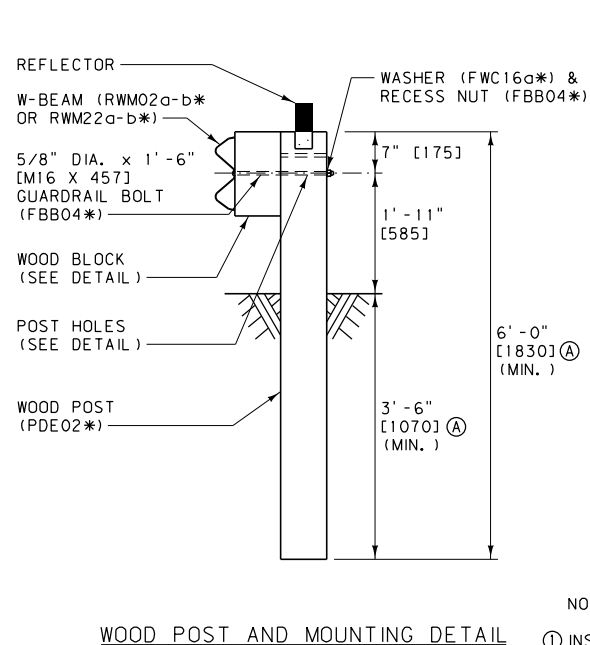
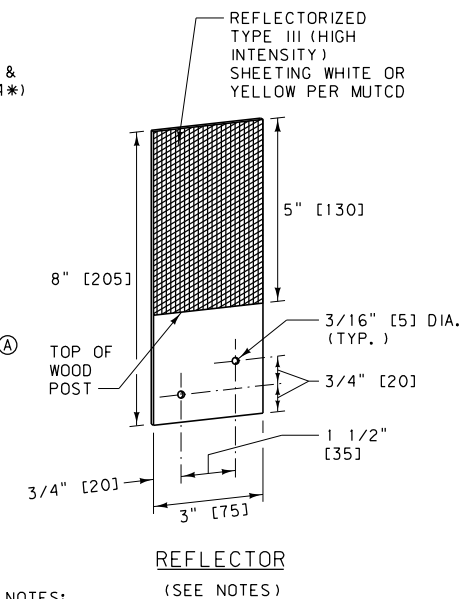
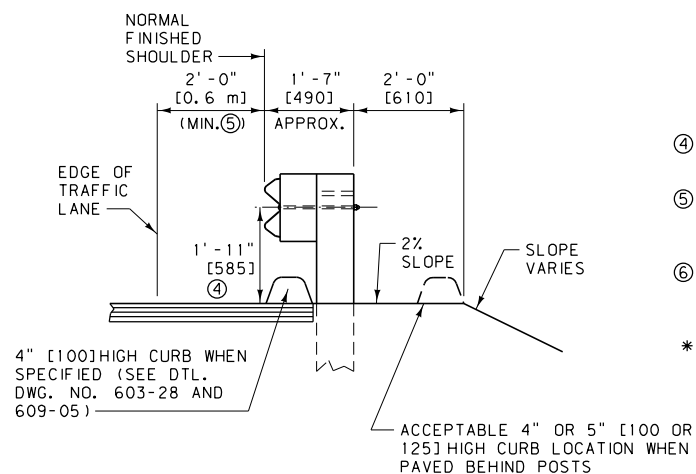


UNITS SHOWN IN BRACKETS [] ARE
METRIC AND ARE IN MILLIMETERS (mm)
UNLESS OTHER UNITS ARE SHOWN.



(A) STANDARD UNLESS SPECIFIED
OTHERWISE IN PLANS.

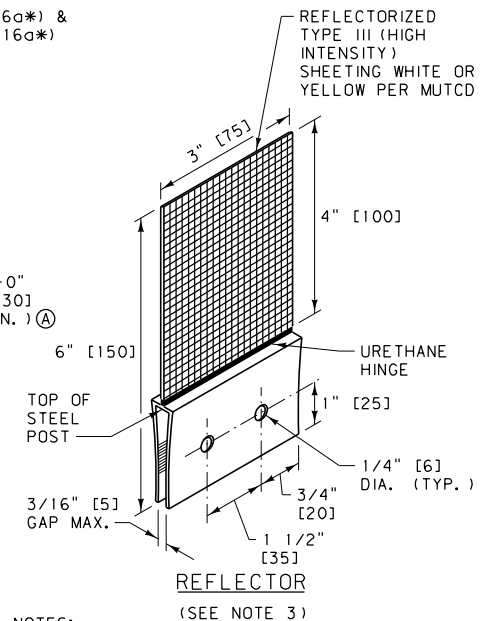
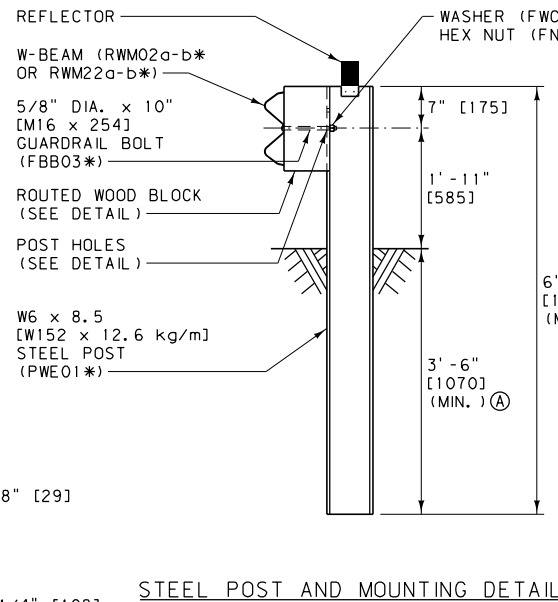
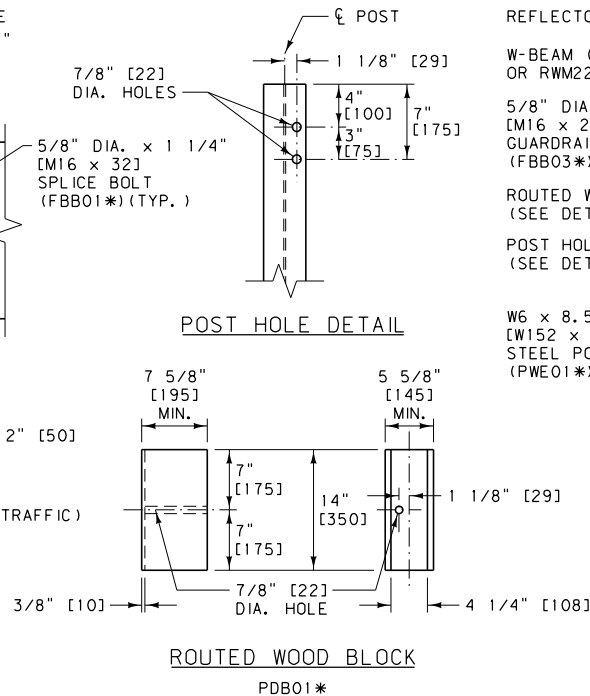
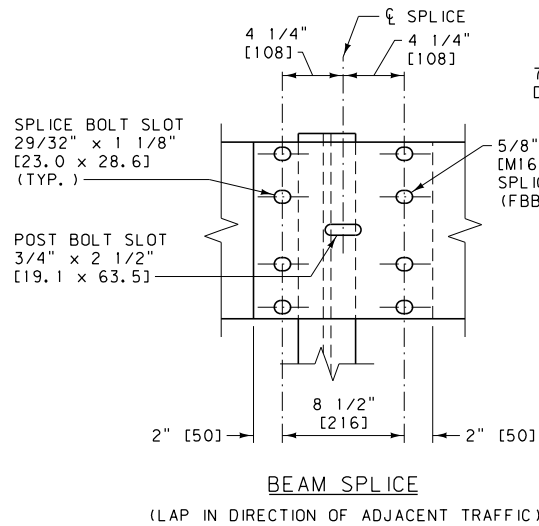


NOTES:

- INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
- USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY GALV. NAILS OR 14 GAGE WIRE WRAP.
- ATTACH REFLECTORS TO POSTS EVERY 25 FEET [7.62 m], INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE FACING ADJACENT TRAFFIC. FABRICATE REFLECTORS FROM 0.063" [1.6 mm] THICK ALUMINUM ALLOW PER SECTION 704. FASTEN REFLECTOR TO WOOD POST USING TWO 16 PENNY RING-SHANKED GALVANIZED NAILS AND TWO 3/16" [4.8 mm] DIA. WASHERS IN PRE-DRILLED HOLES.
- ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 1' - 8" [510 mm].
- WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2' - 0" [0.6 m] FROM THE TRAFFIC LANE.
- DO NOT INSTALL W-BEAM GUARDRAIL FOR OBSTACLES WITHIN 5.6' [1.7 m] OF THE FACE OF THE RAIL.

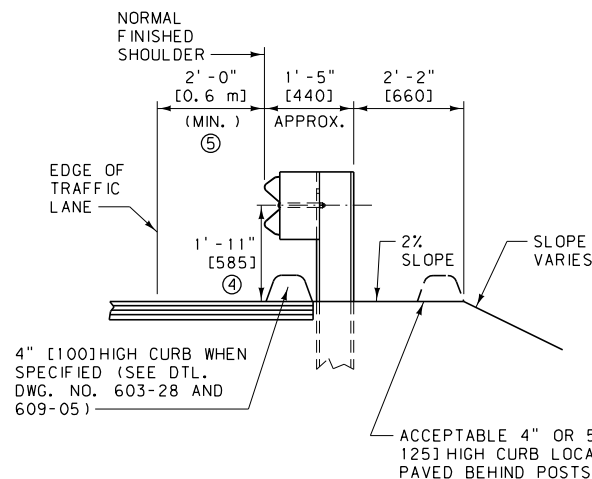
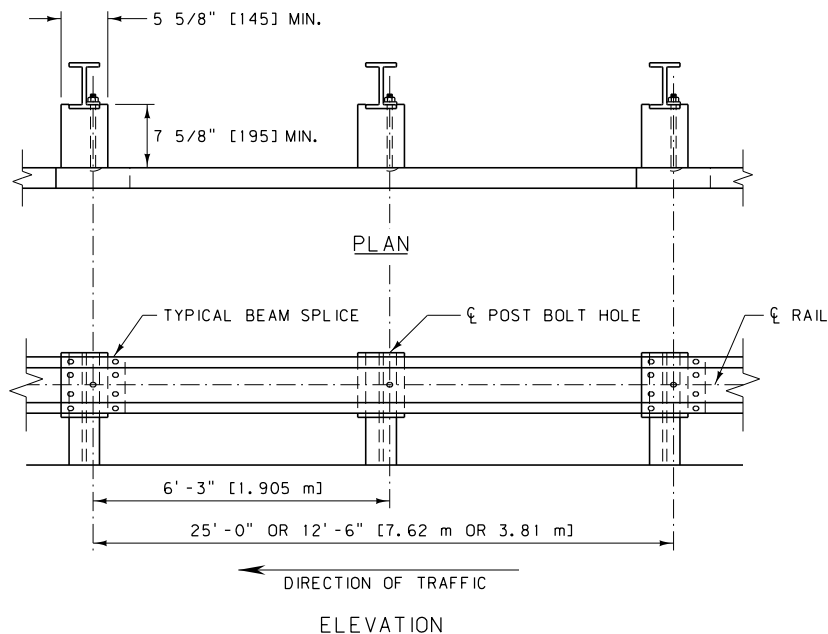
* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-05A
SECTION 606, 704	
METAL GUARDRAIL - WOOD POSTS	
--REVISED--	EFFECTIVE: APRIL 2006
MAY 2011	
DECEMBER 2011	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	



NOTES:

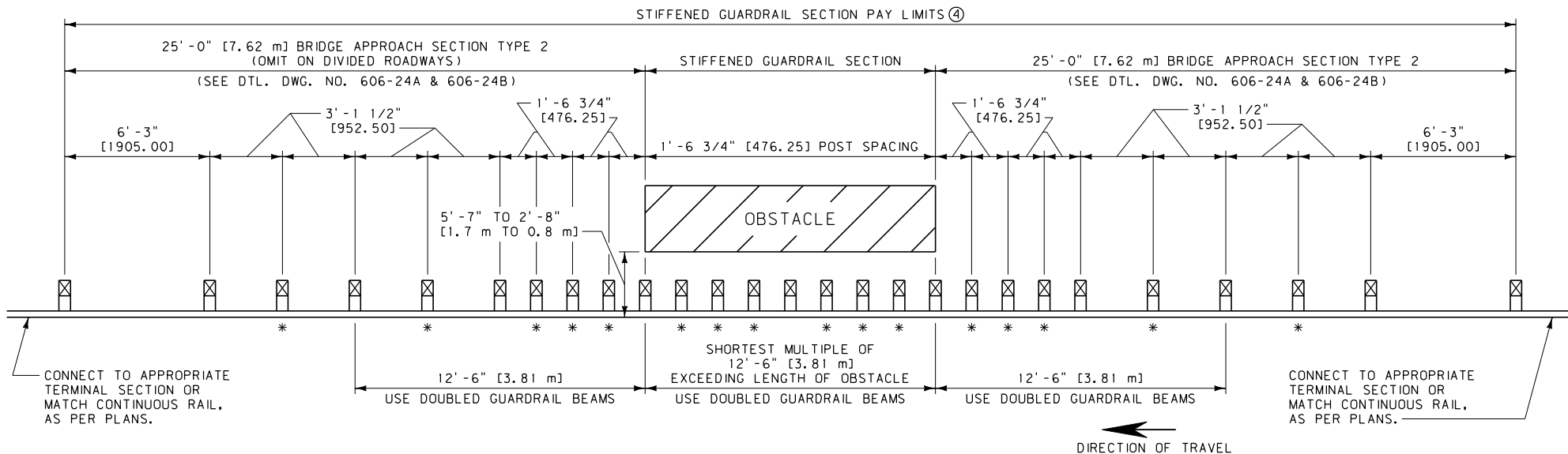
- INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
 - USE ROUTED WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS.
 - ATTACH REFLECTORS TO POSTS EVERY 25 FEET [7.62 m], INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE FACING ADJACENT TRAFFIC. FASTEN REFLECTOR TO STEEL POST USING AN APPROVED ADHESIVE. REFLECTORS MAY BE BOLTED TO POSTS PROVIDED HOLES IN POSTS ARE DRILLED BEFORE BEING GALVANIZED.
 - ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 1' - 8" [510 mm].
 - WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2' - 0" [0.6 m] FROM THE TRAFFIC LANE.
 - STEEL POSTS WITH OTHER POST HOLE CONFIGURATIONS MAY BE ACCEPTED, PROVIDED THEY HAVE AT LEAST THE HOLES DETAILED ON THIS DRAWING AND THEY MEET AASHTO'S PUBLICATION, "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" AND NCHRP 350 REQUIREMENTS.
 - DO NOT INSTALL W-BEAM GUARDRAIL FOR OBSTACLES WITHIN 5.6' [1.7 m] OF THE FACE OF THE RAIL.
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.



DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-05B
SECTION 606	
METAL GUARDRAIL - STEEL POSTS	

--REVISED--	EFFECTIVE: APRIL 2006
MAY 2011	
DECEMBER 2011	
MDTA	MONTANA DEPARTMENT OF TRANSPORTATION

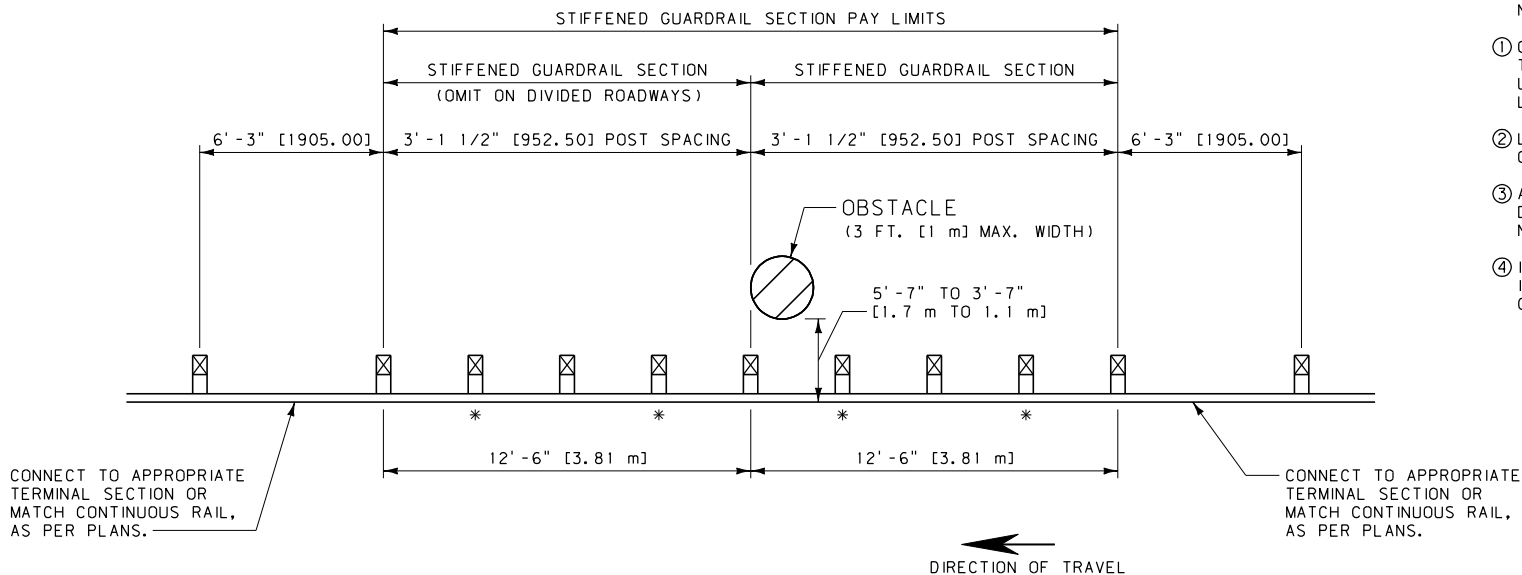
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.



* GUARDRAIL NOT ATTACHED TO ADDED
POSTS. BLOCK-OUT FASTENED TO
POST WITH STANDARD POST BOLT.

GUARDRAIL ATTACHED TO POSTS ONLY AT
STANDARD MULTIPLES OF 6'-3" [1.905 m]
THROUGH OBSTACLE SECTION.

LINE OBSTACLE APPLICATION



NOTES:

- ① OBSTACLES CLOSER TO THE FACE OF RAIL
THAN THE INDICATED LIMITS REQUIRE THE
USE OF A RIGID BARRIER SYSTEM WITH
LITTLE TO NO DYNAMIC DEFLECTION.
- ② LAP ALL DOUBLED RAIL IN THE DIRECTION
OF ADJACENT TRAFFIC.
- ③ ALL POSTS AND BLOCKS ARE STANDARD
DIMENSIONS AS PER DETAILED DRAWING
NO. 606-05A AND 606-05B.
- ④ INCLUDE BRIDGE APPROACH SECTION(S)
IN PAYMENT LENGTH OF STIFFENED
GUARDRAIL.

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

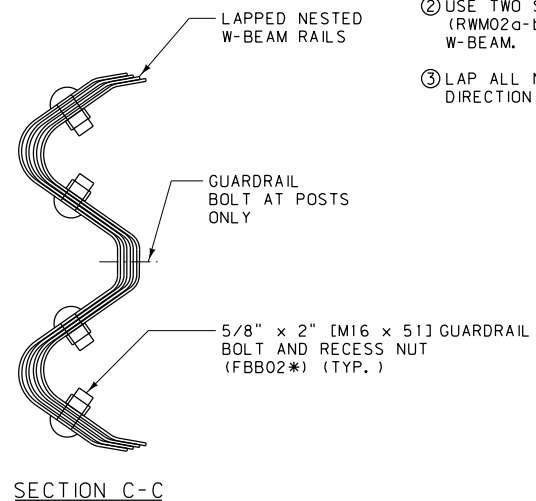
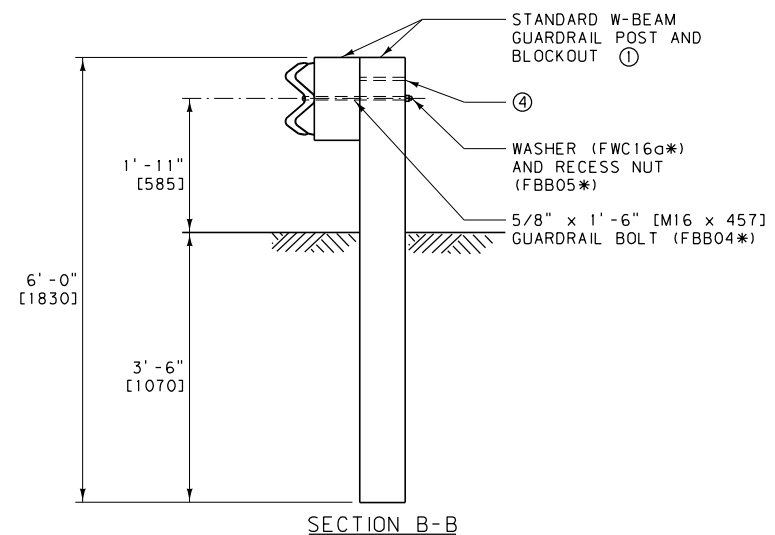
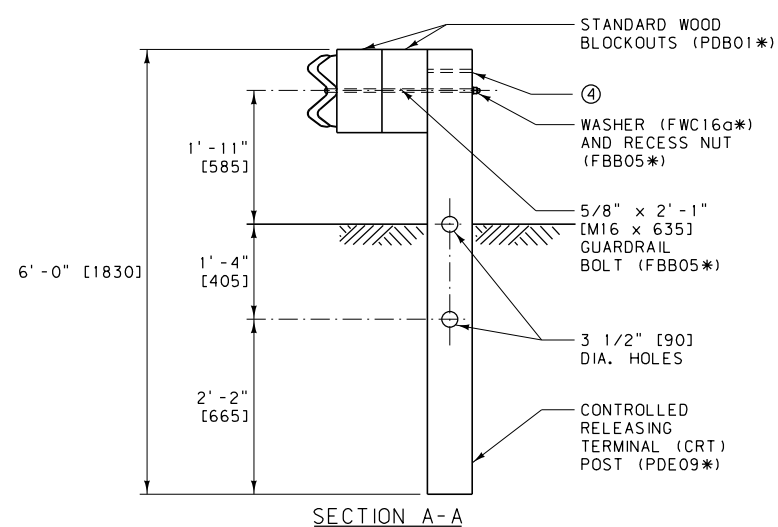
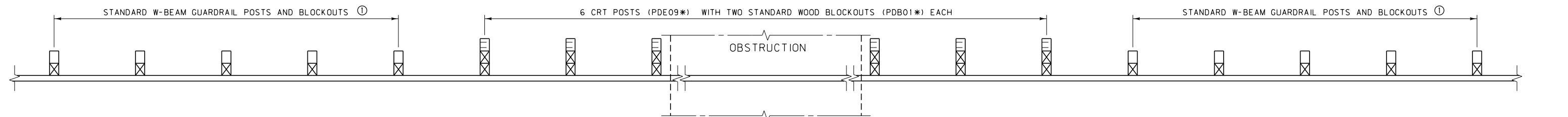
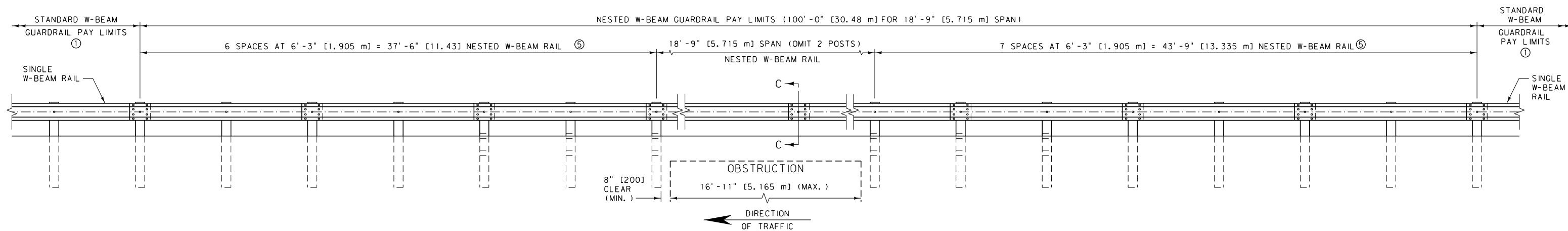
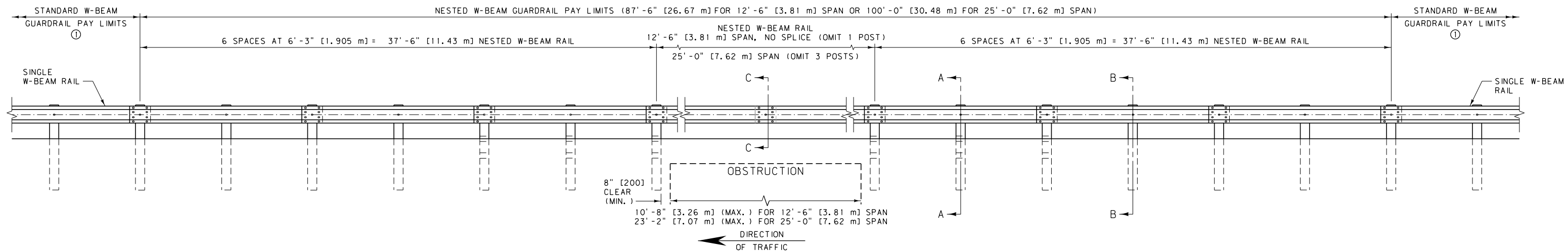
DETAILED DRAWING
REFERENCE DWG. NO.
STANDARD SPEC. 606-07
SECTION 606

STIFFENED GUARDRAIL
SECTIONS

--REVISED-- EFFECTIVE: APRIL 2006
MAY 2011

MDTA MONTANA DEPARTMENT
OF TRANSPORTATION

POINT OBSTACLE APPLICATION




NOTES:

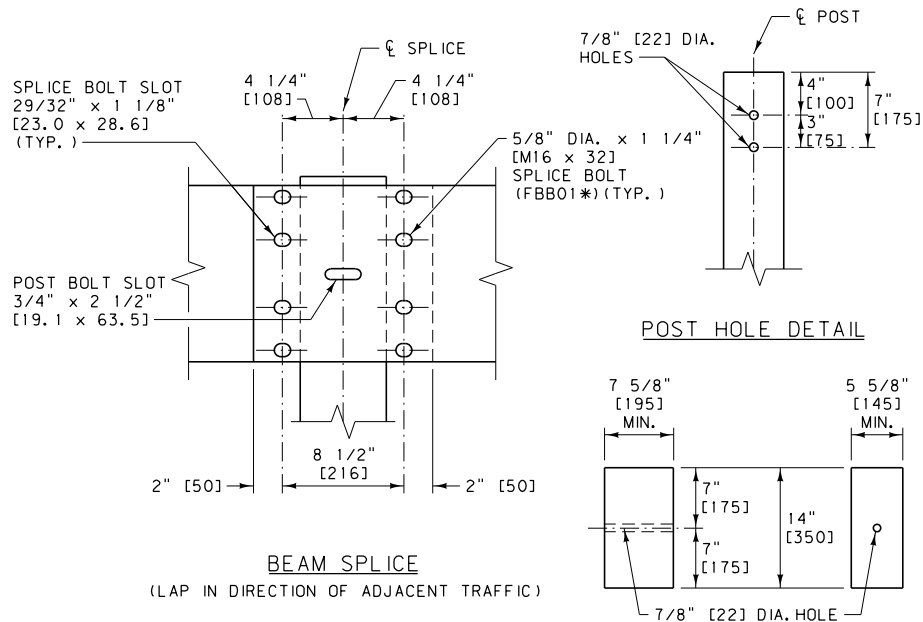
- ① SEE DTL. DWG. NO. 606-05A AND 606-05B FOR STANDARD W-BEAM GUARDRAIL AND ASSOCIATED HARDWARE.
- ② USE TWO STANDARD W-BEAM RAILS (RWM02a-b* OR RWM22a-b*) FOR NESTED W-BEAM.
- ③ LAP ALL NESTED W-BEAM RAIL IN THE DIRECTION OF ADJACENT TRAFFIC.

- ④ ALL POSTS ARE TO HAVE A SECOND BOLT HOLE AT 3" [75] ABOVE THE FIRST.
- ⑤ THE SPLICE LOCATIONS ON THE 18'-9" [5.715 m] SPAN MAY BE SHIFTED DOWNSTREAM BY 6'-3" [1.905 m].
- ⑥ DO NOT INSTALL NESTED W-BEAM GUARDRAIL FOR OBSTACLES WITHIN 7.3' [2.2 m] OF THE FACE OF THE RAIL.

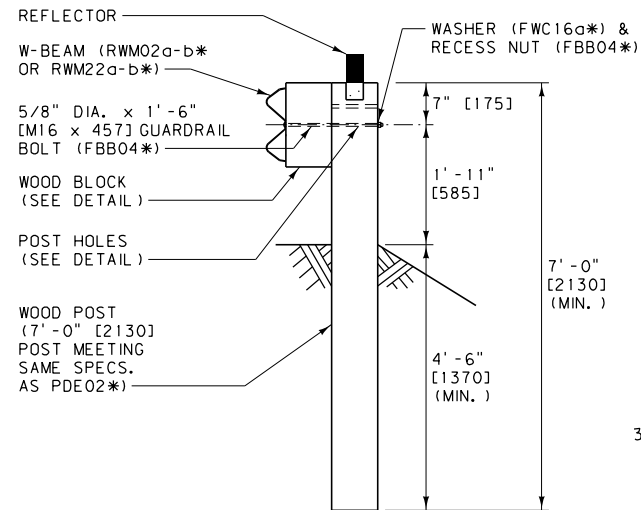
* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

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

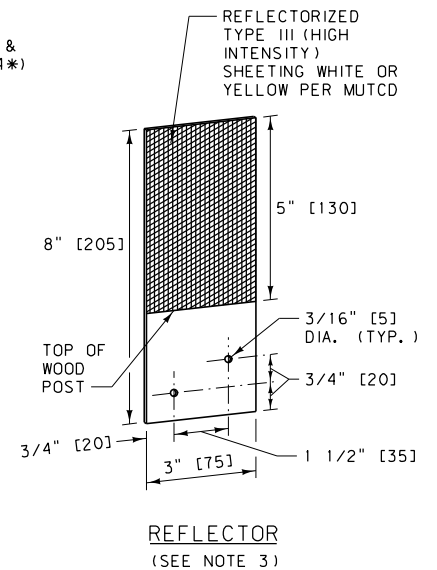
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-09
SECTION 606	
NESTED W-BEAM GUARDRAIL	
EFFECTIVE: APRIL 2006	
<div> <div> --REVISED-- DECEMBER 2011 </div> <div>  MONTANA DEPARTMENT OF TRANSPORTATION serving you with pride </div> </div>	



WOOD BLOCK
PDB01*



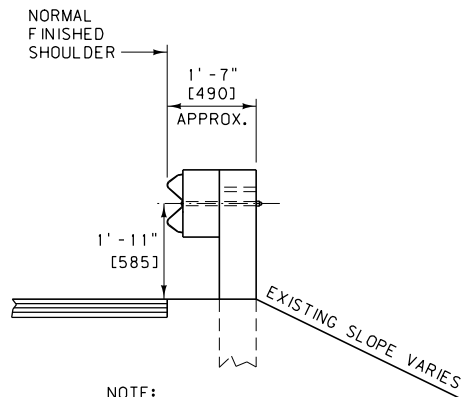
WOOD POST AND MOUNTING DETAIL



NOTES:

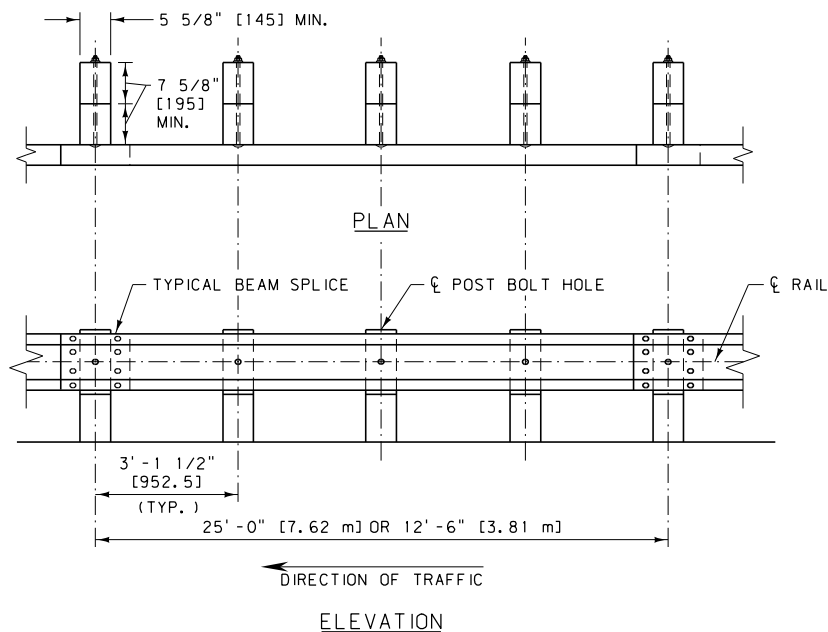
- ① INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
- ② USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY GALV. NAILS OR 14 GAGE WIRE WRAP.
- ③ ATTACH REFLECTORS TO POSTS EVERY 25' [7.62 m], INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE FACING ADJACENT TRAFFIC. FABRICATE REFLECTORS FROM 0.063" [1.6] THICK ALUMINUM ALLOY PER SECTION 704. FASTEN REFLECTOR TO WOOD POST USING TWO 16 PENNY RING-SHANKED GALVANIZED NAILS AND TWO 3/16" [4.8] DIA. WASHERS IN PRE-DRILLED HOLES.
- ④ ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 1'-8" [510].
- ⑤ THE W-BEAM RAIL ON THIS SYSTEM REQUIRES ADDITIONAL HOLES TO ACCOMMODATE BEING BOLTED TO POSTS AT HALF THE NORMAL POST SPACING. DRILL ADDITIONAL HOLES IN THE W-BEAM RAIL PRIOR TO APPLYING CORROSION PROTECTION.
- ⑥ DO NOT INSTALL W-BEAM GUARDRAIL WITH 7' [2.1 m] POSTS FOR OBSTACLES WITHIN 4.6' [1.4 m] OF THE FACE OF THE RAIL.

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.



NOTE:
THIS GUARDRAIL SYSTEM IS USED WHEN THE 2'-0" [610] WIDENING BEHIND THE POSTS CANNOT BE PROVIDED, AS PER DTL. DWG. NO. 606-05A & 606-05B.

PROFILE



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

DETAILED DRAWING

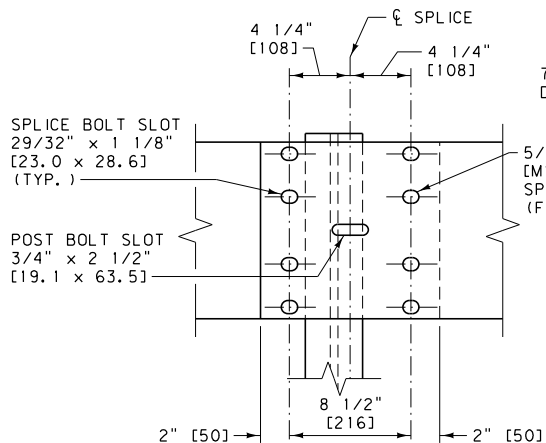
REFERENCE	DWG. NO.
STANDARD SPEC.	606-11A
SECTION 606, 704	

**METAL GUARDRAIL -
7' [2.1 m] WOOD POSTS**

--REVISED--
DECEMBER 2011

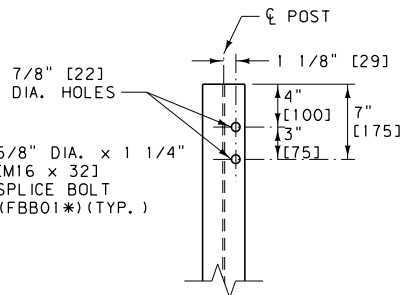
EFFECTIVE: APRIL 2006

MDT MONTANA DEPARTMENT
OF TRANSPORTATION

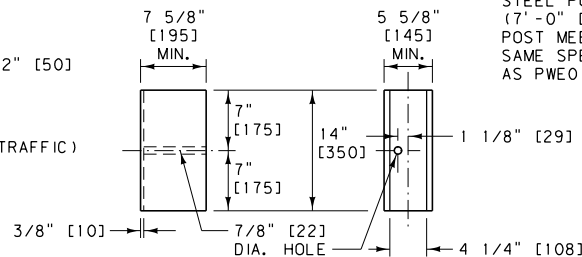


BEAM SPLICE

(LAP IN DIRECTION OF ADJACENT TRAFFIC)

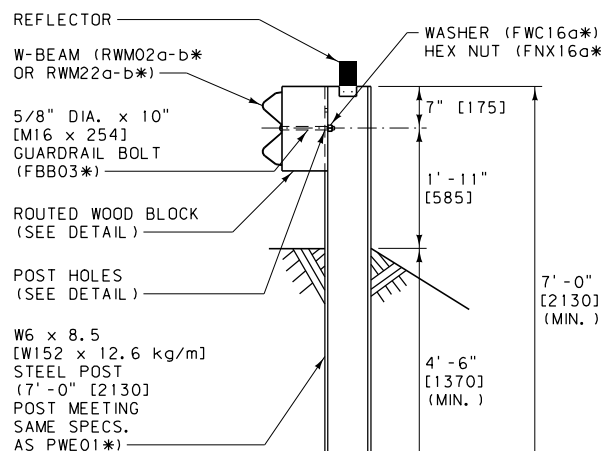
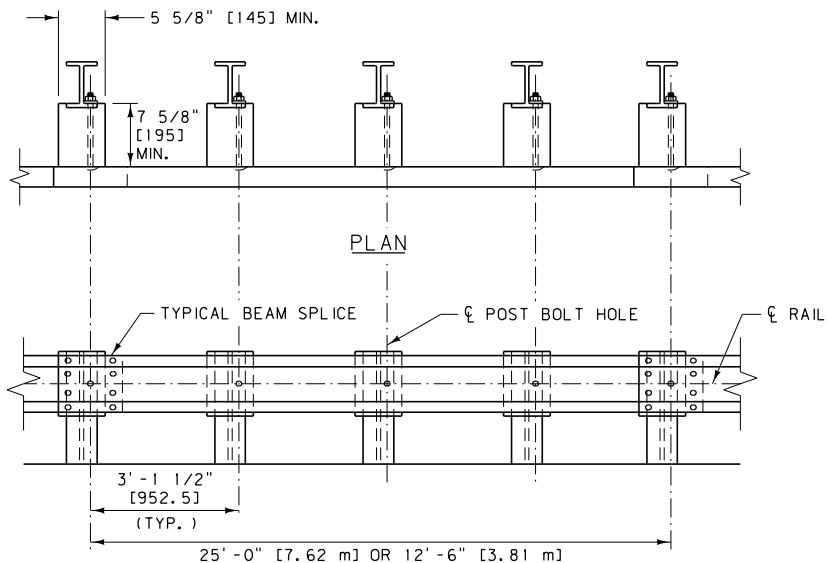


POST HOLE DETAIL

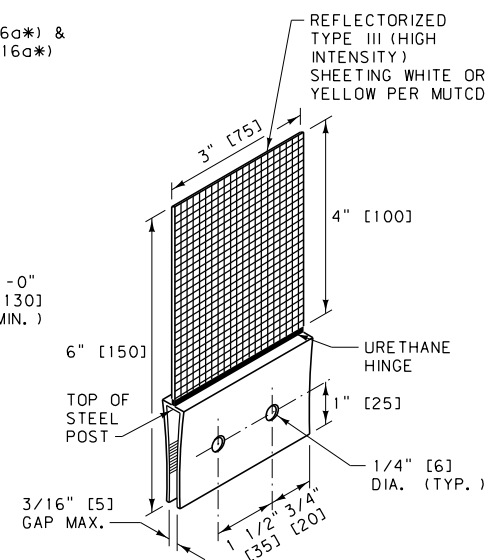


ROUTED WOOD BLOCK

PDB01*

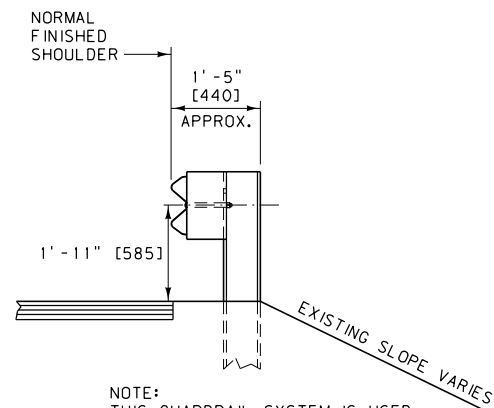


STEEL POST AND MOUNTING DETAIL



REFLECTOR

(SEE NOTE 3)



NOTE:
THIS GUARDRAIL SYSTEM IS USED WHEN THE 2' - 0" [610] WIDENING BEHIND THE POSTS CANNOT BE PROVIDED, AS PER DTL. DWG. NO. 606-05A & 606-05B.

PROFILE

NOTES:

- ① INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
- ② USE ROUTED WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS.
- ③ ATTACH REFLECTORS TO POSTS EVERY 25' [7.62 m], INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE FACING ADJACENT TRAFFIC. FASTEN REFLECTOR TO STEEL POST USING AN APPROVED ADHESIVE. REFLECTORS MAY BE BOLTED TO POSTS PROVIDED HOLES IN POSTS ARE DRILLED BEFORE BEING GALVANIZED.
- ④ ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 1' - 8" [510].
- ⑤ STEEL POSTS WITH OTHER POST HOLE CONFIGURATIONS MAY BE ACCEPTED, PROVIDED THEY HAVE AT LEAST THE HOLES DETAILED ON THIS DRAWING AND THEY MEET AASHTO'S PUBLICATION, "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" AND NCHRP 350 REQUIREMENTS.
- ⑥ THE W-BEAM RAIL ON THIS SYSTEM REQUIRES ADDITIONAL HOLES TO ACCOMMODATE BEING BOLTED TO POSTS AT HALF THE NORMAL POST SPACING. DRILL ADDITIONAL HOLES IN THE W-BEAM RAIL PRIOR TO APPLYING CORROSION PROTECTION.
- ⑦ DO NOT INSTALL W-BEAM GUARDRAIL WITH 7' [2.1 m] POSTS FOR OBSTACLES WITHIN 4.6' [1.4 m] OF THE FACE OF THE RAIL.

*SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

DETAILED DRAWING

REFERENCE	DWG. NO.
STANDARD SPEC.	606-11B
SECTION 606	

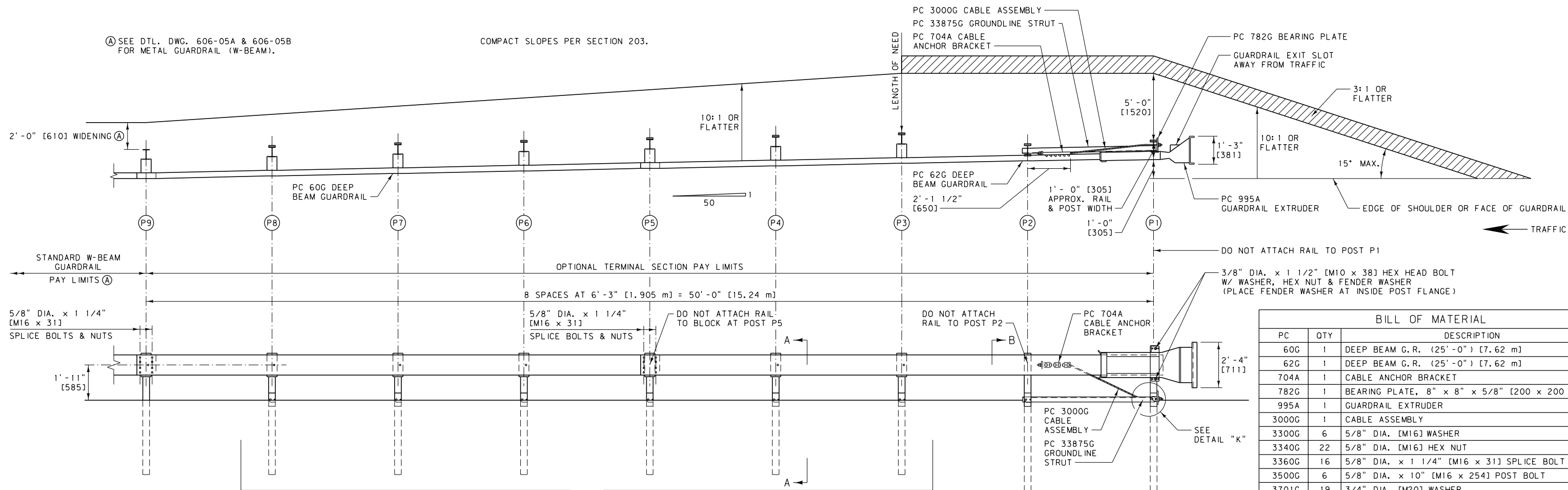
METAL GUARDRAIL -
7' [2.1 m] STEEL POSTS

--REVISED--	EFFECTIVE: APRIL 2006
DECEMBER 2011	
MONTANA DEPARTMENT OF TRANSPORTATION	

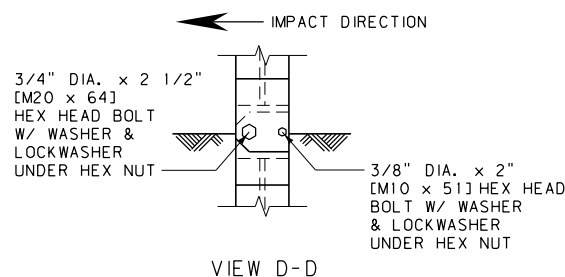
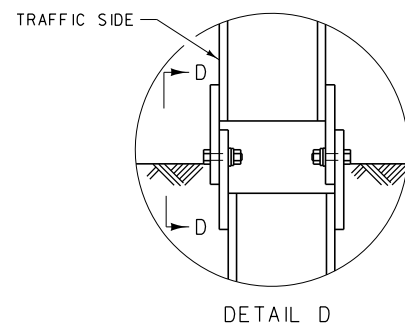
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

(A) SEE DTL. DWG. 606-05A & 606-05B
FOR METAL GUARDRAIL (W-BEAM).

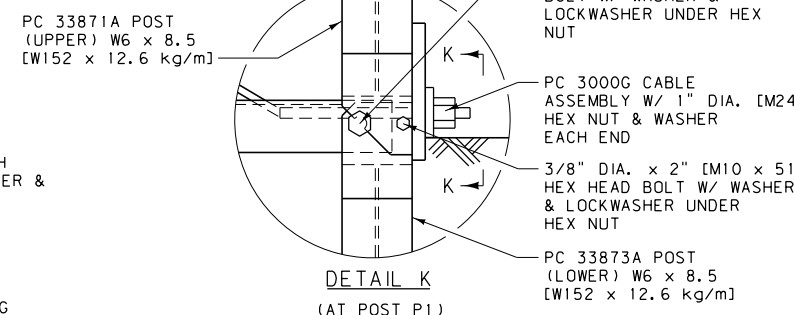
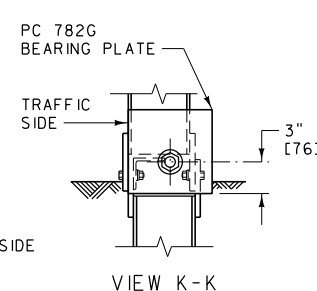
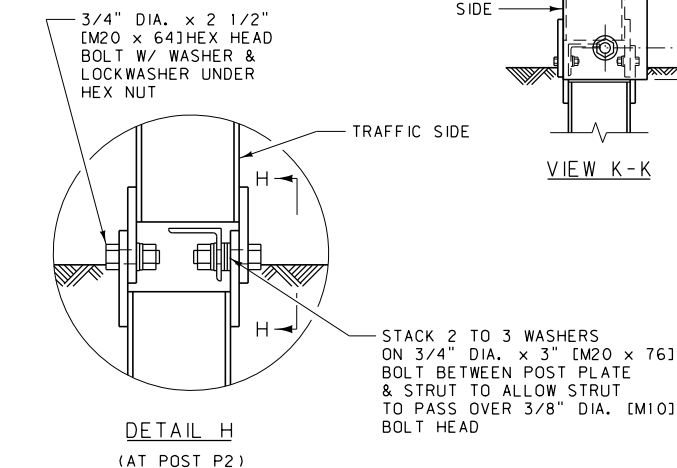
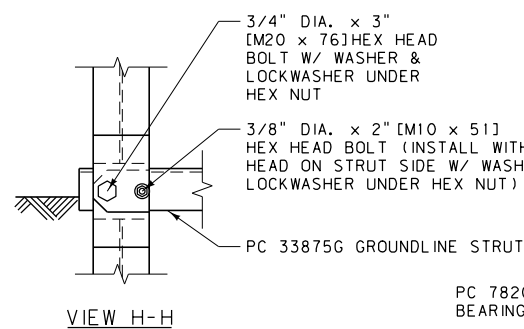
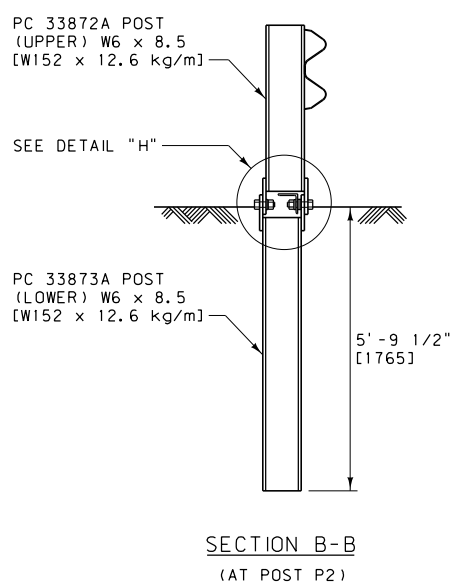
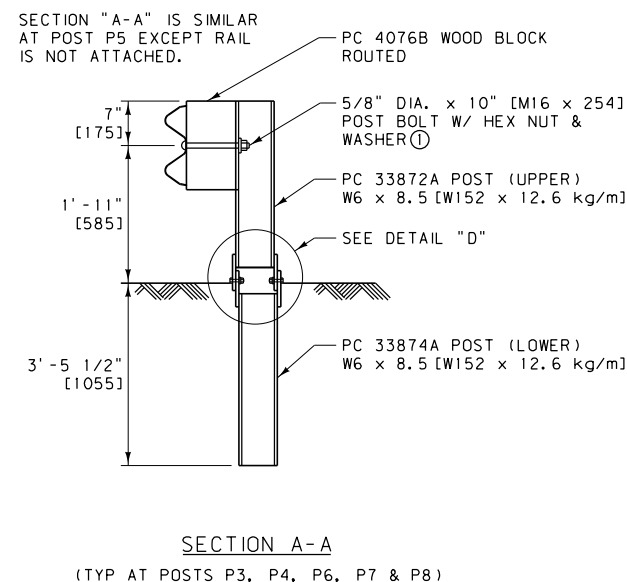
COMPACT SLOPES PER SECTION 203.



BILL OF MATERIAL		
PC	QTY	DESCRIPTION
60G	1	DEEP BEAM G.R. (25'-0") [7.62 m]
62G	1	DEEP BEAM G.R. (25'-0") [7.62 m]
704A	1	CABLE ANCHOR BRACKET
782G	1	BEARING PLATE, 8" x 8" x 5/8" [200 x 200 x 16]
995A	1	GUARDRAIL EXTRUDER
3000G	1	CABLE ASSEMBLY
3300G	6	5/8" DIA. [M16] WASHER
3340G	22	5/8" DIA. [M16] HEX NUT
3360G	16	5/8" DIA. x 1 1/4" [M16 x 31] SPLICE BOLT
3500G	6	5/8" DIA. x 10" [M16 x 254] POST BOLT
3701G	19	3/4" DIA. [M20] WASHER
3704G	16	3/4" DIA. [M20] HEX NUT
3717G	15	3/4" DIA. x 2 1/2" [M20 x 64] HEX HEAD BOLT
3718G	1	3/4" DIA. x 3" [M20 x 76] HEX HEAD BOLT
3900G	2	1" DIA. [M24] WASHER
3910G	2	1" DIA. [M24] HEX NUT
4076B	6	WOOD BLOCK, 6" x 8" x 1'-2" [150 x 200 x 350]
4254G	18	3/8" DIA. [M10] WASHER
4255G	2	3/8" DIA. [M10] FENDER WASHER (1 1/2" [38] O.D.)
4258G	16	3/8" DIA. [M10] LOCKWASHER
4261G	2	3/8" DIA. x 1 1/2" [M10 x 38] HEX HEAD BOLT
4699G	16	3/4" DIA. [M20] LOCKWASHER
6321G	16	3/8" DIA. x 2" [M10 x 51] HEX HEAD BOLT
6405G	18	3/8" DIA. [M10] HEX NUT
33871A	1	ETPLUS HBA POST P1 (UPPER)
33872A	7	ETPLUS HBA POST P2 TO P8 (UPPER)
33873A	2	ETPLUS HBA POST P1 & P2 (LOWER)
33874A	6	ETPLUS HBA POST P3 TO P8 (LOWER)
33875G	1	6'-6" [1981] ANGLE STRUT ET HBA




NOTE:



NOTES:

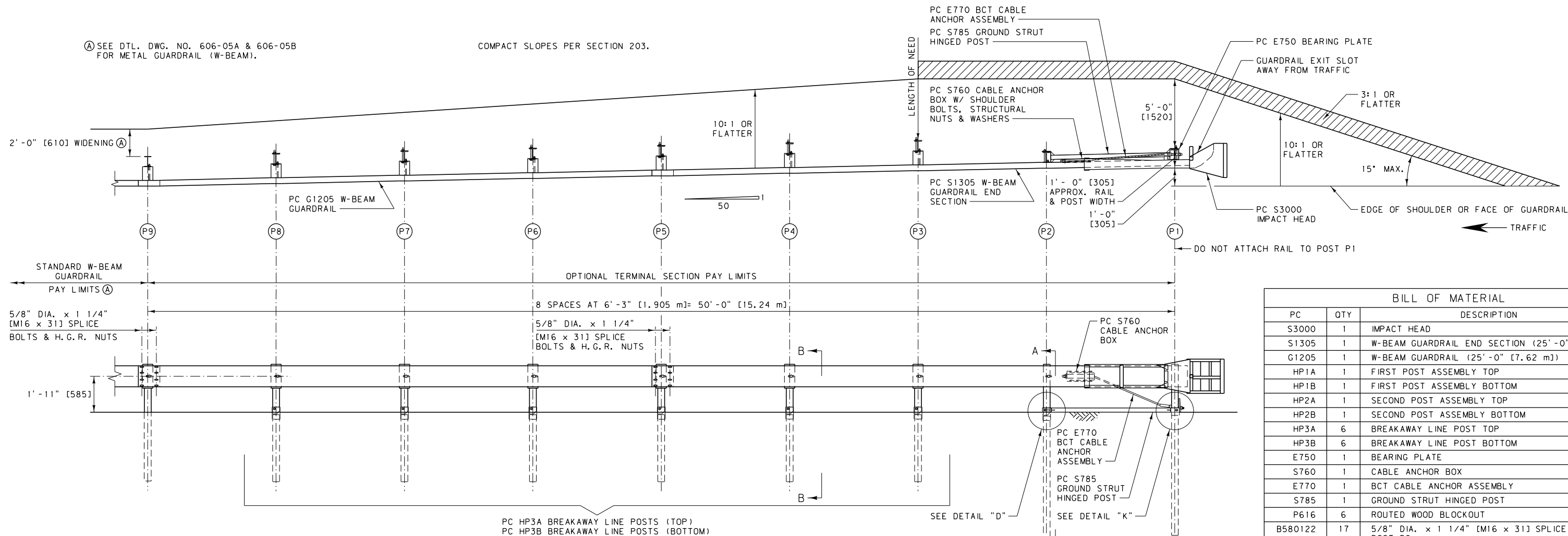
- THE 5/8" DIA. [M16] FLAT WASHER IS USED UNDER THE NUT, BEHIND THE POST ONLY. NO WASHER IS USED AT THE RAIL.
- USE THE ET-PLUS TERMINAL SECTION ON DIVIDED ROADWAYS IF THE WIDTH IS 25 FEET [7.5 m] OR GREATER BETWEEN FINISHED SURFACES. CONSIDER OTHER TERMINAL SECTIONS IF THE WIDTH IS LESS THAN 25 FEET [7.5 m] BETWEEN FINISHED SURFACES.
- FLARE THE END SECTION AWAY FROM TRAFFIC AT A RATE OF 50:1 FOR 50 FEET [15.24 m] (ILLUSTRATED). FLARES OF 50:1 FOR 100 FEET [30.48 m] MAY ALSO BE USED. THE FLARE MAY BE OMITTED ON ROADS WITH SHOULDERS GREATER THAN 2 FEET [0.6 m] IN WIDTH.
- PLACE A SELF-ADHESIVE OBJECT MARKER ON THE GUARDRAIL EXTRUDER FACE, HAVING ALTERNATING RETRO-REFLECTIVE BLACK AND YELLOW STRIPES SLOPED DOWNWARD AT AN ANGLE OF 45° TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS.
- ATTACH REFLECTORS TO TERMINAL SECTION POSTS, PER DTL. DWG. NO. 606-05A & 606-05B.
- OBTAIN ENGINEER'S APPROVAL OF MANUFACTURER INSTALLATION OPTIONS WHEN SITE CONDITIONS PREVENT THE USE OF THE OPTION SHOWN ON THIS DETAIL.
- AFTER FINAL ASSEMBLY, RECHECK CABLE TO MAKE SURE IT IS TAUT AND HAS NOT RELAXED.
- LAP ALL W-BEAM SPLICES IN THE DIRECTION OF ADJACENT TRAFFIC.

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

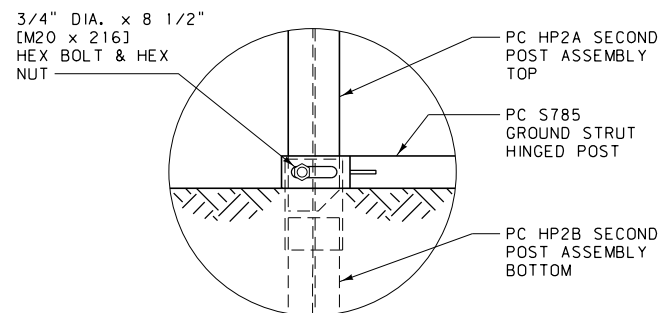
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-13A
SECTION 606, 203	
OPTIONAL TERMINAL SECTION - ET-PLUS	
EFFECTIVE: FEBRUARY 2005	
--REVISED-- DECEMBER 2011	 MONTANA DEPARTMENT OF TRANSPORTATION <i>serving you with pride</i>

(A) SEE DTL. DWG. NO. 606-05A & 606-05B FOR METAL GUARDRAIL (W-BEAM).

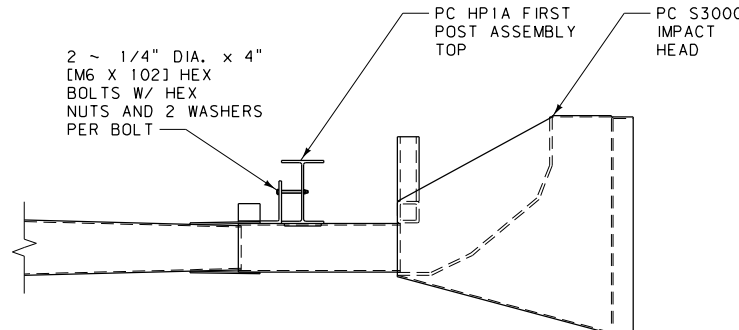
COMPACT SLOPES PER SECTION 203.



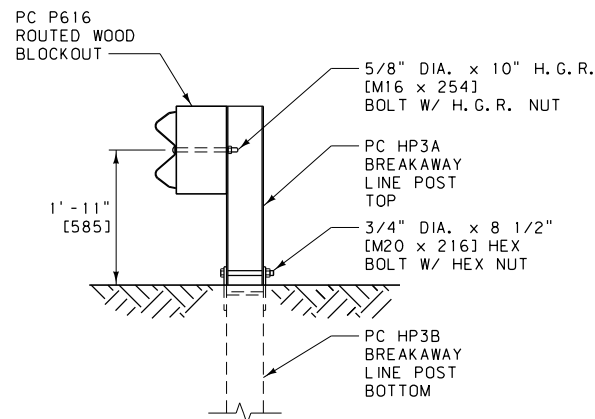
BILL OF MATERIAL		
PC	QTY	DESCRIPTION
S3000	1	IMPACT HEAD
S1305	1	W-BEAM GUARDRAIL END SECTION (25'-0" [7.62 m])
G1205	1	W-BEAM GUARDRAIL (25'-0" [7.62 m])
HP1A	1	FIRST POST ASSEMBLY TOP
HP1B	1	FIRST POST ASSEMBLY BOTTOM
HP2A	1	SECOND POST ASSEMBLY TOP
HP2B	1	SECOND POST ASSEMBLY BOTTOM
HP3A	6	BREAKAWAY LINE POST TOP
HP3B	6	BREAKAWAY LINE POST BOTTOM
E750	1	BEARING PLATE
S760	1	CABLE ANCHOR BOX
E770	1	BCT CABLE ANCHOR ASSEMBLY
S785	1	GROUND STRUT HINGED POST
P616	6	ROUTED WOOD BLOCKOUT
B580122	17	5/8" DIA. x 1 1/4" [M16 x 31] SPLICE BOLT, POST P2
B580904A	1	5/8" DIA. x 9" [M16 x 229] HEX BOLT
B581002	6	5/8" DIA. x 10" [M16 x 254] H.G.R. BOLT
N050	24	5/8" DIA. [M16] H.G.R. NUT
W050	2	5/8" DIA. [M16] WASHER
B340854A	7	3/4" DIA. x 8 1/2" [M20 x 216] HEX BOLT
N030	7	3/4" [M20] DIA. HEX NUT
N100	2	1" DIA. [M24] ANCHOR CABLE HEX NUT
W100	2	1" DIA. [M24] ANCHOR CABLE WASHER
B140404	2	1/4" DIA. x 4" [M6 x 102] HEX BOLT
N014	2	1/4" DIA. [M6] HEX NUT
W014	4	1/4" DIA. [M6] WASHER
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	1/2" DIA. [M12] A325 STRUCTURAL NUT
W050A	16	9/16" DIA. [M14] (1 1/16" [27] O.D.) A325 STRUCTURAL WASHER



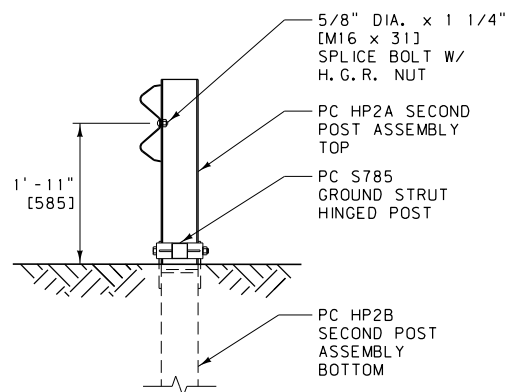
DETAIL D
(AT POST P2)



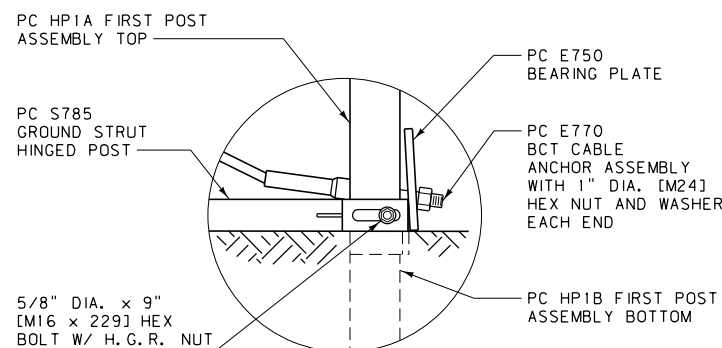
IMPACT HEAD CONNECTION DETAIL



SECTION B-B
(TYP. AT POSTS P3 THRU P8)



SECTION A-A
(AT POST P2)



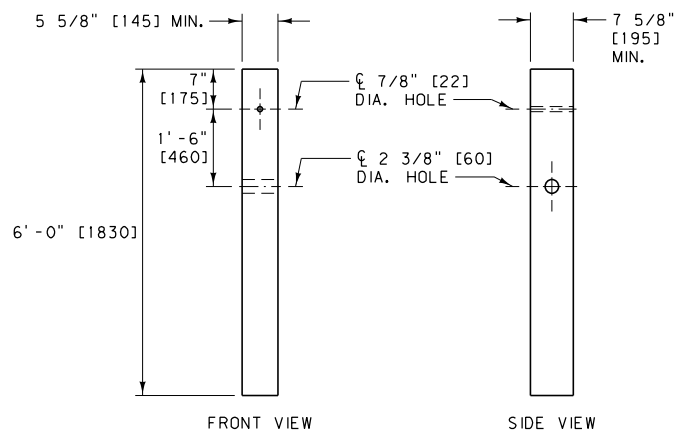
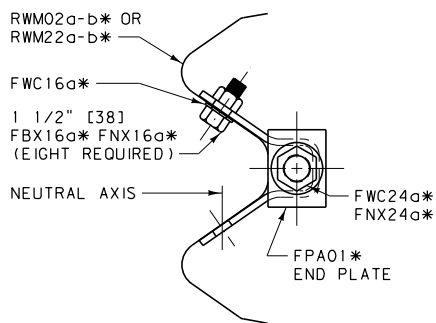
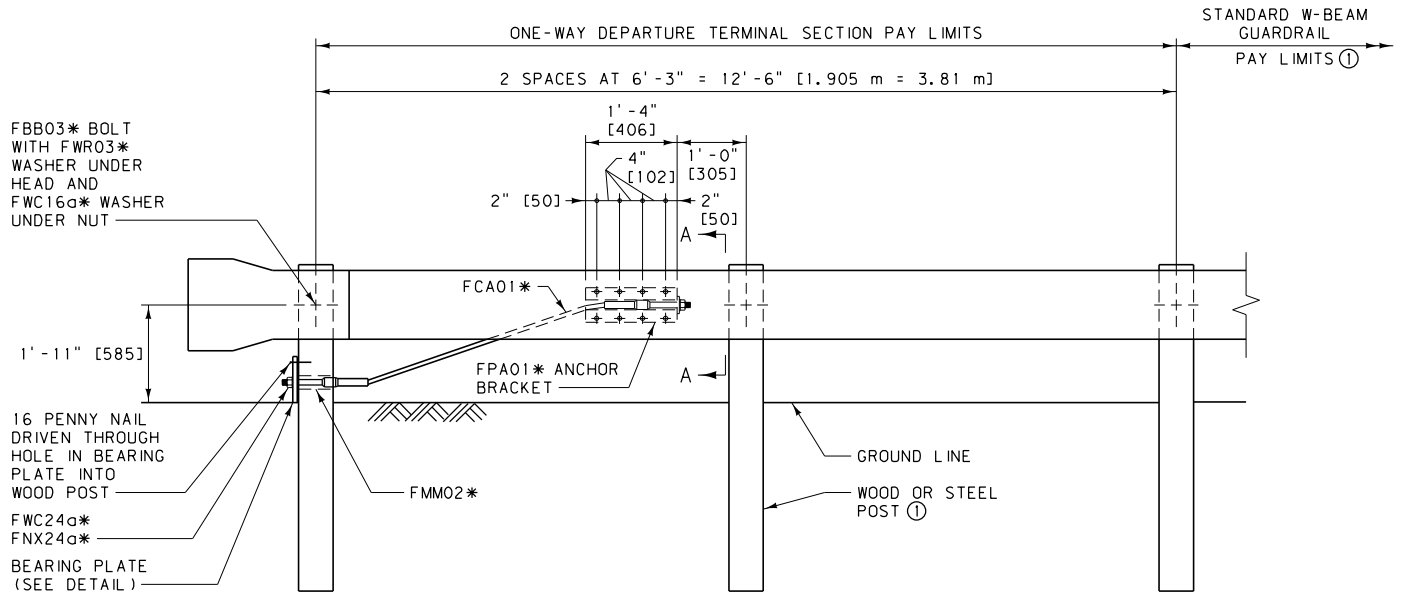
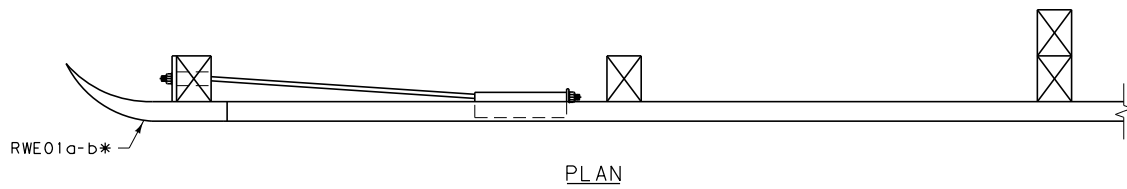
DETAIL K
(AT POST P1)

NOTES:

- USE THE SKT 350 TERMINAL SECTION ON DIVIDED ROADWAYS IF THE WIDTH IS 25 FEET [7.5 m] OR GREATER BETWEEN FINISHED SURFACES. CONSIDER OTHER TERMINAL SECTIONS IF THE WIDTH IS LESS THAN 25 FEET [7.5 m] BETWEEN FINISHED SURFACES.
- FLARE THE END SECTION AWAY FROM TRAFFIC AT A RATE OF 50:1 FOR 50 FEET [15.24 m] (ILLUSTRATED). FLARES OF 50:1 FOR 100 FEET [30.48 m] MAY ALSO BE USED. THE FLARE MAY BE OMITTED ON ROADS WITH SHOULDERS GREATER THAN 2 FEET [0.6 m] IN WIDTH.
- PLACE A SELF-ADHESIVE OBJECT MARKER ON THE GUARDRAIL IMPACT HEAD FACE, HAVING ALTERNATING RETRO-REFLECTIVE BLACK AND YELLOW STRIPES SLOPED DOWNWARD AT AN ANGLE OF 45° TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS.
- ATTACH REFLECTORS TO TERMINAL SECTION POSTS, PER DTL. DWG. NO. 606-05A & 606-05B.
- AFTER FINAL ASSEMBLY, RECHECK CABLE TO MAKE SURE IT IS TAUT AND HAS NOT RELAXED.
- OBTAIN ENGINEER'S APPROVAL OF MANUFACTURER INSTALLATION OPTIONS WHEN SITE CONDITIONS PREVENT THE USE OF THE OPTION SHOWN ON THIS DETAIL.
- LAP ALL W-BEAM SPLICES IN THE DIRECTION OF ADJACENT TRAFFIC.

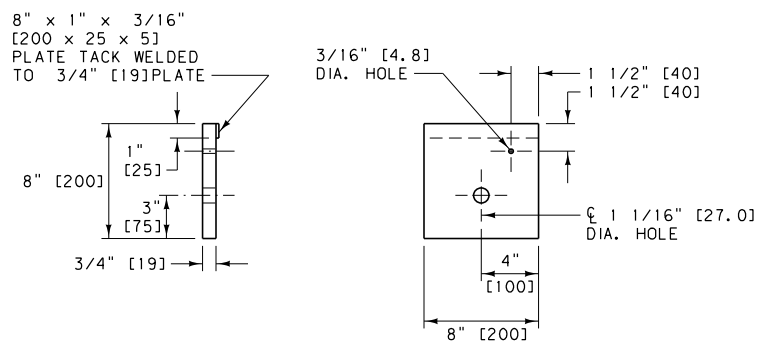
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-13B
SECTION 606, 203	
OPTIONAL TERMINAL SECTION - SKT 350	
EFFECTIVE: APRIL 2006	
--REVISED-- DECEMBER 2011	MDT MONTANA DEPARTMENT OF TRANSPORTATION



END POST DETAILS

PDF03*



BEARING PLATE DETAIL

FPB01*

NOTE:

① SEE DTL. DWG. NO. 606-05A AND 606-05B FOR METAL GUARDRAIL (W-BEAM).

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

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

DETAILED DRAWING

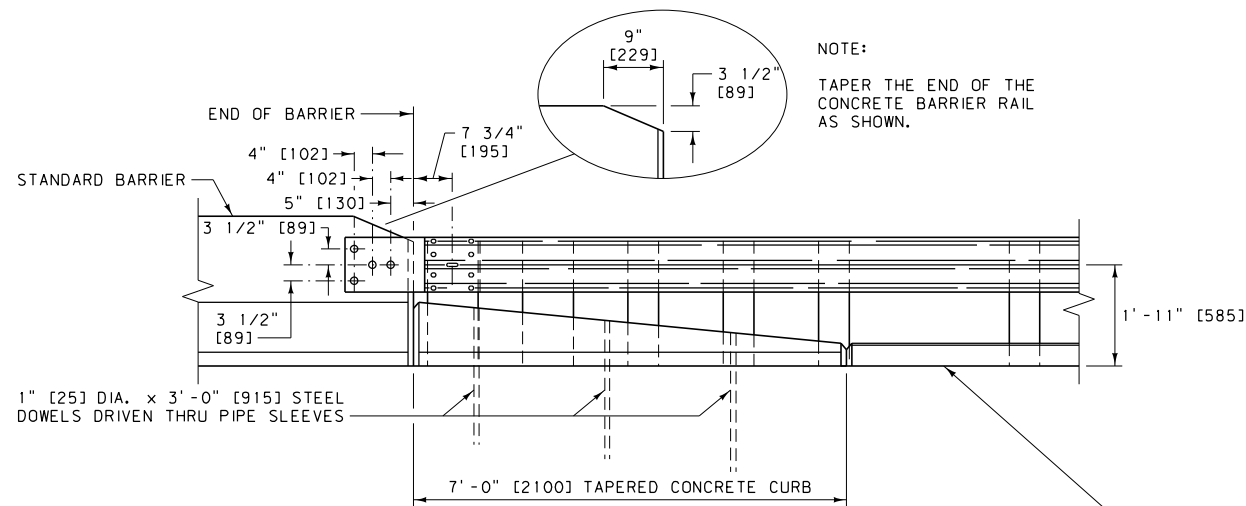
REFERENCE DWG. NO. STANDARD SPEC. 606-18

ONE-WAY DEPARTURE TERMINAL SECTION

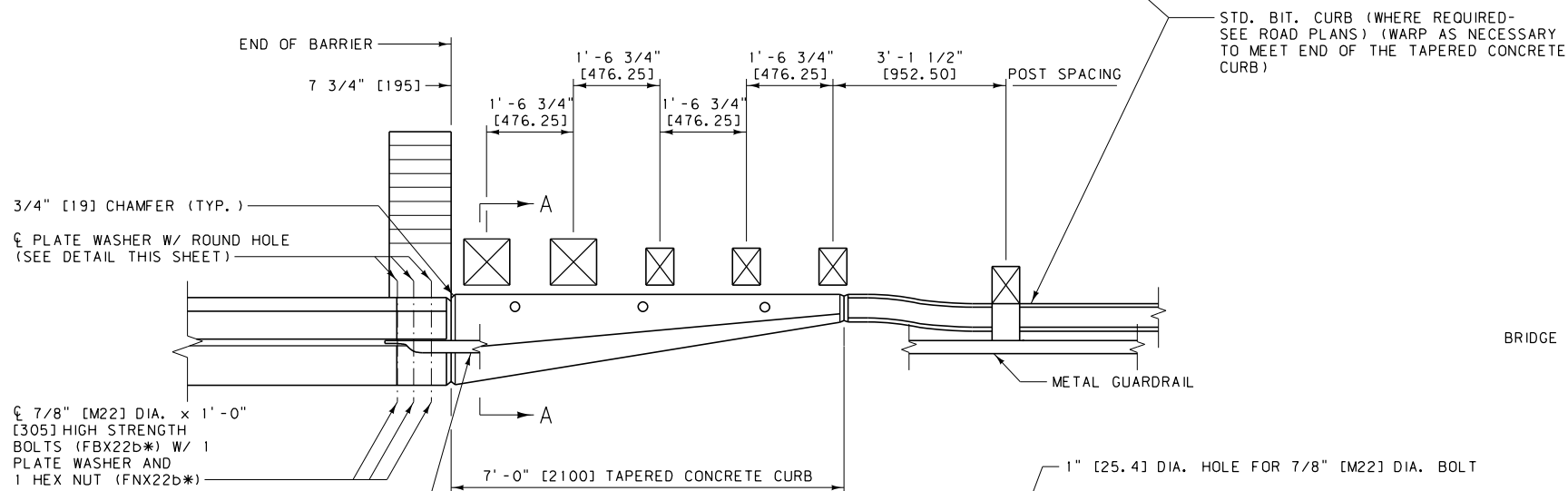
EFFECTIVE: FEBRUARY 2005

--REVISED--
DECEMBER 2011

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ELEVATION



PLAN

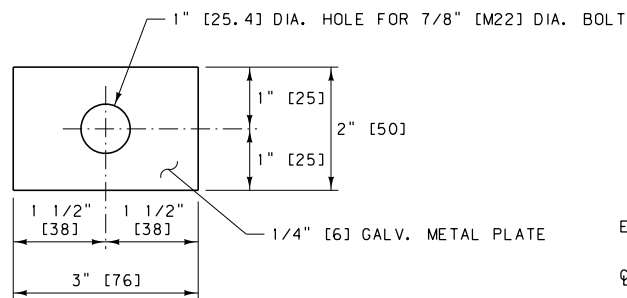
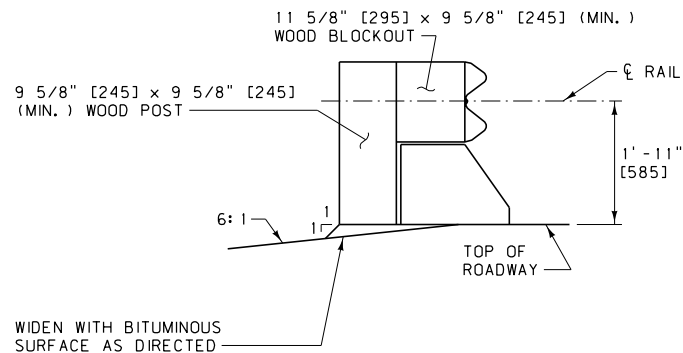
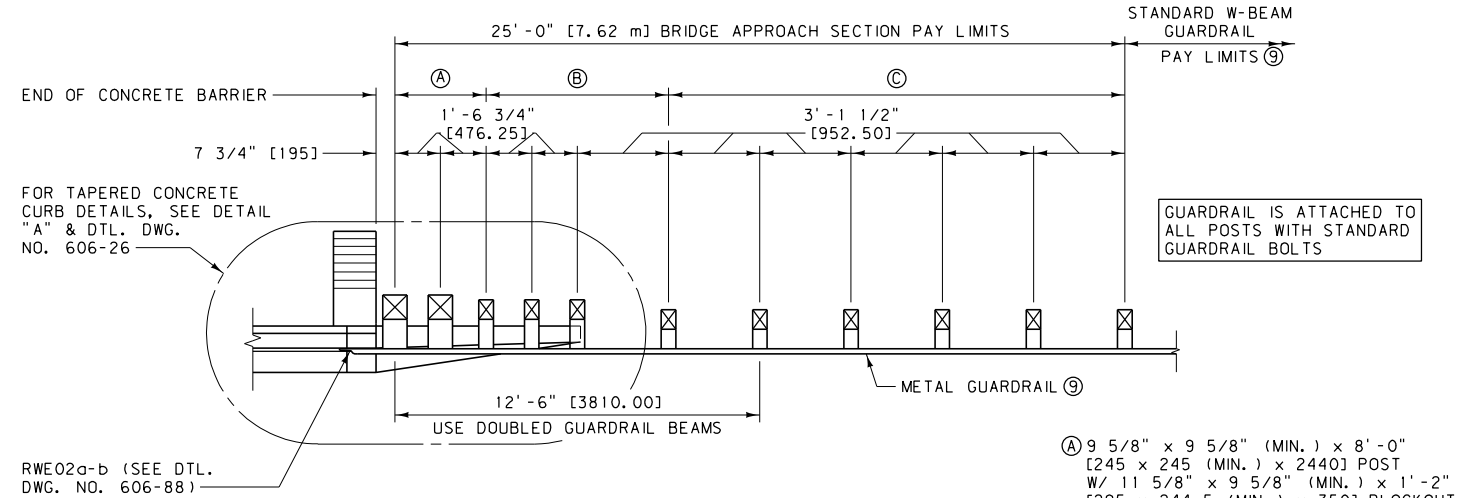


PLATE WASHER



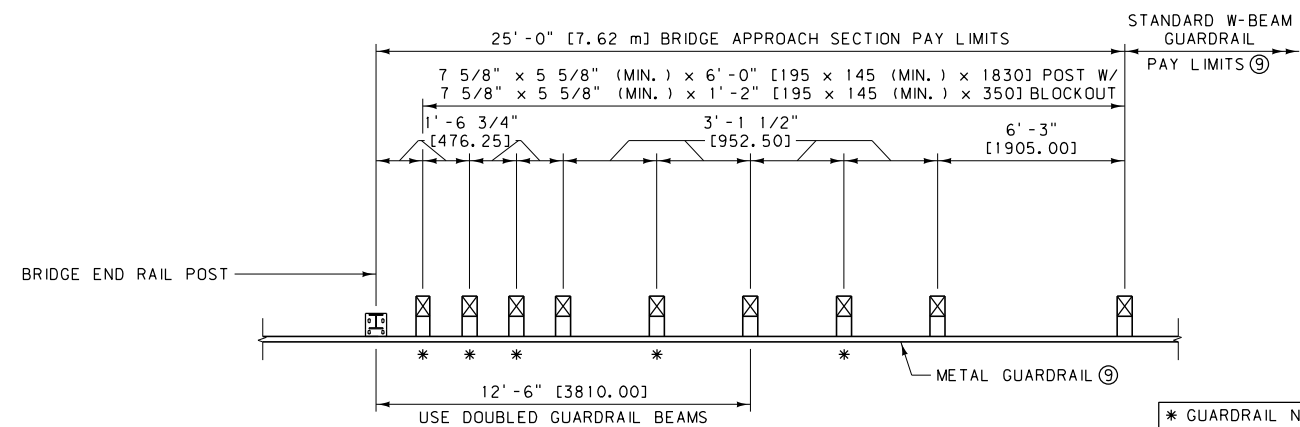
SECTION A-A

- NOTES:
- ① TAPERED CONCRETE CURBS:
TYPE 1, SEE DTL. DWG. NO. 606-26
TYPE 3, SEE DTL. DWG. NO. 606-27
 - ② TAPERED CONCRETE CURBS ARE ALSO REQUIRED ON CONCRETE APPROACH SLABS.
 - ③ PORTIONS OF GUARDRAIL & BLOCKOUTS ARE OMITTED FOR CLARITY.
 - ④ LAP GUARDRAIL IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE. (SEE DTL. DWG. NO. 606-05A).
 - ⑤ LAP W-BEAM TERMINAL CONNECTOR (RWE02a-b) IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE.
 - ⑥ USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.
 - ⑦ DO NOT FLARE BRIDGE APPROACH SECTIONS.
 - ⑧ SEE DTL. DWG. NO. 606-25A FOR SKEWED BRIDGES.
 - ⑨ SEE DTL. DWG. NO. 606-05A FOR METAL GUARDRAIL (W-BEAM).
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

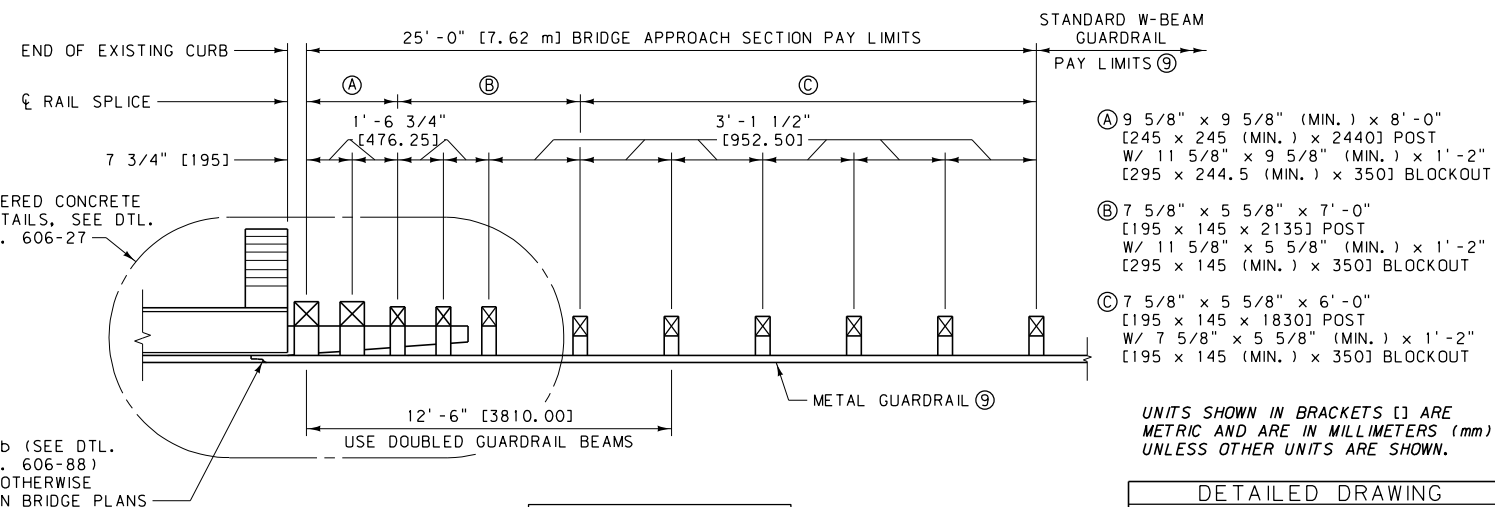


METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1
(FOR BRIDGES USING CONCRETE BARRIER RAIL)

- ① 9 5/8" x 9 5/8" (MIN.) x 8'-0" [245 x 245 (MIN.) x 2440] POST W/ 11 5/8" x 9 5/8" (MIN.) x 1'-2" [295 x 244.5 (MIN.) x 350] BLOCKOUT
- ② 7 5/8" x 5 5/8" x 7'-0" [195 x 145 x 2135] POST W/ 11 5/8" x 5 5/8" (MIN.) x 1'-2" [295 x 145 (MIN.) x 350] BLOCKOUT
- ③ 7 5/8" x 5 5/8" x 6'-0" [195 x 145 x 1830] POST W/ 7 5/8" x 5 5/8" (MIN.) x 1'-2" [195 x 145 (MIN.) x 350] BLOCKOUT



METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 2
(FOR BRIDGES WITHOUT CURBS)



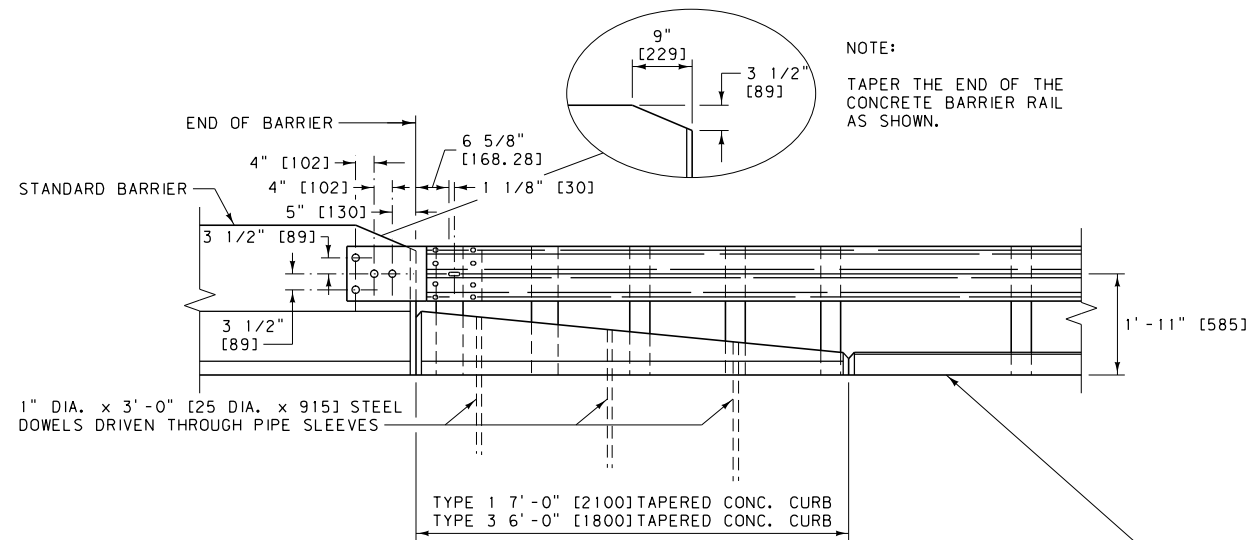
METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 3
(FOR BRIDGES WITH EXISTING CONCRETE CURBS)

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

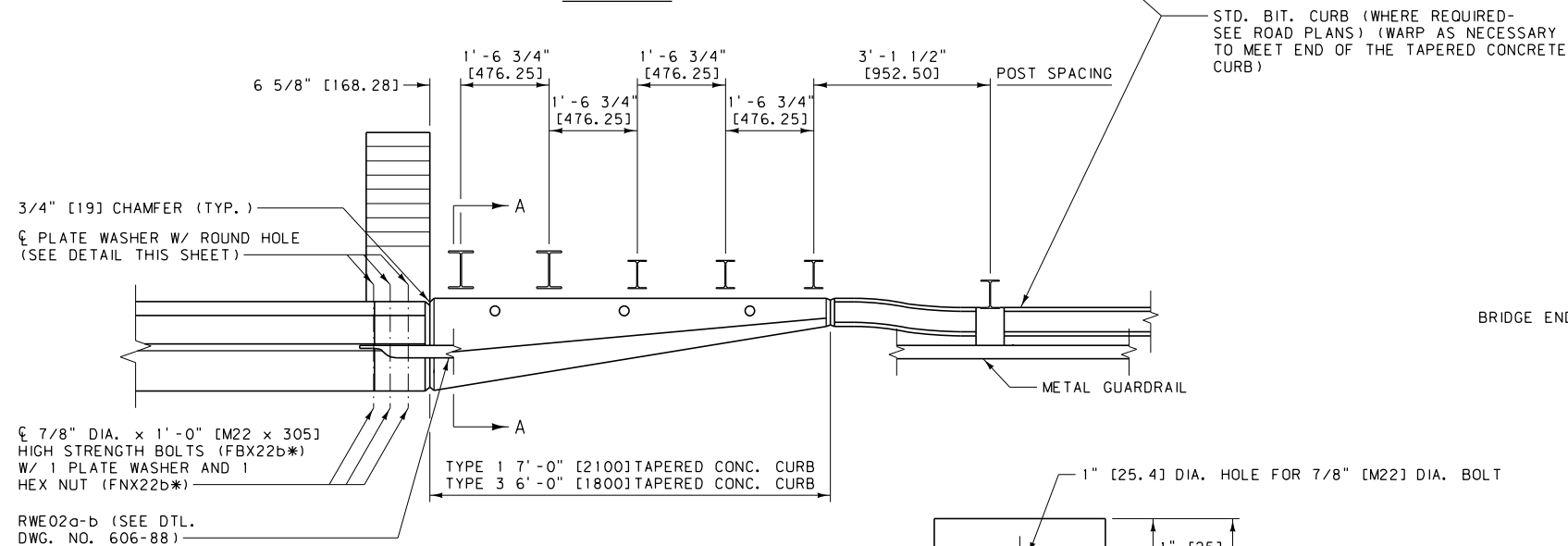
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-24A
SECTION 606	

BRIDGE APPROACH SECTIONS - WOOD POSTS	
--REVISED--	EFFECTIVE: FEBRUARY 2005
JANUARY 2008	
DECEMBER 2011	

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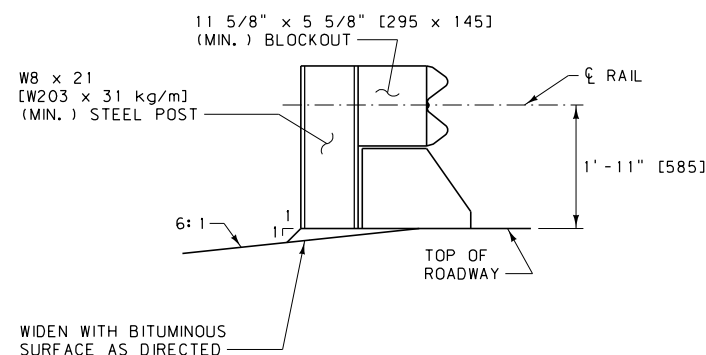


ELEVATION



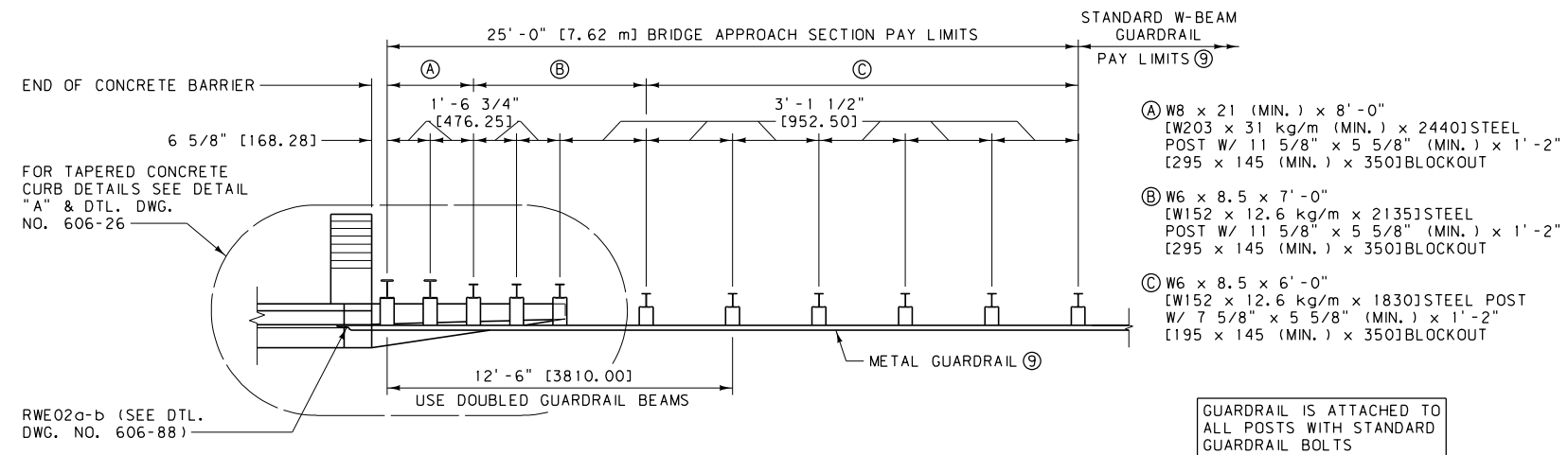
PLAN

DETAIL "A"

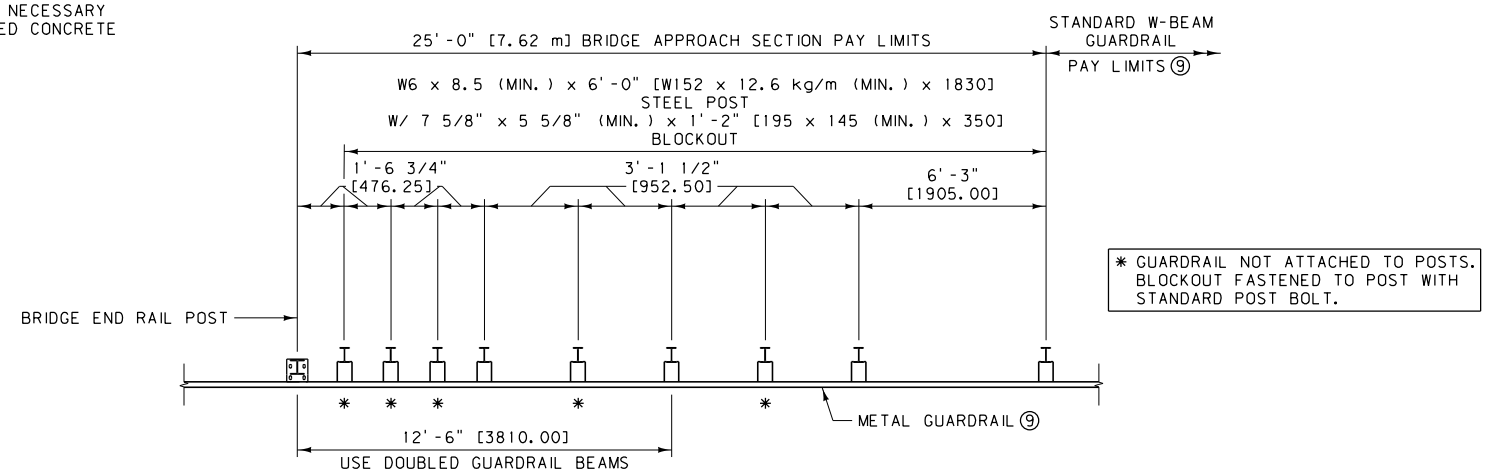


SECTION A-A

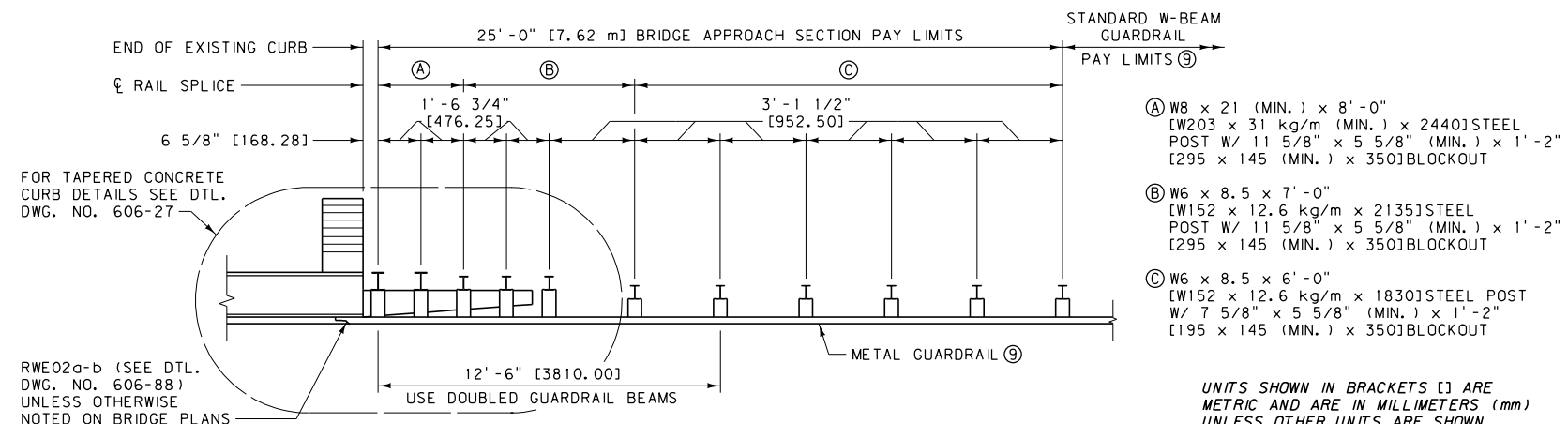
- NOTES:
- ① TAPERED CONCRETE CURBS:
TYPE 1, SEE DTL. DWG. NO. 606-26
TYPE 3, SEE DTL. DWG. NO. 606-27
 - ② TAPERED CONCRETE CURBS ARE ALSO REQUIRED ON CONCRETE APPROACH SLABS.
 - ③ PORTIONS OF GUARDRAIL & BLOCKOUTS ARE OMITTED FOR CLARITY.
 - ④ LAP GUARDRAIL IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE. (SEE DTL. DWG. NO. 606-05B).
 - ⑤ LAP W-BEAM TERMINAL CONNECTOR (RWE02a-b) IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE.
 - ⑥ USE ROUTED WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.
 - ⑦ DO NOT FLARE BRIDGE APPROACH SECTIONS.
 - ⑧ SEE DTL. DWG. NO. 606-25B FOR SKEWED BRIDGES.
 - ⑨ SEE DTL. DWG. NO. 606-05B FOR METAL GUARDRAIL (W-BEAM).
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.



METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1
(FOR BRIDGES USING CONCRETE BARRIER RAIL)



METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 2
(FOR BRIDGES WITHOUT CURBS)



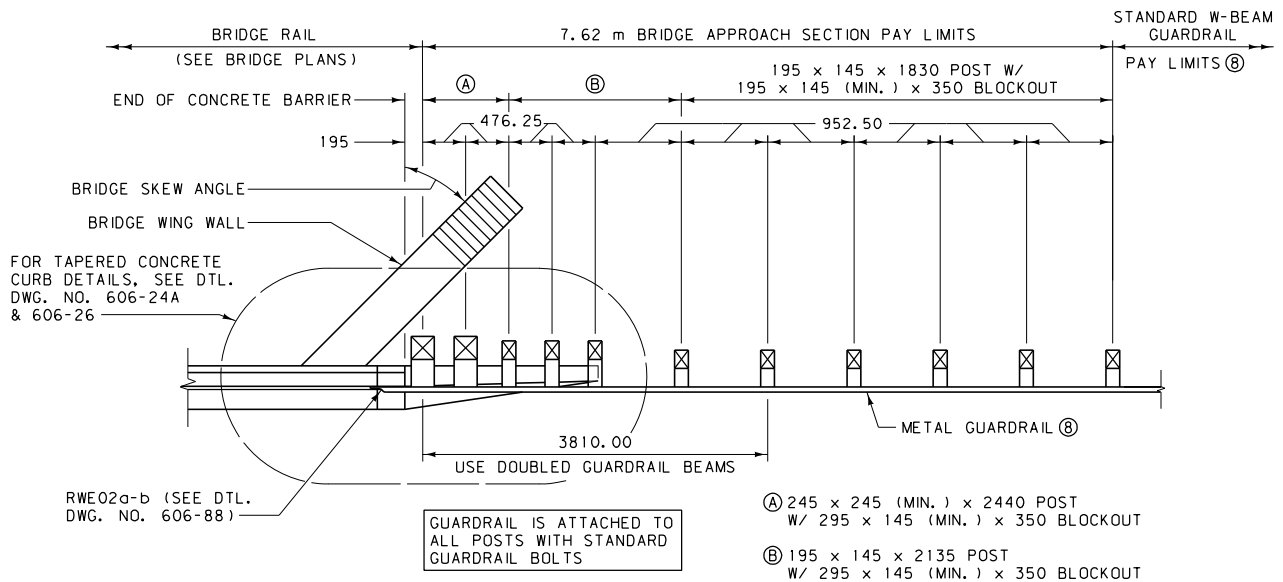
METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 3
(FOR BRIDGES WITH EXISTING CONCRETE CURBS)

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

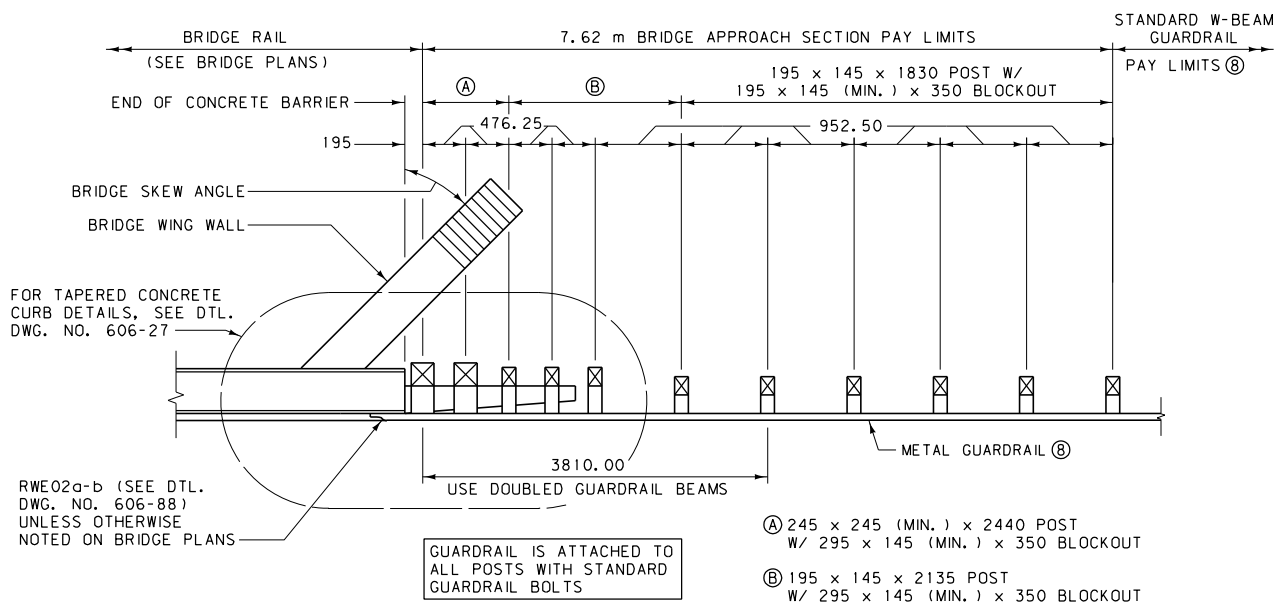
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-24B
SECTION 606	
BRIDGE APPROACH SECTIONS - STEEL POSTS	

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JANUARY 2008	
DECEMBER 2011	

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METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1
(FOR SKEWED BRIDGES USING CONCRETE BARRIER RAIL)




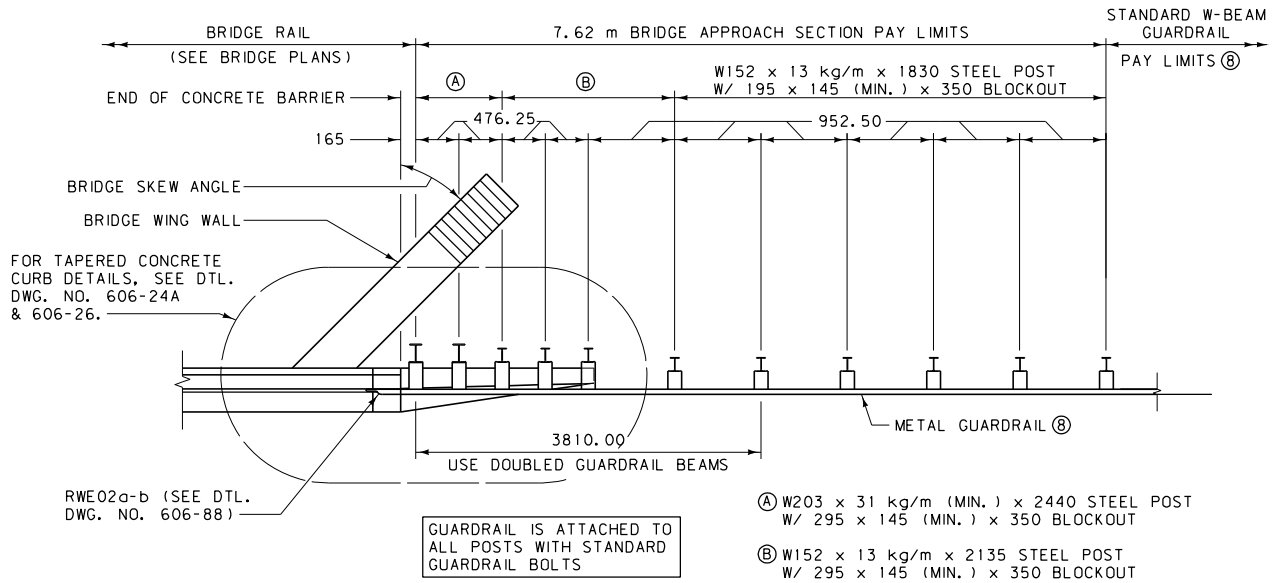
METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 3
(FOR SKEWED BRIDGES WITH EXISTING CONCRETE CURBS)

NOTES:

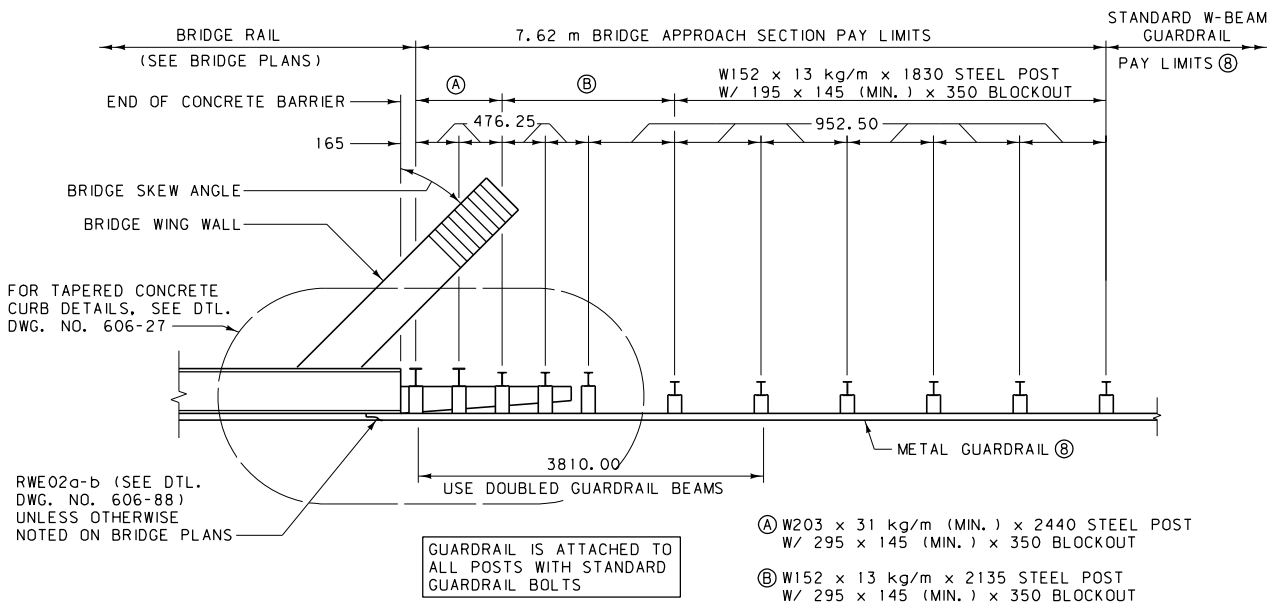
- ① TAPERED CONCRETE CURBS:
TYPE 1, SEE DTL. DWG. NO. 606-26
TYPE 3, SEE DTL. DWG. NO. 606-27
- ② TAPERED CONCRETE CURBS ARE ALSO REQUIRED ON CONCRETE APPROACH SLABS.
- ③ LAP GUARDRAIL IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE. (SEE DTL. DWG. NO. 606-05A).
- ④ LAP W-BEAM TERMINAL CONNECTOR (RWE02a-b) IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE.
- ⑤ USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.
- ⑥ DO NOT FLARE BRIDGE APPROACH SECTIONS.
- ⑦ SEE DTL. DWG. NO. 606-24A FOR ADDITIONAL INFORMATION.
- ⑧ SEE DTL. DWG. NO. 606-05A FOR METAL GUARDRAIL (W-BEAM).

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-25A
SECTION 606	
SKEWED BRIDGE APPROACH SECTIONS - WOOD POSTS	
EFFECTIVE: FEBRUARY 2005	
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METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1
(FOR SKEWED BRIDGES USING CONCRETE BARRIER RAIL)




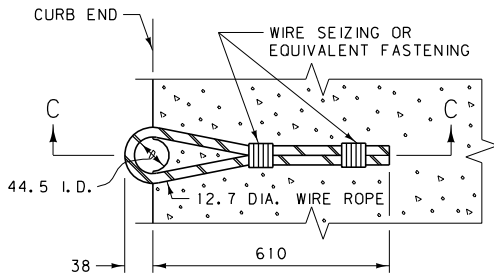
METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 3
(FOR SKEWED BRIDGES WITH EXISTING CONCRETE CURBS)

NOTES:

- ① TAPERED CONCRETE CURBS:
TYPE 1, SEE DTL. DWG. NO. 606-26
TYPE 3, SEE DTL. DWG. NO. 606-27
- ② TAPERED CONCRETE CURBS ARE ALSO REQUIRED ON CONCRETE APPROACH SLABS.
- ③ LAP GUARDRAIL IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE. (SEE DTL. DWG. NO. 606-05B).
- ④ LAP W-BEAM TERMINAL CONNECTOR (RWE02a-b) IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE.
- ⑤ USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.
- ⑥ DO NOT FLARE BRIDGE APPROACH SECTIONS.
- ⑦ SEE DTL. DWG. NO. 606-24B FOR ADDITIONAL INFORMATION.
- ⑧ SEE DTL. DWG. NO. 606-05B FOR METAL GUARDRAIL (W-BEAM).

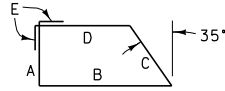
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-25B
SECTION 606	
SKEWED BRIDGE APPROACH SECTIONS - STEEL POSTS	
EFFECTIVE: FEBRUARY 2005	
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WIRE ROPE DETAIL

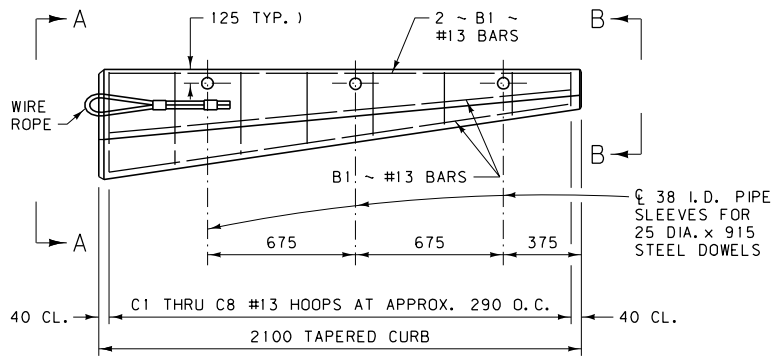
BILL OF REINFORCING STEEL (ONE SECTION ONLY)



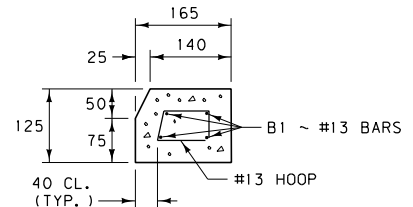
TYPE 1

BENT BARS (ALL DIMENSIONS ARE OUT TO OUT)

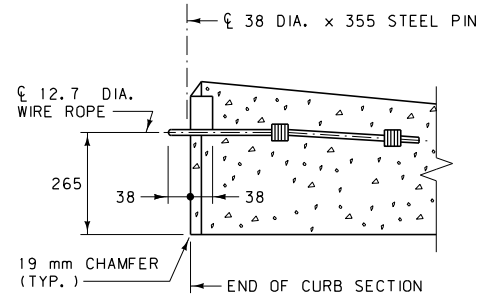
MARK	SIZE	NO.	TYPE	LENGTH	A	B	C	D	E
C1	#13	1	1	1360	270	395	330	205	80
C2				1225	240	350	290	185	
C3				1090	205	310	255	160	
C4				955	175	265	215	140	
C5				820	145	220	175	120	
C6				695	115	180	140	100	
C7				555	80	135	100	80	80
C8		1	1	415	50	90	60	55	40
B1	#13	4	STRAIGHT	2020	~	~	~	~	~



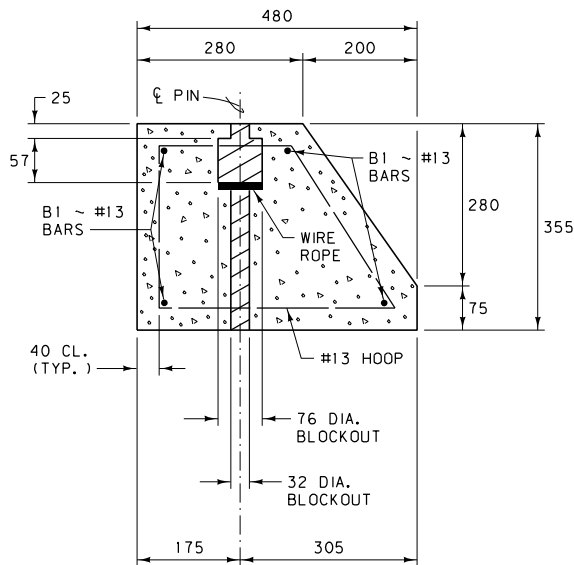
PLAN



VIEW B-B



SECTION C-C



VIEW A-A

NOTES:

- ① TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION TYPE 1 (SEE DTL. DWG. NO. 606-24A AND 606-24B).
- ② WIRE ROPE CONSISTS OF ZINC-COATED STEEL WIRE 7 STRAND UTILITY GRADE WITH A MINIMUM BREAKING STRENGTH OF 111.2 kN, CONFORMING TO ASTM SPECIFICATION A 475.
- ③ ALL REINFORCING STEEL IS OF THE DEFORMED TYPE, MEETING THE REQUIREMENTS OF AASHTO M 31M (ASTM A 615M, GRADE 420).
- ④ ALL CONCRETE IS CLASS "DD".
TOTAL CONCRETE PER 2100 mm TAPERED CURB EST. = 0.17 m³.
TOTAL REBAR WEIGHT PER 2100 mm TAPERED CURB EST. = 15.1 kg.

DETAILED DRAWING

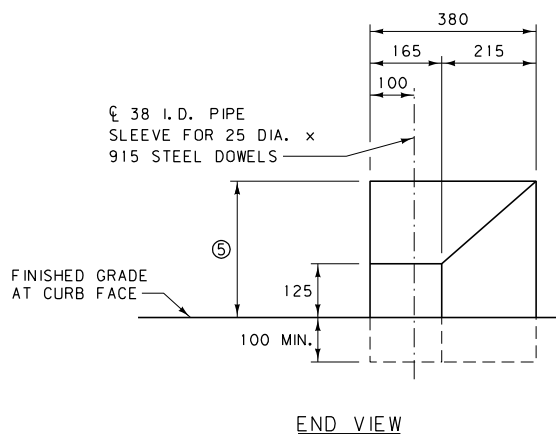
REFERENCE DWG. NO.
STANDARD SPEC. 606-26
SECTION 606

TAPERED CONCRETE
CURB DETAIL

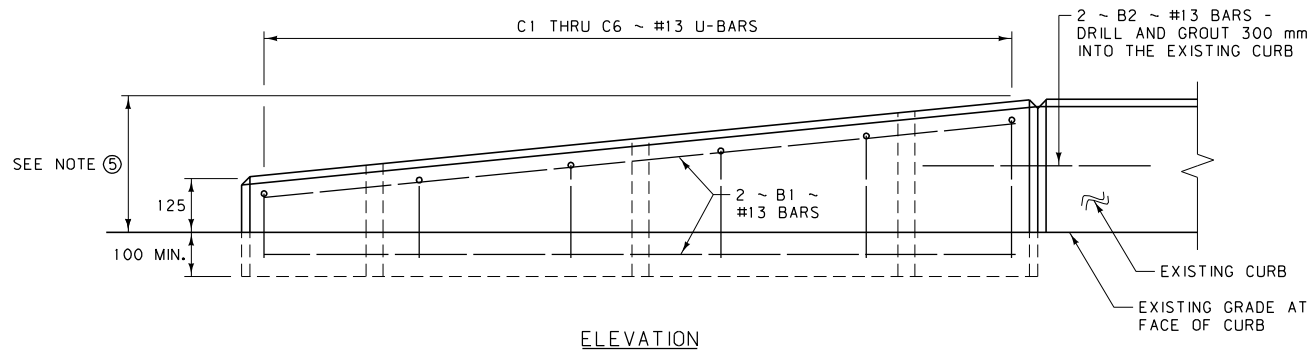
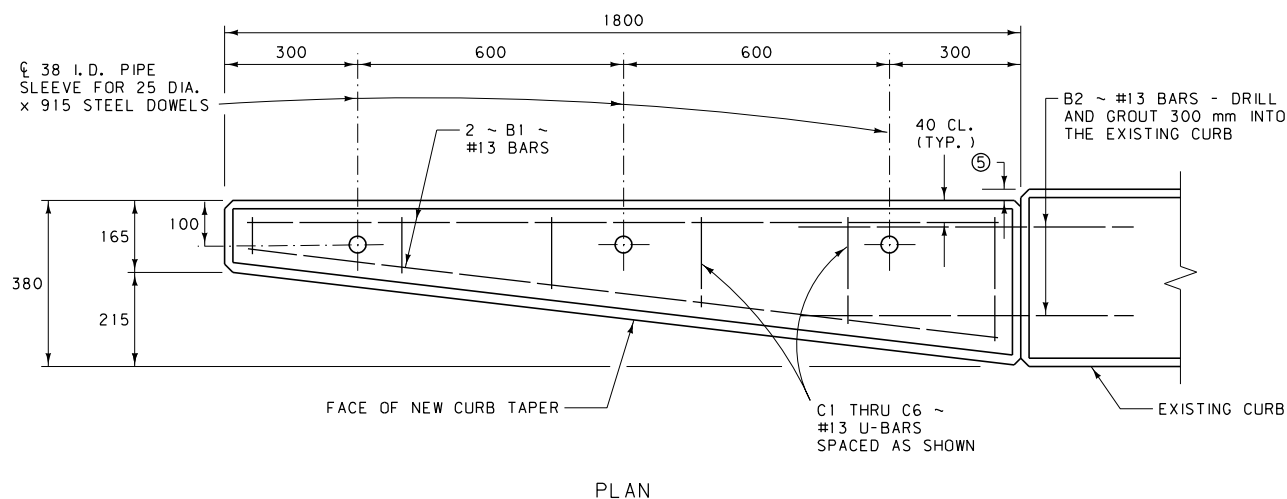
EFFECTIVE: FEBRUARY 2005

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ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.



BILL OF REINFORCING STEEL (ONE SECTION ONLY)						
 TYPE 1						
BENT BARS (ALL DIMENSIONS ARE OUT TO OUT)						
MARK	SIZE	NO.	TYPE	LENGTH	A	B
C1	#13	1	I	390	150	90
C2				480	175	130
C3				570	200	170
C4				665	225	215
C5				755	250	255
C6		1	I	845	270	295
B1		4	STRAIGHT	1720	~	~
B2	#13	2	STRAIGHT	600	~	~



NOTES:

- REMOVE THE EXISTING SURFACE UNDER THE NEW TAPERED CONCRETE CURB AS APPROVED BY THE ENGINEER. EMBED THE TAPERED CONCRETE CURB A MINIMUM OF 100 mm BELOW THE GRADE MEASURED AT THE INSIDE FACE OF THE TAPER.
- ALL REINFORCING STEEL IS OF THE DEFORMED TYPE, MEETING THE REQUIREMENTS OF AASHTO M 31M (ASTM A 615M, GRADE 420).
- ALL CONCRETE IS CLASS "DD".
TOTAL CONCRETE PER 1800 mm TAPERED CURB EST. = 0.16 m³.
TOTAL REBAR WEIGHT PER 1800 mm TAPERED CURB EST. = 11.7 kg.
- TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION TYPE 3 (SEE DTL. DWG. NO. 606-24A AND 606-24B).
- ADJUST DIMENSION TO MATCH EXISTING CURB.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-27
TAPERED CONCRETE CURB DETAIL	
EFFECTIVE: FEBRUARY 2005	
MONTANA DEPARTMENT OF TRANSPORTATION	

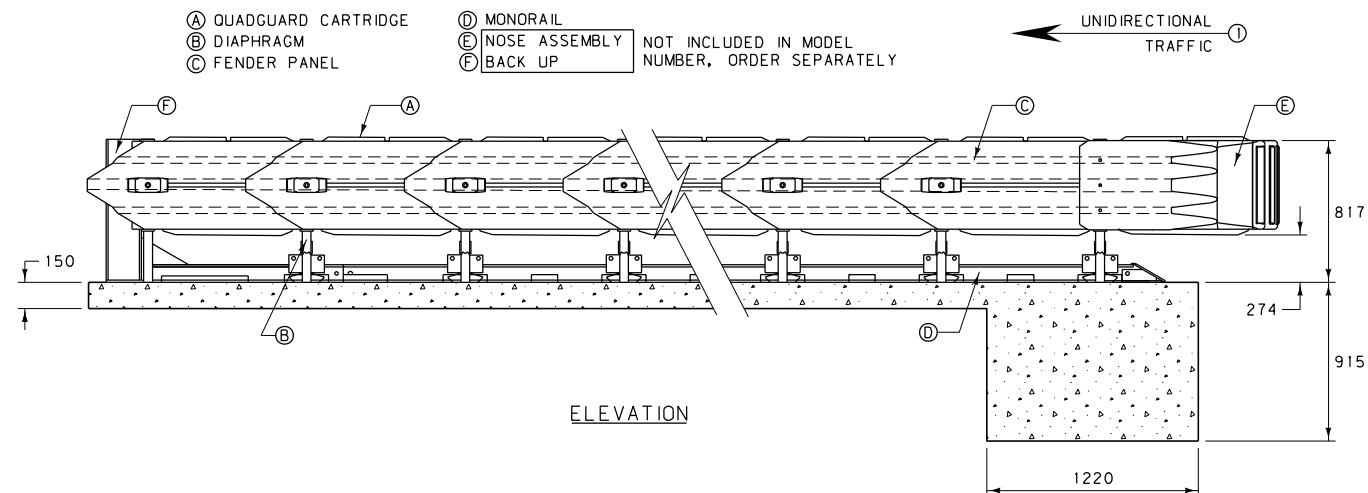
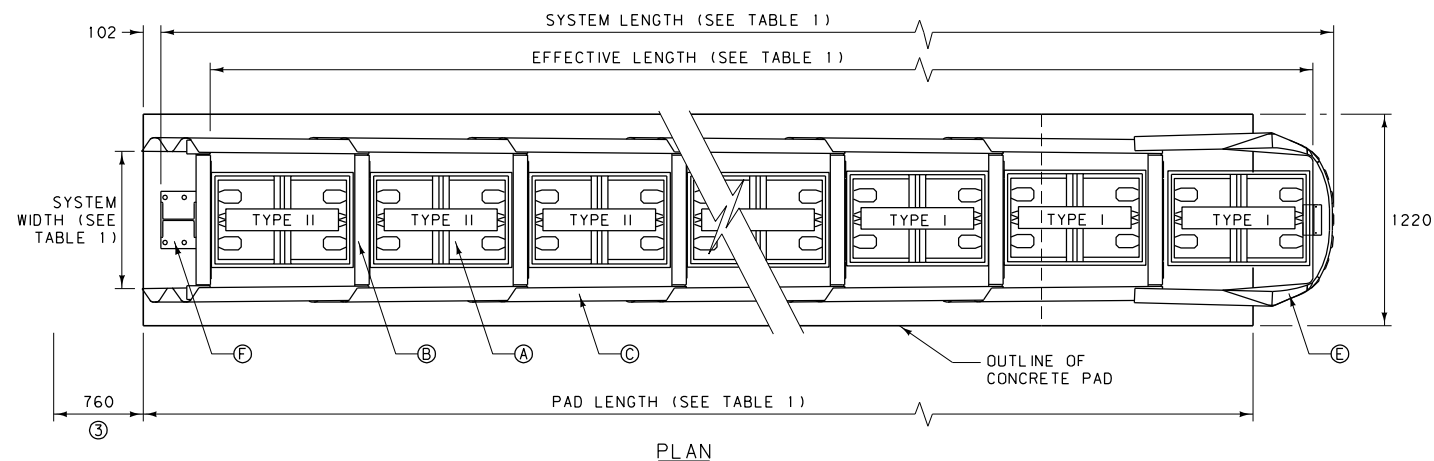


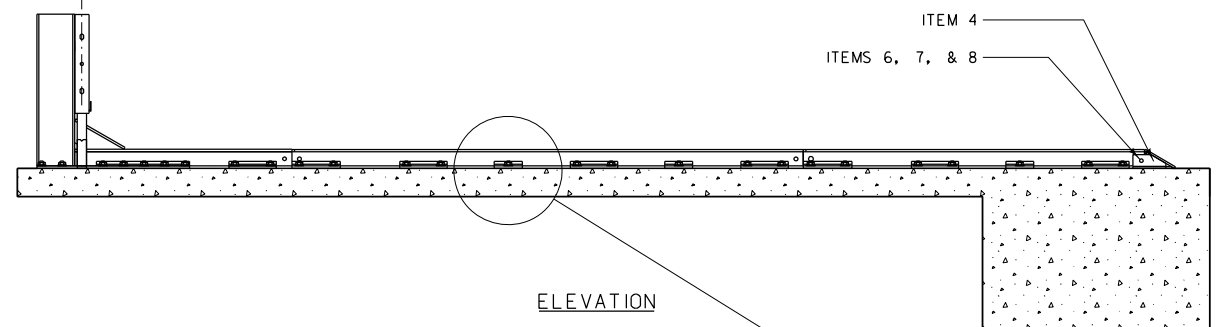
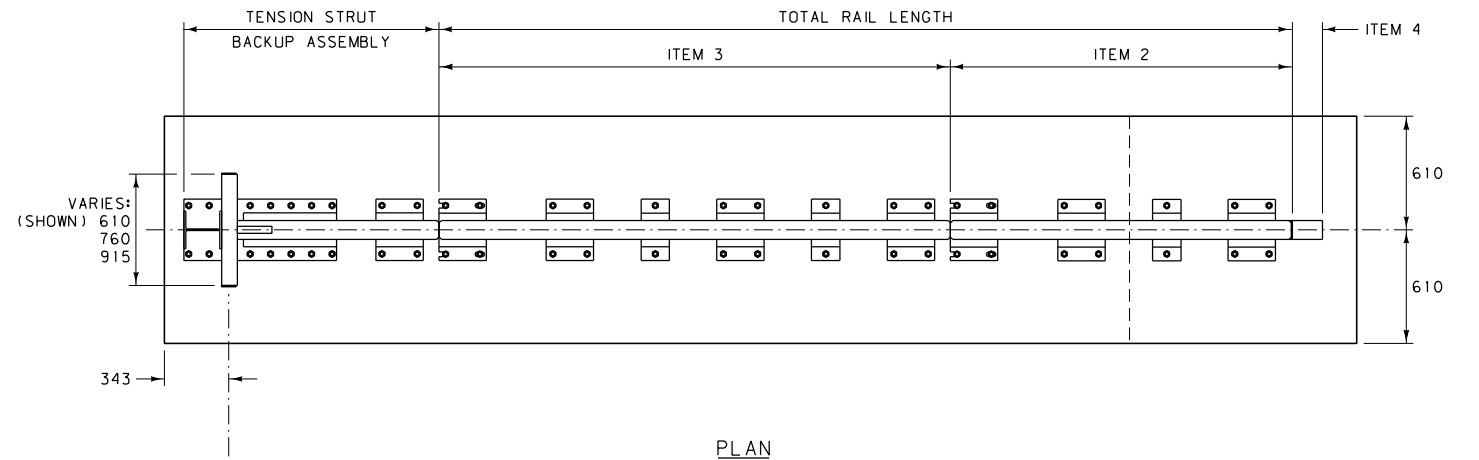
TABLE 1:

BAYS	610 WIDTH MODEL NO.	760 WIDTH MODEL NO.	915 WIDTH MODEL NO.	SYSTEM L (m)	EFFECTIVE L (m)	PAD L (m)	MAX DESIGN SPEED (km/hr)	NO. OF CARTRIDGES	
								TYPE I	TYPE II
1	QS2401*	QS3001*	QS3601*	2.16	1.73	2.74	40	2	0
2	QS2402*	QS3002*	QS3602*	3.08	2.64	2.74	60	2	1
3	QS2403*	QS3003*	QS3603*	4.00	3.56	3.66	70	3	1
4	QS2404*	QS3004*	QS3604*	4.91	4.47	4.57	80	3	2
5	QS2405*	QS3005*	QS3605*	5.83	5.38	5.49	90	4	2
6	QS2406*	QS3006*	QS3606*	6.74	6.30	6.40	100	4	3
7	QS2407*	QS3007*	QS3607*	7.65	7.21	7.32	105	4	4
8	QS2408*	QS3008*	QS3608*	8.57	8.13	8.23	110	4	5
9	QS2409*	QS3009*	QS3609*	9.49	9.04	9.14	115	4	6
10	QS2410*	QS3010*	QS3610*	10.40	9.96	10.06	120	5	6
11	QS2411*	QS3011*	QS3611*	11.32	10.87	10.97	120	5	7
12	QS2412*	QS3012*	QS3612*	12.23	11.79	11.89	120	5	8

* G = GREY OR Y = YELLOW

NOTES:

- ATTACHMENT SHOWN IS TO SHAPES WITH RECTANGULAR CROSS SECTIONS SUCH AS: PIERS, PARAPETS AND MODIFIED CONCRETE BARRIER RAIL. TRAFFIC FLOW IS UNIDIRECTIONAL. ATTACHMENTS AND TRANSITIONS TO OTHER SHAPES, BARRIERS, RAILINGS AND BIDIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE FROM THE MANUFACTURER.
- THE SYSTEM SHOWN INCLUDES THE TENSION STRUT BACKUP ASSEMBLY AND THE CONCRETE PAD AS DETAILED. SEE THE MANUFACTURER FOR DRAWINGS DETAILING THE REINFORCING STEEL FOR THE CONCRETE PAD AND FOR OTHER BACKUP & CONCRETE PAD OPTIONS.
- PROVIDE ADEQUATE CLEARANCE FOR THE DISTANCE SHOWN TO ALLOW FENDER PANELS TO SLIDE REARWARD UPON IMPACT.
- SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, INSTALLATION AND MAINTENANCE OF THE QUADGUARD SYSTEM.



MONORAIL ASSEMBLY
(TYPICAL 6 BAY ASSEMBLY)


TABLE 2:

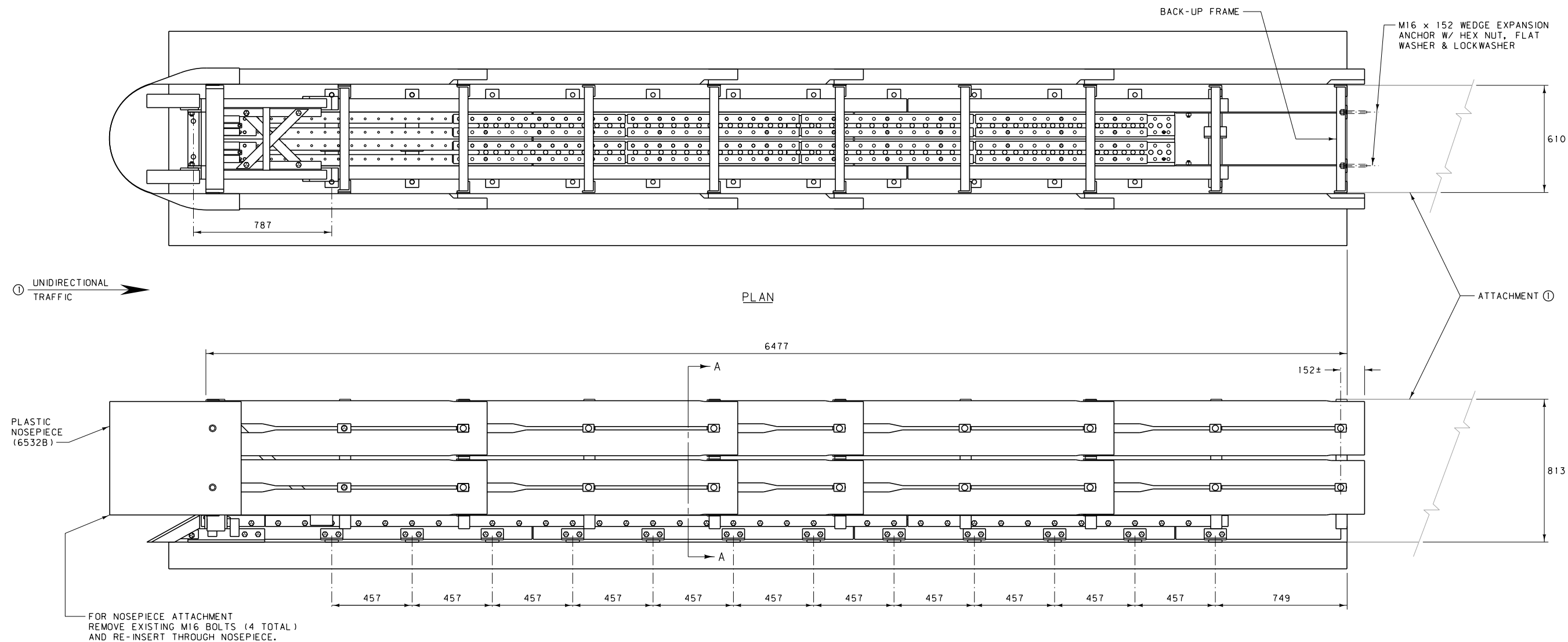
ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	2760051-0000	MONORAIL, ONE BAY	#
2	2760061-0000	MONORAIL, TWO BAYS	#
3	2760071-0000	MONORAIL, THREE BAYS	#
4	2760041-0000	MONORAIL END CAP	1
5	3525300-0000	ANCHOR KIT	#
6	2699571-0000	M16 x 89 HEX BOLT	1
7	2704141-0000	M16 HEX NUT	1
8	2708231-0000	M16 LOCK WASHER	1

TABLE 3:

ASSEMBLY NO.	TOTAL RAIL LENGTH	# ITEM 1	# ITEM 2	# ITEM 3	# ITEM 5	NO. OF BAYS
3540060-0100	0	0	0	0	0	1
3540060-0200	915	1	0	0	2	2
3540060-0300	1830	0	1	0	3	3
3540060-0400	2745	0	0	1	4	4
3540060-0500	3660	1	0	1	5	5
3540060-0600	4575	0	1	1	6	6
3540060-0700	5490	0	0	2	7	7
3540060-0800	6405	1	0	2	8	8
3540060-0900	7320	0	1	2	9	9
3540060-1000	8235	0	0	3	10	10
3540060-1100	9150	1	0	3	12	11
3540060-1200	10 065	0	1	3	13	12

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

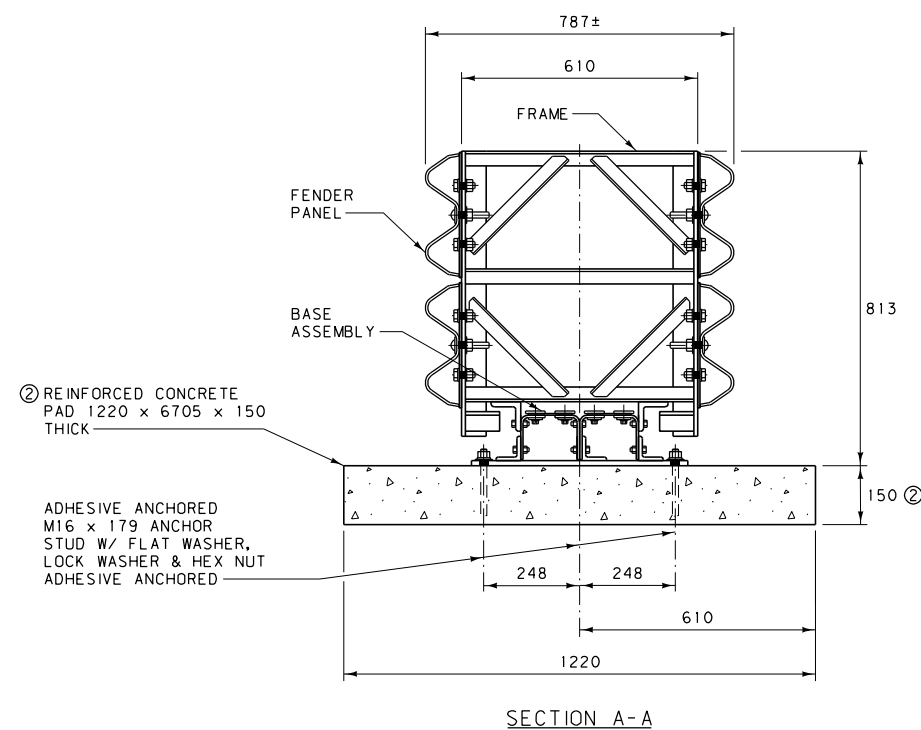
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-30A
IMPACT ATTENUATOR - QUADGUARD	
EFFECTIVE: FEBRUARY 2005	
 serving you with pride	MONTANA DEPARTMENT OF TRANSPORTATION



ELEVATION

TRACC BILL OF MATERIAL		
PART NUMBER	QTY	DESCRIPTION
* 25980A	1	TRACC UNIT (FULLY ASSEMBLED **)
3310G	4	M16 LOCKWASHER
4451G	4	M16 x 152 WEDGE EXP. ANCHOR
6825B	4	REFLECTIVE TAPE
6532B	1	PLASTIC NOSEPIECE
ANCHOR HARDWARE (FULL CONCRETE BASE)		
5204G	26	M16 x 179 ANCHOR STUD
3310G	26	M16 LOCKWASHER
3361G	26	M16 HEX NUT
3300G	26	M16 FLAT WASHER
5206B	3	ADHESIVE HIT HY 150 (CARTRIDGE)
ANCHOR HARDWARE (ASPHALT BASE)		
6380G	26	M16 x 457 ALL THREADED ROD
3310G	26	M16 LOCKWASHER
3361G	26	M16 HEX NUT
3300G	26	M16 FLAT WASHER
5206B	5	ADHESIVE HIT HY 150 (CARTRIDGE)

* SEE DET. DWG. NO. 606-31B
 ** EACH UNIT SHIPS 100% ASSEMBLED
 (PLASTIC NOSE INSTALLED AFTER PLACEMENT)




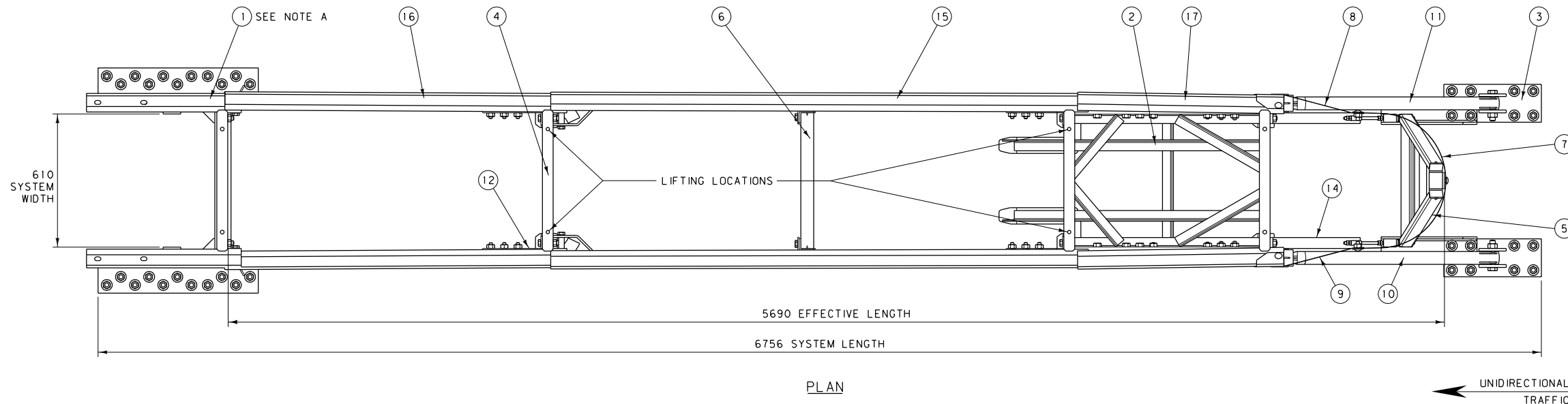
SECTION A-A

NOTES:

- ATTACHMENT SHOWN IS TO SHAPES WITH RECTANGULAR CROSS SECTIONS SUCH AS: PIERS, PARAPETS, AND MODIFIED CONCRETE BARRIER RAIL. TRAFFIC FLOW IS UNIDIRECTIONAL. ATTACHMENTS AND TRANSITIONS TO OTHER SHAPES, BARRIERS, RAILINGS AND BIDIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE FROM THE MANUFACTURER.
- A 150 mm REINFORCED CONCRETE PAD IS SHOWN. OTHER FOUNDATION OPTIONS ARE:
 - 200 mm THICK UNREINFORCED CONCRETE
 - 200 mm THICK ASPHALT
 - 75 mm THICK ASPHALT OVER 75 mm THICK CONCRETE
 - 150 mm THICK ASPHALT OVER 150 mm THICK COMPACTED SUBBASE
- REINFORCEMENT DRAWINGS FOR THE REINFORCED CONCRETE PAD SHOWN ARE AVAILABLE FROM THE MANUFACTURER.
- SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, PRODUCT OPTIONS, INSTALLATION AND MAINTENANCE OF THE TRACC SYSTEM.

ALL DIMENSIONS ARE MILLIMETERS
 (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-30B
IMPACT ATTENUATOR - TRACC	
EFFECTIVE: APRIL 2006	
 MONTANA DEPARTMENT OF TRANSPORTATION	



NOTES:

Ⓐ ATTACHMENT SHOWN IS TO SHAPES WITH RECTANGULAR CROSS SECTIONS SUCH AS: PIERS, PARAPETS, AND MODIFIED CONCRETE BARRIER RAIL. TRAFFIC FLOW IS UNIDIRECTIONAL. ATTACHMENTS AND TRANSITIONS TO OTHER SHAPES, BARRIERS, RAILINGS AND BIDIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE FROM THE MANUFACTURER.

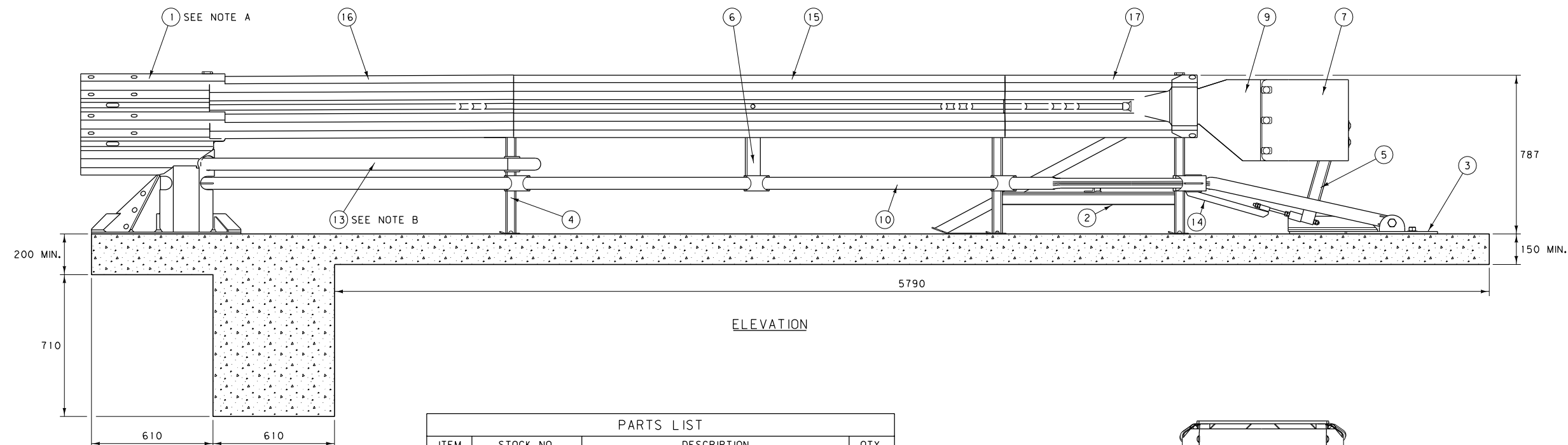
Ⓑ PROVIDE ADEQUATE CLEARANCE (1.5 m MIN.) TO ALLOW REAR RAILS TO SLIDE REARWARD UPON IMPACT.

Ⓒ A 150 mm REINFORCED CONCRETE PAD IS SHOWN. OTHER FOUNDATION OPTIONS ARE:

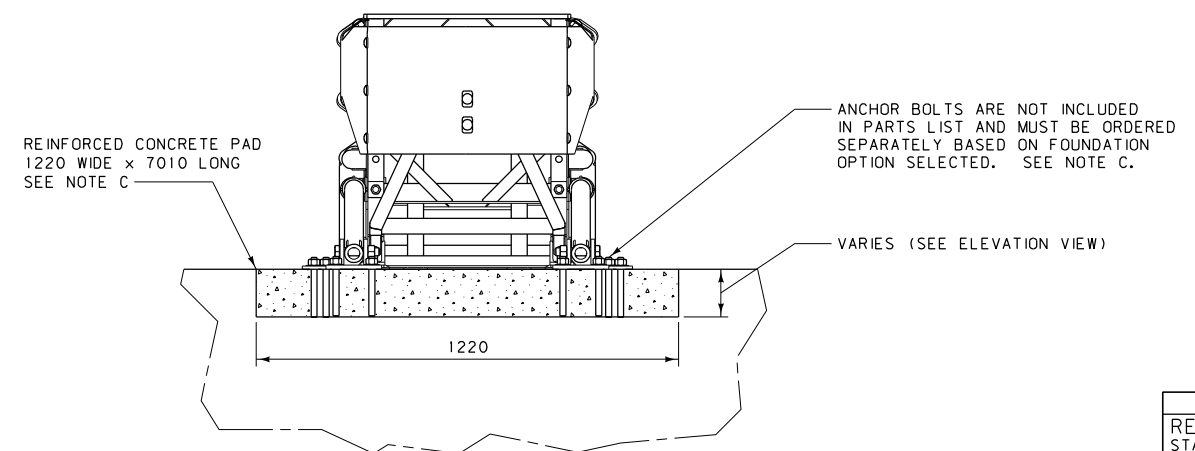
- a) 200 mm THICK UNREINFORCED CONCRETE
- b) 200 mm THICK ASPHALT
- c) 75 mm THICK ASPHALT OVER 75 mm THICK CONCRETE
- d) 150 mm THICK ASPHALT OVER 150 mm THICK COMPACTED SUBBASE
- e) 180 mm THICK REINFORCED DECK STRUCTURE

SEE MANUFACTURER FOR REINFORCEMENT DRAWINGS AND ANCHORAGE REQUIREMENTS FOR ALL FOUNDATION OPTIONS.


Ⓓ SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, INSTALLATION AND MAINTENANCE OF THE QUEST SYSTEM.

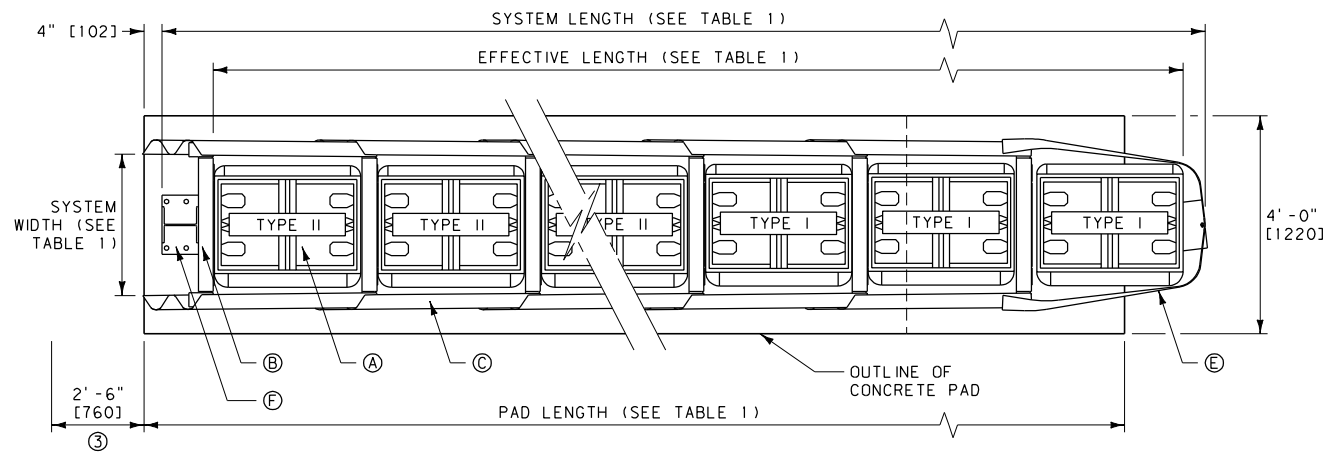


PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3562003-0000	BACKUP ASSEMBLY, 24, QUEST	1
2	3562002-0000	SUPPORT FRAME ASSY, BAY 1, 24, QUEST	1
3	2762015-0000	ANCHOR, FRONT, QUEST, G	2
4	3562005-0000	DIAPHRAGM ASSEMBLY, 24, BAY 3, QUEST	1
5	3562001-0000	TRIGGER ASSEMBLY, QUEST	1
6	3562004-0000	BRIDGE, 24, BAY 2, QUEST	1
7	2762026-0000	NOSE, QUEST, G	1
8	2762024-0000	NOSE TRANSITION, R, QUEST, G	1
9	2762025-0000	NOSE TRANSITION, L, QUEST, G	1
10	276200L-0000	SHAPER RAIL, L, QUEST, G	1
11	276200R-0000	SHAPER RAIL, R, QUEST, G	1
12	2762022-0000	BRACKET, PANEL, DIAPHRAGM, G	2
13	2762023-0000	REAR RAIL, QUEST, G	2
14	2762007-0000	TRIGGER STRAP, QUEST, G	2
15	2762013-0000	PANEL, BAY 2, QUEST, G	2
16	2762014-0000	PANEL, BAY 3, QUEST, G	2
17	2762033-0000	PANEL, BAY 1, QUEST, G	2



ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

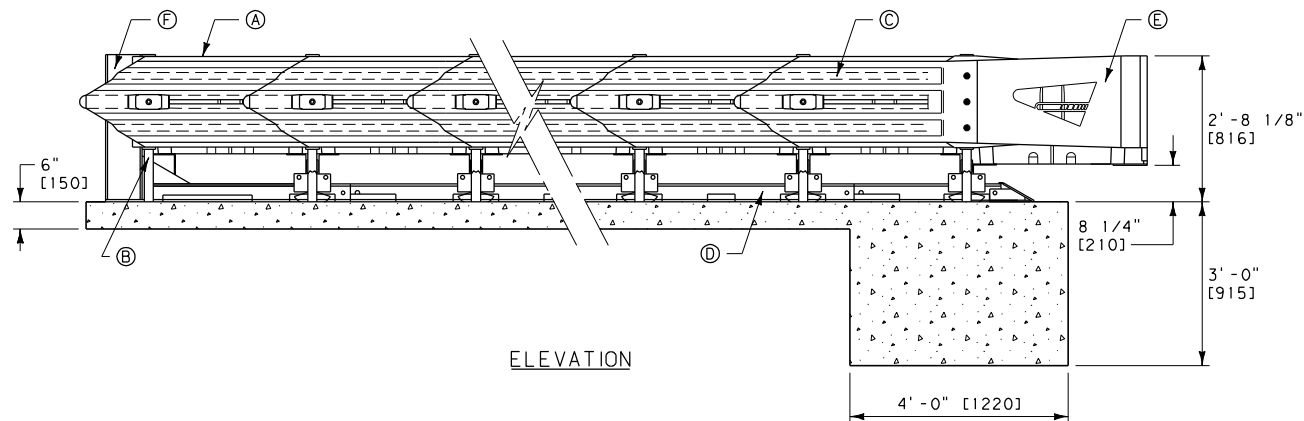
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-30C
IMPACT ATTENUATOR - QUEST	
EFFECTIVE: APRIL 2006	
 serving you with pride	MONTANA DEPARTMENT OF TRANSPORTATION



PLAN

- A QUADGUARD CARTRIDGE
 B DIAPHRAGM
 C FENDER PANEL
 D MONORAIL
 E NOSE ASSEMBLY
 F BACK UP
- NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY

UNIDIRECTIONAL TRAFFIC ①



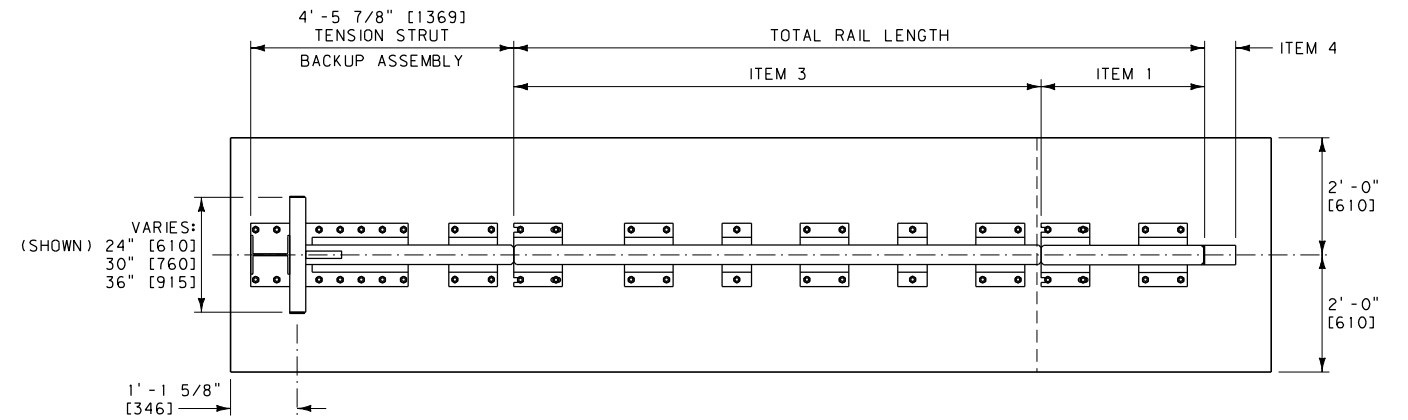
ELEVATION

TABLE 1:

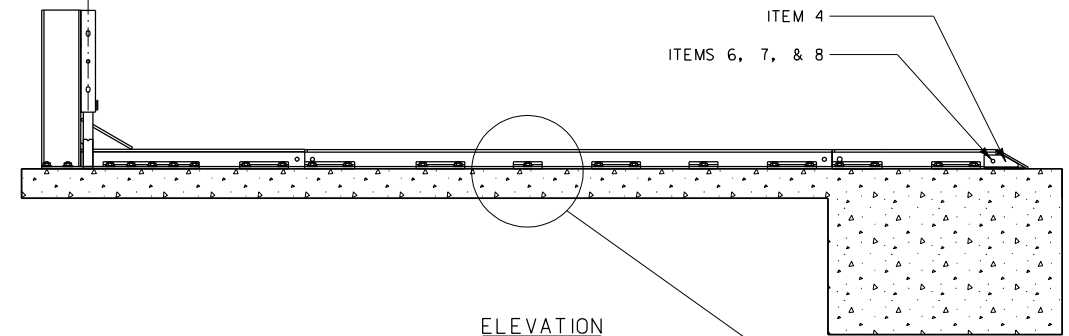
BAYS	24" [610] WIDTH MODEL NO.	30" [760] WIDTH MODEL NO.	36" [915] WIDTH MODEL NO.	SYSTEM LENGTH	METRIC SYSTEM LENGTH (m)	EFFECTIVE LENGTH	METRIC EFFECTIVE LENGTH (m)	PAD LENGTH	METRIC PAD LENGTH (m)	MAX DESIGN SPEED (M. P. H.)	METRIC MAX DESIGN SPEED (km/hr)	NO. OF CARTRIDGES	
												TYPE I	TYPE II
1	QG24024	QG24030	QG24036	7' -0"	2.13	5' -8"	1.73	9' -0"	2.74	25	40	2	0
2	QG27024	QG27030	QG27036	10' -0"	3.05	8' -8"	2.64	9' -0"	2.74	43	70	2	1
3	QG28024	QG28030	QG28036	13' -0"	3.96	11' -8"	3.56	12' -0"	3.66	50	80	2	2
4	QG29024	QG29030	QG29036	16' -0"	4.87	14' -8"	4.47	15' -0"	4.57	56	90	3	2
5	QG210024	QG210030	QG210036	19' -0"	5.79	17' -8"	5.38	18' -0"	5.49	62	100	3	3
6	QG210524	QG210530	QG210536	22' -0"	6.71	20' -8"	6.30	21' -0"	6.40	65	105	4	3
7	QG212024	QG211030	QG211036	25' -0"	7.63	23' -8"	7.21	24' -0"	7.32	68	110	4	4
8	QG211524	QG211530	QG211536	28' -0"	8.53	26' -8"	8.13	27' -0"	8.23	71	115	4	5
9	QG212024	QG212030	QG212036	31' -0"	9.45	29' -8"	9.04	30' -0"	9.14	75	120	4	6

NOTES:

- ATTACHMENT SHOWN IS TO SHAPES WITH RECTANGULAR CROSS SECTIONS SUCH AS: PIERS, PARAPETS AND MODIFIED CONCRETE BARRIER RAIL. TRAFFIC FLOW IS UNIDIRECTIONAL. ATTACHMENTS AND TRANSITIONS TO OTHER SHAPES, BARRIERS, RAILINGS AND BIDIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE FROM THE MANUFACTURER.
- THE SYSTEM SHOWN INCLUDES THE TENSION STRUT BACKUP ASSEMBLY AND THE CONCRETE PAD AS DETAILED. SEE THE MANUFACTURER FOR DRAWINGS DETAILING THE REINFORCING STEEL FOR THE CONCRETE PAD AND FOR OTHER BACKUP & CONCRETE PAD OPTIONS.
- PROVIDE ADEQUATE CLEARANCE FOR THE DISTANCE SHOWN TO ALLOW FENDER PANELS TO SLIDE REARWARD UPON IMPACT.
- SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, INSTALLATION AND MAINTENANCE OF THE QUADGUARD II SYSTEM.



PLAN



ELEVATION

MONORAIL ASSEMBLY
(TYPICAL 5 BAY ASSEMBLY)

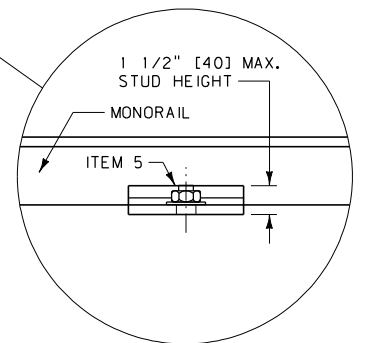


TABLE 2:

ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	2760051-0000	MONORAIL, ONE BAY	MONORAIL, ONE BAY	#
2	2760061-0000	MONORAIL, TWO BAYS	MONORAIL, TWO BAYS	#
3	2760071-0000	MONORAIL, THREE BAYS	MONORAIL, THREE BAYS	#
4	2760041-0000	MONORAIL END CAP	MONORAIL END CAP	1
5	3525300-0000	ANCHOR KIT	ANCHOR KIT	#
6	2699571-0000	5/8" DIA. x 3 1/2" HEX BOLT	M16 x 89 HEX BOLT	1
7	2704141-0000	5/8" DIA. HEX NUT	M16 HEX NUT	1
8	2708231-0000	5/8" DIA. LOCK WASHER	M16 LOCK WASHER	1

- SEE TABLE 3 BELOW

TABLE 3:

ASSEMBLY NO.	TOTAL RAIL LENGTH	METRIC TOTAL RAIL LENGTH (mm)	# ITEM 1	# ITEM 2	# ITEM 3	# ITEM 5	NO. OF BAYS
3540060-0100	0"	0	0	0	0	0	1
3540060-0200	36.0"	915	1	0	0	2	2
3540060-0300	72.0"	1 830	0	1	0	3	3
3540060-0400	108.1"	2 745	0	0	1	4	4
3540060-0500	144.1"	3 660	1	0	1	5	5
3540060-0600	180.1"	4 575	0	1	1	6	6
3540060-0700	216.1"	5 490	0	0	2	7	7
3540060-0800	252.1"	6 405	1	0	2	8	8
3540060-0900	288.2"	7 320	0	1	2	9	9

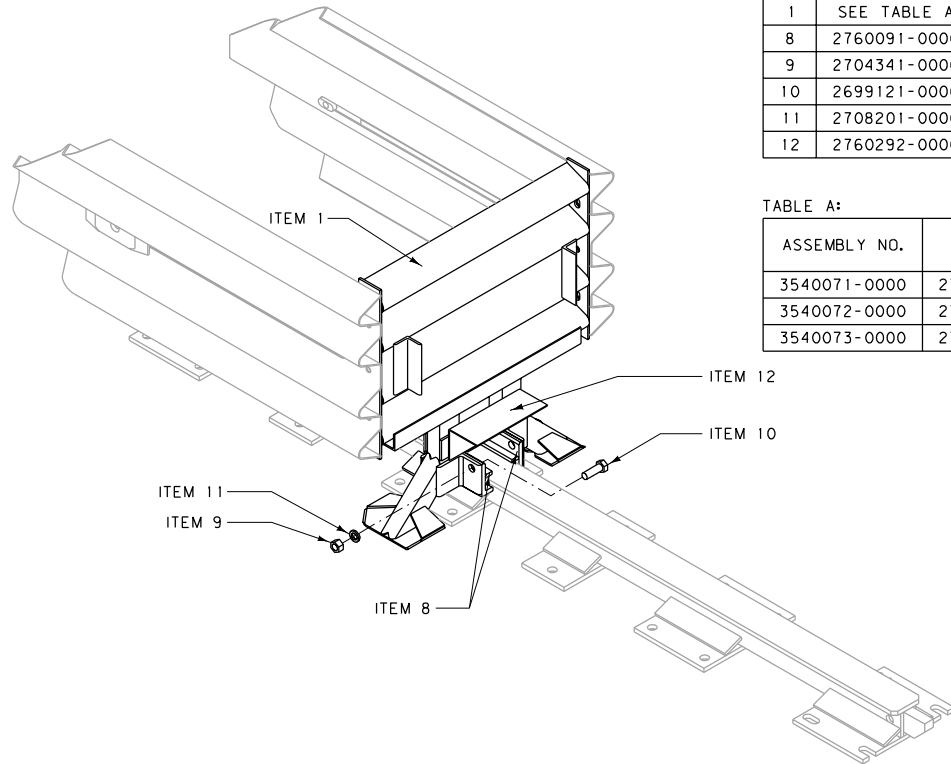
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING
REFERENCE DWG. NO.
STANDARD SPEC. 606-30D
SECTION 606

IMPACT ATTENUATOR -
QUADGUARD II

EFFECTIVE: MAY 2011

MDT MONTANA DEPARTMENT OF TRANSPORTATION

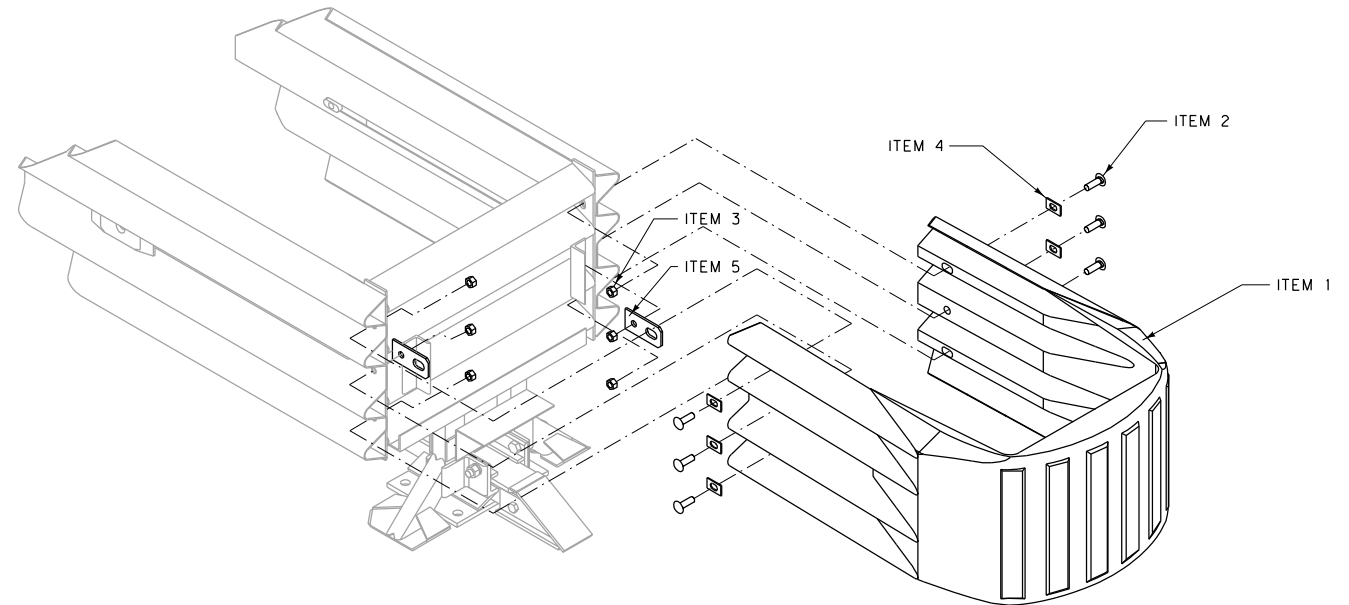


ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	SEE TABLE A	DIAPHRAGM	1
8	2760091-0000	MONORAIL GUIDE	2
9	2704341-0000	M20 HEX NUT	4
10	2699121-0000	M20 x 51 HEX BOLT	4
11	2708201-0000	M20 LOCK WASHER	4
12	2760292-0000	CARTRIDGE SUPPORT BRACKET	2

TABLE A:

ASSEMBLY NO.	STOCK NO.	DESCRIPTION
3540071-0000	2761011-0000	610 WIDE DIAPHRAGM
3540072-0000	2761021-0000	760 WIDE DIAPHRAGM
3540073-0000	2761031-0000	915 WIDE DIAPHRAGM

DIAPHRAGM ASSEMBLY

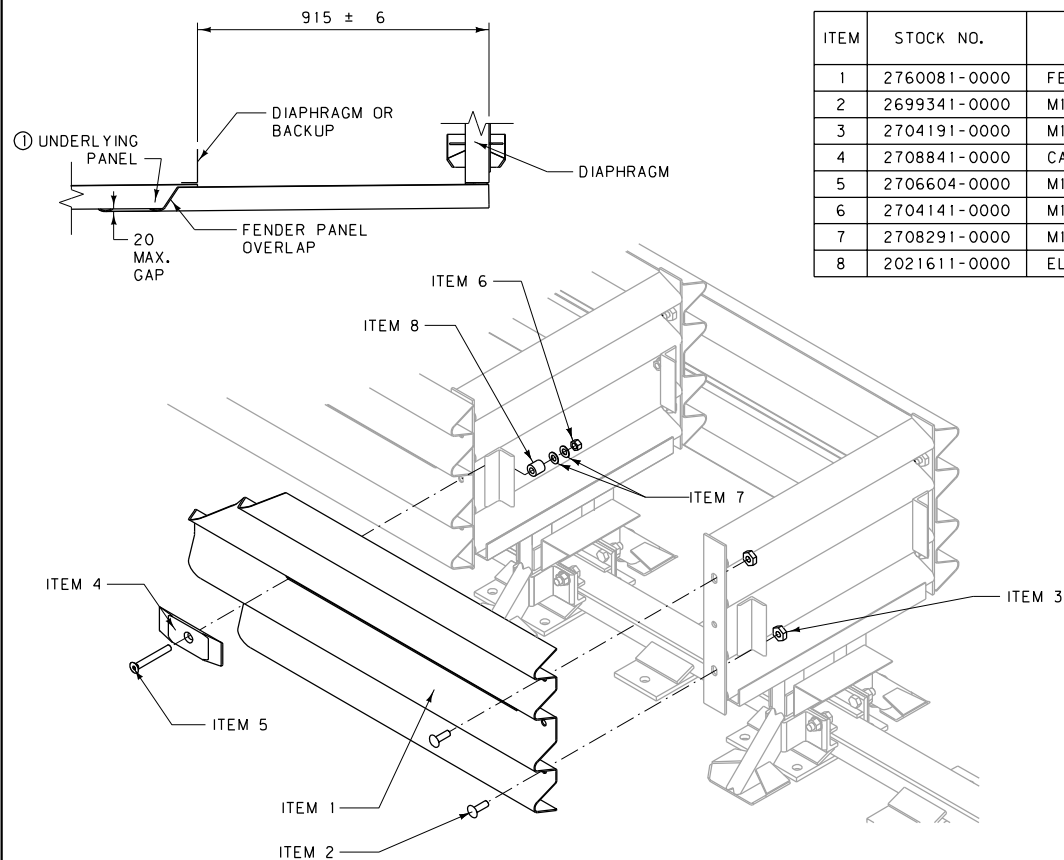


NOSE ASSEMBLY

ASSEMBLY NO. 3540050-0100 (YELLOW)
ASSEMBLY NO. 3540050-0000 (GRAY)

ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	3540130-0*00	NOSE, W/ SUPPORT BRACKET	1
2	2699341-0000	M16 x 51 RAIL BOLT	6
3	2704191-0000	M16 HEX NUT	6
4	2708871-0000	WASHER (BAR 3.2 x 32 x 51, W/ M16 HOLE)	6
5	2760251-0000	PULL-OUT BRACKET	2

* 0 INDICATES GRAY
* 1 INDICATES YELLOW



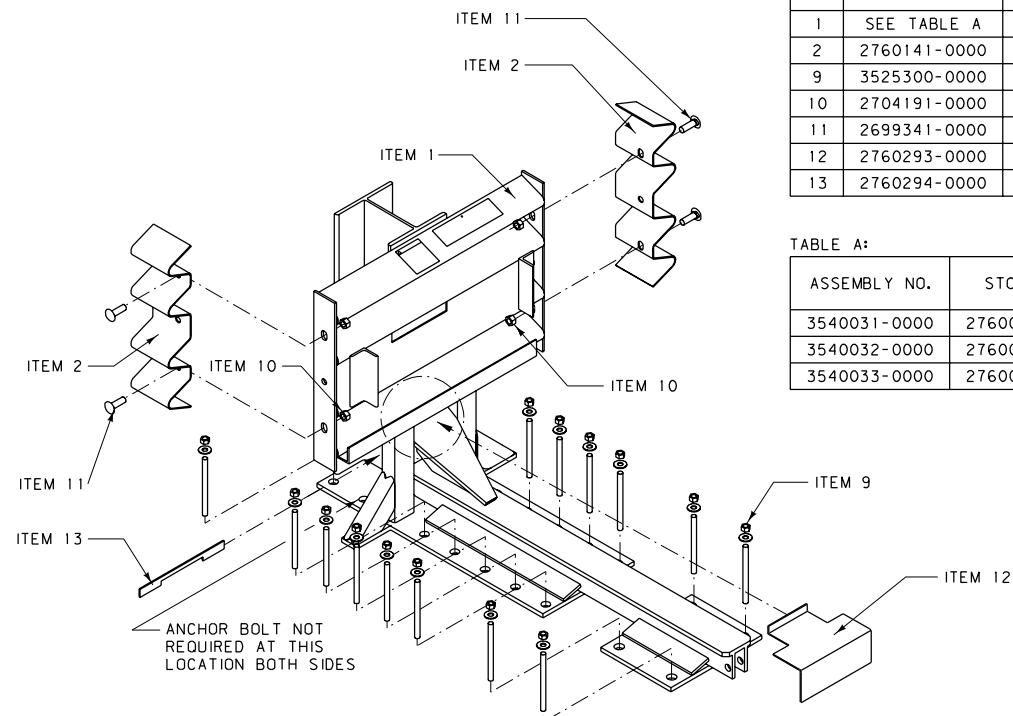
FENDER PANEL ASSEMBLY
ASSEMBLY NO. 3540040-0000

ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	2760081-0000	FENDER PANEL	1
2	2699341-0000	M16 x 51 RAIL BOLT	2
3	2704191-0000	M16 HEX NUT	2
4	2708841-0000	CAST MUSHROOM WASHER	1
5	2706604-0000	M16 x 127 SCREW	1
6	2704141-0000	M16 HEX NUT	1
7	2708291-0000	M16 WASHER	4
8	2021611-0000	ELASTOMERIC BUSHING	1

NOTE:

① UNDERLYING PANEL IS EITHER ANOTHER FENDER PANEL OR, IN THE CASE OF THE LAST FENDER PANEL IT COULD BE A BACKUP SIDE PANEL, EXTENSION PANEL OR TRANSITION PANEL.

② TWO FENDER PANEL ASSEMBLIES ARE REQUIRED PER BAY.



BACKUP ASSEMBLY

ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	SEE TABLE A	TENSION BACKUP	1
2	2760141-0000	SIDE PANEL	2
9	3525300-0000	ANCHOR KIT	3
10	2704191-0000	M16 HEX NUT	4
11	2699341-0000	M16 x 51 RAIL BOLT	4
12	2760293-0000	CARTRIDGE SUPPORT BRACKET	1
13	2760294-0000	CARTRIDGE SUPPORT LOCKING BAR	1


TABLE A:

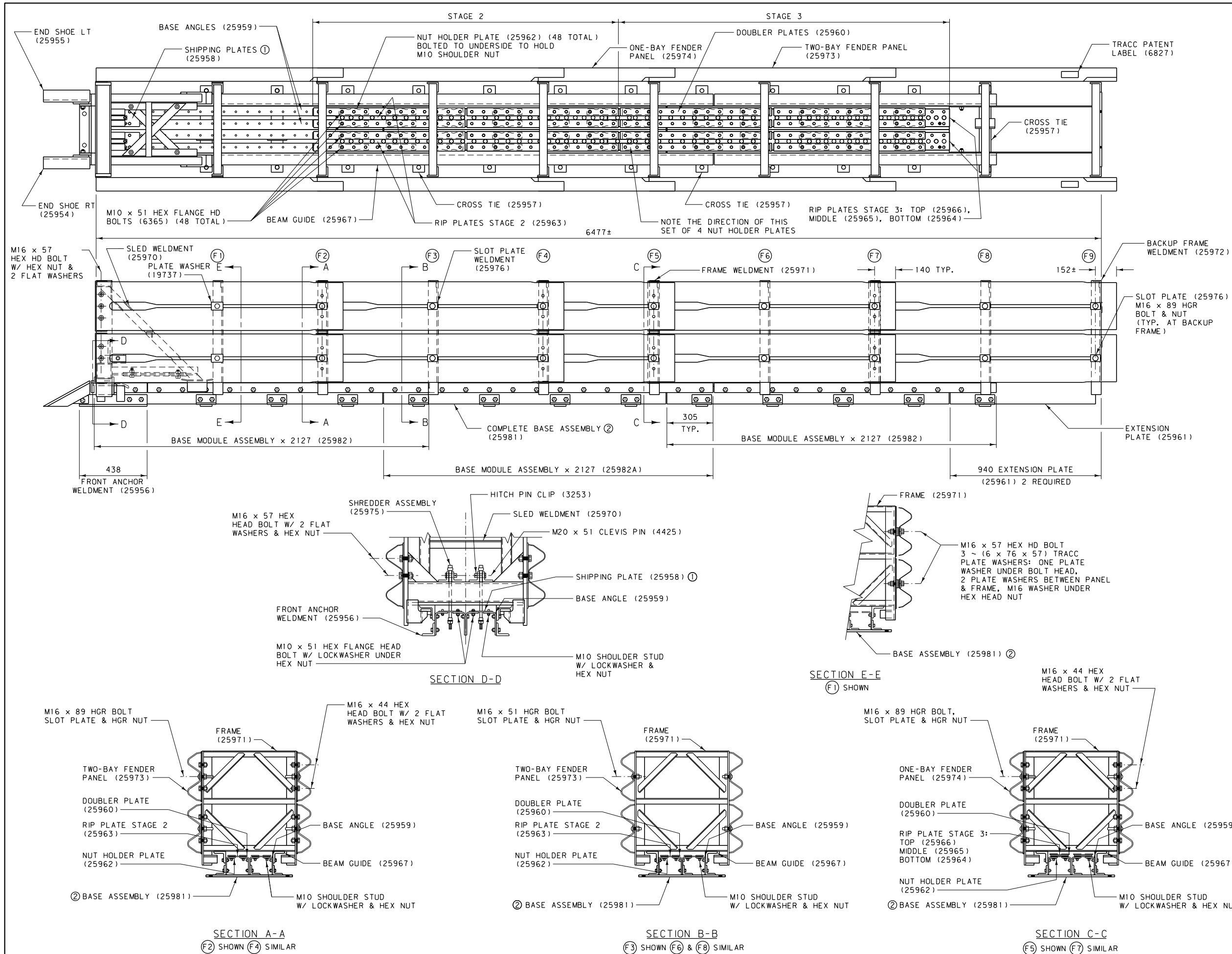
ASSEMBLY NO.	STOCK NO.	DESCRIPTION
3540031-0000	2760011-0000	610 WIDE TENSION BACKUP
3540032-0000	2760021-0000	760 WIDE TENSION BACKUP
3540033-0000	2760031-0000	915 WIDE TENSION BACKUP

NOTE:

③ WHEN TRANSITIONING THE QUADGUARD SYSTEM TO EXISTING BARRIERS, SEE MANUFACTURER FOR PROPER USE OF SIDE PANEL (ITEM 2).

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-31A
IMPACT ATTENUATOR - QUADGUARD ASSEMBLY DETAILS	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION	




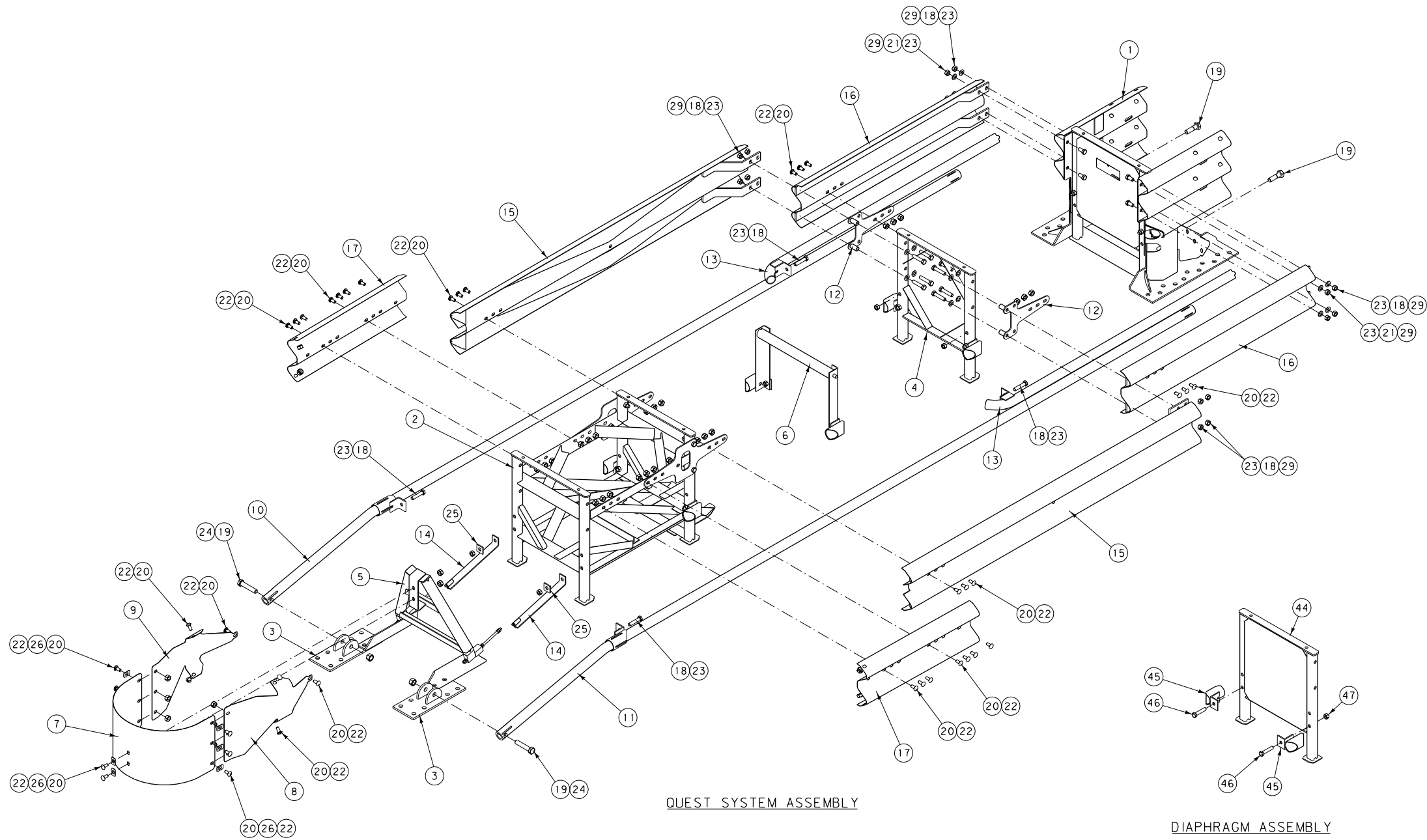
BILL OF MATERIAL		
PART NUMBER	QTY	DESCRIPTION
TRACC (25980A)		
19737G	12	6 x 76 x 57 TRACC WASHER
25970A	1	SLED WELDMENT
25971A	8	FRAME WELDMENT
25972A	1	BACKUP FRAME WELDMENT
25973A	16	TWO-BAY FENDER PANEL
25974A	4	ONE-BAY FENDER PANEL
25975A	2	SHREDDER ASSEMBLY
25976A	32	SLOT PLATE
25981A	1	ASSEMBLED BASE (SEE NOTE 2)
TRACC BASE (25981A)		
3256G	48	M10 SHOULDER NUT
3361G	40	M16 HEAVY HEX NUT
3391G	40	M16 x 44 HEX HEAD BOLT
4252G	180	M10 HEX NUT
4258G	180	M10 LOCK WASHER
6340G	178	M10 x 38 SHOULDER STUD
6365G	50	M10 x 51 HEX FLANGE HD BOLT
25954A	1	END SHOE, RIGHT
25955A	1	END SHOE, LEFT
25956A	1	FRONT ANCHOR WELDMENT
25957A	3	CROSS TIE
25958G	2	RIP PLATE, STAGE 1 (SHIPPING PL.)
25960G	16	DOUBLERS
25961G	2	EXTENSION PLATE, REAR
25962G	48	NUT HOLDER (NUT RETAINER PLATE)
25963G	2	RIP PLATE, STAGE 2
25964G	2	RIP PLATE, STAGE 3, BOTTOM
25965G	2	RIP PLATE, STAGE 3, MIDDLE
25966G	2	RIP PLATE, STAGE 3, TOP
25982A	3	BASE MODULE ASSEMBLY
SHOP HARDWARE		
3253G	2	HITCH PIN CLIP
3340G	32	M16 HGR NUT
3361G	46	M16 HEX NUT
3391G	32	M16 x 44 HEX HEAD BOLT
3400G	12	M16 x 51 HGR BOLT
3435G	20	M16 x 89 HGR BOLT
4372G	88	M16 FLAT WASHER
4425G	2	M20 x 51 CLEVIS PIN
5306G	14	M16 x 57 HEX HEAD BOLT
6827B	2	TRACC PATENT LABEL

NOTES:

- ① SHIPPING PLATES MAINTAIN SLED POSITION DURING SHIPPING. IT IS NOT NECESSARY TO REMOVE SHIPPING PLATES AFTER INSTALLATION OR REPLACE AFTER REPAIRING DAMAGE TO TRACC UNIT.
- ② SEE MANUFACTURER FOR ADDITIONAL DETAILS AND DRAWINGS SHOWING COMPLETE ASSEMBLY OF ALL BASE COMPONENTS.

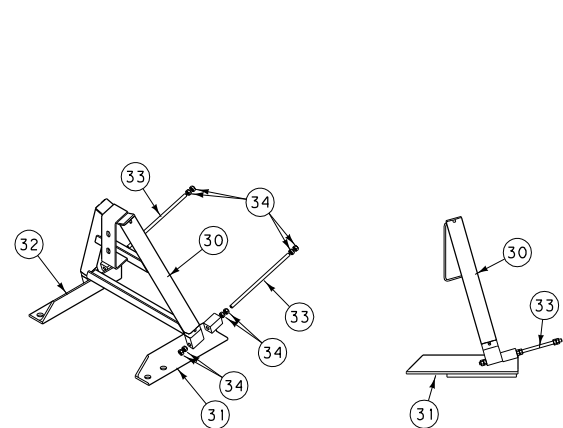
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-31B
IMPACT ATTENUATOR - TRACC ASSEMBLY DETAILS	
EFFECTIVE: APRIL 2006	
 MONTANA DEPARTMENT OF TRANSPORTATION	

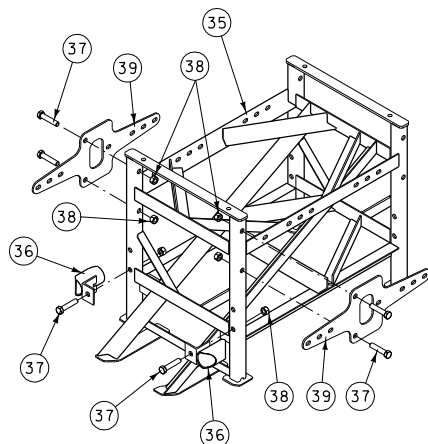


QUEST SYSTEM ASSEMBLY

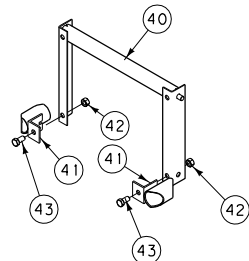
DIAPHRAGM ASSEMBLY
(ITEM 4)



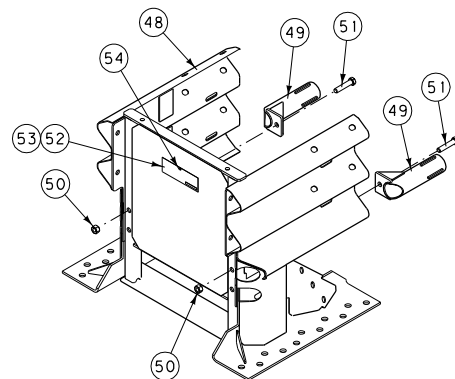
TRIGGER ASSEMBLY
(ITEM 5)



SUPPORT FRAME ASSEMBLY
(ITEM 2)



BRIDGE
(ITEM 6)



BACKUP ASSEMBLY
(ITEM 1)

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3562003-0000	BACKUP ASSEMBLY, 24, QUEST	1
2	3562002-0000	SUPPORT FRAME ASSY, BAY 1, 24, QUEST	1
3	2762015-0000	ANCHOR, FRONT, QUEST, G	2
4	3562005-0000	DIAPHRAGM ASSEMBLY, 24, BAY 3, QUEST	1
5	3562001-0000	TRIGGER ASSEMBLY, QUEST	1
6	3562004-0000	BRIDGE ASSEMBLY, 24, BAY 2, QUEST	1
7	2762026-0000	NOSE, QUEST, G	1
8	2762024-0000	NOSE TRANSITION, R, QUEST, G	1
9	2762025-0000	NOSE TRANSITION, L, QUEST, G	1
10	276200L-0000	SHAPER RAIL, L, QUEST, G	1
11	276200R-0000	SHAPER RAIL, R, QUEST, G	1
12	2762022-0000	BRACKET, PANEL, DIAPHRAGM, G	2
13	2762023-0000	REAR RAIL, QUEST, G	2
14	2762007-0000	TRIGGER STRAP, QUEST, G	2
15	2762013-0000	PANEL, BAY 2, QUEST, G	2
16	2762014-0000	PANEL, BAY 3, QUEST, G	2
17	2762033-0000	PANEL, BAY 1, QUEST, G	2
18	2699251-0000	BOLT, HX, M20 x 89, G5, G	16
19	2701014-0000	BOLT, HX, M24 x 127, G8, G	4
20	2701811-0000	BOLT, RAIL, M16 x 32, G5, G	40
21	2701931-0000	BOLT, HX, M20 x 38, G5, G	4
22	2704191-0000	NUT, HX, M16, G, RAIL	40
23	2704091-0000	NUT, HX, M20, G	20
24	2704161-0000	NUT, HX, M24, G	2
25	2708161-0000	WASHER, BAR, 51 x 51 x 6, G	2
26	2708871-1000	WASHER, BAR, 32 x 51 x 3, ROUNDED, G	8
27	2700031-0000	INSTALL INSTRUCTIONS, QUEST	1
28	2735831-3500	MATERIAL SAFETY INFO NOTICE	1
29	2708081-0000	WASHER, FLAT, M20 (51 O.D.), HVY, G	16
TRIGGER ASSEMBLY (ITEM 5)			
30	2762008-0000	TRIGGER FRAME, QUEST, G	1
31	2762011-0000	ANCHOR, TRIGGER, R, QUEST, G	1
32	2762012-0000	ANCHOR, TRIGGER, L, QUEST, G	1
33	2699034-0000	ROD, THREADED, 13 DIA. x 343, B7, G	2
34	2704911-0000	NUT, HX, M12, G5, G	12
SUPPORT FRAME ASSEMBLY (ITEM 2)			
35	2762010-0000	SUPPORT FRAME, BAY 1, 24, QUEST, G	1
36	2762003-0000	RAIL GUIDE, DIAPHRAGM, QUEST, G	2
37	2699251-0000	BOLT, HX, M20 x 89, G5, G	6
38	2704091-0000	NUT, HX, M20, G	6
39	2762021-0000	BRACKET, PANEL, BAY 1 FRAME, QUEST, G	2
BRIDGE (ITEM 6)			
40	2762016-0000	BRIDGE, 24, QUEST, G	1
41	2762003-0000	RAIL GUIDE, DIAPHRAGM, QUEST, G	2
42	2704091-0000	NUT, HX, M20, G	2
43	2701931-0000	BOLT, HX, M20 x 38, G5, G	2
DIAPHRAGM ASSEMBLY (ITEM 4)			
44	2762018-0000	DIAPHRAGM, 24, BAY 3, QUEST, G	1
45	2762003-0000	RAIL GUIDE, DIAPHRAGM, QUEST, G	2
46	2699251-0000	BOLT, HX, M20 x 89, G5, G	2
47	2704091-0000	NUT, HX, M20, G	2
BACKUP ASSEMBLY (ITEM 1)			
48	2762020-0000	BACKUP, 24, QUEST, G	1
49	2762017-0000	SHAPER, BACKUP, QUEST, G	2
50	2704091-0000	NUT, HX, M20, G	2
51	2699251-0000	BOLT, HX, M20 x 89, G5, G	2
52	2735711-0000	DECAL, CAUTION, ALL PRODUCTS	1
53	2735712-3500	DECAL, PRODUCT, QUEST	1
54	2705121-0000	RIVET, ST, SD68BS, 4.8 DIA. x 12.7, DH	1


ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

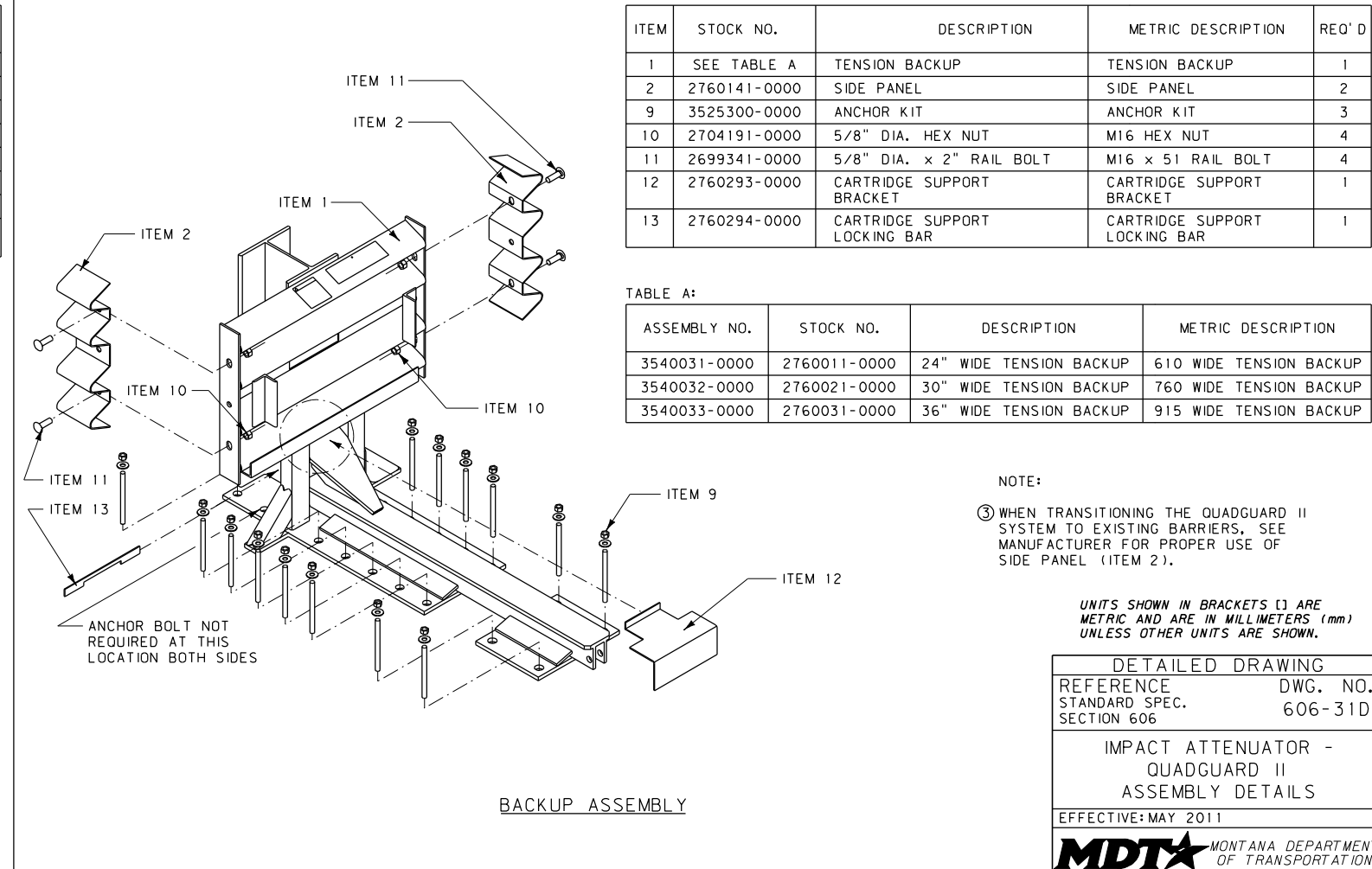
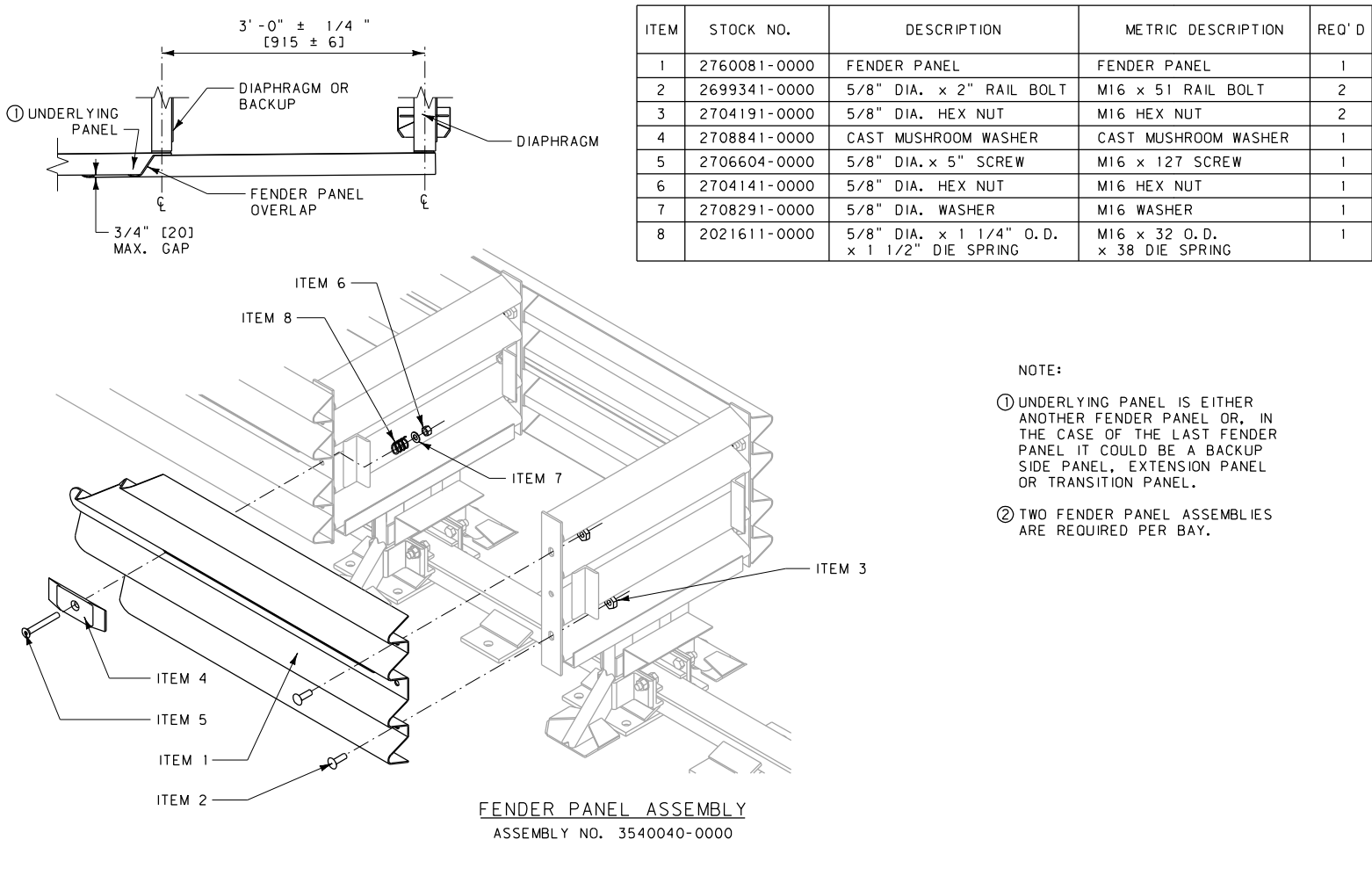
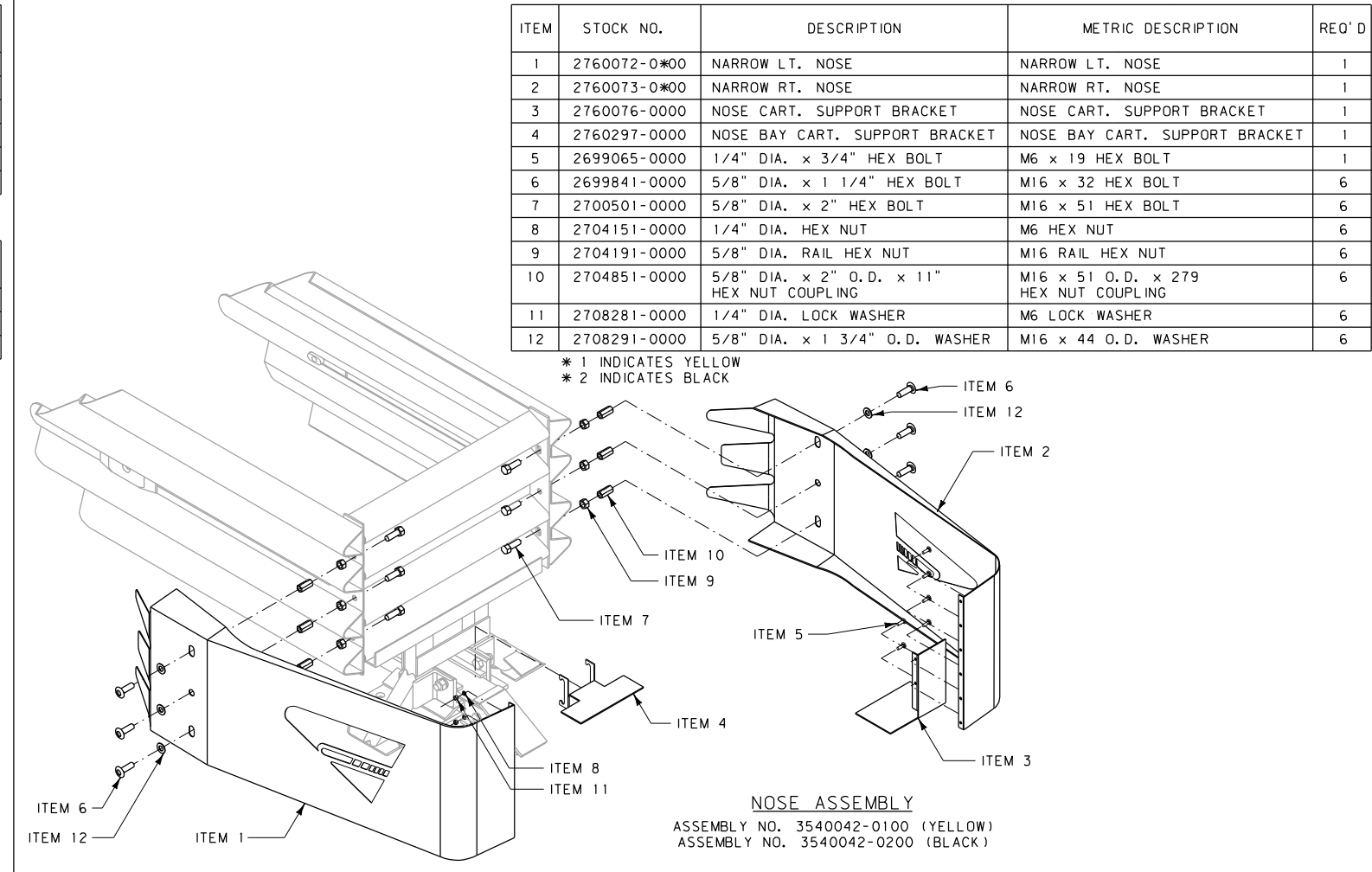
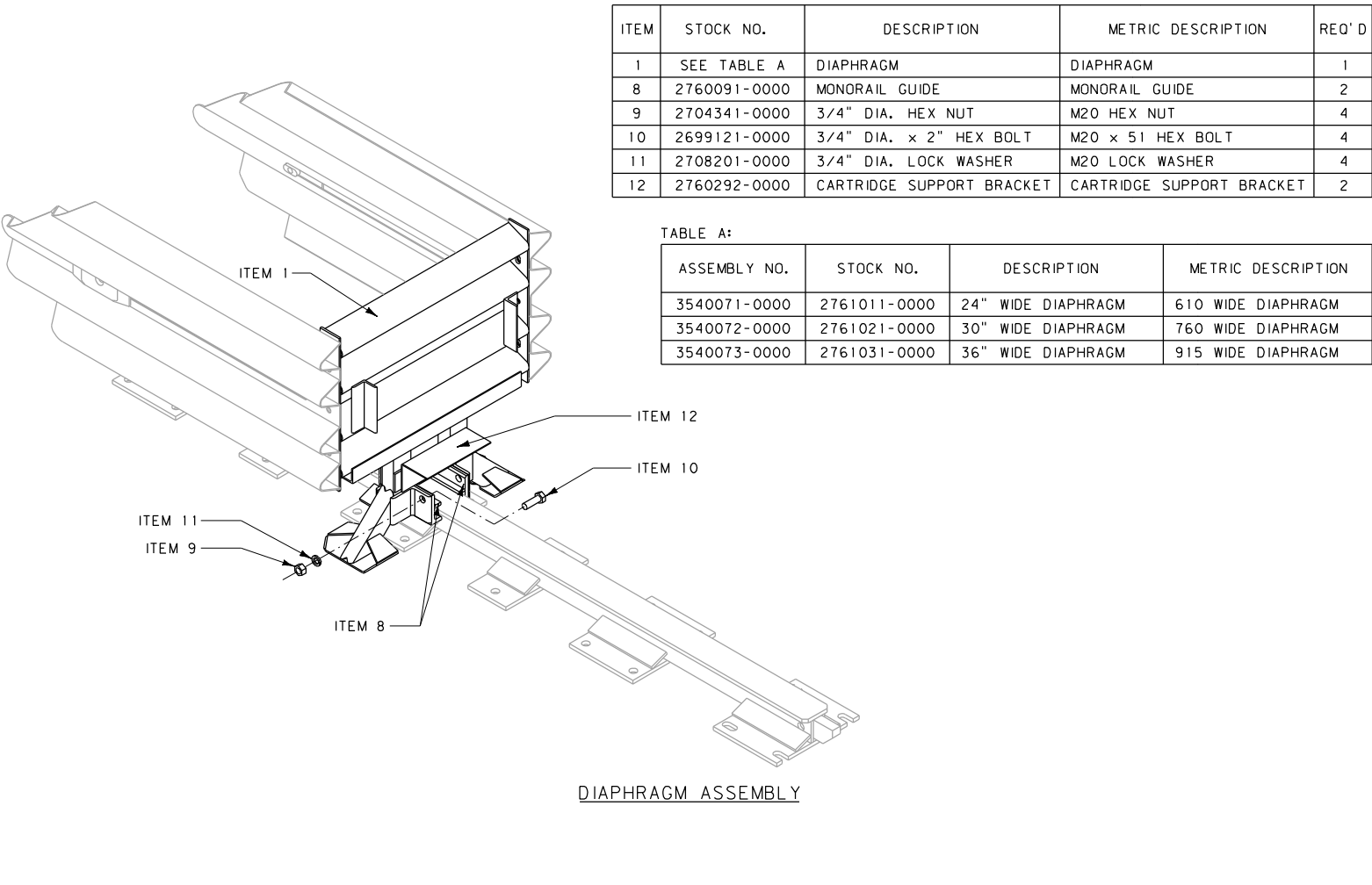
DETAILED DRAWING

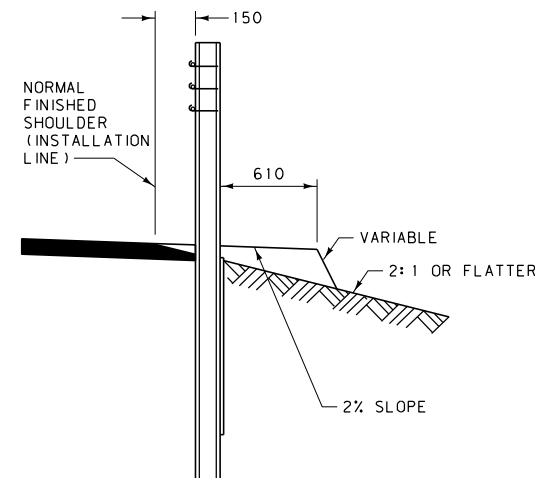
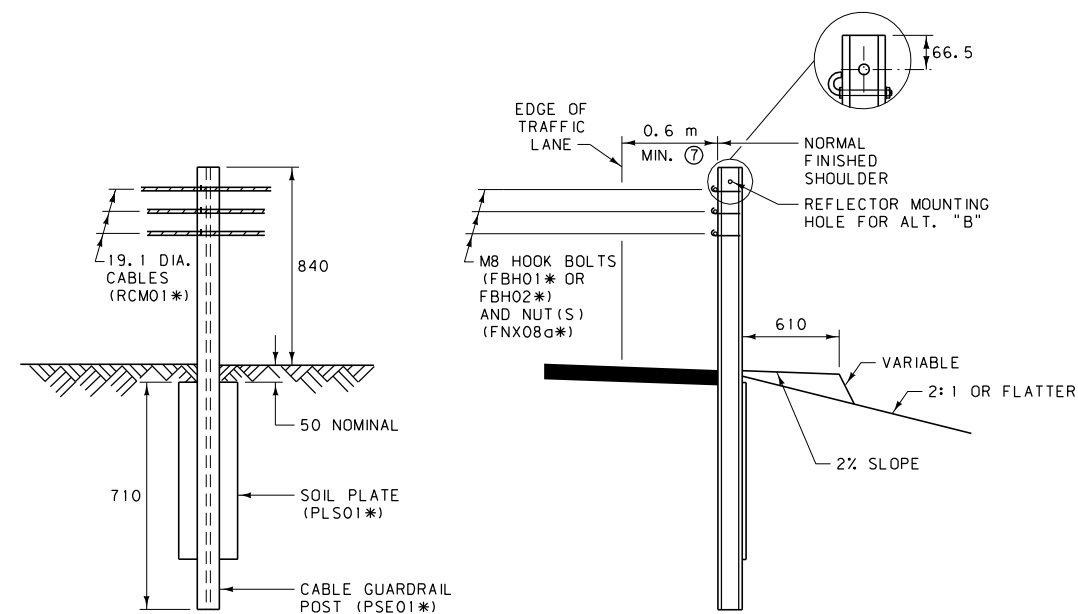
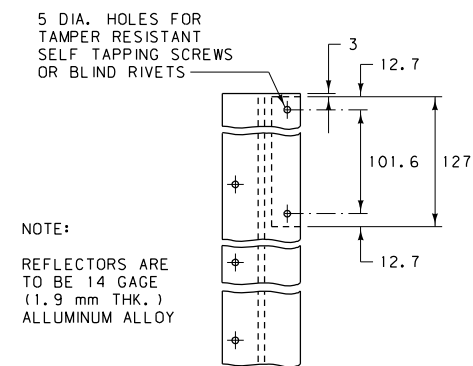
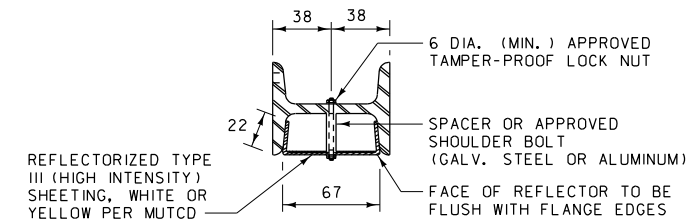
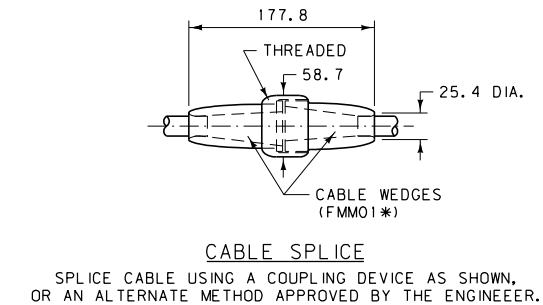
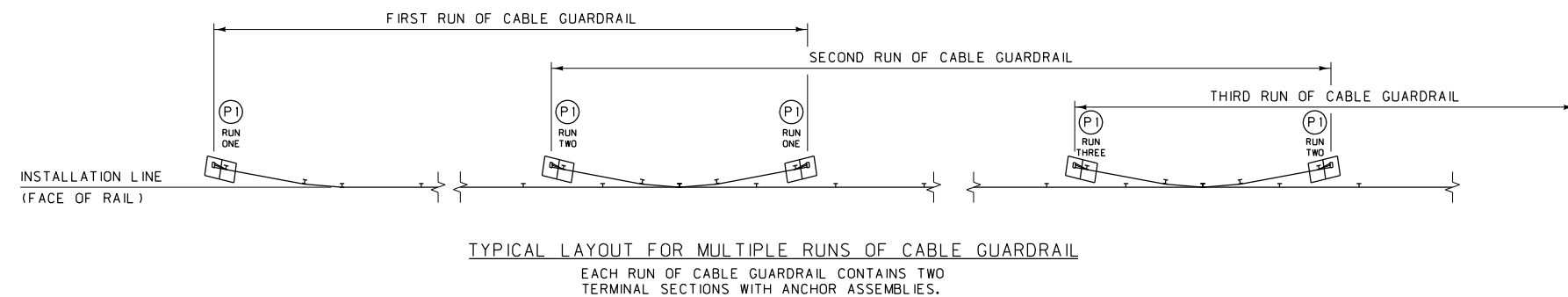
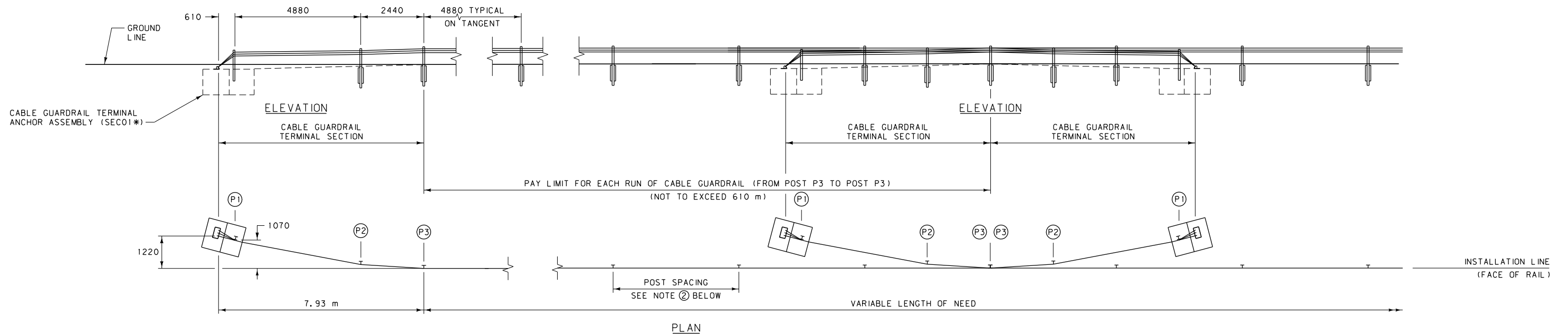
REFERENCE DWG. NO.
STANDARD SPEC. 606-31C
SECTION 606

IMPACT ATTENUATOR -
QUEST
ASSEMBLY DETAILS

EFFECTIVE: APRIL 2006

 MONTANA DEPARTMENT
OF TRANSPORTATION




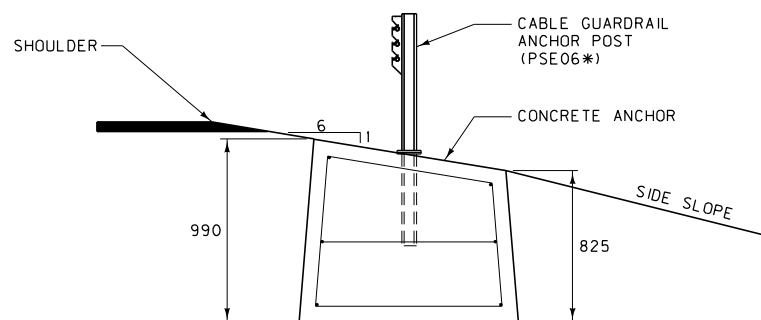
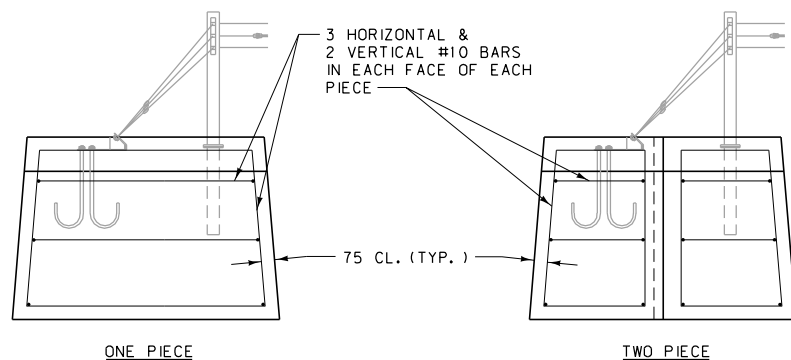


NOTES:

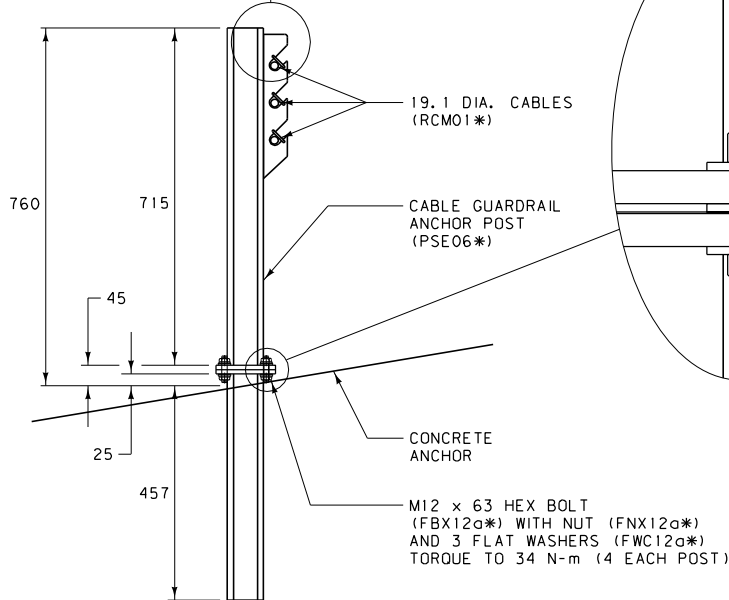
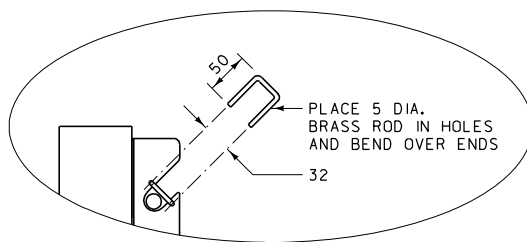
- ① FOR CABLE GUARDRAIL RUNS OF:
 - 318.42 m OR LESS: USE COMPENSATING CABLE END ASSEMBLY (RCE01*) ON ONE END AND TURNBUCKLE CABLE END ASSEMBLY * ON THE OTHER END OF EACH CABLE.
 - GREATER THAN 318.42 m, UP TO 625.86 m MAXIMUM: USE COMPENSATING CABLE END ASSEMBLY (RCE01*) ON BOTH ENDS OF EACH CABLE.
 - ② LINE POST SPACING:
 - TANGENTS AND CURVES WITH RADII 220 m AND GREATER: 4880 mm.
 - CURVES WITH RADII LESS THAN 220 m DOWN TO 135 m: 3660 mm.
 - NOTE: DO NOT INSTALL CABLE GUARDRAIL ON THE INSIDE SHOULDER OF ANY CURVE.
 - ③ UNIFORMLY TENSION ALL CABLES TO COMPRESS SPRINGS BY 90 mm.
 - ④ DO NOT INSTALL CABLE GUARDRAIL FOR OBSTACLES WITHIN 3.7 m OF THE INSTALLATION LINE.
 - ⑤ DO NOT USE CABLE GUARDRAIL WITH FILL SLOPES STEEPER THAN 2:1, UNLESS THE DISTANCE BETWEEN THE BACK OF THE POSTS AND THE BREAK IN THE FILL SLOPE IS AT LEAST 2.5 m.
 - ⑥ ATTACH REFLECTORS TO EVERY OTHER LINE POST (9.76 m TYP.), BEGINNING AT POST P3. DO NOT ATTACH REFLECTORS TO POSTS P1 AND P2.
 - ⑦ WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 0.6 m FROM THE TRAFFIC LANE.
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

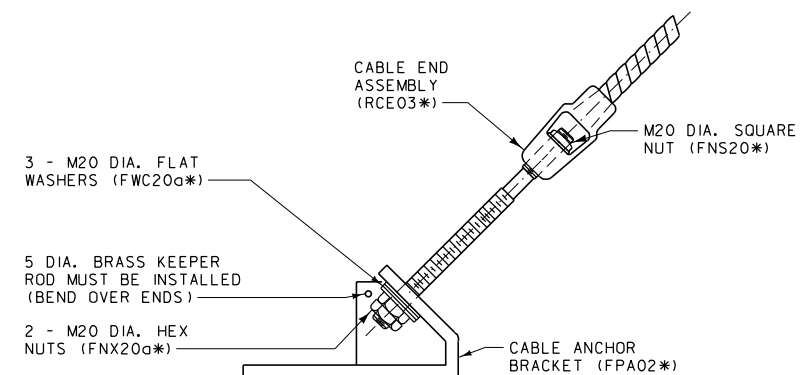
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-40
CABLE GUARDRAIL	
--REVISED-- January 2008	EFFECTIVE: FEBRUARY 2005
 MONTANA DEPARTMENT OF TRANSPORTATION serving you with pride	



ANCHOR UNIT & RE-BAR INSTALLATION DETAILS



ANCHOR POST DETAIL



CABLE END ASSEMBLY TO ANCHOR BRACKET DETAIL

NOTE:
INSTALL ONE WASHER UNDER HEAD, ONE BETWEEN PLATES & ONE UNDER NUT. AN ADDITIONAL WASHER MAY BE PLACED BETWEEN PLATES TO PLUMB THE ANCHOR POST.

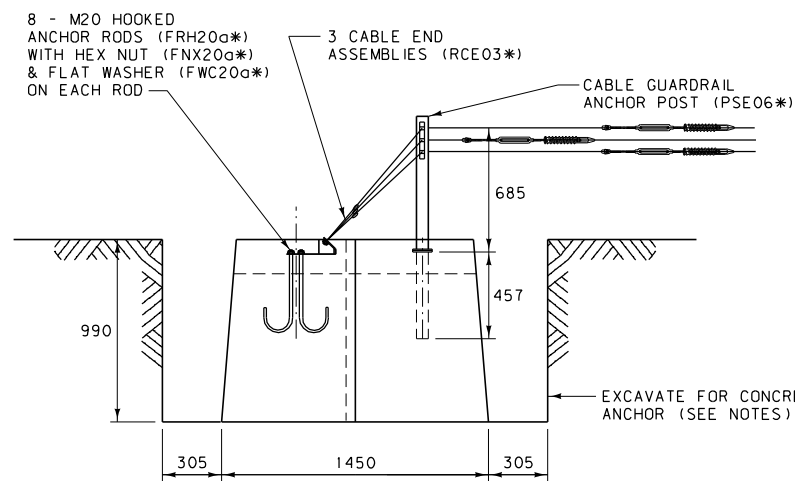
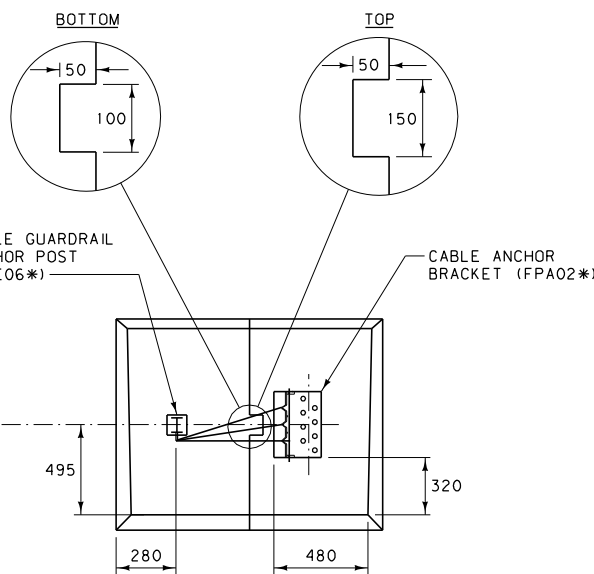
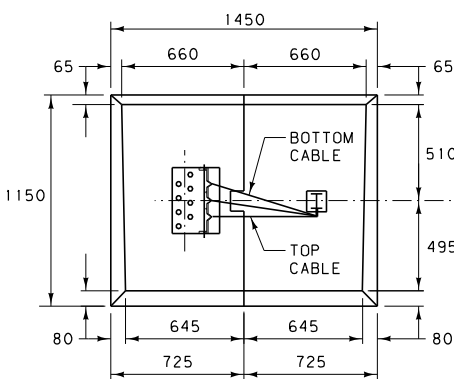
NOTES:

- ① INSTALL THE CONCRETE ANCHOR INTO THE EXCAVATION, AS DETAILED, SO THAT THE BOTTOM OF THE ANCHOR HAS A FULL AND EVEN BEARING ON THE SURFACE UNDER IT. BACKFILL AROUND THE CONCRETE ANCHOR IN ACCORDANCE WITH SECTION 203.03.3 OF THE STANDARD SPECIFICATIONS.
- ② THE CONCRETE ANCHOR CAN BE PLACED AS ONE OR TWO PIECES. THIS DETAIL PRIMARILY SHOWS A TWO PIECE INSTALLATION. FOR ONE PIECE INSTALLATIONS, USE ALL THE SAME DIMENSIONS, LESS THE TAPERED KEYWAY AND THE ADDITIONAL REBAR, AS SHOWN.
- ③ IF LIFTING DEVICES ARE EMBEDDED INTO THE CONCRETE ANCHORS, INSURE THAT THEY HAVE A SAFE WORKING LOAD OF 3.6 METRIC TONS FOR THE ONE PIECE ANCHOR AND 1.8 METRIC TONS EACH FOR EACH OF THE HALVES OF THE TWO PIECE ANCHOR UNIT.
- ④ USE CLASS "DD" CONCRETE TO CONSTRUCT ANCHOR.

*SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

NOTE:

DIMENSIONS FOR LEFT AND RIGHT HAND ANCHOR UNITS ARE THE SAME, WITH THE POSITION OF THE ANCHOR POST AND ANCHOR BRACKET BEING THE ONLY DIFFERENCE.



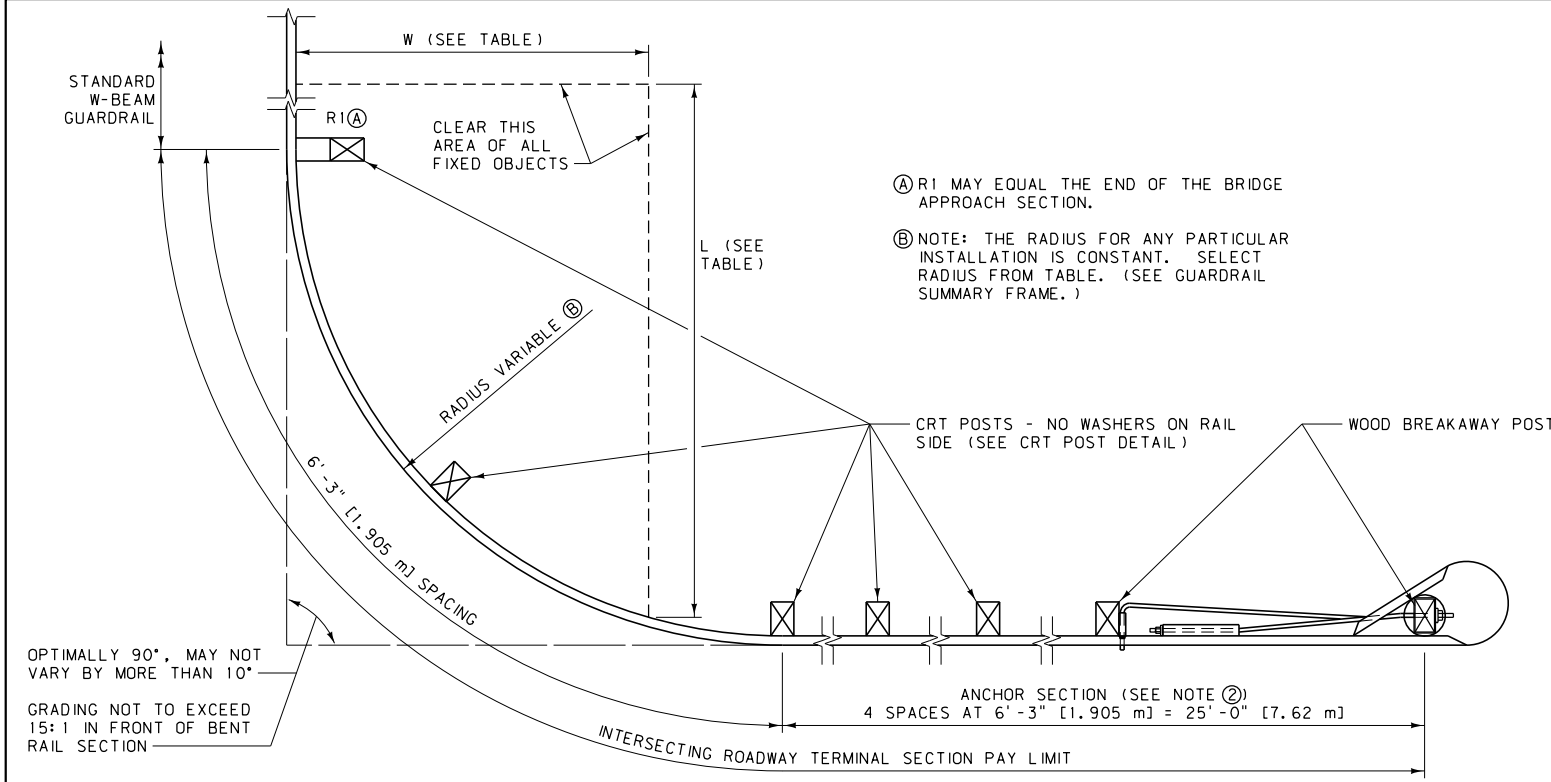
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-41
SECTION 606	
CABLE GUARDRAIL TERMINAL ANCHOR ASSEMBLY	

-- REVISED --
January 2008

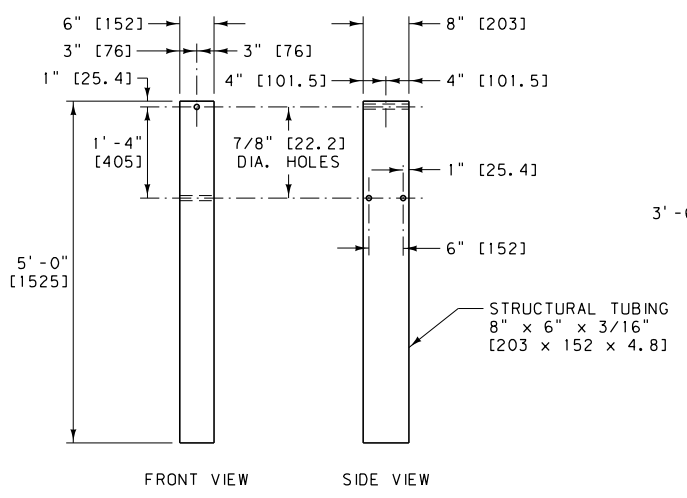
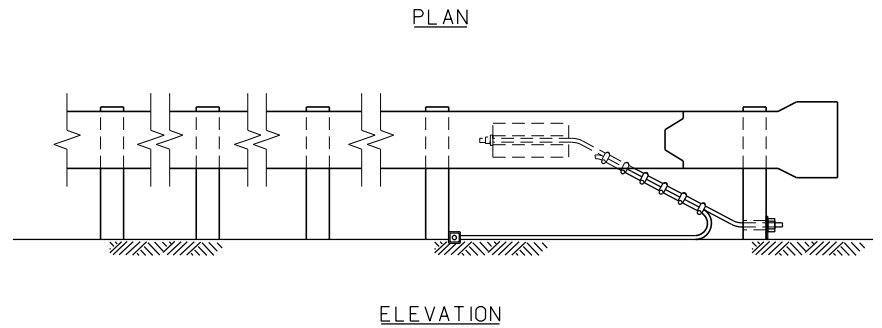
EFFECTIVE: FEBRUARY 2005

MTD MONTANA DEPARTMENT OF TRANSPORTATION
serving you with pride

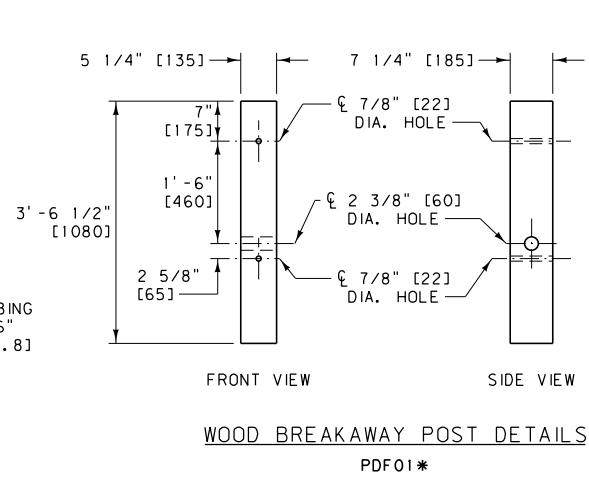


RADIUS TABLE			
RADIUS	LENGTH OF BENT RAIL	L	W
8'	12.5'	25'	15'
16'	25.0'	30'	15'
24'	37.5'	40'	20'
32'	50.0'	50'	20'

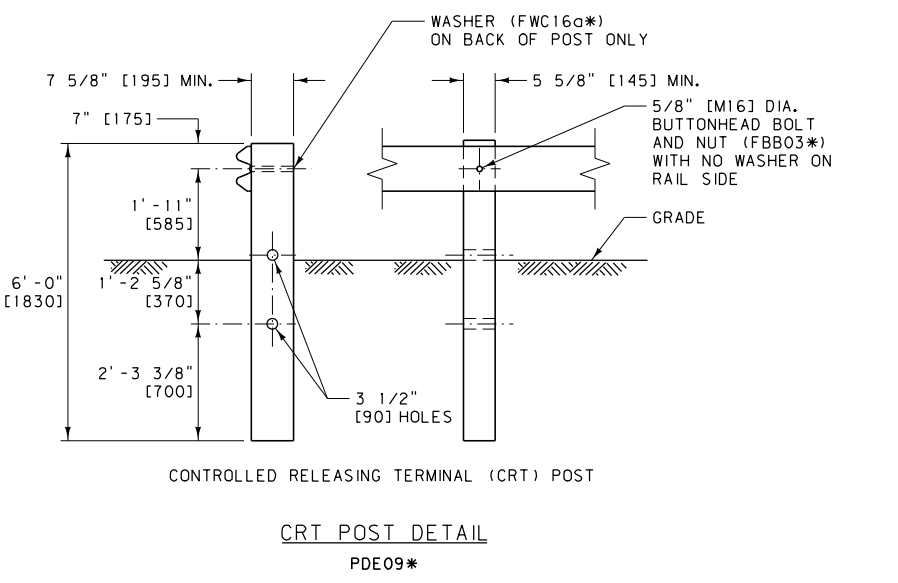
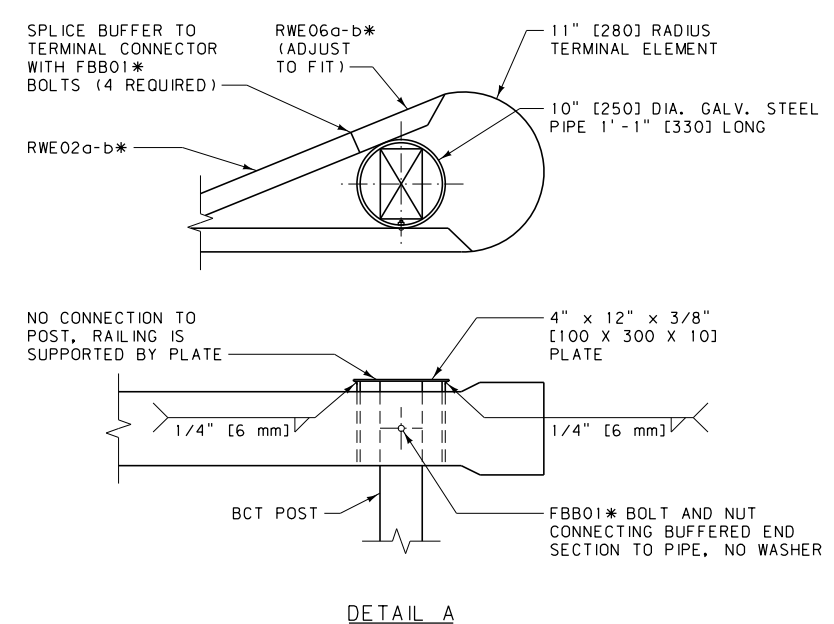
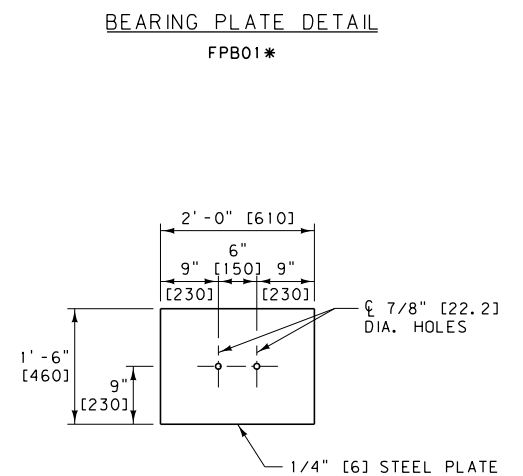
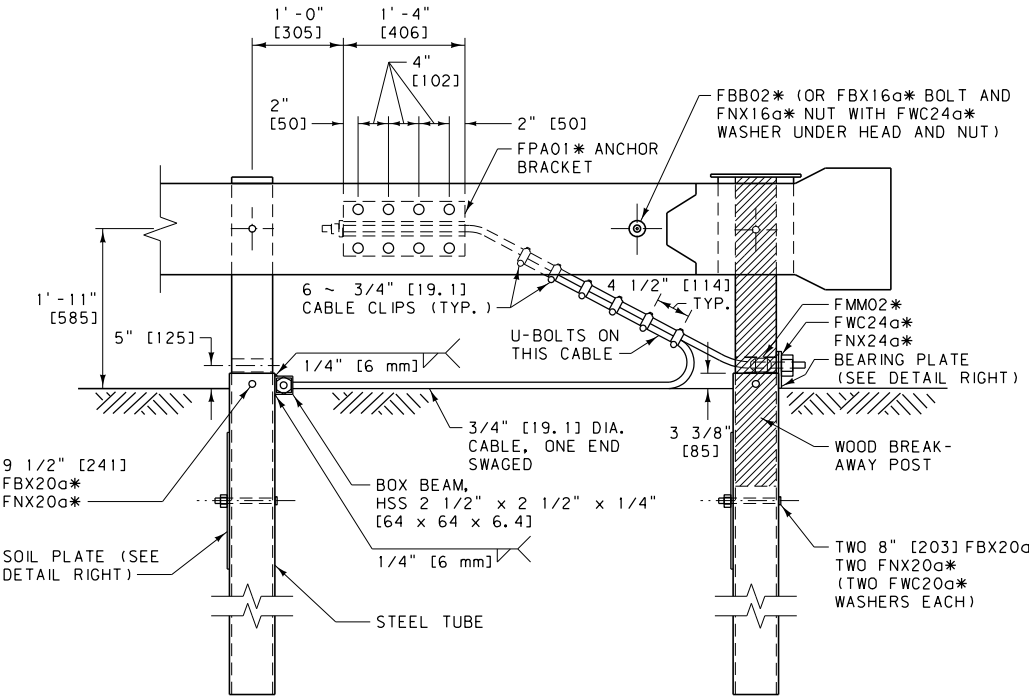
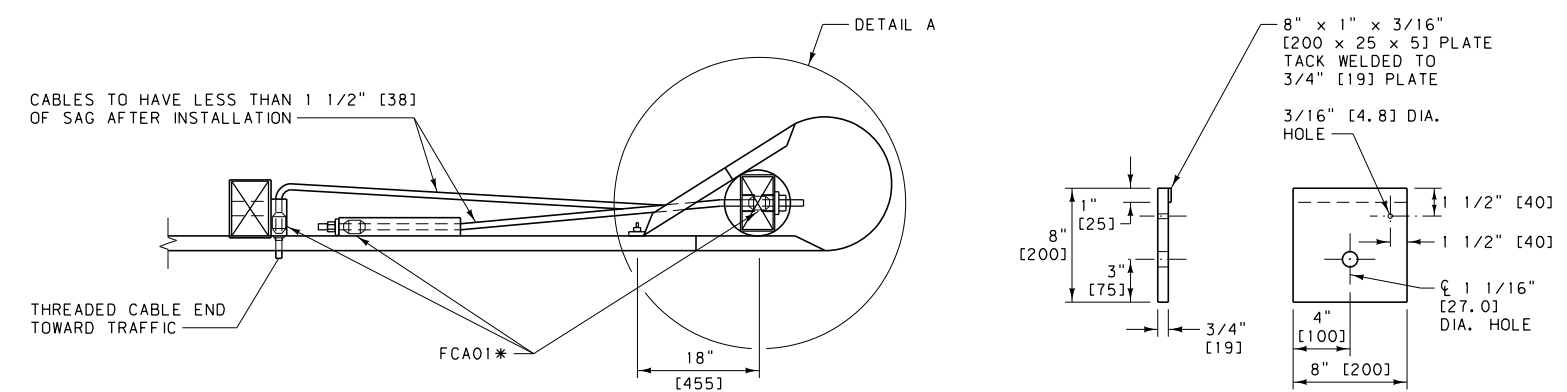
METRIC RADIUS TABLE			
RADIUS	LENGTH OF BENT RAIL	L	W
2450 mm	3.81 m	7.6 m	4.6 m
4850 mm	7.62 m	9.1 m	4.6 m
7300 mm	11.43 m	12.2 m	6.1 m
9700 mm	15.24 m	15.2 m	6.1 m



STEEL TUBE DETAILS
PTE05*

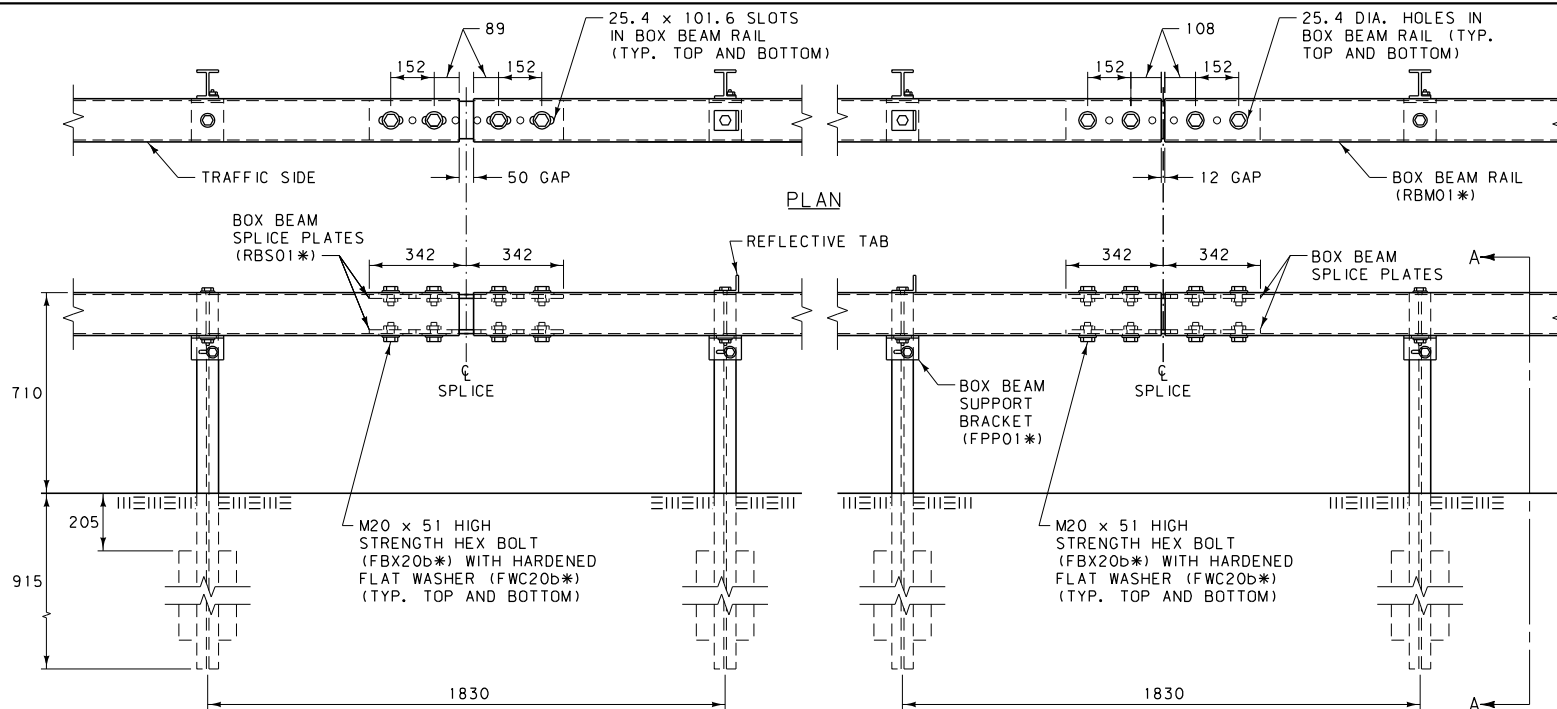


- NOTES:
- DO NOT INSTALL ON SLOPES STEEPER THAN 2:1.
 - DO NOT OMIT OR SHORTEN ANCHOR SECTION.
 - SEE DTL. DWG. NO. 606-05A FOR GUARDRAIL WIDENING REQUIREMENTS.
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.



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

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-46
SECTION 606	
INTERSECTING ROADWAY TERMINAL SECTION	
EFFECTIVE: FEBRUARY 2005	
--REVISED--	
JANUARY 2008	
DECEMBER 2011	
MONTANA DEPARTMENT OF TRANSPORTATION	

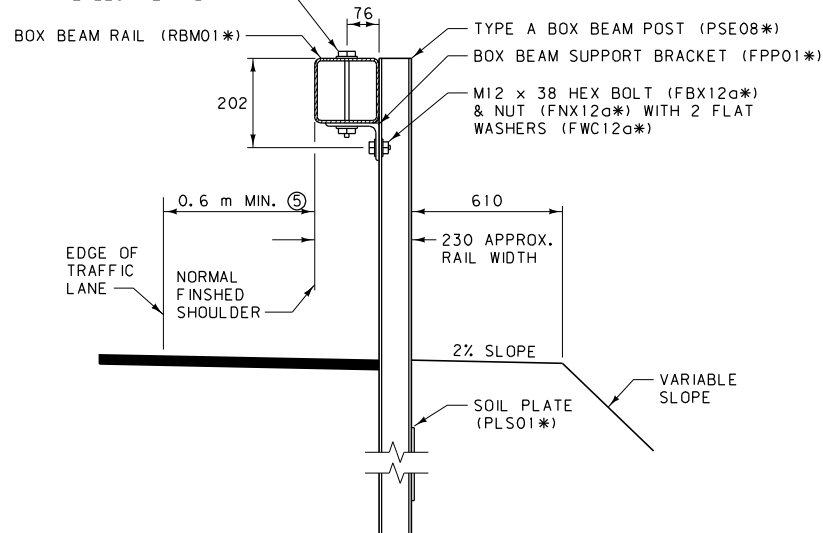


EXPANSION JOINT

ELEVATION

SPLICE DETAIL

12.7 DIA. HOLES FOR M10 x 191 HEX BOLT (FBX10a*) AND NUT (FNX10a*) WITH 2 FLAT WASHERS (FWC10a*) (1 WASHER ON POSTS WITH REFLECTIVE TAB)

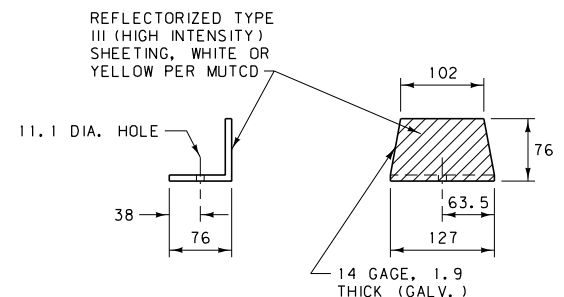


SECTION A-A

NOTES:


- USE BOX BEAM RAIL IN MINIMUM NOMINAL LENGTHS OF 5.49 m UNLESS APPROVED BY THE ENGINEER.
- INSTALL EXPANSION JOINTS ON ALL BOX BEAM GUARDRAIL INSTALLATIONS GREATER THAN 90 m IN LENGTH AT INTERVALS NOT TO EXCEED 150 m.
- ATTACH REFLECTIVE TABS TO EVERY FOURTH POST (7.32 m TYP.) ANGLE TABS SLIGHTLY TOWARDS TRAFFIC. DO NOT USE REFLECTIVE TABS ON WY-BET TERMINALS. WY-BET TERMINALS RECEIVE REFLECTIVE CHANNELS.
- DO NOT INSTALL BOX BEAM GUARDRAIL FOR OBSTACLES WITHIN 1.8 m OF THE FACE OF THE RAIL.
- WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 0.6 m FROM THE TRAFFIC LANE.

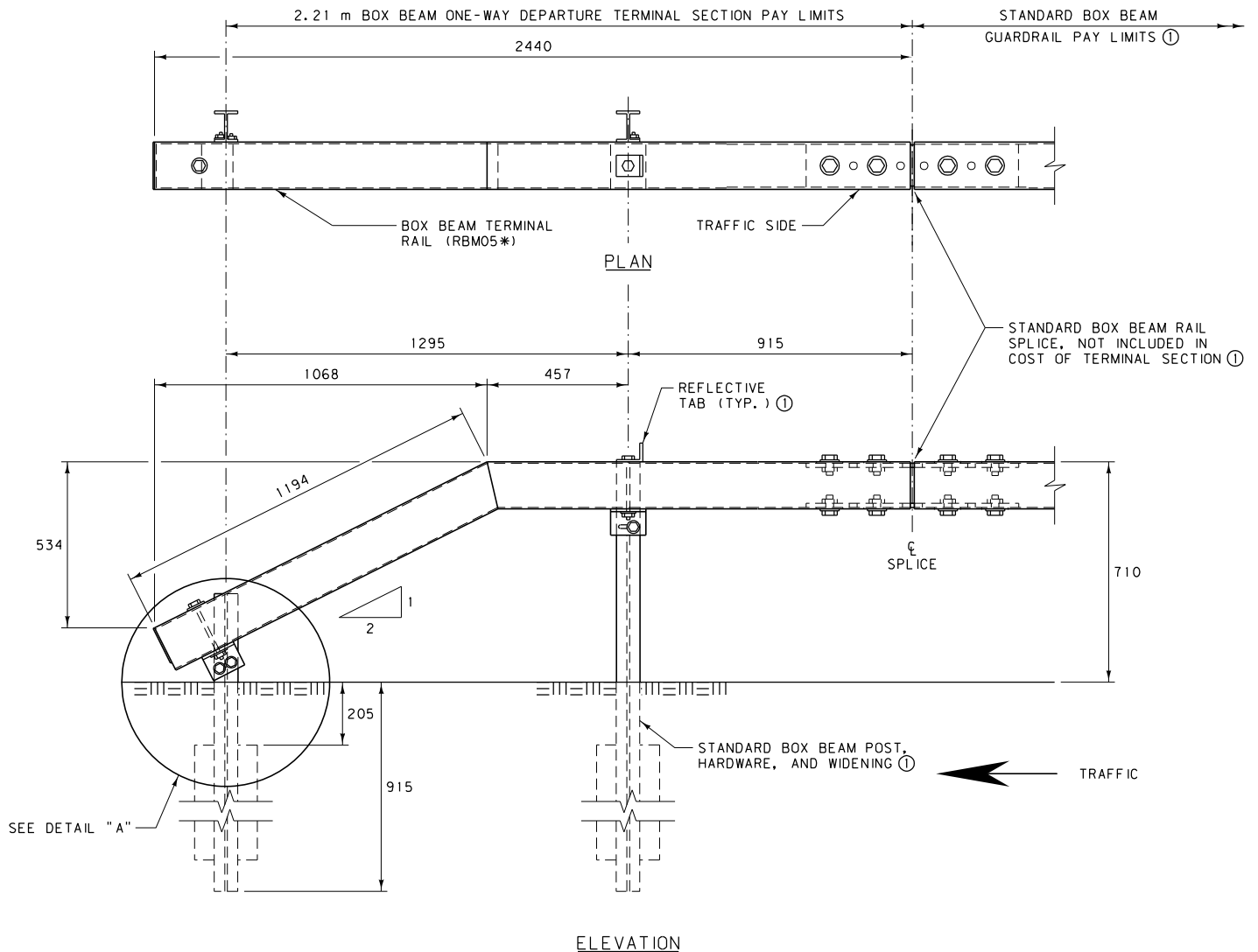
* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.



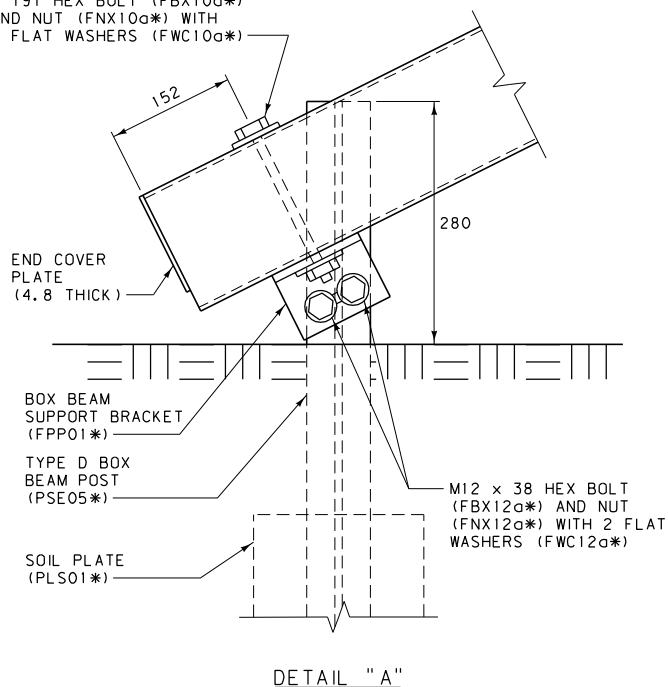
REFLECTIVE TAB

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-50
BOX BEAM GUARDRAIL	
EFFECTIVE: APRIL 2006	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>serving you with pride</i>	



12.7 DIA. HOLES FOR M10
x 191 HEX BOLT (FBX10a*)
AND NUT (FNX10a*) WITH
2 FLAT WASHERS (FWC10a*)




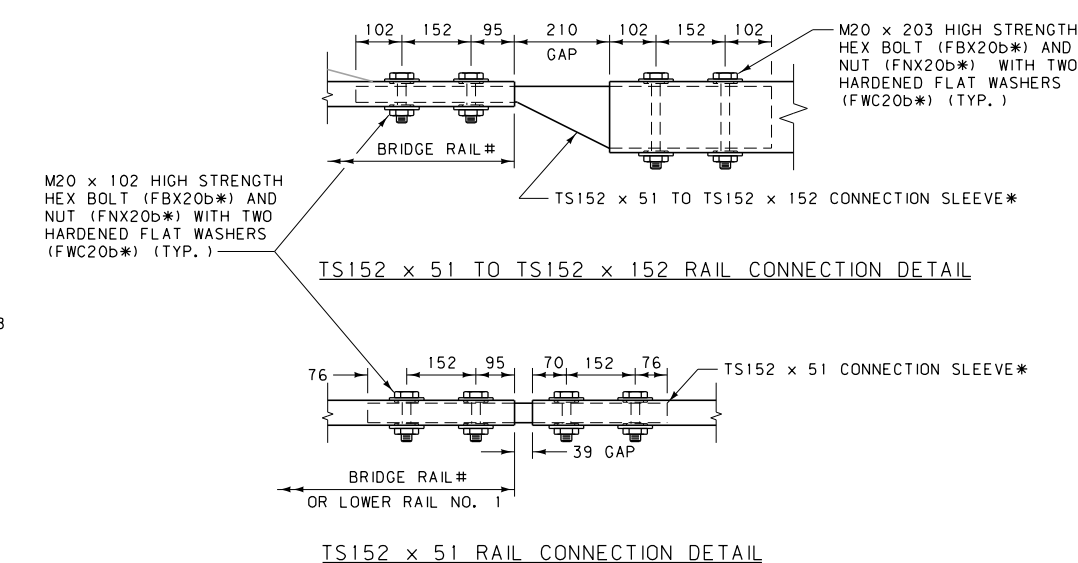
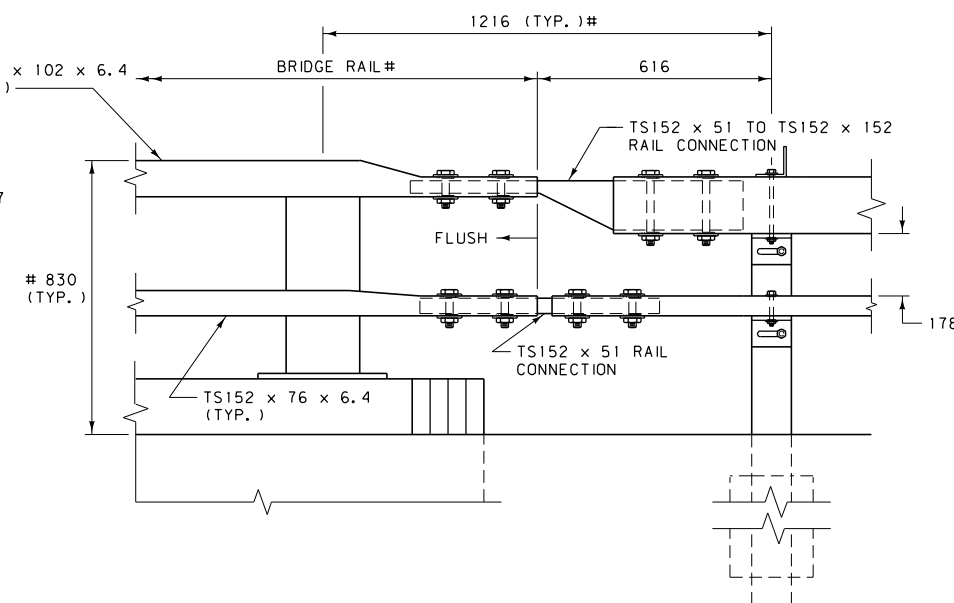
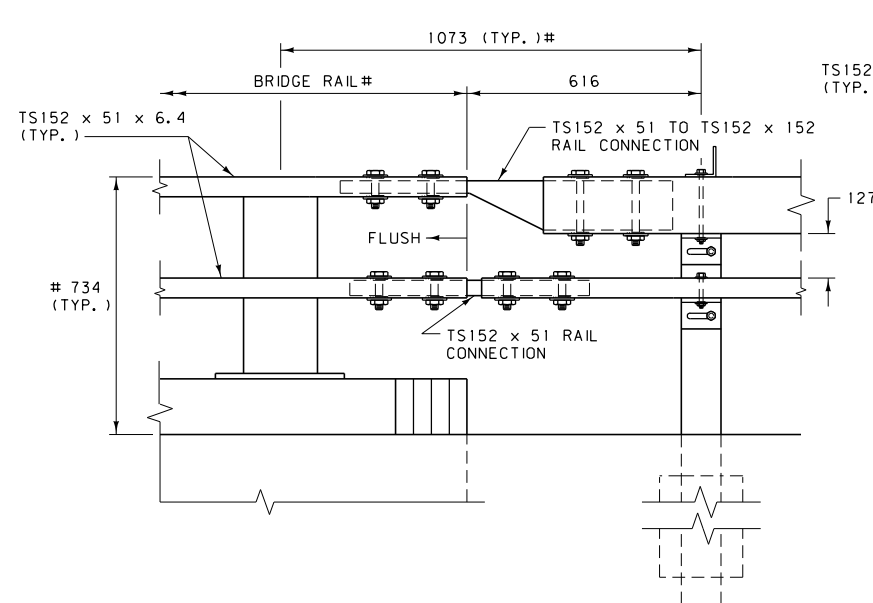
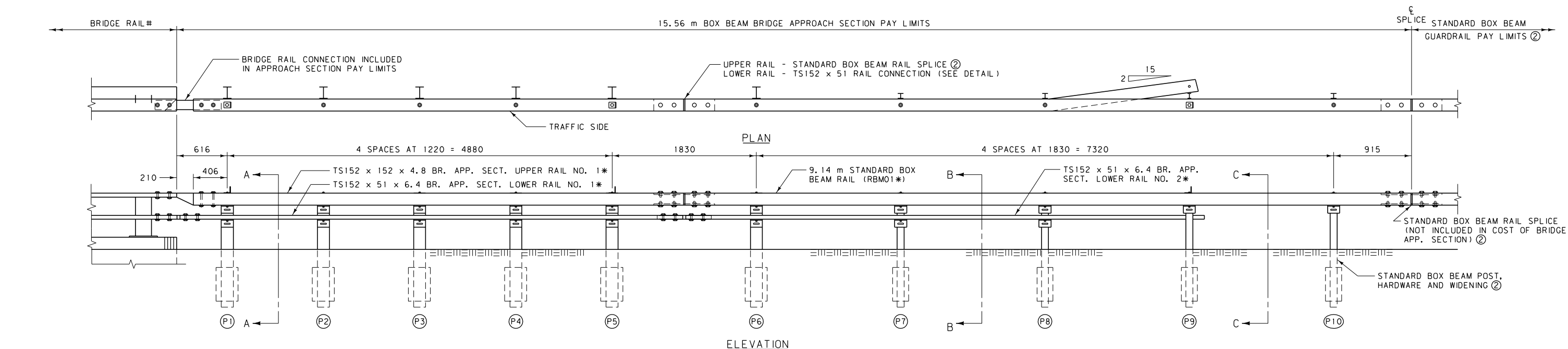
NOTES:

① SEE DTL. DWG. NO. 606-50 FOR
STANDARD BOX BEAM GUARDRAIL
AND ASSOCIATED DETAILS.

* SEE DTL. DWG. NO. 606-80 FOR
SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

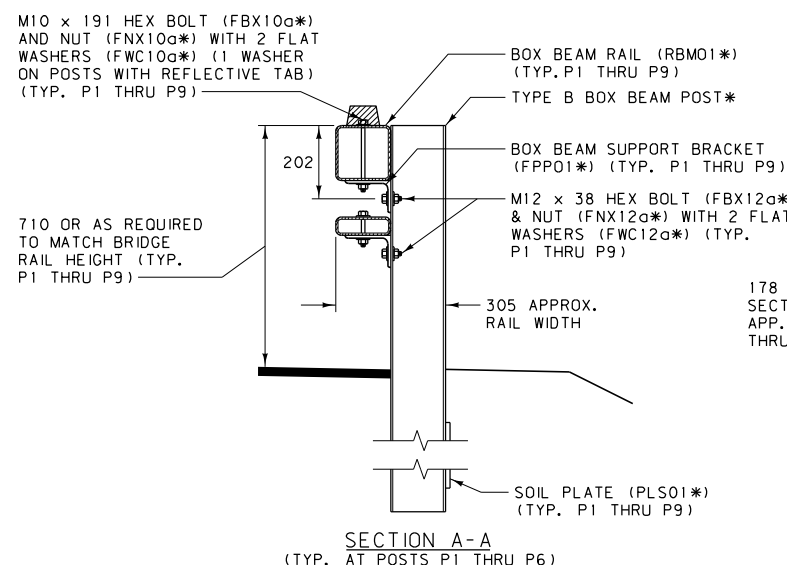
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-52
SECTION 606	
BOX BEAM ONE-WAY DEPARTURE TERMINAL SECTION	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION	



NOTES:

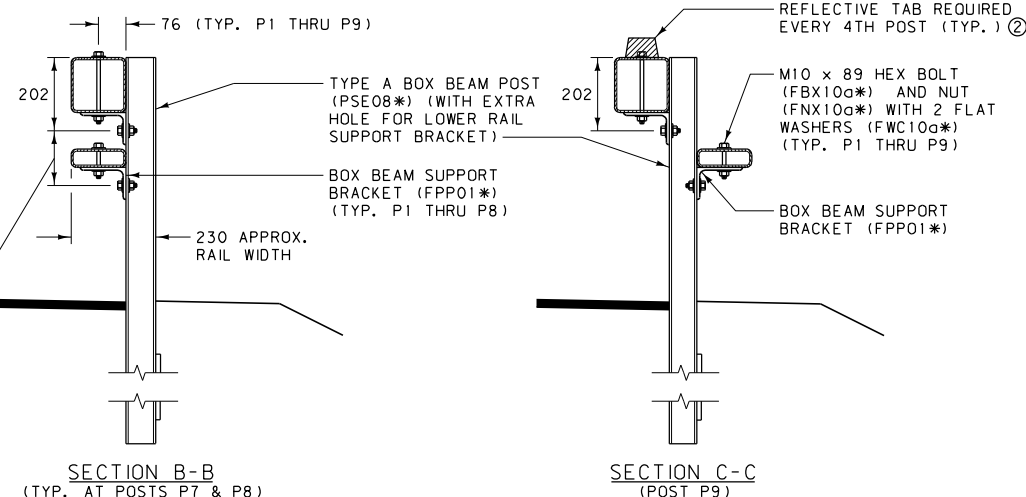
- ① WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 0.6 m FROM THE TRAFFIC LANE.
- ② SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.
- # SEE BRIDGE PLANS.

BOX BEAM - BRIDGE APPROACH SECTION TYPE 1



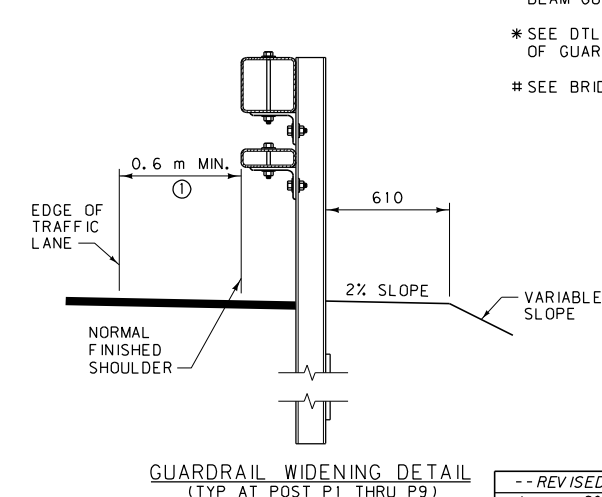
SECTION A-A
(TYP. AT POSTS P1 THRU P6)

BOX BEAM - BRIDGE APPROACH SECTION TYPE 2



SECTION B-B
(TYP. AT POSTS P7 & P8)

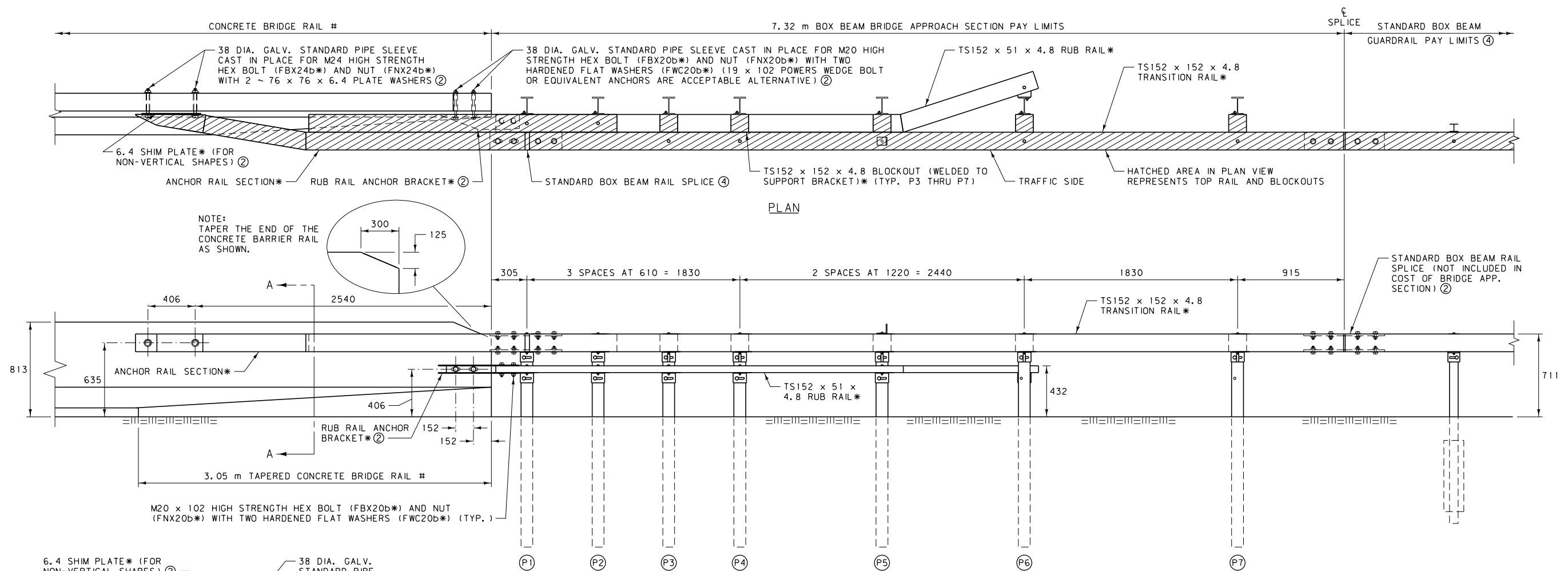
SECTION C-C
(POST P9)



GUARDRAIL WIDENING DETAIL
(TYP AT POST P1 THRU P9)

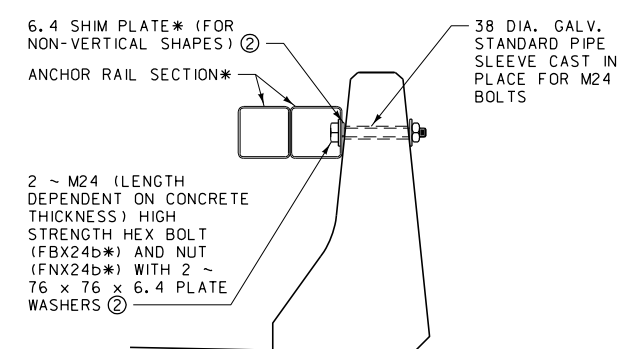
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-53
SECTION 606	
BOX BEAM BRIDGE APPROACH SECTION - TYPES 1 & 2	
EFFECTIVE: FEBRUARY 2005	
-- REVISED --	
January 2008	
MONTANA DEPARTMENT OF TRANSPORTATION	

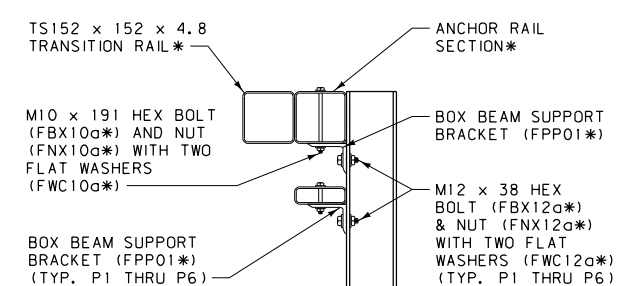


PLAN

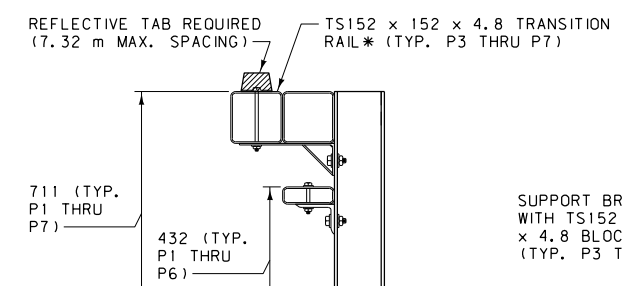
ELEVATION



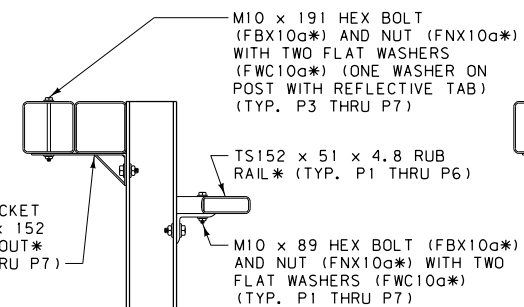
SECTION A-A



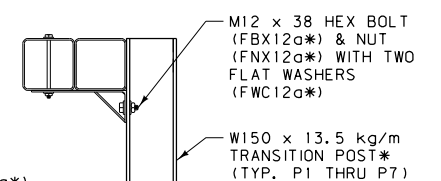
TYP. AT POSTS P1 & P2



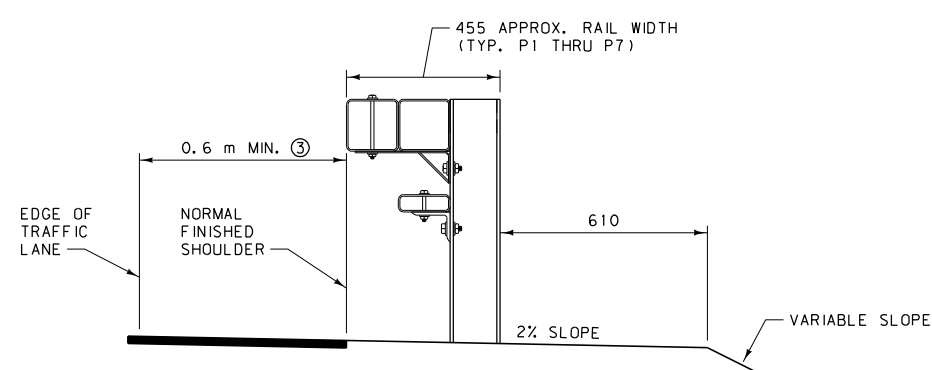
TYP. AT POSTS P3 THRU P5



POST P6



POST P7



GUARDRAIL WIDENING DETAIL

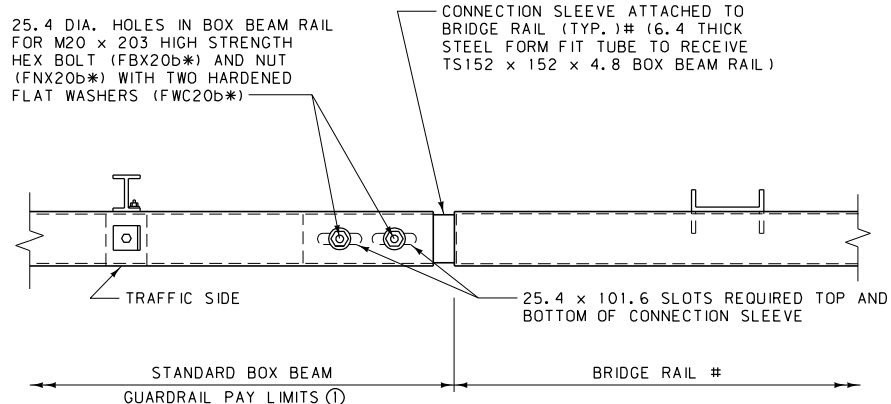
NOTES:

- ① INCLUDE COST OF ENTIRE ANCHOR RAIL SECTION, ALONG WITH ALL HARDWARE NECESSARY FOR ATTACHMENT TO CONCRETE BRIDGE RAIL, IN COST OF BRIDGE APPROACH SECTION.
- ② THE LENGTHS OF CONCRETE ANCHOR BOLTS, TYPE OF RUB RAIL ANCHOR BRACKET AND THE NEED FOR THE 6.4 mm SHIM PLATE IS DEPENDENT UPON THE SHAPE AND THE THICKNESS OF THE CONCRETE BRIDGE RAIL.

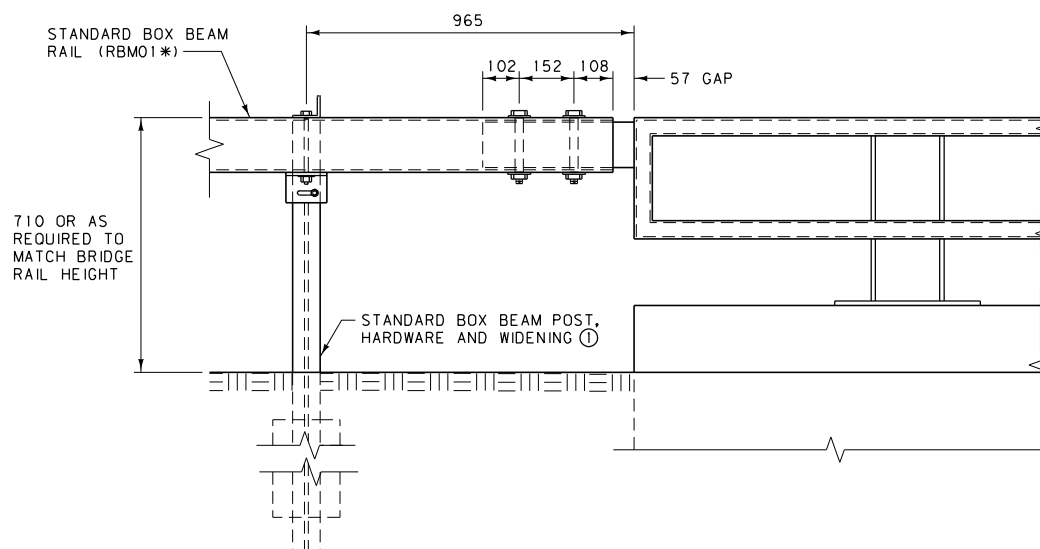
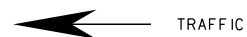
- ③ WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 0.6 m FROM THE TRAFFIC LANE.
 - ④ SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.
- # SEE BRIDGE PLANS.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-53A
BOX BEAM BRIDGE APPROACH SECTION - TYPE 3	



PLAN



ELEVATION

NOTES:


- ① SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.
- ② USE ON EXIT END OF ONE-WAY TRAFFIC BRIDGES ONLY.
- * SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.
- # SEE BRIDGE PLANS FOR MORE DETAILED INFORMATION ON BRIDGE RAIL AND CONNECTION DETAILS.

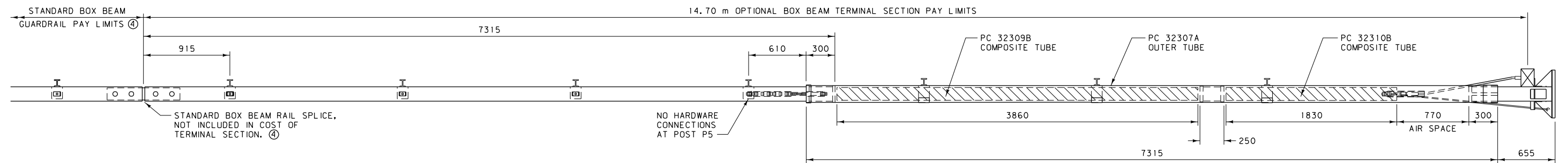
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC. SECTION 606	606-54
BOX BEAM ONE-WAY BRIDGE DEPARTURE SECTION	

-- REVISED --
January 2008

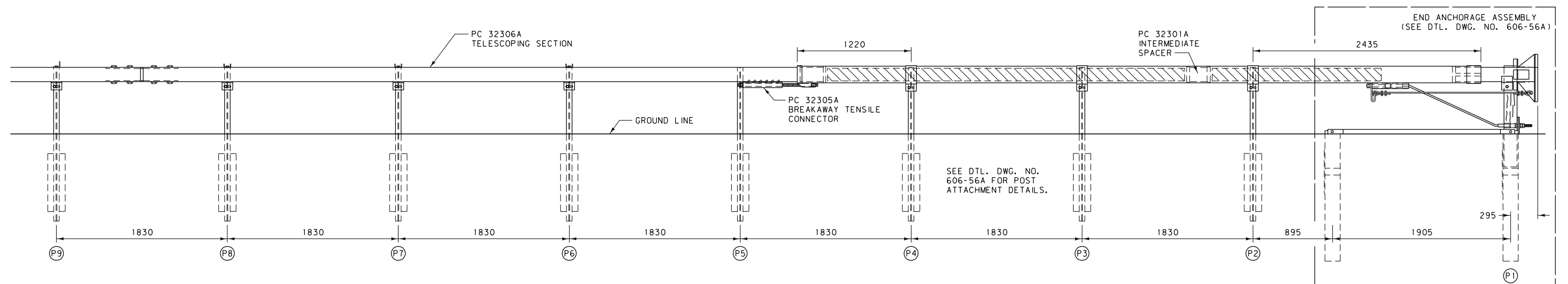
EFFECTIVE: FEBRUARY 2005

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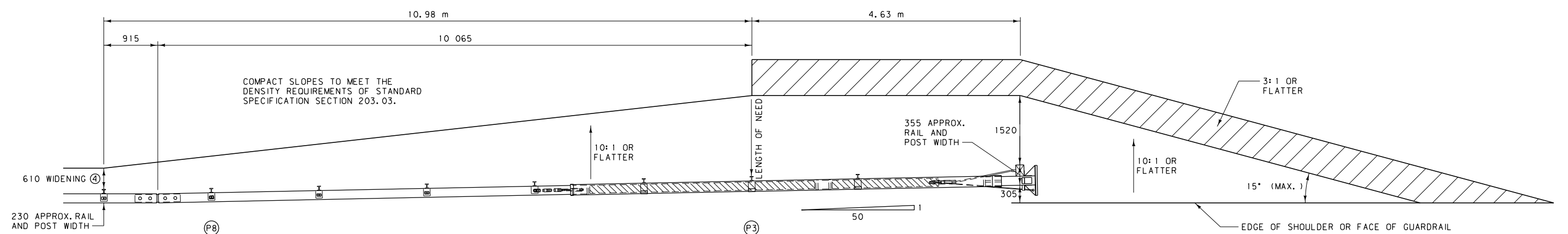


PLAN

(P3)




ELEVATION



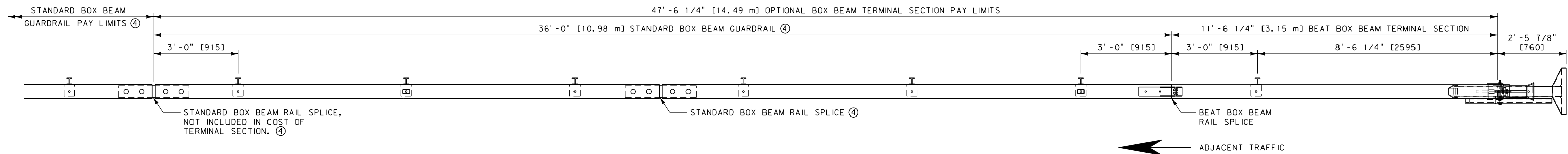
GUARDRAIL WIDENING

NOTES:

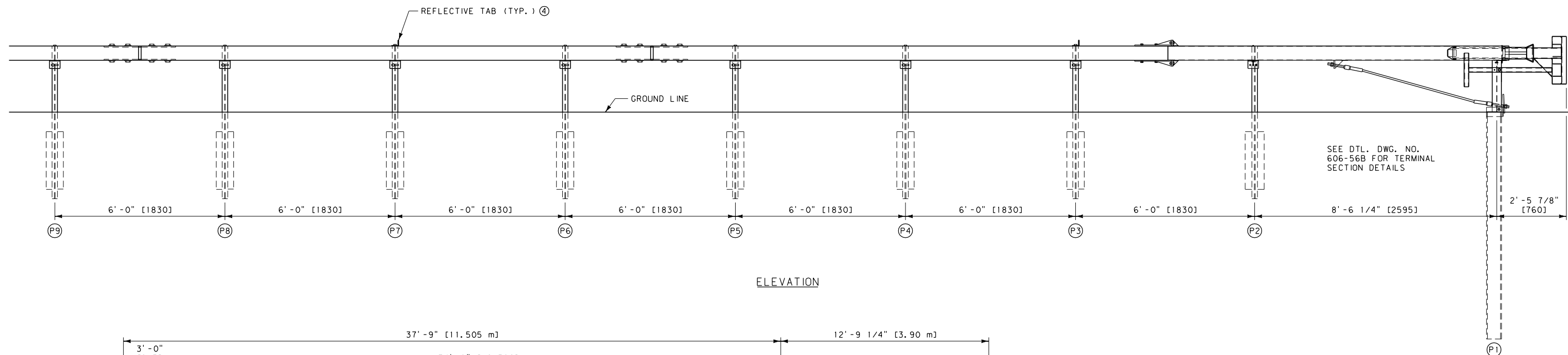
- ① PLACE A SELF-ADHESIVE OBJECT MARKER ON THE FACE OF THE NOSE ASSEMBLY, HAVING ALTERNATING RETRO-REFLECTIVE BLACK AND YELLOW STRIPES SLOPED DOWNWARD AT AN ANGLE OF 45° TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS.
- ② FLARE THE END SECTION AWAY FROM TRAFFIC AT A RATE OF 50:1 FOR 15.24 m (ILLUSTRATED). FLARES OF 50:1 FOR 30.48 m MAY ALSO BE USED. THE FLARE MAY BE OMITTED ON ROADS WITH SHOULDERS GREATER THAN 0.6 m IN WIDTH.
- ③ OBTAIN ENGINEERS APPROVAL OF MANUFACTURER INSTALLATION OPTIONS WHEN SITE CONDITIONS PREVENT THE USE OF THE OPTION SHOWN ON THIS DETAIL.
- ④ SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-55A
OPTIONAL BOX BEAM TERMINAL SECTION - WY-BET	
EFFECTIVE: FEBRUARY 2005	
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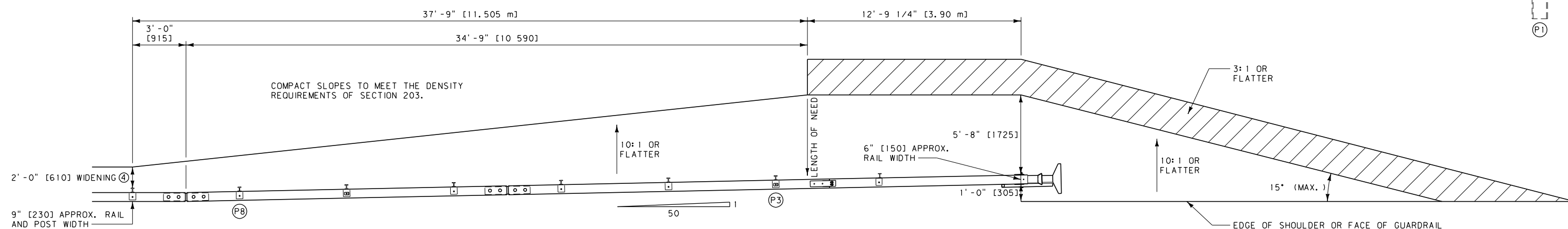
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.



PLAN



ELEVATION



GUARDRAIL WIDENING

NOTES:

- ① PLACE A SELF-ADHESIVE OBJECT MARKER ON THE FACE OF THE NOSE ASSEMBLY, HAVING ALTERNATING RETRO-REFLECTIVE BLACK AND YELLOW STRIPES SLOPED DOWNWARD AT AN ANGLE OF 45° TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS.
- ② FLARE THE END SECTION AWAY FROM TRAFFIC AT A RATE OF 50:1 FOR 50 FEET [15.24 m] (ILLUSTRATED). FLARES OF 50:1 FOR 100 FEET [30.48 m] MAY ALSO BE USED. THE FLARE MAY BE OMITTED ON ROADS WITH SHOULDERS GREATER THAN 2 FEET [0.6 m] IN WIDTH.

- ③ OBTAIN PROJECT MANAGER'S APPROVAL OF MANUFACTURER INSTALLATION OPTIONS WHEN SITE CONDITIONS PREVENT THE USE OF THE OPTION SHOWN ON THIS DETAIL.
- ④ SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.

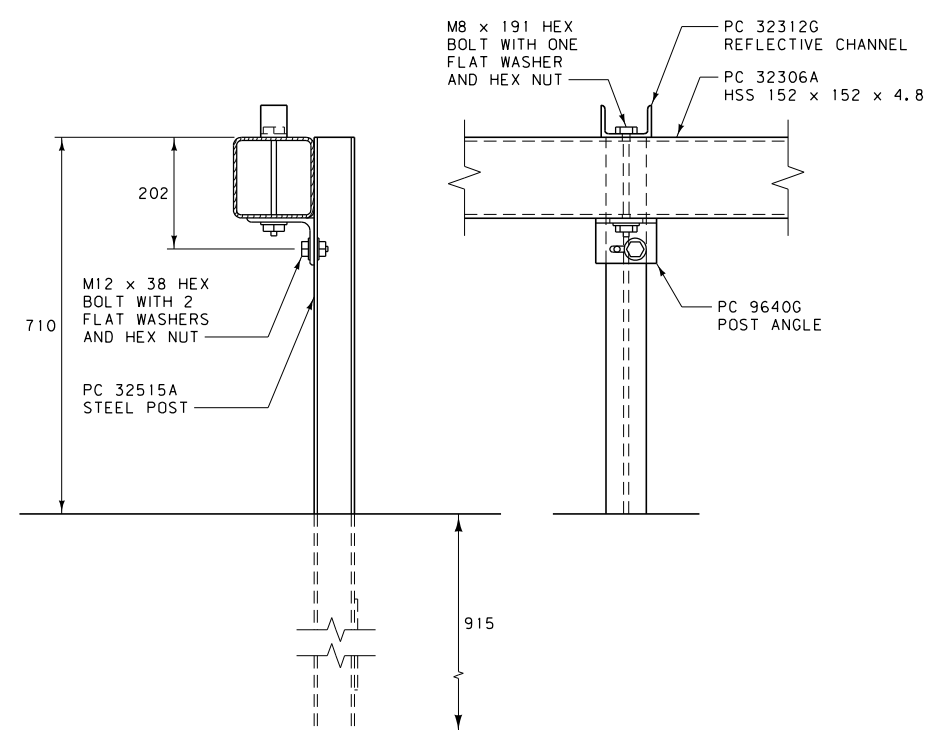
UNITS SHOWN IN BRACKETS [] ARE
METRIC AND ARE IN MILLIMETERS (mm)
UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-55B
SECTION 606	
OPTIONAL BOX BEAM TERMINAL SECTION - BEAT	

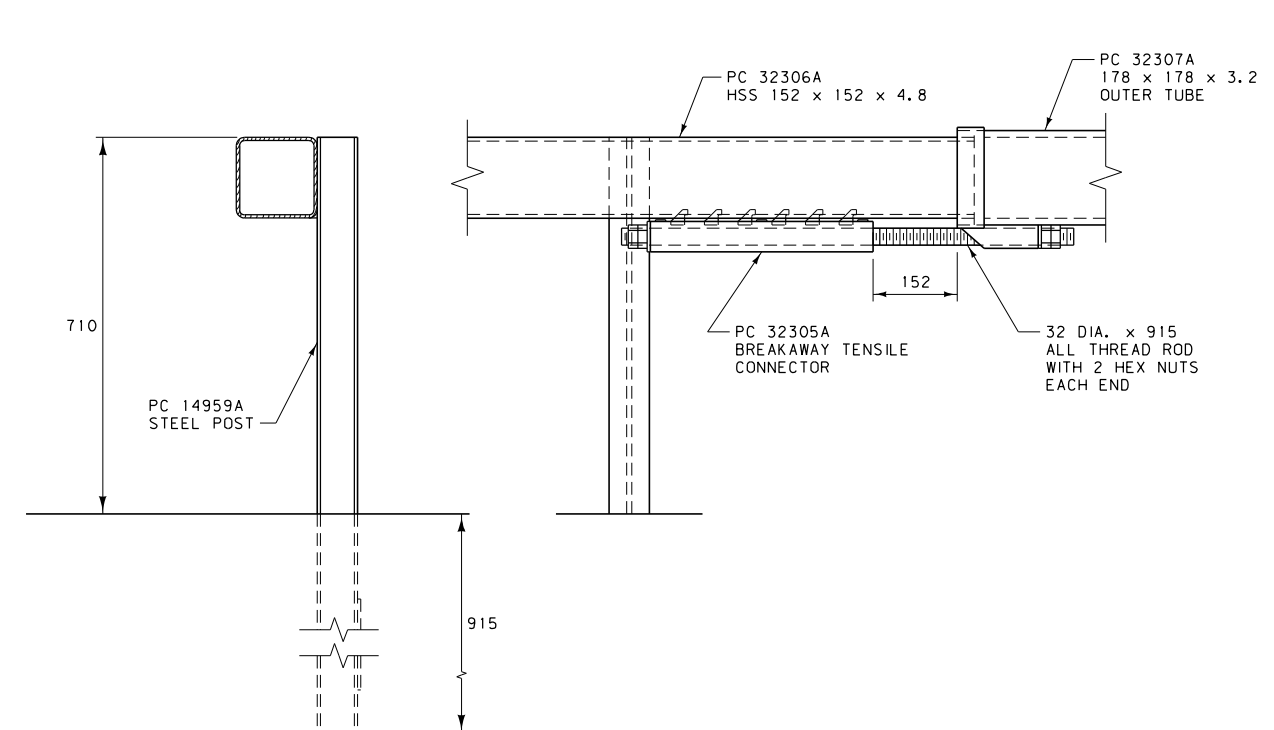
--REVISED--
MAY 2011

EFFECTIVE: FEBRUARY 2005

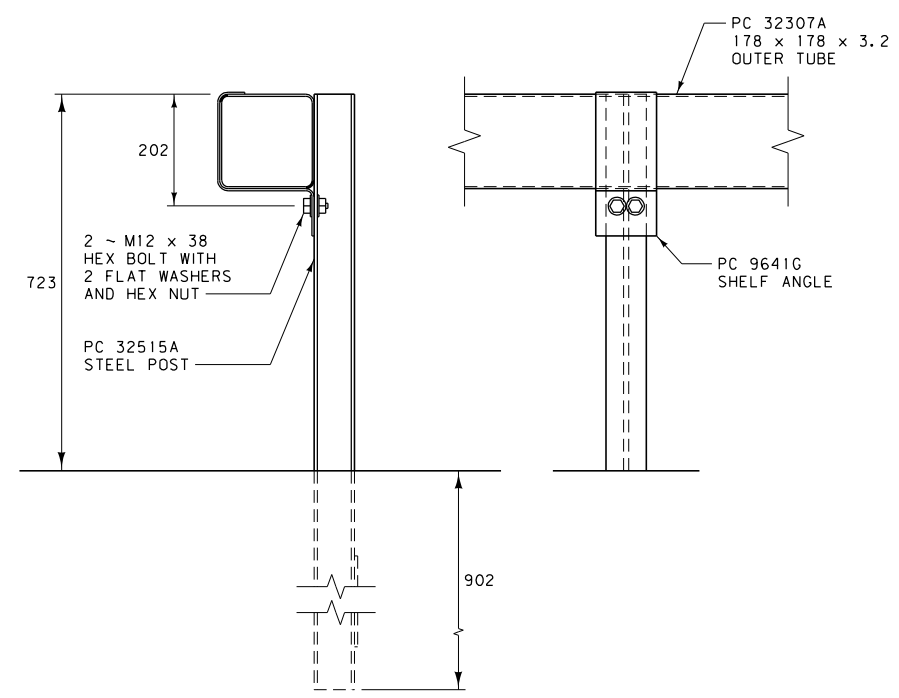
MDT MONTANA DEPARTMENT
OF TRANSPORTATION



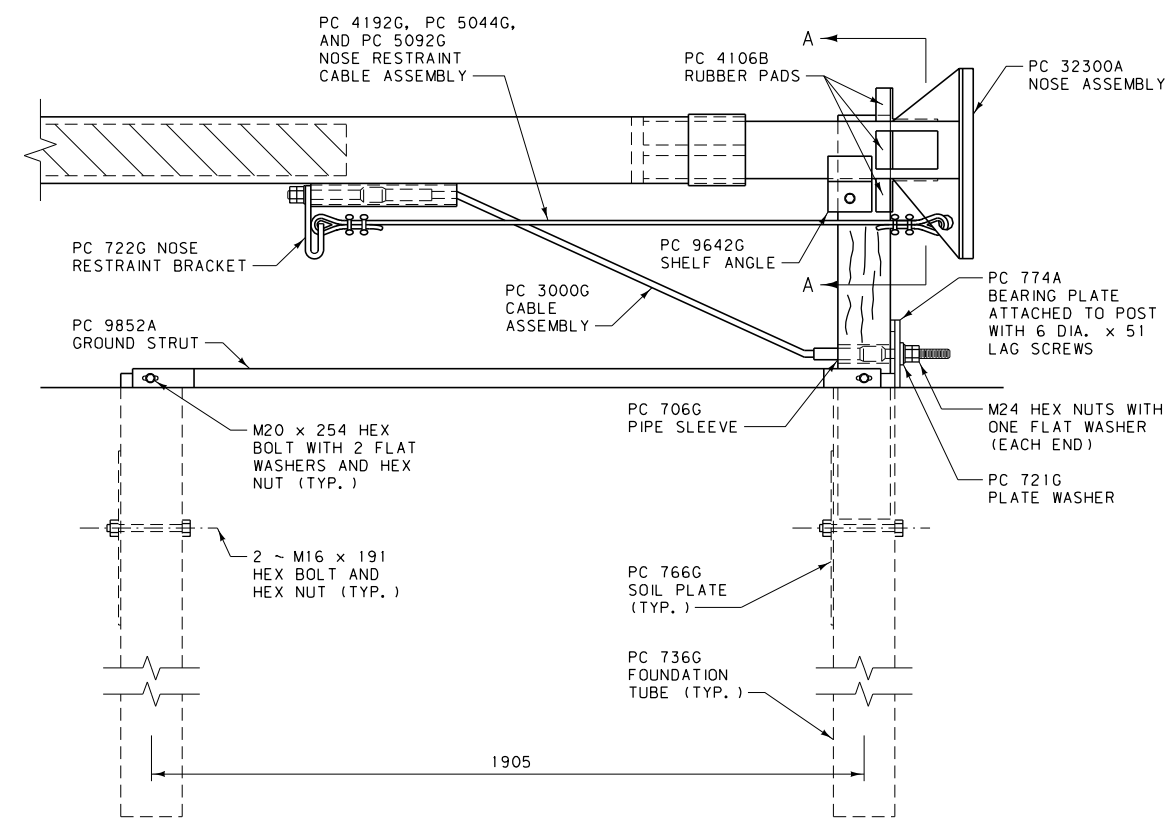
POST ATTACHMENT DETAIL
(TYP. AT POSTS P6, P7 AND P8)



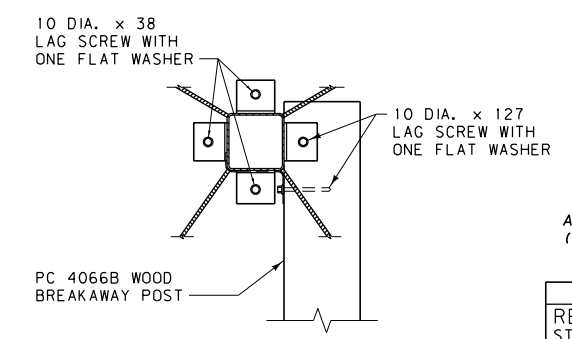
POST ATTACHMENT DETAIL
(POST P5)



POST ATTACHMENT DETAIL
(TYP. AT POSTS P2, P3 AND P4)




END ANCHORAGE ASSEMBLY

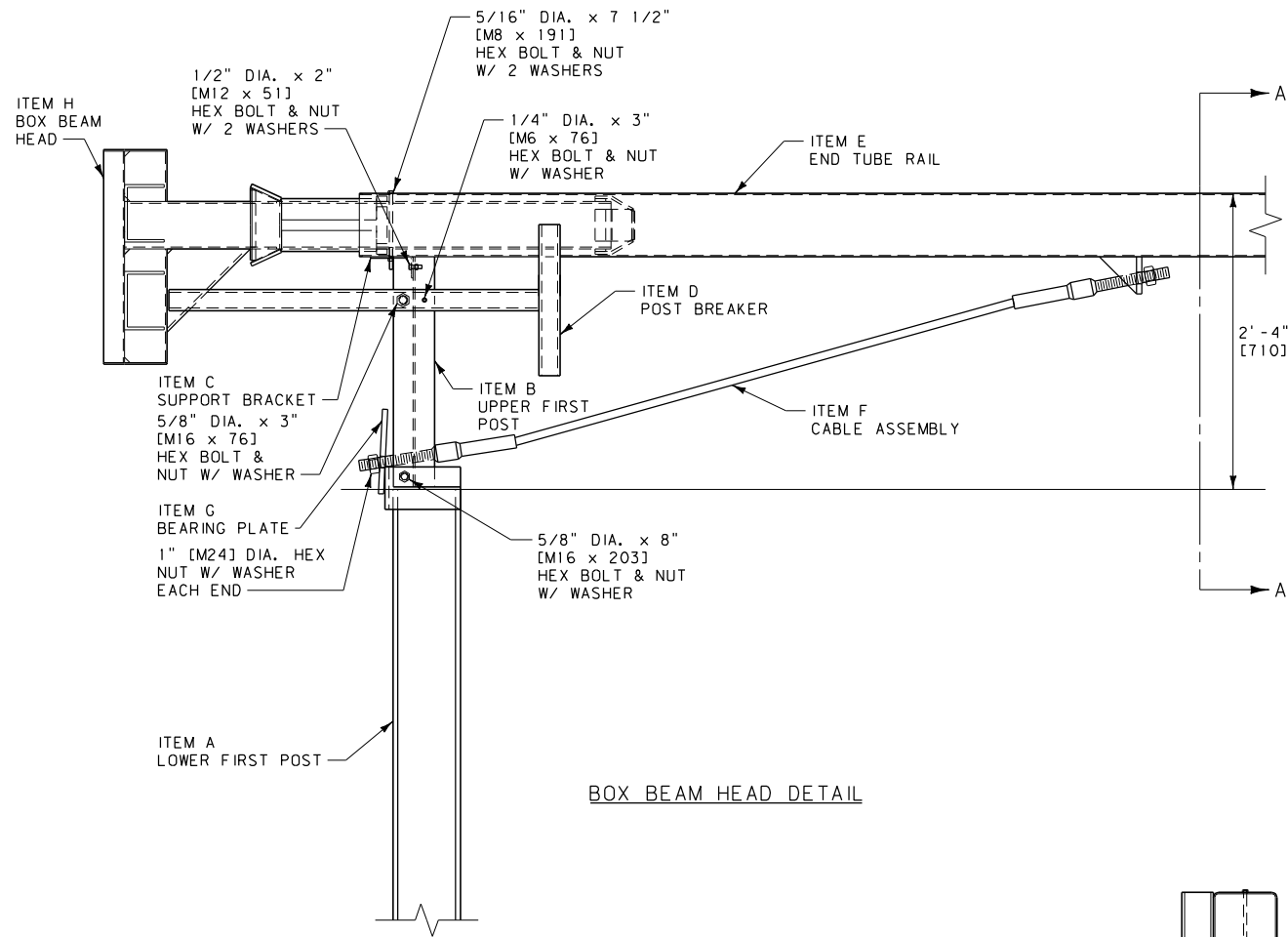


SECTION A-A

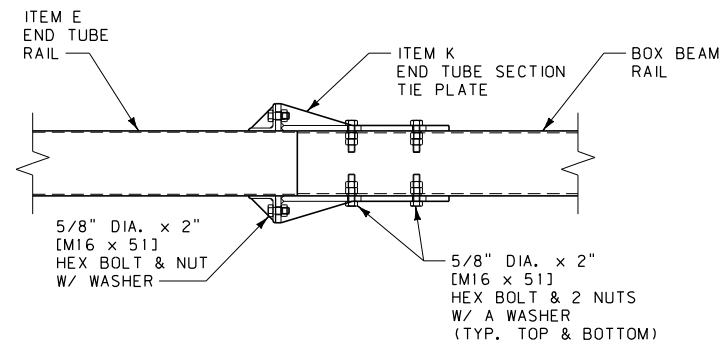
BILL OF MATERIAL		
PC	QTY	DESCRIPTION
706G	1	PIPE SLEEVE, 50 DIA. x 150
721G	1	PLATE WASHER, 75 x 100 x 10
722G	1	NOSE RESTRAINT CABLE BRACKET
736G	2	STEEL TUBE, 152 x 203 x 1525
766G	2	SOIL PLATE, 460 x 610 x 6
774A	1	SLOTTED BEARING PLATE
3000G	1	CABLE ASSEMBLY
3148G	2	6 DIA. x 51 LAG SCREW
3240G	3	M8 ROUND WASHER
3245G	3	M8 HEX NUT
3254G	3	10 DIA. x 38 LAG SCREW
3255G	5	M10 ROUND WASHER
3264G	2	10 DIA. x 127 LAG SCREW
3350G	4	M16 HEX NUT
3478G	4	M16 x 191 HEX BOLT
3700G	4	M20 ROUND WASHER
3710G	2	M20 HEX NUT
4044G	4	32 DIA. HEX NUT
4066B	1	WOOD POST, 150 x 200 x 1080
4106B	3	RUBBER PAD, 38.1 x 88.9 x 101.6
4192G	4	6.4 mm CABLE CLAMP
4300G	18	M12 ROUND WASHER
4303G	9	M12 HEX NUT
4308G	9	M12 x 38 HEX BOLT
4719G	2	M20 x 254 HEX BOLT
4902G	2	M24 ROUND WASHER
4903G	4	M24 HEX NUT
5044G	1	AIRCRAFT CABLE, 6.4 DIA. x 2080
5092G	2	6.4 mm AIRCRAFT CABLE THIMBLE
5188G	3	M8 x 191 HEX BOLT
5423G	1	32 DIA. x 915 ALL THREAD ROD
9640G	3	POST ANGLE, 127 x 89 x 9.5 x 115
9641G	3	SHELF ANGLE, 115 x 3.2 x 486
9642G	1	SHELF ANGLE, 115 x 3.2 x 283
9852A	1	STRUT AND YOKE ASSEMBLY
14959A	1	1625 mm STEEL POST
32300A	1	WY-BET NOSE ASSEMBLY
32301A	1	HSS 152 x 152 x 250 INTERMEDIATE SPACER
32305A	1	BREAKAWAY TENSILE CONNECTOR
32306A	1	HSS 152 x 152 x 4.8 TELESOPING SECTION
32307A	1	OUTER TUBE
32309B	1	152.4 O.D. x 6.4 x 3860 COMPOSITE TUBE
32310B	1	152.4 O.D. x 3.2 x 1830 COMPOSITE TUBE
32312G	3	REFLECTOR CHANNEL
32515A	6	1625 mm STEEL POST

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

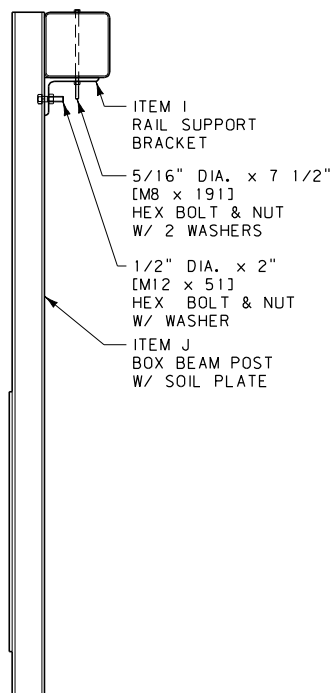
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-56A
WY-BET BOX BEAM TERMINAL SECTION DETAILS	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION	



BOX BEAM HEAD DETAIL



FIRST RAIL TIE DETAIL



SECTION "A-A"

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	METRIC DESCRIPTION
A	1	LOWER FIRST POST, W6x15, 8'-0" LG.	LOWER FIRST POST, W152 x 22.3 kg/m, 2440 LG.
B	1	UPPER FIRST POST, W6x9, 1'-9 1/2" LG.	UPPER FIRST POST, W152 x 13.4 kg/m, 546 LG.
C	1	SUPPORT BRACKET, 10 GAGE BENT PLATE	SUPPORT BRACKET, 10 GA. (3.5 THK.) BENT PLATE
D	1	POST BREAKER	POST BREAKER
E	1	END TUBE RAIL, TS 6" x 6" x 1/8" x 12'-0"	END TUBE RAIL, TS 152 x 152 x 3.2 x 3660
F	1	CABLE ASSEMBLY	CABLE ASSEMBLY
G	1	BEARING PLATE	BEARING PLATE
H	1	BOX BEAM HEAD	BOX BEAM HEAD
I	1	RAIL SUPPORT BRACKET, L 5" x 3 1/2" x 3/8" x 4 1/2"	RAIL SUPPORT BRACKET, L 127 x 89 x 9.5 x 115
J	1	BOX BEAM POST W/ SOIL PLATE	BOX BEAM POST W/ SOIL PLATE
K	2	END TUBE SECTION TIE PLATE	END TUBE SECTION TIE PLATE
a	2	5/16" DIA. x 7 1/2" HEX BOLT (GRADE 5)	M8 x 191 HEX BOLT (GRADE 5)
b	1	1/4" DIA. x 3" HEX BOLT (GRADE 2)	M6 x 76 HEX BOLT (GRADE 2)
c	2	1/2" DIA. x 2" HEX BOLT (GRADE 2)	M12 x 51 HEX BOLT (GRADE 2)
d	8	5/8" DIA. x 2" HEX BOLT (GRADE 5)	M16 x 51 HEX BOLT (GRADE 5)
e	1	5/8" DIA. x 8" HEX BOLT (GRADE 5)	M16 x 203 HEX BOLT (GRADE 5)
f	1	5/8" DIA. x 3" HEX BOLT (GRADE 5)	M16 x 76 HEX BOLT (GRADE 5)
g	2	5/16" DIA. HEX NUT	M8 HEX NUT
h	1	1/4" DIA. HEX NUT	M6 HEX NUT
j	2	1/2" DIA. HEX NUT	M12 HEX NUT
k	14	5/8" DIA. HEX NUT	M16 HEX NUT
n	2	1" DIA. ANCHOR CABLE HEX NUT	M24 ANCHOR CABLE HEX NUT
p	4	5/16" DIA. WASHER	M8 WASHER
q	1	1/4" DIA. WASHER	M6 WASHER
r	3	1/2" DIA. WASHER	M12 WASHER
s	10	5/8" DIA. WASHER	M16 WASHER
u	2	1" DIA. ANCHOR CABLE WASHER	M24 ANCHOR CABLE WASHER

NOTES:

- ① BEAT TERMINAL SECTION TO INCLUDE 36'-0" [10.98 m] OF BOX BEAM GUARDRAIL AS SHOWN ON DTL. DWG. NO. 606-55B.
- ② PLACE POST BREAKER ON TRAFFIC SIDE OF FIRST POST.

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

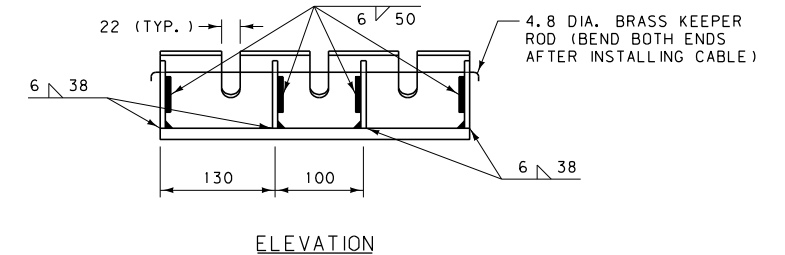
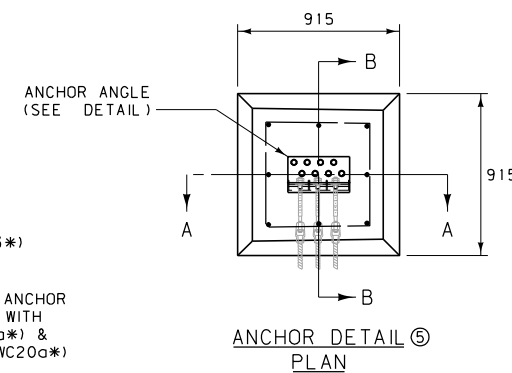
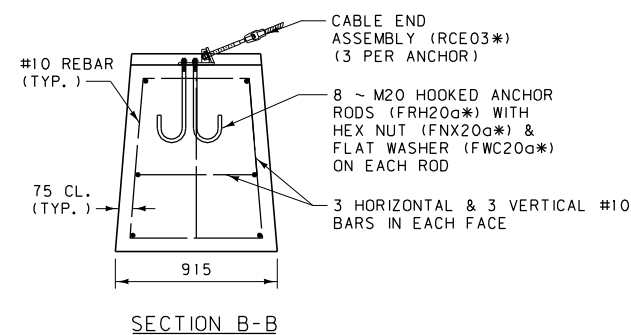
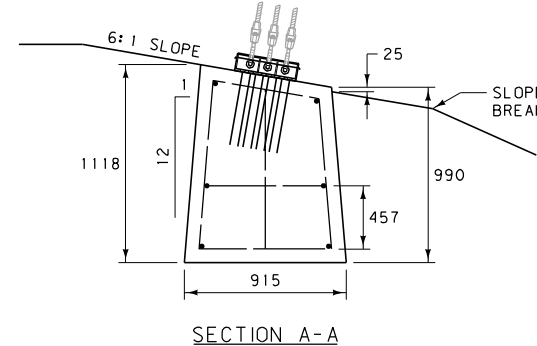
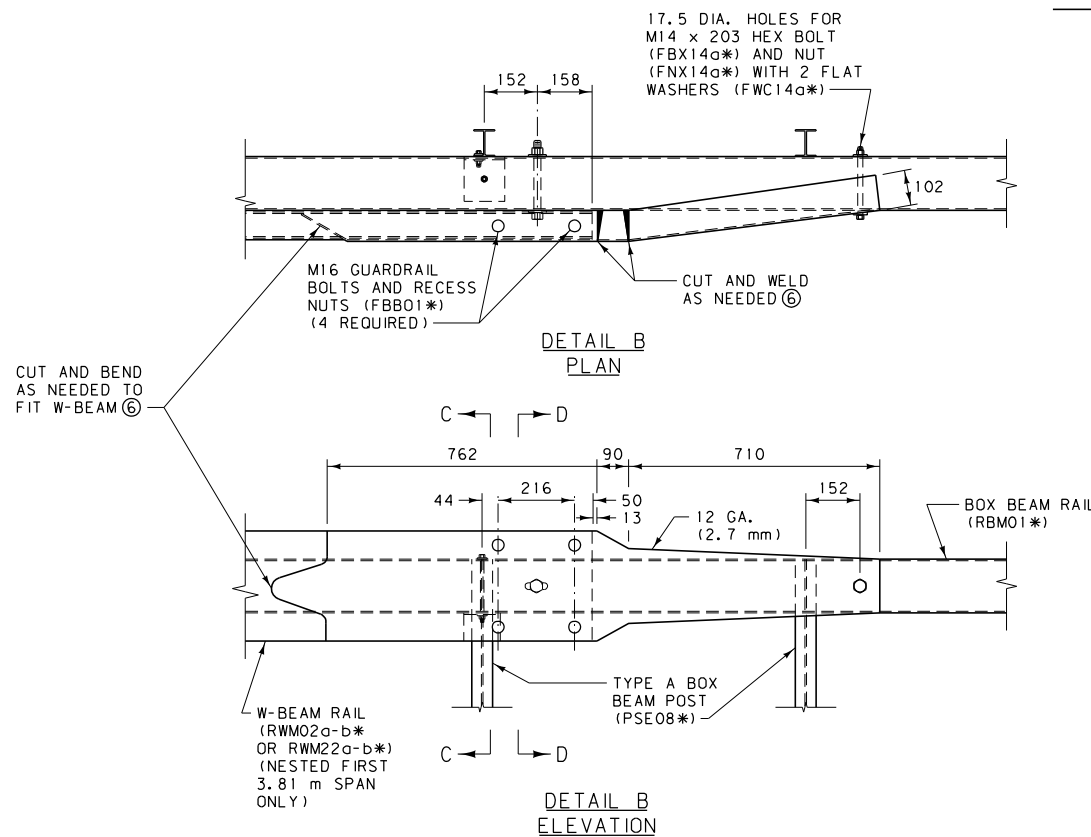
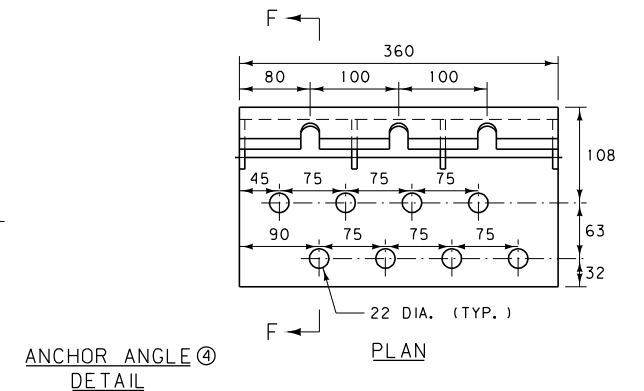
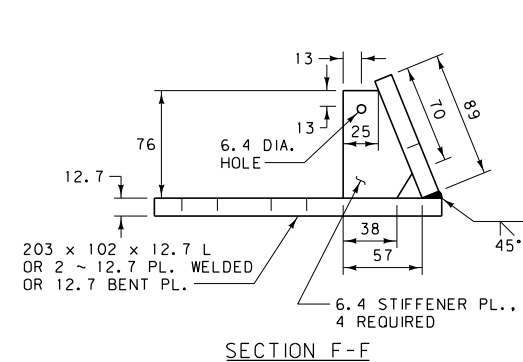
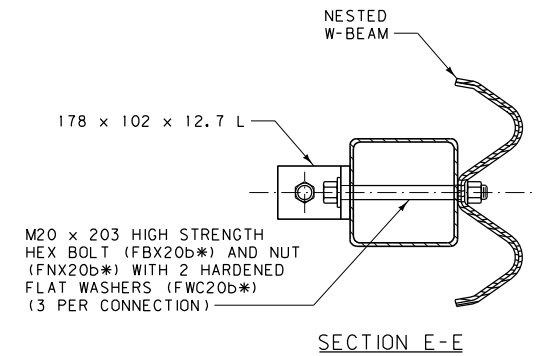
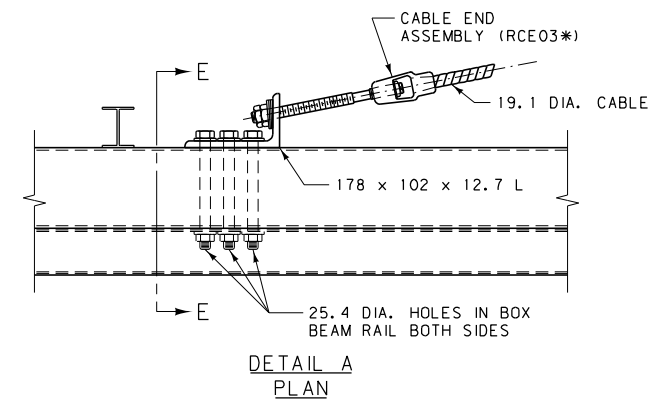
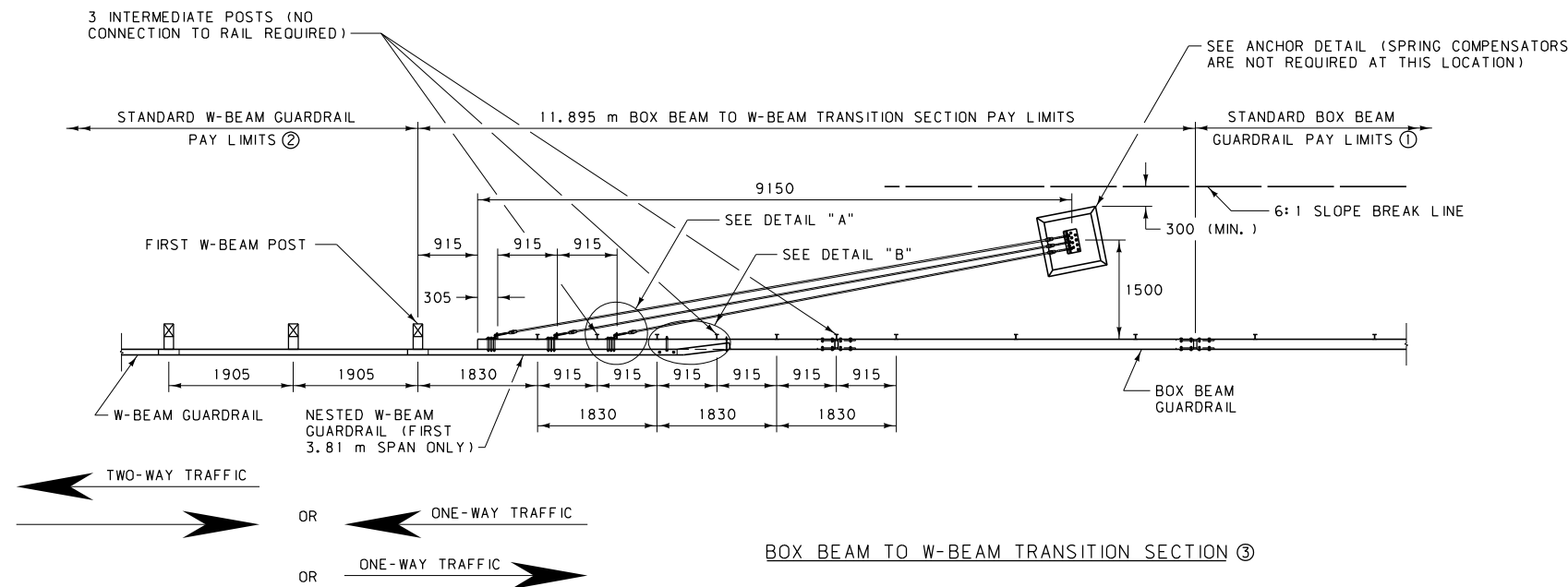
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-56B
SECTION 606	

BEAT
BOX BEAM TERMINAL
SECTION DETAILS

EFFECTIVE: FEBRUARY 2005

MDT MONTANA DEPARTMENT OF TRANSPORTATION

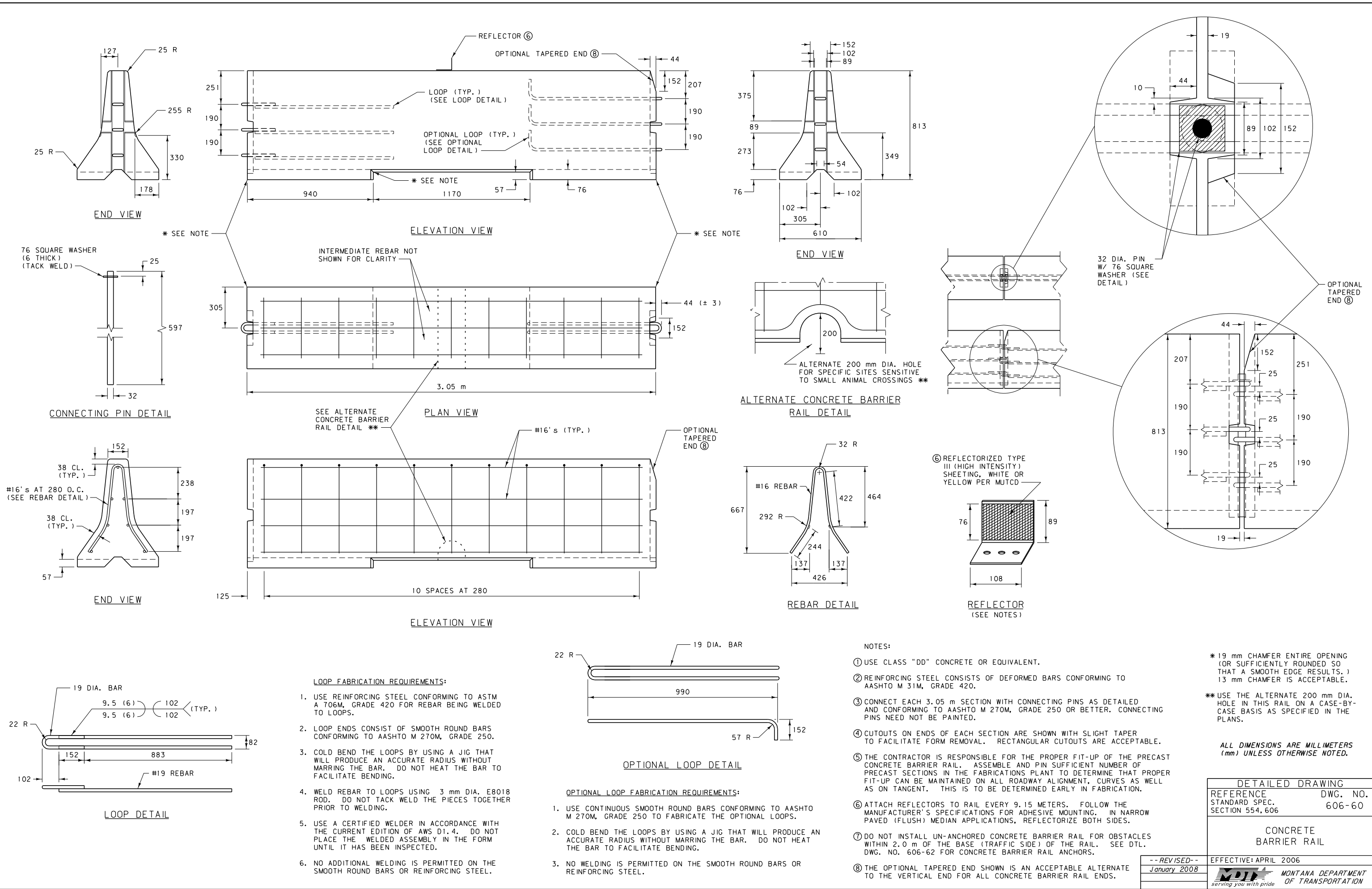
--REVISED--
MAY 2011



- NOTES:
- SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.
 - SEE DTL. DWG. NO. 606-05A AND 606-05B FOR STANDARD W-BEAM GUARDRAIL AND ASSOCIATED DETAILS.
 - MANUFACTURE ANCHOR ANGLES USING AASHTO M 270M GRADE 250 STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.
 - GALVANIZE ANCHOR ANGLES IN ACCORDANCE WITH AASHTO M 111M. NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.
 - USE CLASS "DD" CONCRETE TO CONSTRUCT ANCHOR.
 - ANY HOLES, CUTS, SLOTS OR WELDS MADE ON THE W-BEAM OR BOX BEAM RAIL AFTER GALVANIZING IS TO BE PAINTED WITH AN APPROVED GALVANIZING PAINT.
 - LAP ALL W-BEAM SPLICES IN THE DIRECTION OF ADJACENT TRAFFIC.
- *SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-58
SECTION 606	
BOX BEAM TO W-BEAM TRANSITION SECTION	



LOOP FABRICATION REQUIREMENTS:

1. USE REINFORCING STEEL CONFORMING TO ASTM A 706M, GRADE 420 FOR REBAR BEING WELDED TO LOOPS.
2. LOOP ENDS CONSIST OF SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250.
3. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
4. WELD REBAR TO LOOPS USING 3 mm DIA. E8018 ROD. DO NOT TACK WELD THE PIECES TOGETHER PRIOR TO WELDING.
5. USE A CERTIFIED WELDER IN ACCORDANCE WITH THE CURRENT EDITION OF AWS D1.4. DO NOT PLACE THE WELDED ASSEMBLY IN THE FORM UNTIL IT HAS BEEN INSPECTED.
6. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

OPTIONAL LOOP FABRICATION REQUIREMENTS:

1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250 TO FABRICATE THE OPTIONAL LOOPS.
2. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
3. NO WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.


NOTES:

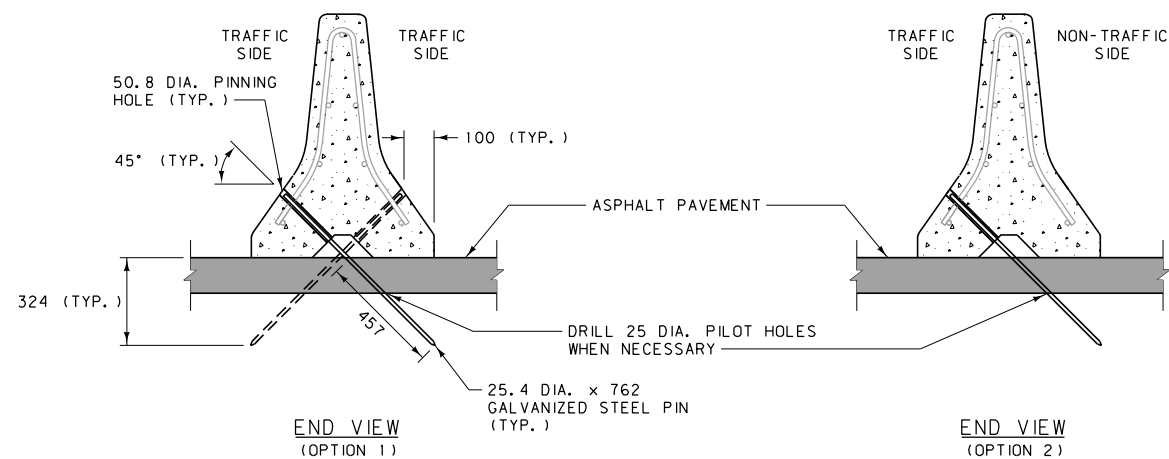
- ① USE CLASS "DD" CONCRETE OR EQUIVALENT.
- ② REINFORCING STEEL CONSISTS OF DEFORMED BARS CONFORMING TO AASHTO M 31M, GRADE 420.
- ③ CONNECT EACH 3.05 m SECTION WITH CONNECTING PINS AS DETAILED AND CONFORMING TO AASHTO M 270M, GRADE 250 OR BETTER. CONNECTING PINS NEED NOT BE PAINTED.
- ④ CUTOUTS ON ENDS OF EACH SECTION ARE SHOWN WITH SLIGHT TAPER TO FACILITATE FORM REMOVAL. RECTANGULAR CUTOUTS ARE ACCEPTABLE.
- ⑤ THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER FIT-UP OF THE PRECAST CONCRETE BARRIER RAIL. ASSEMBLE AND PIN SUFFICIENT NUMBER OF PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER FIT-UP CAN BE MAINTAINED ON ALL ROADWAY ALIGNMENT, CURVES AS WELL AS ON TANGENT. THIS IS TO BE DETERMINED EARLY IN FABRICATION.
- ⑥ ATTACH REFLECTORS TO RAIL EVERY 9.15 METERS. FOLLOW THE MANUFACTURER'S SPECIFICATIONS FOR ADHESIVE MOUNTING. IN NARROW PAVED (FLUSH) MEDIAN APPLICATIONS, REFLECTORIZE BOTH SIDES.
- ⑦ DO NOT INSTALL UN-ANCHORED CONCRETE BARRIER RAIL FOR OBSTACLES WITHIN 2.0 m OF THE BASE (TRAFFIC SIDE) OF THE RAIL. SEE DTL. DWG. NO. 606-62 FOR CONCRETE BARRIER RAIL ANCHORS.
- ⑧ THE OPTIONAL TAPERED END SHOWN IS AN ACCEPTABLE ALTERNATE TO THE VERTICAL END FOR ALL CONCRETE BARRIER RAIL ENDS.

* 19 mm CHAMFER ENTIRE OPENING (OR SUFFICIENTLY ROUNDED SO THAT A SMOOTH EDGE RESULTS.) 13 mm CHAMFER IS ACCEPTABLE.

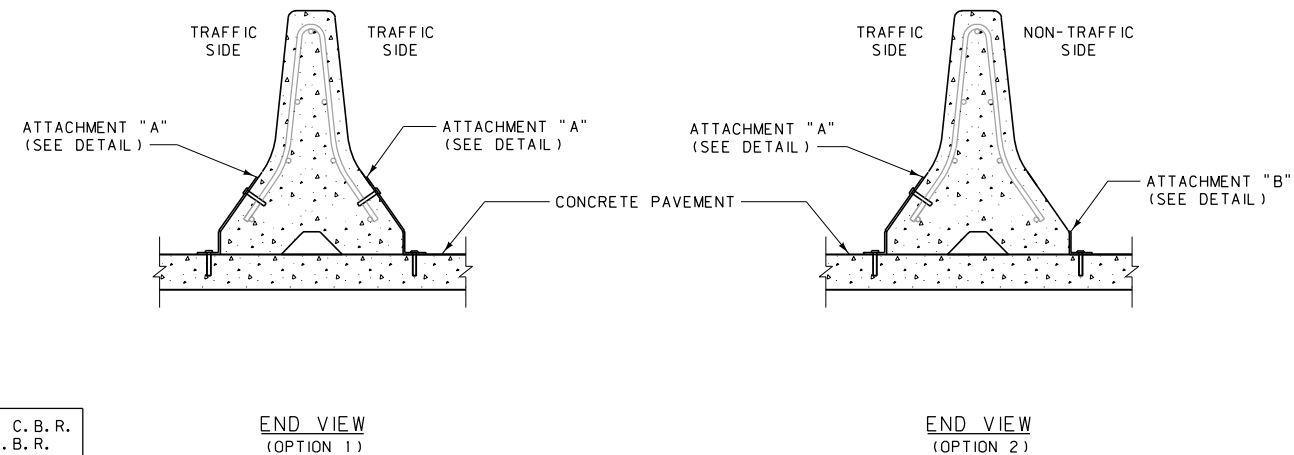
** USE THE ALTERNATE 200 mm DIA. HOLE IN THIS RAIL ON A CASE-BY-CASE BASIS AS SPECIFIED IN THE PLANS.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

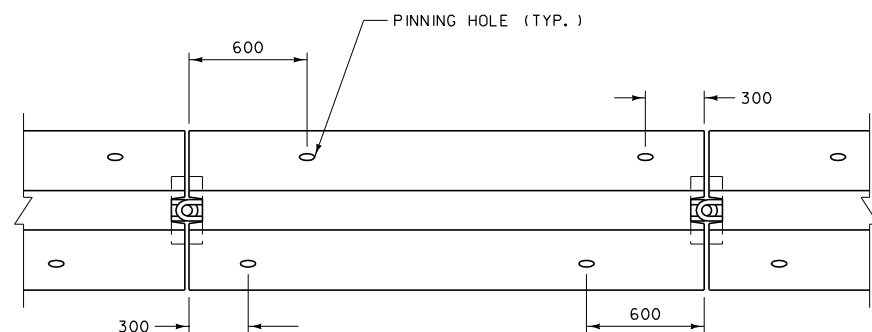
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 554, 606	DWG. NO. 606-60
CONCRETE BARRIER RAIL	
EFFECTIVE: APRIL 2006	
-- REVISED -- January 2008	 MONTANA DEPARTMENT OF TRANSPORTATION



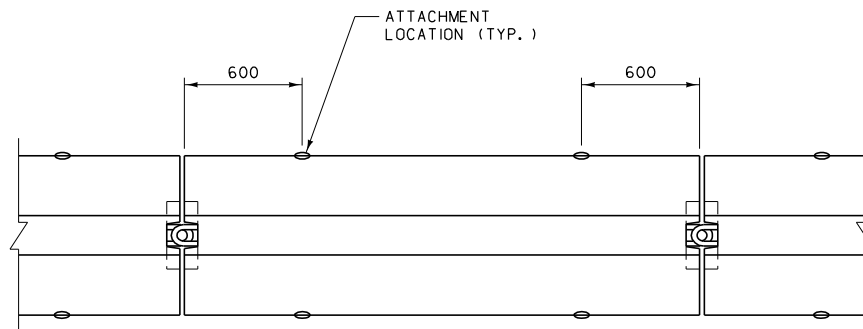
OPTION 1 = TRAFFIC ON BOTH SIDES OF C.B.R.
OPTION 2 = TRAFFIC ON ONE SIDE OF C.B.R.



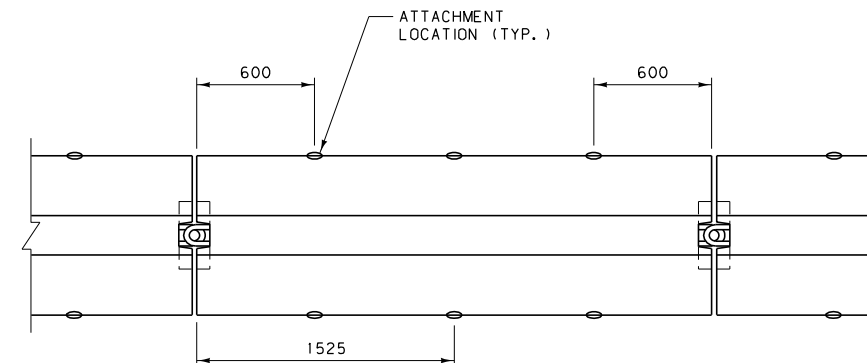
TYPE 1 ANCHOR
(FOR TEMPORARY OR PERMANENT CONCRETE BARRIER RAIL INSTALLATIONS ON ASPHALT PAVEMENT)



TYPE 1 ANCHOR
PLAN VIEW



TYPE 2 ANCHOR
PLAN VIEW




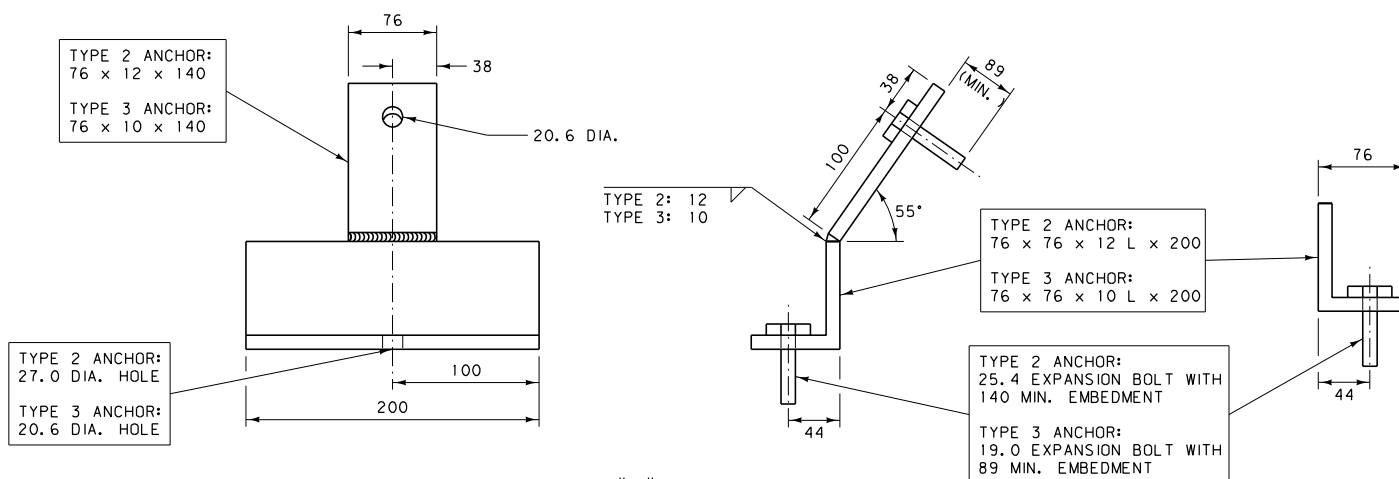
TYPE 3 ANCHOR
PLAN VIEW

NOTES:

- USE THESE ANCHORS WITH STANDARD CONCRETE BARRIER RAIL (C.B.R.), AS SHOWN IN DTL. DWG. NO. 606-60, WHEN DEFLECTION OF THE SYSTEM NEEDS TO BE LIMITED.
- CAST THE PINNING HOLES INTO THE C.B.R. USING 50.8 I.D. STEEL PIPE. DO NOT DRILL THE PINNING HOLES.
- USE STEEL CONFORMING TO AASHTO M270M, GRADE 250 OR BETTER FOR PINS AND ATTACHMENT ANGLES. GALVANIZE IN ACCORDANCE WITH AASHTO M111M.
- USE TYPE 2 ANCHORS WHEN A DEEPER EMBEDMENT (140 mm) INTO THE BRIDGE DECK OR CONCRETE PAVEMENT IS PERMISSIBLE.
- ADJUST THE LOCATION OF THE TYPE 2 OR TYPE 3 ANCHORS TO AVOID THE MAIN REINFORCING WHEN PLACED ON BRIDGE DECKS.
- USE SHIMS TO PROPERLY FIT THE TYPE 2 OR TYPE 3 ANCHORS TO THE BARRIER AND ROADWAY SURFACES.
- AFTER REMOVING TYPE 2 OR TYPE 3 ANCHORS, CLEAN THE HOLES IN THE CONCRETE PAVEMENT AND FILL WITH AN APPROVED NON-SHRINK OR EPOXY GROUT.
- REMOVE TYPE 1 ANCHORS BY FIRST DRIVING THE STEEL PINS DOWN THROUGH THE BARRIER TO ALLOW LIFTING OF THE BARRIER WITHOUT INTERFERENCE. THEN REMOVE THE PINS FROM THE PAVEMENT AND FILL THE PINNING HOLES WITH AN APPROVED SEALANT.
- DO NOT INSTALL ANCHORED CONCRETE BARRIER RAIL FOR OBSTACLES WITHIN 1.1 m OF THE BASE (TRAFFIC SIDE) OF THE RAIL.

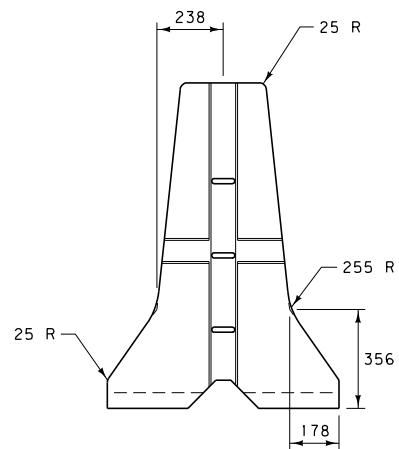
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-62
SECTION 554,606	
CONCRETE BARRIER RAIL ANCHORS	
EFFECTIVE: APRIL 2006	
	MONTANA DEPARTMENT OF TRANSPORTATION

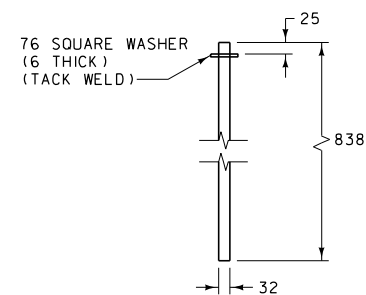


ATTACHMENT "A" DETAIL

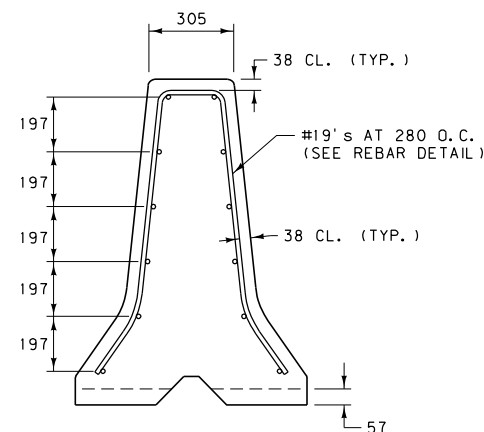
ATTACHMENT "B" DETAIL



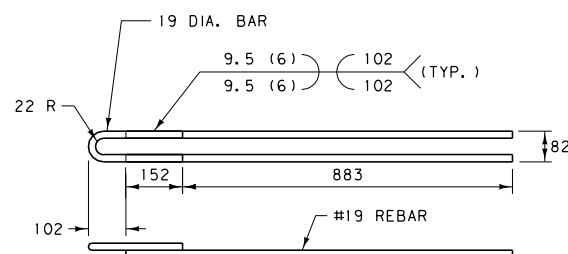
END VIEW



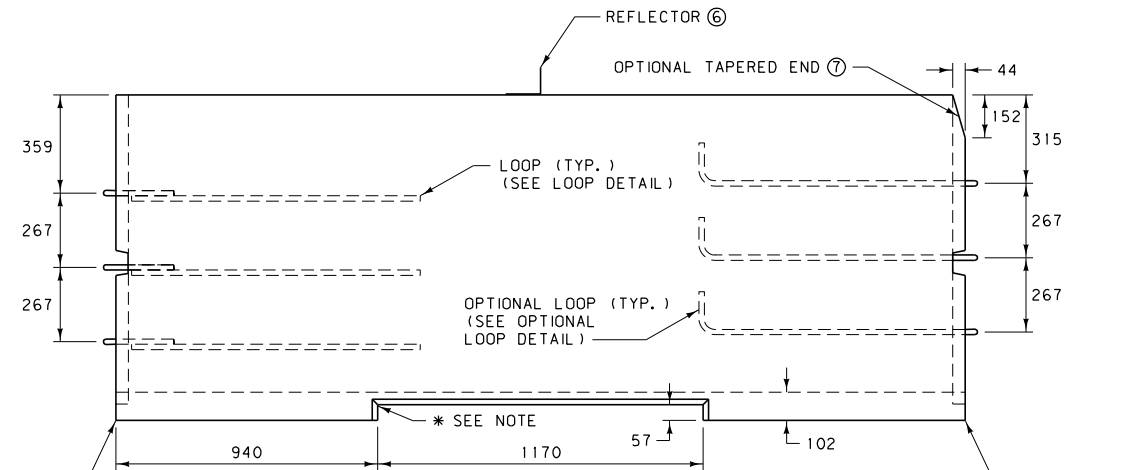
CONNECTING PIN DETAIL



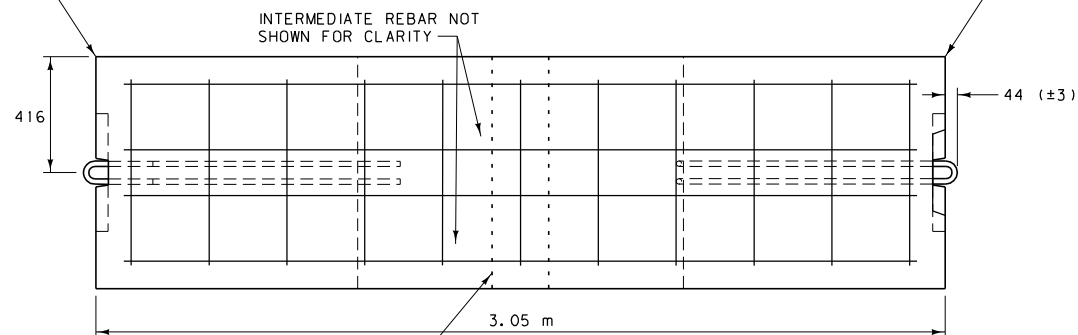
END VIEW



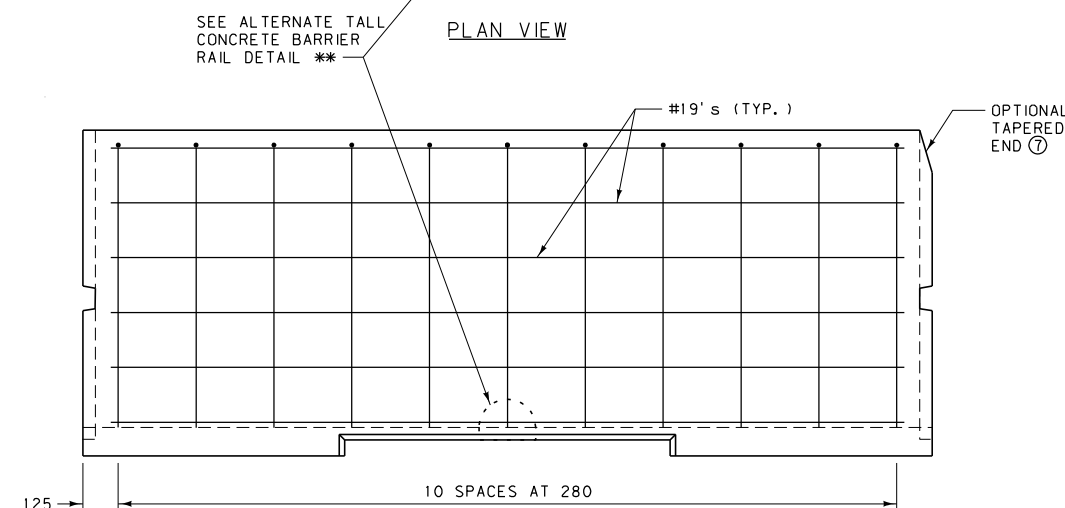
LOOP DETAIL



ELEVATION VIEW



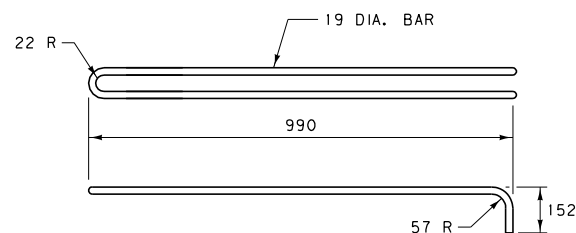
PLAN VIEW



ELEVATION VIEW

LOOP FABRICATION REQUIREMENTS:

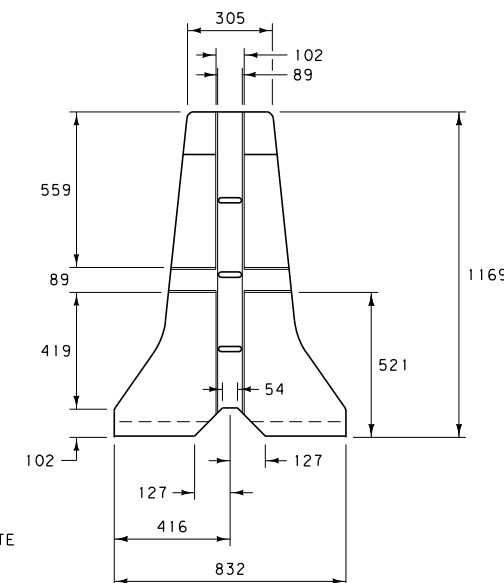
1. USE REINFORCING STEEL CONFORMING TO ASTM A 706M, GRADE 420 FOR REBAR BEING WELDED TO LOOPS.
2. LOOP ENDS CONSIST OF SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250.
3. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
4. WELD REBAR TO LOOPS USING 3 mm DIA. E8018 ROD. DO NOT TACK WELD THE PIECES TOGETHER PRIOR TO WELDING.
5. USE A CERTIFIED WELDER IN ACCORDANCE WITH THE CURRENT EDITION OF AWS D1.4. DO NOT PLACE THE WELDED ASSEMBLY IN THE FORM UNTIL IT HAS BEEN INSPECTED.
6. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.



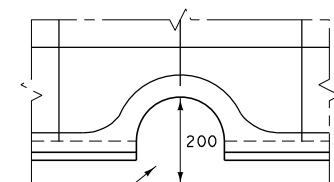
OPTIONAL LOOP DETAIL

OPTIONAL LOOP FABRICATION REQUIREMENTS:

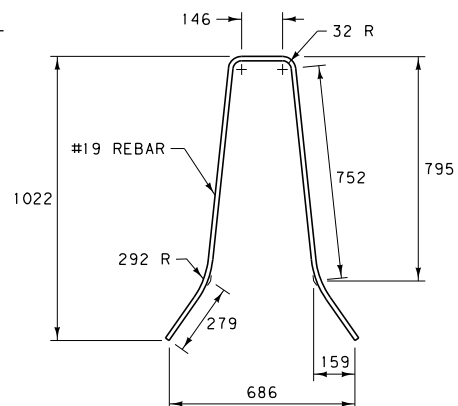
1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250 TO FABRICATE THE OPTIONAL LOOPS.
2. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
3. NO WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.



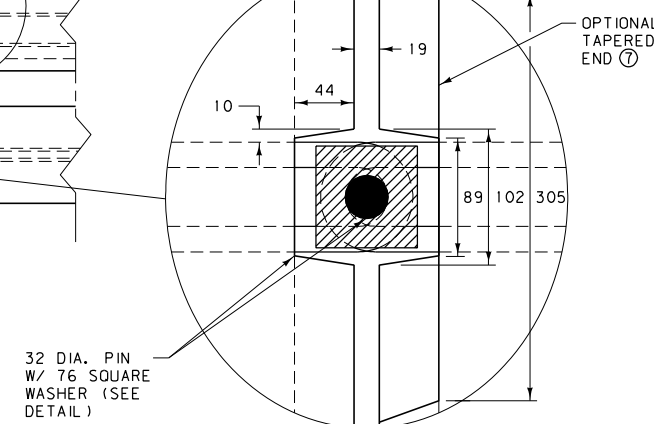
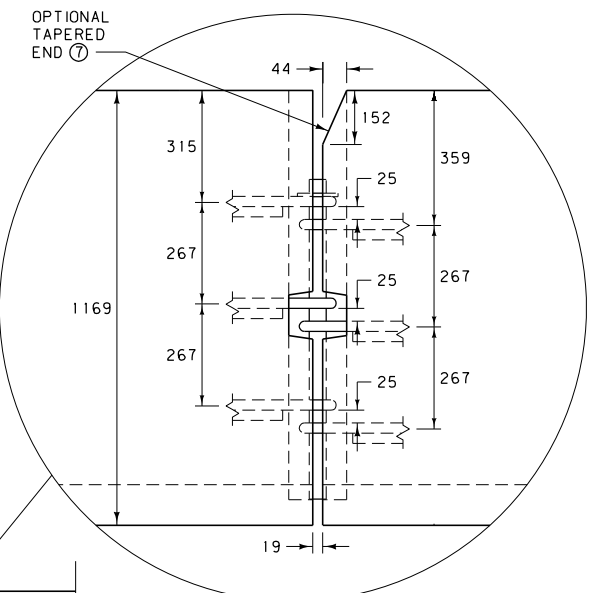
END VIEW



ALTERNATE TALL CONCRETE BARRIER RAIL DETAIL



REBAR DETAIL

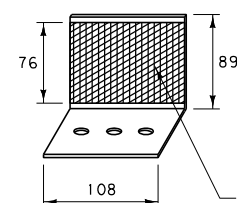


NOTES:

- ① USE CLASS "DD" CONCRETE OR EQUIVALENT.
- ② REINFORCING STEEL CONSISTS OF DEFORMED BARS CONFORMING TO AASHTO M 31M, GRADE 420.
- ③ CONNECT EACH 3.05 m SECTION WITH CONNECTING PINS AS DETAILED AND CONFORMING TO AASHTO M 270M, GRADE 250 OR BETTER. CONNECTING PINS NEED NOT BE PAINTED.
- ④ CUTOUTS ON ENDS OF EACH SECTION ARE SHOWN WITH SLIGHT TAPER TO FACILITATE FORM REMOVAL. RECTANGULAR CUTOUTS ARE ACCEPTABLE.
- ⑤ THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER FIT-UP OF THE PRECAST CONCRETE BARRIER RAIL. ASSEMBLE AND PIN SUFFICIENT NUMBER OF PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER FIT-UP CAN BE MAINTAINED ON ALL ROADWAY ALIGNMENT, CURVES AS WELL AS ON TANGENT. THIS IS TO BE DETERMINED EARLY IN FABRICATION.
- ⑥ ATTACH REFLECTORS TO RAIL EVERY 9.15 m. FOLLOW THE MANUFACTURER'S SPECIFICATIONS FOR ADHESIVE MOUNTING. IN NARROW PAVED (FLUSH) MEDIAN APPLICATIONS, REFLECTORIZE BOTH SIDES.
- ⑦ THE OPTIONAL TAPERED END SHOWN IS AN ACCEPTABLE ALTERNATE TO THE VERTICAL END FOR ALL CONCRETE BARRIER RAIL ENDS.

* 19 mm CHAMFER ENTIRE OPENING (OR SUFFICIENTLY ROUNDED SO THAT A SMOOTH EDGE RESULTS.) 13 mm CHAMFER IS ACCEPTABLE.


** USE THE ALTERNATE 200 mm DIA. HOLE IN THIS RAIL ON A CASE-BY-CASE BASIS AS SPECIFIED IN PLANS.

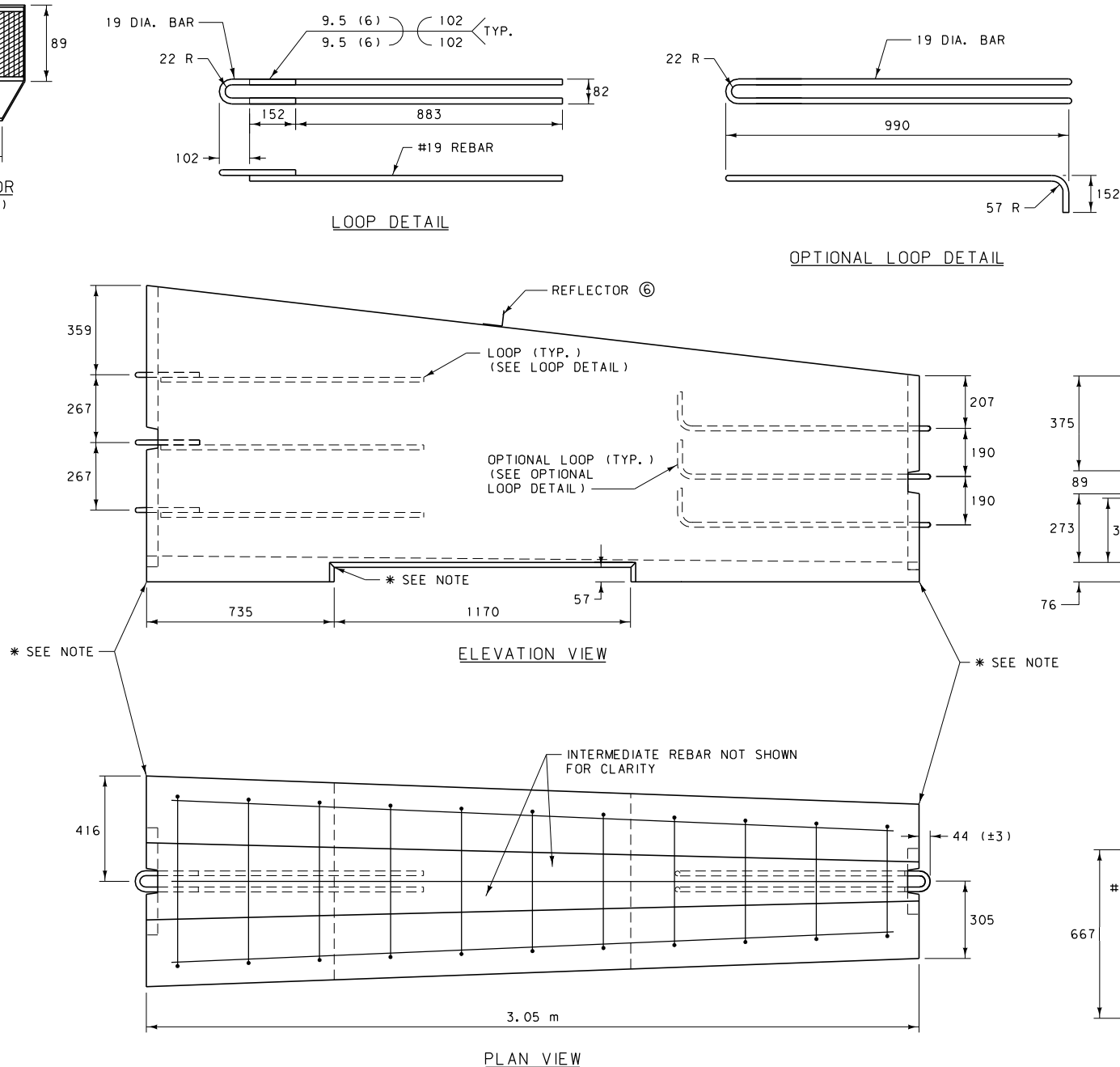
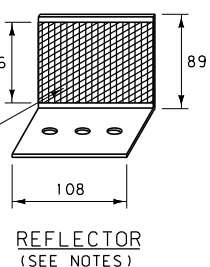
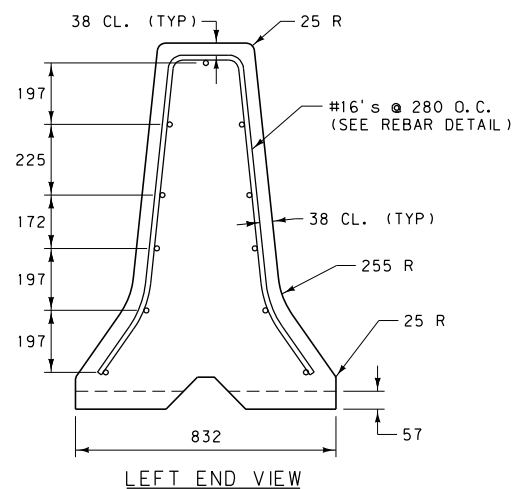
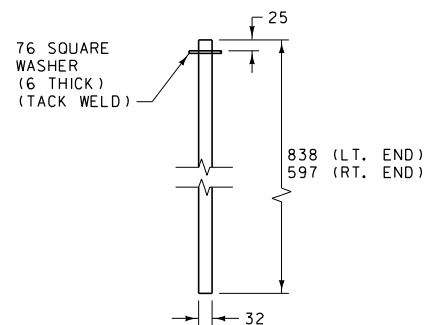
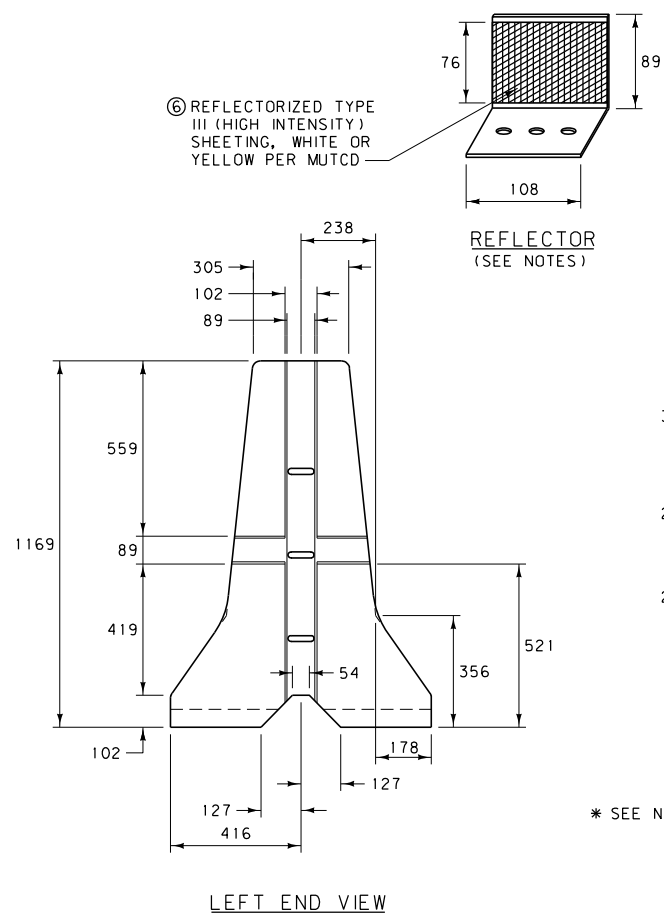


REFLECTOR (SEE NOTES)

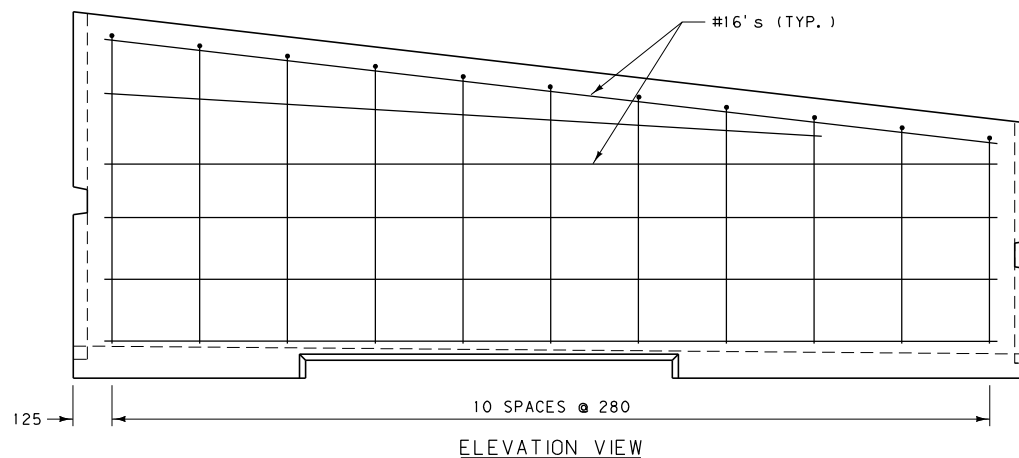
REFLECTORIZED TYPE III (HIGH INTENSITY) SHEETING, WHITE OR YELLOW PER MUTCD ⑥

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 554, 606	DWG. NO. 606-64
TALL CONCRETE BARRIER RAIL	
-- REVISED -- January 2008	EFFECTIVE: FEBRUARY 2005
 MONTANA DEPARTMENT OF TRANSPORTATION	



NOTE:
LEFT AND RIGHT REBAR DETAILS ARE FOR NORMAL TALL AND REGULAR CONCRETE BARRIER RAIL SECTIONS. TAPER REBAR HEIGHT AND WIDTH AS NEEDED BY MAINTAINING THE VERTICAL POSITION FROM THE BOTTOM AND THE 38 mm CLEARANCE AT ALL LOCATIONS.

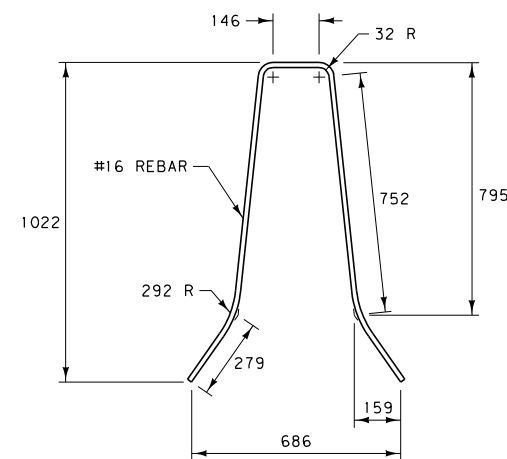
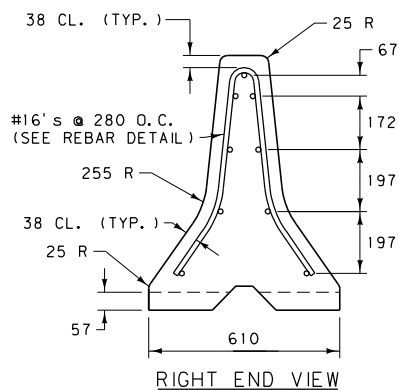
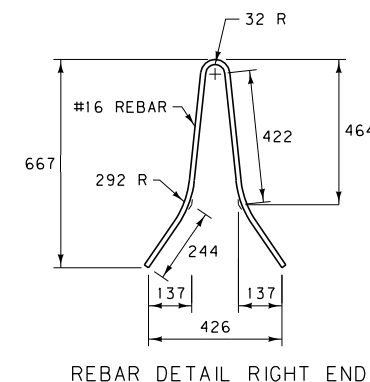
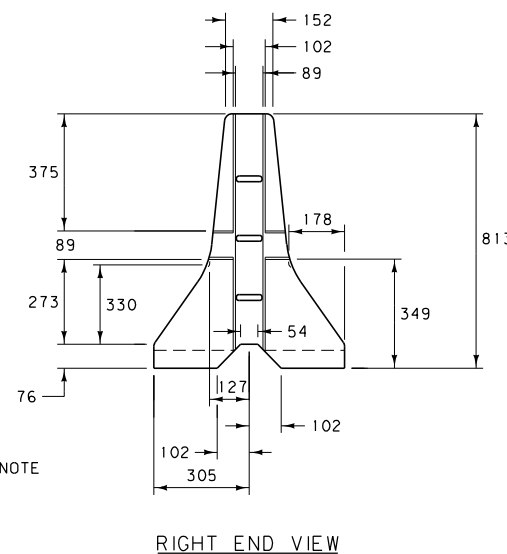


LOOP FABRICATION REQUIREMENTS:

1. USE REINFORCING STEEL CONFORMING TO ASTM A 706M, GRADE 420 FOR REBAR BEING WELDED TO LOOPS.
2. LOOP ENDS CONSIST OF SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250.
3. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
4. WELD REBAR TO LOOPS USING 3 mm DIA. E8018 ROD. DO NOT TACK WELD THE PIECES TOGETHER PRIOR TO WELDING.
5. USE A CERTIFIED WELDER IN ACCORDANCE WITH THE CURRENT EDITION OF AWS D1.4. DO NOT PLACE THE WELDED ASSEMBLY IN THE FORM UNTIL IT HAS BEEN INSPECTED.
6. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

OPTIONAL LOOP FABRICATION REQUIREMENTS:


1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250 TO FABRICATE THE OPTIONAL LOOPS.
2. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
3. NO WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

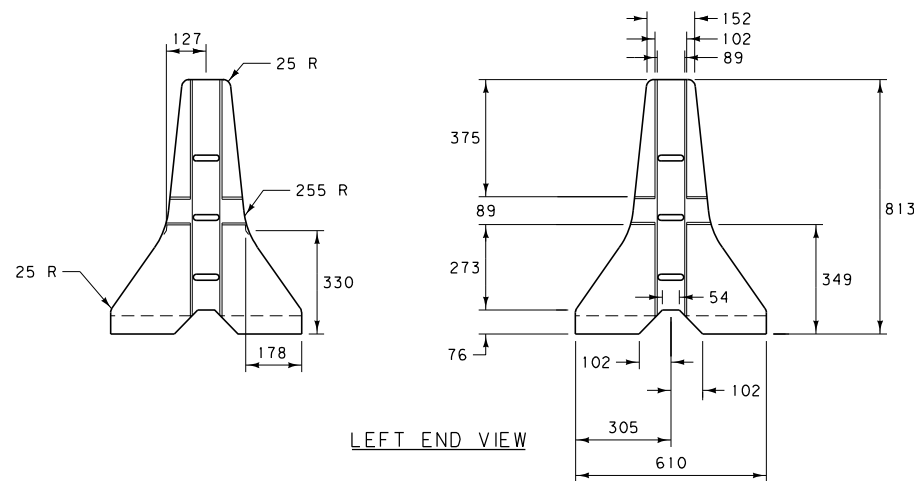


NOTES:

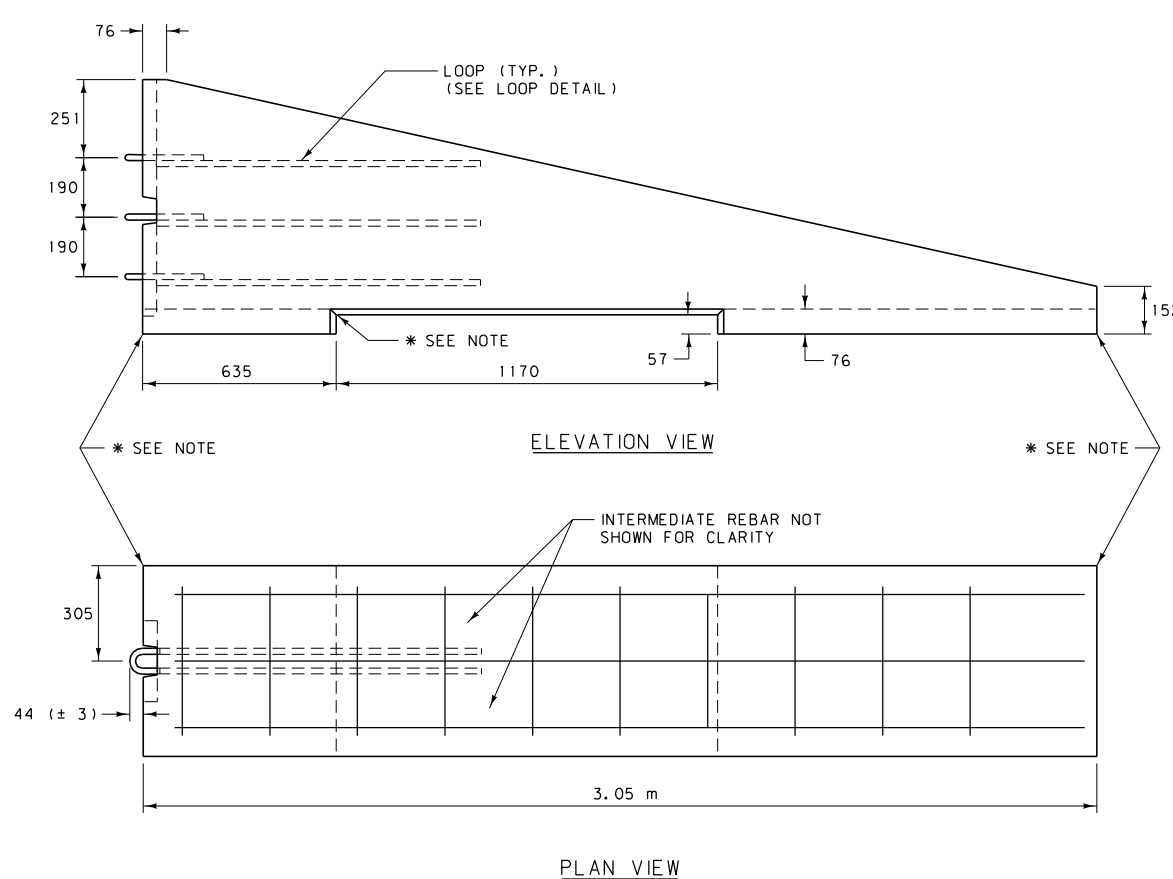
- ① USE CLASS "DD" CONCRETE OR EQUIVALENT.
 - ② REINFORCING STEEL CONSISTS OF DEFORMED BARS CONFORMING TO AASHTO M 31M, GRADE 420.
 - ③ CONNECT EACH 3.05 m SECTION WITH CONNECTING PINS AS DETAILED AND CONFORMING TO AASHTO M 270M, GRADE 250 OR BETTER. CONNECTING PINS NEED NOT BE PAINTED.
 - ④ CUTOUTS ON ENDS OF EACH SECTION ARE SHOWN WITH SLIGHT TAPER TO FACILITATE FORM REMOVAL. RECTANGULAR CUTOUTS ARE ACCEPTABLE.
 - ⑤ THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER FIT-UP OF THE PRECAST CONCRETE BARRIER RAIL. ASSEMBLE AND PIN SUFFICIENT NUMBER OF PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER FIT-UP CAN BE MAINTAINED ON ALL ROADWAY ALIGNMENT, CURVES AS WELL AS ON TANGENT. THIS IS TO BE DETERMINED EARLY IN FABRICATION.
 - ⑥ ATTACH REFLECTORS TO RAIL EVERY 9.15 m. FOLLOW THE MANUFACTURER'S SPECIFICATIONS FOR ADHESIVE MOUNTING. IN NARROW PAVED (FLUSH) MEDIAN APPLICATIONS, REFLECTORIZE BOTH SIDES.
 - ⑦ SEE DETAILED DRAWINGS 606-60 AND 606-64 FOR INFORMATION ON THE ADJACENT CONCRETE BARRIER RAIL SECTIONS. THE OPTIONAL TAPERED END DETAIL MAY ALSO BE USED HERE.
- * 19 mm CHAMFER ENTIRE OPENING (OR SUFFICIENTLY ROUNDED SO THAT A SMOOTH EDGE RESULTS.) 13 mm CHAMFER IS ACCEPTABLE.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 554, 606	DWG. NO. 606-66
CONCRETE BARRIER RAIL TRANSITION	
--REVISED-- January 2008	EFFECTIVE: FEBRUARY 2005
 MONTANA DEPARTMENT OF TRANSPORTATION	

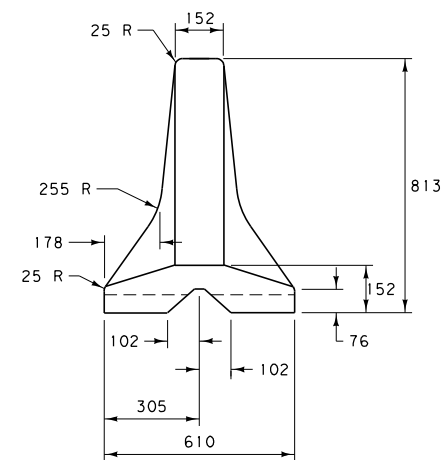


LEFT END VIEW



ELEVATION VIEW

PLAN VIEW



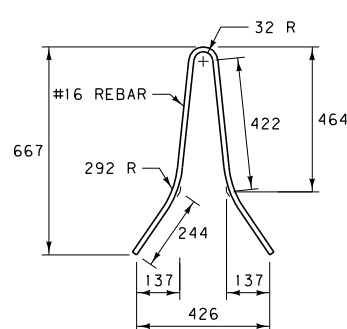
RIGHT END VIEW

NOTES:

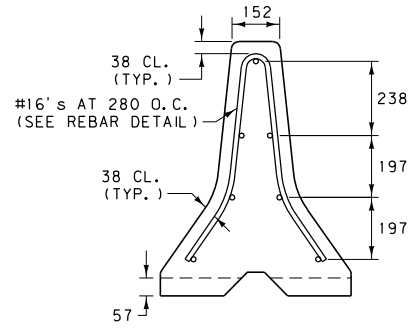
- ① USE CLASS "DD" CONCRETE OR EQUIVALENT.
 - ② REINFORCING STEEL CONSISTS OF DEFORMED BARS CONFORMING TO AASHTO M 31M, GRADE 420.
 - ③ CONNECT EACH 3.05 m SECTION WITH CONNECTING PINS AS DETAILED AND CONFORMING TO AASHTO M 270M, GRADE 250 OR BETTER. CONNECTING PINS NEED NOT BE PAINTED.
 - ④ CUTOUTS ON LEFT END OF EACH SECTION ARE SHOWN WITH SLIGHT TAPER TO FACILITATE FORM REMOVAL. RECTANGULAR CUTOUTS ARE ACCEPTABLE.
 - ⑤ THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER FIT-UP OF THE PRECAST CONCRETE BARRIER RAIL. ASSEMBLE AND PIN SUFFICIENT NUMBER OF PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER FIT-UP CAN BE MAINTAINED ON ALL ROADWAY ALIGNMENT, CURVES AS WELL AS ON TANGENT. THIS IS TO BE DETERMINED EARLY IN FABRICATION.
 - ⑥ SEE DTL. DWG. NO. 606-60 FOR INFORMATION ON THE ADJACENT CONCRETE BARRIER RAIL SECTION. THE OPTIONAL TAPERED END DETAIL MAY ALSO BE USED HERE.
- * 19 mm CHAMFER ENTIRE OPENING (OR SUFFICIENTLY ROUNDED SO THAT A SMOOTH EDGE RESULTS.) 13 mm CHAMFER IS ACCEPTABLE.

NOTE:

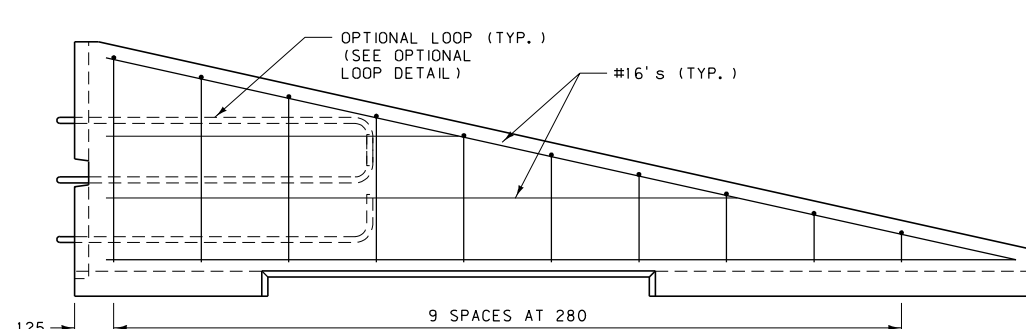
REBAR TYPICAL AT LEFT END ONLY. TAPER THE REBAR HEIGHT AS NEEDED, BY MAINTAINING THE VERTICAL POSITION FROM THE BOTTOM AND THE 38 mm CLEARANCE AT ALL LOCATIONS.



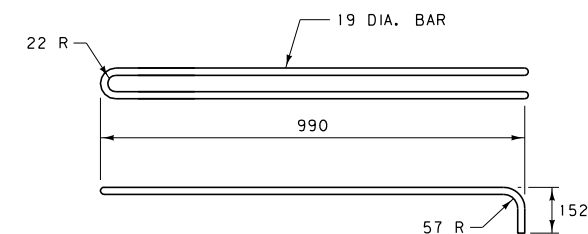
REBAR DETAIL LEFT END



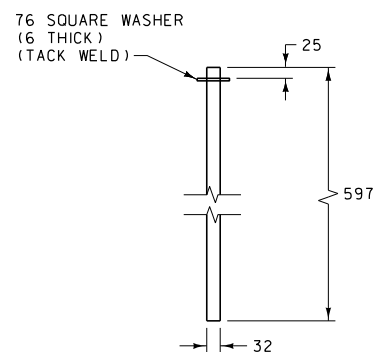
LEFT END VIEW



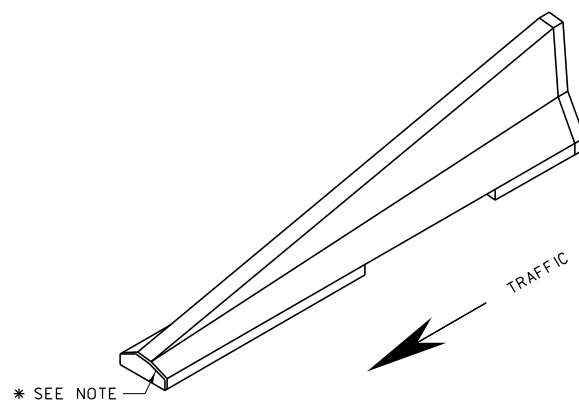
ELEVATION VIEW



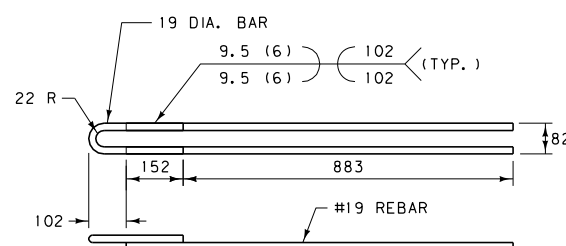
OPTIONAL LOOP DETAIL



CONNECTING PIN DETAIL



ISOMETRIC VIEW



LOOP DETAIL


LOOP FABRICATION REQUIREMENTS:

1. USE REINFORCING STEEL CONFORMING TO ASTM A 706M, GRADE 420 FOR REBAR BEING WELDED TO LOOPS.
2. LOOP ENDS CONSIST OF SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250.
3. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
4. WELD REBAR TO LOOPS USING 3 mm DIA. E8018 ROD. DO NOT TACK WELD THE PIECES TOGETHER PRIOR TO WELDING.
5. USE A CERTIFIED WELDER IN ACCORDANCE WITH THE CURRENT EDITION OF AWS D1.4. DO NOT PLACE THE WELDED ASSEMBLY IN THE FORM UNTIL IT HAS BEEN INSPECTED.
6. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

OPTIONAL LOOP FABRICATION REQUIREMENTS:

1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO AASHTO M 270M, GRADE 250 TO FABRICATE THE OPTIONAL LOOPS.
2. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
3. NO WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-68
SECTION 554, 606	
CONCRETE BARRIER RAIL TERMINAL SECTION (ONE-WAY DEPARTURE)	
EFFECTIVE: FEBRUARY 2005	
-- REVISED --	
January 2008	
 MONTANA DEPARTMENT OF TRANSPORTATION	

SCHEDULE OF GUARDRAIL HARDWARE				DTL. DWGS. WHERE PARTS USED																	
				606-05A	606-05B	606-09	606-11A	606-11B	606-18	606-24A	606-24B	606-25A	606-25B	606-40	606-41	606-46	606-50	606-52	606-53	606-53A	606-54
DESIGNATION ①	DESCRIPTION	DTL. DWG. NO. (606-####)	GUARDRAIL TYPE ②																		
FBB01-05	M16 GUARDRAIL BOLT AND RECESSED NUT	82	W	X	X	X	X	X													X
FBH01	M8 HOOK BOLT	92	C																		
FBH02	M8 ALTERNATE HOOK BOLT	92	C																		
FBX10a	M10 HEX BOLT	82	B																		
FBX12a	M12 HEX BOLT	82	B, C																		
FBX14a	M14 HEX BOLT	82	B																		
FBX16a	M16 HEX BOLT	82	W							X											X
FBX20a	M20 HEX BOLT	82	W																		
FBX20b	M20 HIGH STRENGTH HEX BOLT	82	B																		
FBX22b	M22 HIGH STRENGTH HEX BOLT	82	W																		
FBX24b	M24 HIGH STRENGTH HEX BOLT	82	B																		
FCA01	CABLE ASSEMBLY	84	W						X												
FMM01	CABLE WEDGE	94	C																		
FMM02	POST SLEEVE	84	W						X												
FNS20	M20 SQUARE NUT	82	C																		
FNX08a	M8 HEX NUT	82	C																		
FNX10a	M10 HEX NUT	82	B																		
FNX12a	M12 HEX NUT	82	B, C																		
FNX14a	M14 HEX NUT	82	B																		
FNX16a	M16 HEX NUT	82	W							X											
FNX20a	M20 HEX NUT	82	C, W																		
FNX20b	M20 HIGH STRENGTH HEX NUT	82	B																		
FNX22b	M22 HIGH STRENGTH HEX NUT	82	W																		
FNX24a	M24 HEX NUT	82	W																		
FNX24b	M24 HIGH STRENGTH HEX NUT	82	B																		
FPA01	GUARDRAIL ANCHOR BRACKET & END PLATE	84	W						X												
FPA02	CABLE ANCHOR BRACKET	95	C																		
FPB01	BEARING PLATE	18 & 46	W							X											
FPP01	BOX BEAM SUPPORT BRACKET	97	B																		
FRH20a	M20 HOOKED ANCHOR ROD	82	C																		
FWC10a	M10 FLAT WASHER	82	B																		
FWC12a	M12 FLAT WASHER	82	B, C																		
FWC14a	M14 FLAT WASHER	82	B																		
FWC16a	M16 FLAT WASHER	82	W	X	X	X	X	X	X	X											
FWC20a	M20 FLAT WASHER	82	C, W																		
FWC20b	M20 HARDENED FLAT WASHER	82	B																		
FWC24a	M24 FLAT WASHER	82	W																		
FWR03	RECTANGULAR PLATE WASHER	84	W																		
PDB01	WOOD BLOCKOUT	05A & 05B	W	X	X	X	X	X	X												
PDE02	WOOD GUARDRAIL POST	05A	W	X				X													
PDE09	CRT POST	46	W				X														
PDF01	WOOD BREAKAWAY POST	46	W																		
PDF03	END POST	18	W																		
PLS01	SOIL PLATE	92 & 97	B, C																		
PLS03	SOIL PLATE	46	W																		
PSE01	CABLE GUARDRAIL LINE POST	92	C																		
PSE05	TYPE D BOX BEAM POST	97	B																		
PSE06	CABLE GUARDRAIL ANCHOR POST	95	C																		
PSE08	TYPE A BOX BEAM POST	97	B																		
PTE05	STEEL TUBE	46	W																		
PWE01	STEEL GUARDRAIL POST	05B	W				X				X										
RBM01	BOX BEAM RAIL	98	B																		
RBM05	BOX BEAM TERMINAL RAIL	98	B																		
RBS01	BOX BEAM SPLICE PLATE	98	B																		
RCE01	COMPENSATING CABLE END ASSEMBLY	94	C																		
RCE03	CABLE END ASSEMBLY	94	C																		
RCM01	19.1 DIA. CABLE	94	C																		
RWE01a-b	W-BEAM END SECTION (FLARED)	88	W																		
RWE02a-b	W-BEAM TERMINAL CONNECTOR	88	W																		
RWE06a-b	W-BEAM END SECTION (BUFFER)	88	W																		
RWM02a-b	W-BEAM (3.81 m LENGTH)	88	W	X	X	X	X	X	X	X											
RWM22a-b	W-BEAM (7.62 m LENGTH)	88	W	X	X	X	X	X	X	X											
SEC01	CABLE GUARDRAIL TERMINAL ANCHOR ASSEMBLY	41	C																		

SCHEDULE OF GUARDRAIL HARDWARE				DTL. DWGS. WHERE PARTS USED																	
				606-05A	606-05B	606-09	606-11A	606-11B	606-18	606-24A	606-24B	606-25A	606-25B	606-40	606-41	606-46	606-50	606-52	606-53	606-53A	606-54
DESIGNATION ①	DESCRIPTION	DTL. DWG. NO. (606-####)	GUARDRAIL TYPE ②																		
N/A	TURNBUCKLE CABLE END ASSEMBLY	94	C										X								
N/A	KEEPER PLATE	95	C										X								
N/A	TYPE B BOX BEAM POST	97	B															X			
N/A	SUPPORT BRACKET WITH TS152 x 152 x 4.8 BLOCKOUT	97	B																X		
N/A	TRANSITION POST	97	B																X		
N/A	TS152 x 152 x 4.8 BR. APP. SECT. UPPER RAIL NO. 1	98	B															X			
N/A	TS152 x 51 x 6.4 BR. APP. SECT. LOWER RAIL NO. 1	98	B																X		
N/A	TS152 x 51 x 6.4 BR. APP. SECT. LOWER RAIL NO. 2	98	B																X		
N/A	TS152 x 51 TO TS152 x 152 CONNECTION SLEEVE	98	B																X		
N/A	TS152 x 51 CONNECTION SLEEVE	98	B																X		
N/A	TS152 x 152 x 4.8 TRANSITION RAIL	98	B																	X	
N/A	6.4 SHIM PLATE	99	B																	X	
N/A	ANCHOR RAIL SECTION	99	B																	X	
N/A	RUB RAIL ANCHOR BRACKET (JERSEY RAIL)	99	B																	X	
N/A	RUB RAIL ANCHOR BRACKET (VERTICAL BRIDGE RAIL)	99	B																	X	
N/A	TS152 x 51 x 4.8 RUB RAIL	99	B																	X	

NOTES:

① SEE AASHTO-AGC-ARTBA JOINT COMMITTEE
TASK FORCE 13 REPORT "A GUIDE TO
STANDARDIZED HIGHWAY BARRIER HARDWARE"
PUBLICATION FOR ADDITIONAL AND DETAILED
HARDWARE SPECIFICATIONS.

② GUARDRAIL TYPE CODES:

W = W-BEAM METAL GUARDRAIL
C = CABLE GUARDRAIL
B = BOX BEAM GUARDRAIL

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.


DETAILED DRAWING

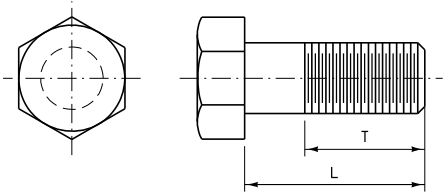
REFERENCE DWG. NO.
STANDARD SPEC. 606-80
SECTION 606

SCHEDULE OF
GUARDRAIL HARDWARE

-- REVISED --
January 2008

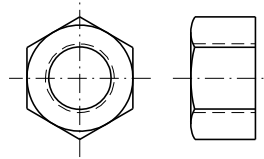
EFFECTIVE: FEBRUARY 2005

 MONTANA DEPARTMENT
OF TRANSPORTATION



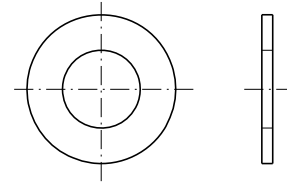
HEX BOLTS

BOLT SIZE	DESIGNATION *	L	T (MIN.)
REGULAR HEX BOLTS			
M10	FBX10a	89	38
M10	FBX10a	191	38
M12	FBX12a	38	FULL
M12	FBX12a	63	44
M14	FBX14a	203	51
M16	FBX16a	38	FULL
M20	FBX20a	203	51
M20	FBX20a	241	51
HIGH STRENGTH HEX BOLTS			
M20	FBX20b	51	38
M20	FBX20b	102	51
M20	FBX20b	203	51
M22	FBX22b	305	AS REQUIRED
M24	FBX24b	AS REQUIRED	AS REQUIRED



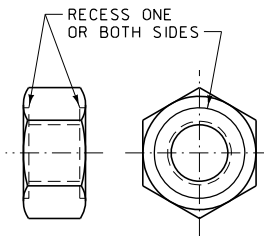
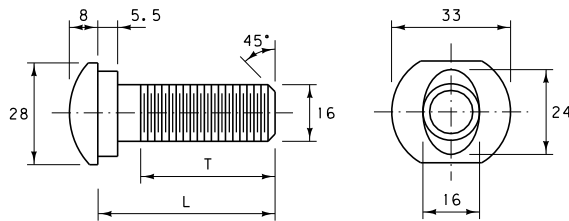
HEX NUT

NUT SIZE	DESIGNATION *
REGULAR HEX NUTS	
M8	FNX08a
M10	FNX10a
M12	FNX12a
M14	FNX14a
M16	FNX16a
M20	FNX20a
M24	FNX24a
HIGH STRENGTH HEX NUTS	
M20	FNX20b
M22	FNX22b
M24	FNX24b



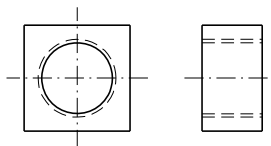
FLAT WASHERS

WASHER SIZE	DESIGNATION *
REGULAR FLAT WASHERS	
M10	FWC10a
M12	FWC12a
M14	FWC14a
M16	FWC16a
M20	FWC20a
M24	FWC24a
HARDENED FLAT WASHERS	
M20	FWC20b

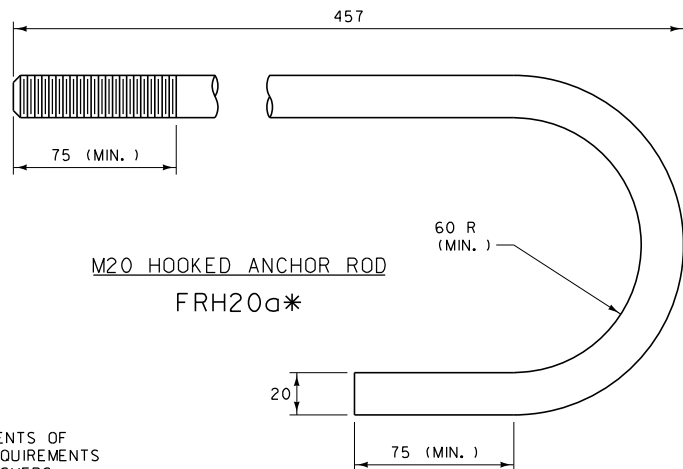


DESIGNATION *	L	T (MIN.)
FBB01	32	29
FBB02	51	44
FBB03	254	102
FBB04	457	102
FBB05	635	102

M16 GUARDRAIL BOLT & RECESSED NUT
FBB01-05*



M20 SQUARE NUT
FNS20*




M20 HOOKED ANCHOR ROD
FRH20a*

NOTES:

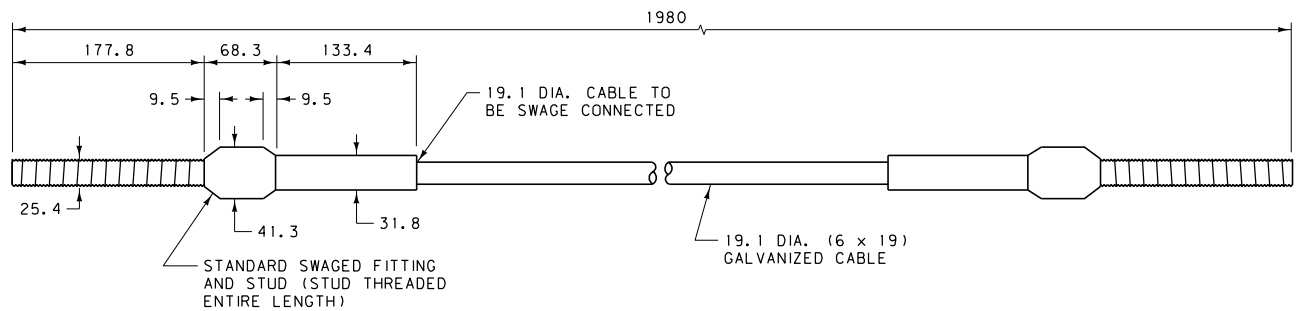
- BOLTS AND ANCHOR RODS ARE TO CONFORM TO THE REQUIREMENTS OF ASTM F 568M CLASS 4.6. NUTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M 291M (ASTM A 563M) CLASS 5. USE STEEL WASHERS.
- HIGH STRENGTH BOLTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M 164M (ASTM A 325M) TYPE 1. HIGH STRENGTH NUTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M 291M (ASTM A 563M) CLASS 10S. HARDENED WASHERS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M 293M (ASTM F 436M).
- GALVANIZE BOLTS, NUTS AND WASHERS IN ACCORDANCE WITH AASHTO M 232M (ASTM A 153M). NO PUNCHING, DRILLING OR CUTTING IS PERMITTED AFTER GALVANIZING.

*SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-82
GUARDRAIL HARDWARE	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION serving you with pride	

-- REVISED --
January 2008

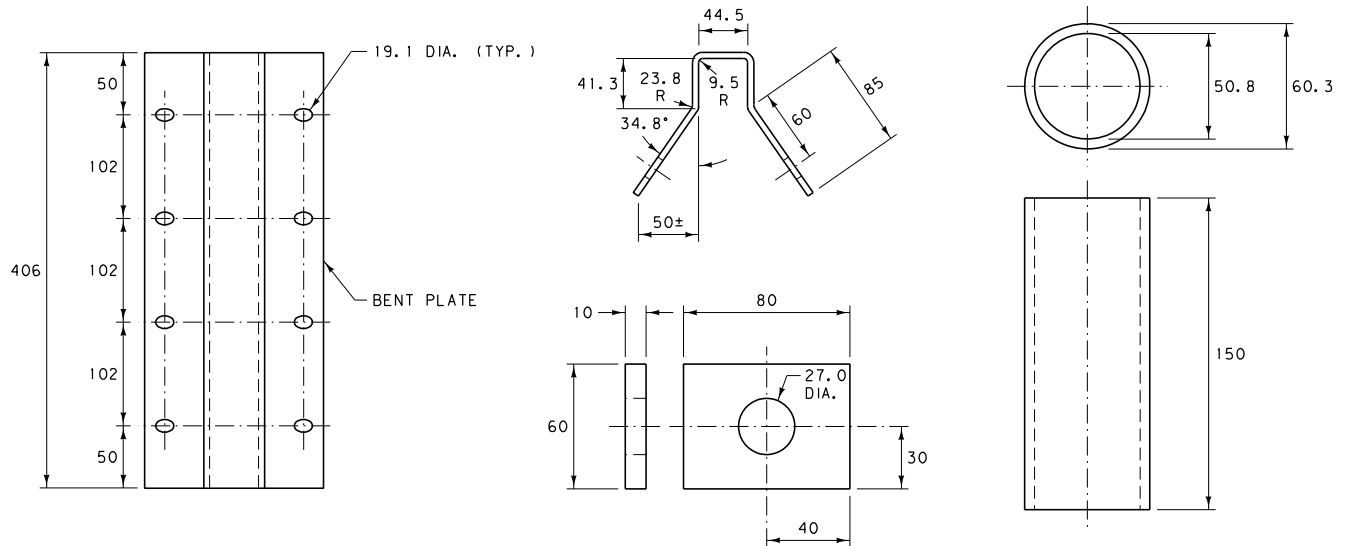


NOTES:

- ① FOR RELATED FASTENER HARDWARE SEE FWC24a*, FNx24a* AND FPA01*.
- ② MACHINE THE SWAGED FITTING FROM HOT-ROLLED CARBON STEEL, CONFORMING TO THE REQUIREMENTS OF ASTM A576M, GRADE 1035, AND ANNEAL SUITABLE FOR COLD SWAGING. GALVANIZE THE SWAGED FITTING IN ACCORDANCE WITH AASHTO M111M (ASTM A123M) BEFORE SWAGING. DRILL A LOCK PIN HOLE TO ACCOMMODATE A 6.4 mm, PLATED SPRING STEEL PIN THROUGH THE HEAD OF THE SWAGED FITTING TO RETAIN THE STUD IN THE PROPER POSITION.
- ③ THE STUD IS TO CONFORM TO THE REQUIREMENTS OF ASTM F568M CLASS 8.8 AND BE GALVANIZED IN ACCORDANCE WITH AASHTO M232M (ASTM A153M). PRIOR TO GALVANIZING, MILL A 9.5 mm SLOT INTO THE STUD END FOR THE LOCKING PIN.
- ④ WIRE ROPE IS TO CONFORM TO THE REQUIREMENTS OF AASHTO M30M AND BE 19.1 mm PREFORMED, 6 x 19, WIRE STRAND CORE OR INDEPENDENT WIRE ROPE CORE (IWRC), GALVANIZED, RIGHT REGULAR LAY, MANUFACTURED OF IMPROVED PLOW STEEL WITH A MINIMUM BREAKING STRENGTH OF 190.4 kN.
- ⑤ THE SWAGED FITTING, STUD AND NUT (FNx24a*) MUST DEVELOP THE BREAKING STRENGTH OF THE WIRE ROPE.

CABLE ASSEMBLY

FCA01*

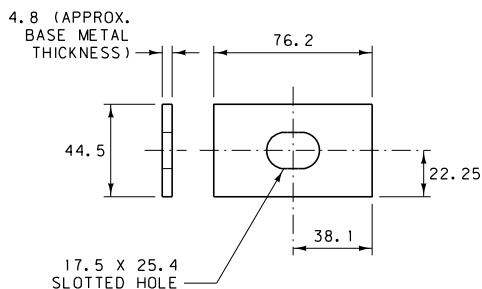


ANCHOR BRACKET & END PLATE

FPA01*

POST SLEEVE

FMM02*



RECTANGULAR PLATE WASHER


FWRO3*

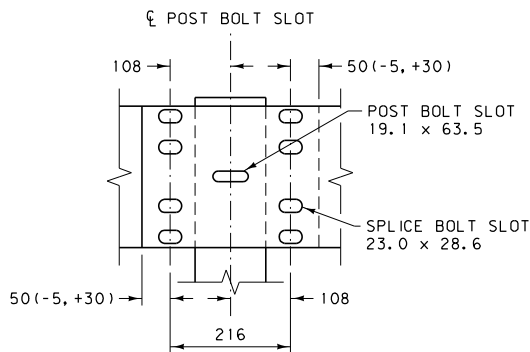
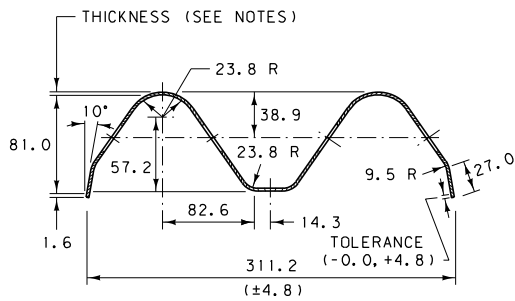
NOTES:

- ⑥ ANCHOR BRACKETS, END PLATES AND RECTANGULAR PLATE WASHERS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M270M (ASTM A709M) GRADE 250 STEEL PLATE. POST SLEEVES ARE TO CONFORM TO THE REQUIREMENTS OF ASTM A53M GRADE B.
- ⑦ GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH AASHTO M111M (ASTM A123M). NO PUNCHING, DRILLING OR CUTTING IS PERMITTED AFTER GALVANIZING.

*SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

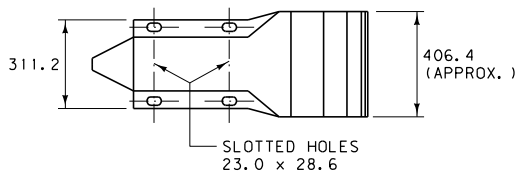
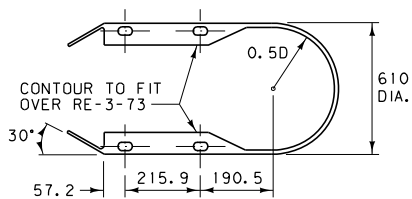
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-84
W-BEAM METAL GUARDRAIL HARDWARE	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION	



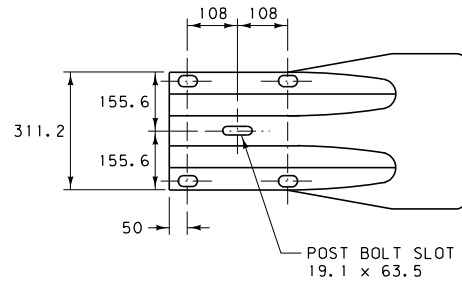
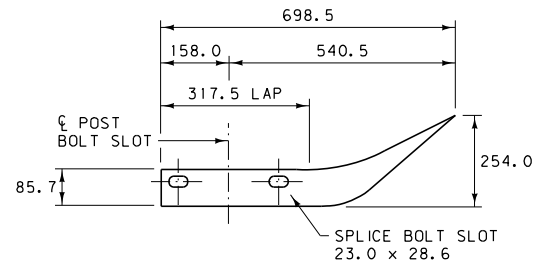
W-BEAM

RWM02a-b* (3.81 m LENGTH) OR RWM22a-b* (7.62 m LENGTH)



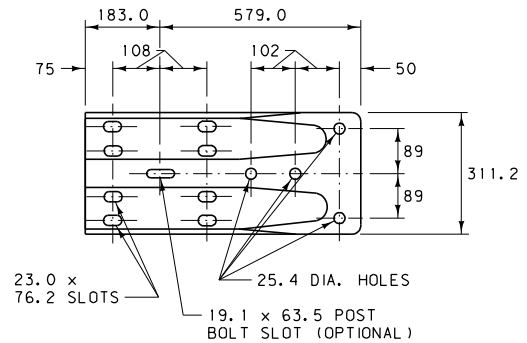
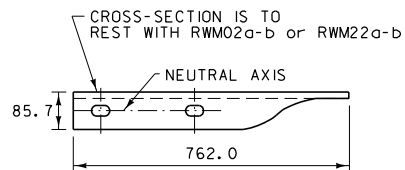
W-BEAM END SECTION (BUFFER)

RWE06a-b*



W-BEAM END SECTION (FLARED)

RWE01a-b*



W-BEAM TERMINAL CONNECTOR


RWE02a-b*

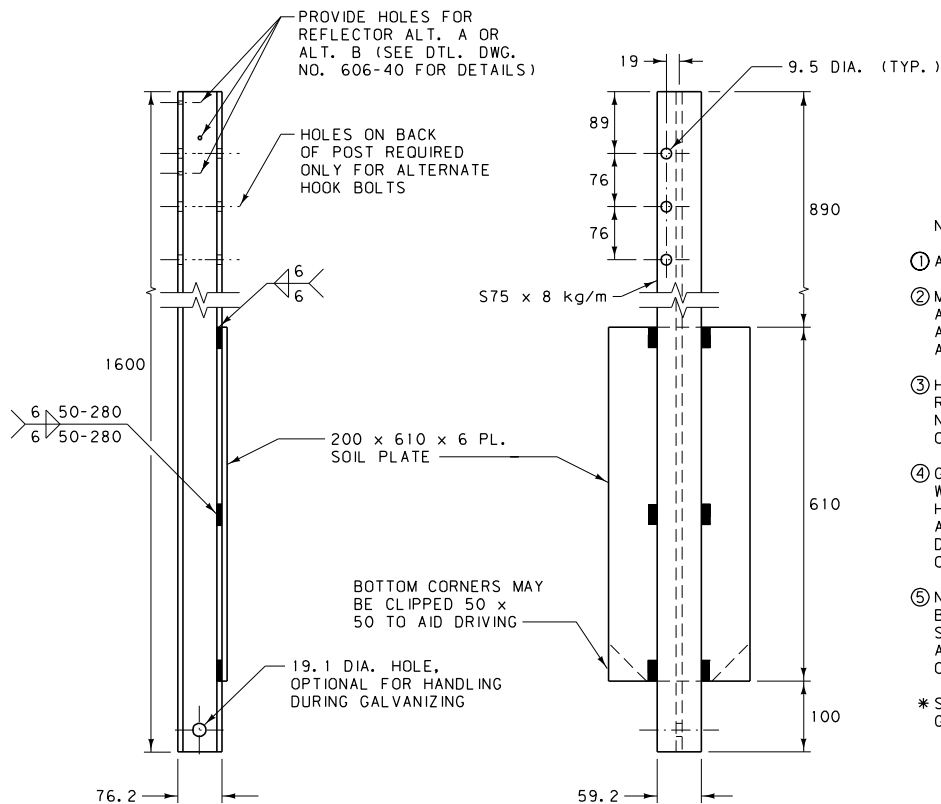
NOTES:

* DESTINATION SUFFIX	METAL THICKNESS
a	12 GAGE (2.7 mm)
b	10 GAGE (3.5 mm)

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-88
W-BEAM METAL GUARDRAIL HARDWARE	
EFFECTIVE: FEBRUARY 2005	
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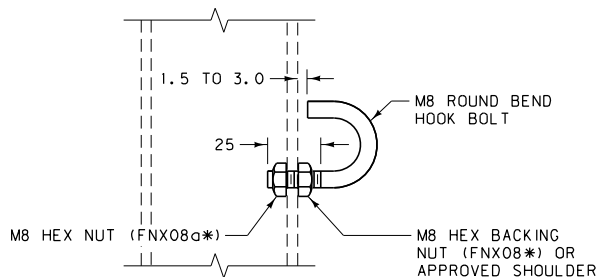


NOTES:

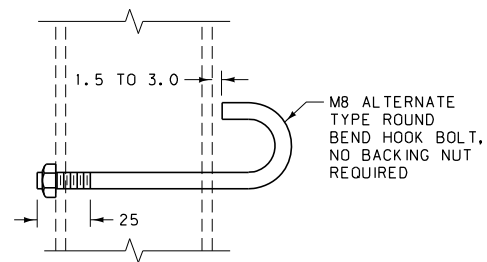
- ① ALL HOLES ARE 9.5 mm DIA. EXCEPT AS NOTED.
- ② MANUFACTURE POSTS AND SOIL PLATES USING AASHTO M270M (ASTM A709M) GRADE 250 STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.
- ③ HOOK BOLTS ARE TO CONFORM TO THE REQUIREMENTS OF ASTM 568M CLASS 4.6. NUTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M291M (ASTM A563M) CLASS 5.
- ④ GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH AASHTO M111M (ASTM A123M). GALVANIZE HOOK BOLTS AND NUTS IN ACCORDANCE WITH AASHTO M232M (ASTM A153M). NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.
- ⑤ NUTS ARE OF THE HEAVY HEX TYPES. INSTALL BOLTS TO DEVELOP AN ULTIMATE PULL OPEN STRENGTH FROM 2225 N TO 4450 N APPLIED IN A DIRECTION NORMAL TO THE LONGITUDINAL AXIS OF THE POST.

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

CABLE GUARDRAIL POST AND SOIL PLATE
PSE01* AND PLS01*




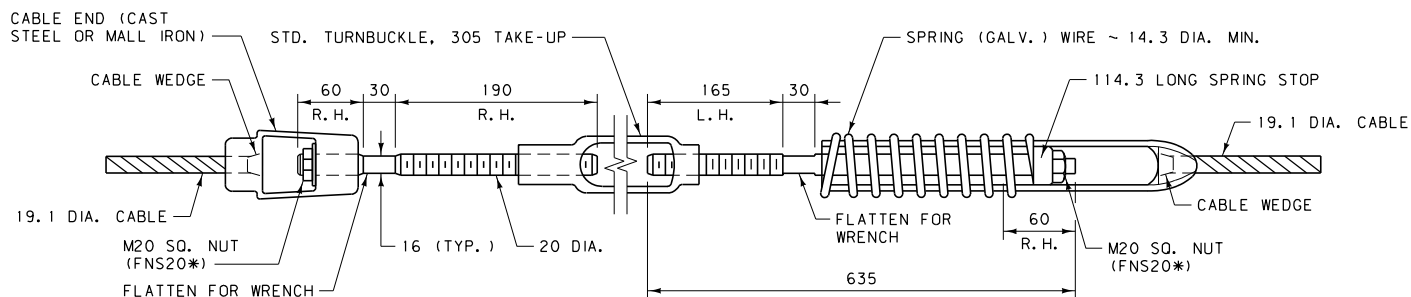
M8 HOOK BOLT
FBH01*



ALTERNATE M8 HOOK BOLT
FBH02*

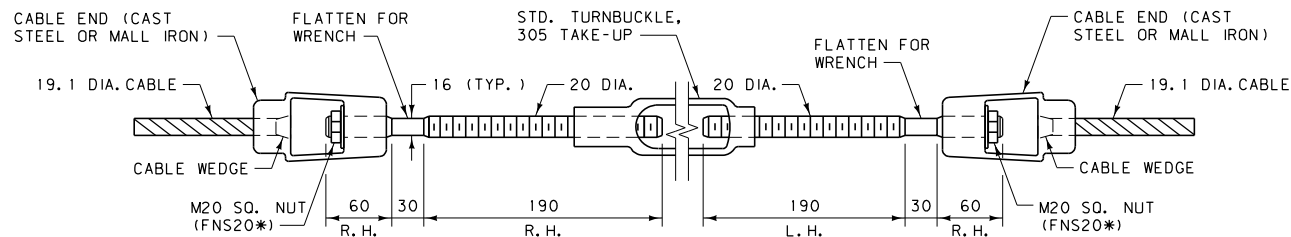
ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-92
CABLE GUARDRAIL HARDWARE	
EFFECTIVE: APRIL 2006	
 MONTANA DEPARTMENT OF TRANSPORTATION serving you with pride	



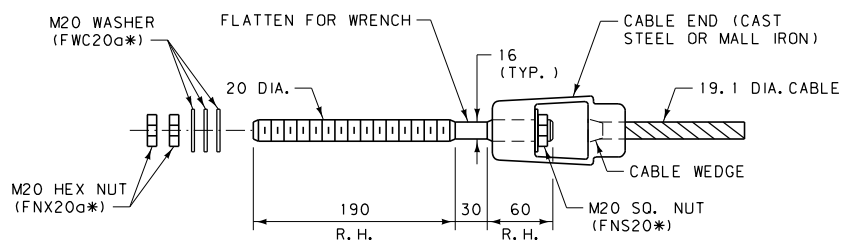
COMPENSATING CABLE END ASSEMBLY

RCE01*



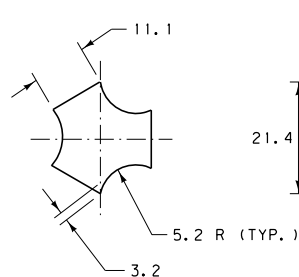
TURNBUCKLE CABLE END ASSEMBLY

R. H. = RIGHT HAND
L. H. = LEFT HAND



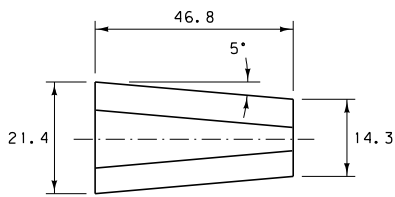
CABLE END ASSEMBLY

RCE03*

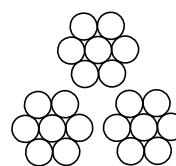
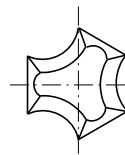


CABLE WEDGE

FMM01*



CAST STEEL
OR MALL IRON



19.1 DIA. - 3 x 7 WIRE ROPE

19.1 DIA. CABLE


RCM01*

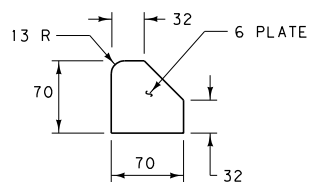
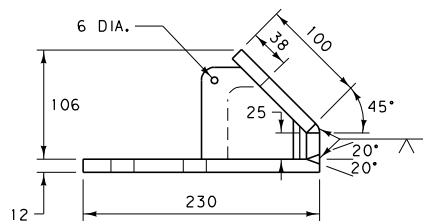
NOTES:

- ① WIRE ROPE AND CONNECTING HARDWARE ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M30M TYPE 1 CLASS A, 19.1 mm ROPE. CONNECTING HARDWARE MUST DEVELOP THE FULL STRENGTH OF A SINGLE CABLE (111.2 kN). CAST STEEL COMPONENTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M103M (ASTM A27M). MALLEABLE IRON CASTINGS ARE TO CONFORM TO THE REQUIREMENTS OF ASTM A47M.
- ② AT ALL LOCATIONS WHERE THE CABLE IS CONNECTED TO A CABLE SOCKET WITH A WEDGE TYPE CONNECTION, CRIMP ONE WIRE OF THE CABLE OVER THE BASE OF THE WEDGE TO HOLD IT FIRMLY IN PLACE.
- ③ COMPENSATING DEVICES ARE TO HAVE SPRING CONSTANTS OF 78.8 N/mm, PLUS OR MINUS 8.8 N/mm, AND PERMIT A TRAVEL OF 150 mm PLUS OR MINUS 25 mm.
- ④ DESIGN SOCKET BASKETS FOR USE WITH THE WEDGE DETAILED IN THIS DRAWING.
- ⑤ ALTERNATE HARDWARE DESIGNS WILL BE CONSIDERED FOR APPROVAL PROVIDED THEIR CONNECTION DETAILS, FOR THE PURPOSE OF MAINTENANCE SUBSTITUTIONS, ARE COMPATIBLE WITH THE DETAILS OF THIS DRAWING AND THEIR OPERATING CHARACTERISTICS ARE SIMILAR TO THOSE OF THE HARDWARE IN THIS DRAWING.

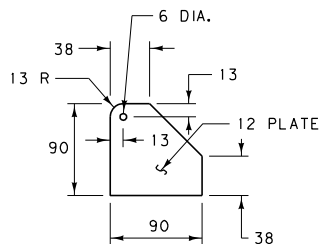
*SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

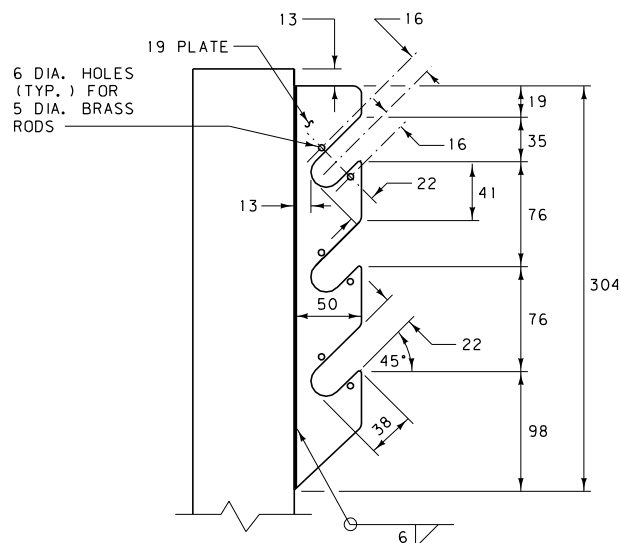
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-94
CABLE GUARDRAIL HARDWARE	
EFFECTIVE: FEBRUARY 2005	
 serving you with pride	MONTANA DEPARTMENT OF TRANSPORTATION



INTERNAL STIFFENER

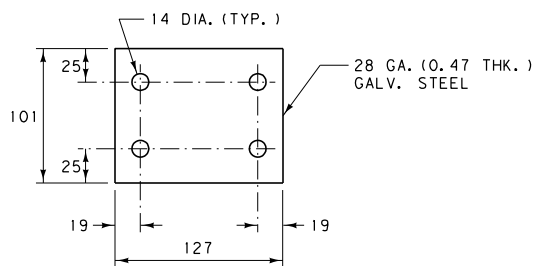


EXTERNAL STIFFENER



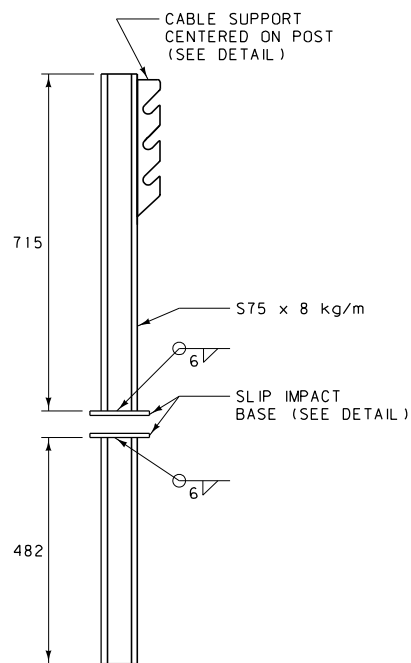
CABLE SUPPORT DETAIL

CABLE ANCHOR BRACKET
FPA02*



SLIP IMPACT BASE
(KEEPER PLATE NOT SHOWN)

KEEPER PLATE



CABLE GUARDRAIL ANCHOR POST
PSE06*

- ① MANUFACTURE ANCHOR POSTS AND BRACKETS USING AASHTO M270M (ASTM A709M) GRADE 250 STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.
- ② GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH AASHTO M111M (ASTM A123M). NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.

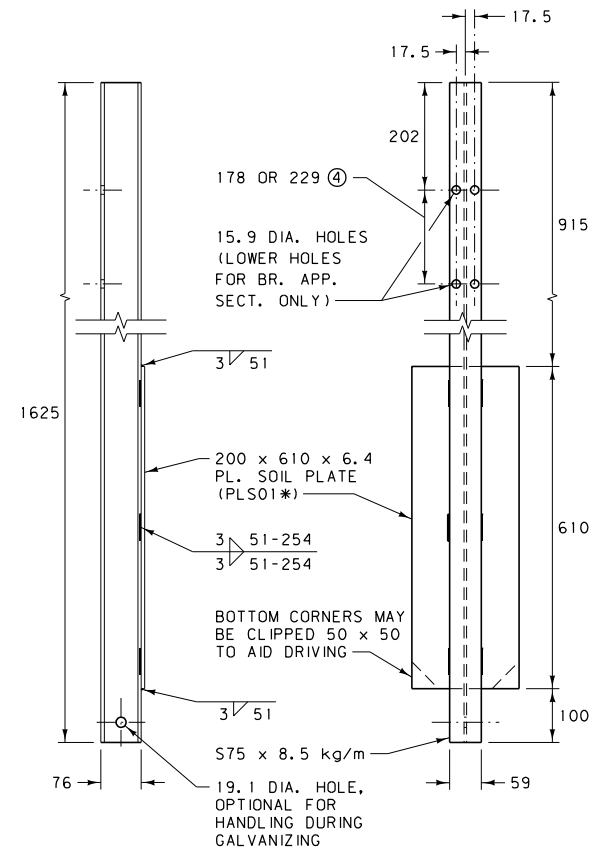
* SEE DTL. DWG. NO. 606-80 FOR
SCHEDULE OF GUARDRAIL
HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

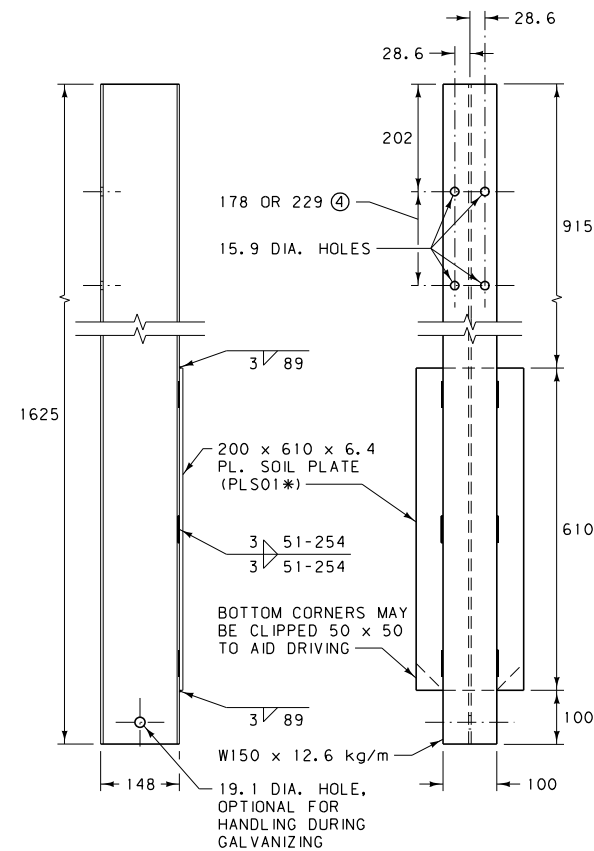
DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-95
SECTION 606	

CABLE GUARDRAIL HARDWARE

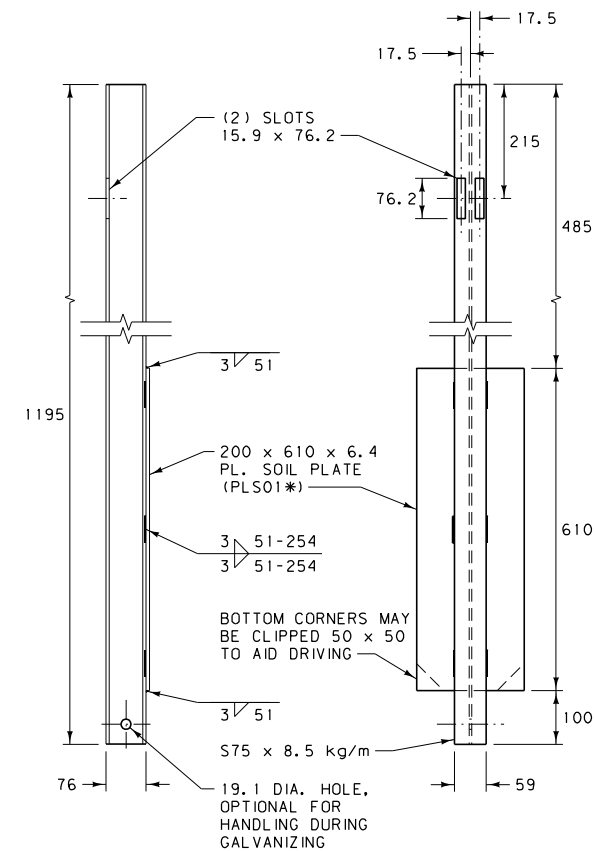
EFFECTIVE: FEBRUARY 2005



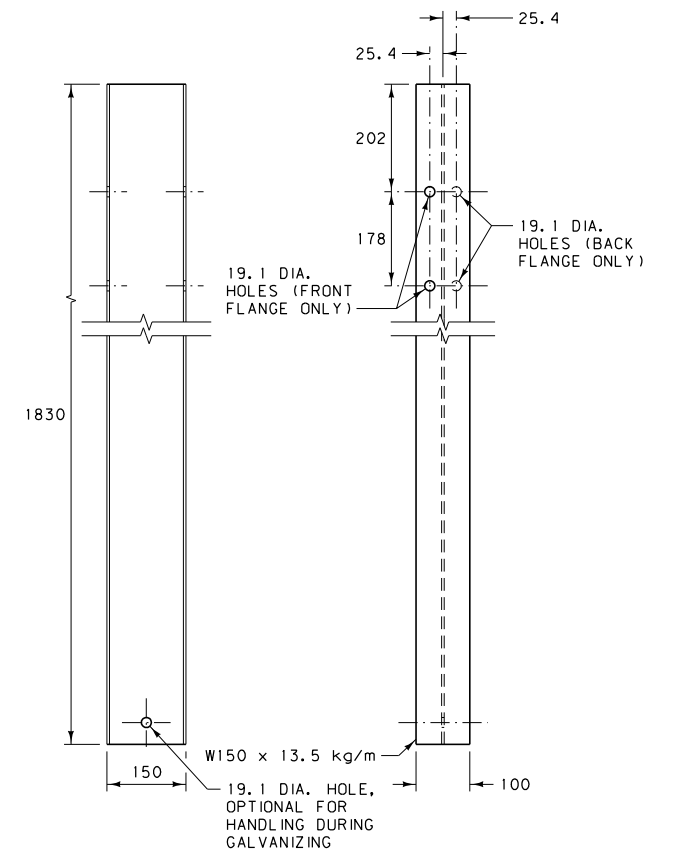
TYPE A BOX BEAM POST AND SOIL PLATE
PSE08* AND PLS01*



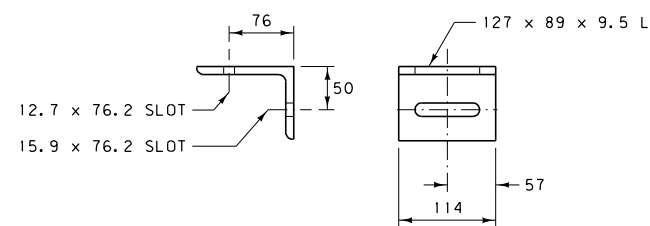
TYPE B BOX BEAM
POST AND SOIL PLATE
PLS01*



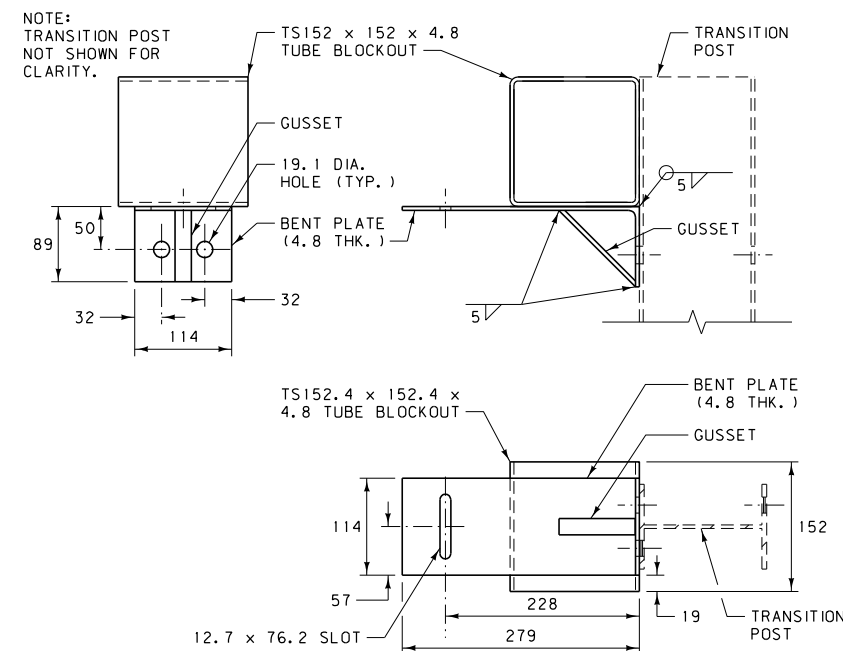
TYPE D BOX BEAM POST AND SOIL PLATE
PSE05* AND PLS01*



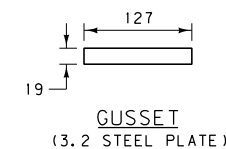
TRANSITION POST



BOX BEAM SUPPORT BRACKET
FPP01*



SUPPORT BRACKET W/BLOCKOUT




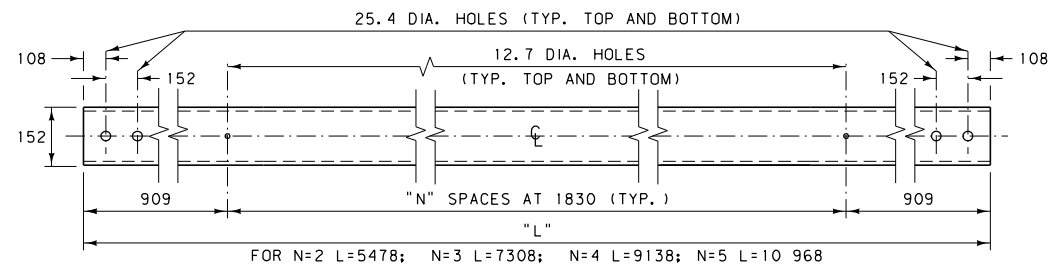
GUSSET
(3.2 STEEL PLATE)

NOTES:

- MANUFACTURE POSTS USING STEEL CONFORMING TO AASHTO M 183M (ASTM A 36M). MANUFACTURE SOIL PLATES, SUPPORT BRACKETS AND MISC. COMPONENTS USING AASHTO M 270M (ASTM A 709M) GRADE 250 STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.
 - MANUFACTURE BLOCKOUTS FROM EITHER ASTM A 500 GRADE B COLD-ROLLED TUBING, ASTM A 501 HOT-ROLLED TUBING OR AUTOMOTIVE ROLLOVER PROTECTIVE STEEL (ROPS). WHEN ASTM A 500 GRADE B STEEL IS USED, TEST THE MATERIAL PER ASTM E 436.
 - GALVANIZE FABRICATED POSTS, BLOCKOUTS, BRACKETS AND MISC. COMPONENTS IN ACCORDANCE WITH AASHTO M 111M (ASTM A 123M). NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.
 - SEE DTL. DWG. NO. 606-53 (BOX BEAM BR. APP. SECT.) FOR REQUIRED LOCATION OF LOWER HOLES IN TYPE A AND B POSTS.
- *SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

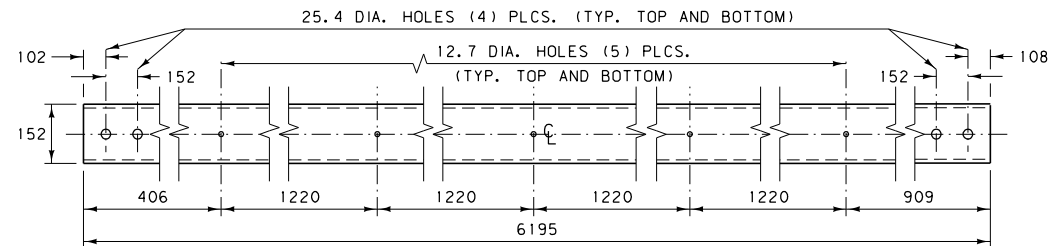
ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-97
SECTION 606	
BOX BEAM GUARDRAIL HARDWARE	
--REVISED--	EFFECTIVE: FEBRUARY 2005
January 2008	
	

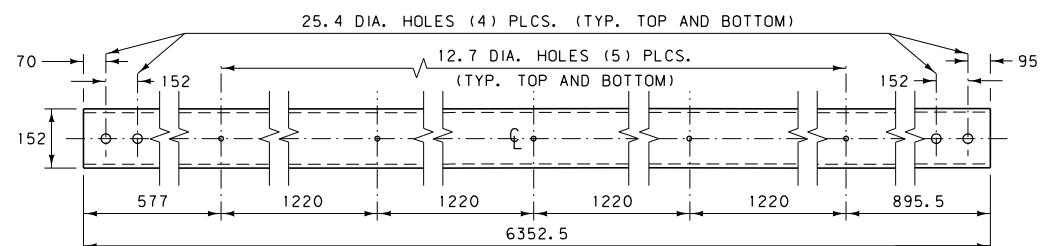


BOX BEAM RAIL (TS152 x 152 x 4.8)

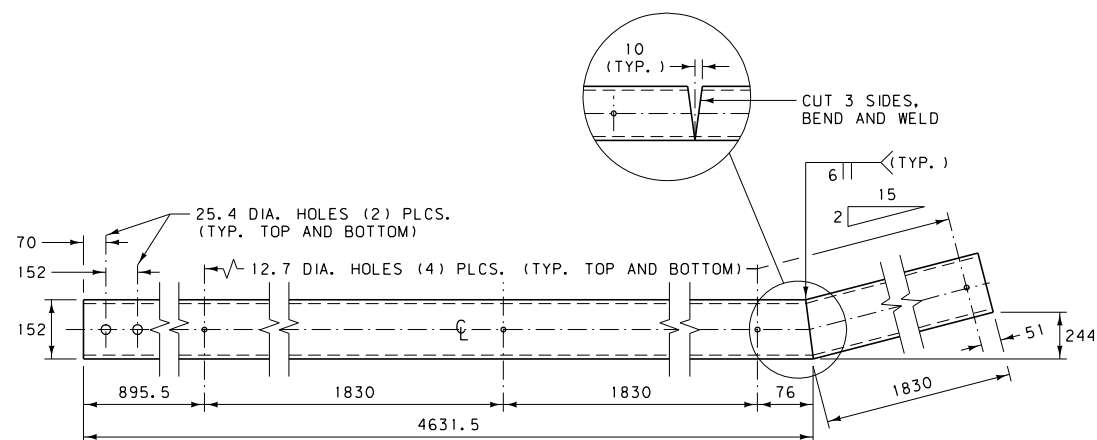
RBM01*



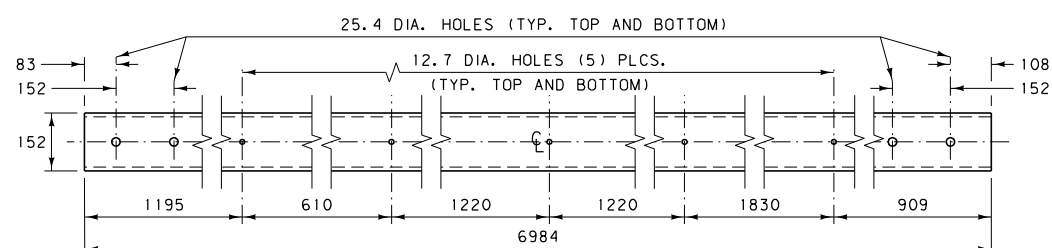
TS152 x 152 x 4.8 BR. APP. SECT. UPPER RAIL NO. 1



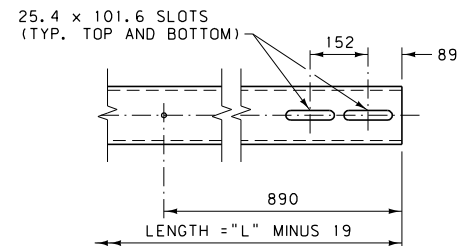
TS152 x 51 x 6.4 BR. APP. SECT. LOWER RAIL NO. 1



TS152 x 51 x 6.4 BR. APP. SECT. LOWER RAIL NO. 2

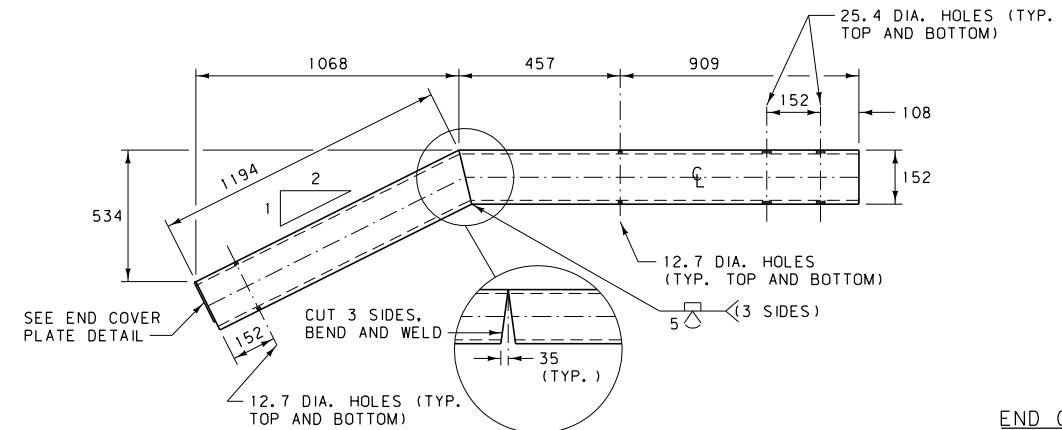


TRANSITION RAIL (TS152 x 152 x 4.8)



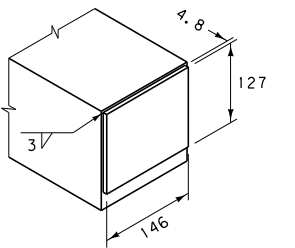
BOX BEAM EXPANSION SPLICE END

ONE END OF BOX BEAM RAIL ONLY. REQUIRED FOR BOTH RAILS AT THE EXPANSION SPLICE.



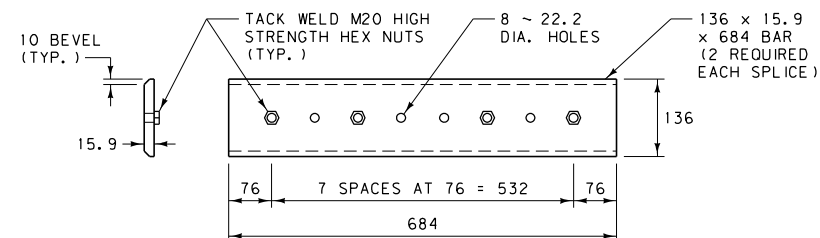
BOX BEAM TERMINAL RAIL (TS152 x 152 x 4.8)

RBM05*



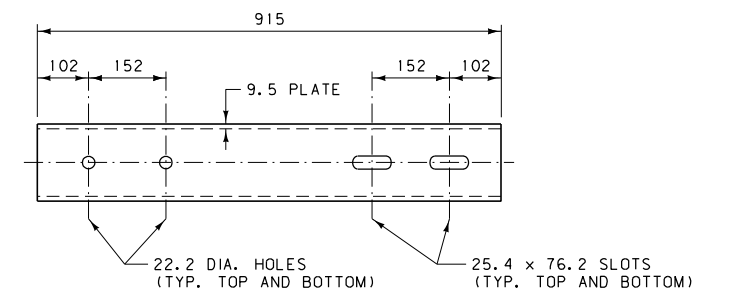
END COVER PLATE DETAIL

(BAR 127 x 4.8 x 146)



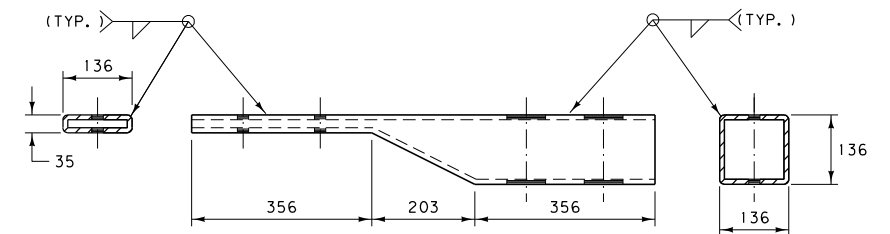
BOX BEAM SPLICE PLATE

RBS01*

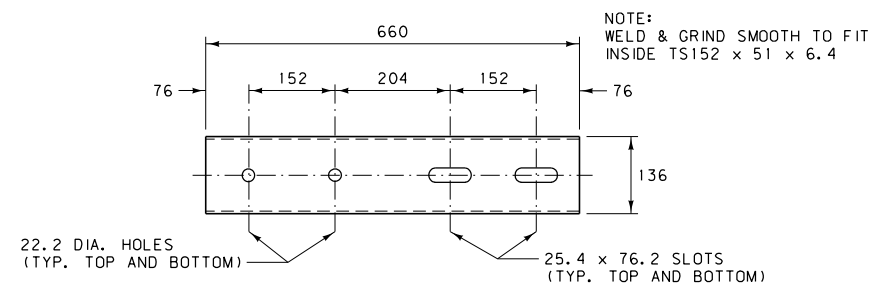


NOTE: WELD & GRIND SMOOTH TO FIT INSIDE TS152 x 51 x 6.4

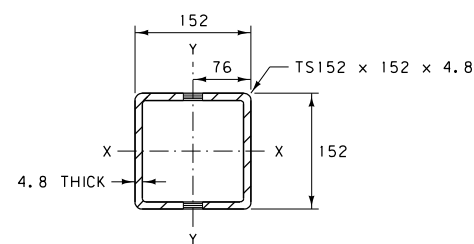
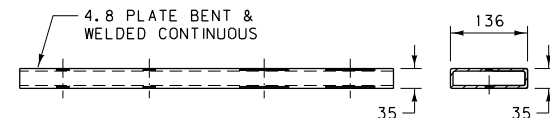
NOTE: WELD & GRIND SMOOTH TO FIT INSIDE TS152 x 152 x 4.8



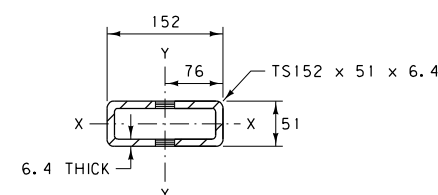
TS152 x 51 TO TS152 x 152 CONNECTION SLEEVE



TS152 x 51 CONNECTION SLEEVE



TS152 x 152 x 4.8 SECTION VIEW



TS152 x 51 x 6.4 SECTION VIEW

NOTES:


① MANUFACTURE BOX BEAM RAIL ELEMENTS FROM EITHER ASTM A 500 GRADE B COLD ROLLED TUBING, ASTM A 501 HOT-ROLLED TUBING OR AUTOMOTIVE ROLLOVER PROTECTIVE STEEL (ROPS). WHEN ASTM A 500 GRADE B STEEL IS USED, TEST THE MATERIAL PER ASTM E 436.

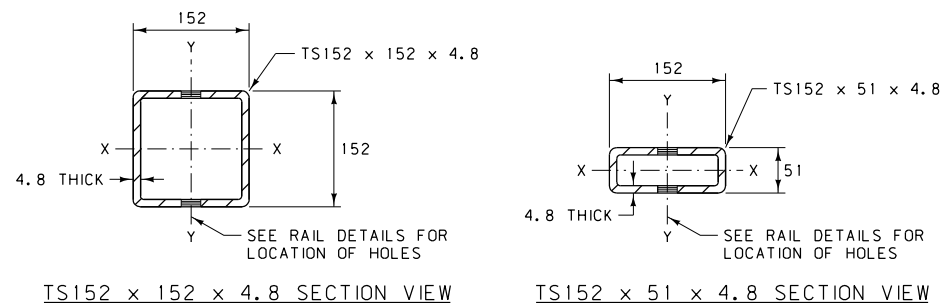
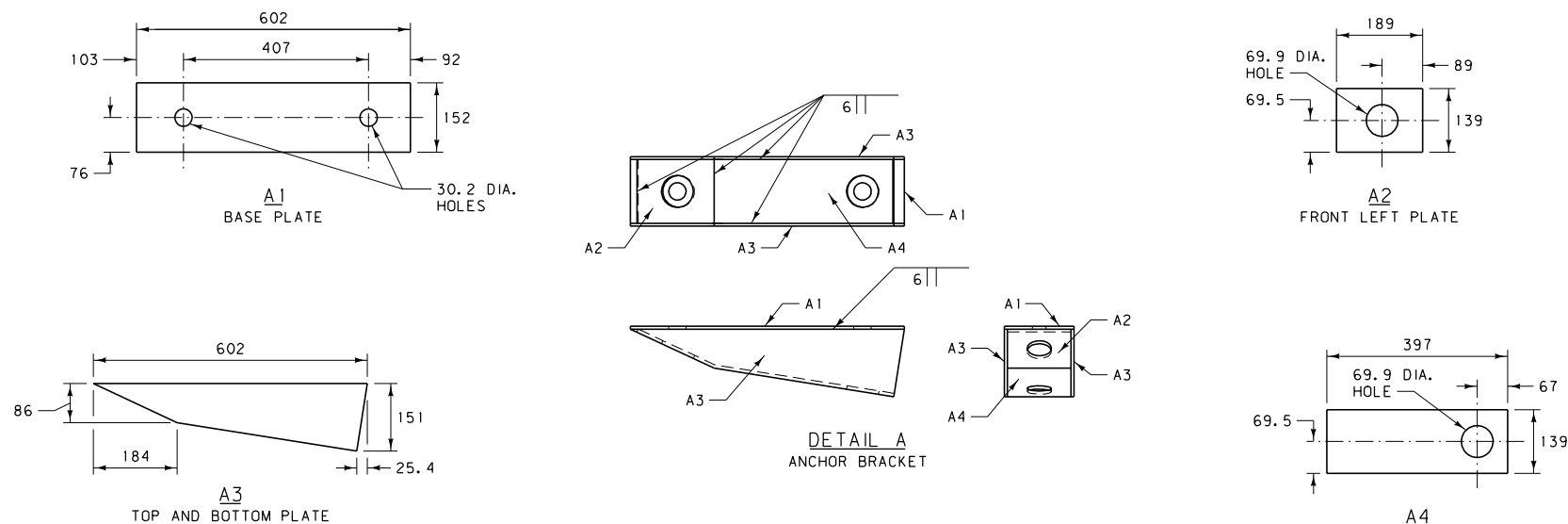
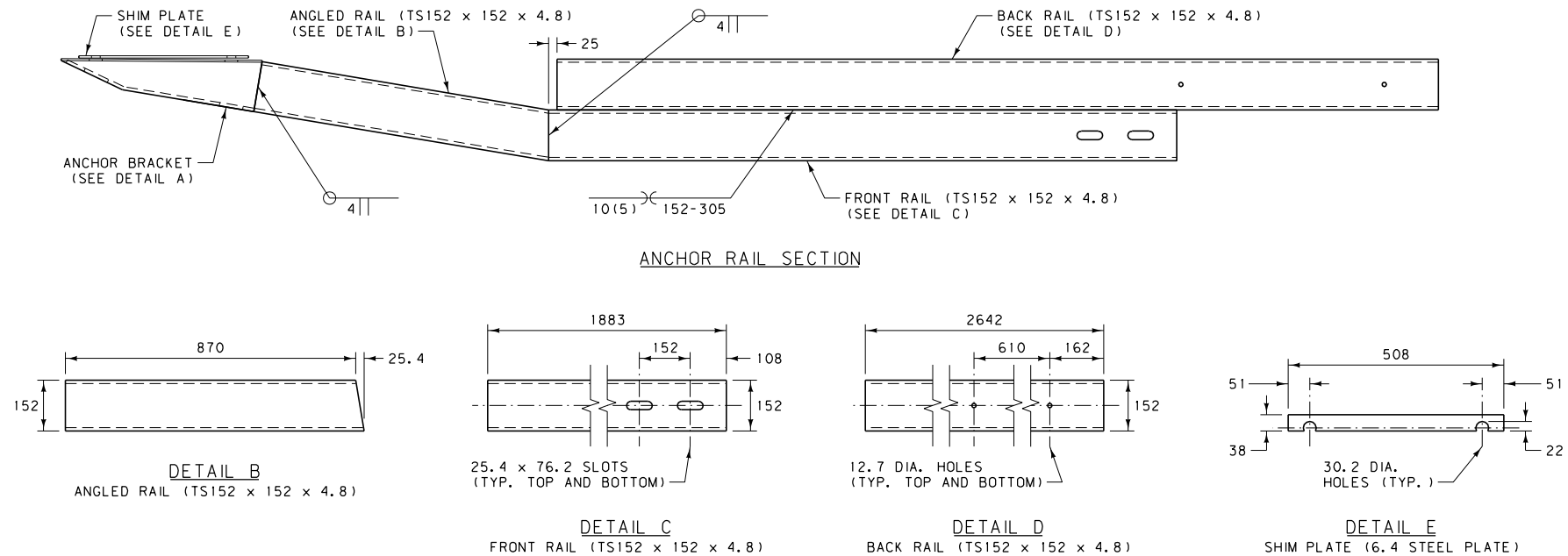
② FABRICATE SPLICE PLATES AND CONNECTION SLEEVES FROM AASHTO M 270M (ASTM A 709M) GRADE 250 STEEL PLATE. THE NUTS ARE TO BE PLAIN UN-COATED M20 HIGH STRENGTH HEX NUTS. WELD THE NUTS TO THE PLATES IN ACCORDANCE WITH THE APPLICABLE AWS CODE.

③ GALVANIZE FABRICATED RAIL, CONNECTION SLEEVES, AND SPLICE PLATES IN ACCORDANCE WITH AASHTO M 111M (ASTM A 123M). NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.

*SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.


DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-98
BOX BEAM GUARDRAIL HARDWARE	
-- REVISED -- January 2008	EFFECTIVE: FEBRUARY 2005
 MONTANA DEPARTMENT OF TRANSPORTATION	



- NOTES:
- ① MANUFACTURE BOX BEAM RAIL ELEMENTS FROM EITHER ASTM A 500 GRADE B COLD ROLLED TUBING, ASTM A 501 HOT-ROLLED TUBING OR AUTOMOTIVE ROLLOVER PROTECTIVE STEEL (ROPS). WHEN ASTM A 500 GRADE B STEEL IS USED, TEST THE MATERIAL PER ASTM E 436.
 - ② FABRICATE ANCHOR BRACKET AND RUB RAIL CONNECTION COMPONENTS FROM AASHTO M 270M (ASTM A 709M) GRADE 250 STEEL PLATE.
 - ③ GALVANIZE FABRICATED RAIL, ANCHOR BRACKET, AND RUB RAIL CONNECTION COMPONENTS IN ACCORDANCE WITH AASHTO M 111M (ASTM A 123M). NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF
GUARDRAIL HARDWARE.

ALL DIMENSIONS ARE MILLIMETERS
(mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING	
REFERENCE	DWG. NO.
STANDARD SPEC.	606-99
SECTION 606	
BOX BEAM GUARDRAIL HARDWARE	
EFFECTIVE: JANUARY 2008	
 <i>serving you with pride</i>	MONTANA DEPARTMENT OF TRANSPORTATION