Research Project Quarterly Progress Report

Date: 8/5/2024 **Project Number:** TPF-5(430) SUPPL. #46

Project Title: ILDOT Steel Railing, Type SMX

Principal Investigator: Rosenbaugh, Loken, Faller, Bielenberg

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

Project Start Date: 12/2/2022 **Project Completion Date:** 12/31/2026

Report Period:

April 1, 2024 to June 30, 2024

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
Project Planning, CAD, and Communications	$19,489	100%	$8,583	$14,355	95%	$5,134
Fabrication of Test Article	$111,818	0%	$0	$0	0%	$111,818
Crash Test MASH 3-11	$73,768	0%	$0	$0	0%	$73,768
Repair of Test Article	$21,830	0%	$0	$0	0%	$21,830
Crash Test MASH 3-10	$58,108	0%	$0	$0	0%	$58,108
Removal, Disposal, and Site Restoration	$15,026	0%	$0	$0	0%	$15,026
Final Reporting and Filing FHWA Eligibility Letter	$19,424	0%	$0	$0	0%	$19,424
Total	$319,463	-	$8,583	$14,355	3%	$305,108

Progress and Accomplishments this Quarter:

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

In Q2 2024, test plans were finalized. Test plans are ready for transmission to the test site pending final review from ILDOT.

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 the end of May 2024.

No challenges have been encountered affecting the timeline of this project, and no significant delays are anticipated at this time.

Anticipated Work Next Quarter:

In Q3 2024, final drawings will be presented to ILDOT for final review prior to construction. Construction and testing of the test specimen is likely to occur in Q3 2024.

Total Percentage of Project Completion:

5%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. 27 – FY22-IND-1-PCB _ Phase I

Project Title: MASH 2016 TL-3 Design and Evaluation of the Indiana F-Shape PCB in Free-Standing, Asphalt-Anchored Configurations, and Transitions

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, CAD, and Reporting	$8,122.00	0	$264.00	82.7	$1,140.00
2. Full Scale Crash Testing	$99,975.00	0	$0.00	76.8	$23,215.00
3. Reporting and Project Deliverables	$7,705.00	0	$0.00	0	$7,705.00
4.					
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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: MwRSF received fianlization of the original contract in July 2023. Rescoping of the research effort was completed in August 2023. MwRSF is awaiting awarding of the contract in order to proceed. MwRSF met with NDOT and INDOT officials in June and it is believed that the effort will restart in the 3rd quarter of 2024.

2. Full Scale Crash Testing: None

3. Reporting and Project Deliverables: None

Note that the

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.)

Based on the failure of the full-scale crash test of the free-standing INDOT PCB, INDOT has requested that the project be rescoped to modify the barrier to meet MASH. MwRSF will attempt to rescope the effort to meet these goals in the upcoming quarter. It should be noted that the contract agreement for this research has was just officially completed in mid July 2203, and the rescope effort had to await the completion of the original contract so that a revised contract can be created with the rescope agreement.

The rescoped research effort was submitted in August 2023. MwRSF is awaiting final contract awarding prior to moving forward on the research. It is anticipated in 3Q 2024.

Anticipated Work Next Quarter:

1. Project Planning, CAD, and Reporting: MwRSF will begin work on the rescoped Phase I research effort when authorized.
2. Full Scale Crash Testing: None.
3. Reporting and Project Deliverables: None

Total Percentage of Project Completion:

72.3%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. 27 – FY22-IND-1-PCB _ Phase II

Project Title: MASH 2016 TL-3 Design and Evaluation of the Indiana F-Shape PCB in Free-Standing, Asphalt Anchored Configurations, and Transitions

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, CAD, and Reporting	$8,122.00	0	$0.00	0	$8,122.00
2. Full Scale Crash Testing	$126,812.00	0	$0.00	0	$126,812.00
3. Reporting and Project Deliverables	$7,705.00	0	$0.00	0	$7,705.00
4.					
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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: None
2. Full Scale Crash Testing: None
3. Reporting and Project Deliverables: None

Note that Phase II will not be initiated until the successful evaluation of the barrier system in Phase I.

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 failure of the free-standing PCB crash testing in Phase I of the effort has led to a rescoping of the project. As such, funds may be diverted from the Phases II and III research efforts to accommodate the rescope and project timelines and tasks may be adjusted accordingly.

Anticipated Work Next Quarter:

1. Project Planning, CAD, and Reporting: None
2. Full Scale Crash Testing: None
3. Reporting and Project Deliverables: None

Note that Phase II will not be initiated until the successful evaluation of the barrier system in Phase I.

Total Percentage of Project Completion:

0.0%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. 27 – FY22-IND-1-PCB _ Phase III

Project Title: MASH 2016 TL-3 Design and Evaluation of the Indiana F-Shape PCB in Free-Standing, Asphalt-Anchored Configurations, and Transitions

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, CAD, and Reporting	$17,433.00	0	$0.00	0	$17,433.00
2. Design and Analysis	$37,592.00	0	$0.00	0	$37,592.00
3. Full Scale Crash Testing	$202,961.00	0	$0.00	0	$202,961.00
4. Reporting and Project Deliverables	$13,704.00	0	$0.00	0	$13,704.00
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.)

1. Project Planning, CAD, and Reporting: None
2. Design and Analysis: None
3. Full Scale Crash Testing: None
4. Reporting and Project Deliverables: None

Note that Phase III will not be initiated until the successful evaluation of the barrier system in Phase I.

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 failure of the free-standing PCB crash testing in Phase I of the effort has led to a rescoping of the project. As such, funds may be diverted from the Phases II and III research efforts to accommodate the rescope and project timelines and tasks may be adjusted accordingly.

Anticipated Work Next Quarter:

1. Project Planning, CAD, and Reporting: None
2. Design and Analysis: None
3. Full Scale Crash Testing: None
4. Reporting and Project Deliverables: None

Note that Phase II will not be initiated until the successful evaluation of the barrier system in Phase I.

Total Percentage of Project Completion:

0.0%

Research Project Quarterly Progress Report

Date: 7/30/2024 **Project Number:** TPF-5(430) SUPPL. #47–FY22-MNDOT-1

Project Title: MASH TL-3 Thrie Beam Bullnose Installation Manual

Principal Investigator: Robert Bielenberg

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

Project Start Date: 12/2/2022 **Project Completion Date:** 12/31/2026

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	$36,540.00	0.0	$0.00	8.8	$33,328.00
2. Design and Analysis	$62,171.00	21.5	$13,370.00	63.8	$22,517.00
3. Reporting and Project Deliverables	$12,051.00	0	$0.00	0	$12,051.00
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. Design and Analysis - None

3. Reporting and Project Deliverables - MwRSF completed the final drraft of the manaul and provided all deliverables to MnDOT.

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.)

Delays occurred on the administrative side of the project related to the initiation of the project. The contract officially started in December 2022, but the contract was not awarded until July of 2023. As such, the contract award date was shifted from 12/2/2022 to 12/31/2026.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

1. Project Planning and Correspondence - None

2. Design and Analysis - None

3. Reporting and Project Deliverables - None

Total Percentage of Project Completion:

38.7% - Project completed. Final billing not yet complete.

Research Project Quarterly Progress Report

Date: 8/9/2024 **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 (12/31/2024)

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 & Correspondence	$27,155	0%	$0	$18,596	70%	$8,559
2. Design and Analysis	$106,064	100%	$678	$73,538	87%	$32,526
3. Bogie Testing	$99,897	0%	$0	$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	-	$678	$140,464	72%	$110,965

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 April 2024, the Pooled Fund sponsors were given an update on the project status and progress during the Annual Meeting of the Midwest Pooled Fund Program. Discussions on post design lead to the conclusion that both a 2-bolt and 4-bolt design would be applicable for the plastically deforming W6x15 AGT post.

The project was set to close at the end of 2023, however significant funds remained in the project. Thus, an NCE was submit to extend the project and allow time to investigate foundation requirements.

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 May 2024.

The project was behind schedule, and a request for a no-cost extension was submit in late 2022. The NCE was granted and the end date was updated to 12/31/2023. A second no-cost extension request was submit in November 2023 (along with a few other Pooled Fund Year 30 projects). This NCE was accepted in the 1st quarter of 2024 and extended the project to the end of 2024.

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:

72%

Research Project Quarterly Progress Report

Date: 7/30/2024 **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:** 12/31/2024

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 % 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%	$0.00	98.0%	$3,564.00
3. Design & Analysis	$39,381.00	9.8	$3,863.00	80.8	$7,571.00
4. Reporting & Deliverables	$22,074.00	0%	$0.00	0%	$22,074.00
5.					
6.					
7.					
8.					
9. Total	$257,208.00	1.5%	$3,863.00	84.5%	$39,888.00

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 worked on further documentation and analysis of the full-scasle testing, development of recommendations for end terminals and curbs, and 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 received a NCE until 12/31/24 as funding remains available in the project.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

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

Total Percentage of Project Completion:
84.5%

Research Project Quarterly Progress Report

Date: 7/30/2024 **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:** 12/31/2024

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 % 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	8.8	$15,498.00	83.9	$28,481.00
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 a short-radius system that dissipates energy through inertial resistance. The simulation effort focused on simulation of additonal impact conditions/locations on the system and determining potential feasiblity issues with the design concept. Results of the simulations were mixed. As such the research team is weighing potential alternative paths for the concept.

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 received approval for a NCE until 12/31/24 as funding remains available in the project.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

MwRSF will make additional progress on simulation of the inertial post short-radius concept. MwRSF will also setup a meeting to review the results to date with sponsors and determine the best path moving forward for the concept as well as other potential options for treatment of intersecting roadways.

Total Percentage of Project Completion:
63.9

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **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 4	4/1/24 - 6/30/24	7/31/24

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	0%	$0.00	90%	$1,131.00
2. Full-Scale Crash Testing	$217,148.00	2%	$2,201.00	90%	$2,265.00
3. Reporting & Project Deliverables	$19,887.00	0%	$0.00	0%	$19,887.00
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.)

Completed internal draft research report. Initiated internal review.

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 internal review of draft report. Potentially submit to sponsors for review

Total Percentage of Project Completion:

80%

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/30/2024 **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:** 12/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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	11.5	$1,539.00	45.6	$7,285.00
2. Design and Analysis	$59,224.00	0	$0.00	100	$0.00
3. Full-Scale Crash / Bogie Testing	$122,413.00	0	$0.00	99.7	$406.00
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.)

In this quarter, MwRSF worked toward the completion of the summary report detailing the design, simulation, and full-scale crash testing.

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.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

In the next quarter, MwRSF will work towards completion of the summary report.

Total Percentage of Project Completion:

83.5%

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/30/2024 **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:** 12/31/2024

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 7/31/24	7/31/2024

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	3.3	$2,665.00	50.5	$40,426.00
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 worked on developing simulation models of the final prototype of the barrier design. Simulations of were conducted on an 8 ft long segment length with revised reinforcement.

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.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

In the next quarter, MwRSF will continue analysis of the staggered, interlocking PCB concept. This will include simulation of the final prototype system with variable gaps between the barrier segments.

MwRSF will also attempt to setup a meeting with manufacturers for feedback on the design and fabrication of prototypes.

Total Percentage of Project Completion:

32.1

Research Project Quarterly Progress Report

Date: 8/9/2024 **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:** 12/31/2024

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	50%	$628	$12,280	50%	$14,845
2. Design and Analysis	$87,468	50%	$1,000	$55,521	70%	$31,947
3. Reporting and Project Deliverables	$31,548	0%	$0	$0	0%	$31,548
4.						
5.						
6.						
7.						
8. Total	$146,141	-	$1,628	$67,801	50%	$78,340

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 this quarter was focused on final calibrations to the AGT models. Speciafically, the soil resistances for ¼-spacing posts in the downstream region of the AGT models appeared to be a little too stiff on the downstream end, so those resistances were softened to better reflect the actual physical crash tests.

Curbs and elevated sidewalks were then added to the validated AGT models to prepare for conducting MASH 3-11 impacts into the AGTS behind elevated sidewalks.

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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 May 2024.

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 Spring of 2023.

Anticipated Work Next Quarter:

MASH 3-11 impacts into the AGT behind curb will begin to be simulated.

Total Percentage of Project Completion:

50%

Research Project Quarterly Progress Report

Date: 8/9/2024 **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:** 12/31/2024

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	$4,705	100%	$0
2. Full-Scale Crash Testing	$109,854	70%	$21,836	$109,854	100%	$0
3. Reporting and Project Deliverables	$6,748	30%	$6,748	$6,748	100%	$0
4.						
5.						
6.						
7.						
8. Total	$121,307	-	$28,584	$121,307	100%	$0

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, two crash tests were successfully conducted on the downstream end of an AGT flared away from the roadway at a 25:1 rate. This configuration passed both MASH 3-10 and 3-11. More recently, both MASH tests were conducted on the upstream stiffness transition near the W-to-thrie transition region.

Test FLAGT-6 was conducted according to MASH test 3-10 with the 1100C small car. The vehicle was contained and redirected back toward the roadway. The front bumper and wheel did wedge under the W-to-thrie transition segment and made significant contact with the guardrail posts (at half-post spacing – 37.5"). this snag caused the car to yaw back toward the system and come to rest in front of the thrie beam region of the AGT. However, this snag was not enough to violate occupant risk criteria as all OIV and ORA values were within MASH limits. The maximum occupant compartment deformations were limited to 1.5 in. in the floorpan. Thus, FLAGT-6 passed MASH 3-10 criteria.

Test FLAGT-7 was conducted according to MASH 3-11 with the 2270P pickup truck. The vehicle was contained and smoothly redirected. The front wheel of the pickup snagged on a few guardrail posts and disengaged from the vehicle. However, the vehicle remained stable and all occupant risk measurements were within MASH limits. Thus, FLAGT-7 passed MASH 3-11 criteria.

Work has also been conducted to document all seven crash tests conducted as part of this research project. There are internal drafts for the first two tests currently being reviewed.

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.)

During Phase II of the flared AGT project, tests FLAGT-1 through FLAGT-3 failed to meet MASH performance criteria. As such, the project has had to be re-scoped and system has had to be redesigned and the tests re-run. Additional project funds were necessary to complete the full-scale testing on flared AGTs. A Phase III was approved as part of the FY 2021 program, and Phase IV of the project was funded in FY 2023.

The budget numbers presented herein include labor charges through May 2024.

This PHASE III of the project is not out of funds, so it will be closed and all future work will be charged to the PHASE IV efforts - project number TPF-5(430) Suppl. #38.

Anticipated Work Next Quarter:

Project reports will be written for all of the crash testing conducted as part of this project. To avoid confusion, each system configuration will be documented separately (own report). Thus, each of the first three failed tests will be documented in individual reports, while the four successful tests will be contained within a single report.

This PHASE III of the flared AGT project will close, and all work will be documented in the Phase IV project, project number TPF-5(430) Suppl. #38.

Total Percentage of Project Completion:
100%

Research Project Quarterly Progress Report

Date: 7/31/2024 **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:** 12/31/2024

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	0	$0	100	$0.00
2. Sign Configuration Analysis & Selection	$28,702.00	15	$3,000	70	$3,336
3. Research Report & Deliverables	$27,357.00	5	$1,534	45	$4,759
4.					
5.					
6.					
7.					
8.					
9. TOTAL	$77,740.00	5	$4,534	67	$8,095

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 – Reviewed state responses to survey.

Task 2 – Continued reviewing analysis methodology for breakaway sign supports from literature. Compared calculated velocity changes (proxy OIVs) from calculations to results from past crash tests.

Task 3 – Continued documentation of findings from Task 1 and methodology for Task 2.

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 – None anticipated.

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

Task 3 – Extend documentation to include survey results and preliminary analysis findings.

Total Percentage of Project Completion:

67%

Research Project Quarterly Progress Report

Date: 08/21/2024 **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:** 12/31/2024

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	0%	$0	$66,665	100%	$0
2. Design and Analysis	$162,291	20.54%	$33,334	$108,617	66.93%	$53,674
3. Reporting and Project Deliverables	$40,509	27.15%	$11,000	$11,000	27.15%	$29,509
4.						
5.						
6. Total	$269,455	16.45%	$44,334	$186,282	69.13%	$83,183

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, efforts were reported to investigate the poles mounted on 4-bolt slip bases with various pole heights and weights. The report is currently undergoing internal review.

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 include labor charges until end of June 2024.

Anticipated Work Next Quarter:

In the upcoming quarter, the report will be finalized and need for additional simulations will be investigated.

Total Percentage of Project Completion:

69.1%

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **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 4	4/1/24 - 6/30/24	7/31/24

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	10%	$4,077.00	65%	$5,329.00
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.)

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:

65%

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/30/2024 **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 4	4/1/24 - 7/31/24	7/31/2024

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	4.7	$2,041.00	100.0	$0.00
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 researchers used the LS-DYNA funding to investigate the implementation of advanced guardrail steel fracture models into existing models of the MGS. a baseline model of the steel fracture material input was developed and validated against existing static component testing. Additionally, a draft of a research paper was developed to document the effort. Research is also in progress to develop mesh size dependency data and adjustements for the material model.

Next quarter, the team will publish the paper and try to implement the material model with existing models of the MGS.

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

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

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:

100%

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **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:** 7/31/2026

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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	1%	$1,000.00	1%	$24,602.00
2. Design & Analysis	$18,893.00	1%	$500.00	96%	$133.00
3. Full-Scale Crash Testing	$203,413.00	1%	$2,530.00	7%	$193,996.00
4.	$14,866.00	0%	$0.00	0%	$14,866.00
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.)

Constructing system in between other higher priority 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.)

Signed contracts for the project were not received until July 2023. Thus, the project close date was shifted back 1 year to account for this delay and allow 3 years for the project to be completed.

Anticipated Work Next Quarter:

System construction. Potentially conduct first test in the test series.

Total Percentage of Project Completion:

12%

Research Project Quarterly Progress Report

Date: 8/9/2024 **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:** 7/31/2026

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	50%	$7,000	$14,956	35%	$29,713
2. Design and Analysis	$69,511	50%	$8,432	$11,432	25%	$58,079
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	-	$15,432	$26,388	10%	$191,452

Progress and Accomplishments this Quarter:

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

The design process began with concept development. It was noted early on, that directly mounting a W6x8.5 to a surface slab would result in a stronger/stiffer post than a standard guardrail post embedded in soil. Thus, the post would need to incorporate a weakening mechanism of some kind. During the April meeting of the Midwest Pooled Fund Sponsors, two design concepts were discussed and selected for further evaluation: (1) a post with weakening slots in the compression flange that causes premature buckling of the post and absorbs energy through plastic deformation of the post and (2) a symmetric post with a thinner base plate that will absorb energy through plate deformations. Note the 2nd option may work for median applications as it is symmetric.

Both options are currently being evaluated using LS-DYNA model simulations. Results of test AGTRB-7 and AGTRB-8 were used to calibrate a steel post and baseplate material model using LS-DYNA, and the calibrated model was then tuned to predict loads and energy absorption for concepts of surface-mounted post designs. A parametric study is being conducted to evaluate various slot sizes, base plate thicknesses, and anchor bolt patterns.

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 May 2024.

Signed contracts for the project were not received until August of 2023. Thus, the project close date was shifted back 1 year to account for this delay and allow 3 years for the project to be completed.

Anticipated Work Next Quarter:

Work will continue on the modeling and simulation efforts to optimize the post configurations for the noted design concepts.

Total Percentage of Project Completion:

10%

Research Project Quarterly Progress Report

Date: 8/9/2024 **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:** 7/31/2026

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	100%	$529	$1,764	5%	$40,786
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	-	$529	$1,764	1%	$232,124

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. Midwest Pooled Fund efforts have been focused on other Pooled-Fund projects with higher priority (e.g., older Pooled Fund projects that were closing).

Charges this quarter were administrative and project communication related.

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 May 2024.

Signed contracts for the project were not received until August of 2023. Thus, the project close date was shifted back 1 year to account for this delay and allow 3 years for the project to be completed.

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:

1%

Research Project Quarterly Progress Report

Date: 7/30/2024 **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	1.6	$402.00	1.6	$24,687.00
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:

0.1

Research Project Quarterly Progress Report

Date: 8/6/2024 **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) 472-906

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2026

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	$38,845.00	11.4	$4,424.07	34.5	$25,438.23
2. Design and Analysis	$85,108.00	19.6	$16,642.93	66.2	$28,787.11
3. Reporting and Project Deliverables	$31,279.00	0	$0.00	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: Internal meetings to discuss LS-DYNA results

2. Design and Analysis: LS-DYNA simulation development was completed. All alternate anchor pin configurations with different impact points including saddle caps were simulated.

3. Reporting and Project Deliverables: None

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 work toward completing simulations of alternate anchor pin configuations and impact points without saddle caps.

Total Percentage of Project Completion:

44.9

Research Project Quarterly Progress Report

Date: 7/30/2024 **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	15.3	$9,939.00	51.8	$31,323.00
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.)

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:
51.8

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **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, Steelman, Stolle

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

Project Start Date: 7/1/2022 **Project Completion Date:** 7/31/2026

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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%	$47.00	0%	$10,725.00
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.)

Project progress is listed in Project No. RPFP-21-MPFW-TPF-5(430) Supplment #23

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.

Signed contracts for the project were not received until July 2023. Thus, the project close date was shifted back 1 year to account for this delay and allow 3 years for the project to be completed.

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 7/30/2024 **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	36.5	$14,585.00	51.9	$20,774.00
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 researchers used the LS-DYNA funding to investigate the implementation of advanced guardrail steel fracture models into existing models of the MGS. a baseline model of the steel fracture material input was developed and validated against existing static component testing. Additionally, a draft of a research paper was developed to document the effort. Research is also in progress to develop mesh size dependency data and adjustements for the material model.

Next quarter, the team will publish the paper and try to implement the material model with existing models of the MGS.

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

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

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:

11.6

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. #37, RPFP-FY2023-MGS-1

Project Title: Modification & evaluation of the MGS Long Span with Increase Span Length

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

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

Project Start Date: 12/1/2022 **Project Completion Date:** 12/31/2026

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/243 - 6/30/243	7/31/24

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	$28,003.00	0%	$298.00	0%	$27,448.00
2. Full-Scale Crash Testing	$331,604.00	0%	$0.00	0%	$331,604.00
3. Reporting & Project Deliverables	$18,263.00	0%	$0.00	0%	$18,263.00
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.)

None

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.)

Signed contracts for the project were not received until July 2023.

Anticipated Work Next Quarter:

Review proposed modifications from previously completed study. Create survey of options for member states.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 8/9/2024 **Project Number:** TPF-5(430) Suppl. #38

Project Title: Guidelines for Flaring AGTs, Phase IV

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

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

Project Start Date: 12/2/2022 **Project Completion Date:** 12/31/2026

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	$26,727	20%	$10,000	$10,098	40%	$16,629
2. Crash Testing MASH TL-3	$262,333	80%	$47,059	$47,059	25%	$215,274
3. Reporting and Project Deliverables	$21,531	0%	$0	$0	0%	$21,531
4.						
5.						
6.						
7.						
8. Total	$310,591	-	$57,059	$57,157	20%	$253,404

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, two crash tests were successfully conducted on the downstream end of an AGT flared away from the roadway at a 25:1 rate. This configuration passed both MASH 3-10 and 3-11. More recently, both MASH tests were conducted on the upstream stiffness transition near the W-to-thrie transition region.

Test FLAGT-6 was conducted according to MASH test 3-10 with the 1100C small car. The vehicle was contained and redirected back toward the roadway. The front bumper and wheel did wedge under the W-to-thrie transition segment and made significant contact with the guardrail posts (at half-post spacing – 37.5”). this snag caused the car to yaw back toward the system and come to rest in front of the thrie beam region of the AGT. However, this snag was not enough to violate occupant risk criteria as all OIV and ORA values were within MASH limits. The maximum occupant compartment deformations were limited to 1.5 in. in the floorpan. Thus, FLAGT-6 passed MASH 3-10 criteria.

Test FLAGT-7 was conducted according to MASH 3-11 with the 2270P pickup truck. The vehicle was contained and smoothly redirected. The front wheel of the pickup snagged on a few guardrail posts and disengaged from the vehicle. However, the vehicle remained stable and all occupant risk measurements were within MASH limits. Thus, FLAGT-7 passed MASH 3-11 criteria.

Work has also been conducted to document all seven crash tests conducted as part of this research project. There are internal drafts for the first two tests currently being reviewed.

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.)

During Phase II of the project, tests FLAGT-1 through FLAGT-3 failed to meet MASH performance criteria. As such, the project has had to be re-scoped and system has had to be redesigned and the tests re-run. Additional project funds were necessary to complete the full-scale testing on flared AGTs. A Phase III was approved as part of the FY 2021 program, and Phase IV of the project was funded in FY 2023.

Phase III of the project (TPF-5(430)_Supplement 19) ran out of funds during Q2 of 2024. Thus, charges for this research effort started to be applied to this project’s (Phase IV) funds in Q2 2024.

The budget numbers presented herein include labor charges through May 2024.

Anticipated Work Next Quarter:

The test site will be cleaned up and the damaged system will be removed and disposed.

Project reports will be written for all of the crash testing conducted as part of this project. To avoid confusion, each system configuration will be documented separately (own report). Thus, each of the first three failed tests will be documented in individual reports, while the four successful tests will be contained within a single report.

Total Percentage of Project Completion:
20%

Research Project Quarterly Progress Report

Date: 8/5/2023 **Project Number:** TPF-5(430) -Suppl #39

Project Title: PF23 GET-1: Generic End Terminal - Further Development and Evaluation

Principal Investigator: Cody Stolle

Principal Contact Information Email: cstolle2@unl.edu **Phone:** (402) 472-4233

Project Start Date: 12/2/2022 **Project Completion Date:** 12/31/2026

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 & CAD	$43,537.00	1%	$297.00	12%	$35,281.00
2. Analysis, Design, Sysetm Modifications	$21,150.00	21%	$4,450.00	51%	$10,025.00
3. Dynamic Bogie Tests	$93,155.00	5%	$19,047.00	31%	$64,738.00
4. Full-Scale Tests	$253,095.00	0%	$0.00	0%	$253,095.00
5. Report	$26,289.00	0%	$0.00	0%	$26,289.00
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.)

Prototype impact heads were received. Test plans were finalized and materials for performing tests were ordered. Mill certs were reviewed for test plan materials.

Component testing is awaiting queue for installation and testing, which is anticipated in the fall of 2024.

Researchers engaged in further discussions with potential manufacturers for alternative concepts and 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.)

Project is awaiting installation and testing in MwRSF pit. Planning completed to prepare for rapid-succession testing if results of tests are acceptable.

Anticipated Work Next Quarter:

The "pull" and "push" tests of the terminal will be conducted. The research team will analyze results and determine if full-scale testing is ready or if additional modification or redesign are warranted. Full-scale system test plans will be developed. Using the same system for the bogie testing, it is anticipated that the system will be rebuilt retested, pending acceptable outcome of the bogie testing.

Test plans are at MwRSF test site awaiting installation and testing.

Total Percentage of Project Completion:

10.2%

Research Project Quarterly Progress Report

Date: 5/1/2024 **Project Number:** PF23 MWQA-1

Project Title: Continuted revisions to MwRSF Pooled Fund Q&A website

Principal Investigator: Cody Stolle

Principal Contact Information Email: cstolle2@unl.edu **Phone:** (402) 472-4233

Project Start Date: 12/2/2022 **Project Completion Date:** 12/31/2026

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 & CAD	$6,815.00	2.5%	$170.00	3.3%	$6,593.00
2. Design and Analysis	$34,277.00	0%	$0.00	0%	$29,711.00
3. Reporting and Project Deliverables	$4,329.00	0%	$0.00	0%	$4,329.00
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.)

Website contractors are still delayed in implementing feedback from the PF Year 29 study. Further work is paused until previously-completed research is added to website and the research team is able to confirm it will function as desired.

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.)

Delays with the web programming team have been prolonged and difficult. Significant turnover at the hired agency and uncompleted work on paid funds are delaying project progress. Progress will resume as soon as the existing recommended updates are implemented.

Anticipated Work Next Quarter:

Upon completion of the website updates, the research team will review the updated website format, content, and data. The prototype website may be sent to state DOTs for initial review and commenting. The research team will then begin the process of reviewing additioanl questions on the Q&A site and updating content again with new filters, links, categories, and attributes to continue the work of PF Year 29 project.

Total Percentage of Project Completion:

1.3

Research Project Quarterly Progress Report

Date: 7/30/2024 **Project Number:** RPFP-FY2023-AUTO-1

Project Title: PF23 AUTO-1: Coordination & Collaboration w/ Vehicle Manufacturers & Auto Industry

Principal Investigator: Bob Bielenberg, Cody Stolle, Ron Faller

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

Project Start Date: 12/2/2022 **Project Completion Date:** 12/31/2026

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.	$40,000.00	39.3	$15,713.00	53.4	$21,359.00
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 continued collaboration efforts. MwRSF collaborated with Tesla engineers to bring Tesla to the 2024 IRSC conference in Orlando Florida. Tesla presented in a panel session with MwRSF and IIHS representatives. Additionally, MwRSF has continued efforts to work with IIHS in contacting other automotive groups.

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

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

MwRSF will continue to discuss potential automotive research conference papers to submit and attend. Papers will focus and potential areas of overalp between roadside safety design and automotive safety as well as potential issues between EVs and current roadside hardware.

Total Percentage of Project Completion:

53.4

Research Project Quarterly Progress Report

Date: 7/30/2024 **Project Number:** TPF-5(430) Suppl. #42 - RPFP-FY2023-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: 12/2/2022 **Project Completion Date:** 12/31/2026

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: 7/31/2024 **Project Number:** TPF-5(430) Suppl. #43, RPFP-FY2023-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: 12/1/2022 **Project Completion Date:** 12/31/2026

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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	$12,868.00	0%	$0.00	0%	$12,868.00
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.)

None

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-22-MPFW – TPF-5(430) Supplement #34, Project Title: Midwest Pooled Fund Website have been exhaused.

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 7/30/2024 **Project Number:** TPF-5(430) Suppl. #44 - 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: 12/2/2022 **Project Completion Date:** 12/31/2026

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	30.5	$12,216.00	30.5	$27,784.00
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 researchers used the LS-DYNA funding to investigate the implementation of advanced guardrail steel fracture models into existing models of the MGS. a baseline model of the steel fracture material input was developed and validated against existing static component testing. Additionally, a draft of a research paper was developed to document the effort. Research is also in progress to develop mesh size dependency data and adjustements for the material model.

Next quarter, the team will publish the paper and try to implement the material model with existing models of the MGS.

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

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

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:

30.5

Research Project Quarterly Progress Report

Date: 7/24/2024 **Project Number:** RPFP-FY2024-CONC-3

Project Title: PF24 CONC-3: Grade-Separated Concrete Median Barirer

Principal Investigator: Tewodros Yosef, Ron Faller, Andrew Loken, Josh Steelman, Scott Rosenbaugh

Principal Contact Information Email: tyosef2@unl.edu **Phone:** (402) 472-2019

Project Start Date: 2/20/2024 **Project Completion Date:** 6/30/2027

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	$56,337.00	0%	$0.00	0%	$56,337.00
2. Design and Analysis	$112,046.00	0%	$0.00	0%	$112,046.00
3. Reporting and Project Deliverables	$45,197.00	0%	$0.00	0%	$45,197.00
4.					
5.					
6.					
7.					
8.					
9. Total	$213,580.00	0%	$0.00	0%	$213,580.00

Progress and Accomplishments this Quarter:

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

Task 1: Project Planning and Correspondence

Status: No progress

Task 2: Design and Analysis

Status: No progress

Task 3: Reporting and Project Deliverables

Status: No progress

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: Project Planning and Correspondence - Literature Review

In the next quarter, MwRSF researchers will initiate a literature review focusing on several key areas: retaining wall design and analysis methodologies under impact conditions, concrete barrier design, and dynamic soil response to impact loading. Additional review efforts will be dedicated to examining previous analytical, numerical, and experimental research related to retaining structures subjected to dynamic loads.

The literature review will encompass research efforts on similar systems, including the analysis and design of concrete barriers on mechanically stabilized earth (MSE) retaining walls, barrier-moment slab systems, full-scale crash testing, and computer simulation of concrete median barriers on MSE walls. The review will critically analyze and describe relevant national and international research based on several criteria: the applicability of the methodologies, the conclusiveness of the research findings, and their utility in developing a MASH TL-4 grade-separated concrete median barrier/wall.

Task 2: Design and Analysis – None Anticipated

Task 3: Reporting and Project Deliverables – None Anticipated

Total Percentage of Project Completion:
0.0

Research Project Quarterly Progress Report

Date: 8/9/2024 **Project Number:** TPF-5(430) Suppl. #54

Project Title: Guidelines for Concrete Median Barrier Anchorage to Slabs

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

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

Project Start Date: 2/20/2024 **Project Completion Date:** 6/30/2027

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	$24,085	0%	$669	$1,235	1%	$24,085
2. Design and Analysis	$93,302	0%	$0	$0	0%	$93,302
3. Dynamic Component Tests	$155,150	0%	$0	$0	0%	$155,150
4. Reporting and Deliverables	$37,378	0%	$0	$0	0%	$37,378
5.						
6.						
7.						
8.						
9. Total	$309,915	-	$0	$0	0%	$309,915

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. This project has just begun and MwRSF has been focusing efforts on other Pooled Fund projects with higher priority (e.g., those closing soon).

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 May 2024.

Signed contracts for the project were not received until February of 2024. Thus, the project close date was shifted back to June 2027.

Anticipated Work Next Quarter:

The research project will begin with a literature review covering concrete barrier strength analysis and barrier anchorage requirements. The literature review will include full–scale crash testing of concrete barriers with various anchorage configurations and numeric simulation efforts concerning impact loading of concrete structures. The data points and knowledge obtained from the literature review will be used to guide the design of the barrier segments evaluated in physical component testing.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. #55, RPFP-24-MGS-1

Project Title: W-Beam and Thrie Beam Splice Joint Redesign – Phase I

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

Principal Contact Information Email: joshua.steelman@unl.edu **Phone:**

Project Start Date: 2/20/2024 **Project Completion Date:** 6/30/2027

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 Background	$21,831	0	$0	0	$21,831
2. Design and Analysis	$35,295	0	$0	0	$35,295
3. Reporting and Project Deliverables	$28,966	0	$0	0	$28,966
4.					
5.					
6.					
7.					
8.					
9. TOTAL	$86,092	0	$0	0	$86,092

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 – No progress.

Task 2 – No progress.

Task 3 – No progress.

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 – Initiate literature review and patent search.

Task 2 – None anticipated.

Task 3 – None anticipated.

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) SUPPL. #56-RPFP-FY2024-MGS-2

Project Title: Reduced Grading for the MGS Long-Span Guardrail System

Principal Investigator: Robert Bielenberg

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

Project Start Date: 4/23/2024 **Project Completion Date:** 06/30/2026

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	$19,460.00	0	$0.00	0	$19,460.00
2. Full-Scale Crash Testing	$209,617.00	0	$0.00	0	$209,617.00
3. Reporting and Project Deliverables	$22,514.00	0	$0.00	0	$22,514.00
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

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 this project is a follow on study with additional testing for an existing WisDOT project to evaluate the long span with reduced grading. That project is currently underway. As such, this effort will not be addressed until the full-scale testing in the exisitng is completed.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

None.

Total Percentage of Project Completion:

0.0

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. #57, RPFP-FY2024-THRIE-1

Project Title: Development of Limited Deflection MASH TL-4 Thrie Beam Guardrail

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

Principal Contact Information Email: mojdeh.pajouh@unl.edu **Phone:** (402) 472-920

Project Start Date: 2/20/2024 **Project Completion Date:** 6/30/2027

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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, CADD	$30,804.00	0%	$0.00	0%	$30,804.00
2. Design, Analysis, LS-DYNA	$117,463.00	0%	$0.00	0%	$117,463.00
3. Reporting & Project Deliverables	$35,995.00	0%	$0.00	0%	$35,995.00
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.)

None

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%

Pooled Fund
Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) Suppl. #58, RPFP-FY2024-GET-1

Project Title: Development of a Generic End Terminal - Phase IV

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

Principal Contact Information Email: cstolle2@unl.edu **Phone:** (402) 472-4233

Project Start Date: 2/20/2024 **Project Completion Date:** 6/30/2027

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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, CADD	$12,972.00	0%	$0.00	0%	$12,972.00
2. Design & Analysis	$0.00	0%	$0.00	0%	$0.00
3. Full-Scale Crash Testing	$125,557.00	0%	$0.00	0%	$125,557.00
4. Reporting & Project Deliverables	$0.00	0%	$0.00	0%	$0.00
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.)

None

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: RPFP-FY2024-GET-1 is a continuation of existing generic end terminal research. The Midwest Pooled Fund States requested that this project be funded to the extent possible in FY2024. The cost for a single full-scale crash test and reporting was determined to be $163,392. This amount would force the total funding to exceed the FY2024 Midwest Pooled Fund Program total funding of $1,514,998 by $24,863. As such, $138,529 will be applied to RPFP-FY2024-GET-1 in FY2024. MwRSF will attempt to perform as much of the research within the available funding as possible. With the current funding level, the reporting of the research effort will need to be funded in a subsequent funding period in order to complete the effort.

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 8/5/2024 **Project Number:** RPFP-FY2024-AUTO-1

Project Title: LS-DYNA Investigation of Electric Vehicles and Roadside Hardware

Principal Investigator: A. Loken, R. Bielenberg, C. Stolle, R. Faller

Principal Contact Information Email: aloken2@unl.edu **Phone:** (402) 417-4694

Project Start Date: April 1, 2024 **Project Completion Date:** March 31, 2027

Report Period:

April 1, 2024 to June 30, 2024

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
Project Planning and Communications	$22,014	90%	0	0	1%	$22,014
EV Selection, Conversion, and Simplification	$48,625	10%	0	0	1%	$48,625
EV Impact Simulations with Roadside Hardware	$55,852	0%	0	0	0%	$55,852
Final Reporting	$15,828	0%	0	0	0%	$15,828
Total	$142,319	100%	0	0	1%	$142,319

Progress and Accomplishments this Quarter:

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

In Q2 2024, preliminary project planning was initiated. The Tesla Model 3 has been tentatively selected as the top priority vehicle for this research effort; however, this selection may be subject to change based on sponsor feedback. An internal kickoff meeting was held to discuss the general work plan and formally initiate the research effort. Model unit conversion to the MwRSF standard was begun on the Tesla Model 3.

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 the end of May 2024. No work was performed on this project prior to June 2024 – therefore, current expenditures total $0.

No challenges have been encountered affecting the timeline of this project, and no significant delays are anticipated at this time.

Anticipated Work Next Quarter:

In Q3 2024, the LS-DYNA input deck will be reorganized, revised, and annotated for more efficient use. Baseline NCAP simulations will also be executed in Q3 2024.

Total Percentage of Project Completion:

1%

Research Project Quarterly Progress Report

Date: 7/30/2024 **Project Number:** TPF-5(430) Suppl. #60 - RPFP-FY2024-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: 12/2/2022 **Project Completion Date:** 12/31/2026

Quarter:	Period of Performance:	Quarterly Report Submittal Deadline:
☐ Quarter 1	July 1 – September 30	October 31
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☐ 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: 7/31/2024 **Project Number:** TPF-5(430) Suppl. #61, RPFP-FY2024-MPFW

Project Title: Midwest Pooled Fund Website

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

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

Project Start Date: 2/20/2024 **Project Completion Date:** 6/30/2027

Identify Quarter:	Identify Period of Performance:	Identify Quarterly Report Submittal Deadline:
Quarter 4	4/1/24 - 6/30/24	7/31/24

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	$12,571.00	0%	$0.00	0%	$12,571.00
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.)

None

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-FY2023-MPFW – TPF-5(430) Supplement #43, Project Title: Midwest Pooled Fund Website have been exhaused.

Anticipated Work Next Quarter:

None

Total Percentage of Project Completion:

0%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) SUPPL. #62-RPFP-FY2024-LS-DYNA

Project Title: LS-DYNA Modeling Enhancement Support

Principal Investigator: Robert Bielenberg

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

Project Start Date: 4/23/2024 **Project Completion Date:** 06/30/2026

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. F					
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 researchers used the LS-DYNA funding to investigate the implementation of advanced guardrail steel fracture models into existing models of the MGS. a baseline model of the steel fracture material input was developed and validated against existing static component testing. Additionally, a draft of a research paper was developed to document the effort. Research is also in progress to develop mesh size dependency data and adjustements for the material model.

Next quarter, the team will publish the paper and try to implement the material model with existing models of the MGS.

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

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

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:

0.0

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) – Suppl. #26

Project Title: FY2022-WISDOT-1: Reduced Grading for the MGS Long-Span Guardrail System – Phase I

Principal Investigator: Robert Bielenberg

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

Project Start Date: 6/30/2021 **Project Completion Date:** 12/31/2026

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	$20,172.00	4.1	$827.00	20.3	$16,607.07
2. Design and Analysis	$11,731.00	0	$0.00	0	$11,731.00
3. Full-Scale Crash Testing	$171,067.00	0	$0.00	0	$171,067.00
4. Reporting and Project Deliverables	$17,801.00	0	$0.00	0	$17,801.00
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.)

1. Project Planning and Correspondence

- In this quarter, MwRSF developed draft test plans and made edits on those plans. The test plans are currently with the field staff for material ordering and system construction.

2. Design and Analysis

- None

3. Full-Scale Crash Testing

- None

4. Reporting and Project Deliverables

- None

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 current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

In the upcoming quarter, MwRSF will work towards procurement of materials for the test system and

Total Percentage of Project Completion:
1.9

Research Project Quarterly Progress Report

Date: 07/23/2024 **Project Number:** TPF-5(430) Suppl. #48, RPFP-FY23-WISDOT-SLOPE-1

Project Title: Guidance for MGS Installed Adjacent to Steep Slopes at Variable Offsets – Phase I

Principal Investigator: Faller, R.K., Bielenberg, R.W., Pajouh M.A., Tewodros Yosef, and Brandon Perry

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

Project Start Date: 12/02/2022 **Project Completion Date:** 12/31/2026

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	$19,994	14.4%	$2,894	$5,764	28.8%	$14,230
2. Dynamic Component Testing	$99,482	0%	$0	$0	0%	$99,482
3. Analysis, Design, and LS-DYNA Simulation	$90,830	0%	$0	$0	0%	$90,830
4. Reporting and Project Deliverables	$29,341	0%	$0	$0	0%	$29,341
Total	$239,647	1.2%	$2,894	$5,764	2.4%	$233,883

Progress and Accomplishments this Quarter:

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

In the past quarter, the research team finalized and dispatched the test plans for six dynamic component tests to the test site. These tests are now scheduled in our testing queue.

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 solutions to those problems.)

None

The project costs detailed in this report encompass all labor charges incurred up to the end of June 2024.

Anticipated Work Next Quarter:

Six dynamic bogie tests will be conducted in the upcoming quarter, encompassing three distinct post and slope offset configurations. Specifically, the tests will include:

1. Two tests using 6 ft long W6x16 posts at the slope break point (SBP) of a 2:1 slope.
2. Two tests using 7 ft long W6x16 posts at the SBP of a 2:1 slope.
3. Two tests using 7 ft long W6x16 posts on level terrain.

The data collected from these dynamic component tests, including force vs. displacement and energy vs. displacement responses, will be analyzed and compared to previous dynamic bogie testing of standard guardrail posts on level terrain. Additionally, this data will be utilized to develop post-soil resistance inputs for computer simulations.

Total Percentage of Project Completion:

2.4%

Research Project Quarterly Progress Report

Date: 7/31/2024 **Project Number:** TPF-5(430) SUPPL. #49-RPFP-FY2023-WISDOT-OVERLAY-1

Project Title: MASH TL-3 Evaluation Of New Jersey Shape Parapet With 3-in. Overlay

Principal Investigator: Robert Bielenberg

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

Project Start Date: 4/23/2024 **Project Completion Date:** 06/30/2026

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	$19,460.00	0	$0.00	0	$19,460.00
2. Full-Scale Crash Testing	$209,617.00	0	$0.00	0	$209,617.00
3. Reporting and Project Deliverables	$22,514.00	0	$0.00	0	$22,514.00
4.					
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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

- MwRSF conducted a kickoff meeting for this project on May 30, 2024. In the meeting, the sponsor and MwRSF reviewed existing WisDOT parapet details and selected a barrier configuration for use in full-scale crash testing. The CAD details were initiated and are currently in development.

2. Full-Scale Crash Testing

-None

3. Reporting and Project Deliverables

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.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

In the upcoming quarter, the researchers will work on procuring materials for the full-scale crash testing and building the test article

Total Percentage of Project Completion:

0.0

Research Project Quarterly Progress Report

Date: 7/30/2024 **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:** 5/9/2026

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	0.0%	$0.00	61.6%	$6,724.00
2. Design and Analysis	$10,862.00	24.6	$0.00	99.7	$35.34
3. Full-Scale Crash Testing	$254,880.00	0.0%	$0.00	31.7%	$173,966.00
4. Reporting and Project Deliverables	$16,147.00	0.0%	$0.00	9.4%	$14,634.00
5.					
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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 met with WYDOT to discuss redesign options in May 2024. North Dakota also attended the meeting as they use a similar gate arm and were interested in the topic and were considering a similar gate with a different gate arm section. The group considered several redesgin options that included:

1. Adjusting the location of the lower arm guide
2. Removal of the lower arm guide
3. Modifying the arm guide

In meeting with the sponsors, there were pros and cons to each option. Additionally, the sponsors are considering switching the gate arm from the 2”x4” version that we tested to a 4”x4” version in order to make the arm stiffer and perform better under wind loading.

Following the meeting, MwRSF reached out to B&B Roadway, the manufactureres of the gate arm, to discuss the options. They were very receptive and seemed willingly to work with the group. We discussed the test results and potential modifications along with considerations for the switch to a 4” wide arm section. The main takeaways are summarized below.

1. B&B uses the 4” arm section for the majority of their gate projects. They have had better luck with its durability and it is more rigid in long arm configurations.
2. The mounting system would be slightly different they are going to send me details of a proposed mounting configuration with masses so we can evaluate the potential mass increase.
3. I noted the concern for manual operation of the heavier arm section. B&B noted that the motorized gate setups can be provided for this application, but their units are relatively expensive. They suggested that they look at coming up with a manual system specifically for the 4” arm section road closure gate application that will be capable of being manually operated to keep costs low and be functional. They will provide me with details on that as well.
4. The 4” gate arm mount has a similar breakaway release if it is impacted in the down position.
5. In terms of system modifications, they had the following thoughts.

a. They did not recommend removal of the gate arm guide for a 2” arm section. They did not believe that would work well operationally.

b. They did believe that removal of the lower gate arm guide would be an option for the 4” arm section.

c. Relocation of the gate arm guides to mitigate windshield contact did not seem to be an issue for them and was a viable option.

They were also agreeable to modifying the gate arm guides to reduce the sharp edges. Additionally, I sent them CAD of Bill Wilson's closed arm guide concept and they are looking into the possibility of making a version of that a reality.

B&B has provided details for a manually operated gate with a 4x4 aluminum base and a 3x3 FRP tip. This is significantly stronger than the rectangular style arms. The drop gate side plates have been modified to accept the cross member and the counterweights. The counterweights are needed due to the weight of the arm. The cross member has a spring-loaded latch which is activated in the event of a car impact and prevents the arm from swinging back into traffic. They added a radius to all the sharp corners of the arm guides in this version. However, the other options we discussed for arm guide modifications are still possible as well. The detail shows two arm guides, but B&B noted that the arm section stiffness increase would allow the use of a single arm guide at the 2/3 height of the pole.

The major drawback of this option is the weight of the new pivot assembly. The new assembly is approximately 350 lbs. heavier than the current assembly due primarily to the large side plates and counterweights. This is a potential concern for the safety performance of the road closure gate. First, the additional mass may create issues with the change in velocity during impacts. Currently, MASH limits the change in velocity to 16 ft/s or less.

The assembly evaluated in the first test weighed approximately 775 lbs. when the gate arm is combined with the pole and other components. Adding 350 lb to that assembly would put the mass over 1,100 lbs. This is a large mass increase and would push the pole mass to a level beyond what has previously been safely evaluated with small cars as it would have the potential to increase the velocity change to an unacceptable level. Previous testing with breakaway pole bases was limited to 1,000 lbs. Of course this was with lighter NCHRP 350 small cars, so there is a chance that we still may meet change in velocity limits, but it would be riskier.

An additional concern is related to the additional mass. The majority of that additional mass would be located low on pole at the pivot location. This may change how the pole rotates when disengaged from the base. If you recall the original NCHRP 350 crash testing of the closure gate, the first test of the system with the small car at slow speed was a failure due to pole rotating down on the roof of the vehicle and causing excessive deformation. To solve that issue TTI made the pole taller which move the cg of the pole up and altered the rotational inertial of the pole sufficiently to mitigate the roof contact. There is concern that adding a large amount of mass lower on the pole may cause the pole rotation behavior to revert more like the original failed test and cause additional roof crush.

Based on this new information, we will need to decide how best to proceed. The options would likely be:

1. Test the revised assembly with the 4” gate arm section and revised pivot. This would pose the risks noted above.
2. Retest the road closure gate with the original pivot system with one of the proposed gate arm guide modifications. We will need to determine which option or combination of options to proceed with.

At this time, the sponsors need to reconvene to discuss the preferred option moving forward.

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 recevied activation of the project in September 2023.

Note that the budget table included has been updated with the revised scope and budget figures.

Note that current budget numbers reflect only labor charges through May 2024 and materials through June 2024.

Anticipated Work Next Quarter:

In the next quarter, MwRSF will setup a meeting with WYDOT and North Dakota to discuss the path forward in terms of design changes.

Total Percentage of Project Completion:

34.7%

Research Project Quarterly Progress Report

Date: 8/6/2024 **Project Number:** TPF-5(430)_Sup.50,RPFP-FY2024-WY-1-BOX

Project Title: Box-Beam Barrier Configuration for Shielding Fixed Objects and Bridge Ends in Medians

Principal Investigator: B. Perry

Principal Contact Information Email: brandon.perry@unl.edu **Phone:** (402) 472-906

Project Start Date: 2/20/2024 **Project Completion Date:** 5/31/2027

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	$46,495.00	15.0	$6,974.58	15.0	$39,520.42
2. Design and Analysis	$19,127.00	0	$0.00	0	$19,127.00
3. Full-Scale Crash Testing	$673,199.00	0	$0.00	0	$673,199.00
4. Reporting and Project Deliverables	$61,177.00	0	$0.00	0	$61,177.00
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.)

1. Project Planning, CAD, and Reporting: Box beam literature review, WYDOT box beam standards review, and a kickoff meeting with project sponsors
2. Design and Analysis: None
3. Full-Scale Crash Testing: None
4. Reporting and Project Deliverables: None

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 complete the literature and standards review and begin to draw concepts

Total Percentage of Project Completion:

0.87