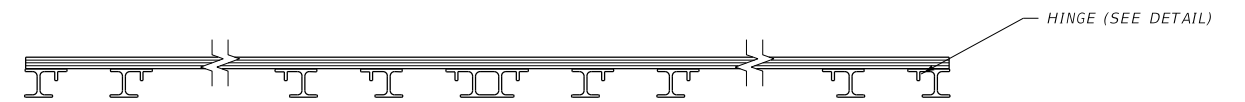
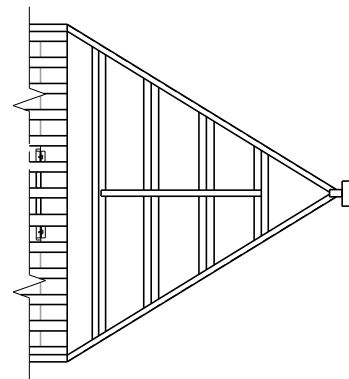
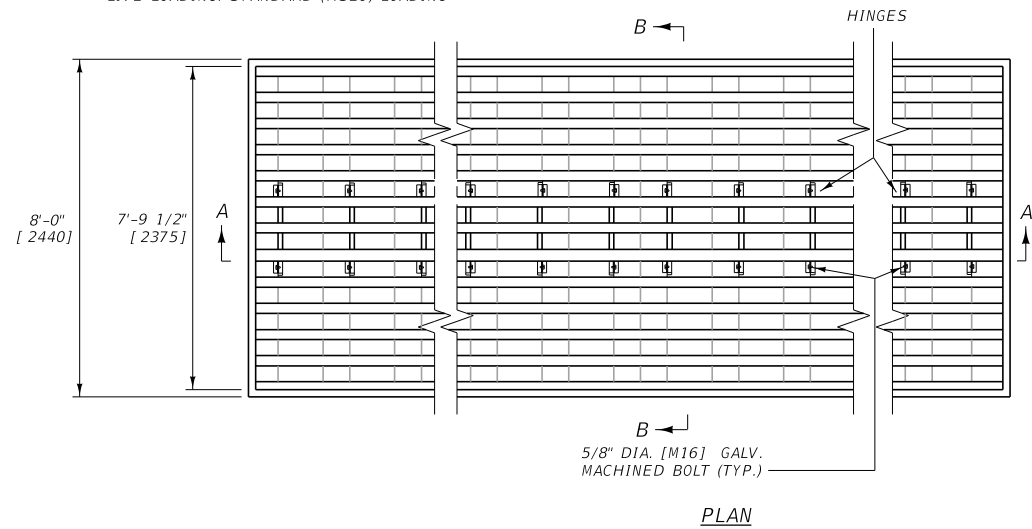


- NOTES:
- USE PRECAST CONCRETE BASES FOR CATTLE GUARDS. SEE DTL. DWG. NO. 611-15.
 - FOR CATTLE GUARDS ON FARM FIELD OR PRIVATE APPROACHES, THE PRECAST CONCRETE BASES IN DTL. DWG. NO. 611-10 MAY BE USED.
 - USE AN EVEN NUMBER OF STEEL CATTLE GUARD GRATES WHEN A CROWNED INSTALLATION IS REQUIRED.
 - ANCHOR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

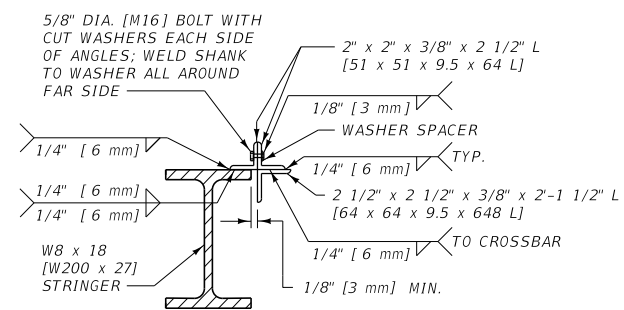
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 611	DWG. NO. 611-00
CATTLE GUARD GRATE	

LIVE LOADING: STANDARD (HS20) LOADING



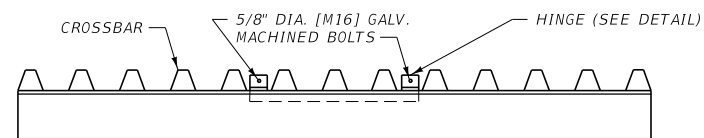
SECTION A-A

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

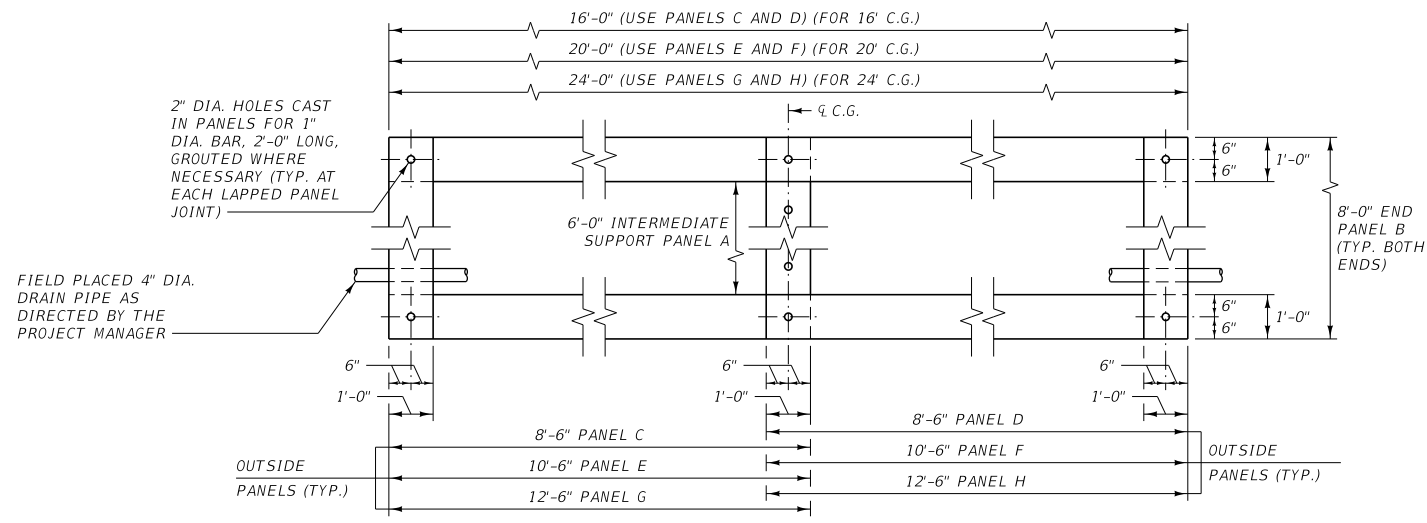
NOTES:

- 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

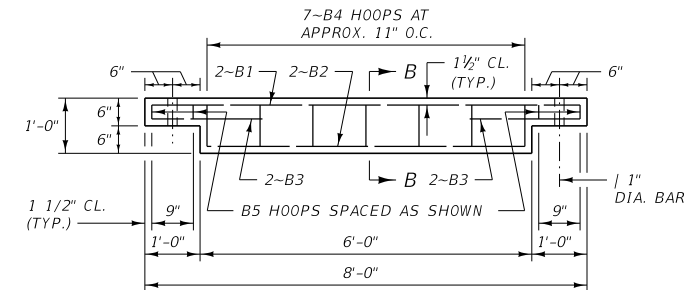
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

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

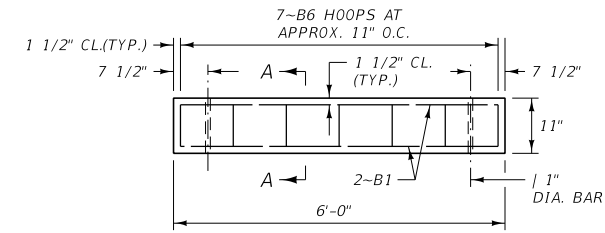
CATTLE GUARD HINGED GRATE



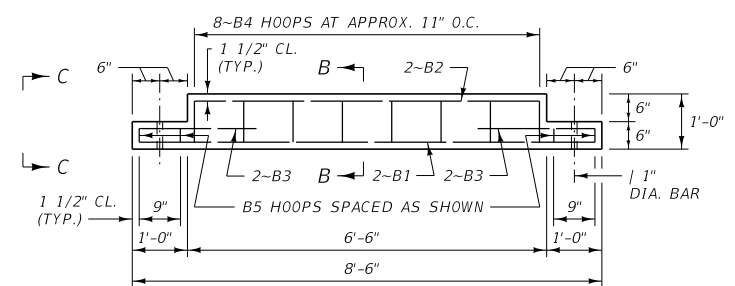
TYPICAL PLAN VIEW



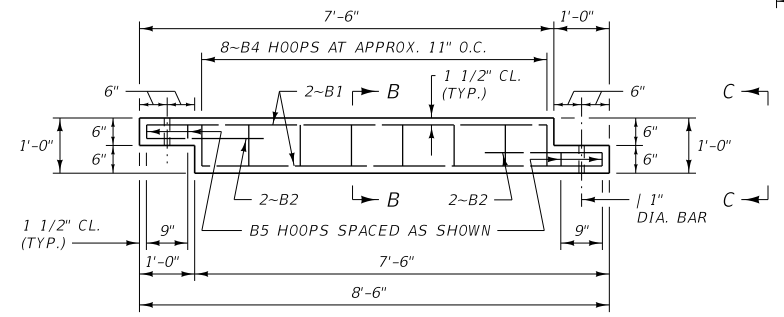
END PANEL B ELEVATION



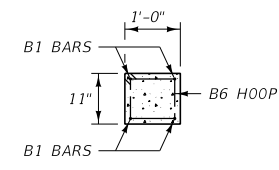
INTERMEDIATE SUPPORT PANEL A ELEVATION



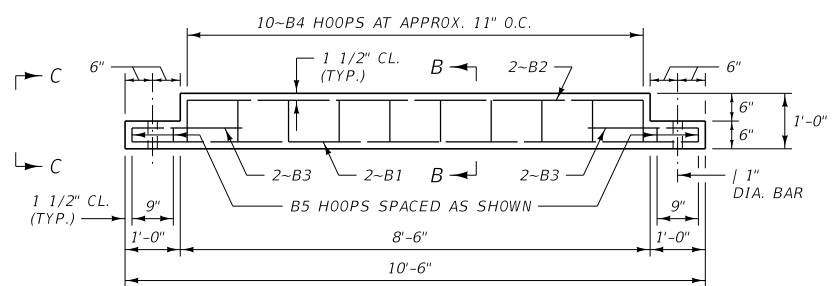
PANEL C ELEVATION



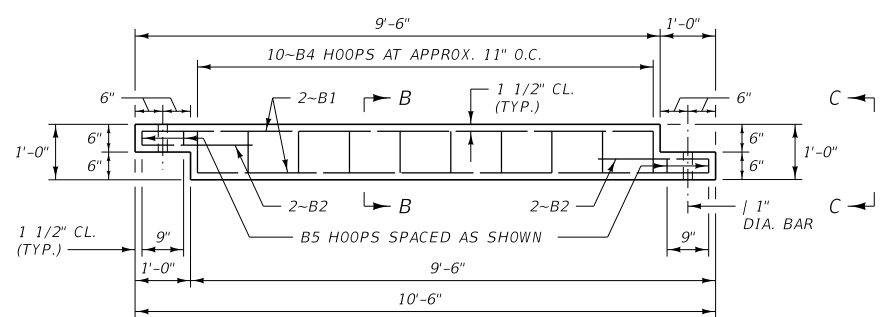
PANEL D ELEVATION



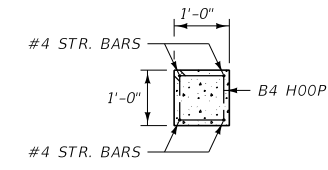
SECTION A-A



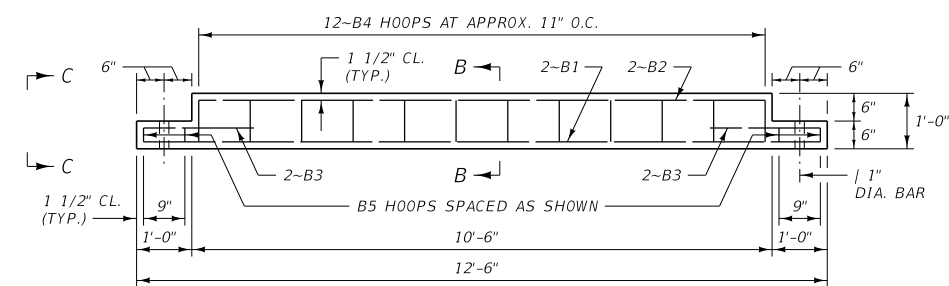
PANEL E ELEVATION



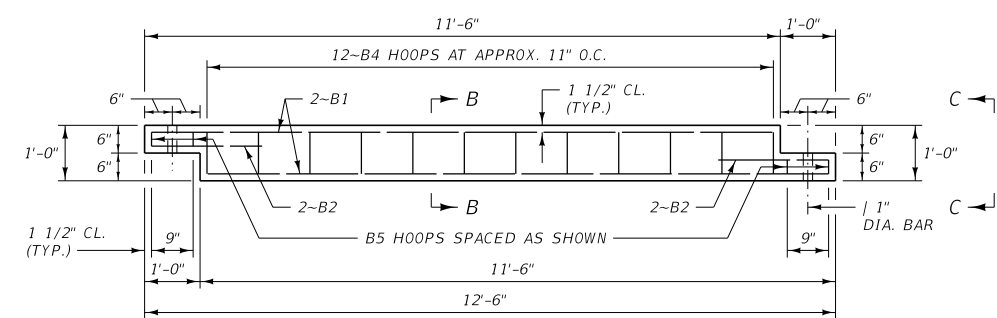
PANEL F ELEVATION



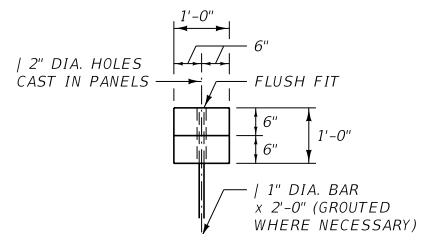
SECTION B-B



PANEL G ELEVATION



PANEL H ELEVATION



VIEW C-C (TYP. LAPPED PANEL JOINT)

- NOTES:
- USE ONLY ON FIELD OR PRIVATE APPROACHES.
 - 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.
 - ALL REINFORCING STEEL IS OF THE DEFORMED TYPE, MEETING THE REQUIREMENTS OF AASHTO M31 (ASTM A615, GRADE 60).
 - 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
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.

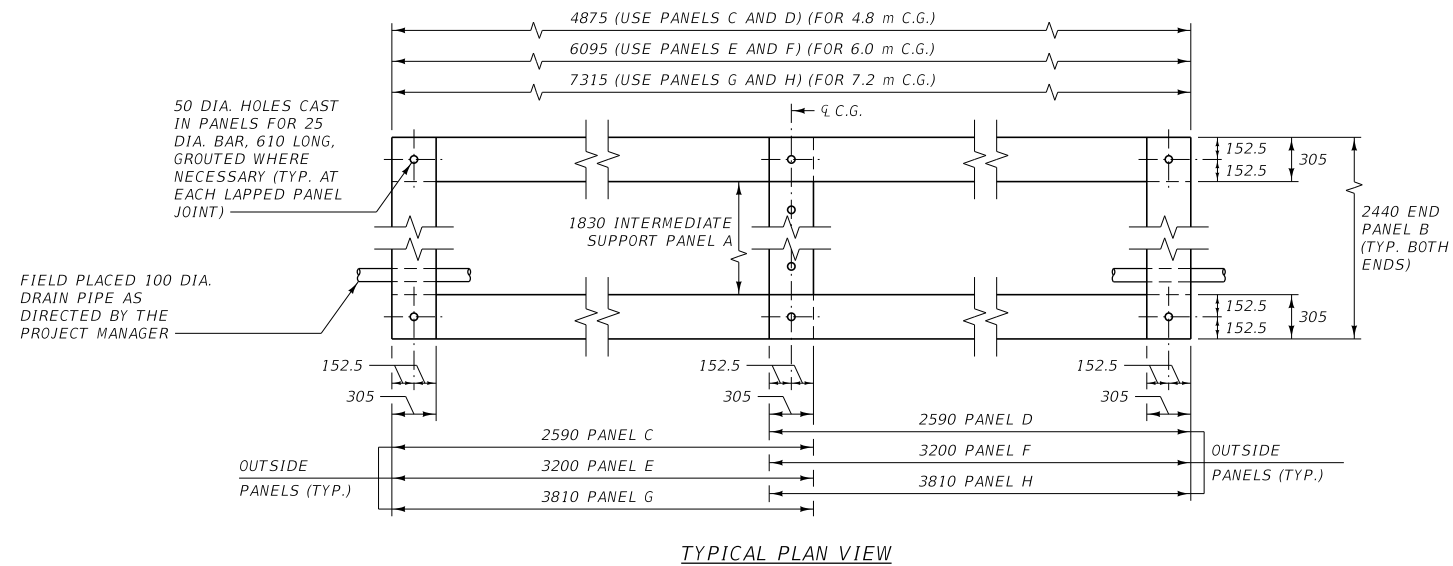
DETAILED DRAWING

REFERENCE DWG. NO. 611-10

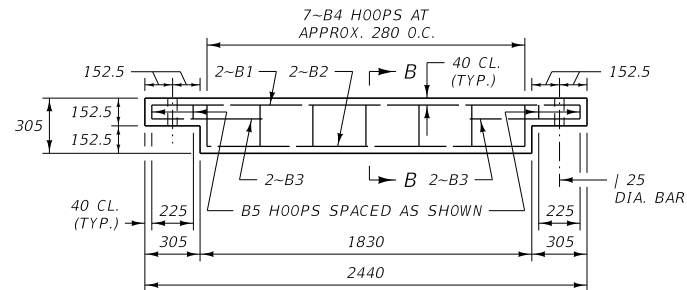
STANDARD SPEC. SECTION 611

LIGHT DUTY CATTLE GUARD - PRECAST

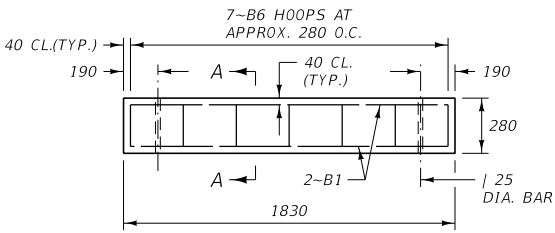
MDTA MONTANA DEPARTMENT OF TRANSPORTATION



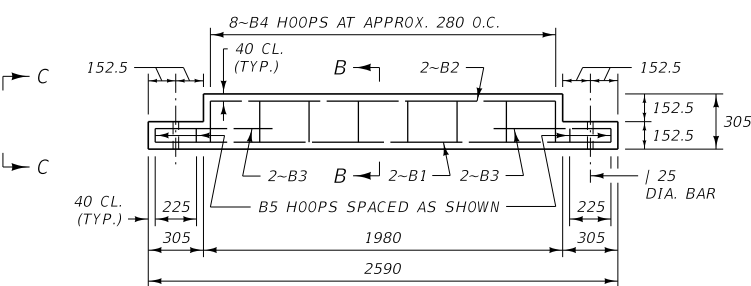
TYPICAL PLAN VIEW



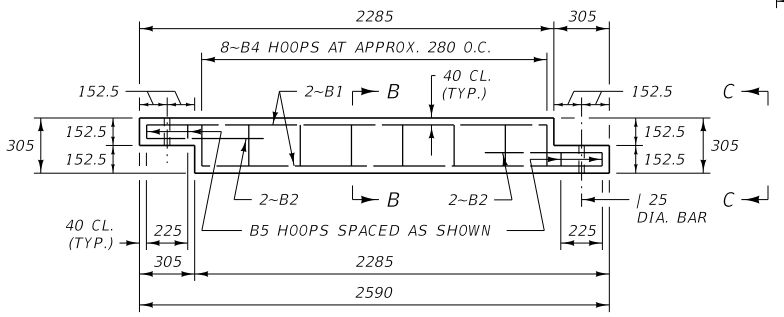
END PANEL B ELEVATION



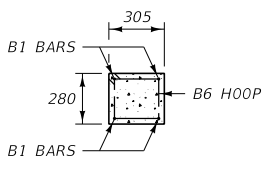
INTERMEDIATE SUPPORT PANEL A ELEVATION



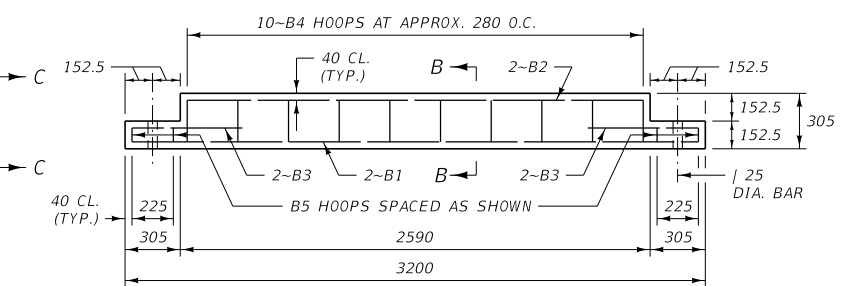
PANEL C ELEVATION



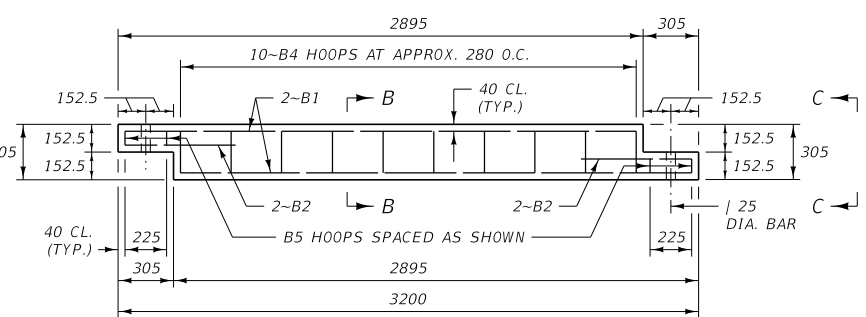
PANEL D ELEVATION



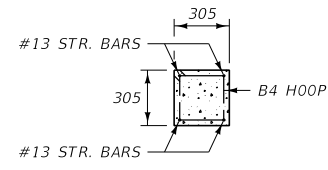
SECTION A-A



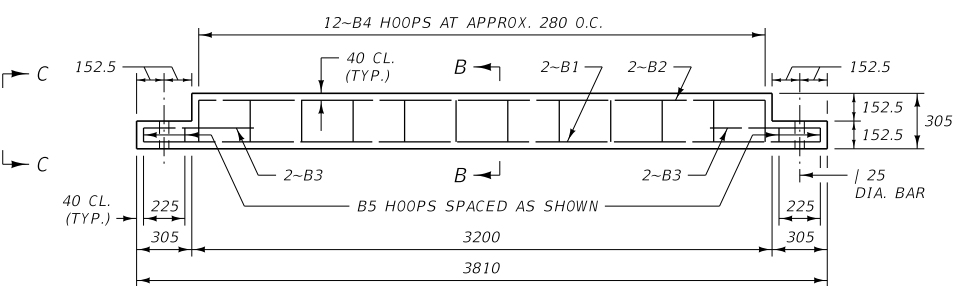
PANEL E ELEVATION



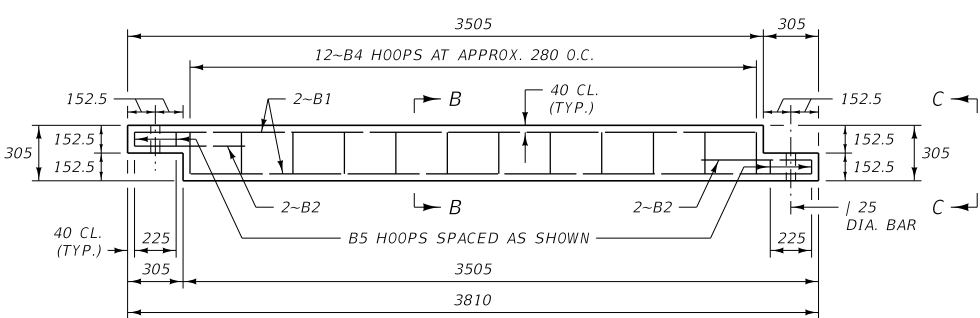
PANEL F ELEVATION



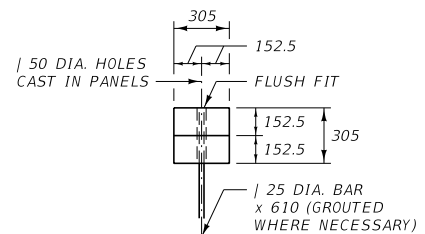
SECTION B-B



PANEL G ELEVATION



PANEL H ELEVATION



VIEW C-C (TYP. LAPPED PANEL JOINT)

- NOTES:
- USE ONLY ON FIELD OR PRIVATE APPROACHES.
 - 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.
 - ALL REINFORCING STEEL IS OF THE DEFORMED TYPE, MEETING THE REQUIREMENTS OF AASHTO M31 (ASTM A615, GRADE 60).
 - 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				

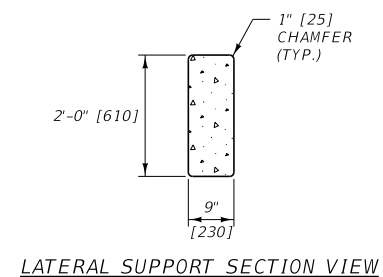
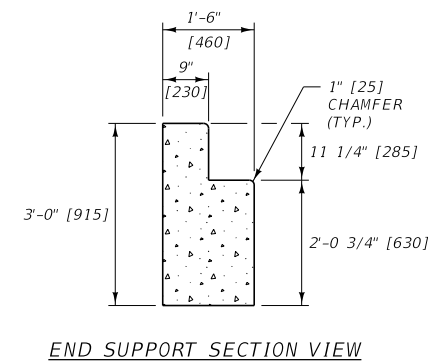
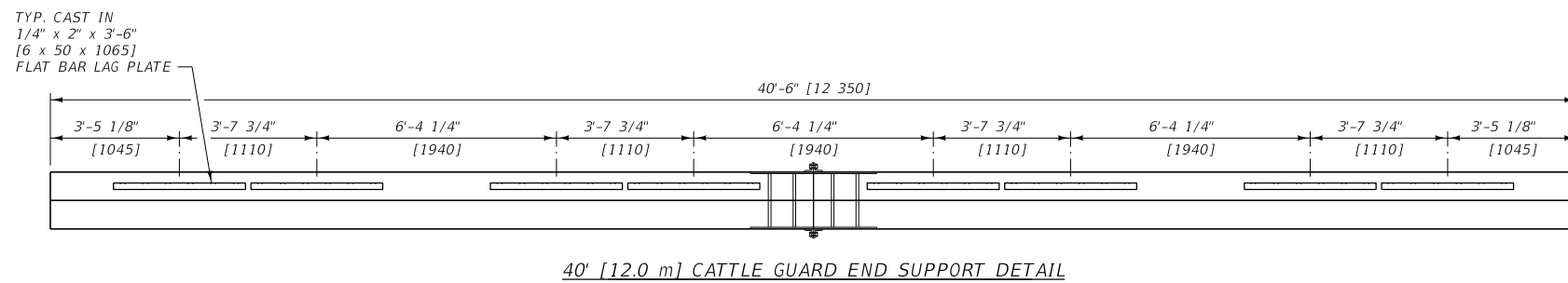
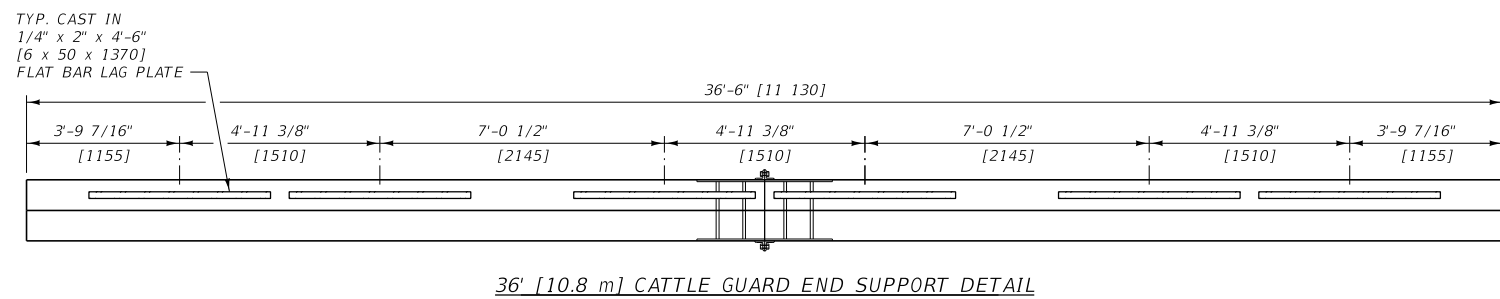
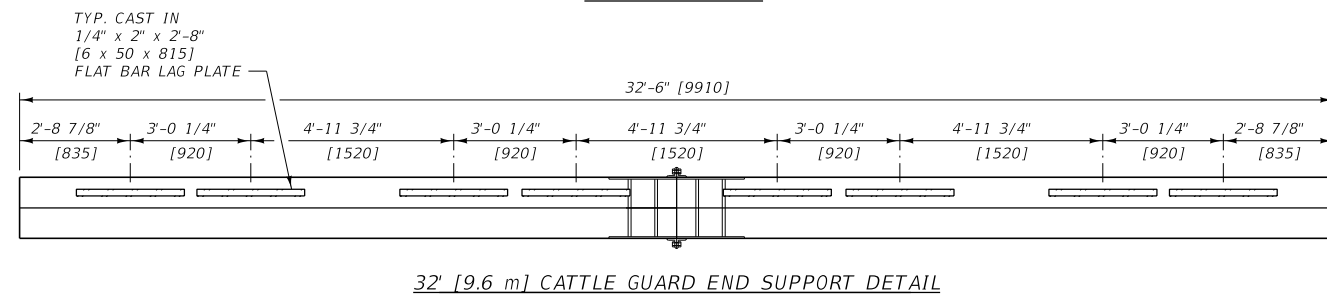
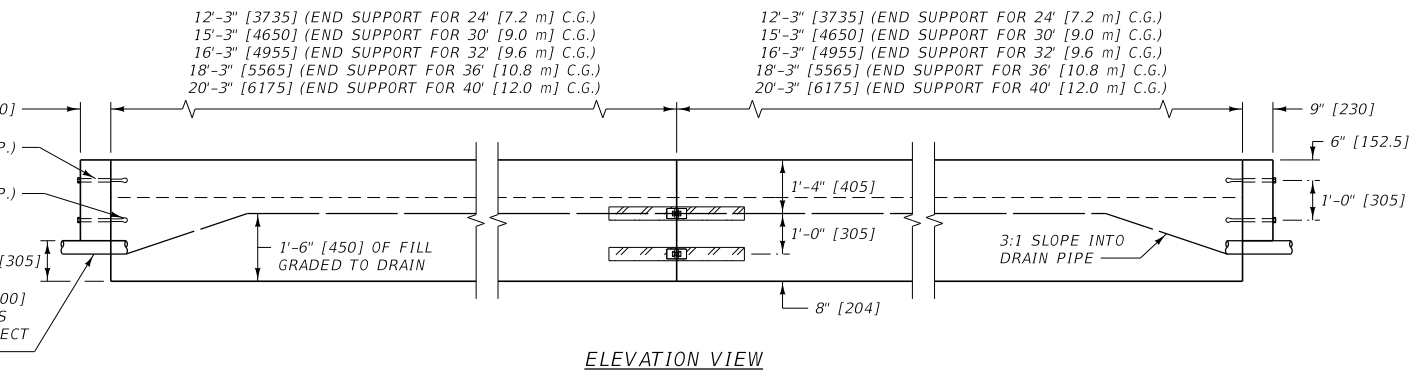
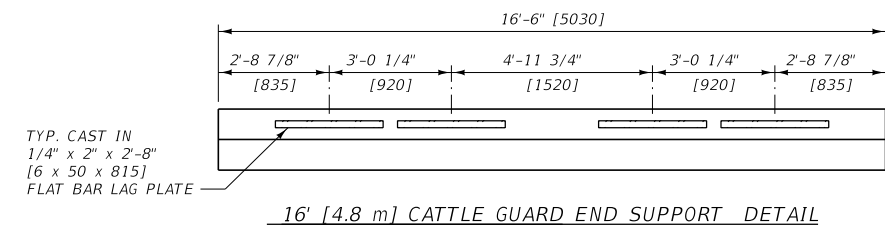
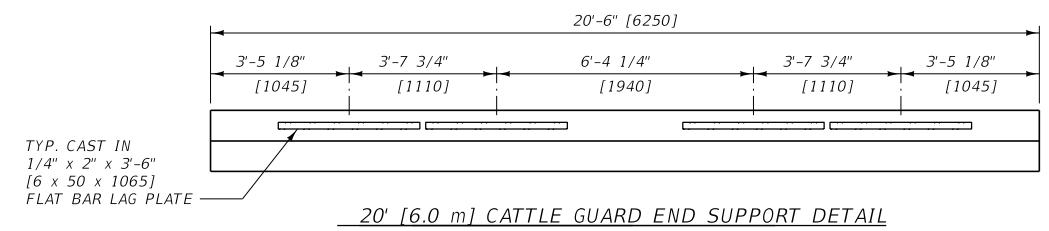
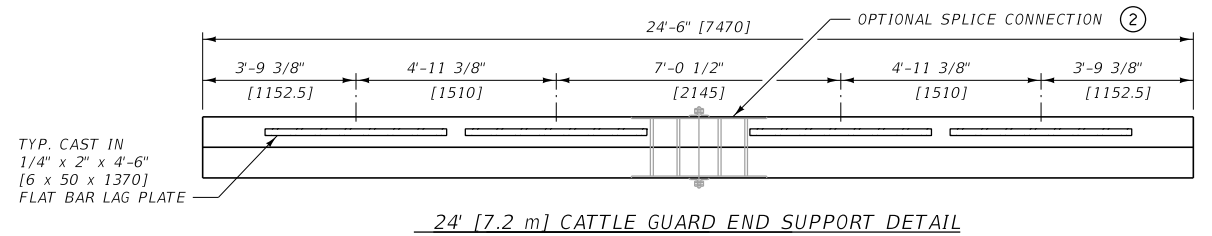
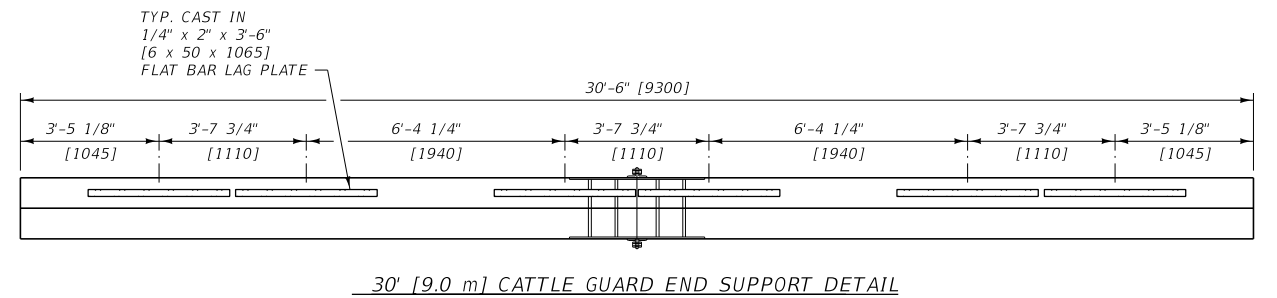
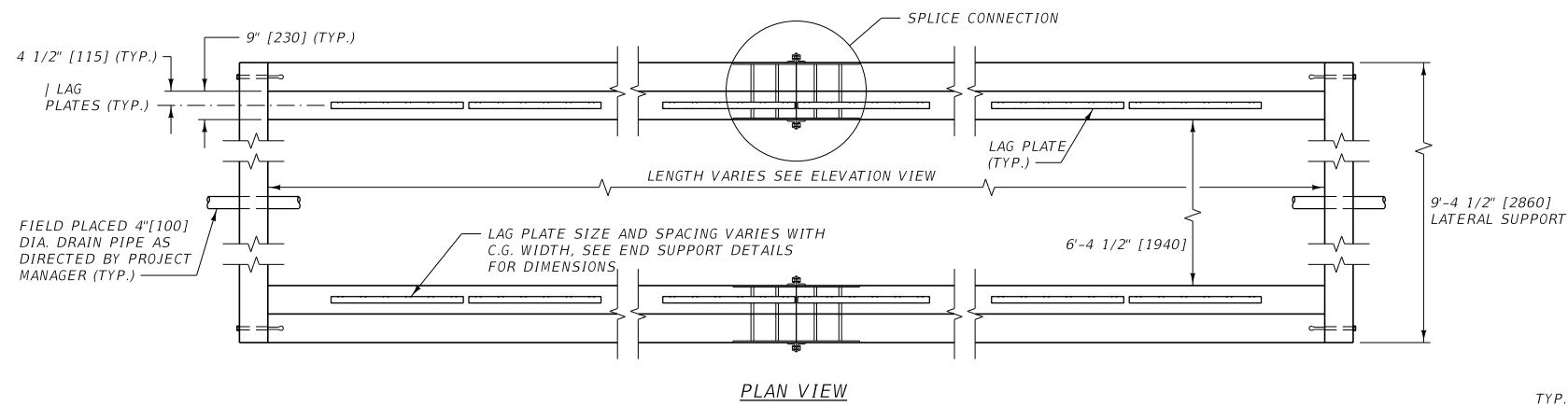
* FOR ONE PANEL ONLY

ESTIMATED CLASS GENERAL CONCRETE QUANTITIES	
1830 SECTION - PANEL A	= 0.16 m ³
2440 SECTION - PANEL B	= 0.20 m ³
2590 SECTION - PANEL C	= 0.21 m ³
2590 SECTION - PANEL D	= 0.21 m ³
3200 SECTION - PANEL E	= 0.27 m ³
3200 SECTION - PANEL F	= 0.27 m ³
3810 SECTION - PANEL G	= 0.33 m ³
3810 SECTION - PANEL H	= 0.33 m ³

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING

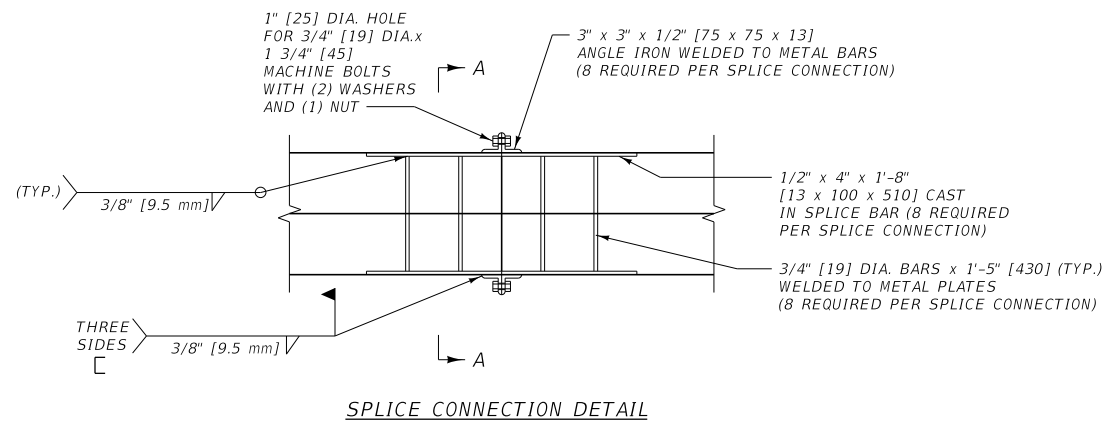
REFERENCE STANDARD SPEC. SECTION 611	DWG. NO. 611-10
LIGHT DUTY CATTLE GUARD - PRECAST (METRIC)	
MDTA MONTANA DEPARTMENT OF TRANSPORTATION	



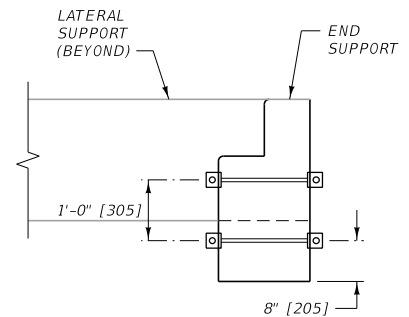
- NOTES:
- METRIC CATTLE GUARD SIZES ARE NOMINAL. STANDARD HS20 LIVE LOADING IS REQUIRED FOR HEAVY DUTY CATTLE GUARDS.
 - USE SPLICE CONNECTIONS WHEN A CROWNED INSTALLATION IS REQUIRED.
 - SEE DTL. DWG. NO. 611-20 FOR ADDITIONAL PRE-CAST CONCRETE CATTLE GUARD BASE AND MATERIAL QUANTITY DETAILS.
 - SEE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

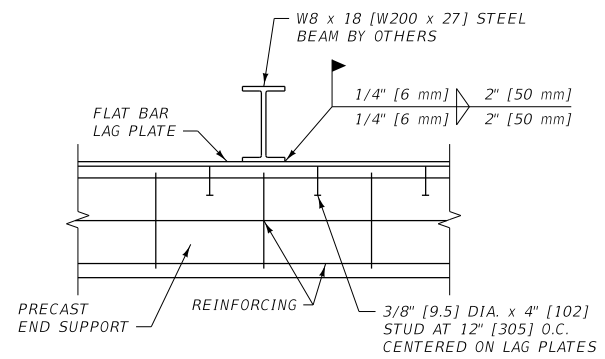
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 611	DWG. NO. 611-15
HEAVY DUTY CATTLE GUARD - PRECAST	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	



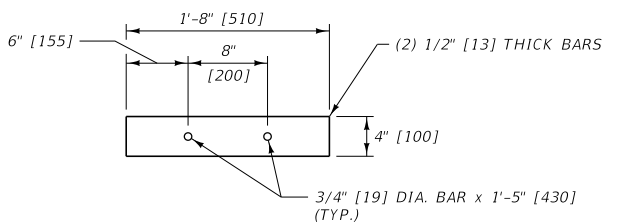
SPlice CONNECTION DETAIL



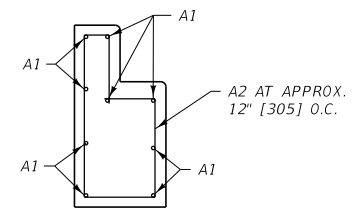
END SUPPORT SECTION A-A



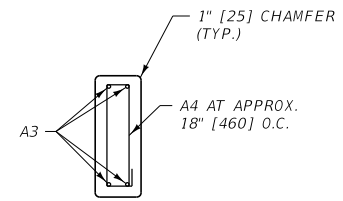
LAG PLATE CONNECTION DETAIL



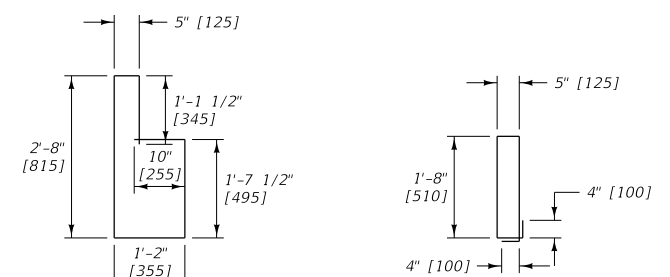
SPlice BAR DETAIL



END SUPPORT REBAR DETAIL



LATERAL SUPPORT REBAR DETAIL



REINFORCING STEEL

NOTE: ALL REBAR DIMENSIONS ARE OUT TO OUT.

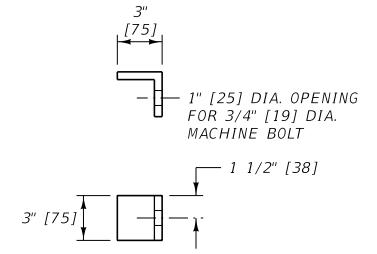
QUANTITIES AND DIMENSIONS ARE APPROXIMATE ONLY
BASED ON ONE COMPLETE CATTLE GUARD.

NOMINAL C.G. SIZE	REINFORCING STEEL (NO. 4 BARS / GRADE 60)								MISC. STEEL				
	A1		A2		A3		A4		ESTIMATED WT. LB.	LAG PLATES	SPlice CONNECTION	ESTIMATED WT. LB.	
	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH					
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.
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. kg.	LAG PLATES	SPlice CONNECTION	ESTIMATED WT. kg.	
	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH	REQUIRED	LENGTH					
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	