

Dare to be first.



Delaware Center
for Transportation

Department of Civil and
Environmental Engineering

355 DuPont Hall
Newark, DE 19716

P: 302-831-1446

F: 302-831-0674

www.ce.udel.edu/dct

Looking for the
table of contents?

Use the interactive bookmark bar—
it's on the upper left of your
Adobe Acrobat window.

Leadership change

ARTICLE BY UDAILY STAFF. PHOTO BY DOUG BAKER

Chris Meehan to direct Delaware Center for Transportation



Ardeshir Faghri (left), former director of the Delaware Center for Transportation, with the center's next director, Chris Meehan.

The Delaware Center for Transportation at the University of Delaware has announced a change in leadership. Effective on July 1, Chris Meehan, Bentley Systems Inc. Chaired Professor of Civil and Environmental Engineering, became the new director, replacing Ardeshir Faghri, professor of civil and environmental engineering who had led the center since 1999. Dr. Faghri will continue with his teaching and research responsibilities in the department.

DCT's primary goal is to serve as a resource to the Delaware Department of Transportation (DelDOT), other state DOT's, local transportation agencies and transportation-related federal organizations. Through collaboration between policy scientists and civil and environmental engineers, the center supports research, development and educational activities to address

transportation needs.

"Transportation plays a vital role in this age of information technology and a global community, and top-quality transportation research and education cannot be provided in isolation," says Faghri.

"At DCT, we maintain a continuous partnership with all the parties involved in transportation. We also strive to integrate all transportation-relevant research and education at the University with the ongoing activities of the center, so that our undergraduate and graduate students, as well as transportation professionals, can take advantage of what we have to offer in a mutually helpful environment."

Meehan's research interests include soil mechanics and soil shear behavior, slope stability, foundation engineering, soil-structure interaction, soil and site improvement, and design of levee systems.

He has two current DCT projects, one focused on monitoring of a geosynthetic reinforced soil integrated bridge system in Delaware and the other on pile down drag issues for bridge design.

About DCT

DCT initiatives include research, education, technology transfer, a distinguished guest speaker series, technical assistance, industrial collaboration and private partnerships,

and global research.

Current research projects are focused on a broad range of topics, including bridge health monitoring, traffic data analysis and evaluation, bridge design, and passenger and rail service support.

The center is home to the Richard E. Hangen ITS Laboratory, which functions as a service and training facility for DelDOT, supports the undergraduate and graduate transportation engineering curriculum and serves as a research facility for University faculty and students.

"Creating ADA-Accessible Communities" Video

BY MARCIA SCOTT

The Institute for Public Administration (IPA) at the University of Delaware, in collaboration with the Delaware Department of Transportation (DelDOT), has produced a video, "Creating ADA-Accessible Communities." The video highlights



DelDOT ADA Title II Coordinator John McNeal used GoPro cameras to capture his perspective of ADA-accessibility challenges during the production of the video.

common Americans with Disabilities Act (ADA) accessibility issues within pedestrian environments. It may be viewed on IPA's Complete Communities YouTube Channel at <https://youtu.be/sxXNVdKdHuM>.

The video is intended to educate local government officials and community stakeholders about common ADA challenges and identify barriers that may prevent persons with disabilities from accessing pedestrian facilities in the public right-of-way. DelDOT ADA Title II Coordinator John McNeal used foot- and chest-level GoPro cameras to record his navigation of pedestrian facilities in an urban setting.

The recorded trip and narration provide a sense of how accessibility challenges are experienced by persons using manual or power-driven mobility devices.

While viewers may recognize the municipality where the video was produced, they should note that issues observed are not unique to this community. By showing issues from the perspective of a person with a disability, local government officials and stakeholders may become better aware of accessibility issues and the possible need to perform a self-evaluation and prepare a transition plan, as required by ADA Title II, or conduct an optional walkability assessment.

Under ADA Title II, public entities (including state and local governments) are required to ensure accessible design, construction, and maintenance of all transportation projects—including pedestrian facilities. Pedestrian facilities include public sidewalks, shared-use paths, curb ramps, crosswalks, pedestrian islands, pedestrian signals, transit stops, and other pedestrian features within the public right-of-way. However, persons with disabilities often face accessibility barriers caused by physical obstructions, improper design, or insufficient maintenance of pedestrian infrastructure. Jurisdictions must address these issues to ensure that access for persons with disabilities is provided wherever a pedestrian facility is newly built or altered. To comply with ADA, the same degree of convenience, connection, and safety afforded the public must also be available to pedestrians with disabilities. Ultimately, pedestrian facilities must be readily accessible to and usable by persons with disabilities.

Additional information on ADA Title II requirements for local governments may be found on IPA's online Delaware Complete Communities Planning Toolbox at www.completecommunitiesde.org/planning/complete-streets/ada/.

Creating Flood-Ready Communities in Delaware

BY MARCIA SCOTT

Many think that only coastal communities, or towns along bodies of water (rivers, ponds, lakes, inland bays, streams, and creeks), are impacted by flooding. Yet, in Delaware, most communities are extremely susceptible to the dangers of flooding. It's one of only three states in which 100 percent of its population lives in coastline counties.

In the future, sea-level rise will exacerbate flooding in Delaware. The First State will become more vulnerable to coastal inundation, storm surge, saltwater intrusion, tidal wetland losses, nuisance flooding from high tides, and inland flooding from extreme precipitation. In addition to climate change, flooding can be caused by issues associated with poor or insufficient management of stormwater, floodplains, and/or drainage—including an increase in impervious surfaces due to sprawling land use patterns and development. Also, each year, 10 – 35 storms such as nor'easters and tropical storms occur in Delaware, often causing severe flooding that can jeopardize public safety, transportation systems, properties, and local infrastructure.

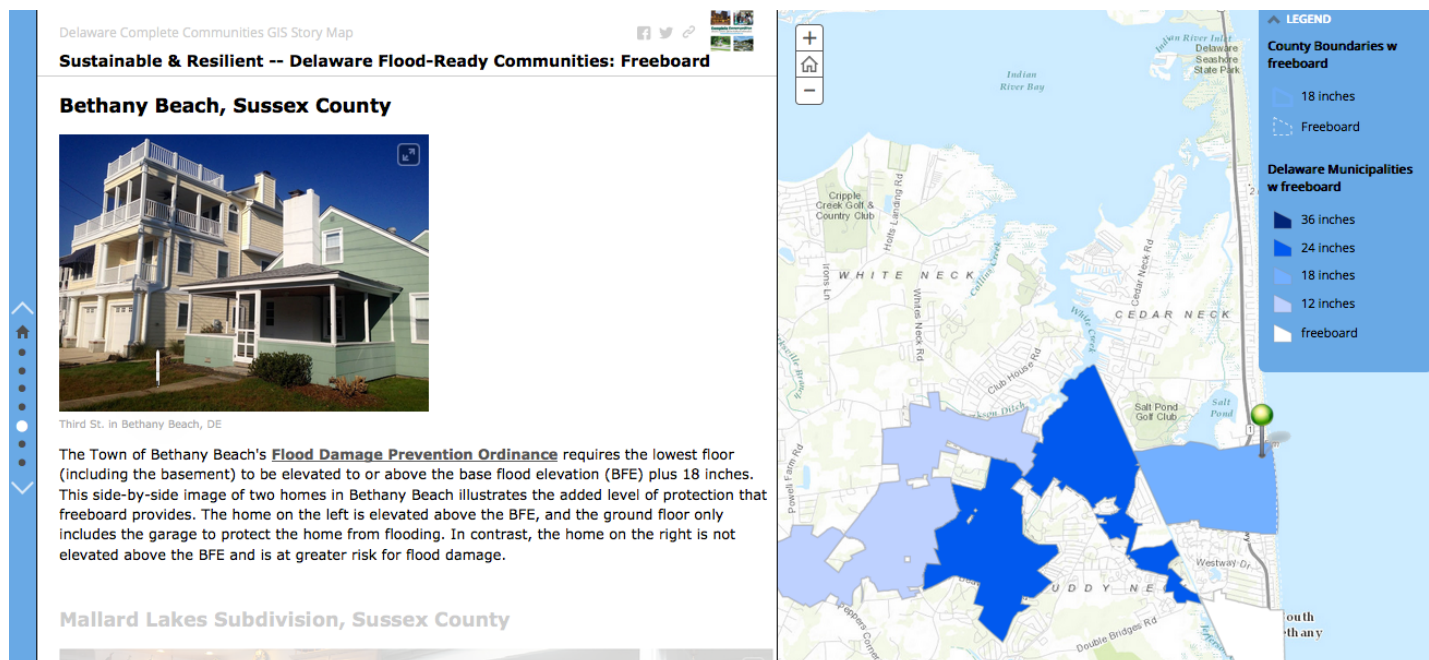
For these reasons, it's essential for Delaware communities to evaluate risks, prepare, and implement plans to address flooding caused by storms and extreme precipitation, seasonal high "king" tides, and climate change—including sea level rise. The Institute for Public Administration (IPA) is working with experts at the Delaware Natural Resources and Environmental Control (DNREC) and the Delaware Sea Grant College Program to create flood-ready communities in Delaware. In collaboration with its partners, and with funding support from the Delaware Department of Transportation, IPA has developed resources and training to help Delaware local government officials assess and address their community's vulnerability to flooding.



In January 2016, Winter Storm Jonas, combined with a "king" high tide, brought severe flooding and erosion in coastal Delaware.

Photo courtesy of James Perno, DelDOT

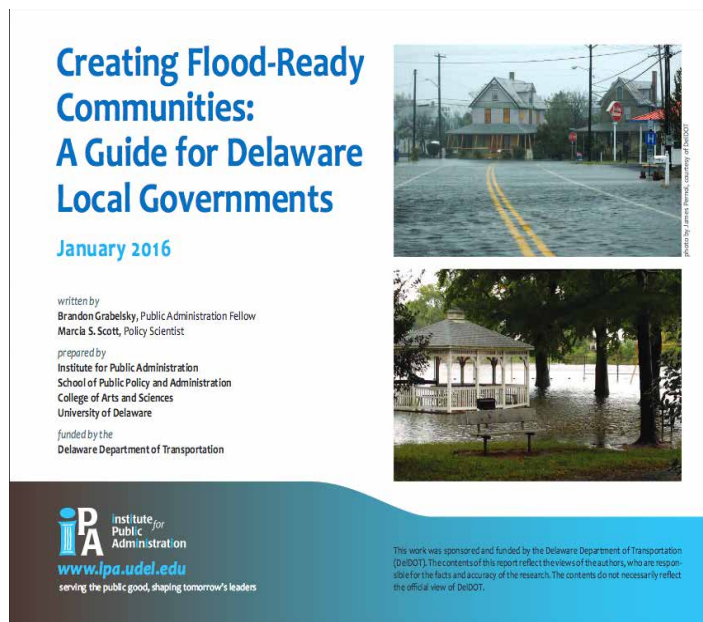
IPA Policy Scientist Marcia Scott and former IPA Graduate Public Administration Fellow Brandon Grabelsky (MPA '16) have crafted new "Creating Flood-Ready Communities" content within IPA's online *Delaware Complete Communities Planning Toolbox* (www.completecommunitiesde.org/planning/sustainable/flood-ready/). The new section provides a planning and policy framework to equip Delaware communities with the tools necessary to transform communities into flood-ready, resilient places. Grabelsky also developed a GIS Story Map showcasing freeboard as a floodplain management strategy, which is showcased within the Toolbox.



The GIS Story Map on "Freeboards" can be viewed at <http://goo.gl/SofEuJ>

Story continued on Page 4

Grabelsky and Scott also co-authored a downloadable publication entitled, *Creating Flood-Ready Communities: A Guide for Delaware Local Governments*. The guide provides resources for evaluating risks, planning adaptations, and executing actions to address the impacts of flooding. It also includes a user-friendly checklist designed to help local officials evaluate the extent to which their jurisdiction has developed planning, regulatory, spending, ecosystem, economic, and community-engagement tools to enhance their community's flood readiness.



IPA's downloadable guide is accessible via the Toolbox and available at www.ipa.udel.edu/publications/creating-flood-ready-communities.pdf

In addition, IPA, with assistance from Delaware Coastal Programs, developed a tool to assist communities identify financial assistance programs for resiliency-building implementation. Led by IPA Post-Doctoral Researcher Philip Barnes, IPA Public Administration Fellows Nikki Golomb (BA '17) and Gemma Tierney (MA '16) researched resiliency-focused funding opportunities at state, federal, and philanthropic levels and compiled the results into a database/website. Called the "Delaware Database for Funding Resilient Communities," the website allows users to easily filter by project scope, funding amount required, match, and the type of assistance. IPA's search prioritized financial assistance programs that support the implementation of high-cost



Visit www.sppa.udel.edu/research-public-service/ddfrc to utilize the database and view the fact sheet

activities such as infrastructure improvements, facility retrofitting, construction, and land acquisition. A fact sheet explains the purpose of the database and a tutorial video (<https://goo.gl/jLqJvA>) demonstrates how to access and use the database.

These new resources complement IPA's Planning 201 education program on "Creating Flood-Ready Communities," which has been conducted annually in collaboration with UD's Sea Grant, DNREC's Flood Mitigation Program, and DNREC's Division of Energy and Climate.

New Tools Help Delaware Local Governments Evaluate Walkability and Low-Stress Bikeability

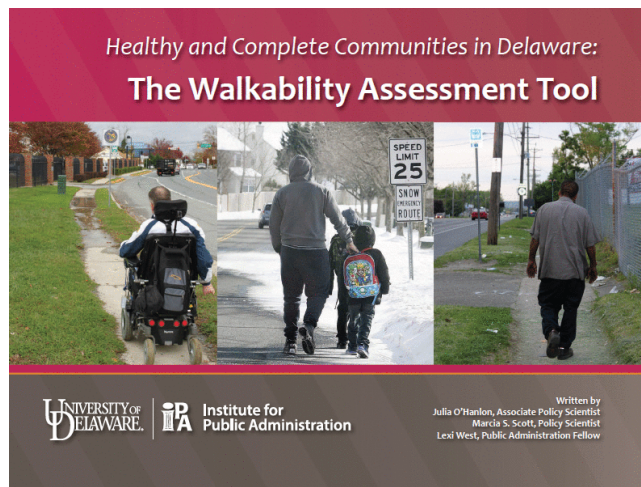
BY MARCIA SCOTT

The Institute for Public Administration (IPA) at the University of Delaware released two new resources designed to assist Delaware local governments with planning for pedestrian- and bicycle-friendly communities. Each tool, along with related resources, is posted on IPA's online *Delaware Complete Communities Planning Toolbox* at www.completecommunitiesde.org. The resources are part of IPA's ongoing commitment to providing high quality resources and technical assistance to Delaware's local jurisdictions.

Walkability Assessment Tool

The **Healthy and Complete Communities in Delaware: The Walkability Assessment Tool** guides local government officials and stakeholders through evaluating the walkability of specific areas within their jurisdiction. It explains the planning and policy framework that supports walkability, provides links to online resources, and prepares participants to engage in an interactive assessment process from pre- to post-walk activities. Using the tool, community stakeholders can consider strategies, policies, and programs to improve local pedestrian networks and infrastructure.

The publication was co-authored by Policy Scientists Marcia Scott and Julia O'Hanlon and Public Administration Fellow Lexi West (MPA '17). A video produced by Summer Undergraduate Public Policy Fellow Tim White (BA '17), *The In-Field Walkability Audit: An Overview of What to Look For*, complements the Walkability Assessment Tool. It is designed for viewing in a facilitated workshop setting, prior to conducting the in-field audit. It can be viewed on the Complete Communities YouTube Channel at <https://goo.gl/7w2mWm>.

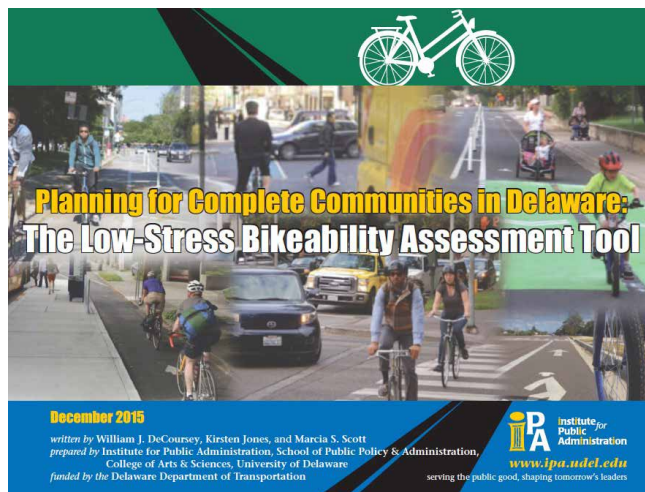


The Walkability Assessment Tool can be downloaded from IPA's online Delaware Complete Communities Planning Toolbox or www.ipa.udel.edu/publications/walkability-assessment-tool-2016-web.pdf

Low-Stress Bikeability Assessment Tool

Policy Scientist Marcia Scott, Assistant Policy Scientist William (BJ) DeCoursey, and former Public Administration Fellow Kirsten Jones (MPA '16) recently published **Planning for Complete Communities in Delaware: The Low-Stress Bikeability Assessment Tool**. The low-stress cycling approach is designed to identify areas within the local transportation network that have on-road bike travel-safety concerns, lack connectivity for bicyclists, are stressful for the "interested but concerned" rider (who lack skill or confidence), and are critical routes to destinations—particularly for "no-choice" riders and commuters. The assessment tool is intended for use with low-stress bikeability basemaps, which have been developed by the Delaware Department of Transportation for most areas within the state of Delaware.

The tool guides local government officials and community stakeholders in a three-step process of evaluating the low-stress bikeability of a priority roadway segment. The assessment process and tool are designed for use in a facilitated workshop setting that is led by a planner, consultant, or municipal staff member. The process enables workshop participants to identify which on-road bicycle routes lack connectivity and



IPA's Low-Stress Bikeability Assessment Tool can be downloaded from the Delaware Complete Communities Planning Toolbox or www.ipa.udel.edu/publications/walkability-assessment-tool-2016-web.pdf

accessibility and suggest strategies for route improvements. The tool also provides visual prompts and a checklist to inform workshop participants on what to look for during an in-field audit. Produced by Jones, a video entitled *Conducting a Low Stress Bikeability Assessment: An Overview of What to Look For*, is designed to be viewed by workshop participants prior to the in-field assessment. It offers visual examples to assess bicycle facilities, network, road conditions, visibility, intersections, and transit interaction. It can be viewed on the Complete Communities YouTube Channel at <https://goo.gl/Kg8SuH>.

Collaboration for Flagger Certification Training

Collaboration enabled the certification or recertification of 60 Delaware municipal personnel this past winter.

The DeLea Founders Insurance Trust (DFIT) is comprised of nearly half the municipalities in Delaware and designed to reduce occupational injuries and their costs through risk management strategies, development of best practices, and training. Our Municipal Circuit Rider, Matt Carter, often attends their safety and stewardship meetings and sometimes provides safety training.

Last fall, DFIT's Terri Desanto and Scott Stohrer asked Matt about flagger certifications, as there were some 60 municipal personnel who needed training and certification or whose certification was about to expire.



In Delaware, only the American Traffic Safety Services Association (ATSSA) is recognized for flagger certification and training opportunities in Delaware are sporadic at times. The cost of the training kits, which must be purchased through ATSSA is high and drives up the cost of participation as well.

Becoming an ATSSA Flagger Instructor requires appropriate experience, a total of five days of training, not all of which is necessarily locally offered, and course fees totaling as

much as \$1,000 or more. Hence, there aren't an abundance of qualified instructors.

Luckily, two to three employees of the Delaware Department of Transportation (DelDOT) are usually ATSSA Flagger Instructors and DelDOT allows them to assist the Delaware T2/LTAP Center from time to time. Over the past five years or so, the Center has arranged sessions and charged enough to cover the cost of the ATSSA kits.

Conveniently, the Delaware T2/LTAP Center pre-purchased a number of kits this past December when ATSSA put them on sale. So when DFIT asked about four sessions to train 60 people across the state, the Center had kits available and could lower the cost.

Wayne Hamilton and Mike Rivera, both from DelDOT and both ATSSA Flagger Instructors, were able to present the four training sessions in February and March in Rehoboth Beach, Dover, and Middletown. The four hour course includes a written exam and a practical demonstration of proper techniques by each student before they can be issued their certification.

The Delaware T2/LTAP Center, DelDOT, and DFIT all share the common interest of reducing the risk of construction injuries and training personnel to be active participants in a safety culture. The collaboration between the three stakeholders enabled us to efficiently train 60 local personnel and we thank our partners for their role in making this happen.

More information about ATSSA's on-line options for flagger certification can be found at <http://www.atssa.com/OnlineFlagger>.



UD Chapter of ITE makes third appearance at Grand Championship Collegiate Traffic Bowl

On Monday, August 15, 2016, the UD chapter of ITE Traffic Bowl team competed in Anaheim, CA as part of the Grand Championship. This was the team's third appearance at the national finals in the seven years of the event. The Traffic Bowl is a Jeopardy-style competition among student ITE chapters from the U.S. and Canada and involves questions in transportation engineering and planning.

The team had qualified for their participation in the Nationals by winning the Mid-Colonial District Competition in April, 2016. The UD team faced challenges from Morgan State University, Penn State University, Villanova University and the University of Pittsburgh and emerged undefeated. Nine teams from the ITE Districts competed in Anaheim. The UD team of Ben Fisher, Zach Nerwinski, James Clem and Megan Rosica, faced the University of South Florida and Purdue University in the first round and was defeated by the eventual champion, Purdue University. The team enjoyed the experience, had a great time at the conference and were excellent ambassadors of UD.



Active Summer for Internships

Engineering students are involved in more internships this summer than ever. The Delaware T²/LTAP Center coordinated nearly 20 positions but is aware that there are many others. These are great opportunities for both employer and student alike. Students, in addition to adding a little to the tuition kitty, can gain great insight into a part of the field and understand better whether that is a direction they'd like to consider after graduation. Employers, in addition to securing some inexpensive, energetic labor, expose tomorrow's workforce to their part of the field with hopes of attracting highly energetic and innovative professionals their way upon graduation.



In the T² Center this summer, we have students filming the 301 Corridor project to develop future training videos and others that are analyzing long-term transportation asset maintenance costs at the local level. The City of Newark has half a dozen students collecting asset management data, evaluating wastewater pre-treatment program options, evaluating compliance with the Americans with Disabilities Act, generating options for new bike path connectivity, and brainstorming long-standing resident

concerns with roadside drainage structures. AECOM has several students engaged in pavement rehabilitation oversight. Diamond Materials has four students assisting with project management, quantity takeoffs, and other construction management issues. Cecil County, in Maryland, has students involved in asset management data collection, analyses, and enhancement of their stormwater best management practices program.

These are just the positions we have had some active involvement with. There are many more internships we are only vaguely aware of. Imagine some of the opportunities other students are involved with this summer.

These employers are typically presenting a project or program to the student or students with little pre-conceived notion of approach or process, allowing the students to take ownership and form a solution. The result is often a solution the professional team hadn't considered or had dismissed too quickly; seeing the forest for the trees is sometimes their strong suit and it's a lot easier when they are given broad license to explore.

The T² Center wants to hear your stories – from both employers and students. Contact Matt Carter at matheu@udel.edu and tell us about your experiences so we learn from them and share them with others considering internship programs. Tell us what you did or what you had students do, share innovative approaches or different results than you expected, and share photos of students on the job. We feel strongly that engineering and other professional internships are an essential part of workforce development, whereby we encourage highly motivated students to learn more about our corner of the engineering world and consider joining us when they graduate.



Upcoming Training Opportunities

September 15 – Asset Management -Comparing Tools for Managing Infrastructure – Embassy Suites

September 20-21 - Managing Snow and Ice Control Operations Course (University of Wisconsin) – Clayton Hall

October 5 - Free Webinar: Innovative Culvert and Drainage Structure Repair.

October 20-Winter Maintenance - Paradee

October 25 & 26 – OSHA 10-Hour Certification – Kent County Levy Building

October 26 – OSHA 3-Hour Fall Protection – Kent County Levy Building

October 27 – Winter Maintenance – DBI, UD

November 15 & 16 OSHA 10-Hour Certification – DBI, UD

November 16 – 3-Hour Fall Protection- DBI, UD

Check our website for details and registration <http://sites.udel.edu/dct/t2-center/courses-workshops-seminars/>

DCT Hosts 13th Annual Research Showcase

The Delaware Center for Transportation (DCT) hosted its 13th annual transportation research showcase on Thursday, May 12th at the University of Delaware's Paradee Center in Dover, Delaware. The showcase offered the opportunity for project investigators and graduate students to display posters and share progress on research projects to DelDOT representatives and other interested parties. Showcased were currently funded projects in the areas of environment, pavement & materials, planning, soils, bridges & structures, plus traffic and intelligent transportation systems (ITS). Also included were projects

from the University Transportation Center (UTC) program. This year we welcomed visitors from various transportation agencies which included: DelDOT; Federal Highway Administration; Urban Engineers, Inc., Advanced Infrastructure Design, Delaware State Chamber of Commerce; Century Engineering and KMJ Consulting. Scoops of ice cream from the University's UDairy Creamery were once again offered to all who cared to indulge.

DELAWARE CENTER FOR TRANSPORTATION 2016 Spring Research Showcase



Additional pictures can be viewed on our website: <http://sites.udel.edu/dct/files/2016/04/Research-Showcase-2016-2f8yff2.pdf>

RESEARCH

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

1687-H TRAFFIC-SAFETY

The end result of this research project will be to provide transportation planners and engineers with guidance for the deployment of radar speed signs which could be employed in a systematic manner to restore and maintain a balance between mobility and neighborhood quality of life. Ending 8/24/16

Principal Investigator: Mingxin Li, Department of Civil and Environmental Engineering

Project Manager: Michael Somers, Division of Planning

DEVELOPMENT OF CAPACITY ADJUSTMENTS FOR ADAPTIVE CONTROL SYSTEMS

This research will compare data on current practices around the country and compare this to conditions along Delaware roads to see if the computed capacities compare to observed behavior. Comparing predicted behavior with data from the Traffic Management Center, this research will further develop the “true” capacity for a segment. No-cost extension request pending.

Principal Investigator: Rusty Lee, Department of Civil and Environmental Engineering

Project Manager: Gene Donaldson, Transportation Management Center

TRAFFIC MONITORING PROGRAM USER’S MANUAL

This project will develop a traffic monitoring program user’s manual containing the most important information and step-by-step procedures for DelDOT personnel to maintain an accurate and up-to-date data on volume, classification and weight for all roads

in the state as well as maintaining a high quality HPMS program. Ending 12/31/16

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

Project Manager: Kevin Gustafson, Division of Planning

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS – PILE DOWNDRAG DESIGN PROVISIONS

This project focuses on assessment of the new AASHTO LRFD bridge design specifications for piledown drag, and the associated implications for the design of future deep foundation projects in the State of Delaware. Ending 8/31/17

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

Project Manager: Jason Hastings, Bridge Design

IRIB ONGOING STRUCTURAL HEALTH MONITORING

The Indian River Inlet Bridge represents a significant investment in infrastructure for the State of Delaware. This funding supports ongoing evaluation of the bridge and preservation of its state-of-the-art structural health monitoring system. Ending 8/31/2019

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

Project Manager: Jason Arndt, Bridge Design

SUMMER AND FALL 2015 TRAVEL TIME, DELAY, AND SPEED DATA COLLECTION AND ANALYSIS

This project entails data collection during peak travel times on roadway segments throughout the state. Each segment will be traveled at least four times for maximum accuracy. Once data collection is completed, data will be transformed into the GIS database and transported to the ARCGIS software. Ending 12/31/16

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

Project Manager: Mark Eastburn, Division of Planning

TRAVEL DEMAND MODELING SUPPORT

Support for this project will assist DelDOT with the development, maintenance, application and evaluation of a travel demand forecasting model. The model supports planning studies for Delaware’s MPOs and various DelDOT sections on an as-needed basis. No cost extension pending.

Principal Investigator: Rusty Lee, Department of Civil and Environmental Engineering

Project Manager: Mike DuRoss, Division of Planning

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

The objective of this research project is to construct and monitor the performance of this innovative bridge technology and hopefully be a model for future GRS-IBS structures in the state of Delaware. Ending 8/31/16

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

Project Manager: Jason Hastings, Bridge Design

A COMPREHENSIVE REVIEW AND UPDATE OF THE TRAFFIC MONITORING PROGRAM AT DELDOT

To assist in the compliance comply with Federal regulations, this research project will evaluate the accuracy of traffic data being presented in the Traffic Summary with regards to traffic volumes. Ending 12/31/16

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

Project Manager: Kevin Gustafson, Division of Planning

FY15 RAIL SUPPORT FOR DELAWARE TRANSIT CORPORATION

The Railroad Engineering and Safety Program at the University of Delaware will provide expert technical review, research and support with regard to passenger and freight operations for the DTC. Ending 2/28/17

Principal Investigator: Allan Zarembski, Department of Civil and Environmental Engineering

Project Manager: Albert Loyola, Delaware Transit Corporation

2015 TRAVEL TIME, DELAY AND SPEED ANALYSIS

This project will conduct a statistical Comparative Analysis of the travel time, delay and speed data collection on pre-selected State of Delaware roads. Ending 10/31/16

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

Project Manager: Mark Eastburn, Division of Planning

STATEWIDE TRAFFIC DATA ANALYSIS AND EVALUATION

Under this project, a specific corridor or signals of interest will be designated by DelDOT for analysis. The data collected in the field and the models developed

will be used by both the Planning and Transportation Solutions Divisions. No cost extension pending.

Principal Investigator: Rusty Lee, Department of Civil and Environmental Engineering

Project Manager: Gene Donaldson, Transportation Management Center

PLANNING LEVEL ESTIMATES OF MUNICIPAL ASSETS AND THEIR MAINTENANCE

This project will develop a tool to assist with the annual cost estimate of life cycle cost of assets to municipalities. These assets include items such as pavement, signage, sidewalks, curb ramps, drainage and lighting, among others. Ending 10/31/16

Principal Investigator: Rusty Lee, Department of Civil and Environmental Engineering

Project Manager: Michael DuRoss, Division of Planning

FIELD MEASUREMENT OF THE DYNAMIC IMPACT FACTOR FOR BURIED CULVERTS

This research is aimed at field investigation of the actual dynamic load effects on buried culverts. The final product is expected to be a refined methodology for estimating the impact factor for buried culverts. Endng 5/4/17

Principal Investigator: Kalehiwot Manahiloh, Department of Civil and Environmental Engineering

Project Manager: Ping Jiang, Bridge Section

INTEGRATING ZERO-VALENT IRON AND BIOCHAR AMENDMENTS IN STORMWATER

Data from a field demonstration stormwater treatment system using biofilter media amendments for removing nitrogen will be used to develop preliminary guidelines for DelDOT which will assist the agency with compliance of the Total Maximum Daily Load (TMDL) regulations for bacteria and nutrients in surface waters. Ending 5/4/17

Principal Investigators: Paul Imhoff, Daniel Cha, Pei Chiu, Julia Maresca, Department of Civil and Environmental Engineering

Mingxin Guo, Delaware State University

Project Manager: Mark Harbeson, Transportation Management Center

EVALUATION OF APPLICATION AND UTILIZATION OF TMC DATA IN CALCULATING THE AVERAGE OPERATING SPEED, TRAVEL TIME, AND DELAY THROUGHOUT THE STATE OF DELAWARE

DelDOT's Traffic Management Center (TMC) data collected by means of Bluetooth sensors, cameras, signal, and other sensors will be evaluated and numerically computed in determining the average operating speed, travel time and delay through the state. No cost extension pending.

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

Project Manager: Mark Eastburn, Division of Planning

EVALUATION OF NEW DATA SOURCES FOR PLANNING AND OPERATIONS FY16

This project will provide DelDOT a demonstration of what some new sources of cell phone data can provide for information and how it would be useful for both operations and planning. Ending 4/30/17

Principal Investigator: Rusty Lee, Department of Civil and Environmental Engineering

Project Manager: Michael DuRoss, Division of Planning

Research Pays Off: Impacts of Home Shopping on Vehicle Operations and Greenhouse Gas Emissions

JAMSHID LAGHAEI, ARDESHIR FAGHRI AND MINGXIN LI

JAMSHID LAGHAEI, *Senior Transportation Planner, Division of Transportation and Traffic, Isfahan Municipality, Iran.*

ARDESHIR FAGHRI, *Professor, Department of Civil and Environmental Engineering, University of Delaware.*

MINGXIN LI, *Research Associate II, Department of Civil and Environmental Engineering, University of Delaware*

As a shopping behavior trend, home shopping has become more popular. Logic suggests that home shopping is “greener” than traditional shopping. But a multi-year regional study at the University of Delaware suggests that home shopping has a greater impact on the transportation sector than we might suspect. The simulation results showed that home shopping puts an additional burden on the local transportation network, as identified through four measures of effectiveness—travel time, delay, average speed, and greenhouse gas emissions.

PROBLEM

Home shopping imposes some mobility problems and costs on society in general. Heavy-duty diesel trucks have long been recognized as one of the most important source of environmental pollution. The increase in the number of delivery trucks contributes significantly to emissions of fine particulate matter (PM_{2.5}). Additionally,

the increase in the number of delivery trucks implies the need for more parking spaces both at package distribution centers and on street networks. Residential and downtown streets were not designed to accommodate frequent truck stops, parking, loading, and unloading. Although there have been extensive previous investigations carried out to estimate the impact of home shopping on total vehicle miles traveled (VMT), less attention has been paid toward the mobility and environmental effects of home shopping versus conventional shopping specifically. Without detailed multi-year regional study, the system-wide impacts on mobility, energy, and the environment are still unclear.

SOLUTION

To understand the current home-shopping expansion and to make predictions for the future, it is important to know the advantages and disadvantages of home shopping and the value people place on them, as well as to understand the different home-shopping technologies and the benefits and the limits they impose on consumers. A study was conducted by the University of Delaware to investigate the effects of home shopping on vehicle operations and greenhouse gas emissions. The purpose of that study was to identify the home-shopping impacts on transportation system, its net effects on traffic volume of the transportation network, its effects associated with environmental sustainability and then to provide some projections for future condition.

METHODOLOGY

The first step was data collection which was performed through a survey questionnaire to identify the shopping behavior of the study area. This was a very important step because the behavioral characteristics of every region depend on the demographic characteristics of that region. There is no identical set of behavioral characteristics that could be a good fit for all societies.

In the second step, the survey results were summarized by product category, in order to obtain an estimation of total home shopping in the area in terms of number of purchased items per customer per year per product category. This measure was used in order to calculate total home shopping in the area regarding the population of home shoppers. The required data for simulation were obtained through a field inspection and the local agencies such as Newark Traffic Police Department and Wilmington Area Planning Council (WILMAPCO) which is a federally funded Metropolitan Planning Organization (MPO) working with Delaware Department of Transportation (DelDOT) and Maryland Department of Transportation (MDOT). The information provided by delivery companies about the number of working days per year and the average package delivery per truck completed the knowledge to calculate the number of trucks for delivery purposes.

The third step was simulation and analysis. Simulation results (Fig. 1) showed that home shopping will put additional burden on Newark transportation network, as identified through four MOEs which were travel time, delay, average speed, greenhouse gases and other typical air pollutants.

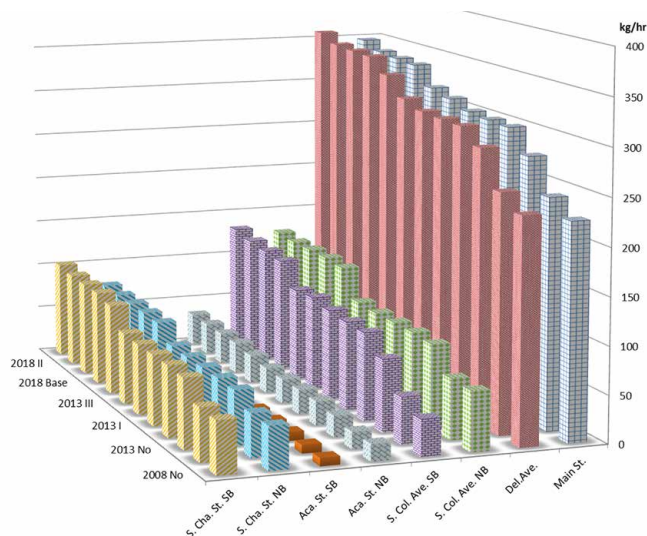


Fig.1 Simulation results of greenhouse gases and other typical air pollutants from road based transportation.

RESEARCH IMPACT

The research article, "Impacts of home shopping on vehicle operations and greenhouse gas emissions: multi-year regional study," was co-authored by Jamshid Laghaei, Ardeshir Faghri and Mingxin Li and published in International Journal of Sustainable Development & World Ecology (2016). This article has been reported by over 180 media in 30 countries, such as New York Times, United Press International (UPI), The Guardian, Science Daily, Helsingin Sanomat, etc. (Fig. 2). As shown in Fig. 3, the Altmetric score 108 puts the article in the top 5% of all articles ranked by attention. More generally, this article has done particularly well and is in the 99th percentile: it's in the top 5% of 5,320,782 articles across all journals ever tracked by Altmetric.



Fig.2 Recent Major Media Exposure.

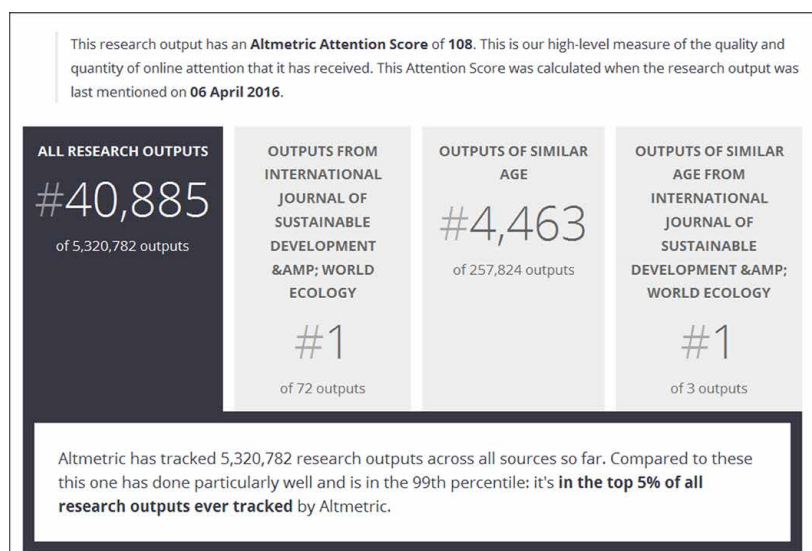


Fig.3 Altmetric Score.

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

Delaware Center for Transportation Staff

Christopher Meehan,
Director
cmeehan@udel.edu

Ellen Pletz,
Business Administrator I
ebourett@udel.edu

Sue McNeil,
Director UTC
smcneil@udel.edu

Mingxin Li
Research Associate II
lmx@udel.edu

Jerome Lewis,
Associate Director
jlewis@udel.edu

Matheu Carter,
T² Engineer
matheu@udel.edu

Earl Rusty Lee,
T² Program Coordinator
elee@udel.edu

Sandra Wolfe,
Event Coordinator
sandi@udel.edu

The University of Delaware does not discriminate on the basis of race, color, national origin, sex, disability, religion, age, veteran status, gender identity or expression, or sexual orientation, or any other characteristic protected by applicable law in its employment, educational programs and activities, admissions policies, and scholarship and loan programs as required by Title IX of the Educational Amendments of 1972, the Americans with Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, Title VII of the Civil Rights Act of 1964, and other applicable statutes and University policies. The University of Delaware also prohibits unlawful harassment including sexual harassment and sexual violence. Inquiries or complaints may be addressed to:

Susan L. Groff, Ed. D.
Director, Institutional Equity & Title IX Coordinator
305 Hullihen Hall
Newark, DE 19716
(302) 831-8063
titleixcoordinator@udel.edu

For complaints related to Section 504 of the Rehabilitation Act of 1973 and/or the Americans with Disabilities Act, please contact:

Anne L. Jannarone, M.Ed., Ed.S.
Director, Office of Disability Support Services
Alison Hall, Suite 130,
Newark, DE 19716
(302) 831-4643

OR contact the U.S. Department of Education - Office for Civil Rights
(<https://wdcrobcolp01.ed.gov/CFAPPS/OCR/contactus.cfm>).

A yellow circular logo with a white border. Inside the circle, the text "UTC NEWS" is written in a bold, sans-serif font, and "INSERT" is written below it in a slightly smaller, bold, sans-serif font.

UTC NEWS
INSERT

The word "TranSearch" is written in a large, stylized font. The letters "Tran" are blue and "Search" are green. The background of the header features a night cityscape with a bridge and light trails from cars.

TranSearch

RESILIENCY OF TRANSPORTATION CORRIDORS

PUBLISHED BY THE UD UNIVERSITY TRANSPORTATION CENTER

SUMMER 2014

Dare to be first.



University
Transportation
Center

Department of
Civil & Environmental
Engineering

355 DuPont Hall
Newark, DE 19716

P: 302-831-1446
F: 302-831-0674
www.ce.udel.edu/dct

Director's Message

The spring and summer have been filled with activities – work on projects, conferences, workshops, the research forum (see the DCT newsletter) as well as preparation of new CAIT at UD proposals. We have completed the projects funded under the CAIT Tier 1 UTC and are currently in our final year of funding under the CAIT National UTC, with a proposal submitted by CAIT to USDOT for the new competition. Our collaboration with CAIT has been productive and beneficial. We hope that by the end of this calendar year we can report that the collaboration can continue.

In the meantime, this newsletter provides updates on current projects, new projects, a workshop with CAIT at Rutgers, and our newest fellowship recipient. These are core activities for our collaboration with CAIT. We also describe the exciting activities our students have been engaged in – the 2016 WTS Annual Conference, the fourth Advanced Infrastructure Management course, fondly referred to as bootcamp, and the Annual Interuniversity Symposium on Infrastructure Management (AISIM). AISIM and bootcamp were hosted this year by Oklahoma State University. Finally, we provide some interesting opportunities for the fall including a workshop and three brown bag seminars.

We hope you find these projects and events as relevant, exciting and interesting as we do!

Sue McNeil

Professor, Department of Civil & Environmental Engineering

Director and Managing Editor
Sue McNeil

Design
University Printing

Highlights from Selected Recent and Ongoing CAIT at UD Tier 1 UTC Projects

While this grant has ended, researchers continue to finalize reports, and build on and disseminate the results of their research from already completed studies.

Final reports recently submitted are:

"Defining and Quantifying State of Good Repair (SOGR) for the Pedestrian Network" by William J. DeCoursey and Jeremy Rothwell

"Biodeterioration of Construction Materials – A General Overview" by Fazana Atique and Nii Attoh-Okine

"Cookbook for Rheological Models – Asphalt Binders" by Offei A. Adarkwa, Nii Attoh-Okine and Pamela Cook.

Imhoff, Paul T., and Pei C. Chiu, "Biochar as a Rechargeable Geobattery to Promote Nitrogen Removal in Stormwater from Roadways," Final Report, December 31, 2015.

Building on an already completed CAIT project on the use of Biochar from Stormwater Remediation, Professors Imhoff and Chiu and colleagues have continued to leverage and disseminate their work through new research grants, presentations, webinars and posters. Dissemination activities include:

US EPA Region 3 Office, Water Protection Division and Environmental Assessment and Innovation Division, "Biochar – What Designers Need to Know", July 12, 2016, invited presentation.

Industrial Technology Research Institute, Hsinchu, Taiwan. "Biochar as a Reversible Electron Storage Medium to Enhance Stormwater Bioremediation", May 19, 2016, invited presentation.

The 3rd Microbial Systems Symposium, Newark, DE. "Black Carbon as a Microbial Electron Donor and

Acceptor", February 3, 2016, presentation.

MATS UTC Research Webinar Series, "Simultaneous Removal of Nitrogen and Phosphorus from Stormwater by Zero-Valent Iron and Biochar in Bioretention Cells", April 27, 2016, webinar.

Chesapeake Bay Day on Capitol Hill, "Using Biochar to Reduce Nitrogen Load to Chesapeake Bay," March 2, 2016, poster.

Delaware Center for Transportation Research Showcase, Dover, DE. "Phosphorus Removal from Stormwater Using Zero-Valent Iron", May 21, 2016, poster.

The 3rd Microbial Systems Symposium, Newark, DE. "Wood-Derived Biochar as a Microbial Electron Donor for Nitrate Reduction", February 3, 2016, poster.

The work on tracking housing recovery in Sea Bright, NJ and the relationship to infrastructure renewal (Professors Trainor and McNeil) also continues. A follow-up survey was prepared and mailed to residents of Sea Bright in late Fall 2015. Responses received as follows:

Total Sent	1017
Undeliverable	5
Responses	131
Response Rate	12.9%

Analysis of this data is continuing.

Highlights from Selected Recent and Ongoing CAIT at UD National UTC Projects and Initiatives

Work continues on several projects that are either nearing completion or have reports in the review

process. In the meantime, presentations disseminating completed research are continuing. These include:

Ozden A., Faghri, A., Li, M., Tabrizi, K. (2016) Evaluation of Synthetic Aperture Radar Satellite Remote Sensing for Pavement and Infrastructure Monitoring. International Conference on Sustainable, Design, Engineering and Construction (ICSDEC 2016), Tempe, Arizona (Paper #. 16-207).

New CAIT at UD National UTC Projects

Three new CAIT at UD projects will be launched using funding from the CAIT National UTC. These projects are:

"Reducing Stormwater Runoff Volumes with Biochar Addition to Highway Soils" – Professors Imhoff and Maresca

"Experimental Evaluation of the Engineering Behavior of Soil-biochar Mixture as a Roadway Construction Material" – Professor Manahiloh

"Sustainable Geotextiles for Transportation Applications from Recycled Textiles" – Professors Clarke-Sather and Meehan

Also a collaborative research project led by Professor McNeil with Dr. Gordana Herning of Rutgers and MIT, Professor Kevin Heaslip of Virginia Tech will be launched this fall. The project entitled "The Connection between State of Good Repair and Resilience: Measures for Pavements and Bridges" builds on the work leading up to and including the workshop on resilience held last December. Graduate student Rachel Chiquoine and Daniel Liu will be working on this project.

Stay tuned for more project updates including Spring brown bags!

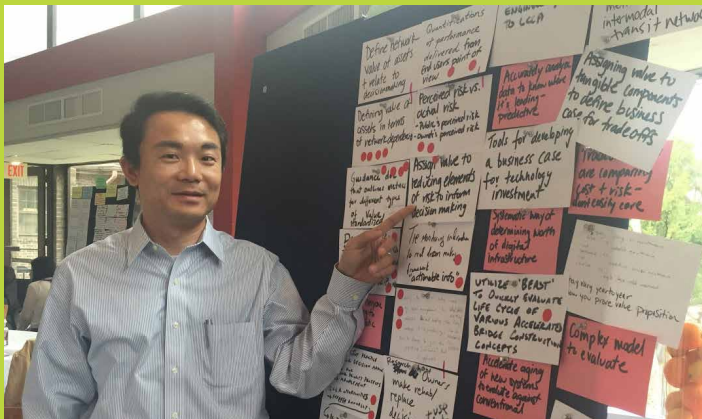
Life Cycle Cost Workshop

Professors Clarke-Sather, McConnell, Mertz and McNeil, and PhD student Daniel Liu attended a workshop on Life Cycle Cost Reduction hosted by CAIT on March 24, 2016 on the Rutgers campus. The objective of the workshop was to identify opportunities for practical and breakthrough CAIT research that can reduce life cycle cost and improve decision-making in the transportation industry. The workshop convened 33 participants, including Center partners from multiple universities, transportation industry representatives, insurance providers, and national and regional government stakeholders in the transportation sector. Participants were challenged to identify how cutting-edge solutions—from design/build

innovations to sensing and data analytics—can help achieve optimal transportation infrastructure performance.

CAIT will use the workshop results to develop a roadmap that will support the development of a cutting-edge Life Cycle Cost Reduction Guideline by CAIT. The guideline will ideally address the specific challenges faced by many infrastructure asset owners and provide critical decision-making tools to optimize both network-level and project-specific improvements.

The roadmap will recognize CAIT's mission to improve the state of good repair of transportation infrastructure, safety, and economic competitiveness, and build on the capabilities of the consortium of universities engaged in the UTC.



Daniel Liu describes some of the issues and opportunities identified at the Life Cycle Cost Workshop



Professors Mertz and McConnell listen to a discussion at the Life Cycle Cost Workshop

2016-2017 CAIT at UD Graduate Student Fellowship



CAIT at UD Fellowship Recipient
Kokeb Abera

Congratulations to Kokeb Abera, the recipient of the 2016-2017 CAIT at UD graduate student fellowship. The fellowship includes tuition, a stipend and modest travel and computing resources. Kokeb is a second year MS student in the Geotechnical Engineering program and a Spring 2015 graduate from Rowan University.

Building on ongoing work (some of which has been funded by CAIT at UD), Kokeb plans to focus on understanding the engineering behavior of biochar remediated soil, including the effects of biochar on flow, volume change, and strength properties. Kokeb's advisor is Professor Kalehiwot Manahiloh. Professor Manahiloh said that Kokeb knew that he wanted to do experimental geotechnical engineering when he joined his graduate group. Kokeb has now been trained in the appropriate techniques and "has shown that he is a critical and creative thinker with an eye for details and devotion to hard work." Kokeb looks forward to being engaged with CAIT at UD.

WTS Annual Conference – 2016

The WTS (Womens Transportation Seminar) conference was held in Austin, Texas from May 18 to May 20, 2016. The conference included speakers, professional development workshops and networking opportunities. Information about the conference was distributed to juniors and seniors in Civil Engineering, and graduate students in transportation and civil infrastructure systems in civil engineering. Three UD students attended:

Sarah Doggett – a senior in Civil Engineering. Sarah attended the conference in 2014 and 2015 and this year had a poster “Transit Friendly Cities” accepted for presentation at the conference. The poster is based on her senior thesis. Sarah will be attending grad school at UC Berkeley in transportation in the fall.

Kate Norris – a senior in Civil Engineering. Kate is interested in transportation and urban planning. She sees this as a great opportunity to build these connections.

Silvia Galvan Nunez – graduate student in transportation. Silvia sees the meeting as “an excellent opportunity to interact with my peers and also gain in-depth knowledge about the academic enterprise for young women.”

After the conference Sarah wrote “The WTS conference was a valuable experience for me because I was able to learn about the transportation field from experienced professionals. I also was able to network and make valuable connections. I made

contact with several of the members of the Bay Area chapter which I will join when I move to Berkeley in the fall. I was also able to present my thesis to many of the conference attendees.” This was the third WTS conference that Sarah had attended.

Kate, a first time attendee, said “The WTS Conference was an incredible experience for networking and it was also very refreshing to see so many women in leadership positions within varied transportation fields. From the many sessions offered over two days, some of the ones I found most engaging and interesting were those that focused on shared or alternative transportation. Some of the most notable sessions that I got to attend include the Discussion on Shared Mobility which featured speakers from TransitScreen, Car2Go, and Lyft, the Shared Mobility Policy Considerations session which discussed equity and access problems, and a discussion on the ways to implement Bus Rapid Transit. Each of these helped me look at the important issues and possible problems that emerging and less common transit solutions can pose. I got to meet many women in the transportation industry including the chapter leader for Philadelphia, and several panelists.”

Silvia, also a first time attendee, wrote “The 2016 WTS Annual Conference provided deep insights of how women lead projects relating to transportation such as multimodal transportation systems, automated transportation, big data applications, transportation funding, and how they advocate for gender equality throughout organizations. Those topics were addressed in both professional development workshops/breakout sessions and networking events.”

Support was provided by the Women in Engineering (WIE) program, and CAIT at UD.



Sarah Doggett with her poster at the WCTR Annual Meeting



Silvia Nunez, Kate Norris and Sarah Doggett

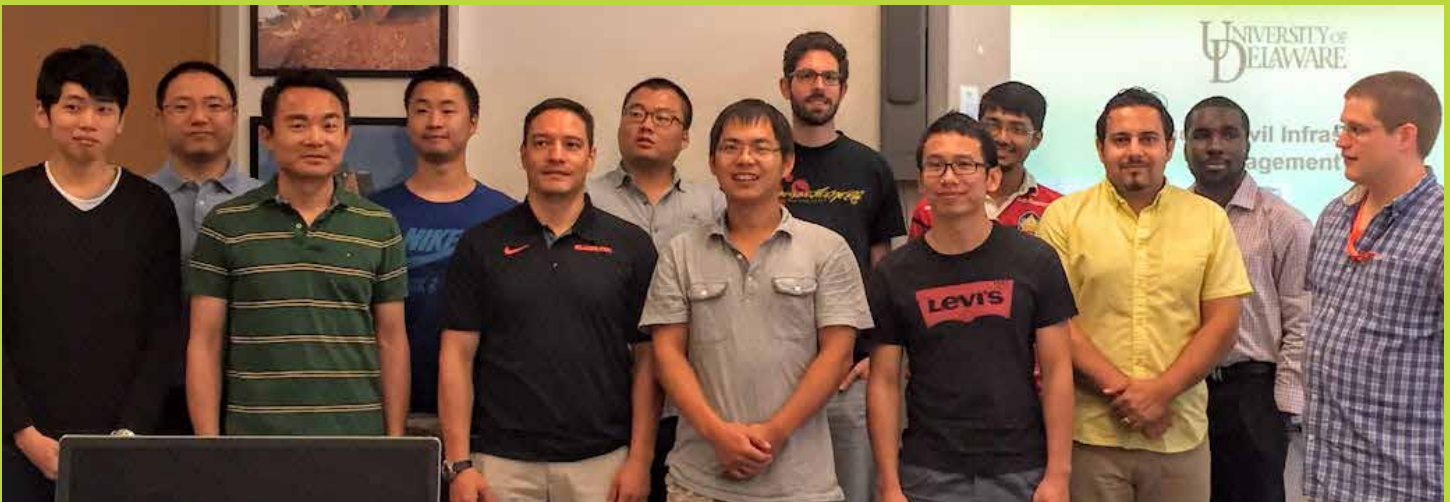
Advanced Infrastructure Management Bootcamp 2016

The fourth Advanced Infrastructure Management “Bootcamp” was held at Oklahoma State University from June 6 to June 17. PhD students Emmanuel Martey (also a CAIT at UD Fellowship recipient) and Yuanchi (Daniel) Liu, both from Civil and Environmental Engineering participated in the 2016 bootcamp. Professor Sue McNeil served as a course coordinator and instructor.

The bootcamp brought together 12 students, a visiting professor from China as a participant and 8 instructors. The students and instructors came from Georgia Tech, Purdue University, Texas A & M, Virginia Tech, University of Delaware,

University of Iowa, and Oklahoma State University as well as three international students from China, Japan and Germany. The course covered performance and asset management, sensors and instrumentation, deterioration modeling, data management, sustainability, risk and reliability, asset valuation, public private partnership, optimization, and research methods. Students participated in lectures, completed homework and a final project. The objective of Bootcamp is to provide an opportunity for students to gain in-depth knowledge, acquire advanced infrastructure management skills, and develop a mini-project and network with others with similar interests in Civil Infrastructure Management.

Professor Joshua Li, from Oklahoma State University and a former postdoctoral researcher at University of Delaware, organized and led the class. Support for the bootcamp came from the Southern Plains University Transportation Center. Support for the University of Delaware students came from CAIT at UD.



Bootcamp Participants 2016 (Daniel Liu, 3rd from right; Emmanuel Martey, 2nd from left)

AISIM 12 – Oklahoma State University, Stillwater, OK

AISIM 12 was hosted by Oklahoma State University in conjunction with the 4th Bootcamp. Four UD students, Yuanchi (Daniel) Liu, Emmanuel Martey, Silvia Galvan Nunez and Matija Radovic, all PhD students in Civil and Environmental Engineering attended and presented papers. Their presentations were well received and show the range of infrastructure topics our students are interested in. The titles of their presentations are:

Daniel Liu – “Integrating Resilience Concepts with Pavement Management: A Case Study in Delaware”

Emmanuel Martey – “Probability Analysis of Train Derailments Using Cupola Function Theory”

Silvia Galvan Nunez – “Assessing Uncertainty of Track Geometry Degradation Based on Evolutionary Markov Chain Monte Carlo”

Matija Radovic – “Real Time Object Recognition Using Convolutional Neural Networks”

AISIM 12 kicked off on Friday, June 10 with a workshop “How to work with a social scientist” delivered by Alex Greer, an Assistant Professor in the Department of Political Science at OSU, and former CAIT at UD research assistant. The group then adjourned to Eskimo Joes for networking.

Oklahoma Department of Transportation Secretary, Gary Ridley, delivered the keynote address at the symposium. He began by discussing the role of government in providing health, security, education and transportation. He emphasized that in transportation you work for the people so they can have better lives, better choices. With a perspective of five decades, he would like to see us be more deliberate

about the decisions we make. This includes research to improve our transportation systems. Even what is perceived as a small impact is important. In response to the question “What has changed?,” the response was “Getting politics out of the process.” Moving forward, we need to do it right the first time. We also need to sometimes step back and look at things. His other piece of advice is that it is always good to “Under Promise and Over Deliver.”

David Ooten, Division Engineer for Strategic Asset and Performance Management Division talked about Asset Management Implementation in the Oklahoma DOT.

The fifteen student presentations were organized around four topics:

Asset performance

Data for asset management

Statistical analysis

Decision making

James Bryce, an AISIM alum, from AMEC Foster Wheeling provided an overview of his experience working in industry. The day concluded with dinner at Bad Brad's BBQ, where the awards for best paper were presented. Silvia Galvan Nunez's presentation “Assessing Uncertainty of Track Geometry Degradation Based on Evolutionary Markov Chain Monte Carlo” was selected as one of the best presentations. The best presentations are then offered an opportunity to present their work in an invited poster session at the Transportation Research Board Annual Meeting in January 2017.

Support for AISIM came from AMEC Foster Wheeling, the School of Civil and Environment Engineering at OSU, the College of Engineering, Architecture and Technology and the Southern Plain University Transportation Center. Support for the UD students to attend AISIM came from CAIT at UD.



Best Presentations at AISIM 11 - Silvia Galvan Nunez with other Awardees



UD Students AISIM (Left to right: Emmanuel Martey, Silvia Galvan Nunez, Daniel Liu, and Matija Radovic)

Comparing Tools for Asset Management

In collaboration with the Mid-Atlantic Geospatial Transportation Users Group (MAGTUG), Delaware T²/LTAP, CAIT at UD is hosting a one-day event “Comparing Tools for Managing Infrastructure.” Our objective is to provide a forum in which local and county governments can better understand what their asset management needs are and how different products address these needs. Our intended audience members are the users of asset management tools in local and county governments recognizing that different organizations have different needs.

The day is slated for 8:30am September 15, 2016 at the Embassy Suites, Newark, DE. Participating vendors are AssetWorks, Munilogic and VueWorks.

The day will include presentations and demonstrations.

For more information see https://sites.udel.edu/dct/files/2016/08/Announcement_RegInfo_Agenda-1rw1ozt.pdf

For registration see https://delaware.ca1.qualtrics.com/SE/?SID=SV_9S3foPGjb25DuVn

Upcoming Brown Bag Seminars and Webinars

This fall we will continue the “Brown Bag” seminars. “Brown Bag” is in quotes because the seminars will be held on Wednesdays from 3:30 to 4:30pm. That would mean a VERY late lunch. However, we will provide drinks and snacks. So, look for the announcements. The following three have already been slated:

October 5: Abigail Clarke-Sather, Jennifer McConnell “Using information at different spatial scales to estimate demand to support asset management decision making.”

November 16: Chris Meehan “Long-Term Monitoring of a Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)”

TBD: Jennifer McConnell. “Multi-Scale Condition and Structural Analysis of Steel Bridge Infrastructure”

Contact Us

Want to learn more about the UTC?

Watch for our new website – there will be a link from: <http://www.ce.udel.edu/UTC/index.html>

Want to be notified by email when CAIT at UD is sponsoring transportation related events? Want to be notified by about CAIT at UD funding opportunities or graduate fellowships?

To be added to the email distribution list, send an email to Sue McNeil (smcneil@udel.edu)