MASH 2016 Implementation: What, When and Why

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Senior Research Engineer
Texas A&M Transportation Institute

June 7, 2016
2016 Traffic Safety Conference
College Station, Texas
Outline

- What
- When
- Why
Outline

• What
• When
• Why
Crash Testing Guidelines

- Uniform guidance for testing roadside safety features
  - Test matrices
    - Vehicle type, impact speed, impact angle, impact location
  - Evaluation criteria
Guideline Evolution

1962: Highway Research Circular 482
1974: NCHRP Report 153
1980: NCHRP Report 230
1993: NCHRP Report 350
2009: MASH
2016: MASH 2016 Update

COMING SOON
Outline

• What
• When
• Why
MASH Implementation Plan

AASHTO Technical Committee on Roadside Safety (TCRS) and Federal Highway Administration (FHWA) have adopted a new MASH implementation plan.

For contracts on the National Highway System with a letting date after December 31, 2019, only safety hardware evaluated using MASH 2016 will be allowed for new permanent installations.
MASH Implementation Timeline

MASH Compliance Timeline

Dec. 31, 2017
- W-beam & cast-in-place concrete barriers

June 30, 2018
- W-beam terminals

Dec. 31, 2018
- Cable barriers, & their terminals, crash cushions

Dec. 31, 2019
- Bridge rails, transitions, all other longitudinal barriers including portable barriers installed permanently, all other terminals, sign supports, & other breakaway hardware
Outline

- What
- When
- Why
Manual for Assessing Safety Hardware (MASH)

• Next step in advancement & evolution of roadside safety testing & evaluation
• Addresses changes in vehicle fleet & highway network
• Reflects advancements in knowledge & technology
• Will result in:
  • Improved roadside safety hardware
  • Enhanced safety for motorists
Key Changes in MASH

- **Small Design Test Vehicle**
  - Weight increased from 1800 lb to 2425 lb
  - 2nd percentile lightest vehicle (i.e., 98% of vehicles sold weigh more than 2425 lbs)

- **Large Design Test Vehicle**
  - Changed from ¾-ton, 2-door to ½-ton, 4-door pickup
  - Better represents SUVs
  - Weight increased from 4410 lb to 5000 lb
  - Minimum c.g. height = 28 in
Key Changes in MASH

- **Test Matrices**

<table>
<thead>
<tr>
<th></th>
<th>NCHRP 350</th>
<th>MASH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small car impact angle</td>
<td>$20^0$</td>
<td>$25^0$</td>
</tr>
<tr>
<td>SUT impact speed</td>
<td>50 mi/h</td>
<td>56 mi/h</td>
</tr>
</tbody>
</table>

- **Test Vehicles**

<table>
<thead>
<tr>
<th></th>
<th>NCHRP 350</th>
<th>MASH</th>
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<tbody>
<tr>
<td>Small car</td>
<td>1,800 lb</td>
<td>2,420 lb</td>
</tr>
<tr>
<td>Pickup truck</td>
<td>4,400 lb</td>
<td>5,000 lb</td>
</tr>
<tr>
<td>SUT</td>
<td>17,600 lb</td>
<td>22,000 lb</td>
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</tbody>
</table>

- **Impact Severity**

<table>
<thead>
<tr>
<th>Test</th>
<th>NCHRP 350</th>
<th>MASH</th>
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<tbody>
<tr>
<td>3-10</td>
<td>-</td>
<td>$+206%$</td>
</tr>
<tr>
<td>3-11</td>
<td>-</td>
<td>$+13%$</td>
</tr>
<tr>
<td>4-12</td>
<td>-</td>
<td>$+56%$</td>
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# Key Changes in MASH

<table>
<thead>
<tr>
<th>Feature</th>
<th>NCHRP 350</th>
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<tbody>
<tr>
<td>Length-of-need testing of terminals and crash cushions</td>
<td>$20^0$</td>
<td>$25^0$</td>
</tr>
<tr>
<td>Gating terminals and crash cushions</td>
<td>15 degrees</td>
<td>5-15 degrees</td>
</tr>
<tr>
<td>Variable message signs and arrow board trailers</td>
<td>No mention</td>
<td>Added</td>
</tr>
<tr>
<td>Breakaway supports and work zone traffic control devices</td>
<td>Only small car tested</td>
<td>Pickup truck added</td>
</tr>
<tr>
<td>Vehicle rebound in crash cushion tests</td>
<td>None</td>
<td>Reported</td>
</tr>
<tr>
<td>Head-on test for mid-size vehicles</td>
<td>None</td>
<td>Added</td>
</tr>
<tr>
<td>TMA tests</td>
<td>Optional</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Longitudinal Channelizers</td>
<td>Not included</td>
<td>Included</td>
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Examples
Example #1

G4(2W) W-Beam Guardrail

MASH TL-3 Testing
Example #1 – G4(2W) Guardrail

Test Vehicles

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NCHRP Report 350 – TL3
27 5/8” W-Beam Guardrail
MASH Test 3-11
31” W-Beam Guardrail
MASH Test 3-11
Example #2

Test Level 4 (TL-4) Barrier

Barrier Height and Design Load Requirements
### Example #2 – TL-4 Barrier

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Example #2 – TL-4 Barrier

MASH Test 4-12
32-in N.J. safety shape barrier
Example #2 – TL-4 Barrier

Sheikh and Bligh (2011) “Determination of Minimum Height and Lateral Design Load for MASH Test Level 4 Bridge Rail”

- Minimum rail height for MASH TL-4 barriers = 36 inches
- Lateral impact load for MASH TL-4 significantly greater than NCHRP Report 350 TL-4
  - 36-inch tall barrier -- design impact load = 68 kips
  - 42-inch tall barrier -- design impact load = 80 kips
Example #2 – TL-4 Barrier

MASH Test 4-12
36-in single slope
concrete barrier
Example #3

Sign Supports

Roof Crush and Pickup Truck Vehicle Testing
Example #3 – Slip Base Sign Support

NCHRP Report 350

5.6” Roof Crush (> 4” MASH Criteria) ✗ MASH
Example #3 – Slip Base Sign Support

TxDOT Research Study 0-6363
Minimum Sign Area for Slip Base Supports

<table>
<thead>
<tr>
<th>Sign Area (ft²)</th>
<th>System</th>
<th>Nominal Diameter (in)</th>
<th>Post Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 14</td>
<td>Wedge &amp; Socket</td>
<td>2</td>
<td>BWG-13</td>
</tr>
<tr>
<td>14 – 24</td>
<td>Slip Base</td>
<td>2.5</td>
<td>BWG-10</td>
</tr>
<tr>
<td>24 – 36</td>
<td>Slip Base</td>
<td>2.5</td>
<td>Sch-80</td>
</tr>
</tbody>
</table>
Example #3 – Slip Base Sign Support

2.5” Roof Crush  ✔ MASH
Example #3 – Temporary Sign Support
Example #3 – Temporary Sign Support

Design 1

Design 2

MASH
Questions?

“MASH 2016 Implementation: What, When and Why”

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