TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
SPR-3(017) Supplement #35	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:		
Cost Effective Measures for Roadside Design		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Rohde, Sicking, Reid, Faller, Lechtenberg	402-472-9070	kpolivka2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611130069002	RPFP-06-01	7/1/2005
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
6/30/06	9/30/12	6

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$103,514	$92,475	100

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$10,700	

Project Description:

The relatively low levels of safety associated with low-volume roads have been well documented over the last 20 years. Many low volume roads have high posted speed limits and virtually no clear zone. Further, narrow pavements and sharp horizontal curves tend to increase the frequency of ran-off-road events. Even though there have been many papers written on this topic, there have been very few efforts to actually develop guidelines and recommendations for implementing roadside safety treatments on low volume roads. Instead, most of the studies have identified a shopping list of feasible safety improvements with no real guidance regarding when each item should be implemented. Guidelines for safety improvements can be developed with a combination of a benefit/cost analysis program like RSAP and a significant amount of engineering judgment.

The objectives of this study include to 1) identifying common hazardous roadside situations associated with low-volume roads, 2) determining if any cost effective safety treatments are available and 3) developing guidelines for when the safety treatments are recommended.

Tasks

1. Field study of roadside hazards on low-volume roads
2. Compilation of field study findings
3. Selection of common roadside hazards for analysis
4. RSAP analysis and evaluation of selected roadside hazards
5. Research report

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Comments received were addressed in the final report. The final report was published and copies of the report were disseminated to the Pooled Fund member states on September 7, 2012. A paper was written and submitted to TRB on the tree hazards. All work on this project was completed.

Anticipated work next quarter:

None as all work was completed during this quarter. Thus, the project will be closed next quarter.

Significant Results:

Rural roadways (ADT < 500 and speed ≥ 55 mph) were surveyed and it was determined that common hazards along these types of roadways are culverts, trees, slopes, ditches, and bridges. Thus, these were the hazards evaluated with a benefit-to-cost analysis. Some sample results include: (1) culverts - remove headwall structures not shielded or transitioned to guardrail; (2) trees - remove trees 6" or greater in diameter located within 10' of roadside; (3) slopes and ditches - install barrier for most 1.5:1 & 2:1 slopes; and (4) bridges – leave existing rail for long bridges, install approved system for short bridges.

Tasks	% Complete
1. Field study of roadside hazards on low-volume roads	100%
2. Compilation of field study findings	100%
3. Selection of common roadside hazards for analysis	100%
4. RSAP analysis and evaluation of selected roadside hazards	100%
5. Research report	100%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Due to a shifting of staff priorities, work of reviewing the internal draft report was greatly diminished. The project was extended through June 2012 in order to submit the draft report to the States for review and to complete the final report.

A three month extension was requested to allow one state to complete their review of the revised draft report, to implement their comments, and publish the final report.

This remaining funds after the final report is completed will be moved to Contingency.

Potential Implementation:

This study will identify safety improvements that are applicable to a number of common hazards found along low volume roads. Guidelines will also be presented that provide objective criteria for determining when these safety improvements should be considered. The identified safety treatments and guidelines for their implementation will provide designers a set of tools for improving safety on low volume roads. This effort could potentially result in language that could be included in the Roadside Design Guide to provide guidance for roadside safety design on low-volumes, similar to the Geometric Guidelines for Very Low-Volume Local Roads published by AASHTO and intended to be incorporated into a future update of the Greenbook.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* SPR-3(017) Suppl.#38	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Testing of Cable Terminal for High Tension Cable (1100C & 2270P)		
Name of Project Manager(s): Reid, Rohde, Sicking, Faller	**Phone Number:** 402-472-3084	**E-Mail** jreid@unl.edu
Lead Agency Project ID: RPFP-07-06	**Other Project ID (i.e., contract #):** 2611120090007	**Project Start Date:** February 26, 2007
Original Project End Date: December 31, 2010	**Current Project End Date:** December 31, 2012	**Number of Extensions:** 1

Project schedule status:

☐ On schedule ☐ On revised schedule ☐ Ahead of schedule ☑ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$100,563	$61,866	60%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date

Project Description:

Objective: Redesign the cable release mechanism and foundation of the three cable end terminal to accommodate four high tension cables.

Tasks
1. Background and literature review - completed
2. Design and analysis, including bogie testing part 1 - completed
3. Report part 1 - completed
4. Design and analysis, including bogie testing part 2 - in-progress
5. Full-scale testing
6. Report

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Task 3. The report documenting the project to date was completed and sent to the states. "Development and Recommendations for a Non-Proprietary, High-Tension Cable End Terminal System," MwRSF Report TRP-03-268-12, July 17, 2012.

Task 4. Bogie tests of the redesigned cable anchor bracket and alternative terminal posts were conducted. Results were not as expected, nor desired. The cables did not release as easily or quickly as desired when the terminal was impacted by the bogie. Further analysis is required to determine the cause(s) of the poorly released cable anchorage and to determine possible improvements.

Anticipated work next quarter:

Task 4. Determine the cause(s) of the poorly behaved bogie testing and develop alternative designs..

Significant Results:

Report TRP-03-268-12 documenting part 1 of this project was published July 17, 2012.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Final design details and full-scale testing for this project cannot be conducted until the High Tension Cable Barrier System is completed.

Potential Implementation:

The revised terminal will provide a non-proprietary end terminal for high tension barrier cable systems.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* SPR-3(017) Supplement #38	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Cost Effective Upgrading of Existing Guardrail Systems		
Name of Project Manager(s): Reid, Rohde, Sicking, Faller, Lechtenberg	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611120090002	**Other Project ID (i.e., contract #):** RPFP-07-01	**Project Start Date:** 2/26/07
Original Project End Date: 12/31/10	**Current Project End Date:** 12/31/12	**Number of Extensions:** 1

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$92,084	$77,523	85

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$8,942	

Project Description:

Existing guardrail installations are often substandard in some way, such as low height, inappropriate post spacing, or inadequate length. Although it is desirable to upgrade substandard barriers to meet current guidelines, available funding is often insufficient to achieve this goal. However, the safety performance of many existing guardrail systems can be greatly improved by eliminating only the most significant deficiencies. In general it is often desirable to implement low cost/high benefit improvements at sites where a complete upgrade cannot be justified. Unfortunately, highway agencies have the potential for creating a liability risk when guardrail is upgrading without bringing it up to current guidelines. Therefore, agencies cannot make any improvements to an existing guardrail or terminal unless it is upgraded to meet current recommendations. As a result, many guardrail systems remain in place for many years with identifiable deficiencies.

Objective: Develop guidelines for upgrading of existing guardrail installations that do not meet current criteria.

Tasks:

1. Field study of existing guardrail installations
2. Compilation of field study findings
3. Selection of installations to investigate
4. Sensitivity study to decrease the size of the analysis matrix
5. RSAP analysis
6. Research report

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Review of the internal draft report continued.

Anticipated work next quarter:

Review of the internal draft report will be completed. The draft report will be submitted to the Pooled Fund member states for review and comment. The comments received will be addressed. The final report will be completed and published and the final copies of the report will be disseminated to the Pooled Fund member states. All work on this project is anticipated to be completed during the next quarter.

Significant Results:

A field survey of more than 60 barrier sites in Kansas revealed deviations from standard guardrail systems with guardrail height being the most prominent issue as well as different hazards that these systems were protecting. To account for the different guardrail height in the RSAP models containment index (CI) had to be changed. The CI was derived from past crash test results and LS-DYNA simulations of the MGS with 22" and 25" rail heights at speeds of 100, 70, and 60 km/h with the 2270P. The 22" and 25" rail heights contained the 2270P at impact speeds of 60 km/h and 70 km/h, respectively.

Task	% Complete
1. Field study of existing guardrail installations	100%
2. Compilation of field study findings	100%
3. Selection of installations to investigate	100%
4. Sensitivity study to decrease the size of the analysis matrix	100%
5. RSAP analysis	100%
6. Research report	80%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

The original analysis was completed with the longer runout lengths. Thus, additional analysis was completed with the shorter runout lengths that were published in the updated Roadside Design Guide.

Potential Implementation:

The guardrail removal and upgrading guidelines developed under this study will provide highway designers with a very important middle ground option between doing nothing and a complete upgrade of deficient guardrail. This middle ground option should provide most of the benefits of a complete upgrade at a much reduced cost. Further, the guidelines will eliminate the potential for increased liability currently associated with using a less-than-complete guardrail upgrade.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Midwest Roadside Safety Facility, UNL

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* SPR-3(017) Supplement #49	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: MGS Implementation (Year 18)		
Name of Project Manager(s): Reid, J.D., Sicking, D.L., & Faller, R.K.	**Phone Number:** 402-472-6864 (Faller)	**E-Mail** rfaller1@unl.edu
Lead Agency Project ID: RPFP-08-07 (2611120095008)	**Other Project ID (i.e., contract #):** SPR-3(017) Supplement #49	**Project Start Date:** September 1, 2007
Original Project End Date: December 31, 2009	**Current Project End Date:** December 31, 2012	**Number of Extensions:** 5

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$15,928 (original)	$11,032	75%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$66 (0.4%)	$66	75%

Project Description:

This project consists of MGS implementation assistance and guidance for the Pooled Fund member states. Four general categories were initiated for the MGS. They are as follows:

Task	% Completed
Standard, Half, and Quarter Post Spacing	100
MGS with Curbs and MGS with 2:1 Slopes	100
MGS with Culvert Applications	100
MGS Stiffness Transition	5

In 2007, Pooled Fund consulting funds were used to assist states with the MGS implementation effort. MwRSF began the effort with a review of CAD details from the Illinois and Washington DOTs. Project correspondence occurred via email with a pre-determined Technical Working group. To date, three subject areas were covered and are as follows: (1) Standard, Half, and Quarter Post Spacing; (2) MGS with Curbs and MGS on 2:1 Slopes; and (3) MGS with Culvert Applications. A fourth category, MGS Stiffness Transition, was delayed in order to await the completion of a simplified, steel-post and wood-post approach guardrail transition.

The final reporting of the simplified, steel-post, approach guardrail transition system attached to the MGS was completed in the Fourth Quarter of 2010. The final reporting of wood post R&D effort was completed in November 2011, including dynamic bogie post testing and Barrier VII analysis. The MGS implementation activities commenced in the 1st Quarter of 2012 with the updating of the discussion group members and request for MGS standards for each State DOT.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The MGS implementation activities commenced in the 1st Quarter of 2012 with the updating of the discussion group members and request for MGS standards for each State DOT. However, limited progress was made this quarter due to effort to prepare & publish final reports, continue progress on R&D of cable median barrier, and to close other Pooled Fund and State DOT projects. Limited review and ongoing discussion was performed on the KsDOT details for the MGS attached to culvert.

Anticipated work next quarter:

The MGS implementation continued in the First Quarter of 2012 after the simplified, wood-post transition report was finalized on November 28, 2011. The project has been extended to December 31, 2012 in order to complete this discussion.

Significant Results:

To date, MwRSF has provided review and comment regarding the MGS standard plans for Washington, Illinois, Kansas, and Nebraska and for 3 out of 4 categories. Since this effort began several years ago, the first three categories will be re-reviewed as many more states are actively preparing and updating MGS details.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

A 3-month project extension was requested to complete the discussion on MGS implementation. The requested extension would cover through December 31, 2012.

Potential Implementation:

MwRSF's review and comment has assisted several State DOTs with the advance implementation of the MGS.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Wisconsin DOT

INSTRUCTIONS:

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Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #14	☐ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☑ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title: Concrete Traffic Barrier Attachment to Deck Utilizing Epoxy Concrete Masonry Anchors		
Name of Project Manager(s): Bielenberg, Dickey, Faller, Reid, Sicking	**Phone Number:** (402) 472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211020001	**Other Project ID (i.e., contract #):**	**Project Start Date:** 7/1/2009
Original Project End Date: 6/30/2011	**Current Project End Date:** 11/30/2012	**Number of Extensions:** 2

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$113,619	$94,619	98%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
	$3,234	

Project Description:

When properly installed, epoxy anchors have been shown to be capable of developing the full strength of the surrounding concrete. Hence, these anchors provide tensile and shear strengths comparable to any cast-in-place straight bar. In fact, because the epoxy is stronger than the surrounding material and it distributes anchor loads over a larger area of concrete, these anchors can be stronger than cast-in-place straight bars with similar embedment. Unfortunately, many cast-in-place bars are bent in order to increase anchor capacity. In this situation, epoxy anchors cannot normally match the strength of cast-in-place anchors, and additional anchors may be needed.

Note that rated capacities published by epoxy anchor manufacturers are based upon static load capacities. When used in conjunction with traffic barriers, epoxy anchors can resist much higher loads. Hence, it is inappropriate to design traffic barrier anchors based solely on published load ratings.

Further, in order to assure long term durability, all anchor components must have some sort of corrosion protection. Any dynamic testing conducted to determine the dynamic capacity of epoxy anchors must include the appropriate corrosion protection.

OBJECTIVE:

The objective of this research effort is to determine if epoxy masonry anchors can be utilized to anchor a crash barrier to bridge decks to allow the use of precast aesthetic concrete traffic barriers or in-board cast-in-place or precast concrete traffic barriers separating traffic and trail traffic without the need to cast reinforcing steel into the deck surface to anchor the barrier. The researchers should establish design criteria/parameters, i.e. embedment depth, size of acceptable bar(s), and strength or type of epoxy (preferably generic epoxy spec criteria) appropriate for this use.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

MwRSF finished the conversion and editing of the thesis into a final research report for submission to WisDOT. The draft report was sent to WisDOT for review on 9/24/2012.

Anticipated work next quarter:

Once review comments on the draft report are received from WisDOT, final revisions will be made to the report and it will be printed and sent to the sponsor.

Significant Results:

Task	% completed
1. Literature search to identify published procedures for estimating dynamic strength of epoxy anchors.	100%
2. Review of standard, cast-in-place anchorage designs used by Pooled Fund member states	100%
3. Conduct 8 dynamic tests to determine shear and tensile capacities of selected anchors	100%
4. Develop predictive equations for chemical adhesive anchors based on dynamic testing.	100%
5. Conduct 8 dynamic tests to verify and/or revise the accuracy of the predictive equations	100%
6. Develop guidelines for anchoring concrete traffic barriers to reinforced concrete decks using epoxy anchors.	100%
7. Prepare draft and final research/test report.	95%

Total percentage of project completion = 98 %

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

This project was intended to close on June 31, 2011. MwRSF received an extension of the project until June 30, 2012 in order to finish the design effort, conduct the required full-scale crash testing, and document the project in a summary report. Other priorities and revisions to the report contents delayed the completion of the draft report for the sponsor review within that time frame. As such, MwRSF requested and was granted a second extension until November 30, 2012 to allow the sponsor to review the draft and allow MwRSF to implement the sponsor comments to the final report.

Potential Implementation:

The development of guidelines for epoxy anchors would allow the use of precast concrete traffic barriers anchored to bridge decks - accelerating bridge construction and providing better quality concrete traffic barrier when aesthetic traffic barriers are utilized. It would also allow anchoring in-board, cast-in-place, or precast concrete traffic barriers to be used without the need for reinforcing steel protruding from the bridge deck surface and disrupting the machine finishing of the bridge deck (eliminating the need for hand finishing large areas of the bridge deck). Finally, development of epoxy anchor guidelines would allow a method for replacing/repairing traffic barriers on bridge decks without the need to remove and replace the bridge deck.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Wisconsin DOT

INSTRUCTIONS:

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Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #15	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title: Development of a Low Deflection Temporary Concrete Barrier		
Name of Project Manager(s): Bielenberg, Faller, Reid, Sicking	**Phone Number:** (402) 472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211022001	**Other Project ID (i.e., contract #):**	**Project Start Date:** 7/1/2009
Original Project End Date: 6/30/2011	**Current Project End Date:** 6/30/2012	**Number of Extensions:** 1

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$178,914	$42,652.00	65

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
	$23,165.00	

Project Description:

The objective of this research effort is to develop a joint stiffening mechanism for use in reducing the deflection of temporary concrete barrier installations without requiring anchorage of the barrier segments to the road surface. The joint stiffening mechanism will be developed for use with the Midwest Pooled Fund States 12.5-ft long, F-shape, temporary concrete barrier. The temporary concrete barrier joint stiffening mechanism will be designed and evaluated to meet the TL-3 requirements set forth in MASH-08.

Task	% completed
1. Project Planning and Literature Search	100
2. LS-DYNA Analysis of Barrier Offset to Drop-Off	30
3. Development of Design Concepts	90
4. LS-DYNA Analysis of Concept Designs	100
5. Fabrication of Design	100
6. TL-3 Full-scale Crash Testing with 2270P Vehicle	80
7. Analysis and Refinement of Design	10
8. Fabrication of Revised Design	0
5. TL-3 Full-scale Crash Testing with 2270P Vehicle	0
6. Summary Report	0

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

In the Third Quarter of 2012, progress was made on the first full-scale crash test of a design for limiting concrete barrier deflection. WisDOT worked with MwRSF to select a relatively conservative design for full-scale testing. The design consists of a cap plate bolted across the joint and a continuous tubes running along the sides of the barriers. It was anticipated that this design will be very effective at limiting barrier motion and that the continuous tubes will provide for increased vehicle stability. MwRSF prepared full CAD details for this design and it was fabricated for testing.

The barrier system was installed with a 2-ft offset from the back of the barrier to the edge of the bridge deck. It was impacted with the 2270P vehicle under MASH TL-3 impact conditions. During the test, the vehicle was safely and smoothly redirected. The maximum deflection of the system was approximately 41.5 in. This deflection was slightly larger larger than was anticipated, but it was not totally unexpected. In an effort to reduce the weight and cost of the components used in the design, MwRSF reduced the size and thickness of some of the components. This allowed for increased deflection at the joints. In addition, retrofitting the reduced deflection hardware on the F-shape PCB segments required allowing sufficient tolerance in the attachment of the hardware to allow for the variation in the width of the PCB joint. This increased tolerance allowed for increased deflection as well.

The system deflected partially off the deck edge during the full-scale crash test, but was not in danger of dropping off of the edge of the bridge deck. The reduced deflection hardware acted to support the barriers that were deflected past the deck edge. Thus, the system would be usable with the deflection we observed in the testing when the back of the system was placed within 24 in. of the edge of the bridge deck.

Currently, MwRSF is attempting to determine what design modifications can be made to further reduce the system deflections. We are attempting to model the system in LS-DYNA in order to find methods to increase the stiffness of the

Anticipated work next quarter:

In the Fourth Quarter of 2012, MwRSF will complete the analysis of the full-scale crash test results and begin the process of redesigning the reduced deflection PCB system. MwRSF will begin the redesign process by constructing a finite element model of the first full-scale crash test in LS-DYNA. Once the model of the first full-scale crash test is validated, MwRSF will apply design changes to the model in an effort to further reduce deflections. Some concepts that will be evaluated are reduction of the barrier gap at the joints, increased thickness and section of the structural elements, the use of additional attachment points between the barrier and the reduced deflection hardware, and increasing the barrier-to-ground friction.

Once these design modifications have been evaluated and their effectiveness estimated a revised design will be developed and presented to the sponsor. Once WisDOT has approved the revised design, MwRSF will conduct a second full-scale test using the revised design.

Significant Results:

The first full-scale crash test of the reduced deflection PCB system was conducted and the system safely redirected the 2270P vehicle under TL-3 impact conditions while retaining the barrier system on the bridge deck. Redesign of the system for the second full-scale test was started.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

This project was intended to close on June 31, 2011. MwRSF received an extension of the project until June 30, 2012 in order to finish the design effort, conduct the required full-scale crash testing, and document the project in a summary report.

Potential Implementation:

Development of a joint stiffening mechanism for use in reducing the deflection of temporary concrete barrier will provide designers with a means to install temporary concrete barriers in limited deflection applications without anchoring the barriers to the roadway surface. This will reduce installation costs and damage to the road surface. In addition, installation and removal of the barrier system would be more efficient, thus reducing worker exposure.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl.#21	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:
Additional Funding to Complete Development of a Crash-Worthy Terminal for Midwest Four-Cable, HT, Barrier System

Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller	402-472-3084	jreid@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
RPFP-10-CABLE-3	2611211028001	July 1, 2009
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
July 31, 2012	April 30, 2013	1

Project schedule status:

☐ On schedule ☐ On revised schedule ☐ Ahead of schedule ☑ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$159,193	$29,694	20%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**

Project Description:

Objective: Redesign the cable release mechanism and foundation of the three cable end terminal to accommodate four high tension cables.

This is Phase II of the project. Phase I was funded in Year 17: SPR-3(017) Suppl.#38 - "Testing of Cable Terminal for High Tension Cable (1100C & 2270P)"

No reporting on this phase of the project will be done until Phase I is complete; see that project for status.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Anticipated work next quarter:

Significant Results:

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Final design details and full-scale testing for this project cannot be conducted until the High Tension Cable Barrier System is completed.

Potential Implementation:

The revised terminal will provide a non-proprietary end terminal for high tension barrier cable systems.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #19	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title: Phase II - Guidelines for Post-Socketed Foundations for 4-Cable, High-Tension, Barrier System		
Name of Project Manager(s): Reid, Sicking, Faller, Rosenbaugh	**Phone Number:** 402-472-9324	**E-Mail** srosenbaugh2@unl.edu
Lead Agency Project ID: 2611211026001	**Other Project ID (i.e., contract #):** RPFP-10-CABLE-1	**Project Start Date:** 7/1/2009
Original Project End Date: 7/31/2012	**Current Project End Date:** 4/30/2013	**Number of Extensions:** 1

Project schedule status:

☐ On schedule ☐ On revised schedule ☐ Ahead of schedule ☑ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$92,207	$11,278	35%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$2,906	

Project Description:

This project is the second Phase of a project which was undertaken the year previous - split up due to available funds in previous year not being sufficient to cover entire project.

High-tension cable barriers often incorporate socketed post foundations to simplify repair of the system after an accident. Barrier posts are designed to slide in and out of a ground socket for easy replacement of damaged components. Unfortunately, there have been numerous examples of socketed post foundations that are damaged during a cable barrier crash. In most cases, socket damage requires repair crews to either replace the socket itself or drive a post directly into the soil adjacent to the damaged component. Either situation defeats the purpose of using sockets and greatly increases the time necessary to restore a damaged barrier. The increased repair time translates into higher maintenance costs and increased risk to repair crews working adjacent to high-speed facilities.

Many existing socketed post foundation designs are constructed by drilling a hole in the soil, placing a steel sleeve in the hole, and backfilling with Portland cement concrete. Many of these designs do not have sufficient reinforcement to resist impact loads that are transmitted into the socket. Further, many of the sockets are too short to resist frost heave that can push the posts out of the ground. Thus, there is a need for general design guidelines that states can incorporate to assure that socketed post foundations perform as intended when used in the field.

Objectives/Tasks:

1. Design new socket foundations for barrier posts.
2. Fabrication and dynamic testing of socketed foundations.
3. Analysis of test data and evaluation of socketed foundation designs.
4. Written report documenting all work and conclusions.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The 3rd round of dynamic bogie testing was conducted in which concrete foundations were evaluated in stiff soil (AASHTO grade B). The 12" diameter concrete foundations continue to see damage in the form of large concrete pieces breaking free from the top - back side of the foundation during testing. Additionally, 30 inches of embedment was deemed too shallow for the foundations as excessive permanent set deflections were observed. The foundation with 36 inches of embedment appears to have limited deflections to an allowable level.

A request was sent out to the member states to gain feedback on: 1) the direction of the project, and 2) the types of mow strips that are currently used around cable barrier posts. The responses from the states will dictate whether work shall continue with 12" diameter foundations, larger diameters are to be investigated to limit damage, or a steel breakaway post type design should be investigated. Data on mow strip practices will guide the selection of a critical design for evaluating foundations in mow strips.

Additionally, work on the report documenting the second round of dynamic testing has continued. The report will include the 3rd round of testing as well.

Anticipated work next quarter:

A critical mow strip design will be selected for evaluation with the socketed post foundations. The foundation design may be modified to reflect the increase in confinement strength that the mow strip will provide. New designs will be dynamically tested to evaluate performance.

Additionally, based on the responses from the member states, other design options including increased diameter sizes and/or a steel foundation option may be investigated.

Significant Results:

Phase I of this project included the evaluation of 4 new socketed foundation designs. All 4 of these first round designs experienced heavy damage in the form of concrete fracture and plastic deformation of the reinforcing steel. As a result, 4 new reinforcement designs were configured to provide additional strength to the socketed foundation.

Round 2 of testing saw four foundations designs evaluated in sand. Although concrete shear failure occurred in all designs, the 60" embedment proved adequate to resist rotation in weak/saturated/sandy soils.

Round 3 of testing determined 36 was the required embedment depth for 12" diameter foundations placed in strong soil (AASHTO Grade B).

Objectives/Tasks:	% Completed (Phase II)
1. Design new socket foundations for barrier posts.	40%
2. Fabrication and dynamic testing of socketed foundations.	40%
3. Analysis of test data and evaluation of socketed foundation designs.	30%
4. Written report documenting all work and conclusions.	20%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Additional (matching) funds for Phase-I of this project were obtained through a Mid-America Transportation Center program. This matching funding was used during the first round of design, testing, and evaluation for the socketed foundations. Thus, some of the original Phase-I funding remains as it was not used until the MATC funding was depleted. As a result, the continuing work which would have been conducted under Phase II of the project is being charged to the Phase I project until the funds are gone. Limited time has been charged to the Phase II project to date, but the test charges from Round 2 of testing have been placed on this project's budget.

This project was originally set to close on July 31, 2012. However, the additional funding obtained for Phase-I of the project has resulted in remaining funds in the Phase-I project and nearly all of the funds remaining for Phase-II. Therefore, an extension was granted extending the closing date to 4/30/2013.

Potential Implementation:

Upon successful completion of this project, State DOT's will have the option to use a socketed post foundation for cable barrier system posts. The socketed foundation will allow for quick, easy, and inexpensive repairs to damaged sections of the barrier.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl.#22	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Maximum MGS Guardrail Height		
Name of Project Manager(s): Reid, Sicking, Faller	**Phone Number:** 402-472-3084	**E-Mail** jreid@unl.edu
Lead Agency Project ID: RPFP-10-MGS	**Other Project ID (i.e., contract #):** 2611211029001	**Project Start Date:** July 1, 2009
Original Project End Date: July 31, 2012	**Current Project End Date:** April 30, 2013	**Number of Extensions:** 1

Project schedule status:

☐ On schedule ☑ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$166,953	$135,373	80%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date

Project Description:

Objective: Identify an upper bound on the acceptable height of the Midwest Guardrail System (MGS).

Tasks
1. Full-scale crash testing - completed
2. Report on full-scale crash testing - completed, Report TRP-03-255-12 published March 9, 2012
3. Analysis phase - in progress

Note: The analysis phase of this project is being supplemented by NDOR project SPR-1(12) M318,"Maximum Safe Guardrail Height."

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

A draft report documenting the analysis phase was prepared during the quarter and is undergoing an internal review. One of the time consuming issues being addressed during this review is the applicability of a raised rail on other MGS based products.

Anticipated work next quarter:

The internal review should be completed, followed by a draft final report being sent to the States for their review.

Significant Results:

On June 29, 2010, MwRSF conducted one small car crash test (test no. MGSMRH-1) into a 34-in. tall Midwest Guardrail System (MGS) using an 1100-kg Kia Rio according to the TL-3 safety performance guidelines of MASH. The small car was successfully contained and redirected.

On September 9, 2010, a second small car test (test no. MGSMRH-2) was conducted into a 36-in. tall Midwest Guardrail System (MGS) using an 1100-kg Kia Rio according to the TL-3 MASH safety performance guidelines. Again, the small car was successfully contained and redirected.

Report TRP-03-255-12 documenting the above crash tests was published March 9, 2012.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

The supplemental project, NDOR project SPR-1(12) M318, was being worked on before completing this project. Results from that project were used to help direct and complete this project. The NDOR project is on time and within budget (i.e., nearing completion), but its' project dates are 7/27/2011 thru 12/31/2012. Thus, an extension for this pooled fund project was obtained.

Potential Implementation:

Clearly defined limits on the upper height for MGS guardrail will allow states to accurately determine when a guardrail is too high, either as a result of improper installation or frost heave. Further, a clearly defined upper height will be very helpful when determining acceptable MGS placement guidelines on moderate slopes or behind curbs.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl.#24	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: LS-DYNA Modeling Year 4		
Name of Project Manager(s): Reid, Sicking, Faller	**Phone Number:** 402-472-3084	**E-Mail** jreid@unl.edu
Lead Agency Project ID: RPFP-10-LSDYNA	**Other Project ID (i.e., contract #):** 2611211031001	**Project Start Date:** July 1, 2009
Original Project End Date: July 31, 2012	**Current Project End Date:** April 30, 2013	**Number of Extensions:** 1

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$37,634	$28,662	75%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date

Project Description:

The objective of this research effort is to set up an annual modeling enhancement program funded by the Pooled Fund Program States to address specific modeling needs shared by many safety programs. Funding from this project would go towards advancement of LS-DYNA modeling capabilities at MwRSF. The exact nature of the issues to be studied would be determined by the most pressing simulation problems associated with current Pooled Fund projects.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Version 2.g of the 1100c Toyota Yaris model was obtained from NCAC on March 29, 2012. This vehicle model requires extensive investigation and some modifications before it can be used in MwRSF projects. That investigation began last quarter and was finalized this quarter. The model is now ready to try on the next MwRSF project that utilizes the 1100c vehicle and LS-DYNA simulation. During testing of the model, it was noted that special care with the contacts will be needed for each project, as opposed to a uniform handling of the contacts as is currently done with the 2270p model.

An updated model of the 2270p pickup truck, based on the Chevy Silverado, was obtained from NCAC and processed to to our standards for usage on future projects. The main feature of this updated model is a correctly working steering mechanism. Future projects that are heavily influenced by the steering mechanism will use this updated model. Initial investigation has shown that impacting the MGS with the updated version had very little effect on the overall simulation result. Indicating that during the actual impact event, the MGS-vehicle interaction/behavior is independent of the steering mechanism.

Anticipated work next quarter:

Due to other project priorities, no work is planned for this project in the next quarter.

Significant Results:

The 1100c Toyota Yaris model is now ready for other Pooled Fund projects that require simulation of the 1100c vehicle.

The updated 2270p Chevy Silverado model is now ready for other Pooled Fund projects that require simulation of the 2270p vehicle where a more accurate steering mechanism is required.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

No problems have been encountered to date.

Potential Implementation:

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(091) Suppl. #2	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Phase I - Guidelines for Post Socketed Foundations for 4-Cable, High-Tension, Barrier Systems		
Name of Project Manager(s): Reid, Faller, Sicking, Rosenbaugh	**Phone Number:** 402-472-9324	**E-Mail** srosenbaugh2@unl.edu
Lead Agency Project ID: 2611211006001	**Other Project ID (i.e., contract #):** RFPF-09-02	**Project Start Date:** 8/15/2008
Original Project End Date: 7/31/2011	**Current Project End Date:** 10/31/2012	**Number of Extensions:** 2

Project schedule status:

☐ On schedule ☐ On revised schedule ☐ Ahead of schedule ☑ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$73,549	$65,110	100%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$13,010	

Project Description:

High-tension cable barriers often incorporate socketed post foundations to simplify repair of the system after an accident. Barrier posts are designed to slide in and out of a ground socket for easy replacement of damaged components. Unfortunately, there have been numerous examples of socketed post foundations that are damaged during a cable barrier crash. In most cases, socket damage requires repair crews to either replace the socket itself or drive a post directly into the soil adjacent to the damaged component. Either situation defeats the purpose of using sockets and greatly increases the time necessary to restore a damaged barrier. The increased repair time translates into higher maintenance costs and increased risk to repair crews working adjacent to high-speed facilities.

Many existing socketed post foundation designs are constructed by drilling a hole in the soil, placing a steel sleeve in the hole, and backfilling with Portland cement concrete. Many of these designs do not have sufficient reinforcement to resist impact loads that are transmitted into the socket. Further, many of the sockets are too short to resist frost heave that can push the posts out of the ground. Thus, there is a need for general design guidelines that states can incorporate to assure that socketed post foundations perform as intended when used in the field.

Objectives/Tasks:

1. Conduct literature review on previous/current high-tension, cable systems.
2. Design new socket foundations for barrier posts.
3. Fabrication and dynamic testing of socketed foundations.
4. Analysis of test data and evaluation of socketed foundation designs.
5. Provide a written report documenting all work and conclusions.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The Phase I research report was published and sent to the sponsors. The Phase I report documents the first round of dynamic testing and evaluation and contains the recommendations for the second round designs of the socketed foundations.

Due to the matching funds received from MATC, a significant amount of money remained in the project upon completion of the first round of component testing. Therefore, time and labor spent to design and conduct further testing of the socketed post foundations has been charged to this project. Through this quarter, an additional 7 component tests have been conducted, but funding still remains. For a summary of the Phase II work, please refer to the progress report for TPF-5(193) suppl #19 - RPFP-10-CABLE-1.

Anticipated work next quarter:

Dynamic component testing will continue on concrete foundation designs utilizing various embedment depths, diameters, and reinforcement configurations. Foundations installed within concrete and asphalt mow strips will also be evaluated. This work (although being charged to the remaining funds of this project until funds are exhausted) will be documented on the Phase II project, please refer to the progress report for TPF-5(193) suppl #19 - RPFP-10-CABLE-1.

Significant Results:

PHASE I only:

Four socketed foundation designs were evaluated through dynamic bogie testing. All 4 of these first round designs experienced heavy damage in the form of concrete fracture and plastic deformation of the reinforcing steel. As a result, 4 new reinforcement designs were configured to provide additional strength to the socketed foundation. These recommended configurations will be evaluated in Phase II of this project.

Objectives/Tasks:	% Complete (Phase I only)
1. Conduct literature review on previous/current high-tension, cable systems.	100%
2. Design new socket foundations for barrier posts.	100%
3. Fabrication and dynamic testing of socketed foundations.	100%
4. Analysis of test data and evaluation of socketed foundation designs.	100%
5. Provide a written report documenting all work,conclusions, and recommendations.	100%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Additional (matching) funds for this project were obtained through a Mid-America Transportation Center program. This matching funding was used during the first round of design, testing, and evaluation for the socketed foundations. Thus, much of the original funding for this project remained as it was not used until the MATC funding was depleted. As a result, the continuing work which would have been conducted under Phase II of the project is being charged to the Phase I project until the funds are gone.

This project is to close October 31, 2012, and all Phase I project funds should be exhausted by that time.

Potential Implementation:

Upon successful completion of this project, State DOT's will have the option to use a socketed post foundation for cable barrier system posts. The socketed foundation will allow for quick, easy, and inexpensive repairs to damaged sections of the barrier.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Supplement #31	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:		
Wood Post for MGS		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Lechtenberg, Bielenberg	402-472-9070	kpolivka2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211045001	RPFP-11-MGS-1	7/1/10
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
12/31/13	12/31/13	0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$121,215	$84,593	75

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$4,339	

Project Description:

Although the Federal Highway Administration has approved the use of the MGS with both W6x9 steel and 6x8-in. wood posts, no rectangular standard southern yellow pine post designs have been subjected to full-scale crash testing according to the MASH criteria. Eventually this testing needs to be conducted to verify the MGS performance with the most common wood post used in the United States.

Objective: Verify that 6x8-in. southern yellow pine wood post option for MGS has similar characteristics to the steel post MGS.

Tasks:

1. Full-scale crash testing (MASH 3-10 and 3-11)
2. Analysis and documentation of test results
3. Research report
4. Hardware guide drawings and FHWA acceptance

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

An internal draft report was completed. Review of the internal draft report was initiated.

Anticipated work next quarter:

Review of the internal draft report will be completed. The draft report will be submitted to the Pooled Fund member states for review and comment.

Significant Results:

On August 3, 2011, MwRSF conducted one pickup crash test (test no. MGSSYP-1) into a 31-in. tall Midwest Guardrail System (MGS) with standard southern yellow pine wood posts using a 2270-kg Dodge QuadCab according to the TL-3 safety performance guidelines of MASH. The pickup was successfully contained and redirected.

On September 13, 2011, MwRSF conducted one small car test (test no. MGSSYP-2) into a 32-in. tall Midwest Guardrail System (MGS) using an 1100-kg Kia Rio according to the TL-3 MASH safety performance guidelines. Again, the small car was successfully contained and redirected.

Task	% Complete
1. Full-scale crash testing (MASH 3-10 and 3-11)	100%
2. Analysis and documentation of test results	100%
3. Research report	75%
4. Hardware guide drawings and FHWA acceptance	50%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

The same test pit was used for Project No.:RPFP-11-MGS-3 – TPF-5(193) Supplement #33, Project Title: MGS without Blockouts. The wood post MGS system was constructed and tested following the completion of the aforementioned project. However, there are no additional problems or issues to report at this time.

Potential Implementation:

Full-scale crash testing and verification of the safety performance of the southern yellow pine post MGS system will provide designers with increased confidence when specifying a rectangular wood post option for the MGS. In addition, specifying wood posts can be a less costly alternative to steel posts in some areas, and wood posts may provide for a more aesthetic treatment.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #32	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title: MGS Guardrail Attached to Culverts		
Name of Project Manager(s): Reid, Sicking, Faller, Rosenbaugh	**Phone Number:** 402-472-9324	**E-Mail** srosenba@unlserve.unl.edu
Lead Agency Project ID: 2611211046001	**Other Project ID (i.e., contract #):** RPFP-11-MGS-2	**Project Start Date:** 7/1/2010
Original Project End Date: 12/31/2013	**Current Project End Date:**	**Number of Extensions:**

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$91,071	$69,828	70%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
	$28,944	

Project Description:

Some cross-drainage culverts are wider than 24 ft and therefore cannot be treated with a long-span guardrail system. Although it is acceptable to utilize the deformable, top-mounted post attachment design developed for metric height guardrail under NCHRP Report No. 350, many existing culverts are too narrow to accommodate the loss of roadway width that comes with a top mounted system. Recently, the MGS Bridge Railing system was successfully developed and crash tested using the TL-3 MASH guidelines. The bridge railing system attaches to the exterior, vertical edge of reinforced concrete decks. It is believed that this bridge railing system could be adapted to mount to the backside face of an existing culvert headwall. The objective of this research effort is to develop an MGS guardrail system that attaches to the outside vertical face of the culvert headwall for box culverts greater than 24 ft wide.

Objectives / Tasks

1. Literature review of current culvert designs
2. Design of MGS attachment to face of headwall
3. Dynamic bogie testing
4. Data analysis and evaluation
5. Written report documenting all design work, testing, and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

A total of 7 dynamic bogie tests were conducted on 4 different attachment designs attached to the 3-span simulated culvert. Each of the 4 attachment designs were first impacted laterally to illustrate the ability to resist the full moment capacity of the S3x5.7 post. All 4 designs performed well and contained no damage. A second lateral test was conducted on the side mounted design, this time the top anchors were epoxied into the headwall as opposed to extended all the way through it. This epoxy anchored design also performed well and had no damage.

The epoxy anchored side mounted design and the single anchor top mounted design were then selected for further testing in the longitudinal (weak axis) direction. These designs were selected based on ease and cost of installation compared to the other designs. Both of these selected designs was then impacted longitudinally (parallel to the roadway) at a load height of 12" to simulated contact from a small car tire during redirection. Again, both attachments held strong and suffered no damage.

Additionally, documentation of the bogie tests has begun in the form of the written report.

Anticipated work next quarter:

The simulated culvert will be removed as all bogie testing has been completed.

Also, work shall continue on the written report to document the design, testing, and conclusions of this project.

Significant Results:

A complete review of culvert designs used by Pooled Fund member states revealed a critical culvert design for testing and evaluation. A simulated culvert matching this critical design was been constructed. Four attachment concepts were developed, fabricated, and tested. The single anchor top mounted design, and the side mounted design both satisfied all resistance and damage requirements during lateral and longitudinal testing. Thus, these two designs will be recommended as attachment designs for the MGS Bridge Rail system attached to culvert headwalls.

Objectives / Tasks	% Complete
1. Literature review of current culvert designs	100%
2. Design of MGS attachment to culvert headwall	100%
3. Dynamic bogie testing	100%
4. Data analysis and evaluation	70%
5. Written report documenting all design work, testing, and conclusions	15%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

none

Potential Implementation:

Development of a new attachment for the MGS system to low-fill culverts will allow designers to install the MGS system on culverts wider than 24 ft without reducing the width of the overall roadway. In addition, it is anticipated that the new attachment design on the outside of the headwall will reduce construction and maintenance costs.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Supplement #33	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title: Wood Post for MGS		
Name of Project Manager(s): Reid, Sicking, Faller, Lechtenberg, Holloway	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611211047001	**Other Project ID (i.e., contract #):** RPFP-11-MGS-3	**Project Start Date:** 7/1/10
Original Project End Date: 12/31/13	**Current Project End Date:** 12/31/13	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$157,655	$94,631	85

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$16,450	

Project Description:

The oversized blockout used with the MGS design is one reason that the guardrail has demonstrated a 100 percent increase in redirective capacity as compared to conventional guardrail systems. However, there are some locations where roadway width is insufficient to accommodate a 12-in. blockout. A number of proprietary adaptations of the MGS design have been developed that do not utilize a blockout, thereby providing more useable roadway in constricted sites. A non-blocked version of the MGS should be feasible for use in those locations with constricted roadway widths.

Objective: Develop a MASH version of the MGS without blockouts for standard steel posts using standard components. If modifications to the system such as post to rail attachment are deemed to be necessary, the new components should be able to replace the existing components for all new construction and repair applications. By changing the standard components in the supply chain, it should be possible to minimize the risk of utilizing the wrong components in a no blockout design.

Tasks:

1. Full-scale crash testing (MASH 3-10 and 3-11)
2. Analysis and documentation of test results
3. Research report
4. Hardware guide drawings and FHWA acceptance

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Review of the internal draft report continued.

Anticipated work next quarter:

Review of the internal draft report will be completed. The draft report will be submitted to the Pooled Fund member states for review and comment.

Significant Results:

On May 15, 2011, MwRSF conducted one pickup crash test (test no. MGSNB-1) into the Midwest Guardrail System (MGS) without blockouts using a 2270-kg Dodge QuadCab according to the TL-3 safety performance guidelines of MASH. The pickup was successfully contained and redirected.

On June 15, 2011, MwRSF conducted one small car test (test no. MGSNB-2) into the Midwest Guardrail System (MGS) using an 1100-kg Kia Rio according to the TL-3 MASH safety performance guidelines. Again, the small car was successfully contained and redirected.

Task	% Complete
1. Full-scale crash testing (MASH 3-10 and 3-11)	100%
2. Analysis and documentation of test results	100%
3. Research report	90%
4. Hardware guide drawings and FHWA acceptance	50%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

There are no problems or issues to report at this time.

Potential Implementation:

Narrow roadways will benefit from a non-proprietary non-blocked out system by making more roadway width available while still providing acceptable guardrail performance. Additionally, a non-proprietary alternative to the existing non-blocked out guardrails would eliminate problems associated with identifying and properly repairing proprietary 31-in. tall guardrail systems.

It should be noted that, even if the MGS is made to function without a blockout, the 12-in. block would still be recommended where there was adequate space existing along the roadside. The blockout greatly improves the barrier's capacity to contain and redirect high-energy impacts with high c.g. vehicles.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #34	☐ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☑ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title:		
Assess Standard Weld Detail		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Rosenbaugh	402-472-9324	srosenba@unlserve.unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211048001	RPFP-11-MGS-4	7/1/2012
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
12/31/2013		

Project schedule status:

☐ On schedule ☐ On revised schedule ☑ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$10,000	$8,819	85%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
	$277	

Project Description:

In 2001, the Midwest Roadside Safety Facility (MwRSF) successfully developed a guardrail connection for low-fill culverts according to the Test Level 3 (TL-3) safety performance guidelines found in NCHRP Report No. 350. After evaluating several base plates, bolts, and weld combinations with undesirable results, a final configuration was chosen which consisted of a ½-in. plate attached with a 5/16-in. three-pass fillet weld on the critical flange and a 1/4-in. fillet weld on the web and back-side flange. The final post design was successfully tested and evaluated using both dynamic component bogie testing and full-scale vehicle crash testing.

During the implementation of the W-beam guardrail system for attachment to concrete box culverts, various State Departments of Transportation have raised questions concerning the use of the three-pass fillet weld on the critical flange. As such, there exists a need to re-examine the use of the three-pass weld and determine whether a simplified alternative weld detail could be used in combination with the rigid post attachment.

Objectives / Tasks

1. Literature review of current practices
2. Design of new weld detail
3. Dynamic testing and analysis
4. Written Report containing design work, testing, and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

All four projected bogie tests (combined between this project and its related project TPF-5(193) Suppl. #47, RPFP-12 MGS 4) have been conducted and analyzed. Similar to the original study, the 3-pass weld was the only weld to hold the impact force without fracturing or tearing the base plate.

Work this quarter continued on the the report documenting all testing and conclusions. The report will cover the results for both projects.

Anticipated work next quarter:

Work will continue on the report documenting testing and conclusions for the two related projects.

Significant Results:

Two weld designs were selected via popular vote from the Pooled Fund members. Both weld designs were evaluated through a dynamic bogie impact test. During the tests the base plate tore adjacent to the weld on the front flange.

Objectives / Tasks	% Completed
1. Literature review of current practices	100%
2. Design of new weld detail	100%
3. Dynamic testing and analysis	100%
4. Written Report containing design work, testing, and conclusions	40%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Potential Implementation:

The development of a simplified, standard weld detail will be compatible with the culvert-mounted, W-beam guardrail system and available for use on low-fill concrete box culverts.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl.#37	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Annual LS-DYNA Modeling Enhancement Support		
Name of Project Manager(s): Reid, Sicking, Faller	**Phone Number:** 402-472-3084	**E-Mail** jreid@unl.edu
Lead Agency Project ID: RPFP-11-LSDYNA	**Other Project ID (i.e., contract #):** 2611211050001	**Project Start Date:** July 1, 2010
Original Project End Date: December 31, 2013	**Current Project End Date:** December 31, 2013	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$35,901	0	0

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
0	0	0

Project Description:

This is a continuation of TPF-5(193) Suppl.#24, "LS-DYNA Modeling Year 4" and thus, no progress to report until funds are exhausted in that project.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Anticipated work next quarter:

Significant Results:

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Potential Implementation:

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Wisconsin Department of Transportation

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #40	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:		
Length of Need - B/C Analysis		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Sicking, Faller, Albuquerque	402-472-9070	dbenicio@huskers.unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211060001		7/1/2011
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
6/30/2014		

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$113,499	$72,963	60%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
	$23,654	

Project Description:

Guardrail is used to shield motorists from collisions with roadside hazards and must extend long distances in advance of any roadside obstacle to minimize the risk of a vehicle traveling behind the barrier and striking the hazard. When the length of guardrail is increased, the risk that a vehicle will travel behind the barrier and strike the hazard is reduced. However, guardrail is also a roadside hazard that produces approximately 1,200 fatal crashes across the nation every year. Increasing the length of a guardrail installation increases the frequency of impacts with the barrier and thereby increases the risk of a serious crash. Further, the increase in barrier crash frequency associated with each incremental increase in guardrail length does not diminish as the guardrail is extended. At some point, the increase in the risk of serious injuries and fatalities associated with extending the guardrail outweighs the reduction in the risk of a vehicle traveling behind guardrail and producing serious injury or fatal impacts with the shielded hazard. Extending the guardrail beyond this optimal length will increase the overall risk that motorists will be involved in a serious injury or fatal crash.

The objective of this research effort is to quantify the probability of a vehicle traveling behind guardrail and striking a shielded hazard and its relationship to guardrail length. This probability will then be used to develop a revised procedure for determining optimal guardrail upstream length. A revised procedure selecting guardrail downstream length on divided highways will also be developed.

Objective / Task
1. Literature review
2. Guardrail, hazard and crash data collection
3. Data analysis
4. RSAP analysis
5. Written report containing all analysis and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The data analysis began and it is in progress. Most of the data (i.e., 80%) has been analyzed and tabulated. The technical report is also being written according to the progress of the analyses.

Anticipated work next quarter:

The data analysis will be completed and fully included in the technical report. The RSAP analysis will be initiated as an attempt to determine how much guardrails may be shortened without significantly increasing the frequency/cost of vehicle-hazard crashes.

Significant Results:

None

Objective / Task	% Complete
1. Literature review	100%
2. Data collection	100%
2. Accident data analysis	80%
3. RSAP analysis	5%
4. Written report containing all analysis and conclusions	40%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None

Potential Implementation:

The proposed research study would develop guardrail length design procedures calibrated to provide optimal safety for occupants of vehicles involved in ran-off-road crashes. These new procedures should provide both a reduction in the cost of guardrail construction and a reduction in the overall risk of motorist injury and fatality.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #46	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Midwest Four-Cable, High-Tension, Median Barrier - Phase III, End Terminal		
Name of Project Manager(s): Reid, Sicking, Faller, Bielenberg	**Phone Number:** 402-472-3084	**E-Mail** jreid@unl.edu
Lead Agency Project ID: RPFP-12-CABLE	**Other Project ID (i.e., contract #):** 2611211066001	**Project Start Date:** July 1, 2011
Original Project End Date: June 30, 2014	**Current Project End Date:** June 30, 2014	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$199,626	0	0

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**

Project Description:

Objective: Redesign the cable release mechanism and foundation of the three cable end terminal to accommodate four high tension cables.

In a previous Pooled Fund Project, a cable end terminal consisting of three cables was designed and successfully crash tested according to NCHRP Report 350 criteria. That end terminal was designed for a low tension system. Further, MwRSF has also been working to develop a non-proprietary, high-tension, cable barrier system. Thus, there is a need to adapt this terminal for use in high-tension cable systems while also being satisfying the safety performance standards of MASH.

This is Phase III of the project.

Phase I was funded in Year 17: SPR-3(017) Suppl.#38 - "Testing of Cable Terminal for High Tension Cable (1100C & 2270P)"

Phase II was funded in Year 20: TPF-5(193) Suppl.#21 - "Additional Funding to Complete Development of a Crash-Worthy Terminal for Midwest Four-Cable, HT, Barrier System"

No reporting on this phase of the project will be done until Phases I and II are completed; see those projects for status.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Anticipated work next quarter:

Significant Results:

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Final design details and full-scale testing for this project cannot be conducted until the High Tension Cable Barrier System is completed.

Potential Implementation:

The revised terminal will provide a non-proprietary end terminal for high tension barrier cable systems.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Supplement #44	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:

Completion of the Development and Evaluation of the Midwest Four-Cable, High-Tension, Median Barrier Phase I

Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Bielenberg, Lechtenberg	402-472-9070	kpolivka2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211064001	RPFP-12-CABLE1&2	7/1/11
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
6/30/14	6/30/14	0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$233,262	$122,793 (+$75,366 from Yr 21 Cont	65

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$61,518 (+$18,005 from Yr 21 Cont.)	

Project Description:

This project is an extension to previous projects (RPFP-08-02: Four-Cable Median Barrier in 4:1 V-Ditch; RPFP-09-01: New Funding for High-Tension Cable Barrier on Level Terrain with New Cable Attachment; and RPFP-10-CABLE-2: Replacement Funding for High-Tension Cable Barrier on Level Terrain).

Original Objective: To complete the development, testing, and evaluation of the four-cable, high-tension, median barrier system for use in 4H:1V sloped medians.

Revised Objective: To complete the development, testing, and evaluation of the four-cable, high tension, median barrier system placed 0 to 4 ft away from the slope break point of a 6H:1V sloped medians.

Tasks:

1. Full-scale crash testing (MASH 3-10)
2. Full-scale crash testing (MASH 3-11)
3. Full-scale crash testing (Additional MASH 1500A)
4. Analysis and documentation of test results
5. Research report (s)
6. Hardware guide drawings and FHWA acceptance

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The text of what was done this quarter extends further than what is shown. Click within the box and scroll down.

The final report for the vehicle trajectory analysis was published and disseminated to the Pooled Fund member states on September 7, 2012.

Review of the internal draft report of test no. 4CMBLT-1 continued.

The two different designs of the one-piece, tabbed brackets (which are an alternative design to the keyway bolts) were fabricated from two different thicknesses. Recall, the advantage of these brackets would be the ease of installation as they are only one piece and can be crimped into place. Sixteen dynamic component tests (test nos. HTTB-1 through HTTB-16) were performed on four different tabbed bracket designs which were anchored to a rigid jig to determine the cable release capacity in the lateral and vertical directions. The tabbed brackets were similar to the keyway bolts in the sense that they were designed to bend and rotate out of a keyway when pulled vertically, but catch in a slot and fracture when pulled laterally. Because the tabbed brackets were cut from sheet steel instead of round bars that the keyway bolts were fabricated from, there was more flexibility in the cross-section designs through which the brackets either bent or fractured.

One of the alternative design were one-piece brackets which were inserted into the keyway and crimped into place. These were tested in test nos. HTTB-1 through HTTB-8. The 10-gauge, crimp-in-place tabbed bracket had a vertical release load of 2.84 kips, with significant scraping against the inside of the flange as the top tab rotated out of the keyway. The lateral release load was 5.93 kips, with fracture through the minimum cross-section of the bottom tab. The 11-gauge, crimp-in-place tabbed bracket exhibited similar behavior, with a vertical release load of 1.32 kips and lateral release load

Anticipated work next quarter:

Complete internal review of the draft research report of 4CMBLT-1. Submit the draft report to Pooled Fund member states for review and comment.

Design modifications of the bolted tabbed bracket design will continue to be investigated. The new designs will aim to further reduce the vertical release loads by extending the distance between the inside of the flange and the part of the top tab which rubs against it. This modification worked in the case of the keyway bolts, completely mitigating scraping against the inside of the flange.

The top cable attachment will continue to be investigated through dynamic component testing of the two best concepts determined from the static testing.

The new folded C-channel post made from sheet steel will be fabricated from two different sheet thickness and investigated through dynamic component testing. If the new post section shows promising results, the new bolted tabbed bracket design will be tested with this post section.

An update meeting with the Pooled Fund member states will be scheduled for the next quarter after the results of the above mentioned component testing has been completed.

Significant Results:

As the result of the guidance from the member States in August 2011, it was decided the four-cable barrier system would be developed for use on sloped medians as steep as 6H:1V instead of 4H:1V but still placed 0 to 4 ft away from the slope break point (Plan B from letter dated August 15, 2011).

Task	% Complete
1. Full-scale crash testing (MASH 3-10)	0%
2. Full-scale crash testing (MASH 3-11) - 4CMB-5	100%
3. Full-scale crash testing (Additional MASH 1500A) - 4CMBLT-1	100%
4. Analysis and documentation of test results - 4CMB-5	100%
5. Analysis and documentation of test results - 4CMBLT-1	100%
6. Analysis and documentation of test results (MASH 3-10)	0%
7. Research report - 4CMB-4 and 4CMB-5	100%
8. Research report - 4CMBLT-1	90%
9. Research report	0%
10. Research report - Vehicle Trajectory Analysis	100%
11. Hardware guide drawings and FHWA acceptance	0%
12. Redesign of system	50%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

This project is an extension to previous projects (RPFP-08-02: Four-Cable Median Barrier in 4:1 V-Ditch; RPFP-09-01: New Funding for High-Tension Cable Barrier on Level Terrain with New Cable Attachment; and RPFP-10-CABLE-2: Replacement Funding for High-Tension Cable Barrier on Level Terrain).

It should be noted that the test conducted with the 1500A on the system placed on level terrain (Test No. 4CMBLT-1 conducted on June 14, 2011) was charged to the Project No.:RPFP-11-CONT – TPF-5(193) Supplement #39, Project Title: Pooled Fund Year 21 Contingency even though it was one of the tests funded in Project No.:RPFP-12-CABLE1&2 – TPF-5(193) Supplement #44, Project Title: Completion of the Development and Evaluation of the Midwest Four-Cable, High-Tension, Median Barrier Phase I, V-Ditch. At the time this test was conducted, Year 22 funds were not available for use. The funds in the above mentioned contingency funds were available and were to be used to fund part of Phase II of this project.

As the result of the guidance from the member States in August 2011, it was decided the four-cable barrier system would be developed for use on sloped medians as steep as 6H:1V but still placed 0 to 4 ft away from the slope break point (Plan B from letter dated August 15, 2011). Depending on the simulation results and future modifications to the proposed MASH test matrices, up to seven full-scale crash tests may be required, including three level terrain tests.

Potential Implementation:

The successful completion of the development, testing, and evaluation of the Midwest four-cable, high-tension, median barrier in sloped medians will allow the member states to implement a non-proprietary, high-tension, cable system along our nation's highways and roadways. The successful completion of this project along with the non-proprietary four-cable, high-tension, median barrier on level terrain and cable guardrail end terminal would help to assure acceptance by FHWA and improve its chances for widespread implementation.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Supplement #45	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title: Completion of the Development and Evaluation of the Midwest Four-Cable, High-Tension, Median Barrier Phase II		
Name of Project Manager(s): Reid, Sicking, Faller, Bielenberg, Lechtenberg	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611211065001	**Other Project ID (i.e., contract #):** RPFP-12-CABLE1&2	**Project Start Date:** 7/1/11
Original Project End Date: 6/30/14	**Current Project End Date:** 6/30/14	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$91,800 (+$91,089 from Yr 21 contingency)	$0	0

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$0	

Project Description:

The Midwest Roadside Safety Facility (MwRSF) has been conducting research for the Midwest States Regional Pooled Fund Program to develop a non-proprietary, high-tension, four-cable, median barrier that is capable of being used anywhere in a V-ditch with 4H:1V side slopes. Three tests still remain to complete the test matrix of the cable barrier system in a V-ditch. In addition, the four-cable, high-tension, median barrier has never been tested on level terrain. There is a concern that FHWA may not approve this design without testing on flat ground, especially when considering the wide cable spacing and increased cable heights. Further, the barrier deflections observed in crash tests performed in a 4H:1V V-ditch are likely higher than would be observed on flat ground. Crash testing of the barrier installed on level terrain would identify barrier deflections and working widths that can be expected when the barrier is used in narrow medians with gentle slopes and would allow for better performance comparisons between the Midwest four-cable barrier and other proprietary systems.

Objective: To complete the development, testing, and evaluation of the four-cable, high-tension, median barrier system for use on level terrain.

Tasks:

1. Full-scale crash testing (MASH 3-10 and 3-11)
2. Analysis and documentation of test results
3. BARRIER VII calibration and analysis for alternate configurations
4. Research report
5. Hardware guide drawings and FHWA acceptance

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

None

Priorities set by the Pooled Fund member States are for the continued development of a high-tension, cable barrier system for relatively-flat and sloped median applications was to focus on the four-cable barrier system for use on sloped medians as steep as 6:1 but still placed 0 to 4 ft away from the slope break point.

Anticipated work next quarter:

None.

Priorities set by the Pooled Fund member States are for the continued development of a high-tension, cable barrier system for relatively-flat and sloped median applications was to focus on the four-cable barrier system for use on sloped medians as steep as 6:1 but still placed 0 to 4 ft away from the slope break point.

Significant Results:

Task	% Complete
1. Full-scale crash testing (MASH 3-10 and 3-11)	0%
2. Analysis and documentation of test results	0%
3. BARRIER VII calibration and analysis for alternate configurations	0%
4. Research report	0%
5. Hardware guide drawings and FHWA acceptance	0%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

A portion of this project ($91,089 is not included in the project budget shown on page 1) will be funded with Project No.: RPFP-11-CONT – TPF-5(193) Supplement #39, Project Title: Pooled Fund Year 21 Contingency.

It should be noted that the test conducted with the 1500A on the system placed on level terrain (Test No. 4CMBLT-1 conducted on June 14, 2011) was charged to the above mentioned contingency funds even though it was one of the tests funded in Project No.:RPFP-12-CABLE1&2 – TPF-5(193) Supplement #44, Project Title: Completion of the Development and Evaluation of the Midwest Four-Cable, High-Tension, Median Barrier Phase I, V-Ditch. At the time this test was conducted, Year 22 funds were not available for use. The funds in the above mentioned contingency funds were available and were to be used to fund part of this project (Phase II).

As the result of the guidance from the member States in August 2011, it was decided the four-cable barrier system would be developed for use on sloped medians as steep as 6:1 but still placed 0 to 4 ft away from the slope break point (Plan B from letter dated August 15, 2011). Depending on the simulation results and future modifications to the proposed MASH test matrices, up to seven full-scale crash tests may be required, including three level terrain tests.

Potential Implementation:

The successful completion of the development, testing, and evaluation of the Midwest four-cable, high-tension, median barrier on level terrain will allow the member states to implement a non-proprietary, high-tension, cable system along our nation's highways and roadways. In addition, the crash testing of the four-cable, high-tension, median barrier on level terrain would also provide a more complete understanding of barrier performance (i.e., dynamic deflections, working width, etc.) when used in relatively flat, narrow medians. The crash results from the level terrain testing will be used in combination with computer simulation to evaluate the effects of reduced post spacing. The successful completion of this project along with the non-proprietary four-cable, high-tension, median barrier in V-ditch and cable guardrail end terminal would help to assure acceptance by FHWA and improve its chances for widespread implementation.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #47	☐ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☑ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title: MGS Culvert Attachment with Epoxied Rods		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Bielenberg, Rosenbaugh	402-472-9324	srosenba@unlserve.unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211067001	RPFP-11-MGS-4	7/1/2011
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
6/30/2014		

Project schedule status:

☐ On schedule ☐ On revised schedule ☑ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$19,935	$10,153	70%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$2,644	

Project Description:

MwRSF has previously developed a TL-3 guardrail system for use on low-fill culverts and according to the NCHRP Report No. 350 safety performance criteria. In this application, the steel guardrail posts were anchored to the top of the culvert slab using through bolts in combination with a base plate that is welded to the bottom of the posts. However, problems can arise when the guardrail post coincides with the location of a vertical support wall found inside the culvert. For this scenario, through bolts cannot be utilized to anchor the guardrail posts to the culvert slab since there is unavailable space to place the lower bearing plate or access the lower end of the through bolt. Instead, it is necessary to use an alternative anchorage option, such as a threaded rod anchored into the culvert slab and upper region of the vertical wall. Unfortunately, no design recommendations exist for using epoxied anchor rods to attach the steel posts to the top of the culvert slab. A small research study is needed to evaluate suitable epoxied anchor rods for use with the W-beam guardrail over culvert system.

In 2010, the Midwest Pooled Fund States funded a small project to determine an alternative, standard weld detail which simplifies the post-plate attachment for the guardrail system mentioned above and to evaluate the new weld detail through both analysis and bogie testing. The proposed project herein is to act as a supplement to the current project, RFPF-11-MGS-4.

Objectives / Tasks

1. Literature review
2. Design of epoxied anchors
3. Dynamic testing and analysis of design
4. Written report containing all design, analysis and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The bogie testing portion of this project (2 tests) were completed. 6 inches of embedment caused the threaded rods to pull out of the concrete. 8 inches of embedment provided adequate strength throughout the impact.

This quarter, work has continued on the report documenting all testing, analysis, and conclusions for this project. Project TPF-5(193) suppl. #34 will be included in the testing report as they both deal with attachment of the top mounted culvert post to existing culvert slabs.

Anticipated work next quarter:

Work shall continue on the documentation report.

Significant Results:

The first dynamic bogie impact test conducted on a post assembly anchored by rods embedded 6" into the tarmac resulted in the anchors pulling out of the concrete. The second test was conducted on a post utilizing an 8" embedment depth. During the second test, both the anchors and the post-to-plate weld held and the post was plastically deformed. Thus, 8 inches of embedment will be required for proper attachment of the top-mounted culvert post in locations where epoxy anchors are desired over the original bolt-through design.

Objectives / Tasks	% Completed
1. Literature review	100%
2. Design of epoxied anchors	100%
3. Dynamic testing and analysis of design	100%
4. Written report containing all design, analysis and conclusions	40%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Potential Implementation:

The development of an epoxied anchor rod alternative to the original through bolt anchorage of the culvert guardrail posts will allow the system to be installed anywhere across the top slab of the concrete culvert, regardless of the location of interior, culvert walls.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #48	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Pooled Fund Center for Highway Safety		
Name of Project Manager(s): Ron Faller, John Reid, Bob Bielenberg	**Phone Number:** 402-472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211068001	**Other Project ID (i.e., contract #):** RPFP-12-PFCHS-1	**Project Start Date:** 7/1/2011
Original Project End Date: 6/30/14	**Current Project End Date:** 6/30/14	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$24,859.00	$395.00	5%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$395.00	

Project Description:

Many of MwRSF's inquiries from members of the Midwest States Pooled Fund program can be answered based upon prior pooled fund or other research. Further, even though answers to pooled fund inquiries are normally routed to all pooled fund states in the quarterly progress report, there are numerous repeat questions every year. The quarterly summaries are helpful to member states, but they are temporary and not well organized by the type of question or specific topic. Many pooled fund inquiries could be answered through the development of a Center of Highway Safety web site. This web site would provide an organized and searchable summary for all State inquiries and MwRSF reports as well as CAD details pertaining to Pooled Fund crash tested systems. This safety center would also be helpful to non-member states with problems or inquiries similar to those identified by the member states.

A dedicated and well-maintained Pooled Fund Center for Highway Safety web site would provide for all of these needs. It would provide for a searchable database of previous MwRSF inquiries and solutions, a searchable online listing of downloadable research reports, and a searchable archive of CAD details for crash tested and/or approved systems and features. Through MwRSF's relationship with the Nebraska Transportation Center (NTC), experienced personnel can be hired to perform website design, programming, as well as provide reliable website hosting facilities. However, the development, maintenance, operation, and hosting of the web site will require funding. It is anticipated that the costs to develop, operate, maintain, and host a Pooled Fund Center for Highway Safety web site would be $24,859.00 in funding for FY 22.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The MwRSF Pooled Fund Consulting web site is fully functional and MwRSF has begun work on the Pooled Fund Center for Highway Safety web site. MwRSF has met with web site developers at UNL and have begun plans for a web site that will house all of the MwRSF research reports and CAD details in a searchable format for downloading. It is anticipated that the web site will tie in with both the existing MwRSF web site and the recently finished MwRSF Pooled Fund Consulting web site. The web site is in its early development phase. This includes a plan for the site design and organization, the search functionality, and determination of materials to archive on the site.

MwRSF has met with the web site development team at UNL and has developed a rough prototype of the web site. MwRSF has determined the list of potential materials that may be added to the web site in the future so that the framework of the site can be programmed to more readily accept these updates at a later time as states request them.

Progress has been limited this quarter on due to work by the web site development team on the MwRSF Consulting Services web site. There were minor issues with the search and attachment functions on the consulting web site and resources were prioritized to address those issues before working on the Pooled Fund Center for Highway Safety web site.

Anticipated work next quarter:

In the coming quarter, MwRSF will continue the process of developing the Pooled Fund Center for Highway Safety web site. The web site development team currently plans to have the web site up and functional by the end of the quarter. This should allow MwRSF to populate the archive during the first quarter of 2013 and have the site full functional by the end of the first quarter of 2013.

Again, at this time, the existing funds for the project should allow for archiving of MwRSF research reports and CAD details.

Significant Results:

None.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None.

Potential Implementation:

The Pooled Fund Center for Highway Safety web site would provide immediate access to a wide library of roadside safety materials for designers and engineers, including reports, CAD details, etc. It would also provide a searchable database of previous solutions and responses to prior Pooled Fund inquiries and problems. The web site would also be available through controlled access to state DOT's around the country which would promote improved roadside safety.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #48	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Pooled Fund Center for Highway Safety		
Name of Project Manager(s): Ron Faller, John Reid, Bob Bielenberg	**Phone Number:** 402-472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211086001	**Other Project ID (i.e., contract #):** RPFP-13-PFCHS	**Project Start Date:** 7/1/2011
Original Project End Date: 6/30/14	**Current Project End Date:** 6/30/14	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$10,958.00	$0.00	0%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$0.00	

Project Description:

Many of MwRSF's inquiries from members of the Midwest States Pooled Fund program can be answered based upon prior pooled fund or other research. Further, even though answers to pooled fund inquiries are normally routed to all pooled fund states in the quarterly progress report, there are numerous repeat questions every year. The quarterly summaries are helpful to member states, but they are temporary and not well organized by the type of question or specific topic. Many pooled fund inquiries could be answered through the development of a Center of Highway Safety web site. A dedicated and well-maintained Pooled Fund Center for Highway Safety web site would provide for all of these needs. It would provide for a searchable database of previous MwRSF inquiries and solutions, a searchable online listing of downloadable research reports, and a searchable archive of CAD details for crash tested and/or approved systems and features. This safety center would also be helpful to non-member states with problems or inquiries similar to those identified by the member states.

In Year 22, the Midwest States Pooled Fund states sponsored the development of a Pooled Fund Center for Highway Safety web site. This project allowed for the development of the first phase of the web site and archiving of materials on the web site. In the past year, a web site for the Midwest States Pooled Fund consulting questions and responses was developed and made available. The web site is currently operational and provides functions for submitting questions and inquiries to MwRSF as well as posting of the responses. It also provides a searchable database of previous MwRSF inquiries and solutions. The website is located at http://mwrsf-qa.unl.edu/.

In addition to the consulting web site, a searchable online listing of downloadable research reports, and a searchable archive of CAD details for crash tested and/or approved systems and features has been started. MwRSF is currently in the process of making this web site operational and uploading the archived reports and CAD. MwRSF anticipates that this archive will be fully functional in the near term. The report and CAD archive as well as the Midwest States Pooled Fund consulting web site will be integrated with the main MwRSF web site in the near future as well.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

At this time, the Pooled Fund Center for Highway Safety web site is still under development and the funding provided in this project has yet to be accessed for web maintenance and updating.

Anticipated work next quarter:

The project funding herein will not be accessed until the Pooled Fund Center for Highway Safety web site is full operational. It is anticipated that the web site will be functional in the first quarter of 2013.

Significant Results:

None.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None.

Potential Implementation:

The Pooled Fund Center for Highway Safety web site would provide immediate access to a wide library of roadside safety materials for designers and engineers, including reports, CAD details, etc. It would also provide a searchable database of previous solutions and responses to prior Pooled Fund inquiries and problems. The web site would also be available through controlled access to state DOT's around the country which would promote improved roadside safety.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Supplement #49	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:		
Annual Fee to Finish TF-13 and FHWA Standard Plans		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Lechtenberg	402-472-9070	kpolivka2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211069001	RPFP-12-TF13	7/1/11
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
6/30/14	6/30/14	0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$3,993	$3,502	75

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$142	

Project Description:

Each year, the Midwest States Pooled Fund program sponsors several roadside safety studies at the Midwest Roadside Safety Facility (MwRSF) of the University of Nebraska-Lincoln. Some of these research efforts result in the development of new roadside safety features. As part of this effort and on behalf of the member states, MwRSF seeks FHWA acceptance for those devices or systems meeting current impact safety standards. In the future, FHWA will require standard Task Force (TF) 13-format CAD details along the typical system details when requests for hardware acceptance are made.

MwRSF prepares 2 D and/or 3 D CAD details for newly developed roadside safety features that are subjected to full-scale vehicle crash testing. The CAD details used to describe the as-tested systems or components are not always prepared and presented in the same format as now required by AASHTO TF 13 and FHWA. As such, additional CAD details and background information must be prepared when FHWA acceptance is sought under MASH or when the new system or associated components are submitted for inclusion in the electronic version of the barrier hardware guide.

Objective: For all new barrier hardware, the member states request that MwRSF seek formal FHWA acceptance and placement of standardized TF-13 CAD details in the electronic version of the highway barrier guide. This funding shall be used to supplement the preparation of the TF-13 format CAD details.

Tasks:

1. Prepare CAD details for Hardware Guide

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Updated drawings based on comments received at the AASHTO TF-13 Spring meeting held in April 2012.

Anticipated work next quarter:

Continue to update drawings based on comments received at the AASHTO TF-13 Spring meeting held in April 2012.

Significant Results:

This project is used to supplement the preparation of the TF-13 format CAD details. Previously, it was determined that there are 14 systems and 11 components that need to be prepared in the TF-13 format. During discussions with the AASHTO TF-13 subcommittee in July 2011, new components had to be generated from the existing system drawings. Thus, the original 11 components became 32. Two of the systems and one component had limited work that need to be completed on the drawings as they were to be included in the Bridge Rail Guide and Luminaire Guide, respectively.

In evaluating the separation of the components, it was determined that some could be combined into one drawing based on the same type of component, but just one varying parameter.

Summary of Barrier Guide individual drawings to date:
31 systems - 25 approved, 6 to be reviewed
41 components - 15 approved, 26 to be reviewed
2 systems submitted to Bridge Rail Guide
1 component submitted to Luminaire Guide

Task	% Complete
1. Prepare CAD details for Hardware Guide	100%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Funding from Project No.: RPFP-11-TF-13 – TPF-5(193) Supplement #38, Project Title: Annual Fee to Finish TF-13 and FHWA Standard Plans used prior to starting this project.

At the present time, standard TF13-format CAD details are now required and subjected to review and comment by TF 13 members. This review is taking place during the TF-13 meetings which occur twice a year. After the initial review, the drawings are edited and then reviewed again at a later meeting. Once the CAD details are deemed acceptable and meet TF 13 guidelines, they are integrated into the electronic, web-based, version of the existing barrier hardware guide. Consequently, it requires a minimum of 6 months to get a drawing accepted for inclusion in the hardware guide; that is if there are only minimal edits to be made to the drawing. Sometimes, TF-13 requires a second review and more edits, thus adding another 6 months on to the time for its acceptance. For example, five (5) of the 13 systems were submitted for review during the September 2010 meeting. However, the allotted time only allowed the review of three (3) of the systems. The other two (2) were reviewed during the May 2011 meeting. Thus, some drawings may be in the review state at TF-13 for over a year before they are even looked at for the first time.

TF-13 is in the process of developing an online review system which will expedite the review process and allow more systems to be reviewed prior to their semi-annual meetings. Then at the TF-13 meetings it will be a final review and vote on if the drawings are ready to be implemented into the online guide.

Potential Implementation:

Newly-developed highway safety hardware will be contained in the electronic, web-based guide, thus promoting the standardization of barrier hardware across the U.S. and abroad.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #50	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Annual Consulting Services Support		
Name of Project Manager(s): Ron Faller, John Reid, Bob Bielenberg	**Phone Number:** 402-472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211070001	**Other Project ID (i.e., contract #):** RPFP-12-CONSULT	**Project Start Date:** 7/1/2011
Original Project End Date: 6/30/14	**Current Project End Date:** 6/30/14	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$39,992.00	$39,992.00	100%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$11,734.00	

Project Description:

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 will now be accessible on a MwRSF Pooled Fund Consulting web site.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

In the past quarter MwRSF has responded to a series of state inquiries. The Quarterly Progress Report summarizing these responses has NOT been attached to this document. It will be submitted at a later date once ssues with the web server noted below are addressed. At that time, it will also be available for download at the recently completed MwRSF Pooled Fund Consulting web site - http://mwrsf-qa.unl.edu/

We would ask that all Pooled Fund member states use the new site from this point forward for their inquiries.

The server housing the MwRSF Pooled Fund Consulting web site was hacked in mid June and the web site was taken offline to fix the security breach. The web site was to be put back online once the server security issues were alleviated. While the security issues have been resolved, the web site programming is currently not fully functional and reliable. As such, the web site has been shut down until these issues can be resolved. In the interim, MwRSF will continue to answer questions submitted through e-mail and phone contact, and these items will be documented and uploaded to the web site by MwRSF when it is functional once again. Due to the these issues the quarterly summary is not available at this time and will be submitted at a later date.

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/

As the web site is currently offline, phone and e-mail contact is currently the best method for getting responses from MwRSF

Significant Results:

A quarterly summary of the consulting effort will be provided at a later date.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None.

Potential Implementation:

None.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): NE Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #51	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Annual LS-DYNA Modeling Enhancement Support		
Name of Project Manager(s): Reid, Sicking, Faller, Bielenberg	**Phone Number:** 402-472-3084	**E-Mail** jreid@unl.edu
Lead Agency Project ID: RPFP-12-LSDYNA	**Other Project ID (i.e., contract #):** 2611211071001	**Project Start Date:** July 1, 2011
Original Project End Date: June 30, 2014	**Current Project End Date:** June 30, 2014	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$36,543	0	0

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
0	0	0

Project Description:

This is a continuation of TPF-5(193) Suppl.#37, "Annual LS-DYNA Modeling Enhancement Support" and thus, no progress to report until funds are exhausted in that project.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Anticipated work next quarter:

Significant Results:

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Potential Implementation:

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Supplement #52	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Deflection of Curved Runs of Cable Guide Under MASH TL-3 Impact - Retest		
Name of Project Manager(s): Faller, Sicking, Reid, Lechtenberg, Bielenberg	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611211074001	**Other Project ID (i.e., contract #):**	**Project Start Date:** 12/15/11
Original Project End Date: 12/31/12	**Current Project End Date:** 12/31/12	**Number of Extensions:**

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$58,350	$31,344	80

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$9,330	

Project Description:

This project was additional funding to retest the 440-ft radius system with the modified top cable height. The original project was TPF-5(193) Supplement #30, Lead Agency Project ID: 2611211054001.

Tasks of original project:
1. Prepare CAD details of 360-ft radius system
2. Construct 360-ft radius system
3. Full-scale test of 360-ft radius system (modified MASH 3-11)
4. Prepare CAD details of 440-ft radius system
5. Construct 440-ft radius system
6. Full-scale test of 440-ft radius system (modified MASH 3-11)
7. Analysis and documentation of test results
8. Draft and final research reports
9. Additional crash investigation and energy dissipation analysis
10. Draft and final report for additional analysis

Tasks for additional work added to original project:
11. Prepare CAD details of modified 440-ft radius system
12. Construct modified 440-ft radius system
13. Full-scale test of modified 440-ft radius system (modified MASH 3-11)

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

A draft research report of the testing was completed. Internal review of the draft report of the testing was initiated.

Energy dissipation estimations continued utilizing the results from all three tests. Additional items of potential energy dissipation were investigated. A draft report of the additional energy dissipation analysis continued to be written.

Anticipated work next quarter:

Internal review of the draft report will be completed. The draft report will be sent to NY State DOT for review and comment. Review comments will be implemented and the final report will be published and disseminated to NY State DOT.

Energy dissipation estimations will be completed utilizing the three test results and prior component testing as well as developing reasonable estimates for the barrier-vehicle friction and vehicle damage. A draft research report of the energy analysis will be completed and sent to NY State DOT for review and comment. Review comments will be implemented and the final report will be published and disseminated to NY State DOT.

Significant Results:

On August 2, 2011, MwRSF conducted one pickup crash test (test no. NYCC-1) into a 360-ft radius curved cable system according to the modified TL-3 safety performance guidelines of MASH. The pickup was successfully contained and redirected. On November 1, 2011, MwRSF conducted one pickup crash test (test no. NYCC-2) into a 440-ft radius curved cable system according to the modified TL-3 safety performance guidelines of MASH. The pickup was not contained nor redirected. Following the failed test of the 440-ft radius system, the NYSDOT decided to retest a modified system with a 2 in. higher top cable. On April 26, 2012, MwRSF conducted one pickup crash test (test no. NYCC-3) into a 440-ft radius curved cable system with a 29-in. top cable height according to the modified TL-3 safety performance guidelines of MASH. The pickup was successfully contained and redirected.

Tasks:	% Completed
1. Prepare CAD details of 360-ft radius system	100%
2. Construct 360-ft radius system	100%
3. Full-scale test of 360-ft radius system (modified MASH 3-11)	100%
4. Prepare CAD details of 440-ft radius system	100%
5. Construct 440-ft radius system	100%
6. Full-scale test of 440-ft radius system (modified MASH 3-11)	100%
7. Analysis and documentation of test results	100%
8. Draft and final research reports	85%
9. Additional crash investigation and energy dissipation analysis	75%
10. Draft and final report for additional analysis	50%
11. Prepare CAD details of modified 440-ft radius system	100%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

The warmer temperatures during the 4th Quarter of 2010 and 1st Quarter of 2011 melted the snow and thawed the soil surface, thus resulting in a muddy work environment not conducive to post installation. In addition, the spring rains came early. Rains continued through the 2nd Quarter of 2011 and the wet conditions made construction quite difficult.

With the unsuccessful second test, NYSDOT requested a retest with raising the top cable height 2 inches. An addition to the original proposal was filed.

Funds for the original project, TPF-5(193) Supplement #30, Lead Agency Project ID: 2611211054001, have been exhausted. All further work will be conducted under this additional funding project.

Potential Implementation:

This will provide justification for limits that have been placed on the amount of curvature that could be used for a given post spacing for a curved cable system since operating speeds on freeways have continued to increase and vehicle weights have continued to grow. In addition, it will allow the New York State Department of Transportation to provide information to help the New York State Police performing accident reconstructions, particularly as it relates to determining impact speeds, such as how much energy is absorbed in the process of deforming a standard weak post.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Supplement #53	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title: Annual Fee to Finish TF-13 and FHWA Standard Plans		
Name of Project Manager(s): Reid, Sicking, Faller, Lechtenberg	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611211079001	**Other Project ID (i.e., contract #):** RPFP-13-TF13	**Project Start Date:** 7/1/12
Original Project End Date: 6/30/15	**Current Project End Date:** 6/30/15	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$3,983	$0	0

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$0	

Project Description:

Each year, the Midwest States Pooled Fund program sponsors several roadside safety studies at the Midwest Roadside Safety Facility (MwRSF) of the University of Nebraska-Lincoln. Some of these research efforts result in the development of new roadside safety features. As part of this effort and on behalf of the member states, MwRSF seeks FHWA acceptance for those devices or systems meeting current impact safety standards. In the future, FHWA will require standard Task Force (TF) 13-format CAD details along the typical system details when requests for hardware acceptance are made.

MwRSF prepares 2 D and/or 3 D CAD details for newly developed roadside safety features that are subjected to full-scale vehicle crash testing. The CAD details used to describe the as-tested systems or components are not always prepared and presented in the same format as now required by AASHTO TF 13 and FHWA. As such, additional CAD details and background information must be prepared when FHWA acceptance is sought under MASH or when the new system or associated components are submitted for inclusion in the electronic version of the barrier hardware guide.

Objective: For all new barrier hardware, the member states request that MwRSF seek formal FHWA acceptance and placement of standardized TF-13 CAD details in the electronic version of the highway barrier guide. This funding shall be used to supplement the preparation of the TF-13 format CAD details.

Tasks:

1. Prepare CAD details for Hardware Guide

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

NONE

Anticipated work next quarter:

NONE

Significant Results:

NONE

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Funding from Project No.: RPFP-12-TF-13 – TPF-5(193) Supplement #49, Project Title: Annual Fee to Finish TF-13 and FHWA Standard Plans will be used prior to starting this project.

Potential Implementation:

Newly-developed highway safety hardware will be contained in the electronic, web-based guide, thus promoting the standardization of barrier hardware across the U.S. and abroad.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #54	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Annual Consulting Services Support		
Name of Project Manager(s): Ron Faller, John Reid, Bob Bielenberg	**Phone Number:** 402-472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211080001	**Other Project ID (i.e., contract #):** RPFP-13-CONSULT	**Project Start Date:** 7/1/2012
Original Project End Date: 6/30/15	**Current Project End Date:** 6/30/15	**Number of Extensions:** 0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$39,992.00	$780.00	25%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$780.00	

Project Description:

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 will now be accessible on a MwRSF Pooled Fund Consulting web site.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

In the past quarter MwRSF has responded to a series of state inquiries. The Quarterly Progress Report summarizing these responses has NOT been attached to this document. It will be submitted at a later date once ssues with the web server noted below are addressed. At that time, it will also be available for download at the recently completed MwRSF Pooled Fund Consulting web site - http://mwrsf-qa.unl.edu/

We would ask that all Pooled Fund member states use the new site from this point forward for their inquiries.

The server housing the MwRSF Pooled Fund Consulting web site was hacked in mid June and the web site was taken offline to fix the security breach. The web site was to be put back online once the server security issues were alleviated. While the security issues have been resolved, the web site programming is currently not fully functional and reliable. As such, the web site has been shut down until these issues can be resolved. In the interim, MwRSF will continue to answer questions submitted through e-mail and phone contact, and these items will be documented and uploaded to the web site by MwRSF when it is functional once again. Due to the these issues the quarterly summary is not available at this time and will be submitted at a later date.

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/

As the web site is currently offline, phone and e-mail contact is currently the best method for getting responses from MwRSF

Significant Results:

A quarterly summary of the consulting effort will be provided at a later date.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None.

Potential Implementation:

None.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #55	☐ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☑ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title: Increased Span Length of the MGS Long Span		
Name of Project Manager(s): Reid, Sicking, Faller, Bielenberg, Lechtenberg	**Phone Number:** 402-472-9324	**E-Mail** srosenbaugh2@unl.edu
Lead Agency Project ID: 2611211081001	**Other Project ID (i.e., contract #):** RPFP-13-UBSP	**Project Start Date:** 7/1/2012
Original Project End Date: 6/30/2015	**Current Project End Date:**	**Number of Extensions:**

Project schedule status:

☐ On schedule ☐ On revised schedule ☑ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	**Total Cost to Date for Project**	**Percentage of Work Completed to Date**
$65,224	$113	10%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
	$113	

Project Description:

MwRSF has recently developed a Universal Breakaway Steel Post (UBSP) for use in the thrie beam bullnose system. The satisfactory performance of the UBSP in the bullnose median barrier system would suggest that there is potential for the UBSP to be used as a surrogate in other CRT applications, such as in the long-span guardrail system, guardrail end terminals, guardrail systems installed in subsurface rock foundations or rigid pavement mow strips, future short-radius guardrails, and new, reduced maintenance barrier systems. However, further analysis and testing would be required to verify its performance in these other guardrail applications. Thus, there exists a need to conduct further analysis and testing of the UBSP in order to investigate its feasibility for use in other barrier systems.

Objectives / Tasks
1. Dynamic bogie tests (8 total)
2. Data analysis and evaluation
3. Ulterior systems design recommendations
4. Written report documenting all testing, analysis, and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The eight originally proposed dynamic bogie tests have been conducted. Results of these tests have not yet been analyzed or evaluated.

Anticipated work next quarter:

The bogie tests shall be analyzed and evaluated. Additionally, the potential for the UBSP to be utilized in other CRT applications may begin upon the testing analysis being completed.

Significant Results:

All eight of the originally proposed dynamic bogie tests have been conducted. The data has not yet been analyzed.

Objectives / Tasks	% Complete
1. Dynamic bogie tests (8 total)	80%
2. Data analysis and evaluation	0%
3. Ulterior systems design recommendations	0%
4. Written report documenting all testing, analysis, and conclusions	0%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None

Potential Implementation:

Further analysis and development of the UBSP post would aid designers by providing a potential surrogate post design for current CRT applications. Because the UBSP design is fabricated from steel, its use offers several benefits over timber posts, including reduced variability, reduced concerns for deterioration over time, and alleviation of environmental concerns regarding disposal of wood posts with preservative treatment.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(193) Suppl. #56	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)	
Project Title: Increased Span Length of the MGS Long Span		
Name of Project Manager(s): Reid, Sicking, Faller, Bielenberg, Lechtenberg	**Phone Number:** 402-472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611211082001	**Other Project ID (i.e., contract #):** RPFP-13-MGS-3	**Project Start Date:** 7/1/2012
Original Project End Date: 6/30/2015	**Current Project End Date:**	**Number of Extensions:**

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$212,730	$0	0%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$0	

Project Description:

The current MGS long-span guardrail system provides the capability to span unsupported lengths up 25 ft. While this span length has many useful applications, many culvert structures exceed the span length of the MGS long-span system. Other solutions for mounting guardrail to culverts exist, but mounting hardware to culverts can also cause difficulties. If the long span can be adjusted to accommodate longer spans, the difficulties associated with mounting hardware to the culvert can be avoided.

The objective of this research effort is to design and evaluate the MGS long-span design for use with unsupported spans greater than 25 ft. The research effort could be focused in one of two directions. The research could focus on determination of the maximum unsupported span length for the current long-span design or it could focus on evaluating potential modifications that may allow for significantly longer unsupported spans. The increased unsupported span design would be designed to meet the TL-3 safety criteria set forth in MASH.

Objectives / Tasks

1. Literature review of previous long-span systems
2. Simulation of both original and any new long-span system designs
3. Design modifications to extend unsupported length
4. Full scale crash testing of new design (two MASH 3-11 tests)
5. Data analysis and evaluation
6. Written report documenting all design work, simulation, testing, and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Work on this project has not begun

Anticipated work next quarter:

It is anticipated that the literature review will begin next quarter

Significant Results:

None

Objectives / Tasks	% Complete
1. Literature review of previous long-span systems	0%
2. Simulation of both original and any new long-span system designs	0%
3. Design modifications to extend unsupported length	0%
4. Full scale crash testing of new design (two MASH 3-11 tests)	0%
5. Data analysis and evaluation	0%
6. Written report documenting all design work, simulation, testing, and conclusions	0%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

This project has a cost of $249,335. There was insufficient funding in Pool Fund Year 23 to fund this entire amount. Thus, The budget for Year 23 is $212,730, and the remaining $36,605 is being funded by contingency funds in Pool Fund Year 23.

Potential Implementation:

The MGS long-span system has the ability to perform safely without nested rail and with a minimal barrier offset. These features make the barrier a very functional, efficient, and safe option for protection of low-fill culverts. Development of an increased unsupported span length for the MGS long-span system will add to the flexibility of the design and provide for improved protection of culvert headwalls and vertical dropoffs with a length greater than 24 ft.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #57	☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☑Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 4 – December 31)

Project Title:		
Increased Span Length of the MGS Long Span		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Bielenberg, Lechtenberg	402-472-9324	srosenbaugh2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211083001	RPFP-13-MGS-5	7/1/2012
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
6/30/2015		

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$162,896	$0	0%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$0	

Project Description:

Over the years, it has become desirable to place a longitudinal concrete slab or continuous asphalt pavement under W-beam guardrail systems in order to reduce the time and costs for mowing operations around guardrail posts. Likewise, many times guardrail posts must be installed in un-yielding pavements. Unfortunately, the placement of guardrail posts in pavement restricts energy dissipation by restricting the posts from rotating through the soil. Thus, installations in pavements have incorporated a blocked-out area or "leave-out" that surrounds each post. These leave-outs allow post rotation in the soil and result in acceptable safety performances for standard W-beam guardrails.

Recently, the MGS Bridge Rail was developed and successfully crash tested under the TL-3 MASH guidelines. This system utilized weak steel posts placed in tubular steel sockets that were side-mounted to a concrete bridge deck. The energy dissipation mechanism for this system was designed as bending of the weak posts instead of post rotation through soil. Since the posts are installed in rigid sleeves, MwRSF believes that the MGS Bridge Rail could be adapted for use in guardrail applications where mow strips are required. In this situation, it would be unnecessary to provide large leave-outs around the posts of guardrail systems installed in un-yielding pavements. Thus, The objective of this research effort is to adapt the MGS Bridge Rail system for use in mow strips and other pavements.

Objectives / Tasks

1. State survey of existing mow strip practices
2. System design and analysis
3. Dynamic bogie component testing
4. Full scale crash testing (MASH 3-10 and 3-11 tests)
5. Data analysis and evaluation
6. Written report documenting all design work, simulation, testing, and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Work on this project has not begun

Anticipated work next quarter:

It is anticipated that the State survey of current mow strip practices will be conducted in the next quarter

Significant Results:

None

Objectives / Tasks	% Complete
1. State survey of existing mow strip practices	0%
2. System design and analysis	0%
3. Dynamic bogie component testing	0%
4. Full scale crash testing (MASH 3-10 and 3-11 tests)	0%
5. Data analysis and evaluation	0%
6. Written report documenting all design work, simulation, testing, and conclusions	0%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None

Potential Implementation:

Adapting the MGS bridge rail to be placed in various pavements will allow designers to install the weak post, MGS system in mow strips without requiring leave-outs, breakaway posts, or other additional hardware. It is anticipated that the new post foundation design will significantly reduce labor and system costs associated with installation, repair, and maintenance of guardrail installed in mow strips and other pavements. Insight will also be gained regarding the potential performance of other weak post guardrail systems when installed in mow strips.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

INSTRUCTIONS:

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

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #58	☐ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☑ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title:		
Increased Span Length of the MGS Long Span		
Name of Project Manager(s): Reid, Sicking, Faller, Bielenberg, Lechtenberg	**Phone Number:** 402-472-9324	**E-Mail** srosenbaugh2@unl.edu
Lead Agency Project ID: 2611211084001	**Other Project ID (i.e., contract #):** RPFP-13-AGT-1	**Project Start Date:** 7/1/2012
Original Project End Date: 6/30/2015	**Current Project End Date:**	**Number of Extensions:**

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$154,217	$30,517	10%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$30,517	

Project Description:

Recently, MwRSF researchers successfully developed and crash tested a simplified, steel-post stiffness transition for adapting the 31-in. tall Midwest Guardrail System (MGS) to existing, thrie beam approach guardrail transition systems. This system utilized an asymmetrical transition piece which maintained a top mounting height of 31 inches. The system was successfully crash tested to TL-3 standards of MASH. However, this barrier system was not evaluated with a lower concrete curb.

Typically, concrete curbs are installed below approach guardrail transitions to increase hydraulic capacity, control water runoff, and mitigate concerns for soil erosion near bridge ends. As such, many states are interested in placing curbs underneath and throughout the length of common approach guardrail transitions. However, the addition of a curb below a transition rail element can lead to severe issues. Specifically, small car vehicles may pinch between the bottom of the rail and the top of the curb and snag under the asymmetric W-beam to thrie beam transition section, while pickup trucks rolling over the curb may cause excessive vehicular instabilities and rollover during redirection. Unfortunately, no crash testing has been performed near the upstream end of approach guardrail transitions where curbs are placed directly below the transition element. Therefore, full-scale vehicle crash testing is deemed necessary to verify the safety performance of curb placement below the asymmetric transition element.

Objectives / Tasks

1. Full scale crash testing (MASH tests 3-20 and 3-21)
2. Data analysis and evaluation
3. Written report documenting all design work, simulation, testing, and conclusions

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

The simplified, steel-post transition system utilizing an asymmetrical transition rail element to connect standard MGS to a thrie beam approach transition was constructed at MwRSF's testing facilities. A 4 in. tall, wedge shaped curb was placed below the entire approach transition system such that the toe of the curb lined up with the back edge of the guardrail. MASH test 3-20 was conducted on the system with the 1100C vehicle impacting 93.75 inches upstream of the transition rail element. During the test, the front corner of the vehicle penetrated under the rail and the front tire overrode the barrier. Eventually, the W-beam rail just upstream of the splice to the transition rail element tore apart. The vehicle was brought to a stop as it snagged on the transition posts at reduced spacing. The test was a failure of the MASH criteria.

Anticipated work next quarter:

The full-scale crash test will be analyzed to identify the cause of the test failure. Once this is concluded, a decision must be made on the direction of the project as the 2nd budgeted test (MASH test 3-21) is no longer necessary.

Significant Results:

MASH test 3-20 illustrated that a 4-in. tall curb placed under the transition rail element of an approach guardrail transition has a severely negative effect on the systems performance. The full-scale crash test resulted in the rail tearing apart and the vehicle snagging on the transition system's posts.

Objectives / Tasks	% Complete
1. Full scale crash testing (MASH tests 3-20 and 3-21)	50%
2. Data analysis and evaluation	5%
3. Written report documenting all design work, simulation, testing, and conclusions	0%

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None

Potential Implementation:

The successful crash testing of the MGS stiffness transition with asymmetric transition element and lower curb will allow state department of transportation personnel to provide continuous hydraulic runoff control between approach guardrail transitions and W-beam approach rails. The use of continuous concrete curb will help to mitigate soil erosion near bridge ends as well as its costly maintenance and repair.

Midwest States Pooled Fund Program
Quarterly Progress Report – Third Quarter 2012
October 9, 2012

DRAFT REPORTS – POOL FUND

Julin, R.D., Reid, J.D., Faller, R.K., and Mongiardini, M., *Determination of the Maximum MGS Mounting Height – Phase II Detailed Analysis with LS-DYNA®*, Draft Report to the Midwest States Regional Pooled Fund Research Program, MwRSF Research Report No. TRP-03-274-12, Project No. TPF-5(193)-Year 20, Project Code: RPFP-10-MGS, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, September 24, 2012.

FINAL REPORTS – POOL FUND

Schrum, K.D., Lechtenberg, K.A., Stolle, C.S., Faller, R.K., and Sicking, D.L., *Cost-Effective Safety Treatments for Low-Volume Roads*, Final Report to the Midwest States Regional Pooled Fund Research Program, MwRSF Research Report No. TRP-03-222-12, Project No. SPR-3 (017)-Year 16, Project Code: RPFP-08-06, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, August 24, 2012.

Terpsma, R.J., Reid, J.D., Faller, R.K., and Sicking, D.L., *Development and Recommendations for a Non-Proprietary, High-Tension, Cable End Terminal System* , Final Report to the Midwest States Regional Pooled Fund Research Program, MwRSF Research Report No. TRP-03-268-12, Project No. SPR-3(017) – Year 17, Project Code: RPFP-07-06, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, July 17, 2012.

Mongiardini, M., Faller, R.K., Rosenbaugh, S.K., and Reid, J.D., *Test Matrices for Evaluating Cable Median Barriers Placed in V-Ditches*, Final Report to the Midwest States Regional Pooled Fund Research Program, MwRSF Research Report No. TRP-03-265-12, Project No. TPF-5(193) – Year 22, Project Code: RPFP-12-Cable 1&2, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, July 13, 2012.

DRAFT REPORTS – PROJECT RUN THROUGH POOL FUND, FUNDED BY INDIVIDUAL STATE

Dickey, B.J. Faller, R.K., Rosenbaugh, S.K., Bielenberg, R.W., Lechtenberg, K.A., and Sicking, D.L., *Development of a Design Procedure for Concrete Traffic Barrier Attachments to Bridge Decks Utilizing Epoxy Concrete Anchors*, Draft Report to the Wisconsin Department of Transportation, MwRSF Research Report No. TRP-03-264-12, Project No. TP)F-5(193) Supplement #14, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, September 24, 2012.

FINAL REPORTS – PROJECT RUN THROUGH POOL FUND, FUNDED BY INDIVIDUAL STATE

Jowza, E.R., Faller, R.K., Rosenbaugh, S.K., Sicking, D.L., and Reid, J.D., *Safety Investigation and Guidance for Retrofitting Existing Approach Guardrail Transitions* , Final Report to the Wisconsin Department of Transportation, MwRSF Research Report No. TRP-03-266-12, Project No. TPF-5(193) Supplement #26, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, August 21, 2012.

DRAFT REPORTS – FHWA PROJECT

None

FINAL REPORTS – FHWA PROJECT

None