

TranSearch

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2007 TRANSPORTATION EDUCATION, RESEARCH AND SECURITY FORUM ATTRACTS 300

Delaware may be the second smallest state in the union, but when it comes to transportation matters, people care. More than 300 stakeholders in the transportation sector gathered in Clayton Hall for the Transportation Education, Research and Security Forum on Wednesday, November 14, 2007. The group included representatives from federal, state, regional, and local governments; students, faculty, and staff from UD and other academic institutions; the private sector; and civic groups.

According to DCT Director Arde Faghri, Professor of Civil and Environmental Engineering, the goal of the transportation forum was to identify issues of importance to Delaware, the region and the Northeast corridor.

UD President Patrick Harker, Delaware Secretary of Transportation Carolann Wicks, and Director of DELDOT's Division of Planning Ralph Reeb presented opening remarks on the importance of the forum and on working together to solve problems.

"Meeting the transportation challenges of the 21st century will require innovation and partnerships," Harker said. "The key for UD is to take the innovations developed on campus and get them into the



hands of the people on the ground who can make them work. That's where partnerships come in—partnerships are crucial to ensuring that Delaware is competitive in the global economy and that our transportation systems meet the needs of the people of Delaware."

Carolann Wicks, Delaware secretary of transportation: "We're at our best when we bring together diverse groups, with different ideas, experiences and perspectives."



UD President Patrick Harker: "In the new model of partnerships, government, industry, community groups and higher education must cooperate from the outset to develop ideas and bring them to the marketplace. We must think differently and more creatively about collaboration."

"In the new model of partnerships," he continued, "government, industry, community groups and higher education must cooperate from the outset to develop ideas and bring them to the marketplace. We must think differently and more creatively about collaboration."

Harker pointed to the transportation forum as a step in that direction. "DCT is a good example of this kind of partnership," he said.

Following Harker, Wicks reiterated the importance of collaboration. "We're at our best when we bring together diverse groups," she said, "with different ideas, experiences and perspectives."

Economic prosperity, quality of life, air quality and safety are all cornerstones of transportation systems, according to Wicks. "Delaware has a critical

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MESSAGE FROM THE DIRECTOR



Ardeshir Faghri, Director

On behalf of the center staff, I would like to wish everyone a happy 2008. During the latter part of last year, our main programs in conducting research, training, and service as well as inviting distinguished guest speakers have all been strong. Many of the articles within this newsletter refer to our ongoing programs.

The two most important items to report are (1) the launch of our new University Transportation Center (UTC) program and (2) our successful Transportation Education, Research & Security Forum.

A special insert in this newsletter is now dedicated to reporting major events of the UTC, which is directed by Professor Sue McNeil. Many of our future events will be jointly planned and hosted, but the UTC will focus specifically on resiliency in the Northeast corridor. You can learn more about the specific activities and events of the UTC in the center's newsletter insert.

More than 300 participants representing a diverse group of stakeholders from Delaware and the surrounding states attended the forum to share ideas and opinions and reach consensus on the most pressing issues facing our transportation system. We will use the results of this dialogue to generate ideas for research projects and to serve as input to our ongoing education and service components.

In June 2007, we said good bye to a dear friend, Dr. David Roselle, who retired after 19 years of excellent service as president of the University of Delaware. Dr. Roselle was a major supporter of our center and played a key role in facilitating the establishment of many of our new programs.

While Dr. Roselle will be missed, we are very pleased to welcome Dr. Patrick Harker as the 26th president of our university. First, Dr. Harker is a civil/transportation engineer by education, and we have many common friends and colleagues in the transportation community. Second, and in my opinion more importantly, we have many common ideas and share the same vision for the future of the University in general and the center in particular. Some of our shared visions include reaching worldwide audiences in this age of a global economy and getting the private sector more involved in the programs that we offer.

Again, a happy 2008 to everyone. We hope your contributions and participation in our programs continue strongly in this New Year and beyond. For all the latest updates, please refer to our web site at www.ce.udel.edu/dct.

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role to play in the region," she said, "but we also have to be concerned about local issues, such as maintenance of our bridges and pavements, fuel efficiency of our buses, and incident management on our highways. This forum is a good example of how all of our issues are interrelated."

Wicks also pointed to the aging population as a factor in a whole range of transportation issues, including land use, driver education, design considerations (e.g., signage and striping) and recruitment of future transportation officials.

Reeb wrapped up the welcoming remarks by pointing out that the best way to address transportation challenges is to ask good researchable questions. "We also have to prioritize," he said, "because there are far more questions in this room than there are dollars, people or time to answer them."

Luncheon keynote speaker Ajay Prasad, Professor in the Department of Mechanical Engineering, summarized the progress and achievements of the zero emission hydrogen fuel cell bus program, a collaborative effort involving civil and mechanical engineering faculty as well as industry and DelDOT.

For the afternoon session, participants were divided into eleven groups representing various areas within transportation: planning, administration, transit, maintenance, traffic, bridge, construction, local issues, design, environment, and transportation security.

"The interaction among the participants in each session was fascinating," Faghri said.

On average, twenty problems were defined in each session, resulting in more than 200 different problems for the forum. A booklet containing the problems within each session has been published; to obtain a copy, call 302-831-1446.

The forum was sponsored by the Delaware Department of Transportation; the Federal Highway Administration; the Delaware River and Bay Authority; the Enterprise Flasher Company; Rummel, Klepper and Kahl, LLP; the Signal Services, Inc.; the Center for Innovative Bridge Engineering; the Institute for Public Administration; and the University Transportation Center.

DCT AUTHORS IN THE NEWS

With this issue, TranSearch begins a new feature that tells you when other media outlets report on our activities or reprint our newsletter articles.

1. *The New York Times* issue of August 29, 2007, prominently reported how several states including Delaware are using native flowers and other plants to replace grass on highway rights-of-way. The article featured the work of Dr. Sue Barton, a University horticulturist, who is an advisor to DelDOT. In this role, she has conducted several research programs for DelDOT as part of the annual research program administered by the DCT.

Wildflowers and other plants that replace grass serve two functions. First, they add to the pleasure of the driving experience by adding beauty and enjoyment to motorists' trips. Second, they reduce the costs of seasonal mowing which can amount to \$163 an acre using state workers, or \$800 an acre using contractors.

The full text of this article may be found at www.nyt.com.

2. *The Indiana Pothole Gazette*, the newsletter of the Indiana T² Center, has reprinted two articles by the Delaware T² Engineer, Alan Kercher P.E. The pieces were (1) New Pavement Construction Standards, and (2) Utility Control Programs. Mr. Kercher's articles first appeared in the Travel-Log, the Delaware T² Center newsletter. The Rhode Island T² Center has also selected these articles for an "extra" of its newsletter that the center will distribute to all local governments in Rhode Island.

The web address for the Indiana T² Center is http://ace.ecn.purdue.edu/ltap_new/home/

3. Adam Catherine (MCE '06) and Julie Trick (BSCE '07) collaborated on research showing that blood alcohol counts of much less than .08 (legal impairment threshold in most states) adversely affect driving skills. Their article, "A False Sense of Security: The Misconceptions About Alcohol's Effects on Driving," was reprinted in transportation newsletters in Washington State and Montana.

This article is posted on the DCT web page at www.ce.udel.edu/dct

4. *TR News*, the bi-monthly magazine of the Transportation Research Board, printed a news brief concerning the ongoing hydrogen fuel cell-powered bus research project currently underway at the University. This article appeared in the July-August 2007 issue.

ITE STUDENT CHAPTER SPONSORS ANNUAL DELDOT TOUR



DelDOT Engineers, Jim Satterfield (left) and Barry Benson (right) discuss project development techniques during the DelDOT tour.

The student chapter of the Institute of Transportation Engineers sponsored its annual visit to DelDOT on November 2, 2007. Eight undergraduate and graduate students got briefings from DelDOT engineers and planners from the Division of Transportation Solutions and the Division of Planning. The students learned how DelDOT plans, prioritizes, designs, and constructs its projects. They also had an opportunity to get to know DelDOT as a potential employer.

DAVIDSON JOINS CEE FACULTY



Dr. Rachel Davidson

In September 2007, Dr. Rachel Davidson, who earned her Ph.D. in Civil Engineering at Stanford University, joined the CEE faculty as an Associate Professor. She comes to the University of Delaware from the School of Civil and Environmental Engineering at Cornell University in Ithaca, NY. Dr. Davidson's research interests involve natural disaster risk assessment and management, and civil infrastructure systems.

DR. EARL "RUSTY" LEE JOINS CEE FACULTY



Dr. Earl "Rusty" Lee

Dr. Earl "Rusty" Lee joined the University of Delaware's Department of Civil and Environmental Engineering in September 2007 as an assistant professor and was also appointed Coordinator of Advanced Traffic Operations for the Delaware Center for Transportation.

He received his bachelor's degree in nuclear engineering from Rensselaer, before joining the Navy's submarine service. His 24 year career, both active duty and reserve, included assignments as Chief Engineer of the nuclear ballistic missile submarine, James K. Polk, staff of the Commander, Submarine Force Atlantic Fleet, and the staffs of the Commander, Navy Region Hawaii and Navy Region Northeast, working in the development of emer-

gency response plans and overseeing training exercises. He returned to Rensselaer in the fall of 2000 as a student and was hired by the Institute in August 2001. He has a master's degree in Management and a Ph.D. in Decision Science and Engineering Systems.

Dr. Lee's research interests include applied operations research methodologies in the areas of homeland security, hazards mitigation, and vulnerability; technologies for collaborative decision making, with particular emphasis on incident and emergency management; advanced traffic engineering; intelligent transportation systems. He is teaching in the areas of transportation engineering and project management.

PROFESSOR ALAIN KORNHAUSER DELIVERS LECTURE

On October 4, 2007, Alain L. Kornhauser, Professor of Operations Research & Financial Engineering at Princeton University, delivered a lecture entitled "Towards Ubiquitous Dynamic Minimum ETA Route Guidance and Experiences with the DARPA Autonomous Vehicle Challenges." Kornhauser is also Director of the Transportation Research Program and Co-Director for the New Jersey Center for Transportation Information and Decision Engineering (NJ Tide).

In his two-part seminar, Kornhauser first provided the audience with an overview of his experiences with a recent FHWA project, "The Capitol District Advanced Traveler Information System." (Coincidentally, that project was managed by CEE Prof. Rusty Lee during his appointment as a staff research associate at Rensselaer Polytechnic Institute.) In the second part of the lecture, Kornhauser discussed Princeton's entries in the autonomous vehicle challenges sponsored by the Defense Advanced Research Projects Agency (DARPA).

According to Kornhauser, the Capitol District project was the first demonstration of real-time data being collected from drivers, processed into network conditions, and returned to the drivers in time to support their routing choices on a trip. He outlined the technological challenges inherent in dynamic routing and discussed the potential for further refinements, including the ability to move beyond real-time control to predictive systems, wherein rerouting can be initiated before congestion develops.



Prof. Kornhauser has advised student teams at Princeton in their development of autonomous land vehicles for the DARPA challenges.

DARPA's 2005 Grand Challenge and 2007 Urban Challenge called for teams of undergraduate students to develop autonomous land vehicles. The 2005 event required self-navigation of the vehicles across 132 miles of desert terrain, while the 2007 contest was set in an urban environment, requiring them to interact with traffic, navigate traffic circles, and avoid obstacles. The 2005 Princeton team advised by Kornhauser was one of 23 finalists from an original pool of 195, while his 2007 team made it to the semifinals.

Following the seminar, Kornhauser delivered a lecture to students in the Urban Transportation Systems class.

Kornhauser's visit to UD was co-sponsored by DCT and the UDUTC.

UNIQUE COMPOSITE BEAM PASSES TEST

by Diane Kukich

On November 7, 2007, a full-size locomotive traversed the first composite railroad bridge in the world with John Hillman, inventor of the unique hybrid-composite beam that formed the structure of the bridge, on board. Hillman, Senior Associate with Teng & Associates in Chicago, patented the technology in 2000 under the name "Plasticon-Optimized Composite Beam System." Now known as the Hillman-Composite Beam, or HCB, the material was designed to be stronger, lighter, and more corrosion resistant than the standard concrete and steel used in infrastructure applications.

After patenting the concept, Hillman turned to the University of Delaware several years ago for support in fabricating and testing the beam. UD offered an ideal combination of expertise and facilities in bridge design and large-scale testing through the Department of Civil & Environmental Engineering and in composites manufacturing through the Center for Composite Materials (CCM).

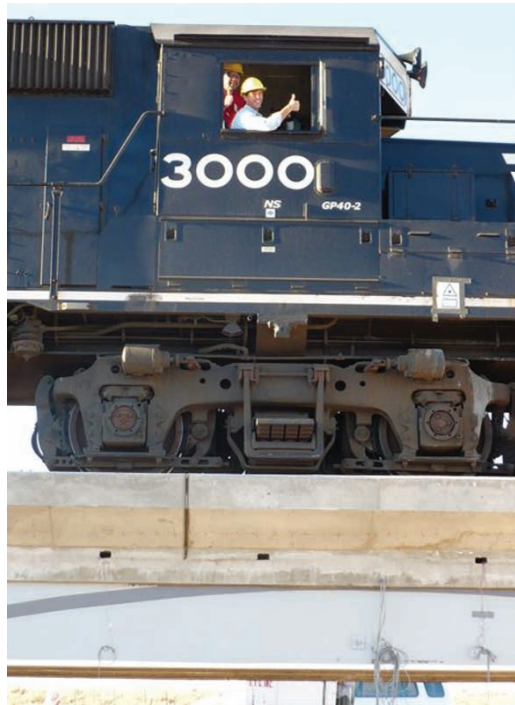
Dennis Mertz, Professor and Director of the Center for Innovative Bridge Engineering at UD, and Jack Gillespie, Donald C. Phillips Professor and Director of CCM, were important resources for Hillman as he began to explore further development and commercialization of the HCB.

For Hillman, the recent load test was evidence that the beam has a future beyond the lab. The test was conducted on the FAST (Facility for Accelerated Service Testing) Loop at the Transportation Technology Center, Inc. (TTCI) near Pueblo, Colorado, a transportation research and testing organization operated by the Association of American Railroads.

"Getting the beam designed, validated, and manufactured was a challenge," says Hillman, "but beyond that, it was critical for us to get the buy-in of the railroad community. If we had tested the beam on a working track somewhere, we could have collected data about the performance of the beam, but we would not have gained the attention of the entire Class I Railroad industry."

A consortium of railways—including Burlington Northern Santa Fe, Canadian National, Canadian Pacific, Norfolk Southern, and Union Pacific—shouldered the substantial cost of the live test. "This was evidence that they were very interested in our technology," says Hillman. He credits TTCI's Duane Otter with pushing the initiative and overseeing the testing operation in Colorado.

Constructed on the 4.8-mile-long FAST Loop at TTCI, the bridge is a 30-foot span comprising eight HCBs. "The response of the bridge matched exactly the predicted strains and displacements calculated in accordance with the limits specified in the AREMA [American Railway Engineering and Maintenance-of-Way Association] design codes," says Hillman.



A full-size locomotive traverses the first composite railroad bridge in the world. The Hillman-Composite Beam, or HCB, was designed to be stronger, lighter and more corrosion resistant than the standard concrete and steel currently used to make railroad bridges.

With the performance of the HCB validated and recognized by the rail community, the next step is production of a prototype for extended testing in Pueblo. "Our ultimate goal is to deploy the technology in revenue service on a Class 1 railroad," Hillman says.

Plans are also in place for the technology to be tested on two highway bridges: a 58-foot span in Illinois and a 36-foot span in New Jersey. The bridges were designed by Teng, with project funding provided by the Federal Highway Administration through the IBRD (Innovative Bridge Research and Design) Program. Hillman has recently established a separate business entity, HC Bridge Company LLC, to promote commercialization of the technology.

In addition to the strong technical support provided by the University of Delaware, Hillman acknowledges the contributions of several industrial partners in the project, including Owens Corning, which donated its "Flow-Tex" quad-weave material for the resin infusion process; Ashland Specialty Chemicals, which supplied the resin; Elliott Company, which provided the foam; and Hardwire LLC, whose steel

reinforcement was used in the beams.

Development of the beam was also enabled by a grant from the Transportation Research Board (TRB) through its IDEA (Innovations Deserving Exploratory Analysis) HSR (High Speed Rail) Program.

Michael Chajes, Professor in the Department of Civil and Environmental Engineering and Interim Dean of the UD College of Engineering, is pleased that the project provided a learning opportunity for students. During the summer of 2005, two civil engineering undergraduates spent 10 weeks working on design, fabrication, and testing of the HCB in the Composites Manufacturing Laboratory and the Civil Engineering Structures Laboratory. Hillman spent time on site at UD to co-advise the two juniors.

"Thanks to all the work that has been done on the composites manufacturing process since then, the beams can now be manufactured in a day," Chajes points out. "But two years ago, the team was facing a number of fabrication challenges, which turned out to be a great experience for our students because it provided them with insights into the research process that they wouldn't have gained if everything had gone smoothly."

For Gillespie, the project is a perfect example of how the contributions of many partners can take an innovative idea from concept to field application. "It also demonstrates successful interdisciplinary research," he says. "The beams are intended for structural applications, which meant that the involvement of civil engineers was critical to complement our knowledge and expertise in composites manufacturing."

ENGINEERS WITHOUT BORDERS



Junior Sarah O'Neill (left) records data for one of the village's wells. UD's EWB contingent found bacteria and impurities in all of the streams and hand-dug wells in and around Bakang.

design and implement sustainable (water quality) solutions in the rural crossroads village of Bakang.

The group chose the Bakang project after consulting with the EWB chapter at the Johns Hopkins University at Baltimore. A member of the Johns Hopkins chapter, Olivia Mukam, was very cognizant of Bakang's water problems. She is a native of Bakang and the daughter of the village's mayor.

Bakang's population of approximately 3,000 people engages mainly in sustenance farming. The village has no electricity or running water. Drinking water comes from both open wells and turbid creeks which have high levels of bacteria because the water is untreated. Disease from polluted water is a constant threat. Village residents must spend considerable time carrying water to their homes.

In June 2007, four members of the UD chapter accompanied by their advisor, Dr. Steven K. Dentel, went to Bakang to conduct a health and quality assessment of the village's water supply. They

Engineers Without Borders (EWB) is a humanitarian organization that seeks to collaborate with developing countries in order to improve their quality of life. EWB consists of professional and student chapters including the student chapter with about forty members established in early 2007 at the UD.

According to Julie Trick ('08), the chapter is in the midst of a project in the African country of Cameroon that will



UD seniors Julie Trick and Barney Fortunato (foreground) with Bakang villagers in the town center.

also mapped the region using GPS equipment and made measurements of the area's water table. The team revived a nonfunctioning well that now provides clean water and can meet about one-third of the water requirements estimated for the community. To ensure local support, they also helped to create a water committee to assist in the choice of future water improvements and commit to maintenance of these improvements in the future.

The chapter plans a second visit to Bakang in January 2008 to collect more data and begin a pilot program to recommend improvements that will soon increase the quality and quantity of drinking water to the village.

Funding improvements in Bakang will place financial hardships on the local and national governments. The EWB chapter will try to raise private donations to help defray the costs of future improvements. Additional information on this project can be found at <http://copland.udel.edu/stu-org/ewb/> or contact the UD chapter at ewb.udel@gmail.com.

MIZUSAWA JOINS CEE



Dr. Daisuke Mizusawa

Dr. Daisuke Mizusawa joined the Department of Civil and Environmental Engineering in September 2007 as a Postdoctoral Research Fellow. Previously, he was a Visiting Scholar at the department and worked under Professor Sue McNeil. He earned his Ph.D. in Urban Planning and Policy at the University of Illinois at Chicago (UIC) in May of 2007. He has research experience in Transportation

Policy in the Urban Transportation Center in UIC and the World Bank.

Dr. Mizusawa's research interests focus on transportation infrastructure development and management. He has civil engineering and traffic planning experience in highway construction, operation and maintenance in the Japan Highway Public Corporation.

MENSAH JOINS DCT AS RESEARCHER



Dr. Stephen Mensah

Dr. Stephen Mensah attended the University of Delaware, where he obtained both his Masters and Ph.D. in Transportation Engineering. His research interest is civil infrastructure systems, particularly the use of microsensor technology for structural health monitoring. "Advancements in microsensor technology present opportunities to enhance asset management through collaboration and rapid application of innovation,"

Mensah says. Dr. Mensah's goal is to contribute to the drive towards sustainable engineering. In addition, he is interested in numerical techniques that facilitate the use of sensors in a sensor network suite. He had worked as a Transportation/Highway Engineer for Century Engineering (Hunt Valley, MD) before joining DCT.

Research

A Principal Investigator/Project Manager (PI/PM) meeting was held at the beginning of October. The PIs each gave a brief report on his/her project and then met one-on-one with his/her PM.

DCT administrators will meet with the DelDOT Research Committee in January to determine which concerns are most important to DelDOT and can be funded as projects for the following fiscal year. Many new research concerns and ideas were also gleaned from our Transportation Education, Research and Security Forum held in November.

The current active research projects are listed below. As each project is completed, an abstract will be available on the DCT website (<http://www.ce.udel.edu/dct>).

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

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

Project Manager: Mark Glaze, Division of Planning

An Examination and Presentation of Travel in Sussex County

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

Project Manager: Mike DuRoss, Division of Planning

Bridge Management Using In-Service Data (Phase II)

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

Project Manager: Jiten Soneji, Bridge Design

Establishment of a Geotechnical Information Database

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

Project Manager: Wayne Kling, Division of Materials and Research

Pavement Performance Models

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

Project Manager: Jennifer Pinkerton, Division of Preconstruction

Clean Energy Use in Vermont and Delaware Land Use Planning

Principal Investigators: Chandra Aleong, Delaware State University and Young-Doo Wang, University of Delaware

Project Manager: Ralph Reeb, Division of Planning

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

Principal Investigator: Bernie Dworsky, Institute of Public Administration

Project Manager: Catherine Smith, Delaware Transit Corporation

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

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

Project Manager: Dennis O'Shea, Bridge Design

Integrating Travel Time Reliability into Planning and Management

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

Project Manager: Mike DuRoss, Division of Planning

Senior Safety: Senior-Based Licensing & Testing

Principal Investigator: Bernie Dworsky, Institute of Public Administration

Project Manager: Mike DuRoss, Division of Planning

Resilience Modulus (continuation)

Principal Investigator: Nii Attoh-Okine, Department of Civil and Environmental Engineering

Project Manager: Wayne Kling, Division of Materials and Research

Calibrated Video System for Traffic Speed and Vehicle Identification

Principal Investigators: Jack Puleo and Harry Shenton
Department of Civil and Environmental Engineering

Project Manager: Jiten Soneji, Bridge Design

Investigation of Intelligent Compaction Technology

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

Project Manager: Wayne Kling, Division of Materials and Research

Characterization of SR-1 Concrete Test

Principal Investigator: Danny Richardson, Department of Civil and Environmental Engineering

Project Managers: Wayne Kling, Division of Materials, and Dan LaCombe, Division of Planning

Letting Scenic and Historic Roads in Delaware Tell Their Story

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

Project Manager: Maria Andaya, Division of Planning

Enhancing Delaware's Highways: A Natural Vegetation Project

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

Project Manager: Chip Rosan, Roadside Environment

Scrap Tire Research

Principal Investigator: Nii Attoh-Okine, Department of Civil and Environmental Engineering

Project Manager: Wayne Kling, Division of Materials and Research

Hot-Mix Asphalt Specification Research

Principal Investigator: Nii Attoh-Okine, Department of Civil and Environmental Engineering

Project Manager: Wayne Kling, Division of Materials and Research

Comparative Analysis of Best Practices in Transportation Planning, Design, Construction and Management to Accommodate Growing Elderly Needs

Principal Investigator: Bernie Dworsky, Institute of Public Administration

Project Manager: Mark Luszczyk, Division of Transportation Solutions

Asset Management as a Strategic Decision-Making Tool in DeIDOT

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

Project Manager: Ralph Reeb, Division of Planning

Examination of GIS and Current Information System Plans and Responsibilities

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

Project Manager: Joseph Cantalupo, Division of Planning

WILMAPCO – Performance of Work-Support of Sub Task 7.04.01, Task #MPO 7.04 Entitled Data Collection, Management and Distribution in FY07.

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

Project Manager: Dan Blevins, WILMAPCO

DCT GRADUATE STUDENTS

During the academic year 2007-2008, DCT projects are supporting more than 20 graduate students and about 20 undergraduate students. These students are being advised by Dr. Lee, Dr. Attoh-Okine, Dr. Faghri and Dr. McNeil. Students come from a variety of different backgrounds, but they all share a common interest in transportation. DCT has graduate students from many countries, such as Iran, China, Kazakhstan, Brazil, Ghana and Nigeria, as well as the US. We have students graduating in January 2008, all the way through the fall of 2012.

Our students are studying a wide range of topics. Here's a sample:

David Adams

"Integrating Travel Time Reliability in Planning and Management of Freeways"

Olufikayo Aderinlewo

"Assessing Infrastructure Systems through Network Analysis and

Fuel Cell Bus

Principal Investigator: Ajay Prasad, Department of Mechanical Engineering

Project Manager: Sean Rickerson, FTA

DOT UTC TIER II

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

Project Manager: Amy Stearns, RITA

Investigating the Cost, Liability and Reliability of Anti-Idling Equipment for Trucks

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

Project Manager: Mark Glaze, Division of Planning

Scour Monitoring of the Indian River Inlet Bridge:

Principal Investigator: Jennifer McConnell, Department of Civil and Environmental Engineering

Project Manager: Doug Robb, Division of Transportation Solutions

Instrumentation and Monitoring of the Indian River Inlet Bridge: Phase I

Principal Investigator: Michael Chajes, Department of Civil and Environmental Engineering

Project Manager: Jiten Soneji, Bridge Design

Fatigue Evaluation

Principal Investigator: Dennis Mertz, Department of Civil and Environmental Engineering

Project Manager: Doug Robb, Division of Transportation Solutions

Development of State-Specific Truck Weights

Principal Investigator: Dennis Mertz, Department of Civil and Environmental Engineering

Project Manager: Percival McNeil, Division of Transportation Solutions

Developing Working Equations to Characterize their Performance"

Anuar Amanzholov

"Offpeak Signal Control"

Albert Ayenu-Prah

"Bidimensional Empirical Mode Decomposition in Civil Infrastructure Systems"

Silvana Croope

"Critical Infrastructure Interdependencies Operations and Disasters"

Yukon Dong

"Assessing Financial Analysis Strategies for Infrastructure Renewal in Regional Transportation Planning"

Rachel Nathman

"Evaluation of Environmental Releases and Material Requirements in Pavement Construction using PaLATE, a Life Cycle Cost Analysis, Integrated Hybrid Model"

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Two students already have jobs lined up to start after graduation.

David Adams will be going to work for PennDOT in Pennsylvania, and **Rachel Nathman** will be going to work for HNTB, in the Aviation Group, in Kansas City, Kansas. Rachel will be pursuing a second Masters Degree in GIS while working at HNTB.

Six students are working on UTC projects.

Matt Hayes

"Assessing the Vulnerability of Delaware's Coastal Bridges to Hurricane Forces." Advised by Dr. Mertz, Civil and Environmental Engineering.

Tim Soper

"The Planning and Policy-Making Infrastructure for Transportation in the Northeast Corridor." Advised by Dr. Warren, Urban Affairs and Public Policy.

Amit Mokashi

"Development of Delaware Regional Freight Data for Geographic Intermodal Freight Transportation (GIFT) Model." Advised by Dr. Corbett, Marine Studies.

Silvana Croope

"Resiliency of Transportation Corridors Before, During, and After Catastrophic Natural Hazards." Advised by Dr. McNeil, Civil and Environmental Engineering; Dr. Nigg, Sociology; Dr. DeLiberty, Geography.

Rebekah Gayley and Michelle Oswald

"Evaluating the Current State of the BOSFOLK Transportation Corridor and Indicators of Resiliency." Advised by Dr. McNeil, Civil and Environmental Engineering and Dr. Ames, Center for Historical Architecture and Design.

These research projects are an invaluable experience for our students. It gives them "hands-on" experience in their areas of interest in transportation, as well as experience in collecting and analyzing real-life data. Our undergraduate research assistants, for the most part, help the graduate students in data collection, data analysis and report presentation. During the past fifteen years, all students, associated with DCT have had a 100% job placement record, meaning each had at least one official job offer before they graduated.

PRINCIPAL INVESTIGATOR PROJECT MANAGER MEETING

On Monday, October 1, 2007, the DCT affiliated faculty members working on FY'08 DelDOT research projects met with their project managers to report on and discuss the work plan and progress made up to that point on each project. A presentation was made by the researcher for each project followed by a general discussion by attendees. After the presentations, the Principal Investigators and the Project Managers met one on one to fine tune their work plans to more closely respond to the research needs of DelDOT. The list of research projects discussed at this meeting is as follows:

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

Principal Investigators: Young-Doo Wang and John Byrne
Project Manager: Mark Glaze

An Examination and Presentation of Travel in Sussex County

Principal Investigator: David Racca
Project Manager: Mike DuRoss

Bridge Management Using In-Service Data (Phase II)

Principal Investigators: Michael Chajes and Harry Shenton
Project Manager: Doug Finney

A Feasibility Study of Bus Rapid Transit (BTR) in Delaware

Principal Investigator: Bernie Dworsky
Project Manager: Catherine Smith

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

Principal Investigators: Chandra Aleong, Delaware State University

and Young-Doo Wang, University of Delaware
Project Manager: Ralph Reeb

Pavement Performance Models

Principal Investigators: Sue McNeil and Nii Attah-Okine
Project Manager: Jennifer Pinkerton

Establishment of a Geotechnical Information Database

Principal Investigator: Chris Meehan
Project Manager: Wayne Kling

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

Principal Investigators: Dov Leshchinsky and Chris Meehan
Project Manager: Doug Robb

Integrating Travel Time Reliability into Planning and Management: Literature Search

Principal Investigator: Sue McNeil
Project Manager: Mike DuRoss

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Research Pays Off

NIGHTTIME CONSTRUCTION: DEVELOPING A SPECIFICATION FOR ROAD WORK AT NIGHT

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More and more states are scheduling construction work at night because of high traffic volumes during the day. Nighttime work, however, has its own hazards. A comprehensive specification can help in adapting to the special circumstances of working at night.

Problem

In 2002, the Nova Scotia Department of Transportation and Public Works (NSTPW) had to repave about 8 kilometers of Highway 125—a two-way, two-lane highway that serves as the main arterial route connecting several communities. In summer, the average daily traffic regularly exceeds 25,000 vehicles, with hourly peaks of more than 2,300 vehicles. The highway is close to reaching its capacity.

Detours were not practical, because the alternative routes also were almost at capacity during the day. The repaving therefore had to be carried out during nighttime hours when traffic volumes were low, to avoid traffic delays and queues that would be unacceptable to highway users.

NSTPW occasionally had performed highway construction work at night but had developed few specific safety requirements. Because Highway 125 would be the first major paving project requiring all work to be done at night, NSTPW decided to develop a specification to address the special concerns of working at night. The measure also would respond to the requirement for due diligence under Nova Scotia's Occupational Health and Safety Act.

Solution

To develop the specification, NSTPW staff relied on published findings from two recently completed National Cooperative Highway Research Program (NCHRP) projects:

- NCHRP Report 476, *Guidelines for Design*



Nighttime paving operation on Highway 125, Nova Scotia, in 2003.

and *Operation of Nighttime Traffic Control for Highway Maintenance and Construction*, which was a source of practical advice on traffic control devices, safety features, and the operation of a nighttime traffic control system¹ and

- NCHRP Report 498, *Illumination Guidelines for Nighttime Highway Work*, which described the three levels of illumination recommended for nighttime construction.²

NSTPW also obtained comments and specifications from many state and provincial departments of transportation (DOTs) in the United States and Canada that had experience with nighttime construction.

In the past 21/2 years, NSTPW has continued to update the specification from experience and onsite observations. For example, a minimum level of point illumination recently was added to the lighting requirements to reduce the variability of illumination in the work area.

The specification addresses several areas of primary concern in working at night. First,

NSTPW analyzes predictions of work zone capacity and traffic flow to establish the hours of work.

The specification defines the following three levels of illumination:

1. Level 1, 60 lux—general site lighting for workers on foot;
2. Level 2, 110 lux—for working near certain types of equipment—for example, behind the paver, so that quality control personnel can monitor the pavement mat closely; and
3. Level 3, 220 lux—required at stations for traffic control persons (TCPs).

The contractor must assemble a trial setup of the traffic control and light systems for NSTPW review before work can begin. The specification also establishes requirements for traffic control devices that will be used at night, such as signage, flashing light units, and channelization—that is, redirecting the traffic flow with temporary markers.

The construction contractor must submit a



Effective lighting systems designed by professionals are key ingredients to the success of a nighttime paving project.

detailed night work plan, which includes night-related traffic control plans, site safety rules, and training materials. The plan also must include detailed lighting plans designed by a professional engineer with expertise in lighting.

TCPs and other workers must receive special training in carrying out their duties at night and must wear high-visibility apparel. TCPs also must have radio communication with other TCPs and staff on the work site.

Haul trucks must have reflective signs mounted on the tailgates, directing motorists not to follow into closed traffic lanes. Trucks and heavy equipment also must add reflective material to produce an outline of the vehicle. All vehicles on the site must have rotating incandescent lights.

Application

The specification was employed during the 10-week construction period for the Highway 125 night paving project. No worker safety incidents occurred, and no complaints were received from motorists who passed through the work site.

The amount of illumination provided was adequate for a safe work environment and

for high-quality work—the contractor earned a bonus for the asphalt work. Design of the lighting plan by a professional ensured that the light tower setup and the lamp-aiming geometry would minimize the glare.

Detailed observations of all aspects of the specification enabled improvements to be made for subsequent projects. The specification was used on five projects in 2003, including a full deck replacement and a structural upgrade of a major bridge. Much of the bridge rehabilitation had to be carried out at night.

Several nighttime construction projects have applied the night work specification in 2004, and others are scheduled for the 2005 construction season. The specification continues to undergo updates and improvements each year.

Notable changes in the latest revision include using only drums to channelize roads with higher traffic volumes; tightening the spacing between channelization devices; setting minimum values for point illumination; and requiring an internal traffic control plan for each work zone, setting out a strategy for the safe operation of

construction vehicles on the site.

Benefits

By implementing the NCHRP research findings and by learning from the experiences of other DOTs, Nova Scotia now has a state-of-the-art specification for night work. The specification has proved effective and practical, and improvements continue in response to onsite observations and further study.

Contractors have found the nighttime work productive — haul vehicles do not have to wait in the long queues that develop during daytime traffic. The motorist delays that were common during daytime construction and maintenance operations were minimized on project sites.

In addition, several jurisdictions in North America have used the NSTPW specification as a model for the development or improvement of their own night work specifications.

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