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Delaware Center for Transportation

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UD student chapter competes at first ITE International Collegiate Traffic Bowl

The University of Delaware competed in the first ITE International Collegiate Traffic Bowl held on Wednesday, August 11 during the 2010 Annual Meeting and Exhibit in Vancouver, BC, Canada. The team, Bob McGurk, Elisa Kropat and Kerry Yost, had earned their spot at the competition by winning the Mid-Colonial District Championship in April. Nine District collegiate teams competed in a Jeopardy style competition that tested the student's knowledge of transportation planning and engineering topics. UD was pitted against the eventual competition winner, Texas A&M, in the semi-final round of the competition and despite losing, were excellent representatives of the university.

The ITE Collegiate Traffic Bowl is a competition amongst ITE student chapters, similar to the TV game shows such as the College Bowl or Jeopardy, but with transportation planning and engineering topics for the clues, questions, and answers. The 2010 Grand Championship was an inaugural event for ITE's Collegiate Traffic Bowl.

In 2010, student teams from 46 universities in the United States and Canada competed in nine districtlevel events for a chance to compete in the Grand Championship in Vancouver, BC, Canada. More than 135 student members of ITE comprised the teams that have competed over the seven months leading up to the Grand Championship.

In addition to the Traffic Bowl, the students were able to attend the ITE annual meeting and attended many of the meetings sessions. Of particular interest to the students were the sessions relating to the





city of Vancouver's planning and transportation management for the 2010 Olympic Games.

Costs for the trip were supported by many sources including the ITE National Office, the ITE Mid- Colonial District, the Mid-Atlantic Section (MASITE) of ITE, the UD College of Engineering and the Department of Civil and Environmental Engineering, the Delaware Center for Transportation and the T2 center.

The UD team will begin its quest for a repeat appearance at the District Annual Meeting in April, 2011 in Alexandria, VA.

Message from the Director

I would like to take this opportunity to wish all of our readers a happy, healthy and prosperous 2011. At this time, the Delaware Center for Transportation (DCT) with its dedicated staff is getting ready to launch the Fiscal Year 2012 research project identification and prioritization process. Ideas related to all fields of transportation are submitted by faculty from departments across campus. The professionals at the Delaware Department of Transportation also submit ideas for consideration. The research committee carefully reviews all ideas and prioritizes them according to how useful a particular idea may be to DelDOT and the State of Delaware as a whole. This fiscal year particular emphasis will be placed on ideas dealing with economics, environment, energy and sustainability.

During the month of January, DCT makes every effort to register interested graduate and undergraduate students for the annual meeting of the Transportation Research Board (TRB) in Washington, D.C. The proximity of our campus to the nation's capitol has enabled us to sponsor a two-night stay for students at the conference annually. Attendance at the TRB meeting, one of the most important for transportation professionals, serves as a great educational opportunity for our students—one that is difficult to match in a class or laboratory environment.

Preparation has already begun also for the 2012 Transportation Forum to take place as a one day meeting at Clayton Hall during the month of November. Just as previous forums we have organized, sessions dealing with different areas of transportation will be offered for discussion and idea generation. Attendees representing the federal, state and local transportation agencies, as well as the private sector, academia, civic groups and all other individuals concerned about the future of our transportation system get together to discuss how a safe, efficient and sustainable transportation system can be achieved. For this upcoming forum, particular attention will be paid to the correlation between transportation and the economy, energy, environment and sustainability. More specific articles and information fliers will be prepared and distributed about the 2012 Forum.

Please also check our web-site at www.ce.udel.edu/dct/ for a series of distinguished guest speakers, brown bag seminars, technology transfer courses and many other programs designed to enhance the transportation system in Delaware and the region.



Ardeshir Faghri, Director

Mobility and transportation providing access to the world

On October 13th, Dr. Lester Hoel, L.A. Lacy Distinguished Professor of Engineering Emeritus at the University of Virginia, gave interested undergrads, grad students and staff a perspective of mobility and transportation through the modern age. The question he asked the packed room was why are you involved in transportation? The answer was generally to help improve the quality of life for the people in the state. Whether transport is by airplanes, trucks, buses, cars, trains, or ships, the modes need to be safe, congestion free, reliable, and operate as a system.

Dr. Hoel noted that mobility, the quality or state of being mobile, is a fairly new phenomenon and has changed dramatically over the last 200 years. Improvements follow an evolutionary process once there is public acceptance and widespread use of the mode of transportation.



This in turn influences lifestyle and land use. For example, railroads created a small series of towns along the new lines. Streetcars simulated a star pattern in the growing cities, and airplane routes developed into a hub-spoke pattern. With the increase of mobility and the use of the mode of transportation, congestion increases as well.

What is the criterion which forecasts if a new mode will be a success? It has to offer better mobility than the existing mode, it must beat the competition at its own game, and it must provide a new level of service. The service characteristics may include cost, comfort, safety and timeliness.

Dr. Hoel closed his lecture challenging the students in the room to adapt to ever changing needs, to have a perspective of how transportation evolved over time and to be curious.

Dr. Lester Hoel is a member of the National Academy of Engineering, a Distinguished Member of the American Society of Civil Engineers, and a Fellow of the Institute of Transportation Engineers, in addition to other engineering societies and councils. He currently resides in California.

ASHE at UD

The student chapter of the American Society of Highway Engineers has completed its first full year of operation with the election of new officers. Starting after the new year, the leadership will be Ryan Barton as President (replacing Kerry Yost), Mike Kelly as Vice President of Organization and Events (replacing Bob McGurk), Anthony Durante as Vice President of Membership and Recruitment (replacing Tom Costabile), Chris Manco as Treasurer (replacing Ryan Barton), and Emmanuel Anagnostakis as Secretary (replacing Anthony Durante). The new officers hope to continue the energetic pace of field visits and attendance at ASHE First State Section dinner meetings.



Recent activities have included attendance at several professional dinner meetings, a behind-the-scenes tour of the I-95 Toll Plaza construction site, and the First State Section Holiday Gala.

The students' success has triggered interest in a number of other ASHE sections across the country. In particular, sections in Ohio and Florida have contacted students and ASHE First State Section members for insight into their early success, as well

as any cautionary tales. It remains to be seen how sustainable the student chapter at UD will be going forward, but the energy and enthusiasm of the inaugural leaders seems to be alive and well within this next group of officers.

ITE Student Chapter

The student chapter of the Institute of Transportation Engineers (ITE) has had a very successful fall semester. In September, the chapter elected officers with Laura Black serving as President, Michelle Oswald as Vice President, Tucker Buchanan as Secretary and Megan Mikrut as Treasurer. The chapter currently has 38 members.

In October, ITE members visited the Indian River Inlet Bridge along with the ASCE and

ASHE student chapters. November 19th was the annual DelDOT tour and a visit to the Traffic Management Center (TMC). Students were able to learn more about what goes on at DelDOT, including presentations by the project development and bridge groups, a poster and open discussion hosted by the Planning Group and an extensive tour of the TMC.

Plans for the spring include a visit to the Amtrak Training Facility in Wilmington, a joint social event with the ITE chapter from Villanova and a possible visit to the Turner Fairbanks Research Center in Virginia. The chapter will also be represented at the ITE District Annual Meeting in April, 2011 in Alexandria, VA where they will defend their championship in the ITE Traffic Bowl.



Students innovate for the UD fuel cell bus program

AJAY K. PRASAD, DIRECTOR, UD CENTER FOR FUEL CELL RESEARCH

During summer 2010, a number of undergraduate students added their energy and imagination to advance the technology of our fuel cell buses. To date, the UD Fuel Cell Bus Program has demonstrated two buses on our campus. The first fuel cell hybrid bus has been in operation since 2007 and incorporates a 20 kW fuel cell stack with 60 kWh of battery storage in a 22-ft platform. The second bus has been in operation since 2009 and is identical to the first bus, except that it features a dual stack for a total power of 40 kW. Two 30-ft fuel cell buses will be added in 2011 and 2012. Since its inception, the Fuel Cell Bus Program has been popular with undergraduate students seeking summer research opportunities. Here, the recent contributions of three students are highlighted.

Shane Marcks, an ME senior, contributed to the design and testing of a novel hydrogen ejector to recirculate unused hydrogen from the fuel cell stack outlet back to the stack inlet. At present, our buses employ a hydrogen recirculation pump for this purpose. This pump is prone to corrosion and seizing, and consumes substantial parasitic power from the stack. A variable flow ejector is preferable because it is driven by the mechanical energy of the high-pressure hydrogen in the fuel tanks rather than electrical power. Our ejector employs a "spike nozzle" design to achieve good supersonic nozzle performance over a wide range of flow rates. A linear actuator is used to adjust the position of the needle at the nozzle opening to regulate hydrogen pressure under feedback control from the stack pressure. Shane first modeled the entire feedback system for the spike nozzle ejector in MATLAB/ Simulink and developed a suitable control algorithm. He then helped to fabricate all the mechanical components, and successfully tested the ejector system on a lab bench using compressed air as a proxy for hydrogen. This was a very significant achievement. Shane's next task will be to implement this novel ejector in the bus itself. The bus manufacturer (EBus) is extremely interested in our progress, and is eager to install this new hydrogen recirculation system in future buses.

Erik Andres, also an ME senior, worked on a "driver user interface" program. This software has been installed on both buses on netbook PCs, which are equipped with touch screens and mounted in a "heads up" position at the very top of the windshield. The software provides a more user-friendly interface for monitoring and controlling the buses' functions than the 16-button keypad and 2-line text display currently afford, and will later perform more advanced functions like accurately estimating remaining charge in the nickel-cadmium batteries and displaying remaining vehicle range. It will also help the driver by providing more detailed descriptions of any faults that the fuel cell/battery hybrid system might experience, along with corrective actions. Erik's new interface is a valuable tool to rapidly familiarize bus drivers with the novel technologies and systems on board our fuel cell hybrid buses, and to facilitate safe and reliable bus operation.

Finally, Rebecca Buxbaum, also an ME senior, created software to automate the generation of statistical data and plots of the buses' performance metrics. On-board



Mechanical Engineering Undergraduate Students (left to right) Shane Marcks, Erik Andres and Rebecca Buxbaum .

data acquisition computers relay critical performance data automatically to a server in our lab using cellular data connections. Rebecca's software analyzes those data and places them on a web page which can be accessed by the research team or the general public (http://fluidsnet.me.udel.edu/bus1data/). This link takes the viewer to a calendar from which a particular bus run can be selected. Each selected run shows up as a summary, and can then be further examined in a variety of more detailed views. For example, it is possible to view the actual path of the bus during the run using the Map option. Next, the Faults option allows one to study the faults (if any) experienced by the bus on that particular run. The Graphs option provides the user with a detailed profile of bus performance in terms of battery state-ofcharge, energy, bus velocity, and hydrogen consumption vs. time. Finally, the Download option allows the user to access the actual data files for further analysis. This software is a very powerful tool to assess the health and effectiveness of our buses both in real-time and on an archival basis. The Federal Transit Administration (our sponsor) has shown great interest in publicizing this development within its organization.

The undergraduate students were mentored in their daily activities by Research Associates Doug Brunner and Adam Kinzey. Dr. Suresh Advani and Dr. Ajay Prasad provided overall guidance and supervision. We look forward to involving more undergraduates in exciting projects in the future.



Principal investigator & project manager meeting

On October 22, 2010, DCT hosted a meeting for the Principal Investigators and their DelDOT Project Managers to discuss the FY'11 research projects. Each principal investigator presented a report on their project followed by a general discussion by the participants. After the meeting, the Principal Investigators met with their Project Managers for a one-on-one discussion on fine tuning their work plans to more closely respond to the research needs of DelDOT. The following lists the research projects presented along with the Principal Investigators and DelDOT Project Managers:

CROSS-FRAME FORCES IN SKEWED STEEL I-GIRDER BRIDGES

Principal Investigator

Jennifer McConnell, Department of Civil and Environmental Engineering

Project Manager Jiten Soneji, Bridge Design

STUDY AND CALCULATION OF TRAVEL TIME RELIABILITY MEASURES

Principal Investigator

David Racca, Center for Applied Demography and Survey Research

Project Manager

Gene Donaldson, Transportation Management Center

DEVELOPMENT OF SPECIFICATIONS FOR THE USE OF CONTINUOUS COMPACTION CONTROL SYSTEMS

Principal Investigator

Chris Meehan, Department of Civil and Environmental Engineering

Project Manager Jim Pappas, Materials and Research

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

Principal Investigator Martha Narvaez, Institute for Public Administration

Project Manager Marianne Walch, Maintenance and Operations

INCREMENTAL PARK AND RIDE DEMAND MODEL

Principal Investigator Bintong Chen, Department of Civil and Environmental Engineering

Project Manager Cathy Smith, Delaware Transit Corporation

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

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

Principal Investigator Jack Puleo, Center for Applied Coastal Research

Project Manager Doug Robb, Bridge Design

2010-2011 GPS TRAVEL TIME AND DELAY DATA COLLECTION AND ANALYSIS

Principal Investigator Arde Faghri, Department of Civil and Environmental Engineering

Project Manager Mark Eastburn, Division of Planning

DELAWARE TRANSPORTATION OPERATIONS MANAGEMENT PLAN - NEW CASTLE COUNTY

Principal Investigator Earl "Rusty" Lee, Department of Civil and Environmental Engineering

Project Manager Gene Donaldson, Transportation Management Center

FY11 REGIONAL TRAVEL DEMAND MODELING SUPPORT

Principal Investigator Earl "Rusty" Lee, Department of Civil and Environmental Engineering

Project Manager

Mike DuRoss, Traffic Engineering

UD students work to improve local traffic conditions

Students from the University of Delaware have been working on two DelDOT sponsored projects this past year with a goal of reducing congestion and improving traffic flow. The projects are the Delaware Enhanced Signal Timing Partnership (DSTEP) and a 2010 update to the New Castle County Traffic Operations Management Plans (TOMPS-NCC). Both projects represent cooperative efforts between the University, DelDOT, and AECOM. Students are able to work alongside their AECOM counterparts, lead or participate in meetings with DelDOT and be able to put the theory and knowledge gained in the classroom to practical use in the field.

The DSTEP project has a goal of evaluating the signal timing and coordination of traffic corridors. The first corridor chosen was Cleveland Avenue, just north of





the UD campus. This corridor was chosen with the joint cooperation of WILMAPCO, the local MPO, AECOM and DelDOT. The goal was to work on a corridor already identified as a problem in the WILMAPCO Congestion Management Studies (CMS), had close proximity to the UD campus, and had signals already connected to the TMC. The corridor consisted of six signalized intersections from West Main St, on the eastern end, to Kirkwood Highway, on the western end.

Students, under the supervision of Laura Black, a Ph.D. student in Civil Engineering, have been responsible for data collection, processing and presentation of findings. Data collection consisted of collecting turning movement data during the AM, midday and PM peak periods. Travel times along the corridor were also collected for the same three periods. From this data and system data provided by DelDOT and AECOM, simulation models were built and new timing plans were developed. These revised timings have been implemented and are still under evaluation for how much the corridor's operations have improved.

The second DSTEP corridor was SR 72, from the I-95 overpass at the south end, to Anna Way at the north end. The corridor underwent a similar process for its selection, driven in part by a desire to further improve the Kirkwood Highway / Cleveland Ave intersection. This effort was led by Trevor Booz, a master's student in Civil Engineering, and was supported by about 20 graduate and undergraduate students. Similar data collection and processing were conducted and the revised timing plans are being developed for a January presentation to DeIDOT.

The original TOMPS study for New Castle County was conducted in 2000 with a goal of providing a sufficient condition evaluation to support prioritizing funding and operations for DelDOT's Transportation Management Program, DelTrac. This new TOMPS will update the data collected during that first TOMPS and evaluate the current and future needs of the county with the additional benefit of providing real-world transportation management experience and exposure for students, strengthening the transportation workforce. This project is being supervised by Civil Engineering Ph.D. student, Chuoran Wang. The project is nearing the end of the data collection phase and data processing and analysis will begin in January, 2011.

Research

Following are the projects approved by the DCT Policy Council for our FY'11 Annual Research Program beginning on September 1, 2010 and ending August 31, 2011:

CROSS-FRAME FORCES IN SKEWED STEEL I-GIRDER BRIDGES

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

Jiten Soneji, Bridge Design

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.

Principal Investigator

David Racca, Center for Applied Demography and Survey Research

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.

Principal Investigator

Chris Meehan, Department of Civil and

Environmental Engineering

Project Manager Jim Pappas, Materials and Research

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.

Principal Investigator

Martha Narvaez, Institute for Public Administration

Project Manager

Marianne Walch, Maintenance and Operations

INCREMENTAL PARK AND RIDE DEMAND MODEL

This research will help DelDOT reduce congestion on the roadways by providing park and ride facilities at optimal locations and also help to generate revenue to offset the capital cost for the facilities.

Principal Investigator

Bintong Chen, Department of Civil and Environmental Engineering

Project Manager

Cathy Smith, Delaware Transit Corporation

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.

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.

Principal Investigator

Jack Puleo, Center for Applied Coastal Research

Project Manager

Doug Robb, Bridge Design

2010-2011 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

DELAWARE TRANSPORTATION OPERATIONS MANAGEMENT PLAN -NEW CASTLE COUNTY

This project, working collaboratively with AECOM, will provide data collection, traffic engineering analysis and transportation system performance analysis to update the county-specific TOMPs to reflect current conditions.

Principal Investigator

Earl "Rusty" Lee, Department of Civil and Environmental Engineering

Project Manager

Gene Donaldson, Transportation Management Center

FY11 REGIONAL TRAVEL DEMAND MODELING SUPPORT

Through this service project, UD will set up, evaluate, and refine an organizational process through which a portion of the current travel demand modeling workload will be conducted at UD.

Principal Investigator

Earl "Rusty" Lee, Department of Civil and Environmental Engineering

Project Manager

Mike DuRoss, Traffic Engineering

Continuing active research projects sponsored by DelDOT

As each project is completed, an abstract will be available on the DCT website (www.ce.udel.edu/dct).

IMPACTS OF BIRD DROPPINGS AND DEICING SALTS ON HIGHWAY STRUCTURES: MONITORING, DIAGNOSIS AND PREVENTION

This research project will develop decision-making criteria and tools useful to DelDOT in monitoring, diagnosis and corrosion prevention brought about by bird droppings and deicing salts. The information to be established in this research will be valuable to life cycle cost modeling of transportation structures. (Ending 8/31/2011)

Principal Investigator

Chin-Pao Huang, Department of Civil and Environmental Engineering

Project Manager Jiten Soneji, Bridge Design

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ENHANCED PEDESTRIAN CROSSINGS

This research will focus on two issues: 1) experimenting with alternatives to MUTCD standards for crossing signals and 2) determining best practices for installing accessible pedestrian signals. (Ending 8/31/2011)

Principal Investigator

Earl "Rusty" Lee, Department of Civil and Environmental Engineering

Project Manager

Mark Luszcz, Traffic Engineering

USING ELECTRICAL DENSITY GAUGES FOR FIELD COMPACTION CONTROL

This project will allow DelDOT to assess the accuracy and repeatability of the Electrical Density Gauge (EDG) for quality control of soil compaction. It will also allow DelDOT to make a smooth transition towards adoption of the EDG as the primary quality control tool for soil compaction, should this outcome be desired by DelDOT upon completion of this research. (Ending 8/31/2011)

Principal Investigator

Chris Meehan, Department of Civil and Environmental Engineering

Project Manager

Jim Pappas, Materials and Research

DEVELOPMENT AND EVALUATION OF A RESIDENTIAL ALLOCATION MODEL USING TIME-SERIES TAX PARCEL DATA IN GIS

The product of this research will be a GIS model allowing interactive analysis of growth management problems using tax parcels at the community level while at the same time accounting for countywide growth allocation forecasts. The project will greatly support travel demand forecasting responsibilities and initiatives at DeIDOT and will support comment and analysis of development proposals at a more detailed level of geography. (Ending 8/31/2011) **Principal Investigator**

David Racca, Center for Applied Demography and Survey Research

Project Manager

Mike DuRoss, Division of Planning

IN-SERVICE MONITORING FOR IMPROVED MAINTENANCE AND MANAGEMENT OF DELDOT BRIDGES

The goal of this project is to continue enhancement of DelDOT's bridge management efforts through the collection and utilization of in-service strain response data for bridges. This is a continuation of earlier projects which initiated the effort to collect in-service data on a series of bridges in Delaware. (Ending 8/31/2011)

Principal Investigator

Tripp Shenton, Department of Civil and Environmental Engineering

Project Manager

Jiten Soneji, Bridge Design

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. (Ending 8/31/2011)

Principal Investigator

Earl "Rusty" Lee, Department of Civil and Environmental Engineering

Project Manager

Gene Donaldson, Transportation Management Center

INSTRUMENTATION AND MONITORING OF THE INDIAN RIVER INLET BRIDGE

This project involves installing a longterm structural health monitoring (SHM) system on the Indian River Inlet Bridge during its construction and monitoring the bridge through the first bi-annual inspection. Following this installation, DeIDOT will be able to understand how the as-built bridge is functioning and through long-term monitoring, will be in a better position to efficiently and effectively manage this significant resource. (Ending 6/30/2012)

Principal Investigators

Tripp Shenton and Michael Chajes, Department of Civil and Environmental Engineering and College of Engineering respectively; Robert Hunsperger, Electrical and Computer Engineering

Project Manager

Doug Robb, Bridge Design

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 t 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 decisionmaking tools.

Principal Investigator

(Ending 6/30/2011)

Sue McNeil, Department of Civil and Environmental Engineering

Project Manager

Curt Cole, Maintenance and Operations

ITS LAB BASELINE SERVICE FY10

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 DelDOT; 2) training for DelDOT and support classroom instruction; and 3) research for faculty and students (Ending 8/31/2011)

Principal Investigator

Earl "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 6/30/2011)

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 pavement Performance Models

RESEARCH PAYS OFF

The Byways Program: Showcasing Delaware

CAROLYN BARRY, ALLISON CALKINS AND DAVID AMES*

The Delaware Byways Program is the state's contribution to the national effort to recognize, preserve, enhance, and distinguish selected roads throughout the United States. Established in 1989, the National Byways Program is administered by the Federal Highway Administration. Created by the Intermodal Surface Transportation Act (ISTEA) in 1991, the first federal transportation law to deal with more than building roads, ISTEA enabled communities to be funded to beautify roadsides with such initiatives as picnic areas, resource protection, and off-road interpretive displays.



Following its provision allowing states to have Byways programs, the Delaware Department of Transportation established the Delaware Scenic and Historic Highway Program

in 2000. In 2010 it was renamed the Delaware Byways Program by Senate Bill 210.

Byways are created in two stages: first a nomination is prepared and submitted to the Delaware Byways Program. If the proposed road is successful and designated as a Delaware Byway, it moves to the preparation of a Corridor Management Plan, which is a plan for protecting, enhancing and managing the new Byway. In terms of funding, the Byway sponsor must fund the preparation of the nomination while

*Ames is the Director of the Center for Historic Architecture and Design and the principal investigator of the Byways and Historic Roads Research Project. Graduate research assistants at the Center for Historic Architecture and Design, Barry and Calkins are pursuing masters degrees in the Urban Affairs and Public Policy Program .

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Jim Gosney, Weifeng Mao, Carolyn Barry, Allison Calkins



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matching funds – 80% federal and 20% local – are available for completing the Corridor Management Plan. Each of the Byways is at a different stage of development as shown on the next page.

The Delaware Byways Program is a grassroots effort for communities to "identify, promote, and manage our country's varied and wonderful systems of highways and roads through community efforts." Byways must be sponsored by a coalition of local groups which can include local governments, businesses and non-profit groups. Public input is a central focus in the process of nomination formation; a feature that sets it apart from other programs. Thus, each community will desire something different from the nomination process and outcome: some localities seek to focus on a preservation management plan for historic or natural features while others might desire economic growth by promoting tourism along the route. In order to be nominated a proposed Byway must exhibit at least one of the following intrinsic qualities: archaeological, cultural, historic, natural, recreational, and scenic.

Currently, Delaware has designated six

Byways: Brandywine Valley, Route 9 Coastal Heritage, Lewes, Harriet Tubman Underground Railroad, Red Clay Valley, and Western Sussex. The Brandywine Valley Scenic Byway has been "promoted" to the top tier of national byways and designated by the Federal Highway Administration as a National Byway. This recognizes that its historical and environmental resources and other intrinsic qualities associated with the road are nationally significant.

Each of Delaware's Byways represent a different facet and area of what the state has to offer in terms of history, scenery, and resources. The Brandywine Valley Scenic Byway takes the visitor through what Delawareans call "Chateau Country" with the many DuPont estates in the area and industrial heritage of the Brandywine River. In northern Delaware, the Red Clay Valley Scenic Byway, which is a lattice of roads rather than a single route, travels through the rocky, wooded hills of the Piedmont area in northern Delaware state and focuses on natural and historic intrinsic qualities. The Route 9 Coastal Heritage Scenic Byway runs along the Delaware River from New Castle to the intersection with State Route 1 just south of Dover. It emphasizes historic, natural and scenic intrinsic qualities. In addition to passing though historic towns such a New Castle,

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Nomination Preparation Corridor Management Plan Underway Corridor Management Plan Completed

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Delaware City, Port Penn and Little Creek, it provides scenic views of the Delaware River, coastal marshes and several wildlife refuges. The Harriet Tubman Underground Railroad Byway celebrates the passage of more than 30,000 Freedom Seekers through Delaware and the bravery of African American Harriet Tubman and Quaker Thomas Garrett in guiding them North. The Delaware Underground Railroad Byway is a continuation of the Maryland Tubman Byway which together form a multi-state Byway presenting and preserving the history of the Underground Railroad. In southwestern Delaware, the Western Sussex Byway travels through farmland, wooded areas and small towns with many recreational opportunities for hiking, bicycling, boating and other activities. In eastern Sussex County, the Lewes Byway, the shortest of the Byways, starts in Lewes, one of the state's oldest and most picturesque towns, and proceeds through views of land and sea that portray the natural beauty, maritime origins and rich history of the area. The Center for Historic Architecture and Design in the School of Public Policy and Administration at the University of Delaware has provided assistance to the program by contributing technical assistance with nominations, such as the Harriet Tubman Underground Railroad Byway, evaluation of the visual intrusions in Delaware's landscape and undertaken other research and support for the Delaware Byways Program.

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

Dare to be first.



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Director's Message

Once again, I have made what is becoming the annual pilgrimage to my native Australia to visit family and to teach CIEG351 Transportation Engineering as a study abroad course in Melbourne, Australia. The long plane trip gives me a chance to reflect on the UTC activities of the past year, the role UTC can play in transportation, and the challenges of continuing to provide a sustainable transportation system given the negative environmental impacts of long journeys across the Pacific Ocean!

Each year as our research progresses, we better integrate concepts of sustainability and resiliency into our undergraduate and graduate curricula. We also better understand the implications of our continued consumption of fossil fuels and the impacts of climate change. This causes me to pause to think about the challenges involved in changing our lifestyles and the impacts of where we choose to live and work have on resiliency and sustainability. I must confess that I feel more than a tad guilty when I think about the environmental impacts of that long plane trip.

This newsletter documents the accomplishments and activities of the University of Delaware University Transportation Center over the past six months. This summer and fall we again supported summer undergraduate researchers, awarded UTC graduate fellowships and the student of the year, and sponsored brown bag discussions and distinguished lecturers. Our graduate students organized the 6th Annual Interuniversity Symposium on Infrastructure Management and participated in the first Infrastructure Management Bootcamp. Faculty and students will present at the Transportation Research Board's Annual Meeting in Washington DC in January 2011.

In the spring we will again host brown bag discussion and distinguished lectures, and there are opportunities to apply for our fifth year of funding: faculty for research project support, graduate students for the UD UTC graduate fellowships and undergraduate students for funding for summer research. We look forward to another productive year in 2011!

Sue McNeil

Professor, Department of Civil & Environmental Engineering

UTC fellows

The recipients of the UTC Fellowships for 2010-2011 are Peter Seymour and Todd O'Boyle.

Pete is a 2nd year Master's student in Civil and Environmental Engineering. He is a graduate of the Department of Civil and Environmental Engineering from the University of Delaware. During his first year he worked with Professor Tripp Shenton on the UTC funded project exploring the resiliency of bridges on the BOSFOLK corridor. In Pete's own words "This work has allowed me to gain an appreciation of the importance of resiliency and for how it should be applied in an engineering sense." Pete is continuing this work so that it becomes his thesis.

Todd is a 2nd year PhD student in the School of Urban Affairs and Public Policy. He is a graduate of Guilford College (BS in German Studies and Psychology) and North Carolina Agricultural and Technical State University (MS in Social Welfare Policy). During his first year at UD he worked on investigating inter-jurisdictional coordination to promote economic development and address transportation policy. He has completed two papers for UTC "A Review of Regional Governance Policies: Select Cases from Metro Areas in the United States" and "Prospects for Regional Coordination in the WILMAPCO Counties". Both papers are available on the UTC website.

Summer undergraduate researchers

Geoff Dilg and Elisa Kropat were supported by UD UTC to participate in Disaster Research Center's Research Experience for Undergraduates Program. Geoffrey worked with Professor Rachel Davidson and Dr. Palm Apivatanagul to explore hurricane wind speeds as they relate to evacuation. Elisa worked with Professor Chris Meehan on the continuation of an earlier project on landslides. In addition to their research Geoffrey and Elisa attended lectures on the social science of disasters and qualitative research methods. They also attended the Natural Hazards Workshop in Colorado and presented their research at the end of the summer to faculty and students.

AISIM6

The 6th Annual Interuniversity Symposium on Infrastructure Management (AISIM) was held in June 2010 at the University of Delaware. This student run symposium provides an opportunity for students to present work in progress and network with other students. AISIM6 included a workshop on Technical Writing for Engineers by David Kmiec of University of Delaware, a keynote on "Riskbased Facility Asset Management" by Al Antelman and Jim Clayton, a networking event plus a conference barbeque. The participants from the University of Delaware in the 2010 conference and their topics were:

- "Analysis of Ground-Penetrating Radar Data Using Markov Chain Monte Carlo Simulation" Leslie N.O. Mills
- "Methodology for Developing a National Infrastructure Index using Analytic Hierarchy Process" Michelle Oswald

Each year presentations are selected for inclusion at a special session during the Transportation Research Board Annual Meeting as "Best Presentations from AISIM." Michelle Oswald was selected to participate in the 2011 session.



The 6th AISIM will be held at Northwestern University, dates to be announced. Watch the UTC website!





Infrastructure management bootcamp

Infrastructure management, civil infrastructure systems, and asset management are emerging as important areas for graduate study as the need for civil engineers to serve as responsible stewards of our physical infrastructure is recognized. However, at most institutions there is often only one faculty member with a handful of students specializing in this area. As a result, doctoral and advanced Master's degree students, and advanced professionals working in infrastructure management generally do not have access to specialized courses, especially more advanced subjects. They also do not have a large cohort of students or colleagues to interact with. This past summer faculty from five different institutions developed and piloted a two-week long summer "Boot Camp." The objective of "Boot Camp" is to provide an opportunity for students and practitioners to have an immersion experience in an advanced infrastructure management course, focused on physical assets and to build a network of like-minded students and professionals with similar interests in infrastructure management.

The pilot "Boot Camp" brought together 17 students from eight different universities (7 from the University of Delaware) for the two- week intensive advanced infrastructure management course at University of Delaware during the summer of 2010. Eight modules were taught by Susan Tighe from University of Waterloo, David Lee from University lowa, Gerardo Flintsch from Virginia Tech, Zhanmin Zhang from University of Texas at Austin and Sue McNeil from University of Delaware. Each module included in-class and homework exercises. A group project provided opportunities for further student collaboration and application of the class material. The course was designed to be equivalent to a three-credit class. The course was scheduled to coincide with the 6th Annual Interuniversity Symposium on Infrastructure Management (AISIM6).

Good things come in threes: three distinguished lectures and three brown bag seminars

Opportunities to broaden your transportation knowledge abounded at UD during the fall semester. Three distinguished lecturers provided different perspectives:

- Les Hoel, L.A. Lacy Distinguished Professor of Engineering, University of Virginia, spoke on "Mobility and Transportation: Providing Access to the World"
- Chuck Larson (pictured, below left), Practice Leader for Stantec's Infrastructure Management and Pavement Engineering (IMPE) group, spoke on "Pavement Management and Infrastructure Asset Management: From the Trenches"
- Richard Little, Executive Director, The Keston Institute for Public Finance and Infrastructure Policy, University of Southern California, spoke on "Taxes or Tolls: What's the Future of Infrastructure Finance?"

In addition, three brown bag discussions presented perspectives on ongoing projects and past experiences:

- Rusty Lee and Dzung Ngo discussed "The Impact of Disruptions along the I-95 Corridor"
- Michael Paul from Duffield Associates provided an Engineers
 Perspective on Disasters, and
- Tripp Shenton and Pete Seymour (pictured, below right) discussed "Historic Resilience of Bridges on the Bosfolk Corridor "







Charlie's thesis, titled "Impact of the Expansion of the Panama Canal: An Engineering Analysis," involves an engineering analysis of the freight impacts of widening the Panama Canal.

Student of the year

Charles Mitchell, better known as Charlie, is the UDUTC Student of the Year. Charlie is completing his Master's of Civil Engineering degree in the Department of Civil and Environmental Engineering. He holds a Bachelor of Engineering in Civil and Environmental Engineering from the University of Delaware. As an undergraduate researcher, Charlie participated in the UTC funded undergraduate research experience with the Disaster Research Center. His paper "Delaware Emergency Evacuation for the Salem/ Hope Creek Nuclear Generators" served as a foundation for a UTC funded project on Emergency Preparedness. In 2009 he was awarded a UD-UTC Graduate Fellowship. He was a member of the organizing committee for the 2010 Annual Interuniversity Symposium on Infrastructure Management, a graduate organized and focused symposium on infrastructure management. Charlie took a leadership role in developing the website, managing submission from participants, and preparing materials for the symposium. He also volunteered to redesign the Delaware Center for Transportation (DCT) website, delivering a sharp and very professional web presence for DCT. His thesis, titled "Impact of the Expansion of the Panama Canal: An Engineering Analysis," involves an engineering analysis of the freight impacts of widening the Panama Canal. Since the UD UTC was established, Charlie has been an active and engaged participant in the center.

Honors & awards

UD UTC graduate student Michelle Oswald received the 2010 Outstanding Collegiate Student Award from the Society of Women Engineers (SWE).

See www.udel.edu/ udaily/2011/nov/societywomen-engineers111110. html.

Communicating sustainability and livability concepts related to transportation to John and Jane Q. Public

Anne Lucey received an honorable mention for her video, "Sustainable Roadside Landscapes" submitted to the TRB Technical Activities Division's Planning and Environment Group's fourth annual competition to find top methods for communicating transportation concepts to nonprofessional audiences. Anne's video was developed as part of her MS thesis work titled "Whether an awareness of benefits positively influences public perception of sustainable roadside vegetation strategies."

Entries should focus on the 2011 Annual Meeting spotlight theme of transportation, livability, and economic development in a changing world. There is no restriction on the form of communication-graphics, illustrations, photos, software, demonstrations, interactive exercises or gamesused to convey the message. Entries may be examples of successful communications efforts or techniques that can be used to communicate transportation concepts to non-transportation professional audiences. The entries will be evaluated by a panel of judges representing technical as well as communication disciplines. The winner will be announced at the 2011 TRB 90th Annual Meeting, Jan. 23–27, 2011, in Washington, D.C. The top ten entries will be showcased in a poster session at the TRB Annual Meeting and featured in an article in TRB's TR News.



To see Anne's video go to www.youtube.com/ watch?v=C1Qqx96poxs.

University of Delaware Presentations at the Transportation Research Board Annual Meeting, Washington DC, January 2011.

Session	Data and Time	Location	Presentation Title	Presenter
112—Innovative Doctoral Research from Dwight David Eisenhower Transportation Fellowship Program.	Jan. 23 2011 9:00a.m.–12:00p.m.	Marriott	Development of a Decision Support System for Transportation Adaptation Practices in Response to Climate Change	Michelle Oswald
256—The Next Frontier in Transportation Asset Management	Jan. 24 2011 9:30a.m.–12:00p.m.	Hilton	Assessments of Highway Investment Objectives Based on Data Envelopment Analysis	Qiang Li and Sue McNeil
274—Context-Sensitive Solutions, Practical Solutions, and Complete Streets	Jan. 24 2011 10:15a.m.– 12:00p.m.	Shoreham	Influencing Public Perception of Sustainable Roadside Vegetation Management Strategies	Anne Lucey
410—Best Papers from Sixth Annual Interuniversity Symposium on Infrastructure Management	Jan. 24 2011 7:30p.m.–9:30p.m.	Hilton	Methodology for Developing a National Infrastructure Index Using Analytic Hierarchy Process	Michelle Oswald
450—Safety Data and Risk Precursors: Innovative Approaches to Analyzing Safety Data	Jan. 25 2011 8:00a.m9:45a.m.	Shoreham	Risk Analysis of Oil Spill in Delaware River and Bay	Morteza Tabatabaie Shourijeh, Jamshid Laghaei, Eric Best, Leslie Mills and Arde Faghri
557—Vulnerability and Resilience of Critical Transportation Infrastructure	Jan. 25 2011 2:30p.m.–5:00p.m.	Shoreham	Improvement of Resilience of Critical Infrastructure System After a Disaster for Recovery and Mitigation	Silvana Croope and Sue McNeil
638—New Advancements in Geosynthetics for Highway Applications	Jan. 26 2011 8:00a.m9:45a.m.	Marriott	Accelerated Pavement Testing of Unpaved Roads with Geocell-Reinforced Sand Bases	Xiaoming Yang, Jie Han, & Sanat Kumar Pokharel, University of Kansas, Chandra Bahadur Manandhar & Robert L. Parsons, University of Kansas Dov Leshchinsky, Izhar Halahmi, PRS Mediterranean Ltd., Israel
650—Data, Data, Data! Using National Data for State and Local Purposes	Jan 26. 2011 8:00a.m9:45 p.m.	Hilton	Capturing Transportation Infrastructure Performance: Data Availability, Needs, and Challenges	Qiang Li, Sue McNeil, Taggart Foulke, Jonathan Calhoun, Michelle Oswald, Erik Kreh, Michael Gallis & Associates, Susanne Trimbath, STP Advisory Services
761 – Status of the Long-Term Bridge Performance Program	Jan 27, 2011 8:00a.m12:00p.m.	Marriott	Panel Discussion	Dennis Mertz

Again University of Delaware faculty and students are participating in the Transportation Research Board annual meeting to be held in Washington DC in January 2010. Scheduled speakers are listed in the table above.

Upcoming events and opportunities

BROWN BAG

Thursday, April 28 | 12:15–1:15 p.m. Charlie Mitchell, "Impact of the Expansion of the Panama Canal: An Engineering Analysis"

DISTINGUISHED LECTURE

Monday, Feb. 28 | 12:15 p.m. "Planning for Mobility: Engineering for Tomorrow." Dr. Mimi Sheller, Drexel University.

RESEARCH SHOWCASE

May Research Showcase, Dover, DE

DEADLINES

Tuesday, Feb. 15 Research Proposals www.ce.udel.edu/UTC/Research.html

Tuesday, March 1 Summer undergraduate research applications www.ce.udel.edu/UTC/ Undergraduate.html

March 1 Graduate Fellowships www.ce.udel.edu/UTC/Opportunities.html

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