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)* SPR-3(017) Supplement #35	**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 Measures for Roadside Design		
Name of Project Manager(s): Rohde, Sicking, Reid, Faller, Lechtenberg	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611130069002	**Other Project ID (i.e., contract #):** RPFP-06-01	**Project Start Date:** 7/1/2005
Original Project End Date: 12/31/11	**Current Project End Date:** 12/31/11	**Number of Extensions:** 4

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	$64,722	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
	$3,049	

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.):

Internal review of the draft research report has continued, but at a very slow rate due to a shifting of staff priorities.

Anticipated work next quarter:

Complete internal review of the draft research report. Submit draft report to Pooled Fund member states for review and comment. Publish the final research report.

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	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).

Due to a shifting of staff priorities, work of reviewing the internal draft report was greatly diminished. The project was extended through the end of 2011 in order to submit the draft report to the States for review and to complete the final report.

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): 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: Evaluation of Safety Performance of Vertical & Safety Shaped Concrete Barriers		
Name of Project Manager(s): Rohde, Sicking, Reid, Faller	**Phone Number:** 402-472-9070	**E-Mail** kpolivka2@unl.edu
Lead Agency Project ID: 2611130069009	**Other Project ID (i.e., contract #):** RPFP-06-08	**Project Start Date:** 7/1/05
Original Project End Date: 12/31/11	**Current Project End Date:** 12/31/11	**Number of Extensions:** 4

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
$69,295	$87,025	95

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$4,922	

Project Description:

Many accident studies have been conducted that show injury and rollover rates for concrete safety shaped barriers are much higher than for other barrier systems. Computer modeling and testing have shown that vertical concrete barriers should produce fewer rollovers and it is believed that this reduction should lead to fewer injuries. However, due to the limited use of vertical concrete barriers there have been no successful accident studies that verify these predictions. Virtually all of Iowa's bridge rails are now either vertical concrete barriers or a safety shape design. Accident records from Iowa's bridge rail crashes should provide a direct comparison between the performance of safety shaped and vertical concrete barriers.

Objective: Analyze accident records from Iowa's bridge rails to the safety performance of vertical and safety shaped concrete bridge railings.

Tasks:

1. Literature review on concrete barriers, rollovers, ran-off-road crashes, and occupant and vehicle safety
2. Acquire accident reports for all bridge rail related accidents in the State of Iowa
3. Identify which accidents actually involve a bridge railing
4. Create data base of accident information for bridge rail crashes
5. Analyze data base to determine added risk associated with safety shaped concrete barriers when compared to vertical concrete barriers
6. Research report

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

The draft report was completed and submitted to the Pooled Fund member states for review and comment.

Anticipated work next quarter:

Once comments (if any from the Pooled Fund States), the final research report will be published.

Significant Results:

Task	% Complete
1. Literature review on concrete barriers, rollovers, ran-off-road crashes, and occupant and vehicle safety	100%
2. Acquire accident reports for all bridge rail related accidents in the State of Iowa	100%
3. Identify which accidents actually involve a bridge railing	100%
4. Create data base of accident information for bridge rail crashes	100%
5. Analyze data base to determine added risk associated with safety shaped concrete barriers when compared to vertical concrete barriers	100%
6. Research report	90%

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 required collecting an additional 6 years of data since the relationship between barrier shape and rollover propensity was being masked by factors such as traffic volume and operating speeds. No work occurred during the Third and Fourth Quarters of 2009 due to shifting of priorities for key project personnel and the need to obtain advanced analysis techniques. Limited data was received for bridge accident sites located on county roads thus the study was limited to bridges located on State maintained highways.

Potential Implementation:

Quantifying the safety implications of utilizing safety shaped barriers versus vertical concrete barriers would provide direction for future concrete barrier development efforts and motivation for highway designers to utilize the safer of the two alternatives.

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 #38	☐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: 12/31/12	**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	$51,477	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
	$9,608	

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.):

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

Anticipated work next quarter:

A draft report of research study will be completed. Submit draft report to Pooled Fund member states for review and comment.

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 a 25" rail height at speeds of 100, 70, and 60 km/h with 2000P and 2270P. The 2000P and 2270P were contained at 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	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 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): 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(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** srosenba@unlserve.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:** 7/31/2012	**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
$73,549	$24,870	90%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$10,520	

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.):

Work this quarter continued on assembling the Phase I research report which will document the first round of dynamic testing and evaluation. The report will also contain the recommendations and designs for the second round testing of the socketed foundations. A draft report was completed and is currently under internal review.

Anticipated work next quarter:

The Phase I report will be finalized and sent out to the Pooled Fund member States.

Dynamic bogie testing of the redesigned socketed foundations will be conducted. Upon completion of the bogie tests, the data will be analyzed and conclusions shall be made concerning the strength and design of the 2nd generation of socketed foundations.

Significant Results:

Previously, 4 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. The 4 new designs for the socketed post foundations were fabricated and are currently waiting to be tested.

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.	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).

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. However, some of the original funding for this 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. Further, the project was extended solely to ensure the remaining funds would be accessible after the original completion date.

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): Nebraksa 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(091) Suppl. #3	**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: Further Development of the MGS Transition using Fewer Components		
Name of Project Manager(s): Reid, Sicking, Faller, Rosenbaugh	**Phone Number:** 402-472-9324	**E-Mail** srosenba@unlserve.unl.edu
Lead Agency Project ID: 2611211007001	**Other Project ID (i.e., contract #):** RPFP-09-03	**Project Start Date:** 8/15/2008
Original Project End Date: 7/31/2011	**Current Project End Date:** 12/31/2011	**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
$78,288	$76,926	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
	$5,435	

Project Description:

In 2008, MwRSF undertook a project to develop a transition between MGS guardrail and thrie beam, approach transitions using only standard steel and wood posts. Work began focusing on the steel post version of the stiffness transition, and a design configuration was selected for full-scale testing. However, during the first crash test, the upstream anchorage fail prematurely due to substandard wooden posts with large knots in the critical region. As a result, it was necessary to re-run the full-scale crash test before continuing with the evaluation process. The full-scale test re-run effectively used up the funds that were previously designated for developing the wood post alternative to the steel post system. Therefore, this project was necessary to fund the work required to develop the wood post equivalent to the standardized steel post stiffness transition.

Objectives / Tasks

1. Literature review
2. Bogie testing program and data analysis
3. BARRIER VII Analysis
4. Written report / Hardware Guide drawings

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

The draft report was completed by MwRSF and sent out to the States for review. Edits and comments have been received, and the report is going through a final revision. Also, Hardware Guide drawings have been developed for both the steel and wood post versions of the stiffness transition and have been submitted to Task Force 13 for approval.

Anticipated work next quarter:

The States' comments and edits will be implemented into the final report. Also, a package will be sent to FHWA asking for acceptance of the wood post version of the stiffness transition. Finally, any necessary edits to the Hardware Guide drawings shall be made.

Significant Results:

Through the literature review and the bogie testing program, wood post equivalents were found for the two sizes of steel posts utilized in the successfully crash tested stiffness transition. Wooden 6"x8" posts were found to perform similarly to the steel W6x9's (both having a 40" embedment depth). Also, wooden 8"x10" posts embedded 48" were found to provide the resistance of the steel W6x15's which were embedded 54" into the ground. The propensity for premature fracture in both 8"x8" and 6"x10" posts lead to these sizes not being recommended as equivalent posts.

The wood post equivalents were determined to provide slightly more resistance to rotation than the original steel posts. However, BARRIER VII models of the stiffness transitions illustrated that the performance of the wood post system (in terms of vehicle snag, pocketing, and deflections) was equivalent or better than the steel post system.

Objectives / Tasks	% Complete (wood post version only)
1. Literature review	100%
2. Bogie testing program and data analysis	100%
3. BARRIER VII Analysis	100%
4. Written report / Hardware Guide drawings	95%

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 project was extended through the end of 2011 in order for the project to remain open through the FHWA acceptance process and the acceptance of the Hardware Guide Drawings.

Potential Implementation:

the development of these stiffness transitions will provide State DOT's: (1) the missing transition segment between standard MGS and thrie beam approach transitions, (2) a stiffness transition that requires only the standard line posts already in stock, and (3) the option to use either steel or wooden posts through the length of the guardrail system.

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(091) Supplement #6	☐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 - Development of an MGS Bridge Rail		
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:**
2611211010001	RPFP-09-06	8/15/08
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
7/31/11	12/31/11	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
$157,256	$139,024	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
	$578	

Project Description:

The MGS system has been tested in a long-span guardrail application. In this design, the back of the guardrail posts were placed on a line that was tangent with the culvert head wall and three posts were omitted to span a maximum distance of approximately 25 ft. A largely unmodified MGS guardrail, without supporting posts in the 25 ft span, was able to contain a 5000 lb pickup. The impacting vehicle did extend some distance beyond the culvert head wall, but the MGS guardrail was able to safely pull it back onto the travelway. Another potential solution for bridges or culverts that are longer than 25 ft is to attach the guardrail posts to the edge of a bridge deck or the back of a culvert head wall. In this situation, the face of the guardrail would be placed approximately 15 in. from the edge of the bridge deck or approximately 9 in. beyond the face of the culvert head wall. This type of bridge railing will provide a low cost alternative that should provide adequate levels of protection for many rural highways.

Objective: Develop an MGS bridge rail for use on bridges and culverts that are longer than 25 ft. The design details should be developed for attaching to most bridge deck and culvert headwall applications.

Tasks:

1. Design of low-cost bridge rail
2. Simulation of design
3. Full-scale crash testing with 2270P and 1100C
4. Documentation and analysis of test results
5. Research report, final CAD details, FHWA acceptance

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

A request for federal acceptance of the MGS bridge rail was submitted to FHWA in July. The CAD details and packet of information for the Bridge Rail Guide was compiled and submitted to AASHTO TF-13 for inclusion in the Bridge Rail Guide.

Anticipated work next quarter:

None as all work has been completed.

Significant Results:

Task	% Complete
1. Design of low-cost bridge rail	100%
2. Simulation of design	100%
3. Full-scale crash testing with 2270P and 1100C	100%
4. Documentation and analysis of test results	100%
5. Research report, final CAD details, FHWA acceptance	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).

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

Potential Implementation:

A low-cost, MGS bridge rail that attaches to the edge of a concrete bridge deck would provide a very cost effective treatment of many rural bridges. Further cost savings could be realized through the elimination of the approach guardrail transition system by keeping the bridge rail stiffness close to that of the approach guardrail. Finally, this sort of low-cost system would be appropriate on many rural highways with moderate or low traffic volumes depending to some extent on the Test Level used in the development process.

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. #18	☐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:		
Impact Evaluation of Free Cutting Brass Breakaway Couplings		
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:**
2611211025001	RPFP-10-POLE	7/1/2009
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
7/31/2012		

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
$37,461	$59,364	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
	$445	

Project Description:

Breakaway couplers are commonly used to mitigate impacts between errant vehicles and luminaires or support poles placed at the edge of the roadway. However, existing breakaway couplers also have several disadvantages. All existing breakaway couplers are proprietary in nature and can be prohibitively expensive. Moreover, existing steel couplings do not have consistent energy absorption as a function of temperature due to the effect of the ductile to brittle transition temperature properties of the steel. Finally, many existing steel couplings are galvanized. Once the zinc is depleted, the coupling begins to corrode, which can potentially change the severity of the notch and altering its fatigue strength. Thus, there exists a need for a new breakaway coupler design that reduces costs and eliminates the disadvantages for existing steel, breakaway coupler designs.

A study was performed at the Illinois Department of Transportation to determine the energy absorption characteristics of a free-cutting brass hexagon, which has sharp internal threads. Based on results from preliminary component testing and evaluation, it is now necessary to determine whether the couplings provide acceptable safety performance when installed with actual support structures. Therefore, pendulum testing is necessary to determine the safety performance of the brass couplings when attached to large luminaire poles or other support structures according to current impact safety standards.

Objectives / Tasks
1. Component fabrication and test site preparation
2. Pendulum testing
3. Data analysis and high speed test extrapolation
4. Determination of pole size/weight limits
5. Written Report
6. FHWA Acceptance

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

MwRSF has received the FHWA acceptance letter for use if the brass couplings under the recommended limitations described in the final report.

Also, the Hardware Guide drawings were completed.

Anticipated work next quarter:

none

Significant Results:

After 2 rounds of unsuccessful tests and 2 redesigns, the final design for the breakaway brass couplings was developed. Through the use of pendulum testing and the high-speed extrapolation analysis procedures, limitation on pole sizes and weights were determined for the acceptable use of the brass couplings. These recommendations are shown in the conclusions section of the report.

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).

After the first round of testing was unsuccessful, additional funds were needed to continue the evaluation process (additional testing). However, the testing needed to be completed very quickly do to the expiring time table for FHWa acceptance of safety hardware tested to NCHRP Report no. 350 guidelines. As a result, the Pooled Fund members opted to use contingency funds to continue work on the project.

Potential Implementation:

With the FHWA acceptance, State DOT's can use the brass couplings as an economical alternative to proprietary breakaway couplings on luminary support poles.

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. #19	☐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):	**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:**
2611211026001	RPFP-10-CABLE-1	7/1/2009
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
7/31/2012		

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	$2,559	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
	$0	

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.):

Work this quarter continued on assembling the Phase I research report which will document the first round of dynamic testing and evaluation. The report will also contain the recommendations and designs for the second round testing of the socketed foundations. A draft report was completed and is currently under internal review.

The revised socketed foundation designs were fabricated, and the test site was prepped for the second round of dynamic testing (bogie pit filled with sand) .

Anticipated work next quarter:

The Phase I report will be finalized and sent out to the Pooled Fund member States.

Dynamic bogie testing of the redesigned socketed foundations will be conducted. Upon completion of the bogie tests, the data will be analyzed and conclusions shall be made concerning the strength and design of the 2nd generation of socketed foundations.

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. The 4 new designs for the socketed post foundations were fabricated and are currently waiting to be tested.

Objectives/Tasks:	% Completed (Phase I and II)
1. Design new socket foundations for barrier posts.	35%
2. Fabrication and dynamic testing of socketed foundations.	35%
3. Analysis of test data and evaluation of socketed foundation designs.	20%
4. Written report documenting all work 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).

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. No time has been charged to the Phase II project to date.

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.#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	July 31, 2012	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
$159,193	$26,787	15%

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): 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:** July 31, 2012	**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
$37,634	$12,940	34%

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.

Current work addresses two main areas:
Task 1. Updating the end anchorage model of the MGS.
Task 2. Customizing vehicle models for cable on slope and v-ditch projects.

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

Task 1. Bogie testing on the end anchorage system is scheduled for next quarter under a separate project. This testing will provide physical behavior of the system during impact, including loads through the components and connections. Additionally, the movement through the soil of the anchorage will be captured. Results from the bogie testing will be used to calibrate and validate this new model. Note, however, that this testing has been scheduled for the last two quarters and for various scheduling reasons has not received high enough priority to be completed as of yet.

Task 2. Vehicle models of the 820c, 1100c, 2000p and 2270p were prepared specifically for studying 4-to-1 and 6-to-1 v-ditch behavior. The one major problem encountered was described in last quarter's progress report. Specifically, the 2270p model developed an instability in the connection between the front panel and bracket of the truck bed. This occurred when using the truck model on 4-to-1 slope for the high tension cable project. Two fixes were found to be successful: (1) provide a stronger connection by adding more spot welds between the two parts and (2) switch to a fully integrated element formulation for the two parts. The second fix was chosen for the model to move forward with on projects using the 2270p.

Anticipated work next quarter:

Due to teaching schedules at UNL, no work will be charged to this project during the 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).

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:

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	$40,098	45

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$34,835	

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.):

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.

Data analysis of the first test was initiated.

Anticipated work next quarter:

Data analysis of test nos. MGSSYP-1 and MGSSYP-2 will be completed. The reporting of the two crash tests will be initiated. The system will be removed.

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	40%
3. Research report	0%
4. 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).

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):	**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:**
2611211046001	RPFP-11-MGS-2	7/1/2010
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
$91,071	$1,960	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
	$1,290	

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.):

The literature review began with a collection of standards and specifications from each of the Pooled Fund states. These documents are currently being complied to identify common and critical culvert characteristics including culvert geometry, headwall geometry, and reinforcement.

Anticipated work next quarter:

The literature review shall be completed and a critical culvert design will be selected. This culvert and headwall design will then be utilized during the barrier attachment design and testing effort.

Significant Results:

Literature review has begun on the Pooled Fund states' culvert standards and specifications.

Objectives / Tasks	% Complete
1. Literature review of current culvert designs	70%
2. Design of MGS attachment to face of headwall	0%
3. Dynamic bogie testing	0%
4. Data analysis and evaluation	0%
5. Written report documenting all design work, 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:

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):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Lechtenberg, Holloway	402-472-9070	kpolivka2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211047001	RPFP-11-MGS-3	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
$157,655	$70,243	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
	$49,786	

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.):

The system was removed. Data analysis of test nos. MGSNB-1 and MGSNB-2 was completed. The reporting of the two crash tests was initiated.

Anticipated work next quarter:

An internal draft report will be completed. Review of the internal draft report will be initiated.

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	50%
4. Hardware guide drawings and FHWA acceptance	10%

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	$443	

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$260	

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.):

A review was conducted on (1) the current weld standard, (2) Illinois and Nebraska's adaptations of the weld standard, and (3) multiple fabricators' recommendation for the weld. From this review, the top 4-5 designs were submitted to the Pooled Fund States for their consideration. The most favored weld design will be selected for testing.

Anticipated work next quarter:

Based on the responses from the Pooled Fund States, a weld design will be selected. Dynamic testing will then be used to evaluate the new weld design.

Significant Results:

Awaiting states' responses to possible weld configurations.

Objectives / Tasks	% Completed
1. Literature review of current practices	85%
2. Design of new weld detail	20%
3. Dynamic testing and analysis	0%
4. Written Report containing design work, 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 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): 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 #38	☐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:**
2611211051001	RPFP-11-TF-13	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
$2,500	$2,499	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
	$1,813	

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.):

Completed preparation of the TF-13 CAD details for the remaining 8 systems. Revised the 5 reviewed system drawings per the comments received. During the September 2011 AASHTO TF-13 meeting, 3 of the revised drawings were approved and 2 of the revised drawing were conditionally approved once a few additional modifications are made.

The 2 bridge rail system drawings were submitted to the AASHTO TF-13 Bridge Rail Guide for review and inclusion. The one component drawing was submitted to the AASHTO TF-13 Luminaire Guide for review and inclusion.

Anticipated work next quarter:

None as all funds have been used in this project. The remaining work to be completed will be completed under Project No. RPFP-12-TF13 – TPF-5(193) Supplement #49, Project Title: Annual Fee to Finish TF-13 and FHWA Standard Plans.

Significant Results:

This project is used to supplement the preparation of the TF-13 format CAD details. Previously, it was determined that there are 13 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.

To Date:
13 systems - 3 approved, 2 conditionally approved, 8 to be reviewed
32 components - 32 to be reviewed

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).

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.

Funding from Project No.: RPFP-12-TF13 – TPF-5(193) Supplement #49, Project Title: Annual Fee to Finish TF-13 and FHWA Standard Plans will now be used to complete the remaining systems.

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)*	**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	$3,754	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
	$3,754	

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.):

On August 10, 2011, MwRSF personnel and members of the Midwest States Pooled Fund Program participated in a conference call to discuss the funded research and development projects pertaining to high-tension, cable barrier systems for use on relatively-flat and sloped medians. Following the conference call, a letter dated August 15, 2011 was sent to the members of the Midwest States Pooled Fund Program seeking State DOT guidance on the continued development of a high-tension, cable barrier system for relatively-flat and sloped median applications. As the result of the guidance from the member States, 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). A planning and design meeting of MwRSF personnel is scheduled for September 23rd to discuss design modifications for the design placed 0 to 4 ft away from the slope break point of a 6H:1V sloped median.

The data analysis of test nos. 4CMB-4, 4CMB-5, and 4CMBLT-1 was completed. An internal draft report of test nos. 4CMB-4 and 4CMB-5 was completed. An internal draft report of test no. 4CMBLT-1 was completed. Review of both internal draft reports was initiated.

Anticipated work next quarter:

Design modifications will be investigated. CAD drawings of the modified system will be prepared. Redesigned system will be constructed. Crash testing could occur toward the end of the next quarter.

Complete internal review of the draft research report of 4CMB-4 and 4CMB-5. Complete internal review of the draft research report of 4CMBLT-1. Submit both draft report to Pooled Fund member states for review and comment.

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	70%
5. Research report - 4CMB-4 and 4CMB-5	75%
6. Research report - 4CMBLT-1	75%
7. Research report	0%
8. 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).

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):	**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:**
2611211065001	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
$91,800	$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.):

On August 10, 2011, MwRSF personnel and members of the Midwest States Pooled Fund Program participated in a conference call to discuss the funded research and development projects pertaining to high-tension, cable barrier systems for use on relatively-flat and sloped medians. Following the conference call, a letter dated August 15, 2011 was sent to the members of the Midwest States Pooled Fund Program seeking State DOT guidance on the continued development of a high-tension, cable barrier system for relatively-flat and sloped median applications. As the result of the guidance from the member States, 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). A planning and design meeting of MwRSF personnel is scheduled for September 23rd to discuss design modifications for the design placed 0 to 4 ft away from the slope break point of a 6:1 sloped median.

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. #46	☐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 III		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Reid, Sicking, Faller, Bielenberg	402-472-9064	rbielenberg2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611211066001	RPFP-12-Cable 1&2	7/1/2012
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
$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
	$0	

Project Description:

This project is an extension to a previous project (RPFP-07-06, titled "Cable Guardrail End Terminal Development using 350 Update Vehicles")

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.

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

Work on this project was conducted and charged to project RPFP-07-06, titled "Cable Guardrail End Terminal Development using 350 Update Vehicles". Once funds are depleted from the noted project, time will begin to be charged to this project.

Anticipated work next quarter:

extensive work / testing of anchorage system not expected until barrier system is fully developed

Significant Results:

extensive work / testing of anchorage system not expected until barrier system is fully developed

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).

extensive work / testing of anchorage system not expected until barrier system is fully developed. Thus, this project is on hold.

Potential Implementation:

The successful completion of the development, testing, and evaluation of a non-proprietary crashworthy guardrail end terminal, 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 development of the non-proprietary, high-tension, cable barrier system 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): 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: