

INSTRUCTIONAL MEMORANDUMS

To Local Public Agencies



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| To: Counties and Cities | Date: April 24, 2018 |
| From: Local Systems Bureau | I.M. No. 3.230 |
| Subject: Traffic Barriers (Guardrail and Bridge Barrier Rail) | |

Contents: This Instructional Memorandum (I.M.) provides guidelines to Local Public Agencies (LPAs) for all projects to determine the need for guardrail at roadway bridges and culverts, as well as guidelines for upgrading bridge barrier rails. This I.M. is not intended to require a system-wide upgrade of guardrail or bridge rail.

Other obstructions, within the right-of-way and clear zone, should be reviewed for removal, relocation, or installation of a traffic barrier; or the “do nothing” option based on a cost-effectiveness approach. Refer to [I.M. 3.240](#), Clear Zone Guidelines.

BACKGROUND

The term crashworthy is defined as having passed a crash test, conducted by an accredited test lab, in accordance with National Cooperative Highway Research Program (NCHRP) Report 350 or AASHTO’s Manual for Assessing Safety Hardware (MASH). NCHRP Report 350 established six test levels (TLs) for traffic barriers, including guardrail and bridge rail, as follows:

- TL-1: A successful test of a 1800 pound car impacting a barrier at 20 degrees, and a 4400 pound pickup truck impacting a barrier at 25 degrees, both at a speed of 31 miles per hour (mph)
- TL-2: A successful test of a 1800 pound car impacting a barrier at 20 degrees, and a 4400 pound pickup truck impacting a barrier at 25 degrees, both at a speed of 44 mph
- TL-3: A successful test of a 1800 pound car impacting a barrier at 20 degrees, and a 4400 pound pickup truck impacting a barrier at 25 degrees, both at a speed of 62 mph
- TL-4: TL-3 car and truck, and a 17,650 pound single-unit truck impacting the barrier at an angle of 15 degrees and a speed of 50 mph
- TL-5: TL-3 car and truck, and a 79,400 pound tractor trailer impacting the barrier at an angle of 15 degrees and a speed of 50 mph
- TL-6: TL-3 car and truck, and a 79,400 pound tanker trailer impacting the barrier at an angle of 15 degrees and a speed of 50 mph

MASH continued these six test levels, with the following differences:

- TL-1: A successful test of a 2420 pound car impacting a barrier at 25 degrees, and a 5000 pound pickup truck impacting a barrier at 25 degrees, both at a speed of 31 miles per hour (mph)
- TL-2: A successful test of a 2420 pound car impacting a barrier at 25 degrees, and a 5000 pound pickup truck impacting a barrier at 25 degrees, both at a speed of 44 mph
- TL-3: A successful test of a 2420 pound car impacting a barrier at 25 degrees, and a 5000 pound pickup truck impacting a barrier at 25 degrees, both at a speed of 62 mph
- TL-4: TL-3 car and truck, and a 22,000 pound single-unit truck impacting the barrier at an angle of 15 degrees and a speed of 56 mph
- TL-5: TL-3 car and truck, and a 79,400 pound tractor trailer impacting the barrier at an angle of 15 degrees and a speed of 50 mph
- TL-6: TL-3 car and truck, and a 79,400 pound tanker trailer impacting the barrier at an angle of 15 degrees and a speed of 50 mph

Test level requirements for traffic barriers vary depending on the roadway system. Requirements for guardrail and bridge rail on the National Highway System (NHS) differ from those off the NHS. Federal Highway Administration (FHWA) requires a TL-3 for both guardrail and bridge barrier rail on the Interstate System; however, it is Iowa DOT’s policy to typically install guardrail systems meeting TL-3 on the Interstate System as well as the NHS. Iowa DOT’s policy requires at least TL-5 levels are met on the Interstate System for bridge barrier rail. Iowa DOT bridge standards for open rail and barrier rail designs pass a TL-4.

For non-NHS routes, including local streets and highways, guardrail and bridge rail must comply with the test level

requirements established by Iowa DOT policies. For primary routes, these policies are provided in the Iowa DOT Design Manual. For non-primary routes, the guidelines contained in this I.M. serve as the policy.

FHWA will pay for crashworthy guardrail on the NHS. If traffic barriers are installed on a non-NHS roadway, FHWA will participate in any traffic barrier installed, regardless of whether it is crashworthy, as long as it complies with Iowa DOT policies.

GUARDRAIL

For Federal-aid projects, the FHWA will participate in guardrail, including at all 4 corners of a bridge, if desired by the LPA. Federal-aid Swap, Farm-to-Market (FM), and Local funds can also pay for guardrail at all 4 corners of a bridge, if desired. In general, guardrail should, but is not required to, be installed or upgraded under the following circumstances:

1. On newly constructed bridges or rehabilitated bridges on the Farm-to-Market system or on collector streets and roads of a higher classification, guardrail should be installed on all 4 corners; except bridges located within an established speed zone of 35 mph or less.
2. On bridges constructed or rehabilitated on local roadways, and if the bridge project is utilizing Federal-aid, guardrail should be installed on the approach corner in both directions (right side in each direction); except bridges located within an established speed zone of 35 mph or less. Consideration should be given to shielding the trailing corner (left side in each direction), especially if it is located on the outside edge of a curve.
3. On roadway construction projects on the Farm-to-Market System or on collector streets and roads of a higher classification:
 - All 4 corners of bridges within the project limits. Existing W-beam installations that are flared and anchored at both ends may be used as constructed without upgrading to current Iowa DOT standards. Some items to consider when deciding on a guardrail upgrade would include rotten posts, un-anchored ends, or ends that are turned down toward the ground.
 - Culverts with openings inside the clear zone, with spans greater than 6 feet (circular pipe culverts greater than 72 inches in diameter), if it is impractical to extend beyond the clear zone and grates are not utilized. Culverts with openings outside the clear zone do not require grates or guardrail. However, the Roadside Design Guide 4th edition 2011, considers culvert openings greater than 3 feet to not be traversable. The Iowa DOT Design Manual Chapters [8A-04](#) and [8B-02](#) explain the Iowa DOT's policy, which can be utilized if the LPA desires.

However, any bridge which is programmed for replacement or rehabilitation in a County Five Year Program (CFYP) or a city capital improvement plan will not require upgrading guardrail as part of a roadway construction project.

Guardrail shall also be upgraded when bridge barrier rail is upgraded.

For roadways with less than 400 vehicles per day, or in established speed zones of 45 mph or less, a shorter length guardrail may be used. Refer to the [Usage of Iowa DOT Standard Guardrail](#) document for guidance on when to use various Iowa DOT guardrail standards, including where shorter guardrail is allowed.

If ALL of the following conditions exist, the LPA may elect to not install guardrail:

1. Current average daily traffic (ADT) at structure is less than 400 vehicles per day.
2. Structure width (curb-to-curb) is 24 feet or greater, and is wider than the approach roadway width.
3. Structure is on tangent alignment.

In some locations, an even shorter guardrail may be necessary. In these cases, it may be possible to install a crash cushion or a guardrail installation that is not considered crashworthy. For example, standard guardrail may not be feasible for a structure located in close proximity to an intersection or entrance, so the guardrail may need to be curved around the radius. Depending on the radius, such an installation might not be considered

crashworthy. However, compared to placing a crash cushion or doing nothing, curving the guardrail around the radius may provide the best compromise of cost and safety. The Iowa DOT Design Manual, [Chapter 8C-02](#) can provide some additional information for these situations. Also, [Iowa DOT Standard Road Plans, Local Systems series](#), can be utilized if desired by the LPA.

BRIDGE BARRIER RAIL

For Federal-aid projects, the FHWA will participate in bridge rail construction or upgrades, if desired by the LPA. Federal-aid Swap, FM, and Local funds can also pay for bridge barrier rail. In general, bridge barrier rail should, but is not required to, be installed or upgraded under the following circumstances:

1. On newly constructed bridges on roadways with 400 vpd or greater, the bridge barrier rail should be constructed using the Iowa DOT Bridge Standards, which is a MASH TL-4 design.
2. On roadways with less than 400 vpd, Iowa DOT Bridge Standards for bridge barrier rail may be used. However, if the project is not utilizing the Iowa DOT Bridge Standards, a bridge rail considered to be crashworthy shall be used, meeting a minimum of TL-1 in NCHRP 350 or MASH. For more information on what bridge rails have been found to be crashworthy to at least TL-1 or above, the FHWA has various bridge rail plans on their Bridge Railings website.
3. A bridge barrier rail upgrade should be considered if all of the following conditions exist:
 - The bridge was designed prior to 1964. According to the Roadside Design Guide 4th Edition 2011, bridge rails designed to AASHTO specifications prior to 1964 may not meet current standards.
 - Current average daily traffic (ADT) at structure is 400 vehicles per day or higher.
 - Structure width (curb-to-curb) is less than 24 feet, or structure width (curb-to-curb) is narrower than the approach roadway width.

However, any bridge which is programmed for replacement or rehabilitation in a County Five Year Program (CFYP) or a city capital improvement plan will not require upgrading as part of a roadway construction project.

When bridge barrier rail is upgraded, approach guardrail shall also be upgraded.

In lieu of bridge rail, consideration may be given to extending the guardrail through the bridge on short bridges or bridges which have no end posts. This may be less costly than constructing an end post and attaching the guardrail as per the Iowa DOT Standard Road Plans. The Iowa DOT has developed a standard for the long span system ([BA-211](#)), which will work in some of these cases. The long span system has successfully passed TL-3 under MASH.