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**Delaware Center
for Transportation**

**Department of Civil and
Environmental Engineering**

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Non-Destructive Testing Methods to Evaluate the Integrity of Concrete Bridge Decks

THOMAS SCHUMACHER, PHD, PE

If a bridge maintenance worker suspects there may be shallow delaminations on a concrete bridge deck, the options for determining the extent of the damage include dragging chains over the surface or 'sounding' with a hammer, both methods are employed to listen for a change of pitch. These give a rough and subjective estimate of the extent of the deterioration. Shallow delaminations are thin air voids oriented parallel to the concrete surface and typically caused by corrosion of the reinforcing steel due to water and chloride penetration. Thomas Schumacher and his research group are evaluating methods that are more quantitative and less subjective to evaluate the integrity of concrete bridge decks.

In a research project funded by the Delaware Department of Transportation, Dr. Schumacher and his team of graduate students have been exploring two methods to determine damage to concrete bridge decks that may have been caused as a result of water and chemicals penetrating the surface through micro-cracks and causing



corrosion of the reinforcing steel.

The first test method is called Impulse Response (IR): a specialized instrumented impact hammer is struck on the bridge deck and the response signals are measured by a sensor held to the concrete surface and stored on a computer. These low-frequency acoustic signals can give a good first overview of the extent of potential delaminations.

The second test method is called Ground Penetrating Radar (GPR): electromagnetic microwaves are sent through the bridge deck and are reflected back to the instrument by steel

reinforcing and shallow delaminations. This is used to confirm IR results and determine depths of the delaminations.

"Our idea is to combine two NDT methods with different strengths to get the best results. IR is easy and quick to apply and can give a good first estimate of where delaminations can be expected. By using a handheld GPR instrument we are able to estimate the depth of such delaminations and in addition show where the steel reinforcing bars are. By combining the two measurements we are trying to obtain a better estimate of the total volume of concrete that needs to be replaced in a repair job. This is important information for a Transportation Department and used to ensure a job can be executed within the planned budget."

Future work for this research group will be continued evaluation of these testing methods as well as other non-destructive methods in the laboratory and in the field. ■



Message from the Director



Ardeshir Faghri,
Director

On Friday, July 6, 2012, President Obama signed the surface transportation bill into law providing \$105 billion new dollars to fund federal highway, transit and safety programs until the end of fiscal year 2014. This transportation authorization bill finalizes a nearly three year effort to create a successor to the SAFETEA-LU program that expired in September 2009. Earlier, the Senate voted 74 to 19 and the House of Representatives passed the measure "Moving Ahead for Progress in the 21st Century (MAP-21)" with an overwhelmingly bipartisan vote of 373 to 52. This bill streamlines the environmental review process for the long term, gives more authority and flexibility to the states, and eliminates or consolidates programs that are duplicative or do not advance the national transportation priorities. The American Society of Civil Engineers (ASCE), which is a member of the Americans for Transportation Mobility (ATM), a coalition lead by the U.S. Chamber of Commerce, had drafted a letter that was delivered to the House and Senate. The Delaware Center for Transportation was a signatory to that letter. The letter basically asked the members of the congress to maintain, but ideally increase, the federal funding for roads, bridges, public transportation and safety investments, so that the nation "can sustain and create jobs and economic activity in the short-term, and improve America's export and travel infrastructure, offer

new economic growth opportunities, and make the nation more competitive over the long-term." Of course, my job as the director of a transportation research center is to make sure that government bills do contain enough funding for Research and Development purposes. I'm happy to report that the new bill also provides \$400 million for transportation research and authorizes 35 competitive grants to be provided annually for University Transportation Centers.

Perhaps never before in the history of mankind has transportation had such direct influence on many social elements including job creation and economy, environment, sustainability, safety, energy, and human health. Many of the research projects that the Delaware Center for Transportation conducts annually have increasingly contained those elements. The era of defining transportation planning and engineering as just planning and designing infrastructure for accommodating auto travel is nearly over. The transportation professionals of the 21st century will need knowledge in the following: how the transportation infrastructure affects the economy and jobs, how to evaluate the environmental impacts of their projects, how they are affecting and helping sustainability, the sources and infrastructure that provide the fuel and energy to the vehicles, and lastly, how their plans and designs affect human health. Of the ten new research projects for fiscal year 2013 that the Delaware Department of Transportation authorized the Delaware Center for Transportation to conduct, two involve environmental impact, two are related to improving public transit and two pertain to the concepts of Smart Growth and

Complete Communities. Smart Growth and Complete Communities are some contemporary transportation terms that are used to describe new transportation infrastructure that respects pedestrian and bicycle movements, provides efficient and safe accessibility to public transit and attempts to optimize the distance between major residential neighborhoods and commercial land-uses. Other areas that are gaining a lot of interest are Safe Routes to Schools to tackle the childhood obesity problem as well as research studying whether or not there is a direct correlation between transportation and many human health issues such as obesity, cardiovascular disease, pulmonary problems and even cancer.

These are exciting times to be involved in transportation. Other than providing the means to travel from an origin to a destination, the contemporary transportation planner and engineer touches so many other aspects of human life. As a transportation research organization, our projects reflect this fact. But it is also our job to integrate these new realities into the courses that are taught so that our students will be better prepared for future leadership positions. The new transportation bill that recently passed the congress and signed by the president will afford us the opportunity to implement many of these programs for at least the next two years.

As always, the Center has many useful and exciting programs scheduled for the next few months. Please check our web-site at www.ce.udel.edu/dct/ for all of our ongoing programs and contact me if you have any questions. ■

2012 Research Showcase

On Wednesday, May 9, 2012, the Delaware Center for Transportation (DCT) hosted the 9th Annual Transportation Research Showcase. It was held at the University of Delaware's Pardee Center in Dover, Delaware adjacent to the DelDOT administrative building. This year's showcase featured posters presented by the principal investigators and graduate students on current DCT projects. The poster displays focused on a number of areas: Environmental Issues, Pavement & Materials, Planning, Soils, Structures & Bridges, and Traffic & Intelligent Transportation Systems.

The showcase was well attended with representatives from various transportation agencies throughout the state and region that were able to meet and discuss ongoing projects in civil and environmental engineering, public administration and extension.

This year, the Center offered an extra special treat to their guests. A scoop of ice cream from the University's UDairy Creamery was served throughout the showcase. It was enjoyed by all who attended.



DelDOT Transportation Secretary Shalin Bhatt speaks with graduate students, Elisa Kropat, Mindy Laybourne and Rebecca Frey about their transit project.



Delaware Department of Transportation Secretary Shalin Bhatt (center) visits the Research Showcase. Pictured from left DCT graduate students, Chuoran Wang, Sepideh Eshragh, Shalin Bhatt, DCT Director, Arde Faghri, Ozden Abdulkadir and Yaw Adu-Gyamfi.



Mingxin Li, Postdoctoral Researcher

WELCOME DCT'S NEW POSTDOC

It is our pleasure to introduce you to Mingxin Li, who is the Center's newest employee. Dr. Li joined the Center as a postdoctoral researcher on February 1 after working in Iowa City, Iowa in software localization. His dissertation work combined his interests in dynamic traffic assignment, traffic demand analysis, traffic flow theory, and congestion pricing. He received his doctorate from the University of Utah in 2011.

Dr. Li has already immersed himself in Center activities: early in the summer he scheduled the training for the team of undergraduate students working on Dr. Faghri's GPS travel time and delay project. The training included using the GPS utility software, introducing the students to ArcGIS and its user interface, and practice runs in order to familiarize the students on the Delaware routes where the data is collected for DelDOT.

We are very fortunate to have Ming as a member of our staff.

Delaware MUTCD Update

BY: MATHEU J. CARTER, P.E.

The Federal Highway Administration (FHWA) has completed its rulemaking process on two fronts for the Manual on Uniform Traffic Control Devices (MUTCD) and issued Revision 1 (dealing with Engineering Judgment) and Revision 2 (dealing with compliance deadlines) to the Federal MUTCD. See Delaware T² Center's Spring 2012 newsletter for a summary of those changes if you haven't already (<http://www.ce.udel.edu/dct/T2Newsletter.html>).

Delaware T² Center's Rusty Lee and Matt Carter met recently with DelDOT Traffic's Don Weber and Mark Luszczyk to get their read on the MUTCD changes and how they would most significantly impact Delaware at both the state and municipal levels.

Revision 1 (Engineering Judgment) is not expected to impact Delaware significantly, since some interim changes by the Federal Highway Administration already provided some of the latitude that was necessary to deal with some of the "Catch 22s" that resulted from the absolute "shall" language of the 2009 MUTCD. It remains important, however, that any excursion from the "shall" and "shall-nots" of the MUTCD must be determined by an engineer under Delaware law and should be documented to protect

the agency. And, such excursions should be rare.

Revision 2 modified the compliance dates in Table I-2 on a large scale, eliminating many of them altogether. As we pointed out in the Spring 2012 T² Center newsletter, this is not the blessing it seems. While the absolute deadline may have been changed or deleted, the requirement has not and the civil liabilities remain. One of the most infamous topics centers on retroreflectivity – the revised compliance date is May 2014 for all agencies to implement and continue use of "an assessment or management method that is designed to maintain regulatory and warning signs retroreflectivity at or above the established minimum levels." Many agencies aren't sure which method(s) to employ and Mark Luszczyk pointed to a brand new synthesis on the topic – it is free for download by searching for "NCHRP Synthesis 431." The synthesis, "Practices to Manage Traffic Sign Retroreflectivity," surveyed 48 agencies to find out how they were addressing sign retroreflectivity requirements. Of interest, only two agencies have selected measured retroreflectivity as their primary method; many agencies selected expected sign life, followed by nighttime inspection, blanket replacement, and control signs.

While retroreflectivity remains a hot topic for all roadway agencies, DelDOT sees two other primary issues that will be challenges in Delaware. Horizontal curve signage required in Table 2C-5 (historically, these were optional) is largely a DelDOT issue but will require extensive study of thousands of horizontal



curves across the state and while the December 2019 date seems far away, the amount of work to be done in preparation assures that it is not. For municipalities, one of the new issues (other than some significant changes in urban sign sizes) is placement of One-Way signs (Section 2B-40), particularly at T-intersections, which may require relocations of these signs and the familiar struggle with flower beds, picket fences, and so on. ■

RECENT GRADUATES – WHERE ARE THEY NOW?

The transportation engineering specialty within the Civil and Environmental Engineering department at the University of Delaware prepares students for varied careers in traffic modeling, construction project management, highway and street design and urban transportation planning among others. So what becomes of our graduates following internships or defense of dissertations? Following is a list of some recent students:

Michelle Oswald	PhD degree earned in Spring, 2011	Assistant Professor in Civil & Environmental Engineering at Bucknell University
Robert McGurk	B.S. degree earned in Spring, 2011	Project engineer at DelDOT
Kate Smagala	B.S. degree earned in Spring, 2011	Design engineer at Pennoni Associates
Lauren Lobo	M.S. degree earned in Spring, 2012	Engineer at Parsons Brinckerhoff
Reza Taromi	PhD degree earned in Spring, 2011	Traffic and ITS Engineer at ARCADIS, Atlanta, Georgia
Amir Shahpar	M.S. degree earned Spring, 2011	Senior Transportation Engineer at AECOM in Washington, D.C.
Sean Humphrey	M.S. degree earned Spring, 2012	Transportation Engineer at RK&K in Baltimore, MD
Drew Pavlick	M.S. degree earned Spring, 2012	Transportation Engineer at NJ Transport Engineers in Montpelier, NJ

LoTrans™ 2012 – Free Virtual Conference in September

Technical conferences are an important part of keeping abreast of new requirements, developing trends, and innovative solutions in transportation. But, the travel costs and time commitment sometimes make them a gamble. What if the conference isn't all it was advertised? What if I'm only interested in some of the topics? What if I have a local meeting during the conference and can't leave town? What if my agency is under a travel ban?

Technology for virtual conferences has developed to the point where they may be a good solution to these worries. And the really good news – such a



virtual conference is coming September 18th-20th – and it's free. The American Road & Transportation Builders Association (ARTBA) is organizing the Local Transportation Asset Management Virtual Conference & Innovation Showcase (LoTrans™ 2012). Registration

is easy at <http://www.lotransvirtualconference.org/> and the conference program is centered on two primary tracks – asset management and work zone safety. Some of the topics you can virtually experience are shown in the table.

<i>Asset Management</i>	<i>Work Zone Safety</i>
<i>Tort Liability & Risk Management</i>	<i>Speed Management in Work Zones</i>
<i>Negotiating Successful Contracts with Architects and Engineering Firms</i>	<i>Motorcyclists & Bicyclists in the Work Zone</i>
<i>Maximizing Staff Time and Project Objectives</i>	<i>Preventing Runovers & Backovers</i>
<i>Local Public Agency Resources for Federal Aid Projects</i>	<i>Internal Traffic Control Plans</i>
<i>Crisis Communications</i>	<i>The Art of Conspicuity</i>
<i>Environmental Legal Issues</i>	<i>Best Contractor Safety Practices</i>
<i>Utility Relocation</i>	<i>Sign Management Strategies</i>

ARTBA promises to bring cutting edge, user-friendly digital technology to bear for LoTrans™ 2012 in a program that is relevant to local government transportation agencies. If you are expecting a low-tech series of webinars, ARTBA refers to this as “webinars on steroids!” The virtual conference center and exhibit hall comes right to your individual desktop or laptop without downloading any unusual software or trudging through a cumbersome registration. You can currently see a video on the

website that gives you a flavor of what the virtual experience will be like.

Take a look today at the LoTrans™ 2012 website. Chances are there is at least a topic or two that captures your interest and without the need to buy plane tickets and shuttle bus passes, book hotel rooms, pay for meals, leave your office, or even pay a registration fee, the risk of this conference being a dud is about as low as you can get.

LoTrans™ 2012 Charter Partners

ARTBA Transportation Officials Division

National Association of County Engineers

National Local Technical Assistance Program (LTAP)
Association

National Work Zone Safety Information Clearinghouse

PLEASE MARK YOUR CALENDARS!!!

DELAWARE TRANSPORTATION FORUM

Wednesday, November 13, 2013
Clayton Hall, University of Delaware

Sponsored by the
Delaware Center for Transportation
at the University of Delaware



Where all parties interested in transportation
come together for one day.

Government Agencies • Private Sector • Academia • Civic Groups • Individuals

We hope you can join us in this event to define the transportation-related
issues facing Delaware and the Mid-Atlantic Region.

Economy • Environment • Energy • Human Health • Sustainability • Planning & Design
and many more....

Additional information about this forum will be coming soon

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IPA Hosts Curbside Intercity Bus Transportation Policy Forum

by **Marcia Scott, IPA Associate Policy Scientist**

"Feds Shut Down 26 Discount Bus Companies," "Fatal Chinatown Bus Kills 15," "Bus-Safety Proposals have Languished for Years." In the last year, these sensational headlines have highlighted policy questions about the appropriate role of transportation regulation in light of the rapid growth of the curbside intercity bus industry.

To facilitate discussion on transportation policy issues related to the industry, the Institute for Public Administration (IPA) at the University of Delaware hosted a Curbside Intercity Bus Transportation Policy Forum at the Perkins Student Center on Wednesday, June 13, 2012.

The forum featured Frank Ross of the Federal Motor Carrier Safety Administration, who described federal strategies to ensure safe operations of intercity curbside buses. President and CEO of the American Bus Association (ABA) Peter Pantuso provided industry perspectives on the curbside bus industry and explained ABA's support for more effective bus safety regulation and particularly enforcement. A panel discussion featured representatives from the City of Philadelphia, New York City Department of Transportation (DOT), District of Columbia DOT, Union Station (D.C.) Redevelopment Corporation, and the Port Authority of New York and New Jersey, who discussed new solutions to managing intercity curbside bus operations. Participants engaged in a roundtable discussion on issues impacting the industry including the recent crackdown against unsafe and unethical operators, need for concurrency in federal rulemaking, competition among bus carriers and rail, and impacts of state and local government attempts to regulate and manage curbside operations.

IPA's research team that planned and facilitated the forum includes associate policy scientist Marcia Scott, UD University Transportation Center (UD-UTC) fellow Arthur Wicks, and public administration fellow Eileen Collins. In addition to hosting the policy forum, the team has conducted a literature review and field assessment of curbside operations that involved photographing curbside conditions, surveying passengers, and riding various intercity buses—including a so-called "Chinatown" bus that was cited as an "imminent hazard" and shutdown by the U.S.DOT.

IPA's research is supported by UD-UTC—whose theme is resiliency of transportation corridors.

The curbside intercity bus industry now represents the fastest growing mode of intercity transportation in the United States—outpacing air and rail transportation. About 720 million American travel by this mode,

yet the industry has been marred by "rogue" bus companies that put passengers at risk by operating unethically and unlawfully. Since March 2011, crashes of so-called "Chinatown" bus lines along the I-95 corridor have killed 22 and injured 169 people.



Curbside Intercity Bus Transportation Policy Forum



June 13, 2012

Perkins
Student
Center

University of
Delaware
Newark, Del.

www.ipa.udel.edu

serving the public good,
shaping tomorrow's leaders



Institute for Public Administration
School of Public Policy & Administration
College of Arts & Sciences



Research

Following are the projects funded for our FY12 Annual Research Program beginning on September 1, 2011 and ending August 31, 2012:

INTEGRATING ZERO-VALENT IRON AND BIOCHAR AMENDMENTS IN GREEN STORMWATER MANAGEMENT SYSTEMS FOR ENHANCED TREATMENT OF ROADWAY RUNOFF

This project will evaluate two technologies involving the addition of biochar and/or zero-valent iron to existing and new stormwater facilities which will reduce nutrients from DeIDOT stormwater discharges.

Principal Investigators

Dan Cha and Paul Imhoff, Department of Civil and Environmental Engineering

Project Manager

Marianne Walch, Maintenance and Operations

EFFECTIVE COUNTERMEASURES FOR CRASH REDUCTION AT UNSIGNALIZED INTERSECTIONS FOR TWO-LANE UNDIVIDED ROADWAYS

The goal of this research project is to improve the safety of motorists at unsignalized intersections on two-lane undivided roadways.

Principal Investigator

Arde Faghri, Department of Civil and Environmental Engineering

Project Manager

Adam Weiser, Traffic Division

DESIGN AND CONSTRUCTION OF A GEOSYNTHETIC REINFORCED SOIL (GRS) INTEGRATED BRIDGE SYSTEM (IBS) IN THE STATE OF DELAWARE

This demonstration project will provide the necessary technical expertise to the design, construction, and long-term inspection process that can be used to enhance implementation of this technology in Delaware.

Principal Investigator

Chris Meehan, Department of Civil and Environmental Engineering

Project Manager

Jason McCluskey, Bridge Design

DELAWARE SIGNAL TIMING ENHANCEMENT PARTNERSHIP (DSTEP) – CORRIDORS 3 & 4

The goals of the DSTEP project are to involve students in traffic engineering services for DeIDOT, to develop a continuous research program that addresses DeIDOT's needs while minimizing the use of DeIDOT's resources, and to maintain a high level of quality so that DeIDOT may apply the results to improve intersection operations across the state. This project will involve data collection and analysis on SR4 and SR273.

Principal Investigator:

Rusty Lee, Department of Civil and Environmental Engineering

Project Manager

Gene Donaldson, Transportation Management Center

DEVELOPMENT AND EVALUATION OF A RESIDENTIAL ALLOCATION MODEL USING TIME SERIES TAX PARCEL DATA, PART II

Continuation of FY11 project – a state-wide tax parcel based land use file is created to support transportation applications and travel demand forecasting in particular.

Principal Investigator

David Racca, Center for Applied Demography and Research

Project Manager

Mike DuRoss, Division of Planning

NON-DESTRUCTIVE TESTING METHODS TO EVALUATE THE INTEGRITY OF CONCRETE BRIDGE DECKS

This research project will evaluate non-destructive testing procedures to help assess the current condition and quantify the extent of deterioration of concrete bridge decks.

Principal Investigators

Thomas Schumacher and Dennis Mertz, Department of Civil and Environmental Engineering

Project Manager

Jim Pappas, Materials and Research

TRAVEL DEMAND MODELING SUPPORT FY12

Support for this project will assist DeIDOT with the development, maintenance, application and evaluation of a travel demand forecasting model. The model supports planning studies for Delaware's MPOs and various DeIDOT sections on an as-needed basis.

Principal Investigator:

Rusty Lee, Department of Civil and Environmental Engineering

Project Manager

Mike DuRoss, Division of Planning

2011-2012 GPS TRAVEL TIME AND DELAY DATA COLLECTION AND ANALYSIS

This project entails data collection during peak travel times on roadway segments throughout the state. Each segment will be traveled at least four times for maximum accuracy. Once data collection is completed, data will be transformed into the GIS database

and transported to the ARCGIS software.

Principal Investigator

Arde Faghri, Department of Civil and Environmental Engineering

Project Manager:

Mark Eastburn, Division of Planning

CROSS-FRAME FORCES IN SKEWED STEEL I-GIRDER BRIDGES, YEAR 2

This research will assess the ability of bridges in Delaware to withstand strikes by overheight trucks and also identify critical bridges that need immediate reinforcement to prevent catastrophic failure if hit by a truck.

Principal Investigator:

Jennifer McConnell, Department of Civil and Environmental Engineering

Project Manager:

Jim Pappas, Materials and Research

ITS LAB BASELINE SERVICE FY12

The objectives of this project is to establish the Delaware Center for Transportation ITS Lab as a state of the art facility with three main focus areas: 1) service to DeIDOT; 2) training for DeIDOT and support classroom instruction; and 3) research for faculty and students

Principal Investigator:

Rusty Lee, Department of Civil and Environmental Engineering

Project Manager:

Gene Donaldson, Transportation Management Center

BASELINE MONITORING AND TESTING OF THE INDIAN RIVER INLET BRIDGE (IRIB)

This project is phase 2 of the long-term structural health monitoring (SHM) system on the Indian River Inlet Bridge. These funds will be used to conduct various baseline tests, studies, and analyses to characterize the baseline performance of the bridge as a permanent record for the future. DeIDOT will be able to understand how the as-built bridge is functioning and

[Continued on next page]

through long-term monitoring, will be in a better position to efficiently and effectively manage this significant resource. (Ending 6/30/2014)

Principal Investigators:

Tripp Shenton and Michael Chajes, Department of Civil and Environmental Engineering and College of Engineering

Project Manager:

Barry Benton, Bridge Management

CONTINUING ACTIVE RESEARCH PROJECTS SPONSORED BY DELDOT

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

**STUDY AND CALCULATION OF
TRAVEL TIME RELIABILITY MEASURES**

Travel time reliability is a better way to assess system performance and it is important especially for shippers, freight carriers and public safety personnel as well as other users. (Ending 8/31/12)

Principal Investigator:

David Racca, Center for Applied Demography and Survey Research

Project Manager:

Gene Donaldson, Transportation Management Center

**NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM (NPDES) AND
NONPOINT SOURCE POLLUTION**

This project will help DelDOT and other permit holders meet the goal of educating the general public about pollution from runoff required by state laws. (Ending 8/31/12)

Principal Investigator:

Martha Narvaez, Institute for Public Administration

Project Manager:

Marianne Walch, Maintenance and Operations

**USE OF RECLAIMED ASPHALT
PAVEMENT (RAP) TO REDUCE
PAVEMENT THICKNESS**

The main objective of this project is to develop protocols and methods of using RAP filled geocell in full depth pavement thickness, through field studies. (Ending 8/31/12)

Principal Investigators:

Dov Leshchinsky and Nii Attoh-Okine, Department of Civil and Environmental Engineering

Project Manager:

Jim Pappas, Materials and Research

**NEAR REAL-TIME MONITORING OF
INDIAN RIVER INLET SCOUR HOLE
EDGE EVOLUTION SEAWARD OF THE
BRIDGE PIERS: PHASE II**

Bridge pier scour is a problem that occurs in riverine and tidal environments. Funding for this project will be used to install a monitoring system that will image the sea bed adjacent to the bridge piers. Additionally, current meter data will yield critical forcing conditions that can be related to scour hold variability. The resulting data can be used to make

informed management decisions and develop appropriate plans of action. (Ending 8/31/12)

Principal Investigator:

Jack Puleo, Center for Applied Coastal Research

Project Manager:

Doug Robb, Bridge Design

ITS LAB BASELINE SERVICE FY11

The objectives of this project are to establish the Delaware Center for Transportation ITS Lab as a state of the art facility with three main focus areas: 1) service to DelDOT; 2) training for DelDOT and support classroom instruction; and 3) research for faculty and students. (Ending 8/31/12)

Principal Investigator:

Rusty Lee, Department of Civil and Environmental Engineering

Project Manager:

Gene Donaldson, Transportation Management Center

**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. (Ending 6/30/12)

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

**DELAWARE SIGNAL TIMING
ENHANCEMENT PARTNERSHIP (DSTEP)**

The goals of the DSTEP project are to involve students in traffic engineering services for DelDOT, to develop a continuous research program that addresses DelDOT's needs while minimizing the use of DelDOT's resources, and to maintain a high level of quality so that DelDOT may apply the results to improve intersection operations across the state. This project will involve data collection and analysis on Cleveland Avenue and SR 72. (Ending 8/31/12)

Principal Investigator:

Rusty Lee, Department of Civil and Environmental Engineering

Project Manager:

Gene Donaldson, Transportation Management Center

**DEVELOPMENT OF SPECIFICATIONS
FOR THE USE OF CONTINUOUS
COMPACTION CONTROL SYSTEMS**

The objective of this research project is to develop specifications that can be used to guide the application of Continuous Compaction Control technology to DelDOT field construction projects. (Ending 8/31/12)

Principal Investigator:

Chris Meehan, Department of Civil and Environmental Engineering

Project Manager:

Jim Pappas, Materials and Research

UD Students Great Ambassadors at ASHE National Conference

BY: MATHEU J. CARTER, P.E.

The student chapter of the American Society of Highway Engineers (ASHE) have enjoyed great success in their first three plus years at the University of Delaware and they wanted to share the secrets of their success with others across the national organization, so ASHE First State Section, the Delaware Center for Transportation, and the Delaware T2 Center set about to make it happen. The result? All three organizations and the University couldn't have sent better ambassadors. During the three day conference at Seven Springs Resort (Champion, Pennsylvania), the students spoke to countless ASHE members and officers about the benefits of student chapters for the students, the sponsoring ASHE section, and the highway industry overall.

Ryan Barton (former President, Class of 2012) championed the effort and rallied his colleagues as they prepared for nearly three months. He was joined at the conference by Winter Wong (President, Class of 2013), Kelly Fearon (Treasurer, Class of 2014), Anthony Durante (former Treasurer, Class of 2012), Erin Collins (Class of 2012), and Matt Carter (Staff Advisor). They reached scores of ASHE members through two key avenues at the National Conference – they manned a booth in the main exhibit hall and they made a presentation at the Friday afternoon meeting of the Section Presidents, Secretaries, and Directors.

In the exhibit hall, they adorned their booth with materials that highlighted their three years of robust activities – visits to construction sites, fabrication shops, maintenance facilities, and operation centers; on-campus meetings where they invited a wide range of speakers from First State Section; and attendance at First State Section dinner meetings. These materials included tri-fold handouts and contact cards, a 3'x6' collage of photographs and quotes from students and First State Section members, a television that scrolled even more photographs and quotes, and a specially designed banner that highlighted the connection between ASHE and the University. Dressed in matching ASHE at UD polo shirts they bought for



Students from left: Erin Collins, Kelly Fearon, Winter Wong, Ryan Barton and Anthony Durante

the occasion, they drew a great deal of attention and seemingly everyone wanted to talk to them. And they talked back. They engaged group after group like trade show pros and clearly made an impression on many that they too should consider starting a student chapter in their own ASHE Section. The students showed boundless energy, not only in their own booth, but by visiting each of the thirty booths to learn about the exhibitors and talk more about their own experiences. Not many conference attendees escaped at least a few minutes with one or more of the students and they quickly became the buzz of the gathering.

On Friday afternoon, they made a formal presentation at the ASHE leadership meeting and succinctly related their perspective on what the student chapter has meant for them and as an introduction to the world of highway engineering in its many forms, what it has meant for First State Section, and what they view as the keys to its success and sustainability. Of course, by then many in the leadership had already had one-on-one conversations with students at the booth, in the hallways, at meals, in the technical sessions, and at the Thursday night hospitality suite.

Their enthusiasm was infectious and many ASHE members made the same remarks – their Sections have wanted to start a student chapter but they weren't sure how to get started or had run into barriers that they weren't sure how to overcome. The students

had answers and gave them freely. Moreover, they came prepared with contact cards to encourage members to follow up with them for advice and any other kind of help they could contribute. Many members left the discussions feeling they now had a better sense for how to overcome their barriers. Invitations were even extended for the UD students to visit other Sections and their target students.

In short, the students were great ambassadors for ASHE First State Section and the University of Delaware, highlighting how a great partnership could benefit all those involved. Their attendance at the National Conference wouldn't have been possible without the financial support of the Delaware Center for Transportation and the Delaware T2 Center, the significant legwork with National by First State Section's immediate past President, Sonia Marichic-Goudy, and the overall encouragement and support from several First State Section members, including Dick Prentice who also attended the conference. The message was clear – a successful student chapter like this is one of the most effective means of drawing highly energized engineering students with great leadership potential to the highway field. Kudos to the students and all the professionals who made this good will trip a great success! ■

¹ Matt Carter is the Advisor for ASHE at UD, a member of the ASHE First State Section Board of Directors and the Municipal Engineering Circuit Rider for the Delaware T2 Center.

Research Pays Off: Automated Speed Enforcement Slows Down Drivers in Work Zones

PRISCILLA TOBIAS

The author works for the Bureau of Safety, Illinois Department of Transportation, Springfield.

In 2009, the United States recorded 667 fatalities and more than 40,000 injuries in highway work zones—a rate of one fatality every 13 hours and one injury every 13 minutes. Crashes are more likely in work zones than on regular highways. Work zone safety must improve to achieve the national goal of zero deaths from traffic crashes.

PROBLEM

More than 7,000 crashes occur annually in highway work zones in Illinois, causing approximately 2,000 injuries. The number of work zone fatalities in the state reached a peak of 44, including 5 workers, in 2003. The percentage of work zone-related fatalities in Illinois is higher than the national average. Speeding is one of the most important contributors, affecting the frequency and severity of work zone crashes. Improving compliance with speed limits in work zones therefore is a pressing need.

SOLUTION

Because state resources are limited, novel approaches were needed to make the most from minimal investment. In 2004, Illinois passed the Automated Traffic Control Systems in Highway

Construction or Maintenance Zones Act, authorizing speed-radar photo enforcement (SPE) in work zones on highways. For the first time, a state department of transportation (DOT) was authorized to implement SPE in work zones on the Interstate Highway System. The objective was to improve speed limit compliance and work zone safety.

Illinois DOT initially deployed two self-contained vans to implement the program (1). The speeds of vehicles approaching the SPE are monitored with two radar systems: down-the-road radar and across-the-road radar (Figure 1). The speed obtained from the down-the-road radar is displayed on a light-emitting diode display on top of the SPE van (see photo). The display gives speeding drivers a final chance to reduce speed and comply with the work zone speed limit. The range of a down-the-road radar is similar to that of a radar typically used in work zones—approximately one-quarter to one-half mile.

Across-the-road radar measures the speeds of vehicles at approximately 150 feet upstream from the van. If the speed of the vehicle, measured by

across-the-road radar, is greater than a specified value, the two onboard cameras are activated to take pictures of the driver and rear license plate of the vehicle. Operation of the SPE van is shown in Figure 1; trained Illinois State Police officers staff the vans.

Regular speeding fines in work zones apply to violations detected by SPE. The fine for the first violation is \$375; for the second, \$1,000, along with a 90-day suspension of license. A court appearance is mandatory for each violation. The vans are provided under contract by a vendor at a cost of \$2,950 per month each—this includes the vehicle, equipment, maintenance,

upgrades, and training—plus a processing fee of \$15 per ticket.

APPLICATION

SPE was pilot-tested in two work zones in Illinois—one on Interstate 64 in summer 2006 and the other on Interstate 55 in summer 2007. Both work zones were part of major reconstruction projects.

Under the supervision of faculty member Rahim Benekohal, a research team from the University of Illinois at Urbana-Champaign led by Madhav Chitturi collected three data sets in the two work zones. The team evaluated the effectiveness of SPE in reducing

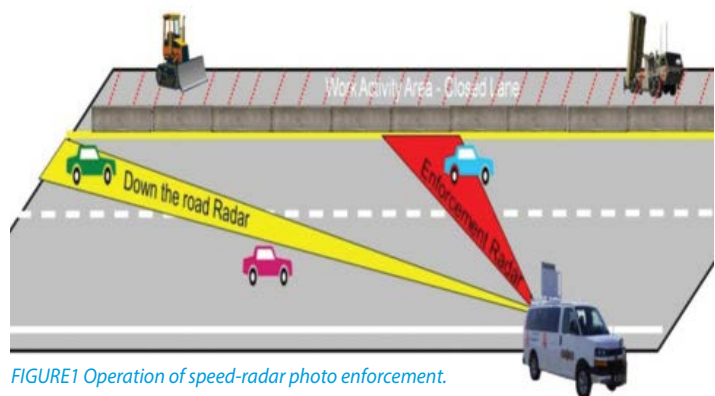


FIGURE 1 Operation of speed-radar photo enforcement.



Speed-radar photo enforcement vehicle; enforcement radar unit is mounted on the rear door; down-the-road radar generates the "Your Speed" reading on the rooftop display.

motorist speeds in work zones and compared the results with those of traditional enforcement approaches, such as police presence with and without patrol lights, speed display trailers, and a combination of police presence and a speed display trailer.

The spatiotemporal effects of SPE and traditional approaches also were measured. To evaluate the spatial effect, speeds were measured at a location 1.5 miles downstream. For temporal effect,

speeds were measured immediately after enforcement was removed from the work zone for a period of 1 hour.

BENEFITS

SPE significantly reduced the speeds of cars and trucks by 3 to 8 mph in work zones (2). At the work zone location, SPE reduced the average speeds significantly below the speed limit of 55 mph in all but one scenario, as shown in Table 1.

The percentage of free-flowing vehicles—with headways greater than 4 seconds—exceeding the speed limit at the treatment location was reduced drastically (Figure 2). The percentage of speeding free-flowing cars decreased from 93, 40, and 30 percent to 45, 8, and 4 percent, respectively, for the three data sets. The percentage of speeding heavy vehicles dropped from 69, 17, and 6 percent to 15, 4, and 1 percent, respectively.

SPE reduced the speeds of vehicles 1.5 miles downstream of the van location by 2 to 5 mph, as shown in Table 1. SPE had a limited halo effect—that is, influence after the departure of the van—reducing the speeds of vehicles by 2 mph or less. Details of the results are available in the final report from this study (3).

Aggressive law enforcement, including the use of SPE vans, in conjunction with educational campaigns and

TABLE 1 Average Speeds of Vehicles

		Data Set	Shoulder Lane			Median Lane		
			Mean Speed, mph (Sample Size)		Speed Reduction, mph	Mean Speed, mph (Sample Size)		Speed Reduction, mph
			Base	SPE		Base	SPE	
Treatment location	Passenger cars	1	61.4 (204)	53.7 (218)	7.7	63.9 (106)	56.0 (101)	7.9
		2	51.2 (135)	47.0 (191)	4.2	57.0 (119)	50.6 (146)	6.4
		3	50.2 (141)	44.8 (71)	5.5	55.4 (181)	49.1 (95)	6.3
	Heavy vehicles	1	57.4 (39)	51.3 (44)	6.1	56.2 (120)	52.2 (100)	4.0
		2	50.3 (41)	46.1 (54)	4.1	53.7 (40)	50.3 (41)	3.4
		3	48.8 (42)	44.8 (40)	4.0	53.2 (40)	46.3 (41)	7.0
Downstream location	Passenger cars	1	59.8 (207)	57.2 (226)	2.6	62.5 (102)	60.5 (102)	2.0
		2	58.6 (188)	57.9 (209)	0.6*	61.8 (98)	61.6 (126)	0.2*
		3	58.6 (165)	55.6 (125)	3.0	63.5 (158)	59.7 (107)	3.8
	Heavy vehicles	1	56.5 (40)	55.6 (35)	0.9*	56.2 (134)	55.4 (107)	0.7*
		2	57.3 (57)	56.4 (73)	1.0*	59.4 (43)	56.8 (52)	2.5
		3	57.8 (57)	53.0 (39)	4.8	59.5 (33)	54.2 (32)	5.2

improvements to work zone traffic control, have reduced work zone fatalities from a high of 44 in 2003 to 31 in 2009. Illinois DOT has expanded the SPE program to five SPE vans, one for each region in the state.

The success of SPE in Illinois led to similar initiatives in Maryland, Oregon, and Washington. The Research Advisory Committee of the American Association of State Highway and Transportation Officials recognized "Speed Photo Enforcement in Illinois Work Zones" as

a high-value research project at the regional level.

ACKNOWLEDGMENTS

The Illinois Center for Transportation, a joint partnership of Illinois DOT and the University of Illinois at Urbana-Champaign, supported and funded the evaluation of SPE.

For additional information, contact Priscilla Tobias, Bureau of Safety, Illinois Department of Transportation, 2300 South Dirksen Parkway, Springfield, IL

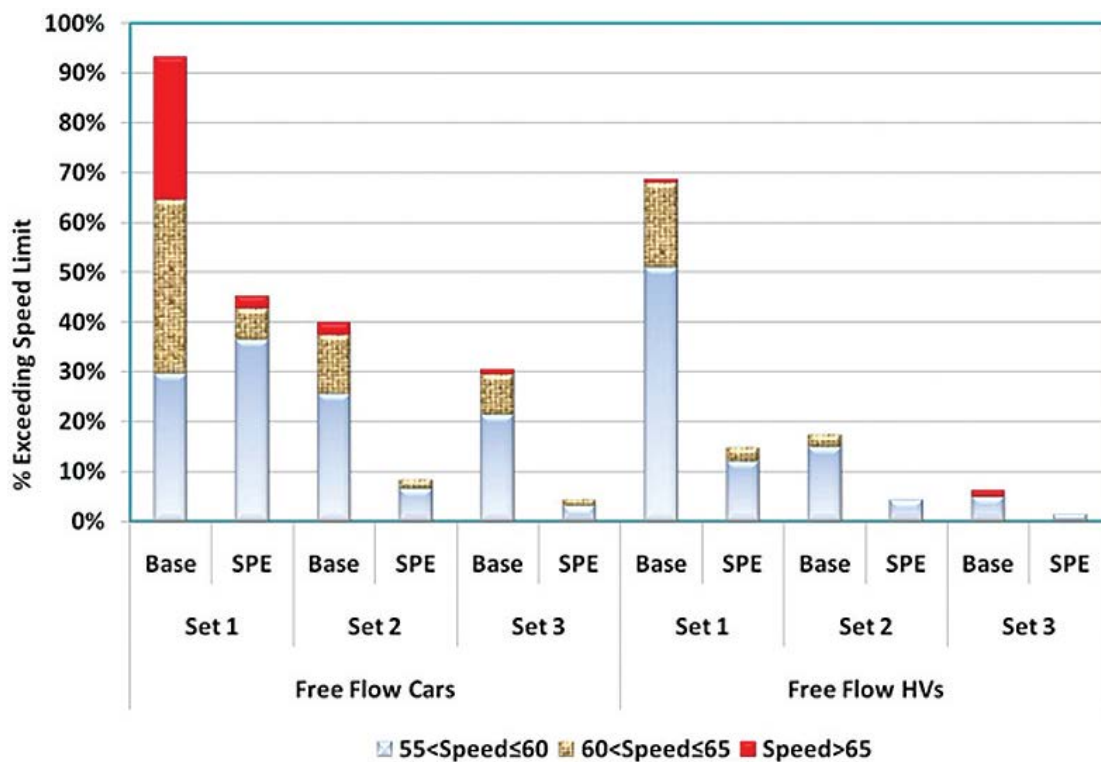
62764; telephone 217-782-3568; e-mail Priscilla.Tobias@illinois.gov. ■

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FIGURE 2 Percentage of free-flowing vehicles exceeding speed limit at the treatment location (HVs = heavy vehicles).



The mission of the Delaware Center for Transportation is to improve the movement of people, goods, and ideas, and be viewed as a valuable resource for transportation-related issues and challenges within the state, the mid-Atlantic region and beyond.

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UTC NEWS
INSERT

RESILIENCY OF TRANSPORTATION CORRIDORS

PUBLISHED BY THE UD UNIVERSITY TRANSPORTATION CENTER

SUMMER 2012

Dare to be first.



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Center

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Civil & Environmental
Engineering

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Director and Managing Editor
Sue McNeil

Design
University of Delaware College of
Engineering communications team

Director's Message

During the fall semester, we worked as a member of a consortium of universities with Rutgers in the lead to assemble an outstanding University Transportation Center proposal for a Tier I center focused on state-of-good-repair. In January, we were delighted to learn that our UTC proposal had been selected for funding. The Center for Advanced Infrastructure and Transportation (CAIT) at Rutgers will be leading the effort. In addition to University of Delaware, other members of the consortium are: Utah State University, Columbia University, New Jersey Institute of Technology, Princeton University, University of Texas, El Paso, University of Virginia, Virginia Polytechnic Institute and State University. The total grant award for each consortium is \$3.5 million. The announcement can be found at: http://utc.dot.gov/about/grant_recipients/html/2012_grant_recipients.html

Building on USDOT strategic goals, **State of Good Repair** (SGR) is the consortium's primary area of Research, and **Safety** and **Economic Competitiveness** are secondary areas. Although we have chosen to concentrate our efforts on these three areas, all the USDOT strategic areas are interrelated and impact the overall transportation system's performance. We will collaborate with other consortium members on research, education and outreach. However, UD's role centers around activities related to:

- *Asset Management (performance-based decision making)*
- *Advanced and Innovative Materials and Devices*
- *Construction Management and Innovation*

This new funding builds on our existing UTC with the theme of "Resiliency of Transportation Corridors." We have a modest amount of funds remaining in the existing UD-UTC grant. After consultation with the UTC Advisory Committee, these funds were allocated to graduate students support and research projects. The projects either link ongoing or past projects to implementation, or provide a bridge to future funded research related to "Resilience of Transportation Corridors." The students and projects funded are reported in this newsletter.

While this transition, from UD-UTC to CAIT at UD, offers some exciting new opportunities, ongoing projects have also been producing some interesting results, and speakers and events provide opportunities to explore new directions. In this newsletter, we report on graduating students, activities and provide some background material on the ongoing Intercity Bus project.

Sue McNeil
Professor, Department of
Civil & Environmental Engineering



Congratulations to our 2012 Graduates!

CIVIL ENGINEERING MCE:

LAUREN LOBO,
MCE, Civil Engineering

MOSI LONDON,
MCE, Civil Engineering

GILLIAN MCCARTHY,
MCE, Civil Engineering

PETER SEYMOUR,
MCE, Civil Engineering

URBAN AFFAIRS AND PUBLIC POLICY MPA

ARTHUR WICKS,
MPA, Public Administration

URBAN AFFAIRS AND PUBLIC POLICY PhD

T. TODD O'BOYLE,
PhD, Urban Affairs and Public Policy

MARINE POLICY PhD

AMIT MOKASHI,
PhD, Marine Policy

AISIM 2012

The 8th Annual Interuniversity Symposium on Infrastructure Management (AISIM) was held in June 2012 at the Georgia Institute of Technology in Atlanta. This student run symposium provides an opportunity for students to present work in progress and network with other students. AISIM8 included a writing workshop, presentations by the Chief Engineer and Commissioner for Georgia Department of Transportation, and a banquet and awards ceremony.

The presenters from the University of Delaware at the 2012 symposium and their topics were:

Erik Archibald, *"Learning from Traffic Data Collected Before, During and After a Hurricane"*

Offei Adarkwa, *"The Hilbert-Huang Transform and Tensor Analysis in Pavement Deterioration Pattern Determination"*

Professor McNeil and Mosi London also attended.

The 9th AISIM will be held at University of California Berkeley in 2013. Watch the UTC website for more information!



Mosi London and Erik Archibald chat at the 8th Annual Interuniversity Symposium on Infrastructure Management

Infrastructure Management Bootcamp

Civil Engineering graduate students Mosi London and Offei Adarkwa participated in the two-week long intensive Advanced Civil Infrastructure Management course at Georgia Institute of Technology from **June 3 to June 15, 2012**. The course (affectionately referred to as "Boot Camp") is a three-credit graduate class that brings together students and instructors from Georgia Tech, University of Delaware, University of Iowa, Purdue University, University of Waterloo, Virginia Tech and University of Texas at Austin. The objective is to provide an opportunity for students to gain in-depth

knowledge, develop a mini-project and network with other students with similar interests. The "Boot Camp" provides an opportunity for students to have an immersion experience in an advanced Infrastructure Management course, focused on physical assets. Bootcamp topics include infrastructure performance, data management, deterioration modeling, sensors, risk analysis, optimization and research methods. The project required teams of students to develop an asset management implementation plan for Georgia DOT.



Offei Adarkwa works on an exercise demonstrating the principles of experimental design.

UD-UTC Distinguished Lecture

UD-UTC DISTINGUISHED LECTURE: VULNERABILITIES, COSTS, AND MITIGATION STRATEGIES FOR THE U.S. TRANSPORTATION NETWORK

Dr. Ira Hirschman, Parsons Brinkerhoff



Ira Hirschman listens to a question during the UD-UTC Distinguished Lecture

On February 21, 2012 Parsons Brinkerhoff's principal economist, Dr. Ira Hirschman, described to faculty, students and staff the major vulnerabilities of the U.S. transportation system, the economic impacts and costs of key freight transport disruptions, along with some of the mitigation strategies for those freight disruptions.

Dr. Hirschman first defined the vulnerabilities of the transportation network which include natural disasters, accidents or catastrophic facility failures, long-run impacts such as climate change, and terrorist attacks. With the events of September 11, the last vulnerability brought a new consciousness to the nation. The 2001 Patriot Act helped define critical infrastructure: facilities in exposed seismic zones, central railroad hubs such as those located in Chicago, areas where the volume and value of goods have major impacts on large industry sectors, such as the automotive corridor. Ports, railroads, highways, and pipelines across the United States all contribute to the economic vitality of the country and thus may be critical for protecting in some manner.

"Legislative milestones, such as The Maritime

Transportation Security Act of 2002 and The Security and Accountability for Every Port Act of 2006 began to address the protection of critical transportation areas," said Dr. Hirschman.

How has the transportation network changed over time? New technologies and business practices such as just-in-time deliveries have reduced the transportation costs, reduced inventories, and made the transportation network very complex with many moving parts. Modern logistics are more efficient using a 'pull' model where orders are placed and satisfied through manufacture and delivery in a short period of time as opposed to keeping a large inventory based on market predictions.

Dr. Hirschman ended the lecture with examples showing how production is globalized in the modern day era. Flooding in Thailand will have supply chain disruption consequences halfway around the globe. As our transportation networks and production becomes more specialized, more vulnerability is introduced.

UD-UTC and CAIT at UD Graduate Fellows

The 2012-2013 UD-UTC And CAIT at UD Graduate Fellows are **Eileen Collins**, **Tucker Smith** and **Diane Wurst**

Eileen Collins is a 2nd year Urban Planning and Policy Masters student. She has been working with Marcia Scott on the Intercity Bus project.

Tucker Smith began the Masters program in Transportation Engineering in January 2012. He is interested in studying how all modes of transportation contribute to supporting transportation demand; and how that demand is affected by increasing cost of transportation. His advisor is Rusty Lee.

Diane Wurst is the first CAIT at UD Graduate Fellow. She is a 2nd year MCE student in Structural Engineering. She has been working with Jennifer McConnell on "Investigation of Load-Path Redundancy in Aging Steel Bridges".



Laura Black – 2011 UDUTC Student of the Year – receiving her award certificate from RITA Deputy Administrator Gregory D. Winfree

Student of the Year Awards Presentation

Laura Black was UD UTC's 2011 Student of the Year. Laura was presented with her recognition at the Council of University Transportation Centers Awards Banquet held during the TRB Annual Meeting in Washington DC in January 2012.

IPA Team Researches Transportation Policy Issues of Intercity Bus Industry

by Eileen Collins and Marcia Scott

Driving along Interstate 95 between New York and Washington, D.C., it is hard to avoid seeing the brightly colored buses advertising tickets as low as a dollar. These buses, which include the companies Megabus, DC2NY, and Boltbus, are part of the emerging low-cost intercity-buses industry that offers rides cheaply between many cities in the Northeast. This industry now represents the fastest growing mode of intercity transportation in the United States—outpacing air and rail transportation.

Researchers at the School of Public Policy and Administration's Institute for Public Administration (IPA) are studying transportation policy issues impacting this emergent industry. IPA's research team includes associate policy scientist Marcia Scott, University of Delaware University Transportation Center (UD-UTC) graduate fellow Arthur Wicks, and public administration fellow Eileen Collins. Topics of

study include factors contributing to the industry's growth, its unregulated environment, lack of intermodal linkages, safety practices, operating differences among carriers, state and local government attempts to control curbside operations, and environmental concerns.

The research involves several tasks, including a literature review. However, information about the industry is hard to procure because of its rapid growth, lack of federal government regulation, and informal operation of non-corporate or so-called "Chinatown" bus lines. Wicks and Collins also conducted an extensive field assessment of curbside operations that involved photographing curbside conditions, administering a survey of passengers, and taking a series of trips on various intercity bus lines between New York City, Philadelphia, Wilmington, and Washington, D.C.

During the course of the team's 13 site visits, a national



Eileen Collins and Arthur Wicks present at the Brown Bag Seminar

issue of federal oversight presented a fantastic opportunity for a case study. The U.S. Department of Transportation's (DOT) Federal Motor Carrier Safety Administration issued a shut-down order of Double Happiness Travel, Inc., a "Chinatown" carrier providing service between curbside locations in New York City and Wilmington. Deemed an "imminent hazard" to passengers for multiple safety violations, the carrier repeatedly defied a federal order and continued to operate. Following actions by the U.S. DOT, a U.S. District Court of Pennsylvania judge, and the Delaware State Police, the City of Wilmington's Licenses and Inspection Department finally padlocked operations after Double Happiness had attempted to reopen under the name New Everyday Bus Tour.

Wicks and Collins recently provided an overview of preliminary research findings at a brown-bag lecture hosted by the UD-UTC. An upcoming round-table discussion of transportation policy issues is planned to bring together industry representatives, government officials, researchers, and other stakeholders. Research results will be summarized in a hard-copy and online briefing paper.

Because intercity bus travel is important to the resiliency of the Northeast Corridor and the overall transportation network, this project is supported by UD-UTC—whose theme is resiliency of transportation corridors. UD-UTC is among the Tier II University Transportation Centers, which are grant-funded programs of U.S. DOT designed to advance the state-of-the-art in transportation research and develop the next generation of transportation professionals.



A Bolt Bus loads passengers in New York City



A Long Road Ahead for Federal Transportation Funding

by **Arthur F. Wicks III, UD-UTC Fellow**

On April 11th, 2012, the UD University Transportation Center (UD-UTC) hosted the UD-UTC Distinguished Lecture given by Jack Basso, Director of Program Finance and Management at the American Association of State Highway and Transportation Officials (AASHTO). AASHTO is a non-partisan, not-for-profit organization that represents the interests of state highway and transportation departments in Washington, D.C.

Basso has worked in the federal sphere of government for over 35 years and is a nationally recognized expert in the field of transportation finance. Before serving as the Director of Program Finance and Management, he served as AASHTO's Chief Operating Officer, the Assistant Secretary for Budgets and Programs at the U.S. Department of Transportation, Assistant Director for General Management at the Office of Management and Budget, Deputy Chair of Management for the National Endowment for the Arts, and the Director of

Fiscal Services at the Federal Highway Administration.

Basso's lecture—"The Future of Surface Transportation in the U.S.: What will Congress Do to Meet the Needs?"—focused on the current funding issues facing the Federal Highway Trust Fund and progress made developing a reauthorization bill for transportation funding. Basso's presentation revealed some rather shocking statistics, including the fact that the United States is only earmarking one-third of the \$200 billion per year that is needed to maintain and improve the transportation system.

According to Basso, one of the major obstacles facing the creation of a reauthorization bill is that there is not a clear method of entirely funding a new Transportation Bill, as current revenues dedicated to the Transportation Trust Fund would be inadequate. He also explained that the growth of Transportation Trust Fund revenue has not kept pace with the growth of transportation costs due to a decline in purchase power of trust-fund revenue sources and a decrease

in vehicle miles traveled in the United States. The lack of adequate funding is further exacerbated by the reluctance of increasing one of the trust fund's major revenue sources—the fuel tax.

Basso's presentation concluded with a number of options available to create a flexible and adoptable system for federal transportation funding. Among these options are to increase existing fees like tolls, create partnerships between the public and private sectors, and establish new user fees for the transportation system. In closing, Basso reiterated that Congress faces difficult decisions in how to move transportation funding forward and that whatever decision is made will have significant consequences (good or bad) for the nation.

UD-UTC would like to thank Jack Basso for taking the time to come to the University of Delaware for his interesting and thought-provoking presentation.



Jack Basso is joined by (from left) Arthur Wicks (MPA'12), T. Todd O'Boyle (UAP-PhD'12), Eileen Collins (MA'13), and Natasha Nau (MPA'12)



2012–2013 Projects

Three projects were selected for funding as part of the 2012-2013 UD-UTC research program. One project is a continuation of a project funded in 2011-2012. It is expected that additional projects will be funded through CAIT at UD. These awards will also begin in September 2012 but will not be announced until late August 2012.

SENSOR FUSION AND INFORMATION INFERENCE FOR BETTER TRAVELER INFORMATION SYSTEMS AND GREATER CORRIDOR RESILIENCE

Principal Investigator

Earl (Rusty) Lee

One measure of the resilience of a corridor can be the quality of information provided to users of that corridor and the usefulness of information provided regarding alternatives routes if incidents or congestion has developed. High quality data could be provided by an extensive, high density sensor network, with relatively small spacing, say quarter mile increments. However, this can be prohibitively expensive considering the number of sensors needed and the supporting infrastructure and data processing required. This work will analyze the capabilities of less dense and mixed sensor networks to still provide high quality data to system managers and system users.

LEARNING FROM TRAFFIC DATA: EVACUATION BEHAVIOR

Principal Investigator

Sue McNeil

Access to real-time collection and analysis of traffic data that can be used for the evacuation planning process and enhance the efficiency of operations before and after a disaster presents an interesting opportunity. The objective of this work is to identify ways to use traffic data to better understand evacuation behavior and to explore ways to integrate traffic data into evacuation planning and

response. Analysis of this data is performed and the usefulness of this type of data is then discussed. Hurricane Irene provides a rich source of data on actual behavior during a mandatory evacuation that has important implications for future events including developing strategies for improving situational awareness, and post incident review and planning. These issues are important as the perceived increases in frequency and intensity of weather related events mean that there are increasing pressures to address evacuation issues. The use of traffic data will ultimately allow government to better plan and execute evacuations and help make the corridors used for evacuation more resilient.

IMPLEMENTATION OF RAPID ASSESSMENT TOOLS FOR STRUCTURAL STEEL PARTS AFTER EXTREME EVENTS

Principal Investigator

Thomas Schumacher

Bridges represent crucial elements of our civil infrastructure network and owners need quantitative assessment tools to know whether they can rely on the bridges that survived an extreme event in order to plan their recovery missions. This research project presents the continuation and implementation phase of a UDUTC project funded last year that is developing a methodology or a rapid assessment tool for structural steel parts after severe events. The objective of this project is to evaluate the developed methods on more realistic structural steel connection details in the laboratory as well as in the field.

Brown Bag Seminars – Fall 2012

Wednesday September 5, 12:15pm

Thomas Schumacher, Nii Attah-Okine and
Andrew Chen

“DEVELOPMENT OF RAPID ASSESSMENT TOOLS FOR STRUCTURAL PARTS AFTER EXTREME EVENTS USING STRESS WAVE METHODS”

Location TBD.

Thursday October 18, 12:30pm

Erik Archibald and Sue McNeil

“LEARNING FROM TRAFFIC DATA COLLECTED BEFORE, DURING AND AFTER A HURRICANE”

Location TBD.

CAIT-UTC Traveling Lecture

Monday, September 17, 1:30pm

John Popovics, University of Illinois, ITS Lab,
341 Dupont Hall.



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