

## **First Quarter 2003 Progress Report**

Midwest Roadside Safety Facility

Mid-States Regional Pooled Fund

March 26, 2003

### **YEAR 9**

#### **Tie-Down System for Existing F-shape Temporary Barrier Rail (TBR)**

Bielenberg, B.W., Faller, R.K., Reid, J.D., Holloway, J.C., Rohde, J.R., and Sicking, D.L.,

##### ***Development***

***of a Tie-Down System for Temporary Concrete Barriers***, Final Report to the Midwest State's Regional

Pooled Fund Program, Transportation Research Report No. TRP -03-115-02, Project No. SPR-3(017)-

Year 9, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, August 16, 2002.

#### **Guidelines for Evaluating Attachments to Bridge Rails**

Keller, E.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Polivka, K.A., ***Guidelines for Attachments to***

***Bridge Rails and Median Barriers***, Final Report to the Midwest State's Regional Pooled Fund Program,

Transportation Research Report No. TRP-03-98-01, Project No. SPR-3(017) - Year 9, Midwest Roadside

Safety Facility, University of Nebraska-Lincoln, February 26, 2003.

#### **Evaluation of Missouri Standards for Placement of Steel and Wood Guardrail Posts in Rock or at Obstructions to NCHRP 350 Specifications.**

Herr, J.E., Rohde, J.R., Sicking, D.L., Reid, J. D., Faller, R.K., Holloway, J.C., and Polivka, K.A., Development of Standards for Placement of Steel Guardrail Posts in Rock, ***Draft Report to the Midwest***

***State's Regional Pooled Fund Program***, Transportation Research Report No. TRP -03-119-03, Project

No. SPR-3(017)-Year 9, Project Code: RFPF-99-01(a), Midwest Roadside Safety Facility, University of

Nebraska-Lincoln, March 6, 2003.

#### **Test and Evaluate Missouri Thrie-Beam Bridge Rail to W-beam Transition to NCHRP 350 Specifications**

Polivka, K.A., Faller, R.K., Reid, J.D., Sicking, D.L., Rohde, J.R., Keller, E.A., and Holloway, J.C., ***Development of an Approach Guardrail Transition Attached to a Thrie Beam and Channel Bridge***

***Railing***, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research

Report No. TRP-03-91-99, Project No. SPR-3(017)-Year 6, Midwest Roadside Safety Facility, University

of Nebraska-Lincoln, March 21, 2000.

#### **Minimum Soil Support Required for Seven Foot Strong Post Guardrail Systems**

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Holloway, J.C., and Keller, E.A.,

##### ***Development of a***

***W-Beam Guardrail System for Use on a 2:1 Slope***, Final Report to the Midwest State's Regional

Pooled Fund Program, Transportation Research Report No. TRP -03-99-00, Project No. SPR-3(017)-

Years 9 & 10, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, October 16, 2000.

#### **Bridge Rails and Transitions for Pedestrian Protection**

Hiser, N.R., Faller, R.K., Sicking, D.L., Rohde, J.R., Reid, J.D., and Polivka, K.A., ***Bridge Rails and***

***Transitions for Pedestrian Protection***, Final Report to the Midwest State's Regional Pooled Fund

Program, Transportation Research Report No. TRP-03-113-02, Project No. SPR-3(017) – Year 9, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, February 20, 2003.

**Modification of the TL-3 Temporary Barrier to Reduce Dynamic Deflection**

Sicking, D.L., Reid, J.D., and Polivka, K.A., *Deflection Limits for Temporary Concrete Barriers*, Final

Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-

03-113-02, Project No. SPR-3(017)-Years 9, Midwest Roadside Safety Facility, University of Nebraska-

Lincoln, March 11, 2002.

**Embankment Widening and Slopes Required for Gating Type End Terminals**

Paulsen, T.J., Sicking, D.L., and Holloway, J.C., *Embankment Widening and Slopes Required for*

*Gating Type End Terminals*, Final Report to the Midwest State's Regional Pooled Fund Program,

Transportation Research Report No. TRP-03-126-02, Project No. SPR-3(017) – Year 9, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, February 7, 2003.

## **YEAR 10**

### **Short Radius – Testing Phase I**

The report for these two tests will be developed as a part of the next phase of this project.

### **Non-Proprietary Guardrail – Phase I**

The report of Year 10 work will be completed along with the crash test results in the report of the Year 11 project.

### **W-Beam Guardrail Over Curb**

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Reid, J.D., and Holloway, J.C., *Guardrail and*

*Guardrail Terminals Installed Over Curbs - Phase II*, Final Report to the Midwest State's Regional

Pooled Fund Program, Transportation Research Report No. TRP -03-105-00, Project No. SPR-3(017)-

Year 10, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, November 5, 2001.

### **Guardrail Attached to Culverts**

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Reid, J.D., and Holloway, J.C., *NCHRP 350 Development and Testing of a Guardrail Connection to Low-Fill Culverts*, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-03-114-02,

Project No. SPR-3(017)-Year 10, Midwest Roadside Safety Facility, University of Nebraska-Lincoln,

November 1, 2002.

### **Breakaway Luminaire Supports**

Nelson, R.M., Sicking, D.L., and Polivka, K.A., *Analysis of Sign Attachments to Breakaway Luminaire*

*Supports*, Final Report to the Midwest States' Regional Pooled Fund Program, Project No. SPR-3(017),

Transportation Report No. TRP-03-122-02, Midwest Roadside Safety Facility, University of Nebraska-

Lincoln, October 23, 2002.

### **Three Cable Barrier on Sloped Fill**

Testing of the system was completed on November 1, 2001. The system was set one foot in front of a

1.5:1 slope. The instability caused by the left side of the vehicle leaving the level ground induced a roll

that caused the vehicle to roll over the top of the guardrail. From initial evaluation of the high-speed video,

it is clear that slope angles substantially less than 1.5:1 would have the same effect. Note that this barrier utilized a new driven steel post anchorage system. The new anchor performed as expected and it did not contribute to the vehicle rollover. Funding in Year 13 will be utilized to re-run this test, this test result will be reported with the result of the Year 13 test.

## **YEAR 11**

### **Steel H-Beam Temporary Barrier Rail and Connections**

Polivka, K.A., Bielenberg, R.W., Faller, R.K., Sicking, D.L., Rohde, J.R., Reid, J.D., and Holloway, J.C.,

#### ***Development of a Steel H-Section Temporary Barrier for Use in Limited Deflection Applications,***

Draft Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No.

TRP-03-120-03, Project No. SPR-3(017)-Year 11, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, January 24, 2003.

### **Development of a Guardrail Treatment at Intersecting Roadways**

A full-scale test (SR-4) was performed at a critical impact location (parallel with the transition section) with

the flared system on September 19, 2002. The system stability redirected the truck, but at the point where

the truck was about to exit the system, the three-beam buckled and impacted the driver's side floorboard,

intruding into the occupant compartment. All other salient safety criteria were met in this test. Currently,

investigation into possible solutions to the system is being undertaken. At this juncture, the direction of

this project requires discussion. The system has grown since the outset of the project, as shown in the

following figure.

### **Triple-Cable Barrier End Terminal and Anchorage Assemblies**

Two full-scale crash tests were performed on this system in the 3<sup>rd</sup> Quarter. The first (CT-1) was a LON

test with a pickup truck to test the anchorage system. The system performed well, meeting all salient

NCHRP 350 criteria, with a maximum dynamic deflection of 651 mm. The second test (CT-2) was a test

of the cable release mechanism. The mechanism performed as designed by releasing the cables.

However as the vehicle rolled over the system's lever arm, it dug into the soil and caused the right rear of

the vehicle to vault, ultimately causing the vehicle to roll. After the data analysis, we are convinced that

this system will work well, but that the release mechanism needs to be retained at the anchor plate. This

additional test is proposed in the Year 14 proposal to the pooled fund.

### **Transition from Standard W-Beam Guardrail to Stiffened Bridge Transition**

Design work and Barrier 7 simulation have been completed on the candidate design. As shown on the

following page, the system on several options is currently underway. We will review the design during the

pooled fund meeting. Testing is anticipated late in the second quarter.

### **Three-Strand Cable Median Barrier (NOW 4-Strand)**

Bogie testing of alternative posts and system modeling have nearly been completed. The final design is a

woven 4 cable system as pictured in the following figure. We anticipate testing in the second quarter of 2003.

#### **Low Profile Bridge Rail for Test Level 2 Applications**

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Reid, J.D., and Holloway, J.C.,

#### ***Development of a***

***Low-Profile Bridge Rail for Test Level 2 Applications***, Final Report to the Midwest State's Regional

Pooled Fund Program, Transportation Research Report No. TRP -03-109-02, Project No. SPR-3(017)-

Year 11, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, August 20, 2002.

## **YEAR 12**

### **Non-Proprietary Steel Beam Guardrail System – Year 2**

Results of this project will be reported in conjunction with Year 13 results.

### **Development of a Guardrail Treatment at Intersecting Roadways-Year 3**

Work on this project will follow completion of work on Year 11.

### **Portable Aluminum Work Zone Signs**

The bogie testing for this project has been completed. A submission to FHWA seeking approval has been

sent. Polivka, K.A., Faller, R.K., Holloway, J.C., Rohde, J.R., and Sicking, D.L., ***Safety***

#### ***Performance***

***Evaluation of Minnesota's Aluminum WorkZone Signs***, Final Report to the Midwest State's Regional

Pooled Fund Program, Transportation Research Report No. TRP -03-107-01, Project No. SPR-3(017)-

Year 11, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, January 29, 2002.

### **Single-Faced Concrete Barrier**

Reinforcing design is currently underway in conjunction with the Wisconsin DOT. Currently the design is

under review in Wisconsin.

### **W-Beam to Thrie-Beam Transition Additional 820C Test**

This test will be performed in conjunction with the Year 11 study, the test will utilize a asymmetrical w- to

thrie transition. This test will be performed based on the successful completion of the test funded in Year

11.

## **Year 13**

### **Generic W-Beam Guardrail with Curb**

This system utilized a 6" type "B" curb, located 6" ahead of the face of the non-proprietary guardrail

system. A full-scale test was performed on September 5<sup>th</sup>. The pickup was safely redirected and all

salient criteria were acceptable. The maximum dynamic deflection of the system was about 40". A report

for this test is anticipated in the second quarter of 2003.

### **Open Railing Mounted on New Jersey Concrete Barrier (2'8")**

The design of the railing system is currently underway. It is anticipated that a concept drawings will be

sent to the States for review in the second quarter.

### **Evaluation of Rigid Hazards in Zone of Intrusion**

A single sided barrier has been constructed in this quarter. The first test involving a luminare pole mounted on the top of the barrier is planed for late in the first quarter of 2003.

### **Three-Cable Guardrail**

We are currently evaluating several post options, as well as geometric considerations and are anticipating

full scale testing early in the Second Quarter of 2003.

### **Non-proprietary Guardrail System – Additional Test**

The retest of the new guardrail system (NPG-4) was performed on June 14, 2002. This system utilized a

31" installation height, 12" blockouts (located off the splices), and 6' soil tubes. The system performed

very well, smoothly redirecting the vehicle and all salient criteria were met. A draft report is anticipated

late this year or early next year. This test forms the basis of the both the curb and stiffening project in

Year 13, as well as the transition projects in Years 11 and 12.

### **Kansas Temporary Barrier Redesign and Test**

A full-scale test of this system was performed on July 31st. The design is essentially the Iowa design with

the addition of three reinforced retaining pin holes on each face of the barrier and triple loops.

The system

performed well, meeting all salient criteria. Based on this test, and communication between the Illinois

Department of Transportation and FHWA, this design employing non-restrained pins should be acceptable both in a tied-down configuration, as well as when unconstrained.

### **System for Stiffening New Guardrail System**

The ¼ post space system was tested on October 18th, 2002. The system performed well, meeting all

salient criteria. Maximum permanent set was approximately 18", film analysis is not yet complete.

After

evaluation of this test, a Barrier VII study will be calibrated and used to predict dynamic deflection of a ½

post spaced system. Design recommendations for both ¼ and ½ post spacing will be included in the test

report.

## **OUTSTANDING ISSUES:**

These projects from past Year's funding are still pending:

### **Strength Requirements for a Wood Post W-Beam Guardrail System**

In discussion with Wisconsin, two species seem to predominate the alternatives desired. Grading of a

large sampling of these has been discussed. We have requested red and white pine samples and are

currently waiting for these.