

Summary of Differences between MASH and NCHRP 350

The AASHTO *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. This manual is recommended for highway design engineers, bridge engineers, safety engineers, maintenance engineers, researchers, hardware developers, and others concerned with safety features used in the highway environment.

MASH is an update to and supersedes NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, for the purposes of evaluating new safety hardware devices. MASH does not supersede any guidelines for the design of roadside safety hardware, which are contained within the AASHTO *Roadside Design Guide*. An implementation plan for MASH that was adopted jointly by AASHTO and FHWA states that all highway safety hardware accepted prior to the adoption of MASH – using criteria contained in NCHRP Report 350 – may remain in place and may continue to be manufactured and installed. In addition, highway safety hardware accepted using NCHRP Report 350 criteria is not required to be retested using MASH criteria. However, new highway safety hardware not previously evaluated must utilize MASH for testing and evaluation.

MASH was developed through National Cooperative Highway Research Program (NCHRP) Project 22-14(02), “Improvement of Procedures for the Safety-Performance Evaluation of Roadside Features,” and contains revised criteria for impact performance evaluation of virtually all highway safety features, based primarily on changes in the vehicle fleet. Major differences between MASH and NCHRP Report 350 include:

Changes in Test Matrices

- The small car impact angle is increased from 20 to 25 degrees to match the impact angle used with light truck testing
- The impact speed for the single-unit truck test is increased from 80 km/h to 90 km/h to better distinguish the TL-4 test from TL-3
- The impact angle for length-of-need testing of terminals and crash cushions is increased from 20 to 25 degrees to match that for longitudinal barriers
- The impact angle for oblique end impacts for gating terminals and crash cushions is reduced from 15 to 5 degrees
- Length-of-need tests with the pickup truck are required to meet occupant risk criteria
- A head-on test with the mid-size car is added for staged impact attenuation systems
- The barrier mounting height is recommended to be set at the maximum for small car tests and at the minimum for pickup truck tests
- The critical impact point for the small car terminal test is defined as the point where the terminal behavior changes from redirection to gating
- The critical impact point for reverse direction impacts requires testing at the transition from backup structure to crash cushion
- Two previously optional TMA tests are now mandatory
- Variable message signs and arrow board trailers are added to the TMA crash test matrix
- A pickup truck test is added to tests of support structures and work zone traffic control devices
- Longitudinal channelizing barricades are added as a category and a test matrix is recommended
- Event data recorded and airbag deployment data to be collected on test vehicles

Changes in Test Installations

- Performance-based specifications for soil are added to the existing material-based specifications to help ensure consistency in soil strength
- The lateral width requirement for fill material is eliminated
- Any rail element splices that are used in the field are required to be installed in the impact region during testing
- Cable tension is required to be set to the value recommended for 100 degrees Fahrenheit
- More detailed documentation of components used in the test installation is required
- Minimum installation length requirements are specified more clearly

Changes in Test Vehicles

- The size and weight of test vehicles is increased to reflect the increase in vehicle fleet size:
 - the 820C test vehicle is replaced by the 1100C
 - the 2000P test vehicle is replaced by the 2270P
 - the single unit truck mass is increased from 8000 kg to 10,000 kg
 - the light truck test vehicle must have a minimum center of gravity height of 28 inches
- The option for using passenger car test vehicles older than 6 years is removed
- Truck box attachments on test vehicles are required to meet published guidelines
- External vehicle crush must be documented using NASS procedures
- A new crushable nose to be developed for use on surrogate test vehicles
- TMA designers are required to select maximum and minimum support truck weight ratings

Changes in Evaluation Criteria

- Windshield damage evaluation uses quantitative, instead of qualitative, criteria
- Windshield damage criteria is applied to permanent support structures in addition to work zone traffic control devices
- The occupant compartment damage evaluation uses quantitative, instead of qualitative, criteria
- All evaluation criteria will be pass/fail, eliminating the “marginal pass”
- All longitudinal barrier tests are required to meet flail space criteria
- Maximum roll and pitch angles are set at 75 degrees
- The subjective criteria for evaluating exit conditions are eliminated; reporting the exit box evaluation criterion is required
- Documentation on vehicle rebound in crash cushion tests is required

Changes in Test Documentation

- CAD drawings of the test device and test installation are required
- Additional documentation of the test and evaluation results is required

Changes in Performance Evaluation

- Language emphasizing the importance of in-service evaluation is added