

13.4 BRIDGE RAILINGS - GENERAL

All bridge railing on the State Highway System and Local/Off System routes shall conform to MASH criteria. Bridge traffic railing on Interstate and 4 lane highways shall conform to at least TL-4 requirements. Bridge railing on all other bridges on the State Highway System shall conform to at least TL-3 requirements and shall be 42" tall (see commentary). This includes all overpass bridges that are over State or Interstate highways.

One of the standard rail types as shown in the Bridge Design Manual Standard Drawings shall be shown on the plans, unless there is a clearly provable advantage in doing otherwise. Among those types, selection shall be made with due consideration of economy, aesthetics, Level of Service, and the preference of the District Engineer. The following table indicates the test level of ITD standard railings. Test Levels are defined in the AASHTO LRFD Bridge Design Specifications Article 13.7.2.

STATE HIGHWAY SYSTEM

Bridge Railing	MASH Test Level
42" Single Slope Concrete Parapet	TL-4*
42" Combination Rail	TL-4
42" Three Tube Curb Mount Rail	TL-4
42" Single Slope Median Barrier	TL-4

*See commentary

LOCAL/OFF SYSTEM

In addition to the State Highway System rails, the following rails may also be used on local/off system bridges.

Bridge Railing	MASH Test Level
32" Concrete Parapet (Jersey Shape)	TL-3
32" Two Tube Curb Mount Rail	TL-3
32" Median Barrier (Jersey Shape)	TL-3

NEW CONSTRUCTION

Concrete parapet is the preferred rail type for safety reasons. When an overlay is placed on the structure during original construction, the height of the rail should be from the top of the overlay. The height of the 42" Single Slope Concrete Parapet does not need to be raised if the depth of overlay is less than 6". Other rail types should be considered to meet Context Sensitive Design criteria.

Concrete parapets and median barriers shall be constructed perpendicular to the roadway cross slope for superelevation rates up to 6%. Bridges with superelevation rates greater than 6% shall be evaluated on a case-by-case basis.

For superelevation rates greater than 6%, revise the Notes on the Standard Drawing as follows:

- Concrete parapet shall be constructed so that the outside face is in a vertical plane. Height control shall be at the inside (traffic) face. End faces that fit up to precast concrete end sections shall be constructed perpendicular to the roadway grade.
- Concrete median barrier shall be constructed vertically.

Combination railings shall be used on a raised sidewalk when there is no barrier between the roadway and sidewalk. The Three Tube Curb Mount Rail also meets the criteria for a combination railing.

Combination railing with a protective pedestrian fence shall be used on sidewalks on bridges over highways. The protective pedestrian fence is only needed where there is a sidewalk or dedicated bicycle lane. Refer to page B13.4C for details of railing. Fencing requirements for bridges over railroads shall follow the BNSF-UPRR Guidelines for Railroad Grade Separation Projects Overhead Structure Barriers and Fences details.

Pedestrian/Bicycle Railing shall be used when a traffic barrier separates the roadway from the sidewalk.

W-Beam railing may be used if the site meets TL-3 criteria and the span length is less than 40'.

REHABILITATION

The following bridge rail options should be considered on a deck rehab project:

DO NOTHING

When no deck replacement or bridge widening is being done on the bridge and the existing rail is in good condition and designed in accordance with the AASHTO Standard Specifications for Highway Bridges, then the existing rail is acceptable. The railing does not require a successful crash test, but the connection to the roadway railing should be modified to meet current standards.

If the railing is in good condition and the work done on the bridge does not impact the railing, the railing does not need to meet MASH criteria.

UP-GRADE

Up-grade the existing rail to MASH criteria when the deck slab is replaced. One of the standard rail types shown in the Bridge Design Manual should be used. The deck slab and exterior girder shall meet the requirements of the current AASHTO code.

Commentary:

All projects with a bid letting date after December 31, 2019 shall conform to MASH criteria to conform to the January 2016 AASHTO/FHWA Joint Implementation Agreement and the August 24, 2017 memo from Kevin Sablan, ITD Design/Traffic Services Engineer.

The 42" single slope parapet meets TL-5 MASH criteria. The parapet was analyzed according to AASHTO Article A13.4 for TL-4 loads to insure the parapet would yield before the cantilever deck. An 8" cantilever deck with a top mat of transverse #5 bars @ 12" and 2-#6 bundled bars at 12" between the #5 bars ($A_s = 1.19$) would provide the moment capacity greater than the parapet for a TL-4 loading.

Although AASHTO is the code that governs bridge design, OSHA regulations govern safety and health regulations for construction activities. The OSHA regulations in 29 CFR 29B Chapter XVII Part 1926 Subpart M 1926.502 state that employers shall provide guardrail systems that are at least 42 inches tall for employees. ITD has decided to provide bridge rail that is 42 inches tall on the state highway system, regardless of the test level required by AASHTO to ensure that future work on the bridge will not require temporary rail or require workers to tie off to meet this OSHA requirement.

Crash Test Reports**STATE HIGHWAY SYSTEM**

RAIL TYPE	REPORT	MASH TEST LEVEL
42" Single Slope Concrete Parapet	MASH Equivalency of NCHRP Report 350-Approved Bridge Railings NCHRP20-07/Task 395 TTI Project 607141 November 2017	MASH Equivalency of NCHRP Report 350-Approved Bridge Railings Table 7.1 NCHRP350 TL5 equals MASH TL5
42" Combination Rail	Texas A&M Transportation Institute Report 0-6946-R2 March 2019	TL-4
42" Three Tube Curb Mount Rail	Texas A&M Transportation Institute Report 612711-01 February 2020	TL-4
42" Single Slope Median Barrier	Texas A&M Transportation Institute Report 0-6946-1 January 2018	TL-4

LOCAL/ OFF SYSTEM

RAIL TYPE	REPORT	MASH TEST LEVEL
32" Concrete Parapet (Jersey Shape)	NCHRP Report 350 Compliance Test of the New Jersey Safety Shaped Barrier FHWA-RD-96-201 March 1997	MASH Equivalency of NCHRP Report 350-Approved Bridge Railings Table 7.1 NCHRP350 TL4 equals MASH TL3
32" Two Tube Curb Mount Rail	NCHRP Report 350 Compliance Test of the Alaska Multi-State Bridge Rail FHWA-RD-98 December 1998	MASH Equivalency of NCHRP Report 350-Approved Bridge Railings Table 7.1 NCHRP350 TL4 equals MASH TL3
32" Median Barrier (Jersey Shape)	NCHRP Project 22-14(03) February 2000	MASH Equivalency of NCHRP Report 350-Approved Bridge Railings Table 7.1 NCHRP350 TL3 equals MASH TL3

Revisions:

June 2006	<p>The Combination Rail Test Level was changed to TL-3 to comply with Article 13.7.3.2.</p> <p>Corrected the w-beam railing reference from PL-1 to TL-3.</p> <p>Added the Delaware Retrofit to the Retrofit options.</p> <p>Added reference for Context Sensitive Design rail options.</p> <p>Added reference to new rail retrofit standard drawings B13.7A – B13.7E.</p>
Oct 2017	<p>Added criteria for using protective pedestrian fence.</p>
July 2018	<p>Added MASH test levels for each rail type.</p> <p>Clarified the rail height when an overlay is placed during new construction.</p> <p>Clarified the need to upgrade the rail to MASH criteria during rehabilitation work.</p> <p>Added ITD policy for the minimum test levels required.</p> <p>Added Commentary for using TL-4 for a 42" single slope concrete parapet and Oregon Three Tube Curb Mount Rail.</p> <p>Added commentary on OSHA rail height requirements.</p>
May 2021	<p>Added Tables for applicable railing for use on State or Local/Off System highways.</p> <p>Added Crash Test Report Tables.</p>