**Meeting Minutes**

**Roadside Safety Pooled Fund**

**October 2 & 3, 2012**

**Gettysburg, Pennsylvania**

Attendance: **Alaska -** Jeff Jeffers, **Louisiana -** Justin Peltier, **Pennsylvania** **-** Mark Burkhead, **Tennessee -** Ali Hangul, **Texas -** Rory Meza, **Washington** **-** Dave Olson, Rhonda Brooks, Rod Erickson, **West Virginia** **-** Donna Hardy, **FHWA** **-** Dick, Albin, Will Longstreet, Nick Artimovich, Ryan Brumfield, **TA&MTI -** Dean Alberson, Roger Bligh, Lance Bullard, William Williams, Dusty Arrington

The business meeting began at 8:00 A.M. in the Eisenhower Hotel. The meeting began with introductions, followed by a meeting overview and agenda review. TA&MTI staff noted that there had been a slight change to their organization’s name to more clearly identify their affiliation with Texas A&M University. They are now known as Texas A&M Transportation Institute (TA&MTI).

Rhonda Brooks provided a financial summary of the Pooled Fund commitments and unexpended dollars from previous contributions. Rhonda identified $1,691,720 in committed funds since the inception of the Pooled Fund through 2012. There is $75,000 in funds for FY2012 that have not yet been received.

Two projects identified as contingency projects in 2011 have not started, and there are funds available for both these projects. After a brief discussion, the group agreed that we should pursue those projects. The 5” inch Single Slope Generic Multi-directional Slip Base (Literature Search) project, and the Small Bridge Barrier/Guide Rail Retrofit project will be initiated in the next few weeks.

Assuming that contributions follow historical trends, Rhonda suggested that the members target $250,000 for research projects in FY 2013. She did emphasize that projects could not be initiated until the funds are actually received.

There was brief discussion on potential “new” states that may be interested in joining the Pooled Fund. Rory Meza is representing Texas DOT, as they have re-joined the group. West Virginia has just joined, with Donna Hardy as the representative. It was noted that Connecticut and Indiana have both expressed an interest. William Williams has contact information for Indiana, and Mark Burkhead identified Monique Burns as a point of contact for Connecticut. Rhonda will follow up with these states to see if they are ready to join.

There was a brief discussion of the Pooled Fund web page. This page is being well-maintained. Members should notify TA&MTI with any observations about the need to update content. There was a question raised about whether the states had linked state DOT web pages to the TA&MTI Pooled Fund web page. The general consensus was that states need to do more in this area, and that all members should review their state web pages and strive to make the TA&MTI web page more prominent within their research programs.

Following these discussions, TA&MTI staff provided a status update for completed and active projects, with the available principal investigators reporting on their projects.

**Status of Projects**

Project – *Guardrail on Slopes – Phase 2* – Task AT –**CRASH TESTS SUCCESSFUL – FINAL REPORT REMAINING TO BE COMPLETED**

The objective of this project is to evaluate beam guardrail designs suitable for placement in front of or on slopes 2H:1V or flatter, with the face of the rail aligned with the break point of a 2H:1V slope. In phase one of this project, the ¾ ton pickup was restrained and redirected, but did not remain upright. In phase 2 of this project, the phase 1 test was used to recalibrate the model. The rail system was redesigned using a 31” high rail, 8’ long W6x9 steel posts, 8” blockouts, and standard 6’-3” post spacing. Full scale MASH crash tests 3-11 & 3-20 were successfully completed. There was 4.3’ of dynamic deflection in the pickup test, and 2.7’ with the small car. The final project report has not been completed. There is a desire to seek an FHWA eligibility letter for this design.

A side discussion ensued about differences between 31” high guardrail using 8” and 12” blockouts. Texas recently had successful tests with a 31” high guardrail using 8” blockouts. Most of the previous testing with 31” high guardrail, particularly the MGS design, had utilized 12” blockouts. Texas will be requesting an FHWA eligibility letter for their project. In general terms there is a belief that if an 8” blockout resulted in a successful test, then a 12” blockout would likely be okay, however it is noted that all scenarios have not been scrutinized, and each situation should be evaluated separately. Perhaps this is an area for further investigation as a project.

Project – *Sign & Light Standard Foundation when Installed on Slopes* – Task AV –**– FINAL REPORT COMPLETE**

This project developed a subsurface concrete foundation with a steel stub post extending to ground line, as a foundation for steel signs and light standards mounted on 2H:1V slopes. The steel stub post terminates 4” above ground line with a slip base. This design reduces the potential for vehicle snagging on a larger diameter concrete foundation that extends to or above ground line. This project conducted an Engineering analysis of 90 MPH wind loads. The design utilized a 5’-6” deep by 18” diameter concrete foundation for XYZ values up to 300 Cu Ft. For larger signs, a 9’-6” deep by 30” diameter foundation was identified for signs up to 1170 Cu Ft, and a 10’-6” deep by 30” diameter foundation for signs between 1170 & 2070 Cu Ft. The final project report is complete and available on the webpage. Nick Artimovich did not see a need for an eligibility letter for this application, as the breakaway mechanism did not change, only the foundation.

Project – *Guardrail over Box Culvert – Phase 2* – Task AX – **11/11/11** **CRASH TEST SUCCESSFUL – FINAL REPORT COMPLETE – FHWA ELIGIBILITY LETTER APPROVAL PENDING**

This project continued the development of previous work conducted under Phase 1 of this project. The objective was to develop a guardrail design with standard 6 ft-3 in. post spacing suitable for use over low-fill box culverts where full post embedment is not possible. The phase 1 crash testing retained the pickup but ruptured the rail element and FHWA indicated that this was an unacceptable outcome. The next iteration of this project evaluated a design that raised the rail height to 31” and moved the rail splices to mid-span to see if that would resolve the issue with rail rupture. The barrier was placed with back of the post offset 18” from the culvert headwall, and with 9” of cover over the top of the culvert. A MASH 3-11 test was conducted with a successful outcome. The rail element did experience some tearing in the vicinity of a post flange, initiated by the impacting tire. The final report is complete, and an FHWA eligibility letter has been requested (approval pending). The eligibility letter was lacking justification of why the small car test was not run.

Project – *Anchoring Temporary Concrete Barrier on Asphalt or Soil - Phase 2* – Task AY – **PROJECT COMPLETE – FHWA ELIGIBILITY LETTER HAS BEEN ISSUED**

This project builds upon work completed in Task AB, Anchored Temp Concrete Barrier Systems for Limited Deflections. Task AB focused on barrier placement on concrete pavement of bridge slabs at least 7” thick. This project evaluated a drop-in/driven pin anchorage method appropriate for use in asphalt pavement or on soil. Initial work on this project indicated that anchor pins in soil and thin asphalt pavements did not provide sufficient pull out resistance. (See Task AZ for additional detail). Analysis focused on a 4” thick asphalt pad with the back face of the barrier offset 12” from the pavement edge at the top of a 1.5H:1V fill slope. 48” long by 1.5” diameter steel pins were driven through recesses in the lower barrier face, into the pavement to anchor the barrier segments. Three pins were used to anchor barrier segments of 12.5’ to 15’, and four pines were used for 20’ long barriers. A MASH 3-11 crash test was conducted on 4” thick asphalt pavement with a successful outcome. An FHWA eligibility letter has been issued approving this pinning configuration for use as a median or roadside barrier.

Project – *Single Slope Half Size Concrete Barrier Wall for Protecting Sound Barrier Walls or MSE Walls* – Task BA – **ANALYSIS COMPLETE – AWAITING FINAL REPORT**

This project evaluated the use of a single slope barrier with a vertical back as a crash absorbing panel to be used in front of Mechanically Stabilized Earth (MSE) walls or Sound Barriers to protect these structures from impact loads. The project used simulation to develop a TL-3 design, comparing a single slope barrier placed directly in front of the wall with a barrier separated from the wall by 18” of backfill between the back of barrier and the front of the wall. The design with an 18” backfill is the recommended design. Added reinforcement on the backfill side of the barrier is also recommended to reduce damage to the barrier. This project did not crash test the recommended design. There is no need for an eligibility letter for this design, as the barrier shape has been previously tested. This usage is viewed as an application of a previously tested barrier shape.

Project – *Crash Testing Single Slope Concrete Barrier with Drainage Scuppers* – Phase 2 – Task BD **– PROJECT COMPLETE (FAILED TEST) - FINAL REPORT COMPLETE**

A Washington single slope barrier with pin & loop connections and 9” high by 28” long drainage opening (scuppers) was subjected to a MASH 3-11 crash test. The drainage scuppers are intended to facilitate sheet flow drainage under the barrier. In phase one the crash test failed when the vehicle overturned. Phase 2 evaluated a larger, stiffer pin to reduce movement at the barrier joints. Engineering analysis indicated that reduced barrier movement was expected to improve vehicle stability upon exiting the barrier system. A second full scale crash test was conducted in late September 2011. Although the barrier deflection was reduced a bit (deflected 64”), the issues with vehicle instability remain. The vehicle also overturned in this test. The toes of barrier segments fractured off, contributing to the large deflection of the barrier. It appears that some of the objectives outlined in this study may not be achievable using the pin & loop connections.

Project – *Rebar locator for Pinned Concrete Barrier Application* – Task BF – **COMPLETE – FINAL REPORT COMPLETE**

This research builds upon work completed in TASK AB, Anchored Temporary Concrete Barrier Systems for Limited Deflections. When the holes are laid out for barrier anchorage with the drop-in pins, it is critical that they not damage the reinforcing steel in a bridge deck or bridge approach panel. This project explored non-destructive test for determining the location of reinforcement within an existing slab. TA&MTI evaluated a variety of different tools for this purpose, including ferrodectors, cover meters, and ground penetrating radar. Test slabs with upper and lower mats of transverse and longitudinal reinforcement were constructed for these evaluations. Ferrodetectors, cover meters, and ground penetrating radar tools were evaluated. The ground penetrating radar units were identified as the most appropriate tools for this work. They are the most accurate and provide visual depictions of rebar placement. Post processing of the information produced the most accurate results. User training is recommended for these tools, which range in price from $12,000 to $32,000.

Project – *Temporary Precast Concrete Barrier with Pinning Holes on Both Sides* – Task BK – **COMPLETE**

This project modified a design from a previous project which devised a scheme for anchoring precast concrete (F-shape) barrier using drop in pins. That project utilized anchor pins on a single side of the barrier, aligned along the traffic side of the barrier. This project modified the previous design to provide additional pinning holes on the other barrier face, suitable for traffic on both sides of the barrier. The pinning holes were offset slightly from the existing ones to avoid interference with rebar and the pinning holes. The final design resulted in barrier that could be flipped end for end and while maintaining the location of the pinning holes in the deck. Louisiana DOT may want to consider asking for a supplemental eligibility letter for this modification.

Project – *Transition for Anchored Temporary Barrier System* – Task AZ – **IN PROGRESS**

This project builds upon work completed in Task AB, Anchored Temp Concrete Barrier Systems for Limited Deflections. The purpose is to develop a transition for the approach end of an anchored section of barrier to reduce snagging potential. This work focuses on a transition for concrete pavements. The initial crash test of this system failed when the impacting vehicle overturned. The observations from the failed tested were used to improve the finite element model, and to develop a revised design. The revised design was subsequently crash tested and passed (test 3-11). The final report is being developed and an FHWA eligibility letter will be requested.

Project – *Field Inspection Technique for Guardrail Beam Integrity* – Task BC – **IN PROGRESS**

On their Frequently Asked Questions webpage dealing with Barriers, Terminals, Transitions, Attenuators and Bridge Railings, FHWA states that weathering steel beam guardrail may be used if the owner agency adopts a frequent periodic inspection and replacement schedule. Some of the states using weathering steel guardrail are not experiencing the levels of rail corrosion that prompted this direction from FHWA. Many of those states wish to continue using and installing weathering steel guardrail. This objective of this project is to identify a means for non-destructive testing of existing guardrail runs. This project is evaluating products and developing a recommended pass/fail testing procedure. An FHWA representative will be participating during the development process. A survey was distributed to gather information about experiences with weathering guardrail across the country. 19 states responded, and 7 of those states indicated they planned to continue with installations of weathering steel guardrail. Sample rail sections were provided for testing purposes. More than ½ the responding states indicated that they haven’t had significant problems with rail deterioration. Five testing devices were initially identified for evaluation and that list was later reduced to three. Ultrasonic thickness gauges show the most promise. This project will produce an inspection guide and a final report. A time extension is being processed for production of the final report. Project completion date is now targeting February 28, 2013.

Project – *Mailbox Hazard & Risk Assessment* –Task BE – **IN PROGRESS**

Mailboxes are generally placed closer to roadways than most any other object, yet little is known about their influence on crashes. This project is evaluating the risk associated with mailbox supports. The project recently implemented a survey inquiring about policies, regulations, and the availability of crash data. 28 states responded to the survey, 15 have electronic crash data available. The crash data is now being used in a comparison of those states with policies against those states that do not have specific policies for mailbox placement.

Project – *Split Single Slope Median Wall* – Task BG – **IN PROGRESS**

This project explores the use of two independent single slope barriers to provide a median barrier on split level highways.  The use of two independent half size single slope barrier walls, back to back with each other, provides design and construction flexibility as shoulder elevations vary along the road.  This study is analyzing the sliding, overturning and bearing capacity, of the wall, as well as finite element modeling to determine its crashworthiness. This type of design and construction provides an economical way to construct a median wall on split elevation highways. TA&MTI has evaluated 3 designs including two independent single slope barrier panels, a single panel using the vertical face along the upper roadway, and a double-sided monolithic section. The independent barriers concept is more problematic than the single casting concept, which was pursued in the later phases of the project. The vertical faced option has an increased risk of occupant contact if there is partial ejection from the vehicle. The double faced single slope option is recommended, with 80’ (minimum) length, up to 112 ½” high. Crash simulations suggest a crashworthy design.

Project – *Single Slope Median Wall for Grade Separations (TL4)* – Task BJ – **IN PROGRESS**

This project builds upon the “Split Single Slope Median Wall – Task BG” project, seeking a Test Level 4 design of slope median barrier for grade separations on split level highways.  The double faced single slope option is under evaluation with an 80’ (minimum) length. Finite Element models are being evaluated for suitability with a TL4 vehicle.

Project – *Anchoring Temporary Concrete Barrier to Rigid Bridge Rail* – Task BH – **IN PROGRESS**

This project builds upon work completed in Task AB, Anchored Temporary Concrete Barrier Systems for Limited Deflections. This project is developing a transition for the approach to permanent concrete barrier or bridge rail to reduce snagging potential. This design focuses on a MASH Test Level 3 design for barrier placed on concrete pavement or bridge deck. The design attempted to identify the barrier combinations with the greatest potential for snagging, isolating the 32” high precast F-shape barrier mated to a 42” high single slope rigid barrier. A thrie beam rail bolted through the barriers with a steel strap backup plate on back side stiffens the barrier at the joint and provides a transition across the barrier faces. A sloped steel cap on the top of the F-shape barrier provides a vertical transition for the 10” height differential. Crash simulations predicted a successful outcome and that was verified with a successful MASH test 3-21. 5” of permanent deflection was found in the crash test. An FHWA eligibility letter is planned for this design.

Project – *Transition for Anchored Temporary Concrete Barrier System in Asphalt Pavement* – Task BI – **IN PROGRESS**

This project is conducting load tests to evaluate lateral resistance and deflection with precast concrete barrier that is anchored with pins into the underlying asphalt. A design has been developed for use on concrete pavements and there is a need to develop an appropriate design for use on asphalt pavement The researcher team is trying to establish a design with a strength equivalent to the transition used for barrier placed on concrete pavement. This approach offers greater flexibility in similar component pieces for both installations. Static and dynamic pull tests and analysis have been completed. Equivalency between pins in concrete pavement and asphalt pavement could not be established. An independent design for asphalt pavements is necessary. A draft technical memo is currently circulating for comment.

**BREAK FOR LUNCH**

After returning from a lunch break, Matt Nolton of McCormick Taylor provided a presentation on a Master Plan for congestion improvements on Interstate 83 in the Harrisburg, PA area. The current highway configuration is a bottleneck and traffic volumes are predicted to grow to nearly 200,000 vehicles per day. Although no funding is secured for the multi-billion dollar project, the master plan is viewed as the first step toward improvements.

Jason Hershock of PennDOT provided an overview of Pennsylvania’s Guiderail Mentors program. Each PennDOT district has one (or more) mentors, who provide assistance to the District Design & Construction Divisions and County Maintenance offices in selecting appropriate guiderail solutions. Guiderail mentors answer technical questions about: eliminating the need for guiderail; if guiderail is warranted; what type of rail to use; proper end treatments; what to do when guiderail is warranted but field conditions aren’t conducive to placement, and what to do when guiderail is not warranted. Guiderail mentors work with PennDOT designers, inspectors and contractors municipalities, Representatives, Senators, and citizens. Mentors have also created guiderail contracts to update/upgrade substandard guiderail installations.

**CONTINUED DISCUSSION OF RESEARCH IN PROGRESS**

Project – *Review of Best Practices for Barrier Protection of Bridge Ends Due to Right of Way Conflicts* – Task BL – **IN PROGRESS**

The purpose of this project is to develop a guidance document presenting best practices for circumstances where length-of-need requirements for bridge approach rails cannot be met.  This most commonly occurs when road approaches are close to the end of the bridge rail, in some cases, as close as 15’. The guide document will be based on findings from a literature review and survey of state DOTs practices. A survey of states has been conducted and follow up conversations are ensuing. 100 surveys were distributed with only 12 responses. While the desire is to present actual solutions when available, there is a high degree of variability in the site conditions, and therefore in the various treatments deployed. Some of this guidance may end up being about a philosophical approach to handling these situations, rather than actual detailed solutions. Recommendations will focus on engineering judgment approaches to improve safety rather than a specific set of recommended solutions. Additional efforts will attempt to gather some feedback from folks that did not respond to the survey.

Project – *Buried Terminal Design for 31 Inch Guardrail* – Task BM – **IN PROGRESS**

This study is evaluating appropriate modifications necessary to adapt a buried terminal design for 27-inch (27¾-inch) guardrail for use with a 31-inch guardrail system. The project will also evaluate the crashworthiness of the design.  Four MASH test will be modeled with FE analysis. There was some discussion about evaluating to MASH criteria versus comparison with the characteristics of the current NCHRP 350 system. The TA&MTI staff will work with the technical monitor (Rod Erickson) to develop some proposed scope modifications (if necessary). This project is expected to culminate with a request for an FHWA acceptance letter for this design. There may be an opportunity to submit the design as a modified NCHRP 350 system.

Project – *W-Beam Bridge Rail for Temporary Timber Deck Bridge Installations* – Task BN – **IN PROGRESS**

The purpose of the study will be to perform engineering strength calculations and develop details of a TL3 W-beam guardrail system that utilizes steel posts with steel base plates bolted through a nominal 6-inch thick timber deck.  Timber deck bridges are occasionally used in some of the more remote areas in Alaska, and the size and weight of precast concrete barriers make them nearly impossible to get to some of these sites. The deck timbers are laminated in the transverse direction. It isn’t clear yet whether a TL-3 design is compatible with the 6-inch deck thickness, the design may be limited to TL-2 applications.  If the 6-inch deck is not appropriate for a TL3 design, a 10-inch deck thickness (or greater) will be considered.  Potential designs are under evaluation with W6x9 steel posts similar to previously tested TexDOT designs.

**Presentation of New Research Proposals**

State representatives outlined their proposed research projects followed by TA&MTI reports on the feasibility and estimated costs for projects proposed in FY 2013.

LA/20 – *5” Single-Post Generic Multi-Directional Slip Base Sign System*

This proposal would develop a generic multidirectional single post sign support utilizing round steel posts up to 5” in diameter. This would reduce the need to rely on proprietary designs for this purpose. This design project will utilize what was learned in the Literature Search on this topic (2012 project), and develop a prototype, conduct static testing and full-scale crash tests. TA&MTI estimates $107,500 for this project. The costs break down to: $30,000 to develop, design, and construct prototype; $7,500 for static testing, and $70,000 for (3) full scale crash tests (presumes that the small car be reused for tests 3-60 & 3-61). During the prioritized voting process, this project was phased, excluding the P/U test (3-11) for a revised cost of $75,500.

LA/47 – *Guardrail Posts Driven Through and Embedded In Roadway Base Course*

On occasion the roadway base course is extended beyond the limits of the roadway shoulder and into the limits of the embankment widening for the guard rail. When this occurs, the guard rail posts may be driven through and embedded in 8”-10” of base course in addition to the 4”-6” of concrete or asphalt mow pad. The base course may include recycled concrete or asphalt pavements, as well as crushed aggregate. This project would utilize bogie vehicle or computer simulation to determine if the guardrail posts rotate properly after being driven through and embedded in those types of materials. TA&MTI estimates $46,000 for analysis, design, and surrogate vehicle testing (Phase 1). Another $90,000 would be needed to construct the installation and conduct MASH tests 3-10 & 3-11 (Phase 2).

LA/48 – *Stacked W-beam Transition*

This project would crash Test the 31” Stacked W-Beam transition in accordance with MASH criteria. A stacked W-Beam guardrail transition to a bridge rail has been successfully tested in accordance with the NCHRP Report 350 criteria with a guardrail height of 27 5/8” (FHWA Eligibility Letter B-65). This transition uses a nested w-beam to stiffen the rail and a w-beam rub rail to reduce the potential for snagging on the end of the bridge rail. Many states are raising the height of their w-beam guardrails to 31” to improve barrier performance. Several transitions have been tested for the 31” guardrails that use a thrie beam rail and a thrie beam to w-beam reducer section. A stacked w-beam transition is considered to be a simpler method of transition without unique rail elements. TA&MTI estimates $98,000 a literature review, design analysis, MASH tests 3-21 & 3-20. Two additional crash tests may be required. During the prioritized voting process, this project was revised/phased, to explore designs using simulation for a revised cost of $45,000. This approach may lead to a lower cost outcome.

LA/49 – *Temporary Precast Concrete Barrier over Large Bridge Joint*

This project would develop an attachment detail for situations where F-Shape barrier units need to span a large bridge joint. A pinned barrier connection would likely over-stress the barrier connection in this situation. A design such as a steel cap spanning the joint may be an appropriate solution. Movement of 10” to 12” should be accommodated by this design. Louisiana DOT could supply the F-Shape barrier needed for this project. TA&MTI estimates $79,000 for this project. That cost breaks down to $6,000 for conceptual design, $28,000 for FE analysis, $45,000 for MASH test with pickup. During the prioritized voting process, this project was revised/phased, with the design and FE analysis as phase 1 for a revised cost of $34,000. Phase 2 was the crash testing.

LA/50 – *Transition for Anchored Temporary Barrier in Asphalt (Phase 2)*

TA&MTI has successfully completed a project that developed a pinned F-shape temporary concrete barrier system providing limited deflection that can be used for bridge or roadway applications. If this application is used on a road and bridge project, it is possible that a non-anchored barrier section may be connected with the anchored section. An on-going TA&MTI project is looking at a transition for concrete but not a transition for asphalt. The objective of this project is to develop a transition detail temporary barrier anchored in asphalt through FE analysis and crash testing. TA&MTI estimates $88,000 for work. That costs break down to $30,000 for design & analysis, $18,000 for test article construction (and freight, LA is supplying barriers), $40,000 for MASH test 3-11. During the prioritized voting process, this project was phased, with the design and analysis as phase 1 at a cost of $30,000. Phase 2 was the crash testing at $58,000.

LA/51 – *Transition for Anchored Temporary Barrier in Asphalt to Permanent Concrete Barrier*

TA&MTI has successfully completed a crash test for a transition from a pinned-down F-shape barrier in concrete to a 42-inch rigid single slope barrier. The permanent deflection of the temporary barrier was around 2.5 inches and the occupant risk factors were all within MASH preferred values. If this application is used on a road and bridge project, the temporary barrier section may be pinned to asphalt pavement rather than concrete. Using finite element analysis, determine if the crash tested detail from the projects Transition Design for Anchored to Rigid Barrier (project number 405160/00034) can be used (and still meet MASH criteria) if the temporary F-shape barrier is pinned down in asphalt. TA&MTI estimates $88,000 for this work. Those costs break down to $30,000 for design & analysis, $18,000 for test article construction (and freight, LA is supplying barriers), $40,000 for MASH test 3-11. During the prioritized voting process, this project was phased, with the design and analysis as phase 1 at a cost of $30,000. Phase 2 was the crash testing at $58,000.

WA/52 – *Guardrail Post Test Methods*

The objectives of this research are to develop a cost effective field inspection method and guidance for determining the integrity of existing wood guardrail posts above and below ground level. Because rot and insect damage frequently occurs inside the post or below ground, visual inspection alone is not an effective means to determine post integrity. As much as possible, this document will also provide recommendations on the suitability of posts for continued service or replacement. The research will develop threshold values that clarify when an existing post has sufficient section loss to be “compromised.” The research will evaluate multiple inspection methods and identify the preferred approaches with consideration of purchase and operational costs, speed, ease of use, and the reliability of the results. The research will produce a guidance document with recommendations for field sampling procedures and sampling frequency. TA&MTI estimates $55,000 for this work.

WA/53 – *Scuppered Barrier (Phase 3)*

This is a continuation of previous work that tested a pin & loop connection in a single slope barrier system. Produce a single slope barrier system with X-Bolt or other appropriate connections and a 9” high drainage scupper incorporated in each barrier segment. Crash test this barrier system with the barrier in a free-standing unanchored placement. Previous crash testing of this design using a pin & loop connection resulted in vehicle instability that appears to be associated with excessive movement at the barrier joints. Precast concrete barrier is regularly used along highways to shield fixed objects; however these barrier systems frequently impact roadway drainage, resulting in a need for collection and dispersion through a subsurface system of inlets and pipes. This approach requires treatment of the runoff prior to discharge. Roadside vegetation can be use to filter water that sheet-flows off the roadway. Openings or “scuppers” can be cast into the base of the barrier to allow the drainage to sheet-flow off the roadway, but these scuppers may impact the barrier’s performance. TA&MTI estimates $140,000 for work. The breakdown of those costs is: $20,000 for engineering, $25,000 for simulation, $60,000 for construction of the test article, and $35,000 for MASH test 3-11. During the prioritized voting process, this project was phased, with the engineering and simulation as phase 1 at a cost of $45,000. Phase 2 was the crash testing at $95,000.

WA/54 – *Guardrail Placement on 1H:1V Slopes*

The objectives of this research are to utilize standard w-beam guardrail components in the development of a 31” high w-beam guardrail system suitable for placement at the top of a 1H:1V fill slope. The AASHTO Roadside Design Guide specifies W-beam guardrail placement at the top of steep slopes with the barrier placed 2 feet back from the slope break point. This placement provides sufficient width behind the post for the soil to resist excessive post rotation. This additional width is often difficult to provide in rolling or mountainous terrain or in locations with restrictive environmental conditions. TA&MTI recently completed successful testing of a guardrail system utilizing 8’ long posts, allowing the guardrail system to be placed with the face of rail at the slope break point of a 2H:1V slope. A similar design is desired for use on a 1H:1V slope. While it is recognized that longer posts are necessary, this project should focus on minimizing post length to the greatest extent possible. Crash simulation will be used in the development of a system followed by MASH test 3-11. Bogie testing may be necessary prior to developing a model. TA&MTI estimates $96,600 for this work. The costs include: $17,500 for dynamic impact tests, $32,000 for finite element analysis, $12,100 to construct the test article, and $35,000 for MASH test 3-11. During the prioritized voting process, this project was phased, with the dynamic impact testing and FE analysis as phase 1 at a cost of $49,500. Phase 2 was the crash testing at $47,100.

WA/55 – *Synthesis of W-Beam Guardrail Transitions to Unrestrained Concrete Barrier*

This research project would poll the states to inquire about current practices with beam guardrail transitions to unrestrained concrete barrier. This outreach effort would also inquire about the level of need for states to utilize these designs. The project would also review acceptance/eligibility letters for tested design, and obtain details about these designs. W-beam guardrail systems often connect with concrete barrier systems. A transition is normally incorporated to minimizing the potential for pocketing as these two systems have different deflection characteristics. There are a number of transitions developed for connecting beam guardrail to anchored barriers, and this information is relatively easy to find. It’s more difficult to find information on guardrail transitions appropriate for use with unanchored concrete barrier. TA&MTI estimates $20,000 for this project.

WA/56 – *Foundation Materials & Slope Configurations Appropriate for Unrestrained Precast Barrier Placement*

The objective of this project is to produce written guidance to address the varying surfacing and slope requirements for the placement of unrestrained pre-cast concrete barrier systems to achieve satisfactory barrier performance under varying field conditions. Precast barrier is regularly used in roadside applications for both permanent and temporary applications. When placing this barrier different kinds of surfacing materials are encountered. For example material types may be concrete, ACP, compacted aggregates, in situ undisturbed or disturbed material, etc. In addition, varying slopes are encountered. When barrier is considered under these potential varying conditions, guidance is needed to address the minimum requirements to achieve adequate barrier performance. TA&MTI doesn’t expect to find much through a synthesis approach and estimates $41,000 for an approach that would conduct 4 drag tests of barriers on various surfaces, with follow up work using finite element analysis. A future project could propose full scale crash testing to validate.

WA/57 – *Minimum and Maximum Height of Thrie Beam Guardrail used on Bridges or Bridge Rail Transitions*

The objective of this project is to produce written guidance to address the minimum and maximum height requirements for the placement of thrie beam bridge barrier systems and their associated transitions to achieve satisfactory barrier performance. It is anticipated that a literature search may be adequate to meet the objectives of this research proposal however, bogie or pendulum or other testing may need to be utilized to supplement this preliminary effort. Thrie beam barrier is regularly used for bridge rail applications. These uses include both bridge rail retrofits which help support existing bridge rails and also new thrie beam installations. In many instances, a bridge deck may be overlaid with ACP pavement after the thrie beam bridge rail is installed. Therefore, decisions need to be made before or after installation to select the appropriate minimum or maximum barrier height on the bridge. In a similar manner, the minimum and maximum height of thrie beam transitions to the rails on the bridge need to be considered. TA&MTI expects to find limited data to support the height tolerances typically associated with thrie beam installations. They recommend FE simulations to analyze vehicle stability and barrier performance at a cost of c $43,000.

TN/58 – *Modified Rounded End Alternative to Flared End Terminal*

The objective of this project is to evaluate the performance of rounded end elements fitted with a HDPE pipe filled with sand. This study is not attempting to produce a MASH compliant system, but is targeting an impenetrable end for side and front impacts conditions at TL-2 speeds. Flared end sections are commonly used to terminate guardrail runs at trailing ends or locations outside the clear zone. Local municipalities and agencies use the flared end sections to terminate guardrail installations. There have been some incidents where an errant vehicle hit the flared end section and rail end penetrated the vehicle. There is a liability concern with this approach that looks to improve performance of terminals beyond the clear zone, where we don’t’ expect them to be hit. TA&MTI estimates $42,000 for and approach using FE simulation to model performance of terminals in end on impacts. TA&MTI staff did note that simulation models don’t do penetration analysis well.

**ADDITIONAL PROPOSAL DISCUSSIONS**

Discussion in the early portion of day 1 identified the comparison of 31” high guardrail with 8” blockouts to 31” guardrail with 12” blockouts. The group indicated that they wanted to consider research on this topic.

*Review of performance similarities (Synthesis of system/vehicle interaction similarities/dissimilarities) with 12" vs. 8" blockouts with 31" mounting height, mid-span splices*

This project would identify and collect information on previous testing conducted with 31” guardrail using either 8” or 12” blockouts. It is expected that much of the available information is relevant to 12” blockouts. For this effort, direct comparisons would be identified where available and an attempt would be made to identify conditions were blockout dimensional differences would be expected to influence performance difference. That information may lead to identification of future testing needs. TA&MTI staff didn’t have much opportunity to estimate costs, and suggested a ballpark number of $25,000 with the understanding that a more accurate estimate would be prepared if this project is prioritized for funding.

Dick Albin asked if the group would consider offering seed money to help sponsor an AFB 20 international roadside safety conference. The topic was added to the list of considerations allowing the committee members to vote on it. Dick suggested a $25,000 amount, for the Roadside Safety Pooled Fund, and planned to continue marketing the concept with other groups.

Representatives from Texas DOT and West Virginia DOT were asked if they had any items they wanted to add, since they had recently joined and had an abbreviate time for submission of research proposals. Two topics emerged from this discussion.

*Guidance for Raising Beam Guardrail Blockout.*

With recent changes/clarifications about appropriate height for beam guardrail, there are more and more existing locations identified where rail height is below the recommended heights. Pavement overlays create additional locations where this occurs. Raising the blockout on the post is a cost effective means to adjust the rail height, however there isn’t any known analysis of how this may affect rail performance. This proposed research would focus on wood posts, and would simulation to analyze system performance. TA&MTI’s preliminary estimate for this work is $40,000. It is recognized that the final cost may vary, depending on the final project scope and more time to assess the costs.

*Allowable Field Adjustments for Thrie beam Connected to Concrete Barriers*

When nested thrie beam guardrail is bolted together and connected to the end section, the multiple rail plies creates a misalignment of the connecting bolt holes. These are typically field modified with either a drill or a torch to enlarge the holes. Little is known about whether these field modifications are negatively affecting rail performance. This research project would TA&MTI’s quick estimate for this work is $25,000 for design analysis and static load testing.

**Project Selection Results**

After the presentation of the proposals, each member state was asked to rank their top five projects. Each contributing state representative was asked to assign 5 points to their highest priority project, 4 points for their second priority, etc. with declining point values down to 1 point for their 5th ranked priority. Individual state scores were added together to determine the total points for each research proposal and the highest point score reflected the group’s top priority. The projects were ranked in priority order and selected for the next research cycle until the costs equaled the anticipated funds available. Projects selected for the next round of research are:

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **Project** | **Estimated Cost** | **Tech. Rep.** |
| 1 | W-Beam Guardrail Placement on 1H:1V Slope | $49,500 | Rod Erickson |
| 2 | Raising Beam Guardrail Blockout guidance | $40,000 | Rory Meza |
| 3 | MASH testing of Stacked W-Beam Transition for 31” Guardrail (Barrier 7/Simulation) | $45,000 | Justin Peltier |
| 4 | Review of performance similarities (Synthesis of system/vehicle interaction similarities/dissimilarities) with 12" vs. 8" blockouts with 31" mounting height, mid-span splices | $25,000 | Ali Hangul |
| 5 | Transition for Anchored Temporary Concrete Barrier System in Asphalt Pavement | $88,000 | Justin Peltier |

The funds available to invest in research over the coming year are estimated to be $250,000 to $275,000. The estimated total for the top five projects listed is $247,500.

**OTHER TOPICS**

Will Longstreet provided an overview of a recent FHWA Memo regarding the Roadside Safety Hardware Eligibility Reimbursement Process (formerly known as “acceptance letter). This memo describes the process for applying for an FHWA eligibility letter for roadside safety hardware. This memo can be found the FHWA web page. <http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/policy_memo/memo120521/>. Will recommends electronic submittals rather than US Mail. Will advised that as new products are being developed, it would be wise to include finite element analysis simulations in the process. That offers more flexibility in assessing future modifications to a product through FE analysis. Will stated that an updated segment of Frequently Asked Questions (FAQs) is coming soon. A form has been developed to streamline the submittal process. The form can be found at <http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/>. This form comes with instructions for how to complete the form.

**CLOSING REMARKS & WRAP-UP**

Next year’s meeting is planned for mid to late October time frame with TA&MTI hosting.

Research Project proposals for the 2013 meeting are expected to be due in August 2013.

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