MASH Implementation
Work Zone Traffic Control Devices

National Work Zone Management Conference
Springfield Virginia, September 21, 2016

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FHWA Office of Safety

U.S. Department of Transportation
Federal Highway Administration

Safe Roads for a Safer Future
Investment in roadway safety saves lives

http://safety.fhwa.dot.gov

MASH 2009

- Incremental update to NCHRP Report 350
- No deadlines were established
- MASH testing concentrated on generic hardware
- In 2013 AASHTO TCRS established a task force to sunset Report 350
- AASHTO/FHWA Joint Implementation Agreement was finalized and balloted in 2015.

MASH Update

AASHTO/FHWA Joint Implementation Agreement for MASH

U.S. Department of Transportation
Federal Highway Administration

Memorandum

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

Date: JAN - 7 2016

From: Thomas Everett
Director, Office of Program Administration

Michael S. Griffith
Director, Office of Safety Technologies

In Reply Refer To: HSST

To: Division Administrators
Directors of Field Services
Federal Lands Highway Division Directors

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

MASH Update

AASHTO/FHWA Joint Implementation Agreement for MASH

- The AASHTO Technical Committee on Roadside Safety (TCRS) will continue to be responsible for developing & 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.

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AASHTO/FHWA Joint Implementation Agreement for MASH

- Agencies are urged to establish a process to replace existing highway safety hardware that as not been successfully tested to NCHRP Report 350 or later criteria.

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- 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.

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AASHTO/FHWA Joint Implementation Agreement for MASH

- 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:

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AASHTO/FHWA Joint Implementation Agreement for MASH

- **December 31, 2017**: w-beam barriers & cast-in-place concrete barriers
- **June 30, 2018**: w-beam guardrail terminals
- **December 31, 2018**: cable barriers, cable barrier terminals, & crash cushions
- **December 31, 2019**: bridge rails, transitions, all other longitudinal barriers (including portable barriers installed permanently), all other terminals, sign supports, & all other breakaway hardware(ie. WZ TCD's)

NCHRP Report 350 v MASH
Focus on Work Zone Traffic Control Devices

- NCHRP Report 350 was a research guideline that FHWA turned into its operational guidance

FHWA adjusted that guideline as necessary

- MASH is an AASHTO standard

Only AASHTO has the authority to adjust MASH guidance.

Category 1 WZ Devices

Cones, Drums*, Road Tubes

May be self-certified as crashworthy

Compare to others, or conduct own informal testing

*Lights are OK on drums. Cones and Road Tubes need to be tested if lighted.

Category 1 WZ Devices - Questions

Shall self-certification of Category 1 devices be permitted under MASH?

Are there any of these devices that need to be MASH tested as a reference for manufacturer's self-certification?

Category 2 WZ Devices

Barricades, Sign Stands, lighted cones, tubes

Two devices hit in single run. Second at 90 deg.

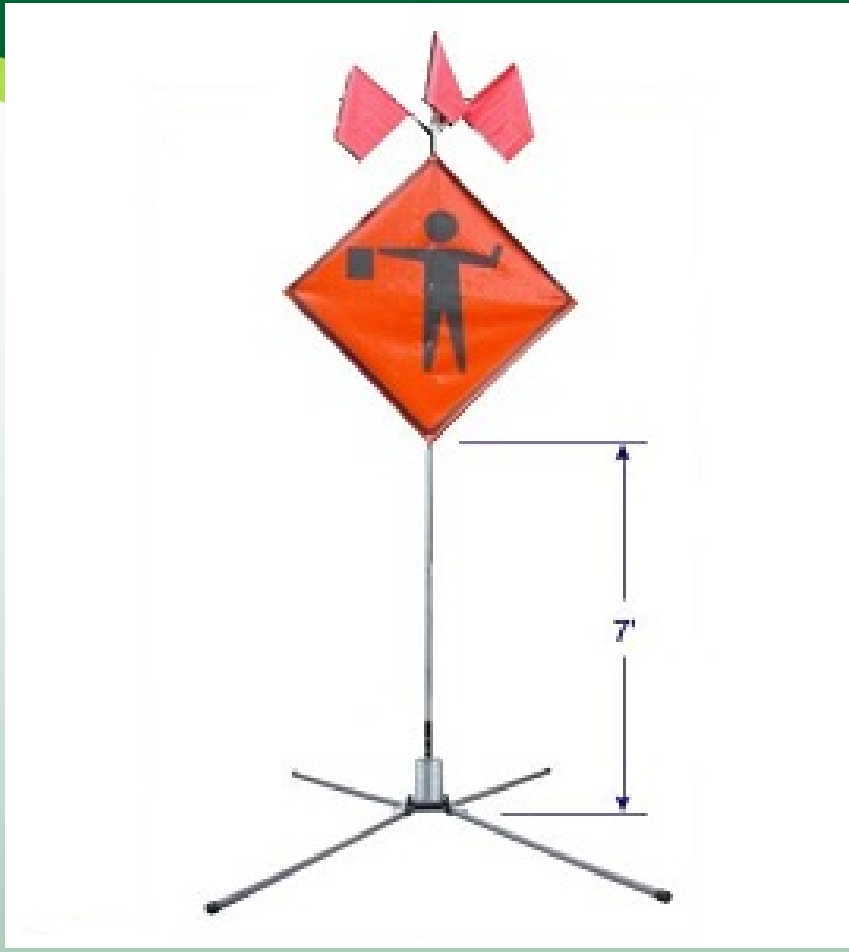
1) Continue “2 for 1” ?

2) Require Ballast?

Category 2 WZ Devices - Questions

Portable sign stands

- Variable height
- Variable leg angle
- Numerous substrates
- Diamond & Rectangular
- Lights, flags, ballast
- 0, 1, or 2 springs at base
- How many tests needed?



Longitudinal Channelizers

Water-filled barriers and barricades need to be tested for highway use.

Should ADA barricades be tested if not adjacent to vehicular traffic?

Category 4 WZ Devices

FHWA deferred crash testing of trailer-mounted devices based on:

- Not in NCRHP Report 350
- State of the art
- Crash history

MASH Tests 50, 51, 52, 53 now apply

Should testing be required?

Existing MASH Research ……

Jennifer D. Schmidt, Ph.D., P.E.
MwRSF, University of Nebraska

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

MwRSF Report No TRP-03-225-10

Safety Investigation and Guidance for Work-Zone Devices in Freight Transportation Systems Subjected to Passenger Car and Truck Impacts with New Crash Standards

http://mwrsf.unl.edu/researchhub/files/Report69/TRP-03-225-10%20(MATC-UNL-100).pdf

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

- Most work-zone devices were designed for Ford Fiesta / Geo Metro geometries
- Current devices may not be compatible with MASH testing small car and pickup truck geometries
- Devices should be tested at orientation angles that may occur while in service (typ. 0° & 90°)

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

FAILURE –

Windshield penetration

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

FAILURE –

Windshield penetration

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

FAILURE–Windshield penetration

Floorboard penetration

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

MwRSF Report No TRP-03-225-10

Table 31. Parameters Deemed Critical for Potential System Failure

Parameter	Pickup Truck	Small Car
Sign Panel Material	Aluminum	Aluminum
Height to Top of Mast	75-135 in.	59-110 in.
Presence of Flags	Without Flags	With and Without Flags
Orientation	Both 0 and 90 degrees	Both 0 and 90 degrees
Sign Locking Mechanism	NA	Rigid Brackets
Base Layout	X-footprint	NA

For information on this study, contact
Dr. Jennifer Schmidt, MwRSF at 402-472-0870.

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

NCHRP Report 03-119

Application of MASH Test Criteria to Breakaway Sign Luminaire Supports and Crashworthy Work-Zone Traffic Control Devices

http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3857

MASH Update – Existing Research

Sign Structures & Temporary Work Zones

NCHRP Report 03-119

Phase I

- ID commonly used devices (Survey underway)
- compile and review available crash test results
- collect information on frequency of not performing as intended in a crash
- recommend designs
- technical interim report

NCHRP Report 03-119

Phase II

- perform finite element modeling simulations
- conduct full scale crash tests
- identify potential changes to the designs
- can surrogate vehicle testing and/or finite element simulation be used?
- final report

Your Turn

Thank you.

- Feedback
  - Questions
    - Key Issues
      - Opportunities

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