



# NUTC NEWS

AT MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

SPRING/SUMMER 2011 ~ VOLUME 6, ISSUE 3

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## A MESSAGE FROM THE

### DIRECTOR:

### JOHN J. MYERS

Another successful academic year, full of transportation-related education, research and technology transfer activities at the Center for Transportation Infrastructure and Safety has come to a close. Happily, the summer will provide us with more opportunities to continue with what we do best!

CTIS is happy to support future professionals of a younger generation. Read more about Missouri S&T's transportation-related summer camps on page 4.

Last, but certainly not least, learn more about specific aspects of our work on the MTI/MoDOT Structural and Geotechnical Research Programs on pages 2 and 3. These initiatives have now come to a close. Final Reports are available on our website. What a success!

Wishing you all a fun and safe summer and pleasant reading!

Warm Regards,  
John

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## MTI/MoDOT STRUCTURAL COLLABORATIVE RESEARCH UPDATE



In 2008, to address MoDOT's and the nation's needs in developing better, faster, and cheaper solutions for transportation structures with superior long-term performance, innovative construction technologies, and effective maintenance and preservation strategies, Missouri Department of Transportation (MoDOT), with administrative oversight from Missouri Transportation Institute (MTI), collaborated with University of Missouri (UM) Structures faculty to cooperatively conduct research on transportation structures.

In order to comprehensively and effectively complete work within these areas, research was divided into tasks and sub-tasks to be conducted by those researchers with the appropriate expertise.

### PROJECT 2D: CALIBRATION OF LOAD AND RESISTANCE FACTORS

The objectives of this project are threefold: 1) to develop a new design methodology for drilled shaft foundations to allow for limited displacements under gravity loads; 2) to analyze representative highway bridges to understand the effect of foundation displacements on the design loads and strength requirements of the bridge superstructure; and 3) to calibrate the load and resistance factors in LRFD design specifications. An additional objective of this project is to provide a mechanism for the Structures Thrust Area to interact and collaborate with the Geotechnical Thrust Area.

The AASHTO LRFD Design Specifications for drilled shaft foundations are yet to be calibrated with test data in Missouri sites. Foundation is a critical part of a bridge system. It not only affects the stability of the overall system, but also constitutes a significant portion of the bridge construction costs. Therefore, better calibrations with field tests are imperative. Additionally, foundation design calibrations warrant the consideration of a bridge system and thus require a close collaboration between geotechnical and structural engineering. Typical bridges will be analyzed to understand the demand (load factor) on drilled shaft foundations and the required strength (resistance factor) given a certain allowable displacement. Both load and resistance factors will be calibrated with the Missouri environment and traffic condition using a reliability-based approach.

The anticipated deliverables from this project include: a rational framework for the development of performance-based design methodology with permissible foundation displacements and new LRFD Specifications that have been calibrated with test data in Missouri.

To learn more about the scope of work and objectives for individual projects and the researchers involved, visit <http://utc.mst.edu/research/2007.html>.



## MTI/MoDOT GEOTECHNICAL TRANSPORTATION RESEARCH UPDATE



In 2008, in order to achieve significant and recurring cost savings for MoDOT (Missouri Department of Transportation) a collaborative project was undertaken by expert researchers within the University of Missouri (UM) system. The execution and completion of this program will address many of MoDOT's most pressing research needs while making notable improvements to the state of the art and practice of geotechnical engineering at a national and international level.

In order to comprehensively and effectively complete work within these areas, research was divided into tasks and sub-tasks to be conducted by those researchers with the appropriate expertise.

### TASK 4: LRFD LOAD AND RESISTANCE SPECIFICATIONS

The objective of this project is to establish MoDOT specific load and resistance factors for design of earth slopes and foundations and to develop recommended LRFD design specifications for adoption by MoDOT to implement the results of this research program. The developed specifications will allow MoDOT to achieve appropriate target risk levels and to account for the variability and conservatism established for relevant design soil parameters and design methods in other tasks.

The focus is on performing analyses to establish improved load and resistance factors for design of bridge foundations and earth slopes and development of a new design specification to allow implementation of these improvements. This task will integrate the results of lab and field investigations performed as part of this research program to produce substantial and recurring cost savings for MoDOT.

This information is expected to result in better choices for bridge foundations (e.g. drilled shafts vs. driven piles vs. spread footings), more appropriately sized foundations, and better decisions regarding the value and appropriateness of various site investigation activities and design or construction phase load tests.

To learn more about the scope of work and objectives for individual projects and the researchers involved, visit <http://utc.mst.edu/research/2008.html>.





# NUTC NEWS

## OPPORTUNITIES FOR FUTURE TRANSPORTATION PROFESSIONALS

Each summer, Missouri S&T offers middle and high school students educational opportunities to explore various math, science, engineering and technology careers. With support from CTIS, the summer 2010 offerings include several opportunities for students to explore the world of transportation, creating a mutual investment for both the future of participating students and the future of transportation infrastructure and safety.

### EcoCAR SUMMER CAMP

**July 10-14, 2011** • *For rising high school sophomores, juniors and seniors*

This week-long residential camp will allow students to learn first-hand how Hydrogen Fuel Cell Plug-In Hybrid Electric Vehicles (FC-PHEV) reduce global environmental impact by minimizing the vehicle's fuel consumption and reducing its emissions while retaining performance, safety and consumer appeal.

At camp, students will take a mini course on energy and the environment; visit Missouri S&T's E<sup>3</sup> Commons; perform total fuel cycle well-to-wheel modeling; conduct fuel cell vehicle simulations; and participate in a hydrogen vehicle design contest.

For more information, visit <http://precollege.mst.edu/ecocar.html>.

### INTRODUCTION TO ENGINEERING

**July 10-14 & 24-28, 2011** • *Rising high school juniors and seniors*

Students spend summer camp mornings learning about engineering disciplines from leaders in their fields, while rubbing shoulders with some of the brightest students in the nation. Participants gain practical engineering experience during lab and industry visits in the afternoon and test their skills in friendly student competitions during the evening. Hands-on activities introduce various disciplines while offering a taste of campus life.

For more information, visit <http://precollege.mst.edu/intro.html>.

### AEROSPACE CAMP

**July 12-14 & 26-28, 2011** •

*Students aged 10-13*

Students experience aeronautics and space flight from a ground-up perspective, learning about the history of flight, astronomy and space exploration. This camp offers computer simulations, interactive teamwork activities and practical hands-on experiences, including: Computer-based Flight Simulation, Hands-on Robotics and Rocket Construction and Launching, among other activities.

For more information, visit <http://precollege.mst.edu/aerospace.html>.

### GIRLS GO GREEN

**July 17-22, 2011** • *Rising 11th and 12th grade girls*

This week-long residential program is designed to provide an opportunity to explore career options that help society while protecting the environment. Attendees live together in a residential hall, meet current female student leaders and professors, participate in team projects and field trips and explore the science and engineering behind a green environment.

For more information, visit <http://precollege.mst.edu/girlsgogreen.html>.