NORTH Dakota | Transportation
Be Legendary.™

Northland Chapter Of ATSSA

Compliant Sign Supports MASH -16 or 350?

ATSSA Northland Chapter's Virtual Safety Spotlight
March 17, 2021

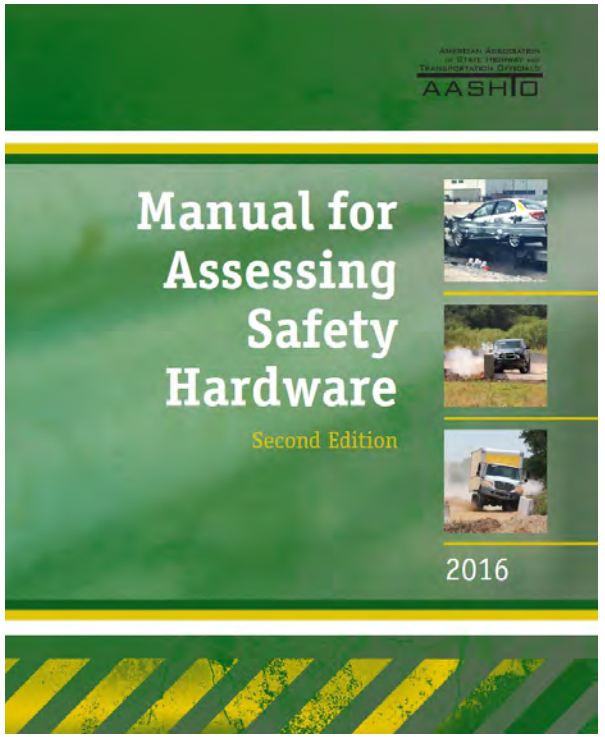
JAMES RATH, PE
DESIGN DIVISION – NDDOT

BRYON FUCHS, PE
LOCAL GOVERNMENT – NDDOT

DOUG SCHUMAKER, PE
DESIGN DIVISION - NDDOT

What is MASH?

- Manual for Assessing Safety Hardware (MASH) presents uniform guidelines for crash testing permanent and temporary highway safety features and recommends evaluation criteria to assess test results. These devices are typically located within the clear zone.



Overview of MASH 2016

- 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

Brief History

- 1993 – NCHRP Report 350 replaced NCHRP Report 230
  - NDDOT Adopted shortly after
- 2009 – MASH (Manual for Assessing Safety Hardware)
  - NDDOT did not implement
- 2016 – MASH
  - Needed because changes in the vehicle fleet since NCHRP Report 350 criteria were adopted in 1993
  - Required for new or reconstruction projects on NHS system
  - NDDOT implemented on all state highways beginning with projects constructed in 2018

NDDOT Implementation of MASH

- Minor rehabilitation projects
  - Comply with NCHRP Report 350, otherwise update to MASH (when available)
- Major rehabilitation or reconstruction projects
  - Comply with MASH (when available)
- Workzones
  - Existing devices that meet NCHRP Report 350 can be used if still serviceable
  - MASH devices are allowed.

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

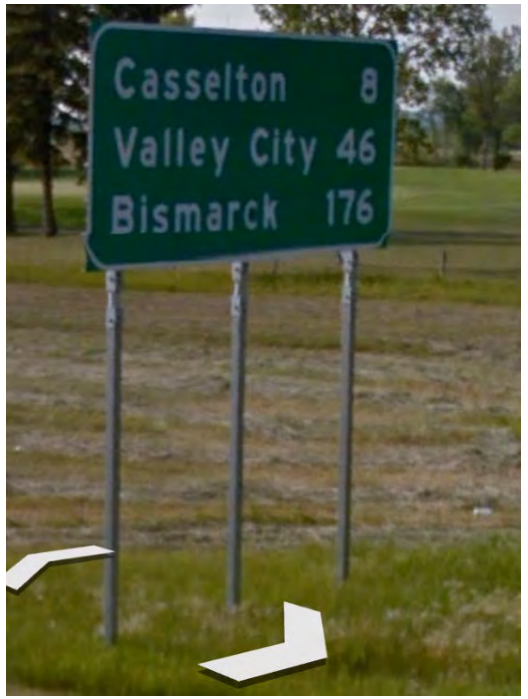
- NDDOT's process:
  - 2) If a Federal-aid eligibility letter has not been issued, the device must have a physical crash test report documenting successful crash testing (relative to MASH test criteria) conducted by an ISO 17025 accredited laboratory.
  - 3) If there are no acceptable devices in compliance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

Sign Supports on the State System

- Continue to use same system that meets NCHRP Report 350
- Xcessories Squared based
- Breakaway Coupler System (pipe and H-Pile)
- Inventory for maintenance

Sign supports that comply with MASH

- MASSH-400 (4 inch square tube) by Xcessories Squared
  - Installed a couple in Fargo (see photos on right)
  - Not competitive with perforated tube
    -concrete foundation required on MASSH-400 device
  - More applicable where smaller round pipe or smaller H-pile are used. Increase sign shop parts inventory.
- Wood posts that meet MASH – Not use because shorter life than metal.
- U-Post- Historically had problems with signs wobbling causing them to come down. Also, it would increase sign shop parts inventory.



I-94 WB

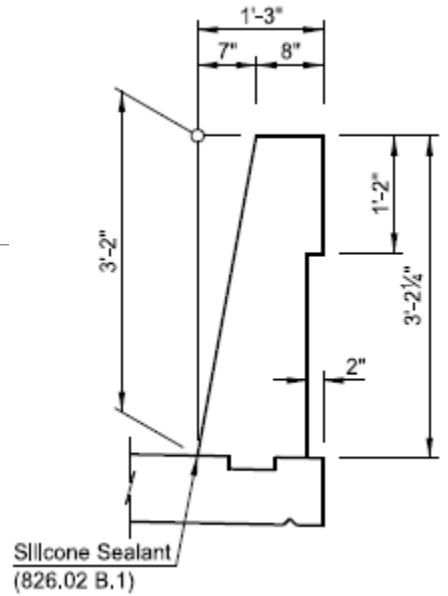
I-29 NB

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.

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

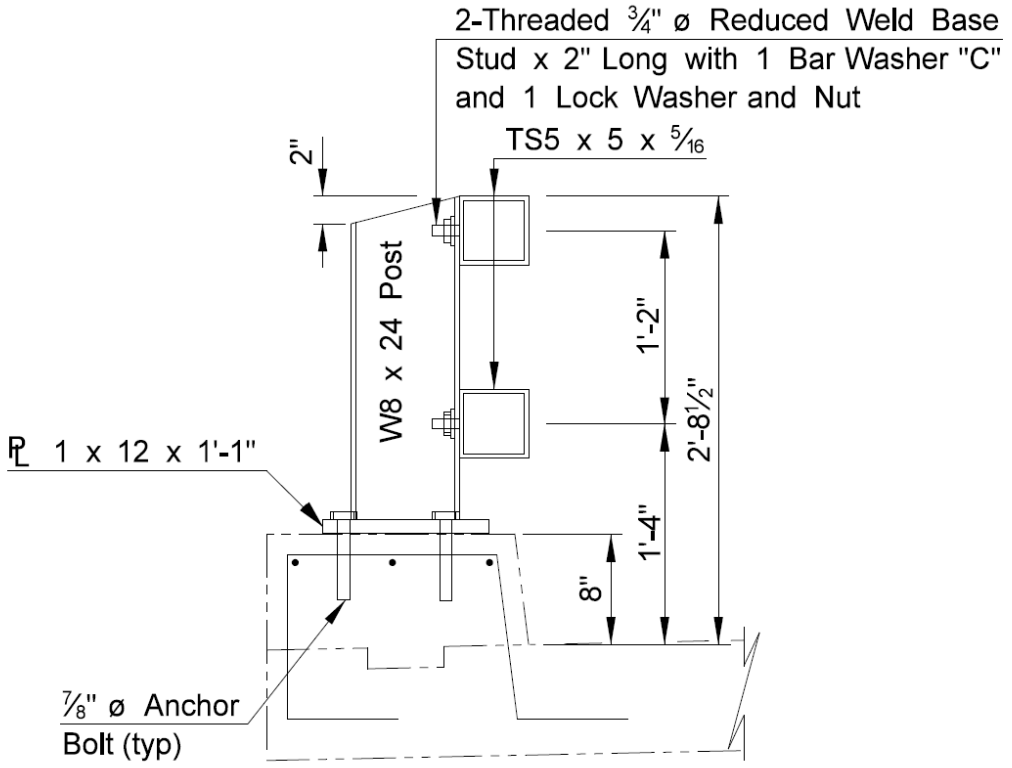


	Included in AASHTO LRFD	New
	Barrier Height 32 in.	Barrier Height 36 in.
Design Forces and Designations	NCRHP Report 350 TL-4	MASH TL-4
F_t Lateral (kip)	54	67.2
F_L Long. (kip)	18	21.6
F_v Vertical (kip)	18	37.8
L_t and L_L (ft)	3.5	4
H_e (in.)	32	25.1

Alaska 2-Tube Bridge Rail

- TTI - 1998 NCHRP Report 350; AK, OR, WA, & ND
  - Currently install as rail retrofit
- TTI – New version of system complies with MASH testing for new installation
- 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 complying with MASH TL-4

Alaska 2-Tube Bridge Rail

- The symmetric w-thrie beam transition is compliant with MASH TL-3
- Tested with Steel posts

County Roads – Bryon Fuchs

- LPA Requirements
- Bridge Rail and Guardrail

MASH Links

- MASH Presentation from 2020

https://www.dot.nd.gov/conferences/construction/presentations/2020/MASHUpdate_June9CPD.pdf

- NDDOT Standard Drawings for end terminals that meet MASH

http://www.dot.nd.gov/divisions/design/docs/standards/D764-50.pdf

http://www.dot.nd.gov/divisions/design/docs/standards/D764-51.pdf

- NDDOT Standard Drawings – general

http://www.dot.nd.gov/dotnet2/view/stddrawings.aspx

- MASH Pooled Fund

https://www.roadsidepooledfund.org/mash-implementation/search/

Questions / Contact Information

State Highways:

Doug Schumaker, PE
Traffic Safety Engineer
Design Division
dschumak@nd.gov

James Rath, PE
Program Manager
Design Division
jrath@nd.gov

County Roads:

Bryon Fuchs, PE
Assistant Local Government Engineer
Local Government
blfuchs@nd.gov