MASH A Tri-State Perspective

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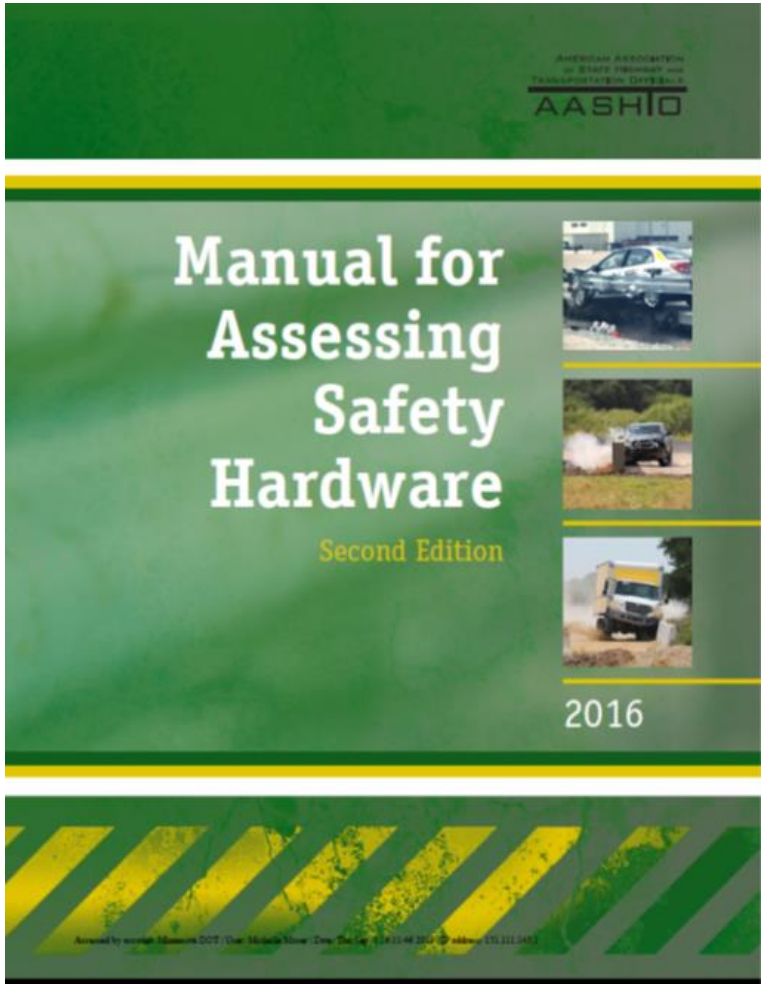
Office of Traffic Engineering

DEPARTMENT OF TRANSPORTATION

Crashworthy Device Standards

- MASH-16 Required for NHS Roadways, MnDOT has decided to adopt for all MnDOT roadways
- Anything within MnDOT ROW must meet MASH-16 or have a MnDOT Crashworthy Compliance Evaluation
- All local agencies on non-NHS roadways can continue to use NCHRP-350 if they elect to



State Processes for Determining MASH Compliance

- Proprietary Products
  - The crash testing of these products is the responsibility of the manufacturer.
  - For these products to be approved by MnDOT for placement on the Approved Products List (APL), the manufacturer must secure a passing MASH-16 crash report (eligibility letter preferred) from an accredited testing facility, which states the product has successfully passed all required crash tests.
  - The manufacturer must submit the documentation, such as crash test reports, videos, installation manuals, and any other pertinent product information to MnDOT for review.
  - If the submittal is satisfactory, the product will be placed on the APL under provisional approval.
  - Provisional approval allows for a limited number of installations that can be evaluated for ease of installation, ease of maintenance, and in-service performance.

State Processes for Determining MASH Compliance

- Proprietary Products (Continued)
  - Once the provisional approval period has lapsed, with satisfactory performance, the product may gain full approval without limitations.
  - FHWA Eligibility Letters and MASH-16 reports approve a particular system and are not component based, so there tends to be a good amount of variation from the approved set-up to cover all the situations it can be used in.
  - Any modifications to these products are reviewed and approved by the MnDOT Crashworthy Committee.
  - Substantial modifications may need to be reviewed by a crash test facility.
  - It should be noted that an eligibility letter, or passing crash tests, does not guarantee that a product will be approved or used.
  - A product may also be removed from the APL at any time if maintenance or performance issues arise.

State Processes for Determining MASH Compliance

- Non-Proprietary Products
  - The design and testing of these products is generally done through one of the two pooled funds that MnDOT is a member.
  - For these products to be used on MnDOT roadways, they must pass all crash tests deemed critical by the test facility.
  - MnDOT staff with roadside safety expertise also participate in the review during the design of many of these products.
  - FHWA eligibility letters are sometimes requested for these products, especially if many states use them, but MnDOT does not consider that a requirement of using a non-proprietary product.

State Processes for Determining MASH Compliance

- Non-Proprietary Products (Continued)
  - These products are not generally placed on the APL but are disseminated as Standard Plans or Standard Plates for use in projects.
  - Modifications to these products are reviewed and approved by MnDOT Crashworthy Committee, along with many other roadside safety experts in the pooled fund states and the participating crash test facilities.
  - Substantial modifications are generally tested using pooled funds.

MnDOT Crashworthy Compliance Evaluation

MNDOT CRASHWORTHY COMPLIANCE EVALUATION

DEPARTMENT OF TRANSPORTATION

Date: 12/05/2018

System: I-Beam Sign Structure Details – Footings and Base Connection

Standard Plan: 5-297.711

Date of Evaluation: 12/05/2018

Device & Testing Criterion

System Type	Device Name/Variant	Testing Criterion	Test Level
Breakaway Support Structures	Steel post cantilever type sign support with breakaway base and friction fuse post detail.	MASH – 3-61	N/A

☒ Existing hardware

☐ New hardware

☐ Significant modification to existing hardware

☐ Non-significant modification to existing hardware

☒ Initial TxDOT determination – MASH compliance

☐ Project specific request to evaluate hardware list item

MnDOT MASH Compliance Evaluation

MNDOT MASH COMPLIANCE EVALUATION

Literature Review

Report Name	Key Findings	Link
Texas Transportation Institute, "Development Guidance For Sign Design Standards," Test Report 0-6363-1 February, 2012	Test 4636301-1: W6x9 Post, 12' Exposed Height Sign area = 40SF (4'x10') Stiffened Base Connection Test 4636301-2: W8x18 Post, 7' Exposed Height Sign area = 160SF (16'x10') Stiffened Base Connection	https://static.tti.tamu.edu/tti.tamu.edu/documents/0-6363-1.pdf

MnDOT MASH Compliance Evaluation

Evaluation Results

The compliance conclusion is based on *(mark all that apply)*:

- ☐ FHWA Eligibility Letter
- ☒ Documentation from an accredited crash-test facility (3rd party expert opinion)
- ☒ MNDOT Engineering Judgement

Discussion

MNDOT considers the system MASH compliant based on similarities between the tested TxDOT systems and the MnDOT I-beam sign support system. Both systems use a stiffened breakaway base anchored to a foundation system with four high-strength fasteners. At the slip base, TxDOT uses a 30 gauge (0.0125") keeper plate, while MnDOT uses a 28 gauge (0.015625"). Above the base, the primary structural component is a flanged steel section. Depending on the size of sign to be supported, TxDOT utilizes post sections ranging from W6x9 to W12x26. Similarly, MnDOT uses posts ranging from W4x13 to W10x39. A friction fuse detail is utilized within the post section positioned immediately beneath the sign. TxDOT fuses range from 14% to 25% of the corresponding flange area and MnDOT fuses range from 23% to 31%.

The two tested configurations cited in the Texas Transportation Institute (TTI) report were selected from the suite of standard TxDOT designs. As such, the TTI tested configurations

MNDOT MASH COMPLIANCE EVALUATION

are considered applicable to the MnDOT standards based on the component comparisons referenced above.

Therefore, given the similarities between the MnDOT and TxDOT sign support structures, and recognizing that MnDOT's supports have no known examples of inadequate in-service performance, the systems are considered sufficiently similar such that the TxDOT testing results are applicable to the MnDOT configurations.

MnDOT MASH Compliance Evaluation

Roadside Safety Key Expert Endorsement

X _____

Title
Office Name

X _____

Title
Office Name

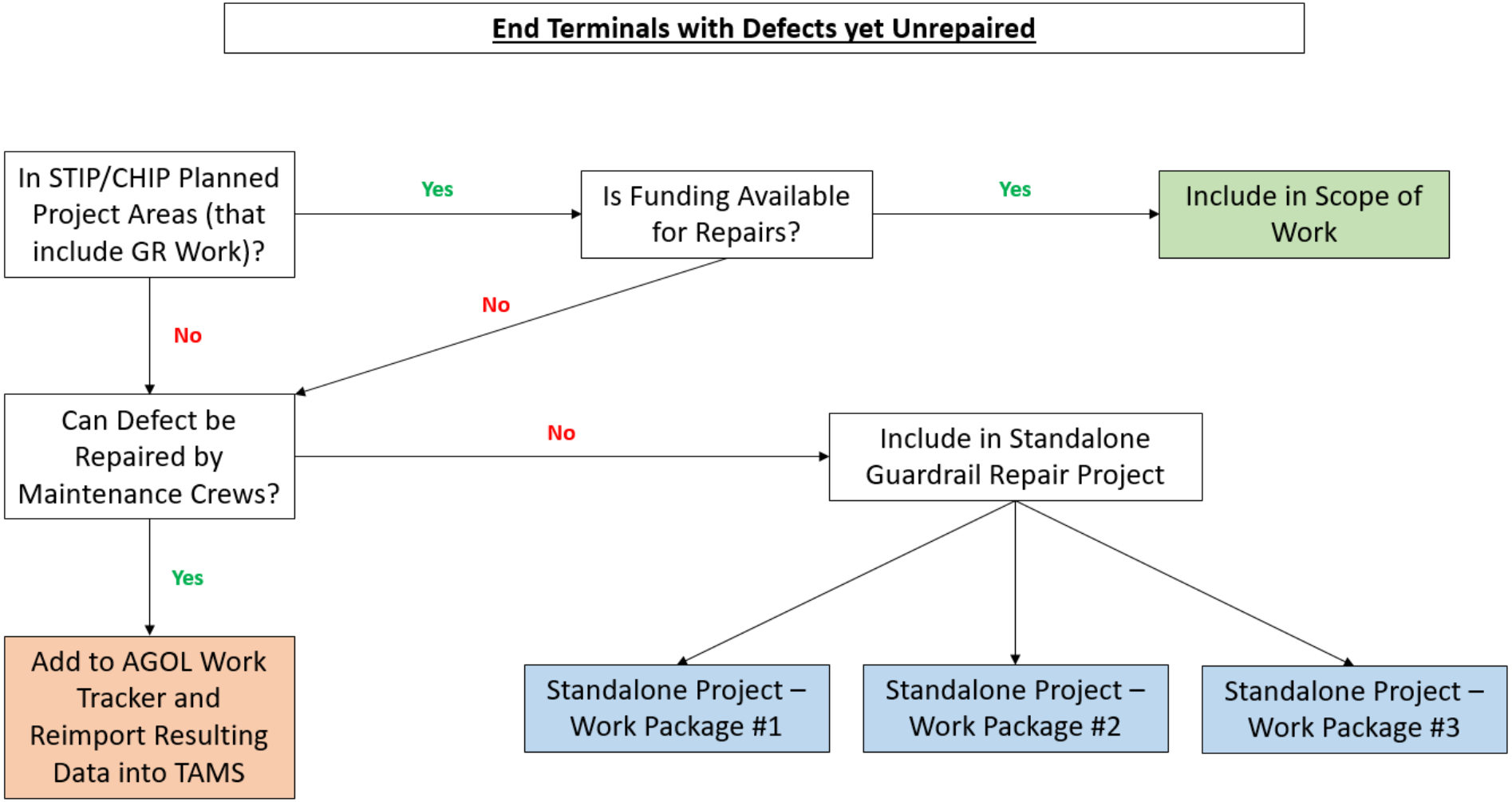
X _____

Title
Office Name

MASH-16 – Replacing 350 Through Attrition

- After December 31, 2019
  - Maintenance Repairs
    - Drive post into ground = square tube
    - Work on structure above ground = either repair in-kind or replace with square tube
  - Corridor Renewals
    - Replace all structures with MASH-16 square tube
    - Exception is requester pay signs that are not being touched
  - Square Tube Maintenance
    - Use crash compliant stringer

Flow Chart


End Terminals with Defects yet Unrepaired
In STIP/CHIP Planned Project Areas (that include GR Work)?
Yes
Is Funding Available for Repairs?
Yes
Include in Scope of Work
No
No
Can Defect be Repaired by Maintenance Crews?
No
Include in Standalone Guardrail Repair Project
Yes
Add to AGOL Work Tracker and Reimport Resulting Data into TAMS
Standalone Project – Work Package #1
Standalone Project – Work Package #2
Standalone Project – Work Package #3

Temporary Traffic Control Implementation

What about TTC devices?

"Temporary work zone devices, including portable barriers, manufactured after December 31, 2019, must have been successfully tested to the 2016 edition of MASH. Such device manufactured on or before this date, and successfully tested to NCHRP Report 350 of the 2009 edition of MASH**, may continue to be used throughout their normal service lives."**

Midwest WZ Roundtable

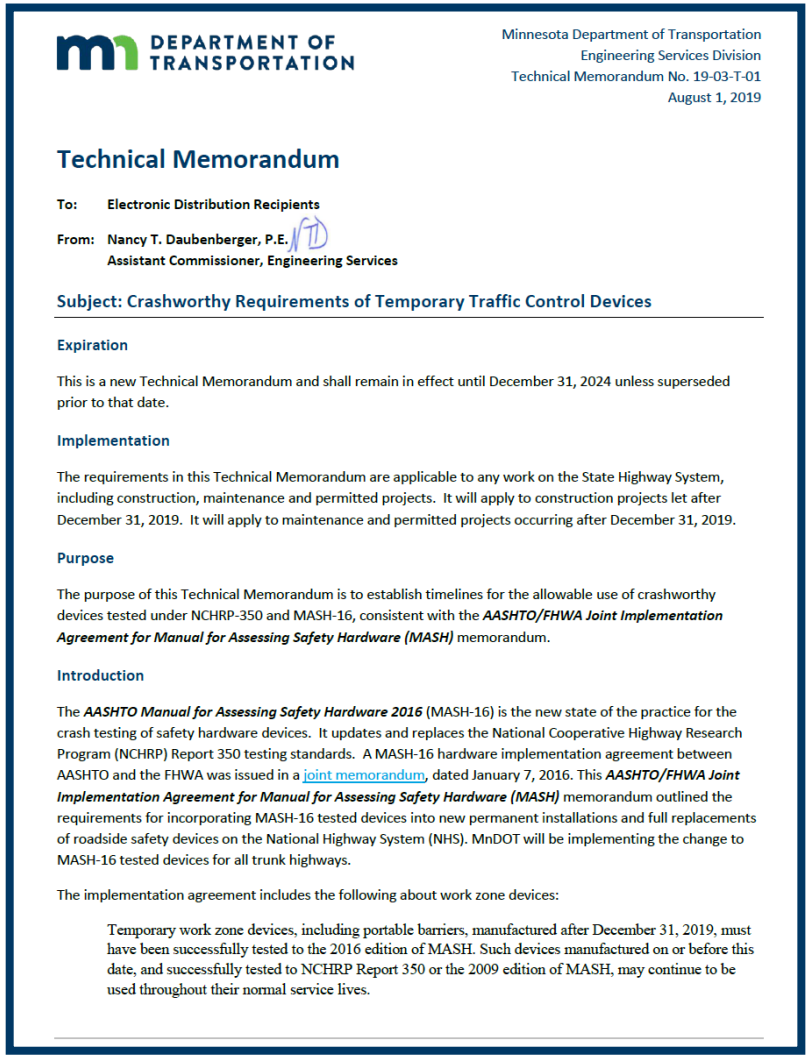
(Illinois, Illinois Tollway, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio & Wisconsin)

- Recommendation to State DOT's Leadership

MnDOT Tech Memo

Crashworthy Requirements of TTC Devices – effective August 1, 2019

Tech Memo



DEPARTMENT OF TRANSPORTATION

Minnesota Department of Transportation
Engineering Services Division
Technical Memorandum No. 19-03-T-01
August 1, 2019

Technical Memorandum

To: Electronic Distribution Recipients

From: Nancy T. Daubenberger, P.E.
Assistant Commissioner, Engineering Services

Subject: Crashworthy Requirements of Temporary Traffic Control Devices

Expiration

This is a new Technical Memorandum and shall remain in effect until December 31, 2024 unless superseded prior to that date.

Implementation

The requirements in this Technical Memorandum are applicable to any work on the State Highway System, including construction, maintenance and permitted projects. It will apply to construction projects let after December 31, 2019. It will apply to maintenance and permitted projects occurring after December 31, 2019.

Purpose

The purpose of this Technical Memorandum is to establish timelines for the allowable use of crashworthy devices tested under NCHRP-350 and MASH-16, consistent with the ***AASHTO/FHWA Joint Implementation Agreement for Manual for Assessing Safety Hardware (MASH)*** memorandum.

Introduction

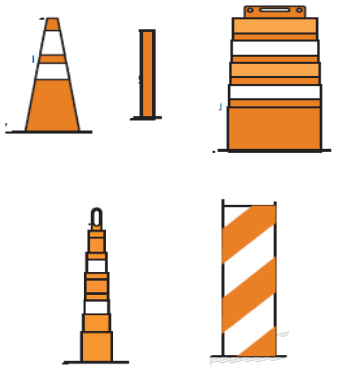
The ***AASHTO Manual for Assessing Safety Hardware 2016*** (MASH-16) is the new state of the practice for the crash testing of safety hardware devices. It updates and replaces the National Cooperative Highway Research Program (NCHRP) Report 350 testing standards. A MASH-16 hardware implementation agreement between AASHTO and the FHWA was issued in a joint memorandum, dated January 7, 2016. This ***AASHTO/FHWA Joint Implementation Agreement for Manual for Assessing Safety Hardware (MASH)*** memorandum outlined the requirements for incorporating MASH-16 tested devices into new permanent installations and full replacements of roadside safety devices on the National Highway System (NHS). MnDOT will be implementing the change to MASH-16 tested devices for all trunk highways.

The implementation agreement includes the following about work zone devices:

> Temporary work zone devices, including portable barriers, manufactured after December 31, 2019, 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 throughout their normal service lives.

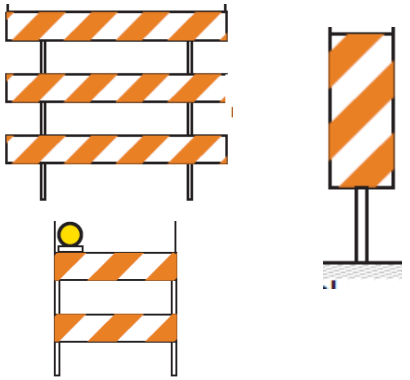
- Any work on the State Highway System
- Construction projects let after December 31, 2019
- Maintenance and permitted work occurring after December 31, 2019

TTC Crashworthy Requirements



Category 1 – manufacturers can self-certify as MASH-16 compliant

- Category 2 –
  - devices manufactured after December 31, 2019 must be MASH-16 compliant
  - NCHRP-350 devices purchased before 12/31/19 may be used until December 31, 2024 – this includes ground mounted sign supports
  - Knee brace may no longer be installed after June 30, 2020



TTC Crashworthy Requirements

- Category 3 (except for temporary barrier) –
  - devices manufactured after December 31, 2019 must be MASH-16 compliant
  - NCHRP-350 devices purchased before 12/31/19 may be used until December 31, 2029

- Category 3 – temporary barrier
  - F-shape concrete barrier is MASH-16 testing and approved and there are many other temporary barriers that are as well.
  - All temporary barrier used after December 31, 2019 must be MASH-16 compliant

TTC Crashworthy Requirements

Category 4

- Historically not considered crashworthy
- Now same test matrix as TMA
- MnDOT will perpetuate Category 4 requirements
  - Should be shielded when possible
  - Should be removed when not needed
  - Shall be delineated when deployed and not shielded

Guardrail Tech Memo

- Implementation of MnDOT Single Slope Median Barrier design and MnDOT Type 31 Guardrail design
- Use single slope barriers and MnDOT Type 31 guardrail
- MnDOT will be following AASHTO & FHWA Joint Memo implementation agreement schedule for all trunk highways
- New single slope concrete barrier roadway and w-beam barrier standards
- 2 proprietary end terminals MASH tested (TL-3)
- Type F temporary portable precast concrete barrier has been successfully crash tested to meet MASH TL-3

Thank you again!

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