

The University of
Alabama

The University of
Alabama at
Birmingham

The University of
Alabama in
Huntsville

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UTCA NEWS

University Transportation Center for Alabama

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Introduction to UTCA

Since becoming a university transportation center (UTC) of the US Department of Transportation in 1999, The University Transportation Center for Alabama (UTCA) has conducted transportation education, research, and technology-transfer activities throughout the state and region. Faculty and students at The University of Alabama (UA), The University of Alabama at Birmingham (UAB), and The University of Alabama in Huntsville (UAH) have participated in all these service areas.

Our mission reflects the mission of the US Department of Transportation: Specifically, the UTCA seeks

to advance technology and expertise in the multiple disciplines that comprise transportation through the mechanisms of education, research, and technology transfer while serving as a university-based center of excellence (2006 *UTCA Strategic Plan*, p. 12).



Fall reaches the UA campus

Our theme – *Management and Safety of Transportation Systems* – reflects the transportation needs of Alabama and the expertise of The University of Alabama System faculty. In 2007 and 2010, the Advisory Board narrowed and sharpened the focus of the UTCA research program. Many projects now focus on sustainability, transit, and minimizing congestion.

The Director's Notes

Fall 2011 brings with it typical activities as we plan for the end of funding under SAFETEA-LU. In the last few months, UTCA upgraded its website to a more robust platform. Though it contains the same information, the new-look website now conforms to College standards and is more easily supported.

In June, RITA Administrator Peter Appel informed the university transportation centers (UTC) that the 59 current UTC Program grants will not be funded for Federal Fiscal Year 2011 but that a new rendition of the UTC program will be fully funded for Federal Fiscal Year 2011. July saw the release of the grant solicitation from RITA for 22 new 'regional' and 'national' UTCs.

UTCA has until December 31, 2012 to complete work on projects funded under SAFETEA-LU, and the three-campus coalition that makes up UTCA will continue those projects through completion. However, the 22 new UTCs must be regional or national in scope, and our three campuses split up to compete with other partners in the new competition. We wish good luck to all groups in that competition.

Sincerely,
Jay K. Lindly



Rural Transit in Alabama

Public-transit systems are vital to the prosperity of the people in rural areas. However, increased demand and financial constraints are increasing pressure on transit providers to improve their service. In **UTCA Project #11305, *Analysis of Rural Public Transit in Alabama***, Dr. Michael Anderson of the University of Alabama in Huntsville (UAH) seeks to help them improve efficiency through good performance measures and evaluation systems.

Using the Transportation Research Board's recently published Transit Cooperative Research Project Report 136 (TCRP 136) *Guidebook for Rural Demand-Response Transportation: Measuring, Assessing, and Improving Performance*, Dr. Anderson is selecting performance measures and collecting data to determine the current levels of performance. Examples include passenger trips per vehicle mile; operating costs per vehicle hour; accidents per 100,000 miles; on-time performance; no-show rate; and passenger-trip length. The data are coming from ALDOT and transportation agencies around the state.



A ClasTran bus. ClasTran gives rides to the elderly, the disabled, and the residents of rural areas in Jefferson and Shelby counties

Once the assessments are complete, Dr. Anderson will provide Alabama's rural transit agencies with recommendations. He will also provide training to ALDOT management through a series of workshops.

The importance of this research is sure to grow. Many rural locations are growing in the over-50 age group. This situation challenges transportation agencies because the elderly tend to require more access to health care and other basic necessities even as they are less able to provide for themselves. Rural public transit systems will be needed to fill the gaps.

Transit Providers and Land Development

Dr. Yingyan Lou, Dr. Steven Jones, and Dr. Jay Lindly of the University of Alabama (UA) are conducting **UTCA Project #11103, *Role of Transit Service Providers in Land Development***, an investigation into the strengths, limitations, and applicability of encouraging transit service providers to invest in land development. Livability and sustainability have been identified as top priorities by three government agencies, and transit systems are recognized as a bridge between urban and transportation development that plays a key role toward achieving them. The idea is to encourage (and subsidize) transit service providers to become involved in land development to fortify the connection between transportation and urban development.

While various transit development initiatives, such as integrated transit and land development and transit-oriented development, have been proposed in the past, the transit systems in the US still suffer small coverage and low ridership, and their operations are often subsidized.

The research team has found plenty of studies related to transit and urban development in the literature, and has also summarized practices of transit-oriented development and joint development around the world. The research team next plans to interview selected agencies – local MPOs, transit authorities, and transit companies – to discuss the findings and hear opinions from a practical point of view. The team also plans to document the redevelopment of Tuscaloosa, AL as a case study. After a spring 2011 tornado destroyed part of the city, there have been discussions about encouraging livable-community development.

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Transit in Complete Streets

In early 2010, the USDOT released a Draft Strategic Plan for 2010-2015 that identified building more “livable” communities as a strategic objective of the Department. Therefore, research on the impact of transit integration in a “complete street” environment is timely and needed, especially given that many of the possible gains from such integration are not fully understood and properly measured. Dr. Virginia Sisiopiku of the University of Alabama at Birmingham is leading **UTCA Project #11206, *Impacts of Transit in a Complete Streets Context***, to better understand the effect of transit availability on livability and human health.

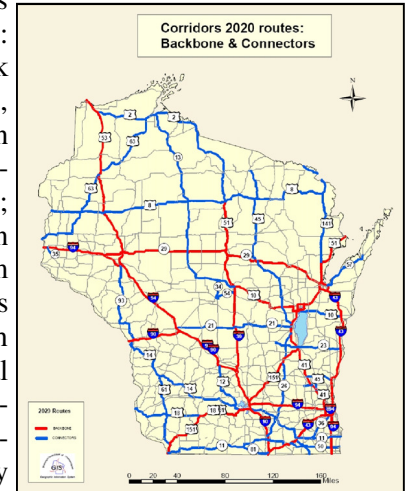
Dr. Sisiopiku’s research team first identified and summarized analytical methods appropriate for estimating transit’s economic benefits as they relate to travel, economic development, societal, and health impacts. Then the team selected a local community as a test bed and proposed changes in transit coverage and other interventions aimed at making the surrounding environment more livable and transit-friendly. Finally, they calculated the economic- and health-related costs and benefits of transit integration to individuals and communities.

Once it is published, the analysis will help transportation, transit, and health professionals recognize the many benefits of transit-oriented developments. It is also likely to encourage stakeholders to better coordinate their future efforts toward creating “livable” communities that offer healthy and sustainable transportation choices for all.



Crash and Analysis Mapping

The Wisconsin Department of Transportation (WisDOT) maintains two geographic information system (GIS) maps of road networks: the State Trunk Network (STN), which focuses on State, US, and interstate highways; and the Wisconsin Information System for Local Roads (WISLR), which focuses on local roads. Unfortunately, these systems largely evolved independently, making it difficult to combine data and examine statewide patterns. Transportation safety engineers are particularly interested in combining crashes that occurred on local roads with crashes on state routes to provide a complete crash data set. Earlier work (“Phase I”) merged the crash data for two counties, but the goal of **UTCA Project #10403, *University of Wisconsin-Madison Wisconsin DOT—Crash and Analysis Mapping Phase II Project***, is to complete the merge for the entire state.



To combine the data, Dr. Andrew Graettinger of the University of Alabama, Dr. Steven Parker of the University of Wisconsin, and Dr. Xiao Qin of South Dakota State University are using a link-based method developed in Phase I. The merge method is a large and complex process that requires several steps, including mapping over 30,000 state-trunk link to the local-road links, the creation of a five-year shapefile of crash locations, migration of the shapefile into WisDOT’s web-based map interface, and documentation of the system for WisDOT’s use.

At the end of the project, the research team will offer a workshop for key WisDOT personnel that covers operational procedures, information updates, and pitfalls. They will also provide hands-on training to WisDOT geo-editors. The final report will include feedback from these sessions.



VMS Support Structures

Dr. Fouad H. Fouad and Dr. Ian Hosch of the University of Alabama at Birmingham (UAB) are working with the Alabama Department of Transportation (ALDOT) to improve the design of bridge-type variable message sign (VMS) support structures. In **UTCA Project #09203, *Design of VMS Bridge Support Structures for Fatigue Loads***, they are investigating the vulnerability of these structures to wind-induced fatigue and developing design standards.

Although there are many types of overhead support structures in operation on DOT highways, overhead variable message sign (VMS) support structures are particularly susceptible to wind-induced fatigue: even minor gusts from passing semi-trailer trucks can weaken the support structures. Their vulnerability has to do with their frequency of vibration. Bridge-type VMS support structures have natural frequencies of vibration close to the frequency of natural- and truck-induced wind gusts. As a consequence, these structures operate in a near-resonant condition on a daily basis, which puts them at risk to fatigue.

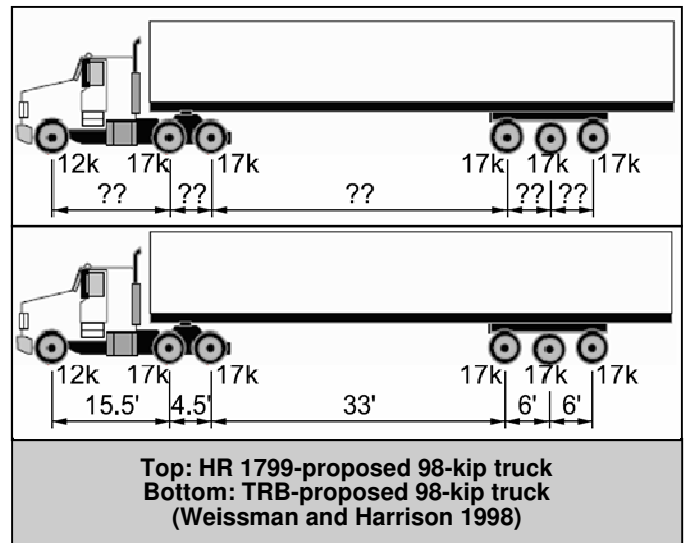
Drs. Fouad and Hosch instrumented a typical bridge-type VMS support structure with various gauges to monitor the structure's dynamic behavior under fatigue loading. They conducted an operational modal analysis to estimate the structure's vibration characteristics, such as its natural frequency, damping percentages, and vibratory modal shapes. They are using this information to develop design fatigue loads for inclusion into design specifications.



Bridge-type overhead VMS support structure

Increasing Truck Weight and Bridges

In 2009, legislation was proposed in the US House of Representatives to increase the maximum gross vehicle weight on interstate highways from 80,000 pounds to 97,000 pounds. However, the proposed weight limits may stress bridges more than is allowed by the Federal Highway Administration. The main goal of **UTCA Project #11202, *Effect of Increasing Truck Weight on Bridges***, led by Dr. Chris Waldron of the University of Alabama at Birmingham (UAB), is to quantify the effect of this increase on the internal forces to which typical slab-on-girder bridges are subjected.



To do this, Dr. Waldron's team is investigating the longitudinal force effects in the girders and the transverse force effects in the deck slab using various axle spacings (for example, see the figures above). Then by comparing those results to the HS20-44 with alternate military loading stipulated in the AASHTO Standard Specifications for Highway Bridges (2002) and the HL-93 design loadings in the AASHTO LRFD Bridge Design Specifications (2010), they will quantify the adequacy or deficiency of current design specifications and existing bridges.

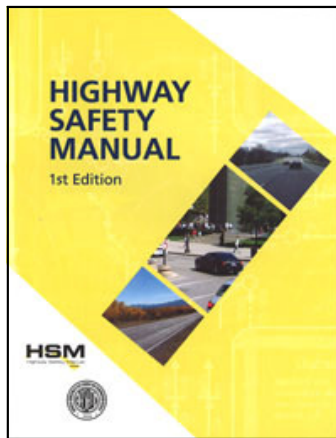
The results of this study will help engineers understand how to better design bridges to cope with the higher limits, how to reduce the impact of higher weight standards on existing bridges, and whether changes need to be made to existing posting and weight restrictions.

TECHNOLOGY TRANSFER

Highway Safety Manual Training

The American Association of State Highway and Transportation Officials (AASHTO) published the first edition of the *Highway Safety Manual* (HSM) in 2010. The HSM represents a significant improvement in quantifying roadway-safety countermeasures and introduces many terms and methodologies. However, the HSM is 972 pages long, its methodologies are complex, and it uses new software, making it difficult to effectively implement the HSM's contents. Through **UTCA Project #10402, Training for the Highway Safety Manual**, and **UTCA Project #11401, Additional Introductory Training for the Highway Safety Manual**, Dr.

Dan Turner and Dr. Steven Jones worked with CH2M HILL to give the Alabama Department of Transportation (ALDOT) a head start on implementing the HSM by providing ALDOT managers and employees with an overview of the HSM.



Drs. Turner and Jones tailored the sessions for ALDOT personnel. Decisionmakers have less need for an intimate understanding of the HSM than do ALDOT division design engineers and traffic engineers, so the sessions were divided in two. Forty professors associated with ALDOT activities and high-level managers from ALDOT's Central Office and Division Offices, the Federal Highway Administration, and the Alabama Department of Public Safety received a two-hour overview of the content and use of the HSM with a focus on terminology and concepts, giving them a feeling for the use of the HSM and its potential for improving safety decision making.

Another 160 employees of state and federal agencies — including division design engineers, traffic engineers, and engineers from safety, planning, and other bureaus and sections — received two days of HSM instruction. The longer training allowed for a more detailed overview, so participants could have a more complete understanding of the terminology, methodologies, data needs, modeling, calibration, and other aspects of HSM implementation.

This training, combined with another UTCA project—**#10404, Scoping Study for Implementation of the Highway Safety Manual in Alabama**—has helped ALDOT get a good start on taking advantage of the benefits offered by the HSM.

New UTCA Website

The University Transportation Center for Alabama has a new website appearance. Please visit <http://utca.eng.ua.edu> to find copies of UTCA publications, descriptions of our education and tech-transfer programs, information for prospective researchers, and more than 200 final reports.

UTCA University Transportation Center for Alabama

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Welcome to the University Transportation Center for Alabama (UTCA)

The University Transportation Center for Alabama conducts transportation education, research, and technology-transfer activities throughout the state and region. All faculty and staff members from **The University of Alabama (UA)**, **The University of Alabama at Birmingham (UAB)**, and **The University of Alabama in Huntsville (UAH)** are eligible to conduct projects in all of these service areas.

The UTCA was created by a resolution of the Board of Trustees of The University of Alabama System (UA System) and began operation on March 15, 1999. *The Transportation Equity Act for the 21st Century (TEA-21)*, Public Law 105-178, provided initial funding and established the UTCA as a "university transportation center" (UTC) under the **US Department of Transportation's Research and Innovative Technology Administration (RITA)**. The UTCA now operates as a Title III UTC under the 2005 *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)*.

The UTCA mission contributes to the overall mission of the US Department of Transportation (USDOT). Specifically, the UTCA seeks to advance technology and expertise in the multiple disciplines that comprise transportation through the mechanisms of education, research, and technology transfer while serving as a university-based center of excellence (2005 UTCA Strategic Plan, p. 12).

The UTCA theme — *Management and Safety of Transportation Systems* — reflects the transportation needs of Alabama and the expertise of The University of Alabama System faculty. In allocating UTCA funding, the Executive Committee and **Advisory Board** give priority to programs and projects that closely follow this theme. Last year the Executive Committee narrowed and sharpened the focus of the UTCA research program to emphasize the topic of congestion. Several management research projects now focus on maximizing traffic management and minimizing congestion. Similarly, safety research projects may now highlight infrastructure sustainability.

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UAB Hosts ALDOT's 2011 Peer Exchange

On May 10, the Department of Civil, Construction, and Environmental Engineering at the University of Alabama at Birmingham (UAB) hosted the Alabama Department of Transportation's (ALDOT) 2011 Peer Exchange, a forum for transportation professionals in the state to meet and discuss ideas. This year's Exchange had several themes: university collaboration, research management in the electronic age, research-project selection and program expansion, and research-program outreach and marketing. Transportation faculty from all three UTCA campuses participated.

Dr. Steven Jones, associate professor at UA; Dr. Fouad Fouad, professor and department chair at UAB and UTCA associate director; and Dr. Houssam Toutanji, professor and department chair at UAH and UTCA associate director gave presentations on their respective campuses' transportation-research activities and networked with other transportation professionals.

Mr. Jeffrey Brown and Ms. Michelle Owens of the ALDOT Bureau of Research and Development initiated this year's program. There were about 40 attendees, including ALDOT senior management, the ALDOT Research Advisory Committee (RAC), and the Federal Highway Administration. ALDOT's new director, Mr. John Cooper, attended and delivered an address during the opening session. The meetings produced fruitful discussions and results that not only highlighted the accomplishments of the ALDOT Bureau of Research and Development but also opportunities to enhance that research program.



ALDOT Director John Cooper at the 2011 Peer Exchange

EDUCATION NEWS

Advanced Transportation Institute

Since its inception in 1999, the UTCA has been committed to recruiting minority students to careers in transportation engineering. For the tenth consecutive year, UTCA and the Alabama Department of Transportation (ALDOT) cosponsored a summer program for rising high-school juniors and seniors from west-central Alabama. **UTCA Project #11101, Advanced Transportation Institute 2011 (ATI-11)**, hosted 17 students for three days in July.



ATI participants tour the Martin Marietta Quarry in Vance, Alabama

The Institute curriculum featured presentations by ALDOT professionals and university faculty. Activities and presentations were designed to prepare students for university life and transportation careers. Students learned about university-admission procedures and transportation-career opportunities. Other presentations focused on transportation planning, design, construction, maintenance, and safety.

The students also toured a quarry. The quarry operators showed how they get the rock out of the ground, move it where they need it, crush it, test it, and load it for shipment. They explained that the strength and size of the rock they provide depends on whether the client needs it for pavement, foundations, commercial manufacturing, and so on.

Every year, a highlight for the students is a series of design competitions. This year ALDOT's lead surveyor arranged a contest where students started at a known elevation, surveyed across a field and back, and determined the elevation of a given point. They learned how to set up and use the surveying instrument, how to take surveying readings through the instrument, and how to calculate the elevation.

UA Grad Student's Poster Earns First-Place Award

A poster constructed by Ms. Shirley (Rong) Li, a third-year operations management doctoral student at The University of Alabama (UA), earned first place at the INFORMS (Institute for Operations Research and the Management Sciences) Regional Transportation, Supply Chain, and Logistics Management Workshop for her poster, "Analysis of an Integrated Maximum Covering and Patrol Routing Problem." Li's poster discussed methods for determining the patrol routes of state troopers for maximum coverage of highway spots with high frequencies of crashes (hot spots).

"This is important as better state-trooper coverage is believed to lead to fewer accidents, lower economic impact due to crashes, and better road safety for everybody," Li's faculty advisor, Dr. Burcu Keskin, said. The research effort was supported through **UTCA Project #09104, *Optimal Traffic Resource Allocation and Management***.

Using data from the state of Alabama, Li provided recommendations for decision makers concerning the number of state troopers and the critical levels of highway coverage that addressed the dynamic changes in routes. The analysis can be used to reallocate resources in the event of a potential budget cut or increase.



Ms. Shirley Li with her poster and award

The poster competition and workshop provides an opportunity for faculty and students to present ongoing transportation, supply chain, and logistics management-related research and identify interdisciplinary collaboration opportunities among universities and research centers in the Deep South. Students who present abstracts of their work are invited to participate in the student poster competition. Student participants give a five-minute presentation to the panel regarding their poster and answer related questions.

Part of this article is quoted verbatim from a UA press release. The complete press release can be viewed at <http://uanews.ua.edu/2011/04/ua-grad-students-poster-earns-first-place-award/>.

UA Student Receives NSF Fellowship

Mr. Moses Tefe, a transportation-engineering doctoral student in the Department of Civil, Construction, and Environmental Engineering at the University of Alabama (UA), has been named a National Science Foundation (NSF) fellow as part of UA's GK-12 Sustainable Energy Systems project.

Every week Mr. Tefe joins second graders in Alabama's impoverished Black Belt to help equip them with science and math skills using applications related to our energy demands. Mr. Tefe works under the supervision of school teachers and UA faculty to prepare classroom modules that will be distributed statewide through the Alabama Math, Science, and Technology Initiative (AMSTI) at the end of the project.

GK-12 Sustainable Energy Systems will operate for five years as part of a \$2.9 million grant from the NSF Division of Graduate Education to faculty from UA's Colleges of Engineering, Education, and Arts & Sciences. The two main goals of the project are to increase the professional caliber of STEM (Science, Technology, Engineering, and Mathematics) graduates from the University and to provide resources for the State of Alabama High School Engineering Academies.



Mr. Moses Tefe, NSF fellow

Dr. Hardin Named Dean, Fellow

Dr. Michael Hardin, associate director for the University Transportation Center for Alabama (UTCA), recently received a promotion and a prestigious honor.

In April, Dr. Hardin was elected a fellow of the American Statistical Association (ASA). The designation of fellow is reserved for professionals in statistics who make outstanding contributions to the field. The fellow designation is limited to no more than one-third of 1 percent of the ASA membership, which now is about 18,000 in the United States, Canada, and overseas.



In June, Dr. Hardin was named the eighth dean of the Culverhouse College of Commerce and Business Administration at The University of Alabama. As senior associate dean for the previous three years, Hardin had been responsible for the day-to-day operation of the college, including academic programs, enrollment management, and financial and administrative matters. He also guided the college through a five-year window of reaccreditation by the AACSB (The Association to Advance Collegiate Schools of Business), which began in 2008.

Dr. Hardin has authored or co-authored more than 85 papers in various journals, including the *Lancet* and the *Journal of the American Medical Association*, and several books dealing with database design and decision support systems. He often serves as a consultant to the healthcare industry, and he has been a consultant with the SAS Institute in the areas of data mining and time-series analysis since 1999. Hardin was the first SAS Quality Partner in the state of Alabama.

Prior to joining UTCA as an associate director, Dr. Hardin served as the principal investigator for **UTCA Project #02115, Crash Safety - Data Mining Approach**, which is available on UTCA's website.

Part of this article is quoted verbatim from UA press releases. The complete press releases can be viewed at <http://uanews.ua.edu>.

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