First Quarter 2005 Progress Report
Midwest Roadside Safety Facility
Mid-States Regional Pooled Fund
April 14, 2005

YEAR 12

Development of a Guardrail Treatment at Intersecting Roadways-Year 3

A full-scale test of this system was performed on 4/12/05. The system, augmented by an anchor placed near the center of the radiused section, safely directed the vehicle and all salient criteria were met. Shown on the following pages are comparisons between the simulation and full-scale test results. The system is currently being rebuilt and an 820C test impacting the nose of the system is planned for the Second Quarter of 2005.

Portable Aluminum Work Zone Signs

The bogie testing for this project has been completed. A submission to FHWA seeking approval was sent and received approval. Polivka, K.A., Faller, R.K., Holloway, J.C.,and Rohde, J.R., ***Safety Performance Evaluation of Minnesota's Low-Height, Temporary Rigid Panel Sign Stand***, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-03-129-03, Project No. SPR-3(017)-Year 12, Sponsoring Agency Code RPFP-02-04, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, January 23, 2003.

Single-Faced Concrete Barrier

Faller, R.K., Sicking, D.L., Larsen, J., Rohde, J.R., Bielenberg, R.W., and Polivka, K.A., ***TL-5 Development of 42- and 51-In. Tall, Single-Faced, F-Shape Concrete Barriers***, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-03-149-04, Project No. SPR-3(017)-Year 12, Project Code: RPFP-02-04, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, April 30, 2004.

MGS W-Beam to Thrie-Beam Transition Contingency 2000P Test and Additional 820C Test

A full-scale test of this system was conducted on July 29, 2004. This test demonstrated that the current welded, asymmetrical W-beam to Thrie-beam section had inadequate capacity. During this Quarter, two manufacturers have committed to producing 10-gauge transitions for this work. We anticipate having materials in house to begin construction early in the 2nd Quarter of 2005. Funding for this test will be proposed at the upcoming annual pooled fund meeting.

Three-Strand Cable Median Barrier

A full-scale small car test was performed on the new 4-cable median barrier on November 10, 2004. As shown in the sequential photos below, the vehicle was redirected and ultimately stopped in the system. While the test passed all salient criteria, the performance of the system was considered less than optimal. While the cable load was transferred into the posts by the new cable attachment system, the cables showed a tendency to come out of the top of the hooks prematurely. A new cable retainer system has been developed and bogie tested. This study will continue, incorporating slopes in the upcoming tests.

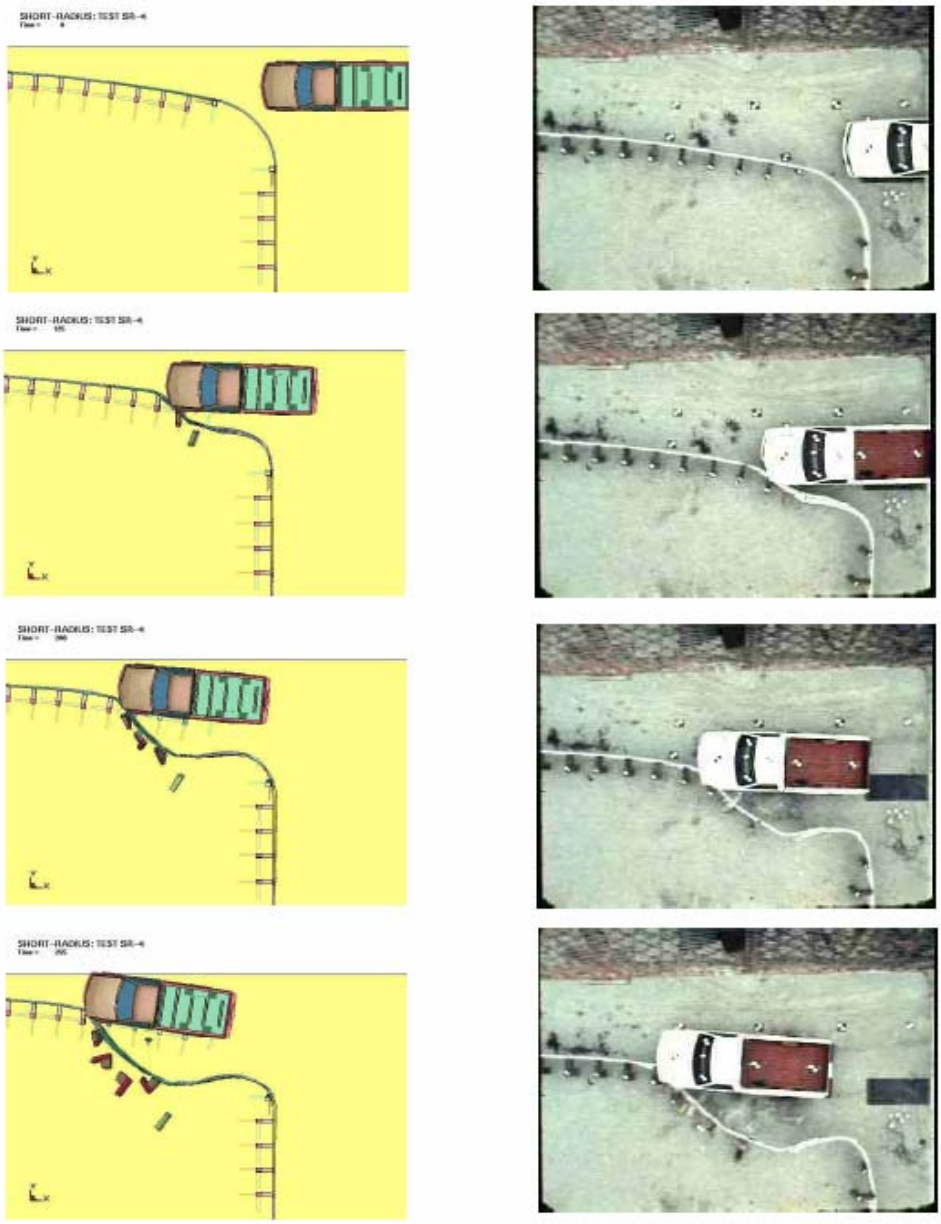


Figure 1. Comparison of Full-Scale Test and LS-DYNA Simulation Model, Test No. SR-4

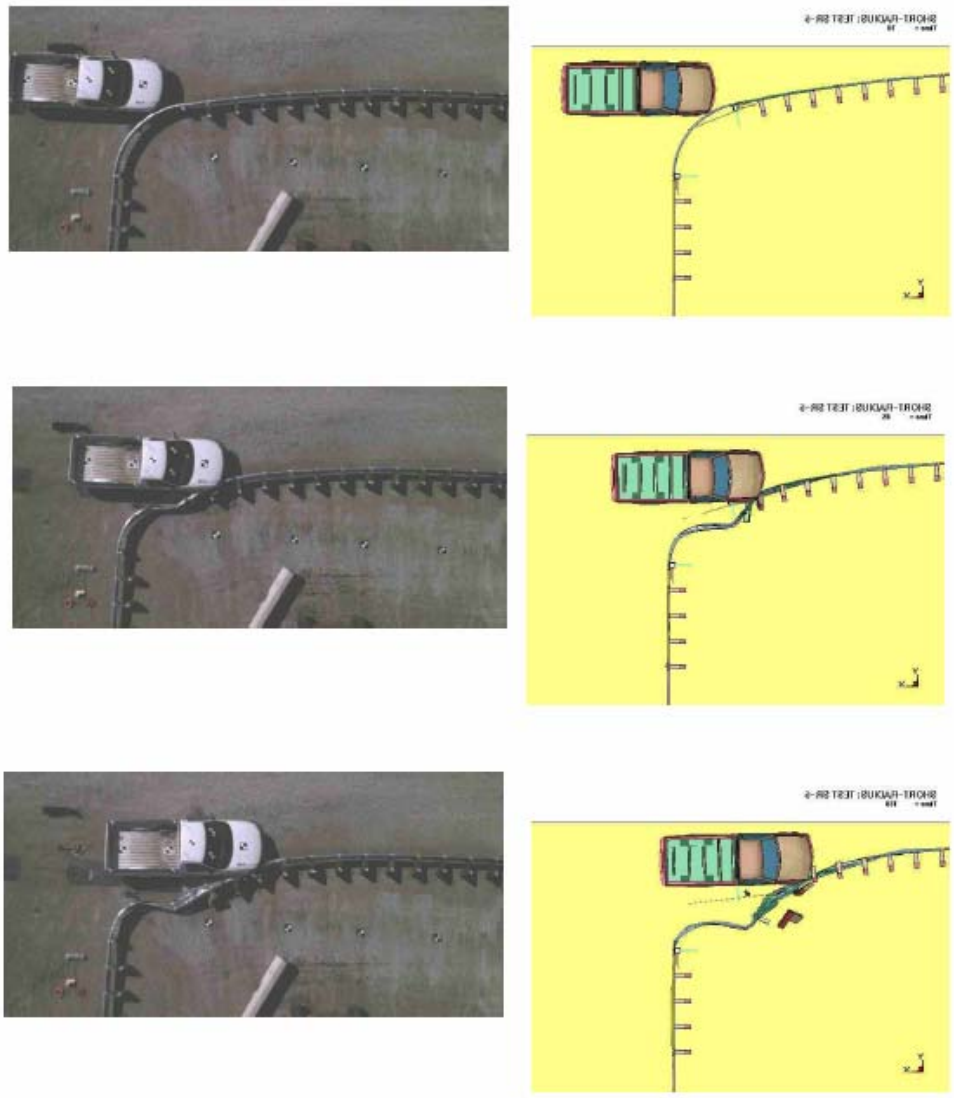


Figure 3. Comparison of Full-Scale Test and LS-DYNA Simulation Model, Test No. SR-5

Year 13

Generic W-Beam Guardrail with Curb

Polivka, K.A., Faller, R.K., Sicking, D.L., Reid, J.D., Rohde, J.R., Holloway, J.C., Bielenberg, R.W., and Kuipers, B.D., ***Development of the Midwest Guardrail System (MGS) for Standard and Reduced Post Spacing and in Combination with Curbs***, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-03-139-04, Project No. SPR-3(017)-Years 10, and 12-13, Project Code: RPFP-00-02, 02-01, and 03-05, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, September 1, 2004.

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

Currently, there is not additional funding for further development so our plan is to report on the two unsuccessful tests and look for recommendations during the next year's annual meeting.

Evaluation of Rigid Hazards in Zone of Intrusion

The third and final full-scale test in this project, a luminarie pole mounted on the concrete deck behind the barrier was performed on 3/3/05. The interaction of the single axle truck and the luminarie pose were incidental and all salient criteria were satisfied. In review both TL-3 and TL-4 tests of a luminarie pole mounted on the top of a 32" single slope barrier and behind that same barrier successfully passed full-scale testing. A report for this study will be initiated.

Three-Cable Guardrail

Based on the results of the median cable work a test of the three cable system in front of a 1.5:1 slope is planned. Currently an offset distance between 4 and 5' is being considered. This test will be performed later this summer.

Non-proprietary Guardrail System – Additional Test

Polivka, K.A., Faller, R.K., Sicking, D.L., Reid, J.D., Rohde, J.R., Holloway, J.C., Bielenberg, R.W., and Kuipers, B.D., ***Development of the Midwest Guardrail System (MGS) for Standard and Reduced Post Spacing and in Combination with Curbs***, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-03-139-04, Project No. SPR-3(017)-Years 10, and 12-13, Project Code: RPFP-00-02, 02-01, and 03-05, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, September 1, 2004.

Kansas Temporary Barrier Redesign and Test

Polivka, K.A., Faller, R.K., Rohde, J.R., Holloway, J.C., Bielenberg, B.W., and Sicking, D.L., ***Development and Evaluation of a Tie-Down System for the Redesigned F-shape Concrete Temporary Barrier***, Final Report to the Midwest States Regional Pooled Fund Program, Transportation Report No. TRP-03-134-03, Project No. SPR-03(017)-Year 13, Sponsoring Agency Code RPFP-03-06, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, NE, August 22, 2003.

System for Stiffening New Guardrail System

Polivka, K.A., Faller, R.K., Sicking, D.L., Reid, J.D., Rohde, J.R., Holloway, J.C., Bielenberg, R.W., and Kuipers, B.D., ***Development of the Midwest Guardrail System (MGS) for Standard and Reduced Post Spacing and in Combination with Curbs***, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation Research Report No. TRP-03-139-04, Project No. SPR-3(017)-Years 10, and 12-13, Project Code: RPFP-00-02, 02-01, and 03-05, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, September 1, 2004.

YEAR 14

Development of a Four-Strand, High-Performance Cable Barrier
Work evaluating the 4 cable system will begin this summer.

Evaluation of Transverse Culvert Safety Grate
Currently the culvert is being designed with full-scale testing is anticipated late in the 2nd or early in the 3rd Quarter of 2005.

Flare Rates for W-Beam Guardrail
The objectives of this research are to evaluate the effect of increased flare rates on impact performance and identify optimal flare rates that minimize total crash costs. A literature review of flare rates, including relevant crash testing and standards, is complete. Additionally, baseline Barrier VII models for the standard W-beam guardrail and for the MGS W-Beam guardrail system have been performed. This effort has resulted in the determination of an impact angle for the initial evaluation of 29.4°. This test is planned for early in the 2nd Quarter of 2005. A great deal of the initial research for this project was funded under NCHRP 17-20(3), Critical Flare Rates for W-beam Guardrail Determining Maximum Capacity Using Computer Simulation. Copies of the final report for that research have been sent to each of the member states for review.

Approach Slopes for W-Beam Guardrails Systems
Initial simulation efforts are underway to predict the effect of slope angle, slope length and barrier height on the performance of W-beam systems. Initial study focused on the Midwest Guardrail system impacted with a 2000P vehicle on a variety of slopes. Example results of this simulation effort are shown on the following page. The rail system in this study was offset 5'from the slope break. Initial evaluation of the simulation results indicate that on 9:1 and shallower slopes the vehicle is redirected; on slopes between 6:1 and 9:1 there is a significant and increasing possibility of vehicle instability; and for slopes steeper than 6:1 the vehicle overrides the rail. More simulation work will be completed before the final test condition is selected

Concept Development of a Bridge Pier Protection System for Longitudinal Barrier
The literature review for this project has been started. This review consists of an overview of the current pier protection standards utilized by the member states.

YEAR 15

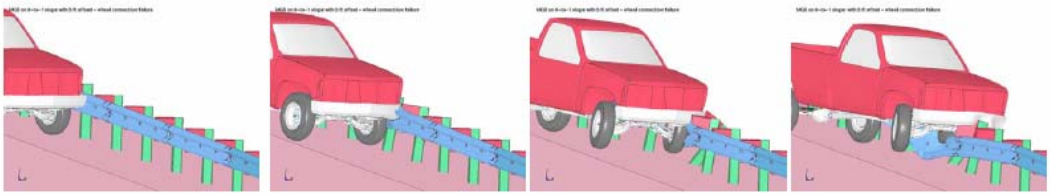
New TL-5 Median Barrier and Anchor
This development will follow initial work on the pier protection system in Year 14.

Retest of the Cable End Terminal
A modified system with additional breakaway posts has been fabricated. Testing of the system is planned for early 2005 dependent on the weather.

Long Span Design for the MGS Guardrail System
No progress to date.

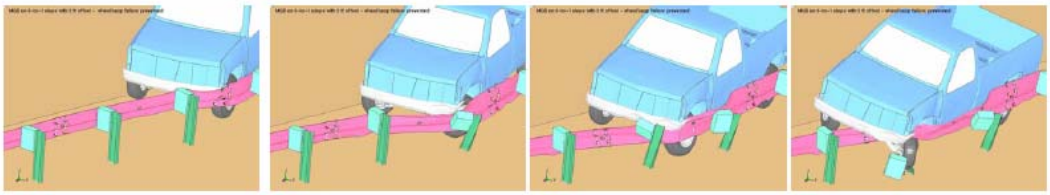
Midwest Guardrail System on Breakpoint of a 2:1 Slope
No progress to date.

MGS on 8-to-1 slope, rail 5 ft offset from break
Pickup truck – 100 km/h at 25 degrees.



T = 130 ms T = 180 ms T = 230 ms T = 280 ms

Figure 1. Wheel-Suspension Connection Failure Allowed – wheel comes off, truck overrides system



T = 180 ms T = 230 ms T = 280 ms T = 330 ms

Figure 2. No Connection Failure Allowed – rail tries to capture via tire, gets jammed up into wheel-well This could easily cause rail rupture or vehicle roll-over.

J.D. Reid – April 13, 2005

SUPPLEMENTAL PROJECTS:

Transitions and Deflection Limiting Modifications for the Kansas Type F3 Concrete Temporary Barrier

This project was initiated with two goals. First, it was necessary to develop a tie-down system to limit the deflection of the barrier system when placed on an asphalt concrete surface with some sort of restraint mechanism. Second, it was deemed necessary to transition from free standing barrier to barrier bolted to a bridge deck.

On September 27th,2004, a full-scale test of the pinned barrier was performed. The barrier was placed on a 2" asphalt pad 6" in front of a vertical drop off, with the barrier restrained utilizing the three existing holes on the impact face with 1.5" diameter, 3' long A36 pins. The full-scale test met all salient criteria and was deemed a pass. The maximum permanent deflection of the barrier was approximately 12". Before and after photos are shown below. A design concept for transitioning from free standing barrier to a bolted bridge section has been developed. As of early December, discussions with FHWA based on this design concept have cleared the way for testing of this system which is planned late 1st or early in the 2nd Quarter of 2005 depending on weather. This is currently the test we are planning for the April MidStates Pooled Fund meeting.

Minnesota Sound Wall Rail

Polivka, K.A., Rohde, J.R., Faller, R.K., Holloway, J.C., and Sicking, D.L., *Design and Evaluation of Minnesota's Timber Rub-Rail for Noise Barriers*, Draft Report to Minnesota Department of Transportation, Transportation Research Report No. TRP-03-156-04, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, November 30, 2004.