

# TranSearch

## DELAWARE CENTER FOR TRANSPORTATION

Your main resource for transportation education, research & technology transfer

Winter 2009

Vol. 9, No. 1



Department of Civil and  
Environmental Engineering  
University of Delaware  
355 DuPont Hall  
Newark, DE 19716

Phone: 302/831-1446

FAX: 302/831-0674

Web Site:

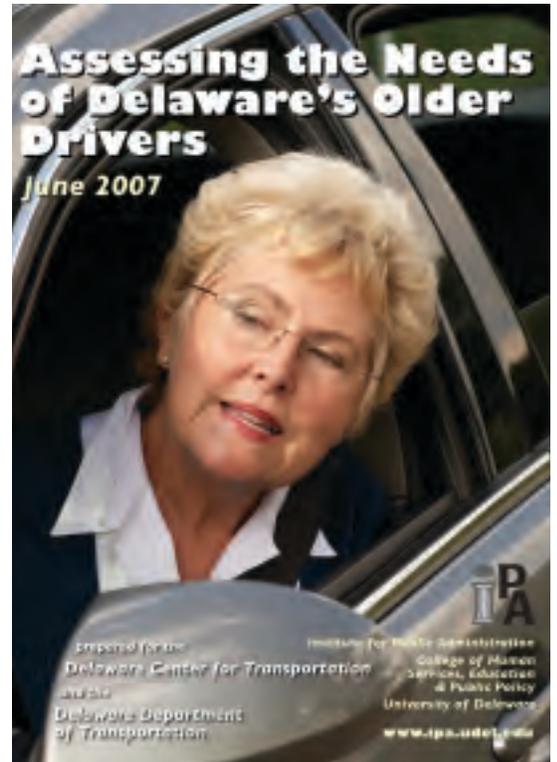
<http://www.ce.udel.edu/dct>

## DCT & IPA RECEIVE \$50,000 GRANT FROM THE ROADWAY SAFETY FOUNDATION TO IMPLEMENT RESEARCH ON OLDER DRIVERS

The Delaware Center for Transportation (DCT) and the Institute for Public Administration (IPA) will share a \$50,000 technical assistance grant from the Roadway Safety Foundation (RSF). The grant is one of six awarded by the foundation as part of its *Safer Roads: Building Safety into Your Drive* public information and education campaign.

The DCT-IPA will conduct a campaign to educate local officials and the public about the importance of roadway modifications to make roads safer for older drivers. The RSF will provide staff time, technical assistance, and materials in support of the grant.

The DCT conducts an annual transportation research program funded by the Delaware General Assembly and administered by the Delaware Department of Transportation (DelDOT). Under the 2007 program, the IPA conducted research on "Assessing the Needs of Delaware's Older Drivers." The IPA  
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## MESSAGE FROM THE DIRECTOR



With the national and state elections behind us, the DCT staff welcomes president-elect Obama and governor-elect Markel and looks forward to working with their respective secretaries

of transportation. Perhaps never before in our history will these cabinet positions play a more direct and important role in the decision making processes affecting the issues of the state and the nation. Transportation will have an impact in developing potential solutions to the current economic crisis and rising unemployment, as well as America's long term competitiveness in the global markets. Congestion, the environment, price and availability of fossil-based fuels, energy independence, plus infrastructure safety and security are all issues involving transportation. Never before has the phrase "Transportation is the lifeline of a nation's economy" made more sense.

Without a solid and reliable transportation infrastructure network, current problems will inevitably get worse. Fortunately, during his campaign and news conferences that he has held so far, president-elect Obama has emphasized the importance of giving high priority to rebuilding and maintaining the transportation infrastructure. Historically, the Transportation Research Board, a unit of the National Research Council, has been a key organization in providing research that not only helps to find new and innovative solutions to transportation problems, but also aids in formulating policies offered by decision makers. Research, innovation, education, and technology transfer will continue to be extremely important components of transportation in the future. It is naive to believe that in the 21st century we can achieve a safe and efficient transportation system without high quality research to find new and improved ways of conducting business and to educate the future workforce. DCT has had an excellent track record for providing quality research, education and technology transfer at the state as well as national levels. We continue to strive to adjust and improve our services to be responsive to the needs of the state, the region, and the nation. It is our hope that our new state and national government officials will continue to take advantage of the services that we offer and use the expertise within our center. No doubt the next few years will bring many new challenges. The DCT staff is willing, ready and capable of facing those challenges and look forward to maintaining and even expanding our operations should the need arise.

*Continued from cover*

gathered and analyzed data for traffic crashes involving older drivers throughout the entire state. Specific "problem areas" were identified based on the frequency of these crashes, traffic volumes, and current and projected percentage of residents age 60 and over. The IPA then developed recommendations for reducing older driver crashes by improving intersection designs; upgrading traffic signs, pavement markings, and signals; and conducting education and awareness programs.

The RSA grant will focus on the public information and education. Planned activities include a television broadcast on Wilmington station WHYH, meetings with older drivers at senior citizen centers, and the production and distribution of several types of marketing materials. These programs will take place during the first half of 2009.

The DCT/IPA effort will include other groups in Delaware concerned with older driver issues such as DelDOT,

the Office of Highway Safety, the Federal Highway Administration, AAA, and AARP.

The five other organizations awarded grants by the RSF are the Departments of Transportation in South Carolina, Utah, and Michigan; Cook County in Minnesota; and the Tribal Technical Assistance Program at the Michigan Technological University. Grants range in size from \$15,000 to \$75,000.

Grant contacts for the University of Delaware are Bernard Dworsky of the IPA and Lawrence Klepner of the DCT.

The Road Safety Foundation is dedicated to reducing deaths by improving the physical characteristics of America's roadways – design and engineering, operating conditions, removal of roadside hazards, and the effective use of safety features. It supports media campaigns and outreach activities nationwide. For more information, visit [www.roadwaysafety.org](http://www.roadwaysafety.org).

## UPDATE ON THE UD FUEL CELL BUS PROGRAM

Ajay Prasad

Professor, Department of Mechanical Engineering

Director, UD Fuel Cell Bus Program

Director, Center for Fuel Cell Research

Imagine driving a hydrogen-powered vehicle all over Delaware and being able to refuel at multiple locations! This vision will soon become a reality, thanks to the activities of the UD Fuel Cell Bus Program. We have recently obtained funding to not only expand our fleet of fuel cell buses, but also to develop a network of hydrogen refueling stations in Delaware.

The first bus (Phase 1) of this fleet has been in operation since April 2007, and transports students daily from the Laird Campus to their classes and back. The bus refuels at the hydrogen refueling station installed by Air Liquide at their Delaware Research and Technology Center in Newark. The second bus (Phase 2), which is an improved version of the Phase 1 bus with a dual fuel cell stack and advanced, lightweight Li-Titanate batteries, is due for delivery in early 2009. A larger, 30-ft Phase 3 bus is in the design stage and will be delivered in late 2009. It will also employ a dual fuel cell stack and advanced Li-Titanate batteries. Finally, a Phase 4 vehicle, which will incorporate lessons learned from Phase 3, will be added to the fleet in 2010. In order to support

demonstration events and fleet operations in all parts of the state, two new hydrogen refueling stations will be constructed in Dover and Wilmington, to add to the one already existing in Newark. These new stations will be constructed for the bus program by Air Liquide in coordination with Delaware Transit Corporation.

With its fleet of fuel cell buses and network of hydrogen refueling stations, Delaware can rightly claim to be a national leader in clean and efficient transportation technology!



Interior image of the UD fuel cell bus.

## NEW EMPLOYEES JOIN DCT

The Delaware Center for Transportation welcomed two new employees this summer: Matheu Carter, the new T<sup>2</sup> Engineer and Ellen Pletz, Assistant to the Director.

Matt, a licensed professional engineer in Delaware, Maryland, Pennsylvania, New York, New Jersey, and Georgia, joined the staff on August 11<sup>th</sup>. He succeeded Alan Kercher who was a part-time consultant to the T<sup>2</sup> Center since 1992. This new position for DCT, supported by DeDOT and FHWA, will cover a multitude of issues such as asset management, safety, utility control, drainage, pavement preservation and others.



"I'm excited about the T<sup>2</sup> Engineer position, particularly its focus on assisting towns that lack full time engineering staff. I hope I'll be able to bring helpful approaches to municipal transportation and safety issues as a result of my rather diverse background in construction, design, and local government," Matt said. "My new colleagues here at the University of Delaware and at DeDOT and FHWA have made me feel welcome and I look forward to some great new professional relationships." Matt is a civil engineering graduate of George Washington University and has held positions in both the

public and private sectors with experience spanning design, construction, regulatory oversight, litigation support, plus business and public administration. With this he brings a wealth of information to provide technical assistance and training to DeDOT and municipalities throughout the state.

As noted in our last issue, Ellen Pletz assumed the position of Assistant to the Director on July 21<sup>st</sup> following Wanda Taylor's retirement at the end of June. Ellen graduated



from the University of New Hampshire and has worked at the University of Delaware in various capacities for the past eighteen years, most recently in the Research Office as a contract and grant administrator. In that position she was responsible for handling proposal submissions, award setup, and award monitoring. Her current placement will involve

grant responsibilities as well as overall assistance with Center administration.

"I am very pleased to have the opportunity to work with Dr. Faghri, Larry Klepner and the entire DCT faculty again" she said. "I'm hopeful my grant experience will make a worthwhile contribution to the continued success of the Center."

## DELDOT HOSTS ANNUAL STUDENT TOUR

Members of the Institute of Transportation Engineers Student Chapter and other civil engineering students toured DelDOT's administration center on December 5, 2008. Several DelDOT engineers and planners briefed the students on current projects and the procedures DelDOT uses to plan, design, build, and maintain the state's transportation network. Speakers included Ralph Reeb and his staff, Barry Benton, and Jim Satterfield.

The tour also included a visit to two active construction projects in the Dover area. The first was South Governors Avenue where DelDOT is replacing an old, structurally deficient bridge across the Punchon Run. Later, the students traveled to the junction of Delaware Routes 1 and 9 at the south end of the Dover Air Force Base where DelDOT has recently begun a grade separated interchange. This project will improve the movement of military cargoes into and out of the base. It will also improve safety and traffic flow along one of the major routes to Delaware's beaches.

DelDOT and the DCT have scheduled the annual tour for several years. It gives the students a glimpse into the workings of a busy, multi-modal transportation agency, and it highlights DelDOT as an employer of first choice after graduation.



*University of Delaware students get a look at work being done on the Governor's Avenue Bridge site.*

## UD PROF LEADS EFFORT TO MONITOR INDIAN RIVER INLET

Jack Puleo, Assistant Professor of Civil and Environmental Engineering, is leading a DelDOT-funded project to conduct scour monitoring of the Indian River Inlet in Sussex County, Delaware. Scour occurs when sediment, including sand and mud, is washed away from the bottom of a body of water. It can have serious effects on bridges when the bridge supports rest in or near scoured areas.

Construction on a new bridge over the Indian River Inlet is slated to begin in 2009. The new structure will be a cable-stayed bridge with all of its piers out of the water, eliminating the scour concerns of the existing span. In the meantime, DelDOT has installed monitoring equipment on the existing bridge, and the agency conducts regular safety checks of the span and its support structure.

The University team, including civil engineering graduate student Jesse Hayden, is interested not only in providing DelDOT with data about how rapidly the bottom is changing and whether the bridge is moving, but also in gaining a fundamental understanding of nearshore bathymetric processes.

"We know that over time, the depth of the inlet has changed," Puleo says. "Its typical depth is about 40 feet, but there are scour holes exceeding 100 feet. We're developing and installing tools now that will enable us to monitor the area continuously and in near-real time."

These include custom-made 3D acoustic profilers to locate the bottom of the inlet and acoustic Doppler current profilers to

measure currents. Computers control data acquisition from the sensors, and, once the network connections are in place, the data will be available to the UD team on campus, almost 100 miles from the inlet.

Puleo explains that data collected by the Army Corps of Engineers every few years with high-resolution imaging equipment has shown the progression of scour holes. "But," he says, "it's not clear whether the changes occurred gradually or all at once, possibly as the result of storms. The equipment we're installing now will enable us to see what happens on short time scales."

One of the new tools that Puleo will be using in this effort is a personal watercraft equipped with a real-time kinematic GPS, a tilt sensor, an acoustic altimeter to determine depth, a monitor, and a keypad with "hot keys" to control data acquisition. All sensors are connected to an onboard computer and powered by a marine cell battery located on the craft stern.

Purchased with matching funds from the University of Delaware, the little vessel, which looks like a jet ski on steroids, is actually a low-cost rapid-response survey system for shallow water environments. "If we know a big storm is coming," Puleo says, "we can get in there quickly, take measurements, get out, and then come back in after the storm has passed to measure the effects."

"DelDOT wants to know as much as they can about the bridge and the bottom so that they can make informed decisions," Puleo says. "For us, the project is producing data that will enable us to explore such questions as 'Why did the scour holes develop where they did?' and 'Why are they growing the way they are?'"

## IPA FORUM EXPLORES THE FEASIBILITY OF A REGIONAL BUS RAPID TRANSIT SYSTEM

The nation's transportation infrastructure is under stress. Roadways designed and constructed decades ago are congested, outdated, and strain to meet capacity needs. Metropolitan area growth trends are aggravating roadway conditions to the extent that many infrastructure projects, planned or underway, are unable to meet current or projected travel demand. This stress comes at a time when federal highway and state transportation trust funds are being stretched thin by a backlog of transportation infrastructure projects.

Travel and freight movement problems are tied to the related issues of traffic congestion, economic competitiveness, and air-quality problems. To address these mobility issues, many metropolitan areas are developing new transportation strategies consisting of a combination of policies, infrastructure improvements, and enhanced mass-transit options. Bus rapid transit (BRT) is one option that can help achieve a significant modal shift away from travel by car to more sustainable forms of transit. BRT attracts "choice riders," who normally commute by car. While characteristics of BRT systems vary, many feature high-speed travel, use of peak-period dedicated lanes, signal priority, fewer stops, off-board fare collection, on-board amenities such as Wi-Fi, and front and rear doors to speed passenger boarding. In addition, BRT offers advantages over light rail in terms of achieving lower capital costs, similar performance, quicker implementation, and ability for phased implementation.

Is a BRT a viable transportation option for the Mid-Atlantic region? A study by the Institute for Public Administration (IPA) at the University of Delaware is helping assess the feasibility of a regional BRT system as a viable, high-speed transportation mode that operates on an interstate, intrastate, and inter-jurisdictional basis. The study, funded



by the Delaware Center for Transportation (DCT), examines where BRT has been successfully deployed, costs of such systems, potential sources of funding, and needed factors for deployment. Regional demographic trends, commuter patterns, congested corridors, and transit use were analyzed, and a "portable transit-scoring methodology" was used to assess the appropriateness of future transit-service intensity/investment. IPA's project team consists of Project Manager and Policy Scientist Bernard Dworsky, Policy Scientist Edward O'Donnell, AICP, Associate Policy Scientist Marcia Scott, Policy Specialist William J. DeCoursey, and UD-UTC Graduate Fellow Todd Franzen.

On November 13, 2008, regional transportation stakeholders from Delaware, Maryland, Pennsylvania, and New Jersey were invited to a forum at Clayton Hall to provide input on the concept as described in a briefing paper prepared by IPA (see: [www.ipa.udel.edu/infrastructure/brt/BRTbriefing.pdf](http://www.ipa.udel.edu/infrastructure/brt/BRTbriefing.pdf)). Topics of discussion focused on the need to obtain multi-jurisdictional support, establish a stakeholder-driven planning process, ascertain availability of future federal funding, leverage and maximize funding resources, develop strategic partnerships, and identify potential pilot route(s). If the concept has support, next steps may be to establish a steering committee and seek funding for future phases of planning.

## ITE STUDENT CHAPTER

The student chapter of the Institute of Transportation Engineers (ITE) had their first meeting of the fall semester on October 16<sup>th</sup>. The chapter is led by President Beatrice Arreola and assisted by Chapter Advisors Kathryn Peacock and Chentell Derrickson of McCormick Taylor, Adam Weiser of RKK Engineers and Faculty Advisor Rusty Lee. New chapter officers were elected – Blair Jones as Vice President; James Kelly as Treasurer; and David Specht as Secretary. Twenty undergraduate and graduate students were in attendance. Kathryn Peacock provided the new members with an overview of the ITE plans for the fall semester, including the possibility of a speaker from DelDOT at a future meeting. The annual tour of Delaware DOT is planned for December 5<sup>th</sup>. Spring semester activities include a tour of another transportation-related facility. Suggestions for future activities included a behind-the-scenes tour at the Philadelphia Airport, the Port of Wilmington or possibly the Joint Traffic Operations Center in New York City.

## DCT HOSTS DISTINGUISHED SPEAKER MICHAEL GALLIS

Michael Gallis of Michael Gallis & Associates in Charlotte, North Carolina, encouraged those attending the distinguished speaker's lecture on October 31 to look at transportation issues not as isolated dots on a map, but an interweaving network which spans the globe. This network encompasses not only the movement of goods and people, but also the interplay of economics, the environment and social systems.

Gallis is widely considered the country's leading expert in large-scale metropolitan regional development strategies. He has pioneered a specialty in building frameworks through which public, private and institutional leaders can work effectively to create globally competitive regions. Through these frameworks, Gallis has mobilized leaders across the country to understand and develop new ways of responding to the challenges and opportunities of states and regions in the 21<sup>st</sup> century. His talk on October 31 held in the Trabant University Center asked the audience 'How will the United States remain a competitive region?' His answer, 'By understanding the patterns of urbanization and the environment plus planning proactively, North America can position itself to prosper in the global economy.'

Our country's transportation system is in crisis, defined by four C's: condition, capacity, configuration, and constraints. The roads and bridges built in the 1960's are now deteriorating with capacity no longer able to keep pace with the burgeoning population. The configurations, or patterns, currently in place are inefficient with constraints in many

of the large urban areas. These problems, if not addressed, will lead to the U.S. becoming a smaller part of the global economy. The trading blocks of Asia and Europe are on the rise. If the U.S. is to remain competitive, the country must develop a plan.

"We are the only major trading block which does not have a strategy in the global age," said Gallis. "Demand on the transportation system will not be driven by population; it will be driven by economic factors and economic change."

With the world economy valued at \$54.3 trillion in 2007, populations around the globe are consuming resources at an unprecedented rate in our history. The effects we are seeing with the development of new transportation systems are depletion, fragmentation, pollution, erosion, and extinction. The global ecosystem's ability to regenerate itself is declining. So how will these trends be reversed? The answers lie in planning: move from a project-driven strategy to one which takes into account the network of economic, environmental, political and social systems; shift from being reactive to being proactive; and finally, develop new strategic partnerships with a vision beyond national borders.

Mr. Gallis holds a bachelor's degree in architecture from the University of California, Berkley and two master's degrees earned at the University of Pennsylvania, one in architecture and one in city planning. He was an associate professor of architecture and planning at the University of North Carolina at Charlotte from 1974 to 1997.

Gallis ended his lecture by fielding questions from UD graduate students, faculty, plus visitors from the Delaware Department of Transportation and the Environmental Protection Agency. He reminded all to think globally while working locally.



## ACADEMIC CORNER

The following lists recent publications, presentations and citations by DCT faculty and staff:

**M. T. Shourijeh, Khaled Hamad, Ardeshir Faghri and Rusty Lee**, "Utilizing the Hilbert-Huang Transform for Near-Term Travel Time Prediction," *Computer-Aided Civil and Infrastructure Engineering*.

**Reza Taromi, S.A. Zargari, Ardeshir Faghri and Rusty Lee**, "Optimizing Configuration of Urban Streets Using Genetic Algorithms," *7th International Conference on Computing, Communications & Control Technologies: CCCT 2009*.

**Sepideh Eshragh, S.A. Zargari, Ardeshir Faghri and Rusty Lee**, "Urban Bus Transit Network Modeling Using Ant Algorithms," *7th International Conference on Computing, Communications & Control Technologies: CCCT 2009*.

**Michael DuRoss, Reza Taromi, Ardeshir Faghri and Scott Thompson-Graves**, "Spatial Allocation Effects of Forecast Land Uses on Statewide Mobile Source Emissions," *2009 Transportation/Land Use Planning and Air Quality Conference*.

**Rusty Lee, J. Mitchell and W. Wallace**, "Network Flow Approaches for Analyzing and Managing Disruptions to Interdependent Infrastructure Systems," *Wiley Handbook of Science and Technology for Homeland Security* (J. G. Voeller, Ed.) John Wiley & Sons, Inc, Hoboken, NJ. (Pending).

**David Capparuccini, Ardeshir Faghri, Abishai Polus and Robert Suarez**, "Fluctuation and Seasonality of Hourly Traffic and Accuracy of Design Hourly Volume Estimates," *Transportation Research Board*, No. 2049, 63-70, 2008.

**Ardeshir Faghri, Rusty Lee, and Reza Taromi**, "Application of Integrated GPS/GIS Technologies to Intelligent Transportation Systems and Data Collection for Freeway Operations," *The Second International Symposium on Freeway and Tollway Operations*, 2008.

## SPRING SEMESTER COURSES OFFERED

**Civil and Environmental Engineering, UD Transportation Program**

### CIEG 453/653 Roadway Geometric Design

3 Credits (Including 2 Design Credits)

Excellent Course for Seniors, Graduate Students, and Professionals in Civil and Environmental Engineering

Tuesdays 6:00 – 9:00 PM (February 9 – May 20, 2009)

**Instructor:** Raymond Harbeson, P.E., RK&K Consulting Engineers, Dover, Delaware

**COURSE DESCRIPTION:** CIEG 453/653 teaches the basic fundamentals of highway and street design. Students are introduced to highway location studies, the highway design process, geometric design concepts and controls, the development of vertical and horizontal alignments, the design of cross section features and the principles of intersection design. The text for this course is AASHTO's "A Policy on Geometric Design of Highways and Streets," 2004 5<sup>th</sup> edition, also known as the "Green Book". Other sources are used to provide an introduction to the process known as "Context Sensitive Design". The course focuses on the application of theories and basic principles developed in undergraduate engineering courses. Students are introduced to "Microstation" computer aided drafting software and are required to produce two individual projects during

**Mizusawa Daisuke and Sue McNeil**, "Asset Management Benefit - Assessment Strategic Directions in Transportation," *VDM Verlag, Mueller e.K., Saarbrücken, Germany, September 2008*.

**Shannon N. Zenk, JoEllen Wilbur, Edward Wang, Judith McDevitt, April Oh, Richard Block, Sue McNeil, and Nina Savar**, "Neighborhood Environment and Adherence to a Walking Intervention in African American Women," *Health Education and Behavior*, 2008. <http://heb.sagepub.com/cgi/rapidpdf/1090198108321249v1>.

**Kristen Sanford Bernhardt and Sue McNeil**, "Agent-Based Modeling: An Approach for Improving Infrastructure Management," *Journal of Infrastructure Systems, Volume 14, Issue 3, pp. 253-261, September 2008*.

**Sue McNeil and Henry Quarantelli**, "Past, Present and Future: Building an Interdisciplinary Disaster Research Center on a Half-Century of Social Science Disaster Research," *Conference on Risk, Crisis and Public Management, Nanjing, China, September, 2008*. (Keynote)

**Sue McNeil**, "Resiliency of Transportation Corridors: Connecting Transportation Planning, Infrastructure Renewal and Disaster Research," *Institute for Transport and Communications (SIKA), Mid Sweden University, November 2008*.

**Sue McNeil**, "Past, Present and Future: Building an Interdisciplinary Disaster Research Center on a Half-Century of Social Science Disaster Research," *Crisis and Risk in a Heterogeneous Society (KRIHS), Mid Sweden University*

**Sue McNeil with Joanne Nigg**, "DRC – Past, Present and Future: Building an Interdisciplinary Center on a Half-Century of Social Science Disaster Research," *Center for Biosecurity of UPMC, July 2008*.

**Sue McNeil**, "Integrating Mitigation Decisions into Asset Management Systems," *Panel of the Role of Engineering Science in Mitigating Large-Scale Hazards, Hazards Workshop, Boulder, CO, July 2008*

the semester to demonstrate their understanding of basic concepts. Prerequisites for this course are CIEG 126, Introduction to Surveying and CAD and CIEG 351, Transportation Engineering.

### CIEG 454/654 Urban Transportation Planning

3 Credits (Including 1 Design Credit)

Excellent Course for Juniors, Seniors, Graduate Students, and Professionals in Civil & Environmental Engineering, & Urban Affairs Mondays 6:15 – 9:00 PM (February 9 – May 20, 2009)

**Instructor:** Michael A. DuRoss, Transportation Planning Supervisor, Delaware Department of Transportation (DelDOT)

**COURSE DESCRIPTION:** The course presents the fundamental theories, concepts, and technical tools used in regional and statewide transportation planning. The course is for students interested in transportation engineering, transportation planning, and urban planning. The course conveys working knowledge of historical trends, data sources, analysis and evaluation methods, and emphasizes presentation formats commonly used in the examination of transportation planning studies. Course topics include: recent Federal planning regulations; congestion reduction; transit, bike and pedestrian projects; analysis of performance measures including cost-benefit analyses; and review of air quality conformity. Students are encouraged to discuss various "tradeoffs" among various stakeholders, agencies and study teams that are often involved in the project identification, analysis, evaluation, and selection processes.

# Research

Following are the projects approved by the DCT Policy Council for our FY'09 Annual Research Program starting on July 1, 2008:

## *Long-Term Performance Monitoring of a Recycled Tire Embankment in Wilmington, Delaware*

This is a continuation of a one-year project requiring additional data analysis. This project will determine the environmental and engineering properties that should be monitored during the construction of shredded tire embankments including instrumentation, installation, monitoring and an analysis plan. The project will investigate what instruments are needed and how to construct plus monitor them. Delaware summer temperatures will be taken into account.

Principal Investigators: Nii Attoh-Okine, Paul Imhoff, Victor Kaliakin and Chris Meehan, Department of Civil and Environmental Engineering

Project Manager: Jim Pappas, Materials and Research

## *Infrastructure Security and Emergency Preparedness*

Delaware is in need of an emergency notification plan. This project will evaluate the ripple effect of evacuating, the need to monitor bridges and tunnels, a plan for rapid construction of roads and bridges, and gas supply during emergencies to prevent vehicles from stalling during evacuation. Additionally, security issues will be investigated if there is a bottleneck for travel along I-95 from Washington to New York.

Principal Investigator: Sue McNeil, Department of Civil and Environmental Engineering

Project Manager: Dwayne Day, Transportation Management Center

## *Testing and Operation of Delaware's First "Smart Bridge" - continuation*

Funding for this project will support diagnostic tests, analysis and interpretation of data from Bridge 1-821 located on Interstate 495 in New Cast County. Additionally guidelines for maintenance of the SB system and integration of new sensor systems will be developed.

Principal Investigator: Tripp Shenton, Department of Civil and Environmental Engineering

Project Manager: Jiten Soneji, Bridge Design

## *Integrating Transportation/ Transit Planning in the Overall*

## *Planning Process*

Since DelDOT is responsible for so many roads in Delaware, there is a need for transportation/transit planning to be proactive rather than reactive. Possible elements of the proposed project may include:

- Creating patterns of future land development that support transit-ready communities
- Using Local Area Plans as a vehicle for ensuring connectivity, mobility-friendly design, transit-ready components, and layout of subdivision and roads that are conducive to mobility, walkability, and all modes of transit.
- Addressing MOU's in the planning process: standardization of MOU's and development of additional MOU's regarding implementation and maintenance.

Principal Investigator: Ed O'Donnell, Institute of Public Administration

Project Manager: Cathy Smith, Delaware Transit Corporation

## *Optimizing Accessible Taxi Service to Augment Traditional Public Transit Services in Delaware*

Is taxi service an option for the disabled or people who do not drive? Is taxi service cheaper than paratransit? This project will explore a possible expansion of accessible taxi-based transportation initiatives, to augment traditional public transit services, particularly in Kent and Sussex Counties, and expand mobility options for Delawareans at the most efficient cost.

Principal Investigator: Doug Tuttle, Institute of Public Administration

Project Manager: Cathy Smith, Delaware Transit Corporation

## *Roundabouts*

The objective of this project is to determine how successfully roundabouts will perform in Delaware. This will be done by carrying out field observations (and software analysis) of the existing roundabouts to make assessments on geometric design parameters, driver/bicyclist behavior in and approaching roundabouts, and pedestrian issues.

Principal Investigator: Stephen Mensah, Department of Civil and Environmental Engineering

Project Manager: Dan LaCombe, Division of Planning

## *Safe Routes to Schools for Children – Mode Share Data Analysis*

The consequences of children not walking or biking to school include environmental impacts, increased traffic in the vicinity of schools, increased rates of obesity in children

# Resiliency of Transportation Corridors

*published by the UD University Transportation Center*

Winter 2009

University Transportation Center

Department of Civil & Environmental Engineering

University of Delaware

355 DuPont Hall  
Newark DE, 19716



UTC Director and Managing Editor:  
Sue McNeil

Copywriter and Technical Editor:  
Diane Kukich

Layout and Design: UD Publications Office

Printing: UD Graphic Communications

## Director's Message



Happy New Year! As another calendar year begins, at the University of Delaware we are in the middle of the academic year. This is always a good time to

reflect on the fall semester and think about the activities we have planned for winter session and spring semester.

The fall semester marked the beginning of the University of Delaware University Transportation Center's (UD UTC) second year of operation and our first year with all components of our program running. Over the summer undergraduates Charlie Mitchell and Sarah Dalton worked on research (featured in the article "CE Undergrads Contribute to Emergency Planning"). This Fall we kicked off another round of projects, our first UDUTC Fellows began, the Urban Transportation Systems course was taught for the second time (with 26 students up from 18 in Fall 2007), we held two brown bag discussions and had two UDUTC/DCT Distinguished lectures. The brown bag discussions – "Regional Freight

Data for Delaware" and "Resiliency of Transportation Corridors – Before, After and During Disasters" – both focused on data and information and generated a lively discussion about data quality and applications. The Distinguished Lectures – "Globalization and Infrastructure Needs" by Michael Gallis, and "Transportation Mega Projects in New York; Behind the Scenes" by Robert Paaswell also generated considerable discussion. An article on Mr. Gallis' presentation appears in the DCT Connector. Mr. Gallis' presentation was followed by a "conversation" in which issues ranged from sustainability to the complex interactions between transportation and land use.

Over Winter session, again UDUTC is joining forces with the Delaware Center for Transportation (DCT) and we have a large group, including 26 students, attending the Transportation Research Board Annual Meeting from January 11 to 14 in Washington, DC. Papers and presentations by UD faculty, and current and recent students are highlighted in this newsletter. In addition Michelle Oswald (featured in the article "Civil engineering student wins national research poster contest") as UDUTC first Student of the Year will attend the Council of University Transportation Centers Awards Banquet on January 10.

Also over Winter session Melissa Stewart and Cory Castelluccio, both juniors in Civil

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and Environmental Engineering, will be working on undergraduate research. Melissa will be working with Nii Attoh Okine on developing a database of the literature on time-varying queues, and Cory will be working with Michelle Oswald and me on developing a case study to rate the sustainability of transportation corridors. Sarah Dalton will also continue to work on evacuation modeling as part of her Science and Engineering Scholars program.

This spring, we have slated another three brown bag discussions. If you have not had an opportunity to participate in one of these events, please try to make the time. The brown bags are intended to provide a forum for members of the transportation community to come together for an informal discussion focused around a current or recent project; the discussions to date have been lively and interesting, and also provide

an informal opportunity to get to know other transportation researchers. The dates and locations are listed on the UDUTC website <http://www.ce.udel.edu/UTC/News.html>.

Looking further into the future, UDUTC research projects will be part of the DCT Research Showcase in the late spring and our UDUTC is actively involved in planning the National UTC Conference “Transportation Infrastructure Preservation and Management: Developing a Problem-Driven Research Agenda” to be held in Washington DC in November 2009. We will also be planning other Distinguished Lectures. Look for email announcing the events or visit our website.

Throughout the year, the UTC Advisory Committee has continued to meet and provide guidance on criteria for selecting projects and fellowship recipients,

setting schedules, and managing the center. In March we had a site visit from Research and Innovative Technology Administration (RITA) University Transportation Centers Program administrators Amy Stearns and Lydia Mercado and Director Curtis Tompkins. The site visit provided an opportunity for us to sort through some of the nuances of the grant administration process and obtain some useful contacts.

In this newsletter, you will also see a list of the activities planned for the fall semester, including several brown-bag discussions focused on our ongoing research. We hope you will join us for some or all of these events and watch our website for updates on our activities.

**Sue McNeil**  
**Professor of Civil and Environmental Engineering**  
**University of Delaware**

## CE Undergrads Contribute to Emergency Planning

Although Delaware has never been hit directly by a hurricane or experienced the fallout from a nuclear accident, the state has plans in place to deal with such disasters. The challenge, according to undergraduate researchers Charlie Mitchell and Sarah Dalton, is dissemination. “We could have the best plan in the world based on the most up-to-date polices,” says Dalton, a junior civil engineering major, “but without public awareness, where are we?”

To provide the state with suggestions for improving development and dissemination of its disaster plans, Dalton and Mitchell, a senior who is also majoring in civil engineering, spent the summer reviewing current documents. Dalton investigated hurricane evacuation in Delaware, while Mitchell addressed emergency evacuation in Delaware and neighboring New Jersey for the Salem and Hope Creek nuclear power generators.



Dalton and Mitchell are both affiliated with the UD University Transportation Center (UDUTC) on resiliency of transportation corridors as well as with the University’s Disaster Research Center (DRC). Their work was carried out in conjunction with DRC’s Research Experiences for Undergraduates (REU) program, which is sponsored by the National Science Foundation.

The REU program, which was initiated at UD in 2005, has focused primarily on the social science aspects of disasters.

Through their nine-week immersion in the program, the two civil engineering students had the opportunity to learn a great deal from the participating sociology, psychology, and business students, while also raising awareness of the engineering perspective among their social science colleagues.

“This reflects the direction of disaster research,” says DRC and UDUTC Director Sue McNeil. “Problems in this area have to be addressed from an interdisciplinary point of view if effective plans are to be developed. We have to simultaneously

*Continued on page 3*



consider, for example, such issues as how people will react to an evacuation order and how road capacities will be affected by the ensuing evacuation. The best engineering approaches won't work if people aren't going to follow them."

What Dalton and Mitchell discovered in their work is that most people are not proactive in emergency preparedness and that a multi-pronged approach is needed for effective information dissemination. "For example, a siren system is used for nuclear accidents in Delaware," Mitchell says, "but evidence suggests that people in their houses with the windows shut might not even hear them." He also points out that information dissemination is largely Internet based, and many people, including tourists, lack access to computers."

The two undergraduates will document their findings in reports, which will be used in further research by McNeil and others on evacuation planning. Both

## Civil engineering student wins national research poster contest



Michelle Oswald, a graduate student in the Department of Civil and Environmental Engineering, won the student research competition at the 8th National Conference on Access Management. Held in Baltimore from July 13-16, 2008, the conference focused on sustainable solutions for transportation.

Oswald is affiliated with the University Transportation Center (UTC) on Resiliency of Transportation Corridors at UD and advised by UTC Director Sue McNeil. Her poster was based on her

derived a great deal of value from their summer research, including the process of doing literature reviews for their papers.

They also participated in all of the REU program activities, including trips to the site of the former World Trade Center in New York City, the Delaware Emergency Management Agency's operations center in Smyrna, Del., and the Natural Hazards Conference in Boulder, Colorado.

"We both want to go to grad school, so it was really good to get experience in proposal and paper writing," says Dalton, who will continue her work during the next academic year through UD's Science and Engineering Scholars Program.

"It was also great to work with the social science students," adds Mitchell. "It made me realize how important it is to consider end users when you do an engineering project."

master's thesis research, which focuses on using transportation corridors as a case study for rating the sustainability of transportation investments. Oswald is investigating the application of green building rating system techniques to transportation corridors in order to promote sustainable development.

"Currently, programs such as LEED [Leadership in Energy and Environmental Design] focus on design and construction of buildings and provide little documentation of the methodology behind the rating systems," Oswald says. "So I developed a universal methodology for creating green rating systems and then applied this methodology to develop a Sustainable Corridor Rating System, or SCRS."

"Michelle's work is very novel as it marries popular concepts of rating sustainability with a rigorous approach to developing the rating system," McNeil says. "She is also able to present her work in an interesting way. Receiving external acknowledgement of these contributions is wonderful."

A graduate of Lafayette College, Oswald completed her master's degree in fall 2008 and will begin work on a Ph.D. under McNeil's advisement next spring. She is interested in pursuing a career in academia.

## UDUTC's First Student of the Year

For the past 17 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. The 18th Annual Outstanding Student of the Year Awards ceremony is scheduled to take place as part of the Council of University Transportation Centers (CUTC) annual banquet on Saturday, January 10, 2009. Each student receives \$1,000 and the cost of attendance at TRB from his/her Center, plus a certificate from USDOT.

Michelle Oswald is the UDUTC Student of the Year. Selection of the UDUTC Student of the Year is based on an essay, the technical merit of the student's research, the student's academic record, and the student's professionalism and leadership capabilities and activities. Evidence of research merit is based on faculty nomination and evaluation of submitted papers or reports. Assessment of academic performance is based on courses taken and grades attained. Evidence of professionalism and leadership can be in the form of presentations at professional society meetings and symposia as well as leadership in student professional activities and organizations. The selection was made by the UDUTC Advisory Committee.

Michelle recently completed her MS degree and will be continuing for a PhD. In her first year at UD she worked with Professors Ames and McNeil on a UDUTC project and currently holds a UDUTC Fellowship. McNeil says "Michelle exemplifies what I expect of the student of the year – committed, interested, motivated, hard-working and willing to share her knowledge."

In December 2008, Michelle was also awarded the Women's Transportation Seminar (WTS) Philadelphia Chapter-Sylvia Alston Graduate Scholarship.

# UDUTC Faculty and Students' Participation in the Transportation Research Board Annual Meeting (Washington DC, January 2009)

## Session 270

### Climate Change and Maritime Transportation

*Impacts of Speed Reductions on Vessel-Based*

*Emissions for International Shipping*

James J. Corbett, and Haifeng Wang (with James J.

Winebrake, Rochester Institute of Technology)

## Session 360

### Asset Management: The Next Generation

*Rating the Sustainability of Transportation*

*Investments: Corridors as a Case Study*

Michelle Oswald and Sue McNeil

## Session 437

### Moving Freight Through Global Change, Part 1:

#### Hunting for Carbon Reductions in Freight Systems

*Visualizing a Future Supply Chain with-*

*Lower-Carbon Goods Movement*

James J. Corbett (with James J. Winebrake, Rochester Institute of Technology)

## Poster Session 604

### Planning for Pedestrians

*Simulating Relaxed Pedestrian Behavior*

Michael Markowski and Ardeshir Faghri

## Session 619

### Sustainability Issues in Pavement and Asset

#### Management

*Integrating Environmental Perspectives into*

*Pavement Management: Adding PaLATE to*

*the Decision-Making Toolbox*

Rachel Nathman, HNTB Corporation (formerly UD)

and Sue McNeil (with Thomas John Van Dam, Applied Pavement Technology, Inc.)

## Session 647 Quantifying the Benefits of Geosynthetics in Highway Applications

*Experimental Evaluation of Influence Factors*

*for Single-Geocell-Reinforced Sand*

Dov Leshchinsky (with Sanat Kumar Pokharel, Jie

Han, and Robert L. Parsons, University of Kansas,

and Izhar Halahmi, PRS Mediterranean Ltd., Israel)

## Steel Bridges Committee

*Destructive Testing And Finite Element*

*Analysis To Determine The Ultimate Capacity*

*Of Skewed Steel I-girder Bridges*

Andrew J Bechtel, Jennifer Righman McConnell and

Michael Chajes, University of Delaware

## Upcoming Events and Opportunities

### Brown bags for Spring 2009

- ◆ **2/21/09** - Susan Barton, Jules Bruck, Anne Lucey, *"Public Perception and Attitudes about Roadside Vegetation: Pre- and Post-Environmental Education"*  
233 Townsend Hall
- ◆ **3/24/09** - Bob Warren *"The Planning and Policy-Making Infrastructure for Transportation in the Northeast Corridor"*  
Location TBD
- ◆ **4/22/09** - Ed O'Donnell, Troy Mix, Geoff Edwards, *"Developing Delaware's Agenda in Transportation within the Northeast Corridor"*  
Location TBD

### Deadlines

#### 3/1/09 - Summer undergraduate research applications

<http://www.ce.udel.edu/UTC/Undergraduate.htm>

#### 2/15/09 - Research Proposals

<http://www.ce.udel.edu/UTC/Research.html>

3/1/09 - **Graduate Fellowships** - <http://www.ce.udel.edu/UTC/Opportunities.html>

## Contact Us

Want to learn more about the UTC?

See our website: <http://www.ce.udel.edu/UTC/index.html>

Want to be notified by email when UDUTC is sponsoring transportation related events?

Want to be notified about UDUTC funding opportunities or graduate fellowships? To be added to the email distribution list, send an email to Marikka Beach ([marikka@udel.edu](mailto:marikka@udel.edu)).

and other associated health problems, and often a decrease in the social health of communities. The purpose of this project is to provide mode share data for a sampling of elementary school students for the Delaware SRTS program. Federal funding is now available specifically for SRTS initiatives, the need for data on transportation modes of K-8 grade children to and from school is more urgent. Having baseline data and trend analysis for Delaware would enable comparison and evaluation of the progress and success of the program once data is collected after projects and local programs have been implemented.

Principal Investigator: William DeCoursey, Institute of Public Administration

Project Manager: Sara Coakley, Division of Planning

***A Meta-Analysis of Studies, Projects and Practices on Planning for a Sustainable Environment with Special Emphasis on the States of Vermont and Delaware – Phase II***

This is a continuation of last year's project.

Principal Investigator: Chandra Aleong, Delaware State University

Project Manager: Ralph Reeb, Division of Planning

***Investigation of Intelligent Compaction Technology: Phase 2 – A Field Study***

Successful adoption of intelligent compaction technology requires careful demonstration and validation with local soils. There is a need to calibrate this technology for local soils in Delaware, a need to demonstrate the utility of this technology to local contractors to ensure that is successfully adopted, and a need to show DelDOT the improvements in compaction monitoring and construction quality that can result when this technology is used.

Principal Investigator: Chris Meehan, Department of Civil and Environmental Engineering

Project Manager: Jim Pappas, Materials and Research

***Advancing Asset Management in DelDOT***

Asset management is about the best way to use limited resources. The concepts are based on performance measures and goals and focus on both the long and short term goals of the organization. Asset management provides an opportunity to respond proactively to land use changes, growing demands, aging infrastructure, and safety and security challenges. Many asset management activities are ongoing, however, there is a need to link these various activities, begin to fill the gaps in data and procedures, and explore new tools to support the integration of existing tools

to decision-making tools.

Principal Investigator: Sue McNeil, Department of Civil and Environmental Engineering

Project Manager: Curt Cole, Maintenance and Operations

***The Current Active Research Projects Include:***

As each project is completed, an abstract will be available on the DCT website: <http://www.ce.udel.edu/dct>.

***Estimating Vehicle-Miles-Traveled by Vehicle Class for the State of Delaware***

The initial stage of the project will involve a thorough literature search and review of documentation related to the existing body of knowledge and practices. A statistically accurate method for functional conversion of the raw vehicle registration and travel data will be developed to identify the contribution of each vehicle type to VMT. This project will convert Division of Motor Vehicle (DMV) reported registration data from percent registration by vehicle type to actual mileage accumulation rates as they contribute to VMT through-out the state. Project output will be a statistically reliable automated process for converting available DMV registration information to an accurate on-road mileage based contribution by vehicle type, acceptable to both USEPA and FHWA as part of the transportation conformity air quality analysis process.

Principal Investigators: Young-Doo Wang and John Byrne Center for Energy and Environmental Policy

Project Manager: Mark Glaze, Division of Planning

***An Examination and Presentation of Travel in Sussex County***

Sussex County needs to be the focus of a comprehensive compilation and presentation of available travel and demographic data including origins and destinations, projections and their impacts, trip purpose, employment, seasonal variation, and trip generation. Available population projections also need to be examined in terms of future impact to areas in Sussex County. The Delaware Transportation Monitoring System, the National Travel Survey, and the Census 2000 CTPP are among practically untapped data sources. These together with Travel Demand Forecasting outputs, traffic studies, and traffic counts could provide a vital resource for planning and understanding for the public. Methods for dissemination of travel demand and traffic count information need to be developed.

Principal Investigator: David Racca, Center for Applied Demography and Survey Research

Project Manager: Mike DuRoss, Division of Planning

### *Bridge Management Using In-Service Data (Phase II)*

Effective bridge management can aid in determining resource allocation and help a DOT in cost-effectively maintaining its inventory of bridges. The current methods used have inherent limitations: the use of as-built conditions and design capacities yields ratings that may be overly conservative, while full-scale load tests yield accurate data but are costly and require closure to traffic. The researchers used an in-house-developed In-Service Bridge Monitoring System (ISBMS) to collect data that was then used to develop a load rating for the bridges studied. Using two weeks of data collected during biannual inspections of bridges, a two-week rating for each bridge in the study was developed. This two-week rating was compared to the 50-year rating that is usually calculated for bridges based on design capacities. The study showed that the two-week rating factors are, for the most part, between three and eight times greater than the 50-year rating factor. It is believed that the projected two-year rating from this data would lead to an increased rating factor in bridges. Additional work is needed to incorporate peak gauge data into the data collected by the ISBMS, enabling better prediction of the load rating stress. It would also be valuable to compare weigh-in motion (WIM) data to the stresses seen during a certain time period to help identify the average weight of trucks crossing the bridge and correlate the truck weights to the stress in the bridge. The proposed project would be a continuation of the work done in the initial bridge management project, with the focus some of these as-yet unaddressed issues.

Principal Investigators: Michael Chajes and Harry Shenton, Department of Civil and Environmental Engineering

Project Manager: Jiten Soneji, Bridge Design

### *Establishment of a Geotechnical Information Database*

DelDOT has subsurface investigation test results and Pile Driving Analyzer test results for foundation studies located throughout the state. Currently this information is located on paper, tape, and disks. It needs to be converted to a standard format that can be easily accessed with current technology and easily converted to future storage technology.

Principal Investigator: Chris Meehan, Department of Civil and Environmental Engineering

Project Manager: Jim Pappas, Materials and Research

### *Pavement Performance Models*

DelDOT collects Pavement Condition data from all the

pavements in their network, and uses this data to develop Annual Paving Programs that address the roads requiring work for each year. This condition data, collected over several years, could be analyzed to predict future condition, predict when maintenance should be applied, and predict the end of a pavement's useful life. Combined with data from initial construction quality records and maintenance activity records, one could develop performance prediction models for similar pavements in the DelDOT network. With these models, DelDOT could better anticipate future needs of each pavement, and could better target the appropriate rehabilitation techniques to pavements at the opportune time.

Principal Investigators: Sue McNeil and Nii Attoh-Okine, Department of Civil and Environmental Engineering

Project Manager: Jennifer Pinkerton, Materials and Research

### *A Feasibility Study of Bus Rapid Transit (BRT) in Delaware*

The State of Delaware like most states in the Mid-Atlantic region is experiencing increasing volumes of traffic and traffic congestion. Delaware is also experiencing an increasing proportion of its aging population (60+) and as a coastal state, an increasing influx of retirees seeking residence in the state. These changes in demographics and traffic volumes will produce greater demands and needs for transportation services and programs. They also suggest the need to explore alternative means to meet the anticipated transportation demands.

Principal Investigator: Bernie Dworsky, Institute of Public Administration

Project Manager: Cathy Smith, Delaware Transit Corporation

### *Construction of Approach MSE Walls to IRIB: Reduction of Geotechnical Field Data*

There were several sections along the north and south embankment where settlement plates, inclinometers, and piezometers were installed. This instrumentation served as construction monitoring assuring that there is no impending failure. However, no real reduction of data was made. Such reduction can provide DelDOT with accurate soil properties in that area as well as feedback regarding the design calculations. Reduction of data can be carried out in the framework of MS thesis and will require funding for a graduate student for 2 years.

Principal Investigators: Dov Leshchinsky and Chris Meehan, Department of Civil and Environmental Engineering

Project Manager: Doug Robb, Bridge Design

**Letting Scenic and Historic Roads in Delaware Tell Their Story**

A web-based manual to facilitate the identification, designation and management of scenic and historic highways

Principal Investigator: David Ames, Center for Historical Architecture and Design

Project Manager: Maria Andaya, Roadside Environment

**Enhancing Delaware's Highways: A Natural Vegetation Project**

The project will investigate vegetation models conceived to restore Delaware's roadside landscapes to a more natural state reflecting the regional flora.

Principal Investigator: Sue Barton, Department of Plant and Soil Sciences

Project Manager: Chip Rosan, Roadside Environment

**WILMAPCO – Performance of Work in Support of Task #MPO 9.04.01 Entitled Data Collection, Cecil County Roadway Travel Time Runs**

This ongoing project uses the state-of-the-art equipment in receiving satellite position information for collecting real-time traffic data. The data is then analyzed and displayed by Geographic Information Systems software.

Principal Investigator: Arde Faghri, Department of Civil and Environmental Engineering

Project Manager: Dan Blevins, WILMAPCO

**Fuel Cell Bus**

This project is a research effort to develop, build, and deploy a fuel cell powered hybrid transit vehicle, to be used on the UD Campus and within the state of Delaware. Fuel cell technology offers the potential to reduce our reliance on foreign oil supplies and to decrease the effects of harmful emissions on our environment. The project will focus on developing a fuel cell powered technology demonstration vehicle, establishing a refueling infrastructure, and conducting reliability, safety, and durability studies.

Principal Investigator: Ajay Prasad, Department of Mechanical Engineering

Project Manager: Sean Ricketson, FTA

**DOT UTC TIER II**

The research under this grant will address rail, surface, air, and water transportation, including complex issues such as air quality, safety, security and pollution.

Principal Investigator: Sue McNeil, Department of Civil and Environmental Engineering

Project Manager: Amy Stearns, RITA

**Near Real-Time Monitoring of Indian River Inlet Scour Hole Edge Evolution Seaward of the Bridge Piers: Phase I**

Funding for this project will be used to install a near real-time monitoring system that will image the sea bed adjacent to the bridge piers. In addition current meter data will yield critical forcing conditions that can be related to scour hole variability. The resulting data can be used to make informed management decisions and develop appropriate plans of action.

Principal Investigator: Jack Puleo, Center for Applied Coastal Research

Project Manager: Doug Robb, Bridge Design

**Delaware Travel Monitoring System**

This project will provide information to DelDOT for the Delaware Travel Monitoring System (DTMS). The goal of DTMS is to conduct a longitudinal, time-series based, multi-modal travel survey using a random sampling population of Delaware travelers. The DTMS data is used to develop and update trip generation and trip distribution elements of the travel demand model and provides general information on travel behaviors in Delaware.

Principal Investigator: Ed Ratledge, Center for Applied Demography and Survey

Project Manager: Mike DuRoss, Division of Planning

**T<sup>2</sup> CENTER UPCOMING EVENTS**

**January 27-29, 2009** Context Sensitive Design Workshop

**February 10-11, 2009** Inspection and Maintenance of Ancillary Highway Structures\*

**February 17, 2009** DelDOT Winter Workshop (open to local governments and consultants)

**April 7-9, 2009** Highways in the Coastal Environment\*

(Workshops marked \* are taught by the National Highway Institute)

Delaware T<sup>2</sup> Center workshops are generally free to public agency employees. Please visit our web site for complete workshop information including agendas, locations, electronic registration procedures, etc. Our web site address is <http://www.engr.udel.edu/outreach/t2/index.html>.

## WHAT OUR FORMER GRADUATE STUDENTS ARE DOING TODAY

The DCT graduate program at the University of Delaware provides the students with the skills that are essential for Transportation Engineering. The program allows the students to build strong foundations in the various fields of transportation engineering. Following graduation or the conclusion of their postdoctoral experience, they are well prepared in research, planning, communications, technical skills, and have been offered positions by top engineering firms around the country. We contacted five of our recent graduate students to see what they are doing today and how their studies may have helped with their current position.

**DAISUKE MIZUSAWA** was a visiting scholar and postdoctoral fellow in the department of Civil and Environmental Engineering from 2006 – 2008, working with Professor Sue McNeil. He earned his Ph.D. in Urban Planning and Policy at the University of Illinois at Chicago. He is currently employed as an Infrastructure Specialist with the Asian Development



Bank in Manila, Philippines. He takes part in rural road improvement projects and a maritime transport project in Solomon Islands in order to reduce poverty and strengthen economic growth. When asked about his research at the University of Delaware, he replied, “presentations provided by the department and discussion with my advisor and colleagues were valuable to develop my research,” and continued, “my research gave me abilities to take into account various aspects, not only engineering but policy and socioeconomic issues, which are very important factors to accomplish international development projects.”

**PRARTHANA BANERJI** (E.I.T.) received her Master’s in Civil Engineering in May 2007. She is currently employed as a Project Engineer in the Transportation Department with EBA Engineering Inc., in Baltimore, MD. Her job involves dealing with different aspects of Highway Geometry and Design using various software such as Microstation,



Inroads and autoCAD. She is also involved in hydrology/hydraulic studies, storm water management, drainage design, traffic engineering, and preparing cost estimates. When asked about her studies at the University of Delaware, she replied, “My experience as a graduate student in the Civil Engineering Department has been a very enriching one. The department as a whole has a very healthy and friendly environment encouraging everyone to excel and do their best. It prepares you very well for the world outside the University, giving you a very strong foundation on which you can build upon and excel overall as a person.”

**DAVID ADAMS** received his Master’s in Civil Engineering in January 2008. He is currently employed as a Senior Civil Engineer Supervisor with the Pennsylvania Department of Transportation – District 6-0 in King of Prussia, PA. He is the traffic signals supervisor covering Montgomery County, where his duties include warrant analyses, signal timing,



intersection design, system plans, ADA pedestrian facilities, and signal construction inspection. When asked about his studies at the University of Delaware, he replied, “The civil engineering program provided outstanding preparation for a transportation engineering career. The significant coursework in traffic engineering software programs prepared me for my current traffic signals position. Furthermore, the research work and mentorship from my advisor prepared me for a career in managing transportation infrastructure.”

**ALBERT Y. AYENU-PRAH, JR.** received his Ph.D. in Civil Engineering with a concentration in transportation infrastructure systems in December 2007. He is currently employed as a Geotechnical Engineer with Camp Dresser & McKee (CDM) in their New Orleans, Louisiana office. Responsibilities in his job include design of deep foundations, levee design,



and geotechnical aspects of transportation infrastructure, including design of road pavements. When asked about his studies at the University of Delaware, he replied, “Beyond equipping me with the tools I needed to carry out my job functions, studying in the Civil Engineering Department provided me with opportunities to develop solid presentation and communication skills from engineering

and scientific standpoints. In addition, my main research area of data and spectral analyses prepared me to be able to work with other areas of civil engineering outside of transportation engineering."

**RACHEL NATHMAN** received her M.C.E. in Civil/Transportation Engineering in May 2005. She is currently employed as an Airport Planner with HNTB Corporation, a multi-service civil engineering private consulting firm, in the Overland Park Aviation group. Rachel would describe her daily work as equivalent to working for seven astounding



individuals whose specialties lie in airport engineering, airport planning, airport management, and airport electrical systems. Her everyday experiences at work include nervousness, excitement, appreciation and amazement. She dreams of her future in airports and hopes to become an expert in this genre. When asked about her studies at the University of Delaware, she replied, "Among the many things my graduate work taught me, one that is unique among the education system, is the lesson on how to be comfortable around and to communicate with experts and senior level professionals on a one-to-one atmosphere through the advisor-graduate relationship and conference attendance. As a result of this unique lesson, I am now a member of more than one professional association, where I attend meetings and conferences, and am considering non-traditional continuing education programs for opportunity for exposure and growth."

## DCT GRADUATE STUDENTS

During the 2008-2009 academic year, the Delaware Center for Transportation's projects will support over 20 graduate students. The students are advised by Professors Ardeshir Faghri, Nii Attoh-Okine, Sue McNeil, Rusty Lee and Rachel Davidson. The students, who all share a common interest in transportation, come from Iran, China, Vietnam, Turkey, and Ghana, as well as the United States. To learn more about our graduate students' transportation interests, please visit our website: <http://www.ce.udel.edu/dct/personnel/students.htm>.



*DCT Graduate Students from left front row: Yi Lou, Sekine Rahimian, Jamshid Laghaei, 2<sup>nd</sup> row: Susan Brink, Leslie Mills, Michelle Oswald, Sepideh Eshragh, 3<sup>rd</sup> row: Sizheng Li, Chuoran Wang, Abdulkadir Ozden, Silvana Croope, Dung Ngo, Yaw Adu Gyamfi 4<sup>th</sup> row: Kel Hannum, Morteza Tabatabaie Shourijeh, Reza Taromi, Bob Suarez, Al-Sulaiman. Not shown: Mary Cate Opila and Roy Wang*

## TRUCKS ADDED TO DCT FLEET

DelDOT has generously loaned the DCT two pick-up trucks for student and faculty use on research projects. They are necessary to carry bulky equipment and to go off-road where autos may bog down. The trucks are a few years old, but they have been well maintained. The trucks are being used on two projects: (1) Long-term performance monitoring of recycled tire embankment, and (2) Near real-time monitoring of Indian River Inlet scour hole edge evolution seaward of the bridge piers. The DCT particularly appreciates the efforts of Mr. Curt Cole, DelDOT's Chief of Administration, for making the trucks available to us.



# Research Pays Off

## INSTRUMENTATION FOR MEASURING SCOUR AT BRIDGE PIERS AND ABUTMENTS

James D. Schall and Paul Davies

Scour is the erosion of waterway soils and sediment that provide support for bridge foundations. More bridge failures are due to scour than to all other factors combined. The resulting disruptions of river crossings represent a safety hazard for travelers and can have devastating impacts on local economies. Thus it is important for bridge owners to know the scour susceptibility of their bridges.

An ongoing scour evaluation program being conducted by the Federal Highway Administration and all state highway agencies has led to the identification of more than 17,000 scour-critical bridges and nearly 100,000 bridges with unknown foundations. An additional 86,000 bridges screened as scour-susceptible have not been evaluated. Given the limited time and funding available, the scour-critical bridges cannot be immediately repaired or replaced, nor can the scour-susceptible bridges be immediately evaluated, and the bridges with unknown foundations will require monitoring.

### Problem

Scour is the primary cause of bridge failure in the United States. Because scour holes generally fill in as stream flows diminish, postflood inspections are not adequate for fully determining the extent of scour damage. Methods for measuring the maximum scour depth are needed in the management of scour-susceptible bridges.

### Solution

Technically and economically feasible instruments for monitoring scour depth were developed under National Cooperative Highway Research Program Project 21-3, Instrumentation for Measuring Scour at Bridge Piers and Abutments. Two instrument systems—a low-cost sonic fathometer and a magnetic sliding collar device using a driven-rod support—were installed and tested in the field under a wide range of bridge substructure geometry, flow, and geomorphic conditions.

The low-cost sonar device (see Figure 1) consists of a simple fish-finder-type sonar connected to a data logger that tells the sonar when to turn on, how much data to collect, and when to turn off. The systems were installed successfully on riverine and tidal bridges by a state highway agency using in-house equipment and personnel.

The magnetic sliding collar device (see Figure 2) consists of a stainless steel pipe driven into the channel bottom with a sliding collar that drops down the pipe as the scour progresses. The location of the collar is detected by the

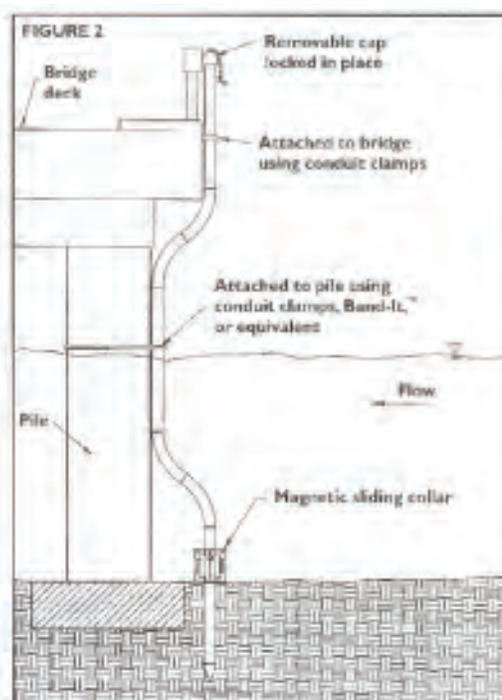
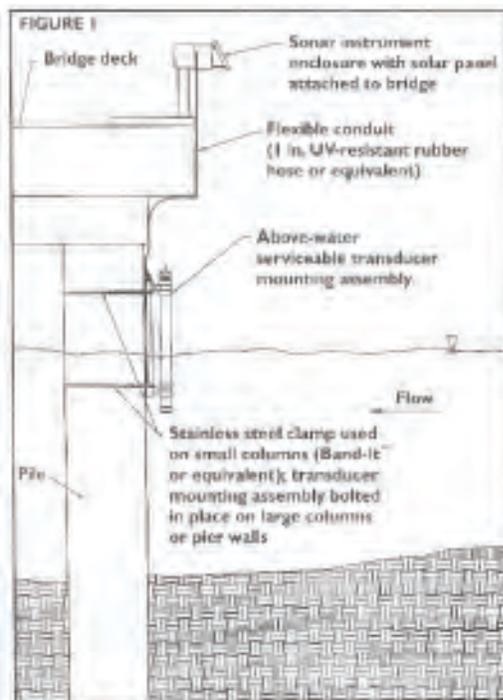


FIGURE 1  
Typical sonar  
monitor  
installation.

FIGURE 2  
Typical magnetic  
sliding collar  
monitor  
installation.

## NCHRP Report on Scour-Measurement Devices

NCHRP Report 396, *Instrumentation for Measuring Scour at Bridge Piers and Abutments*, documents all phases of the development work for the devices described in this article. Findings from laboratory and field testing are presented for each device, and a detailed discussion of the significance of these findings is presented. The companion manuals (NCHRP Report 397A, *Sonar Scour Monitor: Installation, Operation, and Fabrication Manual*; and NCHRP Report 397B, *Magnetic Sliding Collar Scour Monitor: Installation, Operation, and Fabrication Manual*), provide guidance for selecting the device most suitable for a bridge and its location. Detailed instructions, including fabrication of the monitors in most machine shops. Instructions for operation and maintenance are also given.

magnetic field created by magnets on the collar. Installations conducted in cooperation with state highway agencies demonstrated that this simple, low-cost instrument is adaptable to various field situations, and can be installed with the equipment and technical skills normally available at the district level of a state highway agency.

Another innovation, developed independently of the NCHRP project, is a float-out device. This device consists of a radio transmitter buried in the channel bed at a predetermined depth. When the scour reaches that depth, the float-out device rises to the surface and begins transmitting a radio signal that is detected by a receiver in an instrument shelter on the bridge. A conventional drill rig with a hollow stem auger is used to install the transmitter. After reaching the desired depth, the transmitter is dropped down the center of the auger.

## Application

In preparation for storm events driven by El Niño, a variety of instruments were installed at bridges in the southwestern United States in late 1997 and early 1998. Five bridges were instrumented in California, five in Arizona, and four in Nevada. The equipment included automated sliding collar, low-cost sonar, multichannel sonar, and float-out devices.

These installations provided an opportunity to test a number of new concepts, including two- and four-channel sonar devices, application of early warning concepts (through definition of threshold scour levels and automated calls to pagers when that threshold is exceeded), and development and refinement of the float-out instrument concept.

During the testing, the SR 101 bridge over the Salinas River near Soledad, California, experienced several scour events that triggered threshold warnings. In one case the automated sliding collar dropped 1.5 m (5 ft), causing a pager call-out. Portable sonar measurements confirmed the scour recorded by the sliding collar. Several days later, another pager call-out occurred from a float-out device buried about 4 m (13 ft) below the streambed. In both cases, the critical scour depth was about 6 m (20 ft) below the streambed, and no emergency action was needed to ensure public and bridge safety. Because pager call-out was ineffective in alerting maintenance personnel during nonoffice hours, a programmed voice synthesizer call-out to human-operated 24-hour communications centers was implemented at other bridges.

## Benefits

The instruments developed under this research and through additional commercial development have been tested extensively and are fully field-deployable. Use of these instruments for scour monitoring will provide state highway agencies with an essential element of their action plans for bridges that are scour-critical or scour-susceptible, or have an unknown foundation. Use of these devices will allow monitoring of scour-critical bridges so that solutions can be developed before the problem becomes severe. In some circumstances, this monitoring will be able to provide a long-term alternative countermeasure for scour.

*For further information contact Peter F. Lagasse, Ayres Associates, 3665 JFK Parkway, P.O. Box 270460, Building 2, Suite 300, Fort Collins, Colorado 80522 (telephone 970-223-5556).*

*EDITOR'S NOTE: Appreciation is expressed to David Beal, Transportation Research Board, for his efforts in developing this article.*

## CONTACT INFORMATION

Delaware Center for Transportation  
355 DuPont Hall  
University of Delaware  
Newark, DE 19716

Phone: 302-831-1446  
FAX: 302-831-0674  
Web site: <http://www.ce.udel.edu/dct>

### DCT Staff

Ardeshir Faghri, Director (e-mail: [faghri@udel.edu](mailto:faghri@udel.edu))  
Jerome Lewis, Associate Director (e-mail: [jlewis@udel.edu](mailto:jlewis@udel.edu))  
Ellen M. Pletz, Assistant to the Director (email: [ebourett@udel.edu](mailto:ebourett@udel.edu))  
Lawrence H. Klepner, T<sup>2</sup> Program Coordinator (e-mail: [lklepner@udel.edu](mailto:lklepner@udel.edu))  
Matheu Carter, Program Coordinator (e-mail: [matheu@udel.edu](mailto:matheu@udel.edu))  
Sue McNeil, Director, UTC (email: [smcneil@udel.edu](mailto:smcneil@udel.edu))  
Earl Rusty Lee, Coordinator of Advanced Traffic Operations (email: [elee@udel.edu](mailto:elee@udel.edu))  
Stephen Mensah, Postdoctoral Research Fellow (email: [samensah@udel.edu](mailto:samensah@udel.edu))  
Sandra Wolfe, Senior Secretary (e-mail: [sandiw@udel.edu](mailto:sandiw@udel.edu))

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Delaware Center for Transportation  
Department of Civil and Environmental Engineering  
University of Delaware  
355 DuPont Hall  
Newark DE, 19716

