

Center for Transportation Infrastructure and Safety

NUTC NEWS

at Missouri University of Science & Technology



NATIONAL
UNIVERSITY
TRANSPORTATION
CENTER

SUMMER 2008 ~ VOLUME 3, ISSUE 4

A MESSAGE FROM THE DIRECTOR — JOHN J. MYERS

The dog days of summer, with the usual warm temperatures and ever changing weather conditions, have arrived here in the “Show Me” State. Seeing numerous undergraduate and graduate students in transportation complete their degrees and transition into professional practice these past few months led us to think about adding new components to our quarterly newsletter. In this issue, we are pleased to feature articles focusing on our true educational and research backbone, our students.

In addition to highlighting the university-based research activities of two of our recent NUTC Ph.D. Fellowship Awardees and the Hit the Ground Running Program, this Summer issue introduces a “What Are They Doing Now?” series. Our inaugural story features Dr. Danielle Kleinhans, who was the first graduate student to receive the UTC Student of the Year Award at Missouri S&T.

As in past issues, we have and will continue to brag a little about our highly engaged transportation related faculty members and provide updates on research projects. Learn more about Dr. Abdeldjelil “DJ” Belarbi and his high-profile, national-level research and transportation activities on page 5. Read about a recently completed research project working with a new kind of composite on page 2.

This Fall we will kick-off a new Transportation Seminar Series. After almost a year of planning with Angie Rolufs, the Missouri Transportation Institute (MTI) Director, we are excited to host several transportation experts at our Rolla campus. Look for details on page 8 as well as on our website.

Also on campus this Fall, CTIS will hold an informative meeting for faculty and staff interested in learning more about our Center and research funding opportunities. Stay tuned to learn more about new programs and initiatives in future newsletters. Now, please sit back and enjoy the Summer News!

Warm Regards, John

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UPCOMING EVENTS

New Madrid Seismic Zone Conference

August 12-14, 2008
Rolla, Missouri

CTIS-NUTC Funding and Information Seminar

TBA
September 2008
Rolla, Missouri

The Future of Transportation

September 12, 2008
Rolla, Missouri

More information
on page 8.

Fall 2008 ACI Convention: The Spirit of Concrete

November 2-6, 2008
St. Louis, Missouri

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MISSOURI
S&T



PULTRUDED COMPOSITES USING SOY-BASED POLYURETHANE



Students performing the pultrusion process at the Composite Manufacturing Laboratory at Missouri S&T.

Missouri S&T student investigator, Rama R. Vuppalapati, under the supervision of Dr. K. Chandrashekhara and the sponsorship of the CTIS National University Transportation Center (NUTC) and United Soybean Board, has been researching the feasibility and performance of soy-based polyurethane composites for use in manufacturing.

BACKGROUND

Raw materials and the manufacturing process are major cost drivers for composites, which are engineered products made from two or more materials with significantly different properties. Using an automated and continuous manufacturing process like pultrusion, which uses resin and reinforcing fibers to make composites, and a bio-based raw material like soy for resin can reduce the cost of composites.

OBJECTIVES

This NUTC-sponsored project manufactured pultruded panels using both a base polyurethane (PU) resin system and a soy-based PU resin system. The two types of PU composites were then evaluated on respective mechanical properties and impact performance.

APPROACH

To meet the project objectives, investigators implemented the following steps:

1. Synthesis of raw materials
2. Design of an injection box for the polyurethane resin systems
3. Manufacturing of composites using pultrusion
4. Experimental characterization in the areas of:
 - a. Tension
 - b. Flexure
 - c. Impact

BENEFITS

The completed research indicated that bio-based pultruded polyurethane composites demonstrate comparable mechanical performance and improved impact energy absorption when compared to the base polyurethane resin. Soy-based raw materials offer low-cost products and are more environmentally friendly.



HIT THE GROUND RUNNING

With support from CTIS, Student Diversity and Academic Support Programs (SDP) at the Missouri University of Science & Technology (Missouri S&T) has been able to offer Minority Engineering & Science Scholarships (MEP) to academically talented students from ethnic populations that are historically under-represented in Higher Education, particularly in the areas of math, engineering, science or technology degree programs.

"HGR WILL IMPROVE YOUR GRADES!"

For selected Freshman scholarship recipients, Missouri S&T college life started with the Hit the Ground Running Program (HGR) July 6-26, 2008. HGR is a three-week summer learning program offering new students an exciting perspective on learning and an opportunity to sharpen and enhance academic skills. During the HGR Program, students lived in a residence hall and took the following courses for academic credit: Introduction to University Writing, Introduction to University Chemistry, and Introduction to University Mathematics.

In addition to the coursework, students participated in a number of social gatherings, tours, field trips and academic and leadership development

activities, including student team development, the utilization of academic resources, mentor groups



"HGR PROVIDED INSIGHT ON REAL EXPECTATIONS."

and student involvement in campus life and the Rolla community.

By participating in the HGR program, students were given a head-start in developing a social network and constructive strategies for succeeding academically at Missouri S&T, all while acquiring an excellent base of knowledge and course-work experience from which to build on throughout their academic careers. By interacting with faculty and graduate assistants, students

"THE PROGRAM PROVIDED A GREAT INTRODUCTION TO TIME MANAGEMENT."



became familiar with academic expectations and resources available to them so that when the Fall semester opens in a couple of weeks, these students will indeed be able to hit the ground running.



For more information about Hit the Ground Running at Missouri S&T and/or other Student

Diversity and Academic Support Programs, visit <http://sdp.mst.edu>.

Photos by B.A. Rupert



CATCHING UP WITH FORMER UTC STUDENT DANIELLE KLEINHANS

As a Senior Engineer and Group Manager of Structural Engineering and Mechanics at CTLGroup in Skokie, Illinois, Dr. Danielle Kleinhans, P.E., manages a diverse set of engineering projects and a staff of 14 consultants. Her current position permits Dr. Kleinhans to be actively involved in professional organizations and technical committees including, the American Society of Civil Engineers (ASCE), the American Concrete Institute (ACI), and the Transportation Research Board (TRB).

The Structural Engineering and Mechanics Group at CTLGroup documents causes of deterioration and structural distress, and performs structural analysis and repair design for all materials and all structure types, mostly for existing structures. This sometimes includes forensic investigations of structural failures such as the collapse of the World Trade Center in New York City or challenging assignments such as widening the historic Huey P. Long Bridge in New Orleans, LA.

Identifying the causes of such failures is a vital component to structural repair and new design, both of which Dr. Kleinhans gained experience with as a student working with the University Transportation Center at Missouri S&T (formerly University of Missouri – Rolla). “Both my M.S. and Ph.D. were conducted as UTC projects,” says Dr. Kleinhans, “I conducted analytical studies, laboratory testing and field load testing of bridges.” Her research included the use of FRP materials for bridge construction and cracking in prestressed concrete bridge beams in Missouri.



Danielle Kleinhans on site at the Huey P. Long Bridge in Jefferson Parish, Louisiana for a load test in 2008.

Kleinhans earned a Ph.D. in Civil Engineering in 2002 and a M.S. in Civil Engineering in 1999, both from the University of Missouri – Rolla. Her B.S. in Civil Engineering was awarded in 1998 from the University of Alaska – Fairbanks. Kleinhans sites the enthusiasm and dedication of UTC faculty as major factors in her decision to work and study as a graduate assistant with the UTC.

“The experience I gained through my UTC projects has helped tremendously in my professional positions,” says Dr. Kleinhans. High expectations, encouragement and guidance from UTC faculty supported Kleinhans’ professional growth as she developed a base of technical and management skills. “The level of responsibility and professionalism expected from the [UTC graduate] students was very high,” she says, and “the practical nature of the research projects made them directly applicable to industry and the practicing engineer.”

Dr. Kleinhans grew up in Alaska and now lives in the Chicago area with her husband. When she’s not challenging herself with engineering projects, she enjoys the challenge of travel and outdoors activities, including a recent hiking trip along the Inca Trail in Peru for a visit to Machu Picchu, a true “engineering marvel!”

For more information on CTLGroup, visit www.CTLGroup.com. Dr. Kleinhans can be contacted by email at DKleinhans@CTLGroup.com.



ABDELDJELIL "DJ" BELARBI, PH.D., P.E., F.ASCE, F.ACI
DISTINGUISHED PROFESSOR OF CIVIL ENGINEERING

Dr. Abdeldjelil "DJ" Belarbi is a Distinguished Professor of Civil Engineering at the Missouri University of Science & Technology (formerly the University of Missouri–Rolla). He joined the faculty at Missouri S&T as an assistant Professor in 1991 and has since taught thirteen undergraduate and graduate courses on subjects related to structural engineering. He is also actively engaged in a broad spectrum of structural engineering research.

Dr. Belarbi has made significant research contributions in constitutive modeling and analytical and experimental investigation of reinforced and prestressed concrete structures. His research has also focused on seismic and wind structural performance of building envelopes, including experimental structural investigation of glass curtain wall systems employed in low- and high-rise buildings, as well as smart structures development and the use of FRP composites in civil infrastructure.

Currently, Dr. Belarbi is leading several projects related to bridge design and analysis, including: bridge columns under seismic and combined loading; strengthening of AASHTO bridge girders for shear deficiencies with FRP; and the testing and assessment of large scale culverts, innovative bridge decks and precast panels for corrosion effects.

As principal investigator or co-investigator of numerous research projects, Dr. Belarbi has published over 100 technical papers and

has supervised over 30 M.S. theses and Ph.D. dissertations in Civil Engineering. Dr. Belarbi is a Fellow of both the American Society of Civil Engineers (ASCE) and the American Concrete Institute (ACI); he is either a Chair or an active member of several technical, educational and national committees within both organizations.



Among several national awards, Dr. Belarbi has been the recipient of the 1999 University of Houston Distinguished Young Alumnus Award; the Missouri Governor's Award for excellence in teaching; the National James M. Robbins Excellence in Teaching Award; and the ACI National Chapter Activities Award. Dr. Belarbi was the recipient of the Earthquake Engineering Research Institute's (Earthquake Spectra Journal) 1995 Outstanding Paper Award and an Honorable Mention for Outstanding paper from the Masonry Society. For his excellence in research, teaching and service contributions to Missouri S&T, Dr. Belarbi has received nine Faculty Excellence Awards and ten Outstanding Teaching Awards.

In 1991, Dr. Belarbi was awarded a Ph.D. in civil/structural engineering from the University of Houston. He holds a master's degree from the University of Houston and an Engineer Diploma from the University of Science and Technology at Oran, Algeria.



NUTC FELLOWSHIP STUDENTS ARE WORKING TOWARD SOLUTIONS

Each year the Center for Transportation Infrastructure and Safety awards one-year graduate assistantships to students pursuing doctoral studies in a transportation-related field at Missouri University of Science & Technology. The awards are made based on an exemplary academic career and the merit of the proposed research in its potential to solve critical national transportation issues.

CTIS funding supports research, education and technology transfer projects which attempt to address a spectrum of transportation issues and often require an interdisciplinary perspective coupled with innovative solutions. Below are profiles of two fellowship students and descriptions of their current research, which is vastly different, but nonetheless shares a common goal of developing applicable solutions.

For information about fellowship opportunities with CTIS, visit <http://utc.mst.edu/scholar/index.html>.

Shravan K. Vudumu

Under the supervision of Dr. Umit O. Koylu, Shravan Vudumu's research at the Missouri University of Science & Technology focuses on experimental and theoretical studies of hydrogen non-reacting and reacting flows. Hydrogen fuel properties are drastically different from traditional fuels such as gasoline and natural gas, though hydrogen is considered to be one viable solution to the increasing demands for clean and secure energy. The transition from fossil fuels to alternative/renewable fuels involves many challenges that must be overcome for widespread public use and acceptance.



Shravan Vudumu with BMW Hydrogen 7 car at the 19th National Hydrogen Association Conference in Sacramento, CA in April 2008.

Shuying Wang

Shuying Wang's research covers three topics, which fall into the structural and geotechnical engineering arenas: the influence of tunnel construction on bridge performance; seismic analysis; and numerical analysis of tunnel slopes and foundations.

As transportation infrastructures are developed and extended, engineers are finding creative ways to do their work. Tunneling through mountains and beneath existing structures is becoming crucial to meet modern transportation needs. Tunneling and underground engineering are relatively new areas of engineering, which is why developing effective methods to simulate and monitor the effects and interactions of tunnel construction with mountain slopes or structural foundations is so important. "There must be some settlement due to tunneling," says Wang, "which impacts the performance of a bridge."

Wang became interested in these areas of engineering while living in an extremely mountainous region of China. With the implementation of larger highway, railroad and subway systems, tunneling was a necessary development, especially in larger cities. After completing his degrees and half a year in the field, Wang decided he wanted to immerse himself in new ideas and continue his research in the U.S.

Stories continue on the next page...



...Continued from the previous page

With a keen awareness of fast depleting energy resources and growing environmental concerns, Vudumu became interested in immediate efforts to improve conventional fuel efficiency and the exploration and development of new energy resources and fuels for the future. "I want to accelerate these efforts," says Vudumu, doing so would "reduce adverse effects on the environment and fulfill my ambition of [making] a positive contribution to society."

Excellent research projects on alternative fuels, especially hydrogen, made Missouri S&T the obvious choice for Vudumu to pursue doctoral studies. Completing his research and Ph.D. at Missouri S&T will not only allow Vudumu to realize his dream of acquiring "the highest academic qualification in the field from one of the best universities in the world," but will help him move seamlessly into a research and development career in new energy technologies, including research on engineering problems associated with energy production, transportation, utilization and conservation.

Vudumu completed a Bachelor of Technology in Mechanical Engineering and a Master of Technology in Energy Technology/Thermal Engineering from the Indian Institute of Technology-Madras in May 2006. His Master's project was on *Modeling of a Diesel Engine for Speed Control*.

Vudumu was recently selected to sit on the *Outstanding Under 35 Young Scientists Committee* and review papers presented at *HySyDays 2007, Second World Congress of Young Scientists on Hydrogen Energy* organized by the GEA-Energy and Environment Group of CIRPS Interuniversity Research Center for Sustainable Development-Sapienza University of Rome, Italy. He was selected as one of thirteen members from 8 nations.

A strong reputation in the civil engineering domain and a distinguished group of faculty researchers influenced Wang's choice to undertake doctoral studies at Missouri S&T. And "Missouri S&T is located in beautiful and quiet Rolla," says Wang, "it is good for studying." Ultimately Wang would like to work as a geotechnical engineering professor, but for now he remains focused on research. Wang's Ph.D. research topic will focus on the influence of earthquakes on infrastructures.

Wang completed an M.S. in Bridge and Tunnel Engineering from Central South University China in 2007 and a B.S. in Civil Engineering, also from Central South University China in 2005. During his academic career in China, Wang was awarded a state scholarship, placed in two competitions and was honored for academic excellence each year of study.

Recently, Wang traveled to San Francisco to attend the 9th North American Tunnel Conference. He was selected as one of three students to present his research paper at the conference.



Shuying Wang and his advisor, Dr. Ronaldo Luna, after a presentation at Missouri S&T in March 2008.



FALL 2008 TRANSPORTATION SEMINAR SERIES

*presented by
the Center for Transportation Infrastructure and Safety
and the Missouri Transportation Institute*

Seminars are open to the community, faculty, staff and students of Missouri University of Science & Technology and will be held from 1:00 to 2:00 p.m. in Room 125 of Butler-Carlton Civil Engineering Hall. For more information, email rolufs@mst.edu or visit <http://utc.mst.edu/events>.

THE FUTURE OF TRANSPORTATION

September 12, 2008

Kevin Keith, Chief Engineer
Missouri Department of Transportation

MISSOURI'S RAILROAD SYSTEM

November 14, 2008

Donald Curtis, Vice President
Thomas Ryan, Springfield Office Director
HDR Engineers

I-70 ACROSS MISSOURI AND THE NATION

October 10, 2008

Jerry Mugg, Vice President
HNTB Corporation

THE NEW MISSISSIPPI RIVER BRIDGE

December 12, 2008

Peter Clogston, Project Manager
Federal Highway Administration (FHWA)

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