Development of an Energy-Absorbing, Low-Maintenance Median Barrier

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Introduction

- Concrete median barriers widely used along highways for containing and redirecting errant vehicles
  - Withstand high-energy impacts
  - Low maintenance
  - Generally rigid
  - Used in limited deflection areas
Concrete Barriers

- Common shapes
- Increased rollover rates
- High lateral vehicle decelerations
- Need exists to develop alternative barrier
Research Objectives

- Develop energy-absorbing, high-containment longitudinal barrier system
- Reduce lateral acceleration by 30% for passenger vehicles
- Maximum of 36 in. footprint
- Minimal damage
- Fully restorable
- AASHTO MASH TL-4
TL-4 Impact Conditions

- 22,000-lb single-unit truck
  - 56 mph
  - 15 degrees
- 5,000-lb pickup truck
  - 62 mph
  - 25 degrees
- 2,425-lb small car
  - 62 mph
  - 25 degrees
Energy-Absorbing Applications

- SAFER Barrier
- Guardrail
- End Terminal
- Crash Cushion
- Springs/Bumpers
- Motorcycle Barrier
- Ship Docking
Review of Energy Absorbers

- Energy absorption mode – crushing, tearing, friction, tension, shear
- Restorable and reusable materials
- Rubber – customizable & resistant to environmental effects
Design Concepts
Component Testing vs. Simulation

- Determine dynamic behavior
- Evaluate shape and material
- Predict performance
- Allow for modifications
Barrier Components
1100C Simulation
2270P Simulation
10000S Simulation
Test No. SFH-1
Test No. SFH-1
Test No. SFH-1 Damage
Test No. SFH-1 Damage
Force vs. Time (SFH-1)
Test No. SFH-2
Test No. SFH-2 Damage
Test No. SFH-2 Damage
Force vs. Time (SFH-2)
Summary/Conclusions

- Lateral accelerations decreased
  - 43% for pickup truck
  - 21% for small car

- Passed MASH TL-4 impact safety standards

- Minimal barrier damage
  - Spalling (SFH-1)
  - Rubber post tearing (SFH-2)
Recommendations

- Full-scale crash test with single-unit truck
- Design refinements and/or modifications
  - Reduce the spalling
  - Eliminate rubber post tearing potential
- Design rigid concrete parapet transition
Sponsors and Acknowledgements

- Concrete Industries
- USDOT FHWA
- Nebraska Department of Roads
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Report Locations

- [http://mwrsf.unl.edu/researchhub.php](http://mwrsf.unl.edu/researchhub.php)
  - TRP-03-280-14
  - TRP-03-281-13
  - SFH Full-Scale Report (in progress)
  - Design/Bogie Report (in progress)

- [http://digitalcommons.unl.edu/dissertations/AAI3546814/](http://digitalcommons.unl.edu/dissertations/AAI3546814/)
  - Dr. Jennifer Schmidt Dissertation