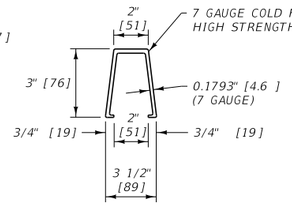


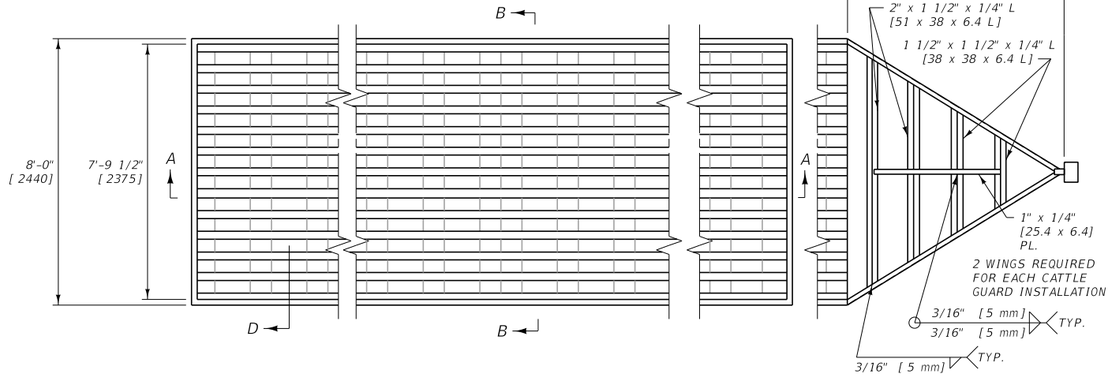
SECTION A-A

(8' [2440] SECTIONS)



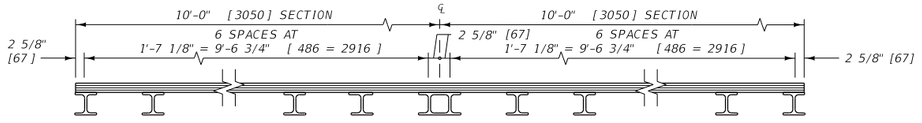
CROSSBAR

LIVE LOADING: STANDARD (HS20) LOADING



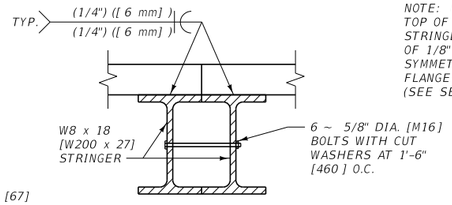
PLAN

STEEL WING

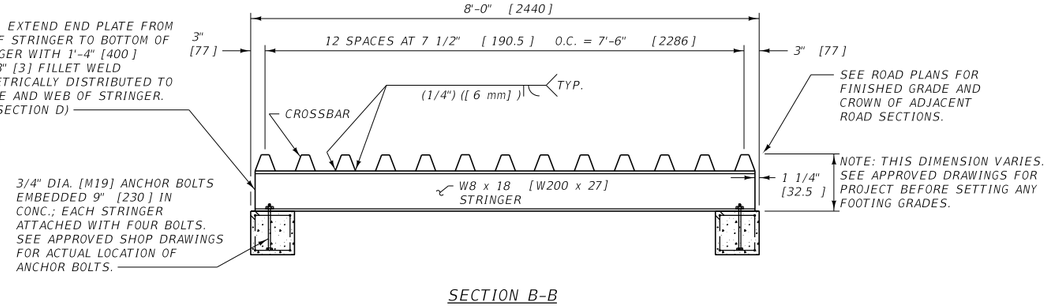


SECTION A-A

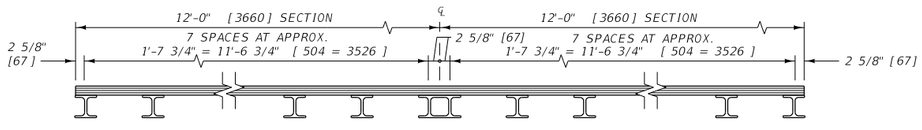
(10' [3050] SECTIONS)



MULTIPLE INSTALLATION JOINT

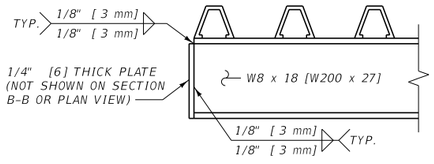


SECTION B-B

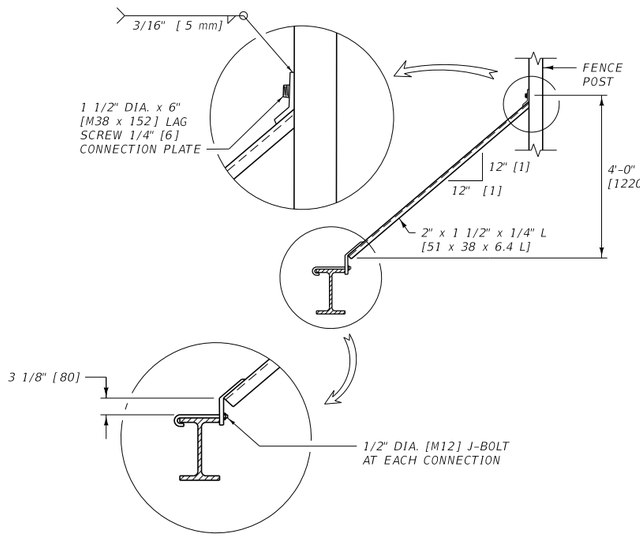


SECTION A-A

(12' [3660] SECTIONS)



SECTION D



STEEL WING CONNECTION DETAILS

NOTES:

1. USE PRECAST CONCRETE BASES FOR CATTLE GUARDS. SEE DTL. DWG. NO. 611-15.
2. FOR CATTLE GUARDS ON FARM FIELD OR PRIVATE APPROACHES, THE PRECAST CONCRETE BASES IN DTL. DWG. NO. 611-10 MAY BE USED.
3. USE AN EVEN NUMBER OF STEEL CATTLE GUARD GRATES WHEN A CROWNED INSTALLATION IS REQUIRED.
4. ANCHOR BOLTS ARE TO CONFORM TO AASHTO M 314 [314M] GRADE 36 [250 MPa].
5. ALL NUTS, BOLTS, AND WASHERS ARE TO BE GALVANIZED.

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

DETAILED DRAWING

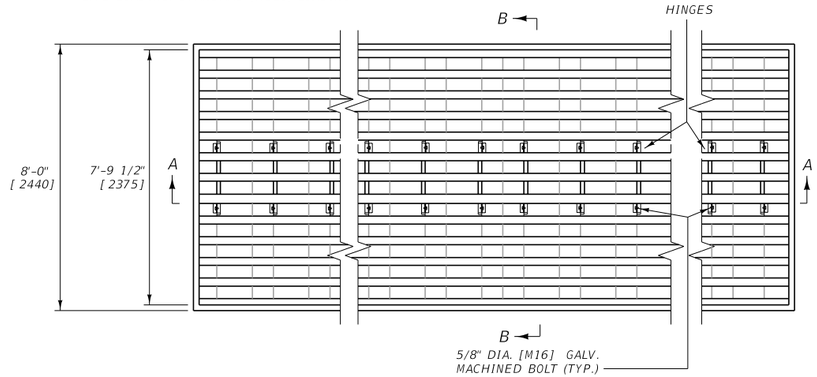
REFERENCE STANDARD SPEC. SECTION 611

DWG. NO. 611-00

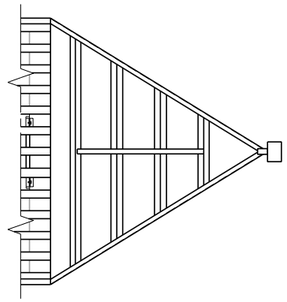
CATTLE GUARD GRATE

MDT MONTANA DEPARTMENT OF TRANSPORTATION

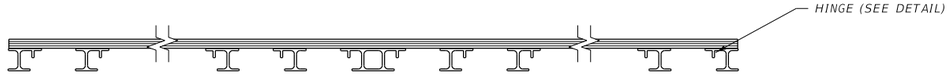
LIVE LOADING: STANDARD (HS20) LOADING



PLAN

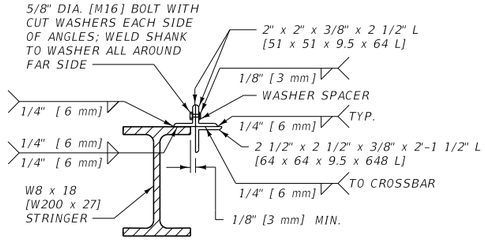


STEEL WING



SECTION A-A

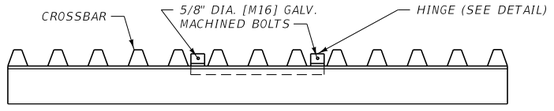
NOTE: SEE DTL. DWG. NO. 611-10
OR DWG. NO. 611-15 FOR BASE DETAILS



HINGE DETAIL

(HINGED AREA OPENS
FOR CLEANOUT)

NOTE: LOCK DETAIL SIMILAR EXCEPT USE 5/8" DIA. [M16] GALV. MACHINED BOLT WITH GALV. CUT WASHER & GALV. HEX NUTS INSTEAD OF WELDED STUD BOLT.



SECTION B-B

NOTES:

1. USE AN EVEN NUMBER OF STEEL CATTLE GUARD GRATES WHEN A CROWNED INSTALLATION IS REQUIRED.
2. ANCHOR BOLTS ARE TO CONFORM TO AASHTO M 314 [314M] GRADE 36 [250 MPa].
3. ALL NUTS, BOLTS, AND WASHERS ARE TO BE GALVANIZED.
4. WELD CROSSBARS TO 2 1/2" x 2 1/2" x 3/8" x 2'-1 1/2" L [64 x 64 x 9.5 x 648 L] ANGLES HINGED AREA ONLY. SEE DTL. DWG. NO. 611-00 FOR CROSSBAR DETAIL.
5. FABRICATE ALL LIGHT DUTY CATTLE GUARDS TO INCLUDE HINGED GRATE

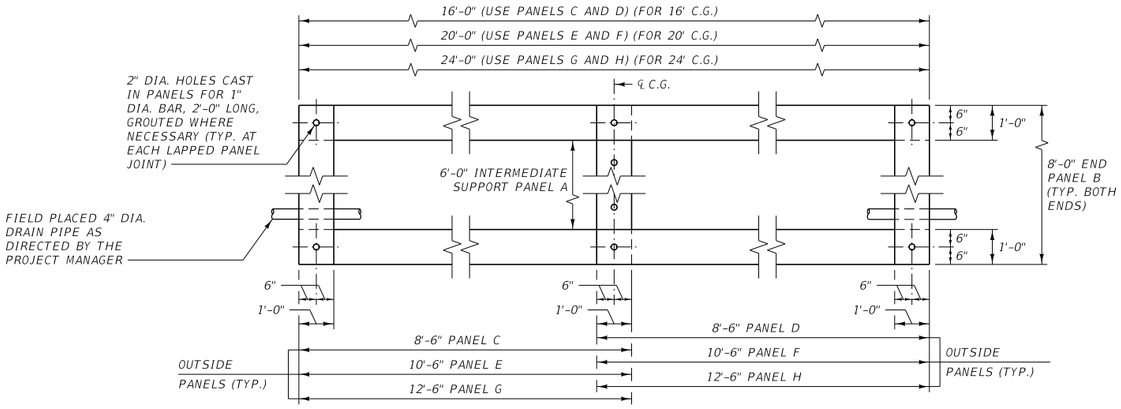
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

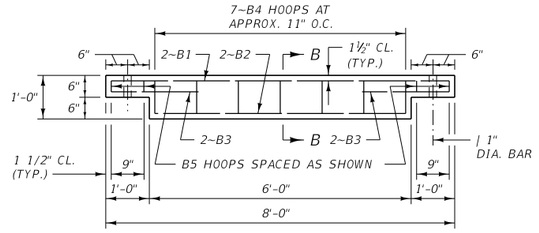
REFERENCE STANDARD SPEC. SECTION 611	DWG. NO. 611-03

CATTLE GUARD
HINGED GRATE

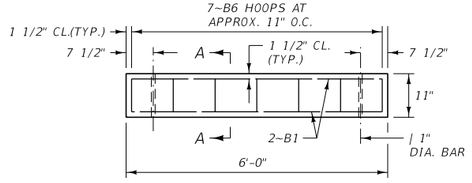
MDT MONTANA DEPARTMENT OF TRANSPORTATION



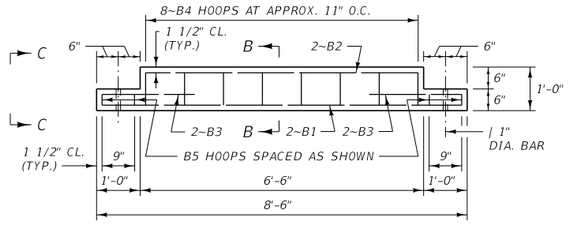
TYPICAL PLAN VIEW



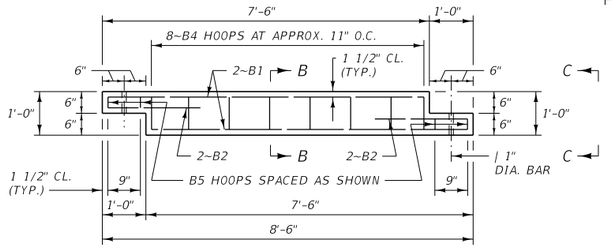
END PANEL B ELEVATION



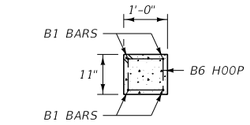
INTERMEDIATE SUPPORT PANEL A ELEVATION



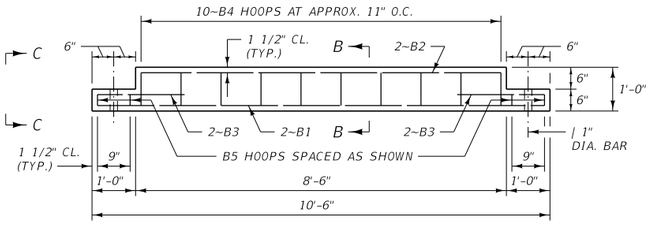
PANEL C ELEVATION



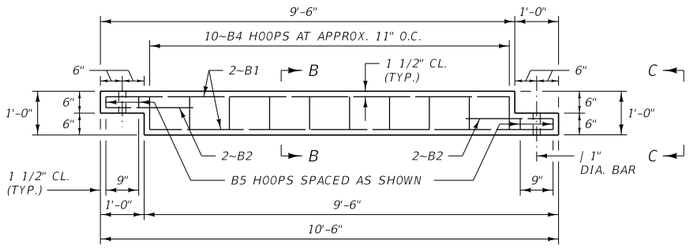
PANEL D ELEVATION



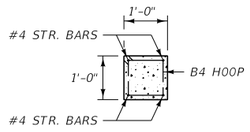
SECTION A-A



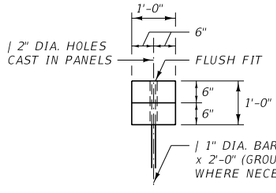
PANEL E ELEVATION



PANEL F ELEVATION

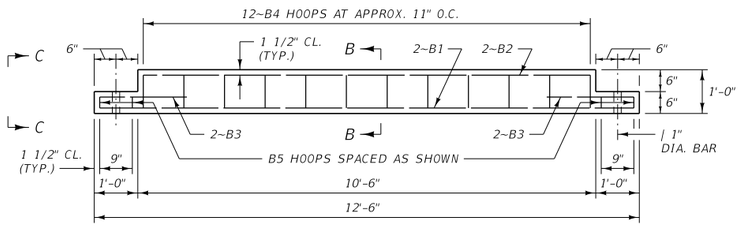


SECTION B-B

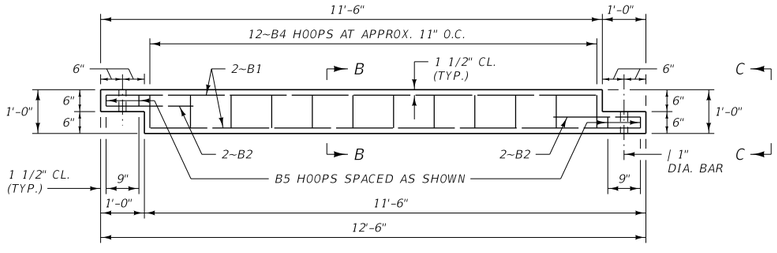


VIEW C-C

(TYP. LAPPED PANEL JOINT)

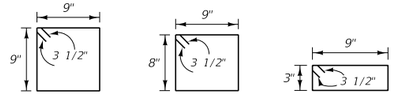


PANEL G ELEVATION



PANEL H ELEVATION

BILL OF REINFORCING STEEL *



STRAIGHT BARS & BENT BARS (ALL DIMENSIONS OUT TO OUT)

MARK	SIZE	NO.	TYPE	LENGTH
6'-0" SECTION - PANEL A				
B1	#4	4	STRAIGHT	5'-9"
B6	#3	7	2	3'-5"
ESTIMATED WT. = 24 LB.				
8'-0" SECTION - PANEL B				
B1	#4	2	STRAIGHT	7'-9"
B2	#4	2	STRAIGHT	5'-9"
B3	#4	4	STRAIGHT	2'-2"
B4	#3	7	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 37 LB.				
8'-6" SECTION - PANEL C				
B1	#4	2	STRAIGHT	8'-3"
B2	#4	2	STRAIGHT	6'-3"
B3	#4	4	STRAIGHT	2'-2"
B4	#3	8	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 40 LB.				
8'-6" SECTION - PANEL D				
B1	#4	4	STRAIGHT	7'-3"
B2	#4	4	STRAIGHT	2'-2"
B4	#3	8	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 40 LB.				
10'-6" SECTION - PANEL E				
B1	#4	2	STRAIGHT	10'-3"
B2	#4	2	STRAIGHT	8'-3"
B3	#4	4	STRAIGHT	2'-2"
B4	#3	10	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 48 LB.				
10'-6" SECTION - PANEL F				
B1	#4	4	STRAIGHT	9'-3"
B2	#4	4	STRAIGHT	2'-2"
B4	#3	10	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 48 LB.				
12'-6" SECTION - PANEL G				
B1	#4	2	STRAIGHT	12'-3"
B2	#4	2	STRAIGHT	10'-3"
B3	#4	4	STRAIGHT	2'-2"
B4	#3	12	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 56 LB.				
12'-6" SECTION - PANEL H				
B1	#4	4	STRAIGHT	11'-3"
B2	#4	4	STRAIGHT	2'-2"
B4	#3	12	1	3'-7"
B5	#3	4	3	2'-7"
ESTIMATED WT. = 56 LB.				

* FOR ONE PANEL ONLY

ESTIMATED CLASS GENERAL CONCRETE QUANTITIES
6'-0" SECTION - PANEL A = 0.20 C.Y.
8'-0" SECTION - PANEL B = 0.26 C.Y.
8'-6" SECTION - PANEL C = 0.28 C.Y.
8'-6" SECTION - PANEL D = 0.28 C.Y.
10'-6" SECTION - PANEL E = 0.35 C.Y.
10'-6" SECTION - PANEL F = 0.35 C.Y.
12'-6" SECTION - PANEL G = 0.43 C.Y.
12'-6" SECTION - PANEL H = 0.43 C.Y.

NOTES:

1. USE ONLY ON FIELD OR PRIVATE APPROACHES.
2. PROVIDE CAST-IN ANCHOR BOLTS AS SHOWN IN DTL. DWG. NO. 611-00 AT THE APPROPRIATE LOCATIONS. CAST-IN LAG PLATES, SIMILAR TO THOSE SHOWN IN DTL. DWG. NO. 611-15, MAY ALSO BE USED.
3. ALL REINFORCING STEEL IS OF THE DEFORMED TYPE, MEETING THE REQUIREMENTS OF AASHTO M31 (ASTM A615, GRADE 60).
4. FOR DETAILS OF STEEL GRATES AND STEEL WINGS SEE DTL. DWG. NO. 611-00.

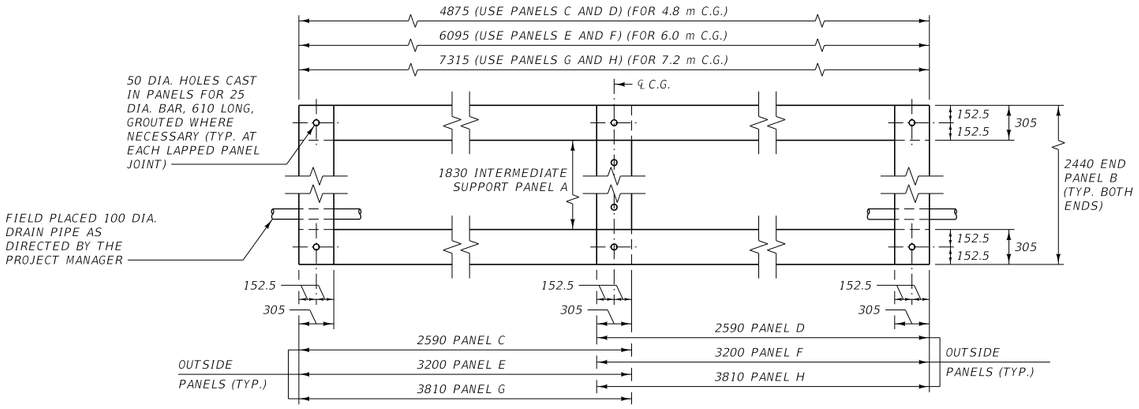
DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 611

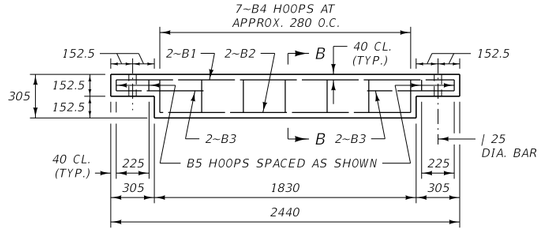
DWG. NO. 611-10

LIGHT DUTY CATTLE GUARD - PRECAST

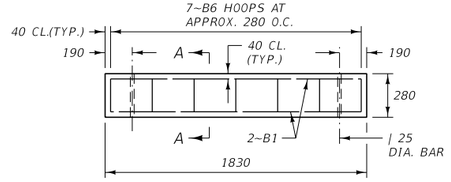
MDT MONTANA DEPARTMENT OF TRANSPORTATION



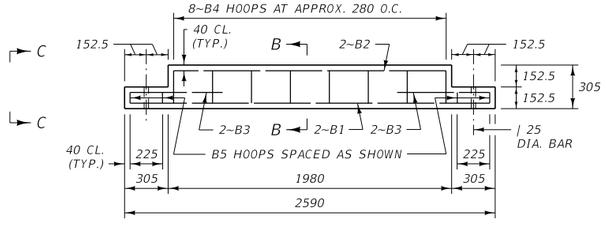
TYPICAL PLAN VIEW



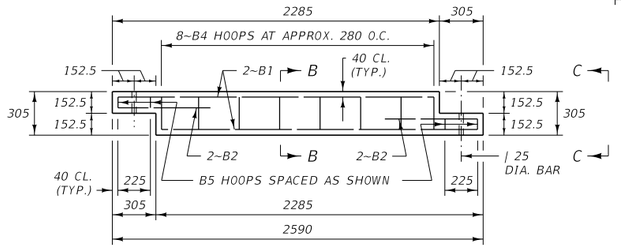
END PANEL B ELEVATION



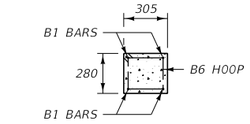
INTERMEDIATE SUPPORT PANEL A ELEVATION



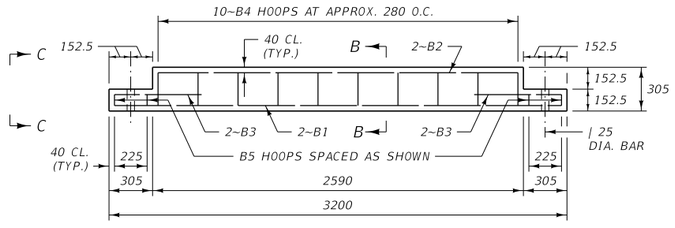
PANEL C ELEVATION



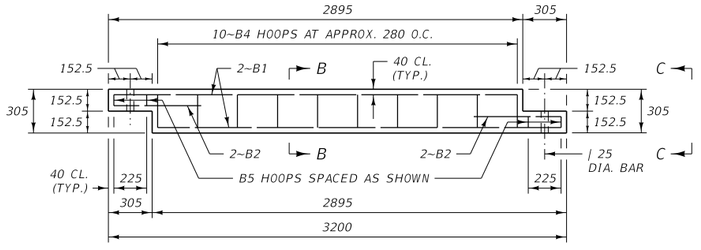
PANEL D ELEVATION



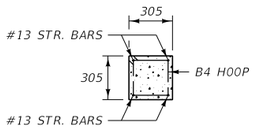
SECTION A-A



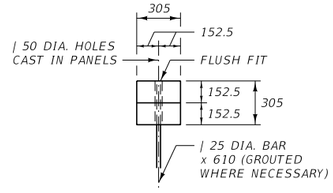
PANEL E ELEVATION



PANEL F ELEVATION

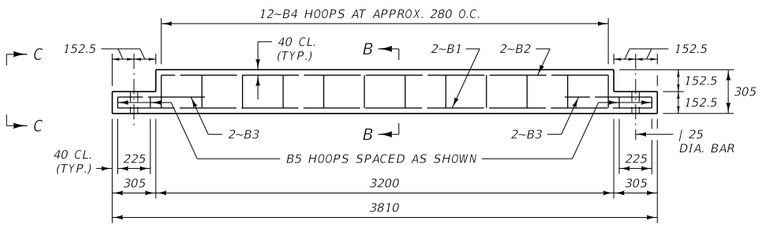


SECTION B-B

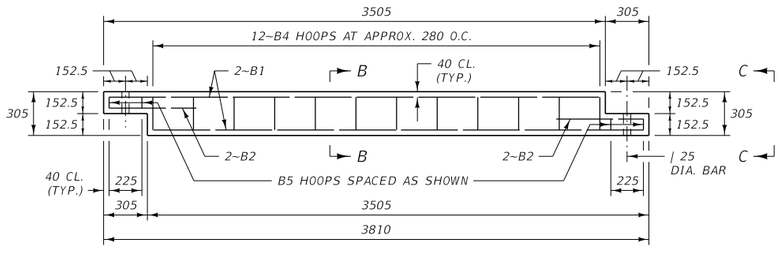


VIEW C-C

(TYP. LAPPED PANEL JOINT)



PANEL G ELEVATION

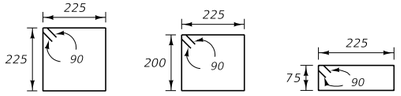


PANEL H ELEVATION

NOTES:

1. USE ONLY ON FIELD OR PRIVATE APPROACHES.
2. PROVIDE CAST-IN ANCHOR BOLTS AS SHOWN IN DTL. DWG. NO. 611-00 AT THE APPROPRIATE LOCATIONS. CAST-IN LAG PLATES, SIMILAR TO THOSE SHOWN IN DTL. DWG. NO. 611-15, MAY ALSO BE USED.
3. ALL REINFORCING STEEL IS OF THE DEFORMED TYPE, MEETING THE REQUIREMENTS OF AASHTO M31 (ASTM A615, GRADE 60).
4. FOR DETAILS OF STEEL GRATES AND STEEL WINGS SEE DTL. DWG. NO. 611-00.

BILL OF REINFORCING STEEL *



STRAIGHT BARS & BENT BARS (ALL DIMENSIONS OUT TO OUT)

MARK	SIZE	NO.	TYPE	LENGTH
1830 SECTION - PANEL A				
B1	#13	4	STRAIGHT	1750
B6	#10	7	2	1030
ESTIMATED WT. = 11 kg				
2440 SECTION - PANEL B				
B1	#13	2	STRAIGHT	2360
B2	#13	2	STRAIGHT	1750
B3	#13	4	STRAIGHT	660
B4	#10	7	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 16.8 kg				
2590 SECTION - PANEL C				
B1	#13	2	STRAIGHT	2510
B2	#13	2	STRAIGHT	1900
B3	#13	4	STRAIGHT	660
B4	#10	8	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 18 kg				
2590 SECTION - PANEL D				
B1	#13	4	STRAIGHT	2205
B2	#13	4	STRAIGHT	660
B4	#10	8	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 18 kg				
3200 SECTION - PANEL E				
B1	#13	2	STRAIGHT	3120
B2	#13	2	STRAIGHT	2510
B3	#13	4	STRAIGHT	660
B4	#10	10	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 21.6 kg				
3200 SECTION - PANEL F				
B1	#13	4	STRAIGHT	2815
B2	#13	4	STRAIGHT	660
B4	#10	10	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 21.6 kg				
3810 SECTION - PANEL G				
B1	#13	2	STRAIGHT	3730
B2	#13	2	STRAIGHT	3120
B3	#13	4	STRAIGHT	660
B4	#10	12	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 25.2 kg				
3810 SECTION - PANEL H				
B1	#13	4	STRAIGHT	3425
B2	#13	4	STRAIGHT	660
B4	#10	12	1	1080
B5	#10	4	3	780
ESTIMATED WT. = 25.2 kg				

* FOR ONE PANEL ONLY

ESTIMATED CLASS GENERAL CONCRETE QUANTITIES
1830 SECTION - PANEL A = 0.16 m]
2440 SECTION - PANEL B = 0.20 m]
2590 SECTION - PANEL C = 0.21 m]
2590 SECTION - PANEL D = 0.21 m]
3200 SECTION - PANEL E = 0.27 m]
3200 SECTION - PANEL F = 0.27 m]
3810 SECTION - PANEL G = 0.33 m]
3810 SECTION - PANEL H = 0.33 m]

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

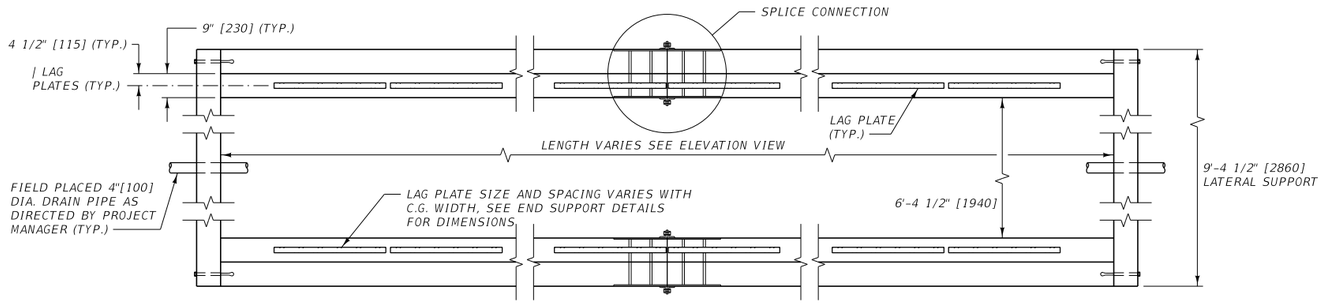
DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 611

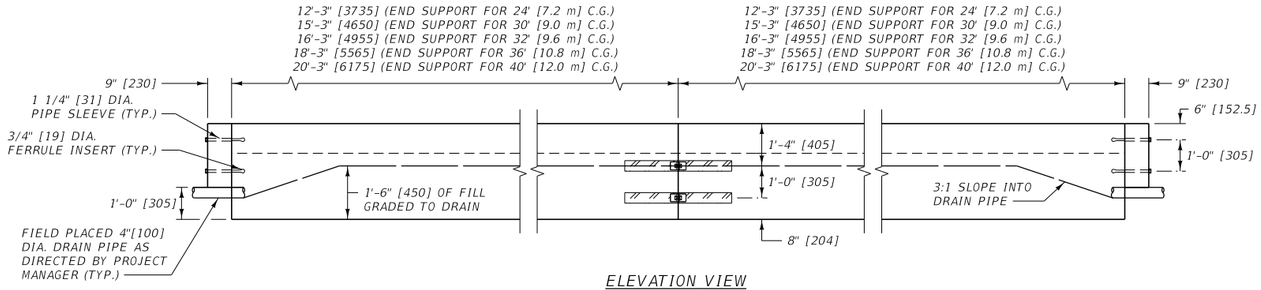
DWG. NO. 611-10

LIGHT DUTY CATTLE GUARD - PRECAST (METRIC)

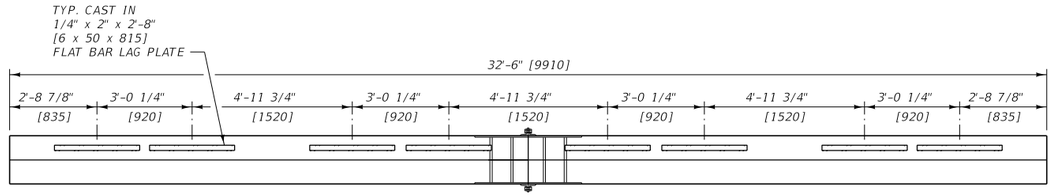
MDT MONTANA DEPARTMENT OF TRANSPORTATION



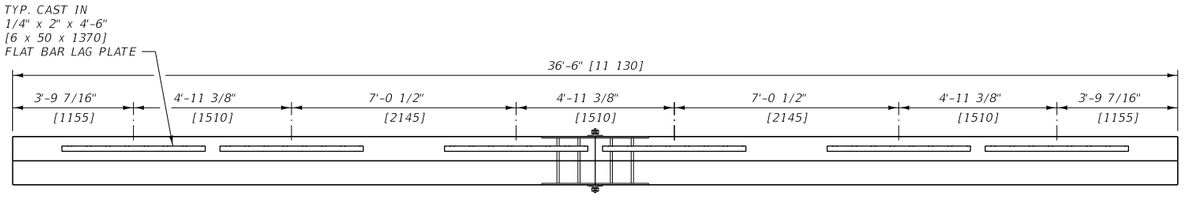
PLAN VIEW



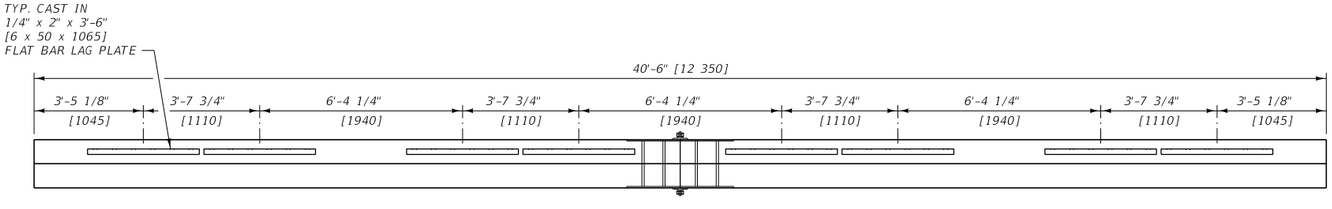
ELEVATION VIEW



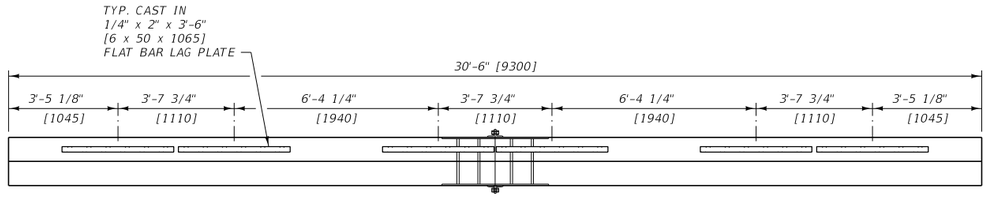
32' [9.6 m] CATTLE GUARD END SUPPORT DETAIL



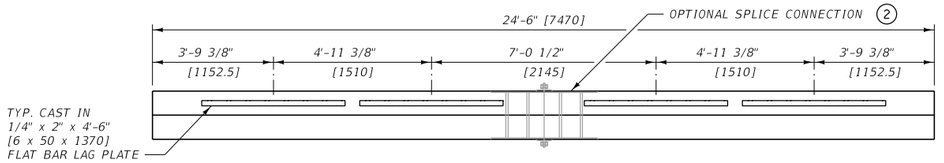
36' [10.8 m] CATTLE GUARD END SUPPORT DETAIL



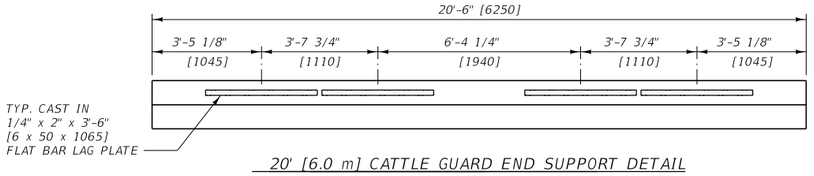
40' [12.0 m] CATTLE GUARD END SUPPORT DETAIL



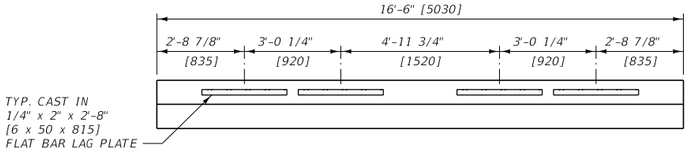
30' [9.0 m] CATTLE GUARD END SUPPORT DETAIL



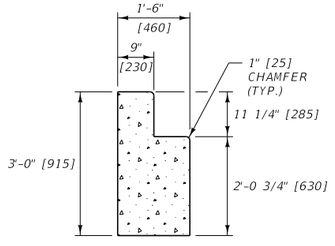
24' [7.2 m] CATTLE GUARD END SUPPORT DETAIL



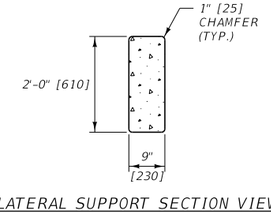
20' [6.0 m] CATTLE GUARD END SUPPORT DETAIL



16' [4.8 m] CATTLE GUARD END SUPPORT DETAIL



END SUPPORT SECTION VIEW



LATERAL SUPPORT SECTION VIEW

NOTES:

1. METRIC CATTLE GUARD SIZES ARE NOMINAL. STANDARD HS20 LIVE LOADING IS REQUIRED FOR HEAVY DUTY CATTLE GUARDS.
2. USE SPLICE CONNECTIONS WHEN A CROWNED INSTALLATION IS REQUIRED.
3. SEE DTL. DWG. NO. 611-20 FOR ADDITIONAL PRE-CAST CONCRETE CATTLE GUARD BASE AND MATERIAL QUANTITY DETAILS.
4. SEE DTL. DWG. NO. 611-00 FOR DETAILS OF STEEL GRATES AND STEEL WINGS.
5. INSTALLATION PROCEDURE:

   EXCAVATE 2'-0" [600] BELOW THE ELEVATION OF THE BOTTOM OF THE CATTLE GUARD BASE. EXTEND THE EXCAVATION HORIZONTALLY AT LEAST 1'-0" [300] IN ALL DIRECTIONS BEYOND THE CATTLE GUARD BASE'S EXTERIOR DIMENSION.

   FILL THE EXCAVATION WITH C.A.C. TO THE LEVEL OF THE BOTTOM OF THE CATTLE GUARD BASE. COMPACT ACCORDING TO SECTION 203.

   AFTER PLACING THE CATTLE GUARD, FILL THE EXTERIOR PORTION OF THE EXCAVATION TO GRADE WITH THE SAME MATERIAL.

   FILL THE INTERIOR OF THE CATTLE GUARD BASE TO A DEPTH OF 1'-6" [450] WITH THE SIMILARLY COMPACTED MATERIAL.

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

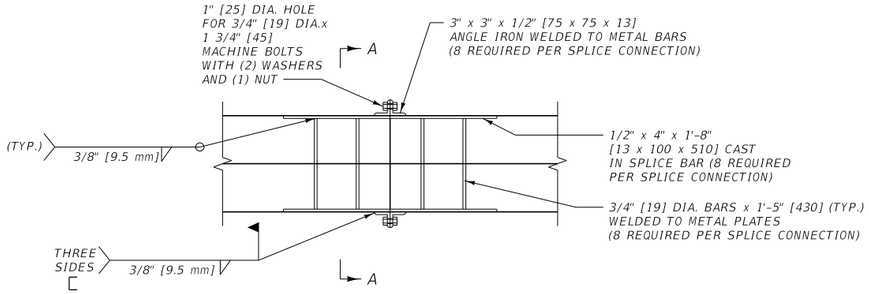
DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 611

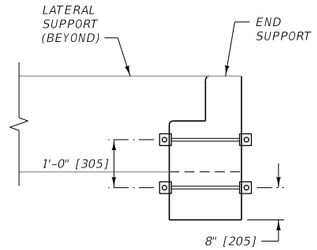
DWG. NO. 611-15

HEAVY DUTY CATTLE GUARD - PRECAST

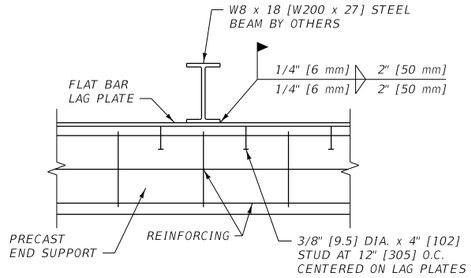
MDT MONTANA DEPARTMENT OF TRANSPORTATION



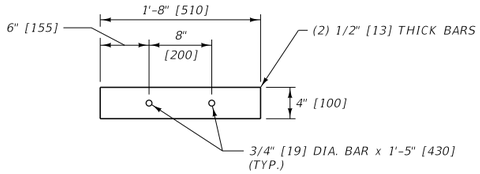
SPLICE CONNECTION DETAIL



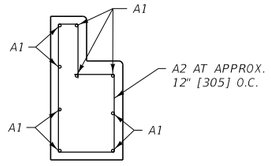
END SUPPORT SECTION A-A



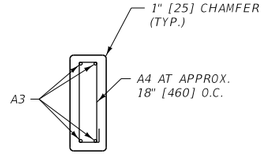
LAG PLATE CONNECTION DETAIL



SPLICE BAR DETAIL

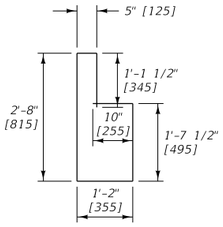


END SUPPORT REBAR DETAIL

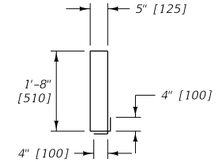


LATERAL SUPPORT REBAR DETAIL

NOTE: ALL REBAR DIMENSIONS ARE OUT TO OUT.



TYPE A2



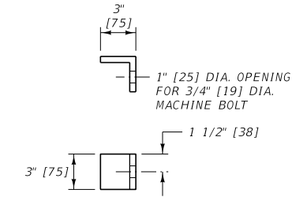
TYPE A4

REINFORCING STEEL

QUANTITIES AND DIMENSIONS ARE APPROXIMATE ONLY BASED ON ONE COMPLETE CATTLE GUARD.													
NOMINAL C.G. SIZE	REINFORCING STEEL (NO. 4 BARS / GRADE 60)									MISC. STEEL			
	A1		A2		A3		A4		ESTIMATED WT.	LAG PLATES		SPLICE CONNECTION	ESTIMATED WT.
	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH	LB.	REQUIRED	LENGTH		LB.
16'-0"	18	16'-2"	36	7'-10"	8	9'-1 1/2"	14	4'-10"	477	8	2'-8"	NO	39
20'-0"	18	20'-2"	44	7'-10"	8	9'-1 1/2"	14	4'-10"	567	8	3'-6"	NO	52
24'-0"	18	24'-2"	52	7'-10"	8	9'-1 1/2"	14	4'-10"	657	8	4'-6"	NO	66
* 24'-0"	36	11'-11"	52	7'-10"	8	9'-1 1/2"	14	4'-10"	653	8	4'-6"	YES	323
30'-0"	36	14'-11"	64	7'-10"	8	9'-1 1/2"	14	4'-10"	788	12	3'-6"	YES	334
32'-0"	36	15'-11"	68	7'-10"	8	9'-1 1/2"	14	4'-10"	833	16	2'-8"	YES	335
36'-0"	36	17'-11"	76	7'-10"	8	9'-1 1/2"	14	4'-10"	923	12	4'-6"	YES	356
40'-0"	36	19'-11"	84	7'-10"	8	9'-1 1/2"	14	4'-10"	1013	16	3'-6"	YES	360

* 24'-0" CATTLE GUARD WITH OPTIONAL SPLICE

ESTIMATED CLASS GENERAL CONCRETE QUANTITIES
16'-0" C.G. = 5.68 C.Y.
20'-0" C.G. = 6.81 C.Y.
24'-0" C.G. = 7.93 C.Y.
* 24'-0" C.G. = 7.93 C.Y.
30'-0" C.G. = 9.62 C.Y.
32'-0" C.G. = 10.18 C.Y.
36'-0" C.G. = 11.31 C.Y.
40'-0" C.G. = 12.43 C.Y.



ANGLE IRON DETAIL

QUANTITIES AND DIMENSIONS ARE APPROXIMATE ONLY BASED ON ONE COMPLETE CATTLE GUARD.													
NOMINAL C.G. SIZE	REINFORCING STEEL (NO. 13 BARS / GRADE 420)									MISC. STEEL			
	A1		A2		A3		A4		ESTIMATED WT.	LAG PLATES		SPLICE CONNECTION	ESTIMATED WT.
	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH	kg.	REQUIRED	LENGTH		kg.
4.8 m	18	4930 mm	36	2390 mm	8	2780 mm	14	1470 mm	216.3	8	815 mm	NO	16.7
6.0 m	18	6150 mm	44	2390 mm	8	2780 mm	14	1470 mm	257.1	8	1065 mm	NO	21.4
7.2 m	18	7370 mm	52	2390 mm	8	2780 mm	14	1470 mm	298.0	8	1370 mm	NO	27.1
* 7.2 m	36	3635 mm	52	2390 mm	8	2780 mm	14	1470 mm	296.2	8	1370 mm	YES	144.2
9.0 m	36	4550 mm	64	2390 mm	8	2780 mm	14	1470 mm	357.4	12	1065 mm	YES	149.1
9.6 m	36	4855 mm	68	2390 mm	8	2780 mm	14	1470 mm	377.8	16	815 mm	YES	150.4
10.8 m	36	5465 mm	76	2390 mm	8	2780 mm	14	1470 mm	418.7	12	1370 mm	YES	157.8
12.0 m	36	6075 mm	84	2390 mm	8	2780 mm	14	1470 mm	459.5	16	1065 mm	YES	159.8

* 7.2 m CATTLE GUARD WITH OPTIONAL SPLICE

ESTIMATED CLASS GENERAL CONCRETE QUANTITIES (METRIC)
4.8 m C.G. = 3.72 m]
6.0 m C.G. = 4.43 m]
7.2 m C.G. = 5.13 m]
* 7.2 m C.G. = 5.13 m]
9.0 m C.G. = 6.19 m]
9.6 m C.G. = 6.55 m]
10.8 m C.G. = 7.25 m]
12.0 m C.G. = 7.96 m]

NOTES:

1. C.G. = CATTLE GUARD.
2. ALL HARDWARE IS TO BE PRIMER PAINTED.
3. ALL STEEL HARDWARE IS TO CONFORM TO AASHTO M270 [270M] GRADE 36 [250].
4. ALL NUTS, BOLTS, AND WASHERS ARE TO CONFORM TO ASTM A307 [307M] AND BE GALVANIZED PER AASHTO M232 [M232M].
5. SEE DTL. DWG. NO 611-15 FOR PRECAST CONCRETE CATTLE GUARD BASE

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 611

DWG. NO. 611-20

PRECAST CONCRETE CATTLE GUARD BASE DETAILS

MDT MONTANA DEPARTMENT OF TRANSPORTATION