Center for Transportation Infrastructure and Safety

NUTC NEW



UPCOMING

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A Message from the Director – John J. Myers

at Missouri University of Science and Technology

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!

One aspect of our work at CTIS which we are particularly proud of is the education and training of future transportation professionals and engineers. Missouri S&T students are involved in our research in numerous ways. Read about Sriram Praneeth Isanaka's work on portable fuel cells for the general population on page 7.

And speaking of new fuel technology, the Missouri S&T Hydrogen Design Team has again taken Grand Prize in the Hydrogen Student Design Contest sponsored by the Hydrogen Education Foundation! Read about it on page 2.

In addition to Ph.D. students and design teams, CTIS also supports future professionals of a younger generation. Read more about Missouri S&T's transportation-related

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NUTC STUDENT SOLUTIONS: SRIRAM PRANEETH ISANAKA.....7 summer camps on page 6 and a year of programs from Women in Science & Engineering (WISE) on page 5.

Last, but certainly not least, learn more about specific aspects of our work on the MTI/MoDOT Structural and Geotechnical Research Programs on page 3 and 4. We will continue to provide updates on these two large initiatives over the next few issues of the NUTC News, so be sure to stay tuned!

Warm Regards, John EVENTS 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

Missouri S&T Summer Camps June & July 2010 • EcoCAR • MITE • STI • It's a Girl Thing! More info on page 6

ANNIE 2010: 20th Year Celebration November 1-2, 2010 St. Louis, Missouri

More info at http:// annie.mst.edu

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MISSOURI S&T WINS GRAND PRIZE IN HYDROGEN DESIGN CONTEST



Left to Right: Jeffrey Serfass (National Hydrogen Association President), Stephen Schrock, Mathew Thomas, Aanchal Shah, Vijay Shah, Yaqin Lin, Amber Gomaz, Matthew Rankins, James Haworth and Dr. John W. Sheffield (Team Advisor)

A design for a hydrogen-powered community in California by students from Missouri University of Science and Technology captured the grand prize in the national Hydrogen Student Design Contest sponsored by the Hydrogen Education Foundation.

Missouri S&T was announced as the grand prize winner Tuesday, May 4, 2010 at the National Hydrogen Association's Hydrogen Conference and Expo in Long Beach, CA. This marks the second time in three years that a Missouri S&T team has won the contest.

For this year's competition, the Missouri S&T team designed a scalable hydrogen fueling station for the community of Santa Monica, CA and identified renewable hydrogen sources in the community as well as customers for early-market hydrogen applications.

The team's eight students designed a station capable of dispensing at least 200 kilograms of hydrogen per day. To better inform the public about the benefits of hydrogen power, team members also designed a public education facility to be constructed from a recycled shipping container.

The work was based on criteria outlined in the California Fuel Cell Partnership's Action Plan 1, a 2009 strategy for developing early hydrogen communities in California over the next eight years.

The Hydrogen Design Contest is an annual event that challenges teams of university-level students from around the world to develop and design hydrogen applications for real-world use. Established in 2004 by the Hydrogen Education Foundation, the contest showcases the talents of students in many disciplines, including engineering, architecture, marketing and entrepreneurship. Students from colleges, universities and vocational schools worldwide are eligible to participate. More than 30 teams from all over the world signed up for the 2009-2010 competition.

As the grand prize winner, the Missouri S&T team was invited to present its design at the Hydrogen Conference and Expo and at the World Hydrogen Energy Conference to be held May 16-19 in Essen, Germany.

In 2008, a Missouri S&T team won the grand prize by designing systems to address air and water quality,

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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.

n 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 1A: STRUCTURAL STEEL COATINGS FOR CORROSION MITIGATION

The objective of this project is to utilize collected data to identify and test an improved system(s) for coating structures in the field. The tasks will consider a broad range of available coating types and result in recommendations that provide low cost, low risk of failure systems for most common scenarios.

Coating of structural steel presents a significant, costly maintenance challenge that is critical to mitigating the detrimental effects of corrosion, thereby extending the service life of bridges and reducing operational costs. The field performance of coating can be inconsistent, being affected by the quality and method of surface preparation and the environment, among many other factors.

Field evaluation of the existing coating systems in Missouri will be conducted to determine the past and current performance. The steel coating systems and procedures being utilized by other state DOTs will be evaluated with respect to current practices to identify areas to be examined for enhancing current practices and potential cost impacts. A consistent and quantitative method for characterizing the condition and performance of an in-place coating will be defined based on experiences in other states, standards and needs so that a systematic study of coating performance in Missouri can be undertaken.

PROJECT 1B: SPALLING SOLUTION OF PRECAST-PRESTRESSED BRIDGE DECK PANELS

The objective of this project is to investigate the cause for spalling in precast-prestressed panels and costeffective mitigation solutions for existing bridge decks, as well as to review improved design options for new construction. Alternative solutions will be proposed and evaluated. This will include fundamental laboratory studies to evaluate and validate the proposed design. It will also include the development of procedures for the design of prototype bridge deck panels that are corrosion-free to eliminate the spalling problem.

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. Or, look for more information in future issues of the NUTC News.

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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 1: SITE CHARACTERIZATION FOR LOWEST COST TRANSPORTATION PRODUCTS The objective of Task 1 is to develop methods and procedures for characterizing design parameters relevant to bridge foundations and earth slopes in a probabilistic manner to allow appropriate consideration of risk in the design process. The focus of these efforts has been to develop the knowledge, procedures and techniques to perform site characterizations that will produce the lowest cost transportation products possible on a system-wide basis. Specific objectives include: 1) Quantify "hidden" conservatism or "bias" in measurements of design parameters relevant to foundations and earth slopes based on current practices and potential improvements to those practices 2) Develop methods to establish site specific variability in design parameters for use in LRFD design

2) Develop methods to establish site specific variability in design parameters for use in LRFD design specifications based on laboratory and field measurements

This specific portion of the work focuses on completing an extensive lab and field testing program to quantify variability and bias in relevant design parameters (e.g. shear strength and consolidation parameters) as a function of specific boring, sampling and testing techniques.

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. Or, look for more information in future issues of the NUTC News.

WISE PROGRAMS AT MISSOURI S&T

For the past 5 years, the Center for Transportation Infrastructure and Safety has been a supporter of the Women in Science and Engineering (WISE) program at Missouri S&T. The WISE program provides a campus focal point for increasing the number of women in science, engineering, math and technology fields through outreach, recruitment and retention efforts from middle school age through undergraduate levels. WISE also provides support programs for young women at Missouri S&T.

The following is a sampling of activities offered/planned from July 2009 through June 2010:



Society of Women Engineers (SWE) National Conference - October 2009

Missouri S&T SWE students participated in both National and Regional conferences. Each year, the National conference attracts nearly 5,000 engineering professionals, students and corporate representatives.

7th "Expanding Your Horizons (EYH)...in Math and Science" - November 4, 2009

EYH is an invitation for 7th & 8th grade girls to visit the Missouri S&T campus and attend a keynote presentation by a successful

woman engineer or scientist, participate in hands-on math/science activities and to interact with female students, faculty and practicing engineers and scientists who serve as positive role models. Over 500 girls participated in 2009.

GIRLS "LOCK-IN" CONFERENCES - OCTOBER 2-3, 2009 AND FEBRUARY 12-13, 2010

Eleventh and 12th grade girls were given the opportunity to camp out in a residence hall, learn more about studying math, science and engineering at Missouri S&T, to meet other perspective and current students, learn tips for financial aid and admission and participate in team projects. A total of 53 students participated in the two conferences and 62 percent of attendees later enrolled at Missouri S&T.

SUMMER SOLUTIONS CAMP - JUNE 21-25, 2010

Summer Solutions Camp is designed to interest freshman and sophomore high school girls in engineering and science. The one-week program enables female students to obtain a clear picture of engineering and science as a profession. Several hands on projects are planned to help the students learn more about career options and work in the field. The 2010 program expects close to 30 participants.



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

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July 11-15, 2010 • 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^3 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://dce.mst.edu/ noncredit/precollege/ecocar.html.

It's a Girl Thing!

June 14-18, 2010 • Rising 7th and 8th grade girls

This week-long residential program is designed to provide a fun and introductory engineering, science and technology experience for girls entering 7th and 8th grades. Attendees will be exposed to the various science, technology, engineering and mathematics (STEM) careers and encouraged to explore their personal interests through group projects and design competitions.

For more information, visit http://dce.mst.edu/ noncredit/precollege/iagt.html.

SUMMER TRANSPORTATION INSTITUTE (STI)

July 11-23, 2010 • Rising high school sophomores, juniors and seniors

Through hands-on laboratories, seminars and field trips students will learn about a variety of aspects of the transportation industry. The curriculum includes activities such as seminars on career opportunities in transportation; field trips to St. Louis Transportation Museum; a tour of the Black Hawk Helicopter facility at Fort Leonard Wood; and recreational activities including a ropes course, pool parties and picnics. This program is sponsored by the U.S. Department of Transportation.

For more information, visit http://www.linnstate. edu/admissions/NSTI.php.

MINORITY INTRODUCTION TO TECHNOLOGY AND ENGINEERING (MITE)

June 6-11 and June 20-25, 2010 • African American, Hispanic and American Indian rising high school juniors and seniors

An introduction to the world of engineering, this one-week program will help students with an interest in engineering, mathematics, science or technology explore a wide variety of job fields and gain first-hand knowledge of what engineers really do. Group design projects; hands-on activities; laboratory and industry visits; and informational discussions with professionals will give students a taste of potential careers.

For more information, visit http://dce.mst.edu/ noncredit/precollege/MITE.html.

NUTC STUDENT SOLUTIONS: SRIRAM PRANEETH ISANAKA

Sriram Praneeth Isanaka has been awarded a one-year graduate assistantship from the CenterforTransportationInfrastructureandSafety to pursue doctoral studies in a transportation-

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related field. The award was made based on an exemplary academic career and the merit of his proposed research.

Under the supervision of Dr. Frank Liou, Isanaka's research at the Missouri University of Science and Technology focuses on the design and manufacture of a portable, efficient and economical fuel cell.

Currently, there is not a single fuel cell costing less than \$100 on the market. Because fuel cell technology is relatively new to the market, there is concern with safety. To address these challenges, Isanaka is developing designs to address flow dynamics and

heat transfer in fuels cells. This work involves simulating the flow and diffusion effects of hydrogen and oxygen in the bipolar plates, a critical component in the fuel cell assembly, using simulation software and also ensuring that the bipolar plate resists corrosion. Isanaka uses a laser deposition system developed by Dr. Liou to deposit and identify good coating materials. The main goal of Isanaka's research is to develop an aesthetic, safe and economical (less than \$100) fuel cell for the U.S. Air force. However, if successful, this technology could be adapted

for and made available to the general public, offering a cheap and environmentally friendly source of household energy.

balanced offering of both Atheoretical and hands-on work led Isanaka to pursue doctoral studies at Missouri S&T. "I am not restricted to just text books, simulations and other theoretical work. Here, I can truly engineer," says Isanaka. After completing his research and Ph.D. at Missouri S&T, Isanaka hopes to work in industry where he can continue developing solutions to engineering challenges as a professional engineer.

I sanaka completed a Bachelor's of Engineering in Mechanical Engineering from Anna University, Chennai, India in 2006. He completed a Master's of Science in Mechanical Engineering at Missouri S&T in May of 2009. Thus far, he has maintained a 4.0 GPA throughout his graduate studies.





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noise pollution, energy efficiency, safety and security issues at the Columbia Metropolitan Airport in Columbia, SC.



Tembers of this year's team are:

•Mathew Thomas, Team Leader, of Rolla, MO Ph.D. student in Engineering Management

•Stephen Schrock of Omaha, NA senior in Architectural Engineering

•James Haworth of Kansas City, MO senior in Architectural Engineering

•Amber Gomaz of Rolla, MO senior in Architectural Engineering

•Matthew Rankins of Eureka, MO senior in Architectural Engineering

•Aanchal Shah of Rolla, MO graduate student in Mechanical Engineering

•Vijay Mohan of Malleswaram, Bangalore, India graduate student in Mechanical Engineering

•Yaqin Lin of Rolla, MO graduate student in Engineering Management

Team advisers include Dr. Paul D Hirtz, Interim Director of Missouri S&T's Student Design Center; Dr. Stuart W. Baur, Assistant Professor of Civil, Architectural and Environmental Engineering; Heath Pickerill, Lecturer of Civil, Architectural and Environmental Engineering and Director of the Missouri Local Transportation Assistance Program; Scott E. Grasman, Associate Professor of Engineering Management and Systems Engineering; Kevin B. Martin, Assistant Research Professor of Mechanical and Aerospace Engineering; Angela Rolufs, Director of the Missouri Transportation Institute and the S&T Center for Environmental Excellence; Dr. John Sheffield, Professor of Mechanical and Aerospace Engineering; and Timothy Montgomery, Owner and Principal Architect of TMA Architects of St. Louis and a 1971 Mechanical Engineering graduate of Missouri S&T (then known as the University of Missouri-Rolla).

This article was adapted from a May 4, 2010 Missouri S&T Public Relations news release.