STATE OF NEW HAMPSHIRE  
BRIDGE DESIGN MEMORANDUM

FROM: Mark W. Richardson, PE  
Administrator  

DATE: September 12, 2013  
AT (Office): Bureau of Bridge Design

SUBJECT: Design Memorandum 2013-01  
Vehicular Collision Pier Protection

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 completed sections of the new manual are being issued for immediate implementation. Consequently, the Bridge Design Manual and Bridge Detail Sheets have been modified as follows:

A. Bridge Design Manual  
   - Chapter 4, Section 4.3.12  
   - Chapter 6, Section 6.6.5

B. Bridge Detail Sheets:
   - 54” Single Slope Concrete Barrier, Precast
   - 54” Single Slope Concrete Barrier Single-Faced
   - Pier Protection Type I (54” Single Slope Concrete Barrier)
   - Pier Protection Type II (54” Single Slope Concrete Barrier)
   - Pier Protection Type II (54” Single Slope Concrete, Precast)
   - 54” to 45” Transition Single Slope Concrete Barrier

C. Summary: The above noted revisions are being implemented to specify:
   - Additional guidance to AASHTO LRFD Bridge Design Specifications 3.6.5, defining when to apply the vehicular collision force or provide pier protection.
   - Types of vehicular collision pier protection and their use.
   - Bridge Detail Sheets of vehicular collision pier protection (.dgn and .pdf format) located on the Bureau of Bridge Design web page:  

D. Background:
   This memorandum incorporates recommendations from the AASHTO LRFD Bridge Design Specifications and the AASHTO Roadside Design Guide, as well as recommendations from other state DOTs.

   Truck traffic has increased on NH roadways and providing taller and crash worthy pier protection, other than the standard w-beam barrier, is warranted.

   This memorandum clarifies NHDOT’s procedures/requirements for the design and construction of vehicular collision pier protection, and incorporates the Bridge Detail Sheets that shall be included in contract plans.

E. Implementation:
   The update to the Bridge Design Manual and the new Bridge Detail Sheets shall be implemented as of the date of this memo and shall be used on all applicable projects.

Mark W. Richardson, PE  
Administrator, Bureau of Bridge Design

enclosures
4.3.12 Vehicular Collision Force

AASHTO LRFD Section 3.6.5 contains provisions for vehicular collision forces (CT) on structures that cross over roadways that routinely carry trucks and have design speeds of 50-mph (80 kph) or higher. The following shall be considered when determining if a vehicular collision force shall be applied to unprotected piers, sign structure foundations, and other structures.

- **AASHTO LRFD Section 3.6.5** states “abutments and piers located within a distance of 30.0-ft. to the edge of roadway shall be investigated for collision.” For clarification, NHDOT Bridge Design defines “edge of roadway” to be “edge of travel lane”.

- **Substructure Type:**
  - Vehicular collision force is not required for abutments or retaining walls (NHDOT Bridge Design policy) due to the soil behind the walls, which will absorb the force. Only unprotected piers, sign structure foundations, and other structures as directed by the Design Chief shall be considered for a vehicular collision force.

- **Route classification, ADTT (average daily truck traffic in one direction), ADT (average daily traffic) and roadway design speed:**
  - The pier may require a vehicular collision force only if it is located on a roadway that routinely carries trucks and has a design speed of 50-mph (80 kph) or higher.

- **Geometry:**
  - Vehicular collision force is not required for pier located a distance greater than 30-feet (9.14 m) from the edge of the travel lane. For new structures, consider planned widenings or future realignments of lower roadways when establishing limits of setback distances and clear zones or horizontal clearance limits.

- **Design Exemption/Impact History:**
  - The designer shall consult with the Design Chief regarding the possibility of a design exemption, as described in **AASHTO LRFD Section C3.6.5.1**, which determines the estimated annual frequency a pier may be hit by a heavy vehicle. This exemption may only be used on redundant piers (3 or more columns) or wall piers (NHDOT Bridge Design policy).

A. New Structures

- Locate piers a distance greater than 30-feet (9.14 m) from the edge of the travel lane. Clear zones for roadways at many locations are equal to or greater than 30-feet (9.14 m). Designing for a vehicular collision force is not required for piers located outside 30-feet (9.14 m) from the edge of the travel lane. Consider planned widenings or future realignments of lower roadways when establishing limits of setback distances and clear zones or horizontal clearance limits.

- If a pier needs to be located within 30-feet (9.14 m) of the edge of the travel lane, the designer shall consult with the Design Chief and investigate an exemption as described in **AASHTO LRFD Section C3.6.5.1**.

- If a pier is within 30-feet (9.144m) of the edge of the travel lane and does not have an exemption, either the pier shall be designed for the 600-kip (2670 kN) vehicular collision force (CT) or it shall be protected with an embankment or barrier that meets **AASHTO LRFD Section 3.6.5.1**. See Chapter 6, Section 6.6.5, for vehicular collision pier protection. When considering the options, the designer shall include aesthetics, maintenance, and cost as they apply to the bridge pier.
• If the barrier protection option is chosen, no further analysis of the collision force acting on the pier is required. The vehicle protection barrier will redirect and absorb the collision force as described and shown in Chapter 6, Section 6.6.5 Vehicle Collision Pier Protection.

• Providing structural resistance in the pier may be a better and more economical option than providing an embankment or barrier, except where a median barrier will be provided as part of the highway design. The bridge designer shall work with the roadway design engineer to determine which alternative is preferred.

• The primary design objective for extreme event load cases is preventing the loss of a span. When considering the 600-kip (2670 kN) vehicular collision force in design, the load and resistance factors shall all be set to 1.0. Plastic deformation of crashwalls, pier columns, etc., is permitted, subject to the requirement that loss of span shall be prevented.

• The vehicular collision force is a point load acting on the pier. The lateral vehicular collision force will transfer to the foundation, but resistance is provided by passive soil pressure, friction, and pile structural capacity. In addition, movement beyond what is reasonable for service loadings is allowed for an extreme event situation where survival of the bridge is the goal. Vehicle collision force transferred to the foundation will be a project specific analysis.

• Generally, a new reinforced concrete wall pier can be designed to resist the vehicular collision force.

B. Existing Structures and Widening of Existing Structures.

• If the existing pier is located within 30-feet (9.14 m) of the edge of the travel lane, the designer shall consult with the Design Chief and investigate an exemption as described in AASHTO LRFD Section C3.6.5.1.

• If the existing pier is within 30-feet (9.14 m) of the edge of the travel lane and does not have an exemption, either the existing pier shall be analyzed to show it is capable of resisting the 600-kip (2670 kN) vehicular collision force (CT) or it shall be protected with an embankment or barrier that meets AASHTO LRFD Section 3.6.5.1. See Chapter 6, Section 6.6.5 for vehicular collision pier protection. When considering the options, the designer shall include aesthetics, maintenance, and cost as they apply to the bridge pier.

• The existing pier can be evaluated for its capacity and connection to the foundation and beam elements to determine its resistance. Factors that affect the pier resistance include, but are not limited to:
  o The continuity of the superstructure.
  o The continuity of the superstructure to the substructure and any frame action which might aid in the distribution of force effects.
  o The condition of the bearing devices and ability to resist translations and rotations.
  o The degree of redundancy of the superstructure.
  o The continuity of the substructure to the foundation system.
  o The amount of confinement reinforcement within the column and potential ultimate reserve capacity beyond the design capacity.
6.6.5 Vehicular Collision Pier Protection

In accordance with AASHTO LRFD Section 3.6.5, a bridge pier that is located within 30-feet (9.14 m) of the edge of a roadway (NHDOT Bridge Design defines “edge of roadway” to be “edge of travel lane”), and does not have sufficient strength to resist the vehicular collision force, nor meet any of the criteria stated in Chapter 4, Section 4.3.12, Vehicular Collision Force, shall be protected in accordance with AASHTO LRFD Section 2.3.2.2.1 and by one of the following:

- A permanent single slope 54-in. (1372 mm) tall concrete barrier designed for TL-5 loading, when the distance from the back of the barrier to the face of the pier is less than or equal to 10’-0” (3 m).
- A permanent single slope 42-in. (1067 mm) tall concrete barrier designed for TL-5 loading, when the distance from the back of the barrier to the face of the pier is greater than 10’-0” (3 m). (NHDOT barrier height is 45-in. [1143 mm])
- An embankment.

A. Single Slope Concrete Barrier 54-in. (1372 mm) Tall

1) Double-Faced Barrier
   - If there is enough room for the single slope double-faced barrier, the pier side toe of the barrier shall be placed a minimum of 3-ft. (1 m) from the face of the pier.
     - See the Bridge Design Detail Sheet, Pier Protection Type I and Type II (54-in. Single Slope Concrete Barrier) [http://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm].

2) Single-Faced Barrier
   - If there is not enough room for a double-faced barrier section, then a single-faced barrier may be used. The pier side face of the single-faced barrier shall be placed a minimum of 9-in. (229 mm) from the pier.
     - See Bridge Detail Sheet, Pier Protection Type I and Type II (54-in. Single Slope Concrete Barrier, Single-Faced) [http://www.nh.gov/dot/org/projectdevelopment/bridgedesign/detailsheets/index.htm].

B. Single Slope Concrete Barrier 45-in. (1143 mm) Tall

- The 45-in. (1143 mm) tall single slope double-faced barrier, the pier side toe of the barrier shall be placed a minimum of 10’-0” (3 m) from the substructure and embedded 3-in. (76 mm).

The 45-in. (1143 mm) and the 54-in. (1372 mm) single slope concrete barrier details are in compliance with requirements per updated NCHRP Report 350 for test No. 5-11 (MASH TL-5). Documentation is included in the FHWA Acceptance Letter B64 ([http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/pdf/b64.pdf]) and NCHRP 157 Vol. 1 ([http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w157.pdf]).

The intended purpose of these barriers is to shield a pier from traffic, primarily large trucks and tractor trailers, so as to reduce the separate but related potential for damage to the pier and collapse of the bridge that might result of a truck collision with a pier.
• The designer shall use the protection barrier as indicated and shown in this Manual, unless directed otherwise by the Design Chief due to other factors such as the following:
  o Crash history indicates that larger vehicle impacts are frequent.
  o Consequence of collision with a fixed object is severe (e.g., causes light pole or sign structure to drop across travel lanes or bridge pier is non-redundant)

• For new structures, consider planned widenings or future realignments of lower roadways when establishing limits of setback distances, clear zones, or horizontal clearance limits.

• When considering the options, the designer shall include aesthetics, maintenance, and cost as they apply to the bridge pier.

• The bridge designer shall work with the roadway design engineer to determine if a median barrier is provided as part of the highway design and the method of transition from the pier protection barrier to the highway median barrier.

• Consider overall safety at a given location, including vehicle and pedestrian traffic, when selecting the appropriate type of pier protection to be used. Consider the effect that tall barriers might have on sight distances, particularly near intersections, and the end treatments that will be required for these taller barriers.

• Select the pier protection barrier terminal treatment for design speeds greater than or equal to 50-mph (80 kph) from the following options:
  o Terminate outside the clear zone of any approaching traffic.
  o Terminate within a shielded location.
  o Terminate by the use of a crash cushion system; or,
  o Terminate in conjunction with a suitably designed transition to another barrier.

• In accordance with the Roadside Design Guide, 4th Ed., 2011, Section 5.5.2, the pier protection barrier shall be extended 10-ft. (3 m) in advance of the pier. Beyond that point, the barrier height should be vertically transitioned on a 10:1 slope to the height of the adjoining barrier. The barrier should continue with a flare-rate in accordance with the Roadside Design Guide for the length of need required, or transition to another barrier.

• The above noted offsets of the barrier to the pier take into account the working widths and zone of intrusion (ZOI) width.
  o The working width is the lateral distance from the front face/toe of barrier to the greatest of vehicle extent, barrier deflection, or barrier width.
  o The zone of intrusion refers to the maximum distance a vehicle extends behind the top front face of the barrier.
  o The Roadside Design Guide, 4th Ed., 2011, Section 5.5.2, shows the zone of intrusion for TL-4 barriers. (See Figure 6.6.5-1)
  o The zone of intrusion for TL-5 loading and a 54-in. (1372 mm) single-slope barrier is 18-in. (457 mm) for a truck cab and 45-in. (1143 mm) for a cargo box, as presented in a paper prepared by Stephen F. Hobbs of McElhanney Engineering Services Ltd. for the 2010 Annual Conference of the Transportation Association of Canada. (See Table 6.6.5-1.)
  o The 54-in. (1372 mm) single-faced single slope concrete barrier is placed a minimum of 9-in. (229 mm) from the back of the barrier to the face of the pier. The top of the barrier
is 9 ¾-in. wide (248 mm). This provides a setback of 18 ¾-in. (476 mm), which is
greater than the zone of intrusion for a truck cab, TL-5 loading.

- The NHDOT pier protection placed at the minimum offsets to the pier does not provide
the required intrusion zone for a truck box. However, an impact from a cargo box would
not cause major damage to the pier nor create the loss of a span and the majority of
barrier impacts are from pick-up trucks or smaller vehicles.

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<th>Table 1</th>
<th>Zone of Intrusion with Concrete Barrier</th>
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<tr>
<td>Test Level</td>
<td>Height of Concrete Barrier (mm)</td>
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Note:

(i) Intrusion widths shown are for safety shaped (F-shaped or New Jersey) or constant
sloped (California or Texas) concrete barrier. There is an inverse correlation between
barrier height and intrusion width. For a specific result for another type of barrier and
crash test level, refer to the appendix of reference (1). Alternately review video or high
speed photos of the specific device crash tests to measure or estimate widths needed.

(1) “Guidelines for Attachments to Bridge Rails and Median Barriers”, Keller, Sicking, Faller,
Polivka & Rohde, February 26, 2003

(7) Charles Boyd, Florida Department of Transportation, Attachments to Traffic Railings,

Zone of Intrusion with Concrete Barrier

(Zone of Intrusion and Concrete Barrier Measure
by Stephen F. Hobbs)11

Table 6.6.5-1
Intrusion Zones for TL-4 Barriers

Figure 6.6.5-1
References


5. New Hampshire Department of Transportation, *NHDOT Standard Specifications for Road and Bridge Construction 2010*, Concord, NH


10. Federal Highway Administration (FHWA), USDOT, Safety Longitudinal Barriers


13. Precast/Prestressed Concrete Institute, *PCI Bridge Design Manual*, Chicago, IL.
NOTES:

(1) Barriers shall be placed for protection of pier shafts or other structures located in the median. For barriers in the 54" single-slope concrete barrier single-faced position.

(2) The 54" single-slope concrete barrier shall extend a minimum 10'-0" beyond the edge of outside pier columns.

(3) The drainage material, sand, shall be placed beyond the concrete barrier for the full depth. Flowable fill shall not be placed behind the barrier.

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGE DESIGN

PIER PROTECTION TYPE II 54" SINGLE SLOPE CONCRETE BARRIER, SINGLE-FACED

ELEVATION VIEW

SECTION A-A

SECTION B-B

SECTION C-C

PLAN VIEW

PIER COLUMN PARTIAL PLAN VIEW
CONCRETE BARRIER AND ALL ITS COMPONENTS SHALL BE FURNISHED BY THE CONTRACTOR AND PAID AS ITEM 606.4135, 54" SINGLE SLOPE CONCRETE BARRIER, PRECAST.

GENERAL NOTES:
1. CONCRETE BARRIERS AND ALL THE COMPONENTS SHALL BE FURNISHED BY THE CONTRACTOR AND PAID AS ITEM 606.4135, 54" SINGLE SLOPE CONCRETE BARRIER, PRECAST.
2. STUD WELDING SHALL BE IN ACCORDANCE WITH SECTION 547.
3. SLOTS IN STRUCTURAL TUBES SHALL BE CUT WITH MECHANICALLY GUIDED MEANS TO A SMOOTH, UNIFORM SURFACE MEETING A SURFACE ROUGHNESS OF 25 μ OR BETTER (ANSI B46.1).
4. CONCRETE BARRIER DETAILS SHOWN ON THIS SHEET ARE IN COMPLIANCE WITH REQUIREMENTS IN ACCORDANCE WITH SECTION 550.
5. SHOP DRAWINGS SHALL INCLUDE REINFORCING SCHEDULE.
6. CONCRETE BARRIER DETAILS SHOWN ON THIS SHEET ARE IN COMPLIANCE WITH REQUIREMENTS IN ACCORDANCE WITH SECTION 550.

MATERIAL NOTES:
1. THE BARRIERS SHALL BE LIGHT COLORED CLASS AA CONCRETE HAVING A MINIMUM 28 DAY COMpressive STRENGTH OF 4,000 PSI. BARRIERS SHALL HAVE A SMOOTH UNIFORM SURFACE MEETING A SURFACE ROUGHNESS OF 25 μ OR BETTER (ANSI B46.1).
2. I-BEAMS AND STRUCTURAL TUBES SHALL BE ASTM A36 OR A572 GALVANIZED AFTER FABRICATION, EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1/8", UNLESS NOTED OTHERWISE.
3. SLOTS IN STRUCTURAL TUBES SHALL BE CUT WITH MECHANICALLY GUIDED MEANS TO A SMOOTH, UNIFORM SURFACE MEETING A SURFACE ROUGHNESS OF 25 μ OR BETTER (ANSI B46.1).
4. CONCRETE BARRIER DETAILS SHOWN ON THIS SHEET ARE IN COMPLIANCE WITH REQUIREMENTS IN ACCORDANCE WITH SECTION 550.
5. CONCRETE BARRIER DETAILS SHOWN ON THIS SHEET ARE IN COMPLIANCE WITH REQUIREMENTS IN ACCORDANCE WITH SECTION 550.
6. LEVELING PADS, SHIMMING MATERIAL, AND FLOWABLE FILL SHALL BE SUBSIDIARY TO THE CONCRETE BARRIER.
7. CONCRETE BARRIER AND ALL ITS COMPONENTS SHALL BE FURNISHED BY THE CONTRACTOR AND PAID AS ITEM 606.4135, 54" SINGLE SLOPE CONCRETE BARRIER, PRECAST.

STATE PROJECT
TOTAL SHEETS
#4 2
SIZE XX ""
FRONT SHEET NO.
2/13
NHDOT (TYP)
8"
#4 SIDE 8"
ABH
FEDERAL PROJECT NO.
12

REVISIONS AFTER PROPOSAL

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

CONCRETE BARRIER REINFORCING SCHEDULE

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ELEVATION
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SECTION DETAILS
SCALE: 1" = 1'-0"

PLAN
SCALE: 1" = 1'-0"

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

CONCRETE BARRIER REINFORCING SCHEDULE

NO MODIFICATIONS SHALL BE MADE TO THIS SHEET.

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

CONCRETE BARRIER REINFORCING SCHEDULE

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PLAN
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PERSPECTIVE VIEW
SCALE: 1" = 1'-0"

CONCRETE BARRIER REINFORCING SCHEDULE

NO MODIFICATIONS SHALL BE MADE TO THIS SHEET.

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

CONCRETE BARRIER REINFORCING SCHEDULE

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STRUCTURAL SECTION DETAILS

SECTION A-A

(REINFORCEMENT)

SCALE: 1" = 1'-0"

SHEET SCALE

19'-4"

1'-0"

SIDE

FRONT

TOTAL SHEETS

STATE PROJECT

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION • BUREAU OF BRIDGE DESIGN

#4 LONGITUDINAL BARS

4'-9"

(6 NS & 6 FS)

BARRIER CONNECTION DETAIL

SCALE: 1" = 1'-0"

SIDE

FRONT

TOP

END VIEW (MASONRY)

SCALE: 1" = 1'-0"

ELEVATION

SCALE: 1" = 1'-0"

GENERAL NOTES

1. CONCRETE BARRIER AND ALL ITS COMPONENTS SHALL BE FURNISHED BY THE CONTRACTOR AND PAID AS ITEM 606.41351, 54" SINGLE SLOPE CONCRETE BARRIER, SINGLE-FACED, PRECAST.

2. I-BEAMS AND STRUCTURAL TUBES SHALL BE ASTM A36 OR A572 GALVANIZED AFTER FABRICATION, FREE OF DEFECTS AND IRREGULARITIES. CASTING DATE SHALL BE SHOWN ON BARRIER. ALL COMPRESSION BARRIERS SHALL HAVE A SMOOTH UNIFORM SURFACE MEETING A SURFACE ROUGHNESS OF 25 u OR BETTER (ANSI B46.1).

3. SLOTS IN STRUCTURAL TUBES SHALL BE CUT WITH MECHANICALLY GUIDED MEANS TO A SMOOTH, FREE OF DEFECTS AND IRREGULARITIES. CASTING DATE SHALL BE SHOWN ON BARRIER. ALL COMPRESSION BARRIERS SHALL HAVE A SMOOTH UNIFORM SURFACE MEETING A SURFACE ROUGHNESS OF 25 u OR BETTER (ANSI B46.1).

4. CONCRETE BARRIER DETAILS SHOWN ON THIS SHEET ARE IN COMPLIANCE WITH REQUIREMENTS IN ACCORDANCE WITH SECTION 550.

5. SHOP DRAWINGS SHALL INCLUDE REINFORCING SCHEDULE.

MATERIAL NOTES

1. THE BARRIERS SHALL BE LIGHT COLORED CLASS AA CONCRETE HAVING A MINIMUM 28 Day COMPRESSIVE STRENGTH OF 4,000 PSI. BARRIERS SHALL HAVE A SMOOTH UNIFORM SURFACE MEETING A SURFACE ROUGHNESS OF 25 u OR BETTER (ANSI B46.1).

2. STUD WELDING SHALL BE IN ACCORDANCE WITH SECTION 547.

3. ALL REINFORCING STEEL SHALL BE AASHTO M31 (ASTM-A615) GRADE 60, EPOXY COATED. STEEL SHALL BE SHOWN ON BARRIER.

4. CONCRETE BARRIER AND ALL ITS COMPONENTS SHALL BE FURNISHED BY THE CONTRACTOR AND PAID AS ITEM 606.41351, 54" SINGLE SLOPE CONCRETE BARRIER, SINGLE-FACED, PRECAST.

5. MATERIAL NOTES SHALL BE MADE TO THIS SHEET.

REVISIONS AFTER PROPOSAL

FILE NUMBER

XX

XX

XX

LIFTING SLOT

(TYP)

LIFTING SLOT

(TYP)

REV. DATE

9/20/13

9/20/13

9/20/13

ISSUE DATE

GMC

XX

XX

XX

DATE

2/13

2/13

2/13

CHECKED

CHECKED

CHECKED

DESIGNED

DRAWN

REV.

0

9/20/13

9/20/13

9/20/13

STATE PROJECT

#4 SINGLE SLOPE CONCRETE BARRIER SINGLE-FACED, PRECAST

149-316-4351-54SF-MED BARRIER.dgn Default 9/23/2013 8:52:52 AM "n18abh"
STATE PROJECT
1. 0
NHDOT
TOTAL SHEETS
FRONT
10
NHDOT
SCALE: 1" = 1'-0"
FRONT SHEET NO.
SIDE SHEET NO.
NHDOT
SCALE: 1" = 1'-0"
S 3 x 7.5
54SS-TAPERED UNIT.dgn Default 9/23/2013 8:54:26 AM "n18abh"

STRUCTURAL SECTION DETAILS
(REINFORCEMENT)
SECTION A-A
6"
# 4 LONGITUDINAL BARS
†" SLOT
(SPACE @ 9" EACH FACE)
SCALE: 1" = 1'-0"
4'-0"
(TALL SIDE)
4'-9"
(SHORT SIDE)
SCALE: 1" = 1'-0"
FRONT
TOP
HSS 4 x 2 x Š
2" CLEAR
#4 STIRRUP
7"
(TYP)
†" STUD 8" LONG
1" RADIUS
6"
(TYP)
3"
4'-6"
§"

2'-3"
9†"
PERSPECTIVE VIEW TAPERED UNIT
À
†" HOLES
8" (TYP)
BARRIER CONNECTION DETAIL
À
†" STUD (TYP)
HSS 4 x 2 x Š
#6 LOOP BAR
2" CLEAR
#4 STIRRUP
7"
(TYP)
1" RADIUS
4'-0"
(TYP)
3"
4'-6"
§"

2'-0"
9†" CONNECTION DETAIL
À
†" STUD (TYP)
HSS 4 x 2 x Š
#6 LOOP BAR
2" CLEAR
#4 STIRRUP
7"
(TYP)
1" RADIUS
4'-0"
(TYP)
3"
4'-6"
§"

GENERAL NOTES
1. CONCRETE BARRIERS AND ALL ITS COMPONENTS SHALL BE PROVIDED BY THE CONTRACTOR AND
PAID AS ITEM 606.41251, 54" TO 45" TRANSITION SINGLE SLOPE CONCRETE BARRIER, PRECAST.
2. STUD WELDING SHALL BE IN ACCORDANCE WITH SECTION 547.
3. CONCRETE BARRIERS AND ALL ITS COMPONENTS SHALL BE PROVIDED BY THE CONTRACTOR AND
PAID AS ITEM 606.41251, 54" TO 45" TRANSITION SINGLE SLOPE CONCRETE BARRIER, PRECAST.

MATERIAL NOTES
1. CONCRETE BARRIER AND ALL ITS COMPONENTS SHALL BE PROVIDED BY THE CONTRACTOR AND
PAID AS ITEM 606.41251, 54" TO 45" TRANSITION SINGLE SLOPE CONCRETE BARRIER, PRECAST.
2. STUD WELDING SHALL BE IN ACCORDANCE WITH SECTION 547.
3. CONCRETE BARRIERS AND ALL ITS COMPONENTS SHALL BE PROVIDED BY THE CONTRACTOR AND
PAID AS ITEM 606.41251, 54" TO 45" TRANSITION SINGLE SLOPE CONCRETE BARRIER, PRECAST.

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION / OFFICE OF DESIGN DIVISION
B R I D G E S
ISSUE NO.
DATE
REVISIONS AFTER PROPOSAL
PROJECT
NHDOT
TOTAL SHEETS
FRONT
SIDE
SHEET NO.
NHDOT
SCALE: 1" = 1'-0"
S 3 x 7.5
54SS-TAPERED UNIT.dgn Default 9/23/2013 8:54:26 AM "n18abh"