




Memorandum

Subject: **INFORMATION:** AASHTO/FHWA
Joint Implementation Agreement for
Manual for Assessing Safety Hardware
(MASH)

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From: 
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In Reply Refer To:
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To: Division Administrators
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Purpose

The purpose of this memorandum is to share information regarding the American Association of State Highway and Transportation Officials (AASHTO)/FHWA Joint Implementation Agreement for the AASHTO Manual for Assessing Safety Hardware (MASH). Recently, the agreement was successfully balloted by AASHTO's Standing Committee on Highways and approved by FHWA.

Information

On November 12th, 2015, FHWA issued a memorandum (http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/policy_memo/memo111215/) indicating that all modifications to NCHRP 350-tested devices will require testing under MASH in order to receive a Federal-aid eligibility letter from FHWA. In addition, a Federal Register Notice (<https://www.federalregister.gov/articles/2015/11/13/2015-28753/manual-for-assessing-safety-hardware-mash-transition>) was also issued regarding this action. This action provided a significant step forward to the implementation of MASH.

Through the AASHTO/FHWA partnership, the agreement was executed to define actions needed for full implementation of MASH over the course of several years. Per the agreement, the implementation of the forthcoming edition (anticipated Spring 2016) of the AASHTO Manual for Assessing Safety Hardware (MASH) will be as follows:

- The AASHTO Technical Committee on Roadside Safety will continue to be responsible for developing and maintaining the evaluation criteria as adopted by

AASHTO. FHWA will continue its role in issuing letters of eligibility of roadside safety hardware for federal-aid reimbursement.

- Agencies are urged to establish a process to replace existing highway safety hardware that has not been successfully tested to NCHRP Report 350 or later criteria.
- Agencies are encouraged to upgrade existing highway safety hardware to comply with the 2016 edition of MASH either when it becomes damaged beyond repair, or when an individual agency's policies require an upgrade to the safety hardware.
- For contracts on the National Highway System with a letting date after the dates below, only safety hardware evaluated using the 2016 edition of MASH criteria will be allowed for new permanent installations and full replacements:
 - December 31, 2017: w-beam barriers and cast-in-place concrete barriers
 - June 30, 2018: w-beam terminals
 - December 31, 2018: cable barriers, cable barrier terminals, and crash cushions
 - December 31, 2019: bridge rails, transitions, all other longitudinal barriers (including portable barriers installed permanently), all other terminals, sign supports, and all other breakaway hardware
- Temporary work zone devices, including portable barriers, manufactured after December 31, 2019, must have been successfully tested to the 2016 edition of MASH. Such devices manufactured on or before this date, and successfully tested to NCHRP Report 350 or the 2009 edition of MASH, may continue to be used throughout their normal service lives.
- Regarding the federal-aid eligibility of highway safety hardware, after December 31, 2016:
 - FHWA will no longer issue eligibility letters for highway safety hardware that has not been successfully crash tested to the 2016 edition of MASH.
 - Modifications of eligible highway safety hardware must utilize criteria in the 2016 edition of MASH for re-evaluation and/or retesting.
 - Non-significant modifications of eligible hardware that have a positive or inconsequential effect on safety performance may continue to be evaluated using finite element analysis.

Division Offices should discuss the MASH implementation agreement with state transportation agency partners and monitor the actions taken and progress towards the dates established in the agreement.

If you have any questions or comments, please contact Brian Fouch in the Office of Safety at (202) 366-0744.

Questions & Answers regarding MASH Implementation Agreement

Definitions

1) Please clarify FHWA's interpretation of the following definitions:

a) "project"

The term "project" is not referenced or defined in the implementation agreement. When used with respect to the Federal-aid highway program, "project" means any undertaking eligible for assistance under Title 23. The implementation agreement uses the term "contracts" to reference work on the NHS in which devices are being newly installed or completely replaced. The agreement defines dates by which the new devices included in contracts on the National Highway System must be compliant with MASH 2016.

b) "damaged beyond repair"

No standard nationwide definition for "damaged beyond repair" exists or is proposed. Each State has the flexibility to define what constitutes "damaged beyond repair." Such a determination could be based on extent of damage to critical components, overall system damage above a specified threshold (such as dollar amount to replace), or some other measure.

c) "new permanent installation"

A new permanent installation would involve the installation of a roadside safety system in a permanent application where none previously existed.

d) "full replacement"

Full replacement is the replacement of all components of an existing roadside safety system including longitudinal barrier, transitions, terminal units, and other roadside hardware elements, in accordance with individual agency policies.

e) "non-significant modifications" (i.e., when finite element analysis can be used instead of crash testing)

Non-significant modifications are modifications to a crashworthy device that do not lead to reduced performance and, instead, provide equal or better performance. Where an engineering analysis clearly shows that the proposed modification will have a non-significant effect, then finite element analysis (FEA) is not needed. Where there is some uncertainty about the performance, FEA can help determine if the effect is significant or not. If FEA determines the effect is significant, full scale crash testing is required for an FHWA Federal-aid reimbursement eligibility letter. Additional guidance can be found at the FHWA's Office of Safety web site under Q&A:

http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/

2) What is the definition of “portable”? When pre-cast concrete barrier is attached to the roadway surface, is it “portable”?

A portable barrier is a barrier that is intended to be moved to a new location at a future time. A barrier that is temporarily attached to the roadway would be considered portable if the eventual plan is to move it to a new location. Pre-cast barriers and other barriers installed permanently under a contract let after December 31, 2019, should be compliant with MASH to be eligible for Federal-aid reimbursement.

3) What entity will finalize these definitions: the State, FHWA Division Office, or FHWA HQ?

The definitions for “damaged beyond repair,” “new permanent installation,” and “full replacement” will be finalized by the individual State agency in cooperation with the FHWA Division Office. “Non-significant modifications” will be determined by FHWA’s Office of Safety in consultation, as needed, with AASHTO’s Technical Committee on Roadside Safety (TCRS).

4) Once defined, will States have adequate flexibility to apply these definitions to the multitude of situations that are likely to arise?

The joint AASHTO/FHWA implementation agreement is intended to provide the general terms by which the States and FHWA have agreed to implement MASH. Not every situation can be addressed in a general agreement. The intent is to provide flexibility to the States to address the unique situations as they arise, considering the overall goals of the agreement and the implementation dates.

5) How will FHWA assure consistency of interpretation and consistency of implementation at its Division offices nationwide?

The terms of the implementation agreement, including compliance dates, will be the same across the country. FHWA Division Offices will not have discretion to deviate from the agreement’s terms and dates.

Dates

6) What, exactly, are FHWA’s proposed dates for the implementation of MASH-compliant devices within the various categories of roadside hardware?

See the AASHTO/FHWA joint agreement.

7) Which category/date applies to the following:

a) Permanent moveable barrier (e.g., barrier that changes lane direction by time of day):

This system is in the category of “all other longitudinal barriers” with a sunset date of December 31, 2019.

b) Precast barrier for permanent installation:

This system is in the category of “all other longitudinal barriers” with a sunset date of December 31, 2019.

c) Barriers on top of retaining walls:

This system is in the category of “bridge rails and all other longitudinal barriers” with a sunset date of December 31, 2019. Design guidance under MASH is available in NCHRP Report 663, “Design of Roadside Barrier Systems Placed on MSE Retaining Walls,” at <http://www.trb.org/Publications/Blurbs/164243.aspx>

8) If a State DOT is unable to get a safety hardware device crash tested to MASH by the transition deadline due to funding problems or capacity at the crash test facility, will FHWA grant the State DOT an extension of the deadline?

AASHTO TCRS and FHWA will evaluate and monitor the availability of MASH-compliant devices and revisit the Implementation Agreement as needed.

9) Can States be assured that industry can accommodate the dates that are being imposed?

AASHTO TCRS and FHWA have both separately discussed the sunset dates with manufacturers and pooled-fund representatives and understand that the roadside safety community can accommodate these dates. AASHTO TCRS and FHWA will evaluate and monitor the availability of MASH-compliant devices and will revisit the Implementation Agreement as needed.

10) Do the crash test facilities have the capacity to test both proprietary and non-proprietary devices within the time frames specified in the proposed agreement?

Based on discussions with crash test facilities and others in the roadside safety community, it is expected that the test facilities will have the capacity to meet the demand for crash testing. A bigger challenge may be identifying funding sources for testing non-proprietary devices, and funding for individual States to test their unique designs. As the research and development process takes time, it will be necessary for the roadside safety community to

begin identifying funding for testing as soon as possible to permit time for crash test scheduling.

State Policies

11) What flexibilities will States have in developing their guardrail replacement policies for projects off the NHS?

On non-NHS facilities, the flexibility remains solely with the State to determine, based upon each State's policy for guardrail replacement. Per 23 U.S.C. 109(o), projects (other than highway projects on the National Highway System) shall be designed, constructed, operated, and maintained in accordance with State laws, regulations, directives, safety standards, design standards, and construction standards.

12) What flexibilities will States have in developing their guardrail replacement policies for projects on the NHS?

On NHS facilities, states have flexibility to determine the level of guardrail replacement that will be required based upon their State policies. Regarding the NHS:

a) Will FHWA accept programmatic risk evaluation (after the MASH implementation dates have passed) with a prioritized list for replacement?

Programmatic risk evaluation is an acceptable method to establish priority programs for guardrail replacement.

b) Does that plan extend to 3R projects?

Yes. It is anticipated 3R agreements will outline the process to address non-compliant roadside safety systems.

c) Regarding maintenance/3R projects, mill-fill projects, bridge deck overlays: will current State guidelines on guardrail replacement for those type of projects continue to apply after implementation dates?

Yes. However, States should review and update their policies and 3R agreements, as necessary, to provide clear guidance on exactly what types of projects and/or impacts will trigger the need for guardrail upgrades (e.g., reduction in rail height, age of system, having to remove any portion of an existing barrier, etc.).

Specific Situations

13) Will FHWA require States to upgrade roadside hardware to MASH on preservation projects, regardless of programmatic agreements, and if the current hardware is still functioning as designed and meets NCHRP 350?

It is envisioned that each State would develop its own guidance and practices to address these types of situations. Agencies are encouraged to upgrade existing highway safety hardware to comply with the 2016 edition of MASH either when it becomes damaged beyond repair, or when an individual agency's policies require an upgrade to the safety hardware. The guidance and practices should demonstrate that the State is moving forward in upgrading NCHRP-350 devices to MASH.

14) Does full bridge replacement require replacement of long approaches of guardrail?

Each State should develop its guidance and practice to address these types of situations. Items such as age of system, composition of posts (i.e., steel or wood), barrier height, etc., may be considered. Full replacement of long approaches of guardrail will only be required if the intent of the project is to replace the approach rail, or if an acceptable (MASH-compliant) transition from the existing approach rail to the new bridge rail cannot be designed and constructed. Often, full bridge replacement involves significant work on the approach roadway that would affect the guardrail as well. If the existing guardrail extends beyond that limit, then the new MASH-compliant guardrail can be transitioned to the existing guardrail (e.g., transitioning one inch in height over each 12-foot panel length is acceptable).

15) Will FHWA require Test Level (TL) 4 barriers on bridges? If so, will concrete bridge barrier that is considered TL-4 under NCHRP 350 be reclassified as TL-3 under MASH if a maintenance project is conducted on that bridge, even if the rail is not touched? Will States be required to upgrade it?

FHWA's current policy on bridge railings installed on the NHS is based on compliance to NCHRP 350 testing criteria to a minimum of Test Level 3. FHWA will work with AASHTO TCRS to provide guidance on appropriate test levels for MASH compliant concrete bridge barriers.

16) When roadside hardware is damaged or is part of a "contract," can the upgrades be deferred and included in a State's upcoming safety improvement project based on the risks at a given site?

It is envisioned each State would develop guidance and practices to address these types of situations. However, full replacements on the NHS are expected to meet the sunset dates of the implementation agreement.

17) How will aesthetic rails in context-sensitive projects (existing and future) be handled?

This type of system is in the category of “all other longitudinal barriers” with a sunset date of December 31, 2019. After this date, all new aesthetic rails or barrier will be required to be crash tested under MASH for the test level condition being applied.

18) Can finite element analysis be used for historic systems?

Finite element analysis (FEA) may be used to evaluate non-significant modifications to hardware previously crash-tested to the MASH criteria. However, FEA may not be used as a substitute for full-scale crash testing of new hardware. After December 31, 2015, FHWA will not issue Federal-aid eligibility determinations for any modifications based on previous crash testing performed using NCHRP Report 350 criteria. FEA cannot be used to validate that a NCHRP 350 device meets MASH criteria.

Implementation of the Agreement**19) Will FHWA issue a memo that identifies which systems are acceptable under MASH 2016 even though they have not been explicitly crash-tested under MASH 2016? For example, it is understood that the loading for TL-5 systems did not change from NCHRP 350 to MASH, and thus these systems would meet the MASH 2016 requirements. A similar memo was issued in 1997 on bridge railings:**

http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/bridgerailings/

FHWA will identify systems with a Federal-aid reimbursement eligibility letter on their website.

20) Can/will FHWA consolidate, maintain, and distribute a list of hardware meeting MASH 2016 criteria to assist States and for consistency purposes?

AASHTO TCRS will coordinate with the FHWA Office of Safety to develop a list of roadside safety hardware meeting MASH 2016. This information will be provided to Task Force 13 to update the web-based barrier guide, located at <http://www.aashtotf13.org/Barrier-Hardware.php> and used by TCRS for the future update of the AASHTO Roadside Design Guide.

21) Will FHWA’s web site of “Crash Tested Hardware” be updated on a regular basis to keep up with MASH testing?

The date shown on the FHWA website reflects when the latest eligibility letter that was posted for a certain group of devices. Each group of devices has its own web page. For example, for work zone devices, the web page shows that it was last updated on September

30, 2015. FHWA will continue to update these web pages as new devices receive eligibility determinations.

- 22) NCHRP Project 22-14(03), “Evaluation of Existing Roadside Safety Hardware Using Updated Criteria,” resulted in NCHRP Web-Only Document 157: Volume 1: *Evaluation of Existing Roadside Safety Hardware Using Updated Criteria – Technical Report*. The objective of this study was to evaluate the safety performance of widely used non-proprietary roadside safety features by using MASH criteria. Will any Federal-aid eligibility letters be issued based on this research?**

If FHWA receives a formal request for any of the hardware tested under this effort, it will be reviewed accordingly.

- 23) Does the FHWA or TCRS anticipate any changes to the MASH crash test matrices (e.g., speed, angle, location of impact, orientation of vehicle, etc.) that would change the requirements for acceptance in the near future?**

MASH 2016 includes new test matrices for cable barriers placed in sloped medians. Knowledge gained from research on the performance of safety hardware systems will drive the frequency of future updates to crash test matrices. The historic revision cycle for roadside safety publications has been 5 to 7 years. As happened with NCHRP 350 and MASH implementation, as revisions are being developed, the impact of the changes would be considered and an implementation plan developed.

- 24) Can feedback on in-service performance of existing devices be incorporated into the review and evaluation process?**

Yes, in-service performance evaluation is encouraged under MASH 2016 to evaluate the safety performance of existing systems, but may not be used in place of crash tests to determine whether devices meet MASH 2016 criteria. In-service performance may be used in setting priorities for retrofitting/replacing existing devices meeting NCHRP Report 350 criteria. FHWA may use in-service performance data for future decisions about Federal-aid eligibility of a given device.

Funding

- 25) How will FHWA give consideration to competing mandates in the face of limited funding, as well as the potential effect of this new requirement on performance measures in other areas?**

The question of how to balance and optimize investment in the highway system in the face of many needs in a fiscally constrained environment has traditionally been left to the States to determine the best path forward. Under MAP-21 requirements, State DOTs will establish performance targets that they will use to make project priority decisions. The funding

needed to carry out the MASH implementation agreement should be considered by State DOTs as they establish performance targets for their system.

26) What can FHWA do to incentivize vendors to develop and contractors to use MASH-compliant devices?

The use of MASH-compliant systems by contractors is controlled by the transportation agency. FHWA has minimal means to incentivize vendors to develop MASH-compliant systems. One of the primary purposes behind sunseting NCHRP 350 devices through the updated MASH Implementation Agreement is to encourage the development and use of MASH-compliant devices.

27) What can FHWA do to incentivize States (e.g., provide funding) to accelerate the replacement of pre-MASH installations?

FHWA does not have discretionary funding available to provide incentives for accelerating compliance with the terms of this agreement. States will need to rely on traditional Federal-aid Highway Program funds or State/local funding. 23 U.S.C. 120(c) (3) allows for a 100% federal share for guardrails, impact attenuators, concrete barrier end treatments, and certain other safety items.

28) Will FHWA consider allowing sole sourcing or other procurement exceptions until additional compliant devices are available? If not, how does FHWA plan to deal with a date that arrives before there is enough competition within a product category?

FHWA will consider supported requests for the use of proprietary products in accordance with regulations established in 23 CFR 635.411. In many cases, States have assumed this responsibility on behalf of FHWA per their Stewardship and Oversight Agreement with the FHWA Division Office. AASHTO TCRS and FHWA will evaluate and monitor the availability of MASH-compliant devices and revisit the Implementation Agreement as needed.