

Center for Transportation Infrastructure and Safety
NUTC NEWS
at Missouri University of Science and Technology



NATIONAL
UNIVERSITY
TRANSPORTATION
CENTER

SUMMER 2009 ~ VOLUME 4, ISSUE 4

A MESSAGE FROM THE DIRECTOR — JOHN J. MYERS

The dog days of summer are coming to an end at Missouri S&T. At CTIS we are preparing for the start of a new semester and a new year of exciting transportation-related research programs.

On page 3, read about how CTIS investigators are putting research in transportation infrastructure to practical use right in our own community. With the construction and monitoring of pedestrian bridges, citizens of Rolla will find it easier to get around while researchers will develop new practices for future implementation on highway bridges.

In this issue, we are pleased to feature University of Missouri – Columbia faculty member Dr. J. Erik Loehr, a key researcher for the MTI/MoDOT Geotechnical Transportation Research Program. Learn more about Dr. Loehr's work on page 6.

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Former UTC-student Dr. Gustavo Tumialan of Simpson Gumpertz & Heger, Inc. in Boston, Massachusetts is featured in this issue's "What Are They Doing Now?" series. Catch up with Dr. Tumialan and learn about his work in structural investigation and rehabilitation on page 5.

Our education focus includes a profile of graduate research assistant Yuepeng Cui on page 7 and an overview of the Summer Transportation Institute on page 4.

Enjoy the last bit of summer and the reading!

Warm Regards,
John

UPCOMING EVENTS

19th Annual ANNIE Conference

Nov. 2-4, 2009
St. Louis, Missouri
More info at <http://annie.mst.edu/>

Developing a Research Agenda for Transportation Infrastructure Preservation and Renewal

Nov. 12-13, 2009
Washington D.C.
More info at <http://www.TRB.org/calendar>

5th International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics

May 24-29, 2010
San Diego, California
More info at <http://conference.mst.edu/5geoeqconf2010/>

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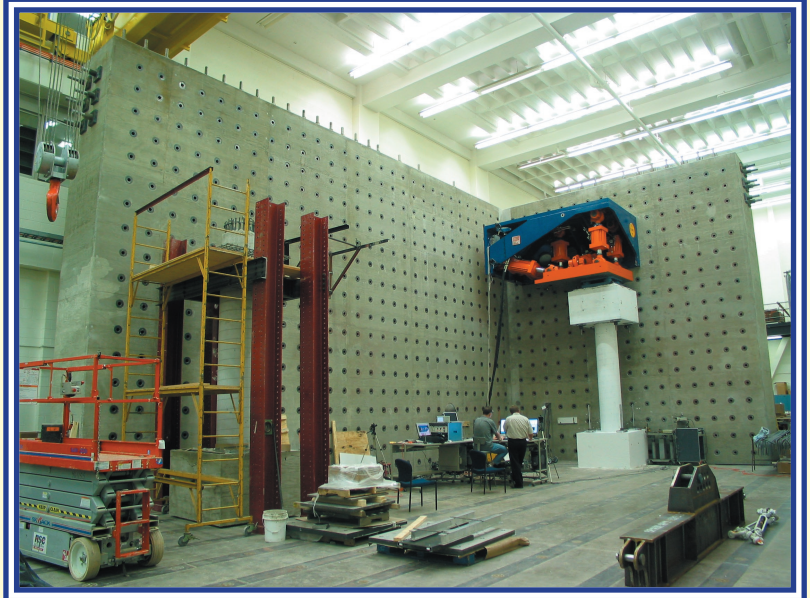


SEISMIC BEHAVIOR OF REINFORCED CONCRETE BRIDGE COLUMNS UNDER COMBINED LOADINGS

Missouri S&T student investigator, Suriya Shanmugam, under the supervision of Dr. A. Belarbi and the sponsorship of the CTIS National University Transportation Center (NUTC), the National Science Foundation (NSF) and the Network for Earthquake Engineering Simulation (NEES), has been researching the behavior of bridge columns under horizontal, vertical and changing loads.

BACKGROUND

Bridge columns under combined loadings can cause complex failure of bridges, especially when a rapid change in load occurs. Over time, bridge columns will fatigue and damage to the foundation of the structure will progress, impacting the bridge system as a whole.



APPROACH

To meet the project objectives, investigators used the following test parameters:

1. Bending to shear (M/V) and torsion to bending (T/M) loading ratios
2. Spiral/transverse reinforcement ratio
3. Cross sectional shape (circular, square, rectangular and interlocking spiral)

BENEFITS

The completed research will result in new design guidelines for improved safety of bridges, including constitutive models for combined loadings, M-V-T interaction surface for predicting the strength, ductility and failure modes of bridge columns under combined loads and educational modules for engineers.

OBJECTIVES



This NUTC-sponsored project intends to investigate the behavior of RC bridge columns when subjected to different kinds of load stresses, including combined axial, bending, shear and torsion both through experimental and analytical studies. Through this investigation, a direct interaction of bending, shear and torsion under constant axial load will be established and used to develop new design tools for engineers.



INNOVATIVE CONCRETE SYSTEMS FOR PEDESTRIAN BRIDGES

Using pedestrian bridges to research and monitor innovative concrete systems has the potential to solve problems on both local and national levels. Implementing small-scale structures in a local setting allows researchers to examine the long-term behavior of new concrete systems while making a valuable contribution to the community. At the same time, testing and developing new materials will aid in the repair of the ailing transportation infrastructure system in the United States.

With support from CTIS, Dr. John J. Myers and his research team will utilize innovative advanced concrete to fabricate, instrument and monitor two new pedestrian bridges in the City of Rolla, MO. One bridge will be constructed with high-strength concrete (HSC) as a baseline structure, while the second bridge will be constructed with high-strength, self-consolidating concrete (HS-SCC).

Because of its beneficial economical and material properties, the use of high-strength concrete (HSC) has become ordinary in the transportation infrastructure industry. The implementation of HSC in bridge construction reduces total material requirements and total costs by permitting longer girder spans and allowing for increased spacing between girders.

Over the past few years, acceptance and use of self-consolidating concrete (SCC) in

bridge construction has increased in the U.S. due to a reduced potential for segregation, voids and surface defects. Due to the availability of new admixtures and fewer required steps in the curing process, the fabrication time and labor costs associated with SCC are less than that of other concretes. With these advantages, and numerous recent research studies investigating the material and mechanical properties of its use in precast members, SCC is becoming the material of choice for the precast industry.

Combining the performance characteristics of SCC with the engineering properties of HSC into one material will produce a cost-effective choice for the construction industry. The Pedestrian Bridges research effort involves the implementation of HS-SCC as an integrated precast system for pedestrian bridges which can be monitored and evaluated for future use in the transportation industry.

This research study will advance the state-of-knowledge on the transfer and development length, prestress losses, serviceability behavior and load distribution of HS-SCC precast elements and panels. Additionally, the system holds promise to provide a cost-effective, durable alternative for rapid construction of bridge systems in general.





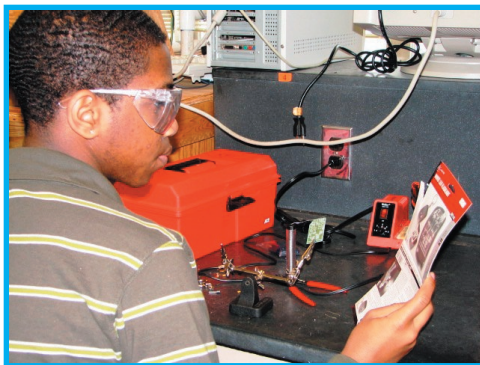
SUMMER TRANSPORTATION INSTITUTE 2009

Thirty-one rising high school sophomores, juniors and seniors interested in the transportation industry attended the two-week Summer Transportation Institute (STI) hosted by Missouri Local Technical Assistance Program (LTAP) July 12-24, 2009.

Week one was spent at the campus of Missouri University of Science and Technology (Missouri S&T) in Rolla and week two at Linn State Technical College in Linn, MO. Students had the opportunity to participate in leadership development and teambuilding activities while learning about a variety of aspects of the transportation industry and getting a taste of university life.

The curriculum included seminars on career opportunities in transportation; hands-on laboratories in which students designed software, mixed and tested concrete samples and learned about the components of asphalt; field trips to Kansas City, Universal Challenge Center in Rolla, St. Louis Transportation Museum and St. Louis' Metrolink; truck driver simulations and a tour

of the Black Hawk Helicopter facility at Fort Leonard Wood; and recreational activities such as a ropes course, indoor and outdoor group games, pool parties and picnics.



Participants were selected based on their academic achievement, expression of interest in transportation as a possible career choice and a written recommendation from the student's high school counselor and/or instructors. Selected students were awarded a scholarship covering room and board as well as any travel expenses associated with program activities and field trips.

STI is sponsored by the U.S. Department of Transportation, Missouri Department of Transportation, Missouri LTAP and the Center for Transportation Infrastructure and Safety and has been offered annually since 1999.

For more information about STI, visit <http://dce.mst.edu/noncredit/precollege/sti.html>. For more about Missouri LTAP, visit <http://131.151.35.63/index.html>.



CATCHING UP WITH FORMER UTC STUDENT GUSTAVO TUMIALAN

As a Senior Staff Engineer in the Boston, Massachusetts office of Simpson Gumpertz & Heger, Inc. (SGH), Gustavo Tumialan works in the investigation, evaluation and repair of concrete, masonry and steel structures of all types. In addition to his engineering responsibilities, he also writes proposals, develops work plans, coordinates between clients, architects and contractors and oversees the work of other engineers.

Tumialan earned a Ph.D. in Civil Engineering in 2001 and a M.S. in Civil Engineering in 1998 from the University of Missouri – Rolla (now Missouri University of Science and Technology). He earned a B.S. in Civil Engineering from Pontificia Universidad Catolica del Peru in Lima, Peru in 1994.

As a graduate student working with the UTC, Tumialan worked on developing strengthening techniques for concrete and masonry structures with Fiber Reinforced Polymer (FRP) systems and the evaluation of bridge structures using in-situ load testing techniques in the State of Missouri. These projects not only required laboratory and analytical work, but extensive field work as well.

Tumialan cites his “exposure to real-world structural projects” and the “opportunities to learn new technologies for repair and rehabilitation of structures” as key reasons for getting involved with UTC research. These opportunities apply directly to his work at SGH. Due to his knowledge of FRP systems for civil infrastructure and in-situ

load testing, Tumialan has been able to make a significant contribution to a variety of projects while expanding his expertise beyond concrete structures and into steel, masonry and wood structures as well. In the future, Tumialan plans to start developing business for the firm in Latin America. He also plans to continue developing his expertise in the field of investigation and rehabilitation of structures.



He is actively involved in American Concrete Institute (ACI) committees on FRP Composites and Strength Evaluation of Concrete Structures. He is a member of the American Society of Civil Engineers (ASCE), International Concrete Repair Institute (ICRI) and American Institute of Steel Construction (AISC). Tumialan also has had the opportunity to lead technical seminars on repair and rehabilitation of structures in the U.S. and Latin America.

Tumialan and his wife, Giuliana Zelada (also a University of Missouri – Rolla alumna), have been enjoying exploring New England with their three year-old son, Eduardo. Being “crazy about soccer,” Tumialan is currently teaching Eduardo how to kick a soccer ball.

He encourages current students to get involved with research projects and technical activities early on in their education, saying: “No matter how small your involvement may seem, it will be an experience that you will have gained and will put you a step ahead of the rest.”



J. ERIK LOEHR, PH.D., P.E.

ASSOCIATE PROFESSOR OF CIVIL AND ENVIRONMENTAL ENGINEERING

Dr. J. Erik Loehr is the James C. Dowell Associate Professor of Civil and Environmental Engineering and Interim Director of Research for the College of Engineering at the University of Missouri–Columbia (MU). Dr. Loehr's research focuses on the use of drilled foundations—such as drilled shafts, micropiles, soil nails and ground anchors—for stabilization of earth slopes and earth retention. He is currently working on collecting and interpreting data on loading of foundations due to moving soil; developing load and resistance factor design (LRFD) methods for geotechnical applications; and the development and application of satellite-based radar measurements to monitor ground movements.

Dr. Loehr's significant contributions to the field of geotechnical engineering have resulted in numerous published papers in refereed journals and conference proceedings. His work on applications related to stabilizing earth slopes using piles, drilled shafts and other foundation elements has relevance to structural loading due to landslides and ground movements from earthquakes. This work has allowed Dr. Loehr to collect and analyze a significant amount of reliable data in an area where there has previously been a large void.

As principal investigator, Dr. Loehr's research has been supported by government agencies including the National Science Foundation (NSF), the Federal Highway Administration (FHWA), the Missouri Department of Transportation (MoDOT),

and the National Geospatial Intelligence Agency (NGA), as well as by private industry including the International Association of Foundation Drilling (ADSC) and Nucor-Yamato Steel.



Dr. Loehr is active in several professional organizations, including the ASCE Geo-Institute, the International Association of Foundation Drilling (ADSC), the Deep Foundations Institute (DFI), the Transportation Research Board (TRB) and the International Society for Micropiles and has been an invited speaker or presenter at numerous seminars and conferences both nationally and internationally.

In 2001, Dr. Loehr was the recipient of a NSF CAREER Award, a prestigious award made to junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. He has also received a Chi Epsilon Excellence in Teaching Award for the 2004-2005 academic year and a MU Excellence in Education Award in 2004, among others.

Dr. Loehr received his Ph.D., M.S. and B.S. degrees in Civil/Geotechnical Engineering from the University of Texas at Austin in 1998, 1993 and 1990, respectively. He joined the faculty at MU in January of 1998.



NUTC STUDENT SOLUTIONS: YUEPENG CUI

Yuepeng Cui has been awarded a one-year graduate assistantship from the Center for Transportation Infrastructure and Safety to pursue doctoral studies in a transportation-related field. The award was made based on an exemplary academic career and the merit of her proposed research.

Under the supervision of Dr. Hojong Baik, Yuepeng Cui's research at Missouri University of Science and Technology focuses on the development of a modeling framework that estimates the nationwide multimodal transportation demand for the U.S. transportation system.

With 1.1 billion U.S. citizens annually making business and leisure trips of more than 100 miles and an estimated 19 billion tons of natural resources and manufactured products being transported annually within the U.S., it is clear that the transportation system plays a key and vital role in the country's economy. Though there are several nationwide multimodal transportation demand models available, finding a comprehensive framework that simultaneously analyzes both passenger trips and freight flow is difficult.

The main goal of Cui's research is to develop a single analytical framework that estimates the demand of both passenger trips and commodity flow.

The framework considers the entire U.S. multimodal transportation system, which contains the national highways, air transportation, rail transportation and the waterway transportation systems.



Distinguished teaching and research faculty, state-of-the-art research facilities and a renowned reputation within the field of civil engineering all led Cui to pursue doctoral studies at Missouri S&T. After completing her research and Ph.D. at Missouri S&T, Cui plans to return to China as a teacher and/or researcher to concentrate on solving traffic problems there. She says, "Earning my Ph.D. would give me the advanced skills and knowledge I need to develop meaningful solutions to the complex traffic problems facing our modern world."

Cui completed a Bachelor's of Science in Traffic Engineering in 2006 and a Master's of Science in Transportation Planning & Management in 2008 at Harbin Institute of Technology in Heilongjiang Province, China. There, Cui was the recipient of a First-Class Scholarship for Excellent Academic Performance (2006-2007), a Third-Class Scholarship for Excellent Academic Performance (2002-2003), an Excellent Student Award (2006-2007) and received recognition for an Excellent Graduation Thesis.



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2009

SHAMSHER PRAKASH FOUNDATION

PRIZE FOR EXCELLENCE

IN THE PRACTICE OF

GEOTECHNICAL ENGINEERING

Shamsheer Prakash Foundation solicits nominations for young practicing engineers (45 years or younger) from all over the world. Candidates should be specialists in Geotechnical Engineering and/or Geotechnical Earthquake Engineering and must have made significant independent contributions to the practice as well as show promise of excellence. The award, consisting of \$1,100 and a plaque, will be announced on December 31, 2009.

Nominations may be made on plain paper. The specified age range may be relaxed in exceptional cases and at the discretion of the judging committee. All nominations will be reviewed by a judging committee of international experts from Canada, Japan, Ireland, Taiwan and the United States.

**NOMINATIONS WILL BE ACCEPTED UNTIL
SEPTEMBER 30, 2009!**

Visit http://www.yoga10.org/prize_excel_MST.html for more information and/or to contact Dr. Shamsheer Prakash directly.