

Question & Answer

09/13/18

*The primary fall meeting objective is to **identify and prioritize research needs** (including potential professional opinion items). There is not time at the meeting to answer every question every state has. This Discussion log is meant to fill the role of capturing and answering team questions (many of which are not directly related to identifying and prioritizing research needs).*

General Discussion

1. Bridge designers say that they are waiting for loading tables to be updated in order to be able to design rigid barrier to MASH. Any status update on this? (WA)

Comments from SCOBS T-7 (Tim Keller):

"After our meeting in June, T-7 has received funding to do a re-write of Chapter 13. We are hoping to get this issue resolved during this re-write. We also have a research problem statement coming out of COBS (No. 1 priority from COBS) to address the loads going into the deck.

We are in process of working through a schedule. One thing to remember is that the LRFD bridge design specification is on a 3 yr. publication cycle with no interims. So the agenda items approved in our 2019 meeting in Alabama will be included in the 9th edition of the specification which will be published a year ish after the meeting. After the meeting in 2022, the 10th edition of the specs will be published. So the rewrite will not be in the specifications until after the 2022 meeting. States may implement the information earlier is they choose."

2. Please clarify the definition from the April 9, 2018 FHWA memo of "significant modification", and what does "adversely affects the crashworthy performance...based on the crash testing criteria" in MASH mean to TTI or FHWA? (Alaska)

(From TTI. Note that this is TTI interpretation after working through the previous FHWA eligibility process on numerous occasions. However, we do not intend to speak for FHWA on the matter)

In their eligibility request form, FHWA used to distinguish non-significant from significant changes. A change that was considered non-significant is one that could be asserted through engineering analysis, simulation, etc. to

not affect the impact performance of the system (i.e., there was no change or perhaps a positive outcome).

A significant change is one whose effect on impact performance cannot be determined without additional crash testing. We think the wording in the recent memo is confusing in this regard. It is not necessarily a change that “adversely affects the crashworthy performance.” It is a change whose effect is uncertain or cannot be confidently established through engineering analysis alone. It may in fact be determined through testing that the “significant change” has no change or a positive effect on impact performance.

From FHWA:

What is considered a significant modification to roadside safety hardware?

A modification that adversely affects the crash worthy performance of roadside safety hardware based on the crash testing criteria in AASHTO MASH is deemed to be significant.

The determination of significance should be based on engineering analyses. A State DOT may choose to have an accredited crash testing lab make this determination. If a State DOT determines that there has been a significant modification to a previously tested roadside safety hardware device, then the relevant manufacturer should retest the device in accordance with AASHTO MASH criteria.

e) “non-significant modifications” (i.e., when finite element analysis can be used instead of crash testing) Non-significant modifications are modifications to a crashworthy device that do not lead to reduced performance and, instead, provide equal or better performance. Where an engineering analysis clearly shows that the proposed modification will have a non-significant effect, then finite element analysis (FEA) is not needed. Where there is some uncertainty about the performance, FEA can help determine if the effect is significant or not. If FEA determines the effect is significant, full scale crash testing is required for an FHWA Federal-aid reimbursement eligibility letter. Additional guidance can be found at the FHWA’s Office of Safety web site under Q&A:

http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/

3) What entity will finalize these definitions: the State, FHWA Division Office, or FHWA HQ? The definitions for “damaged beyond repair,” “new permanent installation,” and “full replacement” will be finalized by the individual State agency in cooperation with the FHWA Division Office. “Non-significant

modifications” will be determined by FHWA’s Office of Safety in consultation, as needed, with AASHTO’s Technical Committee on Roadside Safety (TCRS).

For modifications to existing successfully tested roadside safety hardware:

- Proprietary devices: an engineering analysis conducted by an ISO 17025 accredited crash testing laboratory that determines the modification does not affect the crashworthiness of the roadside safety hardware based on previous crash testing (relative to the AASHTO MASH test criteria). If necessary, crash testing may be warranted based on the results of an engineering analysis.
- Generic devices: an engineering analysis as described above can be conducted by the State DOT or an ISO 17025 laboratory. If necessary, crash testing may be warranted based on the results of an engineering analysis.

3. Do temporary attenuators fall under crash cushions or WZTC devices; affects implementation date and method?

TTI suggests under “Work Zone” area. However TTI also suggests asking AASHTO and FHWA.

4. Heard word of any MASH compliant sand barrels?

Please refer to FHWA Eligibility Letter CC-139 (Big Sandy MASH) https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/barriers/pdf/cc139.pdf

5. GAO Report brings implementation challenges. (Colorado, Neil can elaborate)

Neil to elaborate during the meeting with his concerns.

6. Is anyone (crash test facility) working on a MASH-compliant bull-nose terminal?

According to the MwRSF project list, there is currently an ongoing two-phase project for a Thrie Beam Bullnose System. See the following:

MASH Testing Project	Tests Planned/Conducted	Tests Deemed Not Critical
RPPF-17-BULLNOSE-1: MASH Testing of the Thrie Beam Bullnose System - Phase I	3-32 [C] 3-34 [C] 3-35 [C]	
RPPF-18-BULLNOSE-1: MASH Testing of the Thrie Beam Bullnose System - Phase II	3-30 [C] - Failed 3-30 [C] - Revised Design 3-31 [C] - Revised Design 3-33 [C] - Revised Design 3-37b [C] - Revised Design	3-36 3-37a 3-38 (Based on 1500A estimation)

7. It would be beneficial to State DOTs if testing facilities provided guidance in their reports concerning alternative anchoring options or alternative designs that may be useful to DOTs. For example, in MwRSF's report for the Manitoba Tall Wall concrete barrier, they provided some alternative anchoring options, even though none of the alternative anchoring options were ever crash tested (see excerpt from MwRSF's report). This type of guidance would be highly beneficial for agencies that lack the expertise or comfort level to make modifications to crashworthy designs.

This seems like it is more of a comment than a discussion point. It is feasible to do this, but the objective/expectation of this project would need to be clearly defined so the scope would be understood by all parties.

8. Let it be known that Wisconsin DOT has created a summary document of information asked when attempting to retrofit a bridge rail.

The draft of this summary document can be found on the pooled fund website for members to view.

9. Additional discussion and guidance should be provided on different anchorage options concerning alternatives to the anchorage type used in successful crash tests. For example, with the 42" tall TBTA Bridge Rail (FHWA Letter B-274), the posts near the impact point were attached to a surrogate composite bridge span. However, an agency may want to attach this type of bridge railing to a reinforced concrete bridge deck or perhaps a reinforced concrete shoulder/pavement.

If existing, a general methodical approach should be investigated, otherwise it is almost left to the research engineer to bring up implementation recommendations for a specific rail system anchorage.

10. Discussion on whether may be mounted on a raised curb /brush block or if it need to be mounted on top of the bridge deck (i.e., no brush block), specifically referring to Michigan's aesthetic parapet tube bridge railing. Michigan's standard plan for the aesthetic parapet tube bridge railing provides details depicting the barrier mounted on a brush block (raised sidewalk), and also provides details when the barrier is attached directly to the bridge deck without a brush block. However, the NCHRP 20-07, Task 395 report makes no reference to both options, and only provides a sketch of the railing mounted directly on the bridge deck. The same analogy could be applied to metal post bridge railings and other railing types. Therefore, it would be ideal if guidance could be provided explaining when and under

what conditions it is acceptable (or not) to place a bridge railing on a raised brush block or curb.

The reason why NCHRP 22-07, Task 395 reviewed only the Michigan rail on the deck, and we didn't make any comments on the same rail on the sidewalk is because these are considered two different systems. Although the rail is pretty much the same, there needs to be appropriate evaluation of how the sidewalk would influence the vehicle's impact (maybe height, maybe trajectory, etc...). This was not the only case in this project, I believe. The Michigan's rail was evaluated on the deck because it fell into the prioritized category of the TL-4 combined (TRAFFIC – not traffic and pedestrian) parapet with 2 metal rails.

Questions & Answers from Team Survey

1. Cast-In-Place Barrier

- a) Let's discuss 42" 10.8 deg Single Slope parapets. Can the 42" parapet be considered MASH compliant based on the 36" test? Are there additional forces applied to the parapet simply due to parapet height? (UT)

A 42" 10.8 degree single slope is a MASH compliant profile. 36" height is the minimum height for a TL-4 barrier, so the 42" should be compliant.

There are additional forces that would be applied onto the parapet. NCHRP Task 395, Chapter 4, states that the impact force is 80 kips for a height past the 36" minimum. So this system would be considered compliant both in size and in height, but the structural capability would need to be checked for the additional forces.

- b) What work remains for confirming the 10.8 single slope barrier is MASH TL-5 compliant and when will that be done? It is currently shown as light green meaning TTI feels it is MASH compliant but is not yet completed. (IL)

What remains for this to be completed is a formally recognized opinion on this system. TTI feels that we have the experience to classify the system as MASH compliant, but need a formal document that doesn't currently exist to confirm this. TTI could make this if directly requested.

- c) MnDOT is interested in seeking a "Professional Opinion" validating the 10.8 degree 42" tall single slope barrier meets MASH TL-5. Seeking the same for 54" tall 10.8 degree single slope barrier (used for glare screen protection). (MN)

Both of these have been added to the list of potential projects/opinions to be voted on during the meeting.

d) "42" Single Slope Non-Reinforced Barrier TL-3" (W. VA)

MwRSF has conducted a TL-3 Reinforced Ohio-Barrier, however at the moment no report appears to be available.

e) Precast concrete barrier options for TL-5 permanent median concrete barriers embedded in asphalt on both sides. (ONT)

The request has been added to the list of potential projects/opinions to be voted on during the meeting.

2. Regarding combination concrete & metal bridge rails, the question was asked whether or not the Oregon 3-tube is MASH TL-4 compliant. (AK)

The Oregon 3-Tube rail is a rail that received FHWA eligibility letter under 350 standard testing, for TL-4 (https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/barriers/pdf/b118.pdf). At the moment, no testing programs are known regarding re-testing the Oregon barrier under MASH criteria. Although it does meet the minimum height requirement for MASH TL-4 (the barrier height is 42"), crashworthiness of the system would need to be tested to account for occupant risks; and also, strength should be evaluated to account for MASH TL-4 impact design loads. TTI has worked on this request as an example of a professional opinion to be shown to the Members.

3. W-beam installed 6-inches behind a 6-in curb and gutter. Installing face of guardrail directly above the face of curb is acceptable, however, a little more space would be desirable. Any information on this? (AK).

This has been added to the Guide as a topic for voting.

4. Has median guardrail been MASH tested, as in a double sided 31" mid-span installation? (AK)

A test is present that passed TL-3, titled "31-inch W-beam Median Barrier", that appears to fit this criteria. Link: <https://www.roadsidepooledfund.org/longitudinal-barrier/w-beam-median-barrier/>

5. W-beam or Thrie-beam transition to anchored portable barrier installed permanently. Are there MASH compliant systems available? (UT)

This system appears to match the given description:

<https://www.roadsidepooledfund.org/transition/28-inch-tall-guardrail-to-concrete-barrier-transition-system/>

Although this system may have been pinned and not “installed permanently”, whether or not a concrete barrier stayed pinned/anchored to be permanent is up to individual circumstance. In other words, this pinned system could just as well stay pinned and be considered “permanent”.

6. I'm not sure that the cast in place around fixed objects has been tested or even if it needs to be tested. I have been operating with the understanding that flaring around a fixed object with a 20:1 or flatter flare was acceptable.

This has been added to the Guide as a topic for voting.

7. We are in need of knowing how close to the end of a barrier run can a vehicle impact without barrier failure. For example, can a vehicle impact the last 10 feet of cast-in-place barrier run without barrier failure such as barrier rotation exposing a parapet end? "(UT)

This has been added to the Guide as a topic for voting.

8. With the vertical slope, what is the resistance strength that will be required to meet a MASH TL4? With the F-shape, can the resistance of a barrier that met a NCHRP 350 TL5 crash test be considered equivalent to MASH if it unknown if the ballast was tied down as is now required by MASH? (MASS.)

Refer to table 4.2 in the NCHRP Task 395 report. The values for a vertical slope and F-Shape barrier should be the same. As for NCHRP 350 TL-5 as opposed to MASH TL-5, this is a question where it would be beneficial for the lab to be involved. Table 3.11 in NCHRP Task 395 states that the NCHRP TL-5 is equivalent to the MASH TL-5 test since the vehicle is the same. The trailer length should be a non-issue.

9. Discussion or guidance for retrofitting (dowelling) replacement concrete barriers into existing bridge decks. For example, with reference to Fig. 4.46 or 4.48 from TTI Task 395 report, is guidance available for dowelling the TL-5 F-Shape barriers into existing bridge decks, more specifically , the angled bar adjacent to the lower traffic face of barrier? (ONT)

This has been added to the guide to be put for voting.

10. Have the NHCRP 350 TL-3 compliant guardrail systems designed to span (up to 24') or anchor to the top of box culvert top slabs been tested or deemed equivalent to MASH TL-3 (MN)

Is this the system you were referencing? (FHWA B241)

<https://www.roadsidepooledfund.org/longitudinal-barrier/w-beam-guardrail-on-low-fill-box-culvert/>

11. Deck Mounted TL-3 TxDOT, discuss need for transition to W-Beam Transitions for other unique rail designs (W. VA)

This has been added to the guide.

12. Regarding metal-only bridge rail, side mount; Note that IL and Ohio are currently developing and testing an additional Bridge Rail – Metal Only that will be side mounted to concrete with the goal of achieving TL-4. (IL)

Illinois and or Ohio representatives can discuss this further during the meeting. Also, please refer to Presentation received by MwRSF dated June 27, 2018 (slide 16).

13. Regarding metal-only bridge rail, side mount; could use a brief discussion on existing systems available and more discussion for the proper transitions to W-Beam. (W. VA)

This has been added to the guide.

14. Regarding Combination Bridge Rail - Traffic Only With Curb; brief discussion on existing systems available and more discussion for the proper transitions to W-Beam. (W. VA)

This has been added to the guide.

15. Are there TL2 or TL3 curb mounted railings or traffic mounted with parapet that can be used on top of culverts? (MASS)

This has been added to the guide.