

*Roadside Safety Research for MASH Implementation Pooled Fund TPF-5(343)  
Team*

# PRINCIPLES

## Purpose of this Document

Membership for this Pooled Fund consists of twenty one states and one Canadian province. With such a large group and such diverse needs, some team principles are needed in order for the group to operate effectively. This document summarizes these principles.

This Pooled Fund does not set policy. Other organizations such as FHWA, states, provinces, or other highway agencies, are responsible for establishing their policies. These other organizations may choose to include some or all of these team principles and decisions in their policy. These principles may evolve over time.

### Team Principle 1: Determination of MASH Compliance **(revised for 2018)**

For pooled fund decisions, the team considers hardware MASH compliant if a document from an accredited crash-test facility or NCHRP report states that the hardware is MASH compliant. Considerations include the overall approach, methodology employed and the resulting documentation. The terms used below are also shown in Figure 1.

#### Approach

**The “due diligence” approach vs. the “full-suite” approach** The FHWA memo dated May 26, 2017 requires that a “full suite” of tests be ran in order to obtain an FHWA eligibility letter. The “due diligence” approach basically means that the Pooled Fund continues to do business the way we have for years; crashworthiness is evaluated by establishing the appropriate combination of engineering analysis, finite-element analysis and crash testing that will allow prudent evaluation of crashworthiness. The program may or may not involve the “full suite” of tests as required by FHWA for an eligibility letter. The investment that would have been made running non-critical tests will instead be made in evaluating the many systems in a greater need of evaluation. Part of the “due diligence” approach is determining if crash testing is needed, which tests are critical, and funding and performing those tests. **The team’s default approach is “due-diligence.”**

#### Methodology

Evaluation Methodology for the “full-suite” approach is rigidly defined; all tests within a given testing matrix listed in MASH 16 are performed. Under a “due-diligence” approach, any combination of the following evaluation methods is considered acceptable by this pooled fund for evaluating MASH compliance

- Partial testing matrix is performed that concentrates on the critical test(s).
- Computer modeling and simulations
- Component testing methods including bogie tests and pendulum tests
- Engineering analysis including review of previous research conducted by accredited crash test facilities

Note that some individual states may have other methods for determining MASH Compliance.

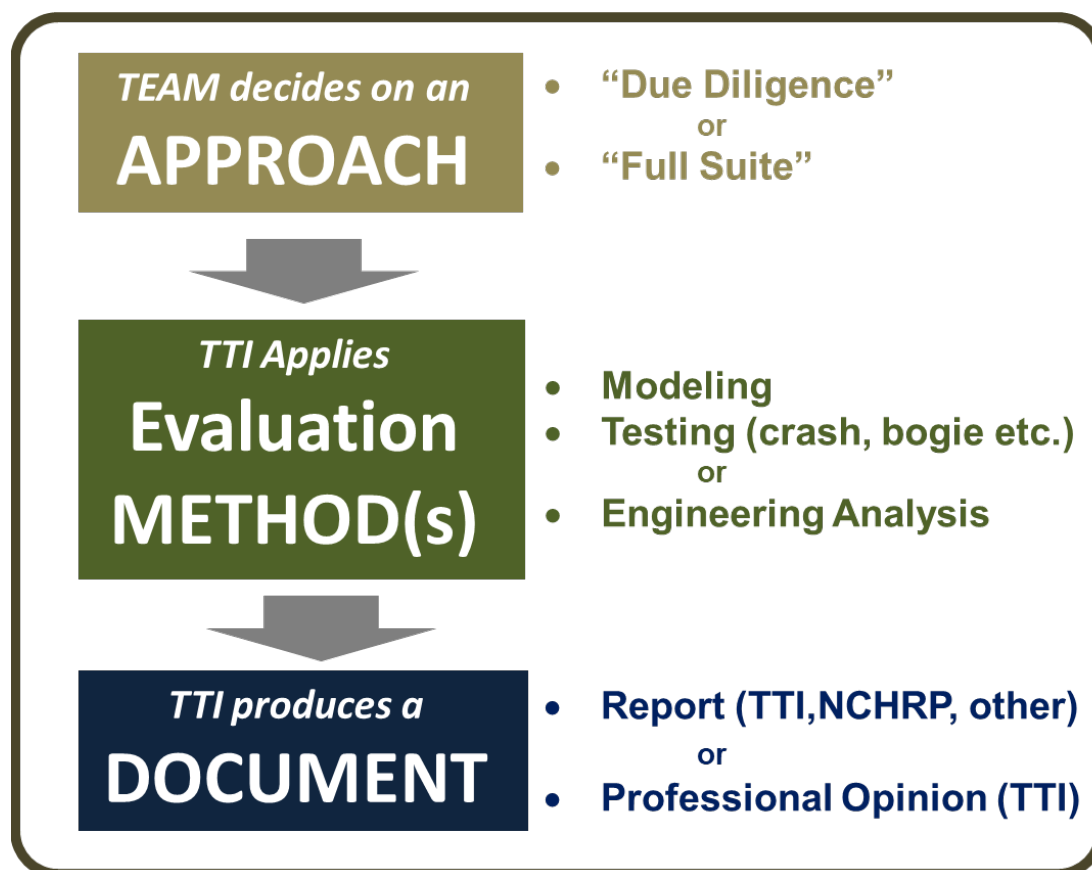
### Documentation

Documentation regarding MASH compliance may take the form of any of the following:

- **FHWA issued eligibility letter** (only applicable for future letters if the “Full-suite” of tests as referenced above has been completed)
- **Report** from an accredited crash-test facility documenting performance of the specific system or modification under discussion
- **NCHRP report** that covers the specific system or modification under discussion
- **Written, professional opinion from an accredited crash-test facility (engineering analysis summary):** for those cases where no report covers the specific system or modification under discussion, however sufficient past research has been done to reach a conclusion.

Note that individual transportation agencies may choose to not accept a written, professional opinion on a particular issue.

**Figure 1. Terminology**



### Team Principle #2: Systems Get Evaluated

The methods described above are generally used to establish the crashworthiness of systems. Systems are comprised of components.

- **Components:** Crashworthiness of components generally get evaluated through their inclusion in systems. For example, a w-beam guardrail buried terminal is a system that is composed of many components such as posts, rail elements, nuts and bolts, etc.
- **Variations:** A *variation* of a crashworthy system may not warrant the cost of a full program of modeling and crash-testing, and may instead warrant a professional opinion regarding crashworthiness.

### Team Principle #3: Crashworthiness of Rigid Barrier

A rigid roadway barrier is considered by the pooled fund to be crashworthy if it has the following characteristics:

1. Adequate height to contain the crash test vehicle(s).
2. Barrier has a crashworthy shape
3. Barrier is determined to be structurally rigid by one of the following methods:
  - a. Crash Testing
  - b. Structural analysis
4. Adequate method to transfer impact energy to the ground (foundation analysis)

Example: if an F-Shape bridge rail of a given height is successfully crash-tested to a given test-level, then the only evaluation required of a roadside or median barrier of the same shape and same height would be a determination that the barrier is structurally rigid (including foundation analysis)

Note that ends of rigid barriers have additional design requirements than middle sections. When there are other large objects placed on a rigid barrier additional evaluation may be required.

### Team Principle #4: MASH Equivalency of NCHRP Report 350-Approved Bridge Railings (NCHRP 20-07, Task 395) (new for 2018)

The team adopts the findings of NCHRP 20-07 (Task 395) *MASH Equivalency of NCHRP Report 350-Approved Bridge Railings*. The findings are key to decisions regarding MASH compliance of many bridge rails in use by the states.

NCHRP 20-07 Task 395 establishes “global equivalency” rules for the different subcategories of bridge rails. In other words, if certain bridge rails were successfully crash-tested under NCHRP 350 those systems can also be considered to be MASH compliant within the restrictions stated in the report. Table 3.11 from NCHRP 20-07 Task 395 is shown below:

**Table 3.11 Summary of Global Test Equivalency for NCHRP Report 350 Bridge Rail Systems.**

NCHRP Report 350 Rail System Type	MASH Test Level			
	TL-2	TL-3	TL-4	TL-5
Solid Concrete Parapet	TL-2	TL-3 TL-4		TL-5
Concrete Beam-and-Post	TL-2 TL-3 TL-4			TL-5
Metal Beam-and-Post Deck Mounted	TL-2 TL-3 TL-4			TL-5
Metal Beam-and-Post on Curb	TL-2 TL-3 TL-4			TL-5
Metal Beam-and-Post on Concrete Parapet*	TL-2	TL-3 TL-4		TL-5

\* Concrete parapet height greater than or equal to 24 inches

For example, the table shows that for solid concrete parapet bridge rails, if a system was successfully crash tested to TL-5 under NCHRP-350, the system can also be considered to be MASH compliant at TL-5. Another example; For concrete beam-and-post bridge rails, if a system was successfully crash tested at TL-2, TL-3 or TL-4 under NCHRP 350, it can be considered to be MASH compliant at TL-2.

#### **Team Principle 5: 12” versus 8” blocks**

The pooled fund considers that, in most cases, 8” blocks and 12” blocks are interchangeable in regard to performance. In most tests performed at TTI, 8” blocks will be used. However, if conditions exist where a 12” block is deemed to be more critical, the 12” block will be used.

### **A Note on Consistency from FHWA Division Offices**

All the states in the pooled fund agree that consistency within FHWA, including consistency across Division offices is critical when dealing with crashworthy hardware.

The pooled fund involves FHWA (Washington D.C.) representation when making decisions regarding which tests are appropriate to evaluate hardware for MASH. The pooled fund then funds those tests. It is then usually years before a FHWA Division office is asked to sign the resulting standard plan or drawing.

It is critical that the pooled fund knows that when the investment is made in a program of research to evaluate hardware crashworthiness, research will be considered adequate by the FHWA Division office once the standard plan or drawing is submitted for FHWA approval. This is most critical for cases where the "Due Diligence" approach is taken, and the full suite of tests has not been run (and an FHWA eligibility letter will thus not be able to be pursued).

A lack of consistency between FHWA (Washington D.C.) and FHWA Division offices, or between Division offices would negate a state's investment in the pooled fund, would not improve safety, would lead to inconsistency between states, and would be a significant waste of tax payer dollars.