



INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 17-10 Policy Change

May 11, 2017

TO: All Design, Operations, and District Personnel, and Consultants

FROM: /s/Elizabeth W. Phillips
Elizabeth W. Phillips
Manager, Office of Standards and Policy
Bridges Division

SUBJECT: *Manual for Assessing Safety Hardware* (MASH) and New
W-beam Guardrail and Guardrail End Treatment Standards

EFFECTIVE: NHS Routes: Letting on or after January 1, 2018
Non-NHS Routes: Letting on or after July 1, 2018

The purpose of this memo is to share information regarding the implementation of new national testing standards for safety hardware (guardrail, end treatments, bridge railing, etc.) and the changes to the Department's w-beam guardrail and guardrail end treatment standards. Revisions to safety hardware other than w-beam guardrail and guardrail end treatments will be provided at a later date.

It is understood that unique constraints may prevent the adherence to the guidance provided below. Please contact the Office of Standards and Policy at DesignManualInquiries@INDOT.in.gov with specific concerns.

The 2016 *Manual for Assessing Safety Hardware* (2016 MASH) is the current standard for crash testing safety hardware. MASH replaces the previous standard NCHRP Report 350. The American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA) entered into a Joint Implementation Agreement for the new installation and full replacement of safety hardware. The agreement sets deadlines after which only MASH-compliant hardware can be installed. The agreement and FAQs are an attachment to this memo.

Additional information is available from the FHWA Safety website at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/policy_memo_guidance.cfm, under AASHTO Guidance.

Agreement Deadlines for W-beam Guardrail and Guardrail End Treatments

NHS:

For contracts on the National Highway System (NHS) with lettings dates listed below, w-beam guardrail and w-beam guardrail end treatments used for new permanent installations and full replacement must be compliant with the 2016 MASH requirements:

- On or after January 1, 2018 for w-beam guardrail
- On or after July 1, 2018 for w-beam guardrail end treatments

Non-NHS:

For contracts off the NHS, the Department has extended the implementation deadline for w-beam guardrail to correspond with the deadline for w-beam guardrail end treatments. Contract letting dates are listed below.

- On or after July 1, 2018 new permanent installations and full replacement of w-beam guardrail and w-beam guardrail end treatments must be compliant with the 2016 MASH requirements

For lettings between January 1 and June 30, 2017 the Department's standard strong-post w-beam guardrail is strongly recommended to be installed at 29" where practical, e.g. long runs of guardrail. The height will have to transition within 25 ft back to 27 ¾" prior to the guardrail end treatment. Where a 29" installation is used, a plan note and/or brief USP should be included to identify the change in rail height. The w-beam guardrail should be specified using the current pay item with the supplemental description "29 inches". Ensure that acceptable stopping sight distance is maintained.

New W-beam Guardrail Standard Drawings

After review of 2016 MASH-compliant w-beam barriers, the Department will be adopting the non-proprietary Midwest Guardrail System (MGS) to replace the current strong-post w-beam guardrail. Although visually similar, notable differences between the two systems are:

- The MGS w-beam guardrail has a top rail height of 31 in. vs. 27 ¾ in. for the strong-post w-beam.
- The MGS w-beam guardrail has a mid-span splice vs. a splice at the post for the strong post w-beam.

- The MGS w-beam guardrail uses a 6-ft post with an embedment depth of 40 in. (3'-4"). INDOT currently uses a 7-ft post with an embedment of 55 1/4 in. (4'-7 1/4") for the strong-post w-beam.

The two systems use the same w-beam rail section and assembly bolts, may use either a steel or wood post, and may use either a wood or composite blockout. Therefore, the MGS w-beam guardrail system will maintain the same 1'-5" typical section (front face of rail to back face of post) as current strong-post w-beam guardrail system. MGS w-beam guardrail assembly details are an attachment to this memo and may be use for preliminary design considerations.

New W-beam Guardrail End Treatments

The Department maintains an Approved Material List for Guardrail End Treatments. There are 31-in. versions of Guardrail End Treatment, Types OS and MS that are NCHRP 350-compliant and compatible with 31-in guardrail systems. Prior to the guardrail end treatment implementation deadline and when used in conjunction with the MGS w-beam guardrail system, the end treatment should be specified using the current pay item for guardrail end treatments with the supplemental description "31 inches".

2016 MASH-compliant guardrail end treatments are currently being evaluated by the Department and will be added to the Approved Materials List when approved.

Design Guidance and Standard Drawings

Until design guidance is incorporated into the Indiana Design Manual, designers should consider the following when specifying MGS w-beam guardrail.

- The width of the MGS w-beam guardrail will remain the same.
- A minimum of 2'-0" of ground sloped at 20:1 or flatter must be provided behind the MGS w-beam guardrail post prior to the shoulder slope break. Where the 2'-0" minimum cannot be met the working width should be adjusted accordingly.
- The length of need (LON) calculations are the same regardless of specifying MGS w-beam or strong-post w-beam guardrail.
- Lines of sight over guardrail will need to be evaluated for the new rail height of 31".

In addition to details for a single-faced standard 6'-3" post spacing, the MGS w-beam guardrail standard drawings will include additional configurations to address various site conditions as described below. Details of the additional configurations are an attachment to this memo and may be use for preliminary design considerations.

Omitted Posts

- A post within an MGS w-beam guardrail run may be omitted to avoid an underground obstruction. Where a post is omitted a minimum length of standard MGS w-beam

guardrail shall be placed between, other omitted posts, transitions, MGS long-span, end treatment, and flared guardrail. Minimum lengths of standard MGS w-beam guardrail must be placed between omitted posts and other MGS features.

Double-faced MGS Guardrail

- Double-faced MGS w-beam guardrail for median barrier has been successfully crash tested in accordance with MASH.

MGS Long-span Guardrail (previously referred to as Nested Guardrail)

- MGS long-span guardrail system, will replace the current INDOT standard for Nested Guardrail. This system can be used to span MGS w-beam guardrail over large culverts. Any obstruction (e.g. a headwall) over 2 inches above the ground should be placed a minimum of 8 ft behind the face of guardrail. Obstructions between 0 to 2 inches above the ground may be placed a minimum of 2 ft behind the face of guardrail.

MGS Guardrail to Bridge Pier Transition

- The MGS guardrail transition should be specified when installed in conjunction with a square-nose pier. For a round-nose pier, projects letting on or before December 2019 should use the current Guardrail Transition Type GP.

MGS Guardrail to Bridge Railing Transition

- The MGS guardrail transition should be specified when installed in conjunction with MGS w-beam guardrail. The MGS guardrail transition will replace the current w-beam Guardrail Transition Types TGB and WGB.
- The MGS guardrail transition length is 42'-6 1/4" vs. 25'-0" for the TGB and WGB.
- The bridge railing attachment details 706-CBRT-04 shown for the TGB transition are also applicable to the MGS guardrail transition.
- The MGS guardrail transition is the only transition that has been successfully crash tested in accordance with MASH. Where needed, current INDOT standard transitions may continue to be installed until the January 1, 2020 implementation deadline.

Concrete Bridge Railing Transitions

- The concrete bridge railing transition type WFC, *Standard Drawings* series 706-TWFC, should no longer be specified.
- The concrete bridge railing transition types TFC or TFT should be specified where an MGS guardrail transition is specified.

Terminal Anchors

- The cable terminal anchor system detail has changed slightly to accommodate the MGS w-beam guardrail mid-span splice. A cable terminal anchor system is required at the

outgoing end of an MGS w-beam guardrail run that is not exposed to oncoming traffic, i.e. where an end treatment is not required. At least 31'-3" of MGS w-beam guardrail, including the cable terminal anchor system, is required beyond the LON. A 25-ft section of MGS w-beam or strong-post w-beam guardrail is not equivalent to a cable terminal anchor system.

Dynamic Deflection

- The maximum dynamic deflection used for the current strong-post w-beam guardrail will be replaced with working width for MGS w-beam guardrail. The working width, like the maximum dynamic deflection, is the distance between the face of the MGS w-beam rail and the closest face of an object behind the MGS w-beam guardrail. The working widths for MGS w-beam guardrail are as follows:

Guardrail Type	Post Spacing	Dist. Between Back of Post and Slope Break	Working Width
Standard MGS W-Beam	6'-3"	2 ft	5.0 ft
Standard MGS W-Beam w/omitted post placed per guidance	6'-3"	2 ft	5.0 ft
Standard MGS W-Beam	6'-3"	0 ft	6.5 ft
Half Post Spacing MGS W-Beam	3'-1 1/2"	2 ft	4.5 ft
Quarter Post Spacing MGS W-Beam	1'-6 3/4"	2 ft	4.0 ft

Curved W-beam Guardrail System

- A MASH-compliant version of the curved w-beam guardrail system, *Standard Drawings* series 601-CWGS, is not currently available. Where a curved w-beam guardrail system is required, the MGS w-beam guardrail must be transitioned down to the strong-post w-beam guardrail height, 2'-3³/₄", prior the curved end treatment. The MGS guardrail height transition details (37'-6" length) should be used in this situation.
- Where there is not sufficient space to transition the MGS w-beam guardrail height prior to placing a curved w-beam guardrail system, that run of guardrail or quadrant of the bridge should specify the strong-post w-beam guardrail at the 2'-3³/₄" height.

Plans and Submittals

- Standard MGS w-beam guardrail and variations of the system, e.g. MGS long-span, MGS guardrail transition, should be detailed on the plans and tabulated in accordance with current practice.

- New pay items for the MGS w-beam guardrail and variations of the system will be provided soon.

A list of various MGS w-beam guardrail crash tests can be found at the Midwest Roadside Safety Facility website at <https://mwrsf.unl.edu/mgs.php>

FHWA eligibility letters for crash-tested roadside safety devices, FAQs, and Policy and Guidance information is available from the FHWA Safety website at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/ at http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/listing.cfm for further design guidance.

Questions should be directed to the Office of Standards and Policy, DesignManualInquiries@INDOT.in.gov.