

# Bridge Railings

Bridge railings differ from other longitudinal roadside barriers because they are physically connected to the bridge structure, and are not usually designed to deflect when struck by a vehicle. Bridge railings are very important components of roadway safety systems and play an important role in preventing and mitigating crashes. Since the primary purpose of a bridge railing is to prevent penetration, it must be strong enough to redirect an impacting vehicle.

## FHWA Bridge Rail Requirements for Bridge Railings on the National Highway System

The FHWA requires all bridge railings used on the National Highway System (NHS) to meet full-scale crash criteria. The test criteria are documented in the AASHTO *Manual for Assessing Safety Hardware* (MASH), which is a 2009 update of NCHRP Report 350: *Recommended Procedures for the Safety Performance Evaluation of Highway Features*.<sup>1</sup> The FHWA reviews test results and issues acceptance letters for each bridge rail that is tested according to the evaluation criteria. The acceptance letters are available on the FHWA web site at:

[http://safety.fhwa.dot.gov/roadway\\_dept/policy\\_guide/road\\_hardware/barriers/bridgerailings/index.cfm](http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/bridgerailings/index.cfm).

The test criteria describe six levels of testing and crashworthiness ratings. The first three levels are based on impact speed, from 31 mph for Test Level 1 to 44 mph for Test Level 2, and 62 mph for Test Level 3. All new or replacement railing on National Highway System bridges must meet Test Level 3 crash-test criteria as a minimum. Test Levels 1 - 3 are based on impacts from light vehicles such as passenger cars and light trucks. Test Levels 4 - 6 contain additional tests for bridge railings designed to contain and redirect heavy vehicles such as buses and larger trucks. A presentation describing the MASH is available on the FHWA web site at:

[https://admin.na3.acrobat.com/\\_a55098539/mashfinal/](https://admin.na3.acrobat.com/_a55098539/mashfinal/).



Source: New Hampshire DOT

## FHWA Recommendations for Railings on Non-NHS Bridges

While State transportation agencies may establish different standards for non-NHS projects, FHWA strongly recommends the use of crashworthy devices on all public facilities where run-off-the-road crashes may occur. Information on crashworthy bridge railings may be found on the AASHTO Task Force 13 web site at

<http://www.aashtotf13.org/Bridge-Rail.php>. This site provides specifications for bridge railing hardware and systems. The Task Force 13 web site includes test level (TL) designations for various bridge rail applications. It also provides individual component details, specifications, and system details.

Guidelines for the design and placement of bridge railings and other roadside safety hardware are presented in the **AASHTO Roadside Design Guide**.

## Bridge Rail Design Standards

Standards for design of bridge railings are presented in Chapter 13 of the AASHTO *Load and Resistance Factor Design (LRFD) Bridge Design Specifications*. Railings on newly constructed bridges and replacement railing should be constructed

<sup>1</sup> Hardware that was under development prior to the adoption of MASH may still be tested under the NCHRP Report 350 procedures. After January 1, 2011, the FHWA will no longer consider applications for acceptance under NCHRP Report 350.

to these standards. However, repair or retrofit of an existing railing system that has previously been found acceptable does not require further testing.

### **Identification of Potentially Deficient Systems**

Bridge railings designed to meet AASHTO specifications prior to 1964 may not meet current specifications. Critical design details – such as base plate connections, anchor bolts, material brittleness, welding details, and reinforcement development – should be evaluated to ensure that the design meets the intent of current specifications.

Open-faced railings can present a snagging hazard, which produces high deceleration forces leading to occupant injuries. Curbs or walkways between the driving lane and the bridge railing are another common hazard of older railing systems. Impacting vehicles may go over the railing or rollover.



Source: K. Beasley

### **Bridge Rail Retrofits**

Retrofit concepts that can be adapted to many types of deficient designs include concrete retrofit (safety shape or vertical); W-beam/three-beam retrofits; and metal post and beam retrofits.

Concrete safety shape barriers are an economical retrofit design if the structure can carry the added dead load and if the existing curb and railing configuration can meet the anchorage and impact forces needed for the retrofit barrier.

Especially for low-volume roadways with structures having timber railings, an inexpensive, short-term solution to pre-1964 bridge railing deficiencies is to utilize a W-beam or three-beam approach roadside barrier across the structure. This can improve the impact performance of a substandard railing, but it may not bring the bridge railing into full compliance with AASHTO design criteria.

For an existing structure that has a relatively wide raised walkway, a metal post and beam retrofit railing mounted at the curb edge functions well as a traffic barrier separating vehicles from pedestrians using a sidewalk across a bridge. The existing bridge rail often may be adapted to use as a pedestrian railing.

### **For More Information**

AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications

[https://bookstore.transportation.org/Item\\_details.aspx?id=1560](https://bookstore.transportation.org/Item_details.aspx?id=1560)

AASHTO Manual for Assessing Safety Hardware (MASH)

[https://bookstore.transportation.org/Item\\_details.aspx?id=1539](https://bookstore.transportation.org/Item_details.aspx?id=1539)

AASHTO Roadside Design Guide [https://bookstore.transportation.org/Item\\_details.aspx?id=148](https://bookstore.transportation.org/Item_details.aspx?id=148)

AASHTO Task Force 13 Website <http://www.aashtotf13.org/Bridge-Rail.php>

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