

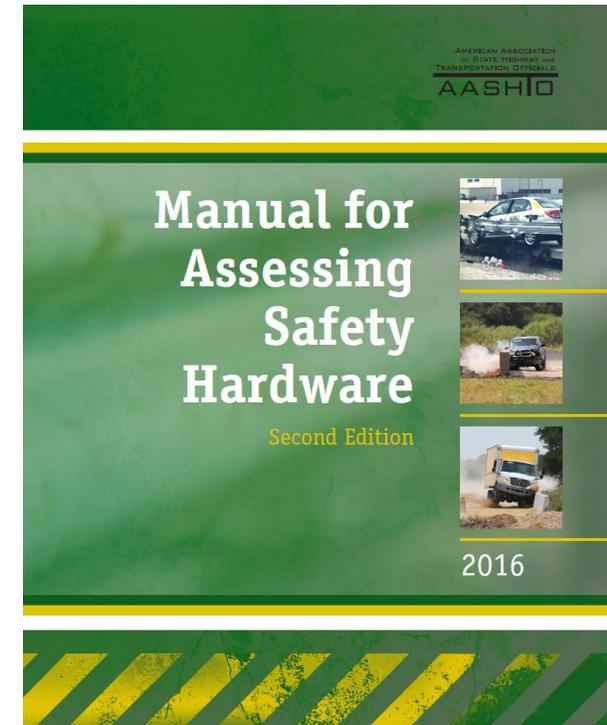
MASH UPDATE

2020 Construction and Project Development
Presentations
June 9, 2020

KRIS ALTEPETER
DESIGN DIVISION - NDDOT

Outline

- What is MASH?
- Compliance Timeline
- Determining Crashworthiness
- Various systems used in North Dakota
 - MASH or NCHRP Report 350



What is MASH?

Manual for Assessing Safety Hardware by AASHTO

- MASH is the latest crash testing performance criteria to evaluate safety hardware.
- Several Test Levels (TL)
 - Test Levels 1-3 includes cars and pickups
 - Test Level 4 includes cars, pickups, and single unit trucks
 - Test Levels 5-6 includes cars, pickups, and tractor trucks



Compliance Timeline

FHWA Memo issued January 7, 2016

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

Date: JAN -7 2016

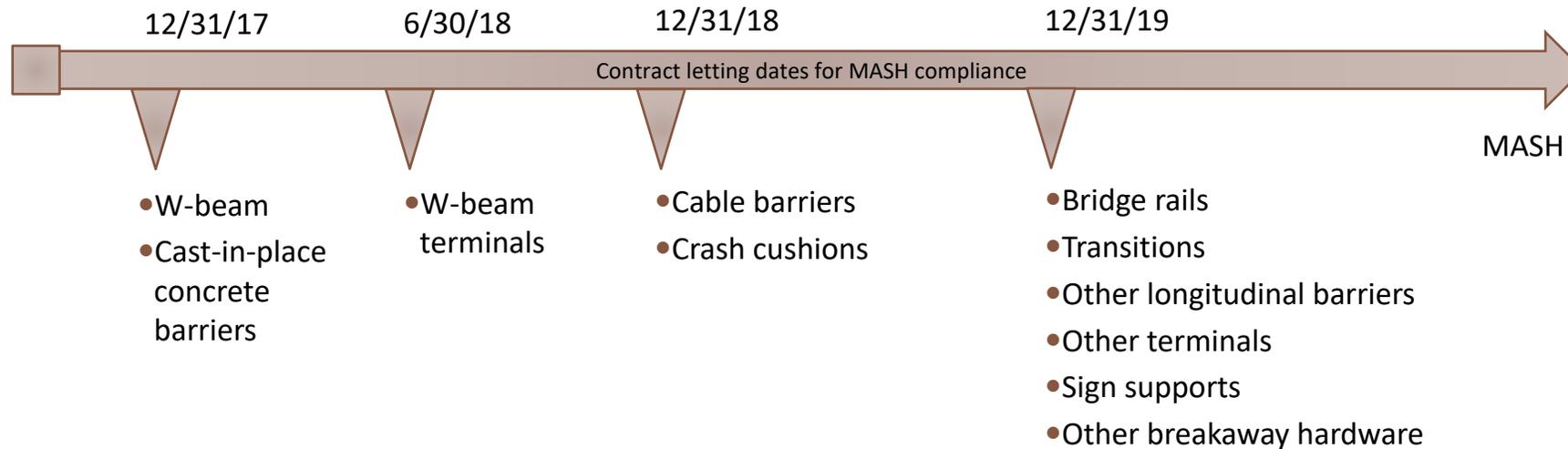
From: *Thomas D. Everett*
Thomas Everett
Director, Office of Program
Administration

In Reply Refer To:
HSST

Michael S. Griffith *Michael S. Griffith*
Director, Office of Safety Technologies

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

NCHRP Report 350



- Temporary work zone devices manufactured after 12/31/19 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 through their normal service life.

Update to Compliance Timeline

FHWA & AASHTO update - November 2019 - Q/A

<https://design.transportation.org/wp-content/uploads/sites/21/2019/11/Clarifications-on-Implementing-MASH-2016-aka-MASH-QA-Updated-Nov-19-2019.pdf>

- May specify MASH 2009 or NCHRP Report 350 compliant when:
 - a) a MASH 2016-compliant device does not exist to address the situation; or
 - b) a MASH 2016-compliant device exists but does not meet the state's needs given project or regional conditions; or

Update to Compliance Timeline

- May specify MASH 2009 or NCHRP Report 350 compliant when:
 - c) the state is awaiting completion of MASH-2016 testing for a specific device, in which case the State must document the plan for testing the device that will be used on future projects in lieu of the specified NCHRP 350 device; or
 - d) the device is a temporary work zone device that has been in use prior to December 31, 2019, and is still within its normal service life.
- States must maintain documentation of non-MASH-2016-compliant devices used and the basis

NDDOT Process

Determining Crashworthiness

- In 2018, FHWA required a letter from each DOT providing their process for determining roadside hardware crashworthiness
- NDDOT's process:
 - 1) Device has a Federal-aid eligibility letter issued by FHWA stating the device is in compliance with MASH test criteria.

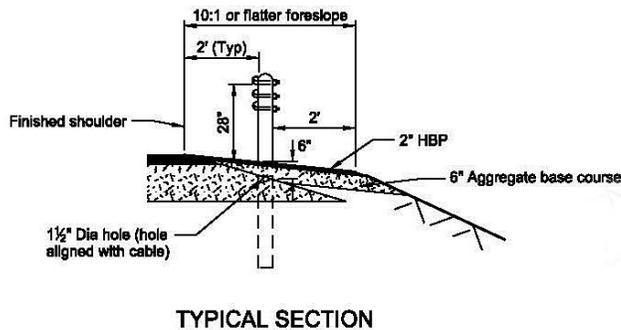
NDDOT Process

Determining Crashworthiness

- NDDOT's process:
 - 2) If a Federal-aid eligibility letter has not been issued, the device must have a physical crash test report documenting successful crash testing (relative to MASH test criteria) conducted by an ISO 17025 accredited laboratory.
 - 3) If there are no acceptable devices in compliance with MASH test criteria, other devices will be utilized that are in compliance with NCHRP 350 test criteria.
- Following pages show examples but are not all inclusive.



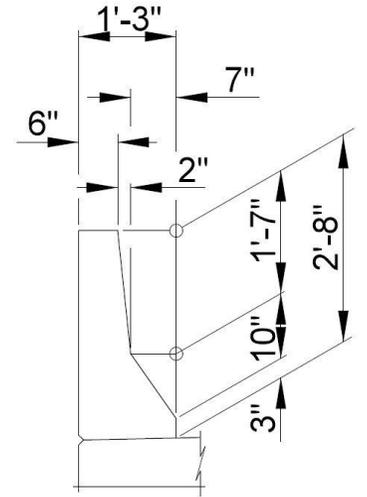
Longitudinal Guardrail



- W-beam
 - Midwest Guardrail System (MGS)
- High Tension Cable (MASH Systems)
 - Brifen Wire Rope Safety Fence (O-Post)
 - Installed in 2019
 - SAFENCE, CASS
- Low Tension Cable
 - Does not meet MASH

Guardrail Transitions

- Connect MGS W-beam to bridge rail (MASH)
 - Single Slope transition (D-764-60)
 - Jersey Barrier transition (D-764-60)
 - Jersey Barrier to Safety Shape transition (D-764-62)
- Connect MGS W-beam to bridge rail (NCHRP 350)
 - Jersey Barrier transition (D-764-64)





W-Beam Guardrail End Terminals

- Flared Guardrail
 - MGS FLEAT - New product, in process of adding
 - MGS Slotted Rail Terminal (MGS SRT) - not currently supplied
- Non-Flared Guardrail
 - MASH SoftStop End Terminal
 - MASH Sequential Kinking Terminal (SKT)

Attenuation Devices

- Do not redirect
- Devices include:
 - Big Sandy
 - CrashGard
 - SLED (water filled)



TraFFix Big Sandy



CrashGard



Sled (MASH)

Crash Cushions

- Redirect side impacts
- MASH Devices include:
 - 24" width SCI Smart Cushion
 - 24" width QuadGuard M10
 - 30" width Tau-M
 - SMA Hercules



Guardrail Training Website

- <http://www.dot.nd.gov/divisions/maintenance/guardrail/>
- Conference Held May 2019
- Good Resource for design and maintenance

The screenshot shows the website header for North Dakota Transportation, featuring the logo and tagline "Be Legendary." along with social media icons and a search bar. Below the header is a navigation menu with links for Home, About NDDOT, Public, Travel, Business, Forms, Publications, and FAQs. The main content area is titled "Guardrail Training and Information" and includes a "Pocket Guide" section with a link to the "NDDOT Highway Barrier Pocket Guide (zip - 31MB) pdf". There are also two training sections: "Installation Inspection and Maintenance Training" with a link to the "Guardrail Installation, Inspection, & Maintenance Flier pdf", and "Design Training" with links to the "Designer Training Flier pdf" and "Designer Notebook (zip - 19MB)".

Sign Supports

- Continue to use same system that meets NCHRP Report 350
 - Inventory for maintenance
 - Xcessories Squared based
 - Breakaway Coupler System
- Current systems that meet MASH
 - MASSH-400 (4 inch square tube) by Xcessories Squared
 - plan to evaluate



Breakaway Lights and Traffic Signal Standards

- Not aware of any that meet MASH
- Continue to use second party bases for poles provided by Millerbernd and Valmont
 - Meet NCHRP Report 350
- Type II, V, VI, and VII Traffic Signal Standards may use break away depending on circumstance
 - Meet NCHRP Report 350

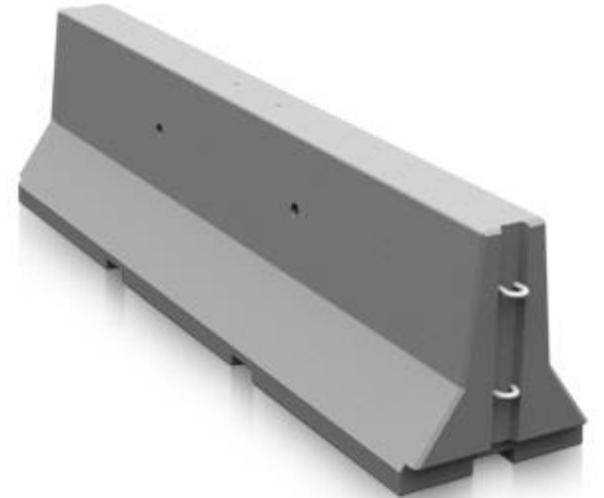
Mailboxes

- Currently use V-Loc[®] driven into dirt. Meets NCHRP 350.
- A number are available that comply with MASH. Most crash tested with concrete foundation.



Portable Barriers

- Continue to use 32 inch portable concrete Jersey barriers that meet NCHRP Report 350 for their service life.
- Examining different portable barriers that meet MASH
- May need to build up inventory for 2021 construction or have contractor provide temporary barriers



Workzone Devices

FHWA and AASHTO clarification:

May 2018 #9. May “Category 1” devices (i.e., drums, cones, road tubes) be self-certified by the manufacturer as crashworthy?

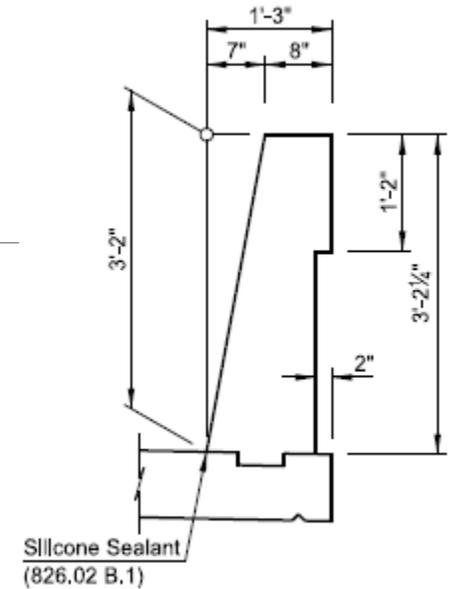
Low-mass, single-piece traffic cones, tubular markers, single-piece drums, and delineators (known as Category 1 devices under NCHRP 350) may be manufacturer-certified as MASH-compliant as long as there are no attachments to the device. If there are attachments, crash testing and/or evaluation to MASH criteria is required.

Workzone Traffic Control Devices

- Sign support in urban areas
 - None comply with MASH
 - Not aware of a skid mounted single vertical 7 ft support that complies with MASH or NCHRP Report 350
 - Continue to allow skid mounted 5 ft single vertical support if visible, or
 - Bolt 7 ft support to pavement (surface mount), or
 - Core pavement and drive anchor for 7 ft support

Concrete Bridge Barrier

- Texas Single Slope Bridge Rail
 - 36 inch meets MASH TL-4
 - Using 38 inch to account for future overlays
 - Used in New or Reconstruction
 - Deck Replacements
 - Design using MASH loading which exceeds NCHRP Report 350
- 32 inch Jersey Shape
 - Meets MASH TL-3
 - Typically used when extending a like system

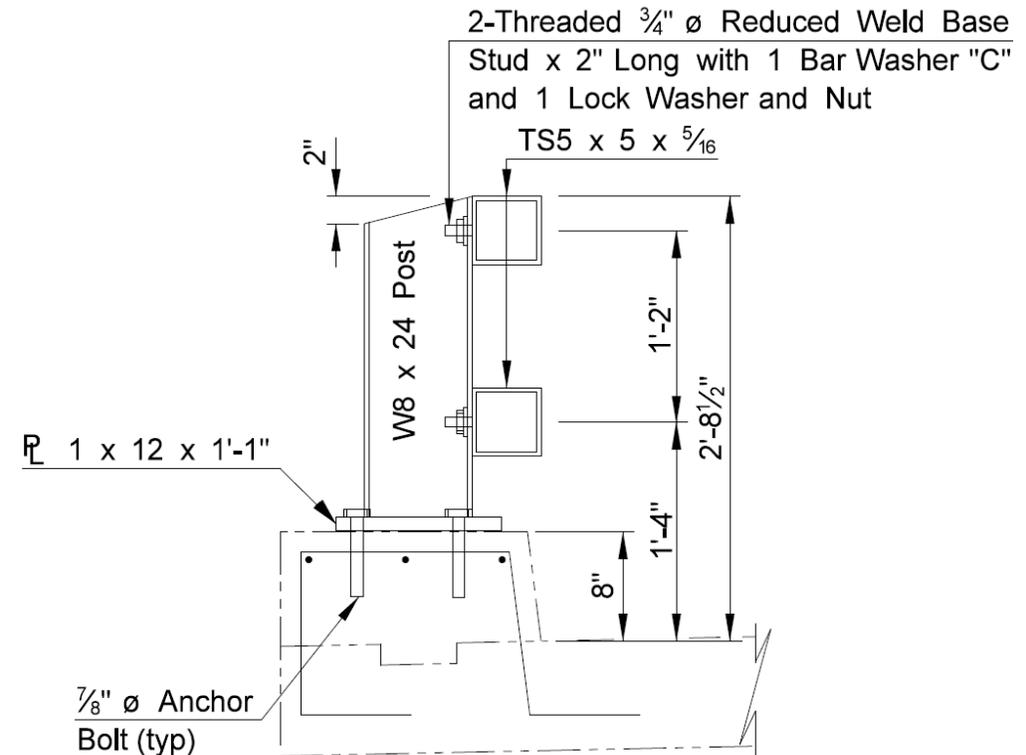


	Included in AASHTO LRFD Barrier Height 32 in.	New Barrier Height 36 in.
Design Forces and Designations	NCRHP Report 350 TL-4	MASH TL-4
F _t Lateral (kip)	54	67.2
F _L Long. (kip)	18	21.6
F _v Vertical (kip)	18	37.8
L _t and L _L (ft)	3.5	4
H _e (in.)	32	25.1

Alaska 2-Tube Bridge Rail

- TTI - 1998 NCHRP Report 350; AK, OR, WA, & ND
 - Currently install as rail retrofit
- TTI – Currently MASH testing; AK and ND
- Goal to have rail retrofit system that meets MASH

- NCHRP 350 TL-4 below:



Alaska 2-Tube Bridge Rail

- January 2019 – Two-tube successfully passed MASH TL-4 for new installations



Alaska 2-Tube Bridge Rail

- Planning on numeric simulation for rail retrofit
- The height of the new retrofit would be increased from 32.5 inches to 36 inches meeting MASH TL-4



Alaska 2-Tube Bridge Rail

- December 2019 – Symmetric w-thrie beam transition appears to be successful for MASH TL-3
- Completing report
- Tested with Steel posts



Summary

- Utilize MASH when available to meet the needs of the NDDOT
- New products vetted to see how they fit the needs of the NDDOT.
- No approved products list.
- Continue to check [pooled fund sites](#), [FHWA eligibility letters](#), [Task Force 13](#), and manufacturers

Questions / Contact Information

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