C5.8.1 Railings

See the Office of Bridges and Structures web site for archived Methods Memos listed under articles in this section.

The Methods Memos for which policies have been partially revised and/or for which document references have been updated are noted as partially revised. Any obsolete Methods Memos that apply to this section are listed at the end.

C5.8.1.1 General

C5.8.1.1.1 Policy overview

Partially revised: Methods Memo No. 162: Bridge Railing Selection on Interstate and Primary Highways
29 June 2007

OBS adopted the use of stainless steel rebar between the barrier rail to bridge deck/wing connections for interstate and primary bridges starting with the January 2015 letting.

Guidelines for conduit and lighting on bridges (Before 01 October, 2007)

The policy for lighting on bridges up until October 1, 2007 has been for the design engineer to evaluate whether the bridge is located near an urban area. For projects determined to be in an urban area, the Engineer had to make a request (send a copy of the TS&L) to the Office of Traffic and Safety to determine the lighting and conduit requirements. Traffic and Safety would determine the conduit size and locate the conduit and light pole bases (if needed) on a TS&L sheet for the bridges submitted and return the information back to our office. This policy was revised on October 1, 2007.

Guidelines for conduit and lighting on bridges (After 01 October, 2007)

Conduit will be provided in at least one rail on all bridges in accordance with the Traffic and Safety Manual, Chapter 6E-1, "Bridge Lighting" (http://www.iowadot.gov/traffic/manuals/pdf/06e-01.pdf). If the bridge is near an urban area or interchange, then the bridge may require light pole blisters. In this case the TS&L should be submitted to the Traffic Engineering section of the Office of Traffic and Safety for review. Traffic and Safety will review the site to determine if existing lighting is present or if a lighting project is planned in the near future. If it is determined that continuous lighting will be present at this location, light pole blisters and possibly underdeck lighting will be located and noted on a TS&L sheet and returned to the Engineer.

Where possible, light pole blisters should be centered above substructure elements. Consult the Office of Traffic and Safety regarding adjustments of light locations to coincide with pier centerlines. Junction boxes will be placed at both ends of a bridge as a minimum. Additional junction boxes may be required to keep the maximum distance between them less than 500 feet. The maximum junction box spacing depends on the equipment used by the contractor. Most contractors can handle pulls under 500 feet and some contractors can handle pulls of 1000 feet and more. Conduits should be placed to line up with the junction boxes provided when possible to limit the number of bends required in the conduit. The sum of the conduit bends between junction boxes shall not be more than 360 degrees as specified in the "National Electric Code".

In discussions with our lighting crews, it was found that conduit could be cleaned out and used even if the bridges have been in service for a number of years. CADD standard 1030A, 1and 2 of 2, "Lighting Details" are available.

Statement concerning PVC conduit (01 July 2015)

Conduit used in concrete barrier rails shall be galvanized rigid steel conduit. PVC conduit shall not be substituted. PVC pipe can experience damage during concrete placement particularly when barrier rails are slip formed.

Additionally the difference in the coefficient of linear expansion between PVC and concrete requires a significant number of expansion fittings which are prone to durability issues.

Additional conduit guidelines for ITS communication wires (01 January 2016)

Separate conduit and junction boxes should be used in the rail when both conductor and communication wires are required. ITS communication wires require a 2" minimum conduit and no more than six 45 degree elbow bends between conduit junction boxes with a minimum inside bend radius of 18 inches. CADD Note E1085 should be included in the plans when I.T.S. conduit is required.

C5.8.1.1.2 Design information

C5.8.1.1.3 Definitions

C5.8.1.1.4 Abbreviations and notation

C5.8.1.1.5 References

C5.8.1.2 Permanent railings

C5.8.1.2.1 Traffic railings

Partially revised: Methods Memo No. 162: Bridge Railing Selection on Interstate and Primary Highways
29 June 2007 (Revised 11 June 2009 to replace flow chart in Attachment A.)
Attachment A, which gives the railing selection policy is given below.

Guidelines for selection of railing for primary and interstate bridges

Generally, TL-4 (minimum height of 34": 32" plus 2" for future overlay) is considered acceptable for most interstate and primary roads with a mixture of trucks and heavy vehicles. But in some cases, other factors may require the use of TL-5 (minimum height of 44": 42" plus 2" for future overlay). These factors may include:

- Traffic volume and mix: The presence of high number of a van-type tractor-trailer as determined from predicted traffic data for the design year.
- Unfavorable site conditions where a rollover or penetration beyond the railing could result in severe consequences. This applies to bridges with fracture critical elements within the zone of intrusion or flyover bridges. Unfavorable site conditions includes:
    - Reduced radius of curvature
    - Steep down grades on curvature
    - Variable cross slopes

  Examples of fracture critical elements may include cables on cable stayed bridges, hangers on arch bridges, and truss members on truss bridges or supports for sign structures.
- Approach roadway rail height
- Headlight glare
- Snow pile up during snow removal spilling over roadways below
- Snow pile up causing ramping up the barrier rail

The need for TL-6 (minimum height of 92") railing which is suitable for higher level of protection is not anticipated for the vast majority of bridges in Iowa.

A flow chart (**Figure 1 was revised on 5 May 2009 to include bridges over BNSF and UP Railroads.**) has been developed to aid in the determination of the appropriate test level. The appropriate test level/rail height will need to be determined by the Pre-Design Section (Office of Design) in the early phase of project conception with input from

the Districts during concept field exam. On projects that are not initiated in the Pre-Design Section, the determination of the test level will be the responsibility of the Preliminary Bridge Section (Office of Bridges and Structures). This effort will require some coordination among the various Engineering Bureau offices and the Districts.

Based on examining the factors discussed above and the predicted truck traffic for 2035 (see Figure 2), all mainline interstate bridges except as noted below would qualify for TL-5 railing with a height of 44". Rail height on mainline bridges near on-ramps need to be investigated for potential conflict with sight distance. Bridges on other highways in Iowa, overhead bridges and ramp bridges would require a similar evaluation using the attached flow chart. Overhead bridges near interchanges, especially in urban areas near side roads/streets, will require close evaluation of the available sight distance to avoid potential conflict.

The evaluation criteria discussed in this memo applies to both the median and outside railings and in some cases may results in different railing heights on the same bridge. Other considerations such as aesthetics may influence the decision on whether same railing height would be used for both the median and outside railings. Cost is a minor contributor based on comparing concrete volumes between the 34" and 44" rails. The 44" rail requires an additional 0.023 cu. yd. of concrete per lineal foot.

This policy is applicable to new bridges, bridge replacements, deck replacements and bridge widening. Bridge repair or rehabilitation projects where the existing railing is not affected by such work will not be required to comply with this policy and no retrofit is needed.

FIGURE 1

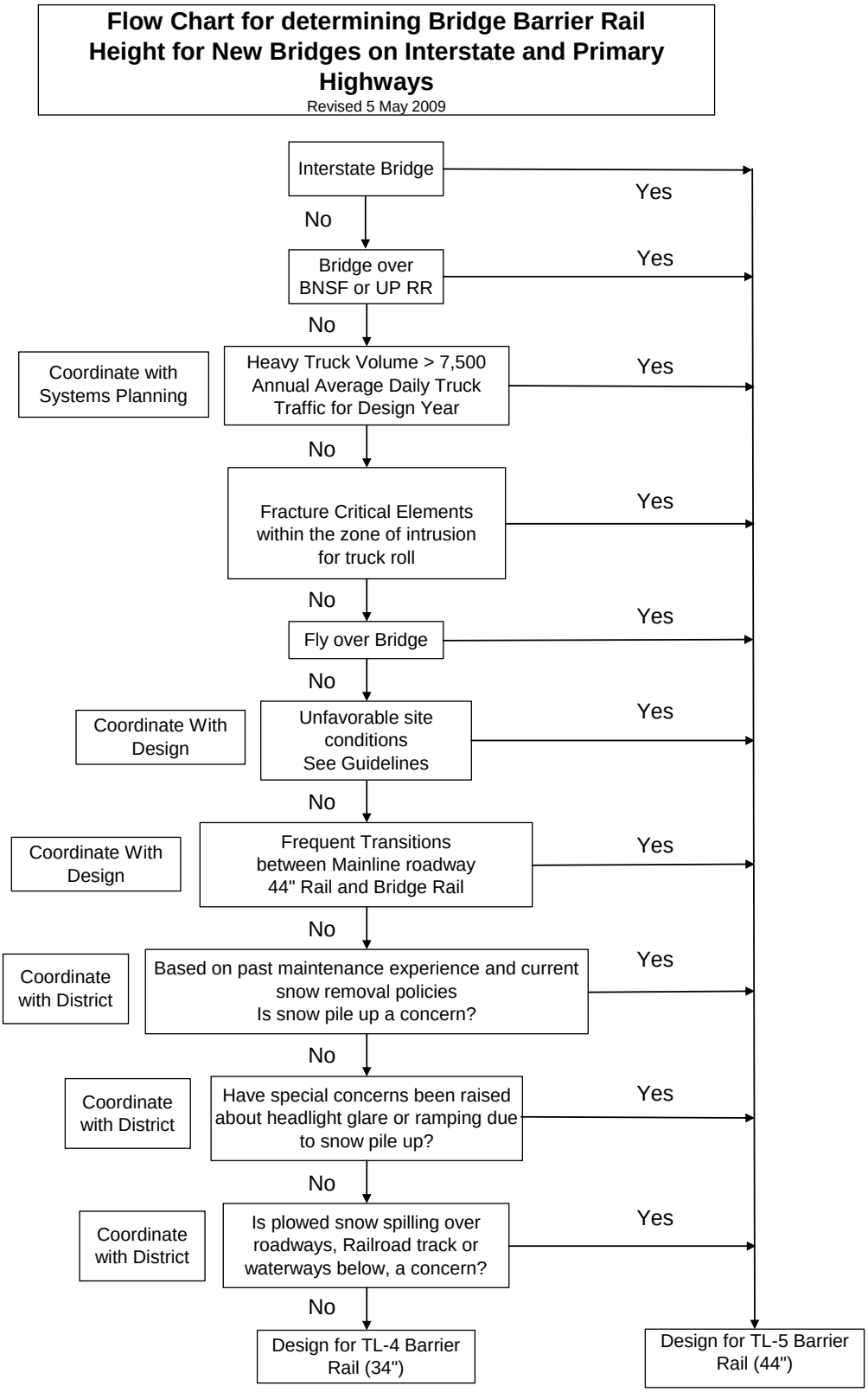
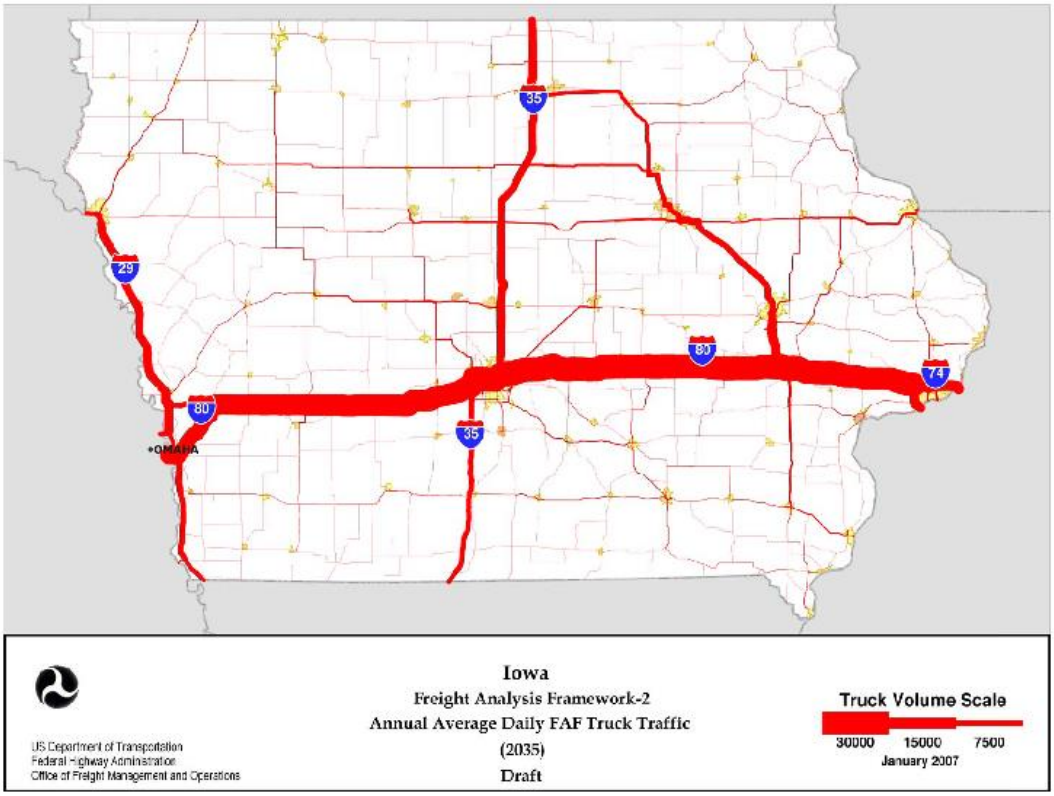

Flow Chart for determining Bridge Barrier Rail Height for New Bridges on Interstate and Primary Highways
Revised 5 May 2009
Interstate Bridge
Yes
No
Bridge over BNSF or UP RR
Yes
No
Coordinate with Systems Planning
Heavy Truck Volume > 7,500 Annual Average Daily Truck Traffic for Design Year
Yes
No
Fracture Critical Elements within the zone of intrusion for truck roll
Yes
No
Fly over Bridge
Yes
No
Coordinate With Design
Unfavorable site conditions See Guidelines
Yes
No
Coordinate With Design
Frequent Transitions between Mainline roadway 44" Rail and Bridge Rail
Yes
No
Coordinate with District
Based on past maintenance experience and current snow removal policies Is snow pile up a concern?
Yes
No
Coordinate with District
Have special concerns been raised about headlight glare or ramping due to snow pile up?
Yes
No
Coordinate with District
Is plowed snow spilling over roadways, Railroad track or waterways below, a concern?
Yes
No
Design for TL-4 Barrier Rail (34")
Design for TL-5 Barrier Rail (44")

FIGURE 2



C5.8.1.2.1.1 F-shape

Methods Memo No. 163: Revision MM No. 17 Lighting on Bridges
1 October 2007

Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)
1 January 2009

Methods Memo No. 25: Sight Distances on Bridges
10 September 2001

C5.8.1.2.1.2 Open

Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)
1 January 2009

C5.8.1.2.1.3 Retrofit

C5.8.1.2.2 Pedestrian railings

C5.8.1.2.3 Bicycle railings

C5.8.1.2.4 Separation railings

C5.8.1.2.5 Aesthetic and special railings

Methods Memo No. 163: Revision MM No. 17 Lighting on Bridges
1 October 2007

Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)
1 January 2009

C5.8.1.2.6 Concrete railings

Partially revised: Methods Memo No. 150: Revision to CADD Note E188/M188
9 March 2006 (Supersedes Methods Memo No. 110)

Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)
1 January 2009

C5.8.1.3 Temporary barrier railings

C5.8.1.3.1 Concrete

C5.8.1.3.2 Steel

Obsolete: Methods Memo No. 17: Lighting on Bridges
24 September 2003

Obsolete: Methods Memo No. 110: Concrete Placement of Concrete Barrier Rail
26 January 2005 (Superseded by Methods Memo No. 150)