STATE OF NEW HAMPSHIRE

BRIDGE DESIGN MEMORANDUM

FROM: Loretta Girard Doughty, PE
Administrator

DATE: November 3, 2020
AT (Office): Bureau of Bridge Design

SUBJECT: **Design Memorandum 2020-01**
Revised Temporary Barrier for Bridge Projects

TO: **Bureau of Bridge Design Staff, Bridge Design Consultants, FHWA, NHDOT Bureaus**

The Bureau of Bridge Design is updating the Bridge Design Manual. During this process, certain design decisions are being issued for immediate implementation. Consequently, the Bridge Design Manual, Bridge Details, and Bridge Detail Sheets have been modified as follows:

A. Bridge Design Manual:

- Revised Chapter 7, Section 7.6.5 Temporary Barrier

B. Bridge Detail Sheets:

- Portable Concrete Barrier – Braced *(Transition piece connects to Highway PCB Standard Plan GR-23)*
- Texas Restrained Barrier (X-Bolt) *(Transition piece connects to Highway PCB Standard Plan GR-23)*
- Revised Portable Concrete Barrier – Braced *(Transition piece connects to Highway PCB Standard Plans GR-24 & GR-25)*
- Revised Texas Restrained Barrier (X-Bolt) *(Transition piece connects to Highway PCB Standard Plans GR-24 & GR-25)*

C. Special Provision:

- Item 606.41741 – Portable Concrete Barrier for Traffic Control - Bridge

D. Summary: The above noted revisions are being implemented to specify the following:

- NHDOT policy for required use of temporary barrier for bridge projects.
- Bridge Detail Sheets (.dgn and .pdf format) for use on bridge projects are located on the Bureau of Bridge Design web page: https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm
- The portable concrete barrier Bridge Detail Sheets will no longer be included in the contract plans.

E. Background:

This memorandum incorporates modifications to current NHDOT Bridge Design Manual and Bridge Detail Sheets and provides the modified details on the NHDOT Bridge Design Website.

For bridge construction, the workers are in close proximity to the portable concrete barrier (pcb). To protect the workers and the traveling public, the required deflection room behind the pcb shall be provided or a low deflection barrier shall be used for *all* phased bridge projects (preservation, rehabilitation, and new construction).

Item 606.41741, Portable Concrete Barrier for Traffic Control - Bridge shall be used for *all* bridge projects except as noted in Chapter 7, Section 7.6.5. The pcb to be used is the Braced or Texas Restrained

Barrier (X-Bolt) with the corresponding transition piece required to attach to the Highway pcb. The pcb sheets will ***not*** be included in the contract plans. The Contractor can choose which barrier to have fabricated and can obtain the pcb sheets from the Bridge Design Webpage: https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm

Both barriers have been successfully crash tested per requirements of updated NCHRP Report 350, TL 3-11 (MASH TL-3). Both barriers remained connected with a dynamic deflection of approximately 27-in. Each barrier has layout requirements and limitations as noted on their respective detail sheets and Chapter 7, Section 7.6.5.

Two additional bridge pcb sheets have been added to the NHDOT Bridge Design Website. Both the Braced and Texas Restrained Barrier (X-Bolt) pcb have been revised for a new transition piece that connects to the new Highway Design MASH compliant pcb (NHDOT Standard Plan No. Gr-24 & 25). The new Highway MASH pcb is an F-shape which matches the Texas Restrained Barrier shape. The Braced barrier is a New Jersey shape which requires the transition piece to taper to an F-shape. A new transition plan sheet has been included for each barrier type.

As stated in the 2016 FHWA memorandum, *Joint Implementation Agreement for the AASHTO Manual for Assessing Safety Hardware (MASH),* "Temporary work zone devices, including portable barriers, manufactured after December 31, 2019, must have been successfully tested to the 2016 edition of MASH. Such devices manufactured on or before this date, and successfully tested to NCHRP Report 350 or the 2009 edition of MASH, may continue to be used throughout their normal service lives." Service life has been defined for portable concrete barrier in the Notice to Contractors in the proposals.

This memorandum clarifies NHDOT's policy for the use of a temporary barrier for bridge construction projects and incorporates the details that shall be included in the contract plans.

F. Implementation:

This update to the Bridge Design Manual and Bridge Detail Sheets shall be implemented as of the date of this memorandum and shall be used on all applicable projects.

Loretta Girard Doughty, PE
Administrator, Bureau of Bridge Design

Enclosures

7.6.5 Temporary Barrier

Temporary barriers are used in work zone areas and shall be crash tested to be able to contain, redirect, and shield vehicles, as well as workers with a limited escape route.

January 7, 2016 FHWA memorandum states, "Temporary work zone devices, including portable barriers, manufactured after December 31, 2019, must have been successfully tested to the 2016 edition of *MASH*. Such devices manufactured on or before this date, and successfully tested to NCHRP Report 350 or 2009 edition of *MASH*, may continue to be used throughout their normal service life."

A. Temporary Barrier Types

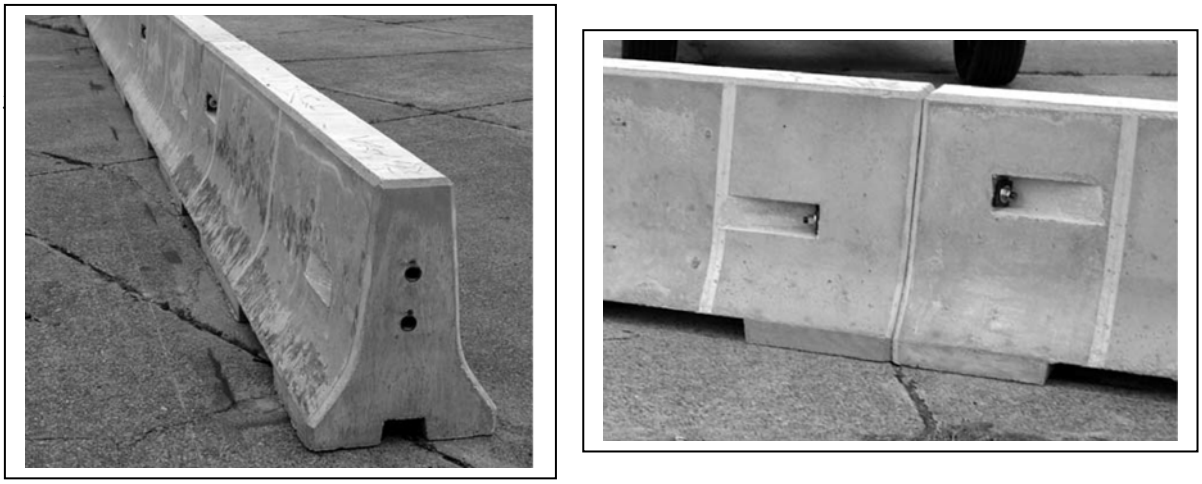
NHDOT preferred temporary barriers are listed as follows:

- Portable Concrete Barrier – Braced:
  - Crash tested by Midwest Roadside Safety: NY Box Beam Stiffening of Unanchored TCB, March 2008 per requirements of updated NCHRP Report 350, TL 3-11 (MASH TL-3). The FHWA approval letter B-239 (11/1/2012) is located at: https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/barriers/pdf/b239.pdf
  - 20-ft. long Jersey-shape precast concrete barrier with a structural steel tube attached. The barrier system has been crash tested with a 27.6-in. dynamic deflection which will allow the braced barrier to be placed a minimum 12-in. from the back of the barrier to the edge of the deck, unanchored, since the barrier did not separate (i.e., stayed connected acting as one long unit).
  - The barrier has a minimum radius of curvature of approximately 230-ft. Gaps created between structural tubes and concrete barrier, during a radial layout, shall be shimmed with 8"x8"x1/2" plates and fender washers to firmly attach structural tubing to barrier.
  - The weight of one 20-ft. F-shape barrier segment is approximately 4.16-tons.
  - For speeds greater than 45-mph, a minimum of two 20-ft. braced segments shall extend beyond the bridge work area before they can be flared or connected to NHDOT Highway Design portable concrete barrier. The final 20-ft. concrete segment shall be anchored to the ground as shown on the Bridge Detail Sheet.
  - Layout and installation shall be according to the Bridge Detail Sheet*: Portable Concrete Barrier – Braced* located at: https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm

Portable Concrete Barrier -Braced

Figure 7.6.5-1

- Texas Restrained Barrier (X-Bolt):
  - Crash tested by Texas Transportation Institute May 2005 per requirements of updated NCHRP Report 350, TL 3-11 (MASH TL-3). Test report is located at: https://static.tti.tamu.edu/tti.tamu.edu/documents/0-4692-1.pdf
  - 10-ft. long F-shape precast concrete barrier with a steel bolts crossing at joints. The barrier system has been crash tested with a 27.0-in. dynamic deflection which will allow the braced barrier to be placed a minimum 12-in. from the back of the barrier to the edge of the deck, unanchored, since the barrier did not separate (i.e., stayed connected acting as one long unit).
  - The barrier has a minimum radius of curvature of approximately 125-ft. and the relative angle that can be achieved between barrier segments is 4-degrees.
  - The weight of one 10-ft. F-shape barrier segment is approximately 2.38-tons.
  - For speeds greater than 45-mph, the 10-ft. long cross-bolt segments shall extend a minimum of 50-ft. beyond the bridge work area before they can be flared or connected to NHDOT Highway Design portable concrete barrier.
  - The Bridge Detail Sheet*: Portable Concrete Barrier – X-Bolt* is located at: https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm



Portable Concrete Barrier –Texas X-Bolt

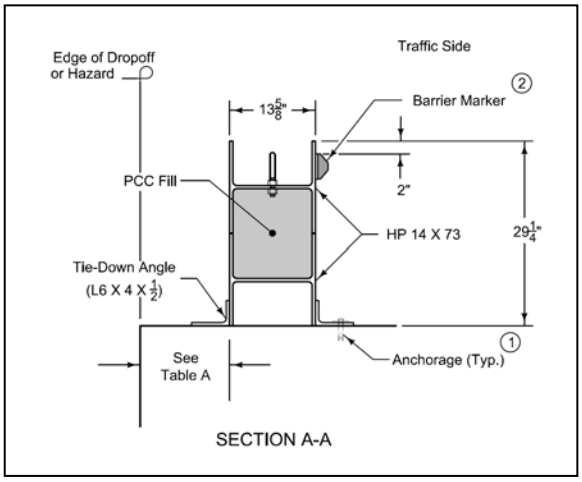
Figure 7.6.5-2

- NHDOT 12.5-ft. Highway Portable Concrete Barrier:
  - The F-shape pcb is in compliance with the requirements of Manual for Assessing Safety Hardware (MASH 16) TL-3 and was tested through the Roadside Safety Research Program Pooled Fund Study No. TPF-5 (114), May 2017.
  - The free standing barrier has a dynamic deflection of 5.28-ft.
  - The Roadside Safety Pooled Fund Test Report is located at: https://www.roadsidepooledfund.org/wp-content/uploads/2017/04/TRNo607911-12-Final.pdf
  - The weight of one 12.5-ft. F-shape barrier segment is approximately 2.84-tons.
  - The 12.5-ft. Highway Portable Concrete Barrier (Highway Standard Plan GR-24 & GR-24) is located at: https://www.nh.gov/dot/org/projectdevelopment/highwaydesign/standardplans/index.htm

Highway Portable Concrete Barrier – NHDOT

Figure 7.6.5-3

- Iowa DOT (BA-400) HP steel beam (concrete filled) with double nested standard beam guardrail:
  - Crash tested by University of Nebraska-Lincoln (Steel H-section Barrier for temporary use on bridge decks) per requirements of NCHRP Report 350, TL 3-11. The FHWA approval letter HSA-10/B-117 (9/12/2003) is located at: https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/barriers/pdf/b117.pdf
  - The HP steel beam (concrete filled) with double nested standard beam guardrail has been crash tested with a 9.5-in. dynamic deflection.
  - The weight of HP steel beam (concrete filled) with double nested standard beam guardrail is approximately 321-lb/ft.
  - The stacked HP steel beams are 29¼ -in. high and 13 5/8-in. depth that are anchored into the deck with ¾-in. diameter x 1¾-in. long ASTM A307 Grade B heavy hex bolt and a ¾-in. Red Head Multi-set II drop-in anchor.
  - Plans are located at *Iowa DOT Standard Road Plans – BA Series* located at: https://www.iowadot.gov/design/SRP/IndividualStandards/e**ba400**.pdf



Temporary Barrier Rail – Iowa BA-400

Figure 7.6.5-4

B. Temporary Barrier Selection

The following is NHDOT Bridge Design's policy for selecting temporary barrier for use on bridges, unless approved otherwise by the Bridge Design Chief:

- Bridges on National Highway System (NHS); use MASH Test Level 3 (minimum).
- Bridges not on NHS and speeds posted ≥ 45 mph; use MASH or NCHRP 350 Test Level 3 (minimum).
- Bridges not on NHS and speeds posted < 45 mph; use MASH or NCHRP 350 Test Level 2 (minimum).
- For bridge construction, the workers are in close proximity to the portable concrete barrier (pcb). To protect the workers and the traveling public, the required deflection

room behind the pcb shall be provided or a low deflection barrier shall be used for *all* bridge projects (rehabilitation and new).

- When developing phase construction on bridges, the following recommendations shall be considered:

  1) New bridge decks and widenings:
     - Use the maximum clear distance from behind the pcb to the edge of the deck while meeting the required lane widths and minimal phases. See *Chapter 7, Section 7.7 Preservation and Rehabilitation of Structures* for further information on developing phase construction and minimum lane widths.
     - Use Item 606.41741, Portable Concrete Barrier for Traffic Control - Bridge, for *all* bridge projects except as noted below. This pcb is the Braced or Texas Restrained Barrier (X-Bolt). Do not include barrier sheets in the contract plans. The Contractor can choose which barrier to use and obtain the sheets from the Bridge Design Website for fabrication.
     - For bridges on Tier 1 roads, the minimum clear distance from behind the pcb to the edge of the deck shall be 2-ft. (0.6-m). If 2-ft. (0.6-m) cannot be obtained, a 1-ft. clear distance behind the pcb to the edge of deck shall be approved by the Design Chief, or the use of an anchored pcb that has been MASH crash-tested. Avoid anchoring through precast concrete panels, if possible. If there is no other option, the panels need to be designed for loss of strains due to the possibility of the anchor hitting the strands.
     - For bridges on Tier 2, 3, 4 or 5 roads, the minimum clear distance from behind the pcb to the edge of the deck shall be 1-ft. (0.3-m). If 1-ft. (0.3-m) cannot be obtained, an anchored pcb that has been MASH crash-tested shall be used or the Iowa DOT (BA-400) HP steel beam (concrete filled) for bridges *not* on NHS roads.

  2) Rehabilitated bridge decks:
     - See *Chapter 7, Section 7.7 Preservation and Rehabilitation of Structures* for further information on developing phase construction and minimum lane widths.
     - Use Item 606.41741, Portable Concrete Barrier for Traffic Control - Bridge, for *all* rehabilitation work (e.g., deck patching, pavement and membrane removal, expansion joint work, and bridge curb and railing work); all roads. This pcb is the Braced or Texas Restrained Barrier (X-Bolt). Do not include barrier sheets in the contract plans. The Contractor can choose which barrier to use and obtain the sheets from the Bridge Design Website for fabrication.

  3) Bridge decks *not* on NHS roads, requiring a lighter portable concrete barrier:
     - Use Iowa DOT (BA-400) HP steel beam (concrete filled) with double nested standard beam guardrail. The weight of HP steel beam (concrete filled) with double nested standard beam guardrail is approximately 321-lb/ft.

PROJECT NAME
PROJECT NUMBER

SAMPLE

November 5, 2020

S P E C I A L P R O V I S I O N

AMENDMENT TO SECTION 606 -- GUARDRAIL

Item 606.41741 – Portable Concrete Barrier for Traffic Control - Bridge

Add to 3.7:

3.7.5 Portable Concrete Barrier for Traffic Control - Bridge. Either of the following barriers are considered acceptable by the Department.

3.7.5.1 Braced. Braced portable concrete barrier shall consist of 20-foot-long sections and shall be braced and pinned as detailed on the contract plans or as otherwise approved.

3.7.5.2 Texas Restrained Barrier (TRB). The TRB portable concrete barrier shall consist of 10-foot-long sections and shall be connected as detailed on the contract plans or as otherwise approved.

3.7.5.3 Refer to NHDOT Bridge Design's website (https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm) for the fabrication plans of the Braced and Texas Restrained Barrier (TRB) and their corresponding transition pieces to the Highway Design portable concrete barrier (GR-23 or GR-24, GR-25).

Amend to 4.4.2 to read:

4.4.2 Portable concrete barrier for traffic control of the type specified will be measured by the linear foot for barrier delivered and installed for use on the project. Relocating portable concrete barriers on the project will not be measured for payment.

Amend 5.3 to read:

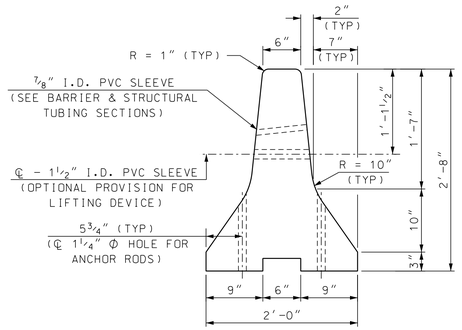
5.3 The accepted quantity of permanent concrete barrier of the type specified and portable concrete barrier for traffic control of the type specified will be paid for at the contract unit price per linear foot.

Add to 5.3

5.3.6 No separate payment will be made for the required bracing, pinning, or connections of the portable concrete barrier for traffic control. All structural steel, steel rods and hardware will be subsidiary.

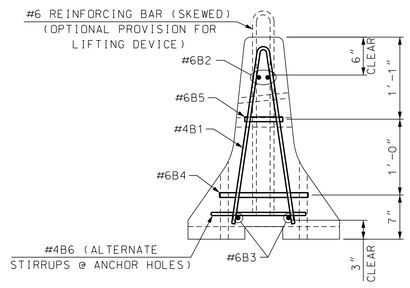
Add to Pay items and units:

606.41741	Portable Concrete Barrier for Traffic Control - Bridge	Linear Foot



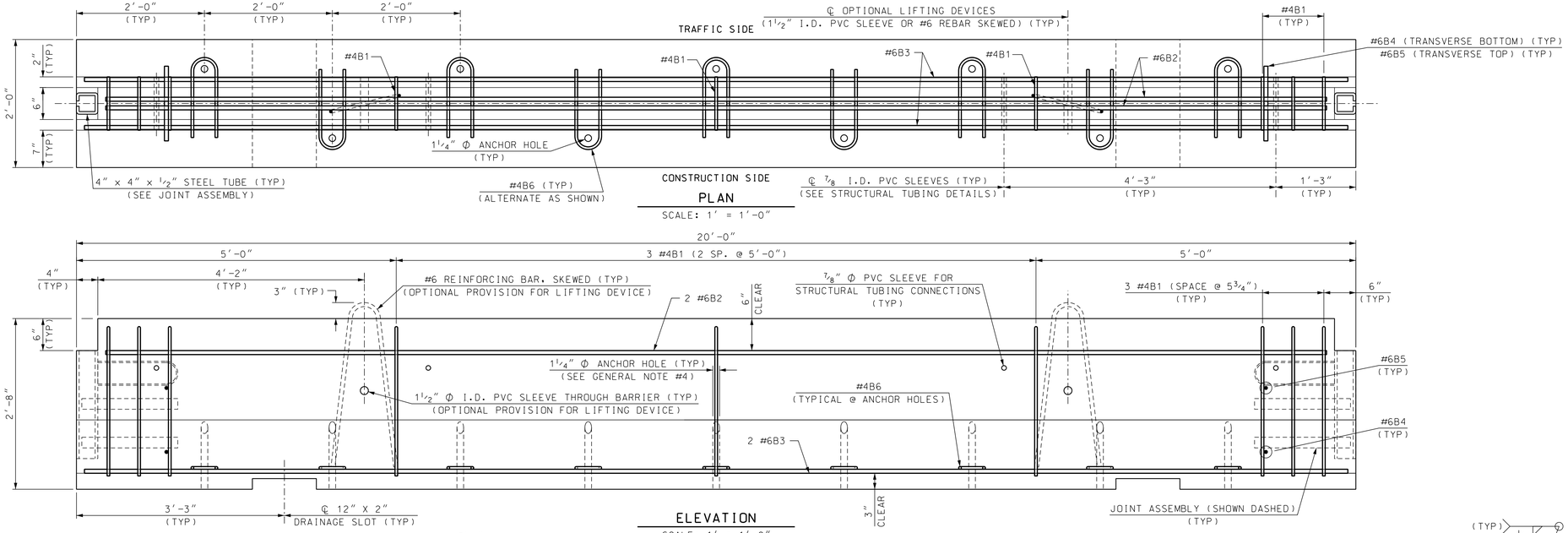
TYPICAL SECTION

SCALE: 1" = 1'-0"



TYPICAL SECTION

SCALE: 1" = 1'-0"



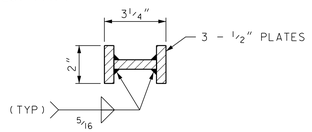
PLAN

SCALE: 1' = 1'-0"

ELEVATION

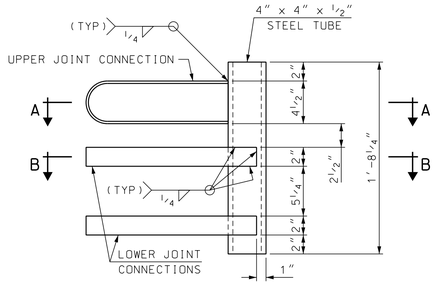
SCALE: 1' = 1'-0"

NO MODIFICATIONS SHALL BE MADE TO THIS SHEET



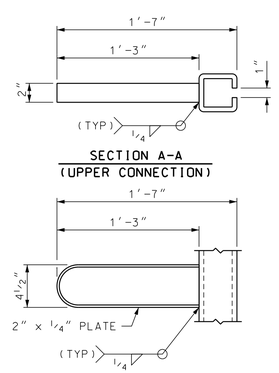
SECTION D-D (CONNECTION KEY)

SCALE: 3" = 1'-0"

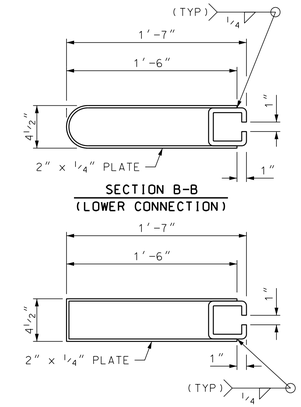


JOINT ASSEMBLY

SCALE: 1 1/2" = 1'-0"



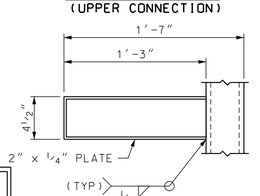
SECTION A-A (UPPER CONNECTION)



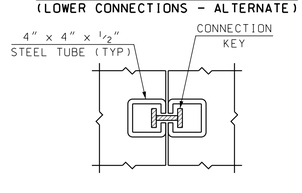
SECTION B-B (LOWER CONNECTION)

ELEVATION (UPPER CONNECTION)

SECTION B-B (LOWER CONNECTIONS - ALTERNATE)



ELEVATION (UPPER CONNECTION - ALTERNATE)

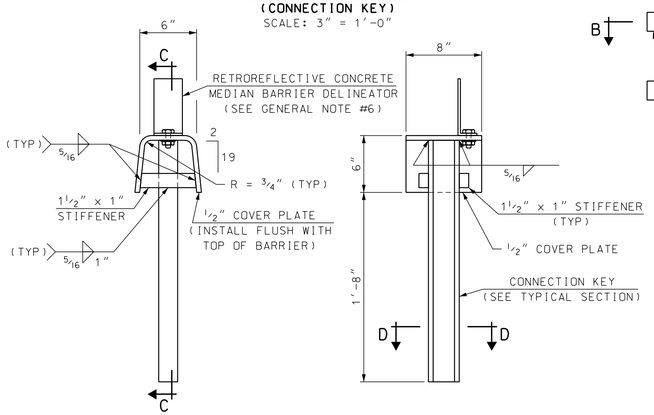


CONNECTION JOINT DETAIL

NOT TO SCALE

JOINT CONNECTION DETAILS

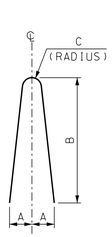
SCALE: 1 1/2" = 1'-0" (EXCEPT AS NOTED)



END VIEW — SECTION C-C

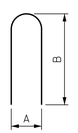
CONNECTION KEY ASSEMBLY DETAILS

SCALE: 1 1/2" = 1'-0"



TYPE "I" REBAR

NOT TO SCALE



TYPE "II" REBAR

NOT TO SCALE

ONLY FOR USE WITH HIGHWAY STANDARD PLAN GR-23, PCB NCHRP 350
SEE NOTICE TO CONTRACTORS "SUNSETTING OF NON-MASH PCB ON THE NHS"

GENERAL NOTES

(1) PORTABLE CONCRETE BARRIER SHALL BE FURNISHED BY THE CONTRACTOR AND PAID FOR AS ITEM 606.41741 PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE). CONCRETE BARRIER AND ALL ATTACHMENTS SHALL BE FABRICATED IN ACCORDANCE WITH SPECIAL PROVISIONS. ALL BARRIER UNITS FOR BRACED SYSTEMS SHALL BE 20' LONG.

(2) PORTABLE CONCRETE BARRIER DETAILS, AS SHOWN IN THESE PLANS, ARE IN COMPLIANCE WITH REQUIREMENTS PER UPDATED NCHRP REPORT 350 FOR TEST NO. 3-11 (MASH TEST LEVEL 3), CRASH TESTED BY MIDWEST ROADSIDE SAFETY: NY BOX BEAM STIFFENING OF UNANCHORED TCB, MARCH 2008, AND ACCEPTED PER FHWA LETTER B-239 (11/1/2012). THE BARRIER SYSTEM HAS BEEN CRASH TESTED WITH A 27.6" DYNAMIC DEFLECTION WHICH WILL ALLOW BRACED BARRIER TO BE PLACED A MINIMUM 12" FROM THE EDGE OF BRIDGE DECK.

(3) A MINIMUM OF TWO BARRIER UNITS, WITH BRACED JOINTS ARE REQUIRED TO BE PLACED BEYOND BOTH ENDS OF THE BRIDGE WORK AREA, FOR SPEEDS GREATER THAN 45 MPH. FOR SPEEDS ≤ 45 MPH, A MINIMUM OF ONE BRACED BARRIER IS REQUIRED TO BE FULLY SET BEYOND EACH END OF BRIDGE WORK AREA.

(4) THE LAST CONCRETE BARRIER UNIT, AT EACH END OF BRACED BARRIER LAYOUT, SHALL BE ANCHORED A MINIMUM 18" BELOW THE ROADWAY SURFACE. REQUIRED 1" Φ ANCHOR RODS (A36 STEEL) SHALL BE INSTALLED WITH 5 ANCHORS ON THE TRAFFIC SIDE OF BARRIER AND 4 ON THE CONSTRUCTION SIDE. IF THE END(S) OF THE BRACED CONCRETE BARRIER SYSTEM EXTENDS 50' OR MORE BEYOND LIMITS OF BRIDGE WORK THE LAST BARRIER UNIT DOES NOT REQUIRE ANCHORAGE.

(5) PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE), ITEM 606.41741, MAY BE INSTALLED WITH A 230' MINIMUM RADIUS. GAPS CREATED BETWEEN STRUCTURAL TUBES AND CONCRETE BARRIER, DURING A RADIAL LAYOUT, SHALL BE SHIMMED WITH 8" x 8" x 1/2" PLATES & FENDER WASHERS TO FIRMLY ATTACH STRUCTURAL TUBING TO BARRIER.

(6) THE CONTRACTOR SHALL FURNISH AND INSTALL APPROVED RETROREFLECTIVE DELINEATORS AT 25-FOOT INTERVALS ALONG TOP AND/OR ONE FOOT DOWN THE SIDE OF PORTABLE CONCRETE BARRIER. SUBSIDIARY TO ITEM 606.41741 (SEE STANDARD NO. DL-1 OF NHDOT STANDARD PLANS FOR ROAD CONSTRUCTION). THE COLOR OF DELINEATORS SHALL, IN ALL INSTANCES, CONFORM TO THE COLOR OF EDGE LINE MARKINGS. DELINEATORS SUPPLEMENT, BUT DO NOT REPLACE, THE NEED FOR RETROREFLECTIVE SOLID EDGE LINE MARKINGS.

MATERIAL NOTES

(1) BARRIERS SHALL BE LIGHT COLORED CLASS AA CONCRETE, WITH MINIMUM COMPRESSIVE STRENGTH OF 4000 psi, AND SHALL HAVE A SMOOTH UNIFORM SURFACE FREE OF DEFECTS AND IRREGULARITIES. CASTING DATE SHALL BE SHOWN ON BARRIER. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS OTHERWISE NOTED.

(2) ALL REINFORCING STEEL SHALL BE AASHTO M31 (ASTM A615) GRADE 60. ALL REINFORCEMENT SHALL HAVE 1 1/2" MINIMUM CLEAR COVER, UNLESS OTHERWISE NOTED.

(3) STRUCTURAL STEEL, EXCEPT THE STEEL TUBES, SHALL BE ASTM A36 OR A572. ALL STEEL SHALL BE FABRICATED IN ACCORDANCE WITH SECTION 550.

(4) STEEL TUBES, 6" x 6" x 3/16" & 4" x 4" x 1/2", SHALL BE ASTM A 500 GRADE B OR C. ALL TUBES SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 550.

(5) ALL STEEL FOR CONNECTION KEY AND TRANSITION KEY ASSEMBLIES SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 550.

(6) A MINIMUM OF 2 LIFTING DEVICES, EACH WITH THE CAPACITY TO LIFT A MASS OF 6 TONS (MINIMUM), SHALL BE INSTALLED TO EACH BARRIER UNIT. TWENTY FOOT LONG CONCRETE BARRIER UNITS ARE APPROXIMATELY 400 LBS./FT.

(7) DELINEATORS SHALL BE ATTACHED TO BARRIER USING AN APPROVED ADHESIVE MATERIAL OR AS SHOWN ON THIS SHEET.

REINFORCING SCHEDULE (PER 20' BARRIER UNIT)

MARK	SIZE	LENGTH	# PIECES	TYPE	A	B	C	LOCATION
B1	#4	4'-10"	9	I	5"	2'-4"	1"	STIRRUPS
B2	#6	19'-1"	2	——				LONGITUDINAL (TOP)
B3	#6	19'-9"	2	——				LONGITUDINAL (BOTTOM)
B4	#6	1'-2"	2	——				TRANSVERSE (BOTTOM)
B5	#6	6"	2	——				TRANSVERSE (TOP)
B6	#4	2'-9"	9	II	5"	1'-3"		STIRRUPS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
English/BARRIER	PCB-BRACED	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN | BRIDGE NO. | STATE PROJECT

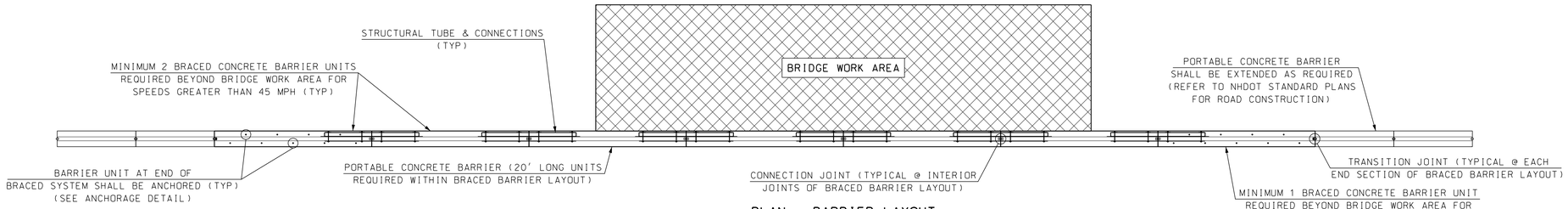
LOCATION

PORTABLE CONCRETE BARRIER - BRACED (1 OF 2)

BRIDGE SHEET OF

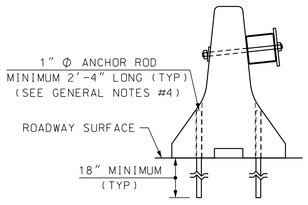
FILE NUMBER

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	NHDOT	7/12	CHECKED	ABH	8/12
	DRAWN	PJP	8/12	CHECKED	ABH	8/12
	QUANTITIES			CHECKED		
	ISSUE DATE	8/15/12	FEDERAL PROJECT NO.		SHEET NO.	TOTAL SHEETS
	REV. DATE	6/1/20	----------			



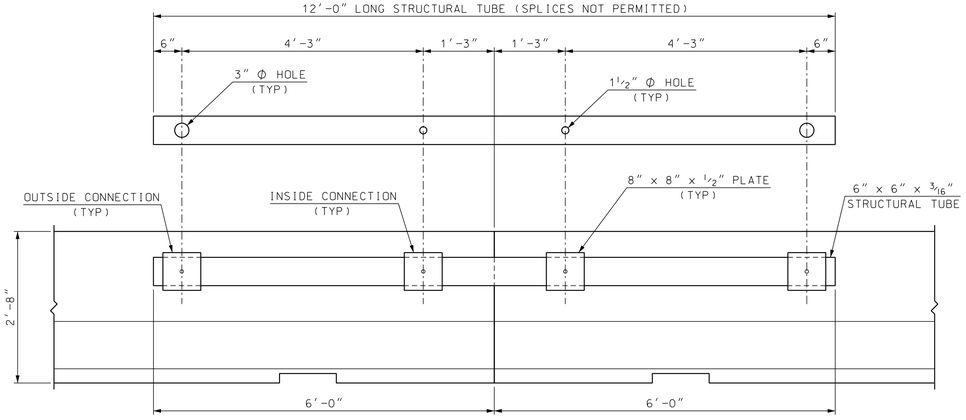
PLAN - BARRIER LAYOUT

NOT TO SCALE



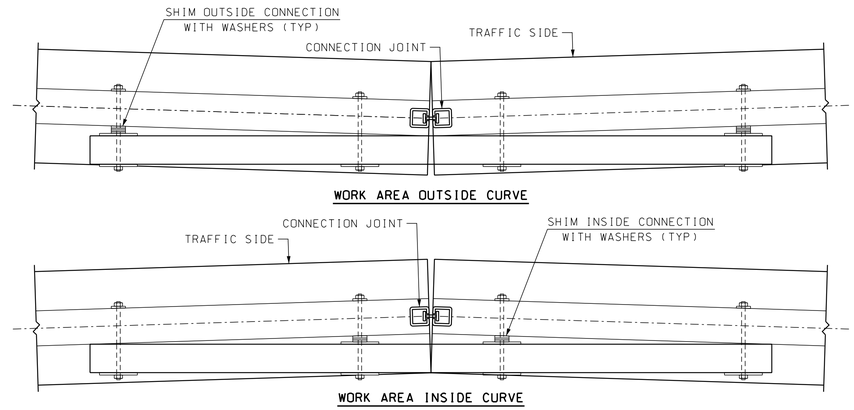
ANCHORAGE DETAIL

SCALE: 3/4" = 1'-0"



STRUCTURAL TUBING DETAILS

SCALE: 3/4" = 1'-0"

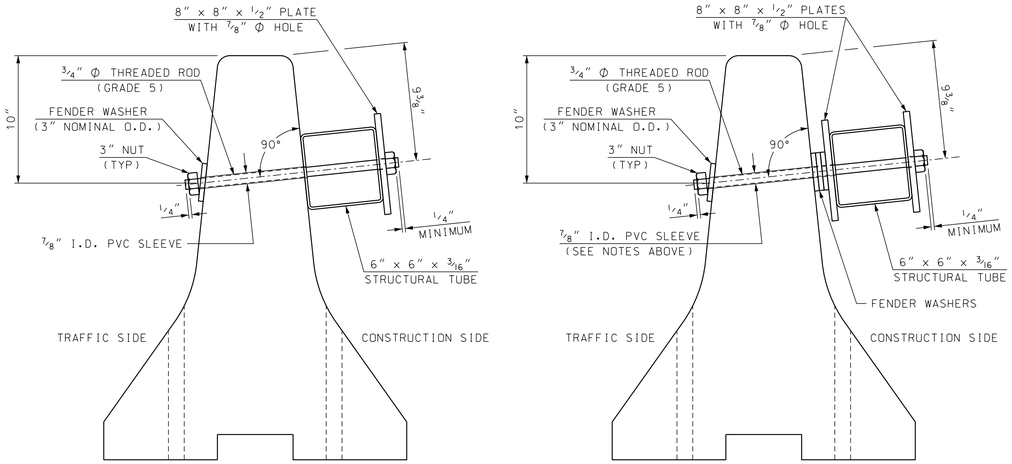


TUBE CONNECTIONS (CURVED ALIGNMENT)

SCALE: 3/4" = 1'-0"

PVC SLEEVE OPENINGS SHALL BE MODIFIED/DRILLED AS REQUIRED TO PROPERLY ALIGN STRUCTURAL TUBE BRACING UNITS FOR CURVED ALIGNMENTS

THE PRESENCE OF NORMAL HOLES WHICH HAVE BEEN MODIFIED/DRILLED WILL NOT AFFECT THE REUSE OF CONCRETE BARRIER UNITS

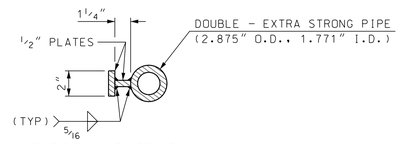


SECTION WITHOUT SHIMS

SECTION WITH SHIMS

BARRIER & STRUCTURAL TUBING SECTIONS

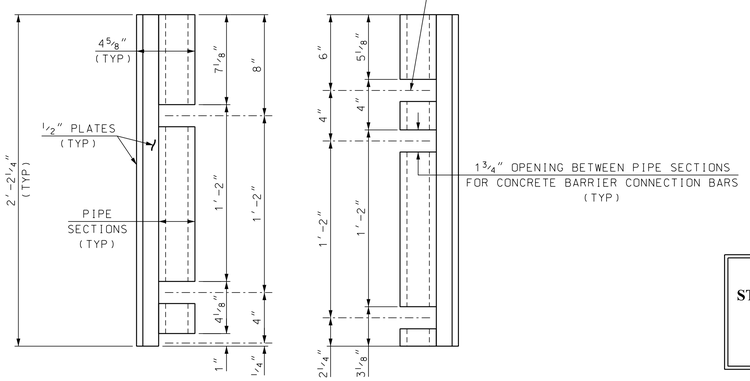
SCALE: 2" = 1'-0"



TYPICAL SECTION

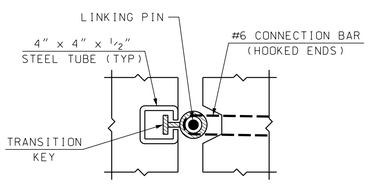
(TRANSITION KEY)

SCALE: 2" = 1'-0"



TRANSITION KEY ELEVATIONS

SCALE: 2" = 1'-0"



TRANSITION JOINT DETAILS

NOT TO SCALE

ONLY FOR USE WITH HIGHWAY STANDARD PLAN GR-23, PCB NCHRP 350

SEE NOTICE TO CONTRACTORS "SUNSETTING OF NON-MASH PCB ON THE NHS"

NO MODIFICATIONS SHALL BE MADE TO THIS SHEET

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN | BRIDGE NO. | STATE PROJECT

LOCATION

PORTABLE CONCRETE BARRIER - BRACED (2 OF 2)

BRIDGE SHEET OF

REVISIONS AFTER PROPOSAL	BY	DATE

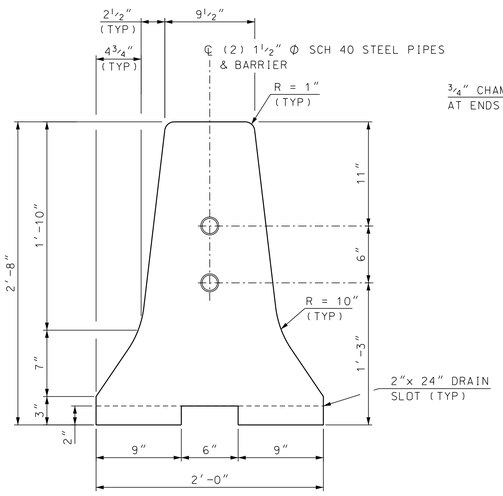
	BY	DATE		BY	DATE
DESIGNED	NHDOT	7/12	CHECKED	ABH	8/12
DRAWN	PJP	8/12	CHECKED	ABH	8/12
QUANTITIES			CHECKED		
ISSUE DATE	8/15/12		FEDERAL PROJECT NO.		
REV. DATE	6/1/20		----------		

FILE NUMBER

SHEET NO.

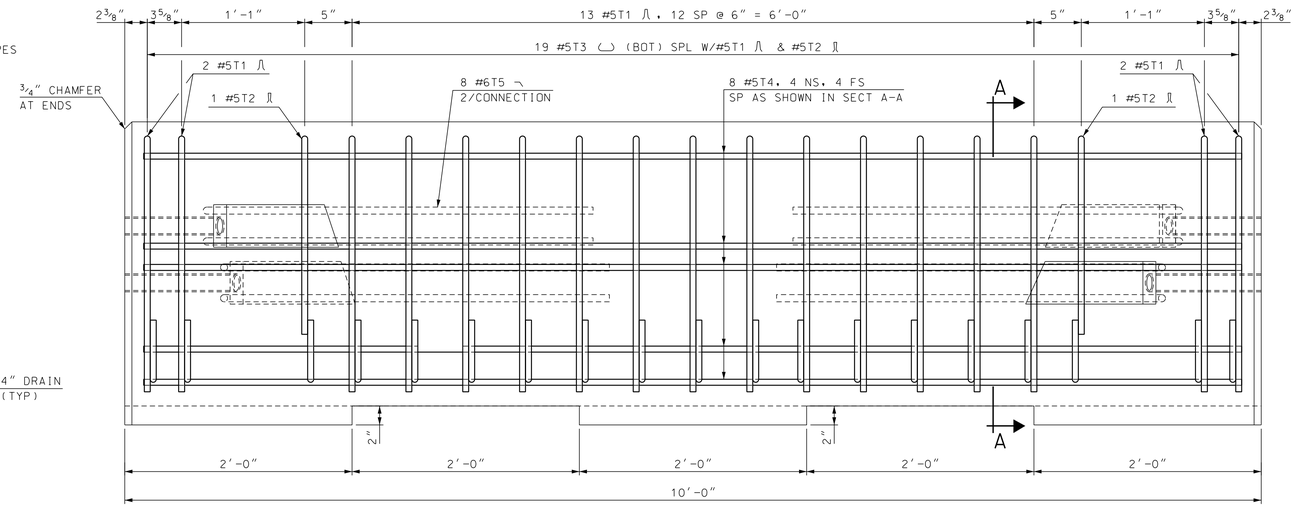
TOTAL SHEETS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
English/BARRIER	PCB-BRACED	AS NOTED



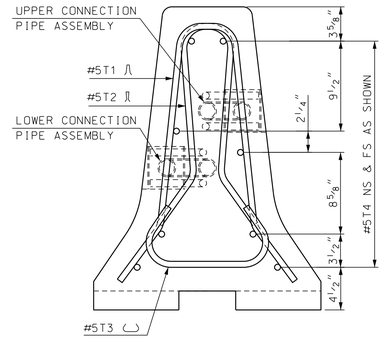
END VIEW

SCALE: 1 1/2" = 1'-0"



ELEVATION

SCALE: 1 1/2" = 1'-0"



SECTION A-A

SCALE: 1 1/2" = 1'-0"

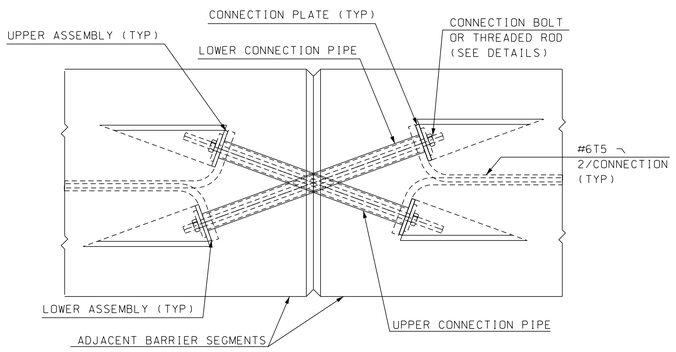
GENERAL NOTES:

1. PORTABLE CONCRETE BARRIER SHALL BE FURNISHED BY THE CONTRACTOR AND PAID FOR AS ITEM 606.41741, PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE). CONCRETE BARRIER AND ALL ATTACHMENTS SHALL BE FABRICATED IN ACCORDANCE WITH SPECIAL PROVISIONS. ALL BARRIER UNITS SHALL BE 10' LONG.
2. PORTABLE CONCRETE BARRIER DETAILS, AS SHOWN ON THESE PLANS, ARE IN COMPLIANCE WITH REQUIREMENTS PER UPDATED NCHRP REPORT 350 FOR TEST NO 3-11 (MASH TEST LEVEL 3), CRASH TESTED BY TEXAS A&M UNIVERSITY SYSTEM, MAY 2005, AND ACCEPTED PER REPORT FHWA/TX-05/0-4692-1.
3. THE BARRIER HAS BEEN CRASH TESTED WITH A 27" DYNAMIC DEFLECTION WHICH WILL ALLOW THE BARRIER TO BE PLACED A MINIMUM 12" FROM THE EDGE OF THE DECK.
4. USAGE OF THE TEXAS X-BOLT BARRIER REQUIRES A MINIMUM OF 100 LINEAR FEET (10 - 10' UNITS). THE X-BOLT BARRIER SHALL EXTEND A MINIMUM OF 50' BEYOND THE BRIDGE AT EACH END, PARALLEL TO THE ROADWAY CENTERLINE. THE ENDS OF THE BARRIER SHALL CONNECT TO THE TRANSITION UNIT AND THEN TO NHDOT PCB FLARED OUT THE REQUIRED CLEAR ZONE AS SHOWN ON SHEET 2 OF 3.
5. THE CONNECTION BOLTS AT THE BARRIER JOINTS SHALL BE TIGHTENED TO THE "TURN OF THE NUT" METHOD IN ACCORDANCE WITH SECTION 550.3.11.6.4 OF NHDOT STANDARD SPECIFICATIONS. AFTER INSTALLATION, ALL X-BOLT JOINTS SHALL BE CHECKED BY THE CONTRACT ADMINISTRATOR CONFIRMING THEY MEET THE TIGHTENED REQUIREMENT.
6. THE TEXAS X-BOLT BARRIER MAY BE INSTALLED WITH A 125' MINIMUM RADIUS OF CURVATURE AND A RELATIVE ANGLE OF 4 DEGREES BETWEEN THE 10' UNITS.
7. THE CONTRACTOR SHALL FURNISH AND INSTALL APPROVED RETROREFLECTIVE DELINEATORS AT 25-FOOT INTERVALS ALONG TOP AND/OR ONE FOOT DOWN THE SIDE OF PORTABLE CONCRETE BARRIER, SUBSIDIARY TO ITEM 606.41741 (SEE STANDARD NO. DL-1 OF NHDOT STANDARD PLANS FOR ROAD CONSTRUCTION). THE COLOR OF THE DELINEATORS SHALL, IN ALL INSTANCES, CONFORM TO THE COLOR OF THE EDGE LINE MARKINGS. DELINEATOR SUPPLEMENT, BUT DO NOT REPLACE, THE NEED FOR RETROREFLECTIVE SOLID EDGE LINE MARKINGS.

MATERIAL NOTES:

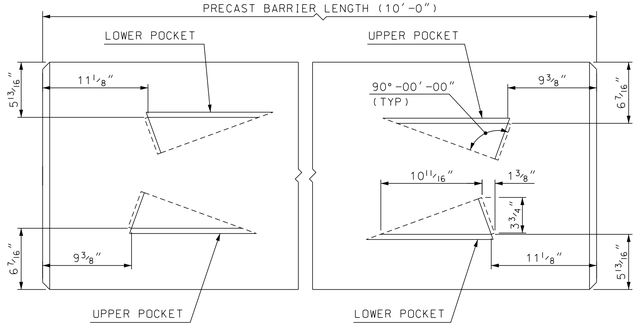
1. BARRIERS SHALL BE LIGHT COLORED CLASS AA CONCRETE, WITH COMPRESSIVE STRENGTH OF 4000 psi, AND SHALL HAVE A SMOOTH UNIFORM SURFACE FREE OF DEFECTS AND IRREGULARITIES. CASTING DATE SHALL BE SHOWN ON BARRIER. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS OTHERWISE NOTED.
2. ALL REINFORCING STEEL SHALL BE AASHTO M31 (ASTM A615) GRADE 60. ALL REINFORCEMENT SHALL HAVE 1 3/4" MINIMUM CLEAR COVER, UNLESS OTHERWISE NOTED.
3. CONNECTION BOLTS SHALL BE 7/8" Φ GALVANIZED HIGH STRENGTH THREADED RODS CONFORMING TO ASTM A325. STEEL PIPES, PLATE WASHERS, AND CONNECTION PLATES SHALL BE GALVANIZED ASTM A36 STEEL.
4. ALL STEEL FOR CONNECTIONS SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 550.

NOTE: CONNECTION HARDWARE SHALL NOT EXTEND BEYOND THE CONCRETE FACE OF BARRIER



TYPE X JOINT CONNECTION DETAILS

SCALE: 1 1/2" = 1'-0"



TOP VIEW CONNECTION POCKETS

SCALE: 1 1/2" = 1'-0"

NO MODIFICATIONS SHOULD BE MADE TO THIS SHEET

ONLY FOR USE WITH HIGHWAY STANDARD PLAN GR-23, PCB NCHRP 350

SEE NOTICE TO CONTRACTORS "SUNSETTING OF NON-MASH PCB ON THE NHS"

BARRIER WEIGHT APPROX. 2.38 TONS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
standard\english\barrier	X-Bolt Barrier	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN XX BRIDGE NO. XXX\XXX STATE PROJECT XX

LOCATION XX

TEXAS RESTRAINED BARRIER (X-BOLT) (1 OF 3)

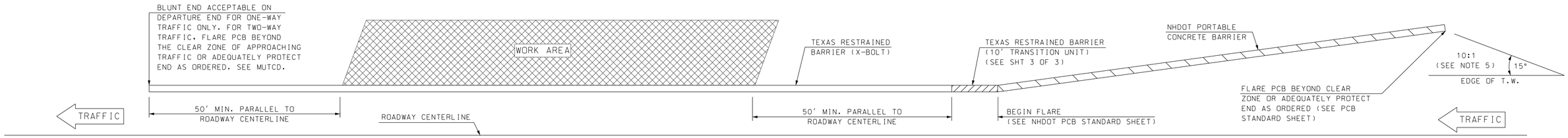
BRIDGE SHEET: XX OF XX

FILE NUMBER: XX-X-X

REVISIONS AFTER PROPOSAL	BY	DATE

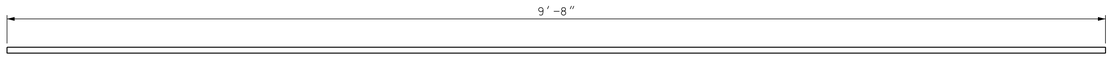
	BY	DATE		BY	DATE
DESIGNED	TXDOT	12/10	CHECKED	NHDOT	4/18
DRAWN	GMC	1/18	CHECKED	NHDOT	4/18
QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX

ISSUE DATE	5/15/18	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	6/1/20	----------		

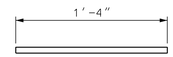


PLAN - BARRIER LAYOUT

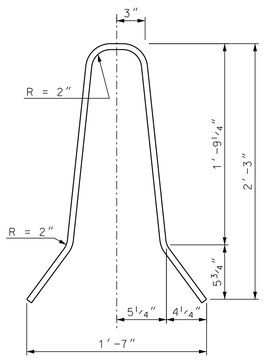
(NTS)



#5T4



#5T7



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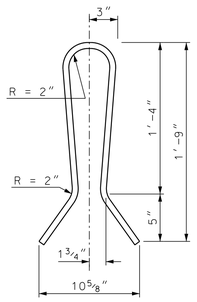

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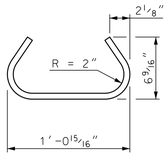
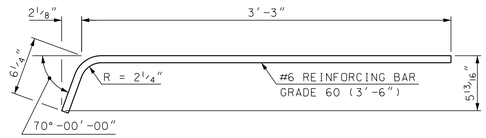
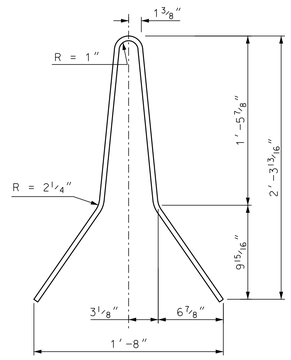


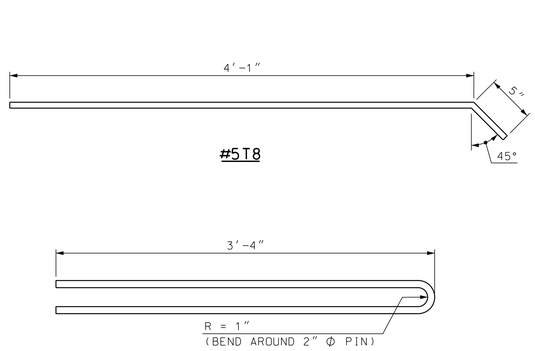
#5T3



#6T5 ⌐



#4T6

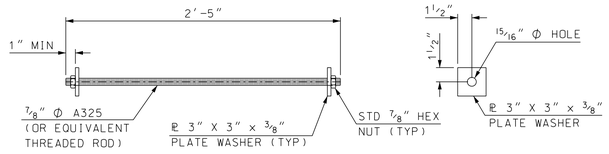


#5T8

#6T9

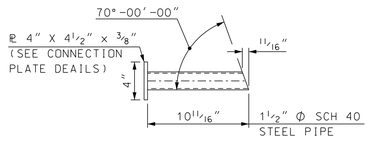
BENDING SCHEDULE

SCALE: 1 1/2" = 1'-0"



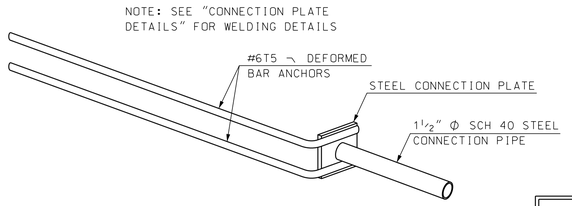
CONNECTION BOLT OR THREADED ROD DETAILS

SCALE: 1 1/2" = 1'-0"



UPPER CONNECTION PIPE DETAIL

SCALE: 1 1/2" = 1'-0"



ISOMETRIC VIEW OF TYPICAL WELD ASSEMBLY

SCALE: N.T.S.

REBAR SCHEDULE TEXAS X-BOLT (10' BARRIER)			
MK		QTY	LENGTH
T1	#5	17	5'-2"
T2	#5	2	4'-0"
T3	#5	19	2'-1"
T4	#5	8	9'-8"
T5	#6	8	3'-9"

REBAR SCHEDULE TRANSITION (10' BARRIER)			
MK		QTY	LENGTH
T1	#5	9	5'-2"
T2	#5	1	4'-0"
T3	#5	10	2'-1"
T4	#5	8	9'-8"
T5	#6	4	3'-9"
T6	#4	4	5'-2"
T7	#5	4	1'-4"
T8	#5	2	4'-6"
T9	#6	3	6'-10"

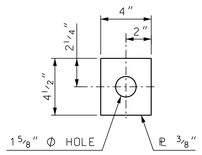
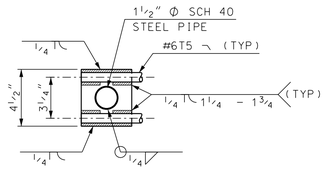


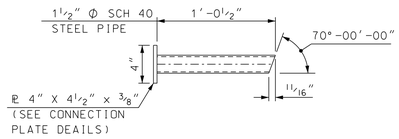
PLATE DIMENSIONS



WELDING DETAILS

CONNECTION PLATE DETAILS

SCALE: 2" = 1'-0"



LOWER CONNECTION PIPE DETAIL

SCALE: 1 1/2" = 1'-0"

NO MODIFICATIONS SHOULD BE MADE TO THIS SHEET

ONLY FOR USE WITH HIGHWAY STANDARD PLAN GR-23, PCB NCHRP 350

SEE NOTICE TO CONTRACTORS "SUNSETTING OF NON-MASH PCB ON THE NHS"

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

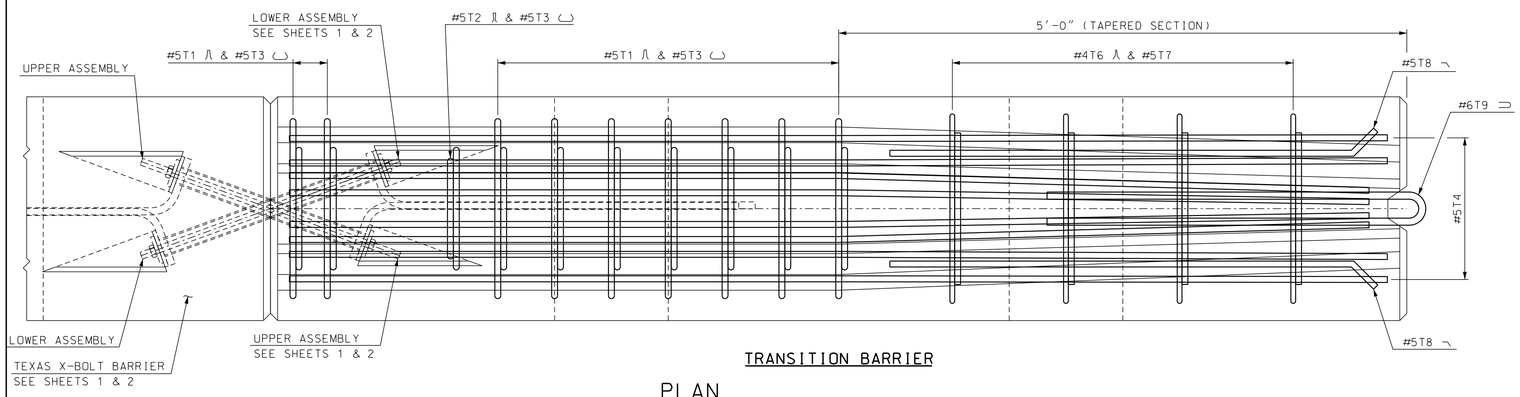
TOWN XX | BRIDGE NO. XXX/XXX | STATE PROJECT XX
LOCATION XX

TEXAS RESTRAINED BARRIER (X-BOLT) (2 OF 3)

BRIDGE SHEET: XX OF XX
FILE NUMBER: XX-X-X

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	TXDOT	12/10	CHECKED	NHDOT	4/18
	DRAWN	GMC	1/18	CHECKED	NHDOT	4/18
	QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX
	ISSUE DATE	5/15/18	FEDERAL PROJECT NO.		SHEET NO.	TOTAL SHEETS
	REV. DATE	6/1/20	----------			

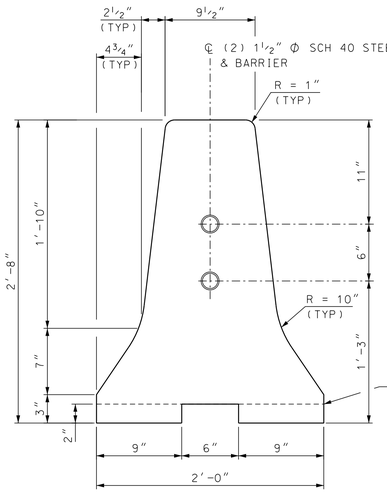
SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
standard\english\barrier	X-Bolt Barrier	AS NOTED



TRANSITION BARRIER

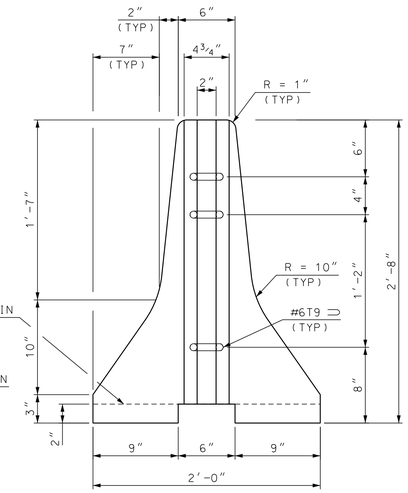
PLAN

SCALE: 1½" = 1'-0"



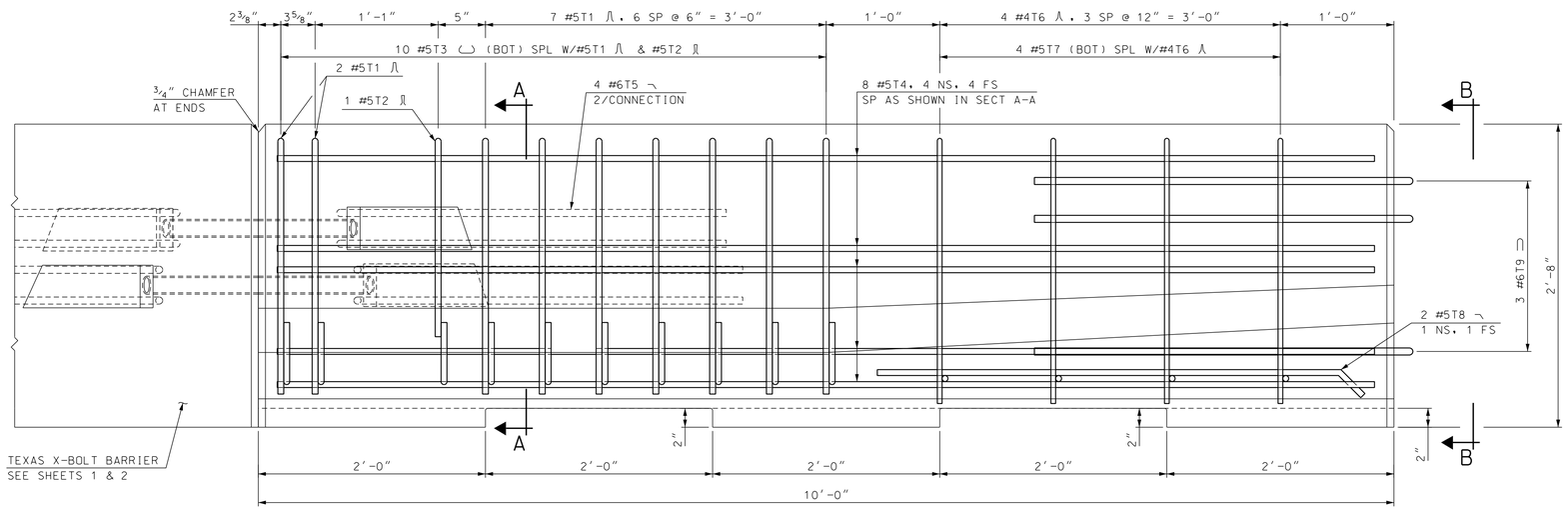
END VIEW SECTION A-A

SCALE: 1½" = 1'-0"



VIEW B-B

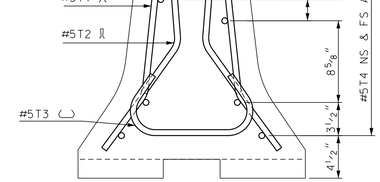
SCALE: 1½" = 1'-0"



TRANSITION BARRIER

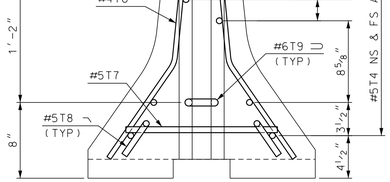
ELEVATION

SCALE: 1½" = 1'-0"



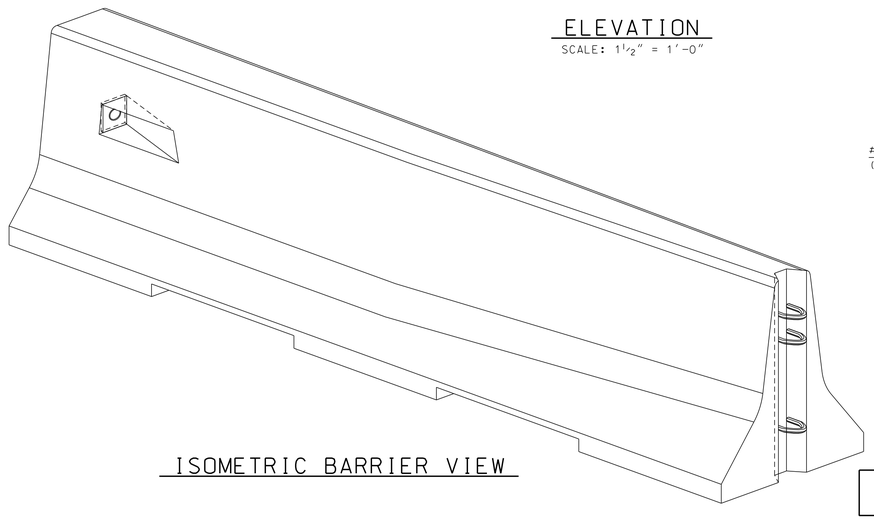
SECTION A-A

SCALE: 1½" = 1'-0"

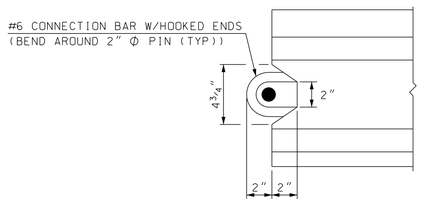


VIEW B-B

SCALE: 1½" = 1'-0"

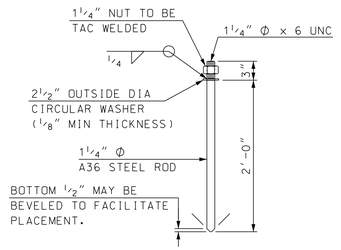


ISOMETRIC BARRIER VIEW



END NOTCH DETAIL (AT VIEW B-B

SCALE: 2" = 1'-0"



CONNECTOR PIN ASSEMBLY

SCALE: 1" = 1'-0"

NO MODIFICATIONS SHOULD BE MADE TO THIS SHEET

NOTES

1. TEXAS RESTRAINED BARRIER (TRANSISTION UNIT) SHALL BE PAID FOR UNDER ITEM 606.41741, PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE).
2. SEE SHEET 1 OF 3 FOR NOTES AND SHEET 2 OF 3 FOR REBAR SCHEDULE.

ONLY FOR USE WITH HIGHWAY STANDARD PLAN GR-23, PCB NCHRP 350

SEE NOTICE TO CONTRACTORS "SUNSETTING OF NON-MASH PCB ON THE NHS"

BARRIER WEIGHT APPROX. 2.28 TONS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
standard\english\barrier	X-Bolt Barrier	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN XX BRIDGE NO. XXX\XXX STATE PROJECT XX

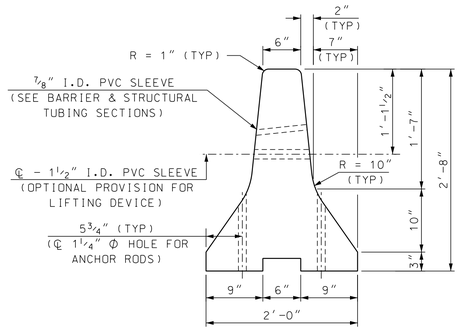
LOCATION XX

TEXAS RESTRAINED BARRIER (X-BOLT) (3 OF 3)

BRIDGE SHEET: XX OF XX

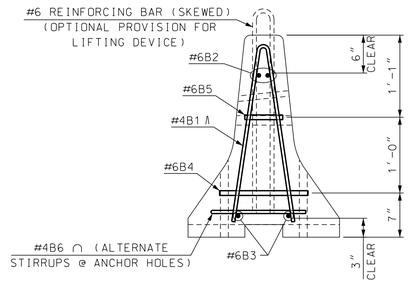
FILE NUMBER: XX-X-X

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	TXDOT	12/10	CHECKED	NHDOT	4/18
	DRAWN	GMC	1/18	CHECKED	NHDOT	4/18
	QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX
	ISSUE DATE	5/15/18	FEDERAL PROJECT NO.		SHEET NO.	TOTAL SHEETS
	REV. DATE	6/1/20	----------			



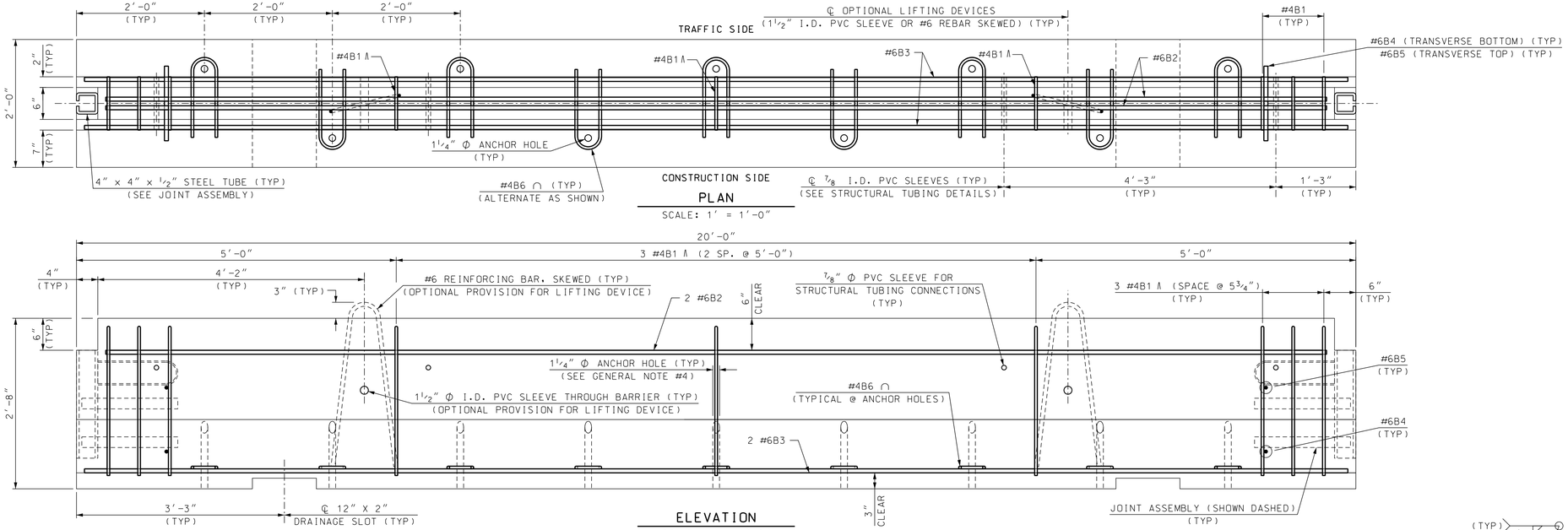
TYPICAL SECTION

SCALE: 1" = 1'-0"



TYPICAL SECTION

SCALE: 1" = 1'-0"



PLAN

SCALE: 1' = 1'-0"

ELEVATION

SCALE: 1' = 1'-0"

GENERAL NOTES

(1) PORTABLE CONCRETE BARRIER, INCLUDING TRANSITION UNIT, SHALL BE FURNISHED BY THE CONTRACTOR AND PAID FOR AS ITEM 606.41741 PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE). CONCRETE BARRIER AND ALL ATTACHMENTS SHALL BE FABRICATED IN ACCORDANCE WITH SPECIAL PROVISIONS. ALL BARRIER UNITS FOR BRACED SYSTEMS SHALL BE 20' LONG.

(2) PORTABLE CONCRETE BARRIER DETAILS, AS SHOWN IN THESE PLANS, ARE IN COMPLIANCE WITH REQUIREMENTS PER UPDATED NCHRP REPORT 350 FOR TEST NO. 3-11 (MASH TEST LEVEL 3), CRASH TESTED BY MIDWEST ROADSIDE SAFETY; NY BOX BEAM STIFFENING OF UNANCHORED TCB, MARCH 2008, AND ACCEPTED PER FHWA LETTER B-239 (11/1/2012). THE BARRIER SYSTEM HAS BEEN CRASH TESTED WITH A 27.6" DYNAMIC DEFLECTION WHICH WILL ALLOW BRACED BARRIER TO BE PLACED A MINIMUM 12" FROM THE EDGE OF BRIDGE DECK.

(3) A MINIMUM OF TWO BARRIER UNITS, WITH BRACED JOINTS ARE REQUIRED TO BE PLACED BEYOND BOTH ENDS OF THE BRIDGE WORK AREA. FOR SPEEDS GREATER THAN 45 MPH. FOR SPEEDS ≤ 45 MPH, A MINIMUM OF ONE BRACED BARRIER IS REQUIRED TO BE FULLY SET BEYOND EACH END OF BRIDGE WORK AREA.

(4) THE LAST CONCRETE BARRIER UNIT, AT EACH END OF BRACED BARRIER LAYOUT, SHALL BE ANCHORED A MINIMUM 18" BELOW THE ROADWAY SURFACE. REQUIRED 1" Φ ANCHOR RODS (A36 STEEL) SHALL BE INSTALLED WITH 5 ANCHORS ON THE TRAFFIC SIDE OF BARRIER AND 4 ON THE CONSTRUCTION SIDE. IF THE END(S) OF THE BRACED CONCRETE BARRIER SYSTEM EXTENDS 50' OR MORE BEYOND LIMITS OF BRIDGE WORK THE LAST BARRIER UNIT DOES NOT REQUIRE ANCHORAGE.

(5) PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE), ITEM 606.41741, MAY BE INSTALLED WITH A 230' MINIMUM RADIUS. GAPS CREATED BETWEEN STRUCTURAL TUBES AND CONCRETE BARRIER, DURING A RADIAL LAYOUT, SHALL BE SHIMMED WITH 8" x 8" x ½" PLATES & FENDER WASHERS TO FIRMLY ATTACH STRUCTURAL TUBING TO BARRIER.

(6) THE CONTRACTOR SHALL FURNISH AND INSTALL APPROVED RETROREFLECTIVE DELINEATORS ON EACH BARRIER OR/WITH A MAXIMUM OF 25-FOOT INTERVALS ALONG TOP AND/OR ONE FOOT DOWN THE SIDE OF PORTABLE CONCRETE BARRIER, SUBSIDIARY TO ITEM 606.41741 (SEE STANDARD NO. DL-1 OF NHDOT STANDARD PLANS FOR ROAD CONSTRUCTION). THE COLOR OF DELINEATORS SHALL, IN ALL INSTANCES, CONFORM TO THE COLOR OF EDGE LINE MARKINGS. DELINEATORS SUPPLEMENT, BUT DO NOT REPLACE, THE NEED FOR RETROREFLECTIVE SOLID EDGE LINE MARKINGS.

MATERIAL NOTES

(1) BARRIERS SHALL BE LIGHT COLORED CLASS AA CONCRETE, WITH MINIMUM COMPRESSIVE STRENGTH OF 4000 psi, AND SHALL HAVE A SMOOTH UNIFORM SURFACE FREE OF DEFECTS AND IRREGULARTIES. CASTING DATE SHALL BE SHOWN ON BARRIER. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED ¾", UNLESS OTHERWISE NOTED.

(2) ALL REINFORCING STEEL SHALL BE AASHTO M31 (ASTM A615) GRADE 60. ALL REINFORCEMENT SHALL HAVE 1½" MINIMUM CLEAR COVER, UNLESS OTHERWISE NOTED. SEE SHEET 3 OF 3 FOR REBAR SCHEDULE.

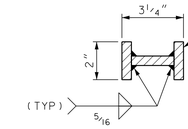
(3) STRUCTURAL STEEL, EXCEPT THE STEEL TUBES, SHALL BE ASTM A36 OR A572. ALL STEEL SHALL BE FABRICATED IN ACCORDANCE WITH SECTION 550.

(4) STEEL TUBES, 6" x 6" x 3/16" & 4" x 4" x ½", SHALL BE ASTM A 500 GRADE B OR C. ALL TUBES SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 550.

(5) ALL STEEL FOR CONNECTION KEY AND TRANSITION KEY ASSEMBLIES SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 550.

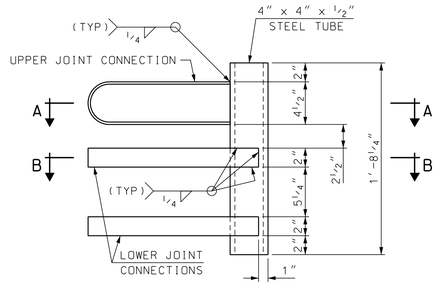
(6) A MINIMUM OF 2 LIFTING DEVICES, EACH WITH THE CAPACITY TO LIFT A MASS OF 6 TONS (MINIMUM), SHALL BE INSTALLED TO EACH BARRIER UNIT.

(7) DELINEATORS SHALL BE ATTACHED TO BARRIER USING AN APPROVED ADHESIVE MATERIAL OR AS SHOWN ON THIS SHEET.



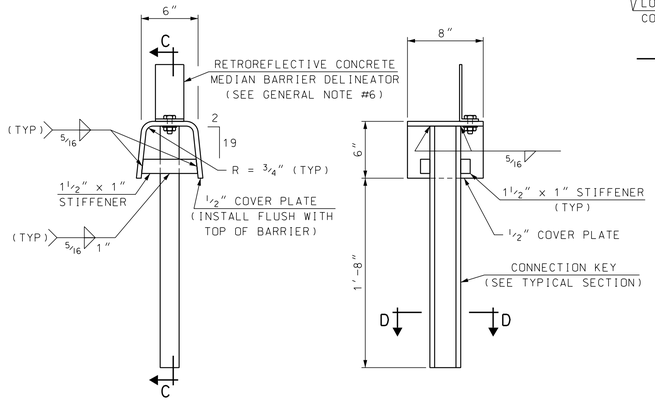
SECTION D-D (CONNECTION KEY)

SCALE: 3" = 1'-0"



JOINT ASSEMBLY

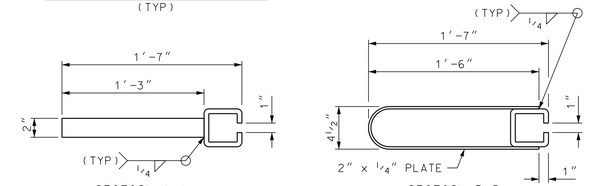
SCALE: 1½" = 1'-0"

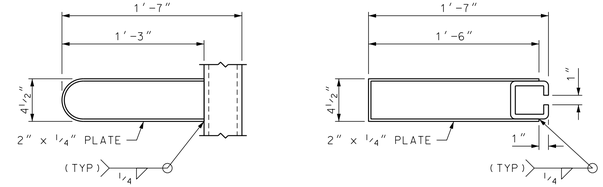


CONNECTION KEY ASSEMBLY DETAILS

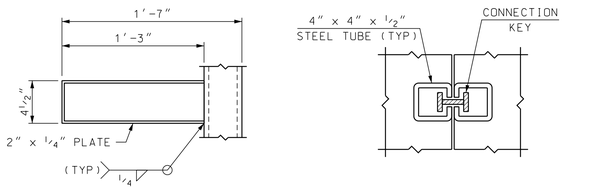
SCALE: 1½" = 1'-0"

BARRIER WEIGHT APPROX. 3.94 TONS





NO MODIFICATIONS SHALL BE MADE TO THIS SHEET



JOINT CONNECTION DETAILS

SCALE: 1½" = 1'-0" (EXCEPT AS NOTED)

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

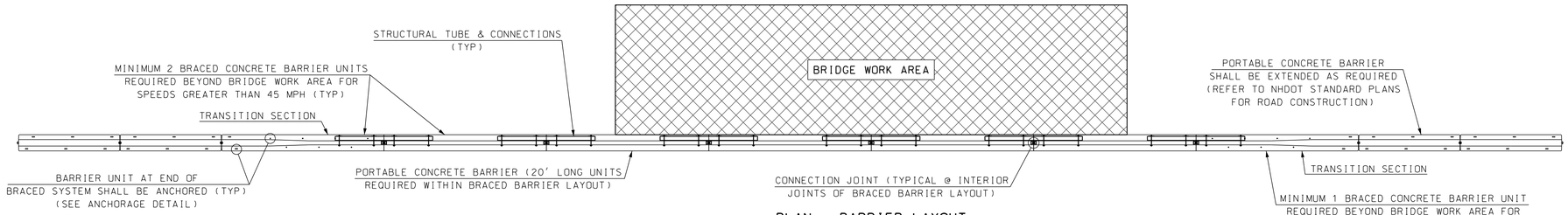
TOWN	BRIDGE NO.	STATE PROJECT
LOCATION		

PORTABLE CONCRETE BARRIER - BRACED (1 OF 3)

BRIDGE SHEET OF FILE NUMBER

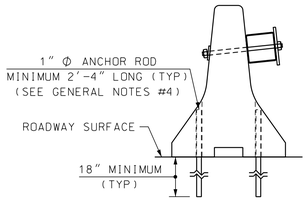
REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	NHDOT	7/12	CHECKED	ABH	8/12
	DRAWN	PJP	8/12	CHECKED	ABH	5/20
	QUANTITIES			CHECKED		
	ISSUE DATE	8/15/12	FEDERAL PROJECT NO.		SHEET NO.	TOTAL SHEETS
	REV. DATE	6/1/20	----------			

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
English/BARRIERCB	BRACED_Revised Transition	AS NOTED



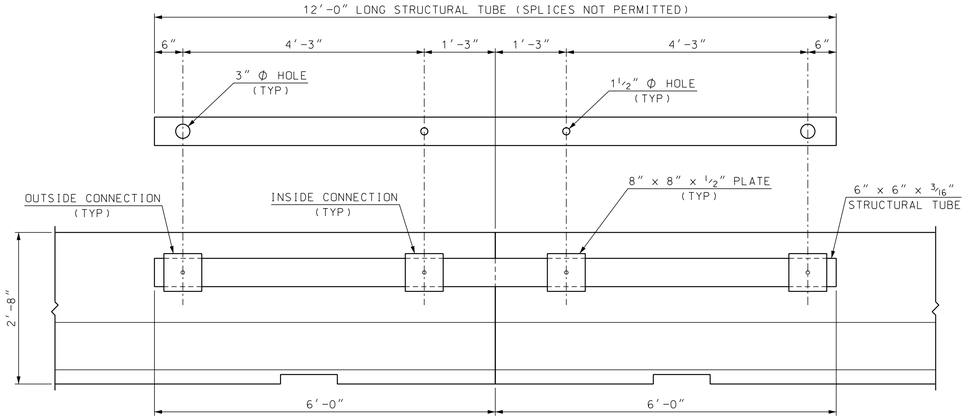
PLAN - BARRIER LAYOUT

NOT TO SCALE



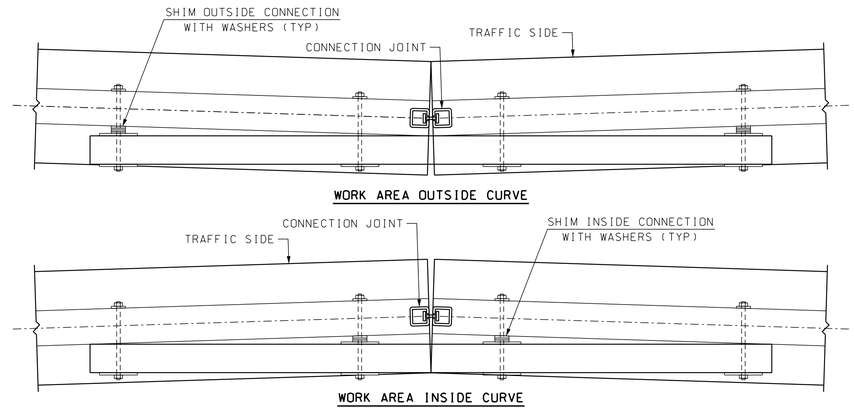
ANCHORAGE DETAIL

SCALE: 3/4" = 1'-0"



STRUCTURAL TUBING DETAILS

SCALE: 3/4" = 1'-0"

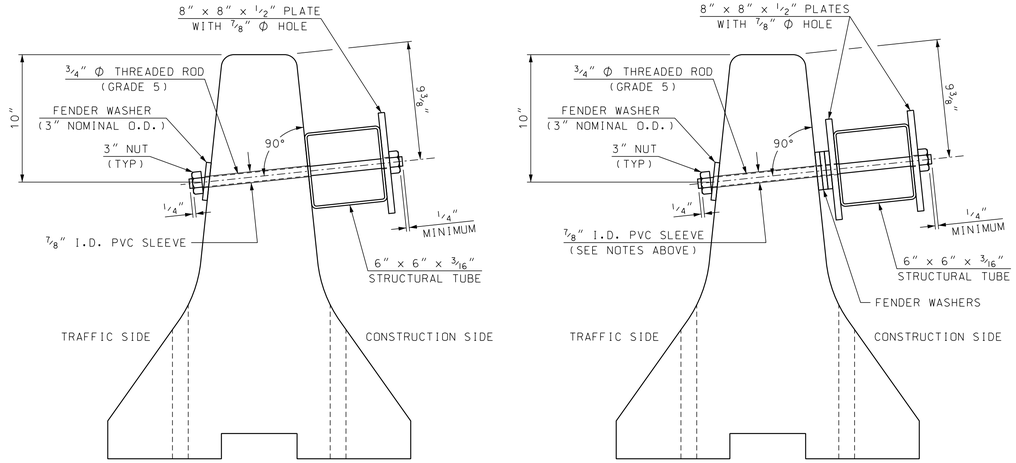


TUBE CONNECTIONS (CURVED ALIGNMENT)

SCALE: 3/4" = 1'-0"

PVC SLEEVE OPENINGS SHALL BE MODIFIED/DRILLED AS REQUIRED TO PROPERLY ALIGN STRUCTURAL TUBE BRACING UNITS FOR CURVED ALIGNMENTS

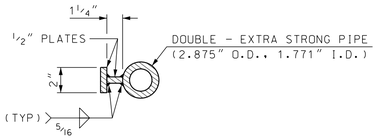
THE PRESENCE OF NORMAL HOLES WHICH HAVE BEEN MODIFIED/DRILLED WILL NOT AFFECT THE REUSE OF CONCRETE BARRIER UNITS



SECTION WITHOUT SHIMS — SECTION WITH SHIMS

BARRIER & STRUCTURAL TUBING SECTIONS

SCALE: 2" = 1'-0"

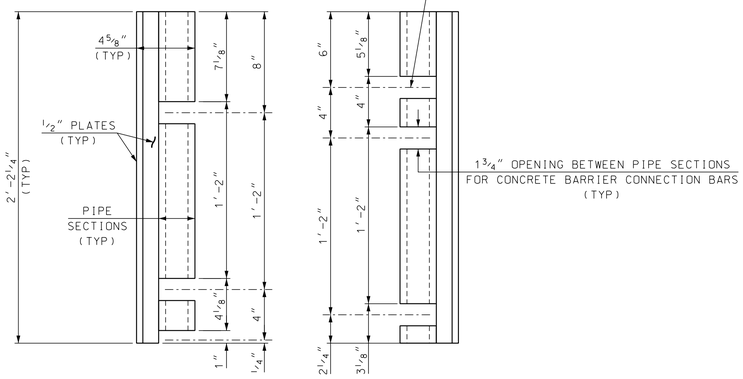


TYPICAL SECTION

(TRANSITION KEY)

(ONLY REQUIRED FOR CONNECTION TO HIGHWAY PCB STANDARD PLAN GR-23 (NCHRP 350))

SCALE: 2" = 1'-0"



TRANSITION KEY ELEVATIONS

(ONLY REQUIRED FOR CONNECTION TO HIGHWAY PCB STANDARD PLAN GR-23 (NCHRP 350))

SCALE: 2" = 1'-0"

NO MODIFICATIONS SHALL BE MADE TO THIS SHEET

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN | BRIDGE NO. | STATE PROJECT

LOCATION

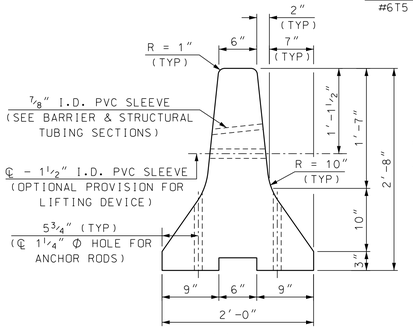
PORTABLE CONCRETE BARRIER - BRACED (2 OF 3)

BRIDGE SHEET OF FILE NUMBER

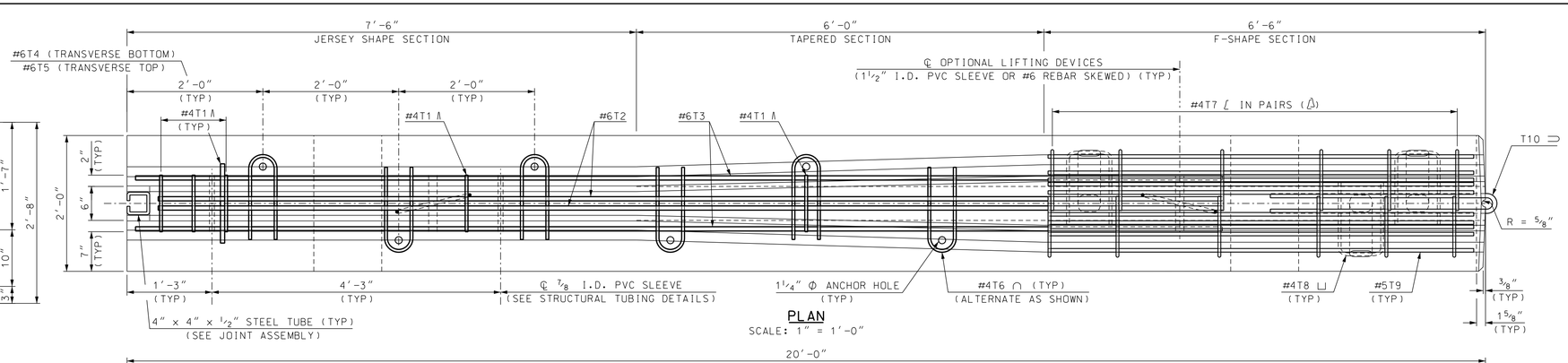
REVISIONS AFTER PROPOSAL	BY	DATE		BY	DATE
			DESIGNED NHDOT	7/12	CHECKED ABH	8/12
			DRAWN PJP	8/12	CHECKED ABH	8/12
			QUANTITIES		CHECKED	

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
English/BARRIER	CB-BRACED_Revised Transition	AS NOTED

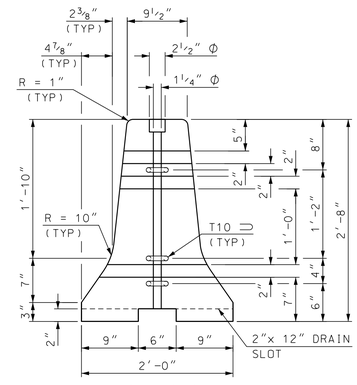
ISSUE DATE	8/15/12	FEDERAL PROJECT NO.	SHEET NO.
REV. DATE	6/1/20	----------	TOTAL SHEETS



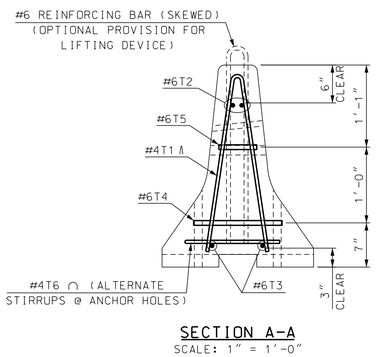
SECTION A-A
SCALE: 1" = 1'-0"



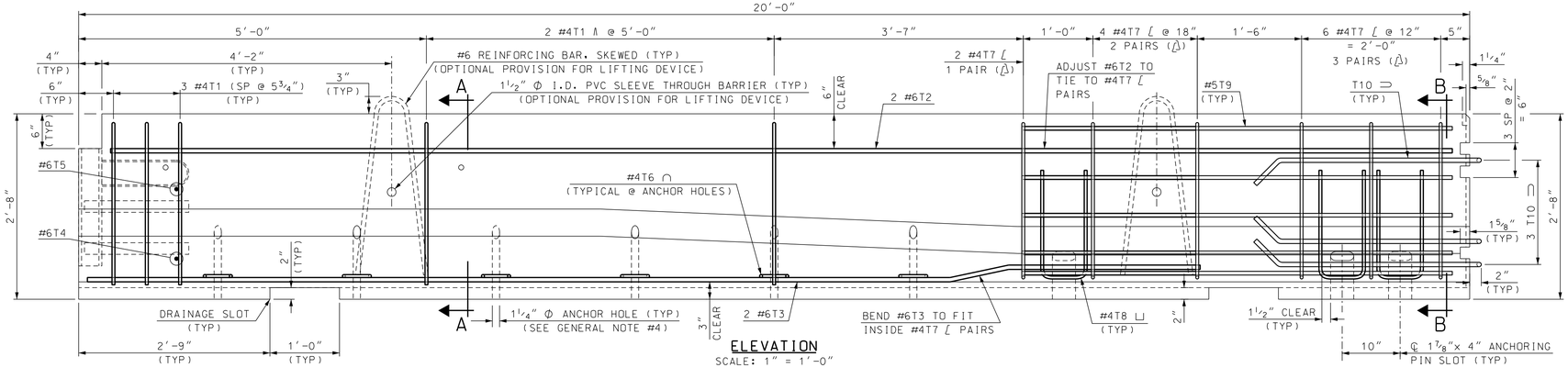
PLAN
SCALE: 1" = 1'-0"



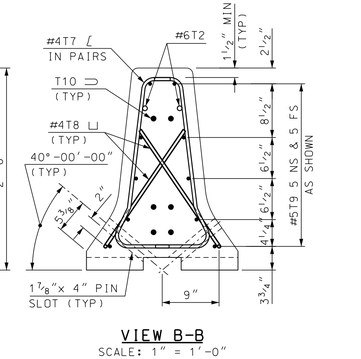
VIEW B-B
SCALE: 1" = 1'-0"



SECTION A-A
SCALE: 1" = 1'-0"



ELEVATION
SCALE: 1" = 1'-0"



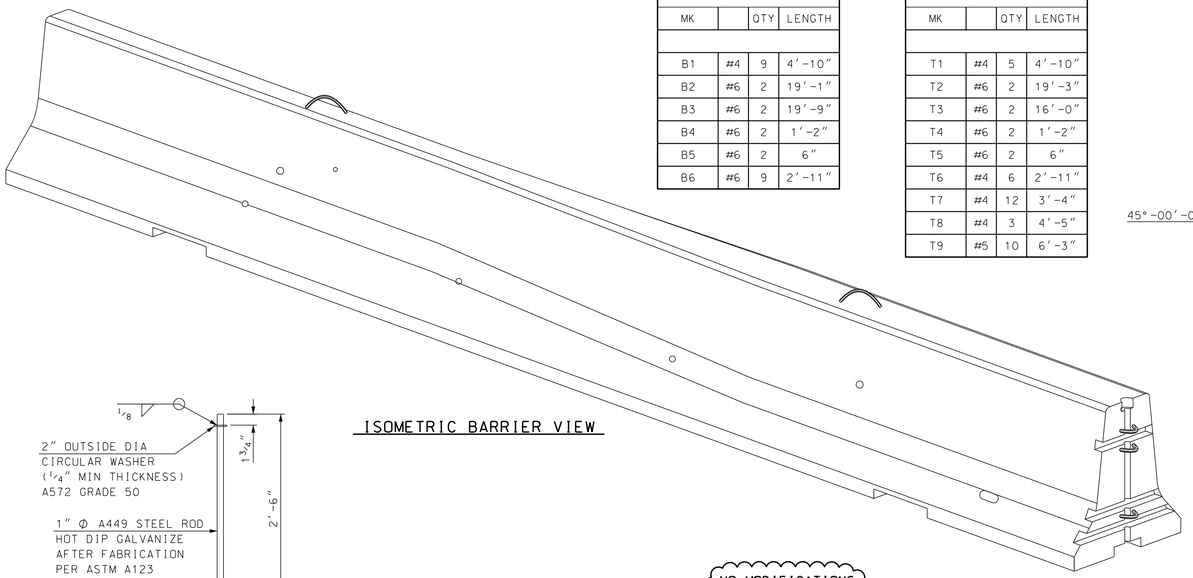
VIEW B-B
SCALE: 1" = 1'-0"

REBAR SCHEDULE
BRACED BARRIER
(20' BARRIER)

MK		QTY	LENGTH
B1	#4	9	4'-10"
B2	#6	2	19'-1"
B3	#6	2	19'-9"
B4	#6	2	1'-2"
B5	#6	2	6"
B6	#6	9	2'-11"

REBAR SCHEDULE
TRANSITION
(20' BARRIER)

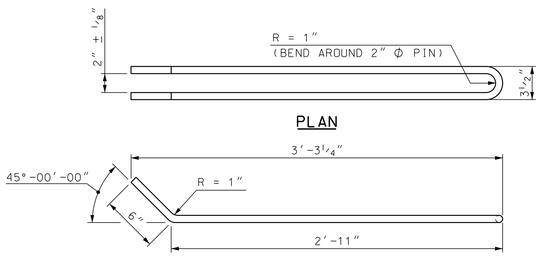
MK		QTY	LENGTH
T1	#4	5	4'-10"
T2	#6	2	19'-3"
T3	#6	2	16'-0"
T4	#6	2	1'-2"
T5	#6	2	6"
T6	#4	6	2'-11"
T7	#4	12	3'-4"
T8	#4	3	4'-5"
T9	#5	10	6'-3"



ISOMETRIC BARRIER VIEW

LINKING PIN ASSEMBLY
SCALE: 1" = 1'-0"

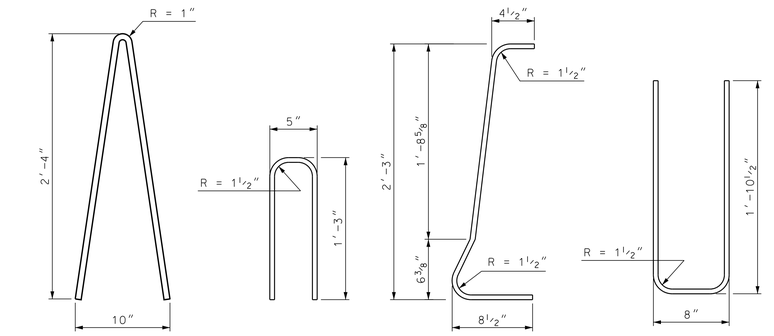
NO MODIFICATIONS SHALL BE MADE TO THIS SHEET



PLAN

ELEVATION
T8 LOOP BAR

3/4" DIA. LOOP BARS (ASTM A36)
(3 BARS, 7'-2" LENGTH/BAR)
(HOT DIP GALVANIZED AFTER FABRICATION PER ASTM A123 OR AASHTO M11)



BENDING SCHEDULE
SCALE: 1 1/2" = 1'-0"

BARRIER WEIGHT APPROX. 4.30 TONS

NOTE: TRANSITION PIECE FOR USE WITH HIGHWAY PCB STANDARD PLAN NO. GR-24 & 25 (MASH 16)

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN | BRIDGE NO. | STATE PROJECT
LOCATION

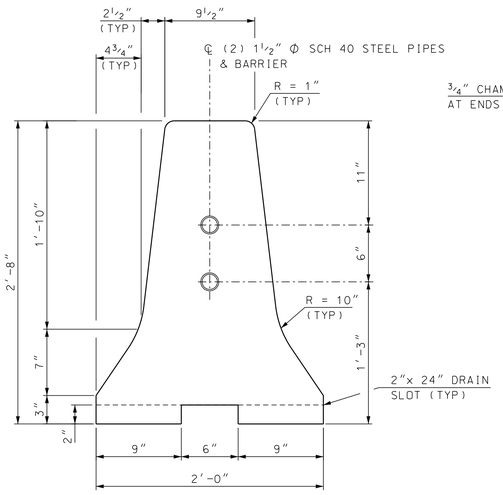
PORTABLE CONCRETE BARRIER - BRACED (3 OF 3)

BRIDGE SHEET OF FILE NUMBER

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	NHDOT	4/20	CHECKED	NHDOT	4/20
	DRAWN	SMG	4/20	CHECKED	ABH	5/20
	QUANTITIES			CHECKED		
	ISSUE DATE	6/1/20		FEDERAL PROJECT NO.		SHEET NO.
	REV. DATE			----------		

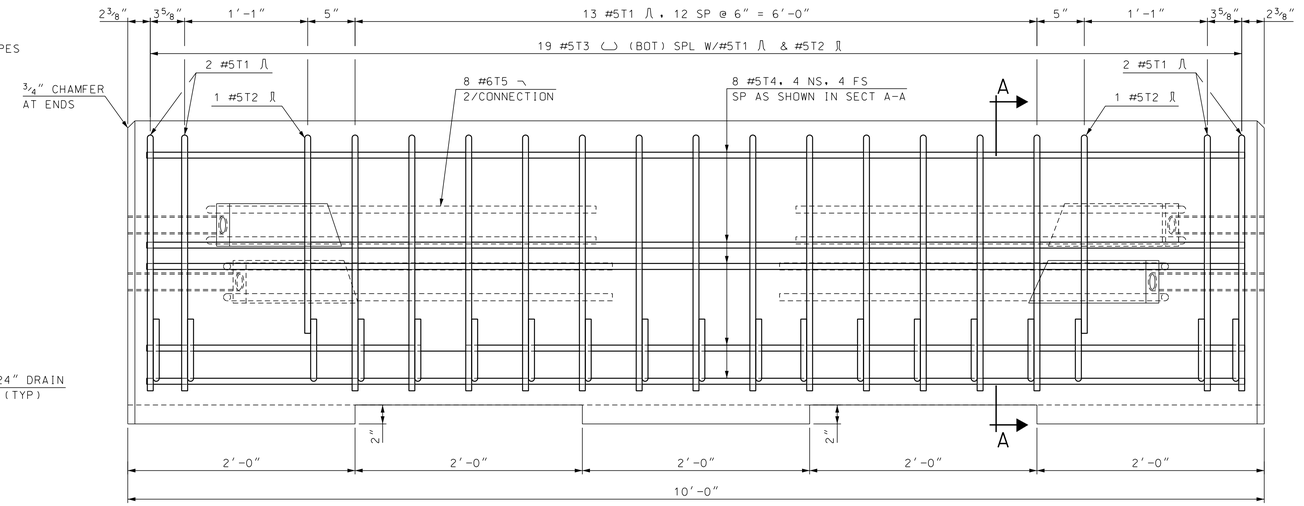
TOTAL SHEETS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
English/BARRIER	CB-BRACED_Revised Transition	AS NOTED



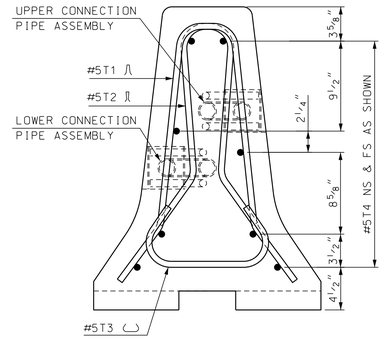
END VIEW

SCALE: 1 1/2" = 1'-0"



ELEVATION

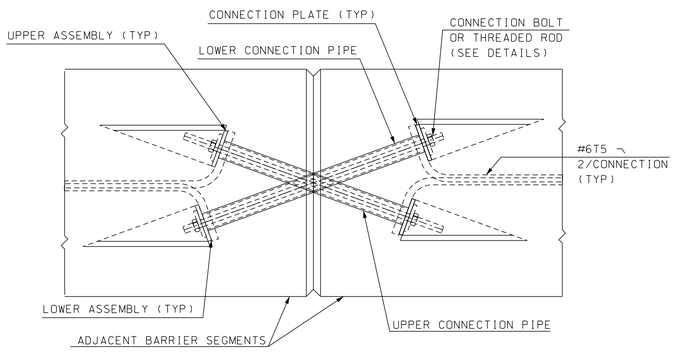
SCALE: 1 1/2" = 1'-0"



SECTION A-A

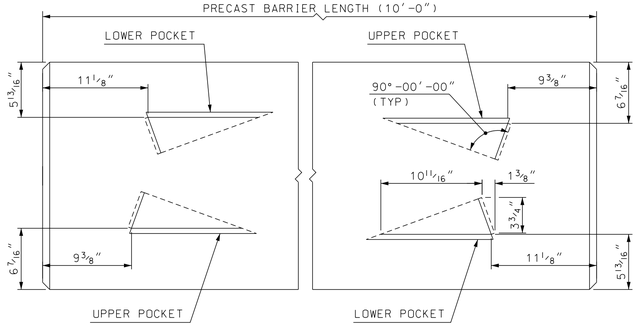
SCALE: 1 1/2" = 1'-0"

NOTE: CONNECTION HARDWARE SHALL NOT EXTEND BEYOND THE CONCRETE FACE OF BARRIER



TYPE X JOINT CONNECTION DETAILS

SCALE: 1 1/2" = 1'-0"



TOP VIEW CONNECTION POCKETS

SCALE: 1 1/2" = 1'-0"

GENERAL NOTES:

1. PORTABLE CONCRETE BARRIER SHALL BE FURNISHED BY THE CONTRACTOR AND PAID FOR AS ITEM 606.41741, PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE). CONCRETE BARRIER AND ALL ATTACHMENTS SHALL BE FABRICATED IN ACCORDANCE WITH SPECIAL PROVISIONS. ALL BARRIER UNITS SHALL BE 10' LONG.
2. PORTABLE CONCRETE BARRIER DETAILS, AS SHOWN ON THESE PLANS, ARE IN COMPLIANCE WITH REQUIREMENTS PER UPDATED NCHRP REPORT 350 FOR TEST NO 3-11 (MASH TEST LEVEL 3), CRASH TESTED BY TEXAS A&M UNIVERSITY SYSTEM, MAY 2005, AND ACCEPTED PER REPORT FHWA/TX-05/0-4692-1.
3. THE BARRIER HAS BEEN CRASH TESTED WITH A 27" DYNAMIC DEFLECTION WHICH WILL ALLOW THE BARRIER TO BE PLACED A MINIMUM 12" FROM THE EDGE OF THE DECK.
4. USAGE OF THE TEXAS X-BOLT BARRIER REQUIRES A MINIMUM OF 100 LINEAR FEET (10 - 10' UNITS). THE X-BOLT BARRIER SHALL EXTEND A MINIMUM OF 50' BEYOND THE BRIDGE AT EACH END, PARALLEL TO THE ROADWAY CENTERLINE. THE ENDS OF THE BARRIER SHALL CONNECT TO THE TRANSITION UNIT AND THEN TO NHDOT PCB FLARED OUT THE REQUIRED CLEAR ZONE AS SHOWN ON SHEET 2 OF 3.
5. THE CONNECTION BOLTS AT THE BARRIER JOINTS SHALL BE TIGHTENED TO THE "TURN OF THE NUT" METHOD IN ACCORDANCE WITH SECTION 550.3.11.6.4 OF NHDOT STANDARD SPECIFICATIONS. AFTER INSTALLATION, ALL X-BOLT JOINTS SHALL BE CHECKED BY THE CONTRACT ADMINISTRATOR CONFIRMING THEY MEET THE TIGHTENED REQUIREMENT.
6. THE TEXAS X-BOLT BARRIER MAY BE INSTALLED WITH A 125' MINIMUM RADIUS OF CURVATURE AND A RELATIVE ANGLE OF 4 DEGREES BETWEEN THE 10' UNITS.
7. THE CONTRACTOR SHALL FURNISH AND INSTALL APPROVED RETROREFLECTIVE DELINEATORS AT 25-FOOT INTERVALS ALONG TOP AND/OR ONE FOOT DOWN THE SIDE OF PORTABLE CONCRETE BARRIER, SUBSIDIARY TO ITEM 606.41741 (SEE STANDARD NO. DL-1 OF NHDOT STANDARD PLANS FOR ROAD CONSTRUCTION). THE COLOR OF THE DELINEATORS SHALL, IN ALL INSTANCES, CONFORM TO THE COLOR OF THE EDGE LINE MARKINGS. DELINEATOR SUPPLEMENT, BUT DO NOT REPLACE, THE NEED FOR RETROREFLECTIVE SOLID EDGE LINE MARKINGS.

MATERIAL NOTES:

1. BARRIERS SHALL BE LIGHT COLORED CLASS AA CONCRETE, WITH COMPRESSIVE STRENGTH OF 4000 psi, AND SHALL HAVE A SMOOTH UNIFORM SURFACE FREE OF DEFECTS AND IRREGULARITIES. CASTING DATE SHALL BE SHOWN ON BARRIER. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS OTHERWISE NOTED.
2. ALL REINFORCING STEEL SHALL BE AASHTO M31 (ASTM A615) GRADE 60. ALL REINFORCEMENT SHALL HAVE 1 3/4" MINIMUM CLEAR COVER, UNLESS OTHERWISE NOTED.
3. CONNECTION BOLTS SHALL BE 7/8" Φ GALVANIZED HIGH STRENGTH THREADED RODS CONFORMING TO ASTM A325. STEEL PIPES, PLATE WASHERS, AND CONNECTION PLATES SHALL BE GALVANIZED ASTM A36 STEEL.
4. ALL STEEL FOR CONNECTIONS SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 550.

BARRIER WEIGHT APPROX. 2.38 TONS

NO MODIFICATIONS SHOULD BE MADE TO THIS SHEET

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN XX | BRIDGE NO. XXX\XXX | STATE PROJECT XX

LOCATION XX

TEXAS RESTRAINED BARRIER (X-BOLT) (1 OF 3)

BRIDGE SHEET: XX OF XX

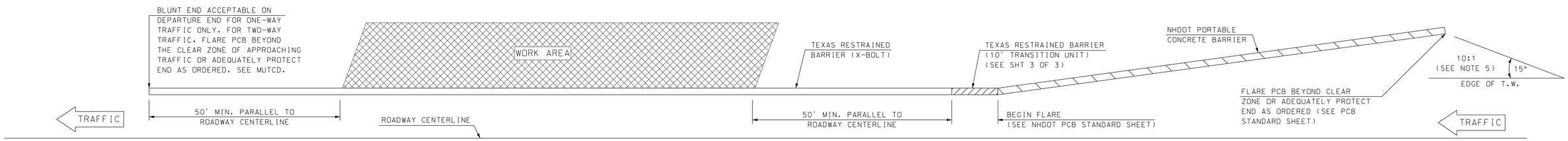
REVISIONS AFTER PROPOSAL		BY	DATE

DESIGNED	TXDOT	12/10	CHECKED	NHDOT	4/18
DRAWN	GMC	1/18	CHECKED	ABH	4/18
QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX

ISSUE DATE	5/15/18	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	6/1/20	----------		

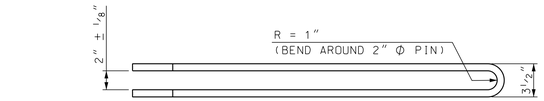
FILE NUMBER: XX-X-X

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
standard\english\barrier	X-Bolt Barrier _Revised Transition	AS NOTED

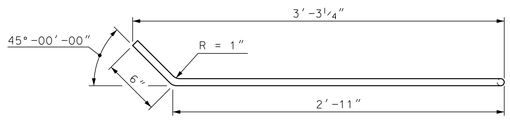


PLAN - BARRIER LAYOUT

(NTS)



PLAN

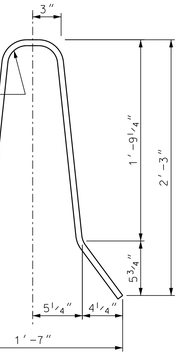


ELEVATION
T7 LOOP BAR

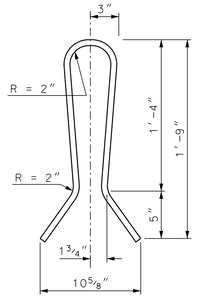
3/4" DIA. LOOP BARS (ASTM A36)
(3 BARS, 7'-2" LENGTH/BAR)
(HOT DIP GALVANIZED AFTER FABRICATION PER ASTM A123 OR AASHTO M11)

CONNECTION BOLT OR THREADED ROD DETAILS

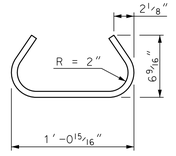
SCALE: 1 1/2" = 1'-0"



#5T1

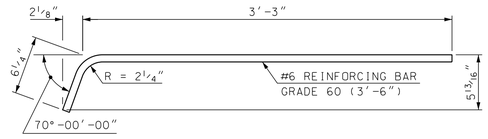


#5T2

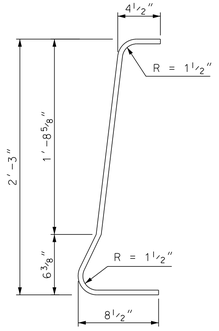


#5T3

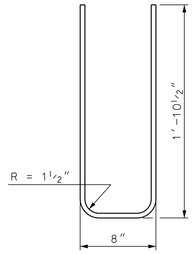
#5T4



#6T5 ¬



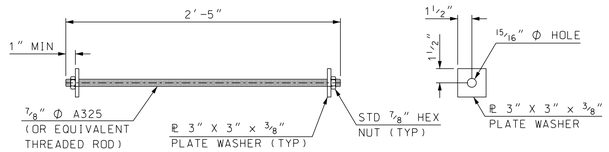
#4T6



#4T8

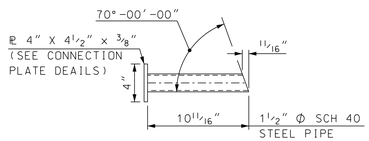
BENDING SCHEDULE

SCALE: 1 1/2" = 1'-0"



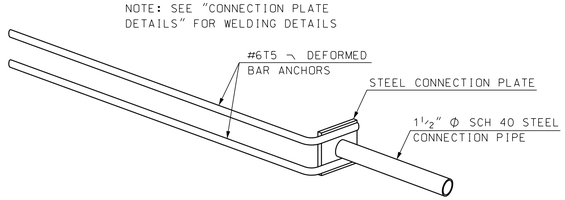
CONNECTION BOLT OR THREADED ROD DETAILS

SCALE: 1 1/2" = 1'-0"



UPPER CONNECTION PIPE DETAIL

SCALE: 1 1/2" = 1'-0"



ISOMETRIC VIEW OF TYPICAL WELD ASSEMBLY

SCALE: N.T.S.

REBAR SCHEDULE TEXAS X-BOLT (10' BARRIER)			
MK		QTY	LENGTH
T1	#5	17	5'-2"
T2	#5	2	4'-0"
T3	#5	19	2'-1"
T4	#5	8	9'-8"
T5	#6	8	3'-9"

REBAR SCHEDULE TRANSITION (10' BARRIER)			
MK		QTY	LENGTH
T1	#5	11	5'-2"
T2	#5	1	4'-0"
T3	#5	12	2'-1"
T4	#5	8	9'-7"
T5	#6	4	3'-9"
T6	#4	10	3'-4"
T8	#5	2	4'-5"

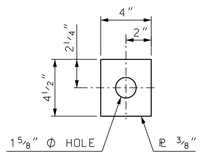
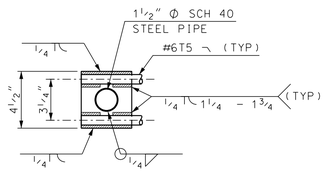


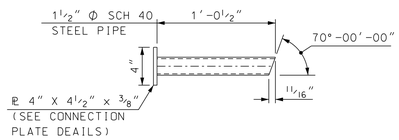
PLATE DIMENSIONS



WELDING DETAILS

CONNECTION PLATE DETAILS

SCALE: 2" = 1'-0"



LOWER CONNECTION PIPE DETAIL

SCALE: 1 1/2" = 1'-0"

NO MODIFICATIONS SHOULD BE MADE TO THIS SHEET

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
standard\english\barrier	X-Bolt Barrier _Revised Transition	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN XX | BRIDGE NO. XXX\XXX | STATE PROJECT XX

LOCATION XX

TEXAS RESTRAINED BARRIER (X-BOLT) (2 OF 3)

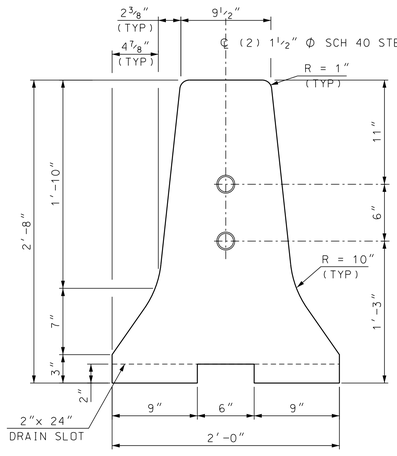
BRIDGE SHEET: XX OF XX

REVISIONS AFTER PROPOSAL		BY	DATE

DESIGNED	TXDOT	12/10	CHECKED	NHDOT	4/18
DRAWN	GMC	1/18	CHECKED	ABH	4/18
QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX
ISSUE DATE	5/15/18	FEDERAL PROJECT NO.		SHEET NO.	
REV. DATE	6/1/20	----------			

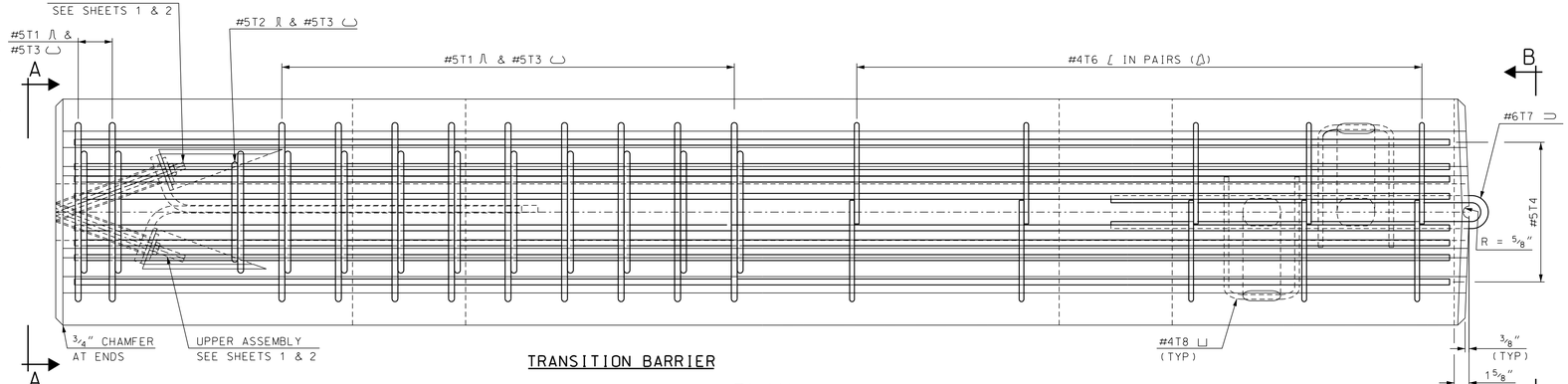
FILE NUMBER: XX-X-X

TOTAL SHEETS



VIEW A-A

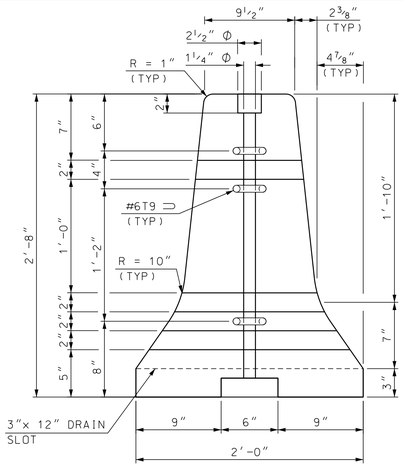
SCALE: 1 1/2" = 1'-0"



TRANSITION BARRIER

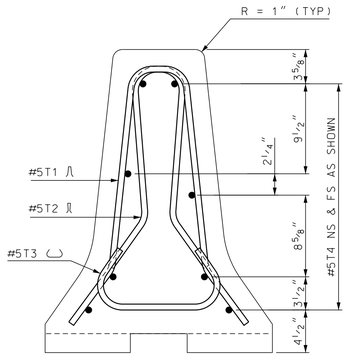
PLAN

SCALE: 1 1/2" = 1'-0"



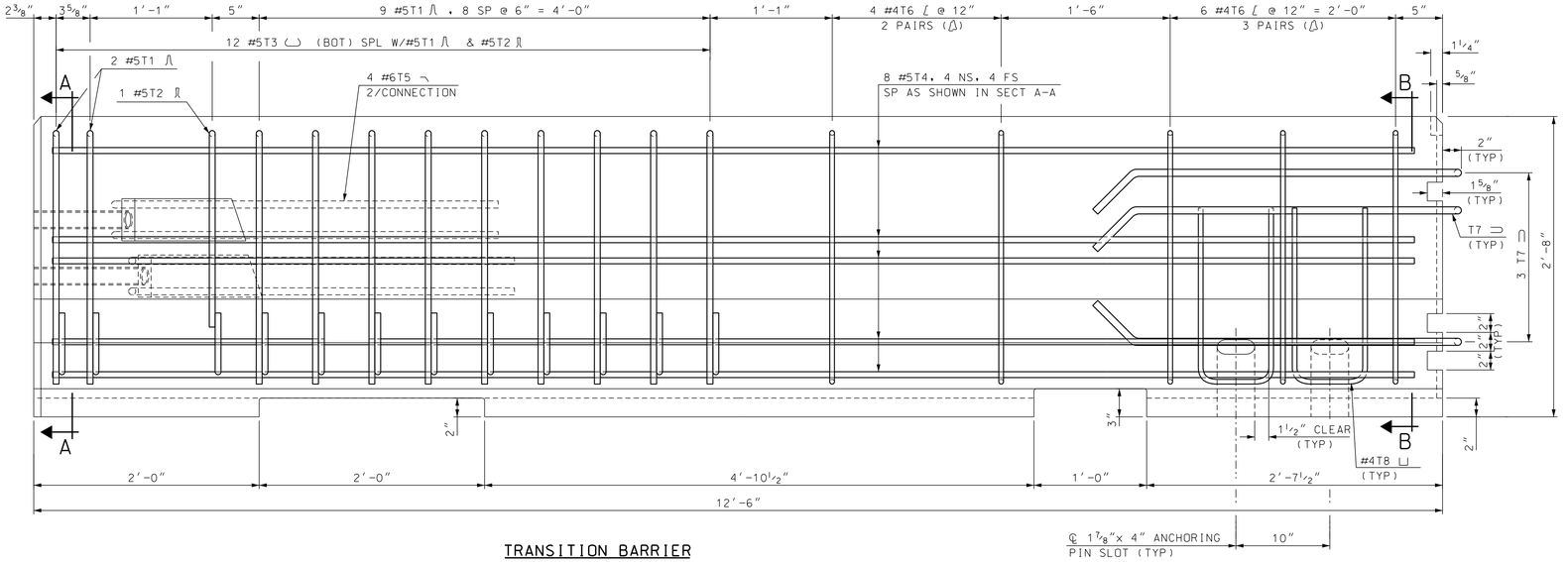
VIEW B-B

SCALE: 1 1/2" = 1'-0"



SECTION A-A

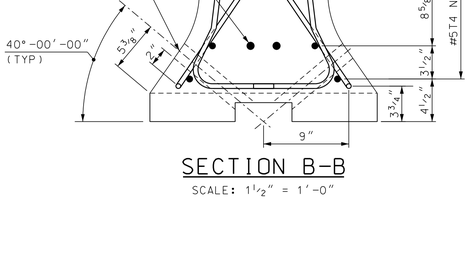
SCALE: 1 1/2" = 1'-0"



TRANSITION BARRIER

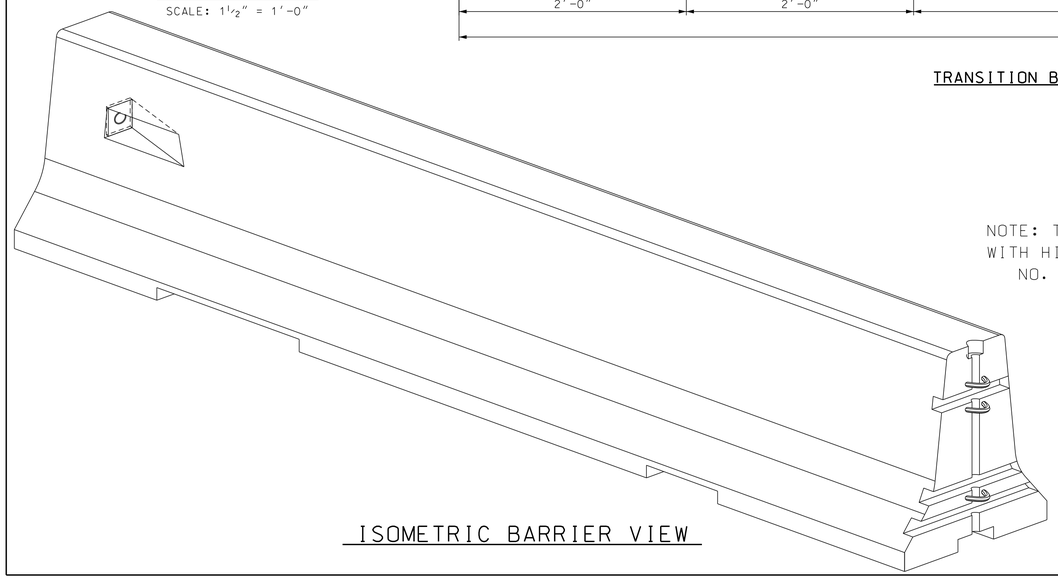
ELEVATION

SCALE: 1 1/2" = 1'-0"



SECTION B-B

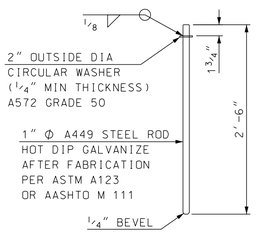
SCALE: 1 1/2" = 1'-0"



ISOMETRIC BARRIER VIEW

NOTE: TRANSITION PIECE FOR USE WITH HIGHWAY PCB STANDARD PLAN NO. GR-24 & 25 (MASH 16)

NO MODIFICATIONS SHOULD BE MADE TO THIS SHEET



LINKING PIN ASSEMBLY

SCALE: 1" = 1'-0"

NOTES

1. TEXAS RESTRAINED BARRIER (TRANSISTION UNIT) SHALL BE PAID FOR UNDER ITEM 606.41741, PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL (BRIDGE).
2. SEE SHEET 1 OF 3 FOR NOTES AND SHEET 2 OF 3 FOR REBAR SCHEDULE.

BARRIER WEIGHT APPROX. 2.84 TONS

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
standard\english\barrier	3Bolt Barrier _Revised Transition	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN XX | BRIDGE NO. XXX\XXX | STATE PROJECT XX

LOCATION XX

TEXAS RESTRAINED BARRIER (X-BOLT) (3 OF 3)

BRIDGE SHEET: XX OF XX

FILE NUMBER: XX-X-X

TOTAL SHEETS

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	NHDOT	4/20	CHECKED	NHDOT	4/20
	DRAWN	SMG	4/20	CHECKED	ABH	4/20
	QUANTITIES	XXX	XX/XX	CHECKED	XXX	XX/XX
	ISSUE DATE	6/1/20	FEDERAL PROJECT NO.		SHEET NO.	
	REV. DATE		----------			