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New Focus for UD's ITS Lab

By Rusty Lee, Assistant Professor

The Delaware Department of Transportation and the Delaware Center for Transportation have formed a new partnership to revitalize the Intelligent Transportation System (ITS) Laboratory. This new partnership will establish the ITS Lab as a state of the art facility with three main focus areas: (1) service to DelDOT, (2) training for DelDOT and support UD for classroom instruction, and (3) research for UD faculty and students.

The ITS lab was established in 2002 and originally consisted of four computer work stations, a direct fiber optic connection



Transportation Engineering graduate students utilize the ITS Lab for traffic studies.

such as large-volume data storage devices, and a new suite of software to support research and education. The data flow from the TMC will also be expanded to allow for greater data sharing and archiving. As a service facility, the ITS lab will be positioned to provide a continuing DelDOT/DCT technical resource. The lab will be available to support travel demand forecasting and simulation, signal corridor re-timing plans, system performance assessments and reports, and data collection and archiving. The lab can also serve to assess new technologies such as video recognition as well as comparison studies of new software. Additionally, the student staff can support DelDOT staff with literature reviews and making reports available at the DCT website and potentially turning these reports into journal or conference papers.

to DelDOT's Traffic Management Center

The lab was expanded to its current eleven

plans include replacement of the existing

large display screens, additional hardware

workstations in 2006. The newest expansion

(TMC), and three large display screens.

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Message From the Director

The main theme emerging from the last few transportation conferences and meetings that I've attended seems to be "Preparing for Change." With the U.S. presidential election



as well as the State of Delaware gubernatorial election looming, some of these changes may materialize in the form of new or revised policies set forth by the new

administrations. Another important change, of course, is the ever-increasing price of gas, with no end in sight. Many economists suggest that the per-gallon cost of gas may go much higher than the current levels before consumers see any stabilization. Parallel with the increased price of gas is the slowing down of the economy. Again, there are reputable economists who are forecasting a long economic recession ahead.

These changes have had and will undoubtedly continue to have an impact on the transportation system and potentially on the way we conduct business. Precisely what these impacts are remains to be seen. Here at the Delaware Center for Transportation, we have been able to position ourselves on a strong foundation so as to welcome any positive changes and absorb the negative effects that may accompany some of these changes. Our annual research program, the technology transfer program, the federally funded University Transportation Center program, and many of our educational programs are continuing as strong as ever. Our Intelligent Transportation Systems laboratory along with our advanced traffic engineering operations program

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As a training facility, the ITS Lab will support training for DelDOT. This could include hands-on with the TMC suite of software, essentially allowing the lab to operate as a simulated version of the Smyrna TMC. The lab will also support training exercises involving simulation, decision making, and follow-up. The facility could develop simulations of key areas within Delaware such as the beach areas or the Dover Raceway and allow agencies to collaborate to look at alternative traffic management strategies. These exercises could include pre-hurricane evacuation of coastal areas.

The lab will also enhance the existing transportation curriculum by improving the quality of lab assignments. Students will be able to use real-time or archived data Delaware Center for Transportation

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are now being coordinated by a new faculty member, Professor Rusty Lee. Rusty has already started many new and state-of-the-art programs and will continue to strengthen and expand research, education and service activities for this module of the center. Professor Sue McNeil got the University Transportation Center program off to a shining start, winning the praise of the program coordinators in Washington, D.C. With our Technology Transfer program going strong, a new full-time professional engineer is currently being hired to serve as the circuit rider engineer for the program. This individual, who will be stationed at the center, will replace our current engineer and president of Kercher Engineering, Alan Kercher, PE, who has been providing his excellent services for DelDOT and the center for more than 15 years.

With the increased level of publications and presentations by our transportation faculty, we have decided to add a new section to our newsletter called the "Academic Corner." In this section, publications and other scholarly activities accomplished by our faculty will be reported. If you are interested in receiving any of the publications, please contact the center.

And finally, I'm sad to report the retirement of my assistant, Wanda Taylor. Wanda, for thirteen years, put her heart and soul into the center and was behind many of our new programs and successes that we are enjoying today. Wanda's excellent services will be greatly missed. Efforts are currently underway to replace her.

During the next few months and certainly before the publication of our next newsletter, we'll be witnessing many changes – new president, new governor, potentially new transportation policies that may affect funding, the ever-increasing price of gas, continued emphasis on global warming, and continued globalization. I feel confident that we, at the center, are prepared to face whatever challenges these changes may bring about, in order to continue our main missions of preparing our students for the realities of the world, to conduct first-class research, and to continue our technology transfer and other public service programs, as we have done in the past.

in support of assignments in a variety of ways including planning models, signal timing, corridor coordination plans, redesign of intersections, roundabout evaluation, and statistical analysis of traffic data.

As a research facility, the lab will expand its role for faculty and students, perhaps even beyond the UD campus. It is foreseeable that other state DOTs and universities might want to take advantage of the facility in support of their research also, leading to new collaborations and funding sources.

Editor's Note: Professor Rusty Lee, Coordinator of Advanced Traffic Operations for DCT, provides oversight for all ITS lab operations.



ACADEMIC CORNER

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

Adjo Amekudzi and Sue McNeil (Editors), "Infrastructure Reporting and Asset Management: Best Practices and Opportunities," *American Society of Civil Engineers*, 2008.

Sue McNeil, "Pavement and Bridge Management and Maintenance," in *Myer Kutz*, Environmentally Conscious Transportation, Wiley, 2008.

Darold T. Barnum, Sonali Tandon, and Sue McNeil, "Comparing the Performance of Bus Routes After Adjusting for the Environment, Using Data Envelopment Analysis," *Journal of Transportation Engineering*, Volume 134, Issue 2, pp. 59-109, February 2008

Daisuke Mizusawa and Sue McNeil, "Demonstrating the Benefits of Highway Economic Requirement System - State Version: A Case Study," Proceedings of the 7th International Conference on Managing Pavement Assets, Calgary, Canada, June 2008.

Christine Moore, Martin Tjioe, Anthony Manzella, Kristen L. Sanford Bernhardt, and Sue McNeil, "Asset Management Insights Using Agent-Based Models," Proceedings of the 7th International Conference on Managing Pavement Assets, Calgary, Canada, June 2008.

Daisuke Mizusawa, and Sue McNeil, "Assessing the Benefits

of Highway Economic Requirement System - State Version," Highway Economic Requirements Modeling and Data Integration Conference, Irvine, CA, April 8-9, 2008.

Yukun Dong and Sue McNeil, "Assessing Financial Analysis Strategies in Regional Transportation Planning using HERS-ST as a BCA Tool," Highway Economic Requirements Modeling and Data Integration Conference, Irvine, CA, April 8-9, 2008.

David Capparuccini, Arde Faghri, and Robert Suarez, "Fluctuation and Seasonality of Hourly Traffic and Accuracy of Design Hourly Volume Estimates," Paper number 08-1728, Transportation Research Board, National Research Council.

Arde Faghri and Adam Catherine, "Application of Carsharing in Small Cities in the U.S. – Framework for Implementation and Analysis," Paper number 08-1806, Transportation Research Board, National Research Council.

Arde Faghri, "Evaluating Conversion of All-Way Stop-Controlled Intersections into Roundabouts," Paper number 08-1815, Transportation Research Board, National Research Council.

Shy Bassan, Arde Faghri, and Abishai Polus,

"Experimental Investigation of Spatial Breakdown Evolution on Congested Freeways," *Journal of Civil Engineering and Environmental Systems*, Volume 24, pages 261-274, 2007.

Shy Bassan, Arde Faghri, and Abishai Polus, "Modeling of Freeway Breakdown Process with Log-Periodic Oscillations," *Canadian Journal of Civil Engineering*, Volume 34, pages 1577-1586, 2007.

DCT HOLDS 5th Annual Transportation Research Showcase

On Tuesday, May 6, 2008, DCT held its fifth annual transportation research showcase at the Paradee Center in Dover. The showcase featured poster sessions for each current research project, with posters presented by the principal investigators and graduate students. Sessions focused on a number of areas: Environmental, Planning, Pavement & Materials, Structures & Bridges, Traffic & ITS, and Transit.

Attendees included representatives of DelDOT, FHWA, WILMAPCO, Dover-Kent MPO, University of Delaware, local town governments, and private industry. The showcase provided them with the opportunity to talk with the researchers and review project posters.

Added to the showcase this year were poster presentations from current projects supported through the University of Delaware University Transportation Center (UDUTC).



DelDOT's Planning Director, Ralph Reeb (left) listens as UD Researcher Jim Corbett explains his project on Development of Delaware Regional Freight Data for GIFT Model.

Graduate students Rob Natale, Mike Cann, Matt Hayes, and Mike Radowski present projects from the Bridge Center.



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UD TEAM WINS REGIONAL STEEL BRIDGE COMPETITION By Diane S. Kukich



Members of UD's steel bridge team include (front, from left): Brian Davis, Mindy Laybourne, Lauren Lobo, Pat Kavanaugh and Chelsea Stachura; and (rear, from left) Kris Weidner, Ryan Cuzme, Nick Ward and Tom Miner.

UD's steel bridge team came home last weekend from the Mid-Atlantic regional competition at Lafayette College with a first-place overall finish, as well as firsts in four of the six award categories. That performance qualified the team to participate in the national Student Steel Bridge Competition (SSBC) at the University of Florida in Gainesville over Memorial Day weekend.

Sponsored by the American Society of Civil Engineers (ASCE) and the American Institute of Steel Construction (AISC), the SSBC requires teams of students to design and fabricate a 21-foot-long steel bridge capable of supporting 2,500 pounds of loading.

Nick Ward, a senior civil engineering major and president of the UD student chapter of ASCE, said the team plans to use feedback from the regional competition to make the bridge even better before the trip to Florida. "We need to change a couple of members to make the bridge lighter," he said, "and we have to keep practicing to get our construction time down."

While the UD team has qualified for nationals for the past several years and has won several first-place awards in specific competition categories, the 2008 event marked the first time Delaware finished at the top overall.

"The tremendous success of this year's team is largely due to great leadership from the team captains," said Jennifer McConnell, an assistant professor of civil and environmental engineering who serves as ASCE student chapter adviser and as adviser to the steel bridge team. "The project also benefited from having a large number of seniors involved and a great group of dedicated underclassmen."

The steel bridge activities are intended to supplement classroom education by providing participants with practical experience in structural design, fabrication processes, construction planning, organization and teamwork. Criteria for excellence are represented by six award categories: display, construction speed, lightness, stiffness, construction economy and structural efficiency.

Junior Tom Miner, one of two co-captains on the team, said he appreciates the value of the steel bridge experience. "We learn the theory in class," he said, "but this competition has helped me understand how things really work."

As project leader, Ward acknowledges the contributions made by all of the members of the team. "We had a lot of freshmen come out to help, which is great as a foundation for future years," he said. "But it's also important to have as many juniors and seniors as possible because they've completed the coursework needed to have a better understanding of the engineering involved."

"The entire team put a tremendous amount of time into the bridge, and it paid off," said Tripp Shenton, interim chairperson of the Department of Civil and Environmental Engineering (CEE). "They had stiff competition from a number of good schools in the region." Other participating teams included Drexel, Penn State, Lehigh, Lafayette, Swarthmore College, the University of Pittsburgh-Johnstown, Villanova and Widener.

The UD team had strong support from several faculty and staff members, including not only McConnell, but also Shenton; Michael Chajes, professor of civil engineering and interim dean of the College of Engineering; Danny Richardson, lab coordinator in CEE; and Steve Beard, master machinist in the Department of Mechanical Engineering. Civil engineering graduate student Dan Kucz also provided design support for the project.

"Dan was great," Ward said, "because he asked questions instead of just giving us answers. He encouraged us to make choices that were best for the long term rather than to just adopt the solution that was easiest at the moment."

The Student Steel Bridge Competition is aimed at increasing students' awareness of real-world issues such as spatial constraints, material properties, strength, serviceability, fabrication and erection processes, safety, aesthetics and cost. The competition also fosters teamwork and provides project management experience. The rules are changed every year to improve the competition and assure that competitors design and build new bridges.

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UD FUEL CELL BUS COMPLETES A YEAR OF SUCCESSFUL SERVICE

Ajay Prasad

Professor, Department of Mechanical Engineering Director, UD Fuel Cell Bus Program

On April 9, 2007, the University of Delaware created a lot of excitement in the local and national media when it formally rolled out its zero-emission fuel cell hybrid bus. Senator Carper, Congressman Castle, former UD President David Roselle, and former Engineering Dean Eric Kaler gave keynote speeches during the event at the Bob Carpenter Center, after which the representatives of the media and guests went on the inaugural ride. Following the event, the bus became part of the UD shuttle bus system. For the past year, it has operated two hours per day, ferrying students from the Laird campus to the main campus. There are only about ten fuel cell buses in actual operation in the entire nation, so we are very proud to belong to such a select group.

The UD fuel cell bus program, which kicked off in 2005, has an ambitious plan to research, build and demonstrate a fleet of the buses on UD's campus and in the state of Delaware. The program is funded by the Federal Transit Administration and by the Delaware Department of Natural Resources and Environmental Control. The UD Fuel Cell Bus Consortium consists of EBus (Downey, CA), which built the bus; Ballard Power Systems (Vancouver, Canada), which provided the fuel cell stack; EPRI (Palo Alto, CA), which helped with vehicle systems modeling; Air Liquide (Newark, DE), which provided a garage to house the bus and built a hydrogen refueling station on their premises; and Delaware Transit Corporation, which is working with UD to conduct bus demonstrations within the state of Delaware.

The current bus (referred to as *Phase 1*) is 22 feet long, and can seat 22 passengers. It is powered by a 20 kW fuel cell stack supplied with hydrogen fuel from two roof-mounted tanks pressurized to 5000 psi. On-board Ni-Cad batteries work in conjunction with the fuel cell to enable hybrid operation including regenerative braking. The maximum speed of the bus is 45 mph, and the range is about 200 miles. The fuel stack has a much greater efficiency than a conventional diesel engine, so the bus has a fuel economy twice that of a similar size diesel-powered bus. Most importantly, the bus produces no harmful emissions; the only product from its tailpipe is pure water!

A second bus is due for delivery to UD in summer 2008. From the outside, it will look identical to the Phase 1 bus, but it will be very different on the inside. For example, it will have a dual stack providing 40 kW of power, and the electrical storage system will comprise advanced Li-Titanate batteries



UD Phase 1 Fuel Cell Bus

which will greatly reduce the overall weight and improve efficiency. Finally, a third bus is being planned for delivery in 2009. This bus will be 30 ft long and closer to the standard buses operated by transit agencies. Such a progression in technology is important to our mission, which is to bring fuel cell transit vehicles closer to commercialization.

The UD fuel cell bus program has provided the opportunity for several graduate and undergraduate students to conduct fundamental research and bus demonstration tasks. Students are researching ways to make the fuel cell more efficient and durable, developing and testing novel fuel cell materials that will cost less and last longer, evaluating fuel cell operating conditions for improved performance, and exploring renewable methods to generate hydrogen using solar-powered thermochemical cycles. In particular, one research project is devoted to developing a computer simulation tool for the fuel cell bus. Here, we model every subsystem on the bus to build a complete vehicle model. We can then "drive" the virtual bus on any desired route and examine important operational outputs such as hydrogen consumption, battery state-of-charge, overall efficiency, etc. Most importantly, we have been able to compare the output of our simulator with actual data collected continuously from the bus (the bus is

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How does a fuel cell work?

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equipped with a variety of sensors as well as GPS for route information) and thus validate the model. With validation complete, our vehicle simulator has become a valuable tool to rapidly and cost-effectively evaluate design modifications before embarking on expensive changes in hardware.

In addition to daily service on UD campus, we have also conducted several public outreach events and bus demonstrations during the past year. The bus was displayed at Winterthur GardenFair, Hagley Museum, Newark Community Day, Newark's 250th Anniversary parade, and much more. It has been a very successful year and we look forward to expanding our efforts as our fleet grows in the next year!



Research Associate Doug Brunner refueling the bus with hydrogen at Air Liquide premises.

IPA HELPS TO ADDRESS MULTI-MODAL TRANSPORTATION NEEDS

An emerging field of research demonstrates linkages among the built environment, mobility-friendly design, and the livability of a community. The Institute for Public Administration (IPA) at the University of Delaware is contributing to this dialogue by researching ways to better coordinate land use and transportation planning. The outcomes of IPA's research, which are highlighted below and may also be found online at **www.ipa.udel.edu/ publications/#infrastructure**, are helping communities build a foundation for development design standards for statewide transportation infrastructure.

Sidewalks and Shared-Use Paths: Improving Mobility and Designing Transit-Ready Communities – Funded by the Delaware Department of Transportation (DelDOT), this February 2008 policy forum continued previous work on security-related design issues on trails and sidewalk facilities. IPA's policy scientists and guest speakers highlighted common safety problems plaguing sidewalk and shared-use path systems and advocated for well-maintained facilities.

Transit-Oriented Design (TOD) – The November 2007 report identifies the concepts of "complete community design," and highlights communities that integrate principles of TOD and interconnectivity. Results of a bus tour of TOD communities and research led to the recommendations for TOD standards and implementation criteria. In April 2008, IPA engaged an interagency group of local and regional planning officials to examine various perspectives related to TOD issues. DelDOT funded this project. *Healthy/Walkable Communities Initiative* – IPA's staff completed walkability assessments and reports for Dover, Townsend, and Bridgeville to identify key aspects of the built environment as they relate to health and opportunities for physical activity. Future assessments are scheduled for Ocean View and Elsmere. An IPA online publication,

Healthy Communities: A Resource Guide for Delaware Municipalities, will show how improving the walkability of a community can lead to environmental, health, and economic benefits. The Delaware Division of Public Health provided funding for this project, which was conducted in collaboration with the University's Department of Health, Nutrition, and Exercise Sciences.

Assessing the Needs of Delaware's Older Drivers – Funded by DCT, this study examined the need to change transportation planning and roadway design to accommodate Delaware's growing population of older drivers. The August 2007 report outlines recommendations for state agencies in areas such as education, assessment and outreach, intersection design, signage, signalization, and lighting to better address the needs of older drivers.

Feasibility of Bus Rapid Transit (BRT) – The mid-Atlantic region is experiencing increasing volumes of traffic, traffic congestion, and vehicle miles traveled. Funded by DCT, a study is underway by IPA to assess the feasibility of a regional BRT system as a viable, high-speed transportation option to meet growing transportation demands and mitigate traffic congestion.

IPA continues its focus on multi-modal transportation issues and options. Upcoming projects funded by DCT include an assessment of accessible taxi services in Delaware, a mode share analysis of how elementary-aged students travel to school, and a study to address the need to better integrate transportation/transit planning in the overall planning process.

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DCT TEAM MEETS ROAD Asset Challenge at International Conference

By Diane Kukich

A team of DCT-affiliated students took advantage of the opportunity to gain some hands-on experience in asset management when they responded to the Investment Analysis and Communication Challenge for Road Assets, offered as part of the 7th International Conference on Managing Pavement Assets (ICMPA). Held in Calgary, Alberta, in June 2008, the conference focused on recent developments in pavement and transportation asset management and was targeted to researchers as well as practitioners.

The challenge was initiated in 2005 at ICMPA6 in Brisbane, with a focus solely on pavement management; it was expanded this year to include associated road assets. The goals were to identify, encourage, and disseminate good practice in asset management; to encourage innovation; and to provide a forum and documentation illustrating state-ofthe-art pavement management systems.

Major emphasis was placed on communicating the message to the informed manager as well as to the non-technical or non-administrative such as the public. "This was a really important aspect of the challenge," says Prof. Sue McNeil, "because successful asset management entails not only good practice but also effective communication about the management plan being proposed or adopted."

Participants were provided with detailed terms of reference,

including database files. The UD team analyzed future asset condition and funding requirements over 20 years based on pavement, bridge, culvert, and sign analyses for the road authority in the fictitious state of "Icompa." They also explored some novel tools for managing assets and various performance measures. The assets managed by the authority included a total of 1,293 road sections spanning 3,240 km, 161 bridges, 356 culverts, and 45 major signs.

The team members and their roles and responsibilities were as follows:

- Yukun Dong (PhD 08) developed and analyzed pavement sections using HERS-ST.
- Daisuke Mizusawa (post-doctoral research associate) analyzed the bridge and culvert data.
- Rachel Nathman (MCE 08) explored the environmental impacts.
- ◆ Valerie Steenhoek (BS 08) analyzed the sign data.
- David Adams (MCE 08) explored the integration of trip time reliability into the decision making process.
- Silvana Croope (PhD student) introduced the role of GIS tools to support the communication of information and then demonstrated the application of these tools in the context of the condition and performance of critical infrastructure prior to and after catastrophic events.
- Olufikayo Aderinlewo (PhD 08) integrated concepts of network resilience and vulnerability into the decisionmaking process using graph theory.

"The Challenge provided the students with an opportunity to apply work from classes and research to a real problem," says McNeil. "It was a great learning experience for them."



Daisuke Mizusawa, Sue McNeil and Rachel Nathman stand in front of the UD Challenge Poster.



Rachel Nathman explains the UD Challenge Poster to ICMPA7 Conference participants.

WANDA TAYLOR RETIRES

Wanda Taylor, Assistant to the DCT Director, Dr. Ardeshir Faghri, retired on June 30, 2008. She had been with the DCT for thirteen years. A large contingent of her family, colleagues, and friends gathered at her retirement party at the Embassy Suites in Newark.

Wanda played a major role in the growth of the DCT during her tenure according to Dr. Faghri. Her ability to work in harmony with students, research faculty, and DelDOT staff while keeping problems to a minimum enabled the DCT to steadily add to its responsibilities and projects.

Among Wanda's retirement goals are a trip to Australia and watching her grandchildren grow up.

Ellen Pletz, a current UD employee, will soon become the new Assistant to DCT Secretary, Sandi Wolfe presents Wanda with a the Director. We will introduce Ellen to you more fully in our next issue.



corsage before her retirement luncheon.

UPCOMING T² CENTER COURSES AND WORKSHOPS

Context Sensitive Design Specific dates to be announced.

This three-day workshop will include theoretical and design aspects of CSS. It will also cover planning issues typically faced by county and local land use planners. Ray Harbeson of RK&K Associates will be the primary instructor. We plan to present this course in October 2008.

Freight Planning and Environmental Considerations August 5-8, 2008

The Federal Highway Administration has developed this new workshop to take account of environmental considerations that are sometimes overlooked in planning freight facilities including highways, terminals, and intermodal connections.

Tire Pavement Noise August 12, 2008

This workshop will discuss many recent developments including new pavement and tire designs that reduce pavement noises negatively affecting drivers, passengers, and occupants of buildings and open spaces adjacent to highways.

Culvert Design September 15-17, 2008

The National Highway Institute will present this workshop on the latest procedures for the hydraulic design of culverts.

Fracture Critical Inspection Techniques for Steel Bridges

November 18-21, 2008

The collapse of the I-35 bridge in Minneapolis has intensified the need to disseminate the latest information on bride inspection techniques. This is an NHI course.

For more detailed information on these events, i.e., course descriptions, locations, and electronic registration procedures, please visit our web page at http://www.engr.udel.edu/outreach/t2/index.html.

Resiliency of Transportation Corridors

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

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



Director's Message



Welcome to the second issue of the University of Delaware University Transportation Center (UDUTC) newsletter! It is almost two years since we first mapped

out our plans for the center and selected our theme "resiliency of transportation corridors," and it is just over a year since we received approval of our strategic plan. Over these two years, the concept of the corridor has served us well as a focus of our research, education and outreach, and, while we still don't all agree on the definition of "resiliency," we see the term frequently used and recognize the value of our discussions on what it means to be a resilient corridor.

In this issue of the newsletter, you will find summaries of our second round of research projects and descriptions of other UTC activities including distinguished lecturers and student profiles. Some of the projects in our first round of research proposals are wrapping up, while others are continuing into the next academic year, and we have initiated six new ones.

In addition, the following research and education activities took place during the past six months:

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 UTC Grad

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- We held virtual meetings with the researchers and research advisory committees for most of the first-year projects.
- We sent all of our graduate research assistants to the Transportation Research Board Annual Meeting in Washington D.C. in January.
- Our students and researchers participated in the Delaware Center for Transportation Project Showcase, displaying posters that captured the breadth of the UDUTC activities.
- We awarded our first UTC graduate fellowships to three outstanding graduate students, two from the Department of Civil and Environmental Engineering and one from the School of Urban Affairs and Public Policy.
- One undergraduate civil engineering student worked on research over winter session, and two students, a senior (Charles Mitchell) and a junior (Sarah Dalton) have begun work with the Disaster Research Center Research Experience for Undergraduates (REU) program and will be researching evacuation planning in Delaware over the summer

Throughout the year, the UTC Advisory Committee has continued to meet and provide guidance on criteria for selecting projects and fellowship recipients, setting schedules, and managing the center. In March we had a site visit from Research and Innovative Technology Administration (RITA) University Transportation Centers Program administrators Amy Stearns and Lydia

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Mercado and Director Curtis Tompkins. The site visit provided an opportunity for us to sort through some of the nuances of the grant administration process and obtain some useful contacts. In this newsletter, you will also see a list of the activities planned for the fall semester, including several brown-bag discussions focused on our ongoing research. We hope you will join us for some or all of these events and watch our website for updates on our activities.

Sue McNeil Professor of Civil and Environmental Engineering University of Delaware

From California to Kansas: UTC Grad Student Uses All the Right Stuff to Choose Career Path



Rachel Nathman's job interview process took her to a number of big cities, including New York, Washington, Chicago, and San

Francisco. But in the end, the recent University of Delaware grad chose to settle in Kansas City, Kansas. With a master's degree in civil engineering and a concentration in transportation, Nathman accepted a position with HNTB, a multinational firm that has offices throughout the U.S.

Lots of factors played into her final decision, including the cost of living. Nathman was able to purchase a townhouse in Kansas, which would have been impossible had she returned to her native California. But probably the most important criteria in her job hunt were the size, organization, and company philosophy of HNTB.

In addition, she liked the managerial style of Mark Williams, director of the Overland Park aviation group, and the mentoring abilities of Brian Tompkins, the airport planner and construction manager on staff with whom Nathman will be working closely.

To reach the point where she could make an intelligent career decision, Nathman used the interview process not just to promote herself to prospective employers but also to let them sell themselves to her. "I looked at each interview not as an end in itself," she says, "but as an opportunity to learn about the company. It shouldn't just be them interviewing you but you interviewing them as well," she says. "Each time I met with someone, I asked myself, 'Why do I want to work here?"

Ultimately, Nathman chose HNTB because the company is very strong on professional development and because its nationally distributed offices will provide her with opportunities to grow and change location once she gains experience. With a strong interest in geographic information systems (GIS), she also liked the resources available at a large company like HNTB, including access to the latest software.

"As an airport master planner, I'll have to learn all of the FAA requirements for the air side, the land side, and the terminal," she says. "Some of the work will involve looking at site-specific issues, for example, factors pertaining specifically to the terminal or the runway. At other times, I'll be addressing problems from a systems perspective and examining how all of the components of the site interact for a specific function, such as passenger flow from one area to another."

Nathman is already looking ahead to getting her P.E., as well as beginning another graduate degree; she plans to start an on-line, part-time M.S. program in GIS at Northwest Missouri State University. "This isn't the end of my education," she says of her graduate work at UD. "There's so much out there in terms of continuing education, from certificate and executive programs to online graduate programs." "Rachel has a great attitude," says Prof. Sue McNeil, who served as Nathman's master's thesis advisor. "She's outgoing and friendly and always open to new ideas and opportunities. I think she'll succeed no matter where she goes or what direction her career takes."

"The tactic she took last summer when she had an internship with Urban Engineers in Philadelphia is a great example of her approach to life," McNeil continues. "To get projects to work on, Rachel put a candy dish on her desk and when people came to 'steal' candy, she asked them what they were working on and suggested ways she could help. It was a great way to get to know people and get some interesting assignments!"

Nathman herself has no apprehension about picking up and moving to a completely new place. "I've done it before, and I'm not worried about doing it again," she says. "I just like being around good people. Whatever there is to learn, I'll learn it and enjoy it."

She hopes that her hard work thus far will pay off and produce a career that will support strong connections with her family and friends regardless of location. "If I can't live near them," she says, "my aim is to have a career that will support travel or whatever else needs to happen to maintain those ties."

Editor's Note: According to Prof. McNeil, Nathman used all the right techniques in identifying opportunities and going through the interview process. The sidebar to this story summarizes Rachel's tips for a successful job search.

OPPORTUNITIES

2

Student of the Year. Nominations are due September 15. See http://www.ce.udel.edu/UTC/SOY.html

Undergraduate research support. Limited resources are available for undergraduate support. Interested students or researchers should contract Sue McNeil at smcneil@udel.edu

UDUTC Awards Grad Fellowships to Three Students

UD-UTC Awards Graduate Fellowships to Three Students

Michelle Oswald, Houston Brown, and Todd Franzen have been selected to receive graduate fellowships. The fellowships are awarded to students pursuing master's and PhD degrees in areas of relevance to the theme of the UD-UTC; selection is based on academic qualifications and relevance to the UDUTC theme and goals.

UTC Fellowships cover graduate school tuition, pay a stipend of \$1800 per month for 12 months, and include a \$1000 allowance for travel and supplies and a \$1500 allowance for computing.

Michelle Oswald is a first-year master's degree student with an interest in sustainable transportation planning. She is currently working with UD-UTC Director Sue McNeil and Prof. David Ames focused on evaluating the current state of the BOSFOLK (Boston-Norfolk) transportation corridor and indicators of resiliency. Oswald has a strong interest in the "green side of transportation," and her goal is to develop a "LEED-type" rating system for roadways.

LEED (Leadership in Energy and Environmental Design) is a thirdparty certification program and the nationally accepted benchmark for the design, construction and operation of high-performance green buildings. The program encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

Over the summer, she plans to talk to people within the transportation community so that she can begin developing a list of credits to form the foundation for such a rating system. Oswald is well-prepared for the job—she became a LEED-certified accredited professional last summer while working for a land development company in Baltimore.

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

Houston Brown is a Ph.D. student advised by Assistant Professor Jennifer McConnell. He is currently doing a literature review on the topic of progressive collapse for buildings, with the ultimate goal of applying the knowledge to bridges. "We want to be able to design bridges for blast and resistance to progressive collapse," he says, "as well as develop methods for assessing the relative vulnerability of various existing structures."

McConnell points out since 9/11, there has been a lot of interest in improving the blast resistance of structures. "Many stakeholders argue that the relatively low probability of any single structure being the target of terrorist activity makes it difficult to justify the increased costs associated with such practice," she says. "An economical approach to improving blast resistance would be to ensure that all structures are resistant to progressive, or disproportionate, collapse even if individual members fail."

The subject is obviously of significant relevance to corridor resiliency, as bridges are a key element in such systems.

Brown, who also has an E.C. Davis Scholarship, is balancing his doctoral work with a very busy family life. He is the father of three children—a one-year-old son and four- and five-year-old daughters.

How does he balance everything? "I treat my day at the University as a nine-to-five job," he says. "If I'm here and I'm not in class, I'm doing research or working on something for my classes. That way, when I get home, I can spend time with my kids." He often returns to his desk after they go to bed at night.

In addition to his research, Brown has served as a TA for the past year, teaching a lab session of CIEG301 in the fall and a problem session of CIEG 302 in the spring. He hopes to have a career in academia when he is finished, although he would also consider a position with a bridge design consulting firm. Todd Franzen is a student in the MPA (Master's in Public Administration) program in the School of Urban Affairs and Public Policy. A graduate of the University of Nebraska, he is currently a research assistant working on a feasibility study of bus rapid transit for Delaware and the surrounding region.

As an undergraduate in Nebraska's leadership and communication program last year, Franzen went on a study trip to Romania, where he focused on traffic congestion and air quality issues. In May 2008, he traveled to Slovak Republic to present a paper on the study at the 16th NISPAcee Annual Conference, "Public Policy and Administration: Challenges and Synergies."

NISPAcee is the Network of Institutes and Schools of Public Administration in Central and Eastern Europe.

The MPA requires an analytical paper, and although Franzen is not yet sure of the direction his paper will take, he hopes to be able to incorporate both the transit feasibility study he is doing now as well as the findings of the Romanian case study into the document.

After completing the MPA, Franzen hopes to follow one of two career paths transportation policy or city management.

For now, he lives in center-city Philadelphia in a 100-year-old brick row house with his wife, who is an attorney. "We really enjoy city living," he says, "and I commute by train as much as possible. With gas at more than \$3.50 a gallon, it's more economical for me to use public transportation than to drive my car."

Franzen is a sports fan who likes to watch baseball and college football. "You can't go to Nebraska and not be a fan of college sports," he says. He also enjoys listening to music.



UDUTC Sponsors Two Guest Lectures

UDUTC hosted two distinguished lecturers during the Spring 2008 semester.

On March

Boyce of

21. Dr. David

Northwestern

University

spoke on

the role of

computing in urban travel

forecasting, and

on April 18, Dr.

José Holguín-



Dr. José Holguín-Veras

Veras, Professor at Rensselaer Polytechnic Institute, talked about the post-Katrina logistical debacle.

Boyce addressed how transportation planning practice shaped software and how, at the same time, software impacted transportation planning practice. Urban travel forecasting for transportation planning was one of the first largescale civilian applications of mainframe computers, beginning in the 1950s. During the past 50 years, the use of computers in urban travel forecasting has steadily evolved, from mainframes to minicomputers to engineering workstations and PCs. "Despite huge

UDUTC Selects Projects for 2008-09

Six projects have been selected for the 2008-09 UDUTC research program. The principal investigators represent five of the University's seven colleges, and several of the projects will be carried out by multidisciplinary teams. The following lists the projects and PIs; brief descriptions are provided on the UDUTC web page http://www.ce.udel.edu/UTC/

Upcoming Events

(see UTC website for dates & locations)

UDUTC Research and Education: *Where to next?* – A Workshop

increases in computer memory and processing speed," Boyce said, "travel forecasting models continue to expand to fully utilize currently available capacity."

In his seminar, Boyce traced the evolution of computer use, especially computer programs and software, from the early urban transportation studies, government in-house computer programming activities, and innovations by consultants to the present software systems supplied by commercial developers/vendors. He also examined the roles of these actors in advancing as well as deterring the application of methods evolving from research and practice.

The seminar was based on interviews and analyses of published reports and papers conducted for the preparation of a chapter in a book on the history of urban travel forecasting that is under preparation by Boyce and a colleague, Huw Williams.

Boyce is Professor Emeritus of Transportation and Regional Science in the Department of Civil and Materials Engineering at the University of Illinois at Chicago; he is also Adjunct Professor of Civil and Environmental Engineering at Northwestern University. He has received a number of awards and honors for his many research and service contributions to the field of regional science. To date, he has published 178 journal articles, books, book chapters, and reports.

Current_Research.html.

- * Application of Freight Transportation and Decision Models to Scope and Compare Freight Infrastructure Investment (James J. Corbett, College of Marine and Earth Studies, and Rusty Lee, Department of Civil and Environmental Engineering)
- * Developing Delaware's Agenda in Transportation within the Northeast Corridor (Ed O'Donnell, AICP, and Troy Mix, Institute for Public Administration)
- Public Perception and Attitudes about Roadside Vegetation: Pre- and Post-Environmental Education (Jules Bruck and Susan Barton, Department of Plant and Soil Sciences)
- * Infrastructure Security and Emergency Preparedness

Brown Bag Discussion – *Regional Freight Data for Delaware* – led by Jim Corbett and Amit Mokashi

Brown Bag Discussion – Transportation Organizations in the BOSFOLK Corridor – led by Robert Warren. Holguín-Veras addressed the challenges inherent in delivering critical supplies (e.g., food, water, and medical supplies) following extreme events that cause severe damage to the physical and virtual infrastructures. "In this context," he pointed out, "the recovery process is made more difficult by the prevailing lack of knowledge about the nature and challenges of emergency supply chains."

The logistical failures following Hurricane Katrina provide an example of the need to significantly improve the efficiency of the supply chains to the site of an extreme event. Holguín-Veras's research is based, to a great extent, on public accounts of the event and interviews conducted by him and his co-authors, including UD's Tricia Wachtendorf, during a number of field visits to the Katrina-impacted area in the aftermath of the event, as part of a research project funded by the National Science Foundation.

Holguín-Veras, who has held leadership positions at a number of key international research organizations, is the author of dozens of articles on transportation modeling and economics.

"We're very pleased to have had these two distinguished researchers share their knowledge with us here at Delaware," says UDUTC Director Sue McNeil. "Their work addresses subjects of great relevance to our UTC."

(Sue McNeil, Rachel Davidson, and Rusty Lee, Department of Civil and Environmental Engineering; Tricia Wachtendorf, Department of Sociology and Criminal Justice; Joseph Trainor, Disaster Research Center)

- * Time-Varying Queueing Systems and Transportation Network Resilience Transportation Corridor (Nii Attoh-Okine, Department of Civil and Environmental Engineering; Stephen Mensah, Delaware Center for Transportation)
- * Commercial Freight and the Resilience of the BOSFOLK Corridor (Rusty Lee, Department of Civil and Environmental Engineering, and James J. Corbett, College of Marine and Earth Studies)

Brown Bag Discussion – *Resiliency of Transportation Infrastructure* – led by Tracy Diliberty, Joanne Nigg, Sue McNeil and Silvana Croope.

Research

Once again the Center is getting ready for another great year of research. In January 2008 we met with DelDOT's Research Committee to identify and prioritize the most important transportation problems facing DelDOT. In June 2008, the DCT Policy Council approved the following projects for our FY'09 Annual Research Program starting on July 1, 2008:

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

This is a continuation of a one-year project that needs more funding. DelDOT needs a data analysis. This project will determine the environmental and engineering properties that should be monitored during the construction of shredded tire embankments. Include instrumentation, installation, monitoring and an analysis plan. Implement the monitoring. What instruments are needed and how to construct and monitor them. The issue in Delaware is that the temperature is much higher in the summer than it is in New England.

Principal Investigators:	Nii Attoh-Okine, Paul Imhoff,
	Victor Kaliakin and Chris
	Meehan, Department of Civil
	and Environmental Engineering
Project Manager:	Wayne Kling, Division of
	Materials and Research

Infrastructure Security and Emergency Preparedness

Delaware is in need of an emergency notification plan. The need to monitor bridges and tunnels. Plan for rapid construction of roads and bridges. Gas supply during emergencies to prevent vehicles from stalling during evacuation. Evaluate the ripple effect of evacuating. Security issues if there is a bottleneck for travel along I-95 from Washington to New York. Prior to Churchmans Crossing and post US-1. Information Sharing. Work on emergency notification/standardization. Evaluate shortcomings. Mitigate congestion.

Principal Investigator:	Sue McNeil, Department of Civil and Environmental Engineering
Project Manager:	Transportation Management Center

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

Using gauges and sensors for feedback on the health of the bridge. Determine what sensors should be added to new bridges.



Principal Investigator:

Tripp Shenton, Department of Civil and Environmental Engineering

Project Manager: Jiten Soneji, Bridge Design

Integrating Transportation/ Transit Planning in the Overall Planning Process

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

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

Principal Investigator:	Ed O'Donnell, Institute of Public Administration
Project Manager:	Cathy Smith, Delaware Transit Corporation

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

Is taxi service an option for the disabled or people who do not drive? Is taxi service cheaper than paratransit? Not many taxi companies in Kent and Sussex Counties where they may be needed the most. There needs to be some kind of regulation of taxi service. Subsidies/ incentives? Market driven service? Assess how taxi services can help address rural transportation challenges.

Principal Investigator:	Doug Tuttle, Institute of Public Administration
Project Manager:	Cathy Smith, Delaware Transit Corporation

Roundabouts

What intersections in Delaware would benefit with the conversion to roundabouts. Prioritized list of intersections most conducive.

Principal Investigator:	Stephen Mensah, Department of Civil and Environmental Engineering
Project Manager:	Dan LaCombe, Division of Planning

T<mark>ranSearch</mark> Summer 2001

Safe Routes to Schools for Children – Mode Share Data Analysis

Lack of sidewalks; a must have for children walking to school. The consequences of children not walking or biking to school include environmental impacts, increased traffic in the vicinity of schools, increased rates of obesity in children and other associated health problems, and often a decrease in the social health of communities. Provide facilities (bike ways, sidewalks), education, etc. School districts don't plan very well for buses. State law prevents school children from riding transit - change in law? Federal funding is now available specifically for SRTS initiatives, the need for data on transportation modes of K-8 grade children to and from school in more urgent. Having baseline data and trend analysis for Delaware would enable comparison and evaluation of the progress and success of the program once data is collected after projects and local programs have been implemented.

Principal Investigator:	William DeCoursey, Institute of Public Administration
Project Manager:	Sara Coakley, Division of Planning

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

This is a continuation of last year's project.

Principal Investigator:	Chandra Aleong, Delaware State
	University
Project Manager	Ralph Reeb Division of Planning

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

Evaluation of how other state DOTs are incorporating intelligent compaction technology into their state qualitycontrol specifications. Exploration of new areas for knowledge growth in intelligent compaction that may be

beneficial for the State of Delaware.

Principal Investigator:	Chris Meehan, Department
	of Civil and Environmental
	Engineering
Project Manager:	Wayne Kling, Division of
	Materials and Research

Advancing Asset Management in DelDOT

Asset management has been receiving greater attention at both the state and national level. Escalating demands by the public for increased accountability, aging infrastructure, increasingly constrained resources, new funding challenges, and increasing emphasis on the private provision of public service and public-private partnership all point to the need for asset management. Asset management is a data driven process that is rooted in comprehensive inventory of physical assets and their condition, and the quantification of the impacts of alternative decision.

Principal Investigator:	Sue McNeil, Department of Civil and Environmental Engineering
Project Manager:	Ralph Reeb, Division of Planning

THE CURRENT AND ACTIVE RESEARCH PROJECTS INCLUDE:

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

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

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

Principal Investigators:	Young-Doo Wang and John Byrne, Center for Energy and Environmental Policy
Project Manager:	Mark Glaze, Division of Planning

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



Principal Investigator:	David Racca, Center for Applied Demography and Survey Research
Project Manager:	Mike DuRoss, Division of Planning

Bridge Management Using In-Service Data (Phase II)

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

Principal Investigators:	Michael Chajes and Harry
	Shenton, Department of Civil
	and Environmental Engineering
Project Manager:	Jiten Soneji, Bridge Design

Establishment of a Geotechnical Information Database

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

Principal Investigator:

Chris Meehan, Department of Civil and Environmental Engineering Project Manager:

Wayne Kling, Division of Materials and Research

Pavement Performance Models

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

Principal Investigators:	Sue McNeil and Nii Attoh- Okine, Department of Civil and Environmental Engineering
Project Manager:	Jennifer Pinkerton, Division of Preconstruction

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

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

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

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

T<u>ranSearch</u> Summer 20

Principal Investigators:	Dov Leshchinsky and Chris Meehan, Department of Civil and Environmental Engineering	Principal Investigators:	Jack Puleo and Harry Shenton Department of Civil and Environmental Engineering
Project Manager:	Dennis O'Shea, Bridge Design	Project Manager:	Jiten Soneji, Bridge Design
Integrating Travel Time Rel Management	liability into Planning and	Letting Scenic and Historic Story	Roads in Delaware Tell Their
The importance of travel ti underestimated. Commut other travelers depend on a to plan schedules and imp	me reliability should not be ers, trucking companies, and a reliable transportation network	A web-based manual to fa designation and managen highways	cilitate the identification, nent of scenic and historic
DelDOT will provide incre hours and fuel are wasted while waiting in long queu	each year by these customers ie lines, and integrating this	Principal Investigator:	David Ames, Center for Historical Architecture and Design
concept into planning and provide an improved trans	l management would certainly sportation system.	Project Manager:	Maria Andaya, Division of Planning
Principal Investigator:	Sue McNeil, Department of Civil and Environmental Engineering	Enhancing Delaware's High	nways: A Natural Vegetation Project
Project Manager:	Mike DuRoss, Division of Planning	The project will investigate restore Delaware's roadsid state reflecting the regiona	e vegetation models conceived to le landscapes to a more natural l flora.
Senior Safety: Senior-Based studies; timing issue	l Licensing & Testing Conduct case	Principal Investigator:	Sue Barton, Department of Plant and Soil Sciences
Principal Investigator:	Bernie Dworsky, Institute of Public Administration	Project Manager:	Chip Rosan, Roadside Environment
Project Manager:	Mike DuRoss, Division of Planning	Hot-Mix Asphalt Specificat A continuation of analysis	<i>ion Research</i> of DelDOT's Hot Mix Asphalt
<i>Resilience Modulus continu</i> This is a continuation of a in an outside laboratory.	<i>ation</i> project. Still need to do testing	Quality Assurance Specific comparison to other states Maryland.	cations. Include an updated s, particularly Pennsylvania and
Principal Investigator:	Nii Attoh-Okine, Department	Principal Investigator:	Nii Attoh-Okine, Department

Project Manager: Wayne Kling, Division of Materials and Research

Calibrated Video System for Traffic Speed and Vehicle Identification

There is an ongoing project for the instrumented bridge headed by Michael Chajes and Tripp Shenton. The investigators are measuring load and strains on bridges through instrumentation. Along with the current instruments, it is proposed to add calibrated cameras on the bridge which would cast the data into a local coordinate system and obtain actual measurements from the imagery (distance and speeds). The primary interest would be to set up some sort of trigger such that if a particular stress was exceeded, the camera would collect a time stamped image. This would be evaluated to determine actual vehicle size and/or if multiple vehicles were responsible for the observed stress.

Engineering Project Manager: Wayne Kling, Division of Materials and Research Comparative Analysis of Best Practices in Transportation Planning Design Construction and Materials

of Civil and Environmental

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

Delaware is experiencing a growing elderly population (60+) due to aging baby boomers. Also, the state is experiencing an influx of retiree's seeking residency, particularly in Sussex and Kent Counties. The number of elderly drivers with longer life expectancies than generations past is likely to present a challenge to the state's transportation system and produce greater demands and needs for transportation services and programs in certain areas. These include services and programs to accommodate the increasing number of elderly drivers, provide alternatives to driving, and improve overall elderly-friendly mobility standards.



Principal Investigator:	Bernie Dworsky, Institute of Public Administration
Project Manager:	Mark Luszcz, Division of Transportation Solutions

Examination of GIS and Current Information System Plans and Responsibilities

To provide an appraisal of the current strength and weaknesses of the existing and proposed GIS and information system efforts in DelDOT as they pertain to the Division of Planning

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.

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

Principal Investigator:	Arde Faghri, Department of Civil and Environmental Engineering
Project Manager:	Dan Blevins, WILMAPCO

Fuel Cell Bus

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

Principal Investigator:	Ajay Prasad, Department of Mechanical Engineering
Project Manager:	Sean Rickerson, FTA

DOT UTC TIER II

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

Principal Investigator:	Sue McNeil, Department of Civil and Environmental Engineering
Project Manager:	Amy Stearns, RITA

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

This project will investigate the cost, liability, and reliability of anti-idling equipments for trucks; evaluate environmental, energy and economic impacts of trucks' anti-idling equipment; and develop a set of policy recommendations to both curb idling and facilitate the entry of anti-idling equipment in the marketplace in Delaware.

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:

There is considerable concern regarding the scour near and around the existing Indian River Inlet Bridge. As a result, the bridge is scheduled to be replaced. However, since the initial design was deemed too expensive to build, the design process will need to start over again. This will result in the existing bridge needing to remain in service for longer than anticipated. As a result, there is concern over the safety of the existing bridge into the future. It is suggested that a research project be initiated that: evaluates existing scour detection technologies, develops a scour detection system for the existing bridge, and assesses the structural integrity and safety of the bridge throughout its remaining service life.

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

To develop and install a long-term structural monitoring system for the new Indian River Inlet Bridge for both the substructure (the high MSE walls used to support the bridge approaches) and for the bridge superstructure.

Principal Investigator:	Michael Chajes, Department of Civil and Environmental Engineering
Project Manager:	Jiten Soneji, Bridge Design

Research Pays Off

IMPROVING GUIDE SIGN LEGIBILITY

New Lettering Reads Larger, Clearer, Farther By Paul J. Carlson

The traditional font-or lettering design-used for text on highway guide signs was developed in the 1950s and was tested on signs using white text on black backgrounds. The test conditions were nearly static- subjects walked toward the signs until they could read the words correctly.

Problem

In the past 50 years, sign fabrication techniques and materials, driver characteristics, and highway speeds have changed substantially. The text on guide signs usually is fully retroreflective, incorporating the latest and most efficient types of retroreflective sheeting materials. The sign lighting can be reduced, along with the costs of sign construction, maintenance, and operation.

Some older drivers, however, have difficulty reading the fully retroreflective text-the reflected light causes the edges of the characters to appear fuzzy. This effect is known as blooming and can be particularly acute for older drivers.

A 1994 study by the Federal Highway Administration (FHWA) found that guide signs did not provide adequate viewing distance and reaction time for older drivers. The report recommended enlarging the size of the letters on signs by 20 percent to increase the legibility distance.

The use of larger letters, however, would require increasing the size of the signs by 40 to 50 percent. Signs would cost more, as would the supporting structures.



FIGURE 1 Guide sign with Series E Modified lettering, which has served as the standard font.

Solution

For more than 10 years, a new font, Clearview, has been under development and testing to improve the legibility of highway guide signs. The Pennsylvania Department of Transportation (DOT) cosponsored research on Clearview in the early 1990s at the Pennsylvania Transportation Institute (PTI), Pennsylvania State University.

In the first study, subjective field evaluation and objective laboratory studies with computer simulation identified deficiencies in the current font, Series E Modified (Figure 1), and guided the development of Clearview as an alternative (Figure 2). Two major improvements-a reduced and variable stroke width and larger holes in letters like "e" and "o" —reduced the blooming effect. A second study concluded that a 5-inch tall Clearview font was legible at substantially greater distances than was a 5-inch tall Series E Modified font.

To build on these findings, Texas DOT sponsored a full-scale legibility study of the Clearview font at Texas Transportation Institute (TTI), part of the Texas A&M University System. Working with larger sizes of letters revealed minor improvements that could be made to the font.

In a second study by Texas DOT and TTI, 60 participants-20 young, 20 middle-aged, and 20 older- drove along a closed course and read full-size guide signs. Each guide sign had a randomly selected test word in either the Clearview or the Series E Modified font. The legibility distance was recorded when the participants correctly read the guide sign aloud.

This study showed conclusively that the legibility distance for the Clearview font is 12 percent greater on average than that for the Series E Modified font. This corresponds to an approximately 25 percent increase in reading time at 70 miles per hour. In addition, older drivers experienced the



FIGURE 2 Clearview version of guide sign increases legibility at greater distances without increasing letter or sign sizes.



largest gains in legibility distance and reading time with the Clearview font.

A third Texas DOT–TTI study used the Clearview font on guide signs to determine the best combinations of retroreflective sheeting for the white Clearview text on a green background. The study showed that the greatest legibility distance was obtained with the most efficient microprismatic materials; moreover, high-intensity retroreflective material in the green back-ground did not compromise the legibility distances.

A combination of the most efficient microprismatic materials for the legend with high-intensity materials for the background yields win-win results. The signing agency gains durability and cost-efficiency in the signs, and drivers gain contrast, which is beneficial for legibility in dark conditions.

Application

As a result of the research, in September 2004 FHWA's Office of Transportation Operations granted interim approval for use of the Clearview font on guide signs.1 At least 12 states, including Pennsylvania and Texas, have adopted the Clearview font for signs.

Research on Clearview continues. Texas DOT and TTI are evaluating the Clearview font for regulatory and warning signs. Because these signs have nonreflective black letters instead of the bright white letters used on guide signs, separate research is needed to evaluate the font's performance.

Benefits

The research shows that use of the Clearview font can improve sign legibility and reading time substantially without increasing the size of the sign. This helps all drivers—particularly older drivers—and will decrease the occurrence of navigational errors and crashes.

Quantifying these effects, however, is not possible, because data on navigational errors are not available, and crash reports do not indicate if the signs were a contributing factor in the crash. A before-and-after study is unlikely to develop a statistically significant crash-reduction factor for the Clearview font because so many other factors are involved.

A definite benefit is that the Clearview font can meet FHWA's recommendations for accommodating older drivers without having to increase the sign size. This allows state DOTs to improve service for drivers age 65 and older at a minimal cost.

Critical to the successful development of the Clearview font is the collaboration and coordination between the developer of Clearview (Don Meeker of Terminal Design), the PTI research team (Phil Garvey and Martin Pietrucha), and the TTI research team (Paul J. Carlson, Gene Hawkins, and Sue Chrysler). The vision, guidance, and support of Art Breneman, formerly with Pennsylvania DOT, and of Greg Brinkmeyer, Texas DOT, were equally vital. For more information about this research or this article, please contact Paul J. Carlson, Division Head, Operations and Design, TTI, at 979-845-6004; paulcarlson@tamu.edu.

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¹ http://mutcd.fhwa.dot.gov/res-ia_clearview_font.htm.



Clearview lettering on highway signs in Texas.



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