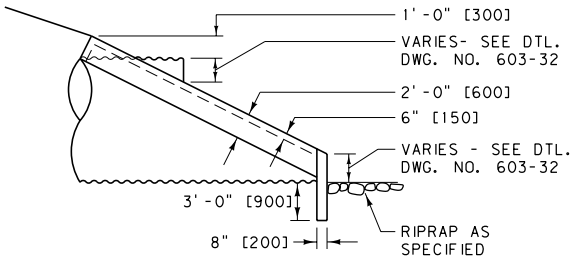
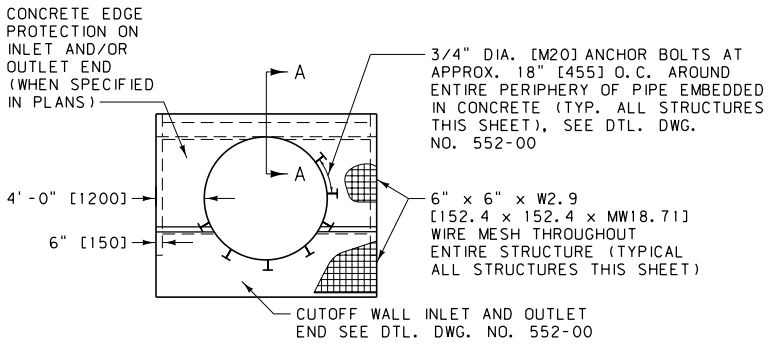
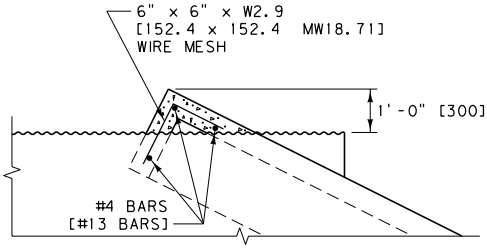
ROUND PIPE



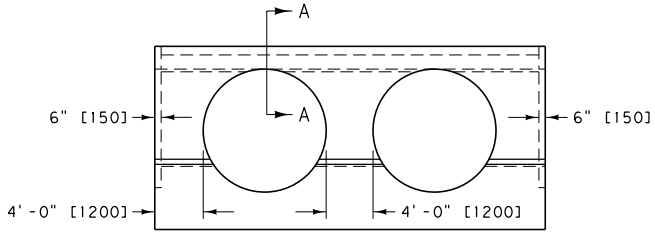
SIDE ELEVATION



FRONT ELEVATION

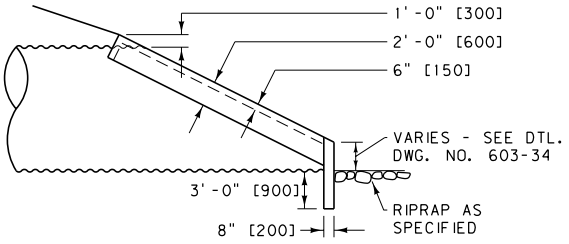


SECTION A-A



FRONT ELEVATION MULTIPLE PIPES

ARCH PIPE



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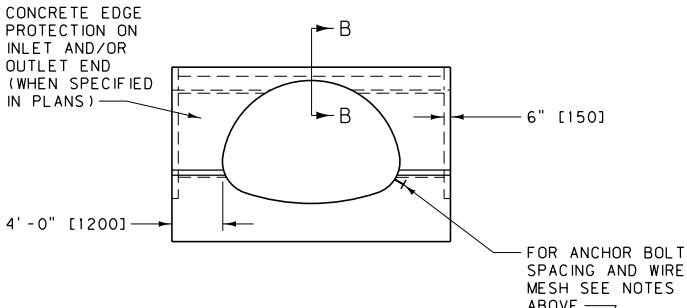

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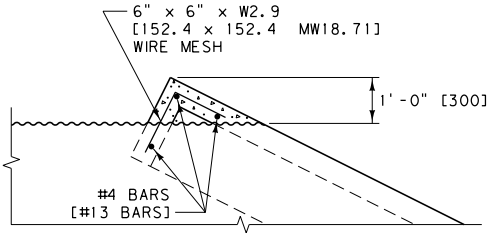
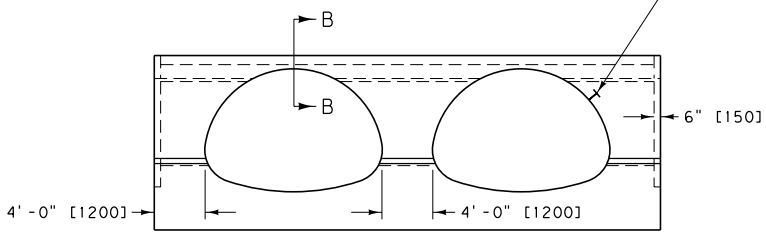


SECTION B-B



FRONT ELEVATION MULTIPLE PIPES

NOTE:
ALL CONCRETE IS CLASS GENERAL OR EQUAL.

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 613, 603, 552

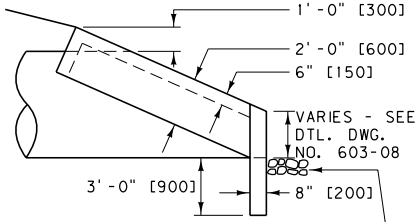
DWG. NO. 613-06

CONCRETE EDGE PROTECTION FOR METAL CULVERTS

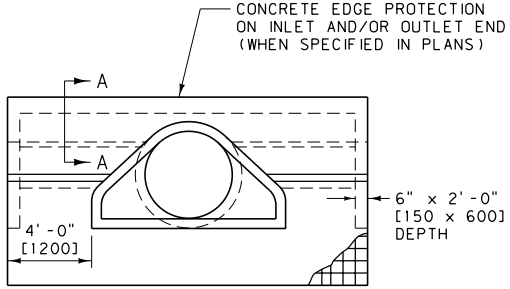
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

ROUND PIPE

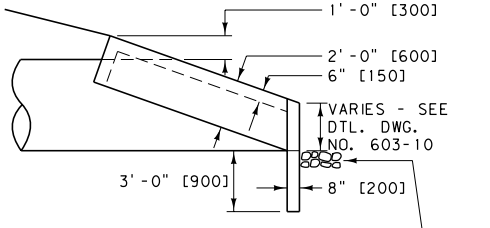


SIDE ELEVATION

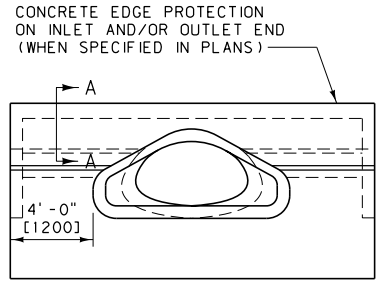


FRONT ELEVATION

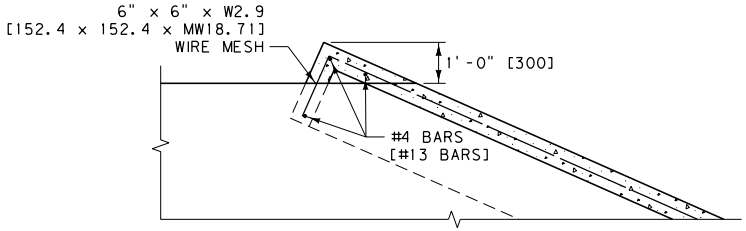
ARCH PIPE



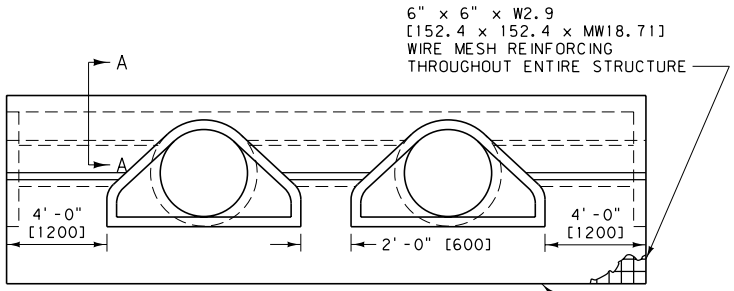
SIDE ELEVATION



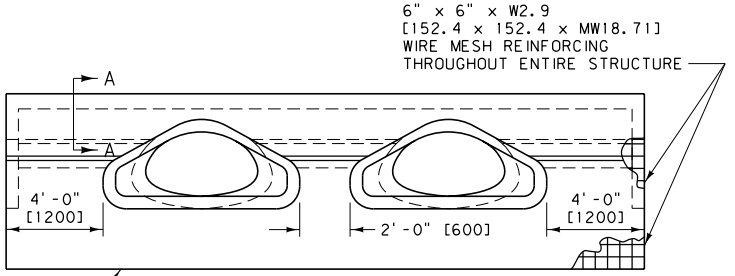
FRONT ELEVATION



SECTION A-A



FRONT ELEVATION MULTIPLE PIPES



FRONT ELEVATION MULTIPLE PIPES

CUTOFF WALL INLET AND OUTLET END SEE DTL. DWG. NO. 552-00 (WHEN SPECIFIED IN PLANS)

NOTE:
ALL CONCRETE IS CLASS GENERAL CONCRETE OR EQUAL.

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

DETAILED DRAWING

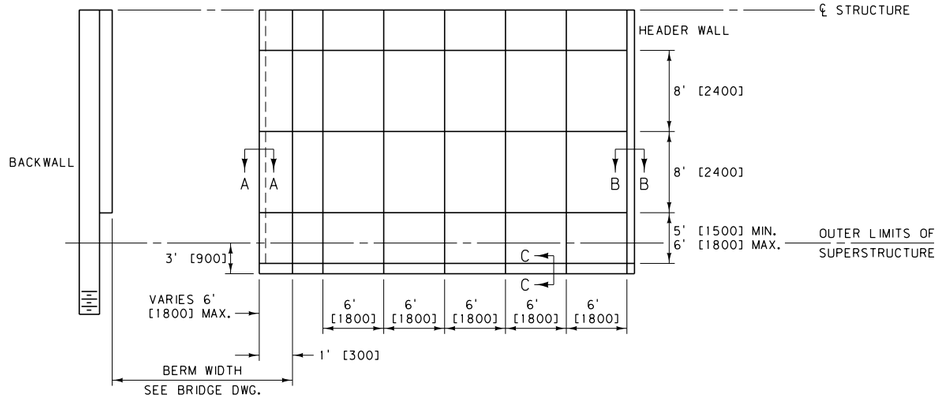
REFERENCE STANDARD SPEC. SECTION 613, 603, 552

DWG. NO. 613-08

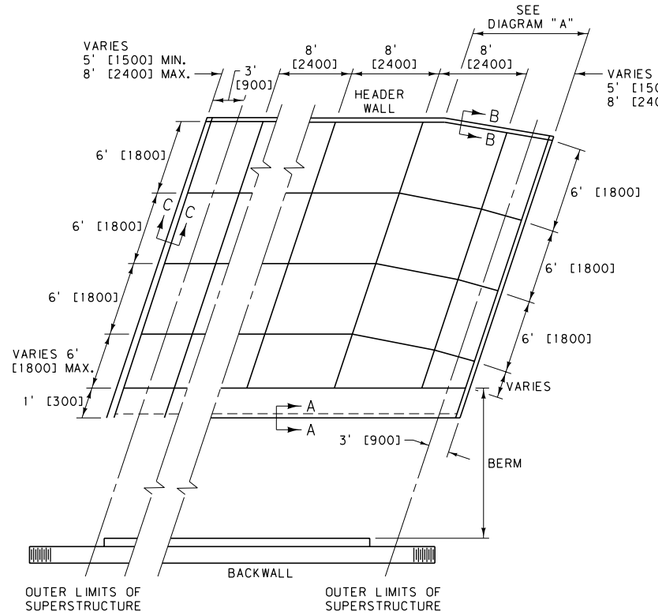
CONCRETE EDGE PROTECTION FOR CONCRETE CULVERTS

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



STRAIGHT STRUCTURE



SKEWED STRUCTURE

CAST-IN-PLACE CONCRETE:

LOCATE JOINTS AS INDICATED ON THE PLANS. IF CONSTRUCTION IS STOPPED FOR OVER TWO HOURS, CREATE A CONSTRUCTION JOINT. USE CLASS GENERAL CONCRETE FOR ALL CAST-IN-PLACE CONCRETE.

USE A 1/2" [13]EXPANSION JOINT FILLER PER SECTION 707 WHENEVER THE CAST-IN-PLACE CONCRETE ABUTS AGAINST ANY PART OF THE BRIDGE STRUCTURE.

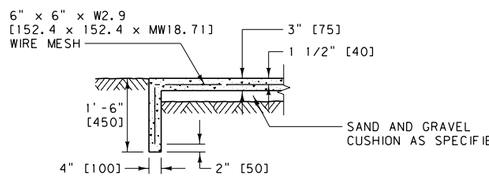
CLEAR THE EMBANKMENT SLOPE OF ALL BRUSH, DEBRIS AND RUBBLE. A CUSHION IS NOT REQUIRED FOR GRAVEL EMBANKMENT SLOPES. FINISH ALL SLOPES TO THE SLOPE INDICATED IN THE BRIDGE PLANS. COMPACT ALL LOOSE MATERIAL. LEAVE THE ADJACENT SLOPE AREA IN A SMOOTH, UNIFORM CONDITION.

REINFORCING STEEL:

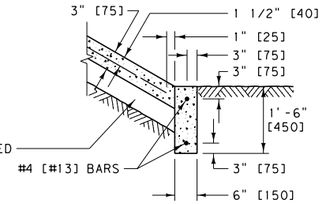
(MAY USE EITHER ALTERNATE LISTED BELOW)

1. #3 [#10]BARS AT 10" [250]O.C. (HORIZONTAL AND VERTICAL SPACING) MIN. COVER OF 2" [50]
2. 6" x 6" x W2.9 [152.4 x 152.4 MW187.1]WIRE MESH

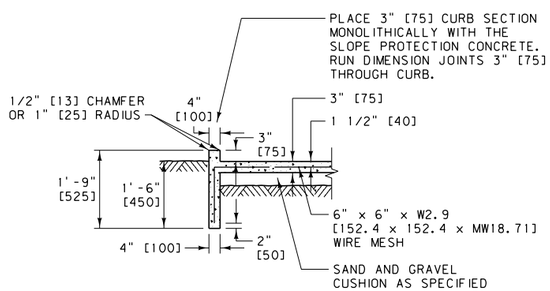
12" [300]OVERLAP REQUIRED AT CONSTRUCTION JOINTS FOR REINFORCING STEEL AND WIRE MESH.



SECTION A-A



SECTION B-B
HEADER WALL



SECTION C-C

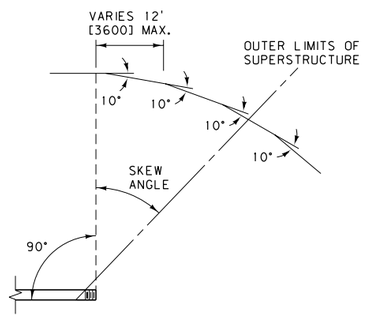
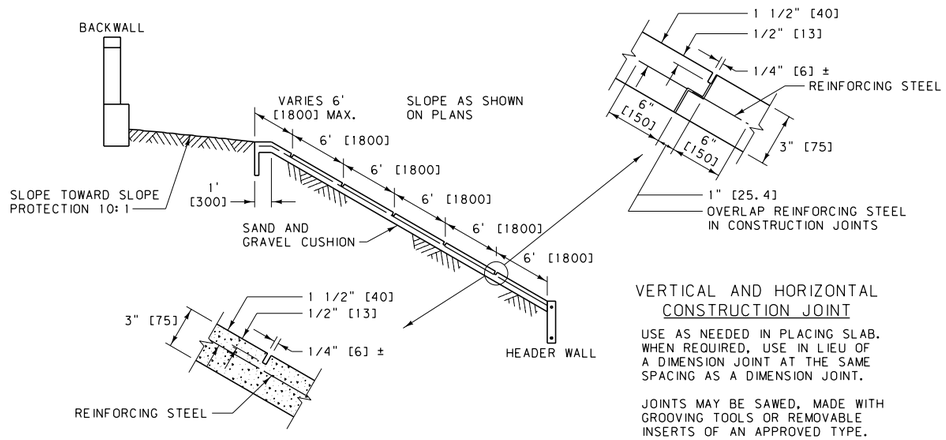


DIAGRAM "A"



VERTICAL AND HORIZONTAL
CONSTRUCTION JOINT

USE AS NEEDED IN PLACING SLAB. WHEN REQUIRED, USE IN LIEU OF A DIMENSION JOINT AT THE SAME SPACING AS A DIMENSION JOINT.

JOINTS MAY BE SAWED, MADE WITH GROOVING TOOLS OR REMOVABLE INSERTS OF AN APPROVED TYPE.

IF JOINTS ARE TO BE SAWED, SAW JOINTS JUST AFTER CONCRETE HAS SET BUT BEFORE UNCONTROLLED CRACKING OCCURS.

VERTICAL AND HORIZONTAL
DIMENSION JOINT

6' [1800] VERTICAL SPACING OR AS NOTED.
8' [2400] HORIZONTAL SPACING OR AS NOTED.
JOINTS MAY BE SAWED, MADE WITH GROOVING TOOLS OR REMOVABLE INSERTS OF AN APPROVED TYPE.

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

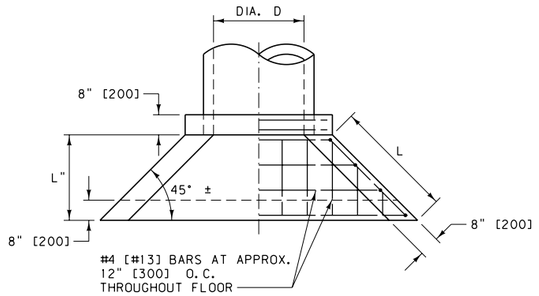
DETAILED DRAWING

REFERENCE	DWG. NO.
STANDARD SPEC. SECTION 613, 707	613-10

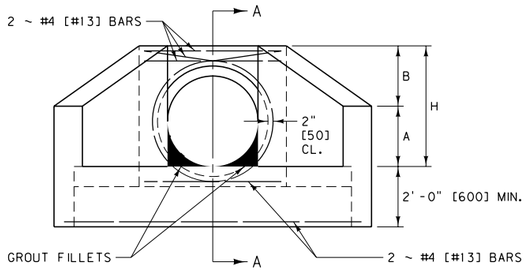
CONCRETE SLOPE PROTECTION

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

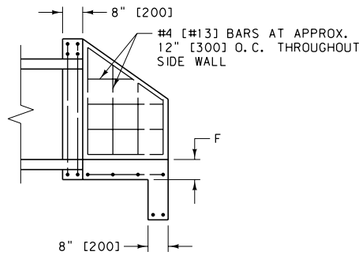


PLAN



ELEVATION

INLET HEADWALL



SECTION A-A

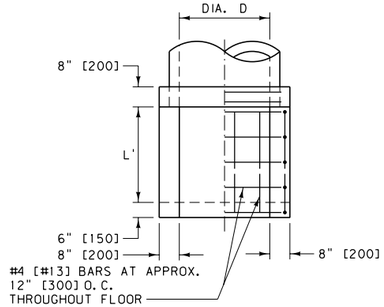
CHAMFER ALL EXPOSED CORNERS 1" [25]. REINFORCING STEEL TO BE NOT LESS THAN 1 1/2" [40] TO NEAREST FACE OF CONCRETE.

INLET AND OUTLET HEADWALLS FOR CMP												
CULVERT		CL. GENERAL CONC. OR EQUAL (C.Y.)		* REBAR #4 (LB.)		DIMENSION TABLE						
DIA. D	AREA (SQ. FT.)	INLET	OUTLET	INLET	OUTLET	A	B	H	L	L"	F	L'
18"	1.77	0.73	0.59	70	60	1'-3"	1'-3"	2'-6"	2'-6"	1'-9"	6"	2'-2"
24"	3.14	0.91	0.76	83	73	1'-6"	1'-6"	3'-0"	3'-0"	2'-1"	6"	2'-6"
30"	4.91	1.06	0.95	109	93	1'-9"	1'-9"	3'-6"	3'-6"	2'-6"	6"	2'-10"
36"	7.07	1.68	1.11	127	108	2'-0"	2'-0"	4'-0"	4'-0"	2'-10"	6"	3'-2"
42"	9.62	2.10	1.40	153	125	2'-3"	2'-3"	4'-6"	4'-6"	3'-2"	6"	3'-6"
48"	12.57	2.32	1.66	178	149	2'-6"	2'-6"	5'-0"	5'-0"	3'-6"	6"	3'-10"

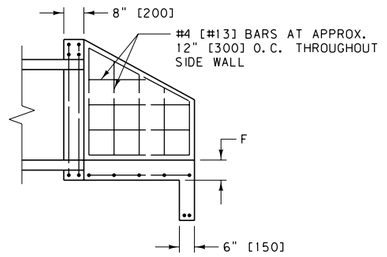
* FOR INFORMATION PURPOSES ONLY INLCUDE IN THE COST OF CLASS DD CONCRETE

METRIC INLET AND OUTLET HEADWALLS FOR CMP												
CULVERT		CL. GENERAL CONC. OR EQUAL (m^3)		* REBAR #13 (kg)		METRIC DIMENSION TABLE (mm)						
DIA. D (mm)	AREA (m^2)	INLET	OUTLET	INLET	OUTLET	A	B	H	L	L"	F	L'
450	0.159	0.6	0.5	32	27	400	400	800	750	550	150	650
600	0.283	0.8	0.6	38	33	450	450	900	900	650	150	750
750	0.442	1.1	0.8	50	42	550	550	1100	1050	750	150	850
900	0.636	1.3	0.9	57	49	600	600	1200	1200	850	150	950
1050	0.866	1.6	1.1	69	57	700	700	1400	1350	950	150	1050
1200	1.131	1.8	1.3	81	68	750	750	1500	1500	1050	150	1150

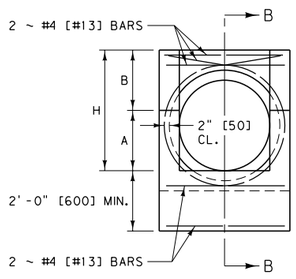
* FOR INFORMATION PURPOSES ONLY INLCUDE IN THE COST OF CLASS DD CONCRETE



PLAN



SECTION B-B



ELEVATION

OUTLET HEADWALL

INLET AND OUTLET HEADWALLS FOR RCP												
CULVERT		CL. GENERAL CONC. OR EQUAL (C.Y.)		* REBAR #4 (LB.)		DIMENSION TABLE						
DIA. D	AREA (SQ. FT.)	INLET	OUTLET	INLET	OUTLET	A	B	H	L	L"	F	L'
18"	1.77	0.80	0.60	71	61	1'-3"	1'-3"	2'-6"	2'-6"	1'-9"	6 1/2"	2'-2"
24"	3.14	1.00	0.86	85	75	1'-6"	1'-6"	3'-0"	3'-0"	2'-1"	7"	2'-6"
30"	4.91	1.42	1.14	112	95	1'-9"	1'-9"	3'-6"	3'-6"	2'-6"	7 1/2"	2'-10"
36"	7.07	1.84	1.43	129	111	2'-0"	2'-0"	4'-0"	4'-0"	2'-10"	8"	3'-2"
42"	9.62	2.12	1.73	156	128	2'-3"	2'-3"	4'-6"	4'-6"	3'-2"	8 1/2"	3'-6"
48"	12.57	2.34	2.07	182	152	2'-6"	2'-6"	5'-0"	5'-0"	3'-6"	9"	3'-10"

* FOR INFORMATION PURPOSES ONLY INLCUDE IN THE COST OF CLASS DD CONCRETE

METRIC INLET AND OUTLET HEADWALLS FOR RCP												
CULVERT		CL. GENERAL CONC. OR EQUAL (m^3)		* REBAR #13 (kg)		METRIC DIMENSION TABLE (mm)						
DIA. D (mm)	AREA (m^2)	INLET	OUTLET	INLET	OUTLET	A	B	H	L	L"	F	L'
450	0.164	0.7	0.5	32	28	400	400	800	750	550	200	650
600	0.292	0.8	0.6	38	34	450	450	900	900	650	200	750
750	0.456	1.1	0.8	51	43	550	550	1100	1050	750	200	850
900	0.657	1.4	1.0	59	50	600	600	1200	1200	850	250	950
1050	0.894	1.7	1.2	71	58	700	700	1400	1350	950	250	1050
1200	1.167	2.0	1.4	82	69	750	750	1500	1500	1050	250	1150

* FOR INFORMATION PURPOSES ONLY INLCUDE IN THE COST OF CLASS DD CONCRETE

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

DETAILED DRAWING

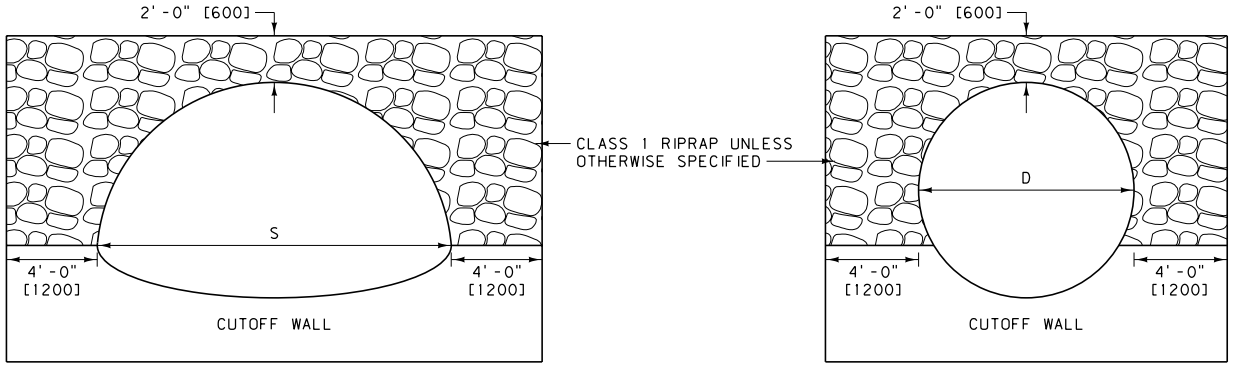
REFERENCE STANDARD SPEC. SECTION 613

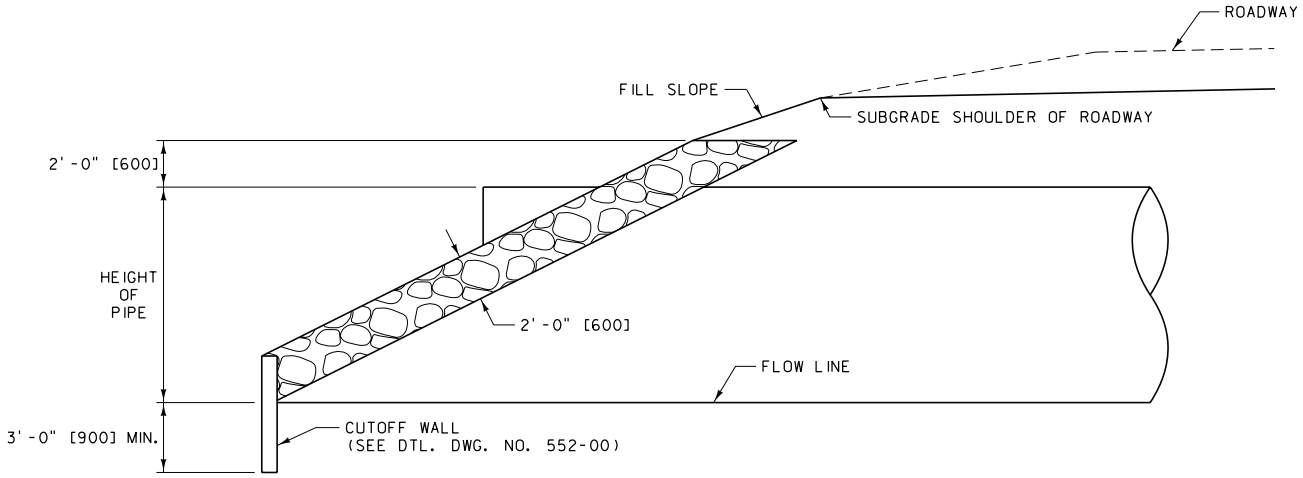
DWG. NO. 613-12

INLET AND OUTLET HEADWALLS FOR RCP AND CMP PIPES

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



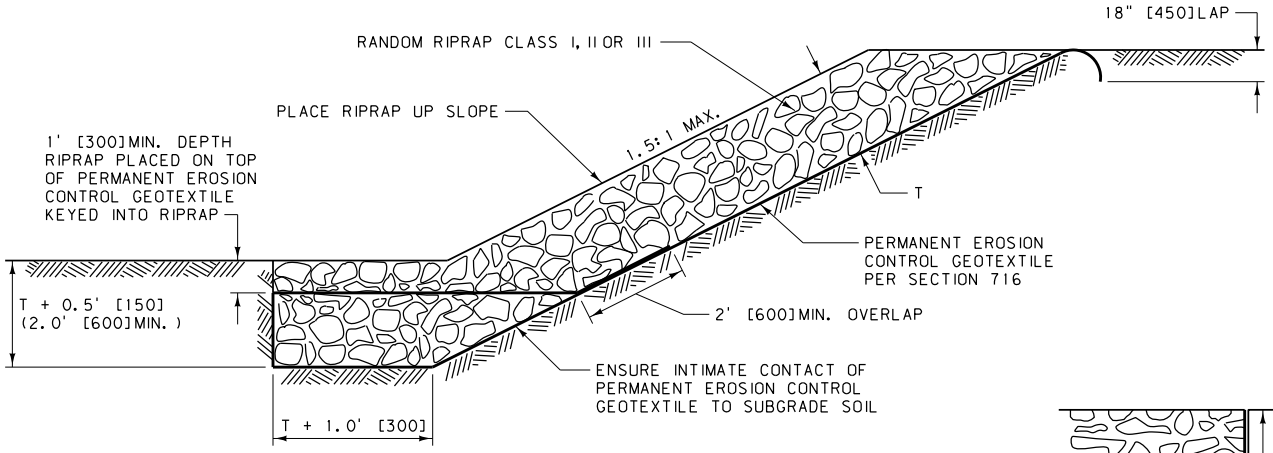


NOTES:

KEY ENDS OF RIPRAP WALLS INTO THE EMBANKMENT SLOPES A MINIMUM OF 2 FEET [600 mm]FROM OUTER FACE OF THE RIPRAP FOR THE FULL HEIGHT OF THE RIPRAP WALL.

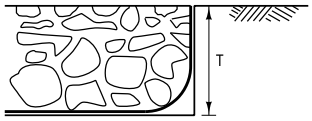
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 613	DWG. NO. 613-14
CULVERT RIPRAP	
EFFECTIVE: SEPTEMBER 2014	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	

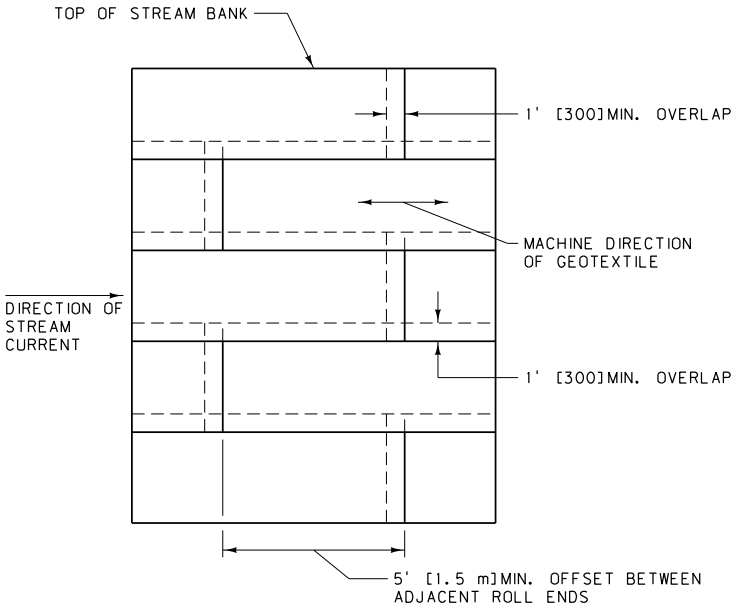


EMBANKMENT PROTECTION

MINIMUM T FOR:
CLASS I RIPRAP = 1.5' [450]
CLASS II RIPRAP = 2.5' [750]
CLASS III RIPRAP = 3.0' [900]

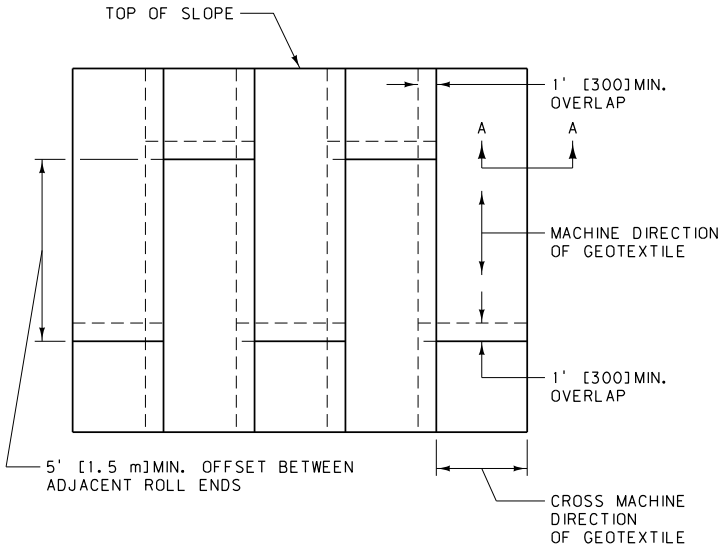


SECTION A-A



GEOTEXTILE PLACEMENT DETAIL

METHOD FOR PLACING PERMANENT EROSION CONTROL GEOTEXTILE FOR PROTECTION OF STREAM BANKS



GEOTEXTILE PLACEMENT DETAIL

METHOD FOR PLACING PERMANENT EROSION CONTROL GEOTEXTILE FOR PROTECTION OF CUT AND FILL SLOPES

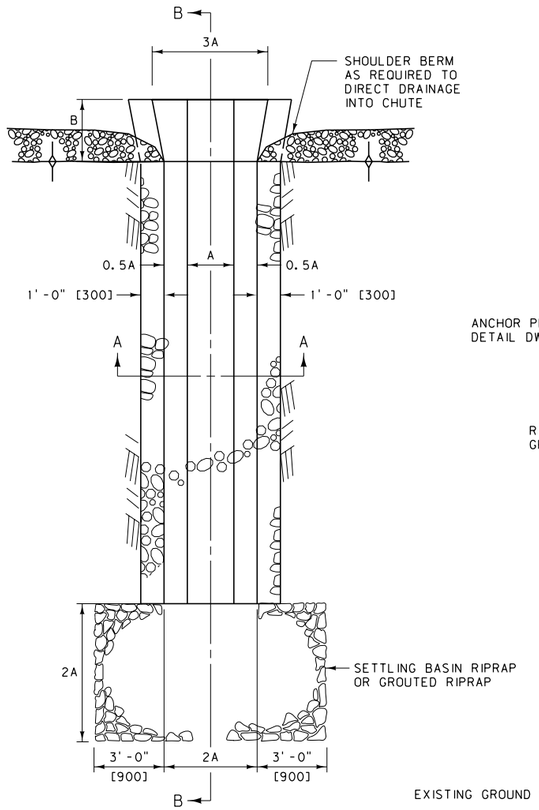
NOTES:

① INSTALL PERMANENT EROSION CONTROL GEOTEXTILE PER SECTION 622.

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

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 613, 622	DWG. NO. 613-16
RIPRAP SLOPE PROTECTION	
--REVISED-- JULY 2016	EFFECTIVE: SEPTEMBER 2014
	MDT MONTANA DEPARTMENT OF TRANSPORTATION

RIPRAP & GROUTED RIPRAP DRAINAGE CHUTE



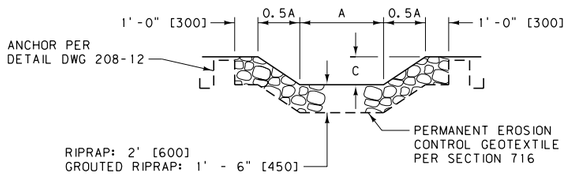
PLAN VIEW

RIPRAP:

USE RANDOM RIPRAP CONFORMING TO SECTION 701.06 OF THE STANDARD SPECIFICATIONS.

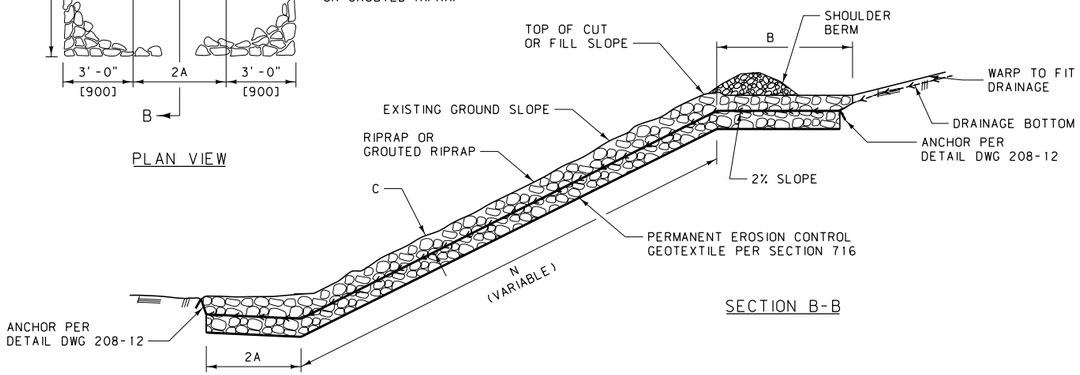
GROUT:

USE CEMENT GROUT CONFORMING TO SECTION 713.04 OF THE STANDARD SPECIFICATIONS.



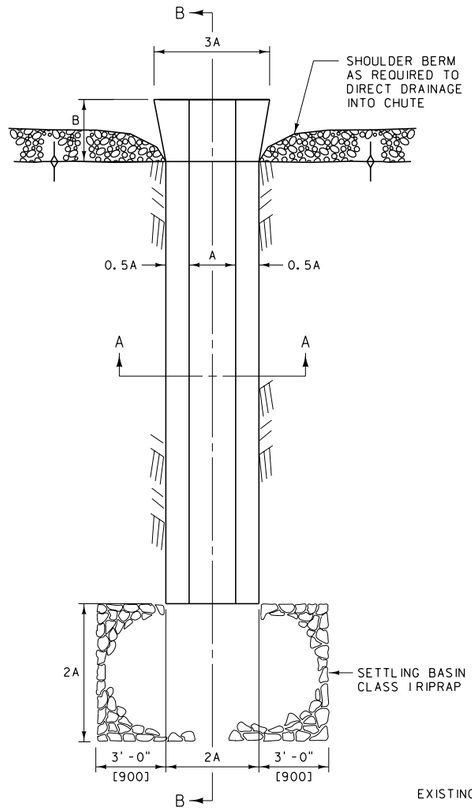
SECTION A-A

RIPRAP & GROUTED RIPRAP CHUTE



SECTION B-B

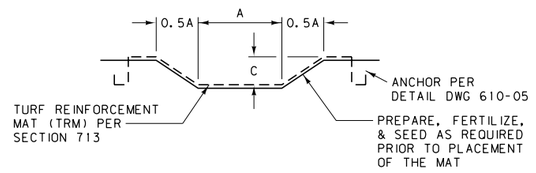
TURF REINFORCEMENT MAT DRAINAGE CHUTE



PLAN VIEW

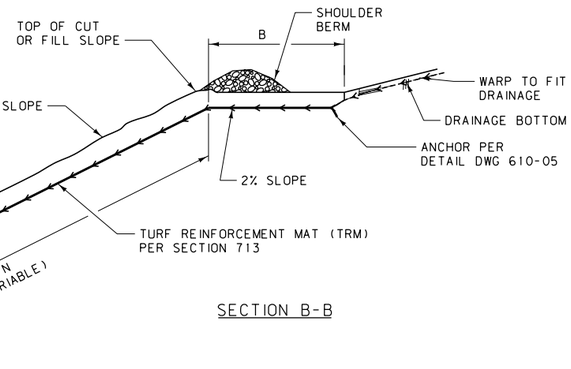
TURF REINFORCEMENT MAT:

USE TURF REINFORCEMENT MAT (TRM) CONFORMING TO SECTION 713.12 OF THE STANDARD SPECIFICATIONS.



SECTION A-A

TURF REINFORCEMENT MAT CHUTE

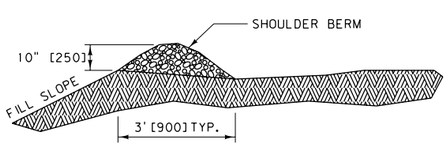


SECTION B-B

TYPE	DIMENSIONS			RIPRAP CLASS	QUANTITIES			
	A	B	C		RIPRAP	GROUTED RIPRAP	TURF REINFORCEMENT MAT	ADD. RIPRAP FOR TRM CHUTES
1	2'-0"	4'-0"	1'-0"	I	5.23 C.Y. + (N x 0.506) C.Y./L.F.	✱ 7.84 S.Y. + (N x 0.759) S.Y./L.F.	6.96 S.Y. + (N x 0.537) S.Y./L.F.	✱ 1.5 C.Y.
2	2'-0"	4'-0"	1'-6"	I	5.42 C.Y. + (N x 0.563) C.Y./L.F.	✱ 8.13 S.Y. + (N x 0.845) S.Y./L.F.	7.25 S.Y. + (N x 0.623) S.Y./L.F.	✱ 2.2 C.Y.
3	4'-0"	8'-0"	1'-6"	II	15.86 C.Y. + (N x 0.815) C.Y./L.F.	✱ 23.80 S.Y. + (N x 1.222) S.Y./L.F.	22.02 S.Y. + (N x 1.000) S.Y./L.F.	✱ 9.8 C.Y.
4	4'-0"	8'-0"	2'-0"	II	16.18 C.Y. + (N x 0.863) C.Y./L.F.	✱ 24.27 S.Y. + (N x 1.295) S.Y./L.F.	22.49 S.Y. + (N x 1.073) S.Y./L.F.	✱ 13.0 C.Y.

TYPE	METRIC DIMENSIONS			RIPRAP CLASS	METRIC QUANTITIES			
	A	B	C		RIPRAP	GROUTED RIPRAP	TURF REINFORCEMENT MAT	ADD. RIPRAP FOR TRM CHUTES
1	600	1200	300	I	3.81 m³ + (N x 1.229) m³/m	✱ 6.35 m² + (N x 2.049) m²/m	5.63 m² + (N x 1.449) m²/m	✱ 1.2 m³
2	600	1200	450	I	3.95 m³ + (N x 1.369) m³/m	✱ 6.59 m² + (N x 2.282) m²/m	5.87 m² + (N x 1.682) m²/m	✱ 1.7 m³
3	1200	2400	450	II	11.57 m³ + (N x 1.980) m³/m	✱ 19.28 m² + (N x 3.300) m²/m	17.84 m² + (N x 2.700) m²/m	✱ 7.5 m³
4	1200	2400	600	II	11.79 m³ + (N x 2.098) m³/m	✱ 19.66 m² + (N x 3.497) m²/m	18.22 m² + (N x 2.897) m²/m	✱ 10.0 m³

✱ USE CLASS-I RIPRAP FOR ALL GROUTED RIPRAP TYPES & TRM CHUTES



SHOULDER BERM DETAIL (TYP. FOR ALL TYPES)

INLET CONDITIONS (TYP. FOR ALL TYPES):

DEPRESS THE INLET BELOW THE NATURAL DRAINAGE BOTTOM TO PREVENT FLOW FROM BYPASSING THE DRAINAGE CHUTE.

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 613, 701, 713, 716

DWG. NO. 613-18

DRAINAGE CHUTES

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION