Research Project Quarterly Progress Report

Date: 5/2/2023 **Project Number:** TPF-5(430) Suppl. #2

Project Title: Additional Retrofit Options for Post Conflicts within AGTs

Principal Investigator: Faller, Rosenbaugh, Rasmussen, Bielenberg, Lechtenberg, Reid, Stolle

Principal Contact Information Email: srosenabugh2@unl.edu **Phone:** (402) 472-9324

Project Start Date: 1/21/2020 **Project Completion Date:** 12/31/2022

Report Period:	**Due Date:**
☐ Quarter 1 (July 1 – September 30)	October 31
☐ Quarter 2 (October 1 – December 31)	January 31
☒ Quarter 3 (January 1 – March 31)	April 30
☐ Quarter 4 (April 1 – June 30)	July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☒ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total Expenses to Date	Total % of Task Completed	Remaining Budget
1. Planning & Correspondence	$27,155	0%	$0	$16,177	60%	$10,978
2. Design and Analysis	$106,064	25%	$3,094	$65,342	75%	$40,722
3. Bogie Testing	$99,897	75%	$15,000	$48,330	60%	$51,567
4. Reporting and Deliverables	$18,313	0%	$0	$0	0%	$18,313
5.						
6.						
7.						
8.						
9. Total	$251,429	-	$15,349	$129,849	60%	$121,580

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

The 2nd round of dynamic component testing was completed. Five new post assemblies were configured including using larger diameter anchor rods, slotted baseplates, and slotted "holes" in the compression flange of the post. These configurations were detailed in CAD and fabricated for potential testing.

Test AGTRB-6 consisted of a W6x15 post welded to a ¾" thick baseplate and utilized 1" diameter anchor rods. The test article was impacted with a bogie vehicle impacting the post at 20 mph at a height of 25" above ground line. The test resulted in the baseplate deforming and allowing the post to rotate backwards. The larger diameter anchor rods did not fracture (as was the case with the 7/8" diameter rods with a ¾" base plate) but the rods were bent due to the prying action of the baseplate.

Test AGTRB-7 consisted of a W6x15 post with 1.25" x 3" long slots cut into both sides of the compression flange. The post was welded to a 1" thick baseplate and anchored with 7/8" diameter anchor rods. The test resulted in compression flange buckling with minimal base plate deformations and no damage to the anchors. The observed impact force averaged 19 kips through 12 inches of displacement. The performance of this post assembly compared well with W6x15's installed in soil. Thus, this post was selected for use in the AGT retrofit designs.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The budgets herein include labor charges through March 2023.

The project is behind schedule and will require and extension to complete. A request for a no-cost extension was submit in late 2022.

The COVID-19 pandemic and business responses may play a factor in future efforts. Changes to businesses outside of MwRSF may lead to possible delays in material acquisition. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Anticipated Work Next Quarter:

Design requirements for the concrete slab/foundation to support the retrofit transition posts will developed and evaluated.

Total Percentage of Project Completion:

60%

Research Project Quarterly Progress Report

Date: 5/3/2023 **Project Number:** TPF-5(430) Suppl. #3, RPFP-20-AGT-2

Project Title: Guidelines for Flaring Thrie-Beam Approach Guardrail Transitions - Phase II

Principal Investigator: Scott Rosenbaugh, Faller, Bielenberg, et al.

Principal Contact Information Email: srosenbaugh2@unl.edu **Phone:** (402) 472-9324

Project Start Date: 1/21/2020 **Project Completion Date:** 12/31/2022

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☐ Quarter 2 (October 1 – December 31)---------- January 31
- ☒ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☒ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning & Correspondence	$12,644.00	0%	$0.00	75%	$1,644.00
2. Full-Scale Crash Testing	$278,516.00	100%	$5,907.00	80%	$54,389.00
3. Reporting	$11,623.00	0%	$0.00	50%	$2,042.00
4.					
5.					
6.					
7.					
8.					
9. Total	$302,783.00		$9,581.00	85%	$58,075.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In the previous quarter, test no. FLAGT-3 was conducted on the Flared AGT with the 2270P Pickup truck inpacting the 20:1 flared AGT at a speed of 62.6 mph and an approximate angle of 25 degrees relative to the roadway (effectively 27.9 degrees from the face of the guardrail). The system captured and redirected the pickup truck with minor system deflections and deformations. However, the right-front (impact side) wheel was disengaged from the vehicle during the impact event. As the vehicle exited the system, the absence of the right-front tire allowed the vehicle to continue its roll toward the system. Eventually, the vehicle rolled onto its side, slid downstream, and finally rolled completely over (360 degrees) before coming to rest in an upright position.

The system sustained only minor damage and consisted mostly of rail deformations and post rotations. Permanent set deflections were around 2 inches. The lower corrugation of the nested thrie beam was flattened and folded backward (as intended with the shortened height thrie-beam blockouts). The middle corrugation contained localized deformations and gouging between posts 16 and 20 that were likely the result of contact with the wheel rim. This rim gouging led to the wheel disengagement. There were not any contact marks on the posts below the rail or on the concrete buttress that would indicate wheel snag on these elements.

The results (rollover) from this test were surprising, especially when the higher 15:1 flare rate tests did not result in excessive roll. The cause of this rollover is still being investigated, and MwRSF will relay the findings of this investigation once it is completed. MwRSF shared these results with the Pooled Fund members and potential system modifications were proposed at the Annual meeting in April 2023.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

Tests FLAGT-1 through FLAGT-3 failed to meet MASH performance criteria. As such, the project has had to be rescoped and system has had to be redesigned and the tests re-run. Additional project funds will be necessary to complete the full-scale testing on flared AGTs. A Phase III of this project has already been approved as part of the FY 2021 program, but Phase II was aimed at additional testing required on the upstream end of the AGT. A Phase IV of the project was funded in FY 2023 to fund retesting of the modified AGT on the downstream end near the buttress.

Due to the three failed crash tests and the corresponding redisgn and retrofit activities, the project is behind schedule. An extension is likely needed to allow more time for full-scale crash testing to continue with the remaining funds.

The budget numbers presented herein include labor charges through March 2023.

The COVID-19 pandemic and business responses may play a factor in future efforts. The pandemic has resulted in material shortages and work backlogs, which has caused the cost of vehilces and construction supplies to increase. This has resulted in increased costs for crash testing. MwRSF will work carefully in an attempt to keep the project within budget.

Anticipated Work Next Quarter:

A survey will be sent out to the project sponsors will proposed modification options. Bsed n the sponsors feedback. a system modification will be selected for further crash testing.

Total Percentage of Project Completion:

85%

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #4, RPFP-20-TERM-1

Project Title: Further Evaluation of the End Terminals Adjacent to Curb

Principal Investigator: Robert Bielenberg and Cody Stolle, Faller, et al

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 1/21/2020 **Project Completion Date:** 12/31/2022

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☐ Quarter 2 (October 1 – December 31)---------- January 31
- ☒ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☒ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning & Correspondence	$19,248.00	0%	$0.00	65.3%	$6,679.00
2. Full-Scale Crash Testing	$176,505.00	0%	$0.00	93.4	$11,694.00
3. Design & Analysis	$39,381.00	16.0%	$6,304.00	52.6%	$18,673.00
4. Reporting & Deliverables	$22,074.00	0%	$0.00	0%	$22,074.00
5.					
6.					
7.					
8.					
9. Total	$257,208.00		$6,304.00	77.0%	$59,120.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In this quarter, MwRSF also worked on completion of the summary report for the research effort.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforseen hurdles. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Currently, the full-scale testing may be delayed due to its status in the MwRSF testing que. COVID-19 has reduced avaiable staff at the outdoor test facility, created increased employee leave, and created material procurement issues. These issues have created a backlog of testing ath the facility. MwRSF is trying our best to resolve the test backlog, but delays are currently expected for most projects. We will continue to update the status of the full-scale testing and its effect on the overall project timeline.

Due to other project constraints and measurement errors in film analysis of the testing, MwRSF will not finish the summary report for the research effort by the current end date. MwRSF has requested and is awaiting approval for a NCE until 12/31/23 as funding remains available in the project.

Anticipated Work Next Quarter:

in the next quarter, MwRSF will continue work on the summary report.

Total Percentage of Project Completion:
77.0

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430)_Suppl5_RPFP-20-SR-1

Project Title: Development of a Short-Radius Guardrail for Intersecting Driveways or Roadways

Principal Investigator: J. Reid, R. Faller, R. Bielenberg, K. Lechtenberg, S. Rosenbaugh

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 1/16/2020 **Project Completion Date:** 12/31/2022

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☐ Quarter 2 (October 1 – December 31)---------- January 31
- ☒ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☒ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$30,952.00	0.0%	$0.00	38.3%	$19,096.00
2. Design and Analysis	$177,021.00	10.3%	$18,205.00	51.6%	$85,632.00
3. Reporting and Project Deliverables	$43,059.00	0.0%	$0.00	0.0%	$43,059.00
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In this quarter, MwRSF continued simulations of an short-radius system that disspates energy through interial resistance. The simulation effort started with modification of the MGS system with interial posts to determine the feasiblity of using inertial posts for vehicle redirection. That effort is still underway.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforseen hurdles. Additionally, changes to businesses outside of MwRSF may lead to possible delays in material acquisition. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Due to other project constraints, MwRSF will not finish the research effort by the current end date. MwRSF has requested and is awaiting approval for a NCE until 12/31/23 as funding remains available in the project.

Anticipated Work Next Quarter:

MwRSF will make additional progress on simulation of the interial post short-radius concept. Simulation results will be evaluated to determine the feasibility of the concept and reviewed with sopnsors. Simulations of impact outside the radiused nose of the system and including the 1100C vehicle will be investigated.

Total Percentage of Project Completion:

41.1%

Research Project Quarterly Progress Report

Date: 1/31/2023 **Project Number:** TPF-5(430) Suppl. #8, RPFP-20-LS-DYNA

Project Title: LS-DYNA Modeling Enhancement Support

Principal Investigator: Reid, Faller, et al.

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 1/21/2020 **Project Completion Date:** 12/31/2022

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☒ Quarter 2 (October 1 – December 31)---------- January 31
- ☐ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. LS-DYNA Modeling Enhancement	$30,616.00	0.0%	$0.00	100%	$0.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9. Total	$30,616.00		$9,796.00		$0.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

None

Note that funding for this project has been depleted and subsequent LS-DYNA support activities will be done under the FY2021 funding.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None.

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforseen hurdles. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Anticipated Work Next Quarter:

MwRSF will continue to use the LS-DYNA funds to support modeling needs in ongoing Midwest Pooled Fund Projects. This may include the following.

1. MwRSF has recently done an extensive amount of research in advance soil modeling techniques for use in modeling dynamic post in soil interactions. These models have been primarily developed on a component level. Research is needed to more fully developed these advanced soil modeling techniques and incorporate them into existing roadside hardware models to improve our model fidelity and allow improved investigation of soil parameters effects on roadside hardware such as post embedment, slopes, and other factors.
2. MwRSF has recently developed advanced steel fracture parameters for the GISSMO material failure command in LS-DYNA. This allows users to relate the stress state of the material to the failure strain in order to aid in predicting failure under multiple types of loading conditions. To date, the research in this area has focused mainly on the simulation of coupon samples used to develop the failure parameters. Research is needed to incorporate this steel failure methodology into existing guardrail and roadside hardware models.
3. MwRSF sees a need for advancement in concrete modeling methods. Currently several concrete material models exists and previous research at MwRSF has investigated the material models themselves. However, further research is needed to investigate the incorporation of reinforcing steel and in the concrete material and ensuring effective load transfer through the reinforcing steel. Additional investigation of bonding and development of the reinforcement is needed as well.
4. Vehicle model improvements are a constant need for Midwest Pooled Fund research efforts. Currently needed vehicle model improvements include more refined tire models, enhanced suspension models with suspension failure, and upgrades to existing TL-4 single unit truck and TL-5 tractor-trailer models.

It is anticipated that summary reports on the soil modeling and AGT modeling will be completed. Additonal work may also occur on the new tire models.

Total Percentage of Project Completion:
100%

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #15, RPFP-21-CABLE-1

Project Title: Redesign of the High-Tension Cable Phase II

Principal Investigator: Faller, Asadollahipajouh, Bielenberg, Holloway, Lechtenberg, Rosenbaugh, Steelman, Stolle

Principal Contact Information Email: kpolivka2@unl.edu **Phone:** (402) 472-9070

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	1/1/23 - 3/31/23	4/30/23

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Plan/Corresp, CAD, Material Certs	$16,861.00	10%	$200.00	85%	$1,542.00
2. Full-Scale Crash Testing	$217,148.00	20%	$25,639.00	20%	$156,333.00
3. Reporting & Project Deliverables	$19,887.00	0%	$0.00	0%	$19,887.00
4.					
5.					
6.					
7.					
8.					
9. Total	$253,893.00	12%	$25,839.00	30%	$177,762.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Continued material acquisition. Construction of system continued.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

.None

Anticipated Work Next Quarter:

Complete system construction. Potentially conduct first test in the series toward the end of next quarter.

Total Percentage of Project Completion:

15%

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Supp#16 - RPFP-21-CONC-2

Project Title: Anchoring of Temporary Barrier to Asphalt - Phase II

Principal Investigator: Faller, Bielenberg, et al.

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	1/1/23 - 3/31/23	4/30/23

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$13,939.00	0	$0.00	34.1	$8,824.00
2. Design and Analysis	$59,224.00	0	$0.00	94.7	$3,145.00
3. Full-Scale Crash / Bogie Testing	$122,413.00	37.4	$45,774.00	60.8	$48,038.00
4. Reporting and Project Deliverables	$29,295.00	0	$0.00	0	$29,295.00
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Previously, the researchers developed a series of potential retrofit concepts to improve the system performance. These concepts were reviewed in terms of their pros and cons, including crash performance, cost, and installation ease. MwRSF presented the concepts to the sponsors and surveyed the sponsors regarding their preferred concepts for further development. Feedback from the survey identified the preferred concept as a saddle cap attached to the PCB connection pin that spans the barrier joint.

MwRSF has completed development of the preferred retrofit concept and provided details to the pooled fund states. The design details and test setup were detailed in CAD and test plans were sent to the MwRSF outdoor testing facility.

In this quarter, MwRSF completed full-scale testing of the anchored PCB system. Test no. WITD-4 was conducted on 3/15/2023. In WITD-4, a 5,019 lb Dodge Ram quad cab pickup truck impacted the barrier at 61.9 mph and a preliminary angle of 24.9 degrees. The vehicle impacted barrier 8 at the intended location and began to be redirected by the barrier. The following events are in reference to the time of initial impact.

- At 9 ms, barrier 8 began to move laterally
- At 24 ms, the saddle cap began to rotate clockwise
- At 36 ms, barrier 9 began to move laterally
- At 86 ms, the lower leading edge of front driver's side door snagged on the saddle cap

The door snag on the saddle cap caused the front left outer door panel to peel away and wedge between the saddle cap and barrier 8. This snag also caused the door to separate from the door frame leaving a 7-in. tall x 1.5-in. wide gap. There was little deformation to the saddle cap at the junction between barriers 8 and 9. As the upstream edge of the saddle cap was not bent outward or peeled away from the barrier, and the lower edge of the door displaced outward and not toward the occupant, the gap was not considered penetration and was deemed acceptable. The wheel well/toe pan deformation was 1.8 in. in WITD-4 while the wheel well/toe pan deformations were 13.5 in. and 10.4 in. in test nos. WITD-2 and WITD-3, respectively. Vehicle capture and stability of the vehicle were adequate and ORA, OIV, and occupant intrusion measures were within the MASH limits.

Note that because of the snag that occurred on the 2270P pickup truck, it is conceivable that snag would also occur with the 1100C small car. As such, some consideration should be given to running a small car test on this system.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforeseen hurdles. Additionally, changes to businesses outside of MwRSF may lead to possible delays in material acquisition. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Anticipated Work Next Quarter:

In the next quarter, MwRSF will work towards completion of the test documentation, data analysis, and summary report.

Total Percentage of Project Completion:

60.2%

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl#17 - RPFP-21-CONC-3

Project Title: MASH TL-3 Portable Barrier System

Principal Investigator: Faller, Bielenberg, et al.

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	Jan 2023 - Mar 2023	4/30/2023

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$33,717.00	0	$0.00	18.9	$27,337.00
2. Design and Analysis	$81,642.00	6.3	$5,131.00	31.9	$55,597.00
3. Reporting and Project Deliverables	$32,937.00	0	$0.00	0	$32,937.00
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In this quarter, MwRSF continued simulation of the preferred barrier concept. Several different reinforcement schemes were simulated that resulted in varying levels of barrier damage during a MASH TL-3 impact. Simulations were alos conducted with two different concrete material models to bracket the overall barrier performance. MwRSF plans to query the DOTs regarding what level of robustness and reinforcment they would like to have in the final barrier design.

Simulations were alos conducted with 8' long PCB segments. While this resulted in slightly increased dynamic barrier deflections, it also allowed for greater curvature in the barrier for real world installations. MwRSF plans to query the DOTs regarding desired segment length as well.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforeseen hurdles. Additionally, changes to businesses outside of MwRSF may lead to possible delays in material acquisition. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Anticipated Work Next Quarter:

In the next quarter, MwRSF will continue analysis of the staggered, interlocking PCB concept. This will include surveying the DOTs regarding reinforcement level and segment length and investigating the effect of gaps between the barrier segments.

Total Percentage of Project Completion:

21.9%

Research Project Quarterly Progress Report

Date: 5/3/2023 **Project Number:** TPF-5(430) Suppl. #18, RPFP-21-AGT-1

Project Title: Approach Guardrail Transition Behind Elevated Sidewalk

Principal Investigator: Faller, Pajouh, Bielenberg, Lechtenberg, Rosenbaugh, Steelman, and Stolle

Principal Contact Information Email: srosenabugh2@unl.edu **Phone:** (402) 472-9324

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) — October 31
- ☐ Quarter 2 (October 1 – December 31) — January 31
- ☒ Quarter 3 (January 1 – March 31) — April 30
- ☐ Quarter 4 (April 1 – June 30) — July 31

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total Expenses to Date	Total % of Task Completed	Remaining Budget
1. Planning and CAD	$27,125	100%	$197	$4,652	15%	$22,473
2. Design and Analysis	$87,468	0%	$0	$2,000	2%	$85,468
3. Reporting and Project Deliverables	$31,548	0%	$0	$0	0%	$31,548
4.						
5.						
6.						
7.						
8. Total	$146,141	-	$197	$6,652	5%	$139,489

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

This project has been on hold waiting for the vehicle and tire models get updated as part of NCHRP 22-39. In the last 6 months, the 2270P pickup model was significantly modified (tires, rims, springs, dampeners, and bump stops) and calibrated against physical trajectory data of a pickup traversing over 6-in tall curbs. Thus, research efforts can begin on this project with the newly updated vehicle model.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The budget numbers presented herein include labor charges through March 2023.

This project was proposed and budgeted with the understanding that the vehicle and tire models had to be updated as part of a different project prior to conducting simulated crash tests as part of this project. As such, the project was put on hold until the beginning of 2023.

Anticipated Work Next Quarter:

The literature review will be completed and the state survey will be sent out. The updated vehicle models will also be carried over from the NCHRP project for use on this project. .

Total Percentage of Project Completion:

5%

Research Project Quarterly Progress Report

Date: 5/3/2023 **Project Number:** TPF-5(430) Suppl. #19, RPFP-21-AGT-3

Project Title: Guidelines for Flaring AGTs, Phase III

Principal Investigator: Faller, Pajouh, Bielenberg, Lechtenberg, Rosenbaugh, Steelman, and Stolle

Principal Contact Information Email: srosenabugh2@unl.edu **Phone:** (402) 472-9324

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Report Period:	**Due Date:**
☐ Quarter 1 (July 1 – September 30)	October 31
☐ Quarter 2 (October 1 – December 31)	January 31
☒ Quarter 3 (January 1 – March 31)	April 30
☐ Quarter 4 (April 1 – June 30)	July 31

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total Expenses to Date	Total % of Task Completed	Remaining Budget
1. Planning and CAD	$4,705	0%	$0	$0	0%	$4,705
2. Design and Analysis	$109,854	0%	$0	$0	0%	$109,854
3. Reporting and Project Deliverables	$6,748	0%	$0	$0	0%	$6,748
4.						
5.						
6.						
7.						
8. Total	$121,307	-	$0	$0	0%	$121,307

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Work on this project, Phase III, has yet to begin as the research efforts are still being conducted on the previous phase of this project – see project TPF-5(430)_Supplement 3 for details on Phase II efforts of the Flared AGT research project.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The budget numbers presented herein include labor charges through November 2022.

The COVID-19 pandemic and business responses may play a factor in future efforts. Changes to businesses outside of MwRSF may lead to possible delays in material acquisition as well as other unforeseen hurdles. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Anticipated Work Next Quarter:

Work on this project will begin once Phase II of this project has been completed.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #20, RPFP-21-SIGN-1

Project Title: Breakaway Systems for Ground Mounted, Large Steel Sign Support Structures

Principal Investigator: Joshua S. Steelman, Ph.D., P.E.

Principal Contact Information Email: joshua.steelman@unl.edu **Phone:** (402) 472-1972

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Quarter:	Period of Performance:	Quarterly Report Submittal Deadline:
☐ Quarter 1	July 1 – September 30	October 31
☐ Quarter 2	October 1 – December 31	January 31
☐ Quarter 3	January 1 – March 31	April 30
☐ Quarter 4	April 1 – June 30	July 31
☐ Quarter 5	July 1 – September 30	October 31
☐ Quarter 6	October 1 – December 31	January 31
☒ Quarter 7	January 1 – March 31	April 30

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Plan/Corresp, Lit search, survey	$21,681.00	30	$6,504	95	$944.70
2. Sign Configuration Analysis & Selection	$28,702.00	15	$15,537	15	$13,165.00
3. Research Report & Deliverables	$27,357.00	15	$4,104	15	$23,253.45
4.					
5.					
6.					
7.					
8.					
9. TOTAL	$77,740.00	18	$26,145	36	$37,363

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Task 1 – Extended review of relevant literature and Pooled Fund member states' relevant standard details. Contacted states to inquire for additional information when data sought in standards was not found.

Task 2 – Initiated analysis of sign behavior using methods identified in literature, focusing on impulse-momentum approaches.

Task 3 – Initiated documentation of findings from Task 1.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None.

Anticipated Work Next Quarter:

Task 1 – Complete review of state DOT details and literature. Collect and synthesize responses from state survey.

Task 2 – Analyze signs identified in Task 1 to identify critical configurations.

Task 3 – Extend documentation to include survey results.

Total Percentage of Project Completion:

36%

Research Project Quarterly Progress Report

Date: 05/02/2023 **Project Number:** TPF-5(430) Suppl. #21, RPFP-21-POLE-1

Project Title: Breakaway Pole Research

Principal Investigator: Faller, R.K., Bielenberg, R.W., Pajouh M.A., Fang C., and Stolle Cody

Principal Contact Information Email: mojdeh.pajouh@unl.edu **Phone:** 402-472-0920

Project Start Date: 07/01/2021 **Project Completion Date:** 07/31/2024

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) — October 31
- ☐ Quarter 2 (October 1 – December 31) — January 31
- ☒ Quarter 3 (January 1 – March 31) — April 30
- ☐ Quarter 4 (April 1 – June 30) — July 31

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total Expenses to Date	Total % of Task Completed	Remaining Budget
1. Project Planning & Management & CAD	$66,665	10.09%	$6,725	$41,489	49.06%	$25,176
2. Design and Analysis	$162,291	0%	$0	$0	0%	$162,291
3. Reporting and Project Deliverables	$40,509	0%	$0	$0	0%	$40,509
4.						
5.						
6. Total	$269,455	-	$6,725	$41,489	15.40%	$227,976

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In the past quarter, two available full-scale crash tests (Utah DOT 4-bolt slip base pole tests) were selected for LS-DYNA modeling validation.The baseline LS-DYNA model for a 4-bolt slip base was developed. Efforts have been made to validate the model using the crash tests. Once the model is validated, variations of pole and slip bases design parameters will be analyzed. Currently, the plan is to include 3-bolt slip base as well.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

The project costs presented herein only include labor charges through February 28, 2022.

Anticipated Work Next Quarter:

In the upcoming quarter, MwRSF will validate the LS-DYNA modeling of the slip base pole using past crash tests.

Total Percentage of Project Completion:

15.4%

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl#22 / RPFP-21-CONSULT

Project Title: Annual Consulting Services Support

Principal Investigator: Faller, Bielenberg, et al.

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	Jan 2023 - Mar 2023	4/30/2023

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$61,446.00	20.5	$12,627.00	54.8	$27,758.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

This project allows MwRSF to be a valuable resource for answering questions with regard to roadside safety issues. MwRSF researchers and engineers are able to respond to issues and questions posed by the sponsors during the year. Major issues discussed with the States have been documented in our Quarterly Progress Reports and all questions and support are accessible on a MwRSF Pooled Fund Consulting web site.

In the past quarter MwRSF has responded to a series of state inquiries. The Quarterly Progress Report summarizing these responses has been attached to this document. The summary will also be available for download at the recently completed MwRSF Pooled Fund Consulting web site - http://mwrsf-qa.unl.edu/

We are continuing to work with and improve the MwRSF Pooled Fund Consulting web site as our experience with it grows. We would ask that all Pooled Fund member states use the new site from this point forward for their inquiries and to contact us with any issues they experience with the web site.

The summary of the consulting effort for this quarter is attached with the progress update.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforseen hurdles. Additionally, changes to businesses outside of MwRSF may lead to possible delays in material acquisition. MwRSF will continue to make progress on this research in the most effective manner possible moving forward

Anticipated Work Next Quarter:

MwRSF will continue to answer questions and provide support to the sponsors during the upcoming quarter.

We would ask that all questions be submitted through the web site so that they can be answered and archived therein.

http://mwrsf-qa.unl.edu/

Total Percentage of Project Completion:
54.8

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #15, RPFP-21-MPFW

Project Title: Midwest Pooled Fund Website

Principal Investigator: Faller, Asadollahipajouh, Bielenberg, Holloway, Lechtenberg, Rosenbaugh, Stolle

Principal Contact Information Email: kpolivka2@unl.edu **Phone:** (402) 472-9070

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	1/1/23 - 3/31/23	4/30/23

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Website Develop, Populate, and Host	$18,573.00	15%	$3,229.00	30%	$9,962.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9. Total	$18,573.00	15%	$3,229.00	50%	$9,962.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Continue maintenance, repair, and upkeep of the website. Update research hub with new completed projects.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

This is continuation funding until the funds from Project No.: RPFP-20-PFCHS – TPF-5(430) Supplement #7, Project Title: Pooled Fund Center for Highway Safety have been exhaused.

The COVID-19 pandemic and business responses may play a factor in future efforts. MwRSF has not been shut down and is still working, but much of the personnel has transitioned to working remotely, as has much of the country during this time of social distancing. This major shift in regular work operations may lead to delays and inefficiencies as well as other unforseen hurdles. MwRSF will continue to make progress on this research in the most effective manner possible moving forward.

Anticipated Work Next Quarter:

Troubleshooting and fixing any issues that have occurred during the transition. Continue maintenance, repair, and upkeep of the website. Update research hub with new completed projects.

Total Percentage of Project Completion:

50%

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #24, RPFP-21-LS-DYNA

Project Title: LS-DYNA Modeling Enhancement Support

Principal Investigator: Faller, Bielenberg, et al.

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2021 **Project Completion Date:** 7/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	Jan 23 - Mar 23	4/30/2023

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. LS-DYNA Modeling Enhancement	$43,823.00	8.1	$3,549.00	31.7	$29,928.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In this quarter, MwRSF researcher used the LS-DYNA funding to investigate the use of new soil modeling techniques. Simulation models of multiple closely spaced posts and posts with reduced embedment were developed and analyzed.Improvements were discussed for further soil model development.

A model of the MGS with one of the new soil models was also developd that compared well with existing test data. Further refinements and additional soil model options are planned.

Soil modeling completed in support of the research regarding the MGS with reduced embedment over low-fill cuvlerts was reported in the appendix of the Phase I report for that research.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

Anticipated Work Next Quarter:

MwRSF will continue to use the LS-DYNA funds to support modeling needs in ongoing Midwest Pooled Fund Projects. This may include the following.

1. MwRSF has recently done an extensive amount of research in advance soil modeling techniques for use in modeling dynamic post in soil interactions. These models have been primarily developed on a component level. Research is needed to more fully developed these advanced soil modeling techniques and incorporate them into existing roadside hardware models to improve our model fidelity and allow improved investigation of soil parameters effects on roadside hardware such as post embedment, slopes, and other factors.
2. MwRSF has recently developed advanced steel fracture parameters for the GISSMO material failure command in LS-DYNA. This allows users to relate the stress state of the material to the failure strain in order to aid in predicting failure under multiple types of loading conditions. To date, the research in this area has focused mainly on the simulation of coupon samples used to develop the failure parameters. Research is needed to incorporate this steel failure methodology into existing guardrail and roadside hardware models.
3. MwRSF sees a need for advancement in concrete modeling methods. Currently several concrete material models exists and previous research at MwRSF has investigated the material models themselves. However, further research is needed to investigate the incorporation of reinforcing steel and in the concrete material and ensuring effective load transfer through the reinforcing steel. Additional investigation of bonding and development of the reinforcement is needed as well.
4. Vehicle model improvements are a constant need for Midwest Pooled Fund research efforts. Currently needed vehicle model improvements include more refined tire models, enhanced suspension models with suspension failure, and upgrades to existing TL-4 single unit truck and TL-5 tractor-trailer models. Additionally, George Mason University (GMU) plans to release a new 1100C vehicle model based on the Hyundai Accent. Conversion and troubleshooting of this new 1100C vehicle model will require a considerable effort. However, it is believed that the new vehicle model could provide much improved 1100C simulation results as the current 1100C vehicle is a 2010 Toyota Yaris that has been discontinued and is not used in MASH crash testing.

5. MwRSF sees the need for development of an improved model of the MGS. The current model is based on older modeling techniques and was validated with older vehicle models that are being phased out. It is believed that its use for studying more complex impact events and system modifications could be significantly improved if the model were updated with the new soil and steel fracture models discussed previously.

Total Percentage of Project Completion:

31.7%

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. 28, RPFP-FY20220-MGS-4

Project Title: Evaluation of Increased Blockout Depth with the Midwest Guardrail System

Principal Investigator: Faller, Asadollahipajouh, Bielenberg, Holloway, Lechtenberg, Perry, Rosenbaugh, Stolle

Principal Contact Information Email: kpolivka2@unl.edu **Phone:** (402) 472-9070

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	1/1/23 - 3/31/23	4/30/23

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

	Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1.	Project Planning, Correspondence, CAD, Material Certs	$25,679.00	0%	$3.00	0%	$25,676.00
2.	Design & Analysis	$18,893.00	0%	$0.00	0%	$18,893.00
3.	Full-Scale Crash Testing	$203,413.00	0%	$0.00	0%	$203,413.00
4.	Reporting & Deliverables	$14,866.00	0%	$0.00	0%	$14,866.00
5.						
6.						
7.						
8.						
9.	Total	$262,851.00	0%	$3.00	0%	$262,848.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

MwRSF has received a notification to proceed on FY2022 Pooled Fund projects, however, the contracts have not been executed, therefore, the project can't be billed at this time.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

Anticipated Work Next Quarter:

Initiate literature review on previous barriers systems with increased blockout depths greater than 12 inches.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 5/3/2023 **Project Number:** TPF-5(430) Suppl. #29

Project Title: Surface Mounted Strong-Post MGS

Principal Investigator: Faller, Pajouh, Bielenberg, Lechtenberg, Stolle, Rosenbaugh, Perry, and Steelman

Principal Contact Information Email: srosenabugh2@unl.edu **Phone:** (402) 472-9324

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Report Period:	**Due Date:**
☐ Quarter 1 (July 1 – September 30)	October 31
☐ Quarter 2 (October 1 – December 31)	January 31
☒ Quarter 3 (January 1 – March 31)	April 30
☐ Quarter 4 (April 1 – June 30)	July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☒ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total Expenses to Date	Total % of Task Completed	Remaining Budget
1. Planning & Correspondence	$44,669	0%	$0	$0	0%	$44,669
2. Design and Analysis	$69,511	0%	$0	$0	0%	$69,511
3. Bogie Testing	$75,357	0%	$0	$0	0%	$75,357
4. Reporting and Deliverables	$28,303	0%	$0	$0	0%	$28,303
5.						
6.						
7.						
8.						
9. Total	$217,840	-	$0	$0	0%	$217,840

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status,

Work on this project has not yet begun as MwRSF has not yet received signed contracts for this project (and the rest of the FY2022 Midwest Pooled Fund Program).

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The budgets herein include labor charges through March 2023.

As of April 2023, MwRSF has not yet received signed contracts for the project.

Anticipated Work Next Quarter:

The research team will begin the literature review on previous top-mounted guardrail systems. Additionally, a patent search will be conducted to identify any protected technologies that would not be available for use in this project.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 5/3/2023 **Project Number:** TPF-5(430) Suppl. #30

Project Title: Median Approach Guardrail Transition to Concrete Median Barrier

Principal Investigator: Faller, Pajouh, Bielenberg, Lechtenberg, Stolle, Rosenbaugh, Perry, and Steelman

Principal Contact Information Email: srosenabugh2@unl.edu **Phone:** (402) 472-9324

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Report Period:	**Due Date:**
☐ Quarter 1 (July 1 – September 30)	October 31
☐ Quarter 2 (October 1 – December 31)	January 31
☒ Quarter 3 (January 1 – March 31)	April 30
☐ Quarter 4 (April 1 – June 30)	July 31

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total Expenses to Date	Total % of Task Completed	Remaining Budget
1. Planning & Correspondence	$42,550	0%	$0	$0	0%	$42,550
2. Design and Analysis	$42,083	0%	$0	$0	0%	$42,083
3. Full-Scale Crash Testing	$134,051	0%	$0	$0	0%	$134,051
4. Reporting and Deliverables	$15,204	0%	$0	$0	0	$15,204
5.						
6.						
7.						
8.						
9. Total	$233,888	-	$0	$0	0%	$233,888

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Work on this project has not yet begun as MwRSF has not yet received signed contracts for the project (or the rest of the FY2022 Midwest Pooled Fund Program).

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

The budgets herein include labor charges through March 2023.

As of April 2023, MwRSF has not yet received signed contracts for the project.

Anticipated Work Next Quarter:

The project will begin with a literature review of guardrail transitions (both roadside and median configurations), median W-beam guardrail, and concrete median barriers. The review will focus on MASH crash tested systems, but AGTs evaluated to NCHRP Report No. 350 standards may be included if more data is deemed necessary. Data collected from this literature review will be utilized to identify critical components and possible failure mechanisms for the median transition.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #31 - RPFP-FY2022-WZ-2

Project Title: MASH TL-3 Portable Barrier System – Phase II

Principal Investigator: Bob Bielenberg

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Quarter:	Period of Performance:	Quarterly Report Submittal Deadline:
☐ Quarter 1	July 1 – September 30	October 31
☐ Quarter 2	October 1 – December 31	January 31
☒ Quarter 3	January 1 – March 31	April 30
☐ Quarter 4	April 1 – June 30	July 31
☐ Quarter 5	July 1 – September 30	October 31
☐ Quarter 6	October 1 – December 31	January 31
☐ Quarter 7	January 1 – March 31	April 30

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$25,089.00	0	$0.00	0	$25,089.00
2. Full-Scale Crash Testing	$291,118.00	0	$0.00	0	$291,118.00
3. Reporting and Project Deliverables	$15,412.00	0	$0.00	0	$15,412.00
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

1. Project Planning and Correspondence: None
2. Full-Scale Crash Testing: None
3. Reporting and Project Deliverables : None

Note that the current Phase I Design effort is underway (TPF-5(430) Suppl#17 - RPFP-21-CONC-3). The full-scale crash testing in this effort will begin once Phase I is completed.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0.0

Research Project Quarterly Progress Report

Date: 4/28/2022 **Project Number:** TPF-5(430)_Suppl. #32, RPFP-FY2022-WZ-3

Project Title: Anchoring Temporary Barriers to Asphalt in Median Installations

Principal Investigator: B. Perry

Principal Contact Information Email: brandon.perry@unl.edu **Phone:** (402) 472-0906

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☐ Quarter 2 (October 1 – December 31)---------- January 31
- ☒ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$38,845.00	6.5%	$2,515.00	6.5%	$36,329.96
2. Design and Analysis	$85,108.00	10.5%	$8,916.96	10.5%	$76,191.04
3. Reporting and Project Deliverables	$31,279.00	0.0%	$0.00	0.0%	$31,279.00
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

1. Project Planning, CAD, and Reporting: The literature review has been completed
2. Design and Analysis: LS-DYNA simulation development is nearly complete
3. Reporting and Project Deliverables: None

MwRSF has received a notification to proceed on FY2022 Pooled Fund projects, however, the contracts have not been executed, therefore, the project can't be billed at this time.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None.

Anticipated Work Next Quarter:

MwRSF will finish LS-DYNA simulatuion development and validation, make progress on the development of CAD details for proposed designs, and a meeting will be schedule with the Midwest Pooled Fund member states to review and select proposed designs.

Total Percentage of Project Completion:

7.4%

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #33 - RPFP-FY2022-CONSULT

Project Title: Annual Consulting Services Support

Principal Investigator: Bob Bielenberg

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Quarter:	Period of Performance:	Quarterly Report Submittal Deadline:
☐ Quarter 1	July 1 – September 30	October 31
☐ Quarter 2	October 1 – December 31	January 31
☒ Quarter 3	January 1 – March 31	April 30
☐ Quarter 4	April 1 – June 30	July 31
☐ Quarter 5	July 1 – September 30	October 31
☐ Quarter 6	October 1 – December 31	January 31
☐ Quarter 7	January 1 – March 31	April 30

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Annual Consulting Services Support	$65,000.00	0	$0.00	0	$65,000.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

This project allows MwRSF to be a valuable resource for answering questions with regard to roadside safety issues. MwRSF researchers and engineers are able to respond to issues and questions posed by the sponsors during the year. Major issues discussed with the States have been documented in our Quarterly Progress Reports and all questions and support are accessible on a MwRSF Pooled Fund Consulting web site.

In the past quarter MwRSF has responded to a series of state inquiries. The Quarterly Progress Report summarizing these responses has been attached to this document. The summary will also be available for download at the recently completed MwRSF Pooled Fund Consulting web site - http://mwrsf-qa.unl.edu/

We are continuing to work with and improve the MwRSF Pooled Fund Consulting web site as our experience with it grows. We would ask that all Pooled Fund member states use the new site from this point forward for their inquiries and to contact us with any issues they experience with the web site.

The summary of the consulting effort for this quarter is attached with the progress update.

Note that no funds will be applied to this effort until the previous consulting funding from previous years is fully expended.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

Anticipated Work Next Quarter:

MwRSF will continue to answer questions and provide support to the sponsors during the upcoming quarter.

We would ask that all questions be submitted through the web site so that they can be answered and archived therein.

http://mwrsf-qa.unl.edu/

Total Percentage of Project Completion:
0.0

Pooled Fund
Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #34, RPFP-YR2022-MPFW

Project Title: Midwest Pooled Fund Website

Principal Investigator: Faller, Asadollahipajouh, Bielenberg, Holloway, Lechtenberg, Perry, Rosenbaugh, Stolle

Principal Contact Information Email: kpolivka2@unl.edu **Phone:** (402) 472-9070

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 3	1/1/23 - 3/31/23	4/30/23

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Website Develop, Populate, and Host	$12,111.00	0%	$915.00	0%	$11,196.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9. Total	$18,573.00	10%	$1,869.00	18%	$15,248.00

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

None

MwRSF has received a notification to proceed on FY2022 Pooled Fund projects, however, the contracts have not been executed, therefore, the project can't be billed at this time.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

This is continuation funding until the funds from Project No.: RPFP-21-MPFW – TPF-5(430) Supplement #23, Project Title: Midwest Pooled Fund Website have been exhaused.

MwRSF has received a notification to proceed on FY2022 Pooled Fund projects, however, the contracts have not been executed, therefore, the project can't be billed at this time.

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) – Suppl. #10 – FY20-WISC-1-MGS SLOPE HALF POST 1Q 2020

Project Title: MASH 2016 TL-3 Evaluation of the MGS with Half Post Spacing and 7-ft Posts Adjacent to Sl

Principal Investigator: R. Bielenberg and R. Faller,

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 1/16/2020 **Project Completion Date:** 7/31/2023

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☐ Quarter 2 (October 1 – December 31)---------- January 31
- ☒ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☒ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$10,490.00	0.0%	$0.00	81.2%	$1,968.00
2. Full-Scale Crash Testing	$193,277.00	0.0%	$0.00	79.7%	$39,171.00
3. Reporting and Project Deliverables	$16,441.00	11.7%	$1,930.00	35.7%	$10,574.00
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

In this quarter, MwRSF worked towards the completion of the summary report for the project. MwRSF also reviewed the results of the full-scale crash test and related literature and completed the development of recommendations for transtioning the stiffened MGS installation adjacent to slopes to standard MGS on level terrian.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

Note that the original start date for the project was listed as October of 2019 with an end date in the 3Q of 2021 (Sept. 30, 2021). Authorization of for the project was not received until January 2020, so the end date has been pushed back accordingly to end of December 2021.

Currently, the full-scale testing has been delayed due to its status in the MwRSF testing que. COVID-19 has reduced available staff at the outdoor test facility, created increased employee leave, and created material procurement issues. These issues have created a backlog of testing at the facility. MwRSF is trying our best to resolve the test backlog, but delays are currently expected for most projects. We will continue to update the status of the full-scale testing and its effect on the overall project timeline.

Due to the delays noted above, MwRSF has requested and received an NCE to extend the project end date to 12/31/2022

Additional project needs within MwRSF's operations delayed completion of the summary report this quarter. MwRSF has requested and received a NCE until 7/31/23 to complete the summary report. The draft is nearly complete and sufficient funding remains in the project.

Anticipated Work Next Quarter:

In the next quarter, MwRSF anticipates working towards the completion of the summary report for the project.

Total Percentage of Project Completion:
76.5%

Research Project Quarterly Progress Report

Date: 4/30/2023 **Project Number:** TPF-5(430) Suppl. #34 - RPFP-FY2022-LS-DYNA

Project Title: LS-DYNA Modeling Enhancement Support

Principal Investigator: Bob Bielenberg

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2025

Quarter:	Period of Performance:	Quarterly Report Submittal Deadline:
☐ Quarter 1	July 1 – September 30	October 31
☐ Quarter 2	October 1 – December 31	January 31
☒ Quarter 3	January 1 – March 31	April 30
☐ Quarter 4	April 1 – June 30	July 31
☐ Quarter 5	July 1 – September 30	October 31
☐ Quarter 6	October 1 – December 31	January 31
☐ Quarter 7	January 1 – March 31	April 30

Project Schedule Status:

- ☒ **On Schedule**
- ☐ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. LS-DYNA Modeling Enhancement	$40,000.00	0	$0.00	0	$40,000.00
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

MwRSF will use this research funding to further research efforts and advance modeling techniques with LS-DYNA.

Current efforts in this area are being funded using existing funds under TPF-5(430) Suppl. #24, RPFP-21-LS-DYNA. Once that funding is depleted, we will convert to using funds from this effort.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

None

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0.0

Research Project Quarterly Progress Report

Date: 1/31/2023 **Project Number:** TPF-5(430) Suppl. 12 – FY20-WY-1-GATE: MASH 2016 Th 3

Project Title: Evaluation of Drop-Arm Road Closure Gate

Principal Investigator: R. Bielenberg and R. Faller,

Principal Contact Information Email: rbielenberg2@unl.edu **Phone:** (402) 472-9064

Project Start Date: 2/26/2020 **Project Completion Date:** 9/30/2022

Report Period: **Due Date:**

- ☐ Quarter 1 (July 1 – September 30) ---------- October 31
- ☐ Quarter 2 (October 1 – December 31)---------- January 31
- ☒ Quarter 3 (January 1 – March 31) ---------- April 30
- ☐ Quarter 4 (April 1 – June 30)---------- July 31

Project Schedule Status:

- ☐ **On Schedule**
- ☒ **On Approved Revised Schedule**
- ☐ **Ahead of Schedule**
- ☐ **Behind Schedule**

Progress:

Task	Total Budget	% work Completed This Quarter	Expenses This Quarter	Total % of Task Completed	Remaining Budget
1. Project Planning and Correspondence	$17,507.00	3.8%	$669.00	50.8%	$8,600.50
2. Design and Analysis	$10,862.00	0.0%	$0.00	75.1%	$2,708.34
3. Full-Scale Crash Testing	$185,441.00	0.0%	$0.00	43.6%	$104,527.00
4. Reporting and Project Deliverables	$16,147.00	0.0%	$0.00	0.0%	$16,147.00
5.					
6.					
7.					
8.					
9.					

Progress and Accomplishments this Quarter:

(Provide an informative summary of tasks/activities that occurred this quarter includes meetings, work plan status, significant progress, etc.)

Following the failure of the ffirst full-scale crash test of the system, WYDOT was presented with several options for moving forward.

1. WYDOT can choose continue moving forward with the higher speed tests. If those tests pass, they could choose to self-certify the road closure gate based on limited concerns for occupant risk in the low-speed test. This may not be the optimal path to take, but it has been chosen by some states. As such, I wanted to list it as an option.
2. MwRSF can suggest modifying the system to alleviate the windshield penetration and rerun test no. 3-60. Several options exist, including modifying the metal plate extension used for the gate arm guide U-bolt attachment to be shorter, have rounded edges, or to flare back the corners. These changes could reduce the potential for windshield penetration significantly. One could also consider redesign of the gate arm guide attachment to a c-clamp or other design that does not create the same windshield hazard. Design and retesting of the modified system would likely require additional funding at some point to complete the test matrix.
3. WYDOT could terminate the effort – although this may leave one without a crashworthy gate system.

WYDOT has indicated that they prefer option 2. MwRSF submitted an updated project budget and scope to WYDOT in 4Q 2021 and is currently awaiting approval to proceed.

Circumstances Affecting Project, Scope, or Budget:

(Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints, along with recommended solution to those problems.)

Currently, material shipping delays and delays to the overall MwRSF test que have put the project behind schedule. MwRSF will attempt to continue to meet the proposed schedule to the degree possible.

Currently, the full-scale testing has been delayed due to its status in the MwRSF testing que. COVID-19 has reduced avaiable staff at the outdoor test facility, created increased employee leave, and created material procurement issues. These issues have created a backlog of testing ath the facility. MwRSF is trying our best to resolve the test backlog, but delays are currently expected for most projects. We will continue to update the status of the full-scale testing and its effect on the overall project timeline.

Due to these delays, MwRSF has requested and received an NCE until 9/30/2022.

As noted previously, the failure of test no. WRCG-1 required revision of the scope and budget for the project. MwRSF revised these items and provided them to WYDOT for approval. MwRSF has not yet received approval to continue on this research effort.

MwRSF has yet to receive notice to proceed on the effort. MwRSF has requested an NCE until 9/30/2023, but has not received confirmation.

Anticipated Work Next Quarter:

In the next quarter, MwRSF will await approval to proceed based on the revised project scope. Once approval is obtained. MwRSF will work on development of design modifications and re-testing of the gate system.

Total Percentage of Project Completion:

42.6%