TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): ____Texas Department of Transportation_____

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # *TPF-5(482)*	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (December 1 – February 28) ☐Quarter 2 (March 1 – May 31) ☐Quarter 3 (June 1 – August 31) ☒Quarter 4 (September 1 – November 30)

Project Title: Development and Evaluation of Roadside Safety System for Motorcyclists		
Name of Project Manager(s): Chris Glancy	**Phone Number:** 512-416-4747	**E-Mail** Chris.Glancy@txdot.gov
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:** 2021
Original Project End Date: 2024	**Current Project End Date:** 2024	**Number of Extensions:**

Project schedule status:

☒ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$200,000	$4,551.49	3%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$4,551.49; 2.5%	$4,551.49	25%

Project Description:
The objective of this pooled fund study is to provide a cooperative approach to conducting research to address roadsi safety issues specifically related to improving motorcyclist safety. Furthermore, the study is intended to provide participating states collaborative opportunities to stay abreast of best practices, new regulatory issues, risk managem strategies, and other research pertaining to roadside safety improvements for motorcyclists. Research activities will in identification, development, and evaluation of strategies and devices for mitigating the frequency and severity of road departure motorcyclist crashes.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):
The following tasks were completed in this quarter:

- *Kickoff Meeting (9/28/2021)*
  -Introduction of participating members and overview of objectives of the Pooled Fund.
  -Task 1: Project Management (deliverables and TxDOT support)
  -Task 2: Analyze Motorcycle Roadside Safety Issues
  -Task 3: Full-Scale Crash Testing
  -Project PM requested that any additional submittals of problems associated with Motorcycle Safety Systems be completed by October 8, 2021. During the first week of November, the submitted DOT problem statements (with inclusion of an anticipated budget and proposal work plan information) were voted on.
- *Meeting with States to discuss the revised Problem Statements (11/03/2021)*
  - States presented their problem statements and ideas. (See Appendix for the Problem Statements).
- *Meeting with Project PM to review prioritization results (11/17/2021)*
  -The PI met with the project PM to revise the results of the project prioritization. The results indicated that "Investigation of Roadway Design Methods to Decrease Likelihood of Roadway Departures for Motorcyclists" (Appendix A) and "Evaluation of a Prioritized Design of a Lower Road Element for Installation to the MGS System to Address Motorcycle Safety" (Append B) were the top projects being voted on.
- The research team met internally to discuss the top prioritized projects, in anticipation of the the meeting with the technical representatives.

Anticipated work next quarter:

- Kickoff meeting (12/09/2021) for the 2 prioritized problem statements with TTI researchers and state representatives.
- Identify research leaders working on the top prioritized projects
- Start working on the prioritized projects.

Significant Results:

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).
No issues at this time.

Potential Implementation:

Appendix

Appendix A
2022-01-R Problem Statement

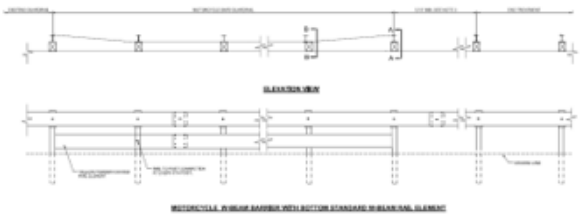
TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-01-R

Research/Testing Need Title:	*Investigation of Roadway Design Methods to Decrease Likelihood of Roadway Departures for Motorcyclists.*
Synopsis:	*A synthesis, and analysis of best state and international practices in regard to reducing roadway departures of motorcycles, and roadway design and roadside safety construction techniques that will increase the likelihood of the recovery of motorcyclists prior to impacting obstructions or roadside safety hardware.* *1) Recommended shoulder widths (e.g., at curve locations), (foreslopes, etc.) that will better allow the recovery of motorcyclists. The 4:1 fore slope is generally considered traversable and recoverable for standard motor vehicles; is this slope applicable for motorcycle recovery as well. As a result, are there different recommended clear zones/clear areas with high motorcycle usage?* *2) Recommended passive methods (e.g., yellow rubrail) that decrease the likelihood of motorcycle departure from the roadway. Summary of existing research on motorcycle safety features including types, level of effectiveness (including non-crash mitigation effects – i.e., delineation).*
Research Goal(s):	*Investigate existing guidelines that specify recommended shoulder widths, foreslopes, and clear zones/clear areas for locations with either high motorcycle usage, or a high incidence of motorcycle roadside departure crashes. Develop a preliminary assessment of the crash databases and information available to us to best develop a plan for crash data analysis in future year.*
Background:	*No existing US significant guidance on roadway design and roadside safety construction techniques to decrease the likelihood of motorcyclist's roadway departures.* *In Utah it was found that installing a lower rail element coated yellow has drastically lowered motorcycle crashes and in some locations no crashes reported since the installation. California has similar experiences.*

Work Plan:	*1. International review on existing guidance for roadway design and roadside safety construction techniques related to motorcycle safety* *2. International review on existing guidance for passive methods related to motorcycle safety* *3. Preliminary assessment of crash data (e.g., TxDOT CRIS) and other data sources (e.g., RHINO) to identify applicable correlations between roadway and roadside geometrics that result in a higher frequency of motorcyclists impacts with obstructions or roadside safety hardware.* *While this will not be a full crash data investigation, we would investigate the crash data that would be available to address the 1. Roadside design (shoulders, foreslopes, clear zones) and 2. Passive methods (delineation). Specifically, we would understand which types of crash data we have available, what are the roadside characteristics available in such databases that would be needed to conduct the study. Also, we do anticipate that we would need to merge databases – for example, TxDOT CRIS with RHiNO, but also the TxDOT data with other states' data.* *This preliminary databases and input investigation will allow us to better understand which approach best to take to address crash data assessment for 1. Roadside design and 2. Passive methods at later time.* *While it is anticipated that foreslopes information is not available in crash databases or other data sources, it is suggested to include a direct measurement of foreslopes at the location of real-world motorcycle crashes (location identified through the crash database). Note: A currently on-going TxDOT project (0-6994) is developing and plans to full-scale crash test a lower rail application for Wood-Post MGS system, to account for motorcycle safety. The results of the already completed crash data component of this TxDOT research will be leveraged to the extent possible for utilization in this TPF Research Need.* *4. Summary of the completed reviews in #1 and #2, and development of a plan for crash data analysis in future year.*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $90,000*
Deliverables:	*A report that provides a summary of existing guidelines found through literature, as well as a plan for development of crash data analysis in future year, on the described topic.*
Need Urgency and Project Expected Benefit:	*Available guidelines would likely be referenced in the State DOT Roadway Design Manual which will be providing a chapter on elements to consider for motorcyclists in roadway design.* *The need for this is immediate, but the underlying data may not be available.*

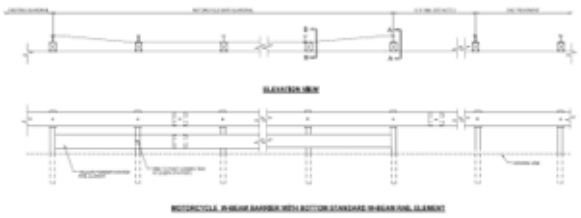
Developer(s):	*Name: Kenneth Mora; DOT: Texas* *Email: Kenneth.mora@txdot.gov; Phone:5124162678* *Name: Shawn Debenham; DOT: Utah* *Email: sdebenham@utah.gov; Phone: 801.518.4180* *Name: Glenn Blackwelder; DOT: Utah* *Email: gblackwelder@utah.gov; Phone: 801.518.4180*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-01a-H

Research/Testing Need Title:	*Evaluation of a Prioritized Design of a Lower Rail Element for Installation to the Steel-Post MGS System to Address Motorcycle Safety.*
Synopsis:	*Evaluate the effectiveness of a prioritized existing design of a lower rail element installed on the Steel-Post Midwest Guardrail System for errant motorcyclists that maintains MASH compliance.*
Research Goal(s):	*Evaluate the effectiveness of a prioritized existing design of a lower rail element installed on the Steel-Post Midwest Guardrail System for errant motorcyclists that maintains MASH compliance.*
Background:	*In Utah we have found that installing a lower rail element coated yellow has drastically lowered motorcycle crashes and in some locations no crashes reported since the installation. To date we do not have information to say if the lower rail element has saved lives of an errant motorcyclist when the body has impacted the barrier. California has similar experiences.* *SR-35 DR-46 Motorcycle Guardrail*  *SR-191 Powder Coated W-beam Rail Element*  
Work Plan:	*1. Drawings /Construction ($45,000)* *2. Full-scale testing (2 tests with instrumented dummies and 2 tests according to MASH)* *(Dummies ($60K + $60K) + MASH ($40K+$50K)) --$210K* *3. Report + Guidance + Recommendations ($10,000)*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $265K = $45K + $210K + $10K*

Deliverables:	*Compile a summary report to document research effort, including CAD details, crash testing, placement guidance, and recommendations for further research in the event of the system failing testing criteria.*
Need Urgency and Project Expected Benefit:	*A MASH-compliant motorcycle rail element or other mechanism design for motorcycle impacts will provide states with a non-proprietary option for upgrading the Steel-Post Midwest Guardrail System.* *(Note: A currently on-going TxDOT project (0-6994) is developing and plans to full-scale crash test a lower rail application for Wood-Post MGS system, to account for motorcycle safety. The results of this TxDOT research will be leveraged to the extent possible for utilization in this TPF Research Need.*
Developer(s):	*Name: Shawn Debenham; DOT: Utah* *Email: sdebenham@utah.gov; Phone: 801.518.4180*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-01b-H

Research/Testing Need Title:	*Development and Evaluation of a Lower Rail Element for Installation to the Steel-Post MGS System to Address Motorcycle Safety.*
Synopsis:	*Evaluate the effectiveness of a lower rail element installed on the Steel-Post Midwest Guardrail System for errant motorcyclists that maintains MASH compliance.*
Research Goal(s):	*Evaluate the most effective shape and material used to construct a lower rail element for applications to the Steel-Post MGS system, for the survival of an impacting motorcyclist. There might be also the need to remove the lower rail to allow for snowplowing. Therefore, there is a desire to develop a lower rail design that can be efficiently removed as needed for such types of operations (although this is a strong design consideration desire, it is not a requirement). In addition, the project will consider the need for potential applications to top rail 8-inch and 12-inch offset blockouts.*
Background:	*In Utah we have found that installing a lower rail element coated yellow has drastically lowered motorcycle crashes and in some locations no crashes reported since the installation. To date we do not have information to say if the lower rail element has saved lives of an errant motorcyclist when the body has impacted the barrier. California has similar experiences.* *SR-35 DR-46 Motorcycle Guardrail*  *SR-191 Powder Coated W-beam Rail Element*  
Background:	*A currently on-going TxDOT project (0-6994) is developing and plans to full-scale crash test a lower rail application for Wood-Post MGS system, to account for motorcycle safety. While a lower rail design would likely have the same effects on motorcycle safety whether it is implemented on a wood- or steel-post system, it is anticipated that there will be some differences on impacting vehicle behavior, as well as post behavior during the impact event. Therefore, a separate project is needed to investigate a lower rail application for steel-posts MGS guardrail system. The results of the TxDOT research will be leveraged to the extent possible for utilization in this TPF Research Need.*
Work Plan:	*1. System design options development ($15,000)* *2. FEA of prioritized options ($90,000)* *3. Component testing ($40,000)* *4. Drawings /Construction ($45,000)* *5. Full-scale testing (2 tests with instrumented dummies and 2 tests according to MASH) (Dummies ($60K + $60K) + MASH ($40K+$50K)) --$210K* *6. Report + Guidance + Recommendations ($10,000)*

Project Timeline & Budget	*Timeline: 22 months* *Budget: $410,000* ***FY22*** ***Phase I*** *Timeline: 10 months* *1. System design options development ($15,000)* *2. FEA of prioritized options ($90,000)* *3. Component testing ($40,000)* *4. Drawings ($5,000)* *Budget: $150K = $15K + $90K + $40K + $5K* ***FY23*** ***Phase II*** *Timeline: 12 months* *1. Construction ($40,000)* *2. Full-scale testing (2 tests with instrumented dummies and 2 tests according to MASH)* *(Dummies ($60K + $60K) + MASH ($40K+$50K)) --$210K* *3. Report + Guidance + Recommendations ($10,000)* *Budget: $260K = $40K + $210K + $10K*
Deliverables:	*Compile a summary report to document research effort, including CAD details, crash testing, placement guidance, and recommendations for further research in the event of the system failing testing criteria.*
Need Urgency and Project Expected Benefit:	*A MASH-compliant motorcycle rail element or other mechanism design for motorcycle impacts will provide states with a non-proprietary option for upgrading the Midwest Guardrail System.*
Developer(s):	*Name: Shawn Debenham; DOT: Utah* *Email: sdebenham@utah.gov; Phone: 801.518.4180*

Appendix D
2022-02b-H Problem Statement

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-02b-H

Research/Testing Need Title:	*Investigation of Available Data towards the Development of Hardware Installation Guidance for Motorcycle Roadside Safety*
Synopsis:	*Investigate available existing guidance, as well as conduct a data revision and merge towards developing a guidance document on motorcycle roadside safety hardware covering what to install and where to install it.*
Research Goal(s):	*Exploration of best practices and crash data merging for selecting installation sites – how to identify where systems are needed (and where they are not justified) based on road geometry, crash records, cost/benefit analysis, etc.; a safety effectiveness evaluation is suggested as Phase II of this study.*
Background:	*In the US we have not developed a crash test regime or any significant guidance on when, what and where to install.*
Work Plan:	*1. Literature review on noteworthy countermeasures implemented for preventing motorcyclist crashes – this task will help to inform the research team about the list of potential hardware devices that can help to improve motorcyclist safety. ($25K)* *2. Data collection and merging – the research team will obtain the roadway, roadside and crash data from relevant data sources and merge them using the ArcGIS tools and Google Street Images ($50K)* *3. Summary document providing best current guidance ($20K)*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $95K = $25K + $50K + $20K* *Anticipation that Phase II is needed to conduct a Safety Effectiveness Evaluation* *Safety effectiveness evaluation – The research team will follow the safety effectiveness evaluation methods described in the Highway Safety Manual to assess the safety and cost benefits of hardware devices. This method includes several steps including with the network screening (i.e., identification of hot spots), countermeasure identification and economic cost-benefit analysis. The research team suggests using the Empirical Bayes to evaluate the safety effectiveness of hardware devices. More information can be found in the HSM and following report: https://trid.trb.org/view/1665762*
Deliverables:	*Compile a summary report to document research effort and placement guidance. Merge database of information that can be proactively used in Phase II to conduct a Safety Effectiveness Evaluation.*
Need Urgency and Project Expected Benefit:	*The need for this is immediate, but the underlying data may not be available.*
Developer(s):	*Name: Shawn Debenham; DOT: Utah* *Email: sdebenham@utah.gov; Phone: 801.518.4180* *Name: Glenn Blackwelder; DOT: Utah* *Email: gblackwelder@utah.gov; Phone: 801.518.4180*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-02a-R

Research/Testing Need Title:	*Feasibility Study to Investigate Roadway Elements Design Characteristics and Their Effects on Motorcycle Safety through BikeSim Computer Simulations*
Synopsis:	*Conduct a feasibility study through the BikeSim software to investigate the critical geometry of roadway elements (i.e., uneven surfaces during constructions), as well as the geometrical characteristics of curbs and crosswalks and their effects on motorcycle safety. Provide a detailed plan for the following FY, to investigate proposed design changes and their effects on motorcycle safety and to develop a design guidance and recommended changes based on findings.*
Research Goal(s):	*Conduct a feasibility study through the BikeSim software to investigate the critical geometry of roadway elements (i.e., uneven surfaces during constructions), as well as the geometrical characteristics of curbs and crosswalks and their effect on motorcycle safety. Relate these geometrical characteristics with motorcycle impact conditions (i.e., speed and angles). Also, investigate roadway elements' geometrical and implementation characteristics against potential driving maneuvers that can be implemented as part of the study (through BikeSim). Conduct feasibility of computer simulation analysis through BikeSim to investigate roadways elements design characteristics and their effects on motorcycle safety. Also, conduct feasibility of BikeSim analysis to evaluate potential recommended changes, based on this FY findings.*
Background:	• *We have had a motorcyclist drive through a roundabout without circulating so they have hit the curb head on and been ejected. I'm not sure if any crash tests are done for motorcyclists redirecting after hitting curbs but this may be an interesting topic.* • *A recent pedestrian countermeasure FHWA has been pushing with Safe Transportation for Every Pedestrian (STEP) is raised crosswalks. Honestly, we have not done a lot of these on state routes so I'm not sure it would be a high priority for us but I would anticipate this may affect motorcyclists if they hit it at the wrong speed or angle.* • *BUMP/DIP signs have come up in our Work Zone Safety Task Force meetings as it relates to motorcyclists. These signs are approved within MUTCD but I'm not sure what the specific guidance is for where/when to put them. Many of our pavement preservation projects result in temporary uneven surfaces during construction so this is where it may be a concern for motorcyclists. At what point should we consider detours for motorcyclists for unfinished roadway surfaces? Is there an acceptable "drop-off" or dip for motorcycles?*
Work Plan:	*1. Review of Curb, Crosswalks, Drop-offs design details and implementation characteristics and State of Practice ($25K)* *2. BikeSim feasibility – Use software to develop preliminary models and use them to identify potential design characteristics and their relationship with motorcycle impact characteristics (impact conditions; e.g. risk level for different speed). ($55K)* *3. Develop more detailed plan for the following FY, to investigate proposed design changes and their effects on motorcycle safety and to develop a design guidance and recommended changes based on findings ($5K).*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $85,000*

Deliverables:	*Compile a summary report to document available literature, state of practice and proposed detailed plan for consideration for next fiscal year.*
Need Urgency and Project Expected Benefit:	
Developer(s):	*Name: Kurt Brauner; DOT: Louisiana* *Email: kurt.brauner@la.gov; Phone: 225.379.1933*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"

Research Need

2022-02a-H

Research/Testing Need Title:	*Development of Hardware Installation Guidance for Motorcycle Roadside Safety Based on Existing Best Practices*
Synopsis:	*Develop guidance document on motorcycle roadside safety hardware covering what to install and where to install it, based on existing best practices.*
Research Goal(s):	*Exploration of best practices for selecting installation sites – how to identify where systems are needed (and where they are not justified) based on road geometry, crash records, cost/benefit analysis, etc.*
Background:	*In the US we have not developed a crash test regime or any significant guidance on when, what and where to install.*
Work Plan:	*1. Literature review on noteworthy countermeasures implemented for preventing motorcyclist crashes – this task will help to inform the research team about the list of potential hardware devices and current installation best practices that could help to improve motorcyclist safety. ($25K)* *2. Summary document providing best current guidance ($20K)*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $45K = $25K + $20K*
Deliverables:	*Compile a summary report to document research effort and placement guidance.*
Need Urgency and Project Expected Benefit:	*The need for this is immediate, but the underlying data may not be available.*
Developer(s):	*Name: Shawn Debenham; DOT: Utah* *Email: sdebenham@utah.gov; Phone: 801.518.4180* *Name: Glenn Blackwelder; DOT: Utah* *Email: gblackwelder@utah.gov; Phone: 801.518.4180*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-02b-R

Research/Testing Need Title:	*Feasibility Study and Focus Group to Investigate Roadway Elements Design Characteristics and Their Effects on Motorcycle Safety through Finite Element Computer Simulations*
Synopsis:	*Conduct human factors focus group, as well as a feasibility study to investigate the critical geometry of roadway elements (i.e., uneven surfaces during constructions), as well as the geometrical characteristics of curbs and crosswalks and their effects on motorcycle safety. Provide a detailed plan for the following FY, to investigate proposed design changes and their effects on motorcycle safety and to develop a design guidance and recommended changes based on findings.*
Research Goal(s):	*Conduct human factors focus group, as well as a feasibility study to investigate the critical geometry of roadway elements (i.e., uneven surfaces during constructions), as well as the geometrical characteristics of curbs and crosswalks and their effect on motorcycle safety. Relate these geometrical characteristics with motorcycle impact conditions (i.e., speed and angles). Also, investigate roadway elements' geometrical and implementation characteristics and the perceived crash severity from the human factors focus group, as well as potential driving maneuvers that can be implemented as part of the study.* *Conduct feasibility of computer simulation analysis through FEA to investigate roadways elements design characteristics and their effects on motorcycle safety. Also, conduct feasibility of FEA analysis to evaluate potential recommended changes, based on this FY findings.*
Background:	• *We have had a motorcyclist drive through a roundabout without circulating so they have hit the curb head on and been ejected. I'm not sure if any crash tests are done for motorcyclists redirecting after hitting curbs but this may be an interesting topic.* • *A recent pedestrian countermeasure FHWA has been pushing with Safe Transportation for Every Pedestrian (STEP) is raised crosswalks. Honestly, we have not done a lot of these on state routes so I'm not sure it would be a high priority for us but I would anticipate this may affect motorcyclists if they hit it at the wrong speed or angle.* • *BUMP/DIP signs have come up in our Work Zone Safety Task Force meetings as it relates to motorcyclists. These signs are approved within MUTCD but I'm not sure what the specific guidance is for where/when to put them. Many of our pavement preservation projects result in temporary uneven surfaces during construction so this is where it may be a concern for motorcyclists. At what point should we consider detours for motorcyclists for unfinished roadway surfaces? Is there an acceptable "drop-off" or dip for motorcycles?*
Work Plan:	*1. Review of Curb, Crosswalks, Drop-offs design details and implementation characteristics and State of Practice ($25K)* *2. Focus Group with motorcycle riders – Understand human factors input, including anticipated risk level and avoidance maneuvers that could be later implemented in FEA analysis ($50K)* *3. Conduct feasibility of computer simulation analysis through FEA to investigate roadways elements design characteristics and their effects on motorcycle safety, and to develop recommended changes based on findings ($25K).* *4. Develop more detailed plan for the following FY, to investigate proposed design changes and their effects on motorcycle safety and to develop a design guidance and recommended changes based on findings ($5K).*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $105,000*

Deliverables:	*Compile a summary report to document available literature, state of practice and proposed detailed plan for consideration for next fiscal year.*
Need Urgency and Project Expected Benefit:	
Developer(s):	*Name: Kurt Brauner; DOT: Louisiana* *Email: kurt.brauner@la.gov; Phone: 225.379.1933*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"

Research Need

2022-01-ISPE

Research/Testing Need Title:	*Development of a Synthesis Document to Identify the Impact of Cable Barrier Installation on Motorcycle Safety*
Synopsis:	*Develop a synthesis document of available international literature on recorded impacts of errant motorcyclists against cable barrier installations.*
Research Goal(s):	*Develop a synthesis document to identify international available experience of cable barrier performances when impacted by errant motorcyclists. Identify safety concerns related to cable barriers design and installation characteristics that could potentially be explored in a second phase from a testing or a human factor's perspective.*
Background:	*In the US, there is a specific concern regarding installation of cable barriers when it comes to motorcycle safety. Cable barriers might be perceived as "dangerous" safety hardware for errant motorcyclists' impact. However, on-going research efforts seem to indicate that the cable barrier impacts might not be more severe than those with other commonly used roadside safety systems.*
Work Plan:	*1. Literature review on existing cable barrier impact on motorcycle safety ($20K)* *2. Summary synthesis document ($10K)*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $30,000*
Deliverables:	*Compile a summary report to document available literature and identified safety concerns.*
Need Urgency and Project Expected Benefit:	
Developer(s):	*Name: Kurt Brauner; DOT: Louisiana* *Email: kurt.brauner@la.gov; Phone: 225.379.1933*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"	**Research Need**	2022-03-H

Research/Testing Need Title:	*Development and Full-Scale Crash Testing of an Improved Steel Railing for Use on Top of Barriers*
Synopsis:	*There is a need to explore design options for an improved combination traffic barrier and railing system to be deployed at appropriate locations. The objective of this project is to design, develop, test, and evaluate an improved railing system that meets American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH).*
Research Goal(s):	*Develop an improved combination traffic barrier and railing system to be deployed at appropriate locations. The barrier needs to be MASH compliant, and the design needs to take into consideration motorcycle upright impacts.*
Background:	*Boston's Central Artery tunnels were constructed with a safety walkway on top of concrete F-shape traffic barriers along the sides of the tunnels. To protect maintenance workers, or anyone utilizing the walkway in an emergency, pedestrian railings were installed on top of the traffic barrier sections that contained a walkway. While both the barrier and pedestrian railings meet their individual design standards, the combination of the steel railing on top of the traffic barrier has, in certain rare cases, proven to cause serious injuries and fatalities to seated motorcyclists. There is a need to explore options for an improved combination traffic barrier and railing system to be deployed at appropriate locations.*
Work Plan:	***Task 1 – Concepts Development:*** *Develop improved railing system concepts for use on top of barriers in the Big Dig Tunnels. Develop the proposed concepts based on identified design constraints and requirements for application. ($15k)* ***Task 2 – Design and Engineering Analysis for Top Design Concept:*** *Select top design option among those proposed for further engineering analysis and development. Develop detailed design and perform engineering analysis of the top design option selected for further development ($15K)* ***Task 3 –Finite Element Analysis of Top Design Concept:*** *Evaluate the impact performance of the selected design through finite element impact simulations. ($55K)* ***Task 4 – Test Plan & Drawings:*** *Develop a testing program including test parameters, test article description, and performance criteria. It is proposed to perform MASH longitudinal barrier tests 3-10 (1100 passenger car) and 3-11 (2270 pick-up truck) to evaluate the impact performance of the improved railing system. ($10K)* ***Task 5 – Construction and Full-Scale Crash Testing of Selected Design:*** *Construct the test article following the approved details and conduct the approved crash tests. ($70K + $40K (car) + $50K (repair) + $50K (pickup) + [$50K (moto-dummy)?])* ***Task 6 – Final Report:*** *Submit a final report that shall document all of the research, test program development, and the results of the crash tests. ($10K)*
Project Timeline & Budget	*Propose phasing it* *Phase I* *Timeline: 10 months* ***Task 1 – Concepts Development:*** *($15k)* ***Task 2 – Design and Engineering Analysis for Top Design Concept:*** *($15K)* ***Task 3 –Finite Element Analysis of Top Design Concept:*** *($55K)* ***Task 4 – Test Plan & Drawings:*** *($10K)* *Budget: $95K* *Phase II* *Timeline: 12 months* ***Task 5 – Construction and Full-Scale Crash Testing of Selected Design:*** *($70K + $40K (car) + $20K (repair) + $50K (pickup) + $50K (moto-dummy))* ***Task 6 – Final Report:*** *($10K)* *Budget: $240K*

Deliverables:	*Compile a report to document accomplished research results and testing performed, including CAD-type drawings of the developed system.*
Need Urgency and Project Expected Benefit:	
Developer(s):	*Name: Jim Danila; DOT: MassDOT* *Email: james.danila@state.ma.us ; Phone: 857.600.0125*

TPF-5(482) "Development and Evaluation of Roadside Safety Systems for Motorcyclists"

Research Need

2022-01-ITS

Research/Testing Need Title:	*Motorcycle Traffic Signal Detection*
Synopsis:	*The motorcycle community has raised concerns about traffic signal detection not being able to detect bikes as accurately as passenger vehicles. Is there a way to improve the detection technology?*
Research Goal(s):	*Develop a synthesis of the technologies available for use of vehicle detection. Identify limitations for such technologies when applied to detection of motorcycle and mopeds.*
Background:	
Work Plan:	*1. Literature review on existing vehicle /motorcycle detection technologies ($20K)* *2. Summary synthesis document, with identification of current technologies limitation ($10K)*
Project Timeline & Budget	*Timeline: 10 months* *Budget: $30,000*
Deliverables:	*Compile a summary report to document available literature and identified technology limitation.*
Need Urgency and Project Expected Benefit:	
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