



# CENTER FOR INFRASTRUCTURE ENGINEERING STUDIES

## **Seismic Retrofit Workshop**

By

Genda Chen, PI

**University Transportation Center Program at**

**The University of Missouri-Rolla**

**UTC  
ETT172**

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16. Abstract <p>Metallic dampers were proposed for the seismic retrofit of deficient highway bridges by the University of Missouri-Rolla (UMR) under the sponsorship of Missouri Department of Transportation (MODOT). A research project (MODOT Study No. RI 01-028) on this subject was recently completed, including a summary of the findings and results from this investigation. The objectives of this project were to develop an economical seismic retrofit solution for continuous steel girder bridges in low recurrence but high consequence regions such as the New Madrid Seismic Zone. Through materials and fatigue tests in small- and full-scale specimens, it was concluded that metallic dampers are potential devices that can be applied to the bridges for their improved seismic performance. A design procedure has also been developed based on this investigation. To facilitate the transfer of this research product, a one-afternoon in-house workshop at the MODOT is being held. The objectives of this workshop are to provide engineers with some background information on response modification technologies, seismic retrofit concept with metallic dampers, installation issues, and step-by-step design procedure.</p>		14. Sponsoring Agency Code	
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## Seismic Retrofit Workshop

The in-house workshop on the Seismic Retrofit Design of Continuous Span Steel-Girder Highway Bridges took place on April 4, 2006, in the Hearing Room of the Missouri Department of Transportation. A total of 26 engineers from the central and district offices throughout the state of Missouri attended the workshop. The workshop covered the background of two seismic retrofit strategies—strengthening and damping. While strengthening was familiar to most participants, seismic response reduction by damping was a new topic. Both base isolation and supplemental damping devices were reviewed in detail. The background review was followed by the development of metallic dampers, design procedures, the laboratory validation of a full-scale damper unit, and several implementation issues.

The workshop was part of the technology transfer effort of the recently completed research project, MODOT Study No. RI01-028. The final report (No RDT 05-007) can be downloaded from the MODOT website (<http://www.modot.mo.gov/services/rdt/byDate.htm>).







# Seismic Retrofit Design of Continuous Span Steel-Girder Highway Bridges

Missouri Department of Transportation  
Jefferson City

April 4, 2006

Genda Chen, Ph.D., P.E.  
Associate Professor of Civil Engineering  
University of Missouri-Rolla

Organizers: Missouri Transportation Institute (MTI)  
Missouri Department of Transportation (MODOT)  
University of Missouri-Rolla (UMR)



## **PREFACE**

Metallic dampers were proposed for the seismic retrofit of deficient highway bridges by the University of Missouri-Rolla (UMR) under the sponsorship of Missouri Department of Transportation (MODOT). A research project (MODOT Study No. RI 01-028) on this subject was recently completed, including a summary of the findings and results from this investigation. The objectives of this project were to develop an economical seismic retrofit solution for continuous steel girder bridges in low recurrence but high consequence regions such as the New Madrid Seismic Zone. Through materials and fatigue tests in small- and full-scale specimens, it was concluded that metallic dampers are potential devices that can be applied to the bridges for their improved seismic performance. A design procedure has also been developed based on this investigation.

To facilitate the transfer of this research product, a one-afternoon in-house workshop at the MODOT is being held. The objectives of this workshop are to provide engineers with some background information on response modification technologies, seismic retrofit concept with metallic dampers, installation issues, and step-by-step design procedure.

## Workshop Schedule

The Missouri Department of Transportation, Jefferson City  
Hearing Room in Central Office Conference, Room 100

April 4, 2006

- |                  |   |
|------------------|---|
| 12:00 – 12:15 pm | Introduction  |
| 12:15 – 1:00 pm  | I. Background Information on Response Modification Devices<br>(a). Objectives of This Workshop<br>(b). Retrofit Philosophy with Response Modification Devices<br>(c). Types and Applications of Response Modification Devices |
| 1:00 – 1:30 pm   | II. Low Cycle and High Stress Fatigue Behavior of Metallic Dampers<br>(a) Selection of Low Carbon Steel<br>(b) Fatigue Properties under Various Loading   |
| 1:30 – 1:50 pm   | III. Design Procedure of Metallic Dampers<br>(a) Metallic Damper<br>(b) Cross Beams<br>(c) Connections  |
| 1:50 – 2:00 pm   | Break   |
| 2:00 – 2:40 pm   | IV. Retrofit Design of the Old St. Francis River Bridge, Butler-Stoddard County, MO<br>(a) Step-by-Step Design<br>(b) Cost<br>(c) Applicability   |
| 2:40 – 3:00 pm   | V. Validation Tests of a Full Scale Metallic Damper and its Connection Elements<br>(a) Failure Mode<br>(b) Fatigue Behavior   |
| 3:00 – 3:15 pm   | VI. Installation of Metallic Dampers  |
| 3:15 – 3:30 pm   | Concluding Comments by MODOT and Wrap-up  |



## CLOSURE

The complete set of presentation slides included here was prepared for the in-house workshop on Seismic Retrofit Design of Continuous Span Steel-Girder Highway Bridges, which took place on April 4, 2006, at the Missouri Department of Transportation (MODOT). The workshop is part of the technical transfer effort of the recently completed research project (MODOT Study No. RI01-028). The final report (No RDT 05-007) can be downloaded from the MODOT website (<http://www.modot.mo.gov/services/rdt/byDate.htm>).

Although every effort has been made to check the accuracy of the statements in all presentations, it is the responsibility of users to properly apply the presented results into their practice. Comments or suggestions on the organization of this workshop should be addressed and emailed to Dr. Genda Chen, P.E. via [gchen@umr.edu](mailto:gchen@umr.edu).

Genda Chen, Ph.D., P.E.  
Associate Professor of Civil Engineering  
328 Butler-Carlton Hall, 1870 Miner Circle  
Department of Civil, Architectural, and Environmental Engineering  
University of Missouri-Rolla  
Rolla, MO 65401