MASH Implementation

Presented to the Fifty-Ninth Annual
Alabama Transportation Conference
February 9-10, 2016

Timothy E. Barnett, P.E., PTOE
Alabama Department of Transportation
Traffic and Safety Operations Engineer
Acknowledgement and Special Thanks!

John C. Durkos
VP Technical Support and Marketing
Road Systems, Inc.
jdurkos@roadsystems.com
• 1962 – Highway Research Circular 482
• 1974 – NCHRP Report #153
• 1978 – Transportation Res. Circular 191
• 1981 – NCHRP Report #230
• NCHRP 350  Published 1993 (Implemented 1998)
• MASH – Published 2009 (Implementation to begin)
• The AASHTO Technical Committee on Roadside Safety is responsible for developing and maintaining the MASH evaluation criteria as adopted by AASHTO.

• FHWA will continue its role in issuing letters of eligibility of highway safety hardware for federal-aid reimbursement.
Background

- **NCHRP 350** is an NCHRP document.
- **NCHRP 350** was published in 1993.
- **NCHRP 350** was implemented in 1998.
- **NCHRP 350** implementation period was 5 years.

- **MASH** is an AASHTO document.
- **MASH** was published in 2009, 7 years ago.

- We are now beginning the implementation process.

- Implementation plan/sunset dates vary for barriers, transitions, terminals, crash cushions, bridge railings, cable, etc.

Rewrite/Changes to MASH
(3 issues were addressed)

• **Test Vehicles** – Update to what’s being produced and sold.

• **Impact Condition Criteria** – Correct for inconsistencies & common conditions.

• **Evaluation Criteria** – Correct existing subjective criteria & better define other criteria.
## NCHRP 350 vs. MASH Vehicles

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>NCHRP 350</th>
<th>MASH - 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small car</td>
<td>820C</td>
<td>1100C</td>
</tr>
<tr>
<td></td>
<td>Weight: 1,809 lb</td>
<td>Weight: 2,420 lb</td>
</tr>
<tr>
<td>Pickup Truck</td>
<td>2000P</td>
<td>2270P</td>
</tr>
<tr>
<td></td>
<td>Weight: 4,409 lb</td>
<td>Weight: 5,000 lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Min. c.g. height: 28 in.</td>
</tr>
<tr>
<td>Single Unit Truck</td>
<td>8000S</td>
<td>10000S</td>
</tr>
<tr>
<td></td>
<td>Weight: 17,636 lb</td>
<td>Weight: 22,000 lb</td>
</tr>
<tr>
<td>Tractor Trailer</td>
<td>36000V</td>
<td>36000V</td>
</tr>
<tr>
<td></td>
<td>Weight: 79,366 lb</td>
<td>Weight: 79,300 lb</td>
</tr>
</tbody>
</table>
## NCHRP 350 vs. MASH Impact Conditions

<table>
<thead>
<tr>
<th>Test Level</th>
<th>Test Vehicle</th>
<th>NCHRP 350</th>
<th>MASH - 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL-3</td>
<td>Small Car</td>
<td>Speed: 62 mph</td>
<td>Speed: 62 mph</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angle: 20°</td>
<td>Angle: 25°</td>
</tr>
<tr>
<td>TL-3</td>
<td>Pickup</td>
<td>Speed: 62 mph</td>
<td>Speed: 62 mph</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angle: 25°</td>
<td>Angle: 25°</td>
</tr>
<tr>
<td>TL-4</td>
<td>S.U.T.</td>
<td>Speed: 50 mph</td>
<td>Speed: 56 mph</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angle: 15°</td>
<td>Angle: 15°</td>
</tr>
<tr>
<td>TL-5</td>
<td>Tractor Trailer</td>
<td>Speed: 50 mph</td>
<td>Speed: 50 mph</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angle: 15°</td>
<td>Angle: 15°</td>
</tr>
</tbody>
</table>
## Other Impact Condition Modifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NCHRP 350</th>
<th>MASH - 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Angle for Pickup L.O.N. Test on Terminals and Crash Cushions</td>
<td>Angle: 20°</td>
<td>Angle: 25°</td>
</tr>
<tr>
<td>Impact Angle for Gating Terminals and Crash Cushions</td>
<td>Angle: 15°</td>
<td>Angle 5°</td>
</tr>
<tr>
<td>Intermediate Test Vehicle</td>
<td>None</td>
<td>1500A Sedan Weight: 3,300 lb</td>
</tr>
<tr>
<td>Support Structure and Work Zone Traffic Control Device Testing</td>
<td>Small Car Impacts Only</td>
<td>Small Car and Pickup Truck Impacts</td>
</tr>
</tbody>
</table>
The most significant change in the draft to MASH 2016 are **Test Matrices for Cable Barrier in Sloped Medians.**

**Other technical changes include:**
- Testing soil strength at the crash test laboratory.
- Length of tractor trailer trucks to use the trailer length currently manufactured (53-ft).
- Ballasting trucks.
- Method of measuring hood heights of test vehicles.
- Impact severity tolerance for single unit trucks and tractor-trailers.
Original Implementation Agreement

• As of January 1, 2011, all newly developed hardware must be tested using MASH.

• NCHRP 350-compliant hardware does not have to be re-tested to MASH.

• NCHRP 350-compliant hardware may remain in place and continue to be installed.

• Non-compliant hardware with no suitable alternatives may be left in place and continued to be installed.
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 ballotted 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/memo112155) 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's members voted in support of the schedule that will require new and replacement installations of roadside safety hardware on the National Highway System:

- **December 31, 2017**: w-beam barriers & cast-in-place concrete barriers.
- **June 30, 2018**: w-beam 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.

- **Temporary work zone devices**, including portable barriers, manufactured after December 31, 2019, must have been successfully tested to 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.*
MASH Implementation Timeline
(January 1, 2009 – January 1, 2020)

2009
- MASH Published
- Cable Barriers
- Cable Terminals
- Crash Cushions

2015
- MASH 2016 Finalized/Published
- W-Beam Barriers
- Cast-in-place Concrete Barriers

2016
- W-Beam Terminals

2017

2018
- June 30, 2018
- Bridge Rails
- Transitions
- Portable Barriers
- Sign Supports
- Other Breakaway Hardware

2019

2020

States May Adjust

7 years
11 years
10 years
9 ½ years
2 years
implementation
[im-pluh-muh n-ty'-shuh]
noun

1. the act of putting into effect; fulfillment; to carry out:
What Does Implementation Mean To YOU?

- FHWA?
- DOT?
- Manufacturer?
- Contractor?
- Test House?
FHWA – Issue eligibility letters

DOT – Oversee MASH, sign off on schedule
- Design - adhere to schedule, standards
- Maintenance - inventory, repair in kind?
- Update QPL

Manufacturer - Design/Test products
- Get “each” DOT to add to QPL

Contractor - Learn new products

Test House - Business is good...
Manufacturers Product Approval

1 - 2 years
Concept/Development

1 - 2 years
Crash Testing

6 mo. - 1 year
FHWA Letter

U.S. Department of Transportation
Federal Highway Administration
Now The Work Begins!!
Questions?

Or maybe just fix the guardrail?