METAL BARRIER INDEX
W-BEAM GUARDRAIL

SHEET NO.	DESCRIPTION	EFFECTIVE DATE	REVISED VERSION
MB-01	INDEX AND NOTES	DEC - 2017	JUN - 2018
MB-02	ASSEMBLY DETAILS	DEC - 2017	JUN - 2018
MB-03	STANDARD SECTION HARDWARE	DEC - 2017	JUN - 2018
MB-04	STANDARD SECTION HARDWARE	DEC - 2017	JUN - 2018
MB-05	STANDARD SECTION HARDWARE	DEC - 2017	JUN - 2018
MB-06	EXISTING W-BEAM STRONG POST TRANSITION TO W-BEAM GUARDRAIL STANDARD HEIGHT	DEC - 2017	JUN - 2018
MB-07	GUARDRAIL REFLECTOR DETAILS	DEC - 2017	JUN - 2018
MB-08	REDUCED POST SPACING DETAIL	DEC - 2017	JUN - 2018
MB-09	ELEVATION DETAILS	DEC - 2017	JUN - 2018
MB-10	ELEVATION DETAILS	DEC - 2017	JUN - 2018
MB-11	ELEVATION DETAILS	DEC - 2017	JUN - 2018
MB-12	ELEVATION DETAILS	DEC - 2017	JUN - 2018
MB-13	MEDIAN TREATMENT DETAILS	DEC - 2017	JUN - 2018
MB-14	MEDIAN TREATMENT DETAILS	DEC - 2017	JUN - 2018
MB-15	OPENING DETAILS	DEC - 2017	JUN - 2018
MB-16	END TERMINALS-TYPE MA	DEC - 2017	JUN - 2018
MB-17	END TERMINALS-TYPE MA	DEC - 2017	JUN - 2018
MB-18	CRASHWORTHY END TERMINALS	DEC - 2017	JUN - 2018
MB-19	ANCHORAGE TYPE MB	DEC - 2017	JUN - 2018
MB-20	ANCHORAGE TYPE MC	DEC - 2017	JUN - 2018
MB-21	ANCHORAGE TYPE MB-MED	DEC - 2017	JUN - 2018
MB-22	ANCHORAGE HARDWARE	DEC - 2017	JUN - 2018
MB-23	TRANSITION CONNECTION DETAILS BRIDGE TRANSITION UPGRADE APPROACH SLAB	DEC - 2017	JUN - 2018
MB-24	TRANSITION CONNECTION DETAILS BRIDGE TRANSITION UPGRADE WINGWALL	DEC - 2017	JUN - 2018
MB-25	TRANSITION CONNECTION DETAILS NEW TRANSITION MODULE SPEED EQUAL OR MORE THAN 45 MPH	DEC - 2017	JUN - 2018
MB-26	TRANSITION CONNECTION DETAILS THRIE-BEAM TRANSITION SECTION TYPE I SPEED EQUAL OR MORE THAN 45 MPH	DEC - 2017	JUN - 2018
MB-27	TRANSITION CONNECTION DETAILS NEW TRANSTION MODULE SPEED LESS THAN 45 MPH	DEC - 2017	JUN - 2018
MB-28	TRANSITION CONNECTION DETAILS THRIE-BEAM TRANSITION SECTION TYPE II SPEED LESS THAN 45 MPH	DEC - 2017	JUN - 2018
MB-29	TRANSITION CONNECTION DETAILS THRIE-BEAM TRANSITION SECTION TYPE III	DEC - 2017	JUN - 2018
MB-30	TRANSITION CONNECTION DETAILS HARDWARE	DEC - 2017	JUN - 2018
MB-RL	REVISION LOG	JUN - 2018	

GENERAL NOTES:
(APPLICABLE TO ALL METAL BARRIER (MB) STANDARD DRAWINGS)

1. DIMENSIONS IN MILLIMETERS SYSTEM UNLESS OTHERWISE NOTED.
2. ALL MATERIALS, LABOR AND EQUIPMENT NECESSARY TO THE INSTALLATION OF THE METAL BARRIERS, CONNECTIONS AND TERMINALS ILLUSTRATED IN THESE DRAWINGS SHALL BE A SUBSIDIARY OBLIGATION.
3. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.
4. MATERIALS NOT COMPLYING WITH THE REQUIREMENTS INDICATED IN THE STANDARD DRAWINGS WILL NOT BE ACCEPTED.
5. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURER'S TOLERANCE EXCEPT WHERE ALLOWABLE TOLERANCE ARE SHOWN ON DRAWINGS.
6. INSTALL GUARDRAIL REFLECTORS ACCORDING TO STANDARD DRAWING MB-07.
7. (1) WHEREVER LETTERS N.T.S. APPEAR, THOSE HAVE THE MEANING "NOT TO SCALE".
8. (1) METAL BARRIERS SHALL BE INSTALLED ACCORDING TO PLANS AND SPECIFICATION 606.
9. (1) WHEREVER A △ APPEARS MEAN THAT A REVISION WAS PERFORMED. A REVISION LOG IS INCLUDED ON SHEET MB-RL.

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

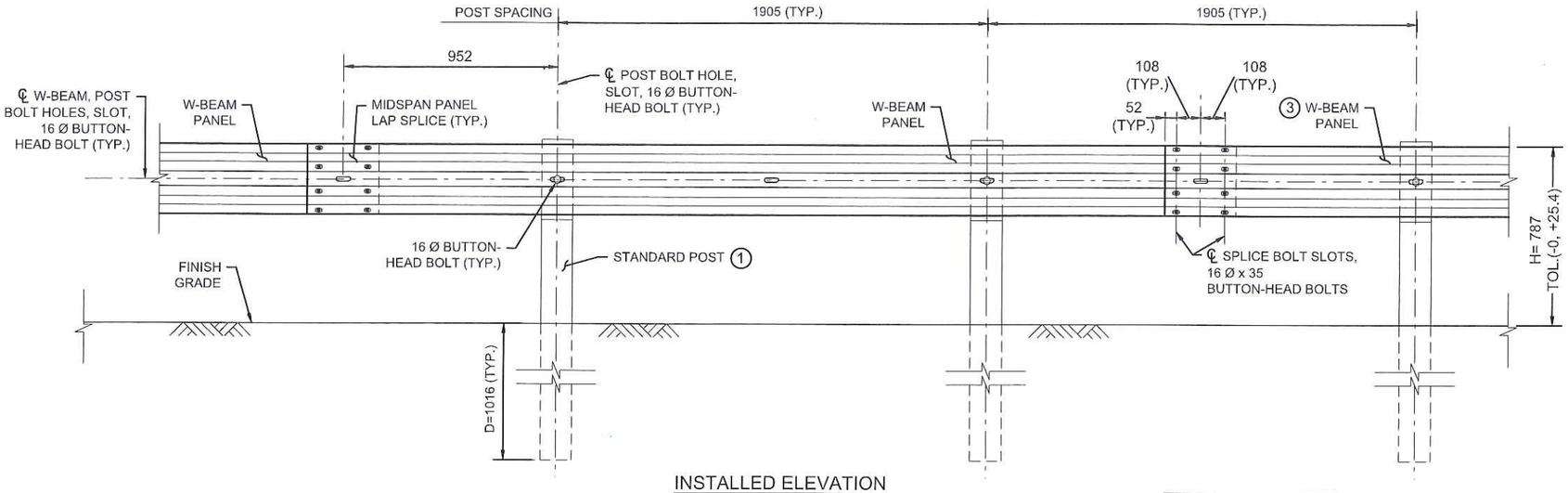
(1) STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21 2018	Jaime A. Lafuente González, DESIGN AREA DIRECTOR	June 22 2018	Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
INDEX AND NOTES

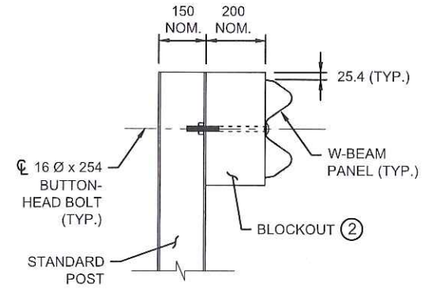
(1) MB-01

JUNE 2018

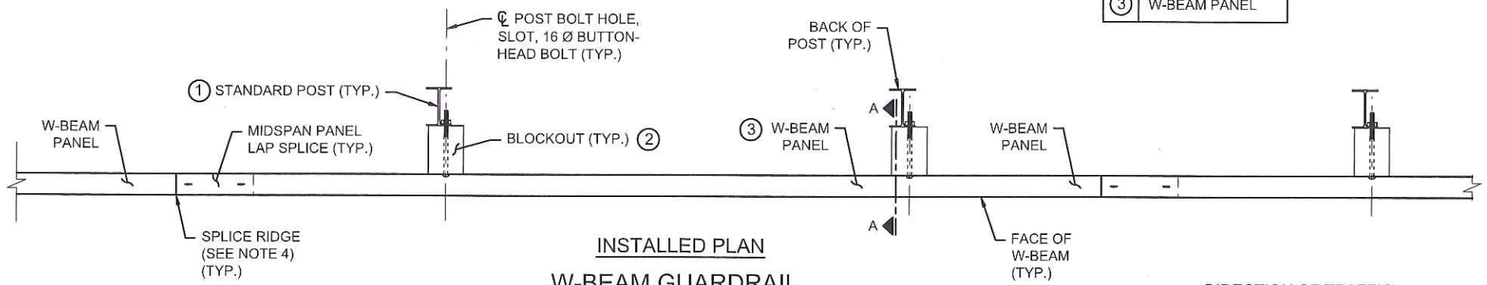


INSTALLED ELEVATION

1	STANDARD POST
2	BLOCKOUT
3	W-BEAM PANEL



SECTION A-A



INSTALLED PLAN

W-BEAM GUARDRAIL

PLAN

NOTES:

1. USE 3810 OR 7621 W-BEAM PANELS. A SINGLE 1905 PANEL MAY BE USED AT THE END OF THE RUN TO MEET THE NOMINAL BEGIN/END GUARDRAIL STA. REQUIREMENTS.
2. WHERE A DIFFERING GUARDRAIL CONFIGURATION IS REQUIRED FOR CONSTRUCTABILITY BEYOND THE OPTIONS SHOWN IN THIS STANDARD DRAWING OR THE PLANS, OBTAIN APPROVAL FROM THE ENGINEER PRIOR TO INSTALLATION.
3. FOR PROPER STRUCTURAL FUNCTION, PLACE ALL LAP SPLICES AT MIDSPAN UNLESS OTHERWISE INDICATED.
4. LAP THE PANELS WITH THE SPLICE RIDGE ORIENTED DOWNSTREAM OF THE FINAL DIRECTION OF TRAFFIC IN THE NEAREST TRAFFIC LANE. FOR REVERSE LANE CONDITIONS, ORIENT THE SPLICE RIDGE DOWNSTREAM OF THE LANE DIRECTION WITH THE HIGHEST TRAFFIC VOLUME.
5. W-BEAM PANEL DETAILS, FASTENERS, POSTS AND BLOCKOUTS DETAILS ARE DEFINED IN STANDARD DRAWINGS MB-03 TO M-05.
6. FOR SECTIONS SHOWING TYPICAL MOUNTING DETAILS, GRADING, AND LATERAL OFFSETS IN RELATION TO ADJACENT ROADWAY FEATURES, SEE MB-09 TO MB-15.
7. WHERE CONCRETE STRUCTURES OR CONCRETE SIDEWALK CONDITIONS ARE ENCOUNTERED, SEE MB-11 FOR ADDITIONAL POST MOUNTING OPTIONS.

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PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: June 22 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL ASSEMBLY DETAILS

MB-02
JUNE 2018

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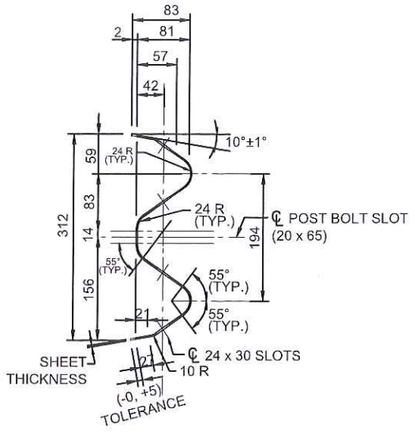
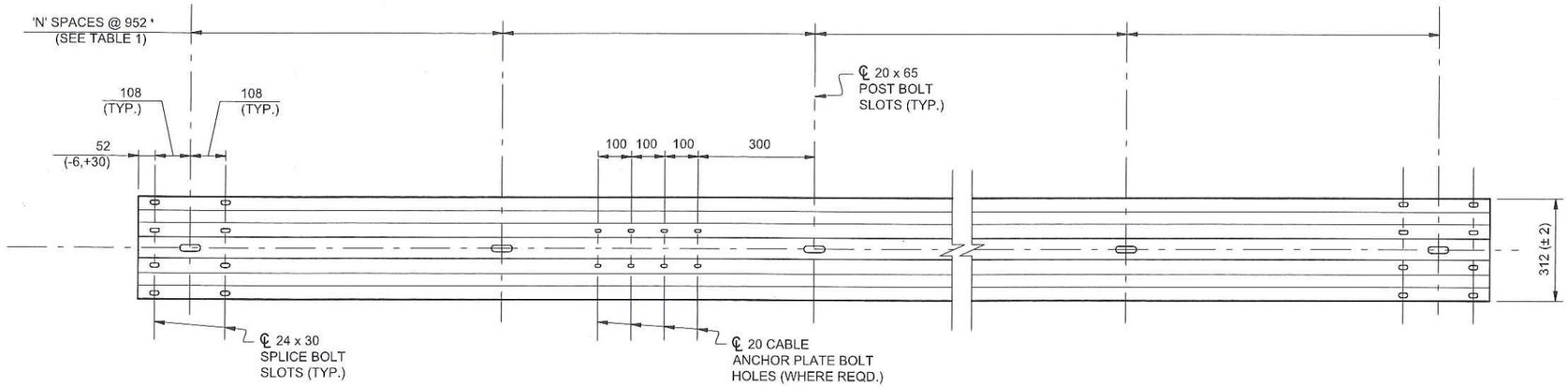


W-BEAM PANEL SECTION



W-BEAM PANEL ELEVATION

NOTES:

1. CORRUGATED SHEET STEEL BEAMS SHALL CONFORM TO THE CURRENT REQUIREMENTS OF AASHTO M180 CLASS A TYPE II.
2. STEEL BEAMS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION ACCORDING AASHTO M111.
3. PLASTIC BLOCKOUTS SHALL BE USED ON ALL NEW W-BEAM GUARDRAIL INSTALLATIONS.
4. ONLY W-BEAM BLOCKOUTS INCLUDED IN THE APPROVED LIST SHALL BE USED.
5. SUPPLIERS AND MANUFACTURERS WHO MAY WISH TO HAVE THEIR W-BEAM BLOCKOUTS INCLUDED IN THE APPROVED LIST, MUST SUBMIT TO THE AUTHORITY FULL DESCRIPTION OF THEIR PRODUCTS, COMPLETE TECHNICAL DATA AND OTHER SUPPORTING DOCUMENTATION.

APPROVED LIST OF W-BEAM BLOCKOUTS

PLASTIC BLOCKOUT	BRAND NAME	MANUFACTURER
1	CENTRAL RECYCLED PLASTIC BLOCK II	CENTRAL FABRICATORS, INC. P.O.BOX 930, KOSCIUSCO, MISSISSIPPI 39090 TELEPHONE 662-289-1980
2	PLASTIC BLOCKOUT WITH LIP	ALOHA PLASTIC RECYCLING, INC. P.O.BOX 1429 PUUNENE, HAWAII 96784 TELEPHONE 1-808-877-0822 / 1-800-865-5884 FAX 1-808-877-2503 WEB PAGE: www.aloha-recycling.com
3	RECYCLED POLYMER OFFSET BLOCK	MONDO POLYMER TECHNOLOGIES, INC. STATE ROUTE 7 RENO, OHIO 45773 TELEPHONE 1-740-376-9396 / 1-888-607-4790 FAX 1-740-376-9960 WEB PAGE: www.MONDOPOLYMER.com
4	MODIFIED KING BLOCK	TRINITY INDUSTRIES, INC. 2525 N. STEMMONS FREEWAY DALLAS, TEXAS 75207 TELEPHONE 214-589-7495

TABLE 1

PANEL TYPE	NUMBER OF SPACES 'N'
1905 W-BEAM	2
3810 W-BEAM	4
7620 W-BEAM	8

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PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR

1 STANDARD DRAWING APPROVAL

DATE: JUNE 22 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
STANDARD SECTION HARDWARE

MB-03

JUNE 2018

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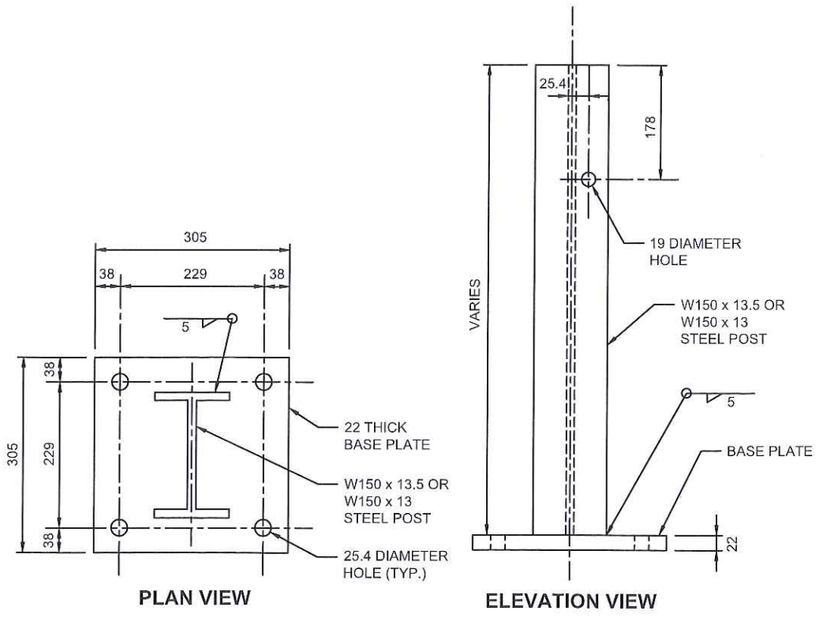


CONCRETE SLAB MOUNTED GUARDRAIL POST

N.T.S.

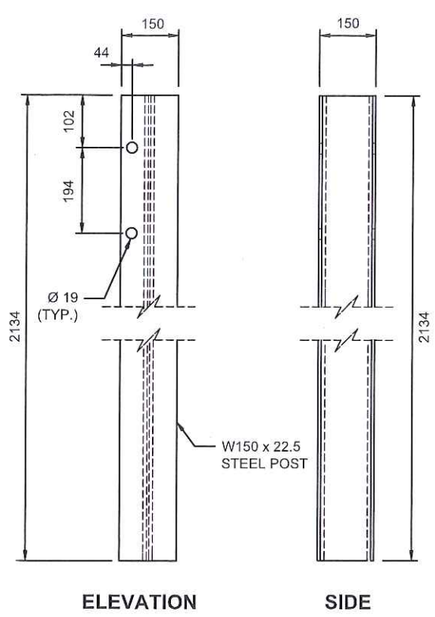
I. SPECIFICATIONS ⚠1

A. THE CONCRETE SLAB MOUNTED GUARDRAIL POST SHALL BE MANUFACTURED USING AASHTO M270M (ASTM A709) GRADE 250 STEEL.THE DIMENSIONS OF THE STRUCTURAL W150 x13.5 ARE DEFINED IN ASTM A6M. AFTER FABRICATION THE CONCRETE SLAB MOUNTED GUARDRAIL POST, SHALL BE HOT DIP GALVANIZED ACCORDING TO ASSHTO M111 (ASTM A123). WELDING SHALL CONFORM TO ANSI/AASHTO/AWS D1.5.

B. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.

NOTES: ⚠1

1. THE POST LENGTH SHALL BE ADJUSTED SUCH THAT THE DISTANCE FROM THE ROAD SURFACE TO THE TOP OF THE W-BEAM PANEL IS 787 (-0, +25.4)
2. THE CONTRACTOR SHALL PROVIDE CONCRETE SLAB MOUNTED GUARDRAIL POST, NECESSARY HARDWARE AND ANCHORAGE TO CONCRETE STRUCTURE AS A SUBSIDIARY OBLIGATION.
3. IF NECESSARY FOR INSTALLATION, ADDITIONAL HOLE IS PERMITTED. FOR DOUBLE FACE INSTALLATIONS, HOLE IN OPPOSITE FLANGE IS PERMITTED.



P1 - P3
TRANSITION POST

W150 x 22.5

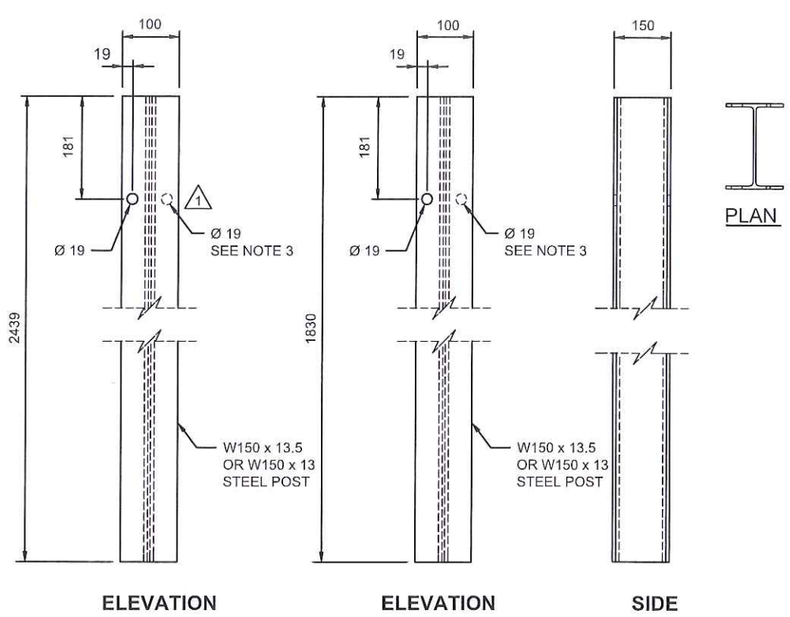
N.T.S

I. SPECIFICATIONS ⚠1

A. CORRUGATED STEEL BEAM GUARDRAIL POSTS SHALL BE MANUFACTURED USING AASHTO M270M (ASTM A709) GRADE 250 STEEL. THE DIMENSIONS OF THE STRUCTURAL CROSS-SECTION SHALL CONFORM A W150 x 22.5 SECTION AS DEFINED IN ASTM A6M.

B. AFTER THE SECTION IS CUT AND ALL HOLES ARE DRILLED OR PUNCHED THE COMPONENT SHALL BE ZINC-COATED ACCORDING TO AASHTO MIII (ASTM A123).

C. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSITENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.



W-BEAM GUARDRAIL
STEEL POST

N.T.S

I. SPECIFICATIONS ⚠1

A. W-BEAM AND THRIE-BEAM GUARDRAIL POSTS SHALL BE MANUFACTURED USING AASHTO M270M (ASTM A709M) GRADE 250 STEEL OR ASTM A36/A36M UNLESS CORROSION RESISTANT STEEL IS REQUIRED IN WHICH CASE THE POST SHALL BE MANUFACTURED FROM AASHTO M270M (ASTM A709M) GRADE 50W STEEL. THE DIMENSIONS OF THE CROSS-SECTION SHALL CONFORM A W150 X 13.5 SECTION AS DEFINED IN (ASTM A6M). W150 X 13 WIDE-FLANGE POSTS ARE AN ACCEPTABLE ALTERNATIVE THAT IS CONSIDERED EQUIVALENT TO THE W150 X 13.5.

B. AFTER FABRICATION THE POST SHALL BE HOT DIP GALVANIZED ACCORDING TO AASHTO M111 (ASTM A123).

C. DIMENSIONS TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

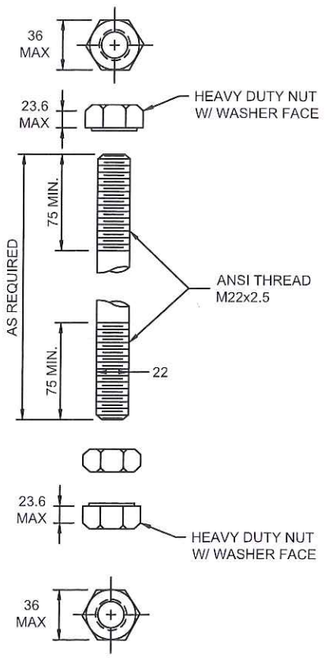
⚠1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González, DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
STANDARD SECTION HARDWARE

MB-04

JUNE 2018



STRAIGHT ANCHOR STUD AND NUTS

N.T.S.

I. SPECIFICATIONS

A. ANCHOR STUDS SHALL CONFORM TO AASHTO M314 EXCEPT THAT THREADS AND NOMINAL DIAMETERS SHALL CONFORM TO ANSI B1.13M FOR CLASS 6g THREADS, ANCHORS STUDS SHALL CONFORM TO: AASHTO M314 GRADE 55 (517 MPa MINIMUM TENSILE STRENGTH).

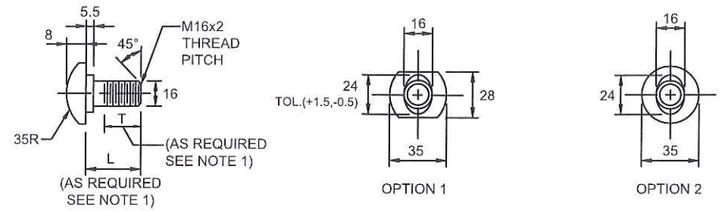
B. HEAVY HEX NUTS SHALL CONFORM TO AASHTO M291M (ASTM A563M) FOR CLASS 10S NUTS AND SHALL CONFORM TO GEOMETRY DEFINED IN ANSI B18.2.4.6M. ALL NUTS SHALL HAVE ANSI B1.13M CLASS 6H THREADS.

C. ZINC-COATED ANCHOR STUDS SHALL BE FINISHED ACCORDING TO EITHER AASHTO M232 (ASTM A153) CLASS C OR AASHTO M298 (ASTM B695) FOR CLASS 50. HEX NUTS SHALL BE ZINC-COATED ACCORDING TO EITHER AASHTO M232 (ASTM A153) CLASS C OR AASHTO M298 (ASTM B695) FOR CLASS 50.

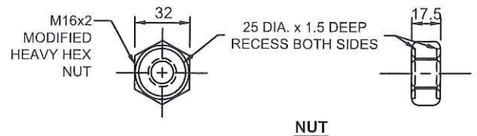
D. DIMENSIONAL TOLERANCE NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.

II. INTENDED USE

A. ANCHOR STUDS ARE USED TO CONNECT BRIDGE RAILING POSTS TO BRIDGE DECKS AND OTHER CONCRETE SLABS.



BOLT



NUT

SPLICE AND POST BOLT AND NUT △1

BUTTON HEAD BOLT

N.T.S.

I. SPECIFICATIONS

A. THE GEOMETRY AND MATERIAL SPECIFICATIONS FOR THIS BOLT AND NUT ARE FOUND IN AASHTO M180. THE BOLT SHALL HAVE M16x2 THREADS AS DEFINED IN ANSI B1.13M FOR GRADE 6g TOLERANCES. BOLT MATERIAL SHALL CONFORM TO ASTM F568M FOR CLASS 4.6 (400 MPa TENSILE STRENGTH AND 240 MPa YIELD STRENGTH). ZINC-COATED BOLT HEADS SHALL BE MARKED WITH THE SYMBOL "4.6" AS DEFINED IN ASTM F568 SECTION 9.

B. NUTS SHALL HAVE ANSI B1.13M M16x2 CLASS 6h THREADS. THE GEOMETRY OF THE NUTS, WITH THE EXCEPTION OF THE RECESS SHOWN IN THE DRAWING, SHALL CONFORM TO ANSI B18.2.4.1M STYLE 1 FOR ZINC-COATED HEX NUTS. MATERIAL FOR ZINC-COATED NUTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A563M FOR CLASS 5.

C. ZINC-COATING SHALL CONFORM TO EITHER AASHTO M232 (ASTM A153) FOR CLASS C OR AASHTO M298 (ASTM B695) FOR CLASS 50. ZINC-COATED NUTS SHALL BE TAPPED OVER-SIZE AS SPECIFIED IN AASHTO M291M (ASTM A563M) EXCEPT THAT A DIAMETRICAL ALLOWANCE OF 0.510 mm SHALL BE USED INSTEAD OF 0.420 mm.

STRESS AREA OF THREADED BOLT SHANK (mm^2)	MINIMUM BOLT BOLT STRENGTH (kN)
157.0	62.8

D. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.

II. INTENDED USE

A. THESE BOLTS AND NUTS AREA USED IN GUARDRAIL AND MEDIAN BARRIER DESIGNS. THEY ARE ALSO USED IN GUARDRAIL TERMINAL DESIGNS AND GUARDRAIL TRANSITION.

NOTES:

1. REQUIRED LENGTH (L) AND TRIM (T) SHALL BE ACCORDING TABLE 1 BELOW:

TABLE 1

BOLT TYPE	LENGTH (L)	TRIM (T)
SPLICE BOLT	35	30
POST BOLT	254	100

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△1 STANDARD DRAWING APPROVAL

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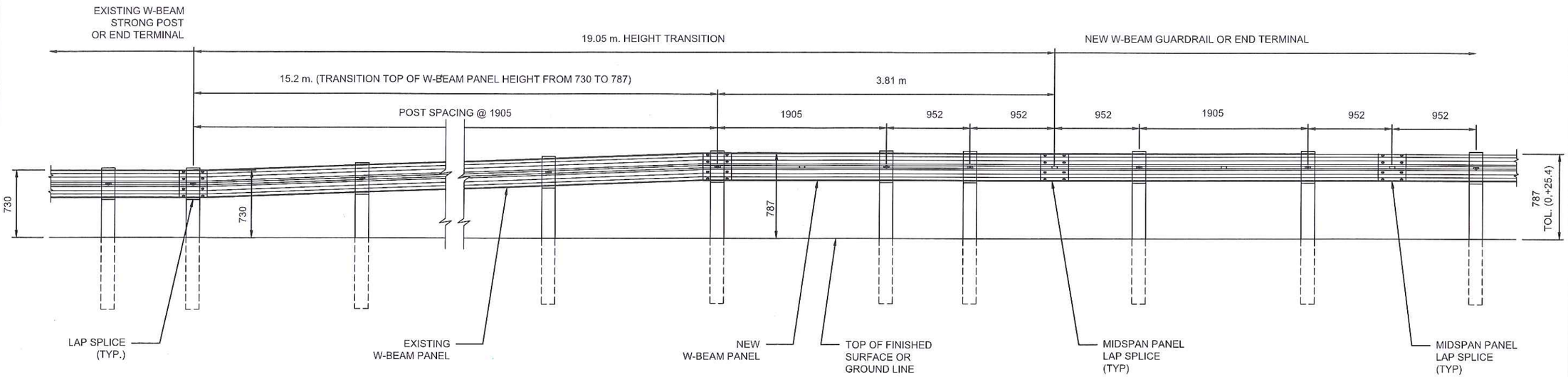
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

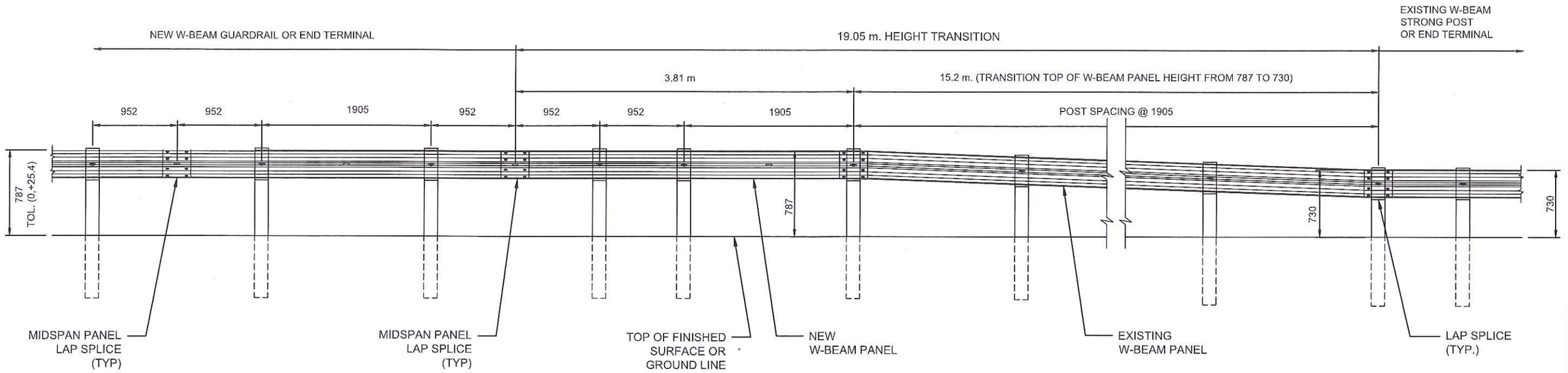
METAL BARRIER
W-BEAM GUARDRAIL
STANDARD SECTION HARDWARE

MB-05

JUNE 2018



ELEVATION VIEW
N.T.S.



ELEVATION VIEW
N.T.S.

GENERAL NOTES:

ALL COSTS FOR FURNISHING AND INSTALLING THE W-BEAM STRONG POST TO W-BEAM GUARDRAIL STANDARD HEIGHT TRANSITION INCLUDING LABOR, EQUIPMENT, AND MATERIALS WHICH INCLUDES ALL RAIL SECTIONS, POSTS AND BLOCKOUTS, HARDWARE, AND INCIDENTALS SHALL BE A SUBSIDIARY OBLIGATION.

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

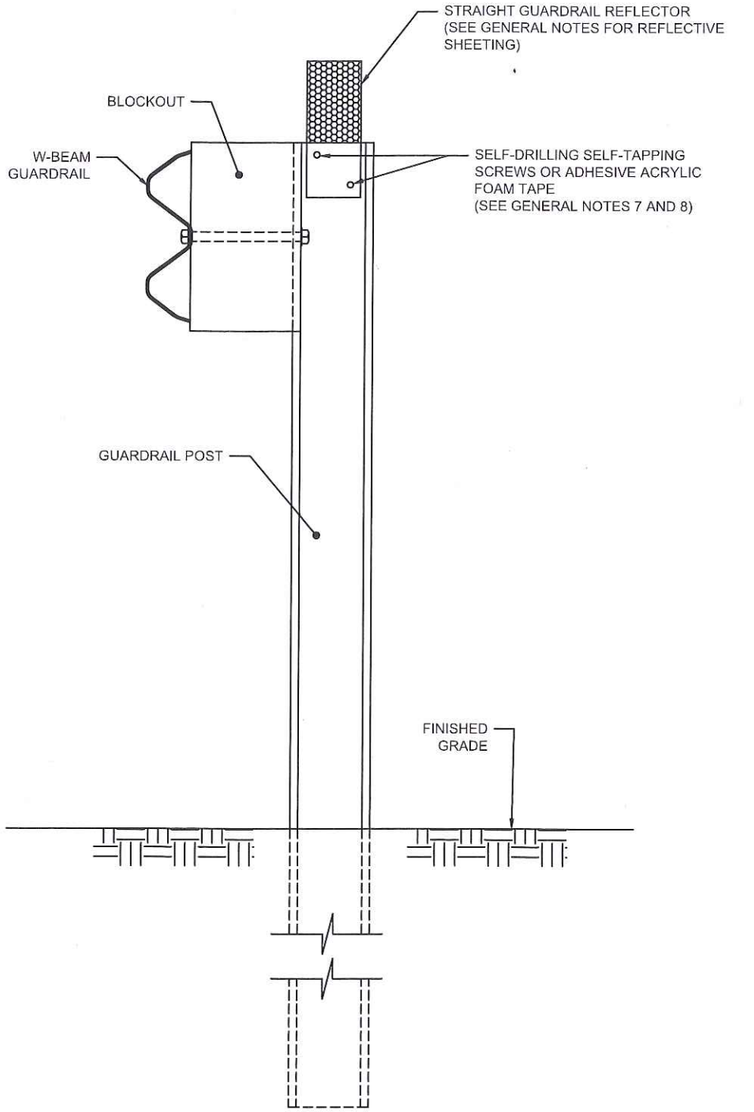
1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: June 22, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

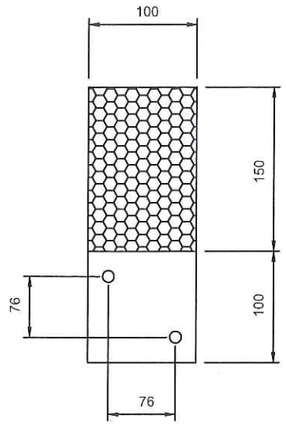
METAL BARRIER
EXISTING W-BEAM STRONG POST TRANSITION TO W-BEAM GUARDRAIL STANDARD HEIGHT

MB-06
JUNE 2018

K:\17-0530\C03\PHASE 01\MASH_Metal Barrier\04-Standard Drawings\06Final Modified



STRAIGHT GUARDRAIL REFLECTOR INSTALLATION DETAIL
N.T.S.



STRAIGHT GUARDRAIL REFLECTOR PANEL DETAIL
N.T.S.

NOTES:

1. THE COLOR OF THE RETROFLECTIVE SHEETING SHALL CONFORM TO THE COLOR OF THE NEAREST PAVEMENT MARKINGS.
2. REFLECTIVE SHEETING SHALL CONFORM TO THE REQUIREMENTS OF ASTM D4956 FOR TYPE IV MATERIAL. THE ADHESIVE BACKING FOR THESE MARKERS SHALL BE CLASS 1 OR CLASS 2.
3. GUARDRAIL REFLECTORS SHALL BE SUBSIDIARY OBLIGATION OF THE CONTRACTOR UNDER THE CORRUGATED STEEL BEAM GUARDRAIL PAY ITEMS.
4. GUARDRAIL REFLECTORS SHALL BE INSTALLED AT EVERY SIX (6) POSTS. IF IS REQUIRED A SPACING ADJUSTMENT TO FIT EXACT GUARDRAIL LENGTH, THE CONTRACTOR SHALL INCLUDE THE RECOMMENDED SPACING ADJUSTMENT IN THE GUARDRAIL INSTALLATION SCHEDULE REQUIRED IN THE SUPPLEMENTAL SPECIFICATION 606.
5. GUARDRAIL REFLECTOR PANEL SHALL BE FABRICATED OF STEEL CONFORMING THE REQUIREMENTS OF ASTM A570 GRADE 33 OR ASTM A36. AFTER ALL PUNCHING, DRILLING, STAMPING AND WELDING IS COMPLETE, THE PANEL SHALL BE ZINC-COATED BY THE HOT DIP GALVANIZED PROCESS ACCORDING TO ASTM A123. DELINEATOR PLATE THICKNESS SHALL BE 1/16 INCHES (16 GAUGE).
6. THE CONTRACTOR MAY USE PLASTIC PANELS FOR GUARDRAIL REFLECTORS AS AN ALTERNATE. PLASTIC PANELS SHALL BE AT LEAST 0.080 INCHES THICK, HAVE A MINIMUM TENSILE STRENGTH AT YIELD OF 5,000 POUNDS PER SQUARE INCH WHEN TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM D638, AND HAVE A MINIMUM IMPACT STRENGTH OF 2.0 FOOT-POUND PER INCH OF NOTCH AT -20 DEGREES F AND 14.0 FOOT-POUNDS PER INCH OF NOTCH AT 73 DEGREES F WHEN TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM D256, METHOD A. PANELS SHALL NOT DETERIORATE WHEN EXPOSED TO UV RAYS, PETROLEUM PRODUCTS, OZONE, EXHAUST FUMES, OR HERBICIDES. THE CONTRACTOR SHALL SUBMIT ALL PRODUCT TECHNICAL DATA FOR ENGINEER EVALUATION AND APPROVAL.
7. THE ATTACHMENT OF THE GUARDRAIL REFLECTOR DIRECTLY TO THE POST WEB SHALL BE BY TWO HOLES ON THE FACE OF THE DELINEATOR. THE MOUNTING HOLES SHALL BE AS NEEDED TO INSTALL SELF DRILLING - SELF TAPPING SCREW #8 INDENTED HEX, 3/4 INCH LENGTH AND POINT #2. AFTER INSTALLATION THE GUARDRAIL REFLECTOR PERFORATED AREA AND BOTH SCREWS SHALL BE PAINTED AS PER SUPPLEMENTAL SPECIFICATION 606-3.04D.
8. THE CONTRACTOR MAY USE AND ADHESIVE ACRYLIC FOAM TAPE AS AN ALTERNATE TO THE BOLTING SYSTEM AS APPROVED BY THE ENGINEER. THE CONTRACTOR SHALL SUBMIT ALL PRODUCT TECHNICAL DATA FOR THE ENGINEER EVALUATION AND APPROVAL. THE CONTRACTOR SHALL FOLLOWS ALL MANUFACTURER RECOMMENDATIONS AND PROCEDURES FOR THE PRODUCT INSTALLATION. IN ADDITION, THE CONTRACTOR SHALL SUBMIT THE TAPE SHAPE, SIZE, POSITION, AND CAPACITY TO FULFILL THE EXPECTED USE.
9. ON GUARDRAIL SECTION, THE FIRST REFLECTOR SHALL BE INSTALLED AT THE END WHICH OPPOSES TRAFFIC FLOW.
10. ALL GUARDRAIL INSTALLATION SHALL BE AS METAL BARRIERS STANDARD DRAWINGS.
11. FOR DOUBLE FACE GUARDRAIL, THE REFLECTIVE SHEETING SHALL BE INSTALLED ON BOTH SIDES OF GUARDRAIL REFLECTOR PANEL.

HIGHWAY & TRANSPORTATION AUTHORITY

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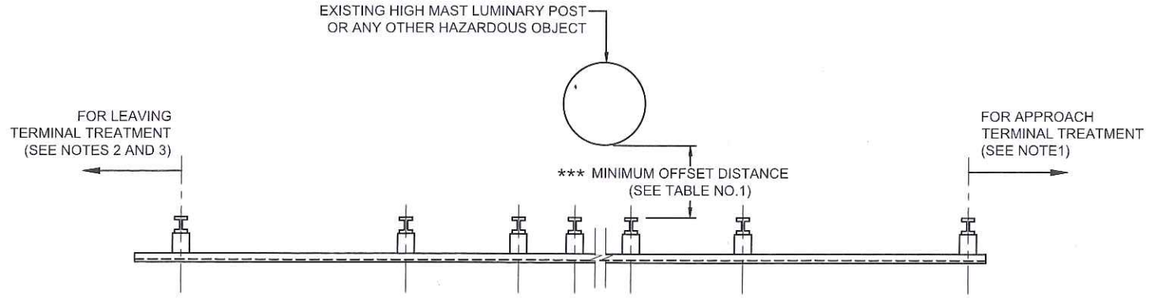
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

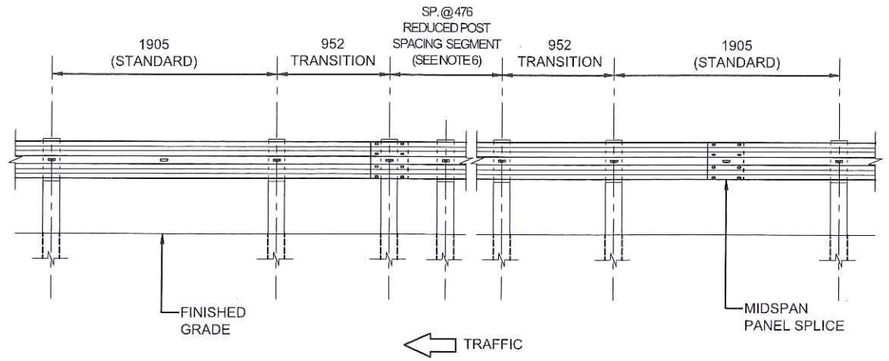
METAL BARRIER
W-BEAM GUARDRAIL
GUARDRAIL REFLECTOR DETAILS

MB-07

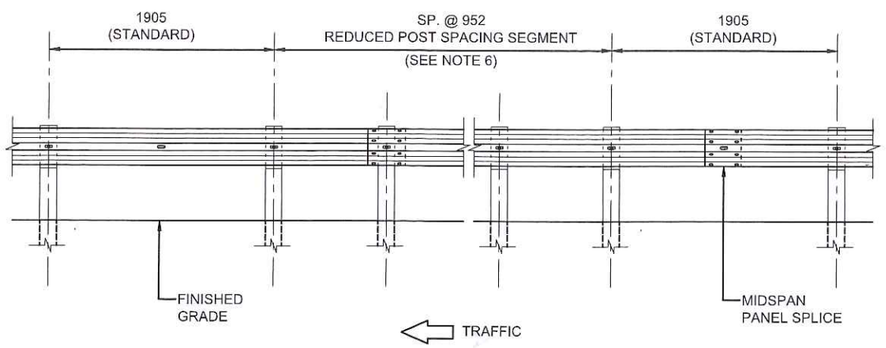
-



REDUCED POST SPACING FOR HAZARDS PLAN (TYP.)
(SEE NOTE 5)
N.T.S.



QUARTER SPACING ELEVATION DETAIL
N.T.S.



HALF SPACING ELEVATION DETAIL
N.T.S.

NOTES:

1. IF THERE IS NO ADJACENT METAL BARRIER, THE CONTRACTOR SHALL INSTALL A CRASHWORTHY OR TYPE MA END TERMINAL AS DESCRIBED IN THE STANDARD DRAWINGS. OTHERWISE, INSTALL W-BEAM GUARDRAIL STANDARD SECTION ACCORDING TO THE PLANS, SPECIFICATIONS AND STANDARD DRAWINGS.
2. FOR DIVIDED HIGHWAYS:
   IF THERE IS NO ADJACENT METAL BARRIER, THE CONTRACTOR SHALL INSTALL A TRAILING ANCHORAGE TYPE MC (NHS OR NON-NHS) AS DESCRIBED IN THE STANDARD DRAWINGS. OTHERWISE, INSTALL W-BEAM GUARDRAIL STANDARD SECTION ACCORDING TO THE PLANS, SPECIFICATIONS AND STANDARD DRAWINGS.
3. FOR UNDIVIDED HIGHWAYS:
   IF THERE IS NO ADJACENT METAL BARRIER, THE CONTRACTOR SHALL INSTALL EITHER A CRASHWORTHY END TERMINAL, TYPE MA END TERMINAL OR TRAILING ANCHORAGE TYPE MB (NHS OR NON-NHS) ACCORDING TO PLANS, SPECIFICATIONS AND STANDARD DRAWINGS.
4. ALL NECESSARY ADDITIONAL POSTS AND NESTED W-BEAMS SHALL BE SUBSIDIARY OBLIGATION UNDER THE GUARDRAIL PAY ITEM.
5. WHERE HAZARDS MUST BE LOCATED LESS THAN 1.0 m. BACK OF THE RAIL POST, REDUCED POST SPACING MAY BE USED TO DECREASE THE OFFSET DISTANCE.
6. PROVIDE REDUCED POST SPACING ALONG THE ENTIRE PORTION OF THE HAZARD(S) REQUIRING A DECREASED OFFSET DISTANCE. PLACE A MINIMUM REDUCED POST SPACING SEGMENT LENGTH OF 7.62 m.
7. MIDSPAN PANEL SPLICES ARE NOT REQUIRED IN REDUCED POST SPACING SEGMENTS.
8. THE LENGTH OF NESTED W-BEAM SHALL BE EQUAL TO THE TOTAL LENGTH OF THE REDUCED POST SPACING.

TABLE NO.1

MINIMUM OFFSET DISTANCE ***	BEAM DESCRIPTION	POST SPACING
737	SINGLE W-BEAM	952
534	SINGLE W-BEAM	476
482	NESTED W-BEAM	952
381	NESTED W-BEAM	476

*** OFFSET DISTANCE SHALL BE MEASURED FROM NEAREST FACE OF OBJECT TO THE BACK OF THE RAIL POST.

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DATE: JUNE 21, 2018
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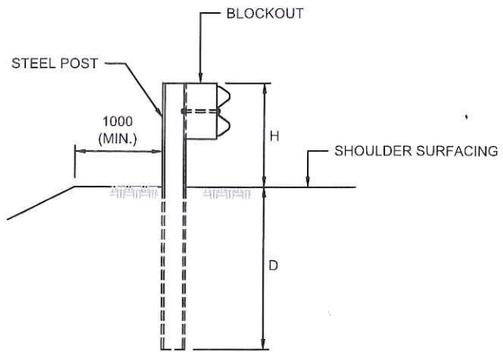
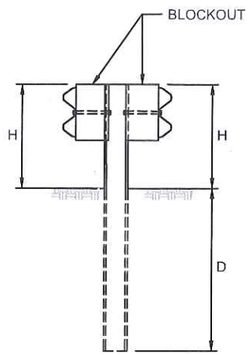
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
REDUCED POST SPACING

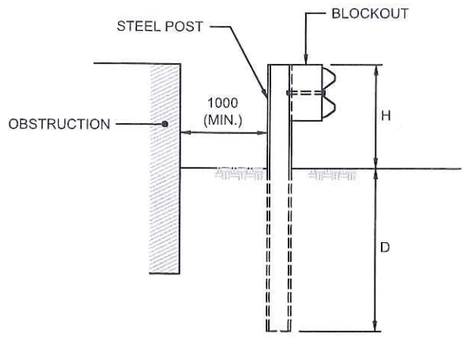
MB-08
JUNE 2018



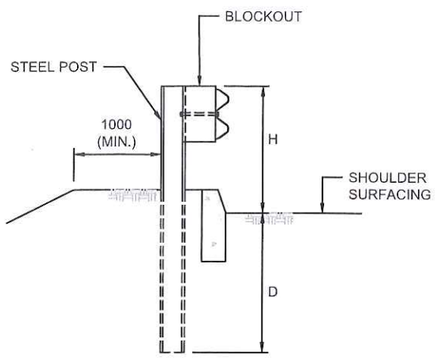
TYPICAL BEAM MOUNTING
SHOULDER INSTALLATION
N.T.S



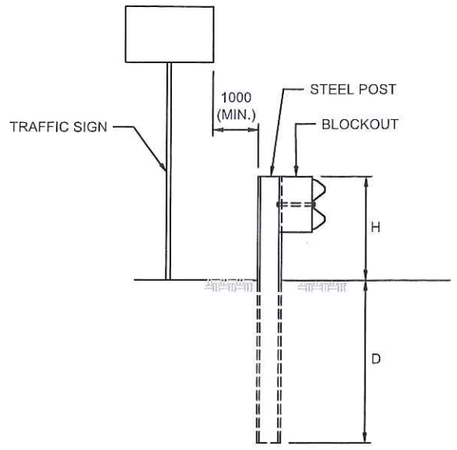
TYPICAL BEAM MOUNTING
MEDIAN INSTALLATION
N.T.S



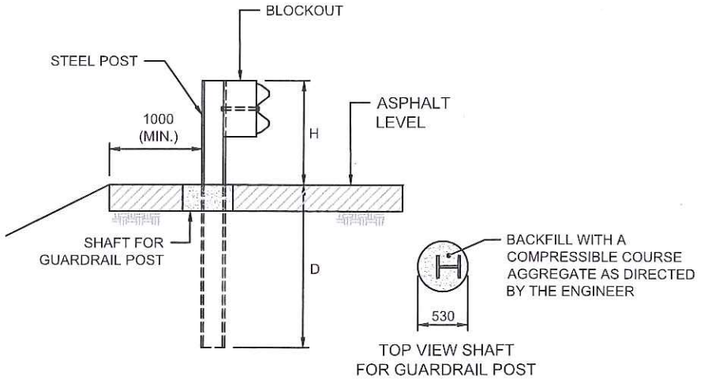
TYPICAL BEAM MOUNTING
NEAR OBSTRUCTION
N.T.S



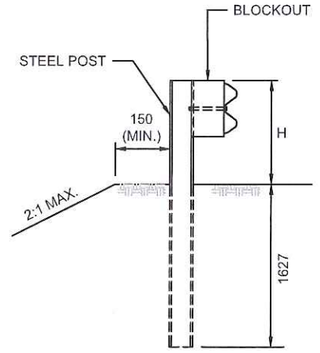
TYPICAL BEAM MOUNTING
WITH CURB
(SEE NOTE 3)
N.T.S



TYPICAL BEAM MOUNTING
TRAFFIC SIGN CASE
N.T.S



TYPICAL BEAM MOUNTING
IN PAVED AREAS
N.T.S



SLOPE BREAK CONDITION
STEEL DEEP POST
N.T.S

NOTES:

1. TYPICAL POST SPACING IS 1.905 METERS.
2. IN AREAS WHERE BEDROCK IS ENCOUNTERED AND THE POST CANNOT BE DRIVEN TO GRADE, REMOVE THE POST, THEN DRILL OR EXCAVATE A HOLE OF SUITABLE DIMENSIONS TO THE REQUIRED DEPTH. FILL THE HOLE WITH COMPRESSIBLE COARSE AGGREGATE, SET THE POST TO GRADE, THEN PLUMB AND SECURE. THIS WORK IS A SUBSIDIARY OBLIGATION.
3. CURB FACE SHALL BE FLUSHED TO BE FACE OF THE W-BEAM GUARDRAIL.
4. "H" AND "D" VALUES SHALL BE AS SPECIFIED IN STANDARD DRAWING MB-02.

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1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	June 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
ELEVATION DETAILS

MB-09

JUNE 2018

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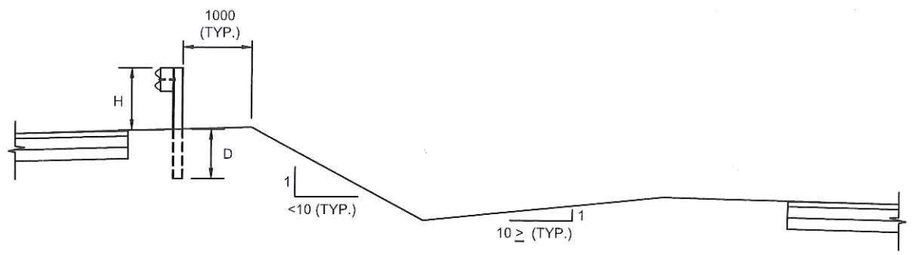
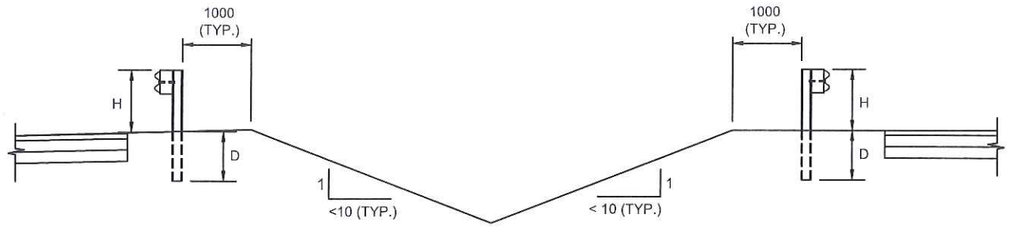
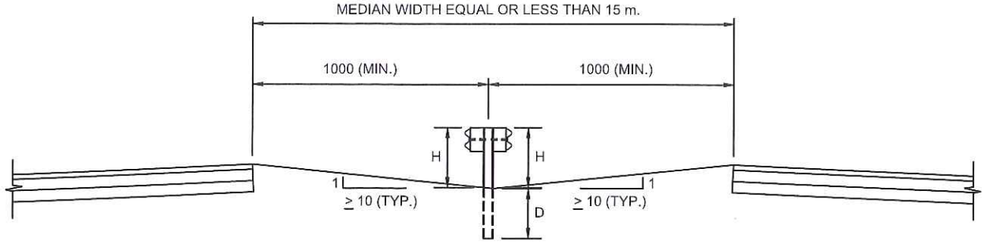


CASE 1



CASE 2



CASE 3

DEPRESSED MEDIANS OR MEDIANS WITH DITCH SECTIONS

N.T.S

NOTES:

1. DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. "H" AND "D" VALUES SHALL BE AS SPECIFIED IN STANDARD DRAWING MB-02.

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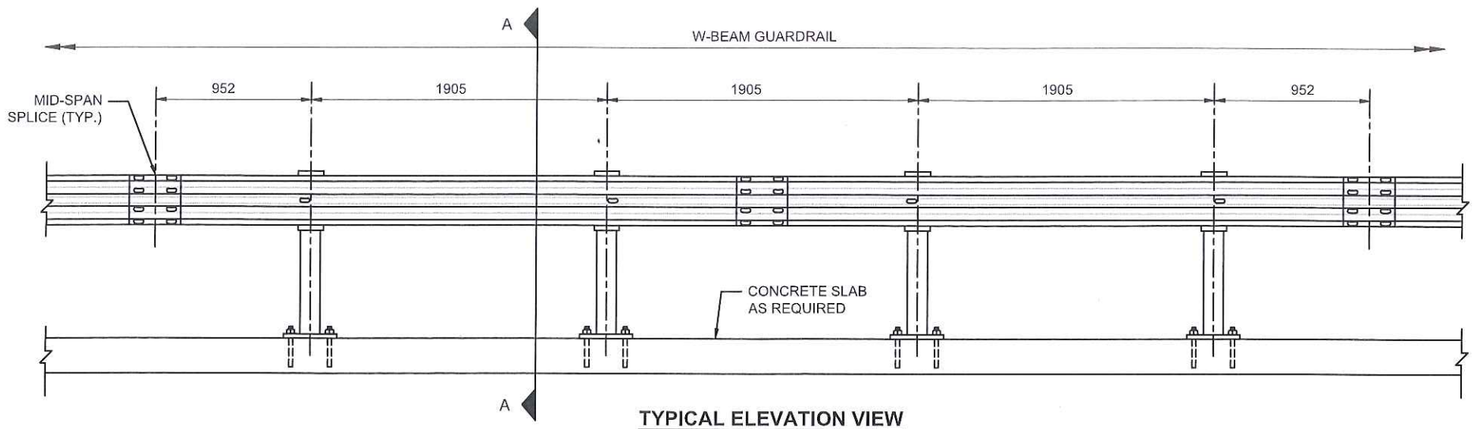
1 STANDARD DRAWING APPROVAL

METAL BARRIER
W-BEAM GUARDRAIL
ELEVATION DETAILS

MB-10

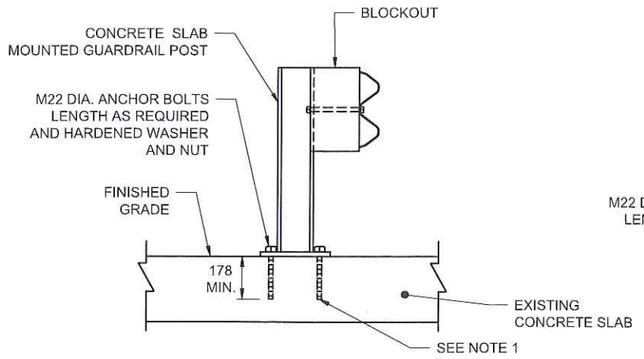
JUNE 2018



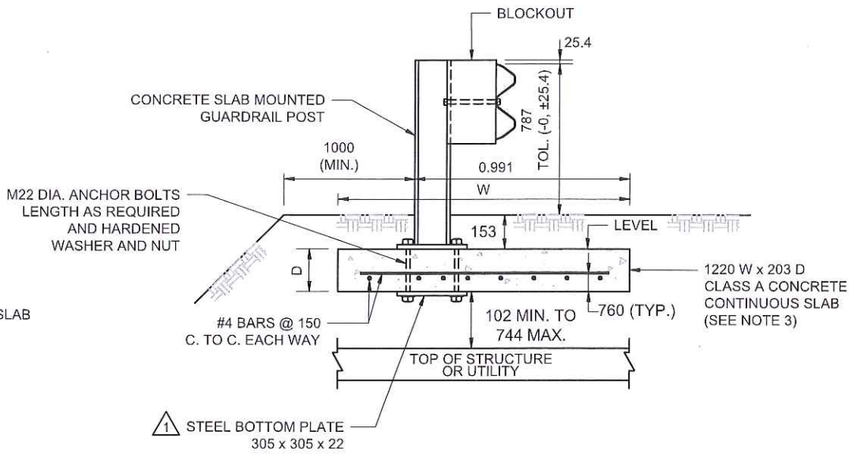
TYPICAL ELEVATION VIEW
N.T.S.

NOTES:

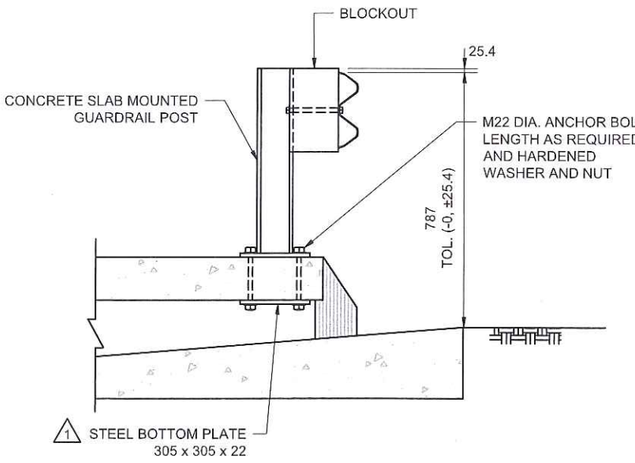
1. THE EPOXY RESIN ADHESIVE FOR ANCHORS SHALL MEET THE REQUIREMENTS OF AASHTO M235 AND ASTM C881, TYPES IV AND V, CLASS C.
2. IN STEEL POSTS OVER UNDERGROUND STRUCTURES, THE EXCAVATION, BACKFILL, SLAB AND REINFORCEMENT ARE A SUBSIDIARY OBLIGATION.
3. THE LENGTH (L) OF THE CONCRETE SLAB SHALL BE A MINIMUM OF 1220 DEPENDING OF THE FIELD CONDITIONS AND AS REQUIRED BY THE ENGINEER.



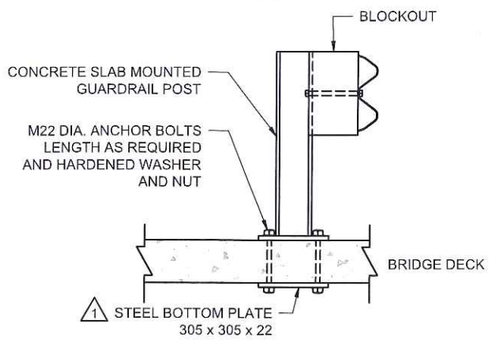
TYPICAL W-BEAM GUARDRAIL MOUNTING
EXISTING CONCRETE SLAB
SECTION A-A
N.T.S.



TYPICAL W-BEAM GUARDRAIL MOUNTING
OVER UNDERGROUND STRUCTURES
(SEE NOTE 2)
N.T.S.



TYPICAL W-BEAM GUARDRAIL MOUNTING
WITH CURB INLETS AND
OTHER SURFACES STRUCTURES
N.T.S.



TYPICAL W-BEAM GUARDRAIL MOUNTING
ON BRIDGE DECKS
N.T.S.

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1 STANDARD DRAWING APPROVAL

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APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
ELEVATION DETAILS

MB-11

JUNE 2018

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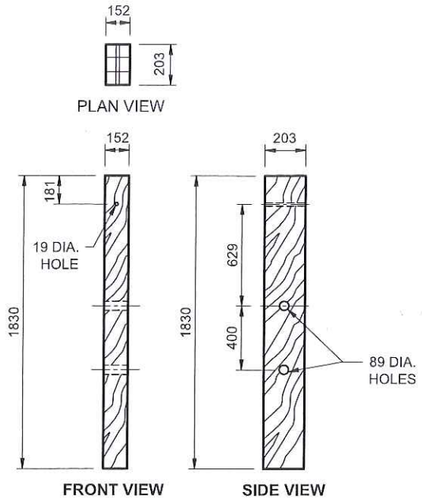
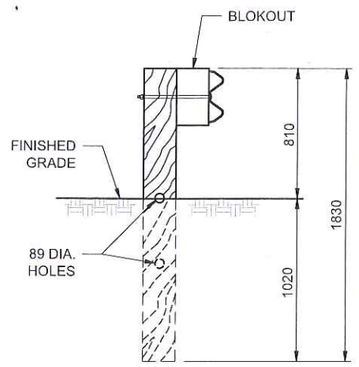
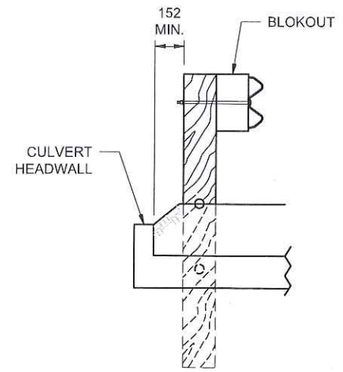


⚠1 **CRT WOOD POST**
N.T.S.



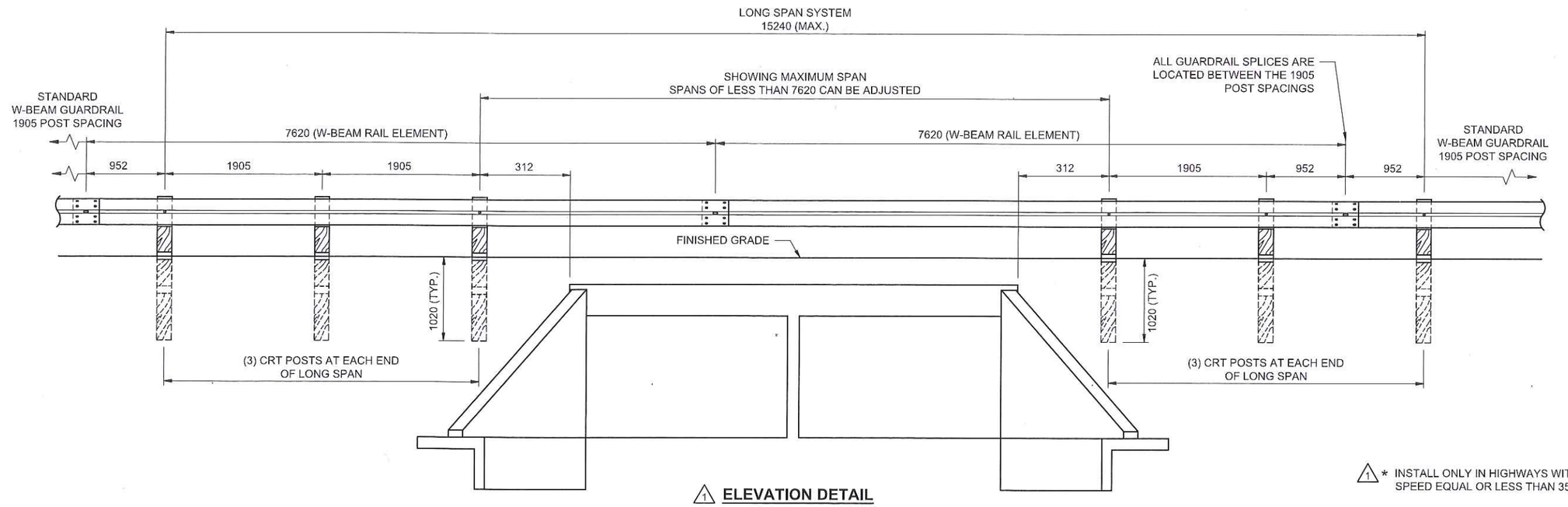
⚠1 **RECTANGULAR CRT POST**
152 x 203 x 1830 LONG
(6) CRT REQUIRED
SEE ELEVATION DETAIL FOR LOCATIONS
N.T.S.



⚠1 **LATERAL OFFSET BETWEEN THE GUARDRAIL AND THE CULVERT HEADWALL**
N.T.S.

NOTES:

1. THE EXACT POSITION OF THE TRANSITION SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.
⚠1 2. FOR LONG SPAN SYSTEM THE CONTRACTOR SHALL FURNISH RAIL ELEMENTS OF 7620 NOMINAL LENGTHS.
⚠1 3. WHERE SOLID ROCK IS ENCOUNTERED OR WHERE SHOWN ON THE PLANS, THE DIAMETER OF THE HOLES SHALL BE APPROXIMATELY 312, THE BACKFILLING SHALL BE WITH A COHESIONLESS MATERIAL, AND EMBEDMENT DEPTH SHALL BE 457 OR MORE AS DIRECTED BY THE ENGINEER THIS WORKS SHOULD BE PAY UNDER UNCLASSIFIED EXCAVATION PAY ITEMS OR AS ESTABLISHED IN CONTRACT DOCUMENTS.
4. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
5. CRT POSTS SHALL BE MADE OF TIMBER WITH A STRESS GRADE OF AT LEAST 8 MPA.
6. ALL TIMBER SHALL RECEIVE A PRESERVATION TREATMENT IN ACCORDANCE WITH AASHTO M133 AFTER ALL HOLES ARE DRILLED AND END CUTS ARE MADE.
7. TIMBER SHALL BE EITHER ROUGH SAWN (UN-PLANED) OR S4S (SURFACE FOUR SIDE).
⚠1 8. LONG SPAN GUARDRAIL SHALL BE ONLY INSTALLED IN HIGHWAYS WITH SPEED EQUAL OR LESS THAN 35 MPH.



⚠1 **ELEVATION DETAIL**
LONG SPAN GUARDRAIL
N.T.S.

⚠1 * INSTALL ONLY IN HIGHWAYS WITH SPEED EQUAL OR LESS THAN 35 MPH.

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METAL BARRIER
W-BEAM GUARDRAIL
ELEVATION DETAILS

MB-12

JUNE 2018

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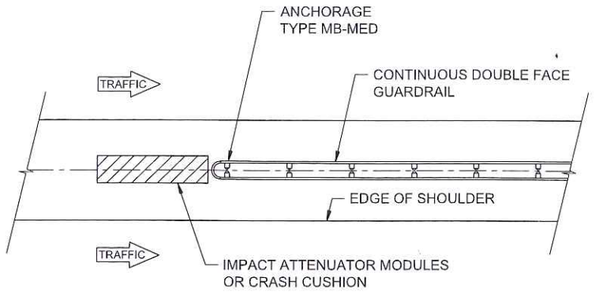
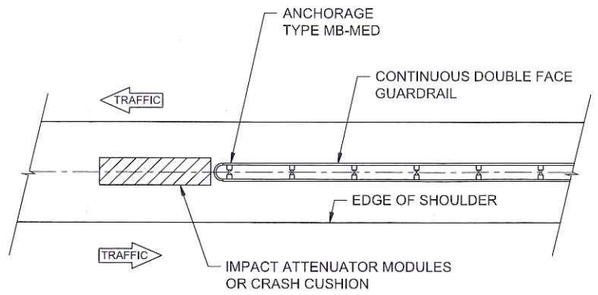
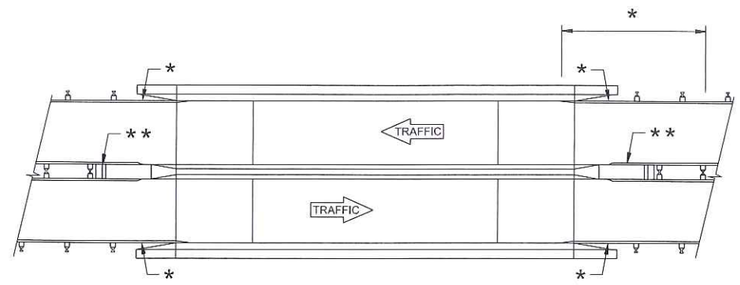


⚠1 **NARROW MEDIAN (LESS THAN 4.2 m) END TREATMENT ONE WAY TRAFFIC**
(SPEED EQUAL OR MORE THAN 45 MPH)
N.T.S.



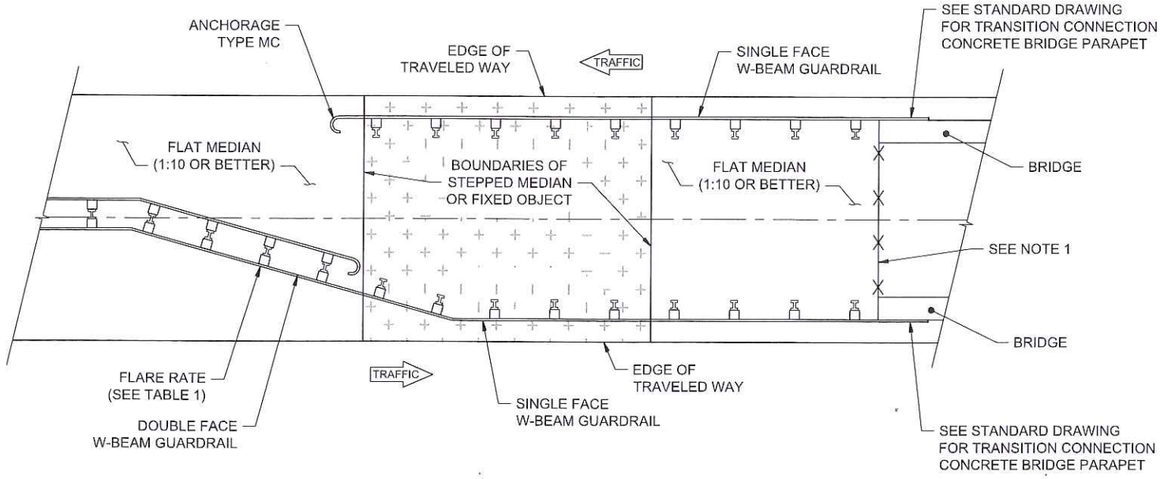
⚠1 **NARROW MEDIAN (LESS THAN 4.2 m.) END TREATMENT TWO WAY TRAFFIC**
(SPEED EQUAL OR MORE THAN 45 MPH)
N.T.S.



⚠1 **TYPICAL INSTALLATION BRIDGE WITH CONCRETE MEDIAN BARRIER**
N.T.S.

* SEE STANDARD DRAWING FOR TRANSITION CONNECTION TO CONCRETE BRIDGE PARAPET

** TRANSITION GUARDRAIL TO CONCRETE MEDIAN BARRIER (SEE DRAWING MB-29)



⚠1 **SPLIT MEDIAN BARRIER PLAN**
N.T.S.

FLARE TABLE 1

SPEED (M.P.H.)	PLARE RATE
35 OR LESS	7:1
40	8:1
45	10:1
50	11:1
55	12:1
60	14:1
65	14:1
70	15:1

USE DESIGN SPEED WHEN INDICATED ON PLANS, OTHERWISE USE POSTED SPEED

NOTES:

1. INSTALL CHAIN LINK FENCE TYPE A AS PLANS, STANDARD DRAWINGS AND SPECIFICATION 607.
2. ⚠1 IF REQUIRED IN PLANS, INSTALL TRAFFIC IMPACT ATTENUATORS MODULES OR CRASH CUSHION ACCORDING TO STANDARD DRAWINGS IA AND SPECIFICATION 620.

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METAL BARRIER
W-BEAM GUARDRAIL
MEDIAN TREATMENT DETAILS

MB-13

JUNE 2018

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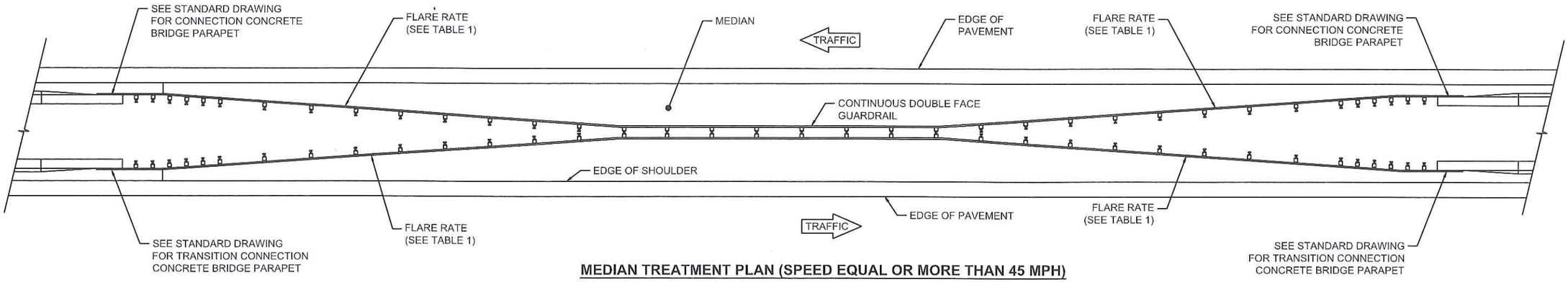


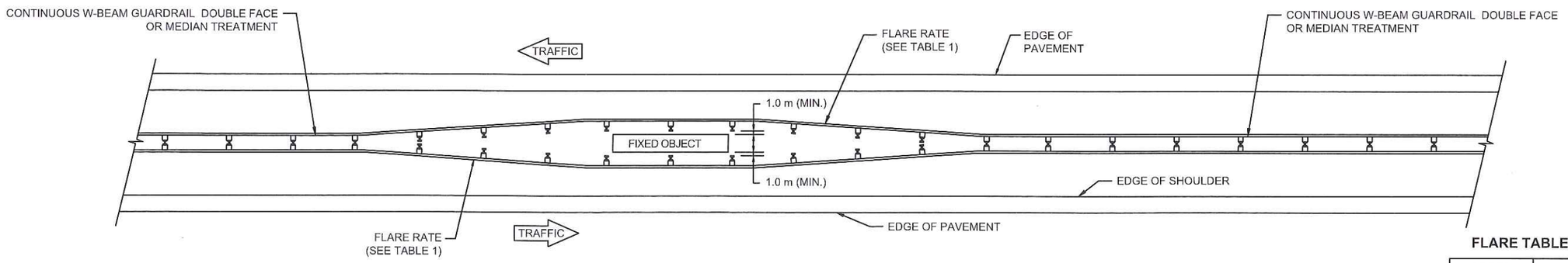
MEDIAN TREATMENT PLAN (SPEED EQUAL OR MORE THAN 45 MPH)

DUAL STRUCTURES RURAL EXPRESSWAY

N.T.S.

NOTE:

DUAL STRUCTURES RURAL EXPRESSWAY DETAIL APPLY TO MEDIANS LESS THAN OF 6.0 m (20') WHERE CONTINUOUS MEDIAN BARRIER IS REQUIRED



MEDIAN TREATMENT AT OBSTRUCTIONS

N.T.S.

FLARE TABLE 1

SPEED (M.P.H.)	PLARE RATE
35 OR LESS	7:1
40	8:1
45	10:1
50	11:1
55	12:1
60	14:1
65	14:1
70	15:1

USE DESIGN SPEED WHEN INDICATED ON PLANS, OTHERWISE USE POSTED SPEED

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

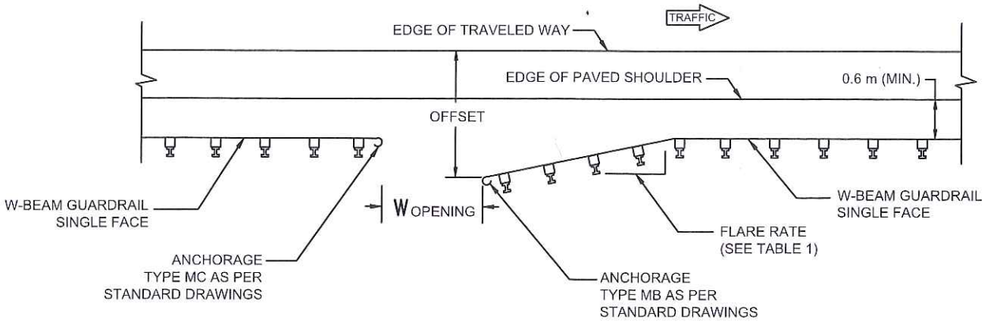
1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: June 22, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

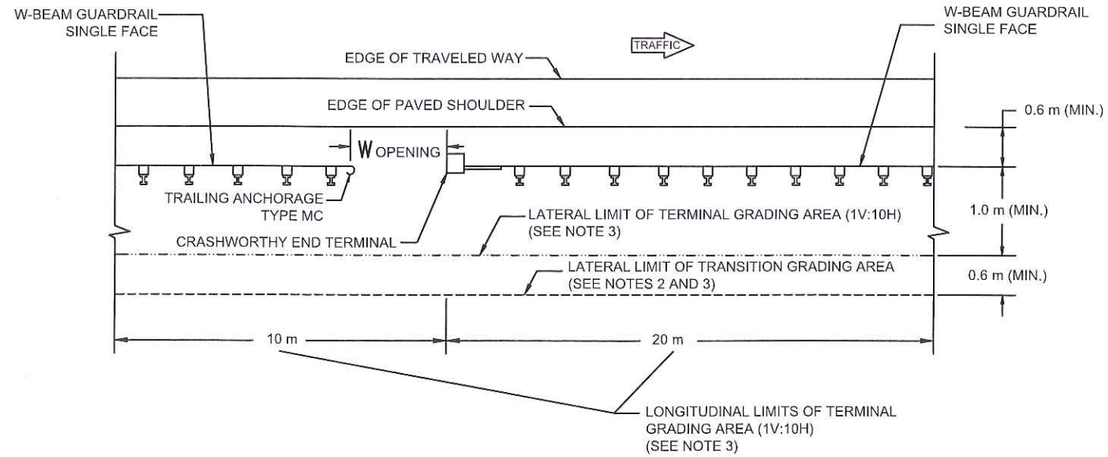
METAL BARRIER
W-BEAM GUARDRAIL
MEDIAN TREATMENT DETAILS

MB-14

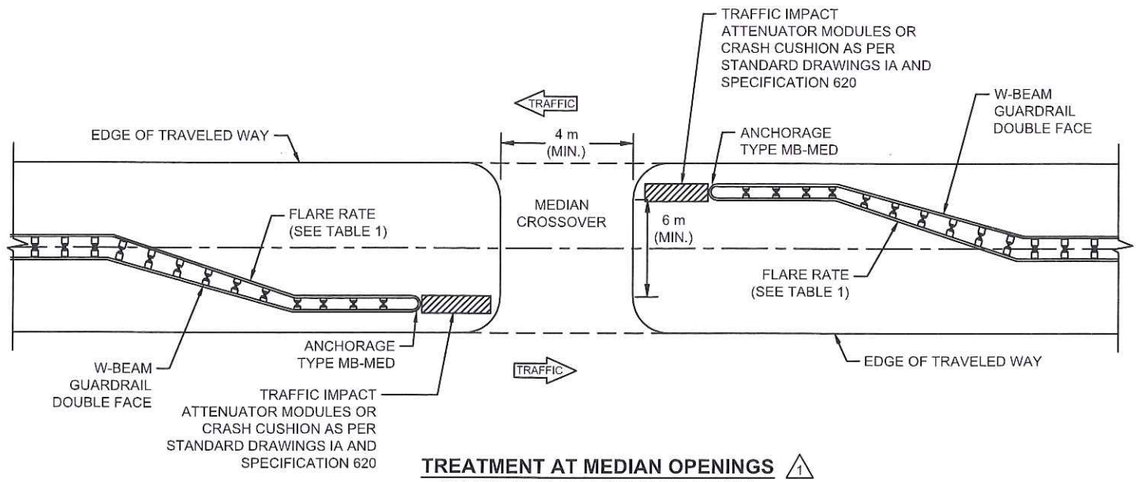
JUNE 2018



⚠1 GUARDRAIL OPENING DETAIL
N.T.S.



⚠1 CRASHWORTHY END TERMINAL OPENING DETAIL
N.T.S.



TREATMENT AT MEDIAN OPENINGS ⚠1
(SPEED EQUAL OR MORE THAN 45 MPH)
N.T.S.

TABLE 1

SPEED (M.P.H.)	OFFSET (METERS)	FLARE RATE
35 OR LESS	2.0	7:1
40	5.5	8:1
45	7.0	10:1
50	8.5	11:1
55	9.0	12:1
60	9.0	14:1
65	9.0	14:1
70	9.0	15:1

USE DESIGN SPEED WHEN INDICATED ON PLANS, OTHERWISE USE POSTED SPEED

TABLE 2

DESCRIPTION	W OPENING
MAJOR MAINTENANCE OR UTILITY ACCESS OPENINGS	6 METERS (MIN.) 9 METERS (MAX.)
MINOR MAINTENANCE OR UTILITY ACCESS OPENINGS	4 METERS (MIN.)

NOTES:

1. THE GUARDRAIL AND TERMINAL INSTALLATIONS SHALL COMPLY WITH ALL REQUIREMENTS OF THE CONTRACT, PLANS, SPECIFICATIONS, AND STANDARD DRAWINGS FOR METAL BARRIER. EXCEPT AS NOTED IN THIS DRAWING.
2. IF LATERAL SPACE IS AVAILABLE, A TRANSITION (0.6m MINIMUM WIDTH) TO THE ADJACENT GRADE SHALL BE PROVIDED AS DIRECTED BY THE ENGINEER.
3. ALL TERMINAL AND TRANSITION GRADING WORKS WITHIN THE LATERAL AND LONGITUDINAL LIMITS INDICATED, WHICH ARE NOT PAID UNDER A SEPARATE PAY ITEM, SHALL BE CONSIDERED AS A SUBSIDIARY OBLIGATION OF THE CONTRACTOR.
4. ⚠1 FOR CRASHWORTHY END TERMINAL SEE STANDARD DRAWING MB-18.

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

⚠1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21 2018	Jaime A. Lafuente González, DESIGN AREA DIRECTOR	JUNE 22 2018	Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
OPENING DETAILS

MB-15

JUNE 2018

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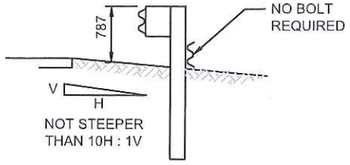
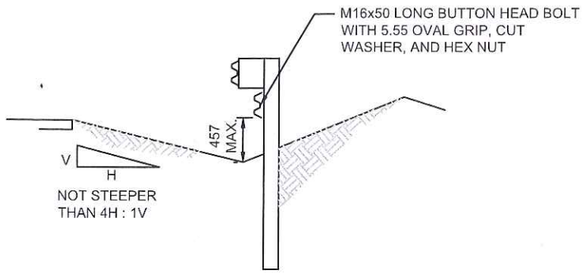
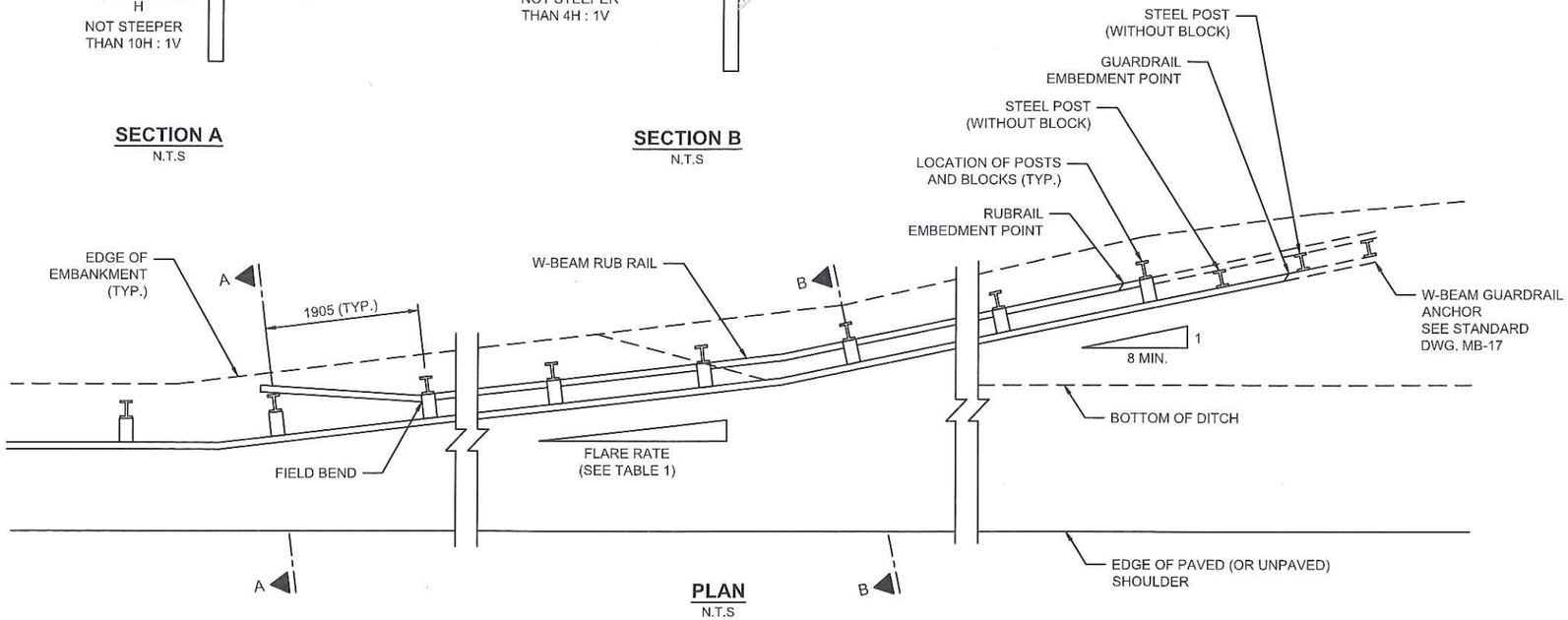


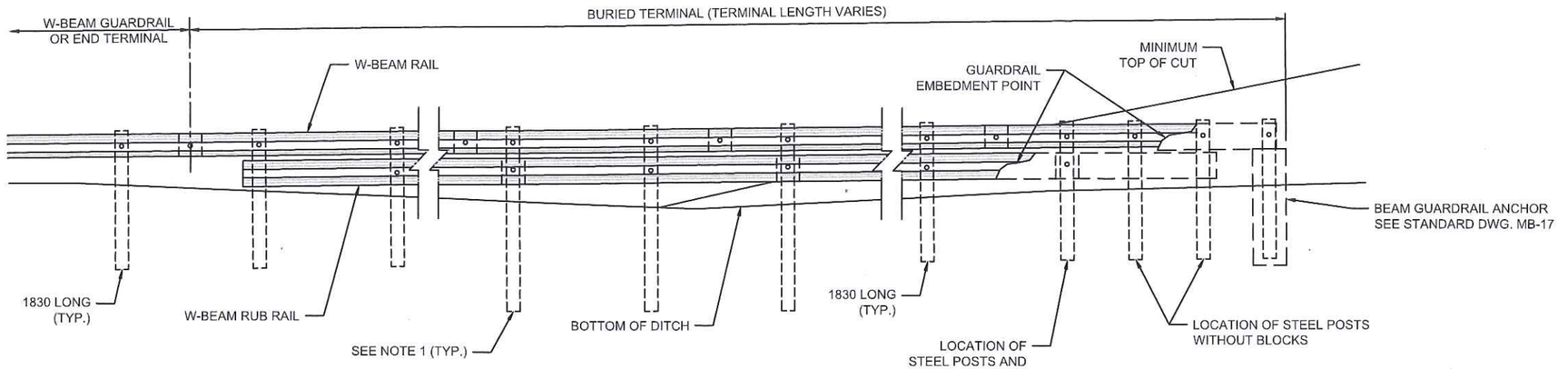
SECTION A
N.T.S



SECTION B
N.T.S



PLAN
N.T.S



ELEVATION
N.T.S

NOTES:

1. POSTS INSTALLED ON SHOULDER SLOPES STEEPER THAN 10H:1V SHALL BE 2439 LONG
2. THE CONCRETE ANCHOR REINFORCEMENT, ALL EXCAVATION DRILLING, EPOXY GROUT AND ALL NECESSARY HARDWARE FOR THE CONSTRUCTION OF TERMINAL MA SHALL BE SUBSIDIARY OBLIGATION OF THE GUARDRAIL ITEM.

TABLE 1

SPEED (M.P.H.)	FLARE RATE
35 OR LESS	7:1
40	8:1
45	10:1
50	11:1
55	12:1
60	14:1
65	14:1
70	15:1

USE DESIGN SPEED WHEN INDICATED ON PLANS, OTHERWISE USE POSTED SPEED

K:\17-0530\C03\PHASE 01\MASH_Metal Barrier\04Standard Drawings\06Final Modified

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

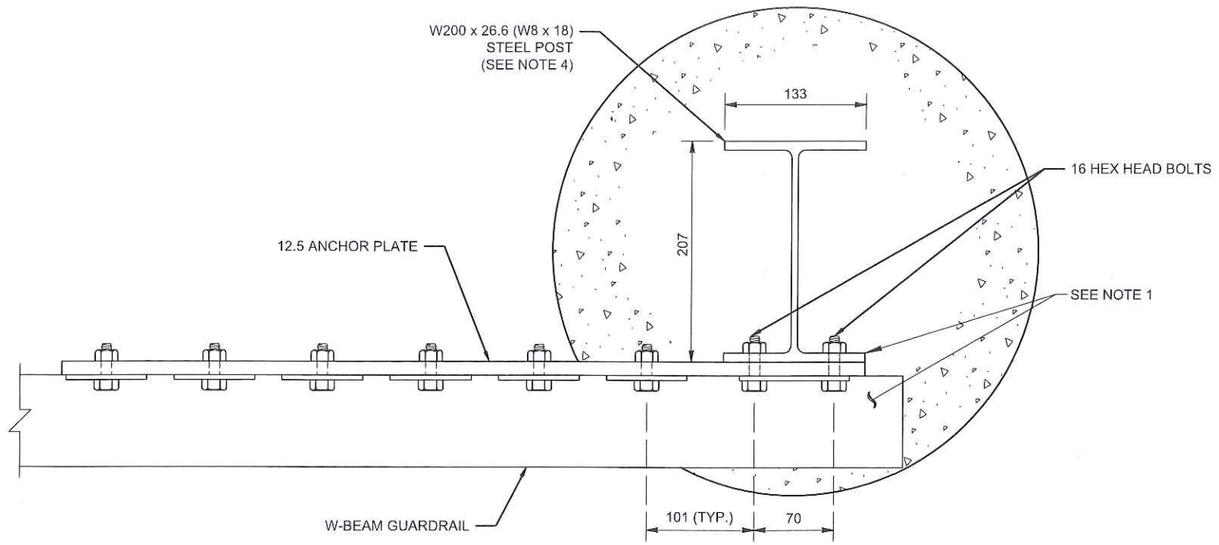
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

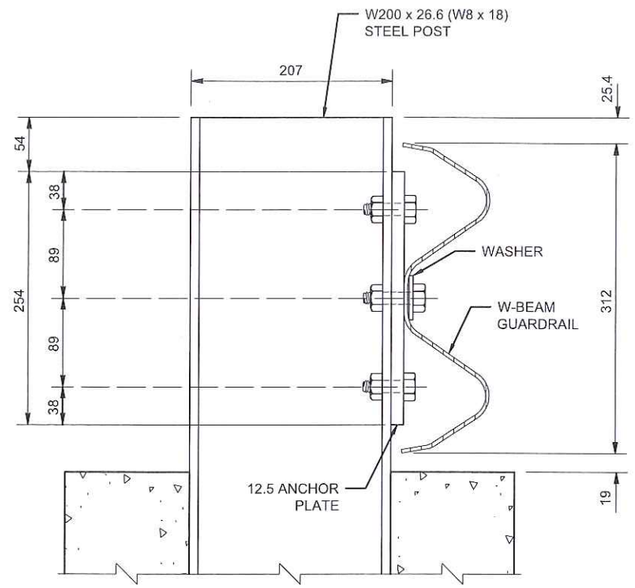
METAL BARRIER
W-BEAM GUARDRAIL
END TERMINALS
TERMINAL TYPE MA

MB-16

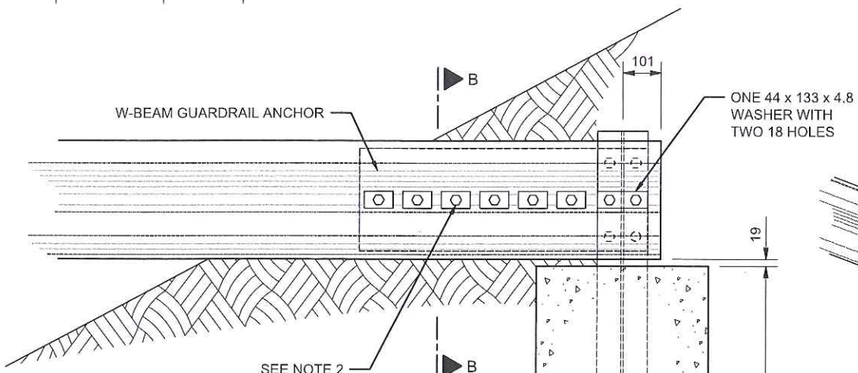
JUNE 2018

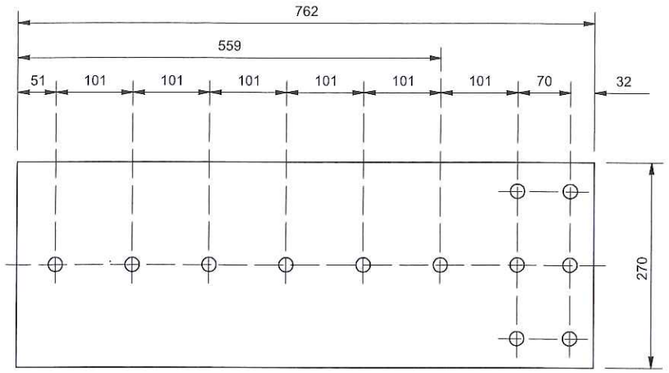


PLAN
N.T.S

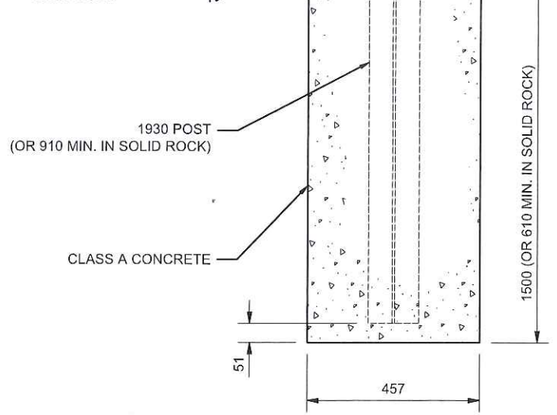


SECTION B
N.T.S

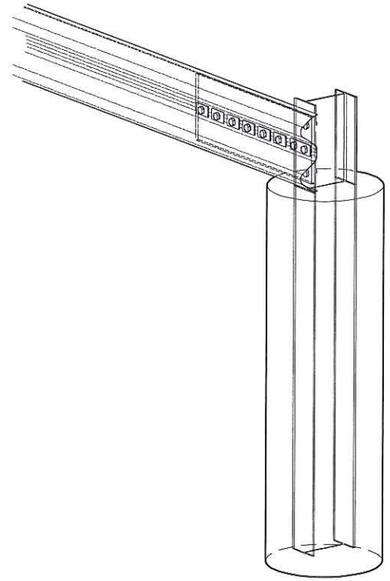




ANCHOR PLATE
N.T.S



ELEVATION
N.T.S



ISOMETRIC
N.T.S

NOTES:

1. RAIL SECTION AND W200 x 26.6 (W8 x 18) STEEL POST SHALL BE FABRICATED TO RECEIVE 16 HEX HEAD BOLTS AS SHOWN.
2. ALL BOLTS SHALL BE HIGH STRENGTH 16 HEX BOLTS WITH ANCHOR RAIL WASHERS.
3. THE ANCHOR PLATE SHALL BE MANUFACTURED ACCORDING TO ASTM A709M GRADE 250 STEEL OR ASTM A36M GRADE 36. AFTER FABRICATION THE ANCHOR PLATE SHALL BE ZINC COATED ACCORDING TO AASHTO M111 (ASTM A123).
4. W200 x 26.6 (W8 x 18) STEEL POST SHALL BE MANUFACTURED ACCORDING TO ASTM A709M GRADE 250 STEEL OR ASTM A36M GRADE 36. THE DIMENSIONS OF THE CROSS SECTION SHALL BE AS DEFINED IN ASTM A6M. AFTER FABRICATION THE W200 x 26.6 (W8 x 18) STEEL POST SHALL BE HOT DIP GALVANIZED ACCORDING TO AASHTO M111 (ASTM A123).

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

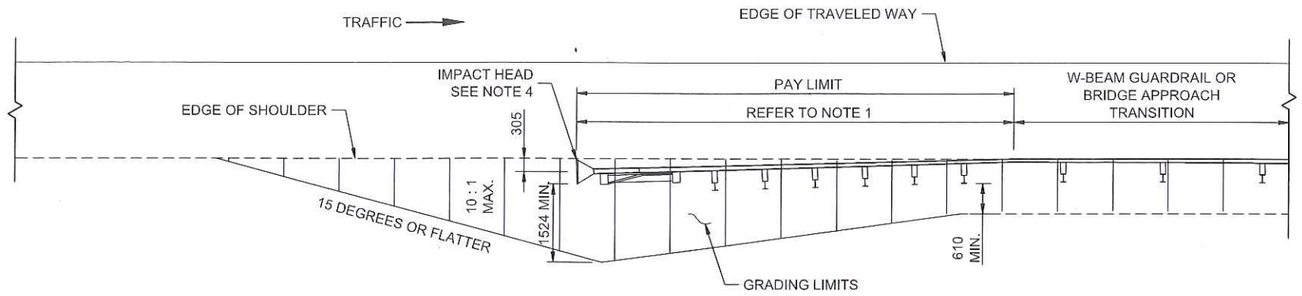
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	June 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

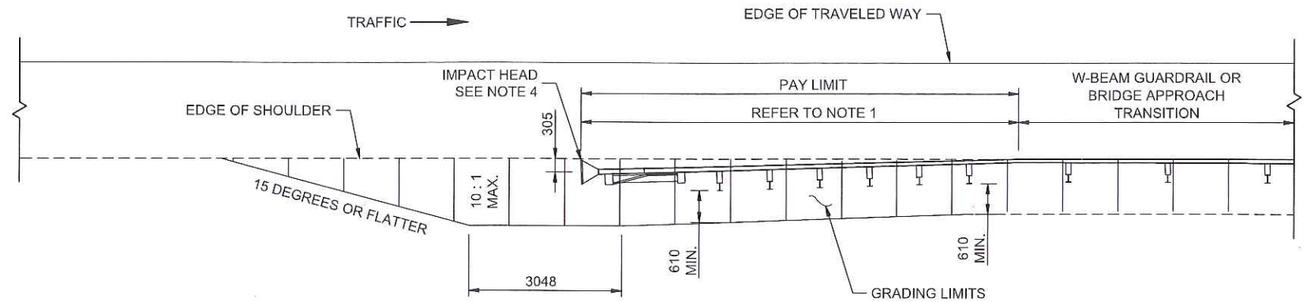
METAL BARRIER
W-BEAM GUARDRAIL
END TERMINALS
TERMINAL TYPE MA

MB-17

JUNE 2018



PREFERRED GRADING LIMITS FOR TANGENT CRASHWORTHY END TERMINALS
N.T.S.



ALTERNATE GRADING LIMITS FOR TANGENT CRASHWORTHY END TERMINALS
N.T.S.

NOTES:

1. INSTALL EITHER A MASH TEST LEVEL 3 (TL-3) OR MASH TEST LEVEL 2 (TL-2) CRASHWORTHY END TERMINAL AS SPECIFIED IN THE PLANS. ONLY MASH W-BEAM GUARDRAIL END TERMINALS INCLUDED IN THE APPROVED LIST AS SHOWN IN THE TABLE I SHALL BE USED.

TABLE I

PROPRIETARY END TERMINAL	MANUFACTURER
MASH Sequential Kinking Terminal (MSKT)	Road Systems, Inc.
SOFTSTOP ® SYSTEM	Trinity Highway Products, LLC
MAX - TENSION ™	Lindsay Transportation Solutions, Inc.

PAY LIMIT FOR THE ABOVE MENTIONED PROPRIETARY END TERMINALS SHOULD BE AS FOLLOWS:

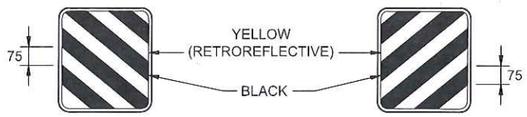
TABLE II

TYPE	SPEED (mph)	TEST LEVEL	PROPRIETARY END TERMINAL	PAY LIMIT (mts)
1	V ≥ 45	3	SOFTSTOP ® SYSTEM	15.5
			MAX - TENSION ™	15.2
			MASH Sequential Kinking Terminal (MSKT)	15.2
2	V < 45	2	SOFTSTOP ® SYSTEM	11.7
			MAX - TENSION ™	7.62
			MASH Sequential Kinking Terminal (MSKT)	7.6

2. THE GRADING LIMITS AND DETAILS SHOWN HEREIN ARE SCHEMATIC ONLY, SHOWING BASIC GEOMETRY FOR END TERMINALS LISTED ON TABLE II.

3. SUPPLIERS AND MANUFACTURERS, WHO MAY WISH TO HAVE THEIR MASH COMPLIANCE W-BEAM GUARDRAIL END TERMINALS INCLUDED IN THE APPROVED LIST, MUST SUBMIT TO THE AUTHORITY FULL DESCRIPTION OF THEIR PRODUCTS, COMPLETE TECHNICAL DATA AND OTHER SUPPORTING DOCUMENTATION.

4. INSTALL OBJECT MARKER SHEETING ON THE APPROACH FACE (NOSE) OF THE END TERMINALS. DEPENDING THE DIRECTION OF TRAFFIC, AS SHOWN ON DETAIL A, APPLY THE OBJECT MARKER TYPE P. MOUNT THE OBJECT MARKER VERTICALLY CENTERED ON THE APPROACH FACE BY ADHESIVE MEANS PER THE MANUFACTURER'S RECOMMENDATIONS. THE APPROACH FACE (NOSE) SHOULD BE ENTIRELY COVERED WITH THE OBJECT MARKER SHEETING AS PER MANUFACTURER'S RECOMMENDATIONS. REFLECTIVE SHEETING SHALL COMPLY WITH ASTM D4956 TYPE III.



TYPE P
(TRAFFIC ON RIGHT SIDE)

TYPE P
(TRAFFIC ON LEFT SIDE)

DETAIL A
N.T.S.

5. ALL WORKS AND MATERIALS NECESSARY TO COMPLETE THE GRADING LIMITS, OBJECT MARKER AND PROPRIETARY END TERMINAL INSTALLATION SHALL BE A SUBSIDIARY OBLIGATION OF THE CONTRACTOR UNDER THE PROPRIETARY TERMINAL PAY ITEM.

6. IF INCLUDED IN CONSTRUCTION PLANS, INSTALL TUBULAR FLEXIBLE DELINEATORS ACCORDING TO SPECIFICATION 621, CONTRACT DOCUMENTS, AND CONSTRUCTION PLANS.

7. THE CONTRACTOR SHALL FOLLOW PLANS, SPECIFICATIONS AND THE MANUFACTURERS RECOMMENDATIONS AND PROCEDURES TO INSTALL PROPRIETARY END TERMINALS.

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

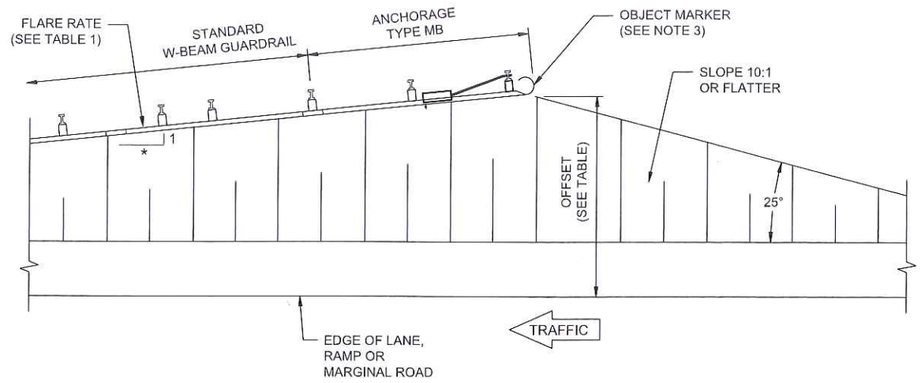
1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: June 21, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
CRASHWORTHY END TERMINALS

1 MB-18

JUNE 2018



ANCHORAGE TYPE MB
N.T.S.

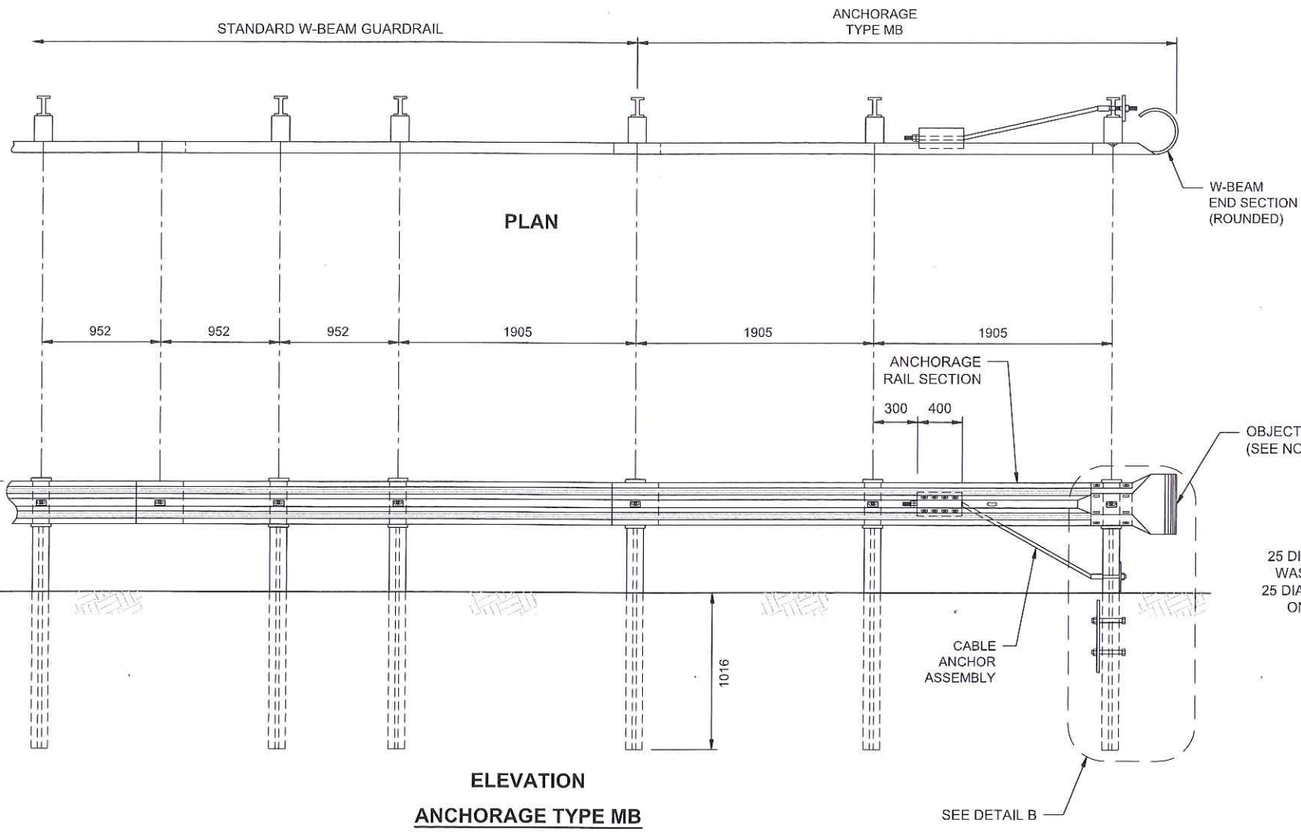
TABLE 1

SPEED (M.P.H.)	OFFSET (METERS)	FLARE RATE
35 OR LESS	2.0	7:1
40	5.5	8:1
45	7.0	10:1
50	8.5	11:1
55	9.0	12:1
60	9.0	14:1
65	9.0	14:1
70	9.0	15:1

USE DESIGN SPEED WHEN INDICATED ON PLANS, OTHERWISE USE POSTED SPEED

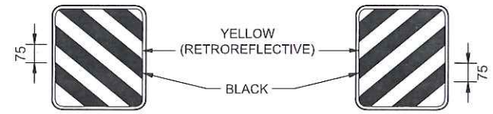
NOTES:

1. THE CONTRACTOR SHALL INSTALL THE ANCHORAGE TYPE MB WITH THE OFFSET AND FLARE AS SHOWN IN THE FLARE TABLE 1.
2. ANCHORAGE TYPE MB SHALL BE SUBSIDIARY OBLIGATION. (1)
3. INSTALL OBJECT MARKER SHEETING ON THE APPROACH FACE (NOSE) OF THE ANCHORAGE. DEPENDING THE DIRECTION OF TRAFFIC, AS SHOWN ON DETAIL A, APPLY THE OBJECT MARKER TYPE P. MOUNT THE OBJECT MARKER VERTICALLY CENTERED ON THE APPROACH FACE BY ADHESIVE MEANS PER THE MANUFACTURER'S RECOMMENDATIONS. THE APPROACH FACE (NOSE) SHOULD BE ENTIRELY COVERED WITH THE OBJECT MARKER SHEETING. REFLECTIVE SHEETING SHALL COMPLY WITH ASTM D4956 TYPE III.
4. INSTALL TUBULAR FLEXIBLE DELINEATORS ACCORDING TO SPECIFICATION 621, CONTRACT DOCUMENTS, AND CONSTRUCTION PLANS.
5. W BEAM END SECTION (ROUNDED), CABLE ANCHOR ASSEMBLY, ANCHOR BRACKET, ANCHORAGE CABLE BEARING PLATE, AND ANCHOR BRACKET END PLATE SHALL BE AS SHOWN IN STANDARD DRAWING MB-22. (1)



ELEVATION

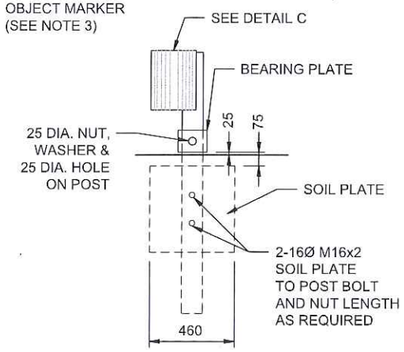
ANCHORAGE TYPE MB
N.T.S.



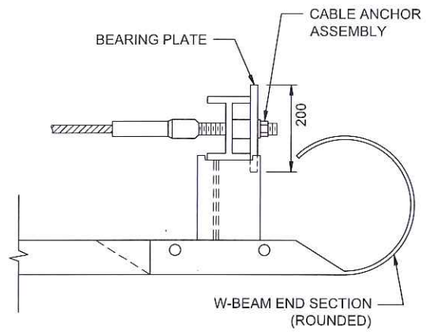
TYPE P
(TRAFFIC ON RIGHT SIDE)

TYPE P
(TRAFFIC ON LEFT SIDE)

DETAIL A
N.T.S.



DETAIL B
N.T.S.



DETAIL C
N.T.S.

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

DATE: JUNE 21, 2018

(1) STANDARD DRAWING APPROVAL

RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR

DATE: June 22, 2018

APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
ANCHORAGE TYPE MB

(1) MB-19

JUNE 2018

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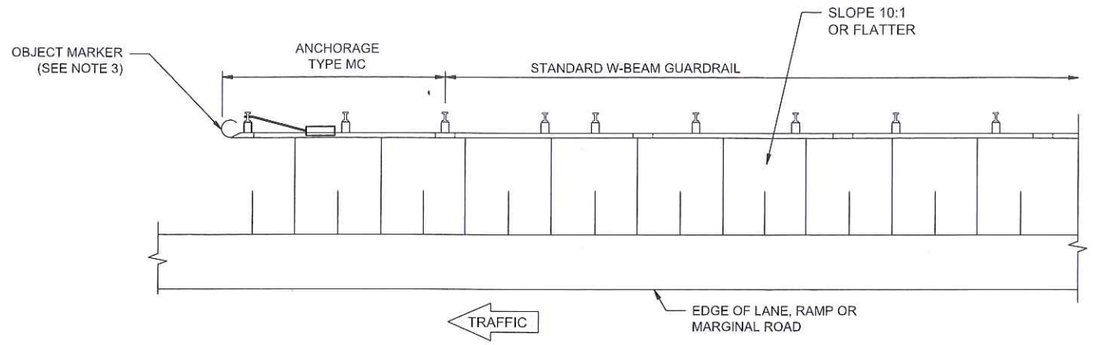
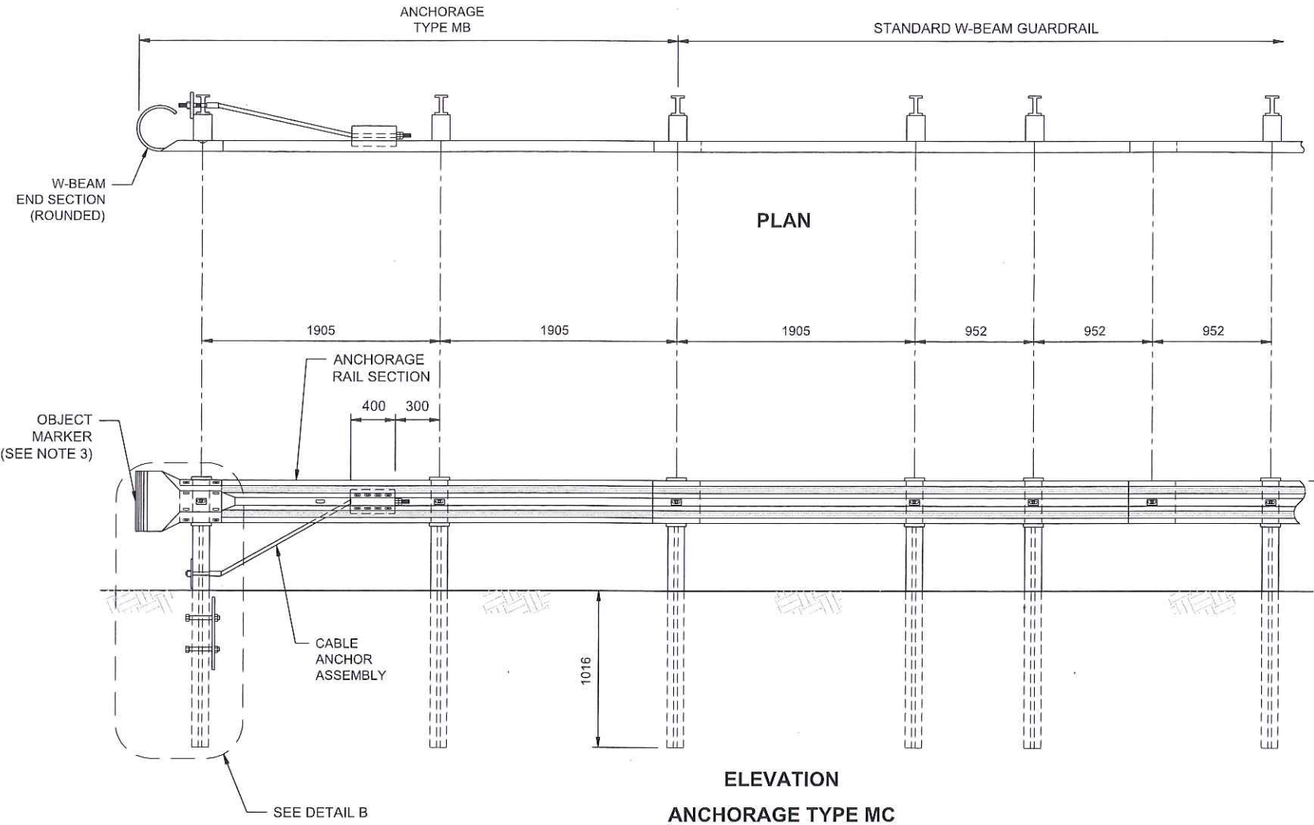


ANCHORAGE TYPE MC
N.T.S.

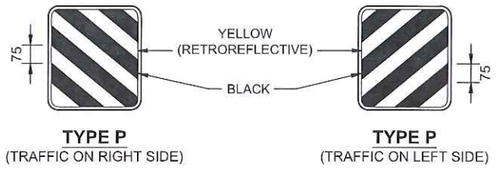


ELEVATION

ANCHORAGE TYPE MC
N.T.S.

NOTES:

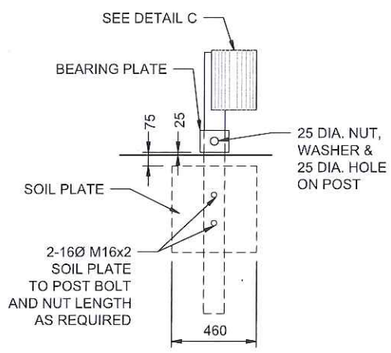
1. INSTALL ANCHORAGE TYPE MC WHEN NO PROBABILITY OF IMPACT FROM OPPOSITE TRAFFIC DIRECTION.
2. INSTALL OBJECT MARKER SHEETING ON THE APPROACH FACE (NOSE) OF THE ANCHORAGE. DEPENDING THE DIRECTION OF TRAFFIC, AS SHOWN ON DETAIL A, APPLY THE OBJECT MARKER TYPE P. MOUNT THE OBJECT MARKER VERTICALLY CENTERED ON THE APPROACH FACE BY ADHESIVE MEANS PER THE MANUFACTURER'S RECOMMENDATIONS. THE APPROACH FACE (NOSE) SHOULD BE ENTIRELY COVERED WITH THE OBJECT MARKER SHEETING. REFLECTIVE SHEETING SHALL COMPLY WITH ASTM D4956 TYPE III.
3. ANCHORAGE TYPE MC SHALL BE SUBSIDIARY OBLIGATION.
1. W BEAM END SECTION (ROUNDED), CABLE ANCHOR ASSEMBLY, ANCHOR BRACKET, ANCHORAGE CABLE BEARING PLATE, AND ANCHOR BRACKET END PLATE SHALL BE AS SHOWN IN STANDARD DRAWING MB-22.



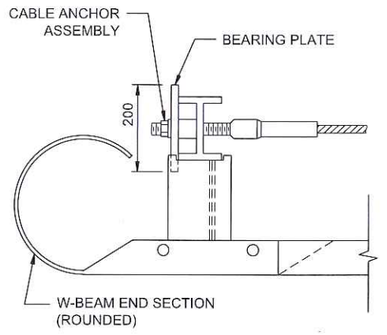
TYPE P
(TRAFFIC ON RIGHT SIDE)

TYPE P
(TRAFFIC ON LEFT SIDE)

DETAIL A
N.T.S.



DETAIL B
N.T.S.



DETAIL C
N.T.S.

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: JUNE 29, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
ANCHORAGE TYPE MC

1 MB-20
JUNE 2018

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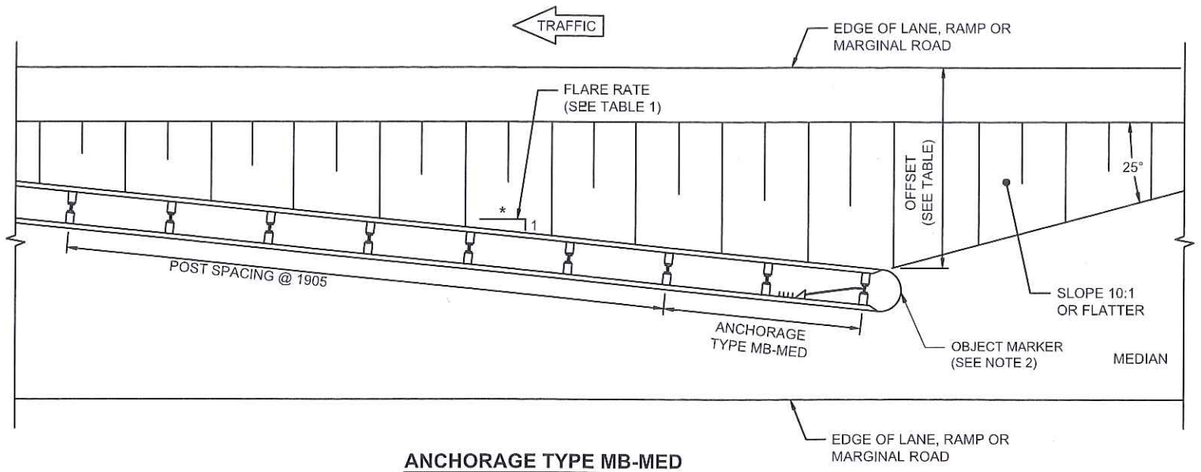


ANCHORAGE TYPE MB-MED
N.T.S.

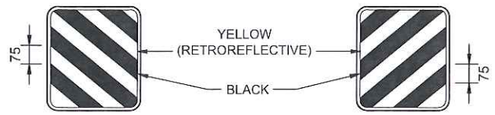
TABLE 1

SPEED (M.P.H.)	OFFSET (METERS)	FLARE RATE
35 OR LESS	2.0	7:1
40	5.5	8:1
45	7.0	10:1
50	8.5	11:1
55	9.0	12:1
60	9.0	14:1
65	9.0	14:1
70	9.0	15:1

USE DESIGN SPEED WHEN INDICATED ON PLANS, OTHERWISE USE POSTED SPEED

NOTES:

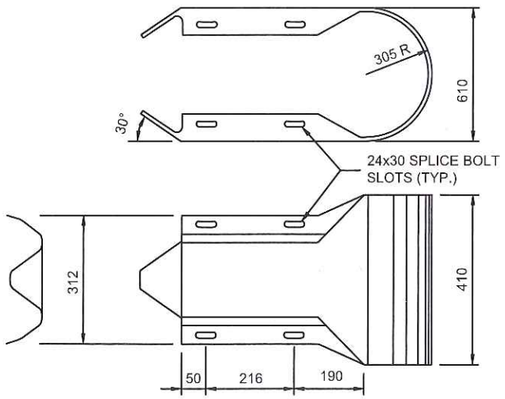
1. ALL NECESSARY HARDWARE FOR THE CONSTRUCTION OF ANCHORAGE MB-MED SHALL BE SUBSIDIARY OBLIGATION.
2. INSTALL OBJECT MARKER SHEETING ON THE APPROACH FACE (NOSE) OF THE ANCHORAGE. DEPENDING THE DIRECTION OF TRAFFIC, AS SHOWN ON DETAIL A, APPLY THE OBJECT MARKER TYPE P. MOUNT THE OBJECT MARKER VERTICALLY CENTERED ON THE APPROACH FACE BY ADHESIVE MEANS PER THE MANUFACTURER'S RECOMMENDATIONS. THE APPROACH FACE (NOSE) SHOULD BE ENTIRELY COVERED WITH THE OBJECT MARKER SHEETING. REFLECTIVE SHEETING SHALL COMPLY WITH ASTM D4956 TYPE III.
3. W BEAM END SECTION (ROUNDED), CABLE ANCHOR ASSEMBLY, ANCHOR BRACKET, ANCHORAGE CABLE BEARING PLATE, AND ANCHOR BRACKET END PLATE SHALL BE AS SHOWN IN STANDARD DRAWING MB-22.

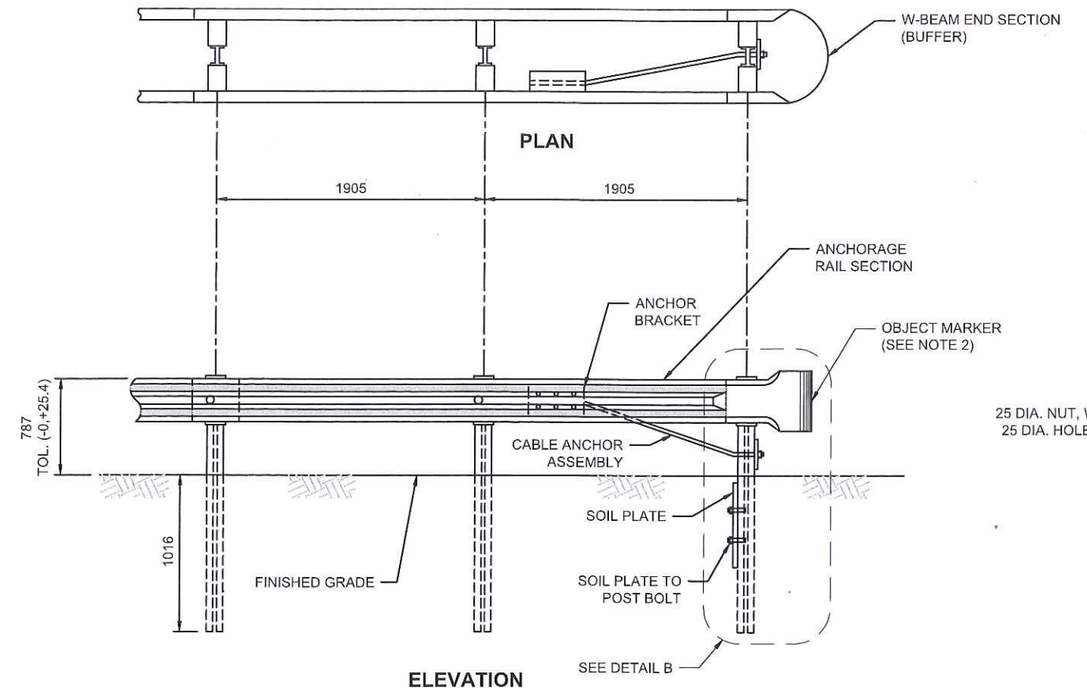


TYPE P
(TRAFFIC ON RIGHT SIDE)

TYPE P
(TRAFFIC ON LEFT SIDE)

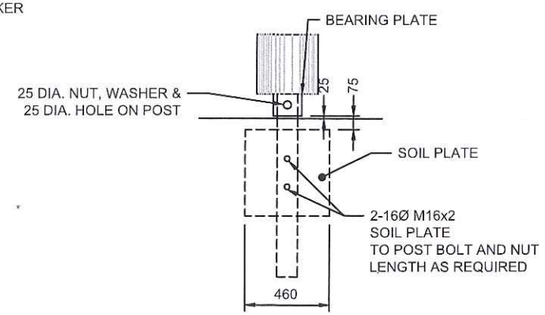
DETAIL A
N.T.S.





ELEVATION

ANCHORAGE TYPE MB-MED
N.T.S.



DETAIL B
N.T.S.

I. SPECIFICATIONS

A. BUFFERED W-BEAM END SECTION SHALL CONFORM TO THE CURRENT REQUIREMENTS OF AASHTO M180, CLASS A. CORROSION PROTECTION SHALL BE TYPE II (ZINC-COATED).

B. THE CROSS-SECTIONAL DIMENSIONS FOR THIS PART SHALL FIT OVER THE RAIL ELEMENT.

C. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE, AND ACCEPTED MANUFACTURING PRACTICES.

W-BEAM END SECTION (BUFFER)
N.T.S.

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

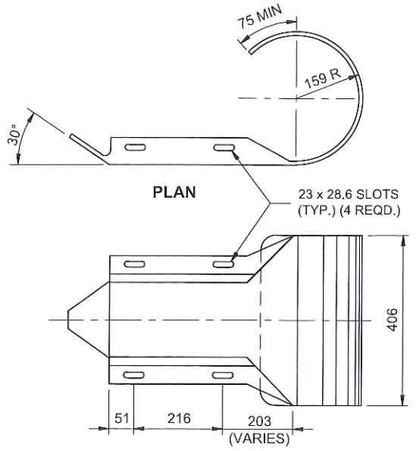
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González, DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
ANCHORAGE TYPE MB-MED

1 MB-21

JUNE 2018



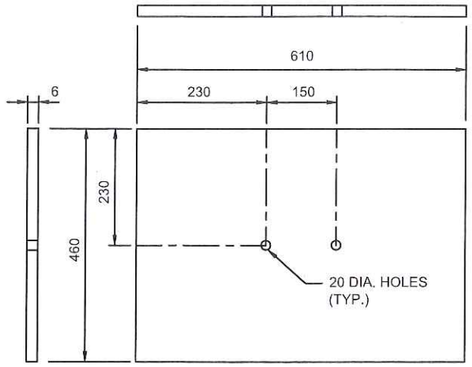
I. SPECIFICATIONS

A. END SECTION SHALL CONFORM TO THE CURRENT REQUIREMENTS OF AASHTO M180, CLASS A. CORROSION PROTECTION SHALL BE TYPE II (ZINC-COATED).

B. THE CROSS-SECTIONAL DIMENSIONS FOR THIS PART SHALL FIT OVER THE RAIL ELEMENT.

W-BEAM END SECTION (ROUNDED)

N.T.S.



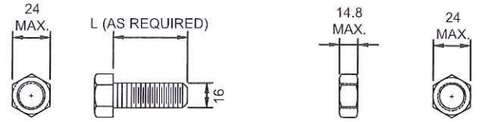
I. SPECIFICATIONS

A. THE SOIL PLATE SHALL BE MANUFACTURED USING AASHTO M270M (ASTM A709M) GRADE 250 STEEL. AFTER ALL PUNCHING, DRILLING, STAMPING AND WELDING IS COMPLETE, THE SECTION SHALL BE ZINC-COATED AFTER FABRICATION ACCORDING TO AASHTO M111 (ASTM A123).

B. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.

SOIL PLATE

N.T.S.



I. SPECIFICATIONS

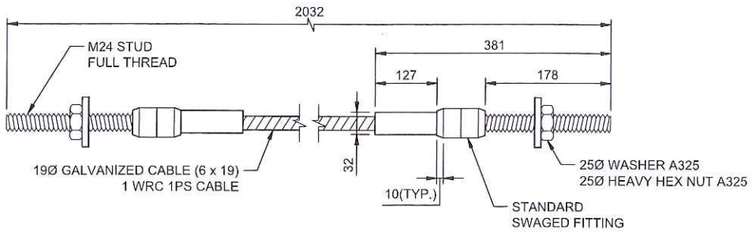
A. CLASS 4.6 BOLTS SHALL BE MANUFACTURED ACCORDING TO THE GEOMETRIC SPECIFICATIONS INCLUDED IN ANSI B18.2.3.5M. THREADS SHALL CONFORM TO ANSI B1.13M FOR CLASS 6G THREADS. MATERIAL FOR CORROSION RESISTANT BOLTS SHALL CONFORM TO ASTM F568 FOR CLASS 8.8.3 (830 MPA TENSILE STRENGTH AND 660 MPA YIELD STRENGTH). BOLT HEADS SHALL BE MARKED AS SPECIFIED IN ASTM F568 SECTION 9 WITH THE MANUFACTURER'S IDENTIFICATION SYMBOL AND THE SYMBOL "8.8.3" CORROSION RESISTANT STEEL. ASTM F569 CLASS 4.6 BOLTS ARE ESSENTIALLY EQUIVALENT TO SAE J429 GRADE 2 BOLTS.

B. ZINC-COATED NUTS SHALL BE MANUFACTURED ACCORDING TO THE DIMENSIONS AND TOLERANCES IN ANSI B18.2.4.1M FOR METRIC STYLE 1 HEX NUTS (SHOW IN DRAWING). CORROSION RESISTANT NUTS SHALL BE MANUFACTURED ACCORDING TO THE DIMENSIONS AND TOLERANCES IN ANSI B18.2.4.6M FOR HEAVY HEX NUTS (NOT SHOWN IN DRAWING). THREADS SHALL CONFORM TO ANSI B1.13M FOR CLASS 6H. CORROSION RESISTANT NUTS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M291M (ASTM A563M) FOR CLASS 8S3 NUTS.

C. ZINC-COATED BOLTS AND NUTS SHALL BE TREATED ACCORDING TO EITHER AASHTO M232 (ASTM A153) OR AASHTO M298 (ASTM B695) FOR CLASS 50.

16 DIA. SOIL PLATE TO POST BOLT AND NUT

N.T.S.



I. SPECIFICATIONS

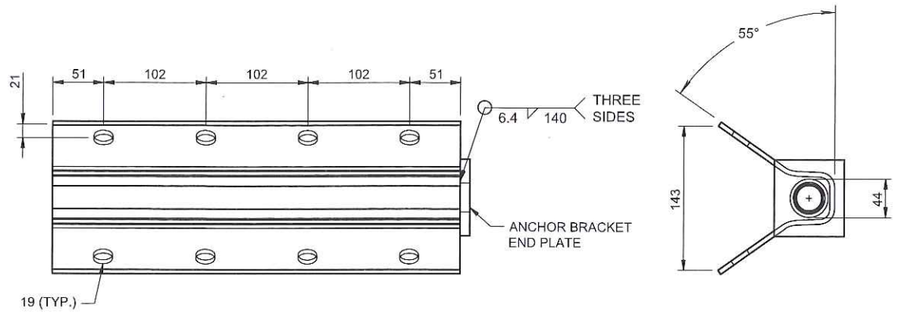
A. THREADS FOR THE STUD SHALL BE MANUFATURED ACCORDING TO ANSI B1.13M M24x3 CLASS 6g PITCH THREADS. THE CABLE SHALL BE SWAGED INTO THE FITTING. THE STUD SHALL CONFORM TO ASTM F566 CLASS 8.8 MATERIAL AND SHALL BE ZINC-COATED ACCORDING TO EITHER AASHTO M232 (ASTM A153) FOR CLASS C OR AASHTO M289 (ASTM B695) FOR CLASS 50. THE 10 mm SLOT FOR THE LOCKING PIN SHALL BE MILLED INTO THE STUD END PRIOR TO THE APPLICATION OF THE ZINC COATING.

B. THE SWAGED FITTING SHALL BE MACHINED FROM HOT-ROLLED CARBON STEEL CONFORMING TO THE REQUIREMENTS OF ASTM A576, GRADE 1035 AND ZINC-COATED ACCORDING TO AASHTO M111 (ASTM A123) BEFORE SWAGING. THE MATERIAL SHALL BE ANNEALED SUITABLY FOR COLD SWAGING. A LOCK PIN HOLE TO ACCOMMODATE A 6mm PLATED SPRING-STEEL PIN SHALL BE DRILLED THROUGH THE HEAD OF THE SWAGED FITTING TO RETAIN THE STUD IN THE PROPER POSITION.

C. THE WIRE ROPE SHALL BE 19mm DIAMETER 6x19 WIRE STRAND CORE OR INDEPENDENT WIRE ROPE CORE (IWRC), ZINC-COATED, RIGHT REGULAR LAY WIRE ROPE CONFORMING TO AASHTO M30. THE WIRE ROPE STEEL SHALL BE IMPROVED STEEL WITH A MINIMUM BREAKING STRENGTH OF 190 kN. THE SWAGED FITTING, STUD AND NUT SHALL DEVELOP THE BREAKING STRENGTH OF THE WIRE ROPE.

CABLE ANCHOR ASSEMBLY

N.T.S.

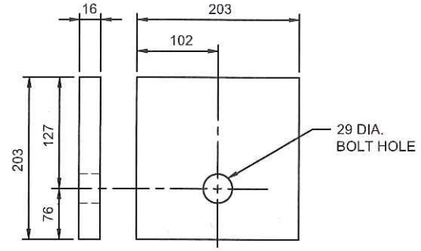


NOTES:

1. END SECTION BOLTS AND NUTS HAVE THE SAME MATERIAL REQUIREMENTS AS SPLICE BOLTS.
2. FOUNDATION TUBE BOLTS ARE 22 DIAMETER ASTM A307 HEX HEAD BOLT. FOUNDATION TUBE BOLTS REQUIRE ASTM A563 A NUT AND TWO ASTM F844 22 DIAMETER FLAT WASHERS. INSTALL ONE WASHER UNDER BOLT HEAD AND ONE WASHER UNDER NUT.
3. ANCHOR BRACKET AND GROUND STRUT BOLTS ARE A 16 DIAMETER ASTM A307 HEX HEAD BOLT. ANCHOR BRACKET BOLTS REQUIRE ASTM A 563 A NUT AND TWO ASTM F844 5/8" DIAMETER FLAT WASHERS. INSTALL ONE WASHER UNDER BOLT HEAD AND ONE WASHER UNDER NUT.
4. W-BEAM END SECTION ROUNDED HAS THE SAME MATERIAL PROPERTIES AS STANDARD STEEL RAIL.
5. TOP OF FOUNDATION TUBE SHALL BE NO MORE THAN 76 ABOVE FINISHED GROUND.

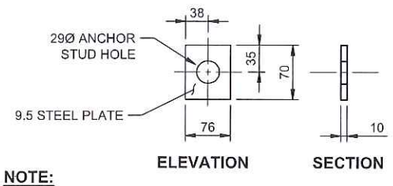
ANCHOR BRACKET DETAIL

N.T.S.



ANCHORAGE CABLE BEARING PLATE

N.T.S.



NOTE:

1. BEARING PLATE SHALL BE FORMED FROM AASHTO M27M (ASTM A709M) GRADE 250 STEEL PLATE AND ZINC-COATED AFTER FABRICATION ACCORDING TO AASHTO M111 (ASTM123). NO PUNCHING, DRILLING OR CUTTING IS PERMITTED AFTER THE PLATE IS ZINC-COATED.

ANCHOR BRACKET BEARING PLATE END PLATE

N.T.S

K:\17-0530\C03\PHASE 01\MASH_Metal Barrier\04Standard Drawings\06Final Modified

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

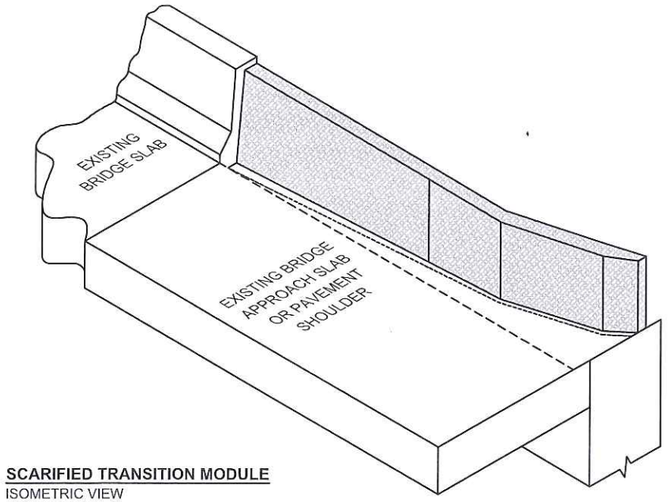
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

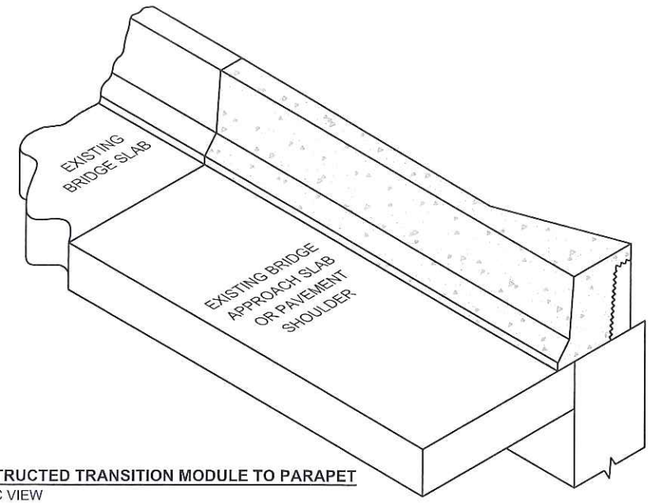
METAL BARRIER
W-BEAM GUARDRAIL
ANCHORAGE HARDWARE

1 MB-22

JUNE 2018



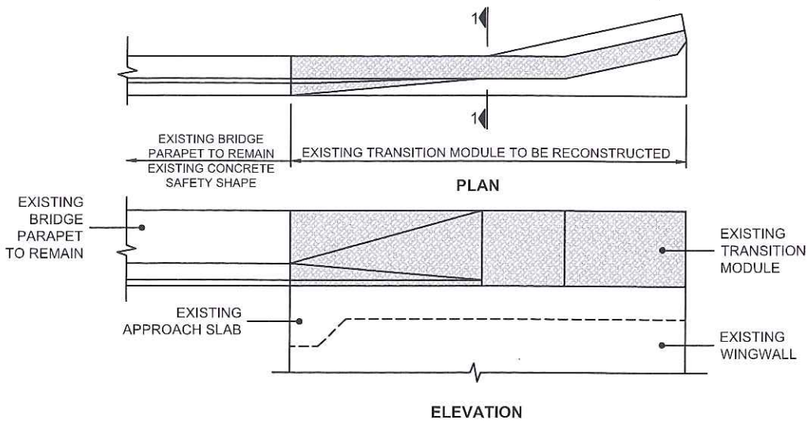
SCARIFIED TRANSITION MODULE
ISOMETRIC VIEW



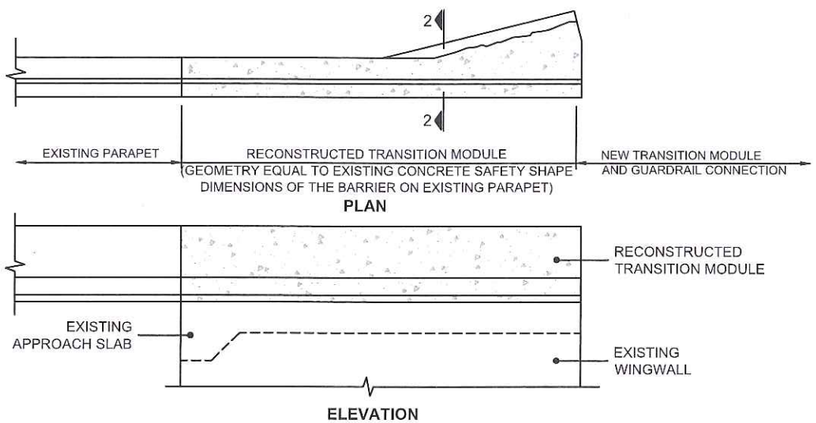
RECONSTRUCTED TRANSITION MODULE TO PARAPET
ISOMETRIC VIEW

NOTES:

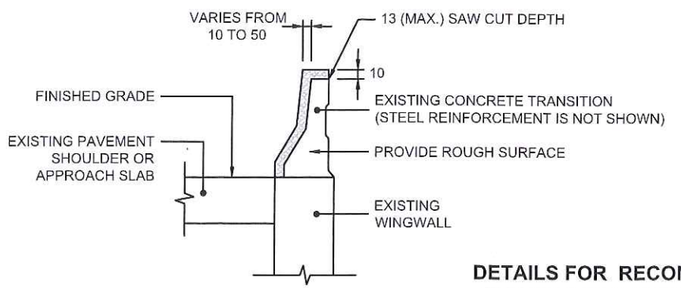
1. THE STRUCTURAL BONDING AGENT SHALL BE AN EPOXY-CEMENTITIOUS BONDING AGENT AND AN ANTI-CORROSION COATING FOR REINFORCEMENT. THE STRUCTURAL BONDING AGENT SHALL HAVE MINIMUM BOND STRENGTH (ASTM C 882) OF 2,500 PSI AT 24 HOURS OPEN TIME, A MINIMUM COMPRESSIVE STRENGTH (ASTM C 109) OF 8,000 PSI AT 28 DAYS AND A MINIMUM POT LIFE OF 60 MINUTES.
2. THE EXISTING REINFORCEMENT SHALL NOT BE DAMAGED AND IT SHALL REMAIN DURING THE SCARIFICATION OF CONCRETE.
3. FOR SCARIFYING THE EXISTING TRANSITION MODULE, THE CONTRACTOR SHALL USE A 15 LBS. MAX. CHIPPING PNEUMATICALLY POWERED.
4. THE RECONSTRUCTION OF TRANSITION MODULE SHALL USE CLASS IV (GENERAL USE) CONCRETE AS PER SPECIFICATION 934.
5. THE NEW STEEL REINFORCEMENT SHALL MEET THE REQUIREMENTS OF STANDARD SPECIFICATION 602- "REINFORCING STEEL", EXCEPT THE ARTICLE 602-5.
6. THE EPOXY RESIN ADHESIVE FOR ANCHORS SHALL MEET THE REQUIREMENTS OF AASHTO M235 AND ASTM C881, TYPES IV AND V, CLASS C.
7. THE CLASS "A" CONCRETE, NEW STEEL REINFORCEMENT, TRAFFIC PAINT, EPOXY RESIN ADHESIVE FOR ANCHORS, AND STRUCTURAL BONDING AGENT SHALL BE CONSIDERED A SUBSIDIARY OBLIGATION BY THE CONTRACTOR AND ITS COST INCLUDED IN THE "BRIDGE TRANSITION UPGRADE" PAY ITEM.



SCARIFIED TRANSITION MODULE DETAILS
N.T.S.

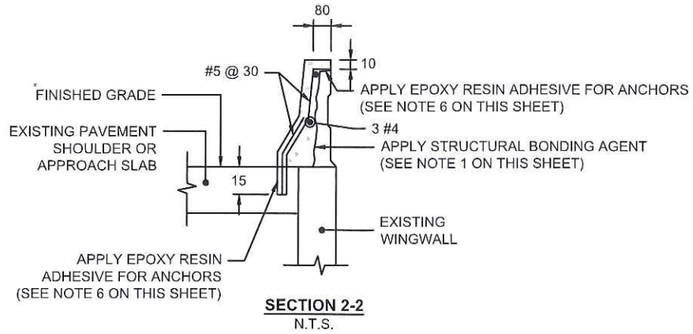


RECONSTRUCTED TRANSITION MODULE DETAILS
N.T.S.



SECTION 1-1
N.T.S.

DETAILS FOR RECONSTRUCTION OF EXISTING TRANSITION MODULE TO PARAPET IN APPROACH SLAB



SECTION 2-2
N.T.S.

LEGEND:

- TO BE SCARIFIED
- TO BE EXCAVATED
- NEW CONCRETE CLASS A

K:\17-0530\C03\PHASE 01\MASH_Metal Barrier\04Standard Drawings\06Final Modified

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

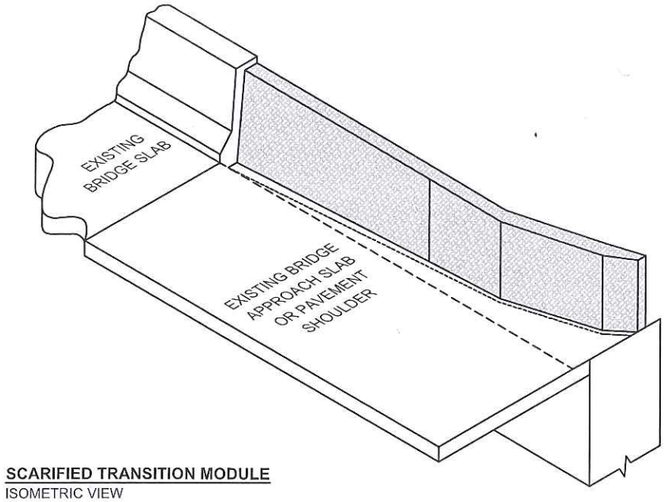
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González, DESIGN AREA DIRECTOR	June 22, 2018	Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

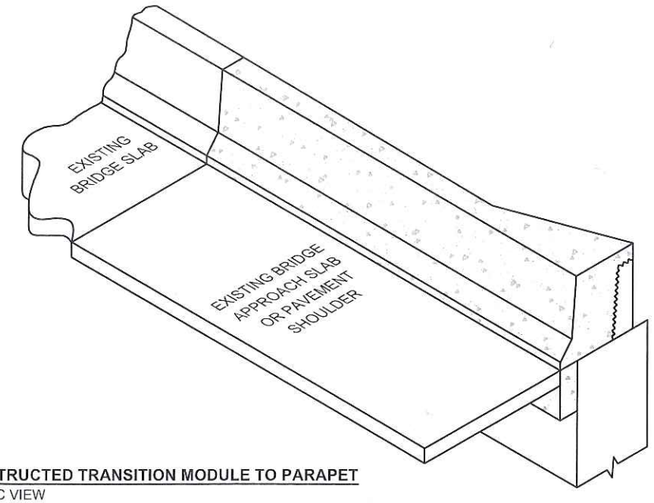
METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTIONS DETAILS
BRIDGE TRANSITION UPGRADE
APPROACH SLAB

MB-23

JUNE 2018



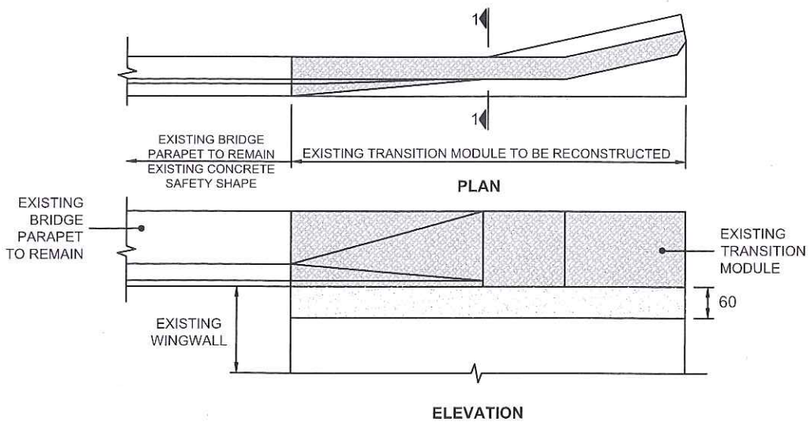
SCARIFIED TRANSITION MODULE
ISOMETRIC VIEW



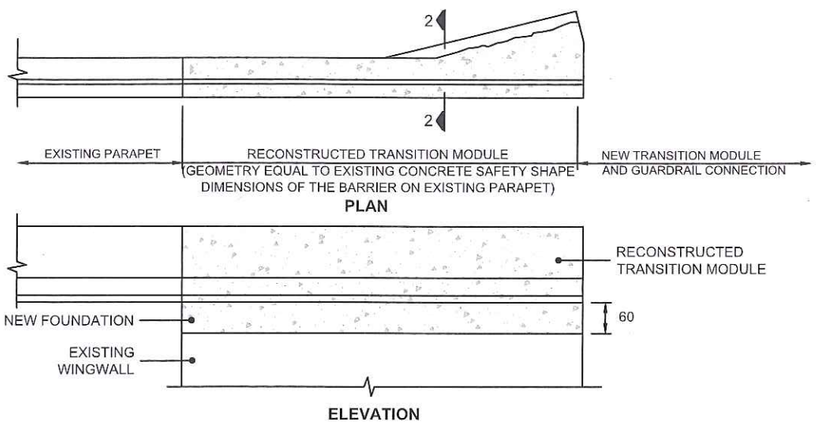
RECONSTRUCTED TRANSITION MODULE TO PARAPET
ISOMETRIC VIEW

NOTES:

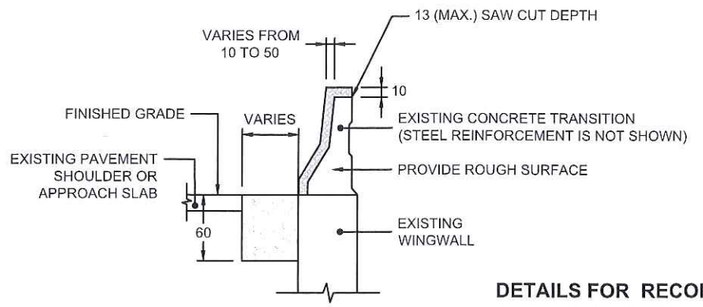
1. THE STRUCTURAL BONDING AGENT SHALL BE AN EPOXY-CEMENTITIOUS BONDING AGENT AND AN ANTI-CORROSION COATING FOR REINFORCEMENT. THE STRUCTURAL BONDING AGENT SHALL HAVE MINIMUM BOND STRENGTH (ASTM C 882) OF 2,500 PSI AT 24 HOURS OPEN TIME, A MINIMUM COMPRESSIVE STRENGTH (ASTM C 109) OF 8,000 PSI AT 28 DAYS AND A MINIMUM POT LIFE OF 60 MINUTES.
2. THE EXISTING REINFORCEMENT SHALL NOT BE DAMAGED AND IT SHALL REMAIN DURING THE SCARIFICATION OF CONCRETE.
3. FOR SCARIFYING THE EXISTING TRANSITION MODULE, THE CONTRACTOR SHALL USE A 15 LBS. MAX. CHIPPING PNEUMATICALLY POWERED.
4. THE RECONSTRUCTION OF TRANSITION MODULE SHALL USE CLASS IV (GENERAL USE) CONCRETE AS PER SPECIFICATION 934.
5. THE NEW STEEL REINFORCEMENT SHALL MEET THE REQUIREMENTS OF STANDARD SPECIFICATION 602- "REINFORCING STEEL", EXCEPT THE ARTICLE 602-5.
6. THE EPOXY RESIN ADHESIVE FOR ANCHORS SHALL MEET THE REQUIREMENTS OF AASHTO M235 AND ASTM C881, TYPES IV AND V, CLASS C.
7. THE CLASS "A" CONCRETE, NEW STEEL REINFORCEMENT, TRAFFIC PAINT, EPOXY RESIN ADHESIVE FOR ANCHORS, AND STRUCTURAL BONDING AGENT SHALL BE CONSIDERED A SUBSIDIARY OBLIGATION BY THE CONTRACTOR AND ITS COST INCLUDED IN THE "BRIDGE TRANSITION UPGRADE" PAY ITEM.



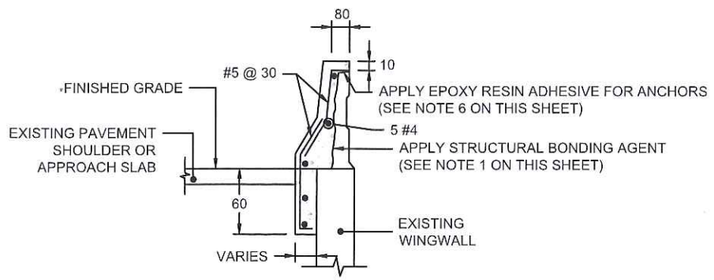
SCARIFIED TRANSITION MODULE DETAILS
N.T.S.



RECONSTRUCTED TRANSITION MODULE DETAILS
N.T.S.



SECTION 1-1
N.T.S.



SECTION 2-2
N.T.S.

DETAILS FOR RECONSTRUCTION OF EXISTING TRANSITION MODULE TO PARAPET IN WINGWALL

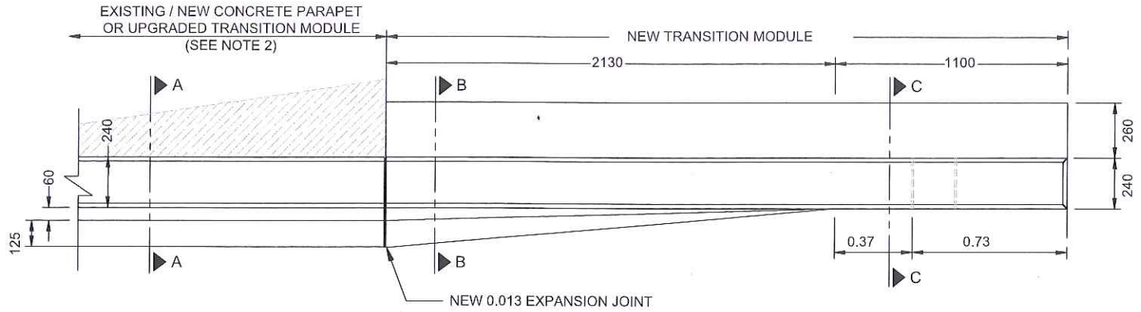
LEGEND:

- TO BE SCARIFIED
- TO BE EXCAVATED
- NEW CONCRETE CLASS A

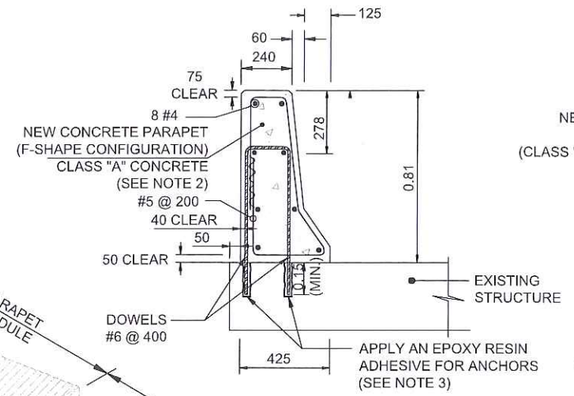
K:\17-0530\C03\PHASE 01\MASH_Metal Barrier\04Standard Drawings\06Final Modified

HIGHWAY & TRANSPORTATION AUTHORITY	PUERTO RICO DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS HIGHWAY AND TRANSPORTATION AUTHORITY	DATE: JUNE 21, 2018	⚠1 STANDARD DRAWING APPROVAL RECOMMENDED BY: Jaime A. Lafuente González DESIGN AREA DIRECTOR	DATE: JUNE 22, 2018	APPROVED BY: Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

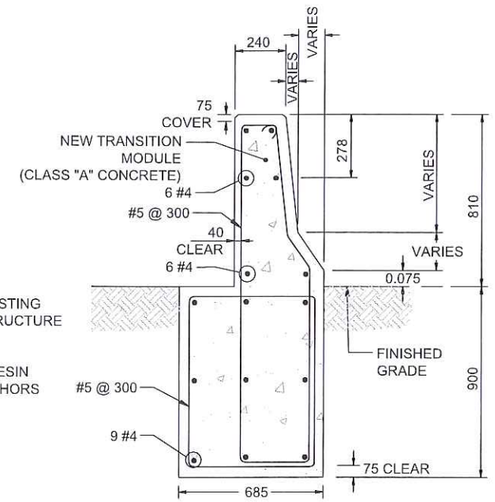
METAL BARRIER W-BEAM GUARDRAIL TRANSITION CONNECTION DETAILS BRIDGE TRANSITION UPGRADE WINGWALL	MB-24 JUNE 2018



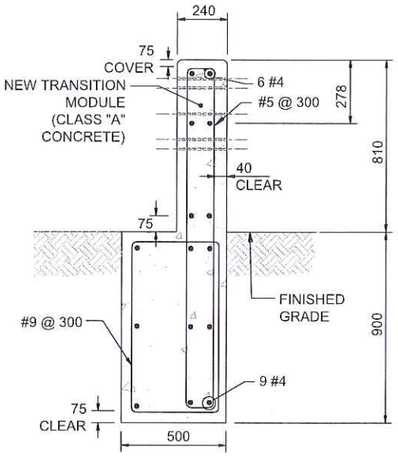
PLAN VIEW
N.T.S.



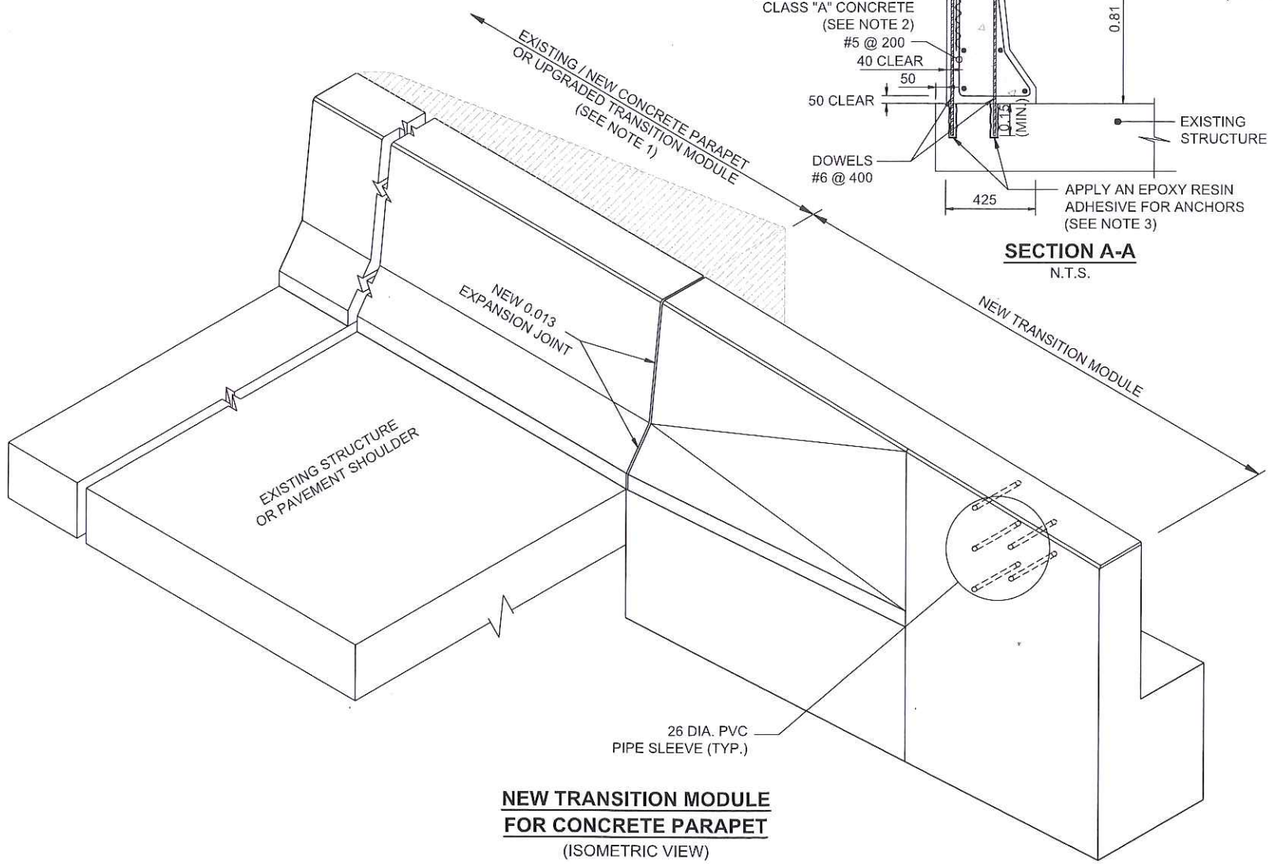
SECTION A-A
N.T.S.



SECTION B-B
N.T.S.



SECTION C-C
N.T.S.



NEW TRANSITION MODULE FOR CONCRETE PARAPET
(ISOMETRIC VIEW)
N.T.S.

NOTES:

1. FOR RECONSTRUCTION OF EXISTING TRANSITION MODULE, SEE DETAILS ON STANDARD DRAWINGS MB-23 AND MB-24.
2. THE ARRANGE OF STEEL REINFORCEMENT SHOWN IN THE CONCRETE PARAPET WILL APPLY IN EXISTING BRIDGE CONCRETE DECK ONLY. FOR NEW BRIDGE CONCRETE DECK, THE ARRANGE OF STEEL REINFORCEMENT OF CONCRETE PARAPET WILL BE PERFORMED BY THE DESIGNER AND/OR AS DIRECTED BY THE ENGINEER.
3. THE EPOXY RESIN ADHESIVE FOR ANCHORS SHALL MEET THE REQUIREMENTS OF AASHTO M235 AND ASTM C881, TYPES IV AND V, CLASS C.

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

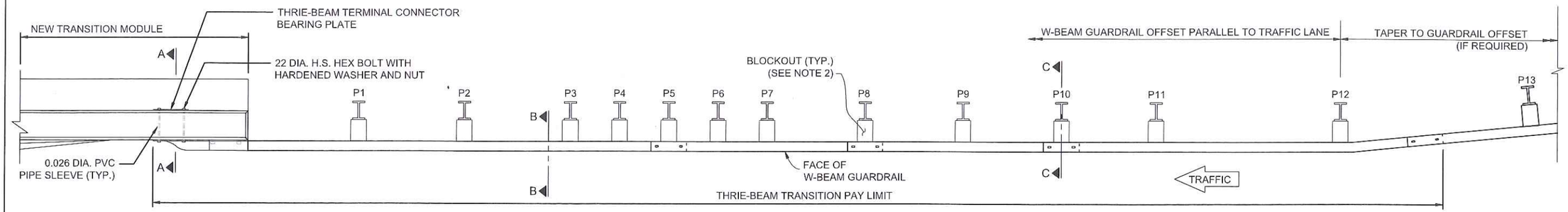
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

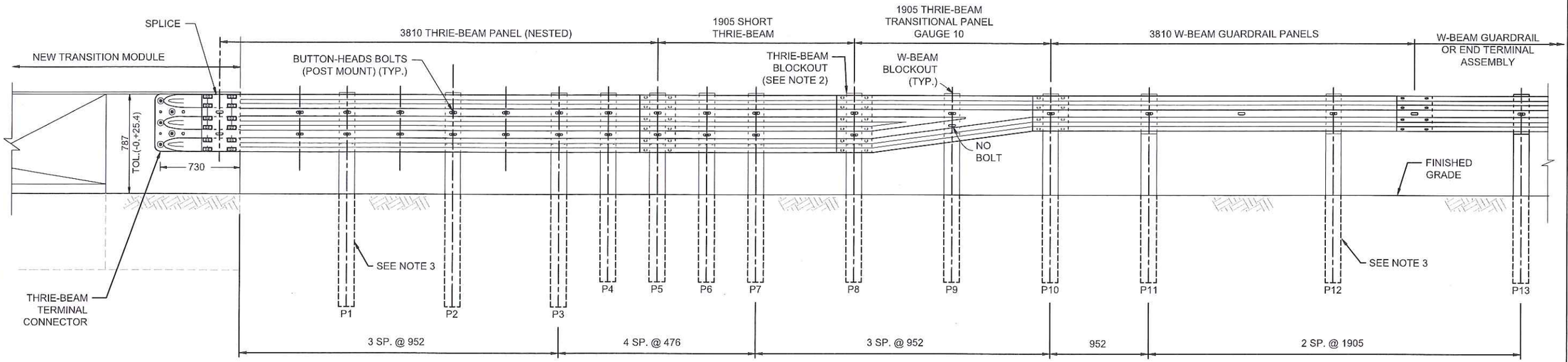
METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTION DETAILS
NEW TRANSITION MODULE
SPEED EQUAL OR MORE THAN 45 MPH

MB-25

JUNE 2018



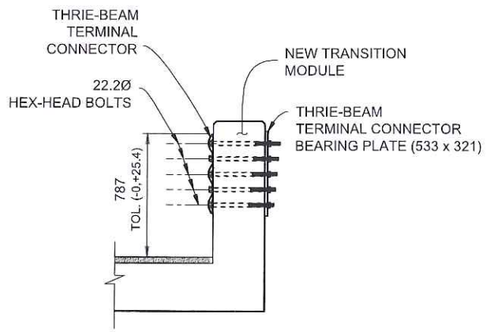
PLAN



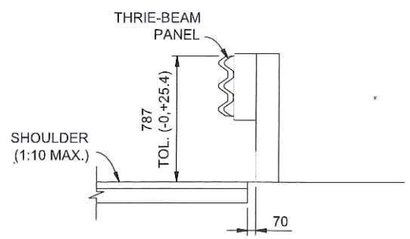
ELEVATION

GUARDRAIL TRANSITION SECTION TO CONCRETE PARAPET

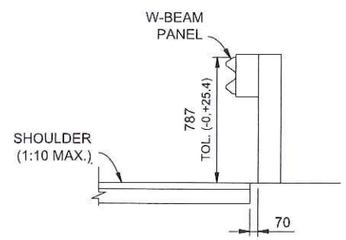
N.T.S.



SECTION A-A
N.T.S.



SECTION B-B
N.T.S.



SECTION C-C
N.T.S.

NOTES:

1. FOR TERMINAL CONNECTOR, BEARING PLATE, TRANSITION SECTION, THRIE-BEAM RAIL, THRIE-BEAM END SECTIONS AND OTHER HARDWARE, SEE DETAILS AND NOTES ON DRAWING MB-30.
2. BLOCKOUTS HEIGHT:

POST NO.	BLOCKOUT HEIGTH
P1 - P9	483
P10 - P13	362

3. POST SECTION AND LENGTH:

POST NO.	SECTION	LENGTH
P1 - P3	W150 x 22.5	2134
P4 - P13	W150 x 13.5 OR W150 x 13	1830

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

⚠1 STANDARD DRAWING APPROVAL

DATE: JUNE 21 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: June 22, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTION DETAILS
THRIE-BEAM TRANSITION SECTION TYPE I
SPEED EQUAL OR MORE THAN 45 MPH

MB-26

JUNE 2018

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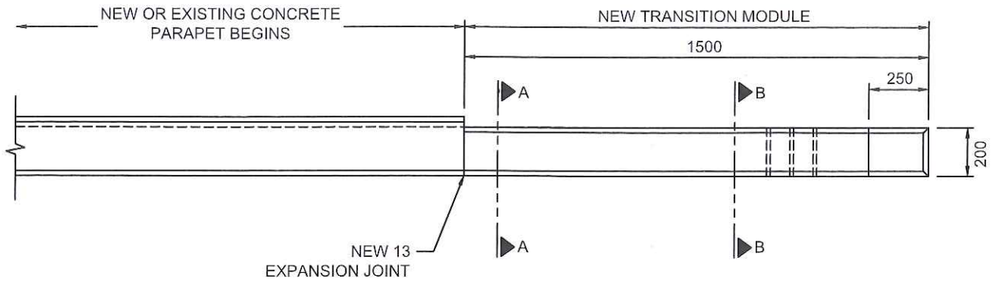
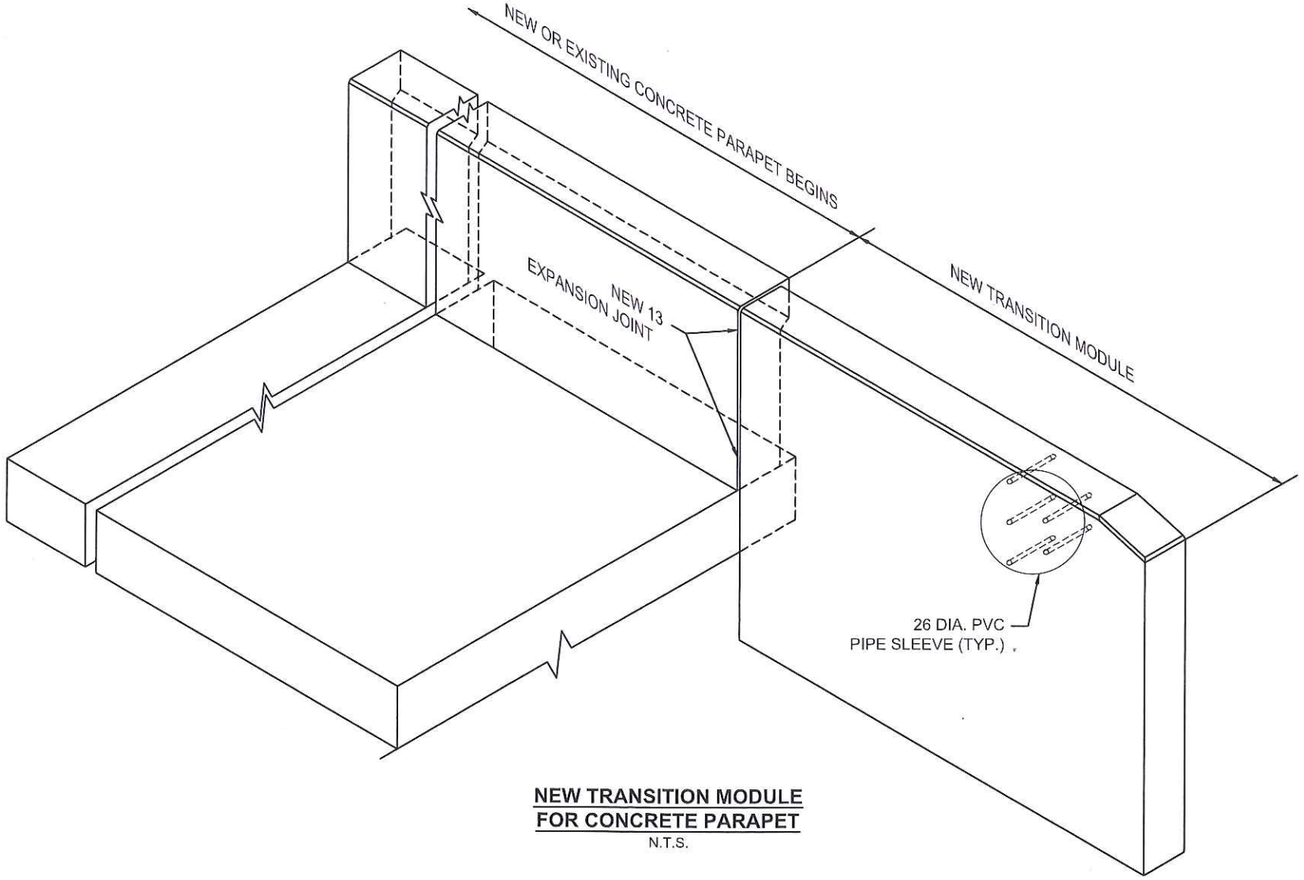
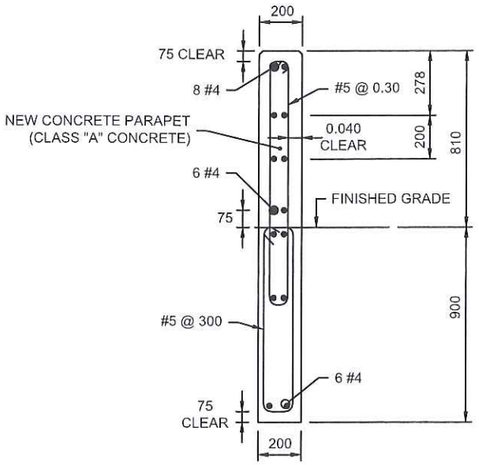


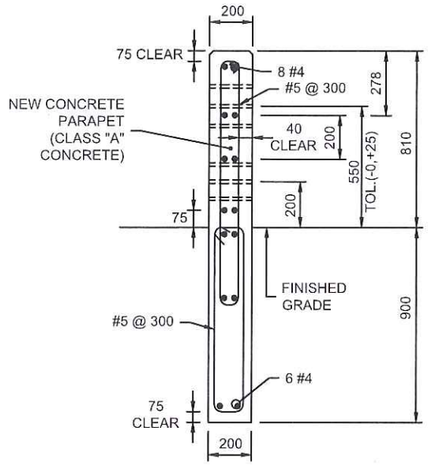
PLAN VIEW
N.T.S.



NEW TRANSITION MODULE FOR CONCRETE PARAPET
N.T.S.



SECTION A-A
N.T.S.



SECTION B-B
N.T.S.

NOTES:

1. FOR RECONSTRUCTION OF EXISTING TRANSITION MODULE, SEE DETAILS ON STANDARD DRAWINGS MB-23 AND MB-24.
2. THE ARRANGE OF STEEL REINFORCEMENT SHOWN IN THE CONCRETE PARAPET WILL APPLY IN EXISTING BRIDGE CONCRETE DECK ONLY. FOR NEW BRIDGE CONCRETE DECK, THE ARRANGE OF STEEL REINFORCEMENT OF CONCRETE PARAPET WILL BE PERFORMED BY THE DESIGNER AND/OR AS DIRECTED BY THE ENGINEER.
3. THE EPOXY RESIN ADHESIVE FOR ANCHORS SHALL MEET THE REQUIREMENTS OF AASHTO M235 AND ASTM C881, TYPES IV AND V, CLASS C.

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

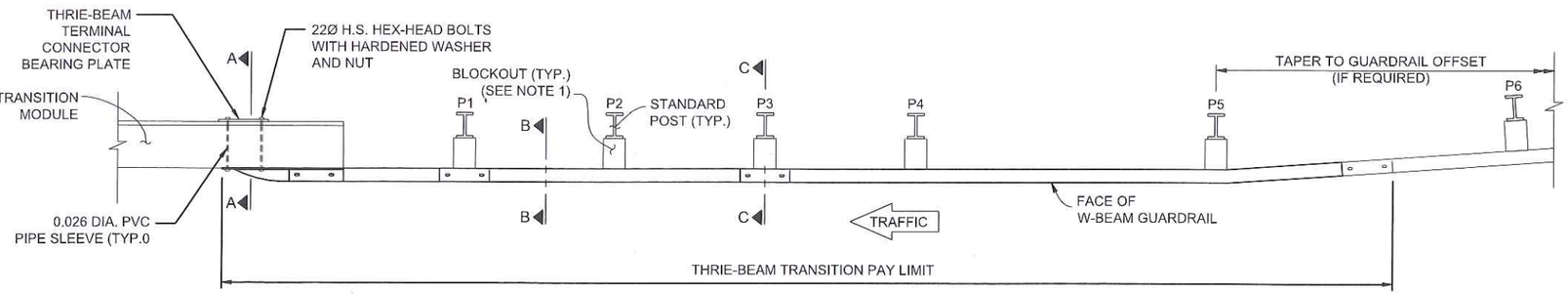
1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González, DESIGN AREA DIRECTOR	JUNE 22, 2018	Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

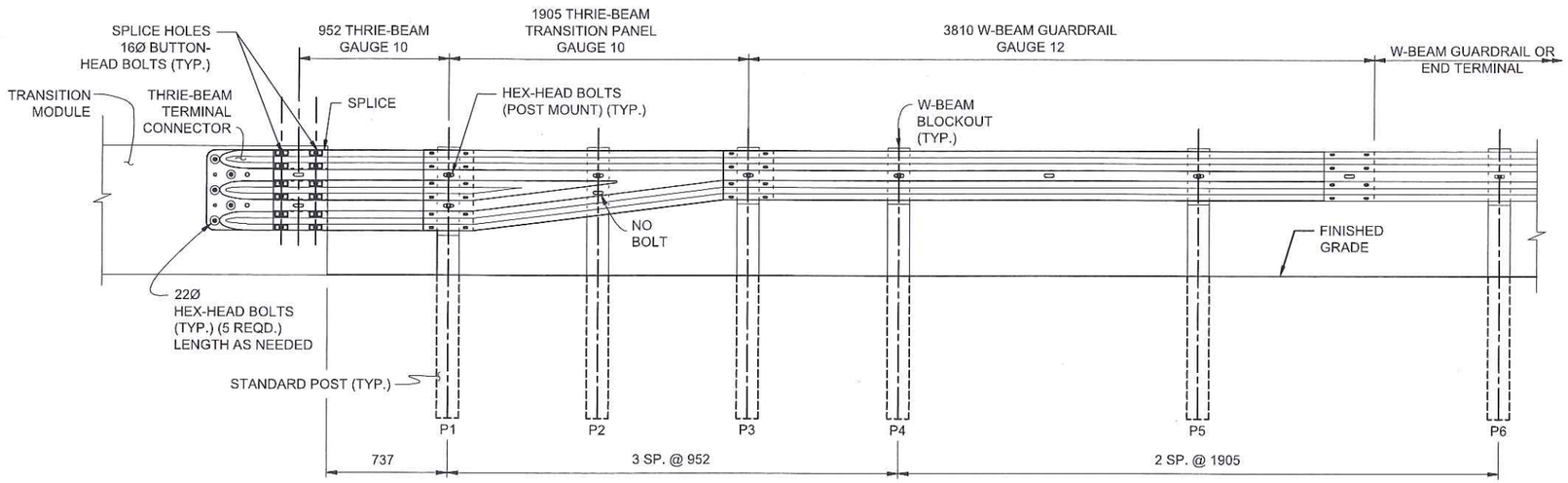
METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTION DETAILS
NEW TRANSITION MODULE
SPEED LESS THAN 45 MPH

MB-27

JUNE 2018



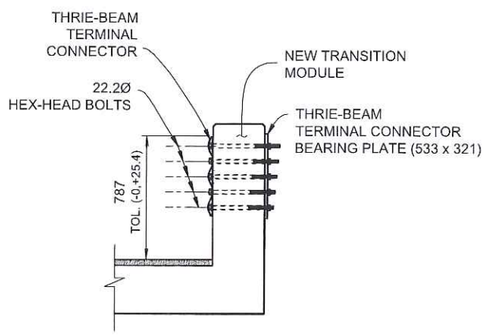
PLAN



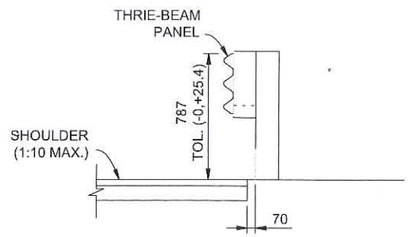
ELEVATION

GUARDRAIL TRANSITION SECTION TO CONCRETE PARAPET

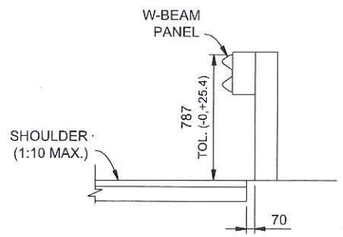
N.T.S.



SECTION A-A
N.T.S.



SECTION B-B
N.T.S.



SECTION C-C
N.T.S.

NOTES:

1. BLOCKOUTS HEIGHT:

POST NO.	BLOCKOUT HEIGTH
P1 - P2	483
P3 - P6	362

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
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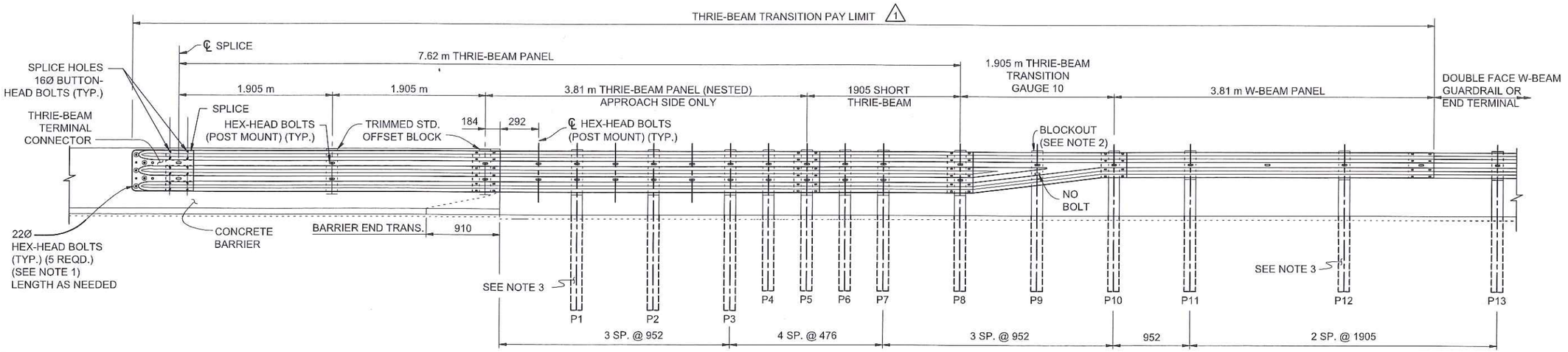
1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR
DATE: June 22, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

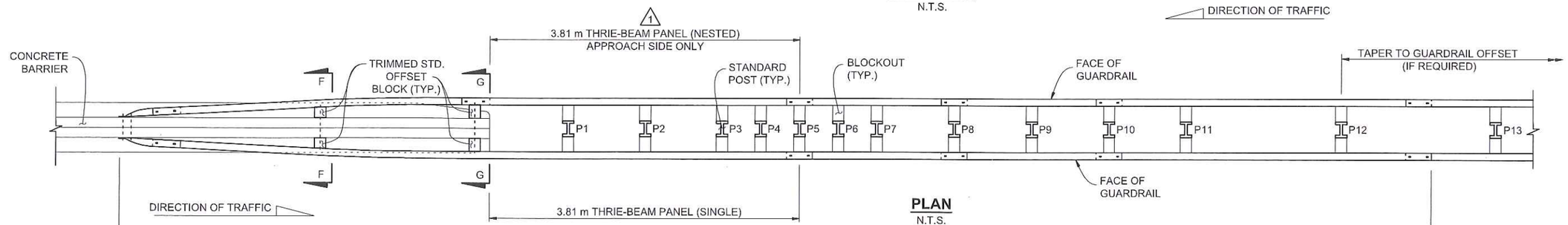
METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTION DETAILS
THRIE-BEAM TRANSITION SECTION TYPE II
SPEED LESS THAN 45 MPH

1 MB-28

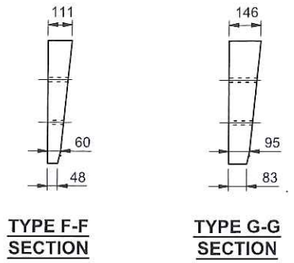
JUNE 2018



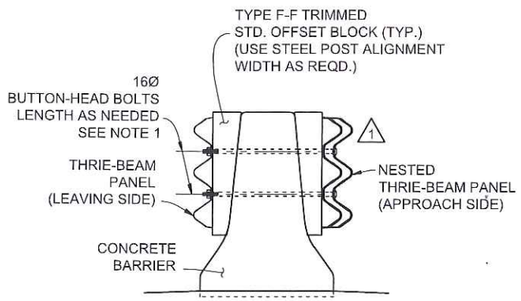
ELEVATION
N.T.S.



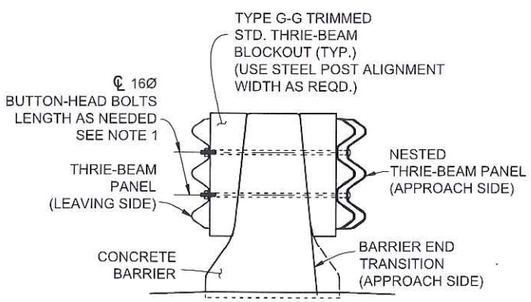
PLAN
N.T.S.



TYPE F-F SECTION **TYPE G-G SECTION**



SECTION F-F



SECTION G-G

TRIMMED STD. OFFSET BLOCKS
N.T.S.

NOTES:

1. THE INSTALLED BOLT'S THREADED PORTION IS NOT PERMITTED TO EXTEND BEYOND 19 mm FROM THE FACE OF THE NUT; TRIM THE THREADED PORTION AS NEEDED AND PAINT WITH TWO COATS OF ZINC-DUST, CONFORMING TO SPECIFICATION 606.
2. BLOCKOUTS HEIGHT:

POST NO.	BLOCKOUT HEIGTH
P1 - P9	483
P10 - P13	362

3. POST SECTION AND LENGTH:

POST NO.	SECTION	LENGTH
P1 - P3	W150 x 22.5	2134
P4 - P13	W150 x 13.5 OR W150 x 13	1830

HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

1 STANDARD DRAWING APPROVAL

DATE: JUNE 21, 2018
RECOMMENDED BY: Jaime A. Lafuente González, DESIGN AREA DIRECTOR

DATE: JUNE 22, 2018
APPROVED BY: Carlos M. Contreras Aponte, EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTION DETAILS
THRIE-BEAM TRANSITION SECTION TYPE III

MB-29

JUNE 2018

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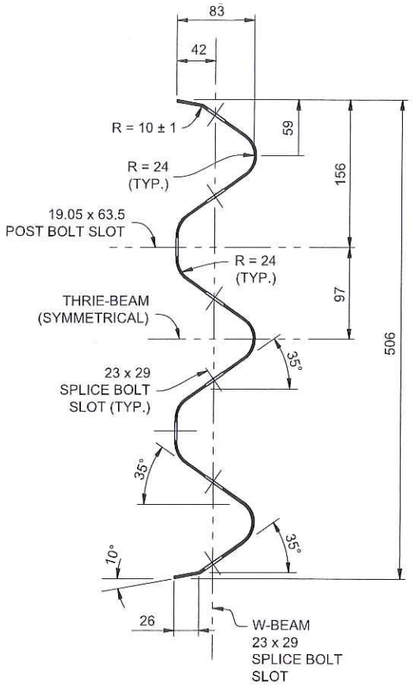


THRIE-BEAM PANEL SECTION

N.T.S.

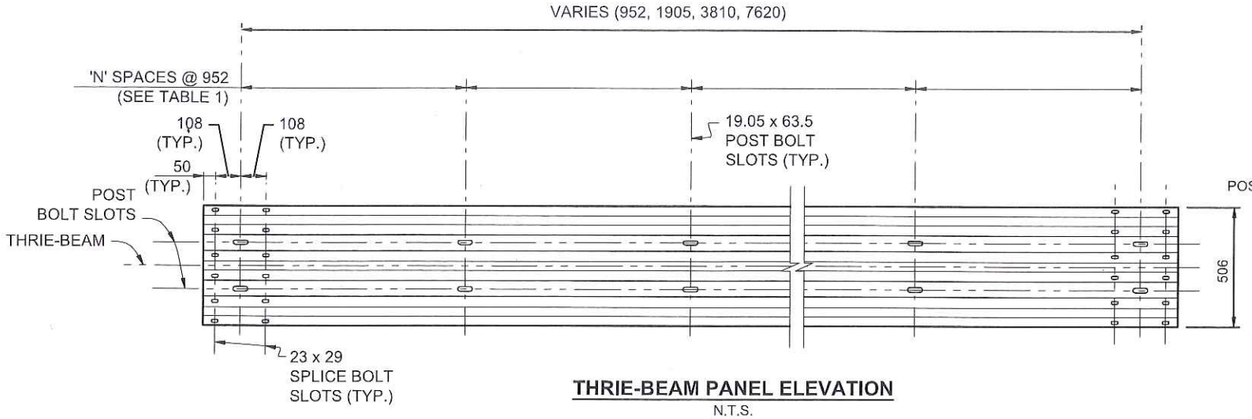
⚠1 I. SPECIFICATIONS

A. CORRUGATED STEEL BEAMS SHALL CONFORM TO THE CURRENT REQUIREMENTS OF AASHTO M180 CLASS A TYPE II.

B. STEEL BEAMS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION ACCORDING TO AASHTO M111.

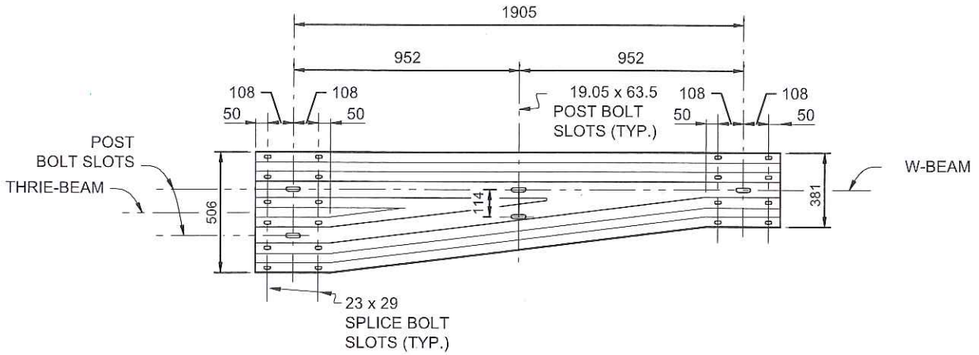
PANEL TYPE SUMMARY TABLE

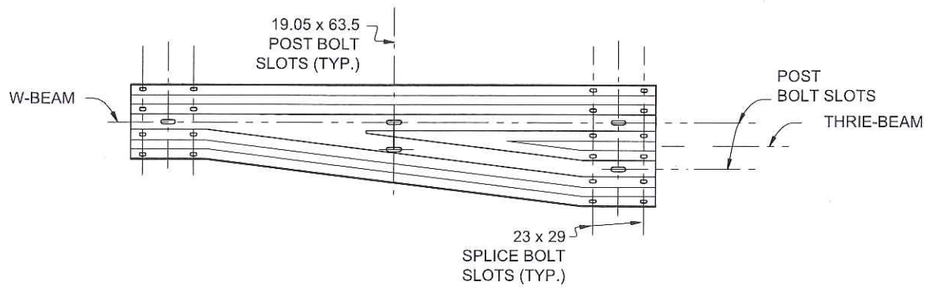
PANEL TYPE (mm)	NUMBER OF SPACES 'N'
952 THRIE-BEAM (GAUGE 10)	1
1905 THRIE-BEAM	2
3810 THRIE-BEAM	4
7620 THRIE-BEAM	8
THRIE-BEAM TRANSITION PANEL (GAUGE 10)	2



THRIE-BEAM PANEL ELEVATION

N.T.S.



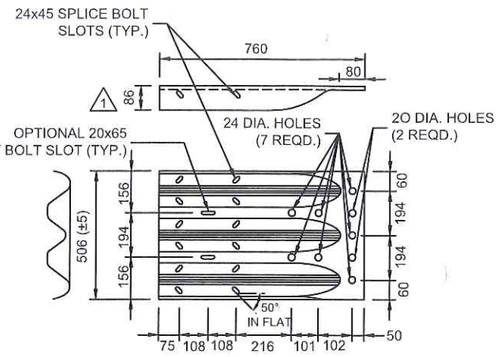


THRIE-BEAM TRANSITION PANEL ELEVATION

N.T.S.

I. SPECIFICATIONS

A. THRIE-BEAM TRANSITION PANEL SHALL CONFORM TO THE CURRENT REQUIREMENTS OF AASHTO M180, CLASS B. CORROSION PROTECTION SHALL BE TYPE II ZINC-COATED AFTER FABRICATION ACCORDING TO AASHTO M111 (ASTM123).



THRIE-BEAM TERMINAL CONNECTOR

N.T.S.

⚠1 I. SPECIFICATIONS

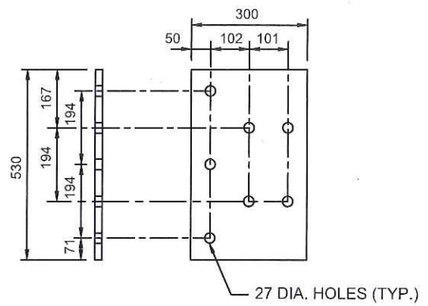
A. TERMINAL CONNECTOR SHALL CONFORM TO THE CURRENT REQUIREMENTS OF AASHTO M180, CLASS B. CORROSION PROTECTION SHALL BE TYPE II ZINC-COATED AFTER FABRICATION ACCORDING TO AASHTO M111 (ASTM123).

B. DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE, AND ACCEPTED MANUFACTURING PRACTICES.

II. INTENDED USE

A. THIS TERMINAL CONNECTOR IS USED TO CONNECT THE GUARDRAIL TO BRIDGE PARAPETS AND CONCRETE BARRIERS.

B. THE CONNECTOR IS FASTENED TO THE GUARDRAIL TERMINAL USING A BEAM TO BLOCK AND A RECTANGULAR PLATE WASHER UNDER THE HEAD AND NUT



THRIE-BEAM TERMINAL CONNECTOR BEARING PLATE

N.T.S.

I. SPECIFICATIONS

A. BEARING PLATE SHALL BE FORMED FROM AASHTO M27M (ASTM A709M) GRADE 250 STEEL PLATE AND ZINC-COATED AFTER FABRICATION ACCORDING TO AASHTO M111 (ASTM123). NO PUNCHING, DRILLING OR CUTTING IS PERMITTED AFTER THE PLATE IS ZINC-COATED.

B. DIMENSIONAL TOLARANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE CONSISTENT WITH THE PROPER FUNCTION OF THE PART, INCLUDING ITS APPEARANCE AND ACCEPTED MANUFACTURING PRACTICES.

II. INTENDED USE

A. THIS BEARING PLATE IS USED IN CONNECTIONS OF GUARDRAIL TO CONCRETE BARRIER OR BRIDGE PARAPET.

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

⚠1 STANDARD DRAWING APPROVAL

DATE:	RECOMMENDED BY:	DATE:	APPROVED BY:
JUNE 21, 2018	Jaime A. Lafuente González DESIGN AREA DIRECTOR	June 22, 2018	Carlos M. Contreras Aponte EXECUTIVE DIRECTOR

METAL BARRIER
W-BEAM GUARDRAIL
TRANSITION CONNECTION DETAILS
HARDWARE

MB-30

JUNE 2018

CURRENT SHEET	INITIAL VERSION	REVISION NOTES	REVISED VERSION
INDEX AND NOTES MB-01	DEC-2017	1. Index modified to include revised version column. Notes 7 and 8 were added Frame updated	JUN-2018
ASSEMBLY DETAILS MB-02	DEC-2017	1. Frame updated	JUN-2018
STANDARD SECTION HARDWARE MB-03	DEC-2017	1. Frame updated	JUN-2018
STANDARD SECTION HARDWARE MB-04	DEC-2017	1. General revision to Specifications and Notes. Installation hole was added to w-beam guardrail post. Frame updated	JUN-2018
STANDARD SECTION HARDWARE MB-05	DEC-2017	1. Revision to include round bolt alternative. Frame updated	JUN-2018
TRANSITION TO W-BEAM GUARDRAIL STANDARD HEIGHT MB-06	DEC-2017	1. Frame updated	JUN-2018
GUARDRAIL REFLECTOR DETAILS MB-07	DEC-2017	1. Frame updated	JUN-2018
REDUCED POST SPACING MB-08	DEC-2017	1. Frame updated	JUN-2018
ELEVATION DETAILS MB-09	DEC-2017	1. Frame updated	JUN-2018
ELEVATION DETAILS MB-10	DEC-2017	1. Frame updated	JUN-2018
ELEVATION DETAILS MB-11	DEC-2017	1. Revision to include steel bottom plate thickness. Frame updated	JUN-2018
ELEVATION DETAILS MB-12	DEC -2017	1. General revision. Note 3, was deleted. Notes were renumbered. New note 8 was added. Frame updated	JUN-2018
MEDIAN TREATMENT DETAILS MB-13	DEC-2017	1. Median treatments details general revision General revision. Note 2, was added. Frame updated	JUN-2018
MEDIAN TREATMENT DETAILS MB-14	DEC-2017	1. Frame updated	JUN 2018
OPENING DETAILS MB-15	DEC-2017	1. General drawings revision. Note 4 was added. Frame updated	JUN-2018
END TERMINALS TERMINAL TYPE MA MB-16	DEC-2017	1. Frame updated	JUN 2018
END TERMINALS TERMINAL TYPE MA MB -17	DEC-2017	1. Frame updated	JUN 2018
END TERMINALS TERMINAL TYPE MB MB-18	DEC-2017	1. Sheet title change. Content modified to show Crashworthy End Terminals in lieu of Terminal Type MB. Frame updated	CRASHWORTHY END TERMINALS JUN-2018
END TERMINALS TERMINAL TYPE MC MB-19	DEC-2017	1. Sheet title change. Content modified to show Anchorage Type MB in lieu of Terminal Type MC Frame updated	ANCHORAGE TYPE MB JUN-2018
END TERMINALS TERMINAL TYPE MB-MED MB-20	DEC-2017	1. Sheet title change. Content modified to show Anchorage Type MC in lieu of Terminal Type MB-Med. Frame updated	ANCHORAGE TYPE MC JUN-2018
END TERMINALS HARDWARE MB-21	DEC-2017	1. Sheet title change. Content modified to show Type MB-MED Anchorage in lieu of End Terminals Hardware	ANCHORAGE TYPE MB-MED JUN 2018
END TERMINALS HARDWARE MB-22	DEC-2017	1. Sheet title change. Content modified to show Anchorage Hardware in lieu of end Terminals Hardware	ANCHORAGE HARDWARE JUN-2018
BRIDGE TRANSITION UPGRADE APPROACH SLAB MB-23	DEC 2017	1. Notes 2 and 4 were revised. Frame updated	JUN 2018
BRIDGE TRANSITION UPGRADE WINGWALL MB-24	DEC 2017	1. Standard drawing document frame was updated. Notes 2 and 4 were revised.	JUN 2018
NEW TRANSITION MODULE SPEED EQUAL OR MORE THAN 45 MPH MB-25	DEC 2017	1. Frame updated	JUN 2018
THRIE-BEAM TRANSITION TYPE I SPEED EQUAL OR MORE THAN 45 MPH MB-26	DEC 2017	1. Frame updated General revision.	JUN 2018
NEW TRANSITION MODULE SPEED LESS THAN 45 MPH MB-27	DEC-2017	1. Frame updated	JUN 2018
THRIE-BEAM TRANSITION SECTION TYPE II SPEED LESS THAN 45 MPH MB-28	DEC 2017	1. Frame updated General revision.	JUN 2018
TRANSITION CONNECTION DETAILS THRIE-BEAM TRANSITION SECTION TYPE III MB-29	DEC 2017	1. Frame updated. Revision to include pay limit. Revised to clarify installation of nested panel. Revision to Trimmed Standard Offset Blocks	JUN 2018
TRANSITION CONNECTION DETAILS HARDWARE MB-30	DEC 2017	1. Thrie-beam panel section: item C of the Specifications section was deleted. Thrie-beam terminal connector: item C of the Specifications section was deleted.	JUN 2018

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HIGHWAY & TRANSPORTATION AUTHORITY

PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY AND TRANSPORTATION AUTHORITY

DATE: JUNE 21, 2018

RECOMMENDED BY:
Jaime A. Lafuente González
DESIGN AREA DIRECTOR

1 STANDARD DRAWING APPROVAL

DATE: June 22, 2018

APPROVED BY:
Carlos M. Contreras Aponte
EXECUTIVE DIRECTOR

METAL BARRIER
REVISION LOG

1 MB-RL

JUNE 2018