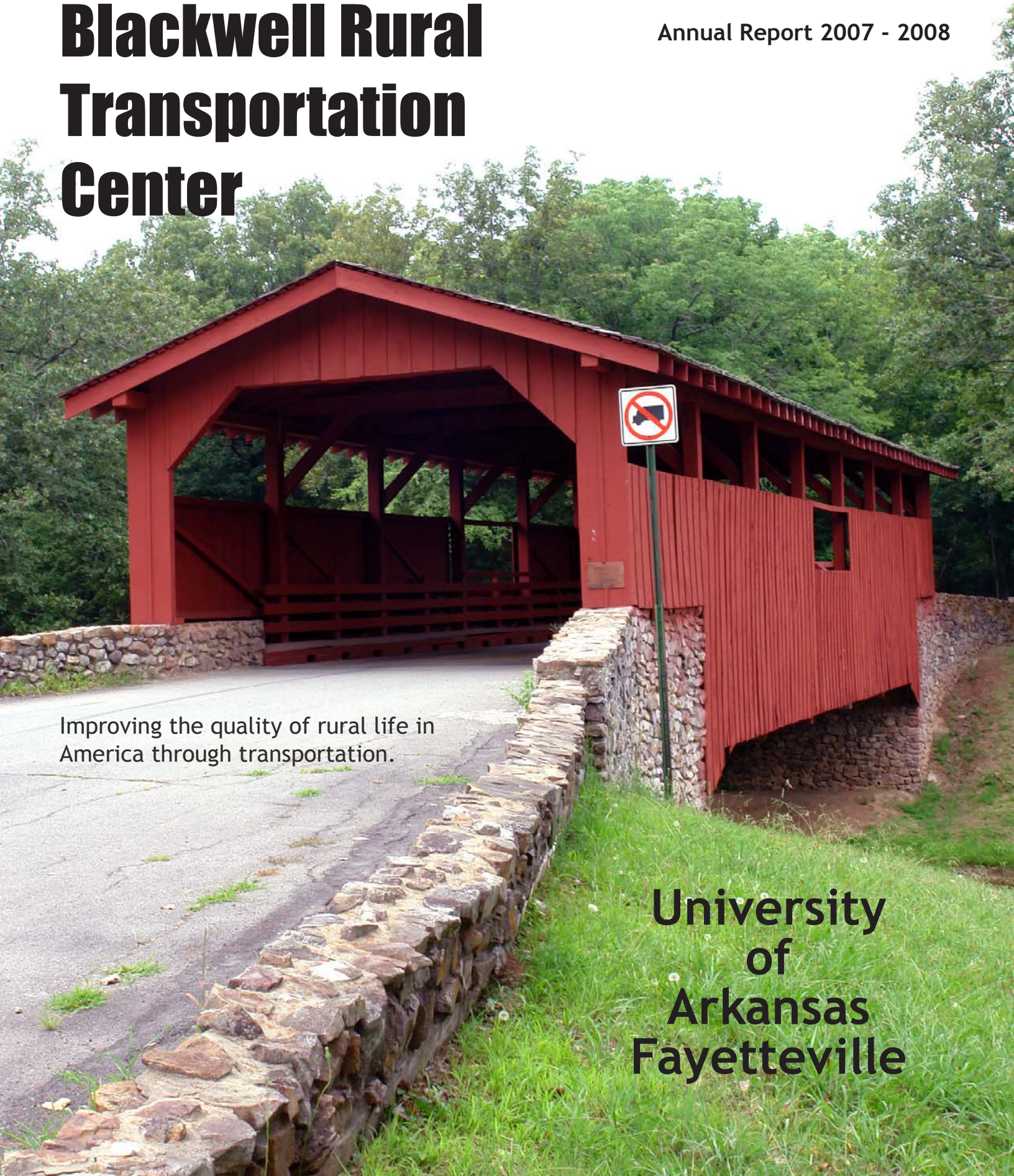
2008

Annual Report, 2007-2008

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

Mack Blackwell Rural Transportation Center

Annual Report 2007 - 2008



Improving the quality of rural life in America through transportation.

University of Arkansas Fayetteville

Staff

Heather Nachtmann, Ph.D.
Director
Associate Professor - Industrial Engineering

Jack E. Buffington, P.E., RADM (Ret.)
Associate Director
Research Professor

Dana Ledbetter
Communications Director

Sandra Hancock CPS
Accountant

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

Frances Griffith
EI Administrator, CTTP

Roselie Conley
Research Technologist, CTTP

Mary Fleck
Instructor, CTTP

Carrie Pennington
Secretary, CTTP

Executive Committee

Collis Geren, Ph.D.
Associate Vice Chancellor for Research
Dean of the Graduate School

Kevin D. Hall, Ph.D., P.E.
Executive Director
Department Head - Civil Engineering

John Ozment, Ph.D.
Professor and Oren Harris Chair of Transportation Marketing and Logistics

Ronald Rardin, Ph.D., P.E.
Interim Department Head
Industrial Engineering

Academic Advisory Board

Doug Adams, Ph.D.
Associate Professor
Sociology and Criminal Justice

Mark Cochran, Ph.D.
Department Head
Agricultural Economics and Rural Sociology

Thomas O. Graff, Ph.D.
Associate Professor
Geosciences

Brinck Kerr, Ph.D.
Professor
Political Science

Ronald Skeith, Ph.D., P.E.
Professor
Computer Science and Computer Engineering

Contents

Message from the Director

Improving the quality of rural life in America through transportation is the theme of the Mack-Blackwell Rural Transportation Center (MBTC). As you read through this year's annual report, you will see that we have made significant progress towards this theme.

MBTC researchers completed eighteen projects during the past year as described later in this report. We are proud of this work and hope you will review the final reports (www.mackblackwell.org) when you find research topics that interest you. In addition to contributions in the theory and practice of transportation science, you will see evidence of the multi-disciplinary approach in which our center is proud. In addition to Civil Engineering and Industrial Engineering, this year's projects include principal investigators from Agricultural Economics, Chemical Engineering, Electrical Engineering, and Landscape Architecture. We also had the pleasure of supporting our fellow transportation professionals at Auburn University, Kansas State University, Tennessee Tech University, University of Arkansas at Little Rock and University of Dayton.

Through the College of Engineering and Walton College of Business, we continue to offer a strong curriculum in transportation studies. During this past year, transportation students were able to take a wide array of courses including Traffic Engineering, Transportation Pavements and Materials, Transportation Logistics, Transportation Carrier Management and Transportation Strategies in the Supply Chain to name a few. Our faculty is dedicated to providing students with the technical skills and practical experiences necessary to excel in today's transportation workplace. This year we placed graduates at top transportation firms and agencies including ABF Freight System, BNSF Logistics, J.B. Hunt, USA Truck, UPS, Wal-Mart, the Arkansas, Missouri, Oregon and Texas state transportation departments, and the Federal Highway Administration field office in Little Rock, AR.

Technology transfer continues to be a priority for MBTC. Our Center for Training Transportation Professionals (CTTP) provided technician and laboratory certification courses to hundreds of transportation professionals. This year's courses ranged from Hot Asphalt Mix to Concrete Strength Testing. CTTP is an active partner of the Arkansas Highway and Transportation Department and support its efforts to provide the highest quality of infrastructure construction. Thank you to Stacy, Frances, Roselie, Carrie and Mary for their commitment to excellence in training of the state's and the nation's transportation professionals.

During this first year as MBTC Director, I enjoyed meeting and working with many people dedicated to improving the nation's transportation systems. I am grateful to Dana, Jack, Kevin and Sandy for all of their hard work, and greatly appreciate the efforts of our advisory board members, faculty, staff and students. Curt, Lydia and the rest of the RITA team continue to provide tremendous support for our education and research programs. I look forward to our 18th year of serving rural America through improved transportation.

Heather Nachtmann

Director,
Mack-Blackwell Transportation Center

Featured MBTC Researchers

Principal and Co-Principal Investigators are the backbone of the Mack-Blackwell Rural Transportation Center. MBTC has sponsored more than 200 research projects at 14 universities in 9 states over the past 17 years. Our researchers are engineers, economists, political scientists, landscape architects, and logistics specialists among many others. These are the profiles of just a few of the people who make MBTC's program a success!

Roy A. McCann, Ph.D.
University of Arkansas

Ph.D., University of Dayton
M.S., Electrical Engineering, University of Illinois at Urbana
B.S., Electrical Engineering, University of Illinois at Urbana

There are continuing security concerns associated with the approximately nine million intermodal shipping containers that pass through the nation's ports every year in route to warehouses and retail centers. The existing security monitoring systems for transporting freight use technologies such as video cameras, infrared/ultrasonic proximity sensors. However, these are high cost and susceptible to failures from the harsh operating conditions (e.g., vibration, temperature, variability of materials/ configurations, etc.) encountered in most freight operations. This has motivated the development of robust systems for detecting the breach of an intermodal shipping container as it travels throughout the supply chain. Dr. McCann's research investigates two methods; First, an acoustical-echo monitoring system was demonstrated to accurately detect changes such as an opening in the container wall or the amount/ position of freight inside the container. The second method demonstrated an RFID device that operates consistently within the highly metallic environment of intermodal shipping containers, thereby providing a means to accurately identify cargo as it travels throughout the supply chain.

Steve L. Johnson, Ph.D., P.E., C.P.E.
University of Arkansas

Ph.D., Industrial Engineering, SUNY at Buffalo
M.S., Engineering Psychology, University of Illinois
B.A., Psychology, University of South Dakota

Dr. Johnson's recent study investigates the human factors issues related to the implementation of lane departure warning systems (LDWS) to reduce side collision and run-off-road crashes for heavy trucks. These active safety systems detect when the truck approaches or crosses the lane boundary and provides an auditory, visual and/or haptic warning signal to the driver. A number of studies (laboratory, test track, and field operational tests), as well as actual fleet experience have recently indicated that LDWS devices have the potential for reducing accidents. His study uses the data from the Large Truck Crash Causation Study and the safety data from eight large commercial fleets to estimate the relative number of accidents that could be positively affected by LDWS. The results indicate that, although the frequency of sideswipe and run-off-road accidents was found to be relatively low, the consequences of these crashes can be very high in terms of

property loss, personal injuries and fatalities. This work investigates the relative advantages of systems that (1) simply warn the driver, (2) apply active steering or brake control, (3) record the event for later download and analysis, or (4) communicate the occurrences to the back office (e.g., dispatcher) for real-time evaluation and intervention, if appropriate. His research also addresses the resources necessary to effectively implement the information from these systems into the driver management system toward the goal of facilitating safe driving behaviors and reducing costly accidents.

Russell D. Meller, Ph.D.
University of Arkansas
Director of the Center of Engineering Logistics and Distribution (CELDi)
Ph.D., Industrial Engineering, University of Michigan
M.S.E., Industrial Engineering, University of Michigan
B.S.E., Industrial Engineering, University of Michigan

The United States has a significant problem with highway congestion, with an estimated cost of $7.8 B in lost productivity annually. To alleviate congestion issues, it is often recommended that the United States should build and encourage more high-speed passenger rail. However, since passenger traffic shares our highways with freight traffic, an alternative to alleviate congestion issues is to remove freight traffic from our highways through the development of a national high-speed network for freight distribution. The objective of their recent research is to explore the maximum impact of instituting a high-speed rail network for freight distribution. In our research we utilize the results of technology feasibility tests indicating that freight in such a system will move approximately two to three times faster than freight distributed via the nation's highways. As a case study application of our model, we evaluate the impact of a high-speed freight network on our nation's highways with data from the Federal Government's Commodity Flow Survey as well as a major truckload carrier. The results of our work show that, with sufficient capacity and associated investment, a high-speed network for freight distribution will have a significant impact on freight transit times and highway congestion, with the potential to address many of the challenges facing transportation today.

Kevin R. Gue, Ph.D.
Auburn University
Ph.D., Industrial Engineering, Georgia Tech
M.S., Operations Research, Georgia Tech
B.S., Mathematics, U.S. Naval Academy

Distinguished Lecture Series

MBTC is proud to present its' ongoing series of lectures for the 2007-2008 year. This year we offered an "***Evening with the Pros***" and two distinguished lectures. The MBTC and Arkansas Highway and Transportation Department hosted the 15th Annual Civil Engineering Career Orientation Program, "Evening with the Pros." Students and other interested parties were invited to attend and learn about "Civil Engineering in the Real World." This year's emcee was Mike Marlar of Marlar Engineering of North Little Rock. The speakers for the evening were Kirby Rowland of Garver Engineers, Steve Beam of Crafton & Tull Engineers, Carl Bachelor of the Arkansas Highway and Transportation Department and Don Mosley of Wal-Mart. They all discussed what to expect during an interview, what types of questions to ask in an interview, how to prepare ahead of time for the interview, and salary negotiations. As each company has different job openings, each gave an overview of what was expected to be open now and in the future. Steve Beam gave useful information to the students as a recent graduate and explained what to expect in the first days on the job. A question and answer session followed the lecture.

Don Mosley of Wal-Mart, Inc. at Evening with the Pros

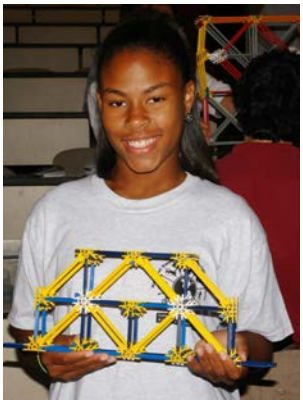
Dean Kashiwagi, Ph.D., P.E.

Dean T. Kashiwagi, Ph.D., P.E., Director of the Performance Based Studies Research Group and Professor at Arizona State University, presented "The Best Value Model for Education: Can Everyone Win?". Arizona State University has discovered a "Best Value" model that allows all participants to win in an environment of efficiency, effectiveness, and measurement. Dr. Kashiwagi demonstrates if it isn't a win-win situation for everyone involved, no one wins. The simple models show that performance measurements need to be simple, logical, and effective in motivating a change of behavior and a change of culture. Professor Kashiwagi is a master at making the complex simple as he uses logic models to simplify the process of cultural change and continuous improvement. The presentation showed how a client/buyer can get vendors to think on their behalf by transferring both risk and control without having to "trust" the vendor.

Ted C. Kennedy is founder of BE&K, Inc., a worldwide engineering, construction, and contract maintenance firm. Mr. Kennedy is one of the most successful engineers/contractors in the U.S. today. Mr. Kennedy's topic for the evening was on Leadership and his lecture detailed his rise in the construction field. He gave advice on courses to take in school as well as what to look for in a job once they were out of college. He also talked about how it was important to show how to be a leader in difficult times. It was a great honor for us to have him come and speak to faculty and students about his experiences.

Summer Transportation Institute Visits Mack-Blackwell

Dr. Brady Cox shows a video of earthquakes to the Summer Transportation Institute students before demonstrating the "shaker truck".



Seventeen students from North Little Rock, Arkansas arrived at the Center for Training Transportation Professionals (CTTP) to learn more about transportation-related careers. Eligibility to attend the Summer Transportation Institute (STI) are a student must have minimum cumulative GPA of 3.0; have an expressed interest in Engineering, Science, Transportation or Technology career; be recommended by a counselor; and submit three letters of recommendation. They ranged in grades 8th to 11th and were asked why they decided to attend this year's STI. Their answers ranged from their father being a graduate of the engineering program to "their mother made them." These answers set the tone for a fun-filled day.

After a quick Q&A session on what to expect from the tour, Ms. Frances Griffith, Administrator for Technician Training at CTTP, walked them through the labs. In one lab she showed a sample of a cylinder of concrete. Ms. Griffith explained that with this sample, they could test the strength by inserting it into a machine and putting pressure on the cylinder until a crack appeared and this would give them information that would be used to make the correct strength of concrete for our roads and highways.

The next stop was with Dr. Brady Cox, Assistant Professor in Civil Engineering. He showed the students a video of earthquakes from all over the world and explained how they cause destruction to buildings and roads. Dr. Cox then took the students outside to show them the "shaker truck" – a truck that simulates earthquakes. The information obtained by testing with the shaker truck will enable engineers to build better highways and structures.

The last stop was Bell Engineering Center where Mr. Bryan Hill, Associate Director for Recruitment, Retention, and Diversity, challenged them to a small-scale bridge building competition. The contest was designed to challenge their structural and mechanical thinking ability. The students also learned why the triangle is such a common shape in structures and what went into the design of the bridges you see every day. The bridge the students built had to span 12" long with a gap in the middle about 1-7/8" and they were to use only the KNEX construction toy provided. The test was to see how much weight it would support before it broke using the pressure applicator. All of the students enjoyed learning about how bridges were designed and built.

MBTC greatly enjoyed hosting STI and looks forward to future visits. The STI is sponsored by the FHWA, AHTD and supported by MBTC.

Center for Training Transportation Professionals (CTTP)

L to R - Roselie Conley, Mary Fleck, Carrie Pennington, Stacy Williams, Frances Griffith and Executive Director of MBTC, Kevin Hall.

The Center for Training Transportation Professionals (CTTP) continues to provide vital training and professional development to the transportation engineering and construction industries. In 2007, CTTP conducted over 40 short courses, seminars, and other training efforts, with over 1000 persons in attendance. New opportunities in 2007 have led to the expansion of course offerings, as CTTP responds to the needs of industry and regulatory agencies. The Center also continues to provide leadership to efforts related to providing training via the world-wide web. The CTTP professional staff have been very active in technical associations at the regional and national level, serving on committees sponsored by organizations such as the American Concrete Institute (ACI), the American Society for Testing and Materials (ASTM), and the Southeast Asphalt User-Producer Group (SEAUPG).

Construction material laboratory activities within CTTP also continue to progress. The CTTP Laboratory Certification program for highway construction material laboratories continues to serve Arkansas and surrounding states, with over 100 member laboratories in the program. For its own laboratories, the Center also participates in accreditation programs sponsored by the American Association of State Highway and Transportation Officials (AASHTO) Material Reference Laboratory program – known as AMRL – and by the Cement and Concrete Reference Laboratory program, or CCRL, sponsored by the National Institute of Standards (NIST). Laboratories shared by CTTP and the University of Arkansas Department of Civil Engineering are AMRL accredited in the areas of hot-mix asphalt, soils, and aggregates, and are CCRL accredited in concrete. A complete description of the activities of CTTP can be found at: www.cttp.org.

MBTC Researcher Honored

The Transportation Research Board's Fred Burggraf Award, which recognizes excellence in transportation research by researchers 35 years of age or under, was presented to Stacy G. Williams on January 14, 2008 at the Thomas B. Deen Distinguished Lecture and Presentation of Outstanding Paper Awards during the Board's 87th Annual Meeting. The Burggraf Award, which includes a cash prize, was established in 1966 to stimulate and encourage young researchers to contribute to the advancement of knowledge in the field of transportation. The award was named in honor of Fred Burggraf, who served as the Transportation Research Board's Executive Director from 1951 until his retirement in 1964. Dr. Williams' paper titled "*Bulk Specific Gravity Measurements of 25.0 mm and 37.5 mm Coarse-Graded Superpave Mixes*" has been published in the *Transportation Research Record: Journal of the Transportation Research Board*, No. 2001.

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

During the design and construction process, the bulk specific gravity (Gmb), a critical measurement of hot-mix asphalt, is used to calculate many of the properties that correspond to pavement quality. The study evaluated four methods for measuring Gmb - the traditional saturated surface dry, the CoreLok, the height/diameter, and the CoreReader methods - using mix designs created from four aggregate sources for 25.0 mm and 37.5 mm nominal maximum aggregate sizes. The study acknowledged the significant advantages indicated by the other methods but does not support the elimination of the traditional Gmb test method.

Dr. Williams is a Research Assistant Professor at the University of Arkansas and the Director of the Center for Training Transportation Professionals (CTTP). She has managed a number of research projects involving asphalt pavements and materials, on topics such as bulk specific gravity of asphalt mixtures, 4.75 mm Superpave mixtures, non-nuclear asphalt density measurements, and asphalt longitudinal joint construction. A registered professional engineer in the state of Arkansas, Dr. Williams holds a Ph.D. in civil engineering from the University of Arkansas.

Pictured left to right - Kevin D. Hall, Executive Director, Jennifer Pazour, and Jack Buffington, Associate Director.

MBTC Outstanding Student of the Year

Ms. Jennifer A. Pazour was selected as the Mack-Blackwell Rural Transportation Center (MBTC) *Outstanding Student of the Year* based on the contributions she is making to MBTC.

Ms. Pazour is a doctoral student in Industrial Engineering at the University of Arkansas. She graduated from South Dakota School of Mines and Technology with a B.S. in Industrial Engineering in 2006. Her research interests are in transportation, material handling, and healthcare logistics. Ms. Pazour's master's thesis is entitled, "A National High-Speed Rail System for Freight Distribution." Her research for MBTC focuses on reducing the amount of freight traffic on the current highway system through the deployment of a national high-speed rail system. After traveling to Germany to investigate the feasibility of Maglev high-speed rail network for freight distribution (and confirming that it is technologically feasible to do so), she turned her attention to optimizing such a network in the United States. She has developed a model that determines where to build high-speed rail arcs in the United States for freight distribution for a particular budget (expressed in terms of the number of miles).

The results from her work indicate that a 20,000-mile network (approximately half of the U.S. interstate highway system) that utilizes the current Maglev technology parameters and proposed 6-minute headways would make it advantageous for a majority of the freight traffic to utilize the high-speed network. This would reduce the overall freight transit times by 38%, which would lead to a net 78% decrease in the annual total truck highway miles. Of course, such a network would require a substantial infrastructure investment, on the order of $2T. Ms. Pazour presented this research at the INFORMS National Conference in November 2007 and will be presenting updated results as an invited speaker at the Maglev 08 Conference in December 2008.

Ms. Pazour aspires to a future career in academia and was selected for this award because of her overall contribution to the academic community at the University of Arkansas. She has exceptional research skills, demonstrated strong academic ability, and provides active service to her field.

The 17th Annual Outstanding Student of the Year Awards ceremony took place in conjunction with the Transportation Research Board's (TRB) 87th Annual Meeting in Washington, D.C. on Saturday, January 22nd, 2008 as part of the Council of University Transportation Centers (CUTC) Annual Banquet. For the past 16 years, the U.S. Department of Transportation (USDOT) has honored an outstanding student from each UTC at a special ceremony held during the TRB Annual Meeting. Each student is recognized during the ceremony by a Departmental official. Each student receives $1,000 plus the cost of attendance at TRB from his/her Center, plus a certificate from USDOT.

Carry-Over Projects

MBTC 3001 (2087) - A Nationwide High-Speed Rail Network for Freight Distribution

Russell D. Meller, Ph.D.
Industrial Engineering
University of Arkansas

Kevin R. Gue, Ph.D.
Industrial & Systems Engineering
Auburn University

In many areas of the country, congestion on the interstate and rural transportation network is significant, with billions of dollars a year in lost productivity associated with this congestion. In addition, it is predicted that the number of cars and trucks on the road will quadruple by the year 2050, and it is clear that the current interstate and rural transportation network cannot currently handle such volume efficiently (i.e., without even more significant delays in transit). These growth predictions are used by many public planners to advocate for high-speed passenger rail systems, which are generally defined as systems where the trains travel in excess of 100 mph. However, in countries like Germany and Japan, magnetic levitation trains (i.e., Maglev trains, which are single-car trains that are levitated above rails via magnetic fields for nearly frictionless travel) are being used effectively for such purposes at very high speeds. MBTC 3001 will lead to a better understanding of high-speed rail technologies in terms of technological feasibility, network design, and infrastructure challenges, including the design and operation of crossdock facilities for freight transfer in the resulting intermodal network. In addition, this project will result in the development of optimization models for designing systems to take advantage of these technologies and traffic load models that measure the impact that freight traffic on high-speed rail technologies has on highway systems.

MBTC 3002 (2090) - Performance Prediction of the Strong Company's Soft Ground Arrestor System Using a Numerical Analysis

Ernie Heymsfield, Ph.D., P.E.
W. Micah Hale, Ph.D., P.E.
Civil Engineering
University of Arkansas

The Federal Aviation Administration (FAA) requires airfields to have a 1000' runway safety area beyond the design runway length for aircraft overruns. At many locations, this requirement cannot be satisfied because of natural or man-made barriers. Therefore, an alternative is to use an engineered material arresting system (EMAS). An EMAS is designed to significantly reduce an aircraft's stopping distance during an overrun. The Strong Company proposes modifying the current design and materials used for an EMAS. The proposed alternative material will be a cementitious material, satisfy the material properties included in FAA Advisory Circular 150/5220-22A, and be economically attractive. The FAA requires that an EMAS design be validated using a design method which can predict the arrestor material's performance (AC 150/5220-22A). Instead of conducting expensive full-scale overrun tests on the modified system, a numerical approach using the FAA computer code, ARRESTOR, is proposed (White et al, 1993). ARRESTOR is an enhanced version of the computer program FITER1 (Cook, 1985) used for U.S. Air Force Operations. Overrun simulations during this study will be performed as a function of EMAS design characteristics, aircraft type, and aircraft runway exit velocity. These parameters will be used as a basis to evaluate performance. Empirical equations as a function of the new arrestor material, aircraft characteristics, and arrestor geometry will be developed during the study to summarize the computer simulations.

MBTC 3003 (2094) - Acceleration Lane Design for Higher Truck Volumes

J.L. Gattis, Ph.D., P.E.
Department of Civil Engineering
University of Arkansas

As both traffic volumes and percentages of heavy vehicles on the highways have increased, traffic problems at certain freeway entry ramps, such as those near truck stops and at heavy-vehicle weigh stations, become more likely. Where there are major concentrations of trucks, the number of slow-moving trucks reentering the highway combined with the volume of high-speed traffic on the main lanes has created undesirable traffic situations. Longer acceleration lanes are needed at locations with significant volumes of trucks, so the trucks entering the highway can accelerate to through-highway speed before the point at which the trucks merge into through traffic. MBTC 3003 will investigate improved design of highway acceleration lanes for higher truck volumes.

MBTC 3004 (2095) - Potential Applications of Nanotechnology for Improved Performance of Asphalt Pavements

R. Panneer Selvam, Ph.D., P.E.
Kevin D. Hall, Ph.D., P.E.
Department of Civil Engineering
University of Arkansas

Nanotechnology is a field in which materials may be manipulated and improved at the molecular level. Successful applications of nanotechnology have been achieved in areas such as electronics, biotechnology, and material science (i.e. metallurgy). Given the composite nature of hot-mix asphalt (HMA) and Portland cement concrete (PCC) – each a mixture of aggregate and a binder – the potential for improvements in the engineering properties of HMA and PCC through the application of nanotechnology is significant, particularly in the areas of resistance to moisture damage (stripping in HMA), durability, and stiffness, among others. MBTC 3004 seeks to explore potential applications of nanotechnology to the performance of paving materials. Improvements to pavement performance would result in significant cost savings to pavement agencies. Ultimately, this research could result in longer-lasting, more durable pavements for highways, airfields, ports, and other facilities. The project will also open new areas of research regarding the improvement of paving materials and pavement performance.

MBTC 3005 (2098) - A Model-Based Risk Map for Roadway Traffic Crashes

Chang S. Nam, Ph.D.
Department of Industrial Engineering
University of Arkansas

Joon J. Song
Department of Mathematical Sciences
University of Arkansas

Visualization of traffic safety data that transforms spatial data into a visual form can help highway engineers and traffic safety officials to effectively analyze the data and make decisions on which roadways and road side features to improve by providing the spatial distribution of the data. However, research efforts in the visualization of traffic safety data, which are usually stored in a large and complex database, are quite limited because of methodological constraints. For example, there are only a few model-based maps that can account for the high variance of traffic crash estimates in low population areas, and at the same time clarify overall geographic trends and patterns. In addition, designers of roadways historically did not take into account the full range of driver characteristics, such as driver perception-response time, age differences, etc. One of the most important components of the roadway transportation is the human driver whose error is a factor in about 90% of traffic crashes. Therefore, it is very important for highway engineers and traffic safety officials to identify and understand the basics of human factors as relevant to driving and traffic safety. The objective of MBTC 3005 is aimed at developing a user-friendly geographic information system (GIS) that displays traffic crash data in Arkansas, estimated traffic risk based on the statistical model to be developed, and human factors in traffic accidents.

MBTC 3006 (2099) - Identification and Analysis of Points and Segments of High Fatality Crashes

Ghulam Bham, Ph.D.
Civil, Architectural & Environmental Engineering
University of Missouri - Rolla

According to the assessments of injuries and fatalities in traffic crashes by NHTSA, approximately 42,850 persons died in an estimated 38,356 motor vehicle traffic crashes in the United States in 2002. This represents an increase of 1.7% fatalities from the 42,116 reported in 2001 and is the highest level of fatalities since 1990. An additional 2,914,000 persons were injured on U.S. public roads and highways in 2002. In 2004, Arkansas had 704 highway fatalities; the fatality rate per 100,000 persons in Arkansas was 25.58 versus 14.52 for the national average and 7.42 for the state with the lowest rate. Moreover, fatality rate per

100 million vehicle miles traveled (VMT) for Arkansas in 2004 was 2.22 versus 1.44 for the national average and 0.87 for the state with the best rate. In addition to the loss of lives, roadside crashes cost society $80 billion per year. The economic costs to society in medical expenses, worker losses, property damage, and emergency services compound the personal tragedies resulting from highway fatalities and crashes. With fatality rates in Arkansas higher than the national average, this research needs to be undertaken to decrease the number of fatalities, rate and severity of crashes, and to reduce the economic cost to society. A GIS based research approach will pinpoint fatalities and crashes, rank highway segments and points by rates and severity, forecast future rates and severity of crashes at highway segments and points, and suggest remedial measures to improve safety using best practices in highway and traffic engineering.

MBTC 3007 (2096) - Solar Powered Lighting for Overhead Highway Signs

Hirak Patangia, Ph.D., P.E.
Department of Engineering and Technology
University of Arkansas at Little Rock

The purpose of MBTC 3007 is to design and develop a solar powered lighting system for overhead highway signs with a view to improving night visibility, driving conditions, and highway safety. Two systems will be developed and tested: one system will utilize regular fluorescent tube lights for shining light on the sign, and the other system will employ Electroluminescent (EL) fibers to highlight the letters in the sign and/or the boundary of the signboard. The engineering aspect will involve designing a highly efficient dc to ac inverter at 60 Hz for fluorescent system and at 1 KHz for the EL system. An improvement in inverter efficiency will allow use of more compact solar panels and reserve energy for rainy or cloudy weather conditions. The inverter signal quality will be similar to that of utility supply (reduced harmonics) for extended life of the fluorescent tubes as well as EL fiber. The system will incorporate a power management controller to adjust the lighting effect to compensate for weather conditions for days with inadequate solar charging. Both the systems will be tested outdoor in a highway environment, and their performance will be closely monitored. A group of volunteers will be recruited to determine their perceptions concerning any benefit to traffic safety due to the overhead lighting.

Ongoing Projects

MBTC 2006 -Investigation of the Long Term Stability of Highway Slopes, Phase III
Norman D. Dennis, Jr., Ph.D., P.E.

MBTC 2007 - Estimating Subgrade Resilient Modulus for Pavement Design
Norman D. Dennis, Jr., Ph.D., P.E.

MBTC 2026 - Using Multi-Spectral Satellite Imagery to Enhance Slope Failure Prediction
Norman D. Dennis, Jr., Ph.D., P.E.

MBTC 2037 - Route and Site Characterization Using Multi-Spectral Satellite Imagery
Norman D. Dennis, Jr., Ph.D., P.E.

MBTC 2055 - Roadway Median Treatments
James L. Gattis, II, Ph.D., P.E.

MBTC 2056 - Applicability of Microelectronic and Mechanical Systems (MEMS) for Transportation Infrastructure Management
Kelvin C.P. Wang, Ph.D., P.E.

MBTC 2067 - Roadway Median Treatments
James L. Gattis, II, Ph.D., P.E.

MBTC 2070 - Development of Methods for Estimating Remaining Life of Hot-Mix Asphalt Field Mixes
Kevin D. Hall, Ph.D., P.E.
Norman D. Dennis, Jr., Ph.D., P.E.

MBTC 2071 - Prestress Losses in Prestressed Bridge Girders Cast with Self Consolidating Concrete
W. Micah Hale, Ph.D., P.E.

MBTC 2074 - Evaluation of Pavement Thickness and Modulus Using Spectral Analysis of Surface Waters
Norman D. Dennis, Jr., Ph.D., P.E.

MBTC 2083 - Human Factors Study of Driver Assistance Systems to Reduce Lane Departure and Side Collision Accidents
Steven L. Johnson, Ph.D., P.E., C.P.E.

MBTC 2086 - Routing Models for Rural Transportation Network Transportation Network with Time-Varying Constraints
Scott J. Mason, Ph.D., P.E.
Russell D. Meller, Ph.D.
Edward A. Pohl, Ph.D.

MBTC 2088 - Integration of GIS and Logistics Planning Methods for Arkansas Rural Transportation Emergency Planning
Manuel D. Rossetti, Ph.D.
Edward A. Pohl, Ph.D.
Fredrick Limp, Ph.D.

MBTC 2089 - Development of a Soft Ground Arrestor System
W. Micah Hale, Ph.D., P.E.

MBTC 2091 - Rural Transportation Emergency Preparedness Plans
Heather Nachtmann, Ph.D.
Edward A. Pohl, Ph.D.
C. Richard Cassady, Ph.D.

Completed Projects

MBTC 2047 - WebShipCostGIS in Inter-modal Transportation

Manuel D. Rossetti, Ph.D., P.E.
Heather Nachtmann, Ph.D.
Industrial Engineering
University of Arkansas

MBTC 2047 provides an investigation of a prototype geographic information system (GIS) and integrated web-based application (WebShipCost-Risk) with the ability to provide cost, time, and uncertainty analysis of inter-modal transportation processes based on up-to-date network information. The prototype system can allow shippers to define, represent and update their specific transportation network and related data within a GIS. The integration of a decision support system with a GIS could provide shippers with more convenient and efficient data management methods to support the decision making in terms of route planning. To achieve the desired goals, a three layer architecture was considered, which was based on a commercial GIS, a database system, and internet components. If fully implemented, the prototype application would provide a graphic, user-friendly analysis of inter-modal transportation networks.

MBTC 2061 - Risk Modeling, Assessment and Management

Edward A. Pohl, Ph.D.
Industrial Engineering
University of Arkansas

Total expenditures on Homeland Security in the 2003 budget are on the order of $31 billion dollars. A significant amount of that funding will be spent on securing our transportation infrastructure. Key to spending those dollars wisely will be the development of an adequate risk analysis, mitigation and management plan for each of the various transportation sectors. The objectives of MBTC 2061 are to develop a senior/first year graduate level course that will provide our student's with an understanding of risk, how to model it, analyze it, and mitigate it. Understanding risk, how to make decisions under risk, as well as techniques for managing risk makes them better stewards of our scarce resources, better prepare them for the future, and increase the likelihood of their success in these uncertain times.

MBTC 2063 - Highway Collision Warning Technology: Determination of Criteria for Detecting and Logging Hazardous Events in Tractor-Trailer Safety and Training Programs

Roy McCann, Ph.D.
Electrical Engineering
University of Arkansas

Advanced electronic safety systems have been increasingly deployed on passenger and commercial vehicles. Most recently, radar-based systems have been introduced for detecting and warning of impending collision. These warning systems are particularly significant for large trucks and tractor-trailers due to the severity and occurrence of rear-end collisions resulting in death and serious injury. Fleet operators are presently able to remotely monitor and record hazardous conditions for evaluating driver skills and assessing the safety and reliability of highway routes. However, the criteria for logging hazardous conditions from the available data and the basis for subsequent corrective actions are not well understood. MBTC 2063 improves the understanding and management of vehicle operating data and how to more effectively use this information to improve highway safety and driver training. As a means to improving highway safety, collision warning technology can be used in the following ways by freight carriers: (1) Driver warning of a hazardous condition to avoid an incident, 2) Communicating the occurrence of hazardous conditions in real-time for fleet operational control, and 3) Collecting of data for subsequent management review and driver training. Vehicle data such as velocity, acceleration, weight, forward object distance and relatively velocity (range-rate) is communicated to the fleet operations center. Presently, only a limited set of data is collected. For example, rapid decelerations are automatically logged. This research expands the collected data to include that available from the radar systems along with other in-vehicle data to obtain a comprehensive view of the driver and traffic operating conditions. From analysis of this improved data set, conclusions and recommendations for improved highway safety and driver training are derived.

MBTC 2064 - Assisted Night Vision for Motorists in Highway Construction Zones: Phase II

Hirak C. Patangia, Ph.D., P.E.
Department of Engineering and Technology
University of Arkansas at Little Rock

Annually, there is a considerable volume of on-going construction in many highways across the nation and the state. Generally, the construction zone employs just one lane with concrete dividers (jersey barriers) for two-way traffic. The passage for driving is narrow, and the motorists have to be extra careful to avoid collision with the dividers. Driving is especially stressful and hazardous on dark rainy nights. Vehicle accidents are often common due to collisions with the jersey dividers. Such a hazardous driving situation can be mitigated if some form of illumination is provided along the side of the concrete blocks similar to driveway lighting in homes or runway lighting at airports. The Phase I of the project develops a flexible low cost solution to provide lighting along the length of the dividers in construction zones. Both electroluminiscent and LED technology have been used to design the lamps. The lamps are powered from 12V batteries with provision for recharge through solar power. Outdoor testing of the system is used to compare the effectiveness of the proposed EL lamps against LED technology, developing a convenient wire harnessing system, fine-tuning the electronic design to maximize energy efficiency, and incorporating design changes. The Phase II involves large scale field-testing of the night vision system in a construction zone to determine its effectiveness with regard to improvement in driving conditions, traffic flow, improved safety, and motorists' perception of the nighttime vision system.

MBTC 2066 - Surface Friction Measurements of Fine-Graded Asphalt Mixtures

Stacy Williams, Ph.D., P.E.
Civil Engineering
University of Arkansas

The use of thin HMA pavement layers containing relatively small aggregates (such as 4.75mm Superpave mixtures and ultrathin friction courses) is gaining popularity in the U.S. These mixes can be economical because they are placed in thin lifts (reducing the quantity and cost of materials); they use screenings (a plentiful by-product of aggregate crushing operations for coarser aggregate mixes and sometimes considered to be a waste product); and they provide a smooth and nice-looking surface that is easy to construct (primarily in areas that must be hand-worked). These types of mixes are especially well-suited for maintenance applications seeking to restore older, aged, weathered, and rutted pavements, especially on low-volume roadways. Although there are many advantages associated with 4.75mm mixtures, there are some issues that must be investigated prior to the construction of these mixes. These issues include safety concerns related to surface friction and hydroplaning in wet weather. Aggregate tests can be used to quantify the shape, texture, and durability of aggregate particles. Friction tests can be used to quantify the performance of a mixture relative to skid resistance. It is durability of aggregate particles. Friction tests can be used to quantify the performance of a mixture relative to skid resistance. It is important to consider both the micro-texture and the macro-texture of the pavement when analyzing pavements and their components. MBTC 2066 investigates these issues to determine whether 4.75mm mixes are safe for construction on Arkansas roadways.

MBTC 2072 - Roundabout Feasibility Study for West Memphis

John V. Crone
Landscape Architecture
University of Arkansas

Otto Loewer
Carolyne Garcia
Economic Development Institute
University of Arkansas

Transportation agencies are often faced with questions from communities concerning the safety and aesthetics of off/on ramps and intersections located below aging and unsightly interstate overpasses in the many rural-to-rapidly-urbanizing areas in Arkansas. A key issue is the challenges encountered by the citizens in their attempts to implement economic development projects, a crucial concern for the Arkansas Delta. These challenges are mirrored by those facing the Arkansas Highway and Transportation Department in dealing with citizens who have substantive issues, but may not understand the technical and regulatory constraints. MBTC 2072 studies the feasibility of interstate bridge and intersection design solutions - including roundabout designs - and develops a model for community-based transportation planning that will facilitate the interface between community stakeholders and the agencies implementing infrastructure modifications. Phase I includes analysis and presentation for community and agency approval of formal design options to advance transportation efficiency, public safety, and visual enhancement as a response to increasing population growth and economic development in West Memphis, Arkansas. Based on the results, Phase 2 focuses on development of a community-based expert-system planning model that could be used to address similar transportation issues throughout the Arkansas Delta and beyond.

MBTC 2073 - Effects of Freeway Frontage Road Conversion

J.L. Gattis, Ph.D., P.E.
Civil Engineering
University of Arkansas

Some freeway frontage roads were originally constructed and operated as two-way roadways. Over time, changes in land development patterns, increased traffic volumes, and an increase in the number and/or severity of crashes may dictate converting the frontage roads to one-way operation. It is not uncommon for these changes to accompany the spread of urban development into previously rural areas. Although one-way operation may eliminate certain vehicle conflict patterns and result in a safer corridor, the perceived increased travel time and the indirection required to reach tracts along the frontage roads can produce protests from abutting property owners. Documenting the tradeoffs that occur as a result of conversion would help the decision makers and guide future frontage road conversions. MBTC 2073 continues parts of a previous September 2002 through June 2004 AHTD study that examined changes in certain measures associated with frontage road conversion.

MBTC 2075 - Non-Nuclear Methods for Density Measurements

Stacy Williams, Ph.D., P.E.
Civil Engineering
University of Arkansas

In-place density is a key property when constructing asphalt pavements. Non-nuclear technology is now available for testing this property, having the advantage of taking many measurements quickly and easily, while not requiring special training or licensing for purchase, use, or transport. Early studies discouraged the use of such devices due to poor correlations with traditional test methods. However, recent technological advancements indicate improved capabilities. In light of these advancements, MBTC 2075 evaluates this type of device to determine its applicability to QC/QA testing in Arkansas. Specifically, the testing variability of this device is measured, and factors affecting the measurements are analyzed. These factors include nominal maximum aggregate size, pavement density, gradation, pavement thickness, mat temperature, joint smoothness, and moisture content.

MBTC 2077 - Networked Sensor System for Automated Data Collection and Analysis

Kelvin C.P. Wang, Ph.D., P.E.
Civil Engineering
University of Arkansas

MBTC 2077 describes the development of a real-time multi-functional system for roadway data acquisition and analysis with multiple sensors. This system, Digital Highway Data Vehicle (DHDV), combined the technologies of laser illumination based digital imaging, inertial profiling and GPS mapping into an integrated system to accomplish the multiple tasks of survey and management for roadway data. It can capture the pavement surface images, the right-of-way (ROW) color images, the roughness and rutting data at a driving speed over 100km/h (60 mph). The resolution of the pavement images is 1-mm in both longitudinal and transverse directions with the use of high resolution gray-scale line cameras. The image covers 4-meter full lane width. ROW color images are acquired with multiple high resolution color frame cameras. The pavement distress analysis and road sign inventory can be conducted in real time. The system provides a comprehensive database engine which streams various imaging and location data into the on-board computer system as the data sets become available. This research presents the designs of this comprehensive data acquisition and analysis platform with respect to multi-function, integration and automation. The reliability and efficiency of DHDV have been demonstrated in different agencies with thousands of running miles.

MBTC 2078 - Evaluations of Economic Impacts of NAFTA on the Transportation System/Sector of Selected Southern States

Gregory L. Hamilton, Ph.D.
Institute for Economic Advancement
University of Arkansas at Little Rock

There is a close interaction between transportation activities and international trade, economic growth, economic development efforts, various public policies, and geographic endowments. The NAFTA has profoundly impacted transportation services both directly and indirectly. The development of trade corridors often furnishes the formation of transportation corridors, which are an integrated transportation system including highway, rail, and airlines. Each transportation mode is related to private cargo and passenger services, public investment on infrastructure, and the related manufacturing and construction activities. MBTC 2078 assesses both the short-term and long-term effects of NAFTA on current trade patterns, commodity

term effects of NAFTA on current trade patterns, commodity flows, and future transportation needs along major trade corridors. The analysis focuses on highway capacity issues, industrial trends, and economic development planning as related to rural areas and regional development patterns.

MBTC 2079 - Study of Driver's Behavior at Passive Railroad-Highway Grade Crossings

Eugene R. Russell, Ph.D., P.E.
Civil Engineering
Kansas State University

Margaret Rys, Ph.D.
Industrial and Manufacturing Systems Engineering
Kansas State University

The majority of highway-rail grade crossings on rural roads in the Midwestern states do not warrant automatic signals and gates, however, the potential for catastrophic crashes is always present. For example, on any given day several hundreds of school buses cross these grade crossings. Catastrophic crashes in other states have led to renewed national emphasis on alternative approaches and policies that states need to consider. There is growing national pressure to use a STOP or YIELD sign at all grade crossings. Many believe this is not the answer. Where railroad tracks parallel state highways, there are many with limited space and a potential risk to school buses, large/long vehicles and farm equipment that need special consideration. Where there are signalized crossings and intersections it is possible to interconnect the systems to provide clear out times for the vehicles in this area between the crossing and the intersection. MBTC 2079 studies the effectiveness of these techniques and develops general guidelines for the most effective ones for all states that have these conditions, i.e., most Midwestern states.

MBTC 2080 - Effectiveness of Seat Belts in Reducing Injuries

Sunanda Dissanayake, Ph.D.
Civil Engineering
Kansas State University

Since almost all Americans are using the transportation system on a daily basis, safety remains one of the most important issues. Motor vehicle crashes are the leading cause of death for ages 2 to 33 years. Total number of fatalities stands around 42,000 and number of injuries is in millions making the total estimated economic losses to be more than $230 billion. While there are many contributing causes to this situation, seat belt usage, or lack there of, has a very significant impact on the outcome of the crash. Severities of crashes seem to have a direct relationship with the safety belt usage as indicated by statistics. Based on 2002 data for the State of Kansas, for example, only 27.4 percent of fatally injured occupants wore seat belts, and the usage rates for injured and unharmed occupants were 71.5% and 84.3% respectively. MBTC 2080 evaluates the effect of not wearing seat belts on the outcome of the crash, i.e. injury severity. This information can be converted to an equivalent monetary amount for the ease in comprehension by the general public, which would be helpful in developing new or improved public policy decisions related to safety belts.

MBTC 2084 - Development of an Intermodal Container Load Status and Security Monitoring Systems

Roy McCann, Ph.D.
Electrical Engineering
University of Arkansas

MBTC 2084 develops an intermodal container security monitoring system that incorporates recent advances in radio frequency identification (RFID) technology and in acoustical signature monitoring (ASM). In addition, the information gathered from RFID and ASM is coupled with wireless remote monitoring of commercial vehicles and assets presently available through satellite and cellular technologies. One of the focus areas for Homeland Security initiatives is to improve the security and monitoring capability of logistics trailers and intermodal shipping containers. Containers/trailers are used to transport goods throughout the world by sea, rail, and truck using a standardized configuration that allows easy transfer between modes. The hazard this transport method is susceptible to illegal use by hostile and malicious groups. In addition, transport tractor-trailers deliver a large percentage of freight throughout North America and are similarly susceptible

to the threats associated with intermodal containers. Existing methods for monitoring intermodal containers have attempted to use conventional security and surveillance technologies such as video cameras and infrared or ultrasonic proximity detectors in a line-of-sight configuration. These systems have had limited success due to high cost, high failure rates in the severe temperature and vibration environment of intermodal containers, and poor accuracy in detecting cargo conditions due to the highly variable materials/configurations encountered in real-world freight transport. In addition, intermodal containers are often untethered and stored in a freight yard for long periods of time, resulting in battery drain of the monitoring system. This research develops alternative approaches by extending the recent advances in RFID technology and acoustical signal processing techniques.

MBTC 2092 - Yield Characteristics of Biodiesel Produced from Chicken Fat-Tall Oil Blended Feedstocks

Robert E. Babcock, Ph.D., P.E.
Edgar C. Clausen, Ph.D.
Chemical Engineering
University of Arkansas

Michael P. Popp, Ph.D.
Agricultural Economics and Agribusiness
University of Arkansas

The primary objective of MBTC 2092 is to investigate the conversion of chicken fat and tall oil, both individually and in a blend, into biodiesel. The conventional base-catalyzed method of biodiesel production has shown to be inappropriate for the conversion of high free fatty acid-containing feedstocks such as tall oil, due to the undesired saponification reaction that takes place. Likewise, the acid-catalyzed method of biodiesel production has been shown to be inappropriate for the conversion of triglyceride-containing feedstocks, such as chicken fat, due to the long reaction times and large excess of methanol required. Therefore, an alternate reaction pathway was investigated for these two very different feedstocks. Supercritical methanol treatment, which requires no separate catalyst, was the method chosen. Following the development of proper protocol, both chicken fat and tall oil fatty acids were reacted in supercritical methanol to produce biodiesel under a matrix of temperatures and methanol to feedstock ratios. Results indicate that the chicken fat and tall oil fatty acids can be converted successfully in a single step with yields in excess of 89% (out of 91% max) and 94% respectively. The optimum temperature and excess methanol was determined, and the results suggest the use of a two step process involving the initial hydrolysis of triglyceride-containing feeds followed by the supercritical esterification of the resulting/existing free fatty acids. The results of one such test proved to be satisfactory, and are reported herein. Furthermore, crude tall oil was also tested in the system to investigate its viability as a biodiesel feedstock with limited success. Cold flow properties, such as viscosity and cloud point, are reported for the resultant fuels. The viscosities of all of the fuels exceeded the ASTM D6751 acceptable specifications for biodiesel; therefore blending with other biodiesel fuels such as methyl soyate would be required for widespread use of the fuels produced under the conditions reported herein as commercial biodiesel.

MBTC 2093 - Improved Traffic Signal Efficiency in Rural Areas Through the Use of Variable Maximum Green Time

Steven Click, Ph.D., P.E.
Civil and Environmental Engineering
Tennessee Tech University

On April 20, 2005, the first National Traffic Signal Report Card was issued by a coalition of leading transportation organizations. This evaluation of traffic signal operations was based on input from 378 state, county, and local agencies. The overall national grade of D- clearly indicates the need to address several key aspects of traffic signal operations. One major issue identified in the report is a lack of regular updates to traffic signal timing. These poor results came as little surprise to transportation professionals. The Federal Highway Administration reports that an estimated 75% of the 260,000 traffic signals in the United States could be improved "by updating equipment or by simply adjusting and updating the timing plans." In addition to the poor overall national score, the Report Card also indicated that agencies responsible for very small signal systems (< 50 signals) "scored markedly lower… than larger systems." Virtually all rural areas will fall in this category, which averaged a full letter grade lower than their larger (i.e. suburban and urban) counterparts. Fortunately, the continuing reduction in cost for computing capabilities has brought with it more advanced traffic signal control capabilities built into standard controllers, including many which have not yet been tested. One such feature is commonly referred to as a Variable Maximum Green Time (VMGT). This feature allows a local signal controller to determine if a phase failed to serve all waiting vehicles, and to adjust its length accordingly in subsequent cycles. The primary objective of MBTC 2093 is to improve traffic signal operating efficiency in rural areas through the use of VMGT as low cost local adaptive control.

MBTC 2097 - Automated Inventory and Analysis of Highway Assets: Phase II

Kelvin C.P. Wang, Ph.D., P.E.
Civil Engineering
University of Arkansas

In addition to pavements, bridges, and tunnels, highway assets include signs, markings, guardrails, billboards, and others. Sign inventory is important in studying the need of using traffic control and advisory devices, and assessing conditions of existing signs. Sign inventory in a state highway agency is mostly managed in an analog format through paper files. Furthermore, the management of lane markings for no-passing zone is largely a manual process. Inventory for no passing zones and knowing their condition are important for safety management on two-lane highways. Through the use of modern gyro sensors and image processing, it is possible to study the necessity of setting up no-passing zones and also archive existing no-passing zones into digital imaging databases. Thirdly, roadside structures, such as guardrails and billboards, need frequent condition survey. All existing technologies for asset inventory are based on post processing, labor-intensive and costly. Full automation of asset inventory and analysis through this research will vastly reduce surveying cost. MBTC 2097 develops technologies in inventorying these types of structures and signs, and conducting automated condition survey on them and obtains sub-meter positioning data to each and every asset element under study, through the use of Differential Global Positioning (DGPS) technology. In the end, performance studies of these man-made objects over time are carried out and integration of the collected and analyzed data sets with GIS databases are conducted.

MBTC 2100 - Evaluation of the Role of Driver's Knowledge of Who Has The Right-Of-Way Contributes to Interstate On-Ramps Crashes

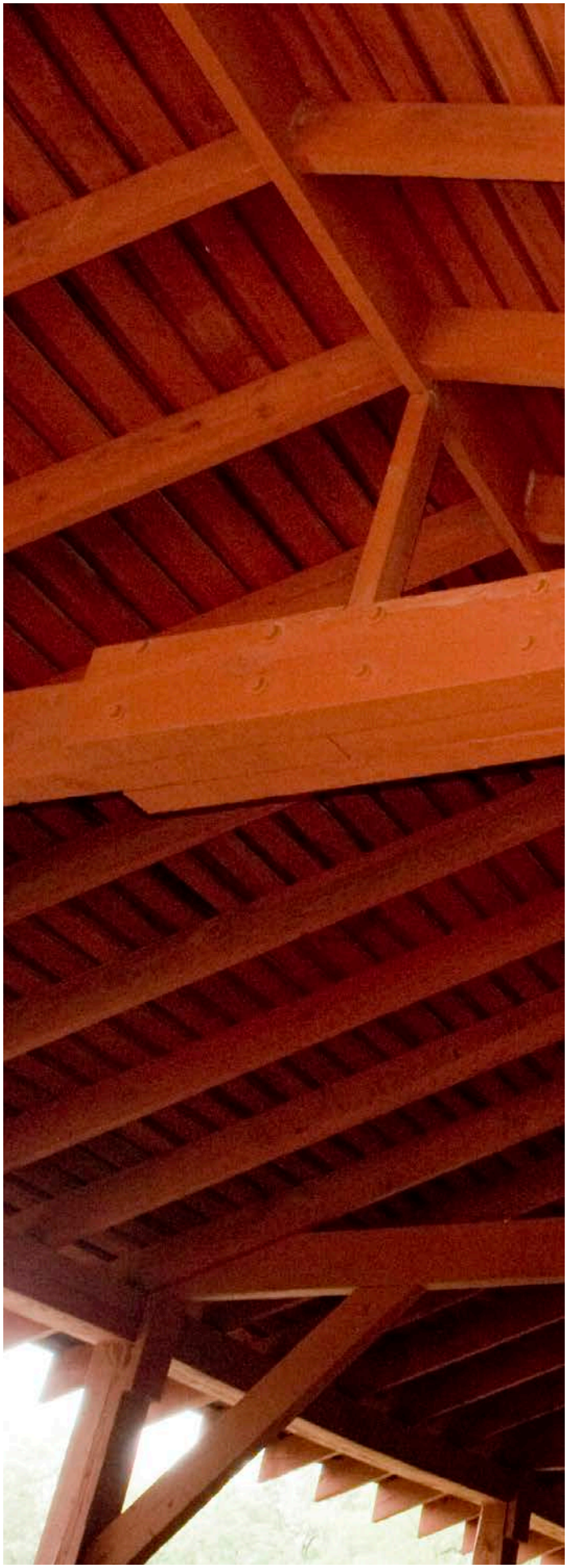
Deogratias Eustace, Ph.D., P.E., P.T.O.E.
Civil and Environmental Engineering and Engineering Machanics
University of Dayton

The characteristics and circumstances of interstate ramp crashes have been sparingly studied in spite of the fact that entrance and exit ramps are among the segments of the interstate system with the highest crashes per mile driven. For ramp related crashes, studies have shown that about 50 percent of all crashes occur on exit ramps and about 36 percent occur on entrance ramps. For exit ramps, the most common type of crash is run-off-road whereby speeding was often found to be a major factor. However for entrance ramps, the most common crash type is rear-end and side-swipe or cutoff. These frequently involve at-fault drivers merging from entrance ramps into the sides of other vehicles already on the freeway mainline lanes. While speeding and ramp geometric design-related factors have been studied extensively, very little has been researched on the factors that contribute to on-ramp merging such as drivers not yielding the right-of-way to freeway mainline-through traffic. Some states' driver license test booklets inform new drivers to accelerating at the onramp to attain the freeway mainline speed. This is also in accordance with AASHTO Policy on Geometric Design of Highways and Streets whereby auxiliary (acceleration) lanes are provided in order to minimally affect through traffic operations. Normally no yield sign is needed for ramps having standard acceleration lanes. The foregoing reasons may cause some on-ramp merging drivers to think that they equally share the right-of-way with the mainline-through traffic and hence become one of the major causes of on-ramp area collisions. As discussed, MBTC 2100 investigates the role that driver knowledge of right-of-way has on interstate on-ramp crashes.

MBTC 7015 - Assessment of Multimodal Transport of Baled Poultry Litter and Dewatered Biosolids from Northwest Arkansas

Harold L. Goodwin, Ph.D.
Kenneth B. Young
Agricultural Economics and Agribusiness
University of Arkansas

Stakeholders in the Ozarks region have expressed concern over the degradation of surface water, with the poultry industry and municipal wastewater plants cited as possible contributors. Exporting poultry litter and municipal biosolids is a possible approach for ameliorating the excess nutrient situation and to improving water quality in the Northwest Arkansas (NWA) region. Handling and truck-transporting raw poultry litter and dewatered biosolids out of the region is costly. Mammoth Corporation (Spokane, WA) and the U of AR Division of Agriculture collaborated to develop technology for plastic-wrapping baled litter and biosolids and to evaluate their quality (USDA-SBIR 2004). The results of that project are useful in addressing excess nutrient issues in the NWA region and to serve as groundwork for solutions to similar problems elsewhere. Co-processing poultry litter and biosolids has never been done, but we expect it to be a cost-efficient and cutting-edge means of deriving the benefit of these products while eliminating potential biosecurity and sanitary threats. Unlike other litter and biosolids materials, plastic wrapped bales can be transported in a variety of truck trailers; thus truckers can take advantage of more backhaul opportunities. The UV plastic wrapped bales can be stored outside at their destination, reducing the need for storage and double handling costs at the market end. Two types of transport methods are investigated in MBTC 7015; truck and a combination of truck and barge. Young et al. compared these options in the shipment of poultry litter in raw and baled forms from Northwest to Eastern Arkansas. They found that, while truck transport of bales is cost effective to supply nearer nutrient markets, a truck and barge combination is more cost effective.



Publications Available @ www.mackblackwell.org

Characterization and Modeling

2008

Crone, John V., Otto Loewer and Carolyne Garcia
MBTC 2072 - Roundabout Feasibility Study for West Memphis

Wang, Kelvin
MBTC 2097 - Automated Inventory and Analysis of Highway Assets: Phase II

2007

Miller, Will
MBTC 2034 - Community Impact of Regional Transportation Infrastructure: Revisted After Completion of Airport and Major Highway

Wang, Kelvin
MBTC 2042 - Automated Survey and Visual Database Development for Airport and Local Highway Pavements

Hale, W. Micah, Mark L. Kuss
MBTC 2053 - Development of an In Situ Permeability for Concrete Structures

Williams, Stacy, Mark L. Kuss
MBTC 2054 – A Comprehensive Study of Field Permeability Using the Vacuum Permeator

Babcock, R.E., Edgar C. Clausen, Michael P. Popp
MBTC 2058 – Biodiesel Production from Varying Grades of Beef Tallow and Chicken Fat

Wang, Kelvin
MBTC 2065 – Automated Inventory and Analysis of Highway Assets

Hardee, John
MBTC 2076 – Physical and Chemical Characteristics of Superpave Binders Containing Air Blown Asphalt from Two Different Feedstocks

2004

Hardee, John R.
MBTC 2049 - A Study of Physical and Chemical Characteristics of Superpave Binders Containing Air Blown Asphalt

2003

Kutanoglu, Erhan, Michael H. Cole, Michael Bartolacci
MBTC 2012 - Modeling and Analysis of Transportation Flows Created by E-Commerce Transactions

Mason, Scott J. and Erhan Kutanoglu
MBTC 2023 - Impact of Wireless Data Systems on the Transportation Systems of the Future

Rossetti, Manuel D. and Terry Collins
MBTC 2015 - Online Benchmarking Database for Transportation Providers

Russell, Eugene R. and Margaret J. Rys
MBTC 2016 - Further Study of Roundabouts

2002

Kutanoglu, Erhan, G. Don Taylor
MBTC 2013 - Efficient Timing of Pickup and Delivery Assignment Decisions Through Simulation and Optimization

Physical Infrastructure Maintenance and Operations

2008

Patangia, Hirak C., John M. Faucett
MBTC 2064 - Assisted Night Vision for Motorists in Highway Construction Zones: Phase II

Wang, Kelvin C.P.
MBTC 2077 - Networked Sensor System for Automated Data Collection and Analysis

2007

Wang, Kelvin
MBTC 2008 – Automation of Pavement Surface Distress Survey Through Parallel Processing

Dennis, Norman, Richard M. Welcher, John H. Lawrence
MBTC 2027 – Investigation of the affect of Fines on Base Course Performance

2005
Patangia, Hirak C.
MBTC 2050 - Assisted Night Vision for Motorists in Highway Construction Zones

2004
Li, Guoqiang
MBTC 2033 - Repair of Damaged Concrete Structures Using Prepreg Composites

Russell, Eugene R.
MBTC 9206 - Update and Modification of the Kansas Low-Volume Roads Handbook and the Handbook of Traffic Engineering Practices for Small Cities

Tran, Nam and Kevin D. Hall
MBTC 2014 - Development of a Simplified Asphalt Concrete Stiffness/Fatigue Device

Wang, Kelvin C.P.
MBTC 9205 - Application and Advancement of the Next Generation Highway Data Vehicle

Fleet Operational Management

2008
McCann, Roy
MBTC 2084 - Development of an Intermodal Container Load Status and Security Monitoring System

2004
Mason, Scott J and, Erhan Kutanoglu
MBTC 2041 - Integrated Analysis of Transportation and Inventory In Intermodal Distribution Networks

2002
Nutter, Darin W. and C. Richard Cassady
MBTC 2017 - Determining Optimal Trailer Duty as a Function of Use and Age

2001
Kutanoglu, Erhan and G. Don Taylor
MBTC 2004 - Efficient Dispatching in a Terminal City Network

Nutter, Darin W., C. Richard Cassady, John R. English, Don Taylor and Chet Tuck Wong
MBTC 2005 - Quantifying the Impact of Refrigerated Unit Failures

Transportation Planning, Economics, and Institutional Issues

2008
Rossetti, Manuel D. and Heather Nachtmann
MBTC 2047 - WebShipCostGIS in Inter-modal Transportation

Gattis, J.L.
MBTC 2073 - Effects of Frontage Road Conversion

Hamilton, Gregory L.
2078 - Evaluation of Economic Impacts of NAFTA on the Transportation System/Sector of Selected Southern States

Goodwin, Harold, Kenneth B. Young
MBTC 7015 - Assessment of Multimodal Transport of Baled Poultry Litter and Dewatered Biosolids from Northwest Arkansas

2007
Goodwin, Harold
MBTC 1802 - Developing A Viable Poultry Litter Transport Option For The Ozarks

Nachtmann, Heather
MBTC 2082 – Ancillary Benefits of the Ouachita River Navigation System

Nachtmann, Heather, Edward A. Pohl, C. Richard Cassady
MBTC 2085 – Homeland Security for Rural Transportation Networks

2005
Asfahl, C. Ray
MBTC 2038 - Physical, Economic, and Political Feasibility for Trade of U.S. Grain for Russian Oil

Nachtmann, Heather and Manuel D. Rossetti
MBTC 2035 - WebShipCost – Quantifying Risk in Intermodal Transportation

2004
Rossetti, Manuel D. and Heather Nachtmann
MBTC 2024 - WebShipCost – Intermodal Transportation Linkage Cost Assessment Via the WWW

2003
Tooley, Melissa S.
MBTC 2022 - Development of a Strategic Plan for Statewide Deployment of Intelligent Transportation Systems in Arkansas

Tooley, Melissa S.
MBTC 2009 - Regional Mobility Plan: Development of Technical Scope of Services

2002
Anderson, Michael
MBTC 2020 - Design of a Mobility Information Management System (MIMS)

Nachtmann, Heather
MBTC 9208 - Economic Evaluation of the Impact of Waterways on the State of Arkansas – Phase II

2001
Russell, Eugene R., E. Dean Landman and Avijit Mukherjee
MBTC 2001 - Quick Response Community Planning

Behavioral Sciences and Human Performance

2008
McCann, Roy and Stephen Johnson
MBTC 2063 - Highway Collision Warning Technology: Determination of Criteria for Detecting and Logging Hazardous Events in Tractor-Trailer Safety and Training Programs

Russell, Eugene R. and Margaret Rys
MBTC 2079 - Study Drivers' Behavior at Passive Railroad-Highway Grade Crossings

Dissanayake, Sunanda
MBTC 2080 - Effectiveness of Seat Belts in Reducing Injuries

Click, Steven M.
MBTC 2093 - Improved Traffic Signal Efficiency in Rural Areas Through the Use of Variable Maximum Green Time

Eustace, Deogratias
MBTC 2100 - Evaluation of the Role of Driver's Knowledge of Who Has the Right-Of-Way Contributes to Interstate On-Ramp Crashes

2007
Gattis, J.L.
MBTC 2040 – Supplemental Signing for Stop Signs - Phase 2

Johnson, Steven L.
MBTC 2062 – Development of a Human Performance Simulation Model to Evaluate In-Vehicle Information and Control Systems in Commercial Trucking Operations

2006
Sabo, George and Lela Donat
MBTC 2044 - Cost Efficient Management Tools for Assessing Cultural Resources

2005
Johnson, Steven L.
MBTC 2048 - Total System Cost/Benefit Assessment of Heavy Truck-Automobile Speed Differentials on Rural Highways

2007
Gattis, J.L.
MBTC 2040 – Supplemental Signing for Stop Signs - Phase 2

Johnson, Steven L. and Chang Soo Nam
MBTC 2062 – Development of a Human Performance Simulation Model to Evaluate In-Vehicle Information and Control Systems in Commercial Trucking Operations

2006
Sabo, George and Lela Donat
MBTC 2044 - Cost Efficient Management Tools for Assessing Cultural Resources

2005
Johnson, Steven L.
MBTC 2048 - Total System Cost/Benefit Assessment of Heavy Truck-Automobile Speed Differentials on Rural Highways

Transportation Education and Technology Transfer

2008
Pohl, Edward A.
MBTC 2061 - Risk Modeling, Assessment and Management

2007
Griffith, Frances
MBTC 9202 – Supplemental Materials for use with Educational Videotapes

Williams, Rodney D. and Kevin D. Hall
MBTC 9204 – Development of a Construction Surveying Certification Course

2006
Rossetti, Manuel D.
MBTC 9209 - Training and Course Materials for Transportation Applications of GIS

2005
Dissanaykke, Sunanda
MBTC 2051- Identification of Countermeasures to Reduce Severity of Rural Highway Crashes

2004
Edwards, Findlay G. and Steven J. Burian
MBTC 9210 - Training and Course Materials of Stormwater Pollution Prevention

Gattis, James L.
MBTC 9211 - Video Tapes/DVD's: "Driving in Orange"

Hall, Kevin D.
MBTC 9201 - Development of Superpave Training Materials for Local Agencies

2001
Gattis, James L.
MBTC 9203-A - Video Tapes/DVD's: "Lane Closures"

Gattis, James L.
MBTC 9203-B - Video Tapes/DVD's: "Pavement Markings"

Construction, Design, Processes, Structures, Materials

2008
Williams, Stacy
MBTC 2066 - Surface Friction Measurements of Fine-Graded Asphalt Mixtures

Williams, Stacy
MBTC 2075 - Non-Nuclear Methods for Density Measurements

Babcock, Robert E., Edgar C. Clausen and Michael Popp
MBTC 2092 - Yield Characteristics of Biodiesel Produced from Chicken Fat-Tall Oil Blended Feedstocks

2007
Williams, Stacy and Kevin D. Hall
MBTC 2030 – Development of 4.75 MM Superpave Mixes by

2006
Dennis, Norman D.
MBTC 2032 - Development of Testing Protocol and Correlations for Resilient Modulus of Subgrade Soils

2005
Edwards, Findlay G.
MBTC 2018 - Environmental Technology Verification Report of the Low-Cost Stormwater BMP Study

Edwards, Findlay G. and Steven J. Burian
MBTC 2031 - GIS-Based BMP Planning Tool for Stormwater Quality Management

Hardee, John R.
MBTC 2049 - Physical and Chemical Characteristics of Superpave™ Binders Containing Air Blown Asphalt

Patangia, Hirak C.
MBTC 2050 - Assisted Night Vision for Motorists in Highway Construction Zones: Phase I

Rys, Margaret J. and Eugene R. Russell
MBTC 2039 - Life Cycle Economic Comparison of Common Sign Post Materials and Types

2004
Babcock, Robert
MBTC 2052 - Comparative Esterification of Agricultural Oils for Biodiesel Blending

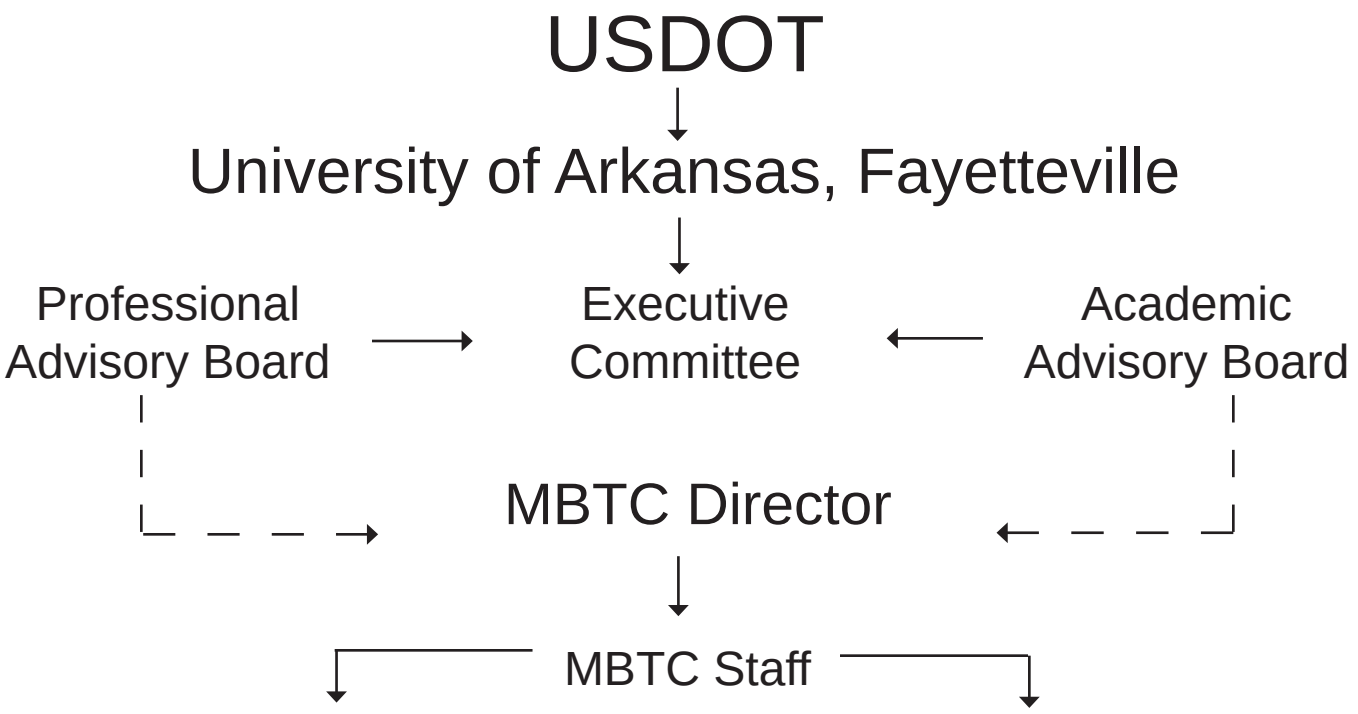
Edwards, Findlay G.
MBTC 2018 - Stormwater Pollution Prevention Best management Practices for Transportation Facilities

2003
Gattis, James L.
MBTC 2019 - Designing Horizontal Curves for Low-Speed Environments

Hall, Kevin D.
MBTC 2014 - Development of Simplified Asphalt Concrete Stiffness/Fatigue Testing Device

Tooley, Melissa S. and James L. Gattis
MBTC 2025 - Evaluation of Automated Work Zone Information Systems

Organizational Chart



Participating Universities

Auburn University

Henderson State University

Kansas State University

Louisiana State University

Tennessee Tech University

University of Alabama - Tuscaloosa

University of Alabama - Huntsville

University of Arkansas – Fayetteville

University of Arkansas - Little Rock

University of Dayton

University of Missouri - Rolla

University of Oklahoma - Norman

University of Tennessee

University of West Virginia

Center for Training Transportation Professionals (CTTP)

Participating University of Arkansas Fayetteville Colleges

College of Education and Health Professions

College of Engineering

Dale Bumpers College of Agriculture, Food, and Life Sciences

J. William Fulbright College of Arts and Sciences

Sam M. Walton College of Business

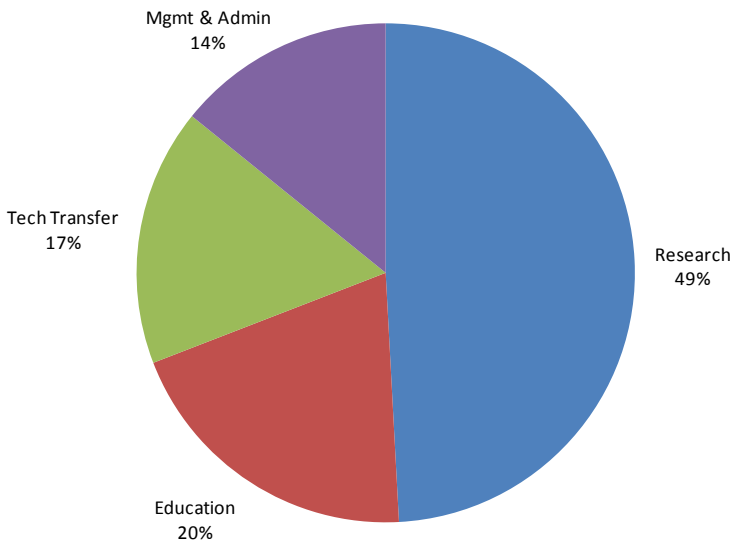
The School of Architecture

Financial Report

Grant Year: July 1, 2007 - June 30, 2008

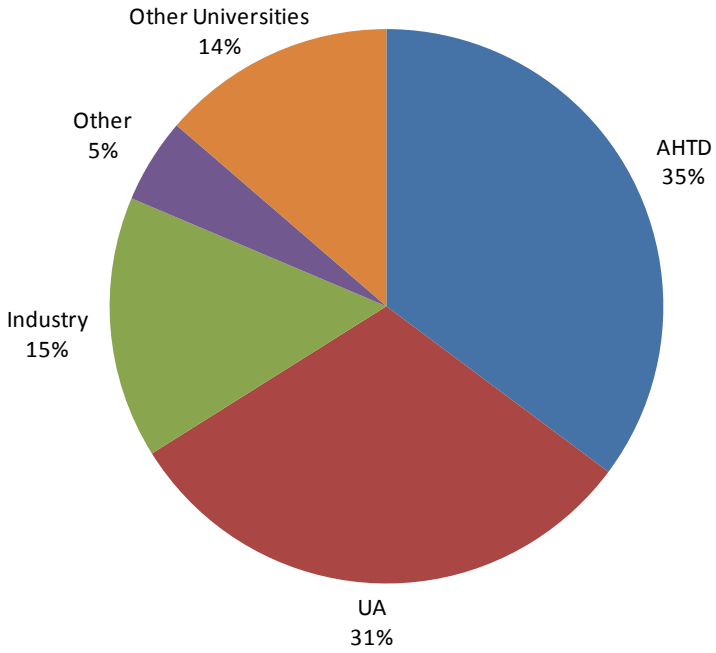
Federal Share - $ 741,410.67
Matching Share - $1,264,687.82
Total - $2,006,098.49

MBTC Expenditure Distribution
July 2007 - June 2008



*36.7% of Management and Administrative Expenditures come from Match Sources

MBTC Match Source Expenditures
July 2007 - June 2008



This year's cover of the MBTC Annual Report is a bridge located over the East Fork White Oak Bayou in North Little Rock. To locate our cover shot, Dana Ledbetter looked through many pictures on the web, personal photos, stock photos and many other locations. She found the perfect subject but did not know if the bridge would still be standing. Above is a snapshot from Google™ Earth that was used to validate the bridge was still in working order as well as find her way to its location.

University of Arkansas
COLLEGE OF ENGINEERING
...serving rural America
MACK-BLACKWELL
Rural Transportation Center

This was a local that posed while Dana was photographing the bridge.

Professional Advisory Board

Tom Dames, Ph.D., P.E.
RADM (Ret.)
Senior Vice President (Ret.)
Transportation Business Group
CH2M Hill

Pat Drennon, P.E.
RADM (Ret.)
Senior Vice President
Parsons Brinckerhoff

Dan Flowers, P.E.
Director
Arkansas Highway and Transportation Department

Keith Garrison
Executive Director
Arkansas Waterways Commission

Randy Hathaway, Ph.D., P.E.
Chief, Engineering and Construction Division
U.S. Army Corps of Engineers

Michael (Mike) R. Johnson, P.E.
RADM,CEC, USN (Ret.)
Associate Vice Chancellor for Facilities
University of Arkansas

Wesley Kemp
Vice President
ABF Freight System, Inc.

Lane Kidd
President
Arkansas Trucking Association

Steve Mitchell
Director of Fleet Operations
Tyson Transportation

Sandy Otto, P.E.
Division Administrator
U.S. Department of Transportation
Federal Highway Administration

Paul Revis, P.E.
Executive Director
Ouachita River Valley Association

Michael J. Right
Vice President - Public Affairs
American Automobile Association

Barbara Sisson
Assistant Chief of Staff for Installation Management
United States Army

Mark Westmoreland
State Program Manager
Federal Motor Carrier Safety Administration

Gary Whicker
Senior Vice President for Engineering Services
J.B. Hunt Transport

Mack Blackwell Rural Transportation Center
4190 Bell Engineering Center
Fayetteville, Arkansas 72701
Phone: 479-575-6026
Fax: 479-575-7168

www.mackblackwell.org