

# Evaluating Roadside Safety Hardware

Design Manual  
Chapter 8  
Roadside Safety

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Members of the MASH Implementation Committee is asked to review roadside safety hardware. After reviewing test reports and videos, they provide the [Roadside Safety Engineer](#) with an evaluation and recommendation. Evaluations and recommendations are reviewed by the MASH Implementation Committee to determine if the hardware is to be added to the approved products list ([MAPLE](#)). The review process consists of three components:

- reading [crash test reports](#),
- watching [crash test videos](#), and
- providing an [evaluation and recommendation](#).

This section provides a brief overview of MASH (Manual for Assessing Safety Hardware) crash test reports and videos, along with a discussion of reviewing the reports and videos to prepare an evaluation and recommendation. Section [8A-7](#) provides a discussion of MASH crash tests and test levels.

Requests for roadside safety hardware approval along with crash test reports and videos are submitted to the Manufactured Materials Engineer in the Construction and Materials Bureau, who then forwards the information to the Design Methods Section. The Design Methods Section reviews the material and prepares a [Roadside Safety Hardware Assessment Form](#).

**Note:** Typically, a letter of eligibility is included with a product approval submittal. This letter simply indicates a device is approved for Federal aid funding. It is not required for a device to be approved. However, an approved device without a letter of eligibility is not eligible for Federal aid funding.

## Crash Test Reports

Manufacturers will provide test reports either as documents with multiple tests run, or as individual documents for each test run. Reports for each test will generally contain several components, though not necessarily in the order given below.

### Introduction

The introduction includes an in-depth description of the hardware. Tests run and a description of each test are also commonly included. Some testing facilities will also provide a chronology of the tests. If one is not provided, it can be created by noting the dates the tests were run.

If modifications were made to the hardware during testing, a discussion of the modifications must be included. A table of tests, organized by modifications, and photos of the changes should also be included.

### Test Requirements and Evaluation Criteria

This section should include a test matrix listing required tests and applicable evaluation criteria. It should also contain a condensed table of evaluation criteria that applies to the hardware.

**Note:** In some cases, Test results from multiple versions of the hardware, e.g. sacrificial, severe use, and/or wide are combined to satisfy the test matrix.

## Test Conditions

This section commonly includes:

- The name and location of the test facility.
- A discussion of the test vehicle (type, weight, etc.) and tow and guidance system.
- A discussion of the data systems and vehicle instrumentation used to gather.
- A discussion of the process for gathering data.

## Crash Test Results

This section commonly provides details of:

- Weather conditions.
- Impact conditions (impact velocity and angle) and post impact vehicle behavior.
- Damage to test article and vehicle.
- Test results.
- The evaluation criteria summary.

Also included is a Summary sheet that includes:

- Overhead sequential photos, path of vehicle, final resting spot, and longitudinal and lateral dimensions from point of impact to final resting spot.
- Tabular presentation of test results. For crash cushions with the potential to result in bounce back, rebound velocity must be provided. See [excerpt from MASH 5.2.3](#).

## Appendices

Typically, one or several, appendices are included in the report. They include:

- Photos of the test setup.
- Photos during the impact.
- Photos of the vehicle and hardware after the test.
- Drawings of the hardware.
- Raw data collected.
- Materials certifications.

## Crash Test Videos

Crash test videos are provided along with crash tests reports. Typically, real time and high speed (i.e. slow motion) videos are provided. Real time videos provide a sense of how quick and hard an impact is. High speed videos allow for a close examination of how the hardware functions and how the vehicle responds after impact.

At a minimum, overhead and side views of each test should be provided.

## Evaluation and Recommendation

Listed below are examples of items to consider for evaluation.

### Crash Test Reports

What modifications were made to the product while testing? At what point were they made during the testing sequence? Could these affect results from earlier tests?

Were all required tests run on the device? If not, why? Were tests run on a similar device instead, for example wide crash cushion vs. narrow crash cushion, or sacrificial crash cushion vs. severe use crash cushion? Are the devices similar enough so the results can apply to both?

What were the impact speed and angle? How close were they to upper or lower MASH limits?

Structural adequacy (criteria A, B, and C of [Table 2](#), Section [8A-7](#)).

- For longitudinal barriers, was the vehicle redirected? For end terminals or crash cushions, was the vehicle redirected or brought to a controlled stop? Did the vehicle underide or override any of these types of hardware?
- For breakaway articles such as sign posts and utility poles, did it break away, fracture, or yield as predicted?

Occupant risk (criteria D through I of [Table 2](#), Section [8A-7](#)).

- Did or debris penetrate the occupant compartment? For work zone devices, could detached fragments:
  - be a hazard to other traffic, pedestrians, or to workers in a work zone,
  - did they interfere with the driver's vision, or
  - could they cause the driver to lose control?
- Was there occupant compartment deformation, and if so, much? How close was it to upper MASH limits? Consider this with impact speed and angle.
- How close was vehicle yaw to upper MASH limits? Did the vehicle remain upright after impact. Consider these with impact speed and angle. Also consider driver's comfort.
- What were the occupant impact velocity (OIV) and occupant ridedown acceleration (ORA) values? How close were they to upper MASH limits? Consider this with impact speed and angle.

Post impact vehicular response (criterion N of [Table 2](#), Section [8A-7](#)).

- For longitudinal barriers, was there any snagging or pocketing of the vehicle? What is the working width of the barrier?
- MASH allows for trajectory behind end terminals, crash cushions, utility poles, and work zone devices. How far behind the device did the vehicle pass? Would it acceptable on the transportation system or in a work zone?
- What is the potential for rebound, see [excerpt from MASH 5.2.3](#) (consider winter driving conditions)? Could vehicles rebound into adjacent traffic. Is rebound velocity provided?

What limitations to the device are the stated in the report?

What are some construction and maintenance concerns? Will contractors need considerable time to install? Will repairs require a significant amount of time, potentially putting workers at risk?

Are potentially difficult to acquire unique or special components required to install or repair the hardware?

## Crash Test Videos

Items to give particular attention to include:

- Snagging or pocketing (longitudinal devices).
- Smooth redirection (longitudinal barriers, end terminals, and crash cushions).
- Vehicle passing behind the article (in particular, longitudinal barriers, end terminals, and crash cushions).
- Excessive vehicle yaw.
- Excessive spinning.
- Flying debris (work zone devices).
- Are full length videos provided for crash cushions with the potential to result in bounce back? See [excerpt from MASH 5.2.3](#).

Once the evaluation is complete, a recommendation is prepared and sent to the [Roadside Safety Engineer](#). The items to address are:

- Should the hardware be added to the approved products list?
- Are there limits to the hardware's use?
- If the hardware is not added to the approved products list, could it be used on a case-by-case basis?

# Chronology of Changes to Design Manual Section: 008A-008 Evaluating Roadside Safety Hardware

1/21/2025 NEW

New. Provides information relevant to evaluating roadside safety hardware crash tests.