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Spring 2010

Mack Nuggets, Spring 2010

Mack-Blackwell National Rural Transportation Study Center (U.S.)

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Mack-Blackwell National Rural Transportation Study Center (U.S.). (2010). Mack Nuggets, Spring 2010. *Mack Nuggets*, 2 (3) Retrieved from <https://scholarworks.uark.edu/mack-nuggets/6>

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MBTC Investigator Visits Haiti



Dr. Brady Cox in Haiti investigating the earthquake with the GEER Team

Civil Engineering professor and Principal Investigator Brady Cox travelled to Haiti as part of a national team of engineers who studied the effects of the massive earthquake that struck the small Caribbean nation on January 12, 2010. Cox, and seven other members of Geo-engineering Extreme Events Reconnaissance (GEER), gathered data to advance understanding of earthquakes and their engineering effects. GEER is funded by the National Science Foundation to conduct reconnaissance efforts of extreme events such as earthquakes, tsunamis and hurricanes.

Cox is an expert in soil dynamics and geotechnical engineering. He helped the GEER team examine the earthquake's effect on buildings, bridges, utilities and ports. Ultimately, this

research will contribute to the design of structures that can respond to the violent effects of earthquakes without falling and possibly save human lives.

Cox suspects that Haiti, one of the poorest and least developed countries in the world, does not have or does not enforce seismic building codes to mitigate the effects of large earthquakes. The recent earthquake—which measured 7.0 magnitude and whose epicenter was only 10 miles west of Port-au-Prince, the nation's densely populated capital – caused massive destruction and killed thousands of Haitians. An estimated 250,000 people have died as a result of the earthquake.

Cox specializes in geotechnical engineering issues related to earthquake loading, soil dynamics and

nondestructive material characterization using stress waves. He participated in previous GEER deployments immediately following the 2008 magnitude 6.9 earthquake in Iwate-Miyagi, Japan, and the 2007 magnitude 8.0 earthquake in Pisco, Peru.

Cox was also deployed to collect shear-wave velocity data at strong motion stations and soil liquefaction sites following the 2006 earthquake in Kiholo Bay, Hawaii; the 2001 earthquake in Nisqually (Seattle), Washington; and the 1999 earthquake in Kocaeli, Turkey. In addition to his participation in GEER, Cox is a member of the Earthquake Engineering Research Institute, the American Society of Civil Engineers and the Arkansas Governor's Earthquake Advisory Council.



Dr. Kevin Hall
Executive Director

Message from the Director

Every so often it seems we need to stop and catch our breath – reading through this Spring 2010 issue of Mack-Nuggets is enough to make one tired! We are blessed to have a wealth of superbly talented researchers, staff, and students who help to turn the concept of a comprehensive transportation system into reality. I am particularly struck by the variety of efforts both completed and ongoing at MBTC –

from inland waterways in Arkansas to the devastation in Haiti, MBTC personnel are at the forefront of efforts to improve and sustain transportation systems at home and abroad.

I am also very proud to highlight MBTC's Outstanding Student of the Year, Mr. Andy Tackett. For all of his accomplishments and accolades, Andy remains the humble young man

from Nashville, Arkansas who charms everyone he meets.

Obviously, you notice that I'm pinch-hitting for our Director, Dr. Heather Nachtmann, in this issue. This spring, Heather and her husband welcomed a next-generation transportation engineer into their home. Young Kate Sinead arrived on March 30, 2010 – congratulations, Heather!

“As transportation security professionals prepare contingency plans for emergency response, it is important to recognize the resource offered by the nation’s inland waterways.”

Emergency Response via Inland Waterways

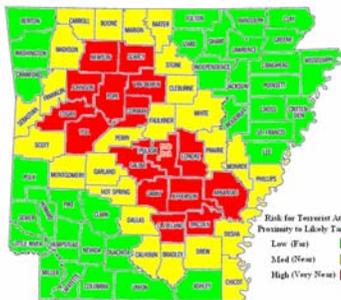
Drs. Heather Nachtmann and Edward Pohl of the University of Arkansas recently completed a study titled “Emergency Response via Inland Waterways.” The objective of MBTC research project 3008 was to conduct a feasibility analysis of improving emergency preparedness and disaster relief through utilization of inland waterway transportation.

important to recognize the resource offered by the nation’s inland waterways. For many communities, inland waterways can provide access for equipment and people when other means of transportation are unavailable due to capacity constraints or destruction. Inland waterways may be especially useful for emergency medical response in rural areas. Because of limited resources in rural communities, emergency planners must take an all-hazard approach to emergency planning across large geographical areas. Inland waterways could be used for medical response to a variety of emergencies across a large area. For example, there are over 1000 miles of navigable waterways in the state of Arkansas. These waterways could be used to assist in response to a catastrophic event such as a New Madrid earthquake in the Northeast corner of the state.

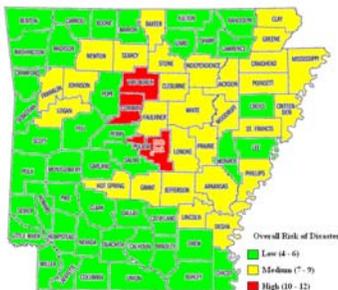
This research is relevant for emergency management professionals of communities with access to inland waterways. A Waterway Emergency Medical Service (WEMS) index is developed that guides emergency planners evaluating the feasibility of incorporating emergency medical response via inland waterways into their EOPs.

Most EOPs assume that standard modes of transportation will be available for disaster response. Given that catastrophic events are by nature destructive, this assumption may need to be reconsidered. A violent tornado or a powerful earthquake may inhibit or destroy major roadways, bridges, and tunnels. Victims of a disaster may quickly overwhelm local medical facilities. Communities with access to navigable inland waterways should consider those waterways as a

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Risk of Terrorist Attack



Overall Risk of Disaster

Many emergency operations plans (EOPs) are based on the assumption that all standard means of transportation will be available and feasible when an emergency occurs. In many cases, however, the disaster that initiates the EOP may disable emergency vehicles or destroy the roads or bridges that are vital to responding to the emergency. As transportation security professionals prepare contingency plans for emergency response, it is

Distinguished Lecture Series

Jose Emmanuel Ramirez-Marquez, Ph.D., was the featured guest speaker for the spring Distinguished Lecture Series held April 23, 2010.

Dr. Ramirez-Marquez is currently Assistant Professor of the School of Systems & Enterprises at Stevens Institute of Technology.

Dr. Ramirez-Marquez's presentation described recent research efforts at the System Maturity &

Development Lab to provide approaches to the problem of quantifying system resilience, vulnerability and protection.

His lecture discussed how the vulnerability analysis of a complex network is highly dependent on the process of identifying the combination of component failures that provide maximum reduction of network performance. The process is based on a

method to completely characterize importance of network disruptions and identify a vulnerability set via the solution of a Multi-objective Network Vulnerability Problem. This approach allows recognizing that decision-makers can benefit from understanding the relationship between different failure scenarios and network performance.



Ed Pohl, Ph.D. and Jose Emmanuel Ramirez-Marquez, Ph.D.



Dr. Ramirez-Marquez speaking with a graduate student after the lecture

MBTC Outstanding Student of the Year

Andrew (Andy) Tackett was selected as the 2010 Mack-Blackwell Rural Transportation Center (MBTC) *Outstanding Student of the Year* for his research and exceptional academic skills. Andy, a native of Nashville, Arkansas, recently traveled to the 13th Annual Council of University Transportation Centers (CUTC) Awards Banquet that was held in Washington, D.C.

Tackett is a master's student in Civil Engineering at the University of Arkansas. In the fall of 2005, he enrolled at the University of Arkansas where he majored in Civil Engineering. He graduated with his Bachelor of Science in Civil Engineering in May 2008 with a GPA of 3.8. During his senior year, he worked on his first of two MBTC research projects.

His undergraduate research focused on developing a computer model for analyzing aircraft performance in arrestor systems. In August 2008, he began his graduate work in Civil Engineering on another MBTC project that examined the effect of mixer type and temperature on Ultra-High Performance Concrete (UHPC). His research, directed by Micah Hale, Associate Professor in Civil Engineering, has received much interest from peers and professionals in his field. His work focuses on developing a better understanding of UHPC and expanding its use in our infrastructure. Andy will graduate with his Master of Science in Civil Engineering in May 2010. Dr. Hale said, "Andy has published and presented his findings at local and state meetings as well as

at an international conference in London. He possesses exceptional research skills and strong character, and he will become a leader in his field."

Andy is the son of Max and Deb Tackett of Nashville, Arkansas. His mother, Deb, and sister, Heather, attended the banquet to see Tackett receive his award.

Each US Department of Transportation (USDOT), University Transportation Center (UTC) has the opportunity to select an outstanding student from their center who is then put forth as a nominee for *Outstanding Student of the Year* of the entire University Transportation Center (UTC) program.

"Andy possesses exceptional research skills and strong character, and he will become a leader in his field."



L to R Deb Tackett, Andy Tackett and Heather Tackett



L to R Executive Director Kevin Hall, Andy Tackett, CTPP Director Stacy Williams, and Frances Griffith, CTPP



Stacy Williams, Ph.D., P.E.
Director



Frances Griffith
Administrator for Technician Training



Roselie Conley
Research Technologist



Mary Fleck - Instructor

Center for Training Transportation Professionals

The Center for Training Transportation Professionals has begun another year of furnishing training, certification, and laboratory inspection for the state of Arkansas. Along with the basic materials training courses, CTTTP has continued to offer a variety of specialized training in transportation construction topics. During the first quarter of 2010, 11 courses have been offered, including 1 Basic Aggregates course, 1 ACI Field Testing Technician (Level 1) concrete course, 2 Hot Mix Asphalt courses, 2 Soils courses, 2 ACI Concrete Strength Testing courses, 1 Roadway Construction Control course, and 2 courses in National Pollutant Discharge Elimination Systems (NPDES). Over 170 certifications have been granted so far this year.

The CTTTP Erosion and Sediment control

certification course (NPDES) is now being offered on a more regular basis, and 10 classes are anticipated for calendar year 2010. This course is primarily intended for personnel from the Arkansas Highway and Transportation Department (AHTD) but is also garnering interest for contractors within the industry.

Effective January 1, 2010, certification in Concrete Strength Testing became a requirement for all applicable AHTD contracts. CTTTP has offered the American Concrete Institute's Concrete Strength Testing Technician certification on a limited basis and is now seeing an increase in the demand for this course.

CTTTP is also continuing to pursue advanced opportunities in online training courses. In order to assist in achieving this goal, a new employee will

soon be added to the CTTTP team. Applications are currently being received for the position of CTTTP Online Products Specialist; it is expected that this employee will be in place by May of 2010. This new position will allow for the implementation of advanced features on the CTTTP website and will also increase the opportunities available for providing training alternatives via web-based training modules as well as real-time webcasts and webinars. Although the online training sessions will not replace personal classroom atmosphere or 'hands-on' laboratory performance requirements, these sessions will be used to reinforce and enhance supplemental information that can lead to greater confidence for CTTTP course participants.



Heather Nachtmann, Director of MBTC and Associate Professor of Industrial Engineering, was named as the third recipient of the John L. Imhoff Chair in Industrial Engineering. The John L. Imhoff Chair in Industrial Engineering is used to attract and retain faculty members who share Imhoff's vision for global cooperation and understanding, excellence in teaching and research, and commitment to the success of students. This endowed chair will provide support for Nachtmann in the form of financial assistance to help enhance funding for graduate assistants, teaching expenses or research initiatives.

John Crone, Professor in Landscape Architecture and MBTC Principal Investigator, will present at the Council of Educators in Landscape Architecture (CELA), held jointly with the International Study Group on Multiple Use of Land (ISOMUL) Conference held in Maastricht, The Netherlands, May 12-14, 2010. Crone will present a paper based on his work from MBTC DOT 3010, A Cost-Driven Policy Approach for Development of On-Street and Off-Street Bicycle, Multi-Use and Single-Use Paths and Related Facilities.

MBTC's Recently Completed Projects

Listed below are projects completed since our Fall 2009 newsletter. Full reports for these and all other completed MBTC projects are listed on our website at www.mackblackwell.org/web/research/all-projects.htm.

JANUARY 2010

MBTC DOT 3008 –
Emergency Response via
Inland Waterways
Principal Investigators:
Heather Nachtmann, Ph.D.
and Edward Pohl, Ph.D.
University of Arkansas

MBTC DOT 3011 –
Analysis of Transportation
Network Design Strategies
for Forced Transfer Busing
Principal Investigators:
Scott Mason, Ph.D. and
Edward Pohl, Ph.D.
University of Arkansas

FEBRUARY 2010

MBTC DOT 3009 –
Economic Issues Related to
Continuous Supercritical

Biodiesel Production
Principal Investigators:
Robert Babcock, Ph.D.,
Michael Popp, Ph.D., and
Ed Clausen, Ph.D.
University of Arkansas

MBTC DHS 1102 –
Simulating Large-Scale
Evacuation Scenarios in
Commercial Shopping
Districts – Methodologies
and Case Study
Principal Investigator:
Manuel Rossetti, Ph.D., P.E.
University of Arkansas

MBTC DHS 1103 –
Automated Real-Time
Object Detection and
Recognition on
Transportation Facilities
Principal Investigator: Kelvin
C.P. Wang, Ph.D., P.E.
University of Arkansas

MBTC DOT 2055/2067 –
Roadway Median
Treatment, Phase 1 and
Phase 2
Principal Investigators:
J.L. Gattis, Ph.D., P.E.
University of Arkansas
Melissa Tooley, Ph.D., P.E.
Texas A&M University

MARCH 2010

MBTC DOT 3013 –
Accelerated
Characterization of Full-
Scale Flexible Pavements
Using a Vibroseis
Principal Investigators:
Brady R. Cox, Ph.D.
University of Arkansas
John S. McCartney, Ph.D.
University of Colorado at
Boulder

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contingency or supplement to their current EOPs. The WEMS Index is a useful tool for emergency planners to gage the feasibility of using navigable inland waterways to provide emergency medical services to disaster victims.

The case study of Arkansas is a useful demonstration of the application of the WEMS index to a wide variety of communities. While most of the counties in Arkansas show at least some potential to benefit from waterway medical services, some counties still show a need but lack of inland waterway access.

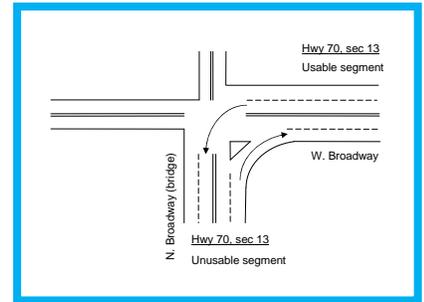
This initial work in the feasibility of emergency medical response via inland

waterways generated several additional research questions. For example, the optimal starting locations of medical barges could be investigated. Identifying strategic locations to dock the vessels could be useful for minimizing response time to key areas. This idea could be further explored to determine if the strategic locations should change based on the time of year or risk of events. For example, during tornado season, it may be prudent to dock a medical barge nearest to those counties at higher risk for tornado.

Further research will include determining which medical services could and should be offered by a

medical response barge. Available funding and specifications of the barge may limit the number and type of emergency medical services that could be provided. For example, a barge with the capability to perform on-site surgeries may be far more useful for certain types of disasters than a barge that is only equipped for first response. It may be useful to explore the layout, capacity, and potential capabilities of various barge configurations in order to identify the level of medical care that could be provided.

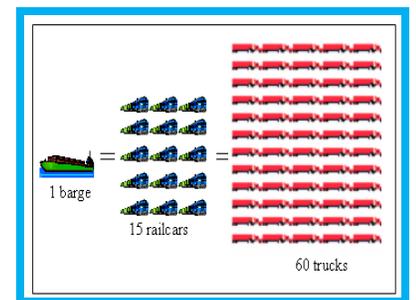
For the complete report, visit the research page at www.mackblackwell.org.



An intersection in North Little Rock



Compression loading configuration on the shaker truck



Cargo Capacity



USNS Comfort. Photo courtesy of defenselink.mil

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The Research and Innovative Technology Administration (RITA) coordinates the U.S. Department of Transportation's (DOT) research programs and is charged with advancing the deployment of cross-cutting technologies to improve our Nation's transportation system and Mack-Blackwell is proud to be a participating university.



The Department of Homeland Security's National Transportation Security Center of Excellence (NTSCOE) is developing new technologies, tools and advanced methods to defend, protect and increase the resilience of the nation's multi-modal transportation infrastructure and education and training base lines for transportation security geared towards transit employees and professionals.

Kevin Hall, Ph.D., P.E.
Executive Director

Heather Nachtmann, Ph.D.
Director

Letitia M. Pohl, Ph.D.
Assistant Director
NTSCOE Program

Dana Ledbetter
Communications Director

Sandra Hancock CPS
Fiscal Support Analyst

We're on the Web!

See us at:

www.mackblackwell.org

About Mack-Blackwell...

The Center for Training Transportation Professionals (CTTP) was created in 1996 through a cooperative agreement with the Arkansas State Highway and Transportation Department (AHTD). The federal 'highway bill' ISTEA, enacted in 1991, led to requirements that all states "...develop a quality assurance program..." for highway construction, and that "...sampling and testing be executed by qualified sampling and

testing personnel." (23 CFR 637) The law also required laboratories performing tests to be qualified. Like most states, AHTD chose to implement the regulation by requiring testing personnel and laboratories to be certified—first publishing the requirement for personnel in its 1996 Edition of the *Standard Specifications for Highway Construction*. The University of Arkansas and AHTD partnered to create an administrative

structure for CTTP in 1996, and the University was given the responsibility for creating a curriculum to meet the intent of the regulations. The first courses were held in February 1997. The cooperative agreement provided for the initial and ongoing funding for CTTP, with further provisions for revising and expanding the curriculum as needed and desired.

Student Represents MBTC at IIE Regional Conference

In February, University of Arkansas undergraduate student Ryan Black presented MBTC research at the Institute of Industrial Engineers (IIE) Regional Conference hosted by St. Mary's University in San

Antonio, Texas. Ryan was chosen to represent the UA student chapter of IIE in its technical paper competition. His paper and presentation detailed contributions to MBTC DHS 1105, Information

Enhancement Among Aviation Security Partners, with Justin Chimka, MBTC PI and Associate Professor of Industrial Engineering.

Department of Homeland Security Summit 2010

The Fourth Annual DHS University Network Summit was held in Washington, D.C., on March 9-12 and is sponsored by the U.S. Department of Homeland Security, Office of University Programs, Science and Technology Directorate. The theme for this year's summit was Science and Technology for Intelligent Resilience (S&TRONG). The summit focused on the contributions of scientific and technological advancement to economic, community and individual resilience.

Tish Pohl, Assistant Director of MBTC, represented the center as numerous experts from academia, industry and government discussed how intelligent investments in science and technology can make the nation more resilient to natural and man-made disasters.

Edward Pohl, MBTC principal investigator and professor of industrial engineering, served as a member of a panel discussing "Transportation System Resiliency."

Hugh Medal, a doctoral candidate in the Department of Industrial

Engineering, was one of 20 students selected nationwide to present their research at the summit. He is currently performing research with industrial engineering professors, Edward Pohl, Chase Rainwater and Scott Mason. The project title is "Designing Resilient Supply Chain Networks." The team is developing mathematical models to determine which transportation infrastructure elements (ports, bridges, tunnels, rail terminals) within a supply chain are most critical.

Kevin Hall, Executive Director of MBTC, and