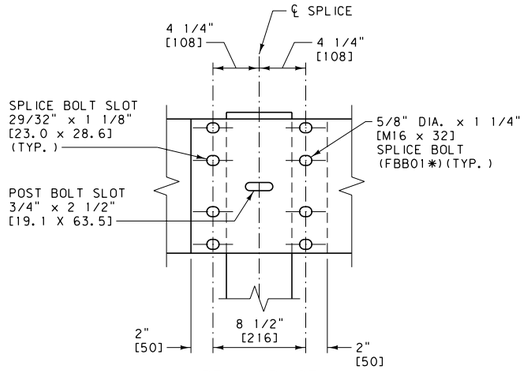
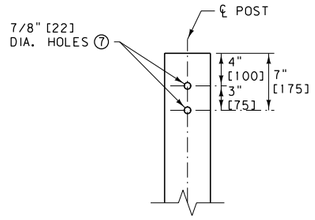
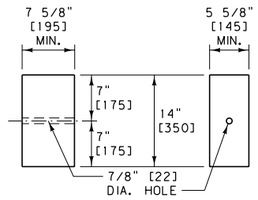


BEAM SPLICE

(LAP IN DIRECTION OF ADJACENT TRAFFIC)

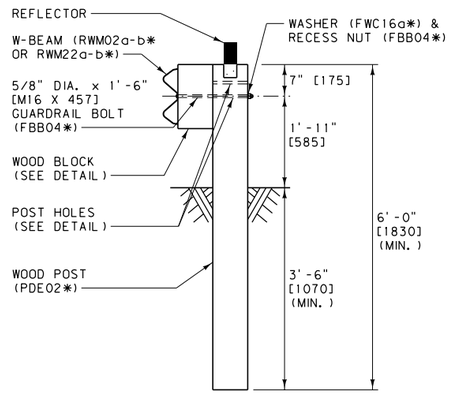


POST HOLE DETAIL

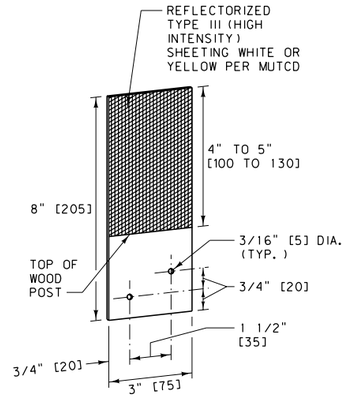


WOOD BLOCK

PDB01*

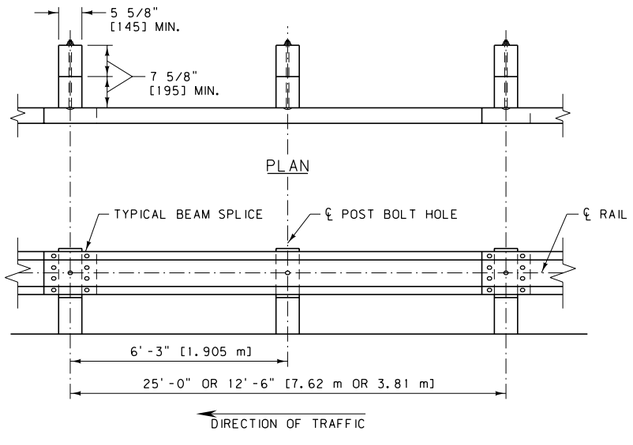


WOOD POST AND MOUNTING DETAIL

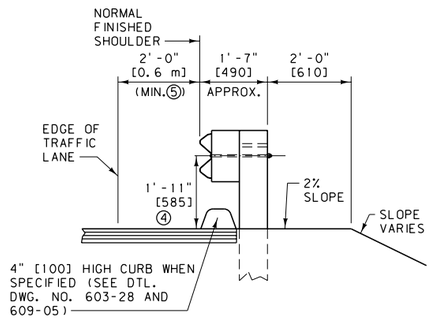


REFLECTOR

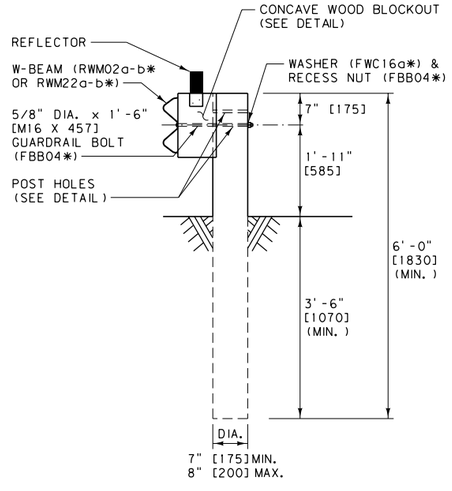
(SEE NOTES)



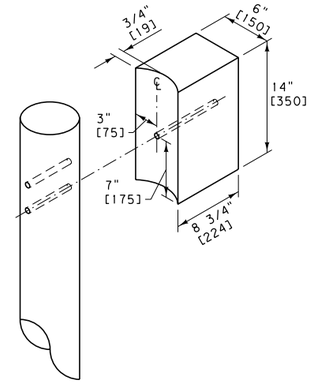
ELEVATION



TYPICAL INSTALLATION



OPTIONAL ROUND WOOD POST MOUNTING DETAIL



CONCAVE WOOD BLOCKOUT FOR USE WITH ROUND POST

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 GAUGE WIRE WRAP.

③ 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] THICK ALUMINUM ALLOY PER SECTION 704 OR PLASTIC REFLECTORS WITH A URETHANE HINGE. 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 WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2'-0" [0.6 m] FROM THE TRAFFIC LANE.

⑥ DO NOT INSTALL W-BEAM GUARDRAIL FOR OBSTACLES WITHIN 5.6' [1.7 m] OF THE FACE OF THE RAIL.

⑦ USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.

⑧ USE 6' [1830] POSTS FOR STANDARD INSTALLATIONS.

* 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.

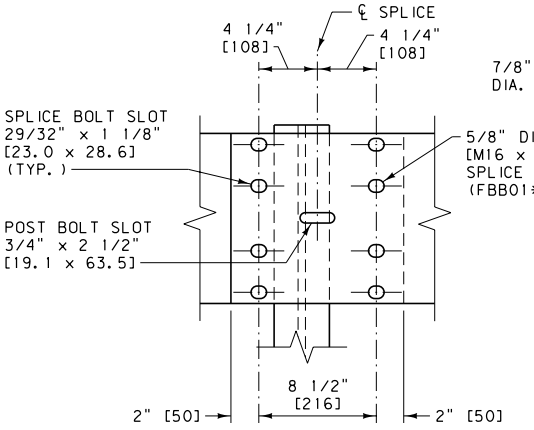
DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606, 704	DWG. NO. 606-05A

METAL GUARDRAIL - STANDARD (WOOD POSTS)

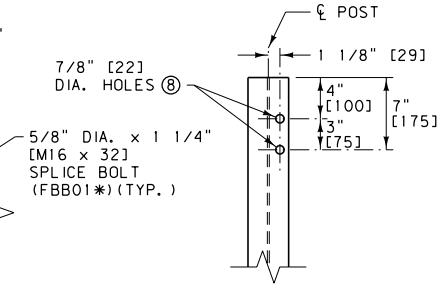
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

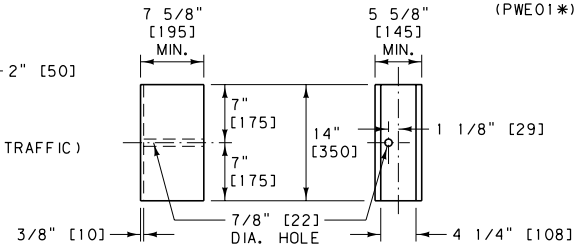


BEAM SPLICE

(LAP IN DIRECTION OF ADJACENT TRAFFIC)

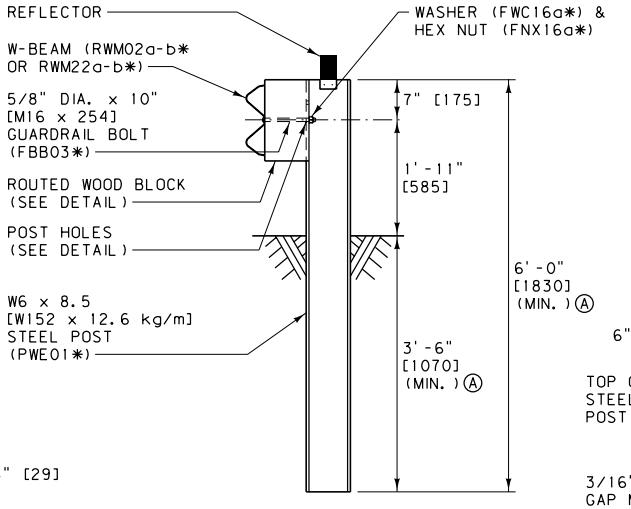


POST HOLE DETAIL



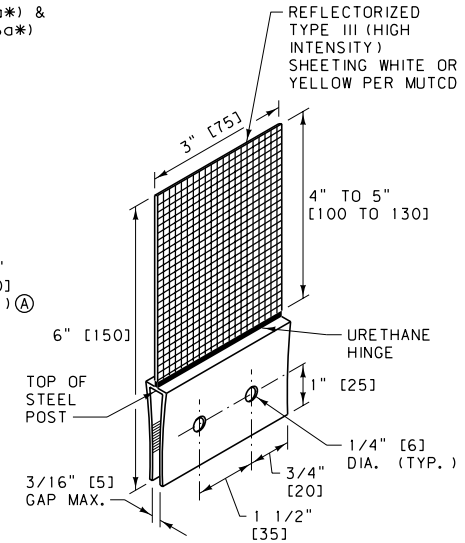
ROUTED WOOD BLOCK

PDB01*



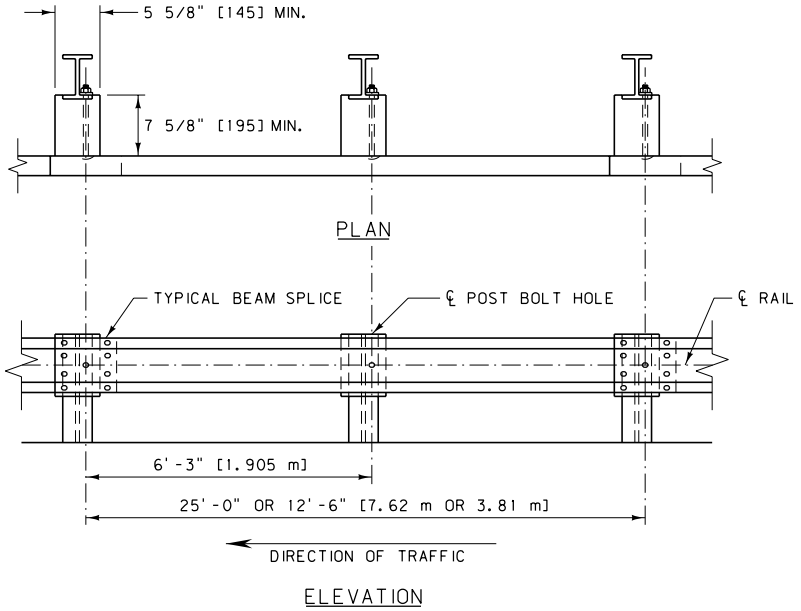
STEEL POST AND MOUNTING DETAIL

Ⓐ STANDARD UNLESS SPECIFIED OTHERWISE IN PLANS.



REFLECTOR

(SEE NOTE 3)



ELEVATION

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 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.

④ ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 1'-8" [510].

⑤ WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2'-0" [0.6 m]FROM THE TRAFFIC LANE.

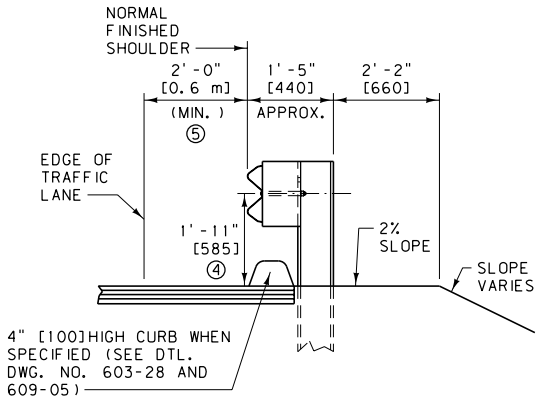
⑥ STEEL POSTS WITH OTHER POST HOLE CONFIGURATIONS MAY BE ACCEPTED, PROVIDED THEY HAVE AT LEAST THE HOLES DETAILED ON THIS DRAWING AND THEY MEET AASHTO'S PUBLICATION, "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" AND NCHRP 350 REQUIRMENTS.

⑦ DO NOT INSTALL W-BEAM GUARDRAIL FOR OBSTACLES WITHIN 5.6' [1.7 m]OF THE FACE OF THE RAIL.

⑧ USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.

⑨ USE 6' [1830] POSTS FOR STANDARD INSTALLATIONS.

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



TYPICAL INSTALLATION

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

DETAILED DRAWING

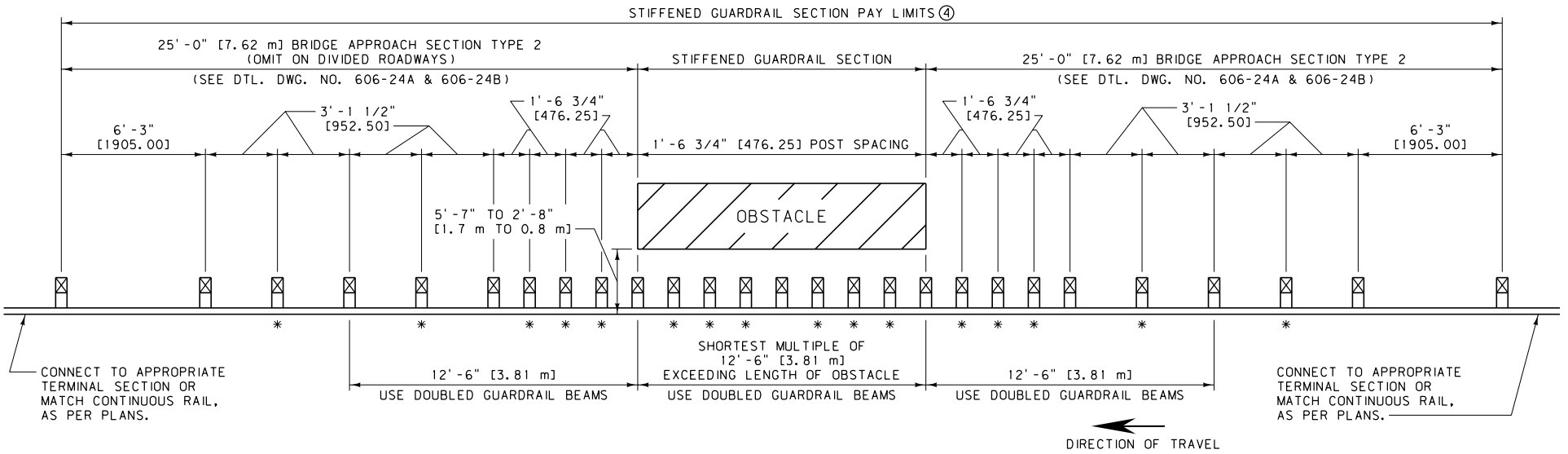
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-05B

METAL GUARDRAIL - STANDARD (STEEL POSTS)

EFFECTIVE: SEPTEMBER 2014

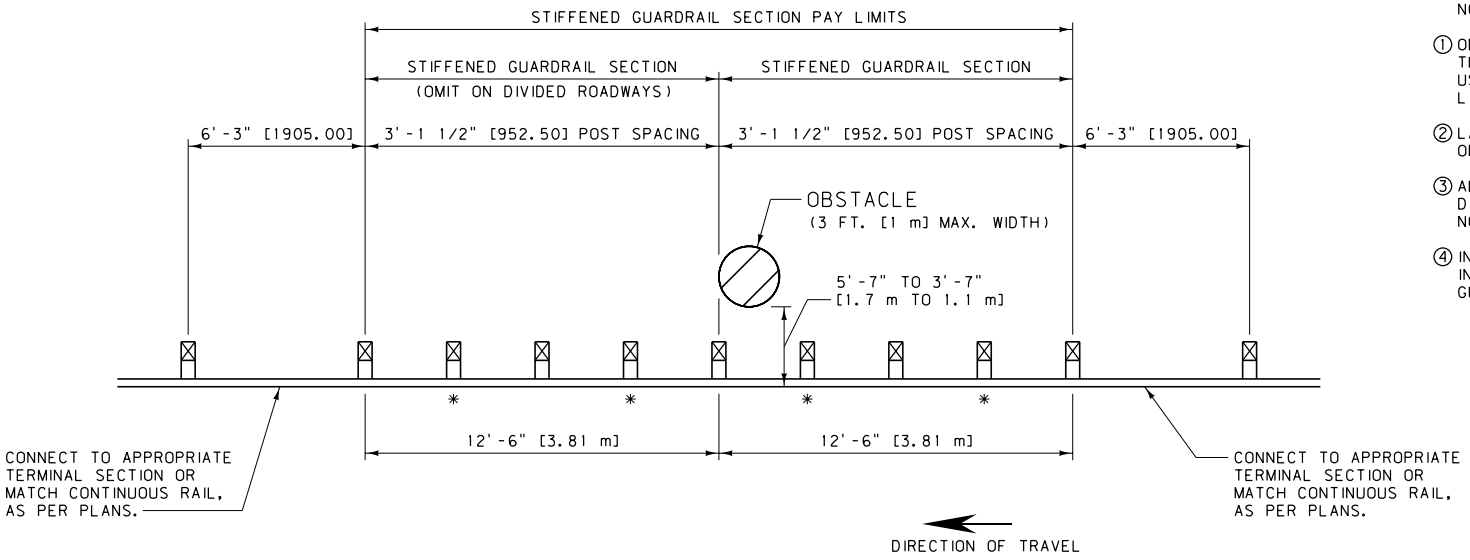
MDT MONTANA DEPARTMENT OF TRANSPORTATION



LINE OBSTACLE APPLICATION

* 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.



POINT 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

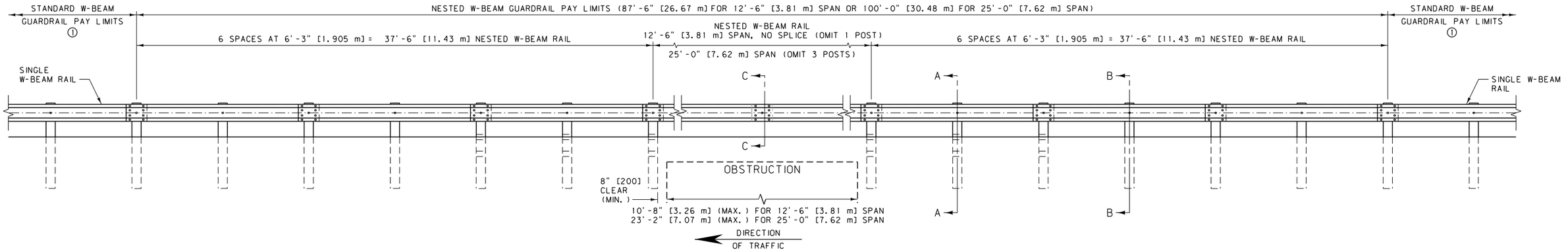
REFERENCE STANDARD SPEC. SECTION 606

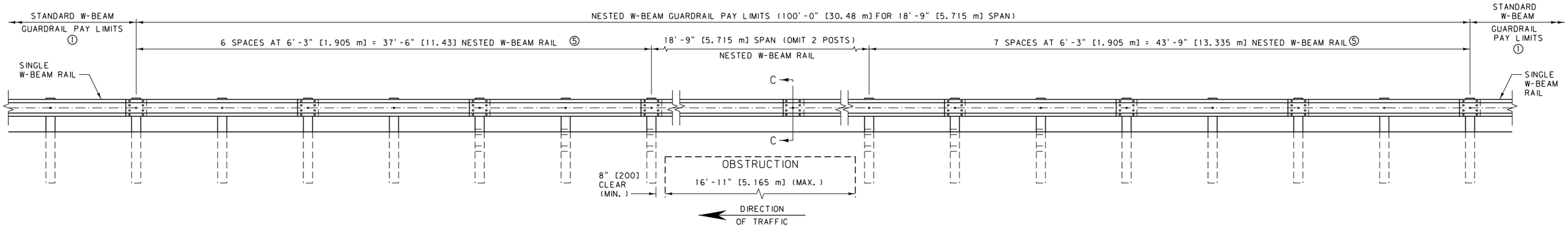
DWG. NO. 606-07

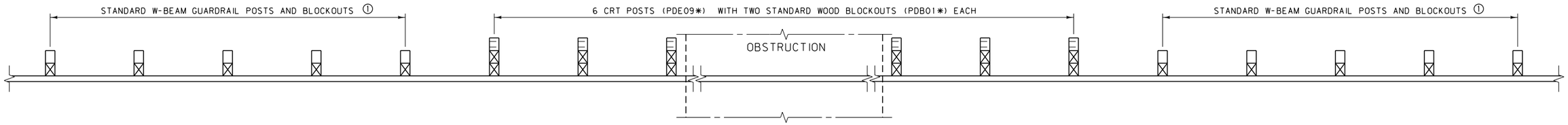
STIFFENED GUARDRAIL SECTIONS

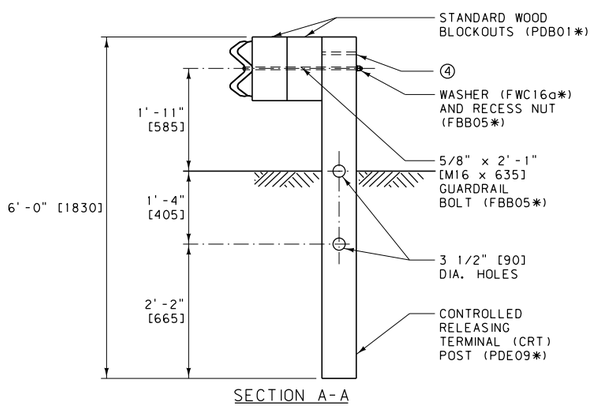
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

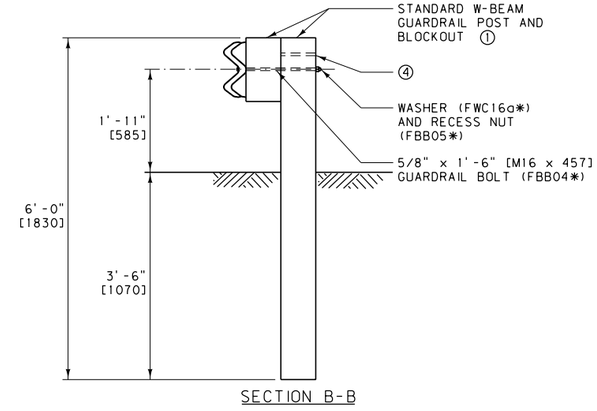




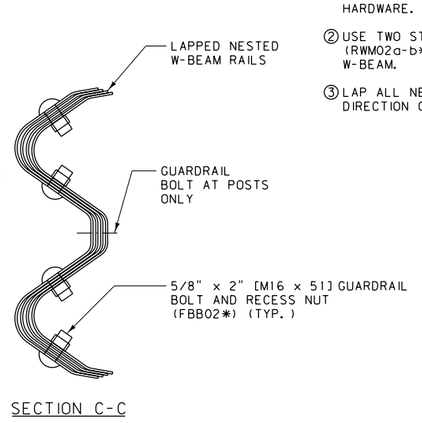




SECTION A-A



SECTION B-B



SECTION C-C

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

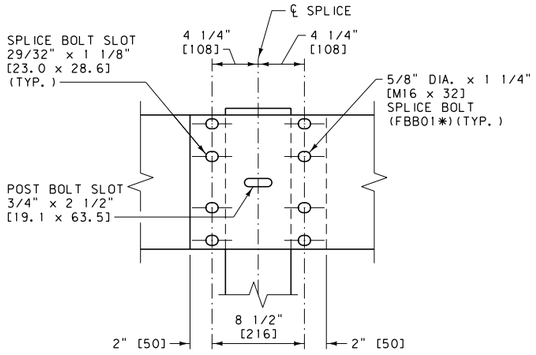
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-09

NESTED W-BEAM GUARDRAIL

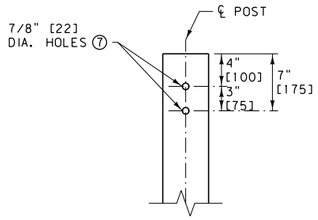
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

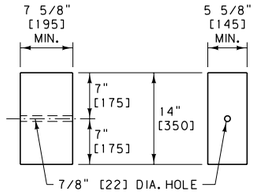


BEAM SPLICE

(LAP IN DIRECTION OF ADJACENT TRAFFIC)

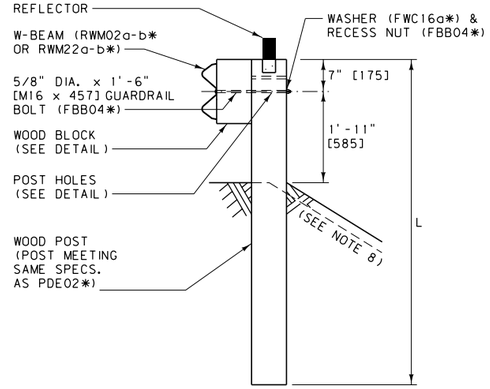


POST HOLE DETAIL

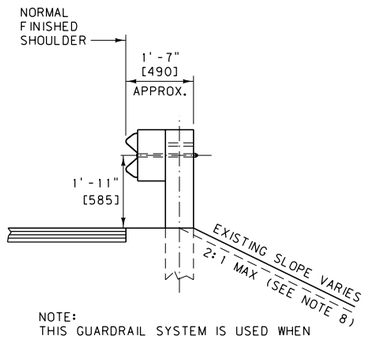


WOOD BLOCK

PDB01*

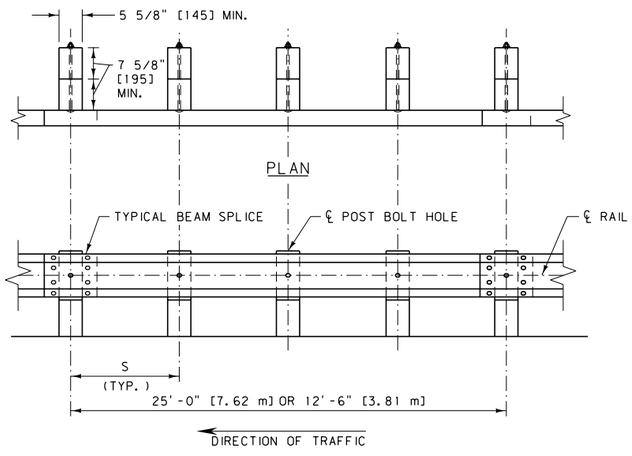


WOOD POST AND MOUNTING DETAIL



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



ELEVATION

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 GAUGE 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 OR PLASTIC REFLECTORS WITH A URETHANE HINGE. 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].

WOOD POST LENGTH AND SPACING	
POST LENGTH (L)	POST SPACING (S)
7'-0" [2.1 m]	3'-1 1/2" [952.5]
7'-6" [2.3 m]	6'-3" [1905]

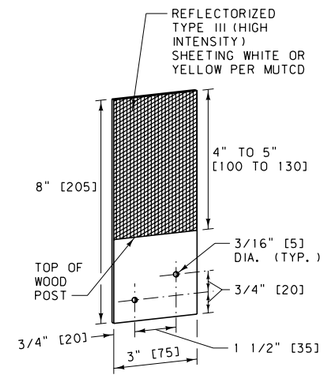
⑤ THE W-BEAM RAIL ON THIS SYSTEM REQUIRES ADDITIONAL HOLES TO ACCOMMODATE BEING BOLTED TO POSTS AT HALF THE NORMAL POST SPACING. DRILL ADDITIONAL HOLES IN THE W-BEAM RAIL PRIOR TO APPLYING CORROSION PROTECTION.

⑥ DO NOT INSTALL W-BEAM GUARDRAIL WITH ANY POST LENGTH FOR OBSTACLES WITHIN 4.6' [1.4 m] OF THE FACE OF THE RAIL.

⑦ USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.

⑧ ON 7'6" [2.3m] WOOD POSTS BEGIN INSLOPE BREAK AT CENTER OF POST.

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



REFLECTOR

(SEE NOTE 3)

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

DETAILED DRAWING

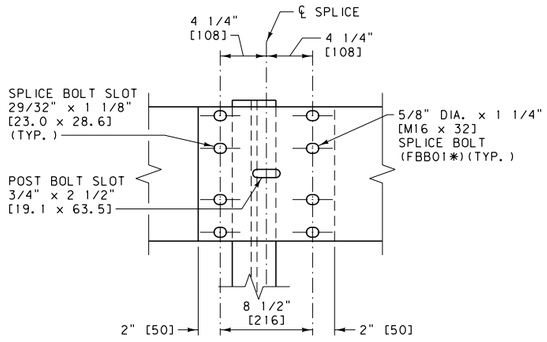
REFERENCE STANDARD SPEC. SECTION 606, 704

DWG. NO. 606-11A

METAL GUARDRAIL - LONG POSTS (WOOD)

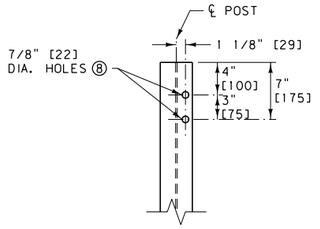
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

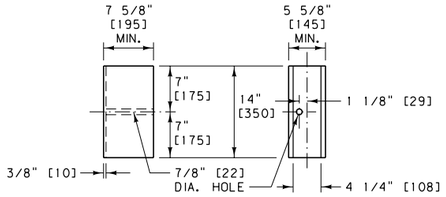


BEAM SPLICE

(LAP IN DIRECTION OF ADJACENT TRAFFIC)

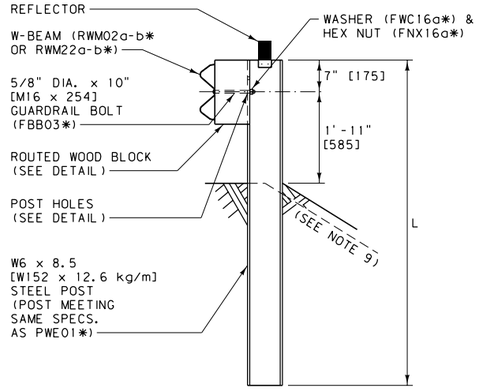


POST HOLE DETAIL

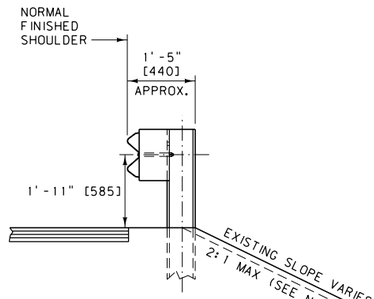


ROUTED WOOD BLOCK

PDB01*

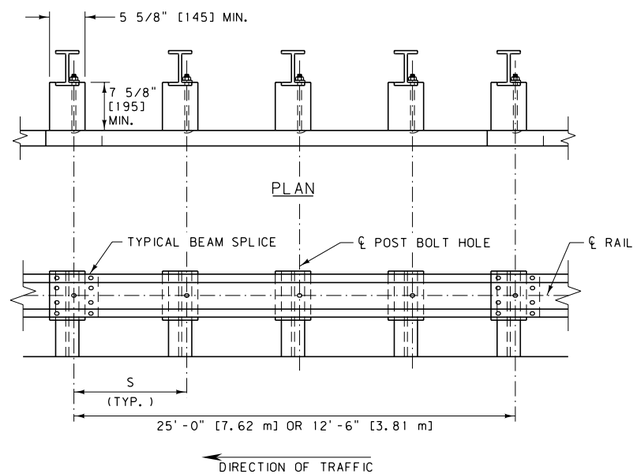


STEEL POST AND MOUNTING DETAIL



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



ELEVATION

STEEL POST LENGTH AND SPACING	
POST LENGTH (L)	POST SPACING (S)
7'-0" [2.1 m]	3'-1 1/2" [952.5]
9'-0" [2.7 m]	6'-3" [1905]

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.

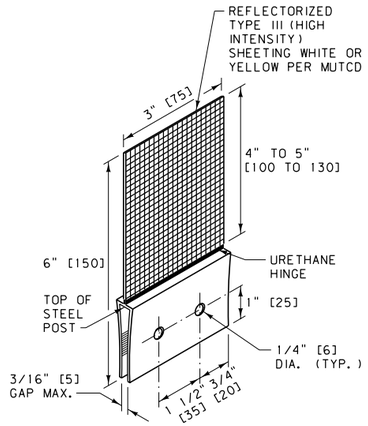
⑥ THE W-BEAM RAIL ON THIS SYSTEM REQUIRES ADDITIONAL HOLES TO ACCOMMODATE BEING BOLTED TO POSTS AT HALF THE NORMAL POST SPACING. DRILL ADDITIONAL HOLES IN THE W-BEAM RAIL PRIOR TO APPLYING CORROSION PROTECTION.

⑦ DO NOT INSTALL W-BEAM GUARDRAIL WITH ANY POST LENGTH FOR OBSTACLES WITHIN 4.6' [1.4 m] OF THE FACE OF THE RAIL.

⑧ USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.

⑨ ON 9'0" [2.7m] STEEL POSTS BEGIN INSLOPE BREAK AT CENTER OF POST.

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



REFLECTOR

(SEE NOTE 3)

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

DETAILED DRAWING

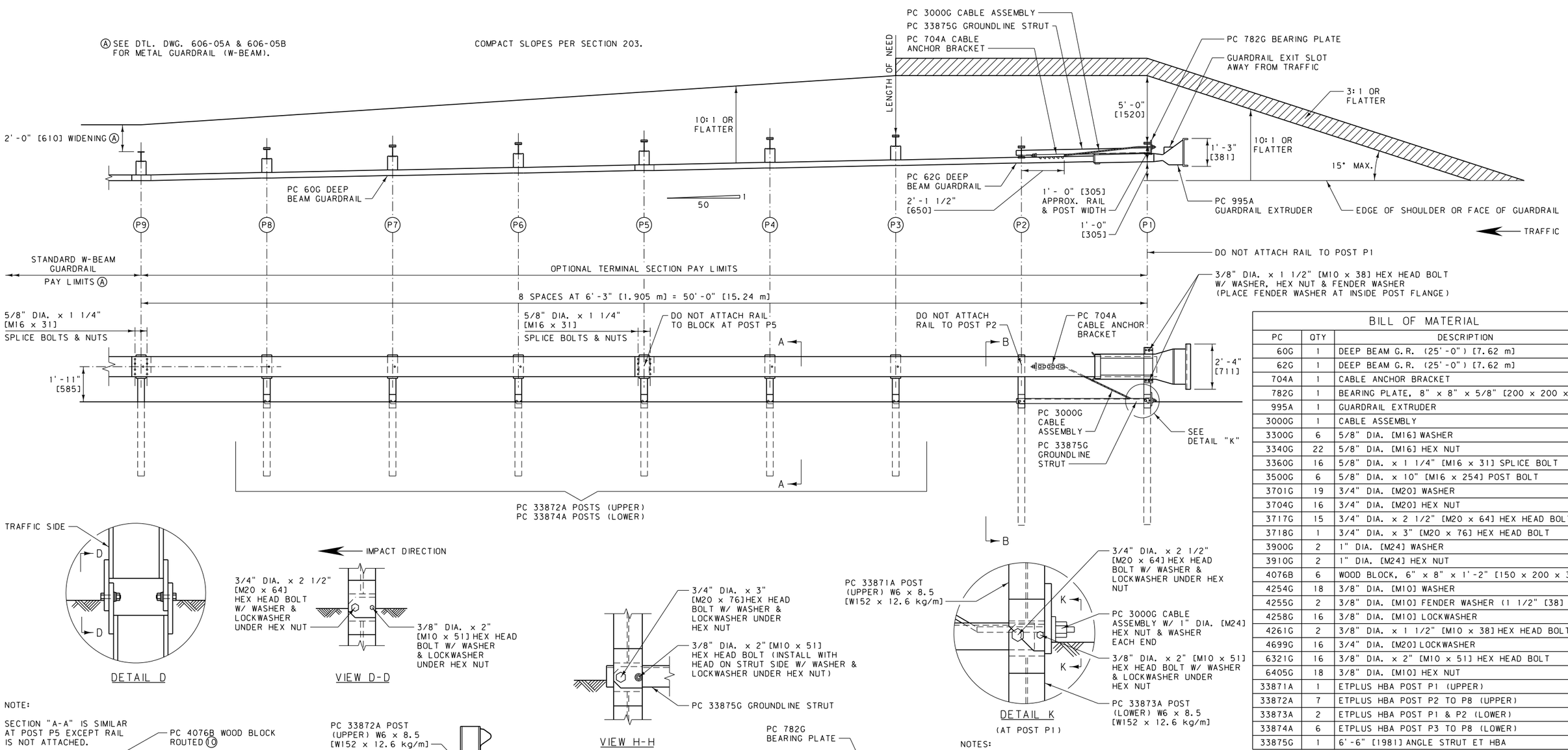
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-11B

METAL GUARDRAIL - LONG POSTS (METAL)

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



DETAIL D

VIEW D-D

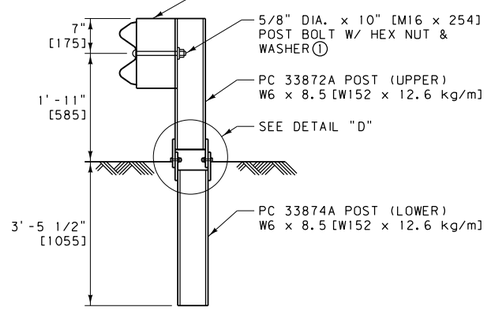
VIEW H-H

DETAIL K
(AT POST P1)

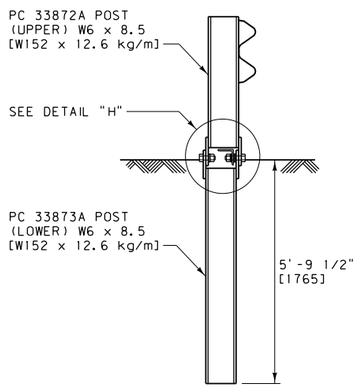
BILL OF MATERIAL		
PC	QTY	DESCRIPTION
60G	1	DEEP BEAM G.R. (25'-0") [7.62 m]
62G	1	DEEP BEAM G.R. (25'-0") [7.62 m]
704A	1	CABLE ANCHOR BRACKET
782G	1	BEARING PLATE, 8" x 8" x 5/8" [200 x 200 x 16]
995A	1	GUARDRAIL EXTRUDER
3000G	1	CABLE ASSEMBLY
3300G	6	5/8" DIA. [M16] WASHER
3340G	22	5/8" DIA. [M16] 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:

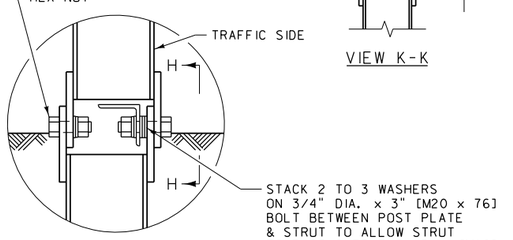
SECTION "A-A" IS SIMILAR AT POST P5 EXCEPT RAIL IS NOT ATTACHED.



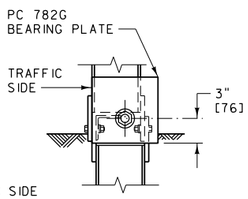
SECTION A-A
(TYP AT POSTS P3, P4, P6, P7 & P8)



SECTION B-B
(AT POST P2)



DETAIL H
(AT POST P2)



VIEW K-K

NOTES:

① THE 5/8" DIA. [M16] FLAT WASHER IS USED UNDER THE NUT, BEHIND THE POST ONLY. NO WASHER IS USED AT THE RAIL.

② 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.

③ 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.

④ 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.

⑤ ATTACH REFLECTORS TO TERMINAL SECTION POSTS, PER DTL. DWG. NO. 606-05A AND 606-05B.

⑥ OBTAIN ENGINEER'S APPROVAL OF MANUFACTURER INSTALLATION OPTIONS WHEN SITE CONDITIONS PREVENT THE USE OF THE OPTION SHOWN ON THIS DETAIL.

⑦ AFTER FINAL ASSEMBLY, RECHECK CABLE TO MAKE SURE IT IS TAUT AND HAS NOT RELAXED.

⑧ LAP ALL W-BEAM SPLICES IN THE DIRECTION OF ADJACENT TRAFFIC.

⑨ ON LOWER POSTS 1 TO 8, INSTALL TOP OF POST A MAXIMUM OF 4 INCHES [100] ABOVE GROUND.

⑩ USE ROUTED WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS.

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606, 203

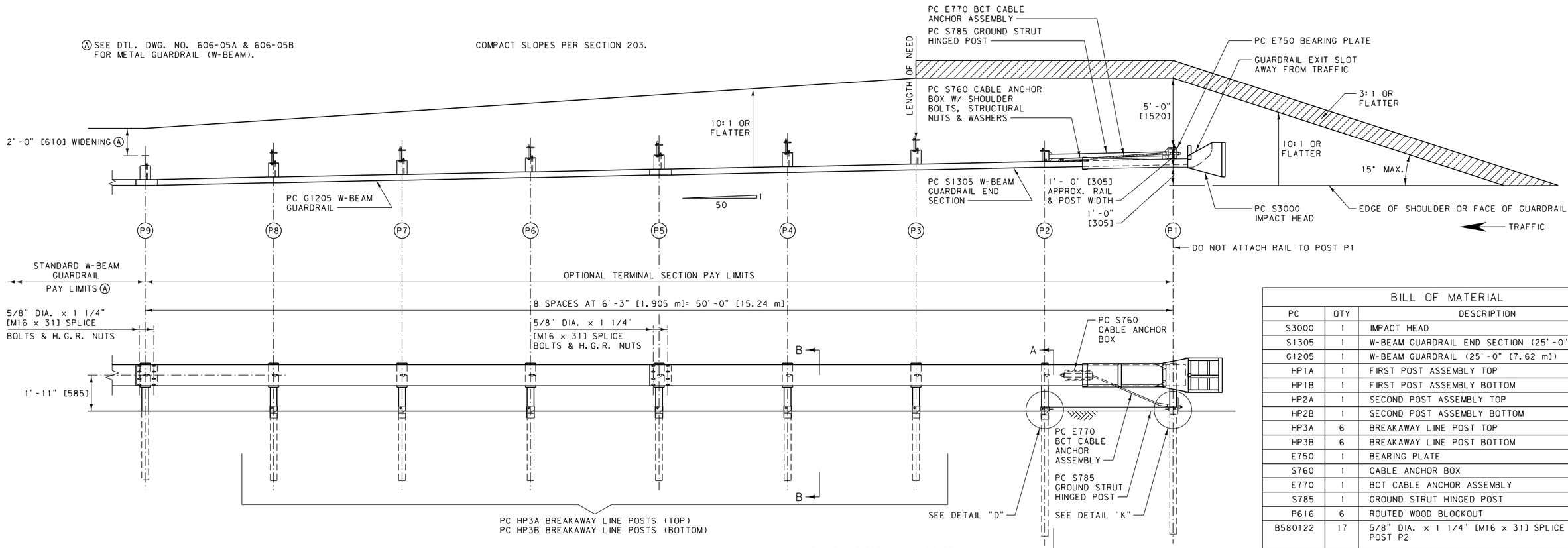
DWG. NO. 606-13A

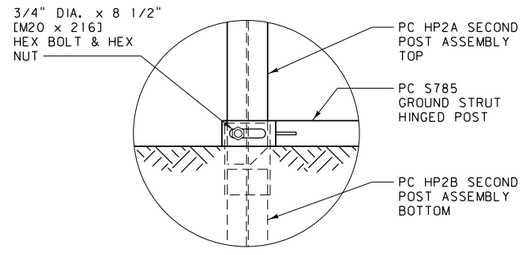
OPTIONAL TERMINAL SECTION - ET-PLUS

--REVISED--
JULY 2016

EFFECTIVE: SEPTEMBER 2014

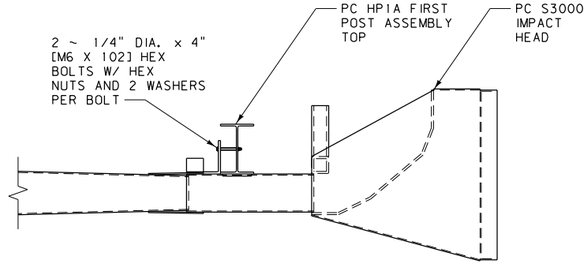
MDT MONTANA DEPARTMENT OF TRANSPORTATION



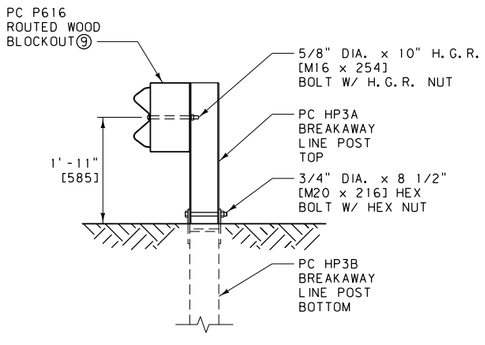


DETAIL D

(AT POST P2)

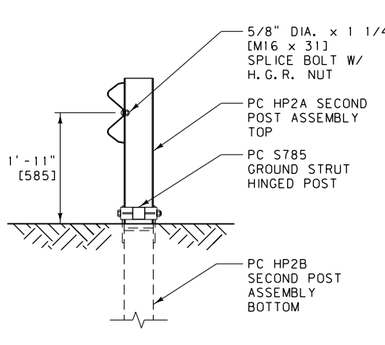


IMPACT HEAD CONNECTION DETAIL



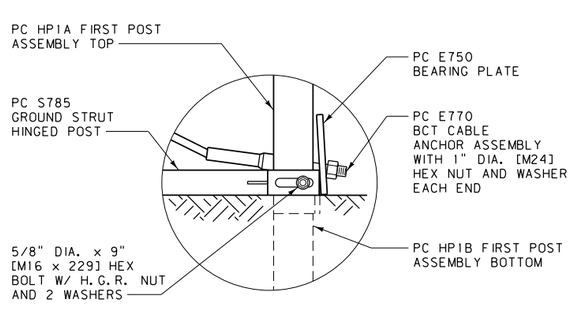
SECTION B-B

(TYP. AT POSTS P3 THRU P8)



SECTION A-A

(AT POST P2)



DETAIL K

(AT POST P1)

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

NOTES:

① 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.

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 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.

④ ATTACH REFLECTORS TO TERMINAL SECTION POSTS, PER DTL. DWG. NO. 606-05A AND 606-05B.

⑤ AFTER FINAL ASSEMBLY, RECHECK CABLE TO MAKE SURE IT IS TAUT AND HAS NOT RELAXED.

⑥ OBTAIN ENGINEER'S APPROVAL OF MANUFACTURER INSTALLATION OPTIONS WHEN SITE CONDITIONS PREVENT THE USE OF THE OPTION SHOWN ON THIS DETAIL.

⑦ LAP ALL W-BEAM SPLICES IN THE DIRECTION OF ADJACENT TRAFFIC.

⑧ ON LOWER POSTS 1 TO 8, INSTALL TOP OF POST A MAXIMUM OF 4 INCHES [100]ABOVE GROUND.

⑨ USE ROUTED WOOD BLOCKS OR OTHER NCHRP APPROVED BLOCKS.

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606, 203

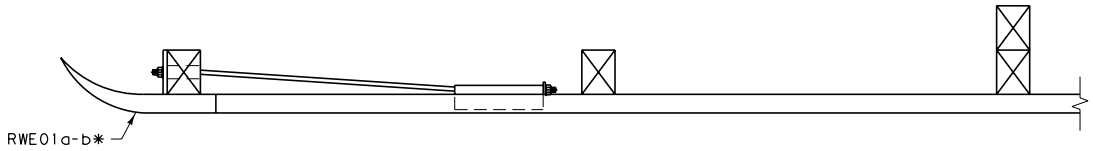
DWG. NO. 606-13B

OPTIONAL TERMINAL SECTION - SKT 350

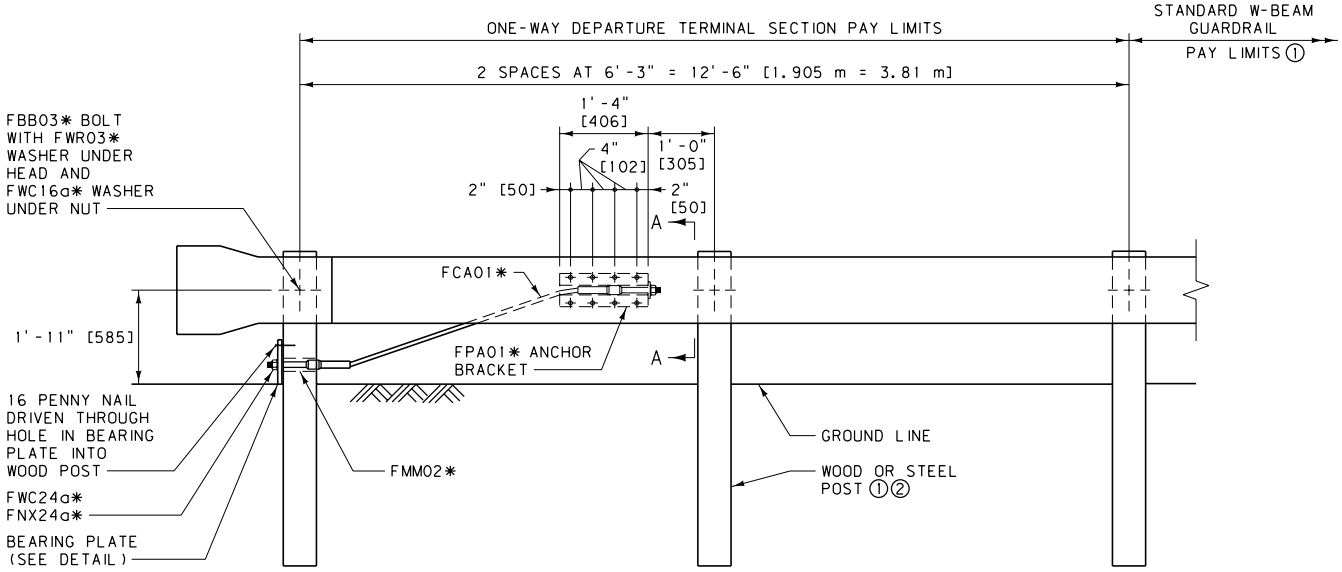
--REVISED-- JULY 2016

EFFECTIVE: SEPTEMBER 2014

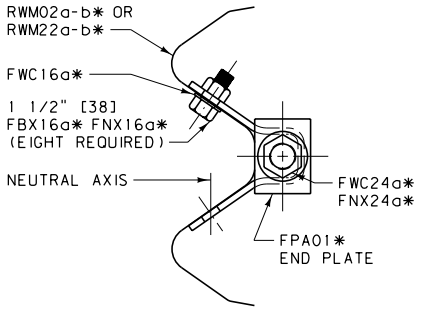
MDT MONTANA DEPARTMENT OF TRANSPORTATION



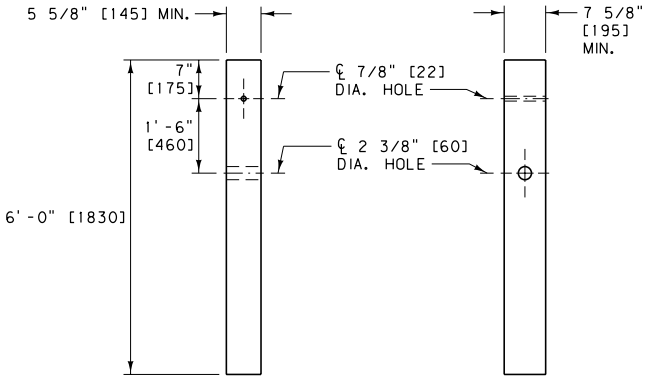
PLAN



ELEVATION

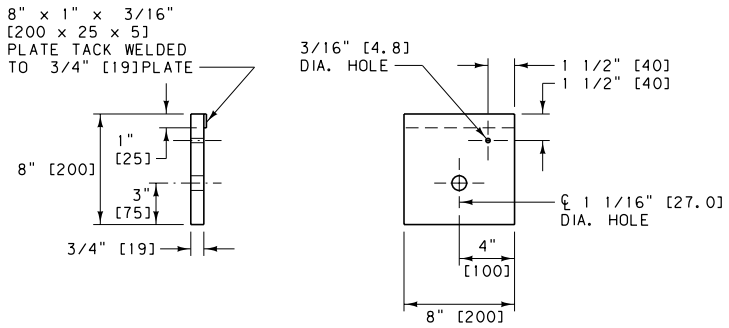


SECTION A-A



END POST DETAILS

PDF03*



BEARING PLATE DETAIL

FPB01*

NOTE:

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

② DO NOT USE ROUND POSTS.

* 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

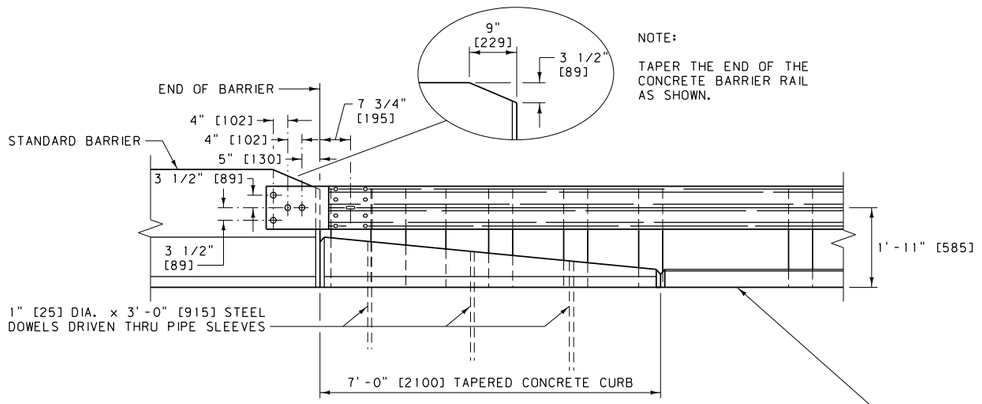
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-18

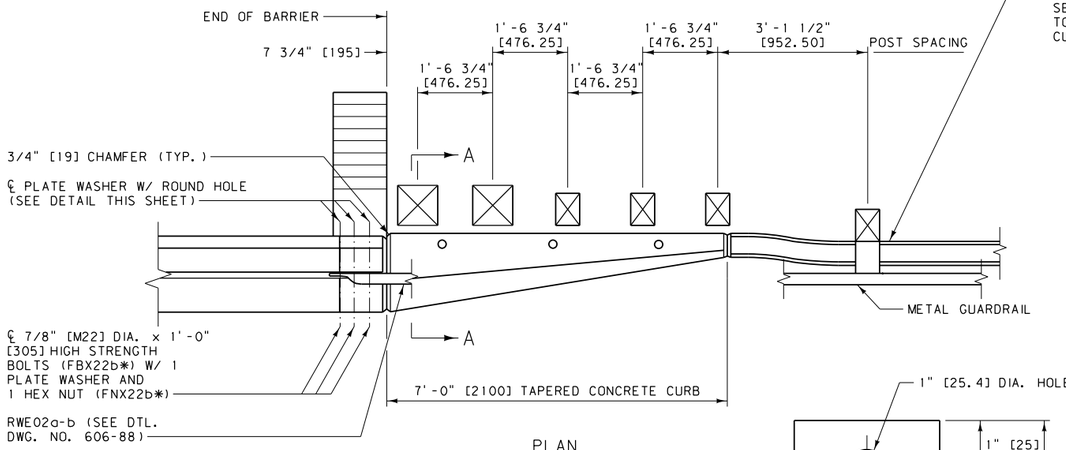
ONE-WAY DEPARTURE TERMINAL SECTION

EFFECTIVE: SEPTEMBER 2014

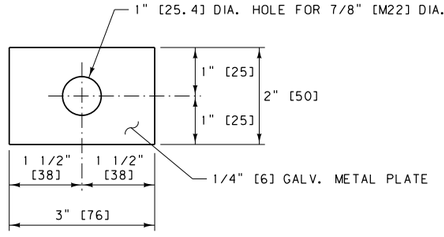
MDT MONTANA DEPARTMENT OF TRANSPORTATION



ELEVATION

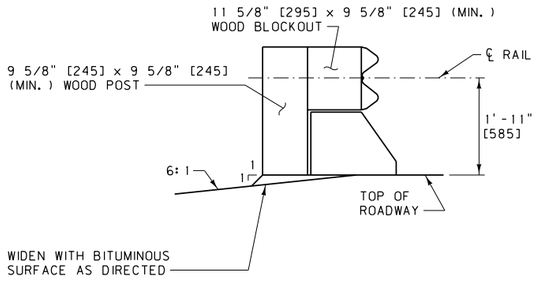


PLAN



DETAIL "A"

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.

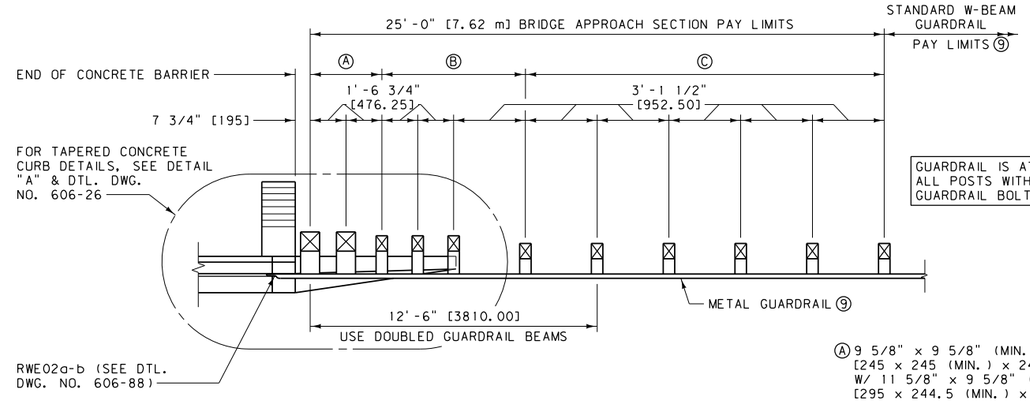
⑥ USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.

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.

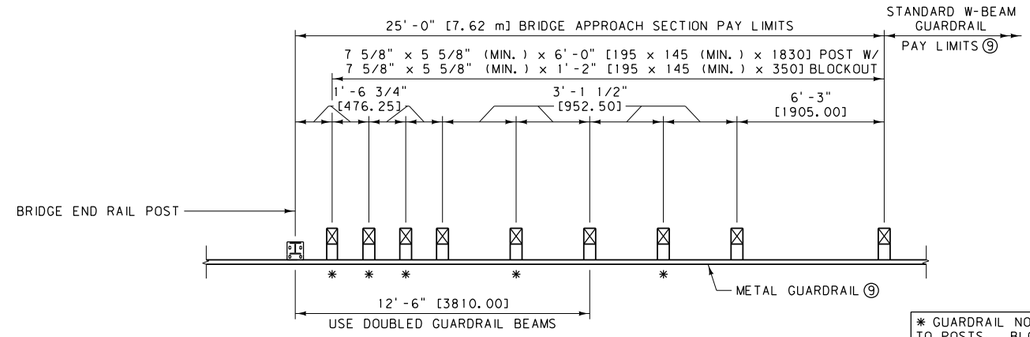


METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1
(FOR BRIDGES USING CONCRETE BARRIER RAIL)

Ⓐ 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

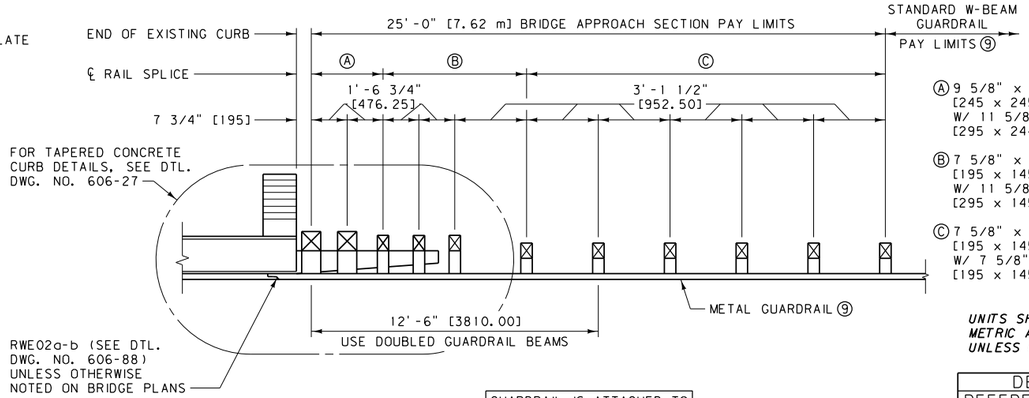
Ⓑ 7 5/8" x 5 5/8" x 7'-0" [195 x 145 x 2135] POST W/ 11 5/8" x 5 5/8" (MIN.) x 1'-2" [295 x 145 (MIN.) x 350] BLOCKOUT

Ⓒ 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



* GUARDRAIL NOT ATTACHED TO POSTS. BLOCKOUT FASTENED TO POST WITH STANDARD POST BOLT.

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



Ⓐ 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

Ⓑ 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

Ⓒ 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

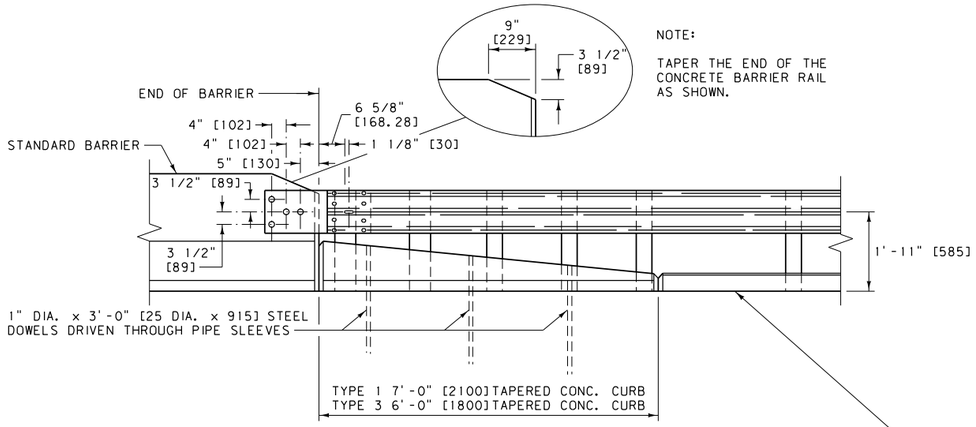
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

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

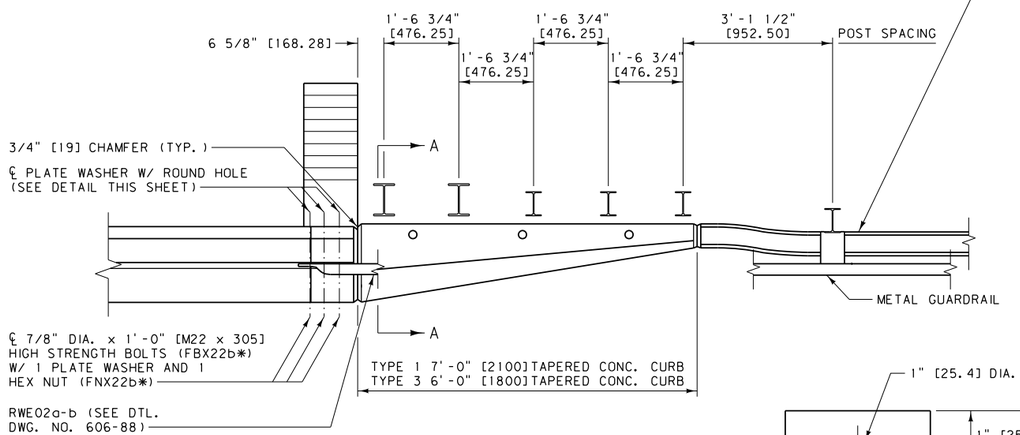
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-24A

BRIDGE APPROACH SECTIONS - WOOD POSTS

--REVISED--	EFFECTIVE: SEPTEMBER 2014
JULY 2016	MDT MONTANA DEPARTMENT OF TRANSPORTATION



ELEVATION



PLAN

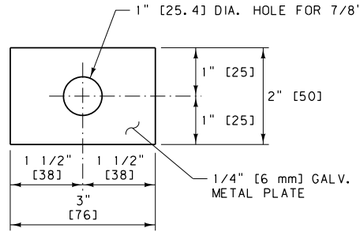
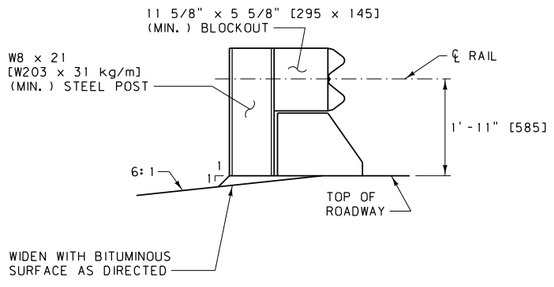


PLATE WASHER

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.

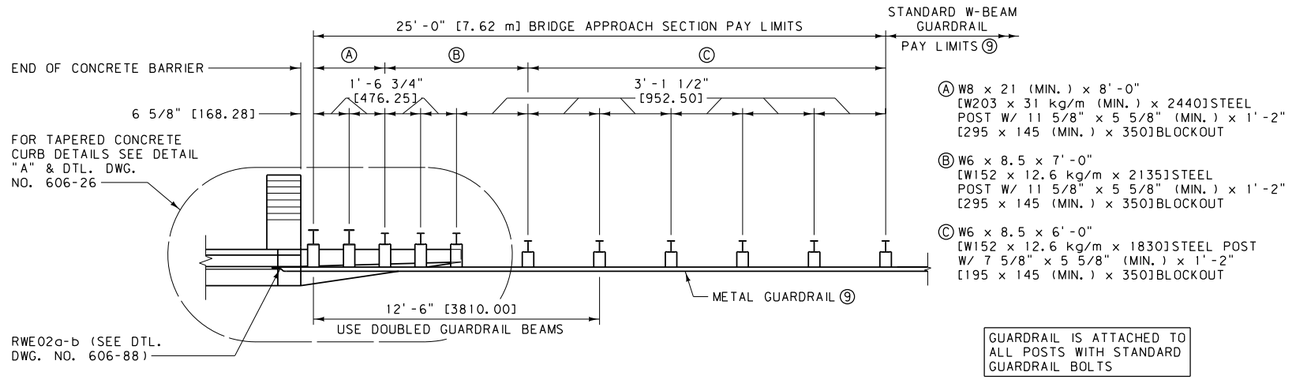
⑥ USE ROUTED WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.

⑦ DO NOT FLARE BRIDGE APPROACH SECTIONS.

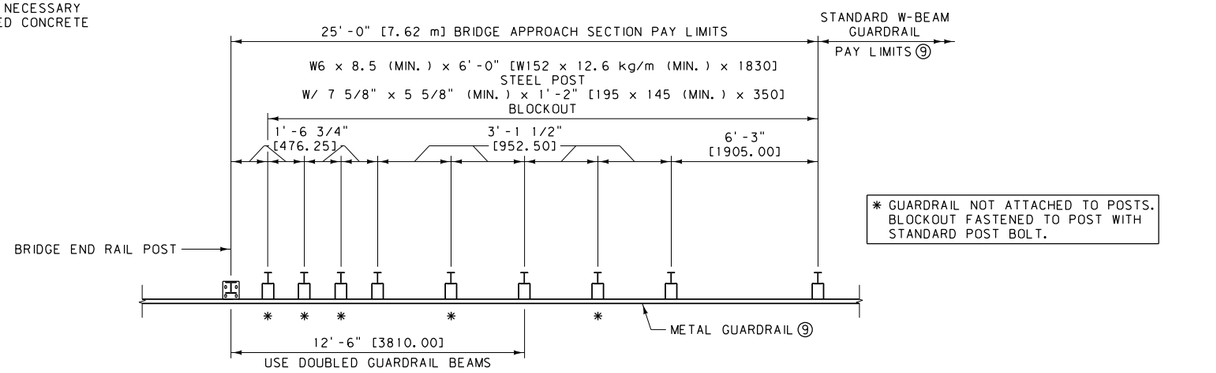
⑧ SEE DTL. DWG. NO. 606-25B FOR SKEWED BRIDGES.

⑨ SEE DTL. DWG. NO. 606-05B FOR METAL GUARDRAIL (W-BEAM).

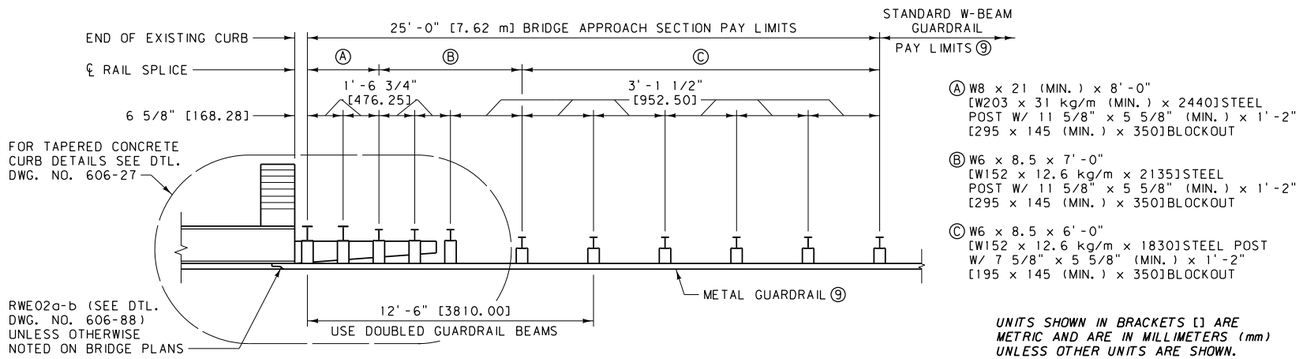
* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.



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.

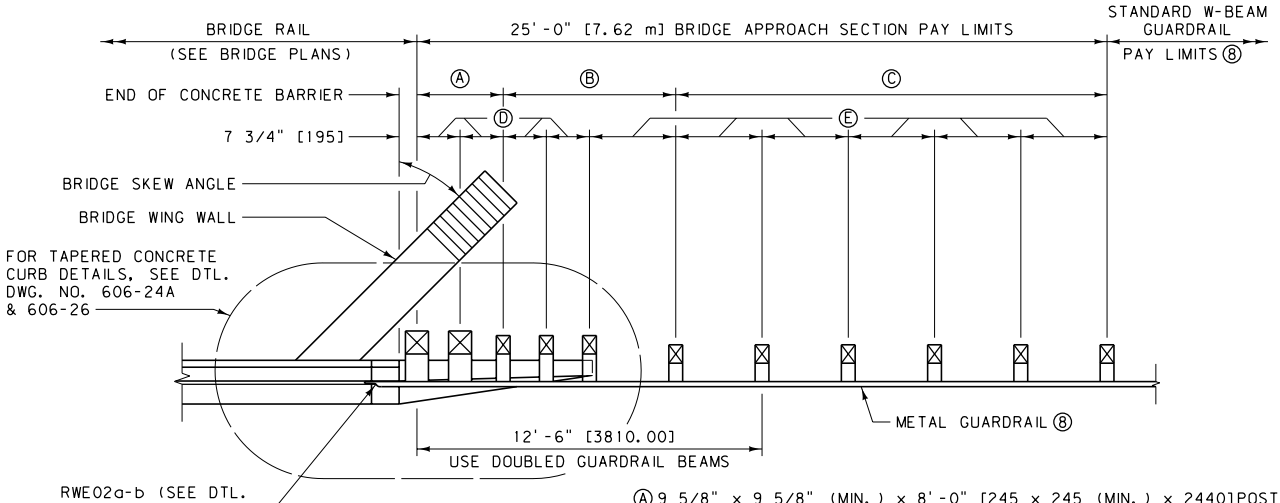
DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-24B

BRIDGE APPROACH SECTIONS - STEEL POSTS

--REVISED-- JULY 2016	EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



GUARDRAIL IS ATTACHED TO ALL POSTS WITH STANDARD GUARDRAIL BOLTS

Ⓐ 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 245 (MIN.) x 350] BLOCKOUT

Ⓑ 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

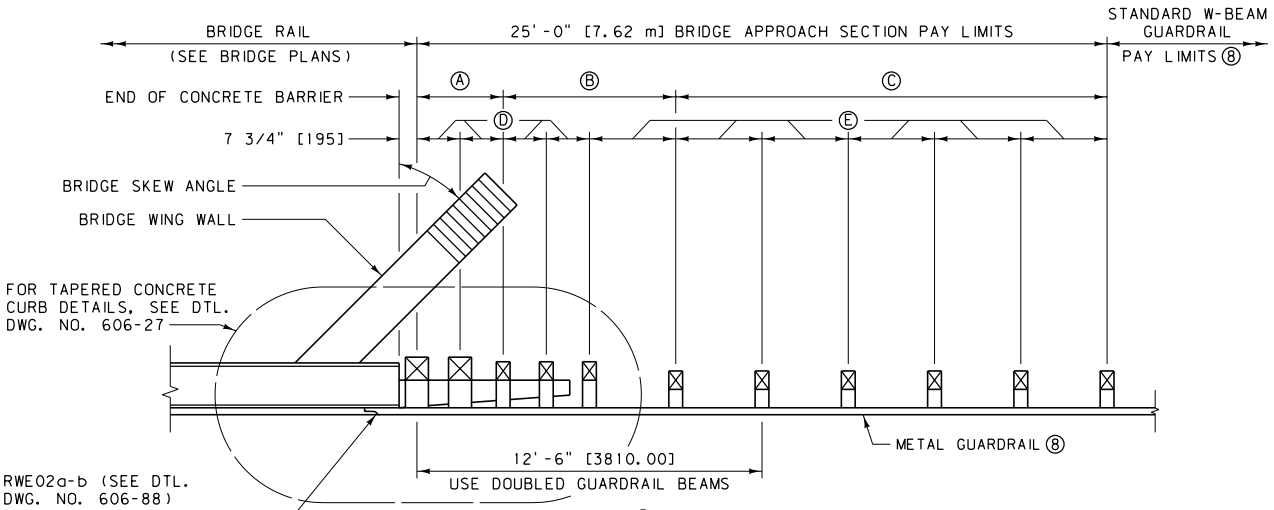
Ⓒ 7 5/8" x 5 5/8" x 6'-0" [195 x 145 x 1830]POST
W/ 7 5/8" x 5 5/8" (MIN.) x 1'-2" [195 x 145 (MIN.) x 350]BLOCKOUT

Ⓓ 1'-6 3/4" [476.25]

Ⓔ 3'-1 1/2" [952.50]

METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1

(FOR SKEWED BRIDGES USING CONCRETE BARRIER RAIL)



GUARDRAIL IS ATTACHED TO ALL POSTS WITH STANDARD GUARDRAIL BOLTS

Ⓐ 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 245 (MIN.) x 350] BLOCKOUT

Ⓑ 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

Ⓒ 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

Ⓓ 1'-6 3/4" [476.25]

Ⓔ 3'-1 1/2" [952.50]

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 DIRECTON 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).

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

DETAILED DRAWING

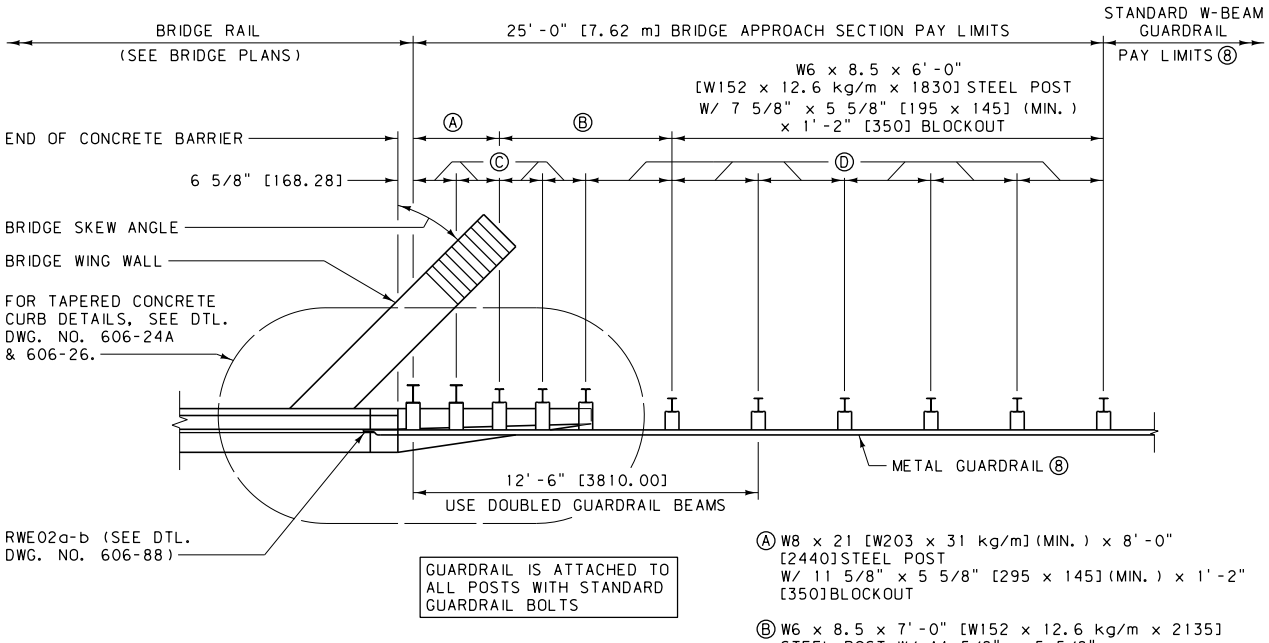
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-25A

SKEWED BRIDGE APPROACH SECTIONS - WOOD POSTS

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



Ⓐ W8 x 21 [W203 x 31 kg/m] (MIN.) x 8'-0" [2440] STEEL POST W/ 11 5/8" x 5 5/8" [295 x 145] (MIN.) x 1'-2" [350] BLOCKOUT

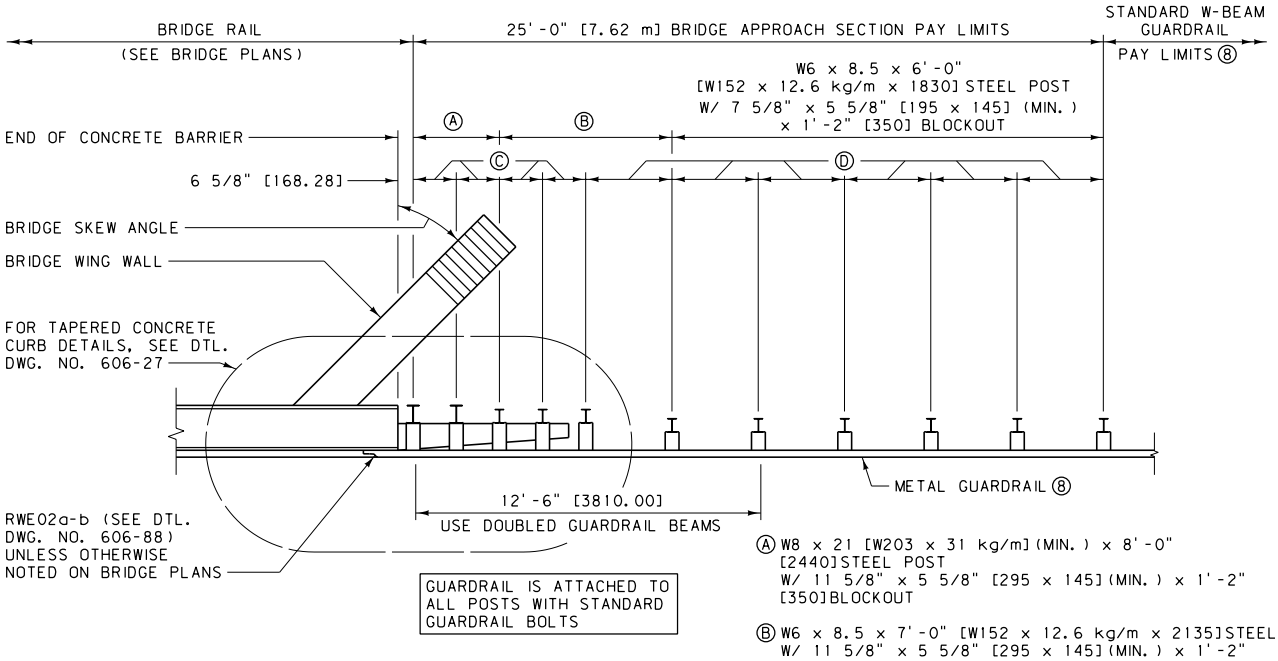
Ⓑ W6 x 8.5 x 7'-0" [W152 x 12.6 kg/m x 2135] STEEL POST W/ 11 5/8" x 5 5/8" [295 x 145] (MIN.) x 1'-2" [350] BLOCKOUT

Ⓒ 1'-6 3/4" [476.25] SPACING BETWEEN POSTS

Ⓓ 3'-1 1/2" [952.50] SPACING BETWEEN POSTS

METAL GUARDRAIL-BRIDGE APPROACH SECTION TYPE 1

(FOR SKEWED BRIDGES USING CONCRETE BARRIER RAIL)



Ⓐ W8 x 21 [W203 x 31 kg/m] (MIN.) x 8'-0" [2440] STEEL POST W/ 11 5/8" x 5 5/8" [295 x 145] (MIN.) x 1'-2" [350] BLOCKOUT

Ⓑ W6 x 8.5 x 7'-0" [W152 x 12.6 kg/m x 2135] STEEL POST W/ 11 5/8" x 5 5/8" [295 x 145] (MIN.) x 1'-2" [350] BLOCKOUT

Ⓒ 1'-6 3/4" [476.25] SPACING BETWEEN POSTS

Ⓓ 3'-1 1/2" [952.50] SPACING BETWEEN POSTS

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.

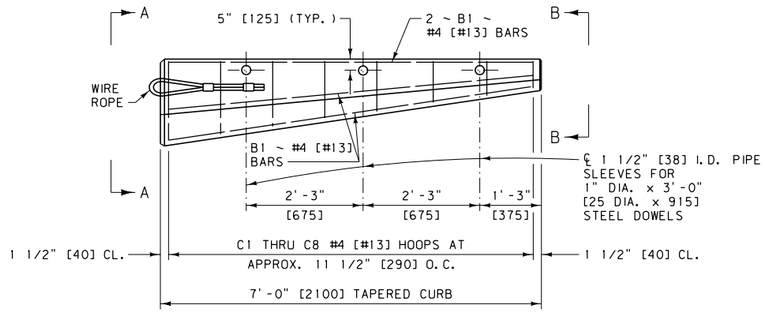
⑥ DO NOT FLARE BRIDGE APPROACH SECTIONS.

⑦ SEE DTL. DWG. NO. 606-24B FOR ADDITIONAL INFORMATION.

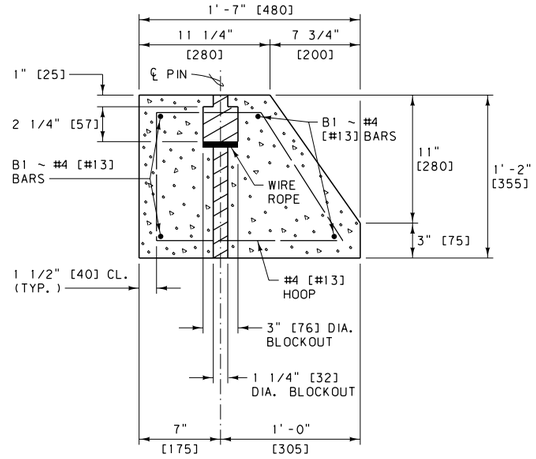
⑧ SEE DTL. DWG. NO. 606-05B FOR METAL GUARDRAIL (W-BEAM).

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

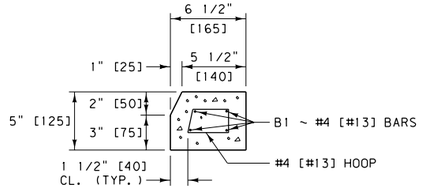
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-25B
SKEWED BRIDGE APPROACH SECTIONS - STEEL POSTS	
EFFECTIVE: SEPTEMBER 2014	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	



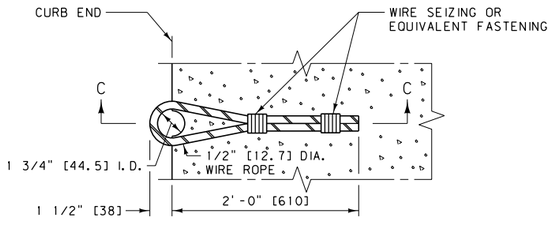
PLAN



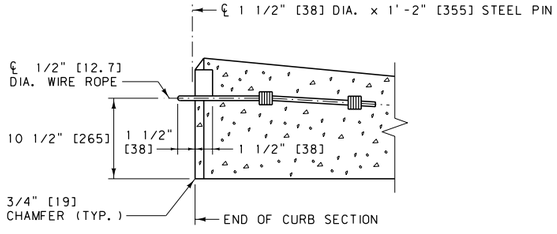
VIEW A-A



VIEW B-B



WIRE ROPE DETAIL



SECTION C-C

NOTES:

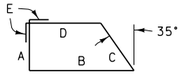
① TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION TYPE 1 (SEE DTL. DWG. NO. 606-24A AND 606-24B).

② FURNISH WIRE ROPE MEETING SECTION 705.

③ FURNISH GRADE 60 [420] REINFORCING STEEL MEETING SECTION 711..

④ ALL CONCRETE IS CLASS GENERAL.
TOTAL CONCRETE PER 7' [2100 mm] TAPERED CURB EST. = 0.2 C.Y. [0.17 m³]
TOTAL REBAR WEIGHT PER 7' [2100 mm] TAPERED CURB EST. = 34 LB [15.1 kg].

BILL OF REINFORCING STEEL (ONE SECTION ONLY)

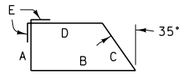


TYPE 1

BENT BARS (ALL DIMENSIONS ARE OUT TO OUT)

MARK	SIZE	NO.	TYPE	LENGTH	A	B	C	D	E
C1	#4	1	1	4'-8"	11"	1'-4"	1'-1"	9"	3 1/2"
C2	↑	↑	↑	4'-2"	9 1/2"	1'-2"	11 1/2"	8"	↑
C3				3'-9"	8 1/2"	1'- 1/2"	10"	7"	
C4				3'-3"	7"	10 1/2"	8"	6 1/2"	
C5				2'-11"	6"	9"	7"	6"	
C6				2'-4"	4"	7"	5"	5"	↓
C7		↓	↓	2'-0"	3 1/2"	5 1/2"	3 1/2"	4 1/2"	3 1/2"
C8	↓	1	1	1'-6"	2"	3 1/2"	2"	3 1/2"	1 1/2"
B1	#4	4	STRAIGHT	6'-9"	~	~	~	~	~

METRIC BILL OF REINFORCING STEEL (ONE SECTION ONLY)



TYPE 1

BENT BARS (ALL DIMENSIONS ARE OUT TO OUT IN mm)

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	~	~	~	~	~

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

DETAILED DRAWING

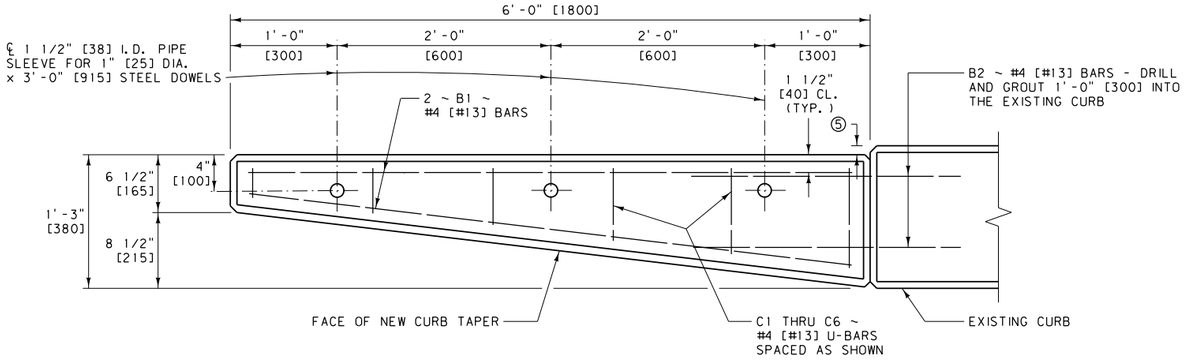
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-26

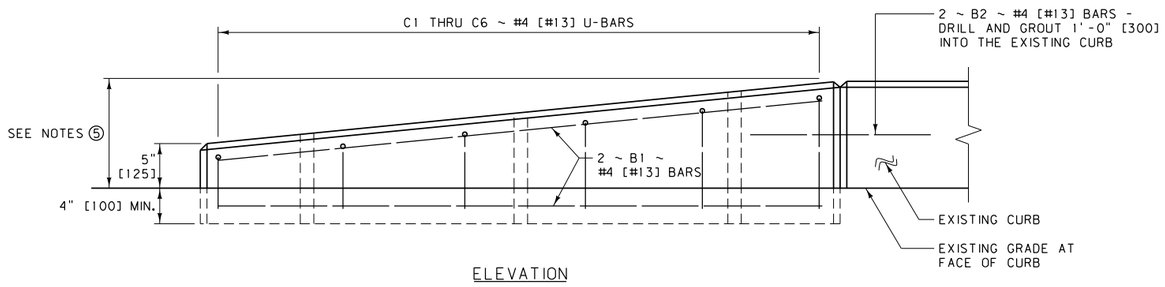
TAPERED CONCRETE CURB DETAIL

EFFECTIVE: SEPTEMBER 2014

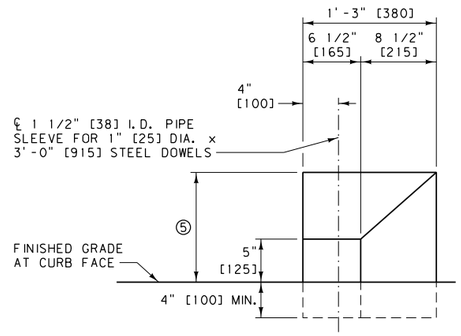
MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN



ELEVATION



END VIEW

NOTES:

① REMOVE THE EXISTING SURFACE UNDER THE NEW TAPERED CONCRETE CURB AS APPROVED BY THE PROJECT MANAGER. EMBED THE TAPERED CONCRETE CURB A MINIMUM OF 4" [100] BELOW THE GRADE MEASURED AT THE INSIDE FACE OF THE TAPER.

② FURNISH GRADE 60 [420] REINFORCING STEEL MEETING SECTION 555 AND 711.

③ ALL CONCRETE IS CLASS GENERAL.
TOTAL CONCRETE PER 6' [1800] TAPERED CURB EST. = 0.2 C.Y. [0.16 m³]
TOTAL REBAR WEIGHT PER 6' [1800] TAPERED CURB EST. = 27 LB. [11.7 kg]

④ TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION TYPE 3 (SEE DTL. DWG. NO. 606-24A AND 606-24B).

⑤ ADJUST DIMENSION TO MATCH EXISTING CURB.

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	#4	1	1	1'-4"	6"	4"
C2	↑	↑	↑	1'-8"	7"	6"
C3	↑	↑	↑	1'-11"	8"	7"
C4	↑	↑	↑	2'-3"	9"	9"
C5	↑	↓	↓	2'-6"	10"	10"
C6	↑	1	1	2'-10"	11"	1'-0"
B1	↓	4	STRAIGHT	5'-8"	~	~
B2	#4	2	STRAIGHT	2'-0"	~	~

METRIC BILL OF REINFORCING STEEL (ONE SECTION ONLY)

TYPE 1

BENT BARS (ALL DIMENSIONS ARE OUT TO OUT)

MARK	SIZE	NO.	TYPE	LENGTH (mm)	A (mm)	B (mm)
C1	#13	1	1	390	150	90
C2	↑	↑	↑	480	175	130
C3	↑	↑	↑	570	200	170
C4	↑	↑	↑	665	225	215
C5	↑	↓	↓	755	250	255
C6	↑	1	1	845	270	295
B1	↓	4	STRAIGHT	1720	~	~
B2	#13	2	STRAIGHT	600	~	~

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606

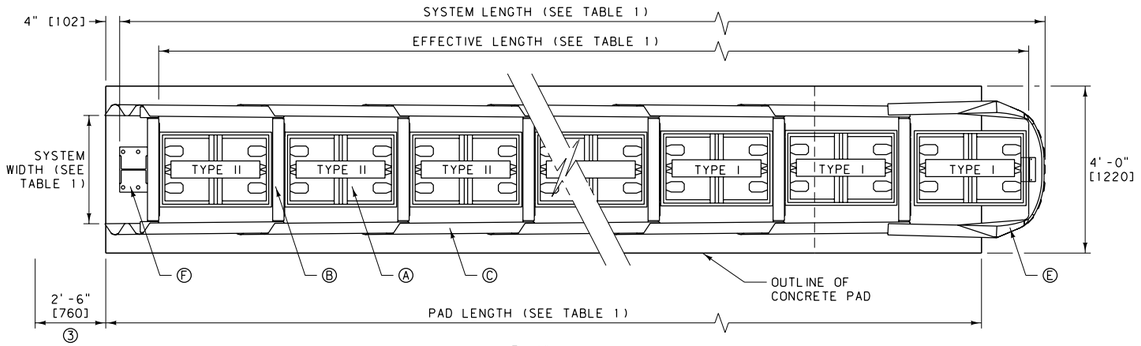
DWG. NO. 606-27

TAPERED CONCRETE CURB DETAIL

--REVISED-- JULY 2016

EFFECTIVE: SEPTEMBER 2014

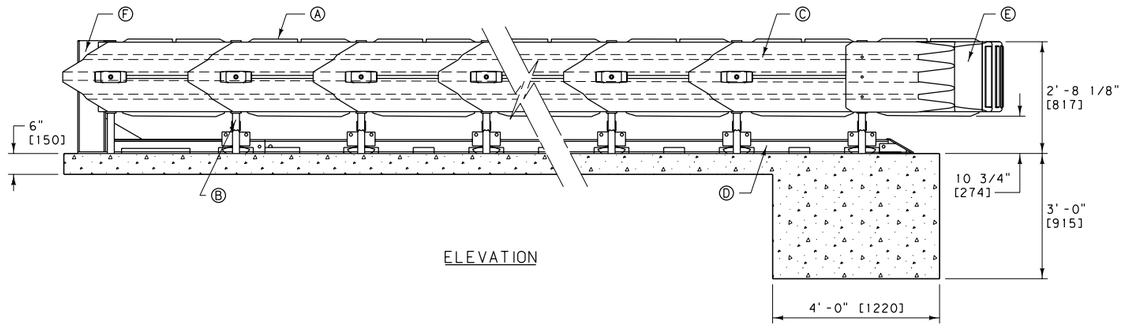
MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN

Ⓐ QUADGUARD CARTRIDGE
Ⓑ DIAPHRAGM
Ⓒ FENDER PANEL
Ⓓ MONORAIL
Ⓔ NOSE ASSEMBLY
Ⓕ 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	OS2401✱	OS3001✱	OS3601✱	7'-1"	2.16	5'-8"	1.73	9'-0"	2.74	25	40	2	0
2	OS2402✱	OS3002✱	OS3602✱	10'-1"	3.08	8'-8"	2.64	9'-0"	2.74	37	60	2	1
3	OS2403✱	OS3003✱	OS3603✱	13'-1"	4.00	11'-8"	3.56	12'-0"	3.66	44	70	3	1
4	OS2404✱	OS3004✱	OS3604✱	16'-1"	4.91	14'-8"	4.47	15'-0"	4.57	50	80	3	2
5	OS2405✱	OS3005✱	OS3605✱	19'-1"	5.83	17'-8"	5.38	18'-0"	5.49	56	90	4	2
6	OS2406✱	OS3006✱	OS3606✱	22'-1"	6.74	20'-8"	6.30	21'-0"	6.40	62	100	4	3
7	OS2407✱	OS3007✱	OS3607✱	25'-1"	7.65	23'-8"	7.21	24'-0"	7.32	65	105	4	4
8	OS2408✱	OS3008✱	OS3608✱	28'-1"	8.57	26'-8"	8.13	27'-0"	8.23	68	110	4	5
9	OS2409✱	OS3009✱	OS3609✱	31'-1"	9.49	29'-8"	9.04	30'-0"	9.14	71	115	4	6
10	OS2410✱	OS3010✱	OS3610✱	34'-1"	10.40	32'-8"	9.96	33'-0"	10.06	75	120	5	6
11	OS2411✱	OS3011✱	OS3611✱	37'-1"	11.32	35'-8"	10.87	36'-0"	10.97	75	120	5	7
12	OS2412✱	OS3012✱	OS3612✱	40'-1"	12.23	38'-8"	11.79	39'-0"	11.89	75	120	5	8

✱ G = GREY OR Y = YELLOW

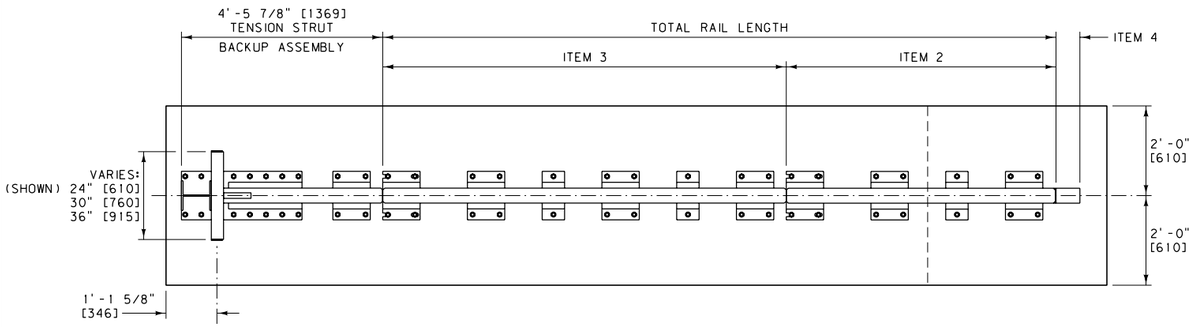
NOTES:

① 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.

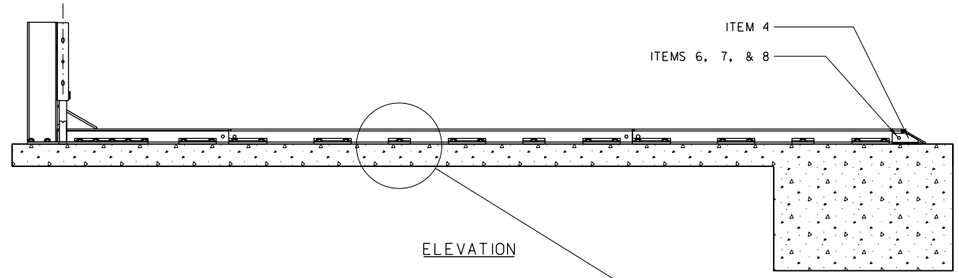
② THE SYSTEM SHOWN INCLUDES THE TENSION STRUT BACKUP ASSEMBLY AND THE CONCRETE PAD AS DETAILED. SEE THE MANUFACTURER FOR DRAWINGS DETAILING THE REINFORCING STEEL FOR THE CONCRETE PAD AND FOR OTHER BACKUP & CONCRETE PAD OPTIONS.

③ PROVIDE ADEQUATE CLEARANCE FOR THE DISTANCE SHOWN TO ALLOW FENDER PANELS TO SLIDE REARWARD UPON IMPACT.

④ SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, INSTALLATION AND MAINTENANCE OF THE QUADGUARD SYSTEM.



PLAN



ELEVATION

MONORAIL ASSEMBLY
(TYPICAL 6 BAY ASSEMBLY)

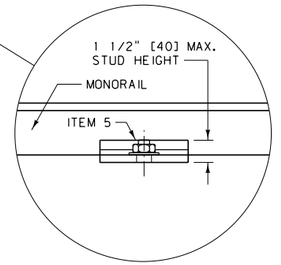


TABLE 2:

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
3540060-1000	324.2"	8 235	0	0	3	10	10
3540060-1100	360.2"	9 150	1	0	3	12	11
3540060-1200	396.2"	10 065	0	1	3	13	12

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

DETAILED DRAWING

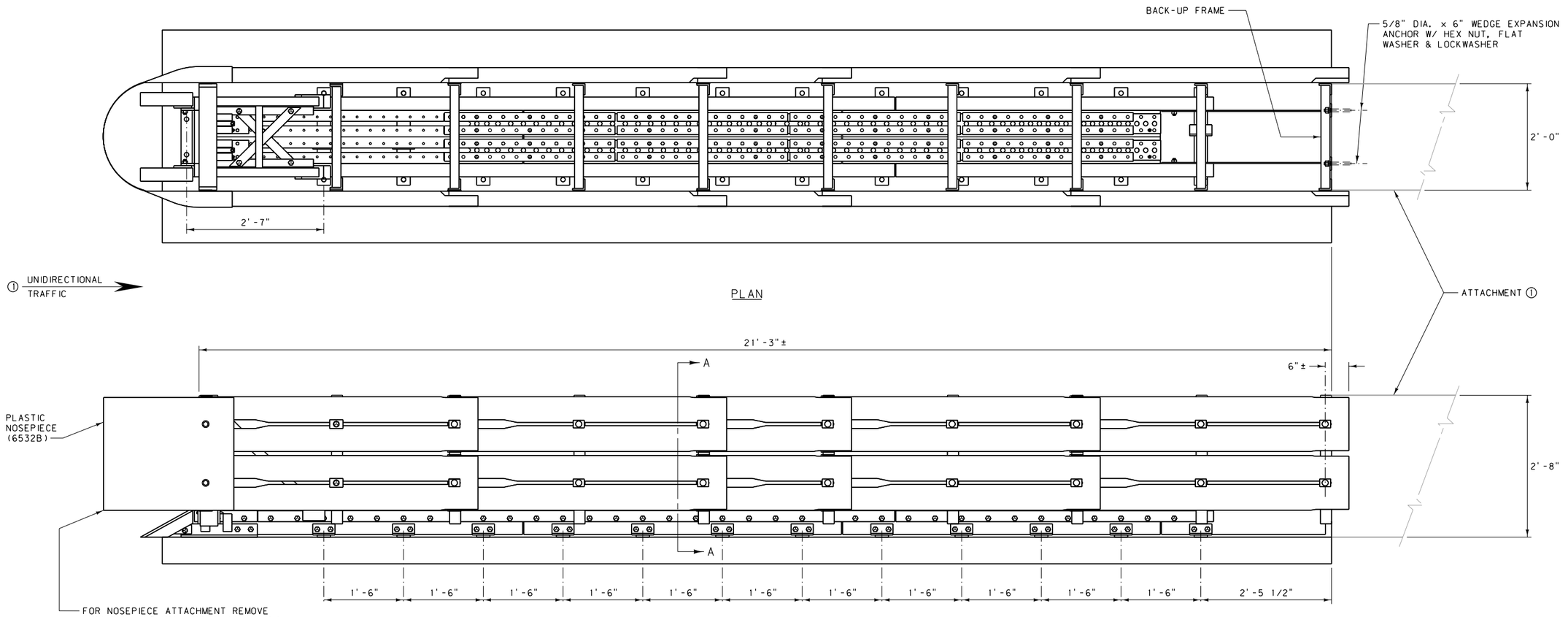
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-30A

IMPACT ATTENUATOR - QUADGUARD

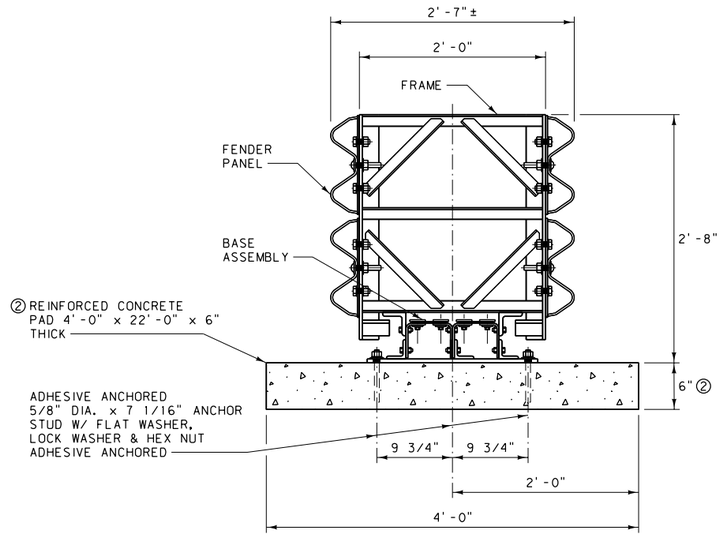
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN

ELEVATION



SECTION A-A

TRACC BILL OF MATERIAL		
PART NUMBER	QTY	DESCRIPTION
* 25980A	1	TRACC UNIT (FULLY ASSEMBLED **)
3310G	4	5/8" DIA. LOCKWASHER
4451G	4	5/8" DIA. x 6" WEDGE EXP. ANCHOR
6825B	4	REFLECTIVE TAPE
6532B	1	PLASTIC NOSEPIECE
ANCHOR HARDWARE (FULL CONCRETE BASE)		
5204G	26	5/8" DIA. x 7 1/16" ANCHOR STUD
3310G	26	5/8" DIA. LOCKWASHER
3361G	26	5/8" DIA. HEX NUT
3300G	26	5/8" DIA. FLAT WASHER
5206B	3	ADHESIVE HIT HY 150(CARTRIDGE)
ANCHOR HARDWARE (ASPHALT BASE)		
6380G	26	5/8" DIA. x 18" ALL THREADED ROD
3310G	26	5/8" DIA. LOCKWASHER
3361G	26	5/8" DIA. HEX NUT
3300G	26	5/8" DIA. 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)

NOTES:

① 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.

② A 6" REINFORCED CONCRETE PAD IS SHOWN. OTHER FOUNDATION OPTIONS ARE:

a) 8" THICK UNREINFORCED CONCRETE
b) 8" THICK ASPHALT
c) 3" THICK ASPHALT OVER 3" THICK CONCRETE
d) 6" THICK ASPHALT OVER 6" THICK COMPACTED SUBBASE

REINFORCEMENT DRAWINGS FOR THE REINFORCED CONCRETE PAD SHOWN ARE AVAILABLE FROM THE MANUFACTURER.

③ SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, PRODUCT OPTIONS, INSTALLATION AND MAINTENANCE OF THE TRACC SYSTEM.

DETAILED DRAWING

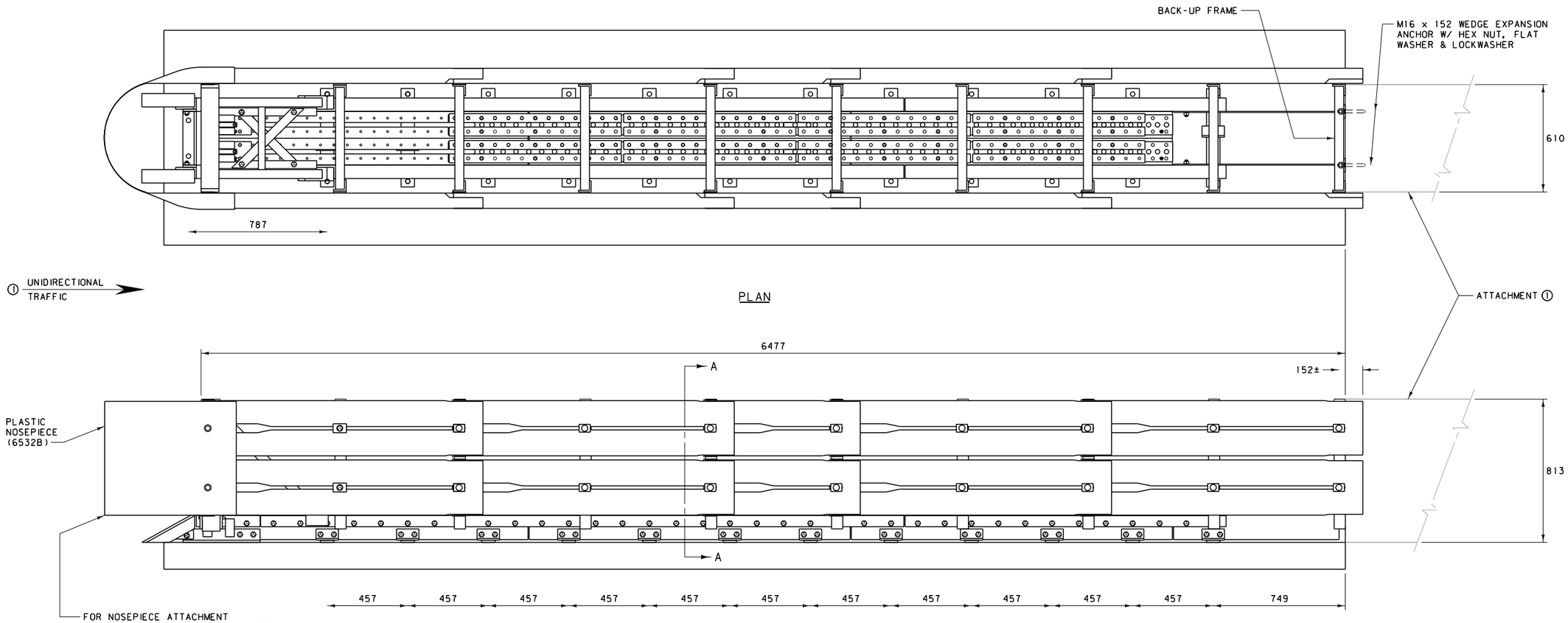
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-30B

IMPACT ATTENUATOR - TRACC

EFFECTIVE: SEPTEMBER 2014

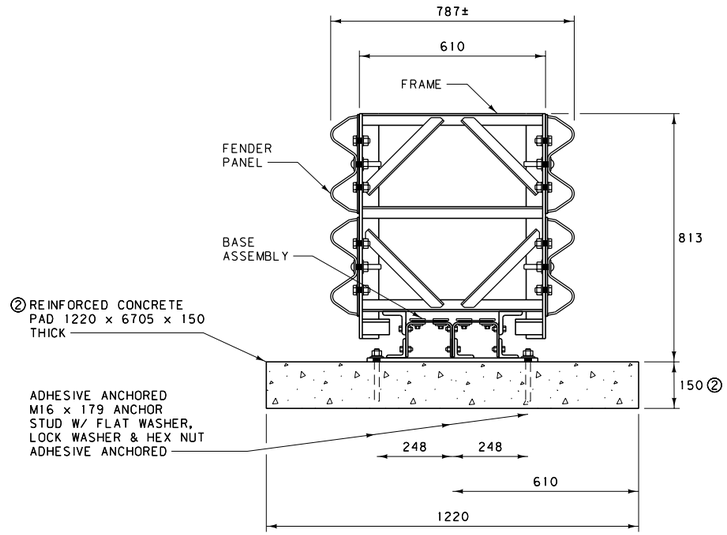
MDT MONTANA DEPARTMENT OF TRANSPORTATION



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)

ELEVATION



SECTION A-A

NOTES:

① 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.

② 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

REINFORCEMENT DRAWINGS FOR THE REINFORCED CONCRETE PAD SHOWN ARE AVAILABLE FROM THE MANUFACTURER.

③ 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

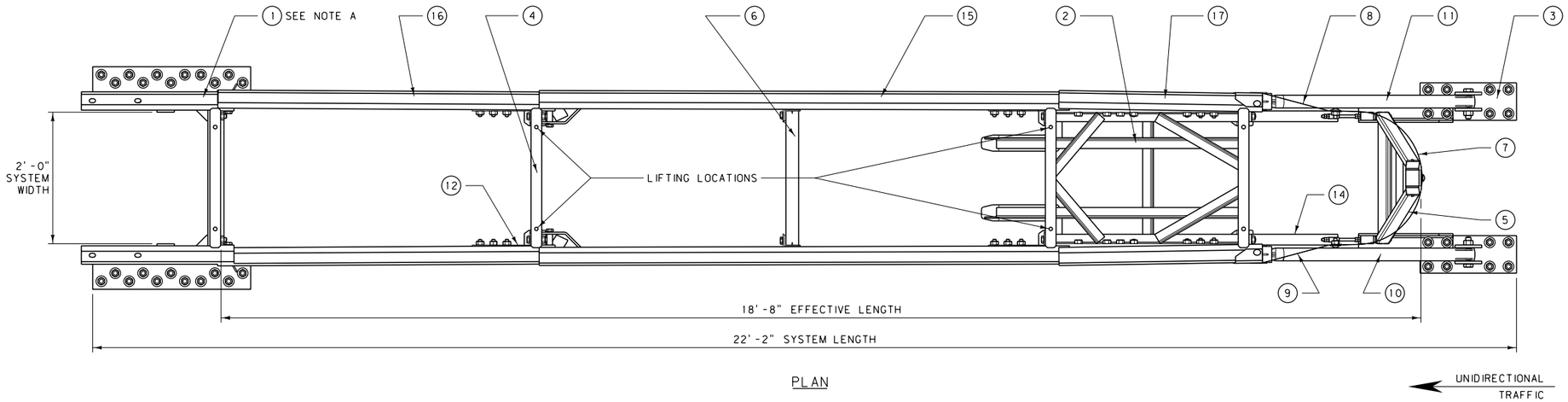
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-30B

IMPACT ATTENUATOR - TRACC (METRIC)

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN

UNIDIRECTIONAL TRAFFIC

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.

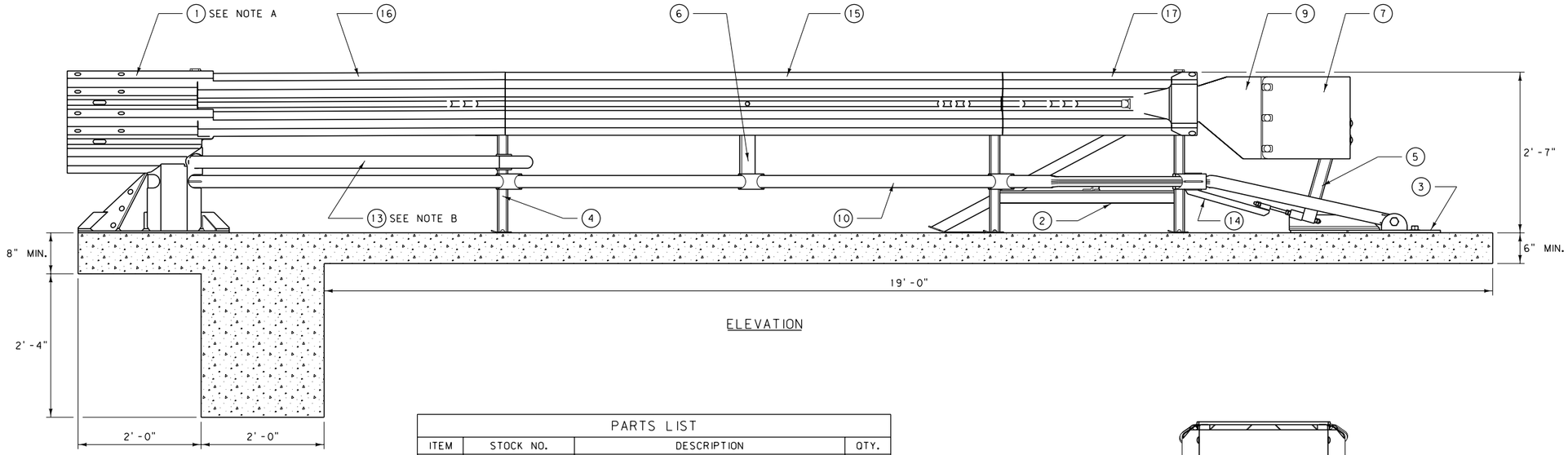
Ⓑ PROVIDE ADEQUATE CLEARANCE (5' -0" MIN.) TO ALLOW REAR RAILS TO SLIDE REARWARD UPON IMPACT.

Ⓒ A 6" REINFORCED CONCRETE PAD IS SHOWN. OTHER FOUNDATION OPTIONS ARE:

a) 8" THICK UNREINFORCED CONCRETE
b) 8" THICK ASPHALT
c) 3" THICK ASPHALT OVER 3" THICK CONCRETE
d) 6" THICK ASPHALT OVER 6" THICK COMPACTED SUBBASE
e) 7" THICK REINFORCED DECK STRUCTURE

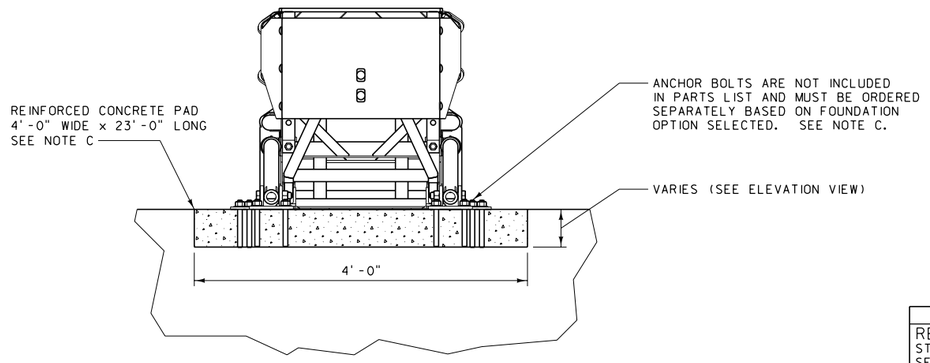
SEE MANUFACTURER FOR REINFORCEMENT DRAWINGS AND ANCHORAGE REQUIREMENTS FOR ALL FOUNDATION OPTIONS.

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



ELEVATION

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



DETAILED DRAWING

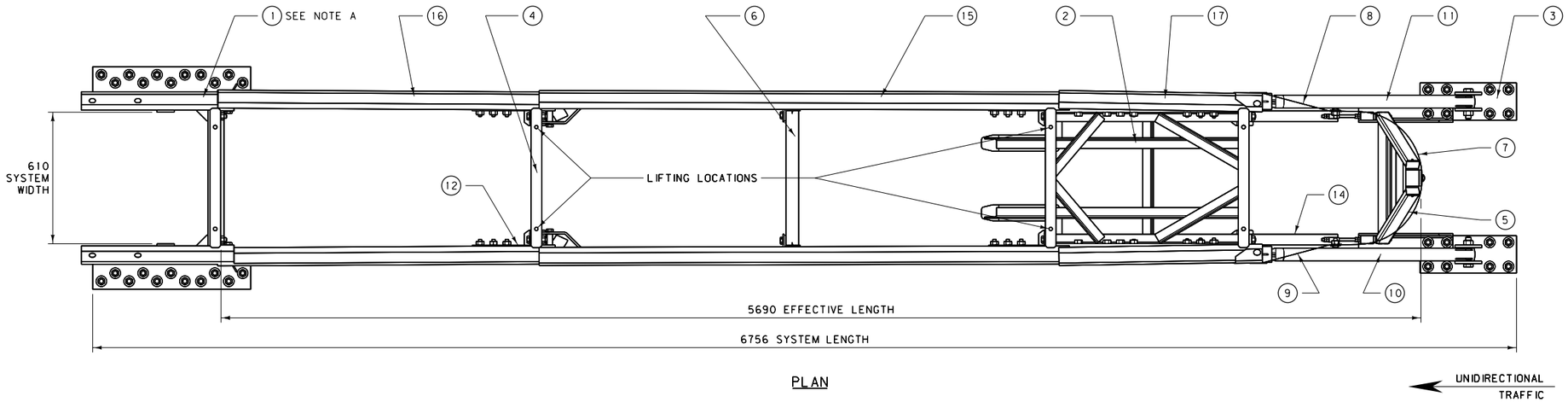
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-30C

IMPACT ATTENUATOR - QUEST

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN

UNIDIRECTIONAL TRAFFIC

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.

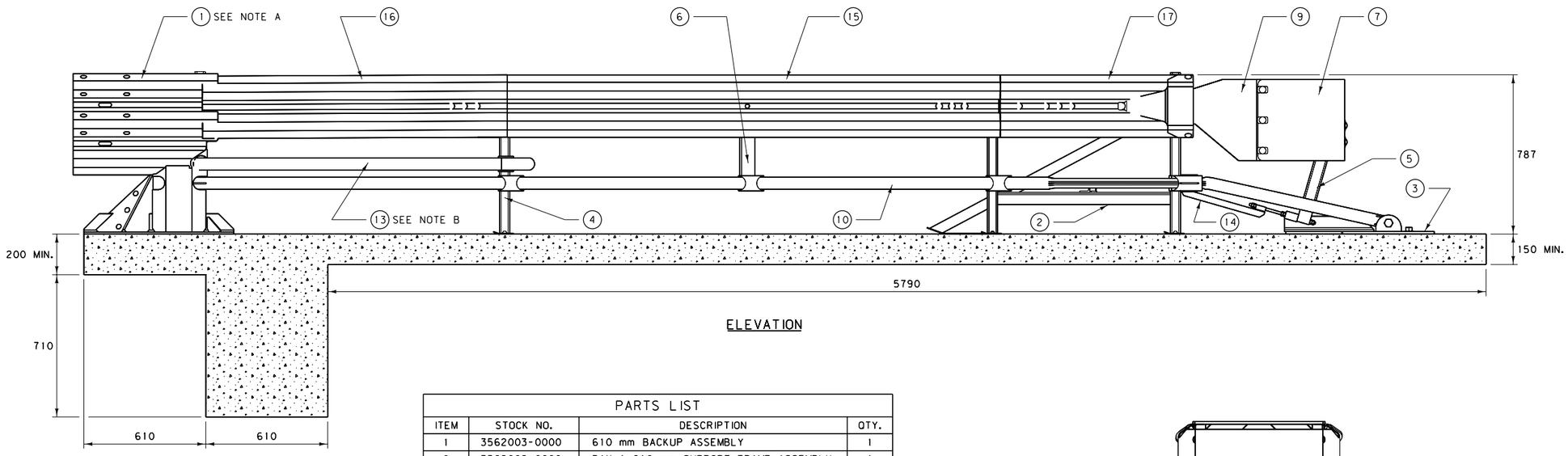
Ⓑ PROVIDE ADEQUATE CLEARANCE (1.5 m MIN.) TO ALLOW REAR RAILS TO SLIDE REARWARD UPON IMPACT.

Ⓒ 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

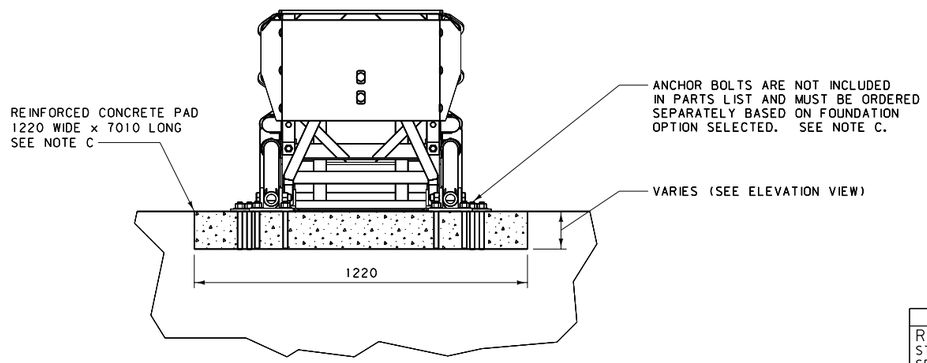
SEE MANUFACTURER FOR REINFORCEMENT DRAWINGS AND ANCHORAGE REQUIREMENTS FOR ALL FOUNDATION OPTIONS.

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



ELEVATION

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3562003-0000	610 mm BACKUP ASSEMBLY	1
2	3562002-0000	BAY 1 610 mm SUPPORT FRAME ASSEMBLY	1
3	2762015-0000	FRONT ANCHOR	2
4	3562005-0000	BAY 3 610 mm DIAPHRAGM ASSEMBLY	1
5	3562001-0000	TRIGGER ASSEMBLY	1
6	3562004-0000	BAY 2 610 mm BRIDGE	1
7	2762026-0000	NOSE	1
8	2762024-0000	RT. NOSE TRANSITION	1
9	2762025-0000	LT. NOSE TRANSITION	1
10	276200L-0000	LT. SHAPER RAIL	1
11	276200R-0000	RT. SHAPER RAIL	1
12	2762022-0000	DIAPHRAGM PANEL BRACKET	2
13	2762023-0000	REAR RAIL	2
14	2762007-0000	TRIGGER STRAP	2
15	2762013-0000	BAY 2 PANEL	2
16	2762014-0000	BAY 3 PANEL	2
17	2762033-0000	BAY 1 PANEL	2



ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING

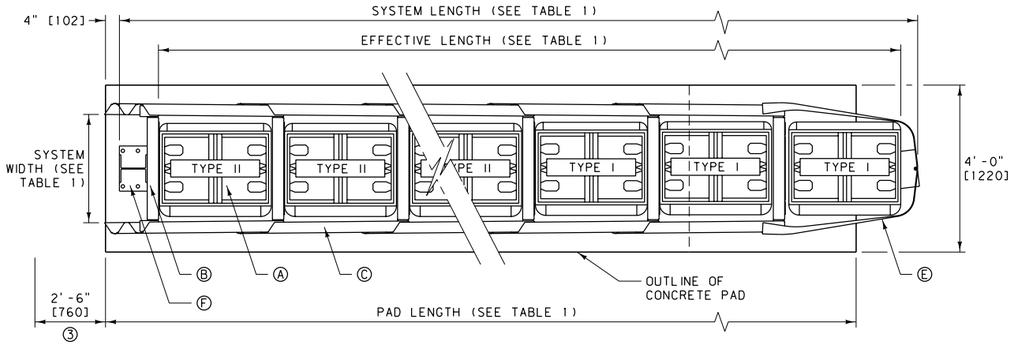
REFERENCE STANDARD SPEC. SECTION **606**

DWG. NO. **606-30C**

IMPACT ATTENUATOR - QUEST (METRIC)

EFFECTIVE: SEPTEMBER 2014

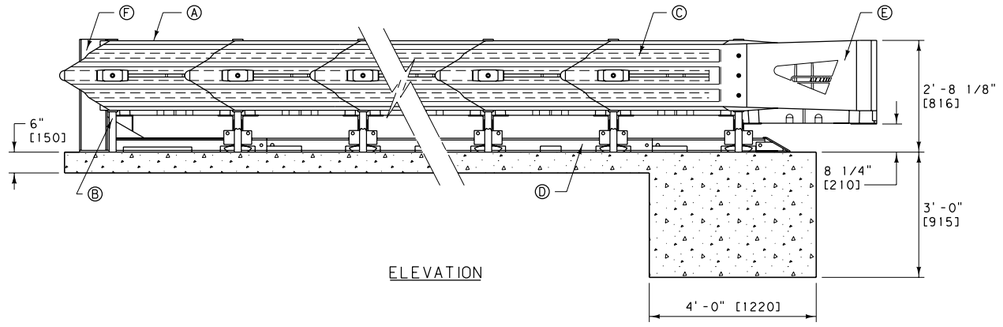
MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN

Ⓐ QUADGUARD CARTRIDGE
Ⓑ DIAPHRAGM
Ⓒ FENDER PANEL
Ⓓ MONORAIL
Ⓔ NOSE ASSEMBLY
Ⓕ 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

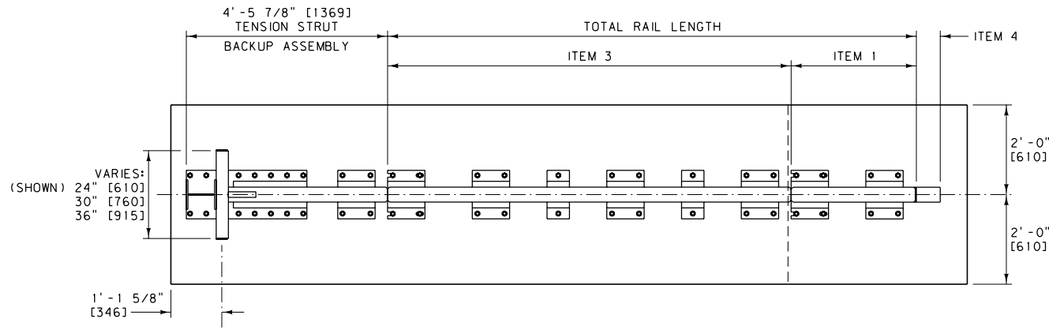
NOTES:

① 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.

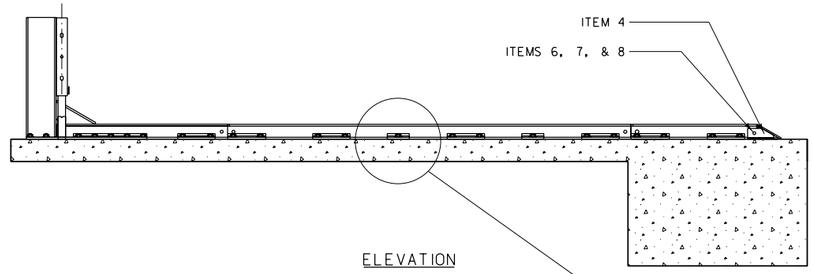
② THE SYSTEM SHOWN INCLUDES THE TENSION STRUT BACKUP ASSEMBLY AND THE CONCRETE PAD AS DETAILED. SEE THE MANUFACTURER FOR DRAWINGS DETAILING THE REINFORCING STEEL FOR THE CONCRETE PAD AND FOR OTHER BACKUP & CONCRETE PAD OPTIONS.

③ PROVIDE ADEQUATE CLEARANCE FOR THE DISTANCE SHOWN TO ALLOW FENDER PANELS TO SLIDE REARWARD UPON IMPACT.

④ SEE MANUFACTURER FOR MORE INFORMATION ON SPECIFIC DESIGNS, INSTALLATION AND MAINTENANCE OF THE QUADGUARD II SYSTEM.



PLAN



ELEVATION

MONORAIL ASSEMBLY
(TYPICAL 5 BAY ASSEMBLY)

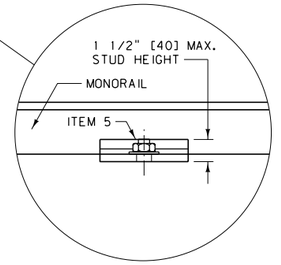


TABLE 2:

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 STANDARD SPEC. SECTION 606

DWG. NO. 606-30D

IMPACT ATTENUATOR - QUADGUARD II

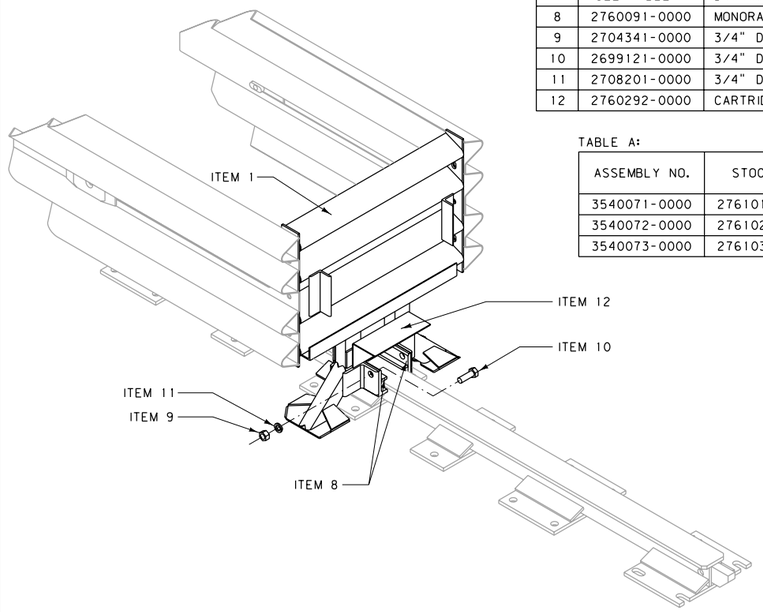
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	SEE TABLE A	DIAPHRAGM	DIAPHRAGM	1
8	2760091-0000	MONORAIL GUIDE	MONORAIL GUIDE	2
9	2704341-0000	3/4" DIA. HEX NUT	M20 HEX NUT	4
10	2699121-0000	3/4" DIA. x 2" HEX BOLT	M20 x 51 HEX BOLT	4
11	2708201-0000	3/4" DIA. LOCK WASHER	M20 LOCK WASHER	4
12	2760292-0000	CARTRIDGE SUPPORT BRACKET	CARTRIDGE SUPPORT BRACKET	2

TABLE A:

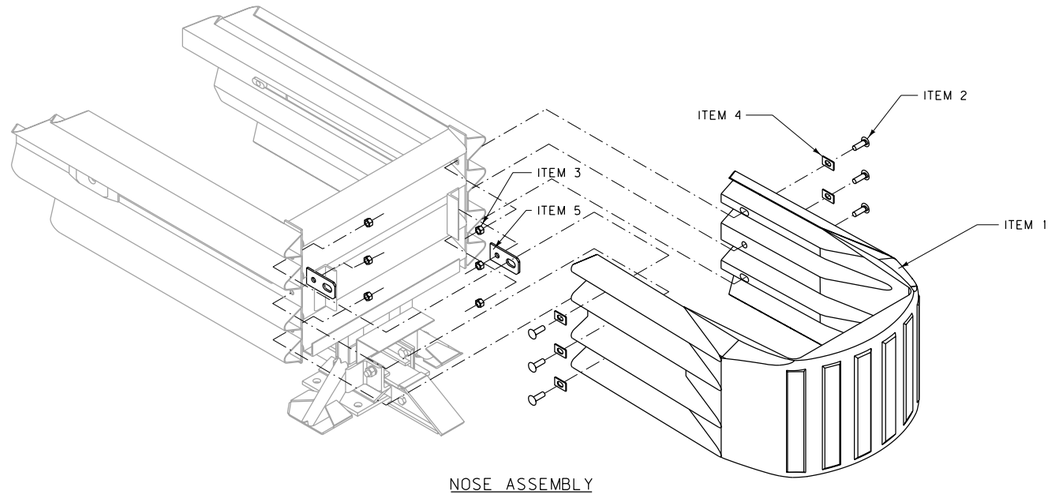
ASSEMBLY NO.	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION
3540071-0000	2761011-0000	24" WIDE DIAPHRAGM	610 WIDE DIAPHRAGM
3540072-0000	2761021-0000	30" WIDE DIAPHRAGM	760 WIDE DIAPHRAGM
3540073-0000	2761031-0000	36" WIDE DIAPHRAGM	915 WIDE DIAPHRAGM



DIAPHRAGM ASSEMBLY

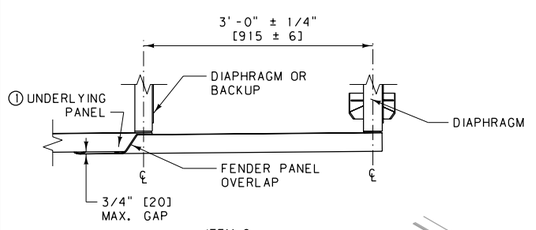
ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	3540130-0*00	NOSE, W/ SUPPORT BRACKET	NOSE, W/ SUPPORT BRACKET	1
2	2699341-0000	5/8" DIA. x 2" RAIL BOLT	M16 x 51 RAIL BOLT	6
3	2704191-0000	5/8" DIA. HEX NUT	M16 HEX NUT	6
4	2708871-0000	WASHER (BAR 1/8" x 1 1/4" x 2", W/ 5/8" DIA. HOLE)	WASHER (BAR 3.2 x 32 x 51, W/ M16 HOLE)	6
5	2760251-0000	PULL-OUT BRACKET	PULL-OUT BRACKET	2

* 0 INDICATES GRAY
* 1 INDICATES YELLOW



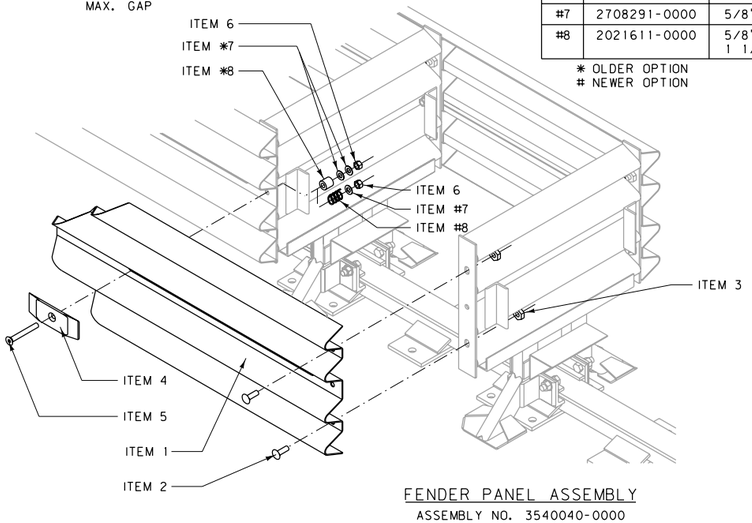
NOSE ASSEMBLY

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



ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	2760081-0000	FENDER PANEL	FENDER PANEL	1
2	2699341-0000	5/8" DIA. x 2" RAIL BOLT	M16 x 51 RAIL BOLT	2
3	2704191-0000	5/8" DIA. HEX NUT	M16 HEX NUT	2
4	2708841-0000	CAST MUSHROOM WASHER	CAST MUSHROOM WASHER	1
5	2706604-0000	5/8" DIA.x 5" SCREW	M16 x 127 SCREW	1
6	2704141-0000	5/8" DIA. HEX NUT	M16 HEX NUT	1
*7	2708291-0000	5/8" DIA. WASHER	M16 WASHER	2
*8	2021611-0000	ELASTOMERIC BUSHING	ELASTOMERIC BUSHING	1
#7	2708291-0000	5/8" DIA. WASHER	M16 WASHER	1
#8	2021611-0000	5/8" x 1 1/4" O.D. x 1 1/2" DIE SPRING	M16 x 32 O.D. x 38 DIE SPRING	1

* OLDER OPTION
# NEWER OPTION



FENDER PANEL ASSEMBLY

ASSEMBLY NO. 3540040-0000

NOTE:

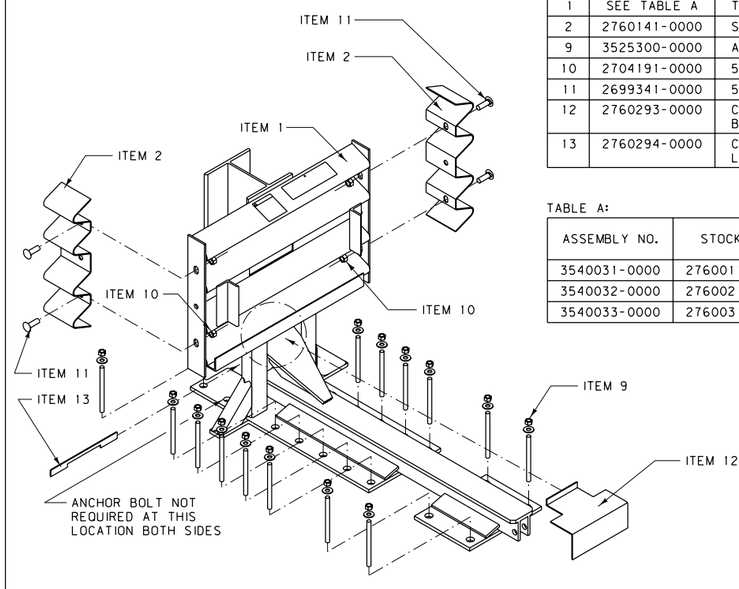
① UNDERLYING PANEL IS EITHER ANOTHER FENDER PANEL OR, IN THE CASE OF THE LAST FENDER PANEL IT COULD BE A BACKUP SIDE PANEL, EXTENSION PANEL OR TRANSITION PANEL.

② TWO FENDER PANEL ASSEMBLIES ARE REQUIRED PER BAY.

ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	SEE TABLE A	TENSION BACKUP	TENSION BACKUP	1
2	2760141-0000	SIDE PANEL	SIDE PANEL	2
9	3525300-0000	ANCHOR KIT	ANCHOR KIT	3
10	2704191-0000	5/8" DIA. HEX NUT	M16 HEX NUT	4
11	2699341-0000	5/8" DIA. x 2" RAIL BOLT	M16 x 51 RAIL BOLT	4
12	2760293-0000	CARTRIDGE SUPPORT BRACKET	CARTRIDGE SUPPORT BRACKET	1
13	2760294-0000	CARTRIDGE SUPPORT LOCKING BAR	CARTRIDGE SUPPORT LOCKING BAR	1

TABLE A:

ASSEMBLY NO.	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION
3540031-0000	2760011-0000	24" WIDE TENSION BACKUP	610 WIDE TENSION BACKUP
3540032-0000	2760021-0000	30" WIDE TENSION BACKUP	760 WIDE TENSION BACKUP
3540033-0000	2760031-0000	36" WIDE TENSION BACKUP	915 WIDE TENSION BACKUP



BACKUP ASSEMBLY

NOTE:

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

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

DETAILED DRAWING

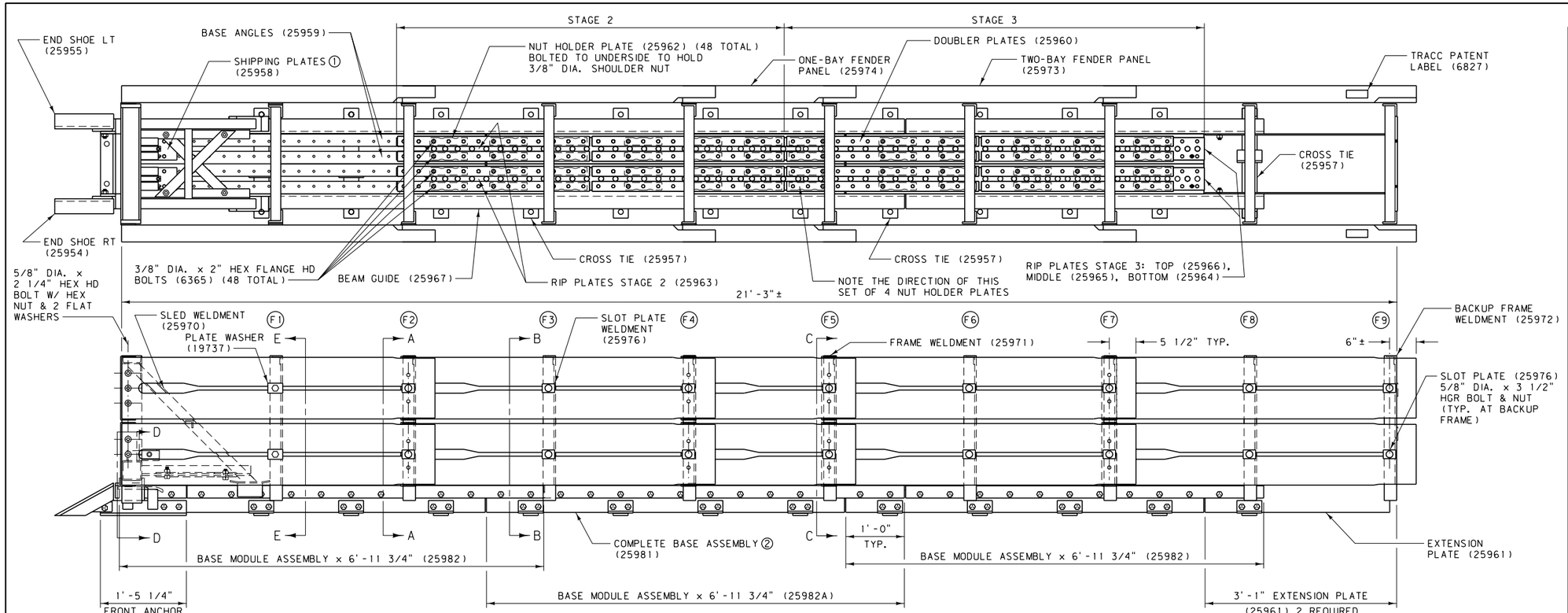
REFERENCE STANDARD SPEC. SECTION 606

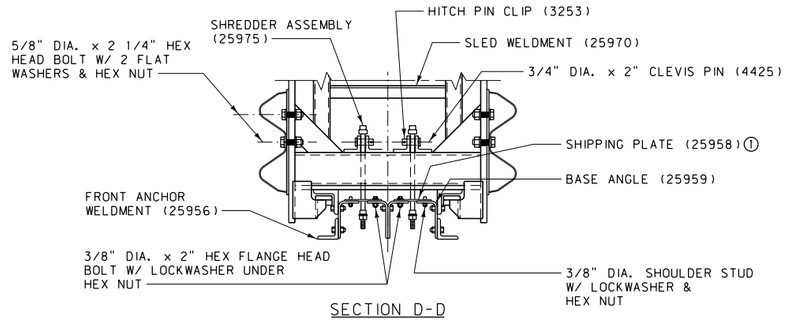
DWG. NO. 606-31A

IMPACT ATTENUATOR - QUADGUARD ASSEMBLY DETAILS

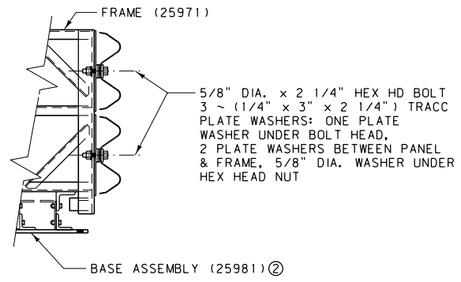
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

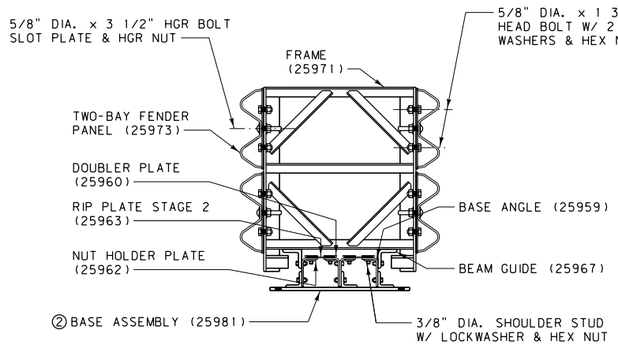




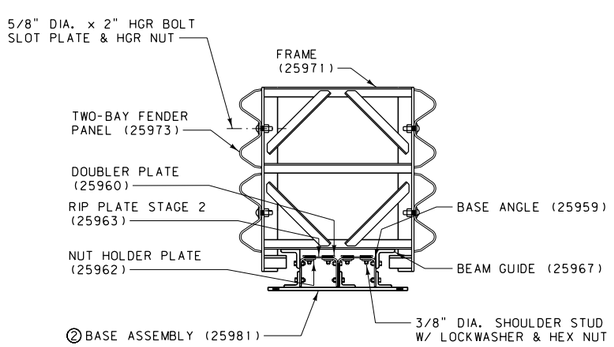
SECTION D-D



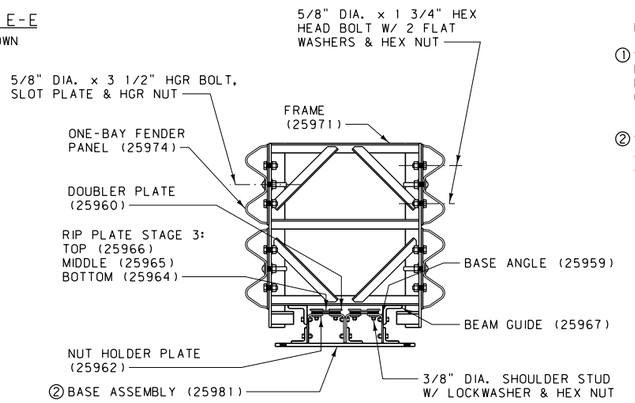
SECTION E-E
(F1) SHOWN



SECTION A-A
(F2) SHOWN (F4) SIMILAR



SECTION B-B
(F3) SHOWN (F6) & (F8) SIMILAR



SECTION C-C
(F5) SHOWN (F7) SIMILAR

BILL OF MATERIAL

PART NUMBER	QTY	DESCRIPTION
		TRACC (25980A)
19737G	12	1/4" x 3" x 2 1/4" 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	3/8" DIA. SHOULDER NUT
3361G	40	5/8" DIA. HEAVY HEX NUT
3391G	40	5/8" DIA. x 1 3/4" HEX HEAD BOLT
4252G	180	3/8" DIA. HEX NUT
4258G	180	3/8" DIA. LOCK WASHER
6340G	178	3/8" DIA. x 1 1/2" SHOULDER STUD
6365G	50	3/8" DIA. x 2" 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	5/8" DIA. HGR NUT
3361G	46	5/8" DIA. HEX NUT
3391G	32	5/8" DIA. x 1 3/4" HEX HEAD BOLT
3400G	12	5/8" DIA. x 2" HGR BOLT
3435G	20	5/8" DIA. x 3 1/2" HGR BOLT
4372G	88	5/8" DIA. FLAT WASHER
4425G	2	3/4" DIA. x 2" CLEVIS PIN
5306G	14	5/8" DIA. x 2 1/4" 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.

DETAILED DRAWING

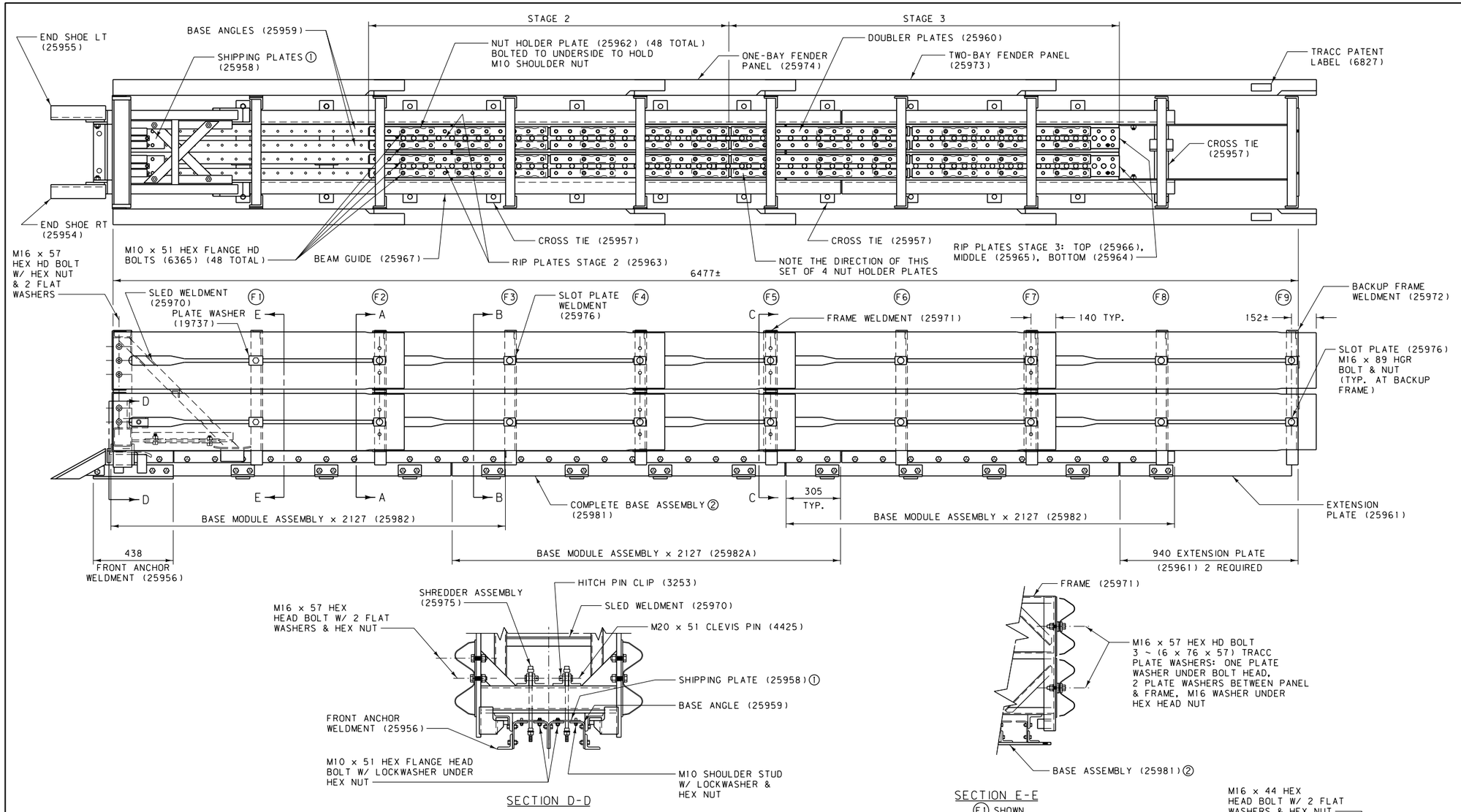
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-31B

IMPACT ATTENUATOR TRACC ASSEMBLY DETAILS

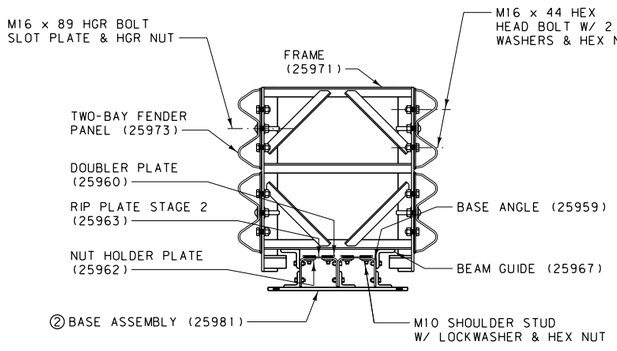
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

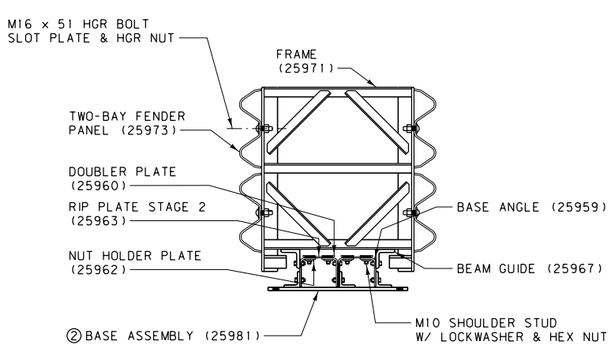


SECTION D-D

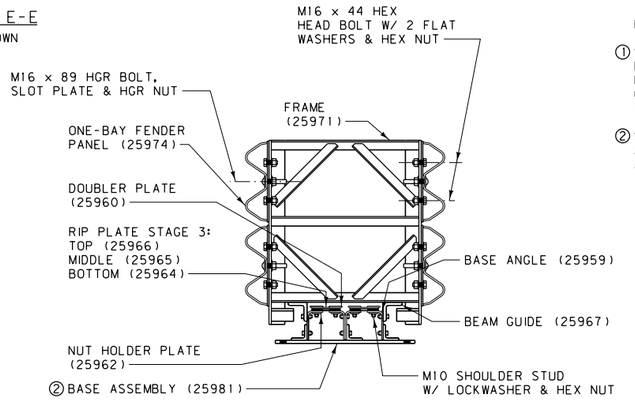
SECTION E-E
F1 SHOWN



SECTION A-A
F2 SHOWN F4 SIMILAR



SECTION B-B
F3 SHOWN F6 & F8 SIMILAR



SECTION C-C
F5 SHOWN F7 SIMILAR

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

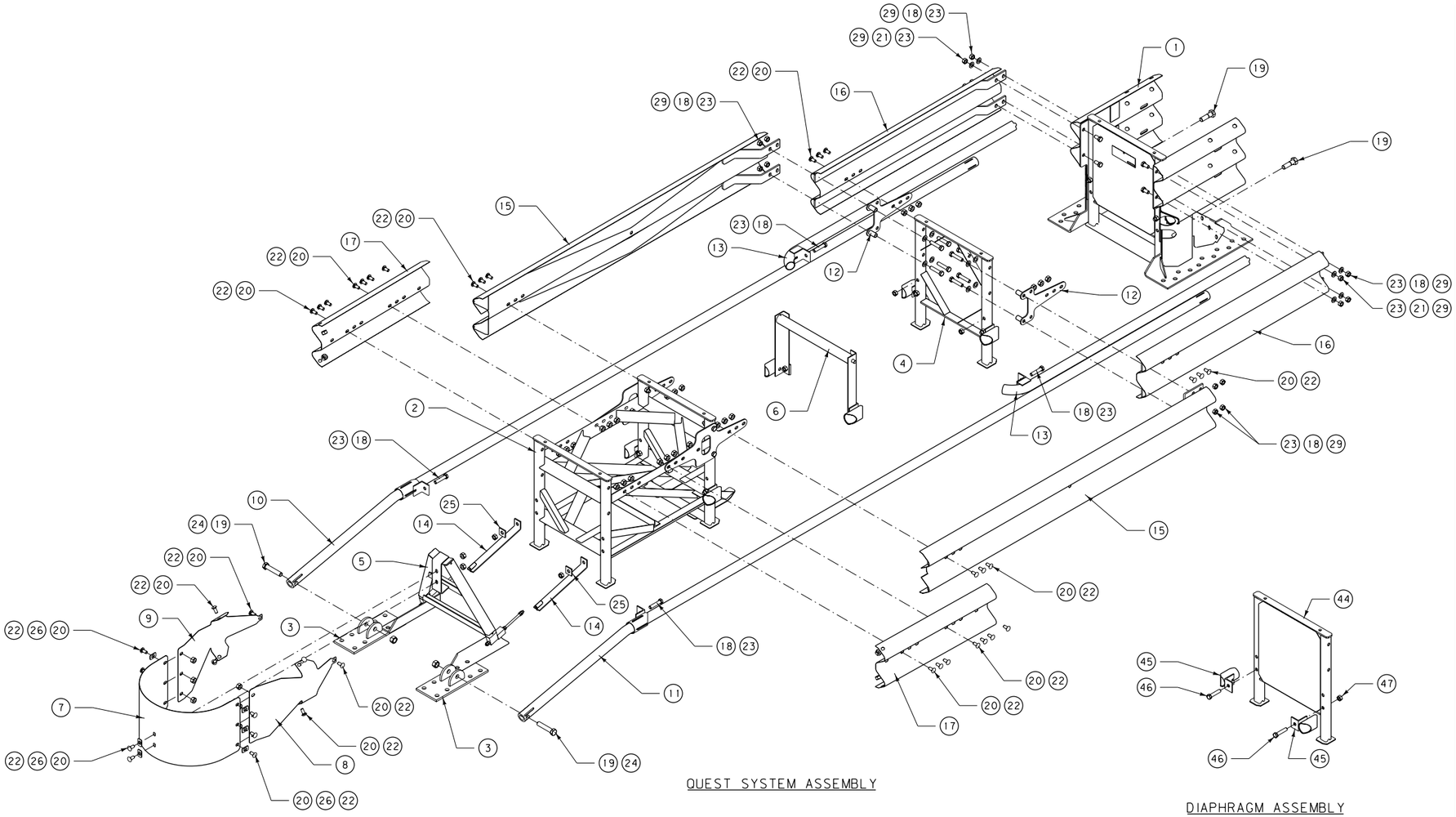
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-31B

IMPACT ATTENUATOR - TRACC ASSEMBLY DETAILS (METRIC)

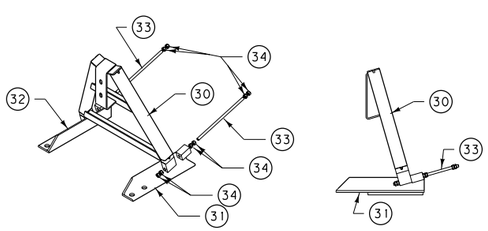
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

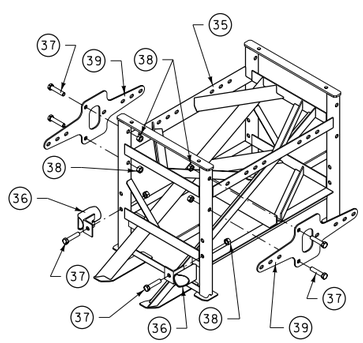


QUEST SYSTEM ASSEMBLY

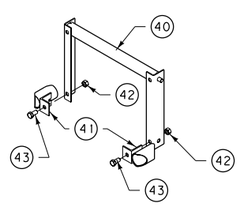
DIAPHRAGM ASSEMBLY
(ITEM 4)



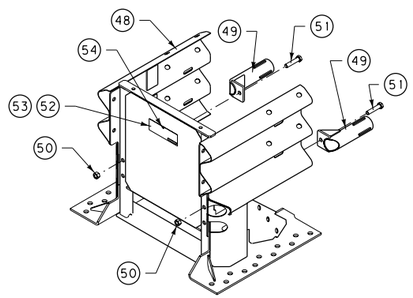
TRIGGER ASSEMBLY
(ITEM 5)



SUPPORT FRAME ASSEMBLY
(ITEM 2)



BRIDGE
(ITEM 6)



BACKUP ASSEMBLY
(ITEM 1)

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

DETAILED DRAWING

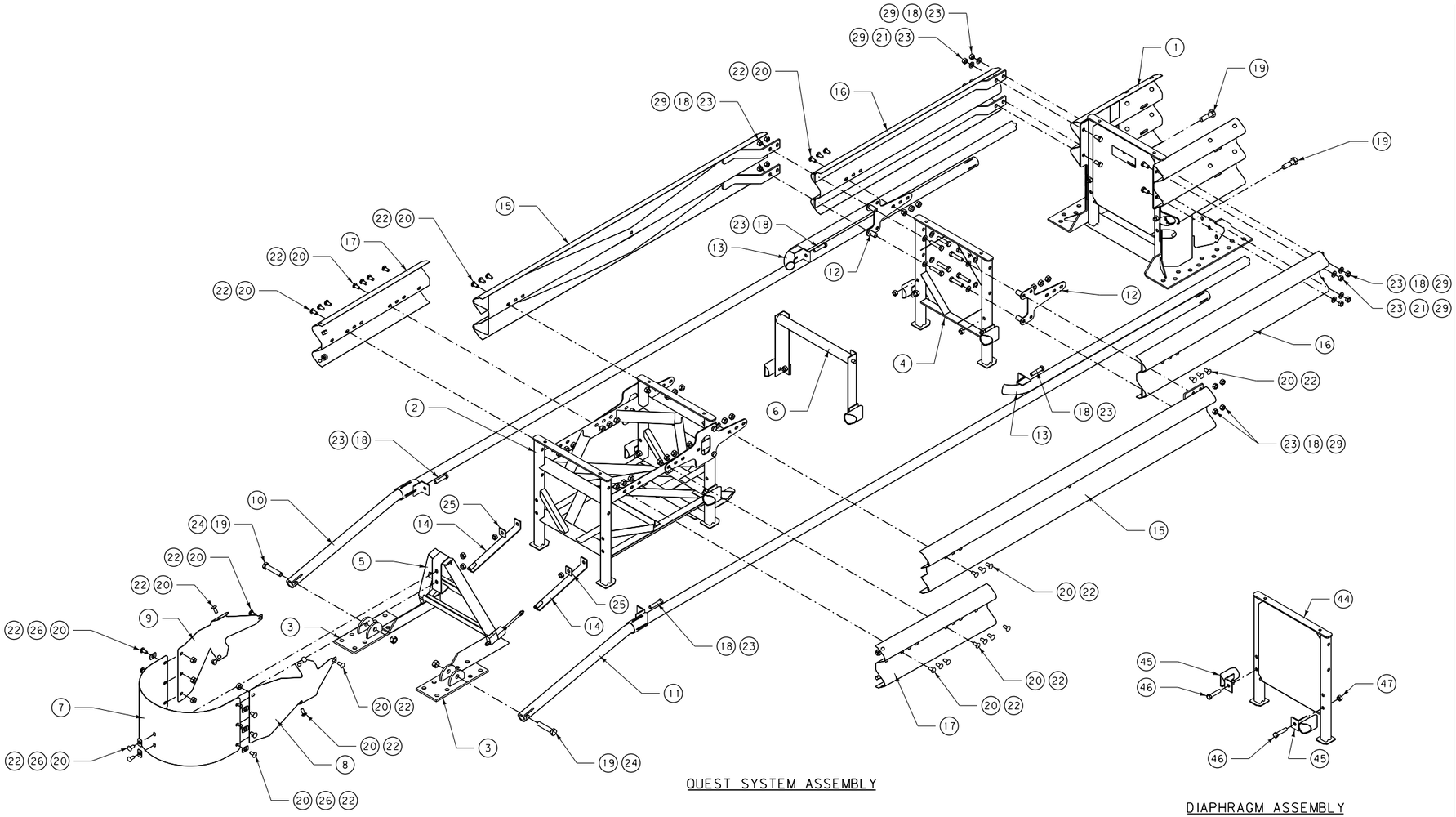
REFERENCE STANDARD SPEC. SECTION **606**

DWG. NO. 606-31C

IMPACT ATTENUATOR - QUEST
ASSEMBLY DETAILS

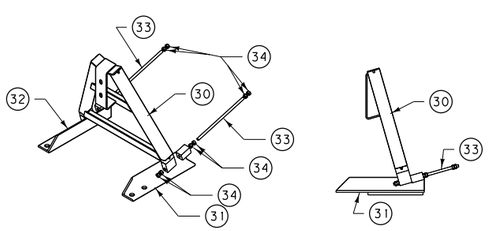
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

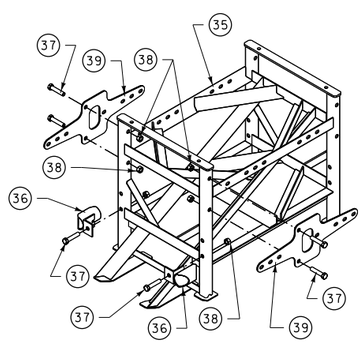


QUEST SYSTEM ASSEMBLY

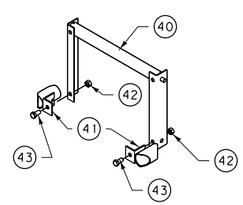
DIAPHRAGM ASSEMBLY
(ITEM 4)



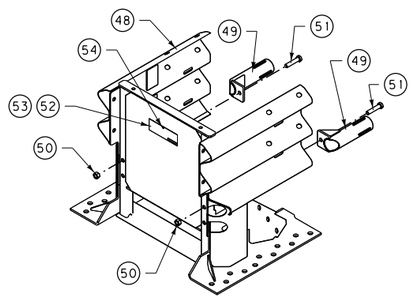
TRIGGER ASSEMBLY
(ITEM 5)



SUPPORT FRAME ASSEMBLY
(ITEM 2)



BRIDGE
(ITEM 6)



BACKUP ASSEMBLY
(ITEM 1)

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

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-31C

IMPACT ATTENUATOR - QUEST
ASSEMBLY DETAILS (METRIC)

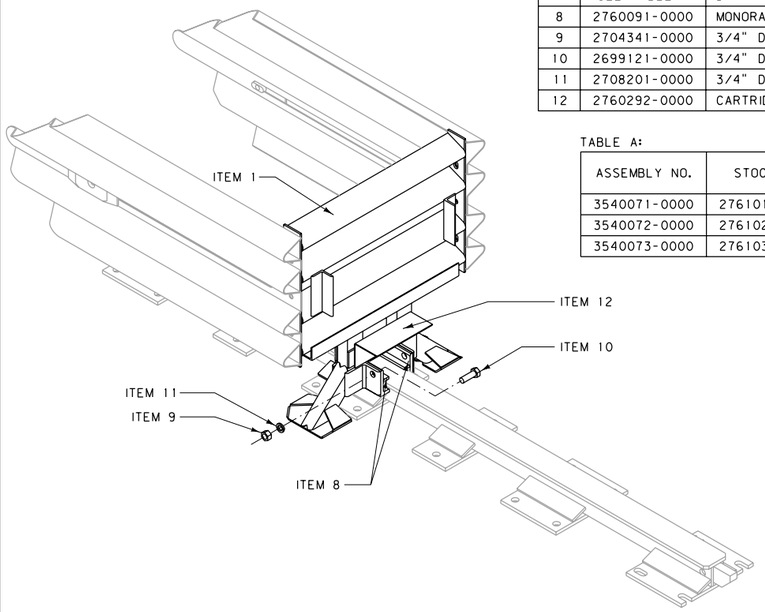
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	SEE TABLE A	DIAPHRAGM	DIAPHRAGM	1
8	2760091-0000	MONORAIL GUIDE	MONORAIL GUIDE	2
9	2704341-0000	3/4" DIA. HEX NUT	M20 HEX NUT	4
10	2699121-0000	3/4" DIA. x 2" HEX BOLT	M20 x 51 HEX BOLT	4
11	2708201-0000	3/4" DIA. LOCK WASHER	M20 LOCK WASHER	4
12	2760292-0000	CARTRIDGE SUPPORT BRACKET	CARTRIDGE SUPPORT BRACKET	2

TABLE A:

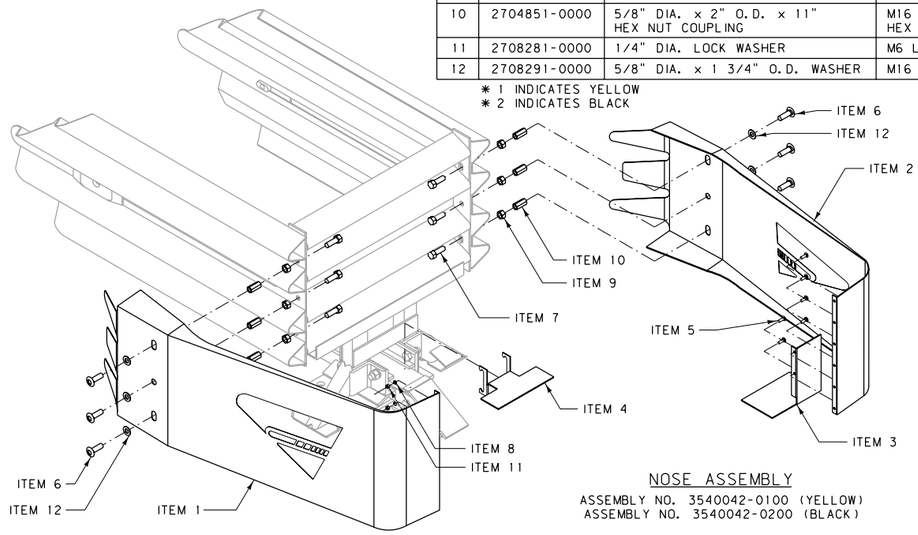
ASSEMBLY NO.	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION
3540071-0000	2761011-0000	24" WIDE DIAPHRAGM	610 WIDE DIAPHRAGM
3540072-0000	2761021-0000	30" WIDE DIAPHRAGM	760 WIDE DIAPHRAGM
3540073-0000	2761031-0000	36" WIDE DIAPHRAGM	915 WIDE DIAPHRAGM



DIAPHRAGM ASSEMBLY

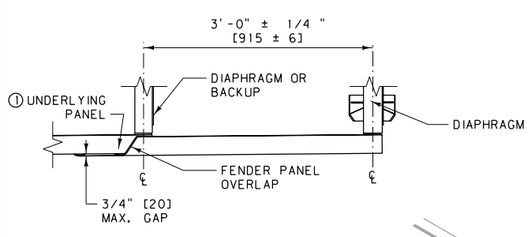
ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	2760072-0*00	NARROW LT. NOSE	NARROW LT. NOSE	1
2	2760073-0*00	NARROW RT. NOSE	NARROW RT. NOSE	1
3	2760076-0000	NOSE CART. SUPPORT BRACKET	NOSE CART. SUPPORT BRACKET	1
4	2760297-0000	NOSE BAY CART. SUPPORT BRACKET	NOSE BAY CART. SUPPORT BRACKET	1
5	2699065-0000	1/4" DIA. x 3/4" HEX BOLT	M6 x 19 HEX BOLT	1
6	2699841-0000	5/8" DIA. x 1 1/4" HEX BOLT	M16 x 32 HEX BOLT	6
7	2700501-0000	5/8" DIA. x 2" HEX BOLT	M16 x 51 HEX BOLT	6
8	2704151-0000	1/4" DIA. HEX NUT	M6 HEX NUT	6
9	2704191-0000	5/8" DIA. RAIL HEX NUT	M16 RAIL HEX NUT	6
10	2704851-0000	5/8" DIA. x 2" O.D. x 11" HEX NUT COUPLING	M16 x 51 O.D. x 279 HEX NUT COUPLING	6
11	2708281-0000	1/4" DIA. LOCK WASHER	M6 LOCK WASHER	6
12	2708291-0000	5/8" DIA. x 1 3/4" O.D. WASHER	M16 x 44 O.D. WASHER	6

* 1 INDICATES YELLOW
* 2 INDICATES BLACK



NOSE ASSEMBLY

ASSEMBLY NO. 3540042-0100 (YELLOW)
ASSEMBLY NO. 3540042-0200 (BLACK)

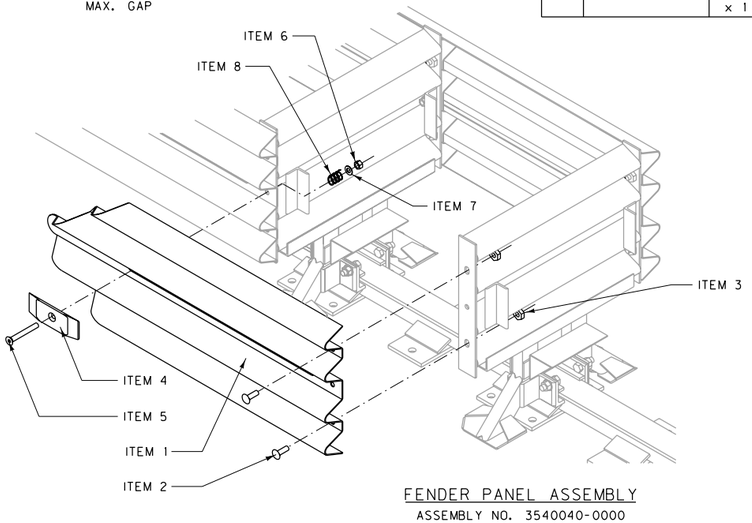


ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	2760081-0000	FENDER PANEL	FENDER PANEL	1
2	2699341-0000	5/8" DIA. x 2" RAIL BOLT	M16 x 51 RAIL BOLT	2
3	2704191-0000	5/8" DIA. HEX NUT	M16 HEX NUT	2
4	2708841-0000	CAST MUSHROOM WASHER	CAST MUSHROOM WASHER	1
5	2706604-0000	5/8" DIA. x 5" SCREW	M16 x 127 SCREW	1
6	2704141-0000	5/8" DIA. HEX NUT	M16 HEX NUT	1
7	2708291-0000	5/8" DIA. WASHER	M16 WASHER	1
8	2021611-0000	5/8" DIA. x 1 1/4" O.D. x 1 1/2" DIE SPRING	M16 x 32 O.D. x 38 DIE SPRING	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.



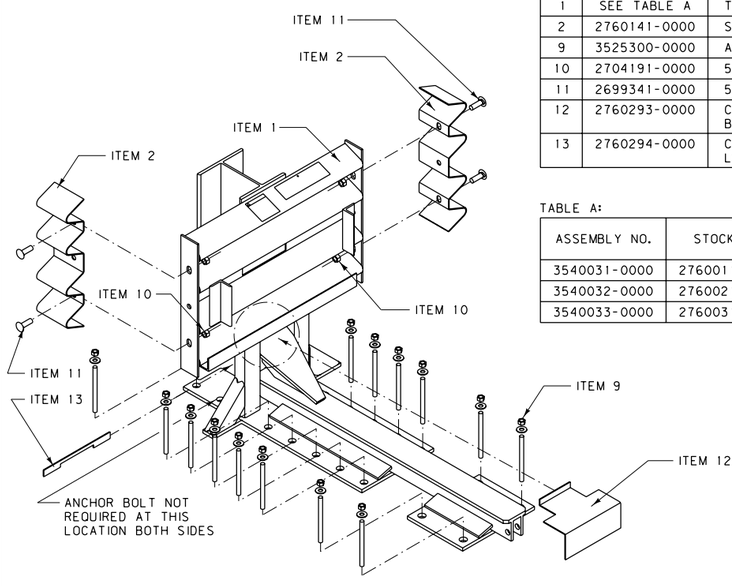
FENDER PANEL ASSEMBLY

ASSEMBLY NO. 3540040-0000

ITEM	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION	REQ'D
1	SEE TABLE A	TENSION BACKUP	TENSION BACKUP	1
2	2760141-0000	SIDE PANEL	SIDE PANEL	2
9	3525300-0000	ANCHOR KIT	ANCHOR KIT	3
10	2704191-0000	5/8" DIA. HEX NUT	M16 HEX NUT	4
11	2699341-0000	5/8" DIA. x 2" RAIL BOLT	M16 x 51 RAIL BOLT	4
12	2760293-0000	CARTRIDGE SUPPORT BRACKET	CARTRIDGE SUPPORT BRACKET	1
13	2760294-0000	CARTRIDGE SUPPORT LOCKING BAR	CARTRIDGE SUPPORT LOCKING BAR	1

TABLE A:

ASSEMBLY NO.	STOCK NO.	DESCRIPTION	METRIC DESCRIPTION
3540031-0000	2760011-0000	24" WIDE TENSION BACKUP	610 WIDE TENSION BACKUP
3540032-0000	2760021-0000	30" WIDE TENSION BACKUP	760 WIDE TENSION BACKUP
3540033-0000	2760031-0000	36" WIDE TENSION BACKUP	915 WIDE TENSION BACKUP



BACKUP ASSEMBLY

NOTE:

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

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

DETAILED DRAWING

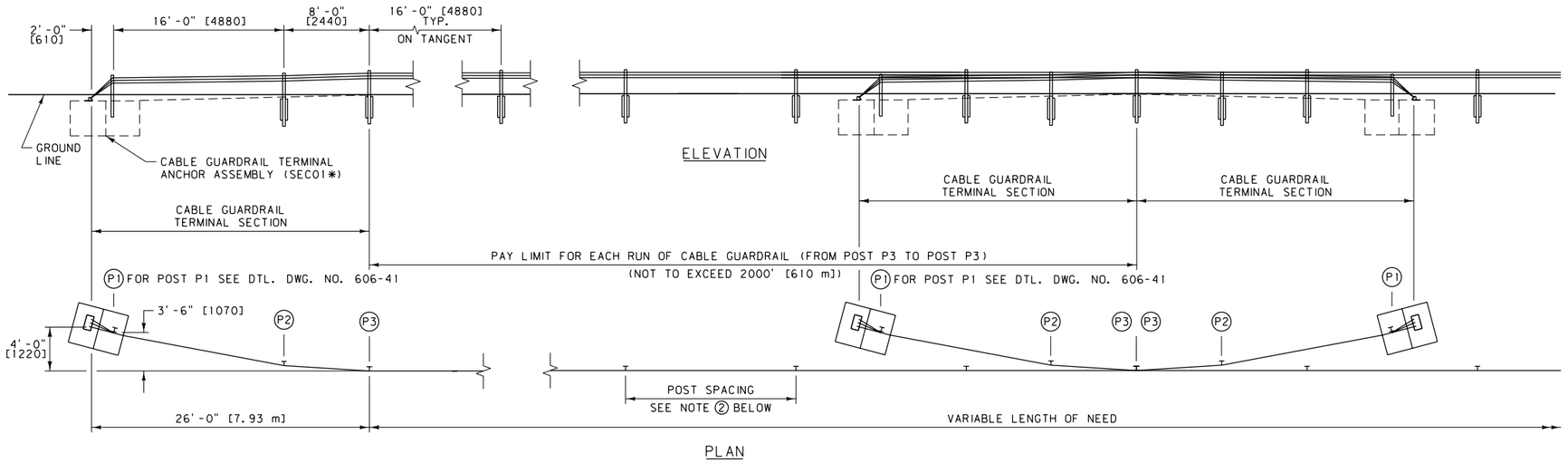
REFERENCE STANDARD SPEC. SECTION 606

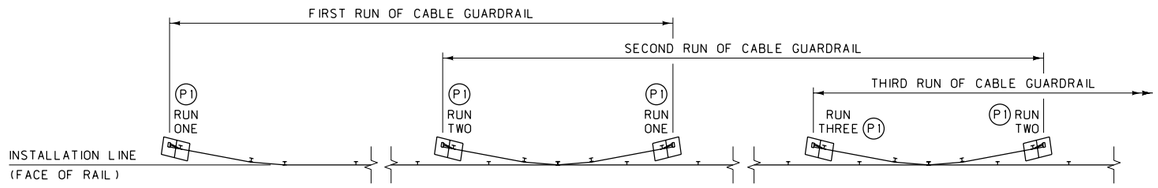
DWG. NO. 606-31D

IMPACT ATTENUATOR - QUADGUARD II ASSEMBLY DETAILS

EFFECTIVE: SEPTEMBER 2014

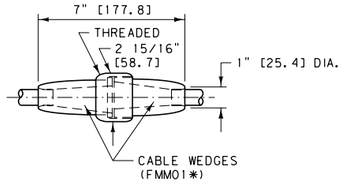
MDT MONTANA DEPARTMENT OF TRANSPORTATION





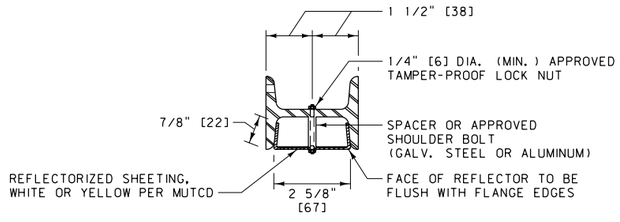
TYPICAL LAYOUT FOR MULTIPLE RUNS OF CABLE GUARDRAIL

EACH RUN OF CABLE GUARDRAIL CONTAINS TWO TERMINAL SECTIONS WITH ANCHOR ASSEMBLIES.

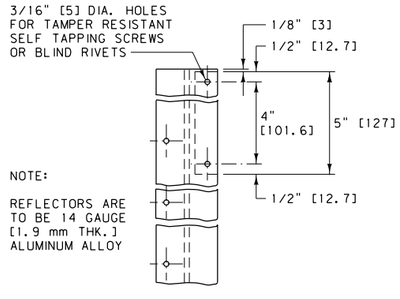


CABLE SPLICE

SPLICE CABLE USING A COUPLING DEVICE AS SHOWN, OR AN ALTERNATE METHOD APPROVED BY THE PROJECT MANAGER



REFLECTOR ALT. "B"



REFLECTOR ALT. "A"

NOTES:

(1) FOR CABLE GUARDRAIL RUNS OF:

1044 FT. [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 1044 FT. [318.42 m], UP TO 2052 FT. [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 700 FT. [220 m] AND GREATER: 16 FT. [4880 mm].

CURVES WITH RADII LESS THAN 700 FT. [220 m] DOWN TO 440 FT. [135 m]: 12 FT. [3660 mm].

NOTE: DO NOT INSTALL CABLE GUARDRAIL ON THE INSIDE SHOULDER OF ANY CURVE.

(3) UNIFORMLY TENSION ALL CABLES TO COMPRESS SPRINGS BY 3 1/2" [90 mm].

(4) DO NOT INSTALL CABLE GUARDRAIL FOR OBSTACLES WITHIN 12 FT. [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 8 FT. [2.5 m].

(6) ATTACH REFLECTORS TO EVERY OTHER LINE POST (32 FT. [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 2'-0" [0.6 m] FROM THE TRAFFIC LANE.

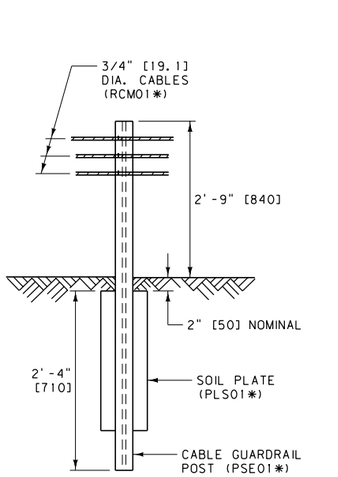
(8) GUIDANCE FOR TENSIONING CABLES USING THE TURNBUCKLES IS GIVEN IN CABLE TENSIONING TABLES.
CABLE TENSIONING - NCHRP 230 TESTS HR 22-4 (1986)
METRIC CABLE TENSIONING - NYDOT STD. M606-1R1 (1996)

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

CABLE TENSIONING	
TEMPERATURE (°F)	COMPR. # (INCHES)
120 TO 110	1.00"
109 TO 100	1.25"
99 TO 90	1.50"
89 TO 80	1.75"
79 TO 70	2.00"
69 TO 60	2.25"
59 TO 50	2.50"
49 TO 40	2.75"
39 TO 30	3.00"
29 TO 20	3.25"
19 TO 10	3.50"
9 TO 0	3.75"
-1 TO -10	4.00"
-11 TO -20	4.25"

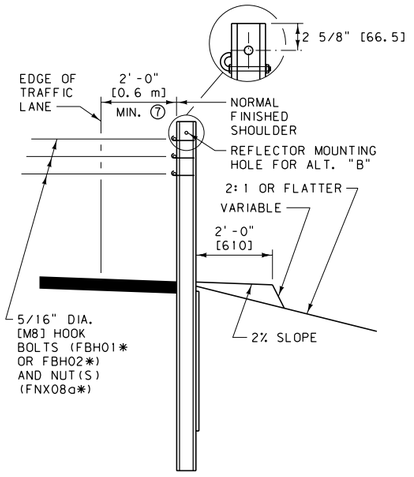
METRIC CABLE TENSIONING	
TEMPERATURE (°C)	COMPR. # (mm)
50 TO 43	25
42 TO 38	32
37 TO 32	38
31 TO 27	45
26 TO 21	50
20 TO 16	57
15 TO 10	64
9 TO 5	70
4 TO -1	75
-2 TO -7	83
-8 TO -12	89
-13 TO -18	95
-19 TO -23	100
-24 TO -29	108

- SPRING COMPRESSION FROM UNLOADED POSITION



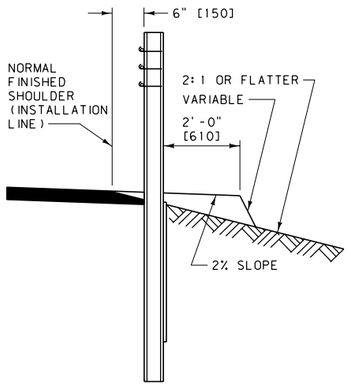
TYPICAL INSTALLATION DETAIL

LINE POST & POST P3



TYPICAL INSTALLATION DETAIL

POST P2



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

DETAILED DRAWING

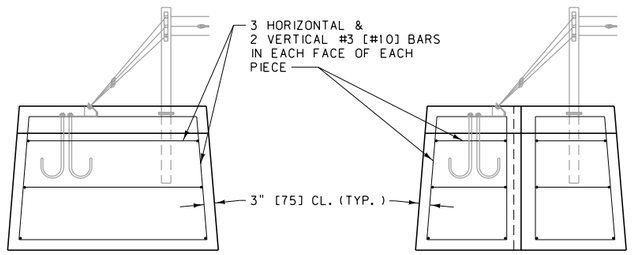
REFERENCE STANDARD SPEC. SECTION 606

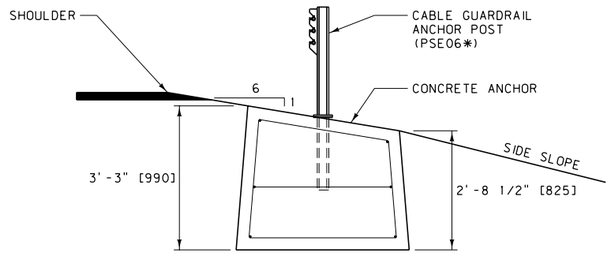
DWG. NO. 606-40

CABLE GUARDRAIL

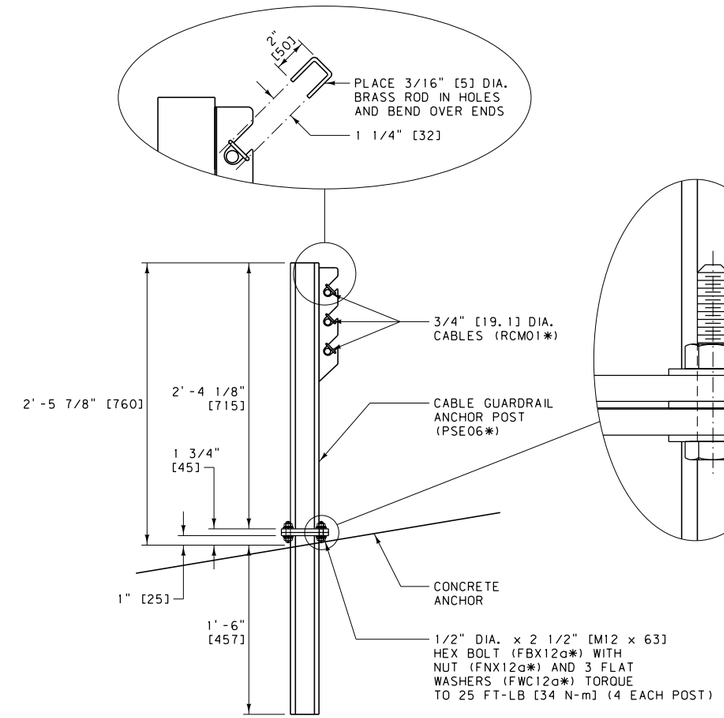
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

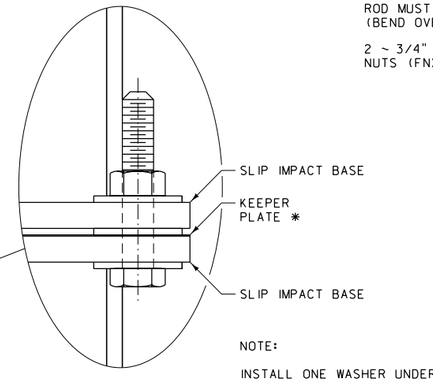




ANCHOR UNIT & REBAR INSTALLATION DETAILS

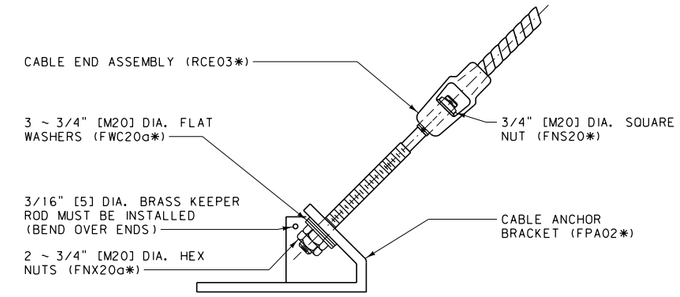


ANCHOR POST DETAIL



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.



CABLE END ASSEMBLY TO ANCHOR BRACKET DETAIL

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 PER SECTION 203.

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.

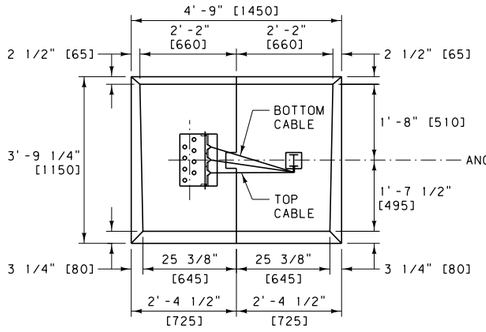
③ IF LIFTING DEVICES ARE EMBEDDED INTO THE CONCRETE ANCHORS, ENSURE THAT THEY HAVE A SAFE WORKING LOAD OF 4 TONS [3.6 METRIC TONS]FOR THE ONE PIECE ANCHOR AND 2 TONS [1.8 METRIC TONS]EACH FOR EACH OF THE HALVES OF THE TWO PIECE ANCHOR UNIT.

④ USE CLASS GENERAL CONCRETE TO CONSTRUCT ANCHOR.

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

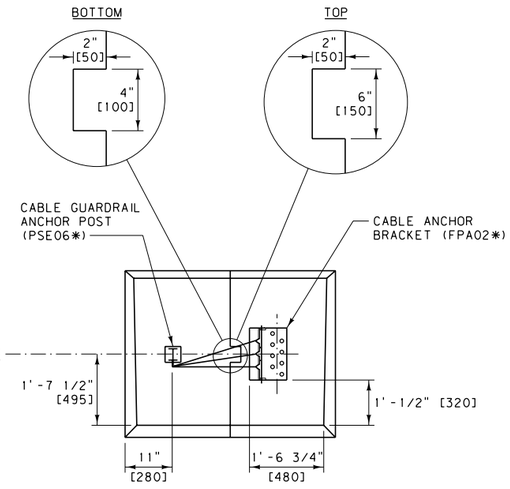
NOTE:

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.

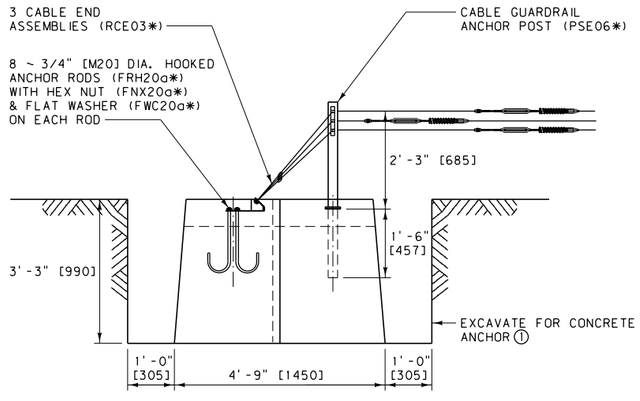


PLAN
(LEFT HAND ANCHOR UNIT)

TAPERED KEYWAY DETAIL
(TWO PIECE INSTALLATION)



PLAN
(RIGHT HAND ANCHOR UNIT)



ELEVATION
(LEFT HAND ANCHOR UNIT)

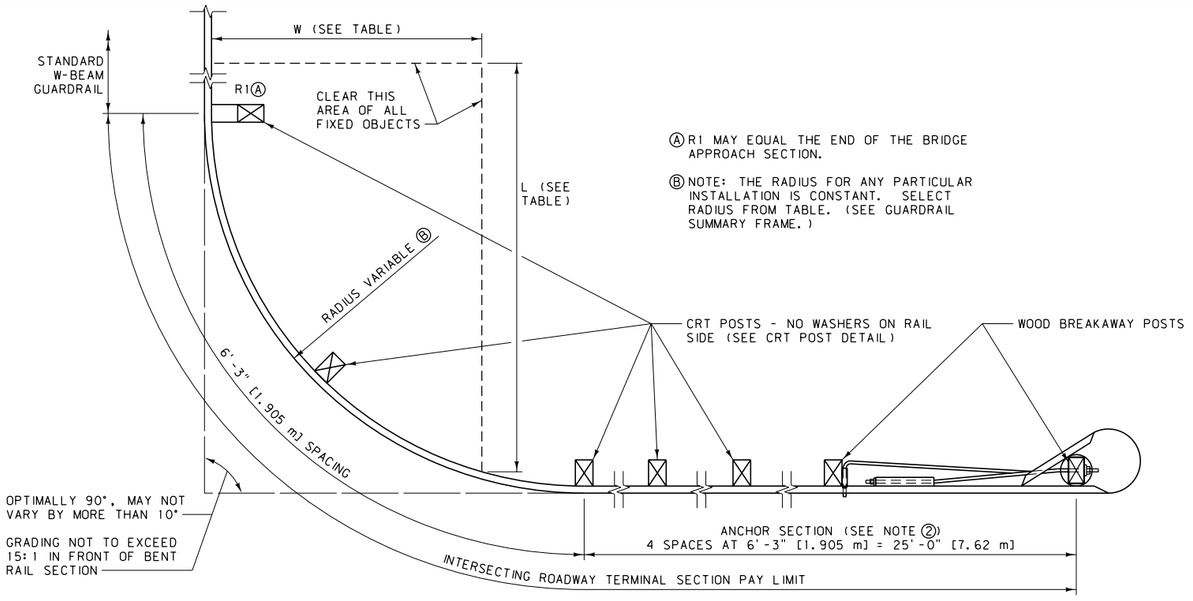
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-41

CABLE GUARDRAIL TERMINAL ANCHOR ASSEMBLY

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



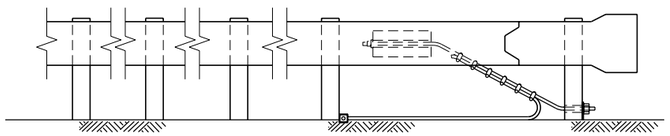
Ⓐ R1 MAY EQUAL THE END OF THE BRIDGE APPROACH SECTION.

Ⓑ NOTE: THE RADIUS FOR ANY PARTICULAR INSTALLATION IS CONSTANT. SELECT RADIUS FROM TABLE. (SEE GUARDRAIL SUMMARY FRAME.)

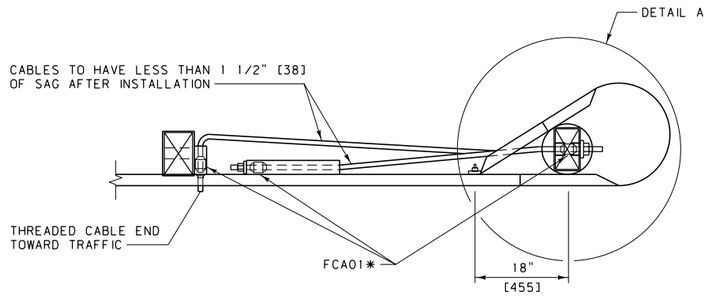
RADIUS TABLE			
RADIUS	LENGTH OF BENT RAIL	L	W
8'	12.5'	25'	15'
16'	25.0'	30'	15'
24'	37.5'	40'	20'
32'	50.0'	50'	20'

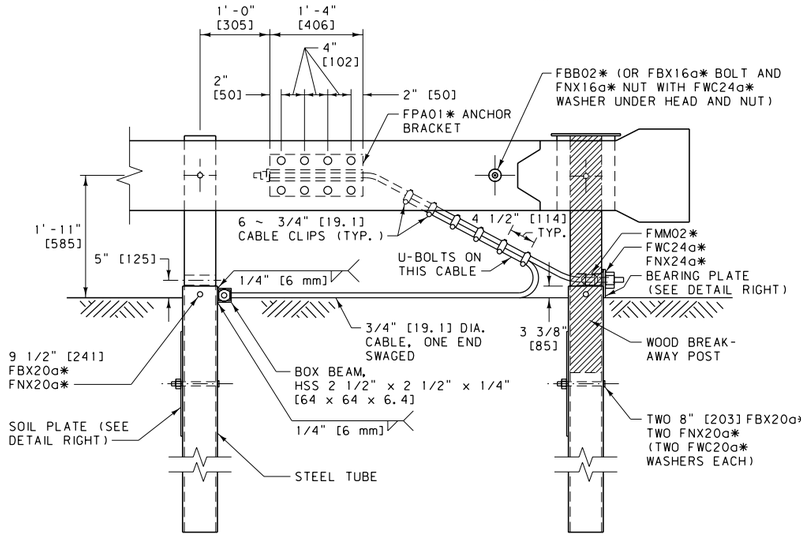
METRIC RADIUS TABLE			
RADIUS	LENGTH OF BENT RAIL	L	W
2450 mm	3.81 m	7.6 m	4.6 m
4850 mm	7.62 m	9.1 m	4.6 m
7300 mm	11.43 m	12.2 m	6.1 m
9700 mm	15.24 m	15.2 m	6.1 m

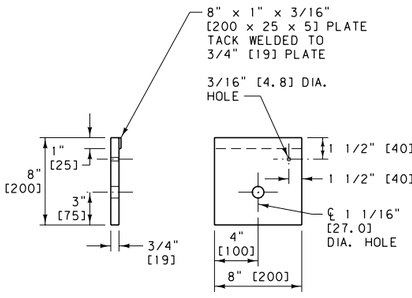
PLAN



ELEVATION

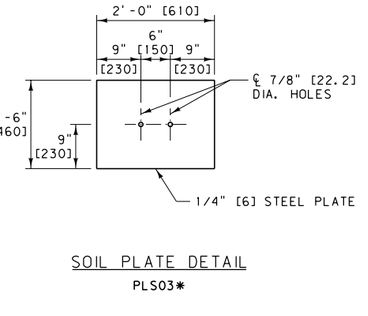






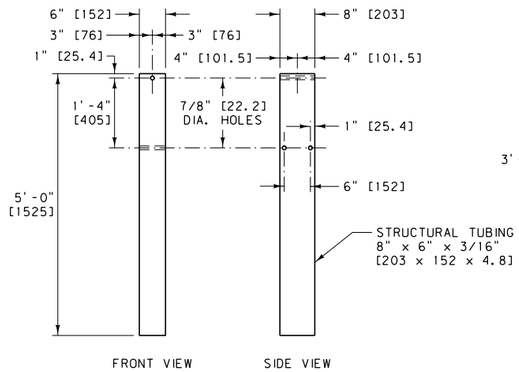
BEARING PLATE DETAIL

FPB01*



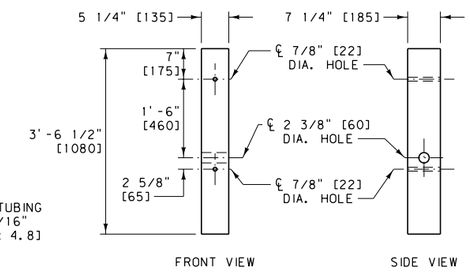
SOIL PLATE DETAIL

PLS03*



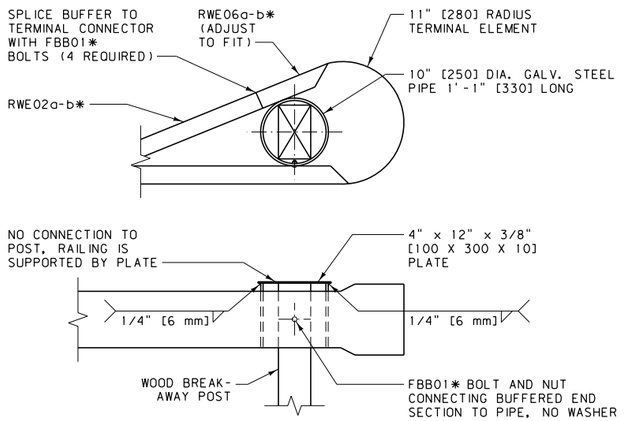
STEEL TUBE DETAILS

PTE05*

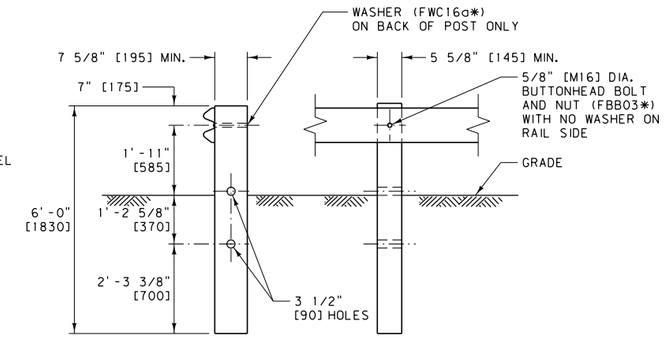


WOOD BREAKAWAY POST DETAILS

PDF01*



DETAIL A



CONTROLLED RELEASING TERMINAL (CRT) POST

CRT POST DETAIL

PDE09*

NOTES:

① DO NOT INSTALL ON SLOPES STEEPER THAN 2:1.

② DO NOT OMIT OR SHORTEN ANCHOR SECTION.

③ 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

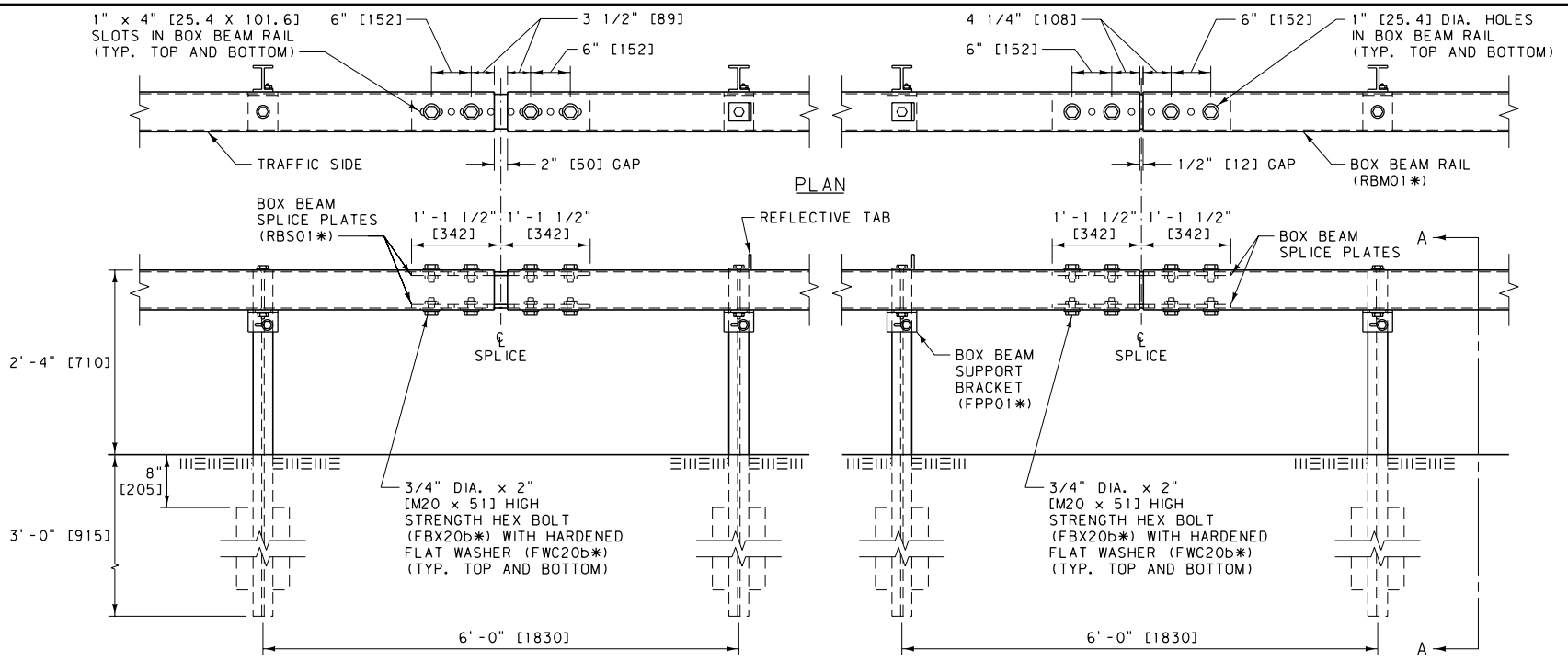
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-46

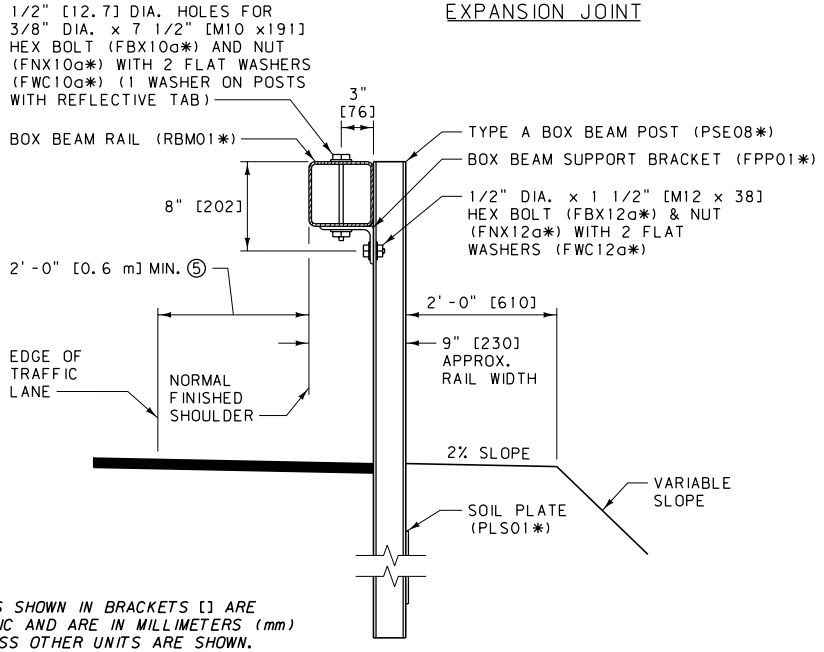
INTERSECTING ROADWAY TERMINAL SECTION

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



EXPANSION JOINT ELEVATION SPLICE DETAIL



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

SECTION A-A

NOTES:

① USE BOX BEAM RAIL IN MINIMUM NOMINAL LENGTHS OF 18 FT. [5.49 m] UNLESS APPROVED BY THE PROJECT MANAGER.

② INSTALL EXPANSION JOINTS ON ALL BOX BEAM GUARDRAIL INSTALLATIONS GREATER THAN 300 FT. [90 m] IN LENGTH AT INTERVALS NOT TO EXCEED 500 FT. [150 m].

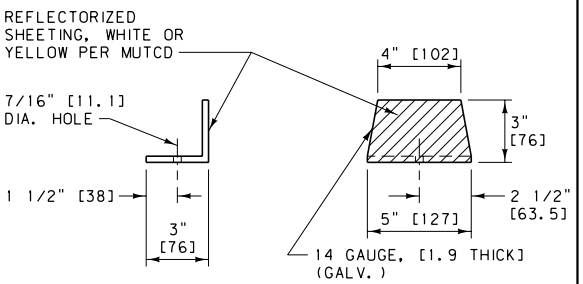
③ ATTACH REFLECTIVE TABS TO EVERY FOURTH POST (24 FT. [7.32 m] TYP.). ANGLE TABS SLIGHTLY TOWARDS TRAFFIC. DO NOT USE REFLECTIVE TABS ON WY-BET TERMINALS. WY-BET TERMINALS RECEIVE REFLECTIVE CHANNELS.

④ DO NOT INSTALL BOX BEAM GUARDRAIL FOR OBSTACLES WITHIN 5.8' [1.8 m] OF THE FACE OF THE RAIL.

⑤ WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2'-0" [0.6 m] FROM THE TRAFFIC LANE.

⑥ PROVIDE SHOP BENT BOX BEAM RAIL FOR ROADWAY CURVATURE WITH RADII OF LESS THAN 715 FEET [218 m].

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



REFLECTIVE TAB

DETAILED DRAWING

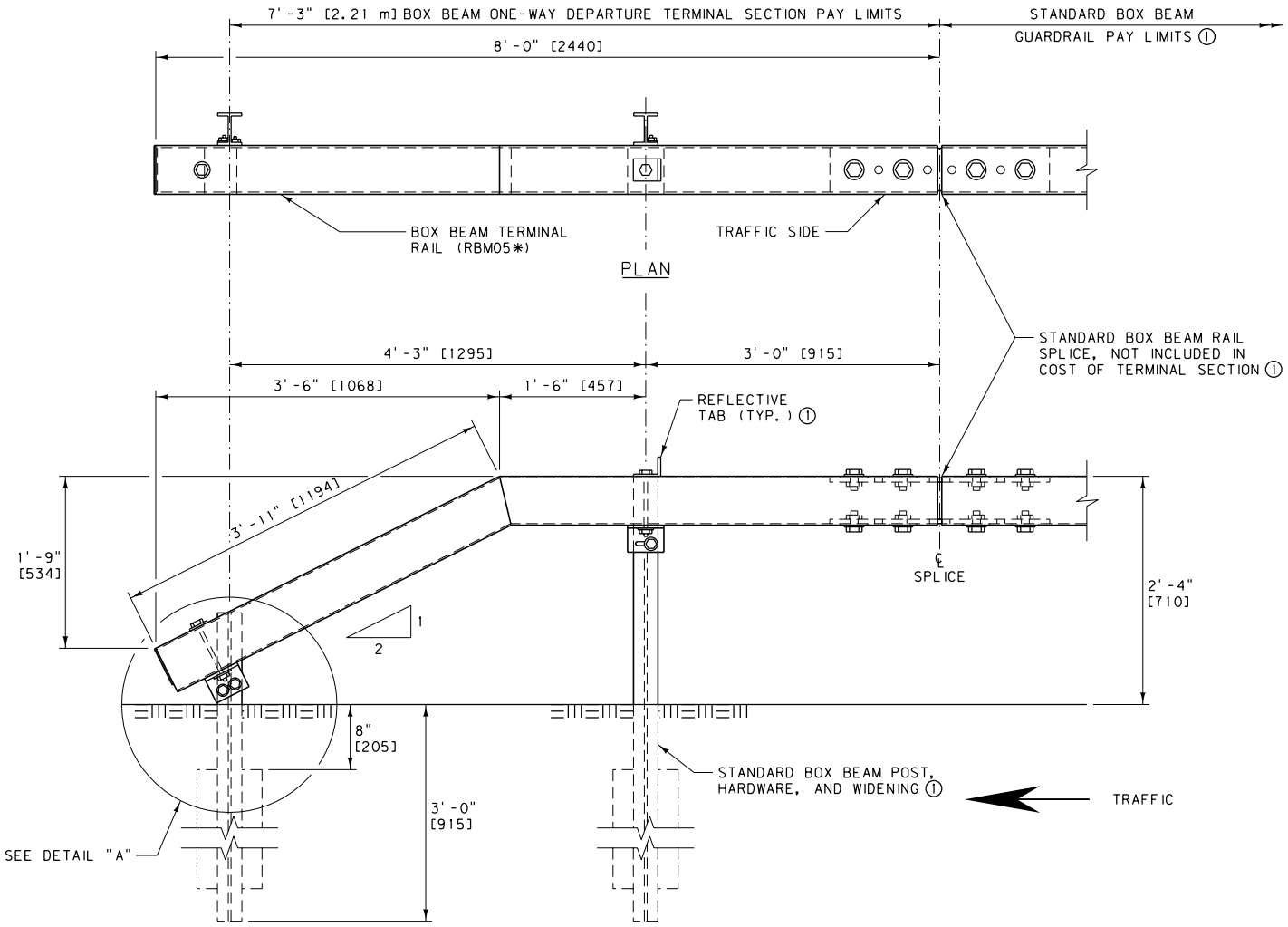
REFERENCE STANDARD SPEC. SECTION 606

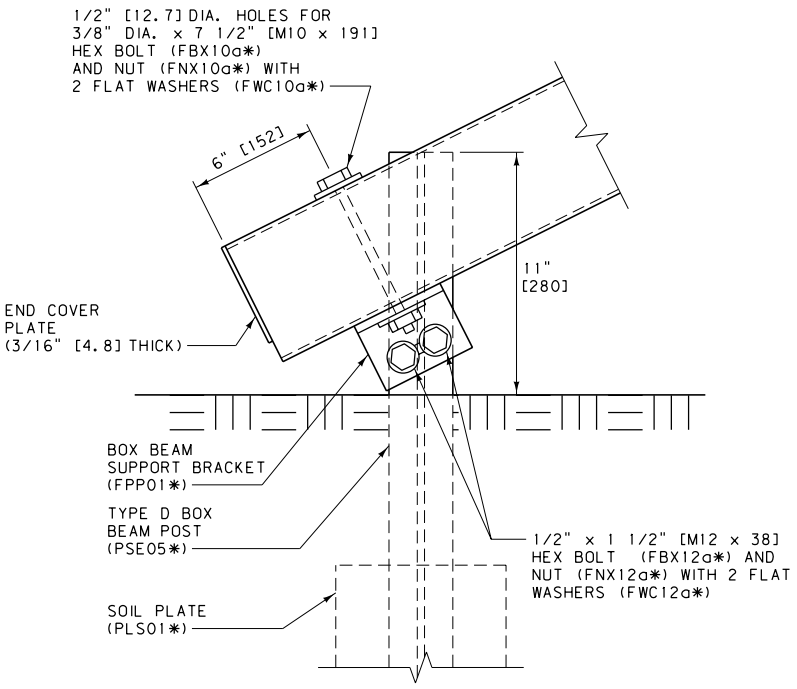
DWG. NO. 606-50

BOX BEAM GUARDRAIL

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION





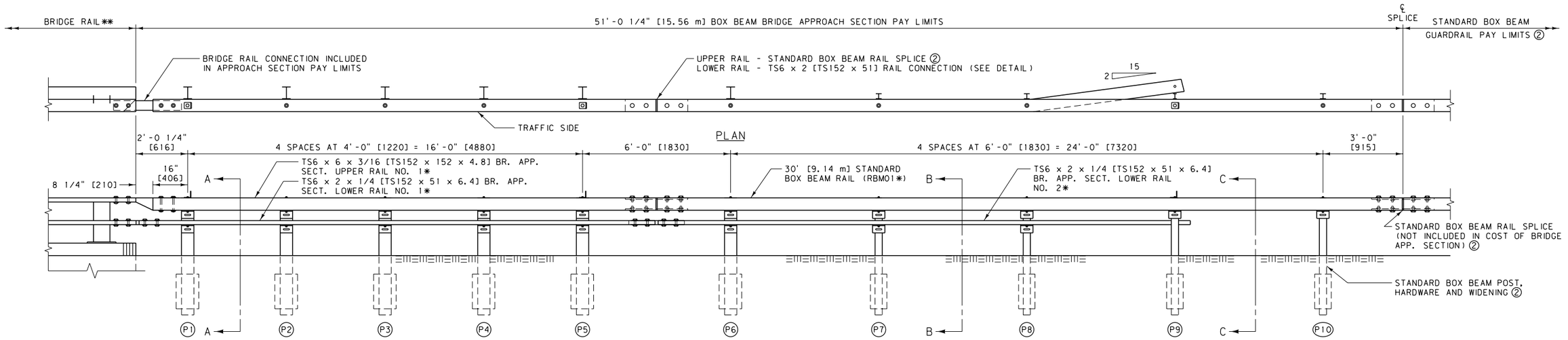
NOTES:

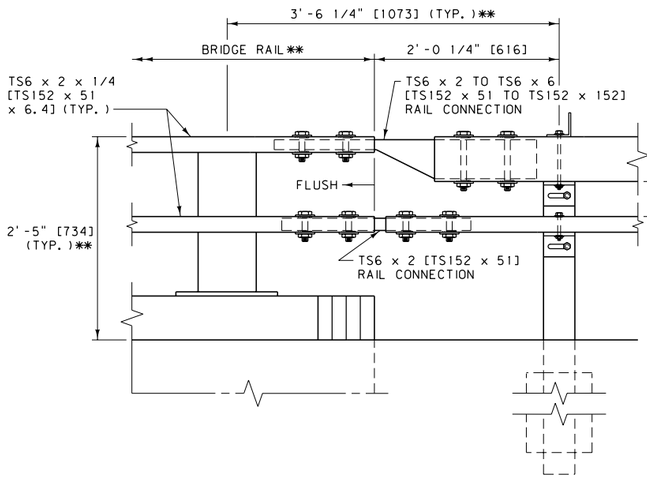
(1) SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.

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

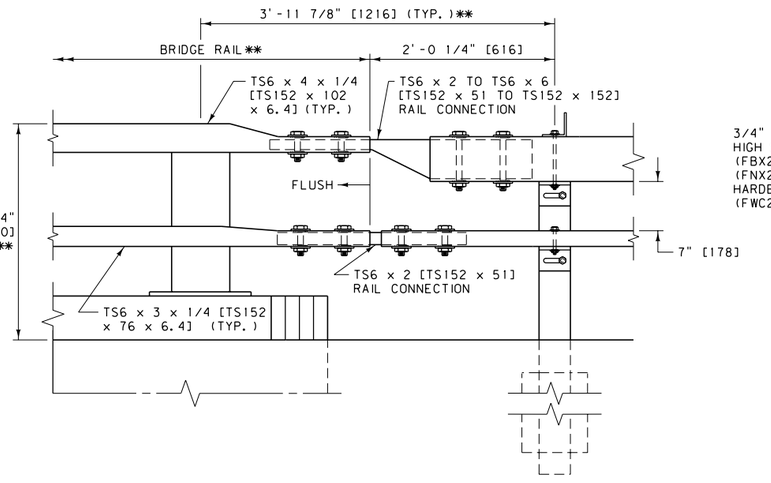
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-52
BOX BEAM ONE-WAY DEPARTURE TERMINAL SECTION	
EFFECTIVE: SEPTEMBER 2014	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	

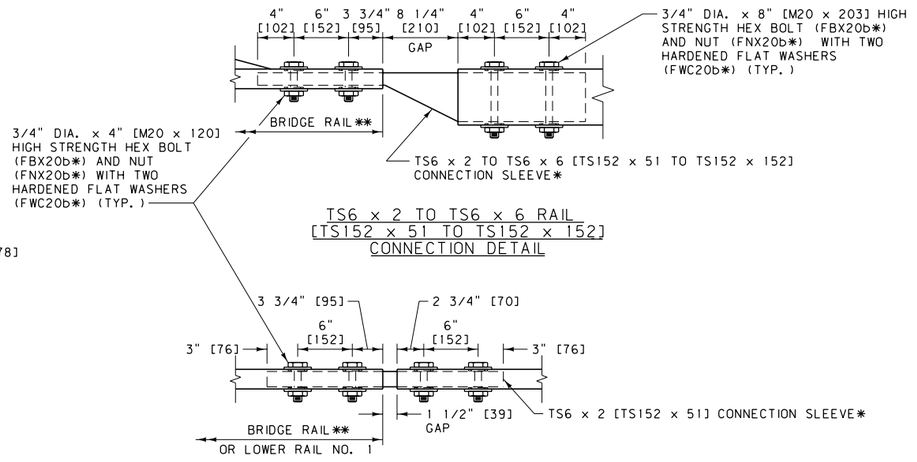




BOX BEAM - BRIDGE APPROACH SECTION TYPE 1

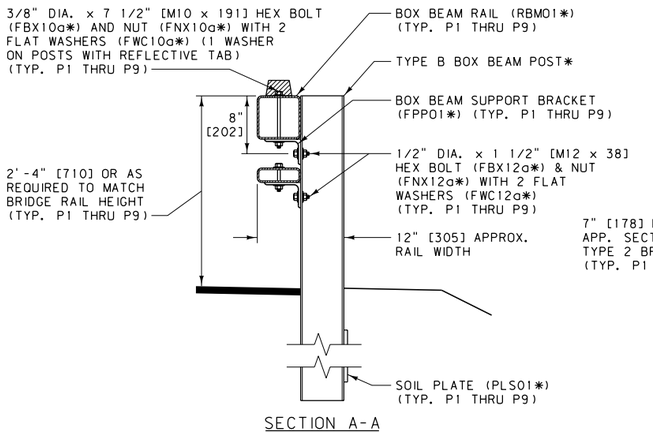


BOX BEAM - BRIDGE APPROACH SECTION TYPE 2



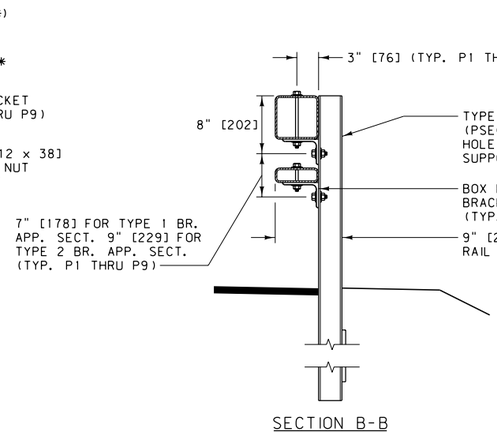
TS6 x 2 TO TS6 x 6 RAIL [TS152 x 51 TO TS152 x 152] CONNECTION DETAIL

TS6 x 2 [TS152 x 51] RAIL CONNECTION DETAIL



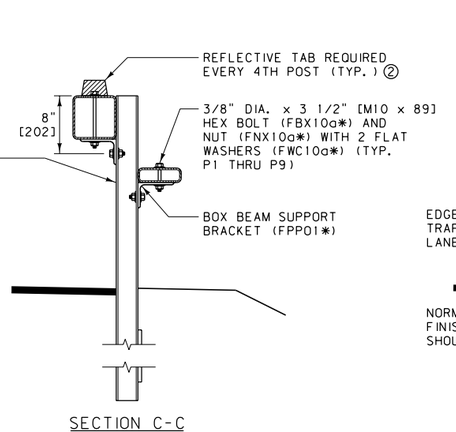
SECTION A-A

(TYP. AT POSTS P1 THRU P6)



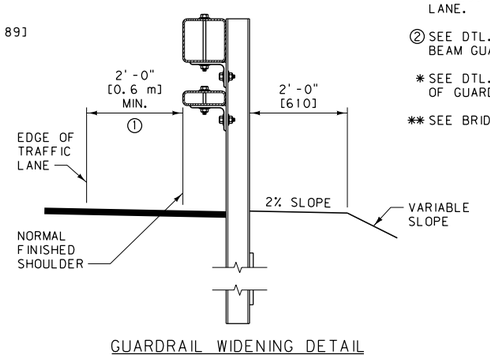
SECTION B-B

(TYP. AT POSTS P7 & P8)



SECTION C-C

(POST P9)



GUARDRAIL WIDENING DETAIL

(TYP AT POST P1 THRU P9)

NOTES:

1. WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2'-0" [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.

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

DETAILED DRAWING

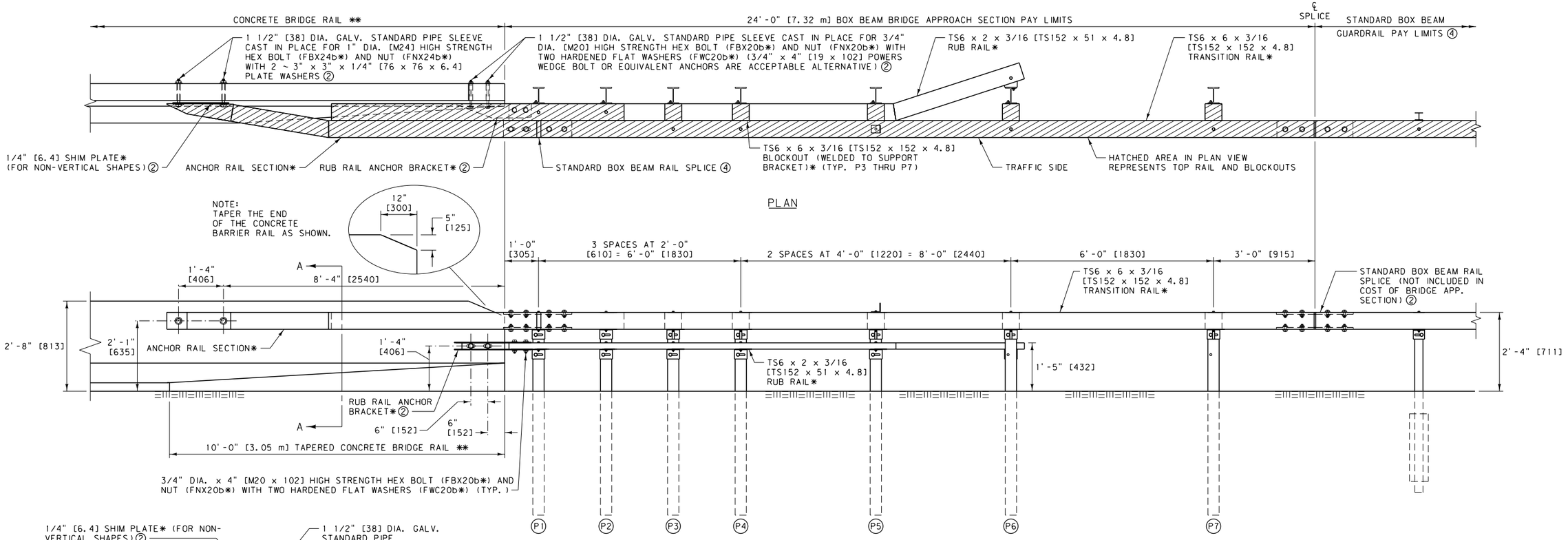
REFERENCE STANDARD SPEC. SECTION 606

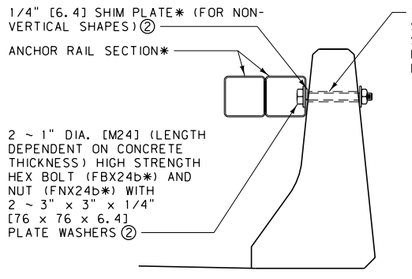
DWG. NO. 606-53

BOX BEAM BRIDGE APPROACH SECTION - TYPES 1 & 2

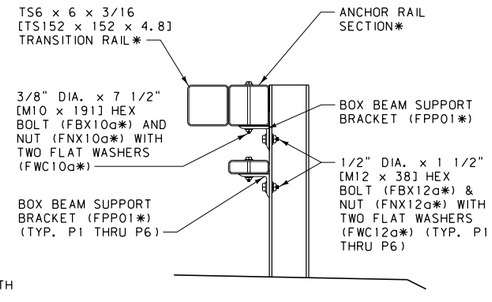
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

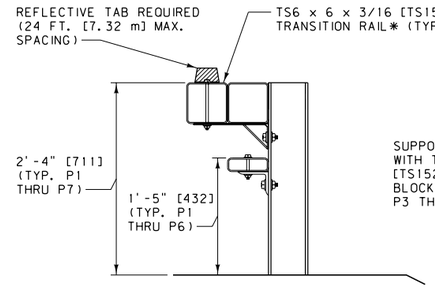




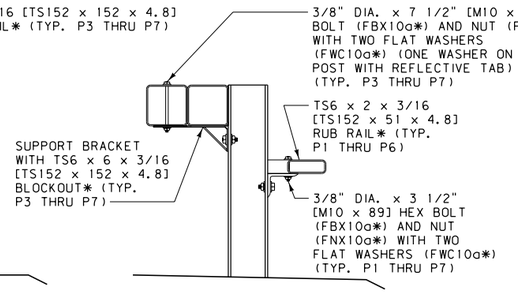
SECTION A-A



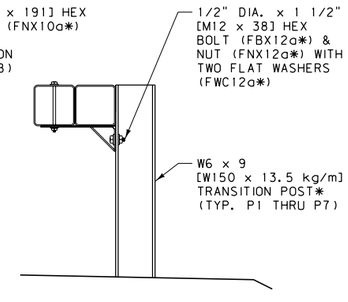
TYP. AT POSTS P1 & P2



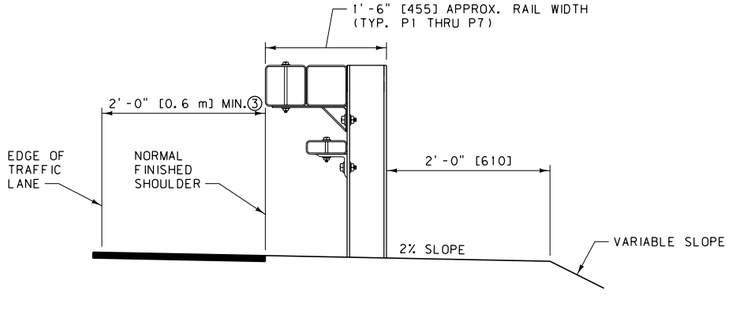
TYP. AT POSTS P3 THRU P5



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 1/4" [6.4] 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 2'-0" [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.

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

DETAILED DRAWING

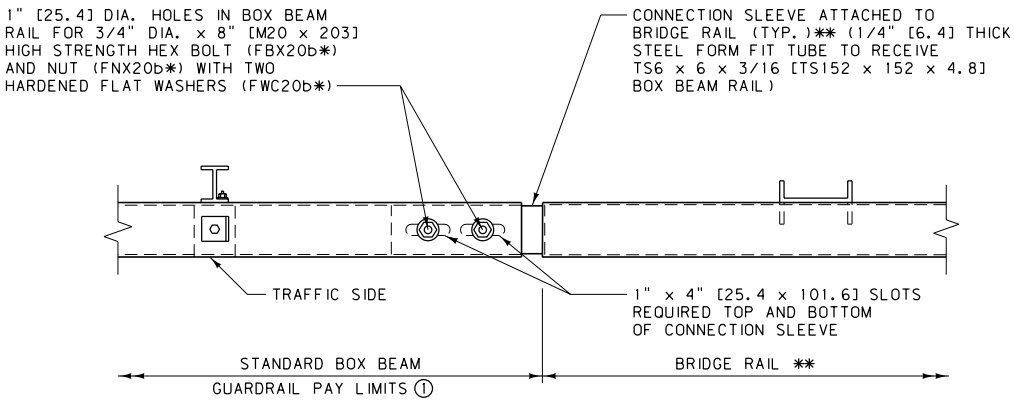
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-53A

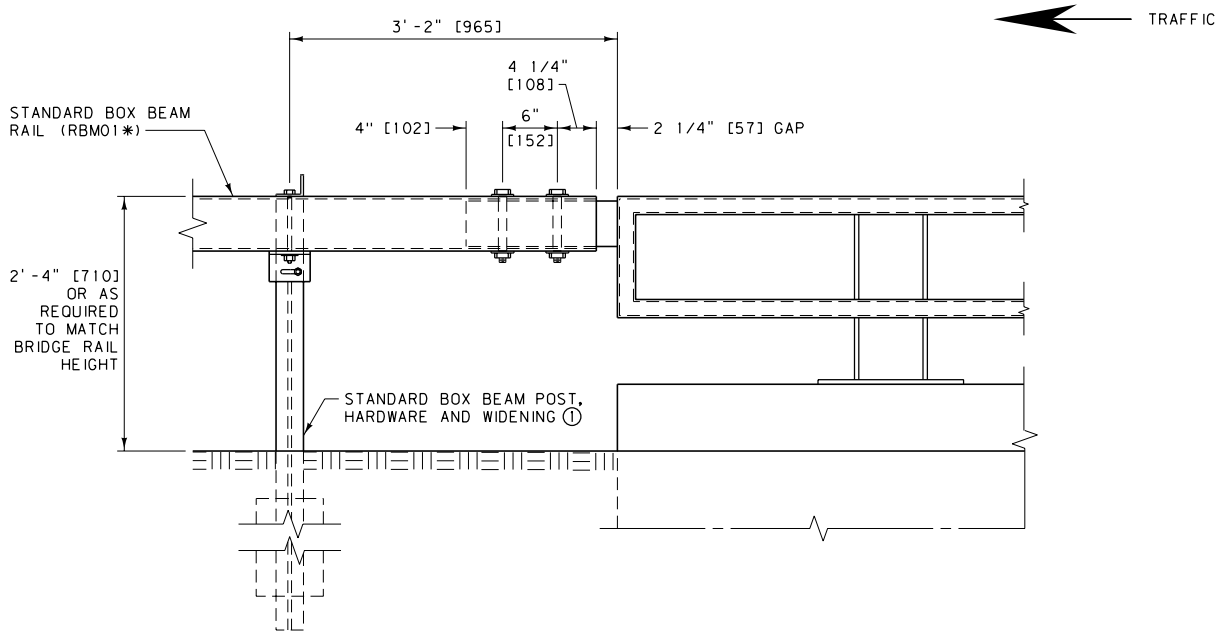
BOX BEAM BRIDGE APPROACH SECTION- TYPE 3

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



PLAN



ELEVATION

NOTES:

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

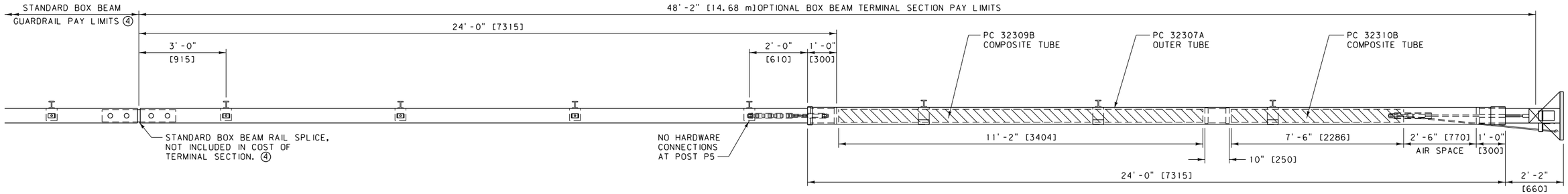
(2) USE ON EXIT END OF ONE-WAY TRAFFIC BRIDGES ONLY.

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

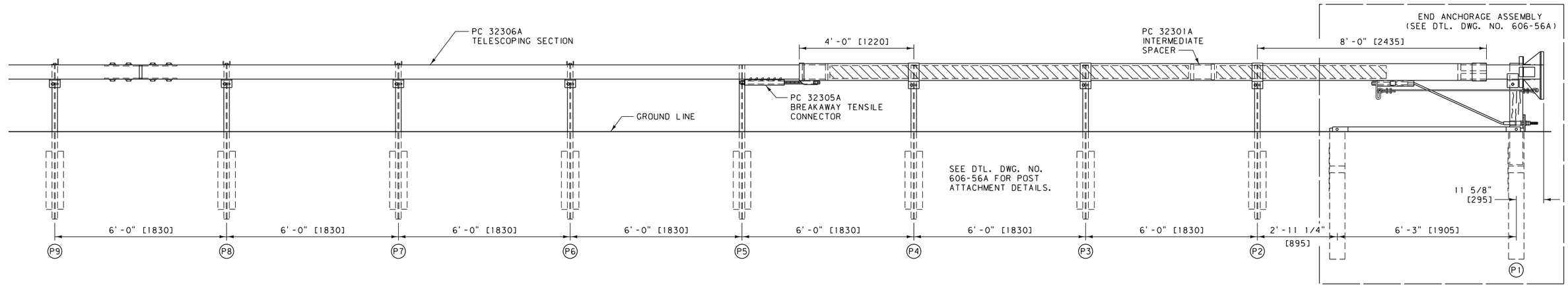
** SEE BRIDGE PLANS FOR MORE DETAILED INFORMATION ON BRIDGE RAIL AND CONNECTION DETAILS.

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

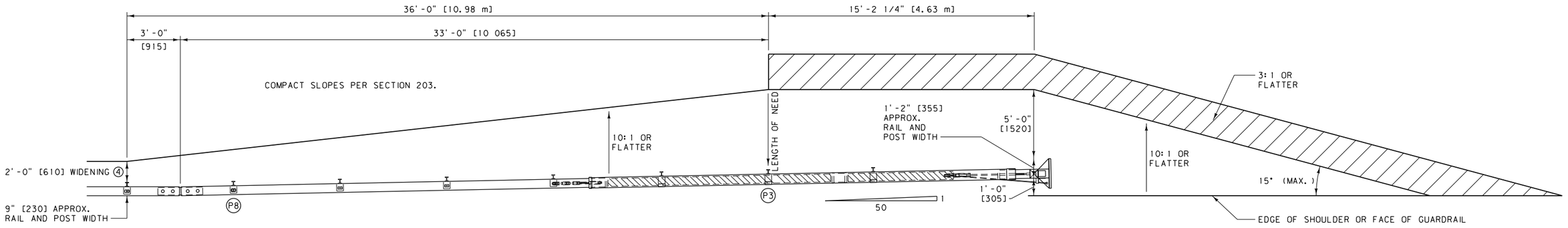
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-54
BOX BEAM ONE-WAY BRIDGE DEPARTURE SECTION	
EFFECTIVE: SEPTEMBER 2014	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	



PLAN



ELEVATION



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.

⑤ USE WOOD OR OTHER NCHRP 350/MASH APPROVED BLOCKS.

GUARDRAIL WIDENING

TRAFFIC

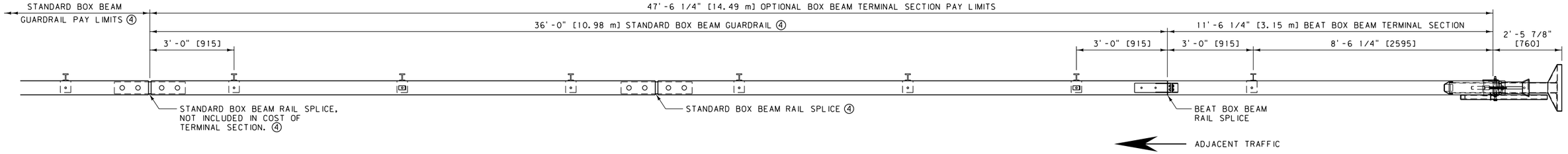
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

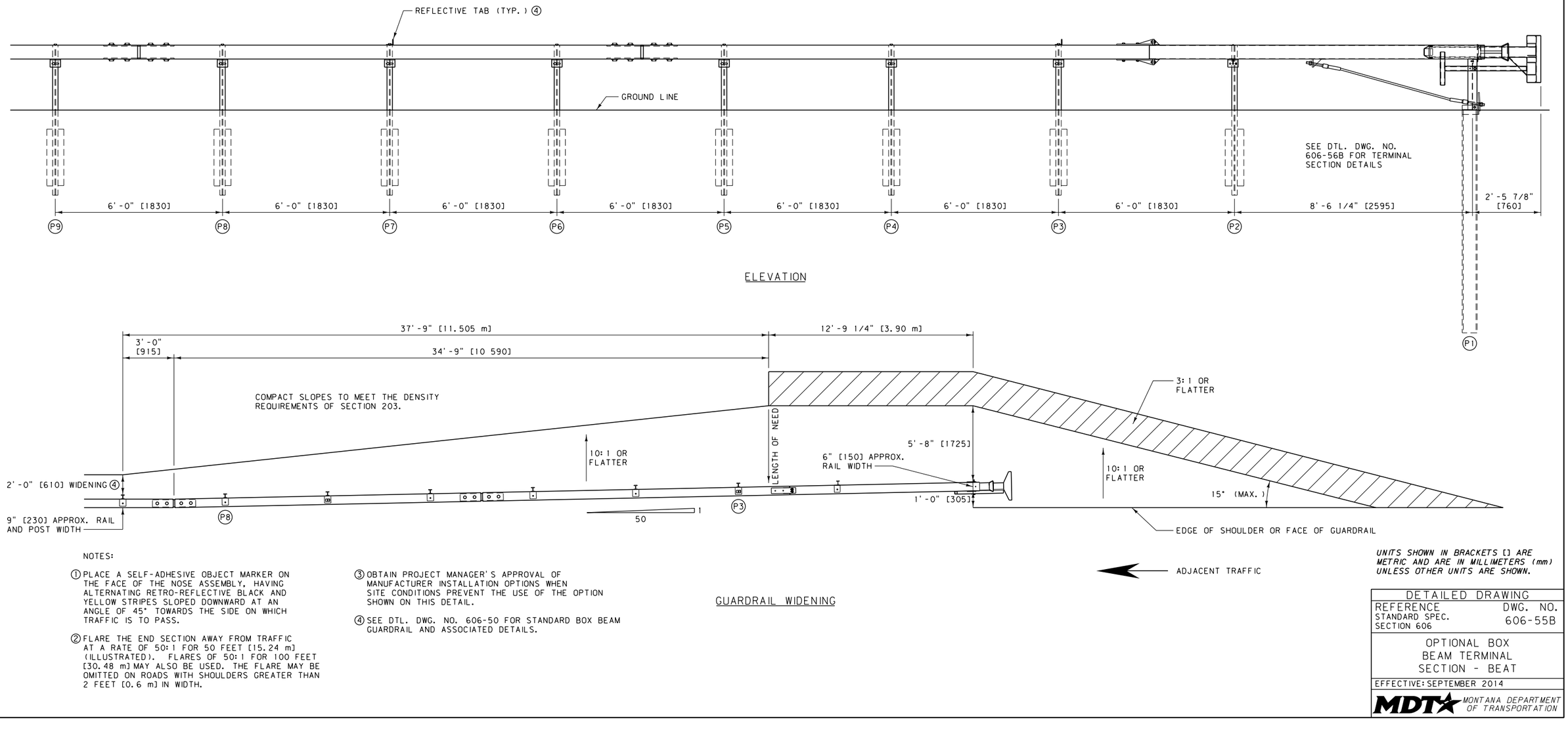
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-55A

OPTIONAL BOX BEAM TERMINAL SECTION - WY-BET

--REVISED--	EFFECTIVE: SEPTEMBER 2014
JULY 2016	MDT MONTANA DEPARTMENT OF TRANSPORTATION



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

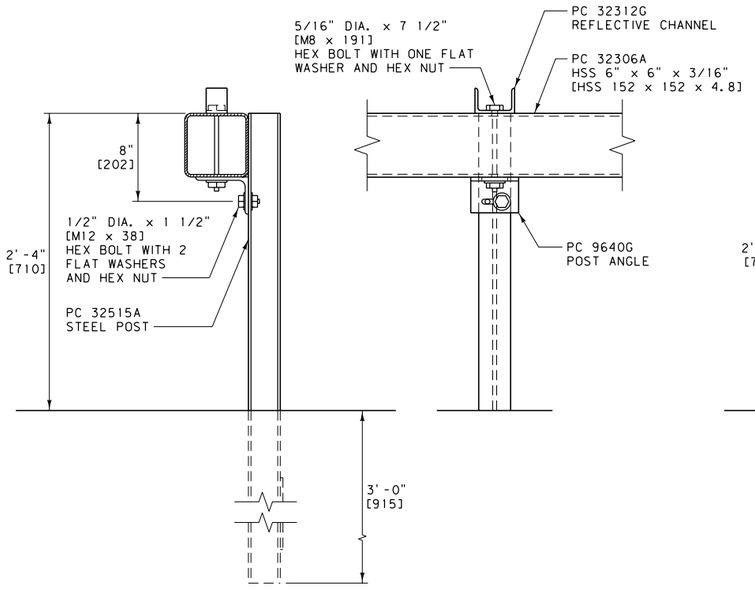
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-55B

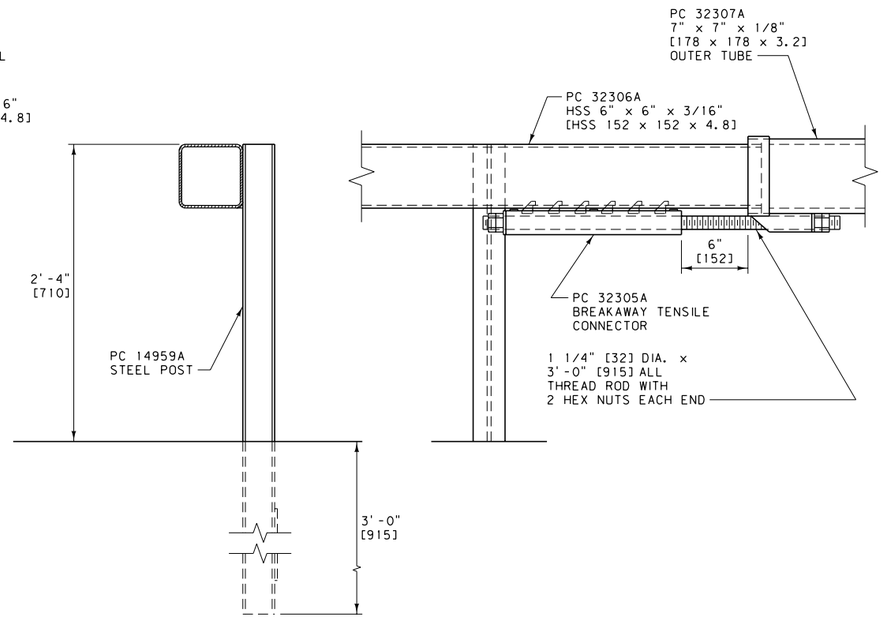
OPTIONAL BOX BEAM TERMINAL SECTION - BEAT

EFFECTIVE: SEPTEMBER 2014

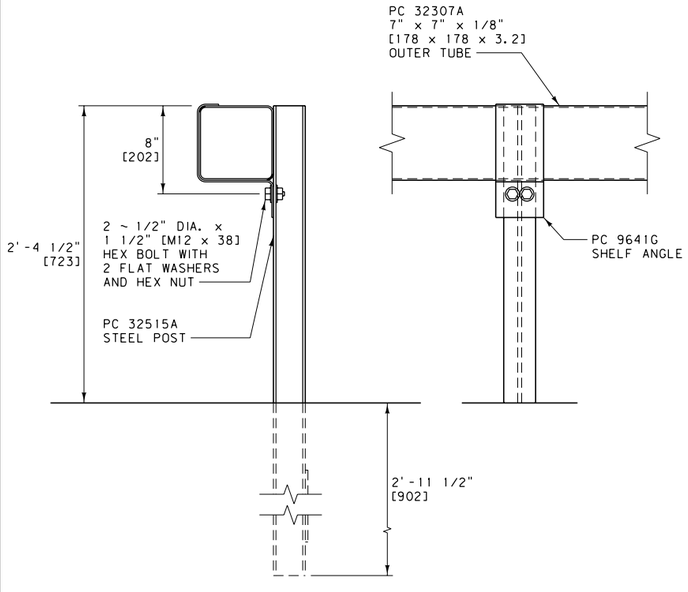
MDT MONTANA DEPARTMENT OF TRANSPORTATION



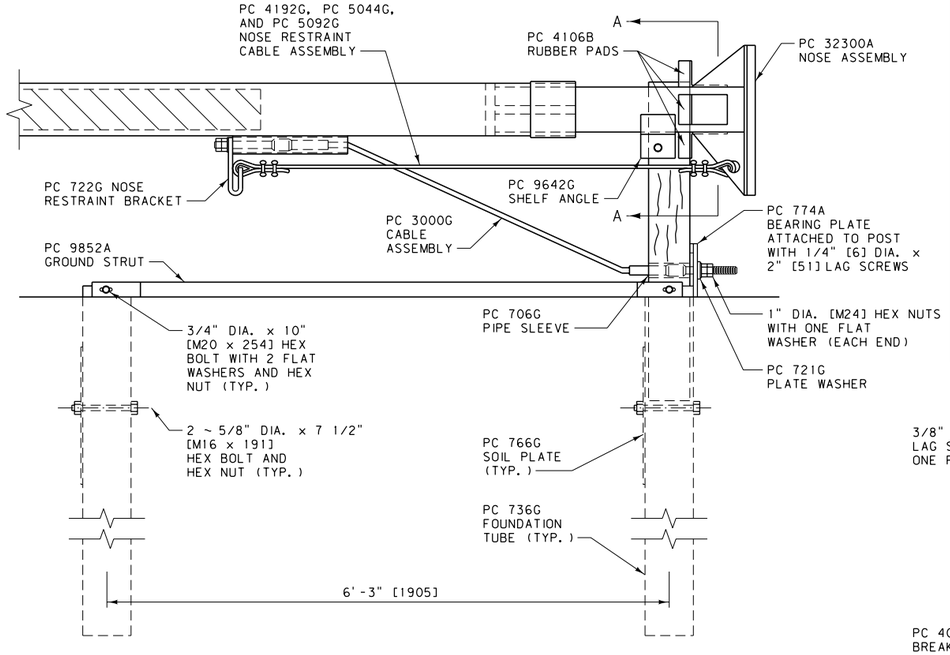
POST ATTACHMENT DETAIL
(TYP. AT POSTS P6, P7 AND P8)



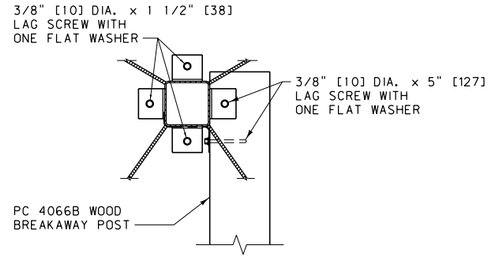
POST ATTACHMENT DETAIL
(POST P5)



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



END ANCHORAGE ASSEMBLY



SECTION A-A

BILL OF MATERIAL

PC	QTY	DESCRIPTION	METRIC DESCRIPTION (mm)
706G	1	PIPE SLEEVE, 2" DIA. x 6"	PIPE SLEEVE, 50 DIA. x 150
721G	1	PLATE WASHER, 3" x 4" x 3/8"	PLATE WASHER, 75 x 100 x 10
722G	1	NOSE RESTRAINT CABLE BRACKET	NOSE RESTRAINT CABLE BRACKET
736G	2	STEEL TUBE, 6" x 8" x 5'-0"	STEEL TUBE, 152 x 203 x 1525
766G	2	SOIL PLATE, 18" x 24" x 1/4"	SOIL PLATE, 460 x 610 x 6
774A	1	SLOTTED BEARING PLATE	SLOTTED BEARING PLATE
3000G	1	CABLE ASSEMBLY	CABLE ASSEMBLY
3148G	2	1/4" DIA. x 2" LAG SCREW	6 DIA. x 51 LAG SCREW
3240G	3	5/16" DIA. ROUND WASHER	M8 ROUND WASHER
3245G	3	5/16" DIA. HEX NUT	M8 HEX NUT
3254G	3	3/8" DIA. x 1 1/2" LAG SCREW	10 DIA. x 38 LAG SCREW
3255G	5	3/8" DIA. ROUND WASHER	M10 ROUND WASHER
3264G	2	3/8" DIA. x 5" LAG SCREW	10 DIA. x 127 LAG SCREW
3350G	4	5/8" DIA. HEX NUT	M16 HEX NUT
3478G	4	5/8" DIA. x 7 1/2" HEX BOLT	M16 x 191 HEX BOLT
3700G	4	3/4" DIA. ROUND WASHER	M20 ROUND WASHER
3710G	2	3/4" DIA. HEX NUT	M20 HEX NUT
4044G	4	1 1/4" DIA. HEX NUT	32 DIA. HEX NUT
4066B	1	WOOD POST, 6" x 8" x 3'-6 1/2"	WOOD POST, 150 x 200 x 1080
4106B	3		RUBBER PAD, 38.1 x 88.9 x 101.6
4192G	4	1/4" CABLE CLAMP	6.4 CABLE CLAMP
4300G	18	1/2" DIA. ROUND WASHER	M12 ROUND WASHER
4303G	9	1/2" DIA. HEX NUT	M12 HEX NUT
4308G	9	1/2" DIA. x 1 1/2 " HEX BOLT	M12 x 38 HEX BOLT
4719G	2	3/4" DIA. x 10" HEX BOLT	M20 x 254 HEX BOLT
4902G	2	1" DIA. ROUND WASHER	M24 ROUND WASHER
4903G	4	1" DIA. HEX NUT	M24 HEX NUT
5044G	1	AIRCRAFT CABLE, 1/4" DIA. x 6'-10"	AIRCRAFT CABLE, 6.4 DIA. x 2080
5092G	2	1/4" AIRCRAFT CABLE THIMBLE	6.4 AIRCRAFT CABLE THIMBLE
5188G	3	5/16" DIA. x 7 1/2" HEX BOLT	M8 x 191 HEX BOLT
5423G	1	1 1/4" DIA. x 36" ALL THREAD ROD	32 DIA. x 915 ALL THREAD ROD
9640G	3	POST ANGLE, 5" x 3 1/2" x 3/8" x 4 1/2"	POST ANGLE, 127 x 89 x 9.5 x 115
9641G	3	SHELF ANGLE, 4 1/2" x 1/8" x 1'-7 1/8"	SHELF ANGLE, 115 x 3.2 x 486
9642G	1	SHELF ANGLE, 4 1/2" x 1/8" x 11 1/8"	SHELF ANGLE, 115 x 3.2 x 283
9852A	1	STRUT AND YOKE ASSEMBLY	STRUT AND YOKE ASSEMBLY
14959A	1	5'-4" STEEL POST	1625 STEEL POST
32300A	1	WY-BET NOSE ASSEMBLY	WY-BET NOSE ASSEMBLY
32301A	1	HSS 6" x 6" x 10" INTERMEDIATE SPACER	HSS 152 x 152 x 250 INTERMEDIATE SPACER
32305A	1	BREAKAWAY TENSILE CONNECTOR	BREAKAWAY TENSILE CONNECTOR
32306A	1	HSS 6" x 6" x 3/16" TELESCOPING SECTION	HSS 152 x 152 x 4.8 TELESCOPING SECTION
32307A	1	OUTER TUBE	OUTER TUBE
32309B	1	6" O.D. x 1/4" x 12'-7 7/8" COMPOSITE TUBE	152.4 O.D. x 6.4 x 3860 COMPOSITE TUBE
32310B	1	6" O.D. x 1/8" x 5'-11 7/8" COMPOSITE TUBE	152.4 O.D. x 3.2 x 1830 COMPOSITE TUBE
32312G	3	REFLECTOR CHANNEL	REFLECTOR CHANNEL
32515A	6	5'-4" STEEL POST	1625 STEEL POST

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

DETAILED DRAWING

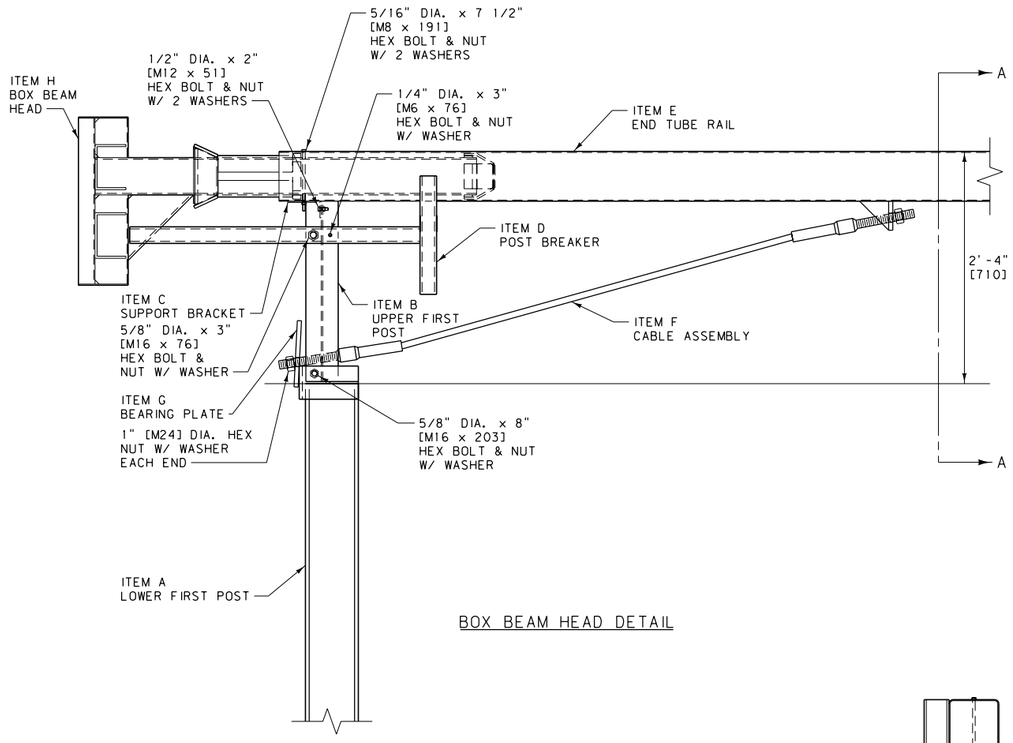
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-56A

WY-BET BOX BEAM TERMINAL SECTION DETAILS

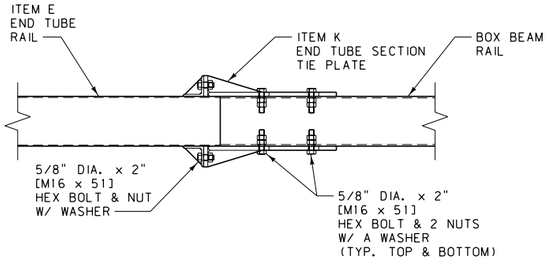
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

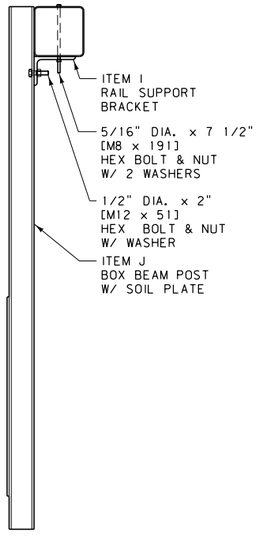


BOX BEAM HEAD DETAIL

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 GAUGE 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



FIRST RAIL TIE DETAIL



SECTION "A-A"

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

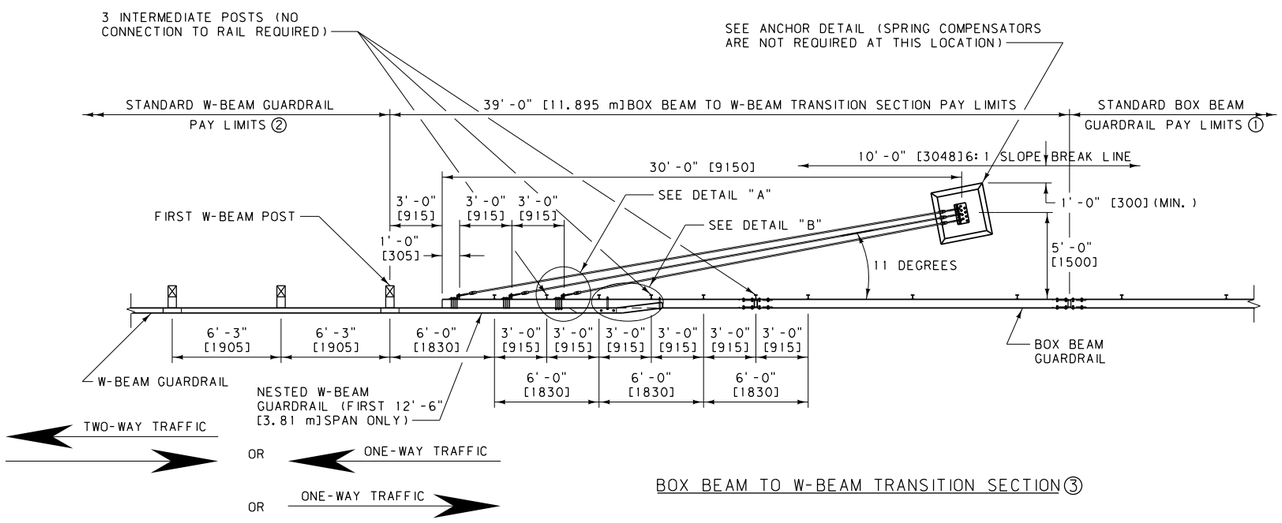
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-56B

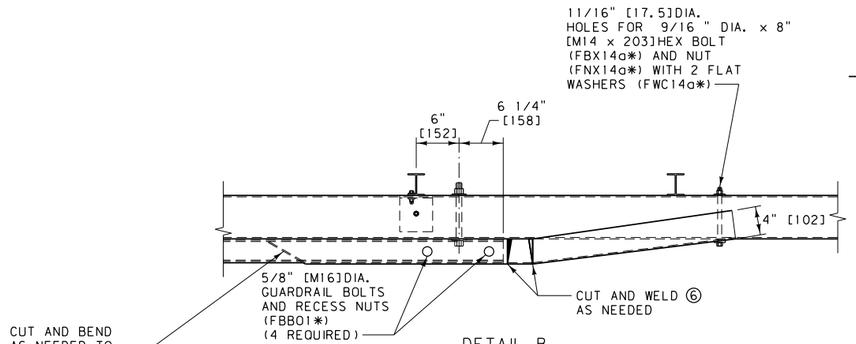
BEAT BOX BEAM TERMINAL SECTION DETAILS

EFFECTIVE: SEPTEMBER 2014

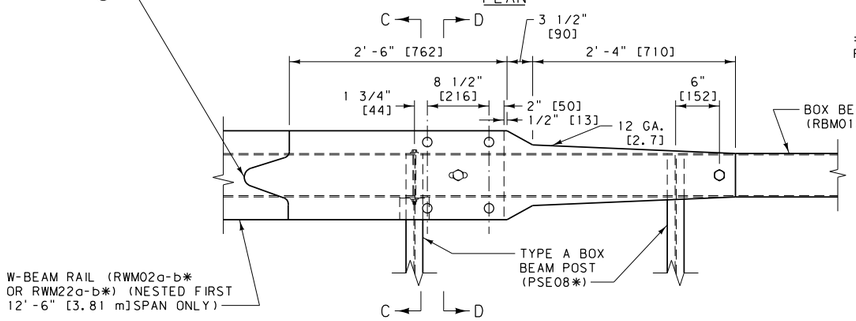
MDT MONTANA DEPARTMENT OF TRANSPORTATION



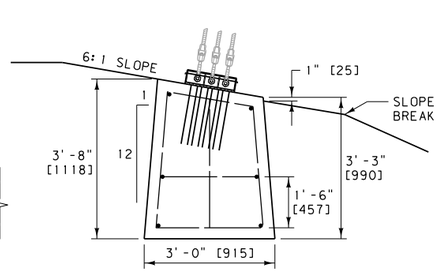
BOX BEAM TO W-BEAM TRANSITION SECTION ③



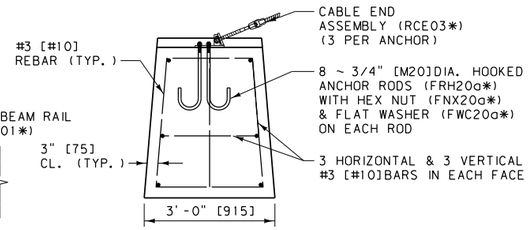
DETAIL B
PLAN



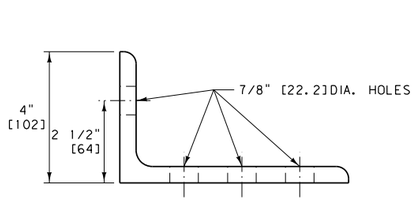
DETAIL B
ELEVATION

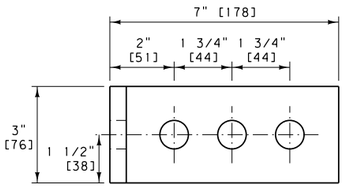


SECTION A-A

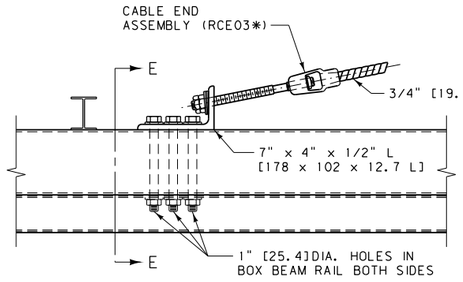


SECTION B-B

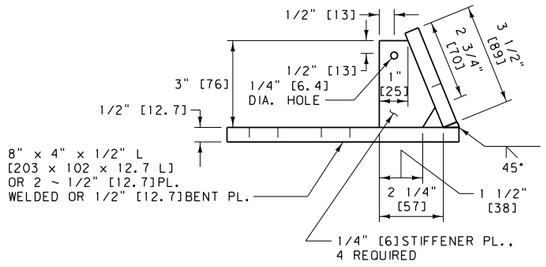




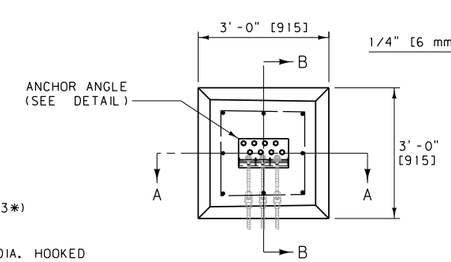
7" x 4" x 1/2" L [178 x 102 x 12.7]
DETAIL



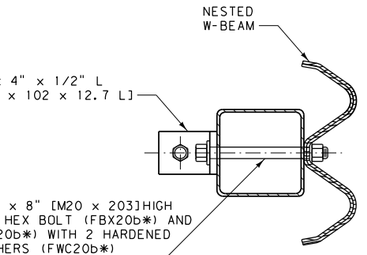
DETAIL A
PLAN



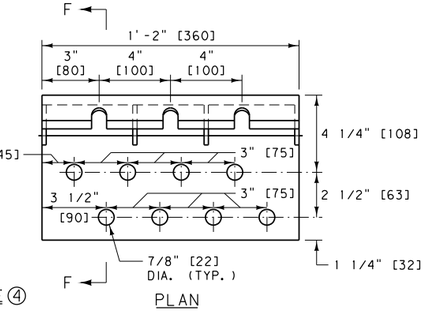
SECTION F-F



ANCHOR DETAIL ⑤
PLAN

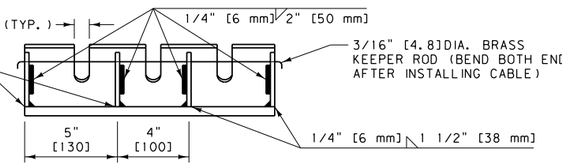


SECTION E-E

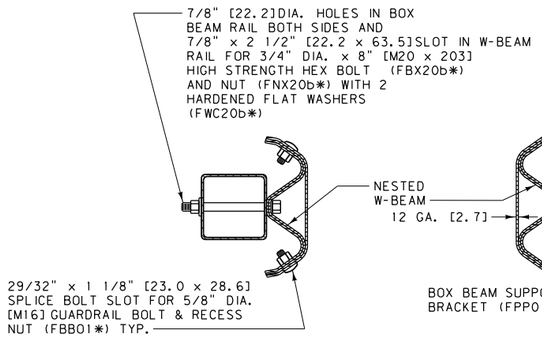


PLAN

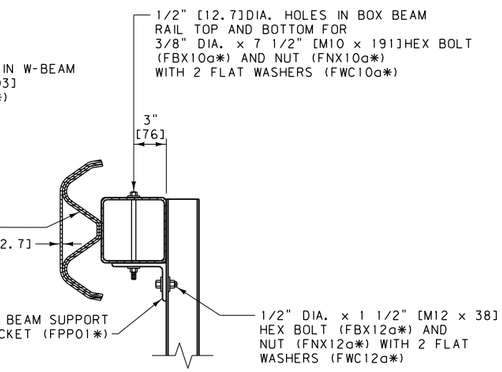
ANCHOR ANGLE ④
DETAIL



ELEVATION



SECTION D-D



SECTION C-C

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

NOTES:

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

② SEE DTL. DWG. NO. 606-05A AND 606-05B FOR STANDARD W-BEAM GUARDRAIL AND ASSOCIATED DETAILS.

③ MANUFACTURE ANCHOR ANGLES USING AASHTO M 270 [270M]GRADE 36 [250]STEEL MEETING SECTION 711. WELD PER SECTION 711.

④ GALVANIZE ANCHOR ANGLES PER SECTION 711. NO PUNCHING, DRILLING, WELDING OR CUTTING IS PERMITTED ON COMPONENTS AFTER GALVANIZING.

⑤ USE CLASS GENERAL CONCRETE TO CONSTRUCT ANCHOR.

⑥ PAINT ANY AREAS WHERE GALVANIZING IS BROKEN OR METAL IS BARE ON W-BEAM OR BOX BEAM RAIL WITH ONE COAT OF ZINC RICH PAINT AND TWO COATS OF ALUMINUM PAINT PER SECTION 710.

⑦ LAP ALL W-BEAM SPLICES IN THE DIRECTION OF ADJACENT TRAFFIC.

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

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606, 710, 711

DWG. NO. 606-58

BOX BEAM TO W-BEAM TRANSITION SECTION

--REVISED--
JULY 2016

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

SCHEDULE OF GUARDRAIL HARDWARE

DESIGNATION ①	DESCRIPTION	METRIC DESCRIPTION	DTL. DWG. NO. (606-###)	GUARDRAIL TYPE ②	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	606-58
FBB01-05	5/8" DIA. GUARDRAIL BOLT AND RECESS NUT	M16 GUARDRAIL BOLT AND RECESS NUT	82	W	X		X	X		X							X						X
FBB01-05	5/8" DIA. GUARDRAIL BOLT	M16 GUARDRAIL BOLT	82	W		X			X														
FBH01	5/16" DIA. HOOK BOLT	M8 HOOK BOLT	92	C											X								
FBH02	5/16" DIA. ALTERNATE HOOK BOLT	M8 ALTERNATE HOOK BOLT	92	C											X								
FBX10a	3/8" DIA. HEX BOLT	M10 HEX BOLT	82	B														X	X	X	X		X
FBX12a	1/2" DIA. HEX BOLT	M12 HEX BOLT	82	B, C												X		X	X	X	X		X
FBX14a	9/16" DIA. HEX BOLT	M14 HEX BOLT	82	B																			X
FBX16a	5/8" DIA. HEX BOLT	M16 HEX BOLT	82	W						X							X						
FBX20a	3/4" DIA. HEX BOLT	M20 HEX BOLT	82	W													X						
FBX20b	3/4" DIA. HIGH STRENGTH HEX BOLT	M20 HIGH STRENGTH HEX BOLT	82	B														X		X	X	X	X
FBX22b	7/8" DIA. HIGH STRENGTH HEX BOLT	M22 HIGH STRENGTH HEX BOLT	82	W							X	X											
FBX24b	1" DIA. HIGH STRENGTH HEX BOLT	M24 HIGH STRENGTH HEX BOLT	82	B																X			
FCA01	CABLE ASSEMBLY	CABLE ASSEMBLY	84	W						X							X						
FMM01	CABLE WEDGE	CABLE WEDGE	94	C											X								
FMM02	POST SLEEVE	POST SLEEVE	84	W						X							X						
FNS20	3/4" DIA. SQUARE NUT	M20 SQUARE NUT	82	C												X							
FNX08a	5/16" DIA. HEX NUT	M8 HEX NUT	82	C											X								
FNX10a	3/8" DIA. HEX NUT	M10 HEX NUT	82	B														X	X	X	X		X
FNX12a	1/2" DIA. HEX NUT	M12 HEX NUT	82	B, C												X		X	X	X	X		X
FNX14a	9/16" DIA. HEX NUT	M14 HEX NUT	82	B																			X
FNX16a	5/8" DIA. HEX NUT	M16 HEX NUT	82	W		X			X	X							X						
FNX20a	3/4" DIA. HEX NUT	M20 HEX NUT	82	C, W												X	X						X
FNX20b	3/4" DIA. HIGH STRENGTH HEX NUT	M20 HIGH STRENGTH HEX NUT	82	B																X	X	X	X
FNX22b	7/8" DIA. HIGH STRENGTH HEX NUT	M22 HIGH STRENGTH HEX NUT	82	W							X	X											
FNX24a	1" DIA. HEX NUT	M24 HEX NUT	82	W						X							X						
FNX24b	1" DIA. HIGH STRENGTH HEX NUT	M24 HIGH STRENGTH HEX NUT	82	B																X			
FPA01	GUARDRAIL ANCHOR BRACKET & END PLATE	GUARDRAIL ANCHOR BRACKET & END PLATE	84	W						X							X						
FPA02	CABLE ANCHOR BRACKET	CABLE ANCHOR BRACKET	95	C												X							
FPB01	BEARING PLATE	BEARING PLATE	18 & 46	W						X							X						
FPP01	BOX BEAM SUPPORT BRACKET	BOX BEAM SUPPORT BRACKET	97	B														X	X	X	X		X
FRH20a	3/4" DIA. HOOKED ANCHOR ROD	M20 HOOKED ANCHOR ROD	82	C												X							X
FWC10a	3/8" DIA. FLAT WASHER	M10 FLAT WASHER	82	B														X	X	X	X		X
FWC12a	1/2" DIA. FLAT WASHER	M12 FLAT WASHER	82	B, C												X		X	X	X	X		X
FWC14a	9/16" DIA. FLAT WASHER	M14 FLAT WASHER	82	B																			X
FWC16a	5/8" DIA. FLAT WASHER	M16 FLAT WASHER	82	W	X	X	X	X	X	X							X						
FWC20a	3/4" DIA. FLAT WASHER	M20 FLAT WASHER	82	C, W												X	X						X
FWC20b	3/4" DIA. HARDENED FLAT WASHER	M20 HARDENED FLAT WASHER	82	B														X		X	X	X	X
FWC24a	1" DIA. FLAT WASHER	M24 FLAT WASHER	82	W						X							X						
FWR03	RECTANGULAR PLATE WASHER	RECTANGULAR PLATE WASHER	84	W						X													
PDB01	WOOD BLOCKOUT	WOOD BLOCKOUT	05A, 05B, 11A, &11B	W	X	X	X	X	X														
PDE02	WOOD GUARDRAIL POST	WOOD GUARDRAIL POST	05A & 11A	W	X			X															
PDE09	CRT POST	CRT POST	46	W			X										X						
PDF01	WOOD BREAKAWAY POST	WOOD BREAKAWAY POST	46	W													X						
PDF03	END POST	END POST	18	W						X													
PLS01	SOIL PLATE	SOIL PLATE	92 & 97	B, C											X			X	X	X			
PLS03	SOIL PLATE	SOIL PLATE	46	W													X						
PSE01	CABLE GUARDRAIL LINE POST	CABLE GUARDRAIL LINE POST	92	C											X								
PSE05	TYPE D BOX BEAM POST	TYPE D BOX BEAM POST	97	B															X				
PSE06	CABLE GUARDRAIL ANCHOR POST	CABLE GUARDRAIL ANCHOR POST	95	C												X							
PSE08	TYPE A BOX BEAM POST	TYPE A BOX BEAM POST	97	B														X		X			X
PTE05	STEEL TUBE	STEEL TUBE	46	W													X						
PWE01	STEEL GUARDRAIL POST	STEEL GUARDRAIL POST	05B	W		X			X														
RBM01	BOX BEAM RAIL	BOX BEAM RAIL	98	B														X		X		X	X
RBM05	BOX BEAM TERMINAL RAIL	BOX BEAM TERMINAL RAIL	98	B															X				
RBS01	BOX BEAM SPLICE PLATE	BOX BEAM SPLICE PLATE	98	B														X					
RCE01	COMPENSATING CABLE END ASSEMBLY	COMPENSATING CABLE END ASSEMBLY	94	C											X								
RCE03	CABLE END ASSEMBLY	CABLE END ASSEMBLY	94	C												X							X
RCM01	3/4" DIA. CABLE	19.1 DIA. CABLE	94	C											X	X							
RWE01a-b	W-BEAM END SECTION (FLARED)	W-BEAM END SECTION (FLARED)	88	W						X													
RWE02a-b	W-BEAM TERMINAL CONNECTOR	W-BEAM TERMINAL CONNECTOR	88	W							X	X	X	X			X						
RWE06a-b	W-BEAM END SECTION (BUFFER)	W-BEAM END SECTION (BUFFER)	88	W													X						
RWM02a-b	W-BEAM (12'-6" LENGTH)	W-BEAM (3.81 m LENGTH)	88	W	X	X	X	X	X	X													X
RWM22a-b	W-BEAM (25'-0" LENGTH)	W-BEAM (7.62 m LENGTH)	88	W	X	X	X	X	X	X													X
SEC01	CABLE GUARDRAIL TERMINAL ANCHOR ASSEMBLY	CABLE GUARDRAIL TERMINAL ANCHOR ASSEMBLY	41	C											X								
N/A	TURNBUCKLE CABLE END ASSEMBLY	TURNBUCKLE CABLE END ASSEMBLY	94	C											X								
N/A	KEEPER PLATE	KEEPER PLATE	95	C												X							
N/A	TYPE B BOX BEAM POST	TYPE B BOX BEAM POST	97	B																X			
N/A	SUPPORT BRACKET WITH TS6 x 6 x 3/16 BLOCKOUT	SUPPORT BRACKET WITH TS152 x 152 x 4.8 BLOCKOUT	97	B																	X		
N/A	TRANSITION POST	TRANSITION POST	97	B																	X		
N/A	TS6 x 6 x 3/16 BR. APP. SECT. UPPER RAIL NO. 1	TS152 x 152 x 4.8 BR. APP. SECT. UPPER RAIL NO. 1	98	B																X			
N/A	TS6 x 2 x 1/4 BR. APP. SECT. LOWER RAIL NO. 1	TS152 x 51 x 6.4 BR. APP. SECT. LOWER RAIL NO. 1	98	B																X			
N/A	TS6 x 2 x 1/4 BR. APP. SECT. LOWER RAIL NO. 2	TS152 x 51 x 6.4 BR. APP. SECT. LOWER RAIL NO. 2	98	B																X			
N/A	TS6 x 2 TO TS6 x 6 CONNECTION SLEEVE	TS152 x 51 TO TS152 x 152 CONNECTION SLEEVE	98	B																X			
N/A	TS6 x 2 CONNECTION SLEEVE	TS152 x 51 CONNECTION SLEEVE	98	B																X			
N/A	TS6 x 6 x 3/16 TRANSITION RAIL	TS152 x 152 x 4.8 TRANSITION RAIL	98	B																	X		
N/A	1/4" SHIM PLATE	6.4 SHIM PLATE	99	B																	X		
N/A	ANCHOR RAIL SECTION	ANCHOR RAIL SECTION	99	B																	X		
N/A	RUB RAIL ANCHOR BRACKET (JERSEY RAIL)	RUB RAIL ANCHOR BRACKET (JERSEY RAIL)	99	B																	X		
N/A	RUB RAIL ANCHOR BRACKET (VERTICAL BRIDGE RAIL)	RUB RAIL ANCHOR BRACKET (VERTICAL BRIDGE RAIL)	99	B																	X		
N/A	TS6 x 2 x 3/16 RUB RAIL	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 METRIC DESCRIPTION DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

MONTANA DEPARTMENT OF TRANSPORTATION

EFFECTIVE: SEPTEMBER 2014

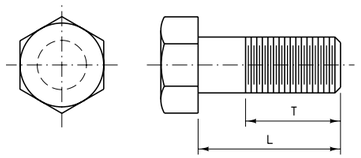
SCHEDULE OF GUARDRAIL HARDWARE

DETAILED DRAWING

REFERENCE STANDARD SPEC. SECTION 606

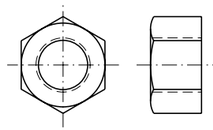
DWG. NO. 606-80

GUARDRAIL HARDWARE



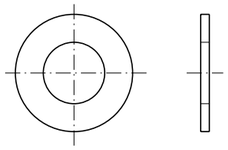
HEX BOLTS

BOLT SIZE	DESIGNATION *	L	T (MIN.)
REGULAR HEX BOLTS			
3/8" DIA.	FBX10a	3 1/2"	1 1/2"
3/8" DIA.	FBX10a	7 1/2"	1 1/2"
1/2" DIA.	FBX12a	1 1/2"	FULL
1/2" DIA.	FBX12a	2 1/2"	1 3/4"
9/16" DIA.	FBX14a	8"	2"
5/8" DIA.	FBX16a	1 1/2"	FULL
3/4" DIA.	FBX20a	8"	2"
3/4" DIA.	FBX20a	9 1/2"	2"
HIGH STRENGTH HEX BOLTS			
3/4" DIA.	FBX20b	2"	1 1/2"
3/4" DIA.	FBX20b	4"	2"
3/4" DIA.	FBX20b	8"	2"
7/8" DIA.	FBX22b	1'-0"	AS REQUIRED
1" DIA.	FBX24b	AS REQUIRED	AS REQUIRED



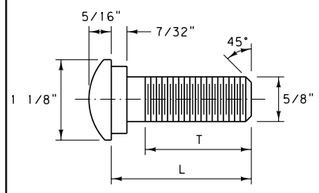
HEX NUT

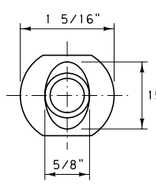
NUT SIZE	DESIGNATION *
REGULAR HEX NUTS	
5/16" DIA.	FNX08a
3/8" DIA.	FNX10a
1/2" DIA.	FNX12a
9/16" DIA.	FNX14a
5/8" DIA.	FNX16a
3/4" DIA.	FNX20a
1" DIA.	FNX24a
HIGH STRENGTH HEX NUTS	
3/4" DIA.	FNX20b
7/8" DIA.	FNX22b
1" DIA.	FNX24b

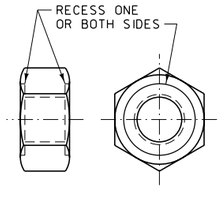


FLAT WASHERS

WASHER SIZE	DESIGNATION *
REGULAR FLAT WASHERS	
3/8" DIA.	FWC10a
1/2" DIA.	FWC12a
9/16" DIA.	FWC14a
5/8" DIA.	FWC16a
3/4" DIA.	FWC20a
1" DIA.	FWC24a
HARDENED FLAT WASHERS	
3/4" DIA.	FWC20b



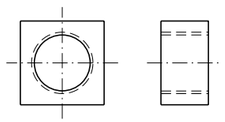




DESIGNATION *	L	T (MIN.)
FBB01	1 1/4"	1 1/8"
FBB02	2"	1 3/4"
FBB03	10"	4"
FBB04	1'-6"	4"
FBB05	2'-1"	4"

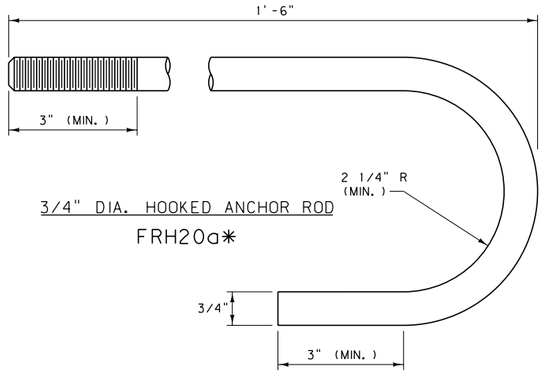
5/8" DIA. GUARDRAIL BOLT & RECESSED NUT

FBB01-05*



3/4" DIA. SQUARE NUT

FNS20*



3/4" DIA. HOOKED ANCHOR ROD

FRH20a*

NOTES:

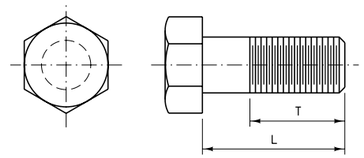
① FURNISH BOLTS AND ANCHOR RODS MEETING THE REQUIREMENTS OF SUBSECTION 705.01.1.

② FURNISH HIGH STRENGTH BOLTS MEETING THE REQUIREMENTS OF SUBSECTION 711.06.

③ GALVANIZE BOLTS, NUTS AND WASHERS IN ACCORDANCE WITH SUBSECTION 705.01.1.

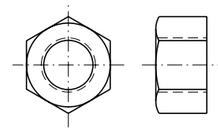
* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

METRIC GUARDRAIL HARDWARE



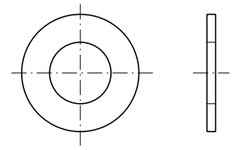
HEX BOLTS

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



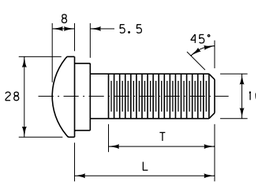
HEX NUT

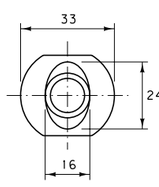
NUT SIZE	DESIGNATION *
REGULAR HEX NUTS	
M8	FNX08a
M10	FNX10a
M12	FNX12a
M14	FNX14a
M16	FNX16a
M20	FNX20a
M24	FNX24a
HIGH STRENGTH HEX NUTS	
M20	FNX20b
M22	FNX22b
M24	FNX24b

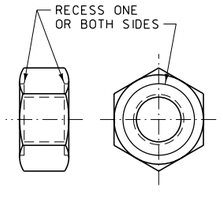


FLAT WASHERS

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



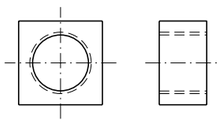




DESIGNATION *	L	T (MIN.)
FBB01	32	29
FBB02	51	44
FBB03	254	102
FBB04	457	102
FBB05	635	102

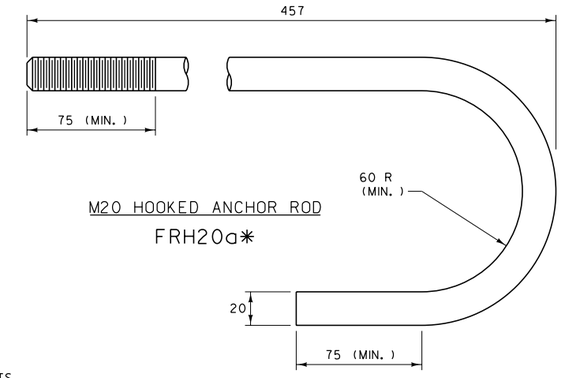
M16 GUARDRAIL BOLT & RECESSED NUT

FBB01-05*



M20 SQUARE NUT

FNS20*



M20 HOOKED ANCHOR ROD

FRH20a*

NOTES:

① FURNISH BOLTS AND ANCHOR RODS MEETING THE REQUIREMENTS OF SUBSECTION 705.01.1.

② FURNISH HIGH STRENGTH BOLTS MEETING THE REQUIREMENTS OF SUBSECTION 711.06.

③ GALVANIZE BOLTS, NUTS AND WASHERS IN ACCORDANCE WITH SUBSECTION 705.01.1.

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

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

DETAILED DRAWING

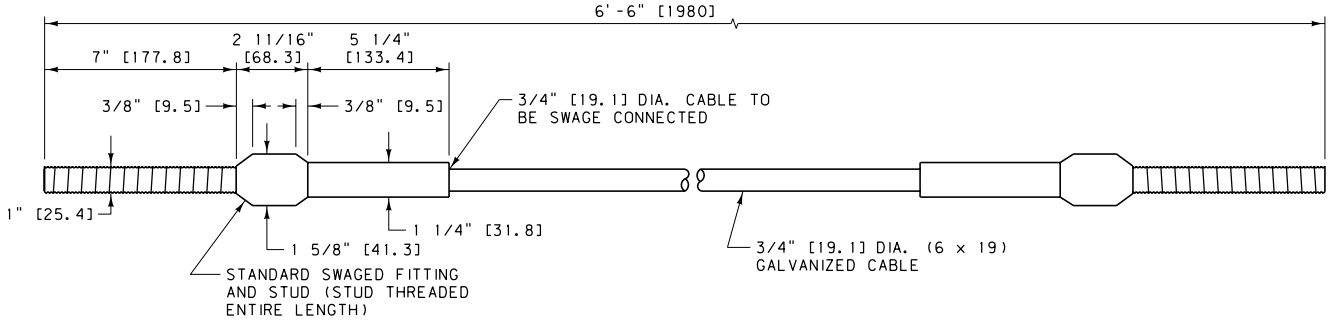
REFERENCE STANDARD SPEC. SECTION 606, 705, 711

DWG. NO. 606-82

GUARDRAIL HARDWARE

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



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 A576 [A576 M], GRADE 1035, AND ANNEAL SUITABLE FOR COLD SWAGING. GALVANIZE THE SWAGED FITTING IN ACCORDANCE WITH SUBSECTION 711.08 BEFORE SWAGING. DRILL A LOCK PIN HOLE TO ACCOMMODATE A 1/4" [6.4 mm], PLATED SPRING STEEL PIN THROUGH THE HEAD OF THE SWAGED FITTING TO RETAIN THE STUD IN THE PROPER POSITION.

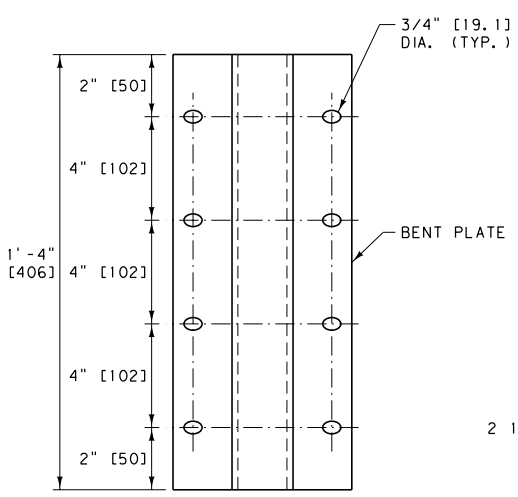
③ THE SWAGED FITTING, STUD AND NUT (FNX24a*) MUST DEVELOP THE BREAKING STRENGTH OF THE WIRE ROPE.

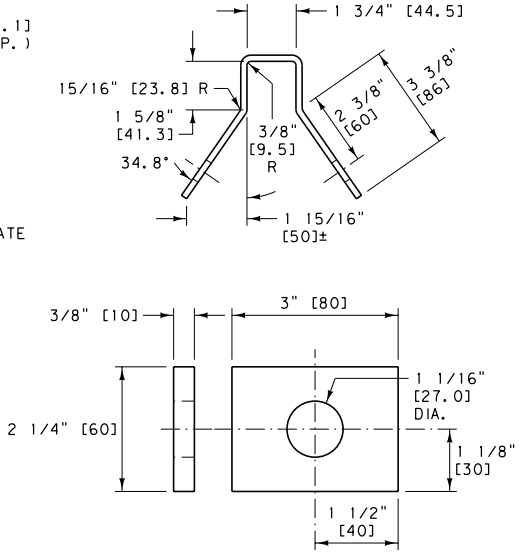
④ WIRE ROPE IS TO CONFORM TO THE REQUIREMENTS OF AASHTO M30 [M30M] AND BE 3/4" [19.1 mm] PREFORMED, 6 x 19, WIRE STRAND CORE OR INDEPENDENT WIRE ROPE CORE (IWRC), GALVANIZED, RIGHT REGULAR LAY, MANUFACTURED OF IMPROVED PLOW STEEL WITH A MINIMUM BREAKING STRENGTH OF 42,800 POUNDS [190.4 kN].

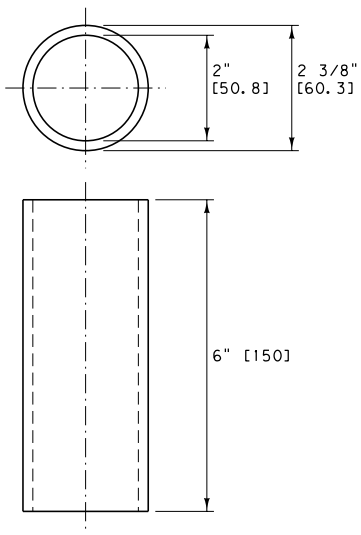
⑤ THE STUD IS TO CONFORM TO THE REQUIREMENTS OF ASTM F568 [F568M] CLASS 8.8 AND BE GALVANIZED IN ACCORDANCE WITH AASHTO M232 [M232M] (ASTM A153 [153M]). PRIOR TO GALVANIZING, MILL A 3/8" [9.5 mm] SLOT INTO THE STUD END FOR THE LOCKING PIN.

CABLE ASSEMBLY

FCA01*





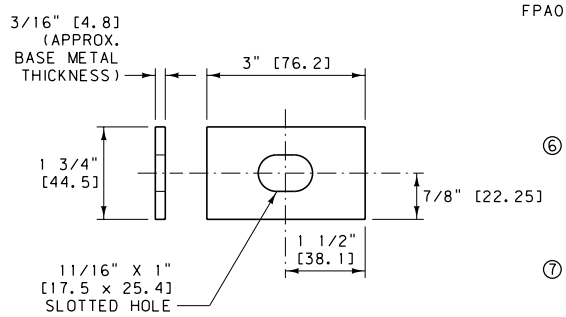


ANCHOR BRACKET & END PLATE

FPA01*

POST SLEEVE

FMM02*



RECTANGULAR PLATE WASHER

FWR03*

NOTES:

⑥ ANCHOR BRACKETS, END PLATES AND RECTANGULAR PLATE WASHERS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M270 [M270M] (ASTM A709 [A709M]) GRADE 36 [250] STEEL PLATE. POST SLEEVES ARE TO CONFORM TO THE REQUIREMENTS OF ASTM A53 [A53M] GRADE B.

⑦ GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH SUBSECTION 711.08. DO NOT PUNCH, DRILL, OR CUT AFTER GALVANIZING.

* 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

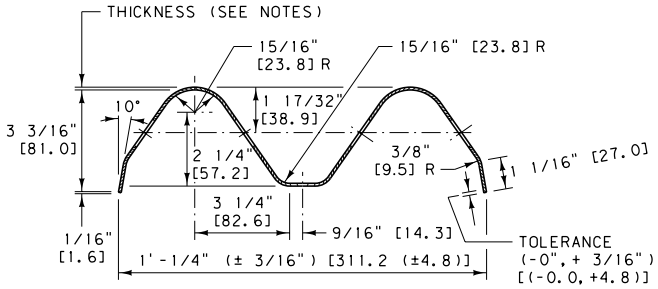
REFERENCE STANDARD SPEC. SECTION 606, 711

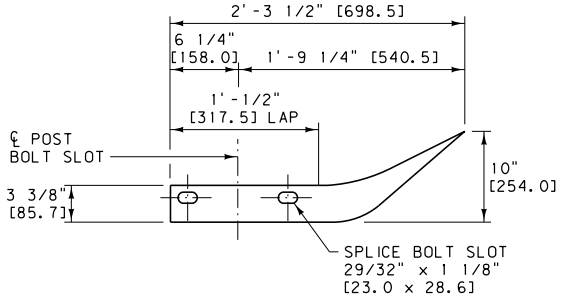
DWG. NO. 606-84

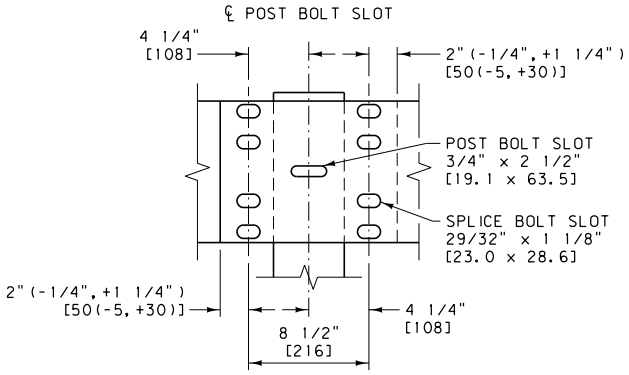
W-BEAM METAL GUARDRAIL HARDWARE

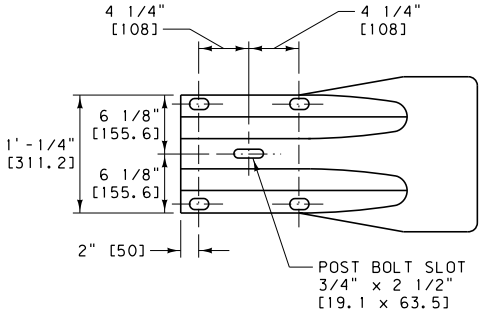
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION







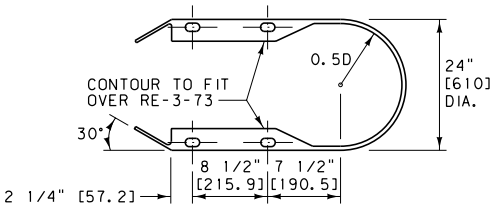


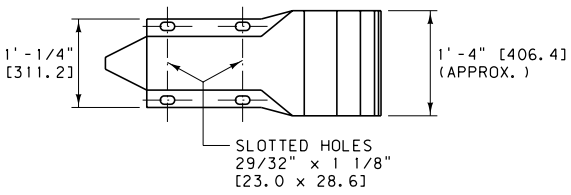
W-BEAM

RWM02a-b* (12'-6" [3.81 m] LENGTH) OR RWM22a-b* (25'-0" [7.62 m] LENGTH)

W-BEAM END SECTION (FLARED)

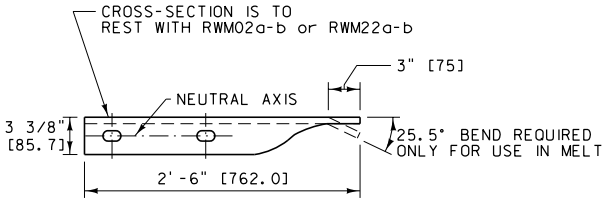
RWE01a-b*

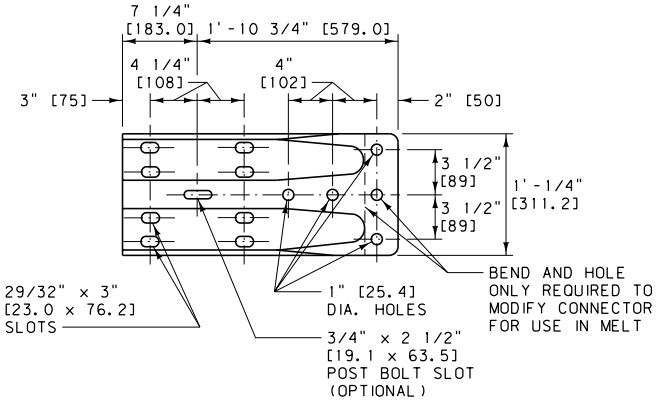




W-BEAM END SECTION (BUFFER)

RWE06a-b*





W-BEAM TERMINAL CONNECTOR

RWE02a-b*

NOTES:

*DESTINATION SUFFIX	METAL THICKNESS
a	12 GAUGE [2.7 mm]
b	10 GAUGE [3.5 mm]

*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

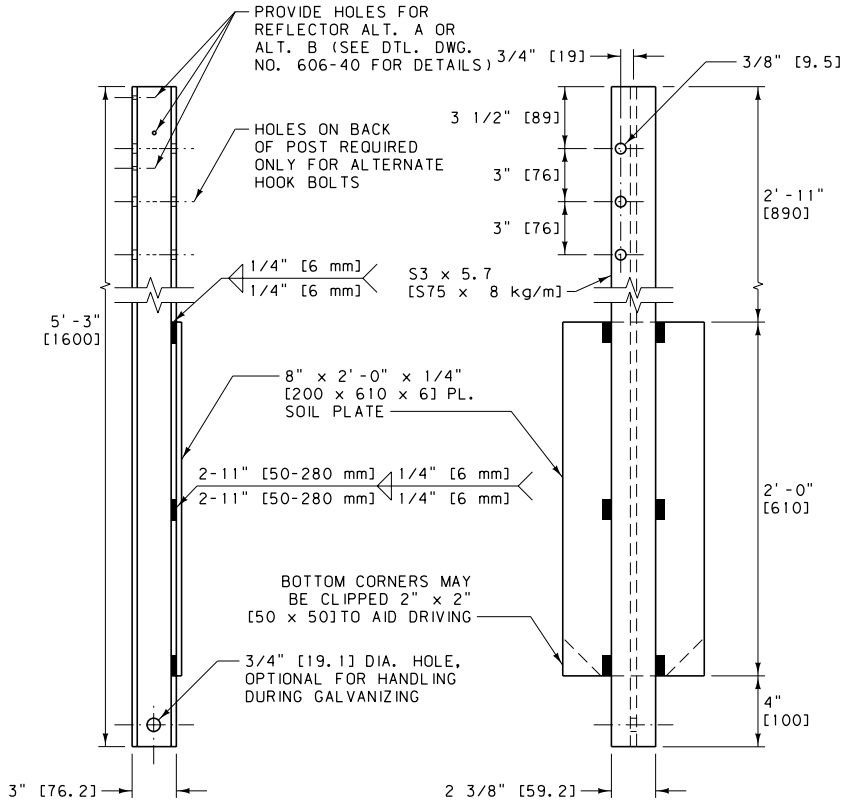
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-88

W-BEAM METAL GUARDRAIL HARDWARE

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



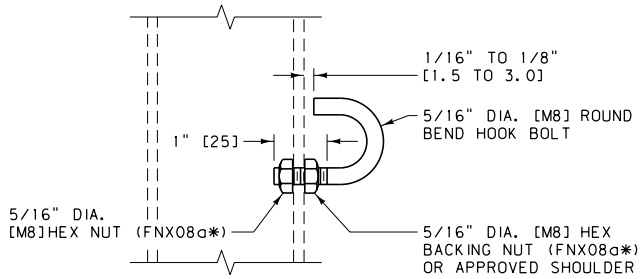
NOTES:

1. ALL HOLES ARE 3/8" [9.5] DIA. EXCEPT AS NOTED.
2. MANUFACTURE POSTS AND SOIL PLATES USING AASHTO M 270 [270M] (ASTM A 709 [A709M]) GRADE 36 [250] STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.
3. HOOK BOLTS ARE TO CONFORM TO THE REQUIREMENTS OF ASTM 568 [568M] CLASS 4.6. NUTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M 291 [291M] (ASTM A 563 [A563M]) CLASS 5.
4. GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH SUBSECTION 711.08. GALVANIZE HOOK BOLTS AND NUTS IN ACCORDANCE WITH AASHTO M 232 [232M] (ASTM A 153 [A153M]). DO NOT PUNCH, DRILL, OR CUT AFTER GALVANIZING.
5. NUTS ARE OF THE HEAVY HEX TYPES. INSTALL BOLTS TO DEVELOP AN ULTIMATE PULL OPEN STRENGTH FROM 500 LB. TO 1000 LB. [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.

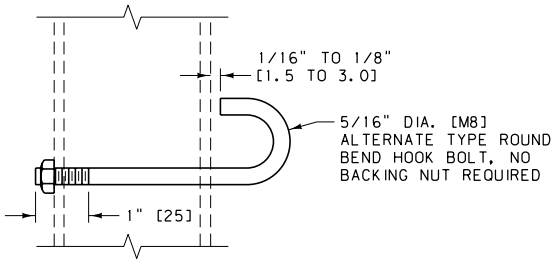
CABLE GUARDRAIL POST AND SOIL PLATE

PSE01* AND PLS01*



5/16" DIA. [M8] HOOK BOLT

FBH01*

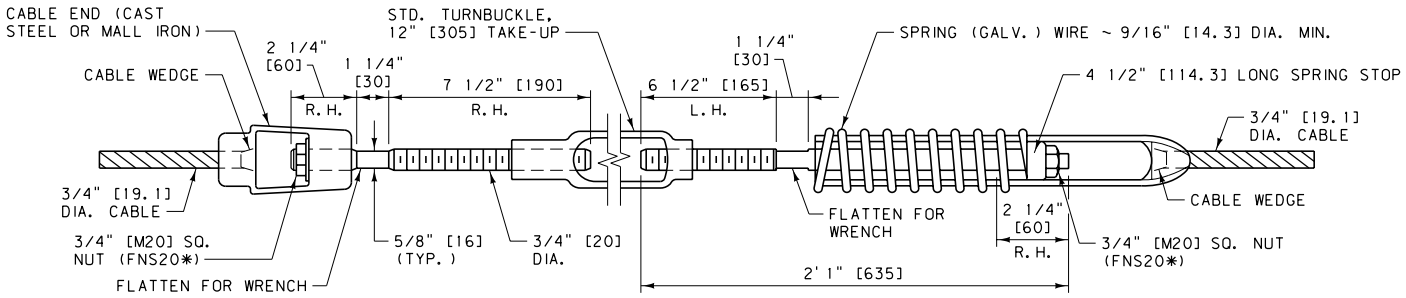


ALTERNATE 5/16" DIA. [M8] HOOK BOLT

FBH02*

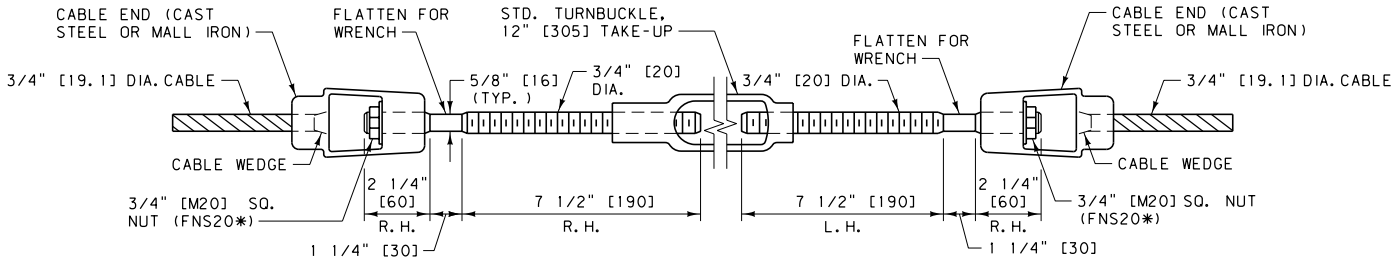
UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 606	DWG. NO. 606-92
CABLE GUARDRAIL HARDWARE	
EFFECTIVE: SEPTEMBER 2014	
MDT MONTANA DEPARTMENT OF TRANSPORTATION	

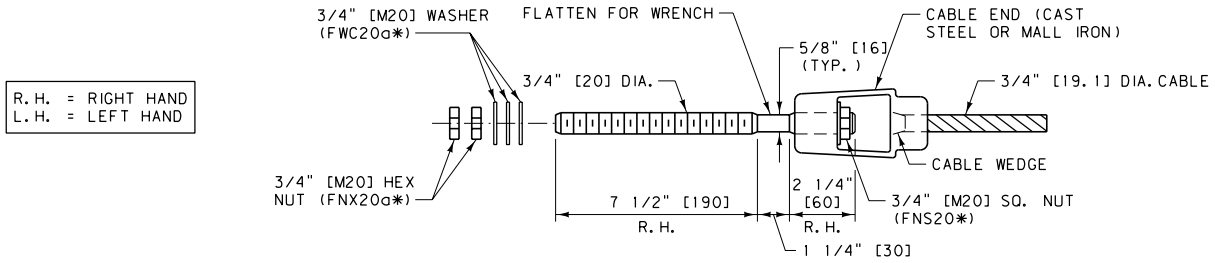


COMPENSATING CABLE END ASSEMBLY

RCE01*



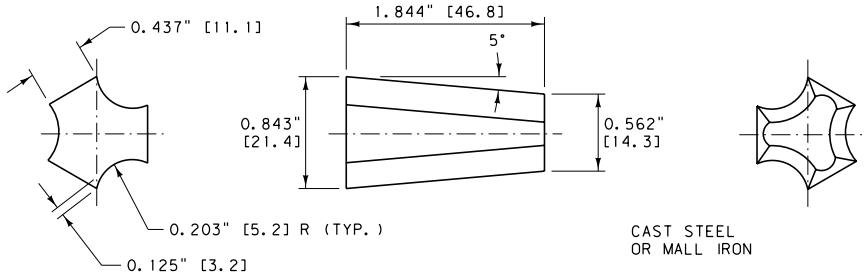
TURNBUCKLE CABLE END ASSEMBLY



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

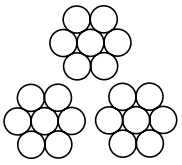
CABLE END ASSEMBLY

RCE03*



CABLE WEDGE

FMM01*



3/4" [19.1] DIA. - 3 x 7 WIRE ROPE

3/4" [19.1] DIA. CABLE

RCM01*

NOTES:

① WIRE ROPE AND CONNECTING HARDWARE ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M30 [M30M] TYPE 1 CLASS A, 3/4" [19.1] ROPE. CONNECTING HARDWARE MUST DEVELOP THE FULL STRENGTH OF A SINGLE CABLE (25,000 LB [111.2 kN]). CAST STEEL COMPONENTS ARE TO CONFORM TO THE REQUIREMENTS OF AASHTO M103 [M103M] (ASTM A27 [A27M]). MALLEABLE IRON CASTINGS ARE TO CONFORM TO THE REQUIREMENTS OF ASTM A47 [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 450 POUNDS PER INCH [78.8 N/mm], PLUS OR MINUS 50 POUNDS PER INCH [8.8 N/mm], AND PERMIT A TRAVEL OF 6 INCHES [150] PLUS OR MINUS 1 INCH [25].

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.

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

DETAILED DRAWING

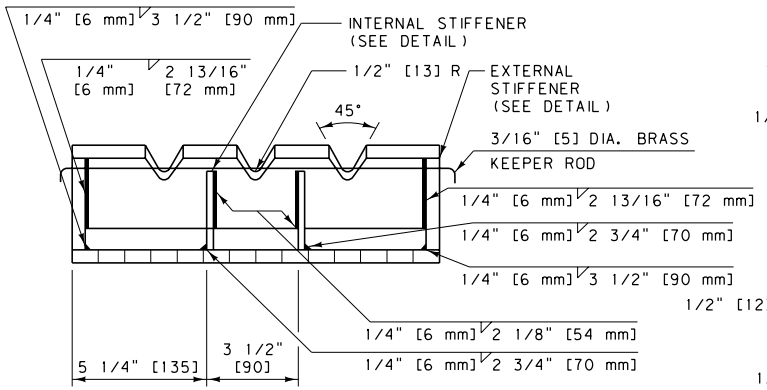
REFERENCE STANDARD SPEC. SECTION 606

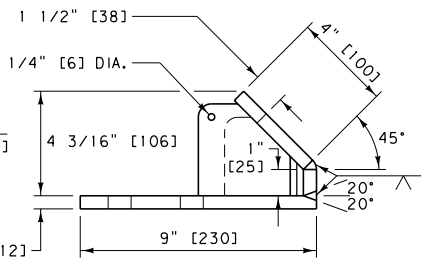
DWG. NO. 606-94

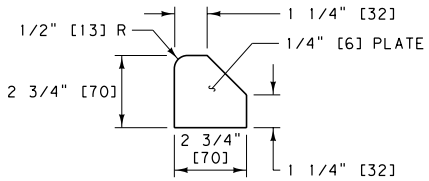
CABLE GUARDRAIL HARDWARE

EFFECTIVE: SEPTEMBER 2014

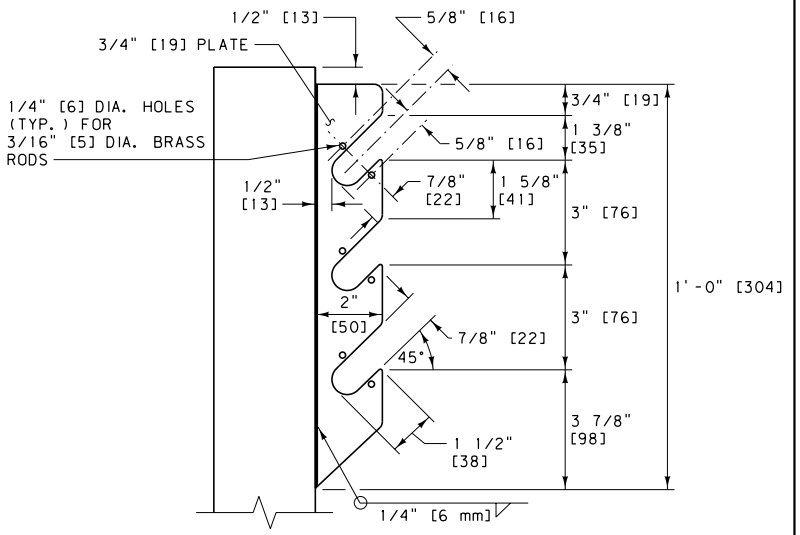
MDT MONTANA DEPARTMENT OF TRANSPORTATION



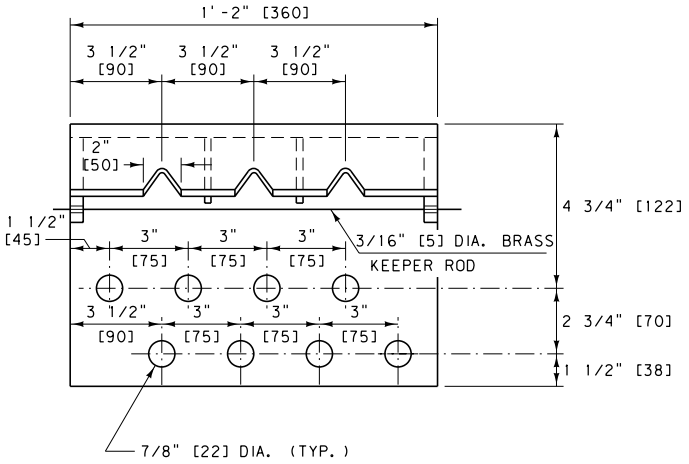




INTERNAL STIFFENER

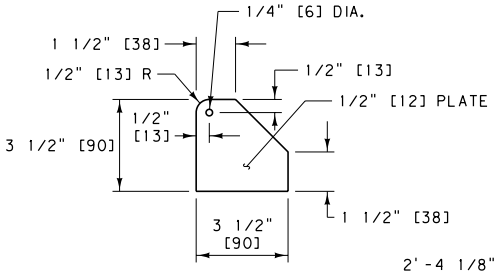


CABLE SUPPORT DETAIL

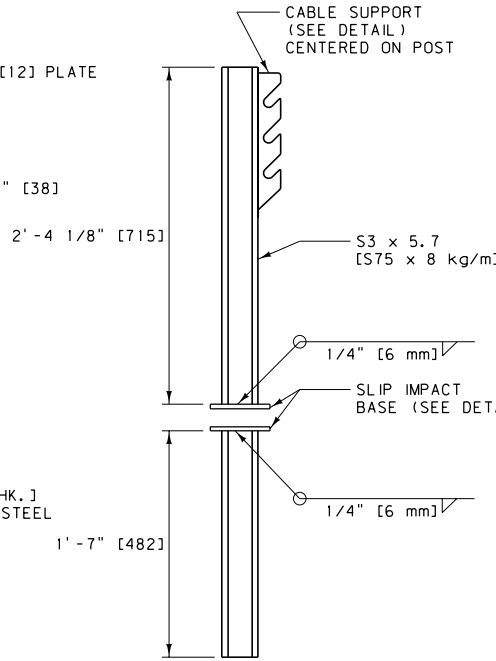


CABLE ANCHOR BRACKET

FPA02*



EXTERNAL STIFFENER



NOTES:

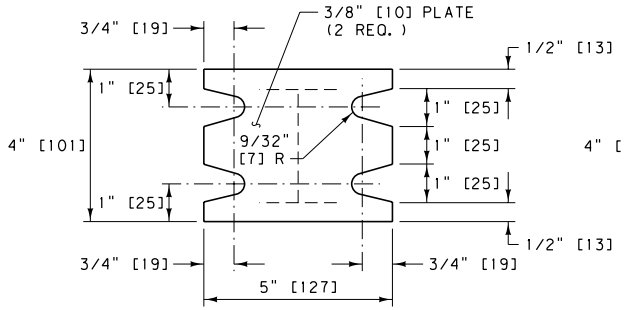
① MANUFACTURE ANCHOR POSTS AND BRACKETS USING AASHTO M 270 [270M] (ASTM A709 [A709M]) GRADE 36 [250] STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.

② GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH SUBSECTION 711.08. DO NOT PUNCH, DRILL, OR CUT AFTER GALVANIZING.

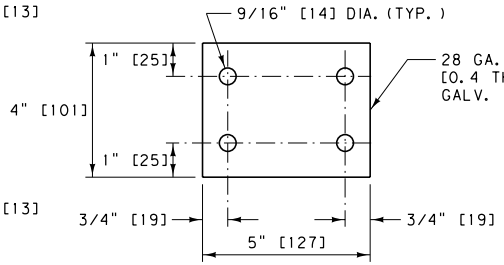
* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

CABLE GUARDRAIL ANCHOR POST

PSE06*



SLIP IMPACT BASE
(KEEPER PLATE NOT SHOWN)



KEEPER PLATE

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

DETAILED DRAWING

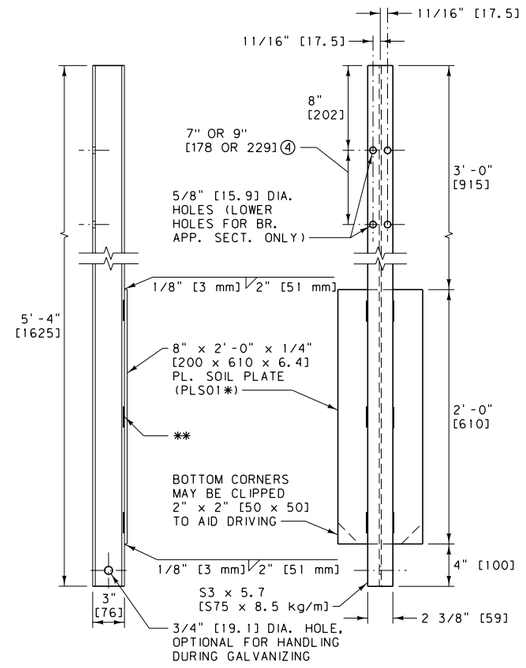
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-95

CABLE GUARDRAIL HARDWARE

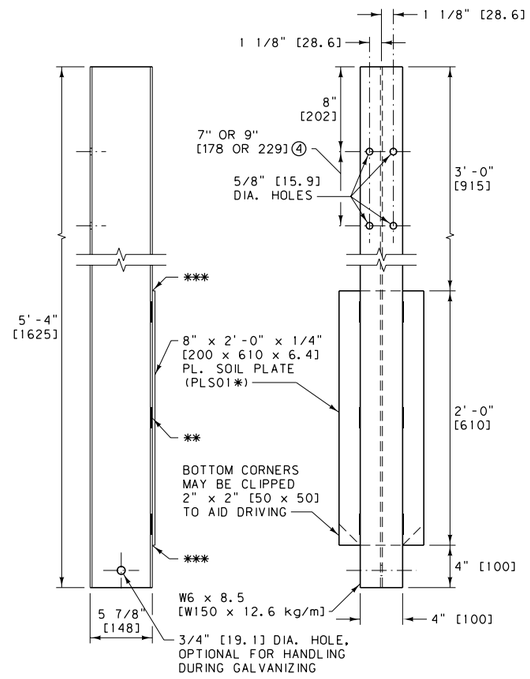
EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION



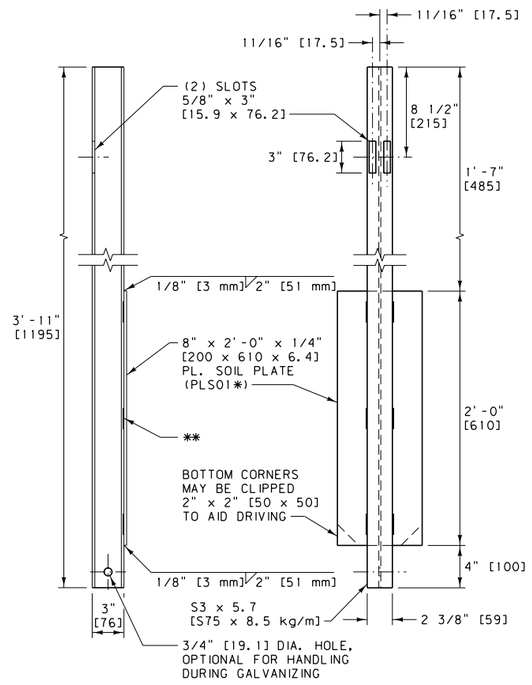
TYPE A BOX BEAM POST AND SOIL PLATE

PSE08* AND PLS01*



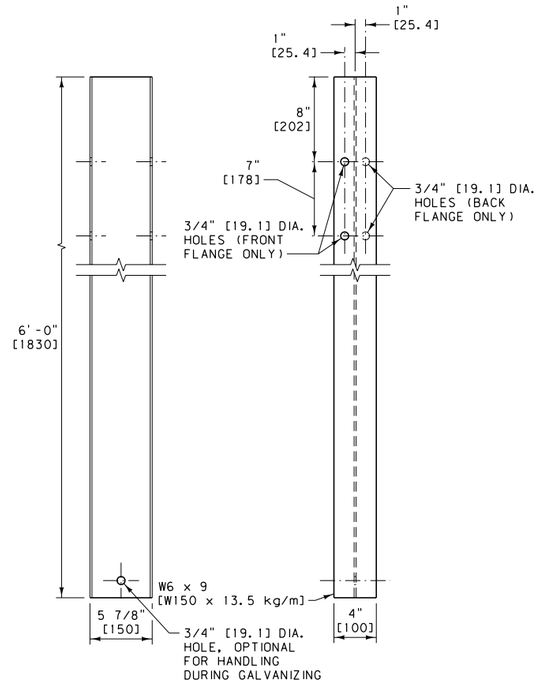
TYPE B BOX BEAM POST AND SOIL PLATE

PLS01*

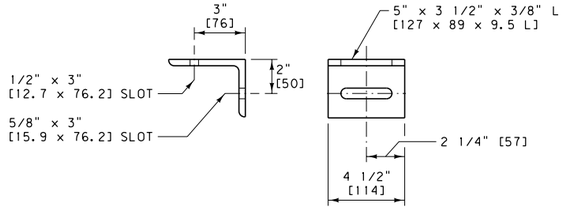


TYPE D BOX BEAM POST AND SOIL PLATE

PSE05* AND PLS01*

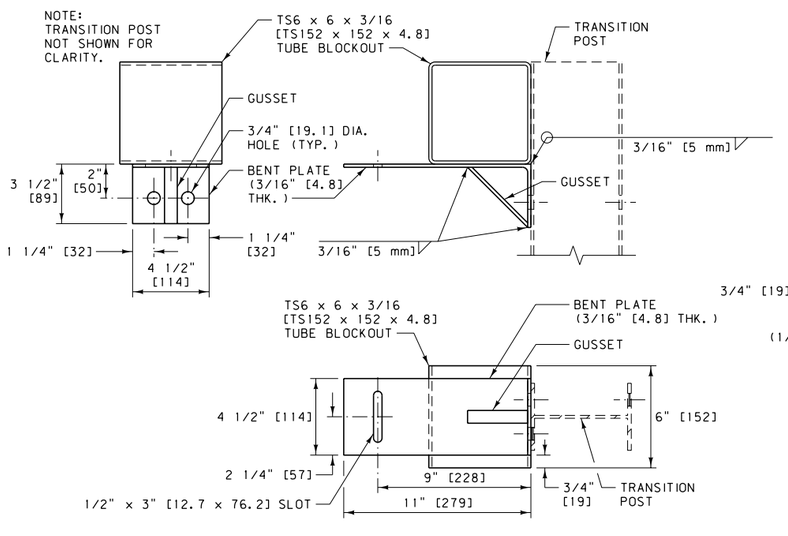


TRANSITION POST

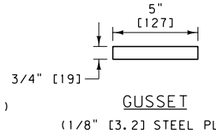


BOX BEAM SUPPORT BRACKET

FPP01*



SUPPORT BRACKET W/BLOCKOUT



GUSSET

(1/8" [3.2] STEEL PLATE)

NOTES:

① MANUFACTURE POSTS USING STEEL CONFORMING TO AASHTO M 183 [183M] (ASTM A 36 [36M]). MANUFACTURE SOIL PLATES, SUPPORT BRACKETS AND MISC. COMPONENTS USING AASHTO M 270 [270M] (ASTM A 709 [709M]) GRADE 36 [250] STEEL. ALL WELDING IS TO CONFORM TO THE APPLICABLE AWS CODE.

② 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.

③ GALVANIZE FABRICATED POSTS, BLOCKOUTS, BRACKETS AND MISC. COMPONENTS IN ACCORDANCE WITH SUBSECTION 711.08. DO NOT PUNCH, DRILL, OR CUT AFTER GALVANIZING.

④ 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.

** 1/8" [3 mm] 2-10" [51-254 mm]
1/8" [3 mm] 2-10" [51-254 mm]

*** 1/8" [3 mm] 3 1/2" [89 mm]

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

DETAILED DRAWING

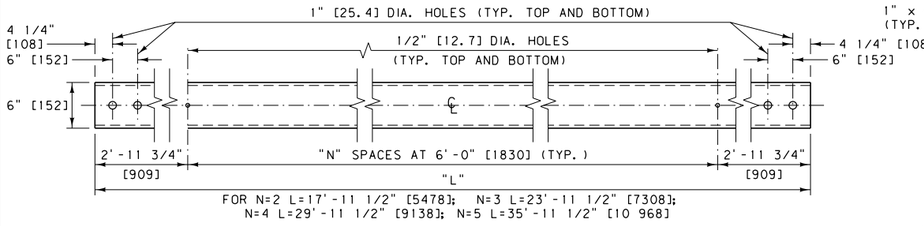
REFERENCE STANDARD SPEC. SECTION 606

DWG. NO. 606-97

BOX BEAM GUARDRAIL HARDWARE

EFFECTIVE: SEPTEMBER 2014

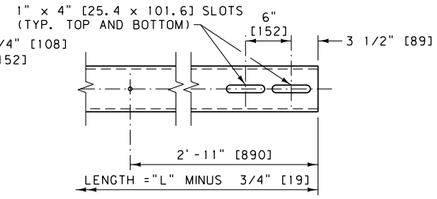
MDT MONTANA DEPARTMENT OF TRANSPORTATION



FOR N=2 L=17'-11 1/2" [5478]; N=3 L=23'-11 1/2" [7308];
N=4 L=29'-11 1/2" [9138]; N=5 L=35'-11 1/2" [10 968]

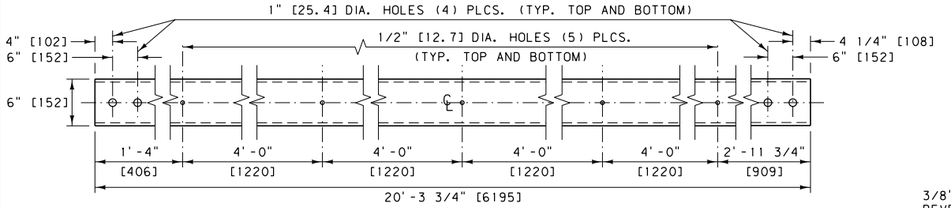
BOX BEAM RAIL (TS6 x 6 x 3/16 [TS152 x 152 x 4.8])

RBM01*

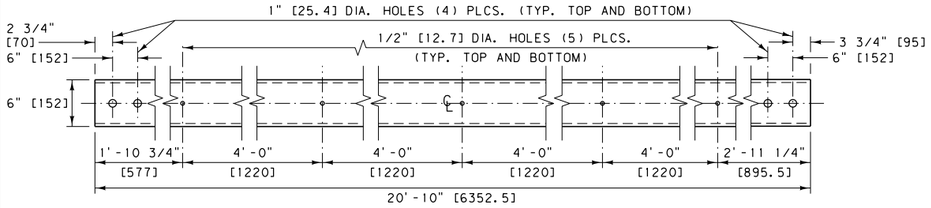


BOX BEAM EXPANSION SPLICE END

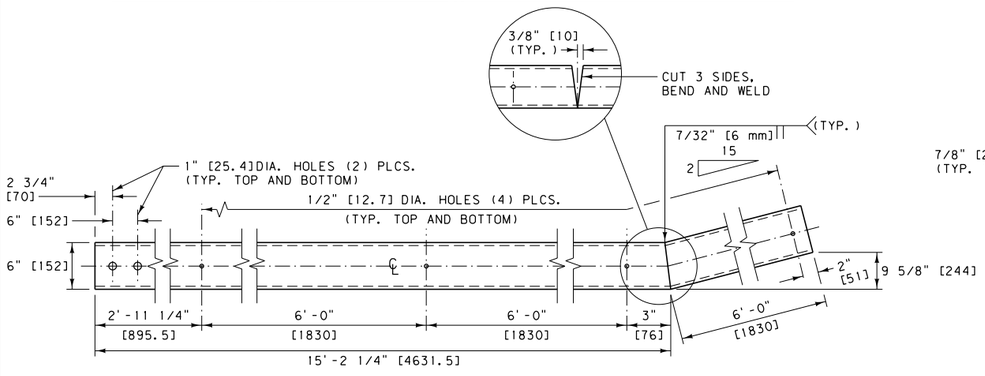
ONE END OF BOX BEAM RAIL ONLY. REQUIRED FOR BOTH RAILS AT THE EXPANSION SPLICE.



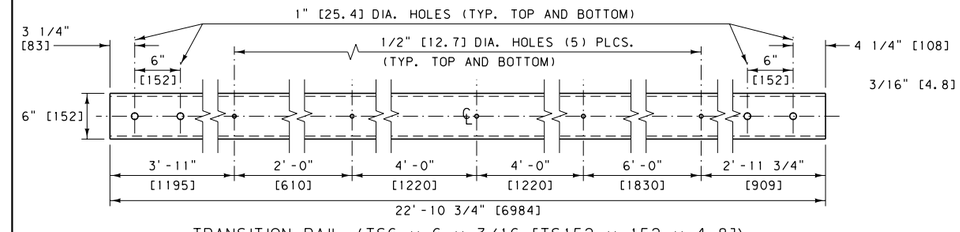
TS6 x 6 x 3/16 [TS152 x 152 x 4.8] BR. APP. SECT. UPPER RAIL NO. 1



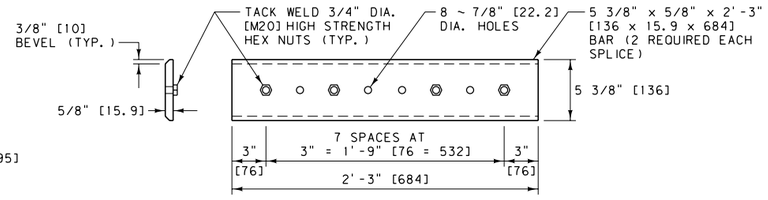
TS6 x 2 x 1/4 [TS152 x 51 x 6.4] BR. APP. SECT. LOWER RAIL NO. 1



TS6 x 2 x 1/4 [TS152 x 51 x 6.4] BR. APP. SECT. LOWER RAIL NO. 2

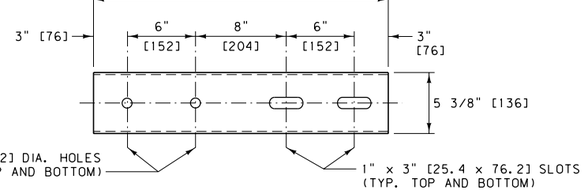


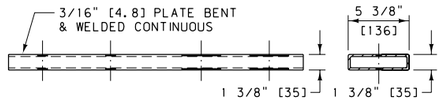
TRANSITION RAIL (TS6 x 6 x 3/16 [TS152 x 152 x 4.8])



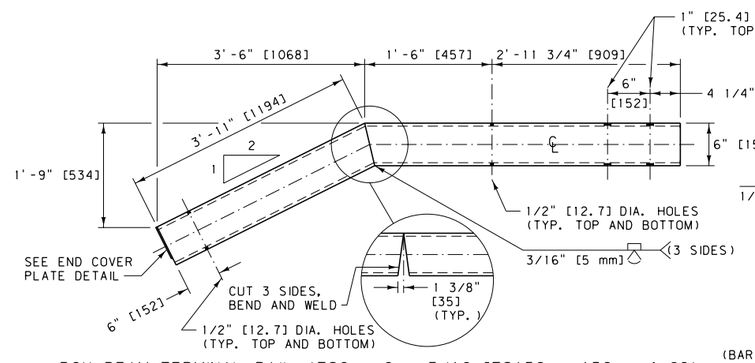
BOX BEAM SPLICE PLATE

RBS01*



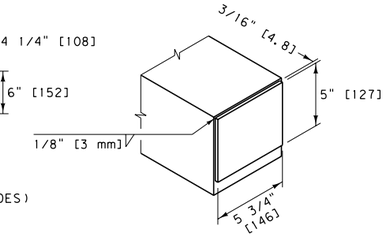


TS6 x 2 [TS152 x 51] CONNECTION SLEEVE



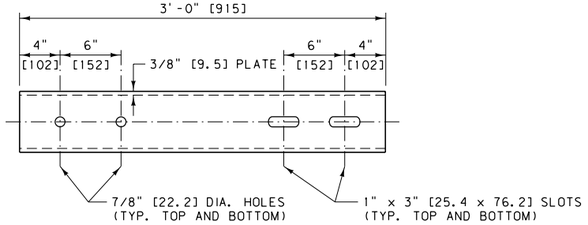
BOX BEAM TERMINAL RAIL (TS6 x 6 x 3/16 [TS152 x 152 x 4.8])

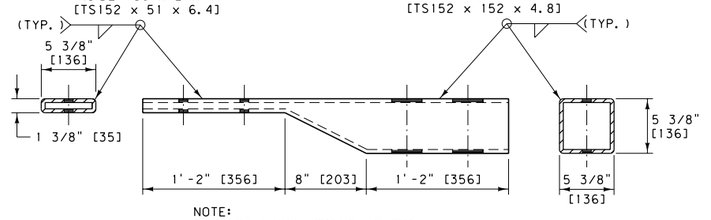
RBM05*



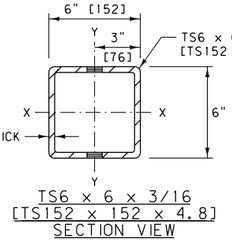
END COVER PLATE DETAIL

(BAR 5" x 3/16" x 0'-5 3/4" [127 x 4.8 x 146])

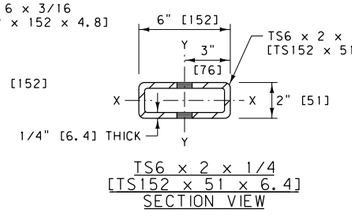




TS6 x 2 TO TS6 x 6 [TS152 x 51 TO TS152 x 152] CONNECTION SLEEVE



TS6 x 6 x 3/16
[TS152 x 152 x 4.8]
SECTION VIEW



TS6 x 2 x 1/4
[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 270 [270M] (ASTM A 709 [709M]) GRADE 36 [250] STEEL PLATE. THE NUTS ARE TO BE PLAIN UN-COATED 3/4" DIA. [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 SUBSECTION 711.08. DO NOT PUNCH, DRILL, OR CUT AFTER GALVANIZING.

*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

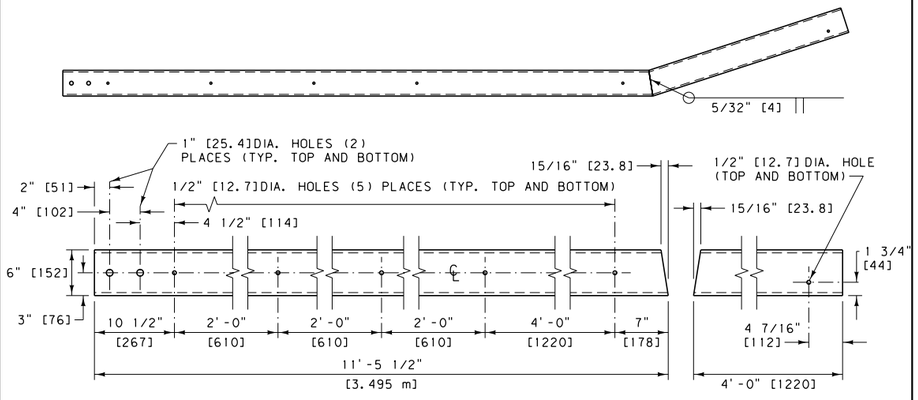
REFERENCE STANDARD SPEC. SECTION 606, 711

DWG. NO. 606-98

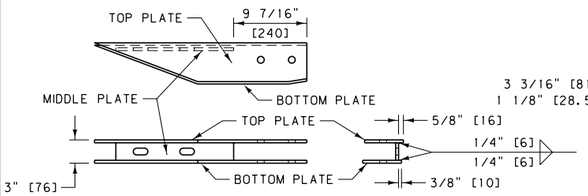
BOX BEAM GUARDRAIL HARDWARE

EFFECTIVE: SEPTEMBER 2014

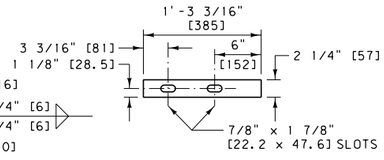
MDT MONTANA DEPARTMENT OF TRANSPORTATION



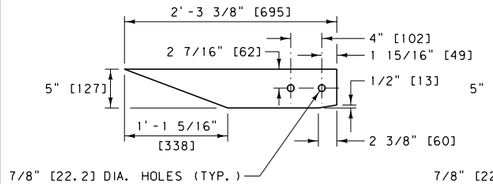
RUB RAIL (TS6 x 2 x 3/16) [TS152 x 51 x 4.8]



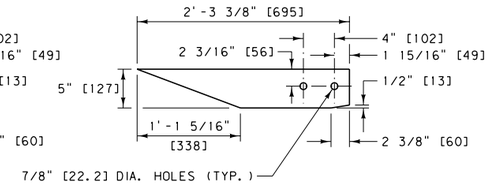
ANCHOR BRACKET FOR RUB RAIL CONNECTION TO JERSEY SHAPE BRIDGE RAIL



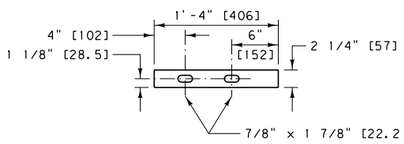
MIDDLE PLATE
(3/8" [9.5] STEEL PLATE)



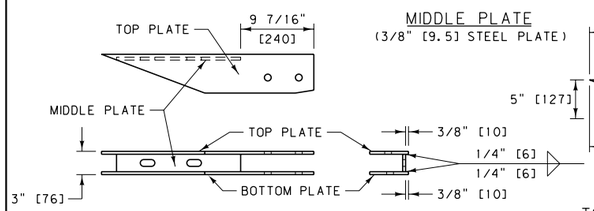
TOP PLATE
(3/8" [9.5] STEEL PLATE)



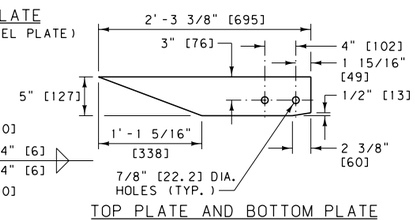
BOTTOM PLATE
(3/8" [9.5] STEEL PLATE)



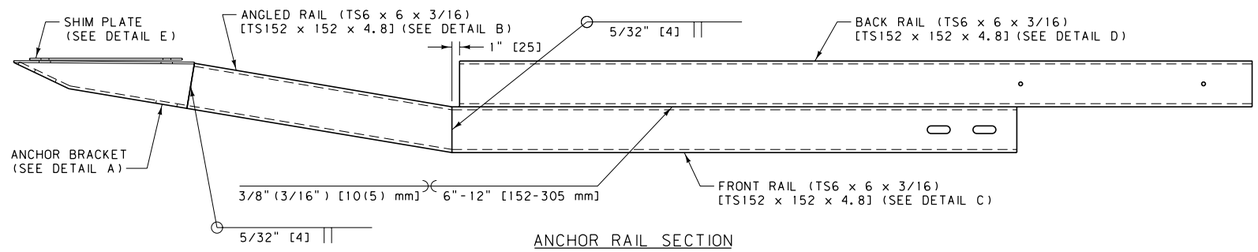
MIDDLE PLATE
(3/8" [9.5] STEEL PLATE)



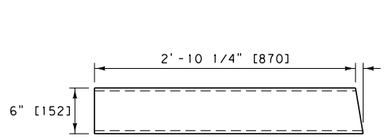
ANCHOR BRACKET FOR RUB RAIL CONNECTION TO VERTICAL CONCRETE BRIDGE RAIL



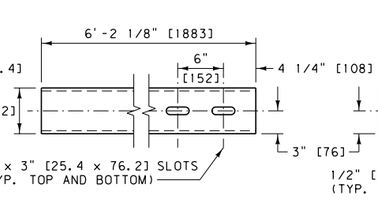
TOP PLATE AND BOTTOM PLATE
(TOP AND BOTTOM PLATES ARE IDENTICAL 3/8" [9.5]STEEL PLATES FOR CONNECTIONS TO VERTICAL SHAPES.)



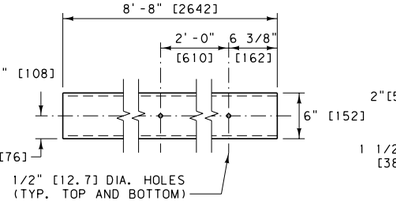
ANCHOR RAIL SECTION



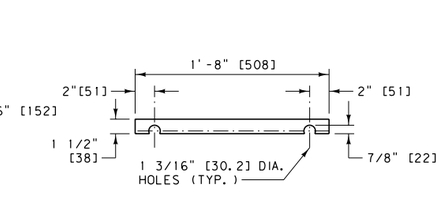
DETAIL B
ANGLED RAIL (TS6 x 6 x 3/16)
[TS152 x 152 x 4.8]



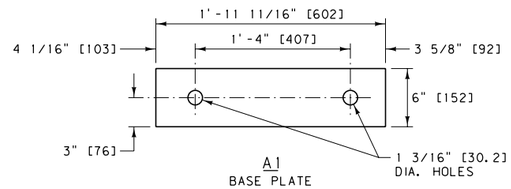
DETAIL C
FRONT RAIL (TS6 x 6 x 3/16)
[TS152 x 152 x 4.8]



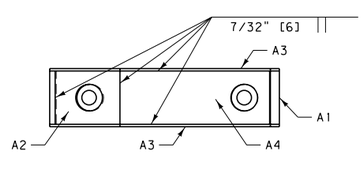
DETAIL D
BACK RAIL (TS6 x 6 x 3/16)
[TS152 x 152 x 4.8]

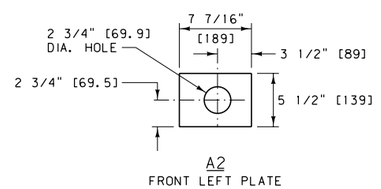


DETAIL E
SHIM PLATE (1/4" [6.4] STEEL PLATE)

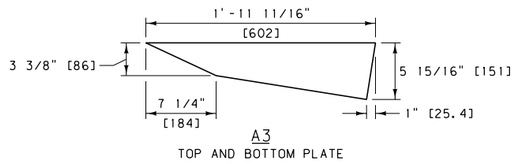


A1
BASE PLATE

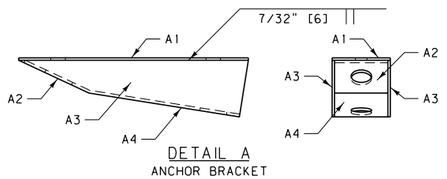




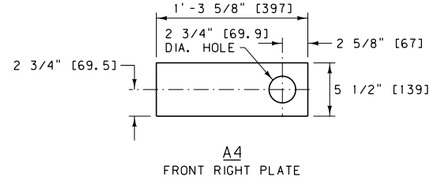
A2
FRONT LEFT PLATE



A3
TOP AND BOTTOM PLATE

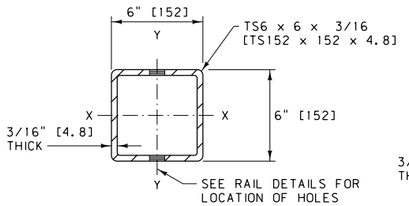


DETAIL A
ANCHOR BRACKET

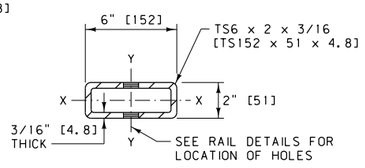


A4
FRONT RIGHT PLATE

NOTE:
ALL ANCHOR BRACKET COMPONENTS ARE FABRICATED FROM 1/4" [6.4] STEEL PLATE MATERIAL.



TS6 x 6 x 3/16
[TS152 x 152 x 4.8]
SECTION VIEW



TS6 x 2 x 3/16
[TS152 x 51 x 4.8]
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 ANCHOR BRACKET AND RUB RAIL CONNECTION COMPONENTS FROM AASHTO M 270 [270M] (ASTM A 709 [709M]) GRADE 36 [250]STEEL PLATE.
3. GALVANIZE FABRICATED RAIL, ANCHOR BRACKET, AND RUB RAIL IN ACCORDANCE WITH SUBSECTION 711.08. DO NOT PUNCH, DRILL, WELD OR CUT AFTER GALVANIZING.

* 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 STANDARD SPEC. SECTION 606, 711

DWG. NO. 606-99

BOX BEAM GUARDRAIL HARDWARE

EFFECTIVE: SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION