

## Technical Memorandum

**To:** Electronic Distribution Recipients

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

### **Subject: Crashworthy Requirements of Temporary Traffic Control Devices**

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This is a new Technical Memorandum and shall remain in effect until December 31, 2024 unless superseded prior to that date.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

The FHWA provides additional information about crashworthiness and crashworthy requirements on the website [Countermeasures that Reduce Crash Severity](#) and the [Roadside Hardware Policy Memoranda and Guidance](#).

### *Temporary Traffic Control Device Crashworthy Categories*

When the joint memorandum was published there was no clear guidance on the four categories of work zone devices previously recognized by the FHWA related to NCHRP Report 350. The categories are represented by the following device groupings:

- Category 1 – Includes small and lightweight channelizing and delineating devices that have been in common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable safe performance. These devices include cones, tubular markers, flexible delineator posts, and plastic drums. These devices were typically self-certified by the manufacturer as crashworthy under NCHRP-350.
- Category 2 – Includes devices that are not expected to produce significant vehicular velocity change but may otherwise be hazardous. Examples include sign supports, barricade supports, small portable (balloon) lighting, and Category 1 devices with attachments or sign panels.
- Category 3 – Includes hardware that is expected to cause significant velocity change or other potentially harmful reactions to impacting vehicles. Examples include temporary barrier, crash cushions and truck/trailer mounted attenuators.
- Category 4 – Trailer mounted devices such as portable changeable message signs, arrow boards, automated flagging assistance devices, portable signals, and cameras. The FHWA previously exempted these from crash-testing under NCHRP Report 350 as the benefit of the use of these devices outweighs the risk exposure; however, the FHWA required that they should be shielded when possible, should be removed when not needed, and must be delineated when deployed.

In a memo, ***Clarifications on Implementing the AASHTO Manual for Assessing Safety Hardware, 2016***, dated May 2018, the FHWA and AASHTO provided additional information related to some of the categories.

- Related to Category 1 – “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.”
- Related to Category 4 – “MASH contains crash testing criteria for devices previously known as “Category 4” devices. See MASH 2016, Section 2.2.3, p 36, “Truck- and Trailer-Mounted Attenuators and Portable Work-Zone Traffic Control Trailers.” The AASHTO/FHWA Joint Implementation Agreement states that temporary work zone devices manufactured after December 31, 2019, must have been successfully tested to the 2016 edition of MASH.”

### *Midwest Work Zone Round Table*

MnDOT is a member of the Midwest Work Zone Round Table, which consists of representatives from Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin. The Round Table representatives would like to be consistent between the member states on how to implement MASH-16 and the requirements of this Technical Memorandum are reflective of this consistency. To simplify the phasing in of MASH-16, the Round Table also recommends perpetuating the Temporary Traffic Control Device Crashworthy Categories.

### *MnDOT MASH Compliance Evaluation*

Many MASH-16 approved devices are modified in order to be used for specific applications and the FHWA & AASHTO have granted agencies the ability to accept modifications per the ***Clarifications on Implementing the AASHTO Manual for Assessing Safety Hardware, 2016*** memo:

A significant modification to a device is a modification that adversely affects the crashworthy performance of the device based on the crash testing criteria in MASH. Owner-agencies may make determinations as to whether a modification is significant and what additional testing and/or engineering analysis is required for them to approve a modified device.

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Owner-agencies may accept modifications made to or variations of a tested device based on engineering analysis and/or additional crash testing in accordance with MASH.

The MnDOT Office of Project Management and Technical Support has developed a methodology and form, ***MnDOT MASH Compliance Evaluation***, for MnDOT to evaluate modifications and apply engineering judgment to determine if a modified device is crashworthy under MASH-16. MnDOT has followed this methodology for specific devices in order to meet its business needs. Contractors may use devices that have received approval through this process. If MnDOT does not have a ***MnDOT MASH Compliance Evaluation*** form for a MASH-16 compliant device that was modified, the modified device will not be allowed. MnDOT will not be required to perform an Evaluation for a contractor proposed modification. MnDOT considers devices evaluated and approved through this Evaluation to be MASH-16 compliant.

## **Requirements**

MnDOT will perpetuate the Crashworthy Categories and utilize them to establish the timelines under which NCHRP-350 devices are allowed to be used and when MASH-16 devices are required. As mentioned previously, the requirements of this Technical Memorandum apply to projects let after December 31, 2019.

### *Category 1*

Category 1 devices include cones, tubular markers, surface mounted delineators, weighted channelizers, ballasted vertical panels, and drums.

After December 31, 2019, only MASH-16 compliant Category 1 devices may be used. Category 1 devices 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-16 criteria is required.

## *Category 2*

Category 2 devices include post-mounted sign supports (including vertical panels); portable sign supports; barricade supports; and Category 1 devices with attachments or sign panels.

Category 2 devices manufactured after December 31, 2019 must be MASH-16 compliant. Category 2 devices that meet NCHRP-350 purchased before this date may be used through December 31, 2024 provided they meet MnDOT specifications. Modifications made to any Category 2 device manufactured prior to December 31, 2019 and crashworthy under NCHRP-350 will require full crash testing under MASH-16.

Ground mounted sign supports that are NCHRP-350 compliant will be considered Category 2 devices and system components manufactured prior to December 31, 2019 may be used through December 31, 2024. MnDOT is discontinuing the Minnesota Type "C" and "D" Braced Leg U-Channel (knee brace) sign support and this design shall not be installed after December 31, 2019.

## *Category 3*

Category 3 devices include temporary barriers, crash cushions for temporary applications, and truck/trailer mounted attenuators (TMAs).

Category 3 devices manufactured after December 31, 2019 must be MASH-16 compliant. Category 3 devices, with the exception of temporary barriers, that meet NCHRP-350 manufactured before this date may be used through December 31, 2029 provided they meet MnDOT specifications. Modifications made to any Category 3 device purchased prior to December 31, 2019 and crashworthy under NCHRP-350 will require full crash testing under MASH-16.

Unanchored portable concrete barrier (PCB) that meets MnDOT specifications is MASH-16 compliant. Anchored PCB in concrete that meets MnDOT specifications has been successfully tested under MASH-16. Anchored PCB in bituminous has not yet been successfully tested under MASH-16, though it is NCHRP-350 compliant. Due to the prevalence of PCB and the satisfactory performance MnDOT has experienced, PCB installed to MnDOT specifications is considered to be acceptable. Once a PCB anchored in bituminous system has been successfully tested under MASH-16, MnDOT will modify specifications appropriately.

All other temporary barriers installed in construction projects after December 31, 2019 must be MASH-16 compliant.

MnDOT owned temporary barriers may be used for their useful life. MnDOT will only purchase temporary barrier that is MASH-16 compliant after December 31, 2019.

## *Category 4*

Category 4 devices include trailer mounted devices such as portable changeable message signs, arrow boards, automated flagging assistance devices, portable signals, and cameras.

Category 4 devices were not tested in NCHRP-350, though there is a testing methodology in MASH-16. However, MnDOT is not aware of any stand-alone trailer mounted devices that are MASH-16 compliant. Due to this, and since MnDOT has determined that the net benefit of these devices out-weigh the exposure risk, no crashworthy testing will be required for Category 4 devices at this time. These devices will be allowed following the requirements of the *Minnesota Manual on Uniform Traffic Control Devices* (MN MUTCD) and MnDOT specifications. MnDOT will reevaluate once MASH-16 compliant “Portable Work-Zone Traffic Control Trailers” are available and after an assessment of their functionality and availability can be made.

Category 4 devices should be shielded when possible, should be removed when not needed, and shall be delineated when deployed. The ‘shall’ and ‘should’ of the previous sentence follow the conventions of the MN MUTCD.

## Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to either of the following:

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Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, [DesignStandards.DOT@state.mn.us](mailto:DesignStandards.DOT@state.mn.us). A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

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