

NC STATE

Engineering

CCEE NEWS

**DEPARTMENT OF CIVIL, CONSTRUCTION,
AND ENVIRONMENTAL ENGINEERING**
NC STATE UNIVERSITY | FALL 2015

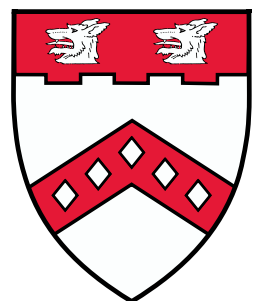


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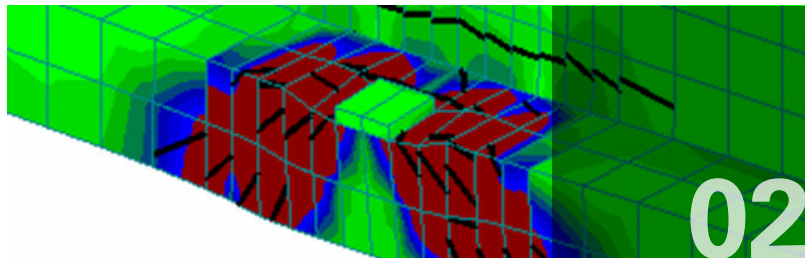
CCEE News is published by the Department of Civil, Construction, and Environmental Engineering to share information among faculty, staff, students, alumni and friends of the Department.



IN THE SPOTLIGHT

RAIL YARD TOUR HIGHLIGHTS
EMISSIONS RESEARCH
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CCEE research is helping to reduce emissions from locomotives.



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ABOUT THE COVER

A new exhibit in the lobby of Mann Hall documents NC State's and CCEE's role in the 1999 relocation of the Cape Hatteras Lighthouse 2,900 feet inland to save the landmark from the encroaching waves.

LETTER FROM THE DEPARTMENT HEAD MORTON A. BARLAZ



Welcome to the fall 2015 newsletter. I always enjoy the opportunity to provide an update on all that is going on in the department. We welcomed about 230 new undergraduates to the department as well as about 85 new graduate students in August. It is fun to watch the excitement and curiosity on the faces of students entering Mann

Hall and to watch our classrooms fill up with the next generation of civil, construction, and environmental engineers.

We will be welcoming a new faculty member in January. Dr. **Fernando Garcia Menendez** is completing a postdoc at MIT and has expertise in large-scale air quality models and the impacts of climate policy on air quality.

I am pleased to offer congratulations to several faculty members who were promoted. Drs. **Chris Bobko** and **Joe DeCarolis** were promoted to associate professor with tenure and Drs. **Sankar Arumugam**, **Akhtar Tayebali** and **Billy Williams** were promoted to professor. In addition to promotions, I am pleased to be able to announce the appointments of Dr. **H. Christopher Frey** as the Glenn E. Futrell Distinguished University Professor, Dr. **Ed Jaselskis** as the E. I. Clancy Distinguished Professor, Dr. **Richard Kim** as the Jimmy D. Clark Distinguished University Professor and Dr. **Min Liu** as the Edward I. Weisiger Distinguished Scholar. As always, I am grateful to the donors who made these endowed professorships possible and am pleased to be able to recognize excellence with these appointments.

We started the semester with our traditional welcome back ice cream social for all of our students. I used the opportunity to meet with undergraduates new to the department and encouraged them to take advantage of the programs that make NC State a great university, including our student organizations and undergraduate research. We have been working to introduce students to the department and have established a short orientation session during the first week of classes.

Our students received some encouraging news this month. In a survey of graduating seniors in CCEE, 80 percent had a job offer within two weeks of graduation in 2015, while another 11 percent were planning on graduate school. Just four years ago, only 48 percent had a job offer and 23 percent planned on graduate school. I continue to hear about strong demand for our graduates from our advisory board.

This newsletter features research briefs from our faculty, highlighting contributions to civil infrastructure including research on methods to simulate the long-term aging of asphalt, safer design of concrete parking decks, assessment of the condition of earth-retaining structures and an educational tool to help students visualize the behavior of metabolic pathways. These briefs are just a few examples of how civil, construction, and environmental engineers are working to improve public welfare and environmental sustainability.

We continue to develop our web site and I have updated the PowerPoint presentation that describes our academic and research programs. Please check out the presentation, www.ce.ncsu.edu/about, and let me know what you think.

As you read this newsletter, I hope that you get a sense of all of the wonderful activities in our teaching, research and extension programs. As everyone is aware, we continue to suffer from decreasing budgets. I have explained budget reductions in past letters and asked our friends and alumni for help. Many of you have responded and your contributions are sincerely appreciated. Private support must increase to simply continue, not to mention enhance, what we do. Please make a contribution to the department a regular event. Your gifts provide help with the special things that make us excellent, whether it is field trips for undergraduates, allowing graduate students to make a presentation at a conference, or helping to recruit and retain the best students and faculty in the world. We need your support as we continuously work to excel in all that we do.

Thank you.

A handwritten signature in black ink, appearing to read 'Morton A. Barlaz', with a long, sweeping horizontal line extending to the right.

Morton A. Barlaz
CCEE Department Head

CCEE AT NC STATE SUSTAINABLE INFRASTRUCTURE FOR SOCIETY

- \$18.2 million** in research expenditures
- 156** ongoing research projects
- 11** winners of CAREER and other NSF young faculty awards
- 48** faculty members
- 336** graduate students
- 754** undergraduate students



Oven conditioning of asphalt concrete in a loose mix state for accelerated aging

Technique predicts asphalt performance

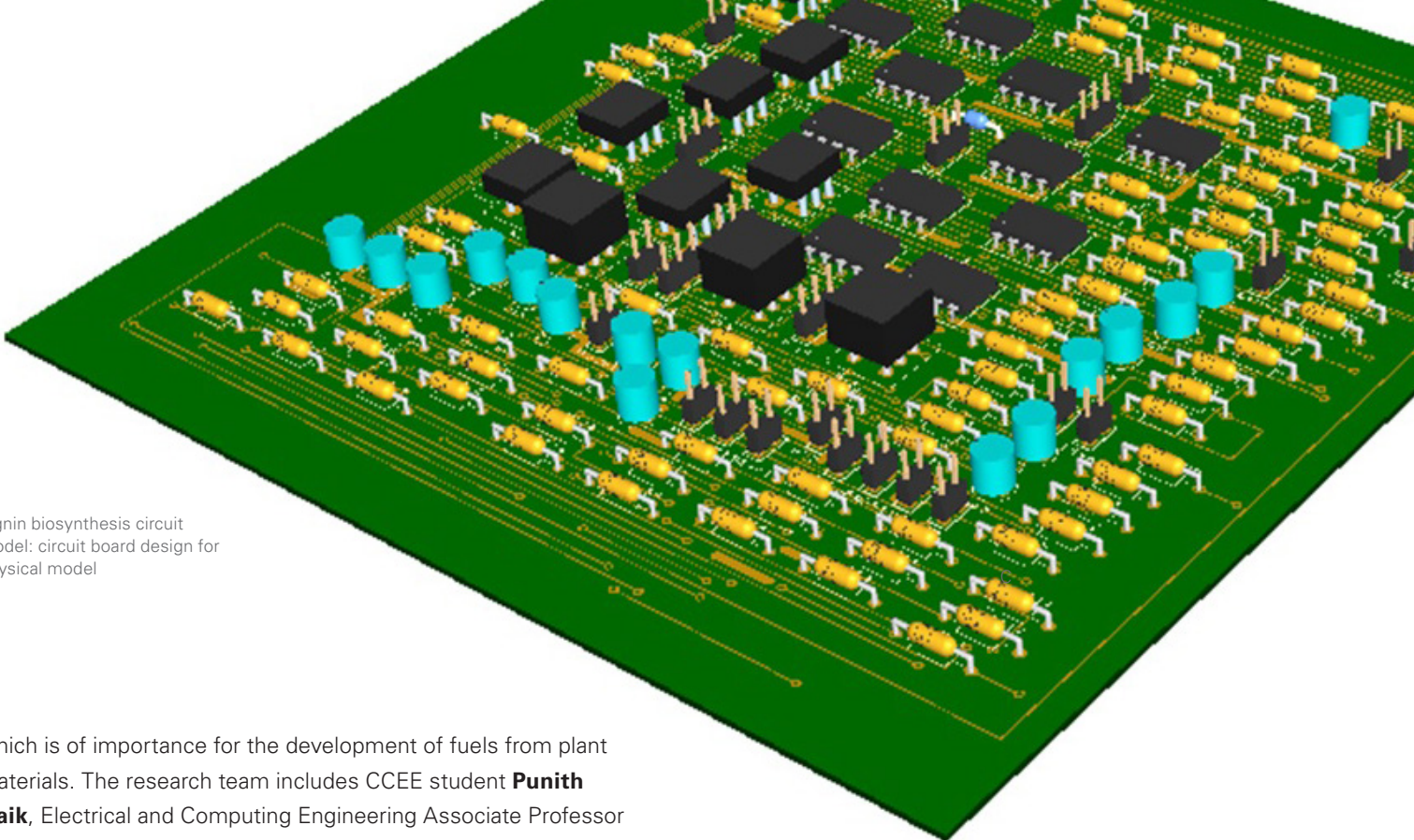
Asphalt pavement represents a major investment in infrastructure in the U.S. and we are all familiar with potholes that develop as asphalt ages. An accelerated laboratory aging procedure is needed to predict the long-term performance of pavement and better guide mixture design. Drs. **Y. Richard Kim** and **Cassie Castorena** and Ph.D. students **Michael Elwardany** and **Farhad Yousefi Rad** are leading a project funded by the **National Cooperative Highway Research Program** (NCHRP) to develop a laboratory procedure to simulate the long-term aging of asphalt mixtures. Long-term aging results from oxidation that leads to increased hardness and brittleness of asphalt concrete, consequently increasing cracking susceptibility of pavements.

The research team evaluated several alternatives and showed that a procedure based on oven conditioning of asphalt concrete in a loose mix state is best in terms of versatility, cost and efficiency. The research team is now calibrating this procedure to reflect field conditions based on a broad set of materials and field cores acquired from pavements throughout the United States. The ability of the laboratory procedure to replicate real-world conditions is being evaluated based on comparison of samples from the laboratory with those extracted from the field. Collaborators in this effort include **Arizona State University**, **Nichols Consulting Engineers** and **Western Research Institute**. ■

New tool simulates metabolic pathways

Genetic modifications of organisms and plants are becoming commonplace in many applications such as genetically modified foods, paper production and biofuel production. Genetic modifications have the potential to offer many advantages, such as providing the scientific basis for growing agricultural products with reduced use of insecticides and producing fuels with reduced environmental impact. The successful development of genetically modified products requires that engineers and scientists from a range of disciplines and backgrounds work

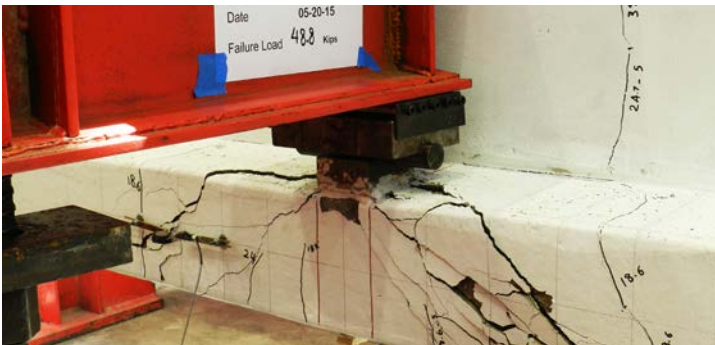
together. In research funded by the National Science Foundation, a research team led by CCEE professor Dr. **Joel Ducoste** is developing an electronic circuit framework as an educational tool for simulating and visualizing the behavior of metabolic pathways, thus making it easier for engineers and scientists to collaborate. This novel tool will also allow students to learn in a “hands on” way how biological pathways behave and respond to genetic modifications or environmental stresses. Current work is focused on representing the lignin biosynthesis pathway,



Lignin biosynthesis circuit
model: circuit board design for
physical model

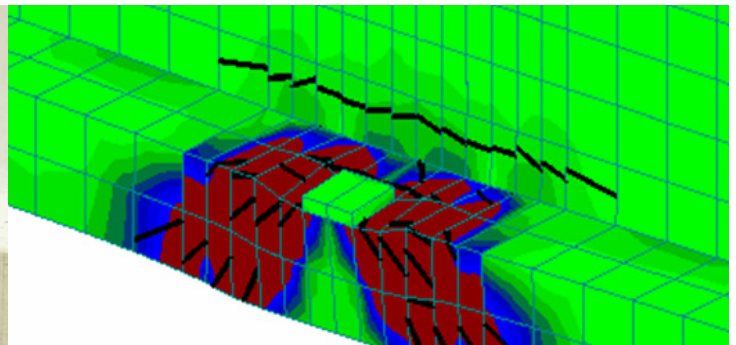
which is of importance for the development of fuels from plant materials. The research team includes CCEE student **Punith Naik**, Electrical and Computing Engineering Associate Professor Dr. **Cranos Williams** and students **Cody Ellington** and **Julio Valeriano**. ■

Building a better parking deck



Typical failure of the ledge in experiment and analysis

At the Constructed Facilities Laboratory (CFL), researchers are improving design procedures for parking garage decks. The research involves investigating the ways in which the precast concrete beam ledges commonly used to support garage decks fail. Knowledge of failure modes can be used to develop better designs. With funding from the Precast Concrete Institute (PCI) and the National Science Foundation Center for Integration of Composites into Infrastructure (CICI), graduate students **Mohamed Nafadi** and **Omar Khalaf Alla** are measuring and analyzing ledge failure mechanisms. The research is conducted



in collaboration with **WJE Consulting Engineering Company** under the direction of Drs. **Sami Rizkalla**, **Paul Zia** and **Gregory Lucier**. Full-scale experiments along with detailed analytical work have demonstrated that the current design procedure overestimates the capacity of the ledges. The results also indicate that several parameters currently not considered by the design procedure directly affect the performance of the ledge. Ultimately, this research will be used to develop a practical design procedure for L-shaped beam ledges to be included in the PCI Design Handbook used throughout the world. ■

NEW RESEARCH

In the first part of 2015, the CCEE faculty received more than **\$5.1 million** of research support from state, federal and international sources to support **33 new projects**. This support will enable **29 CCEE faculty members**, their teams of graduate, undergraduate and postdoctoral researchers and their collaborators to address a diverse range of problems in the construction, structures, mechanics, geotechnical, transportation and environmental areas.

Dr. **ALEX ALBERT** was awarded funding from the **NC Department of Transportation (NCDOT)** to identify and propose appropriate supplementary fall protection devices for bridge railings. Drs. **MURTHY GUDDATI** and **SHAMIM RAHMAN** will develop an inexpensive and easy-to-use nondestructive testing method to assess bridge condition and enable foundation reuse, also with funding from NCDOT. In a project sponsored by the **Alaska Department of Transportation (AKDOT)**, Drs. **MERVYN KOWALSKY**, **JAMES NAU**, and **CHAD GOODNIGHT** will predict damage levels in bridges subjected to earthquake motions. Also with AKDOT support, Drs. Kowalsky, Nau and **RUDI SERACINO** will challenge conventional wisdom regarding the damage level that bridges can sustain and still be repaired.

Dr. **MOHAMMAD POUR-GHAZ** received funding from the **American Society for Nondestructive Testing** to develop sensing-skin technology for rapid detection of cracking in reinforced concrete structures. In a NCDOT-funded project, Drs. Pour-Ghaz and **GREG LUCIER** will develop methods to minimize cracking of concrete overlays. Dr. **ABHINAV GUPTA**,

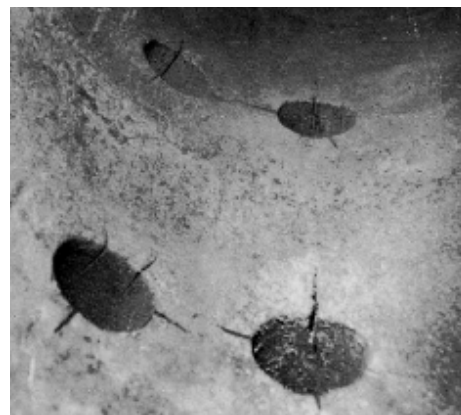
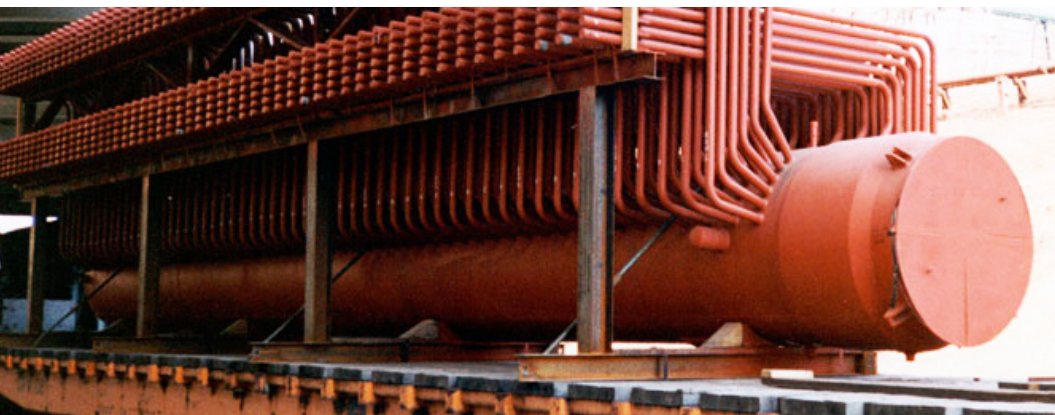
director of NC State's **Center for Nuclear Energy Facilities and Structures**, is leading new research on evaluating hazards that compromise plant safety.

In a project sponsored by **The Babcock and Wilcox Company**, Dr. **TASNIM HASSAN** will develop an advanced material model for steel used in high temperature applications to simulate damage accumulation and failure.

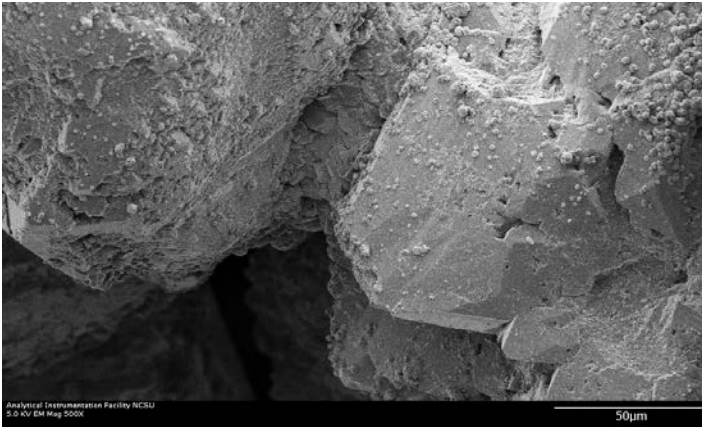
Drs. **BRINA MONTOYA** and **CASSIE CASTORENA** will work on NCDOT-funded research to improve the specification for aggregate base course used to support highway pavements. With funding from the **National Science Foundation (NSF)**, Dr. Montoya will be working with **Dr. Matt Evans** at **Oregon State University** to predict the behavior of soils strengthened by microbes. Dr. Montoya was also awarded a project from the **Electric Power Research Institute** to study the effect of cementation induced by microbes on the behavior of ponded coal ash. With NSF support, Drs. Castorena, **JIM LEVIS**, and **WAYNE YUAN** (Biological and Agricultural Engineering) will develop bio-renewable paving binders.

Several new NCDOT-sponsored projects address transportation issues. Dr. **NAGUI ROUPHAIL** is leading a project to improve traffic bottleneck analysis. Dr. **WILLIAM RASDORF** is evaluating the impact of freeway and ramp service signage on driver attention and performance. Drs. **BILLY WILLIAMS** and Roupail will develop a tool to quantify the operational impacts of arterial work zones and to assess the benefits of mitigation strategies and signal retiming.

The **U.S. Department of Transportation (USDOT)**, via the **National Transportation Center at the University of Maryland**, is funding several new projects.



Dr. Tasnim Hassan will conduct research on cracking that can occur with superheater boiler headers (Courtesy: Babcock & Wilcox).



Dr. Brina Montoya will research microbially induced calcite cementation binding two sand grains together.

Drs. **H. CHRISTOPHER FREY** and **NAGUI ROUPHAIL** will develop a new computationally efficient energy and emissions estimation model for heavy duty trucks to be incorporated into a large scale traffic simulation model. Drs. Roupail and **BILLY WILLIAMS** will identify potentially hazardous locations for traffic by using measured vehicle data and model predictions. Drs. **GEORGE LIST** and Roupail will continue research aimed at improving the reliability of freight transportation.

Drs. **NAGUI ROUPHAIL** and **H. CHRISTOPHER FREY** are part of a large multi-institutional team led by the **University of Maryland** and sponsored by the **U.S. Department of Energy's "ARPA-e" program** to develop a simulation model of energy used by each person traveling by passenger car, transit bus and train in the Baltimore, MD and Washington, DC metro areas, and a "control architecture" to guide personal choices regarding transportation use in the region.

Drs. **MORTON BARLAZ** and **JAMES LEVIS** received support from **Procter & Gamble Co.** to review the environmental emissions from waste disposed in uncontrolled dumps typically found in developing countries. The **Environmental Research and Education Foundation** is sponsoring Drs. Barlaz and **JOEL DUCOSTE** to better understand the phenomena of elevated temperatures within municipal solid waste landfills.

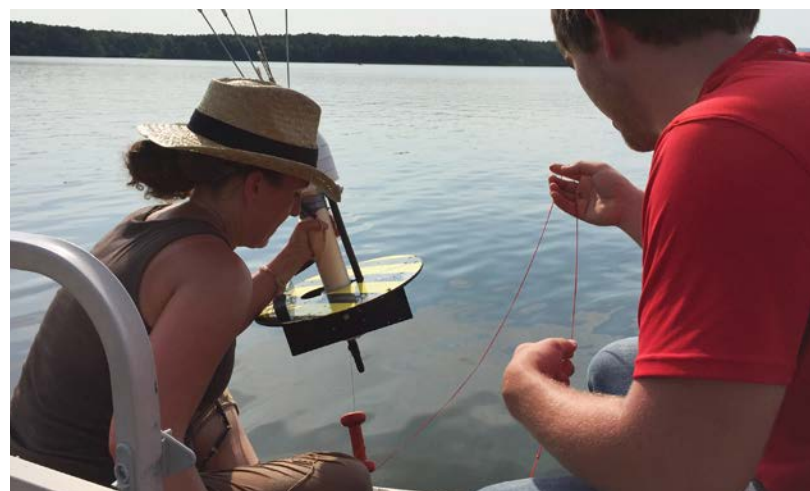
Dr. **EMILY BERGLUND** received funding from NC State's **Laboratory for Analytic Science** to explore the security of water distribution systems, which are susceptible to both terrorist actions and natural hazards. As part of a new **Department of Homeland Security Coastal Resilience Center of Excellence**, Dr. **CASEY DIETRICH** is working with collaborators from the **University of Texas at Austin** to improve the speed of models for storm-related coastal flooding.

Dr. **DETLEF KNAPPE** received funding from **Hazen and Sawyer**, via the **Water Research Foundation**, to study the use of granular activated carbon in drinking water treatment systems to control disinfection byproducts.

In a project funded by the **University of North Carolina Research Opportunities Initiative**, Drs. **DOUG CALL** and **JOE DECAROLIS**, along with collaborators from **UNC-Chapel Hill** and **East Carolina University**, will develop and assess the potential of energy extraction from the natural salinity gradients present along the North Carolina coast.

NCDOT is funding Dr. **H. CHRISTOPHER FREY** and his team to measure the effect of alternative fuels, engines, emission controls and operator behavior on the energy use and emissions of diesel passenger rail locomotives. NC State's **Center for Human Health and the Environment** is sponsoring Drs. Frey and **ANDY GRIESHOP**, along with collaborators Drs. **Jonathan Casper** and **Kyle Bunds** from the **Department of Parks, Recreation and Tourism Management**, to measure cyclist exposure to air pollution from vehicles. Drs. Frey, Bunds and Casper also received university funding to measure personal exposure to air pollution before Wolfpack football games (during 'tailgating'). Dr. Grieshop received funding from the **Global Alliance for Clean Cookstoves** to conduct field measurements of emissions from traditional and improved stoves being used in Malawi.

Drs. **DAN OBENOUR**, **TAREK AZIZ**, and **Robyn Smyth** from **Bard College** will conduct a field study to determine whether mechanical circulators deployed in Jordan Lake are affecting algal blooms under a new NSF-funded project. ■



NC State undergraduate researcher Jeremy Smithheart works with physical limnologist Dr. Robyn Smyth from Bard College to measure vertical diffusivity profiles in upper Jordan Lake.



Gina McCarthy, administrator of the U.S. Environmental Protection Agency, delivers the keynote address.

CCEE environmental research helps connect the dots

From June 22-25, more than 1,700 environmental problem solvers from around the world called the LEED-certified Raleigh Convention Center home while attending the **108th Annual Conference and Exhibition of the Air and Waste Management Association**. The theme of this year's gathering, held for the first time in North Carolina, was 'Connecting the Dots: Environmental Quality to Climate.' From the exhibit hall to poster sessions, technical presentations and technical tours, CCEE faculty, staff, students and alumni were prominent contributors. Furthermore, CCEE students were lauded with awards. Here's a sample.

SOLID WASTE MANAGEMENT

Ongoing research at CCEE includes development and use of the Solid Waste Optimization Life-cycle Framework (SWOLF) (go.ncsu.edu/swolf), which is a life-cycle optimization tool capable of developing and assessing SWM strategies that meet environmental and economic objectives. Ph.D. student **Megan Jaunich** presented a paper, co-authored by Drs. **James Levis**, **Morton Barlaz** and **Joseph DeCarolis**, on the municipal solid waste collection model used in SWOLF. The model was developed and applied to compare fuel use and greenhouse gas emissions for refuse collection trucks powered by diesel and compressed natural gas (CNG).

Jaunich also presented a paper on "A Multi-Stage Life-Cycle Optimization Framework for Sustainable Waste Management

Planning," co-authored by Drs. Levis, DeCarolis, **Ranji Ranjithan** and Barlaz. This application of SWOLF illustrates how greenhouse gas emissions can be reduced and material recovery (recycling) increased for a suburban U.S. city over the next 30 years. Also in the solid waste area, Ph.D. student **Joseph Weaver** presented a study, co-authored with Dr. Barlaz, to develop a test method to verify biodegradability for plastic products.

AIR QUALITY

Dr. **H. Christopher Frey**, his group and collaborators presented nine papers. Dr. Frey presented on lessons learned from more than 15 years of field measurements of the activity, energy use and emissions of a wide variety of onroad and nonroad vehicles. Ph.D. student **Maryam Delavarrafiee** presented a comparison of the energy use and emissions of



From left to right, Dr. Gurdas Sandhu (Ph.D., 2015), Disha Gadre (MENE, 2015), Tanzila Khan, Dr. Chris Frey, Maryam Delavarrafiee, Xiaohui Zheng, and Dr. Wan Jiao (Ph.D., 2013).

hybrid electric and conventional gasoline vehicles. Master's student **Xiaohui Zheng** presented a characterization of the operating modes of a plug-in hybrid electric vehicle (PHEV) to assess interactions between vehicle activity, energy use and emissions. Ph.D. student **Tanzila Khan** reported on a first-of-a-kind study to assess the accuracy of EPA car and light truck fuel economy ratings and emissions certification compared to real-world driving. All of these papers were based on data obtained using Portable Emission Measurement Systems (PEMS).

Several papers focused on diesel vehicles. Recent graduate **Gurdas Sandhu** (Ph.D. CE, 2015) reported on a field study that quantified the real world activity, fuel use and emissions of several types of refuse collection trucks using PEMS. Three papers were presented related to real-world emissions from railroad diesel locomotives. These included a paper led by Dr. Frey regarding the effect of biofuels on locomotive emissions, a paper led by Ph.D. student **Jiangchuan Hu** on the distribution of nitrogen oxides and hydrocarbons and a paper led by Ph.D. student **Brandon Graver** (MS ENE, 2010) regarding how differences in engineer behavior affect emissions.

Dr. Frey was co-author of a presentation with colleagues from the **Hong Kong University of Science and Technology** on the assessment of the exposure of children to ozone and particulate matter air pollution.

Several posters and papers were presented from the research group led by Dr. **Andy Grieshop**. Ph.D. student **Roshan Wathore** presented a poster regarding cookstove emission fieldwork planned for two rural villages in India. Graduate student **Ryan Repoff**, who took top honors in the student platform competition, developed ways to evaluate how closely laboratory



James East (center) presents his poster to Dr. Ashok Kumar (left) of the University of Toledo and Dr. Pam Heckel (right).

tests can replicate real-world cookstove operation, based on experiments conducted locally and comparison to prior data collected in India. Graduate student **Stephen Reece** is exploring the development and use of a small field deployable oxidation reactor to simulate the production of atmospheric particles from organic gases that are emitted from cookstoves. Ph.D. student **Provat Saha** earned a first place tie in the graduate level poster sessions for his study to improve the understanding of the transport and transformation of multiple air pollutants downwind of a highway.

OTHER TOPICS

Ph.D. student **Ling Wang** presented on how to better manage grease interceptor waste (GIW) from restaurants. GIW is a wastewater challenge because of the high content of fat, oil and grease (FOG) along with food particles and wastewater. Wang's work, co-authored with Drs. **Francis de los Reyes**, **Tarek Aziz**, and **Joel Ducoste** explores ways to co-digest GIW with sewage sludge.

Undergraduate student **James East** presented a poster, co-authored with Dr. **Emily Berglund**, in which a modeling framework was applied to the Falls Lake system near Raleigh to examine the potential effects of drought and population growth on water supply. Undergraduate student **Jacob Monroe** presented a poster, co-authored with Drs. Berglund and Ducoste, in which he applied a heuristic optimization approach to develop mathematical models for predicting the performance of UV disinfection reactors. East was awarded 1st place in the undergraduate poster competition and Monroe was awarded 2nd place.

The AWMA meeting was a great opportunity for CCEE students to share their research with a global audience and to gain valuable experience in developing and delivering presentations under the mentorship of their faculty advisors. ■



CCEE Ph.D. student Provat Saha presents his poster



Rail yard tour highlights CCEE emissions research

Locomotive NC 1755

As part of the AWMA conference, several dozen attendees visited the **North Carolina Department of Transportation (NCDOT)** Capital Rail Yard. NCDOT owns locomotives and passenger cars operated by **Amtrak** and dispatched by **Norfolk Southern** for twice-daily roundtrip service between Raleigh, NC and Charlotte, NC. NCDOT is pioneering efforts to reduce locomotive emissions. Over the last eight years, NC State has conducted research to quantify the real-world emissions of train operations and to help NCDOT and the **Federal Railroad Administration** identify strategies for emissions reduction.

As part of the tour, Dr. **H. Christopher Frey** and Ph.D. student **Jiangchuan Hu** demonstrated how Portable Emission Measurement Systems are used to measure real-time emissions from the 3,000 horsepower “prime mover” engine of a locomotive. Frey and his team have measured the activity, energy use and emissions of all six locomotives in NCDOT’s fleet. This research has established new



Dr. Chris Frey presents a poster on biodiesel fuel and its impact on exhaust emissions of diesel locomotives.

NC State featured in exhibition hall

The place to meet and be seen during the 108th Annual Conference and Exhibition of the Air and Waste Management Association was the exhibition hall booth sponsored by NC State’s **Engineering Online program**, courtesy of EOL director Dr. **Linda Krute**. CCEE Graduate Services Coordinator **Renee Howard** answered questions regarding graduate programs

from conference attendees, including prospective students, parents of prospective students and alumni. A&WMA Student Chapter president and recent graduate **Disha Gadre** (MENE, 2015) was among the approximately dozen NC State students who continuously staffed the booth. ■

Department alumni prominent at AWMA

Several CCEE alumni were authors or co-authors of presentations, including **Terry Albrecht** (MCE, 1996), **Brandon Graver** (M.S. ENE, 2010), **Wan Jiao** (Ph.D., 2013), **Phil Lewis** (Ph.D., 2009), **Meagan McGrath** (B.S. ENE, 2012), and **Gurdas Sandhu** (Ph.D., 2015). Other CCEE alumni, such as **Karoline Johnson** (B.S. ENE, 2013), **Ozge Kaplan** (Ph.D., 2006) and **Kitty Hiortdahl** (B.S. ENE, 2012) participated in the meeting.

Dr. Jiao (Ph.D., 2013) was runner up for the Young Professional Best Paper Award in the air group for her work on low cost air quality sensors. **Meaghan McGrath** (B.S. ENE, 2012) was runner up for the Young Professional Best Paper Award in the sustainability group for her work on spatial analysis to determine priority landfill gas-to-energy projects. ■

measurement procedures, enabled comparison of how much emissions change if a person takes the train instead of driving their own car and enabled evaluation of the effects of engine rebuilds, the use of biodiesel fuel, and operator behavior on actual emissions under real-world operating conditions. Further work is planned in the coming year to measure the effectiveness of retrofitted emission controls to be installed on a locomotive. ■



Attendees view locomotive emissions data as explained by Ph.D. student Jiangchuan Hu (right).



Lynn Harris (red shirt) of McDowell Engineers leads a tour of NCDOT's rail yard and train equipment.



Demonstration of how locomotive engine emissions are measured in the rail yard. The same instruments can be installed onboard the train for over-the-rail measurements.



Hosts and attendees of the technical tour of the NCDOT Capital Rail Yard

FACULTY ANNOUNCEMENTS

New faculty member brings air quality focus



Dr. Fernando Garcia Menendez

Dr. **Fernando Garcia Menendez** recently accepted an offer to join NC State as an assistant professor in the CCEE Department. Dr. Menendez completed his Ph.D. in environmental engineering at the Georgia Institute of Technology, where his doctoral research focused on high-resolution methods for regional-scale photochemical air quality models and simulating the impact of wildland fires on air pollution. He is currently a postdoctoral associate with the **Center for Global Change Science** at the **Massachusetts Institute of Technology** (MIT). At MIT, Dr. Menendez is studying the impacts of climate change and climate policy on air quality. Specifically, his research investigates the propagation of uncertainty in climate projections to air pollution impact assessments. At NC State, he plans to use computational models to further explore the connections between air pollution, climate change, energy use and public health. Dr. Menendez received a B.S. in chemical engineering from the **Monterrey Institute of Technology and Higher Education** (ITESM) in Mexico and an M.S. in civil and environmental engineering from **Stanford University**. ■

Seracino chairs Committee on International Programs

The global economy includes global education. CCEE's Dr. **Rudolf "Rudi" Seracino**, professor and associate head for undergraduate programs, is taking over as chair of the **University Standing Committee on International Programs** (CIP) at NC State this fall. CIP has many roles, which include advising and consulting the **Office of International Affairs** (OIA) and the **Provost's Office** on matters relating to international programs, as well as reviewing and recommending policies, regulations and administrative measures related to international programs.

For Seracino, it's important that students see what's beyond their local community. For civil engineers, the study abroad experience creates context for their work: "It makes them better civil engineers," says Seracino. "It makes them appreciate the impact of our designs and decisions on societies. Different societies perceive things in different ways sometimes."

Seracino wants to facilitate opportunities for creating and fostering strategic partnerships by leveraging collaborations that already exist. Seracino also believes that faculty members need to be drivers of internationalization. "OIA's role is to initiate and create some of the opportunities, play a supporting role, but in



Dr. Rudi Seracino

the end these goals or objectives ... can't be achieved unless the faculty step up and do the work," says Seracino. CCEE faculty members are already involved in international collaborations with universities in China, Brazil, the United Kingdom, Portugal, Australia and elsewhere. ■

CCEE partners across NC State for three new Faculty Excellence Clusters

In the fall of 2011, Chancellor Randy Woodson announced an innovative faculty-hiring program to be known as the Chancellor's Faculty Excellence program. This program is bringing some of the best and brightest minds to join NC State University's interdisciplinary efforts to solve some of the globe's most significant problems. Proposals for new clusters were developed by faculty members working across colleges and departments. The ground rules were that the clusters must consist of interdisciplinary teams and position NC State for high impact research. CCEE is involved in three recently announced clusters. These clusters will enable NC State to leap to the forefront nationally and internationally in addressing critical energy, environmental and public health issues. Furthermore, these clusters will leverage existing faculty expertise in CCEE to more comprehensively address critical societal needs, while providing opportunity for development of new courses and research experiences for students.

The **Sustainable Energy Systems and Policy** cluster is led by Dr. **Joe DeCarolis** of CCEE and Dr. **Laura Taylor** of **Agricultural and Resource**

Economics. This cluster will develop an interdisciplinary research team capable of addressing societal challenges related to energy sustainability. The vision of the cluster is to transform NC State into a preeminent and high visibility hub for transdisciplinary research that informs key energy decisions at the state, federal and international levels. It will catalyze the development of a coordinated campus-wide energy effort that leverages existing expertise to develop research, education and outreach programs that link technical research with policy, economics and environmental impact assessment to deliver actionable energy solutions. The cluster involves collaboration among Agricultural and Resource Economics, Public Administration, Electrical and Computer Engineering, and Civil, Construction, and Environmental

Engineering. In addition to Dr. DeCarolis, CCEE faculty members including Drs. **Ranji Ranjithan** and **Chris Frey** are involved.

The **Global WaSH (Water, Sanitation, and Hygiene)** cluster is led by Dr. **Francis de los Reyes** of CCEE. This cluster aims to position NC State as the leading university in the U.S. conducting critical research and teaching in vital and complex global water and sanitation issues. It will address the scientific, social and policy issues associated with providing sustainable water and sanitation in underserved populations in the developing world; its research and teaching will be inspired and anchored on international community-based projects.

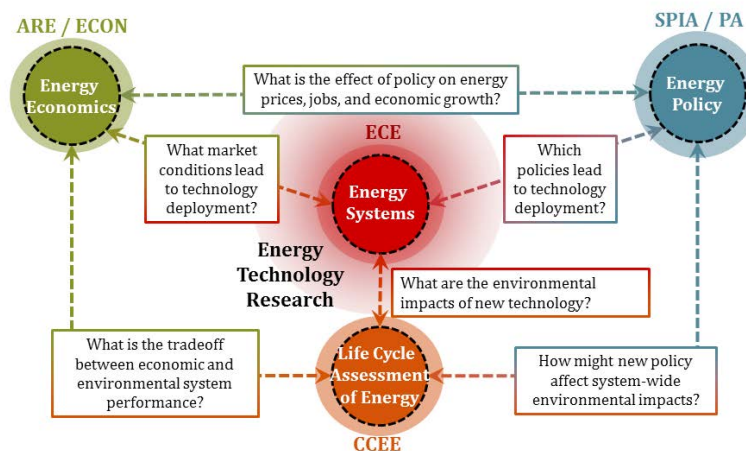
Cluster faculty expertise will include environmental science and technology, public health, social science and socioecology, entrepreneurship and development economics and public policy. The Colleges involved are: Engineering (CCEE and Biological and Agricultural Engineering), Agriculture and Life Sciences (Agricultural and Resource Economics, Soil Science), Natural Resources (Forestry and Environmental Resources), Humanities and Social Sciences (Sociology and

Anthropology), Design (Architecture and Industrial Design) and Science (Statistics).

Several CCEE faculty members are involved in a third cluster on **Microbiomes and Complex Microbial Communities (MC)2** that is led by Dr. **Michael Hyman**, Plant and Microbial Biology, and Dr. **Chase Beisel**, Chemical and Biomolecular Engineering. The participating CCEE faculty members include Drs. **Douglas Call**, **Francis de los Reyes** and **Detlef Knappe**. The goal of this cluster is to establish an internationally recognized center of excellence in the analysis and engineering of plant, animal and insect microbiomes and of complex microbial communities in soil and water environments.

Faculty searches will be initiated during the fall semester. ■

Sustainable Energy Technology and Policy



Concept of the Sustainable Energy Systems and Policy Cluster



EXHIBIT HIGHLIGHTS HATTERAS MOVE

Department played prominent role in Move of the Millennium



The Cape Hatteras Lighthouse, the tallest brick lighthouse in the country, has long been considered a national treasure.

Originally 1,500 feet from the breaking waves, the ocean advanced to within a mere 120 feet over the course of more than a century. Construction of this impressive structure on a rugged barrier island, just after the Civil War, is an engineering feat. But it is the 1999 moving of the lighthouse to evade the encroaching sea that provides an inspiring civil engineering case-study complete with controversy, engineering, science and history.

NC State, including the CCEE department, was intimately involved in the "Move of the Millennium." In the summer of 1999, anxious crowds, alongside television and newspaper reporters, watched apprehensively over the 23 days it took to safely edge the lighthouse, freed from its foundation, along a steel runway 2,900 feet to its new home. The nearly 200-foot-tall lighthouse is one of the 10 heaviest buildings ever moved, weighing almost 5,000 tons. It has no internal structural supports and had been battered by 129 years of hurricanes and beach erosion. Many citizens opposed the move, convinced that it would end in catastrophic loss of the lighthouse.

A museum display created for the lobby of Mann Hall contains artifacts and photographs to introduce visitors and students to this fascinating success story that encompasses so many disciplines including structural, geotechnical, construction, environmental and coastal engineering.

"Engineering Excellence: Saving Cape Hatteras Lighthouse from the Sea" was dedicated on April 27, 2015 with an enthusiastic gathering of many key players from the 1999 move, as well as the designers and creators of the new display.

Dr. **Paul Zia**, Distinguished University Professor Emeritus of Civil Engineering and Alumni Distinguished Graduate Professor Emeritus, along with Dr. **Ellis B. Cowling**, Distinguished Professor At-Large Emeritus of Forestry and Plant Pathology, served on an interdisciplinary team from the **National**



Mike Booher's photos documented the lighthouse's 2,900-foot journey.

Academy of Sciences (NAS) called upon in 1986 to advise the **National Park Service** (NPS). In a 1988 report, the committee, which included engineers, scientists, historians and construction experts, recommended relocation after carefully studying a myriad of options. However, nearly a decade passed with no action.

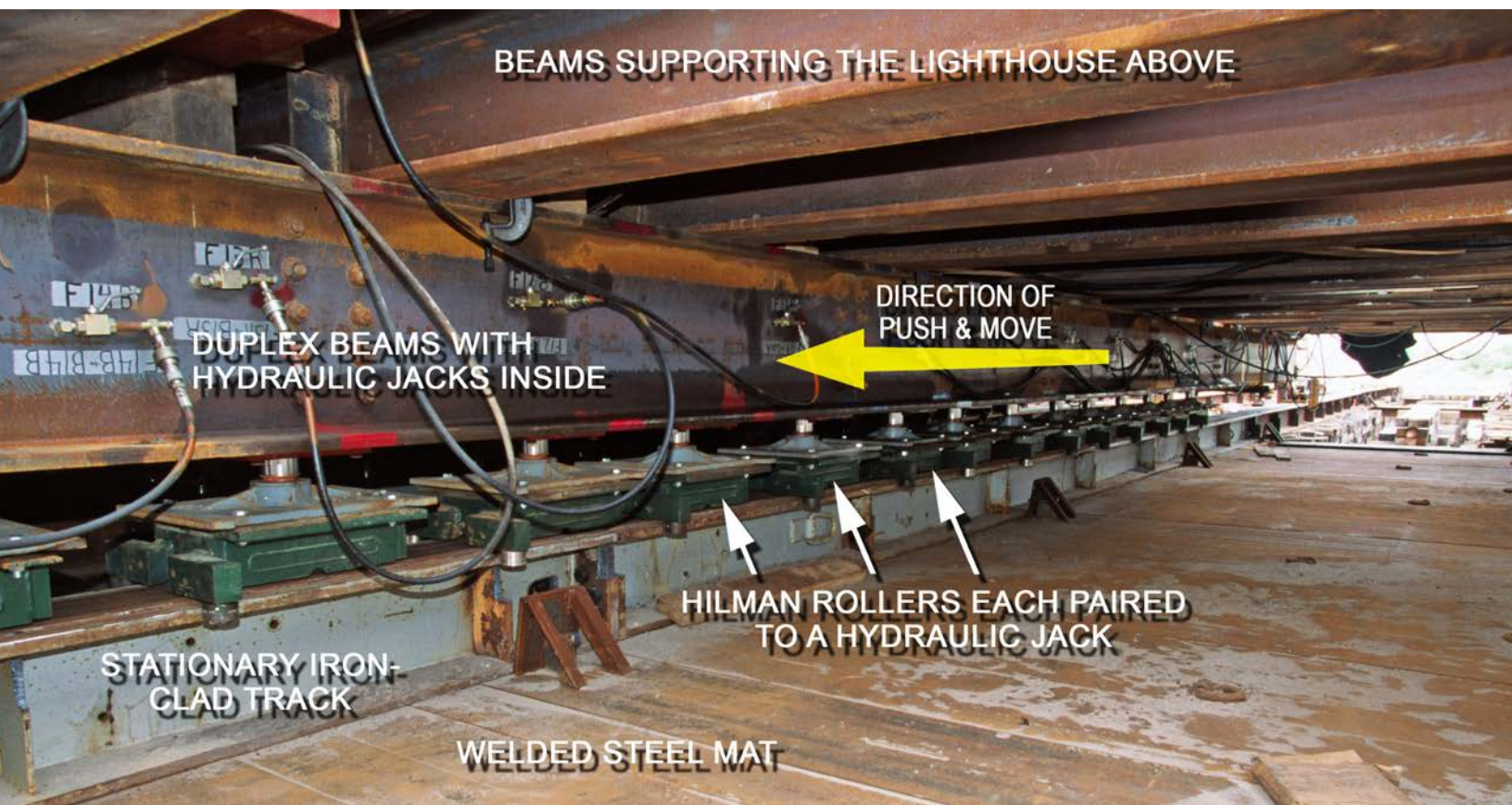
In 1996, NC State issued its own report, co-authored by Zia, that endorsed the original NAS findings. When funding was finally secured in 1998, Dr. Zia was again called upon, this time to evaluate contractors' bids.

In 1999, Zia and Cowling received the NPS Citizen's Award for Exceptional Service for their role as advisors and consultants. Zia smiles when he relays that part of his award included a hard hat, and part of Cowling's award included a piece of one of the original yellow pine timbers that was part of the foundation. Upon retirement in 2013, Cowling began looking for a home for the piece of timber he had proudly displayed in

his campus office. It was this artifact that spurred the idea for the current exhibit.

Department Head Dr. **Morton Barlaz** and Zia worked closely with **John Havel** to write and design the exhibit. Presently a graphic designer with the **U.S. Environmental Protection Agency**, Havel spent 10 years designing exhibits with the **NC Museum of History** and is authoring a book about North Carolina lighthouses. **Mike Booher**, the official photographer during the 1999 move, graciously provided numerous photographs. **Jake Rhoads**, CCEE facilities maintenance technician, assisted with the construction of the design cases and the mounting of large artifacts such as the Hilman roller. During the final phase of the move, 100 Hilman rollers, fitted with guides and each paired to a hydraulic jack, were used to move the lighthouse along steel beams.

We invite our readers to visit and view this great new addition to Mann Hall. ■





Allison Hunt Ester, granddaughter of the late Walter Skellie Hunt, III, peruses the exhibit. A Raleigh native and NC State graduate, Hunt was employed by International Chimney Corporation as the site manager during the move of the lighthouse. Seen in the display case here is the segment of yellow pine timber presented to Dr. Cowling.



Mike Booher, official photographer during the 1999 move of the Lighthouse, photographs the new exhibit in Mann Hall.



Left to right – Mike Booher, official photographer during the 1999 move of the Lighthouse, Dr. Paul Zia, and John Havel, exhibit designer. Seen in the exhibit case here is one of the hundreds of Hilman rollers used to move the Lighthouse.

Just after the end of the Civil War, the Lighthouse Board hired Dexter Stetson to construct the third Cape Hatteras Lighthouse. Conditions were difficult and his crew labored long hours under the southern sun, battling mosquitoes on what was at the time a very remote, sparsely populated island. It was impossible to drive pilings into the compacted sand as the structural drawings called for. Instead, he dug a six-foot hole, pumped out the fresh water that filled it, then laid layers of yellow pine timbers, which he

knew would not rot as long as they stay submerged in the fresh water. Dr. Paul Zia says “The science did not even exist at this time for him to understand why the pine would not rot, but he knew it. The science would come later.”

When the National Park Service completed the move of the Cape Hatteras Lighthouse in 1999, the 131-year old timbers were indeed still in immaculate condition. Visitors can view a piece of the timbers in the exhibit in the Mann Hall lobby. ■

AWARDS

CCEE faculty members and students have received university, national and international awards and honors and other forms of recognition in recent months.



Dr. Morton Barlaz

Dr. **MORTON BARLAZ** was awarded the 2015 **Frederick George Pohland Medal** from the **Association of Environmental Engineering and Science Professors (AEESP)**.

This award recognizes an individual who has made sustained and outstanding efforts to

bridge environmental engineering research, education and practice. Dr. Barlaz has established an internationally recognized research program on biological and chemical processes in landfills and on the application of life-cycle assessment to the analysis of solid waste management systems. His research has been utilized by both regulatory agencies and industry.



Dr. Francis de los Reyes

Dr. **FRANCIS DE LOS REYES** received an **NC State Alumni Association Outstanding Extension Service Award**. Dr. de los Reyes was also conferred membership in the **Academy of Outstanding Faculty Engaged in Extension**. These honors are in recognition of his

internationally recognized research and service in the areas of global sanitation technology development and public awareness of the global sanitation crisis. Dr. de los Reyes was also awarded the **Water Environment Federation (WEF) Fair Distinguished Engineering Educator Medal**. Named for Dr. Gordon Fair, this medal recognizes accomplishments in the education and development of future engineers in the water environment profession. Dr. de los Reyes received the award on September 29 at the 2015 WEFTEC conference in Chicago, IL.

Dr. **ABHINAV GUPTA** has been appointed as a member of the Board for the **International Association of Structural Mechanics in Technology (IASMiRT)**. Gupta currently serves as secretary of the IASMiRT Board. Gupta will serve as the chair of the 25th SMiRT conference, which is scheduled for 2019 in Charlotte, NC.

Dr. **KERRY HAVNER**, professor emeritus, was inducted into the **College of Engineering, Architecture and Technology's (CEAT's) Hall of Fame at the Oklahoma State University**. Dr. Havner received the award in October at the annual Hall of Fame and Lohmann Medal Dinner in Stillwater, Oklahoma.

Dr. **MARC HOIT**, CCEE professor and vice chancellor for information technology, received a **2015 American Society of Civil Engineers (ASCE) President's Medal** for his leadership of ASCE's Continuing Education Blue Sky Task Committee, his significant contributions to ASCE publications and his commitment to advancing higher education and lifelong learning for civil engineers. Dr. Hoit received the award in October at the ASCE annual conference in New York City.



Dr. David Johnston

Dr. **DAVID JOHNSTON**, professor emeritus, was recognized for his authorship of the eighth edition of SP-4(14) Formwork for Concrete Manual of the American Concrete Institute. The manual received a **Most Innovative Products (MIP) Industry Choice Award** from the 2015

World of Concrete meeting and the Hanley Wood editorial staff. The MIP Award is presented annually during the World of Concrete meeting.

R&H HONORS



Dr. Richard Kim (center), Dr. Louis Martin-Vega (left), and Dr. John Gilligan (right).

models and test methods for the characterization of asphalt concrete and pavements, many of which are used by all state highway agencies and most contractors for the fatigue testing of asphalt concrete. He received the award on April 29 at the spring College of Engineering faculty meeting.



Dr. George List

globally for the best student paper in the area of finite element analysis. This award was inaugurated by **Duke University's Department of Civil and Environmental Engineering** in honor of Robert J. Melosh. Dr. Eslaminia's paper, "Amplitude-Preserving Propagators to Improve Efficiency of Full Waveform Inversion," was selected from numerous entrees submitted from around the world. His advisor was Dr. **MURTHY GUDDATI**.

Dr. **RICHARD KIM** received the **NC State College of Engineering Alcoa Foundation Distinguished Engineering Research Award** for 2015. This award is made to a senior faculty member for research achievements over a period of at least five years at NC State. Dr. Kim was recognized for his research in developing mechanistic

Dr. **GEORGE LIST** received a **Lifetime Membership** award from the **Institute of Transportation Engineers**.

STUDENTS AND RECENT GRADUATES

Dr. **MEHRAN ESLAMINIA**, a 2014 Ph.D. graduate, was selected as one of seven **Melosh Medal** finalists

Dr. **CHAD GOODNIGHT**, a fall 2014 Ph.D. graduate in structural engineering, received the **Nevada Medal for Distinguished Graduate Student Paper in Bridge Engineering** for his paper titled "Strain Limits for RC Circular Bridge Columns." The Nevada Medal, given by the **Civil and Environmental Engineering Department at the University of Nevada in Reno**, recognizes graduate student contributions to state-of-the-art bridge engineering. Dr. Goodnight was advised by Drs. **MERVYN KOWALSKY** and **JIM NAU**.



Amir Mazrooei

training session on decision making from the **United States Geological Survey** climate science center. Mazrooei's advisor is Dr. **SANKAR ARUMUGAM**.

AMIR MAZROOEI, a Ph.D. candidate in water resources management, received a **Global Change Graduate Fellowship** from the **Department of the Interior's Southeast Climate Science Center**.

The one year fellowship includes both stipend and tuition support in addition to a one week



Elizabeth Ramsey

ELIZABETH RAMSEY, an MS student in water resources, received a **Fulbright Fellowship** to spend a year in Jaipur, India to conduct surveys on water use and conservation and to engage in discussion with residents about water issues. She also received a Graduate Research

AWARDS & HONORS

Fellowship from the **National Science Foundation**, which she will use to build a computational model of the social dynamics surrounding the use and depletion of groundwater resources in Jaipur as part of her Ph.D. program. Dr. **EMILY BERGLUND** is her advisor.

STEVEN THORNTON, CCEE undergraduate, won the inaugural W. Calvin McCall Fellowship from the **American Concrete Institute (ACI) Foundation**. These fellowships are provided to high-potential students in engineering and construction management and aim to attract outstanding professionals to careers in the concrete field. Dr. **ROBERTO NUNEZ** is his advisor.

ANDY WAGNER, an M.S. student in transportation systems, received a 2015 **Dwight David Eisenhower Graduate Fellowship** from the **Federal Highway Administration's Universities and Grants Program**. This fellowship is awarded to students pursuing degrees in transportation-related disciplines, with the goal of attracting the brightest minds to the transportation workforce. His advisor is Dr. **BILLY WILLIAMS**.



From left to right: Dr. Seyed Alireza Abbasian Hosseini, Dr. David Johnston, Mohamad Shoaib Samander, and Cedrick Butler

received the **Charles Smallwood Environmental Engineering Fellowships**; **SHAMS TANVIR** received the **Ramey Kemp Transportation Engineering Graduate Fellowship**; **SEYED ALIREZA ABBASIAN HOSSEINI**, **CEDRICK BUTLER** and **MOHAMAD SHOAIB SAMANDER** received the first **David Johnston Graduate Fellowship Awards in Construction Engineering and Management**; **VICTORIA MARIE LOPEZ** and **MACHEL MORRISON** received **Freese and Nichols Graduate Fellowships**; and **CASEY SHANAHAN** received the **Sean McGrath Memorial Fellowship for Geotechnical**

Engineering. At the undergraduate level, **CARMELINA PAPPALARDO** received the **Mulkey Shelton Leadership Award**; **JOHN HOLMES**, **ALEXANDRE MANGOT**, **CARMELINA PAPPALARDO** and **SARA TROUTMAN** each received the **Freese and Nichols Undergraduate Award**. Holmes, Mangot,



Dr. Morton Barlaz (left), Victoria Lopez (right)

PappalarDO and Troutman were CCEE's nominees for the engineering senior awards in citizenship, humanities, leadership and scholarship, respectively. ■



Dr. Morton Barlaz (left), Dr. Eric Domonell (center), Dr. Michael Borden (right)

the **Bruce Edward Matthews Graduate Scholarship for Transportation Engineering**; **SEUNG BEOM SEO**, **JONATHAN MILLER**, **MICHELLE SCHMIDT** and **LING WANG**

The following graduate students received departmental awards and fellowships: At the graduate level **ERIC DOMONELL**, **DAVID OVERBY** and **YURIY VEYTSKIN** received the **C. C. Mangum Graduate Student Awards for Structural Engineering**; **ELIZABETH WILLIAMS** received

Department hosts “We are Women in Engineering” networking program

The “We are Women in Engineering” (We are WE) networking luncheon and seminar was held on March 5-6, 2015. Based on applications from women across the country, 17 students attended the event. They hailed from North Carolina, Alabama, California, Florida, Michigan, Mississippi, New York, Oregon, Pennsylvania and Wisconsin. An additional 27 undergraduate and graduate students in CCEE also participated.

The two-day event included a workshop on conducting research, a tour of the NC State campus and a seminar and open discussion. The keynote seminar was presented by Dr. **Susan Burns** of Georgia Tech. Dr. Burns spoke about her career in engineering and the challenges she faced in teaching and research. The seminar was followed by a panel discussion, with Dr. Burns and CCEE faculty Drs. **Brina Montoya** and **Margery Overton**. The panelists talked about balancing work and family in academics, obtaining faculty positions and finding good mentors.

On the second day, We are WE participants chose to attend either the Annual Water Resources and Environmental Engineering Spring Symposium or the First Research Symposium in Geotechnical Engineering. Students met



Local and visiting students and faculty participated in the We are WE Program.

individually with professors and current students throughout the day to discuss research and graduate school opportunities.

Three of the visiting women enrolled in graduate school at NC State in the fall 2015 semester. Funding to support travel costs was provided by **McKim & Creed, FDH, CCEE, the NC State Engineering Foundation** and the **National Science Foundation** via a grant to Dr. Montoya. Individuals and organizations interested in supporting the We are WE Program in the future should contact the NC State Engineering Foundation through **Lora Bremer** at lfbremer@ncsu.edu. ■

Students organize 16th Symposium in Structural Engineering and Mechanics



Dr. Michael Borden delivered a lecture at the Structural Engineering and Mechanics symposium

The Structural Engineering and Mechanics (SEM) group held its 16th Student Symposium on Friday, March 20th at Monteith Research Center on Centennial Campus. The symposium featured presentations by nine doctoral and four master's students. Professor **Michael Borden** delivered a lecture on computational models for material failure.

Student presentations covered areas such as nondestructive testing,

nanomechanics, material characterization, earthquake safety of bridges and buildings, base isolation, assessment, retrofit and FRP strengthening of concrete and steel members and flooding risk at nuclear power plants.

The symposium organizing committee was comprised of graduate students and was co-chaired by **Omar Khalafallah** and **Emrah Tasdemir**. The symposium was sponsored by **FDH Inc.** and **Tindall Corporation**. Dr. **Abhinav Gupta** served as the faculty advisor. Presentations were judged by Drs. **Jim Nau, Tasnim Hassan, Chad Goodnight** (Ph.D. 2015) and **Easa Khan** (Ph.D. 2015). The winner of the best presentation award was **Harleen Sandhu** for her work on flood defense structures at nuclear power plants.

The 17th SEM Symposium will be held in Nov. 2015. Individuals and organizations interested in sponsoring the event should contact **Lora Bremer** at lfbremer@ncsu.edu. ■

STUDENT NEWS

Air & Waste Management Association

The student chapter of the Air & Waste Management Association had an especially busy 2014-2015 year because the international A&WMA held its annual meeting in Raleigh. Members of the student chapter were active in preparing for and participating in the annual meeting. They hosted an NC State booth at the exhibition hall, participated in the student poster competition and the main technical program and hosted a technical tour at the North Carolina Department of Transportation rail yard. Several students won best poster and best paper awards. More details about the annual meeting are on page 6.

American Concrete Institute

In April of 2015, eight students from the Student Chapter of the American Concrete Institute (ACI) attended the Spring Convention in Kansas City, Missouri, where they participated in the Fiber-Reinforced Polymer (FRP) Composite Beam student competition and attended committee meetings, seminars and social events. The chapter plans to have a team participate in the student competition at the ACI Convention in Denver, Colorado in the fall.

American Society of Civil Engineers

The American Society of Civil Engineers Student Chapter welcomed many professionals to monthly meetings throughout Spring 2015, and hosted panels on land development, structural engineering, subcontracting and other topics. The student chapter made a number of site visits including the new NC State indoor football practice facility. ASCE also took part in Service Raleigh, helping to improve facilities at the local Boys & Girls Club.

In April, ASCE competed in the regional student chapter conference, which was hosted by Georgia Tech in Atlanta. The Steel Bridge team placed third overall in its competition. The team's final product is now on display on the front porch of Mann Hall. The students also constructed a concrete canoe, "Claws," that was entered into competition. **McKim & Creed, Kimley-Horn** and **Fastenal** provided support.



The 2015 Concrete Canoe "Claws" hits the water at the ASCE Carolinas conference.

Association of General Contractors and National Association of Home Builders

The Association of General Contractors (AGC) and National Association of Home Builders (NAHB) chapters hosted speakers from **Holder Construction, T.A. Loving** and **Leidos Construction**. Representatives from **Carolinas AGC, C.T. Wilson, Duffey Southeast, The Milestone Group, S.T. Wooten** and **State Utilities Contractors** participated in student chapter events. Students attended a site tour with **Holder Construction** to view an 18-story high rise in North Hills. **T.A. Loving** also gave a site tour of the NC State indoor football practice facility. Students assisted in building a bike trail at Lake Crabtree for Service Raleigh. AGC/NAHB capped off the semester with the 3rd annual kickball tournament, with participation from students and employees from **Balfour Beatty, Lend Lease** and **Lithko**.



Members of the ASCE Steel bridge team load testing their bridge.

Chi Epsilon

Chi Epsilon is the civil engineering honor society and students majoring in civil, construction, or environmental engineering are eligible for membership. In April 2015, the NC State Chapter of Chi Epsilon initiated 13 new members at the spring awards banquet ceremony.

Earthquake Engineering Research Institute

During the 2015 spring semester, two seminars were hosted by the Earthquake Engineering Research Institute (EERI) student chapter. Dr. **Chad Goodnight** (Ph.D. 2014), presented the results of his doctoral dissertation regarding reinforced concrete bridge columns. As part of the Friedman Family Visiting Professional program, the chapter was selected to host Dr. **Nathan Gould**, who is the director and chief of technology for ABS Consulting



Dr. Nathan Gould (left) visiting the Constructed Facilities Laboratory during his trip to NC State. M.S. student David Overby explains his research on high strength steel for seismic applications.

Advanced Engineering Division in St. Louis, MO. Dr. Gould spoke on performance-based seismic retrofitting. Five graduate students made presentations on their research at the 2015 EERI Annual Meeting. The chapter plans to participate in the 2016 Undergraduate Seismic Design Competition at the next annual meeting.

Engineers Without Borders

The NC State student chapter of Engineers Without Borders USA (EWB-NCSU) sent a team to its Water Supply (BWS) project site in Bolivia this past summer. The team assessed the current water needs of a school via community interviews, performed maintenance on existing water systems and surveyed locations for future projects. With increased water supply, the school has been able to increase crop yield and the number of students it is able to support. The BWS team is now planning for the installation of a new rainwater catchment system. The Sierra Leone Renewable Energy team is working with the Dele Village Learning Center to implement a solar photovoltaic system as a reliable source of electricity for expanding their computer lab to hold night classes for women. The Sierra Leone Water team, led by **John Merrill** (ENE), plans to drill a well to provide a clean and sustainable water supply for the community. However, travel to the area has been delayed as a result of the Ebola outbreak. Locally, the chapter is hosting the 2015 Southeast Regional Conference in early October at NC State's Centennial Campus.

Geo-Institute Graduate Student Organization

For the first time, the Geo-Institute Graduate Student Organization (GI GSO) held a Geotechnical Engineering research symposium on March 6th and hosted geotech faculty, graduate students, local companies and We are Women in Engineering (WE) participants. Dr. **Susan Burns** from Georgia Tech was the symposium keynote speaker. Graduate students gave oral and poster presentations on their research. GI-GSO also hosted a seminar by Dr. **Muhannad T. Suleiman** from Lehigh University. In the late spring, GI-GSO students presented their latest research at the 8th Geo3T2 conference hosted by the North Carolina Department of Transportation.

Institute for Transportation Engineers, American Society of Highway Engineers, and American Railway Engineering and Maintenance-of-Way Association

The NC State joint student chapter of the Institute for Transportation Engineers, American Society of Highway Engineers and American Railway Engineering and Maintenance-of-Way Association (ITE/ASHE/AREWA) traveled to the Transportation Research Board (TRB) Annual Meeting in January. Thirty-two students attended the meeting and many gave research presentations. In February, the chapter helped welcome U.S. Secretary of Transportation Anthony Foxx to Centennial Campus, where he spoke on the nation's growing transportation infrastructure needs. The student chapter held monthly meetings and hosted professionals who spoke on topics including public-private partnerships and the North Carolina Railroad. In March, the chapter held its regular Adopt-a-Highway cleanup and conducted a pedestrian study along Avent Ferry Road for the University Graduate Student Association. Social events included a bowling outing with North Carolina ITE professionals and an end-of-semester visit to Adventure Landing.

Professional Engineers of North Carolina

During the spring 2015 semester, the student chapter of the Professional Engineers of North Carolina (PENC) hosted a Habitat for Humanity service day, several social events with PENC Central Carolina Chapter (CCC) professionals, Boy Scout Engineering Day and monthly meetings with local engineering firms. The chapter has regular monthly lunch meetings planned for fall during which members will have the opportunity to connect with local engineers. Also planned is a site visit to Reynolds Coliseum, which is under renovation. PENC also conducts an on-going mentorship program to connect students with practicing engineers. ■



Summer practicum hosts Venezuelan college students

CE practicum 2015 group in front of the Belltower.

The CCEE department hosted 20 civil engineering students from Venezuela for a summer practicum in July. The students are seniors at Universidad Católica Andres Bello (UCAB) in Caracas, the UCAB campus in Guyana or Universidad Metropolitana in Caracas.

The practicum included three weeks of classroom, laboratory and site visit activities led by CCEE faculty members and graduate students. Students were exposed to a number of areas of civil engineering including lectures and labs related to concrete design, bridge design, earthquake engineering, project management, lean construction, traffic management, asphalt materials and environmental systems analysis. The exercises included competitions to design an earth foundation, a steel bridge, concrete beam and a filter to treat pond water. Another competition was a “scavenger hunt” to locate and identify the most examples of damaged pavement on the NC State campus and in nearby neighborhoods. In addition, the students traveled to Washington, D.C. and New York City.

Jose Aleman, a participant, describes the practicum as “a

wonderful experience that helped us grow as engineers.” Since 2001, approximately 340 students from Venezuela, in addition to others from Ecuador, Guatemala, and Puerto Rico, have attended 12 practicums. Practicum alumni include engineers practicing in the U.S., Europe and Central and South America. Many students have returned to the U.S. for a M.S. or Ph.D. in civil engineering, including several who have returned to NC State, including **Luis Mata** MSCE, 2005; Ph.D., 2008, currently a professor at Lawrence Technical University in Michigan.

The idea for the CE practicum was conceived by UCAB Dean of Engineering **Jose Ochoa Iturbe** and NC State professor Dr. **Downey Brill**. UCAB Professor **Jose Gerardo Castillo** organizes the incoming students, and Dr. **John Stone** manages the on-campus program at NC State. According to Castillo, the practicum “has been over the years one of the most rewarding experiences we had, not only for the students, but also for the professors that have been part of it.” He goes on to state that the “CE practicum has been a life-experience for students and we hope it will continue for years.” ■

Civil engineering summer high school camp

High school students from North Carolina and the Southeast visited the CCEE department this July to attend a civil engineering summer camp for a week. Each day, the students participated in morning and afternoon activities organized by Lecturer **Steven S. Welton**. Faculty members from across the department made presentations to describe the multitude of diverse opportunities encompassed within civil, construction, and environmental

engineering. CCEE graduate students **Greg Adams** and **Andrew Rice** served as camp counselors while undergraduate **Daniel Coble** served as the resident counselor. Among other activities, the students worked in groups to design and construct a wooden bridge with a 5-foot span. On the last day of camp, the students tested their structures, which carried nearly 100 lbs. ■

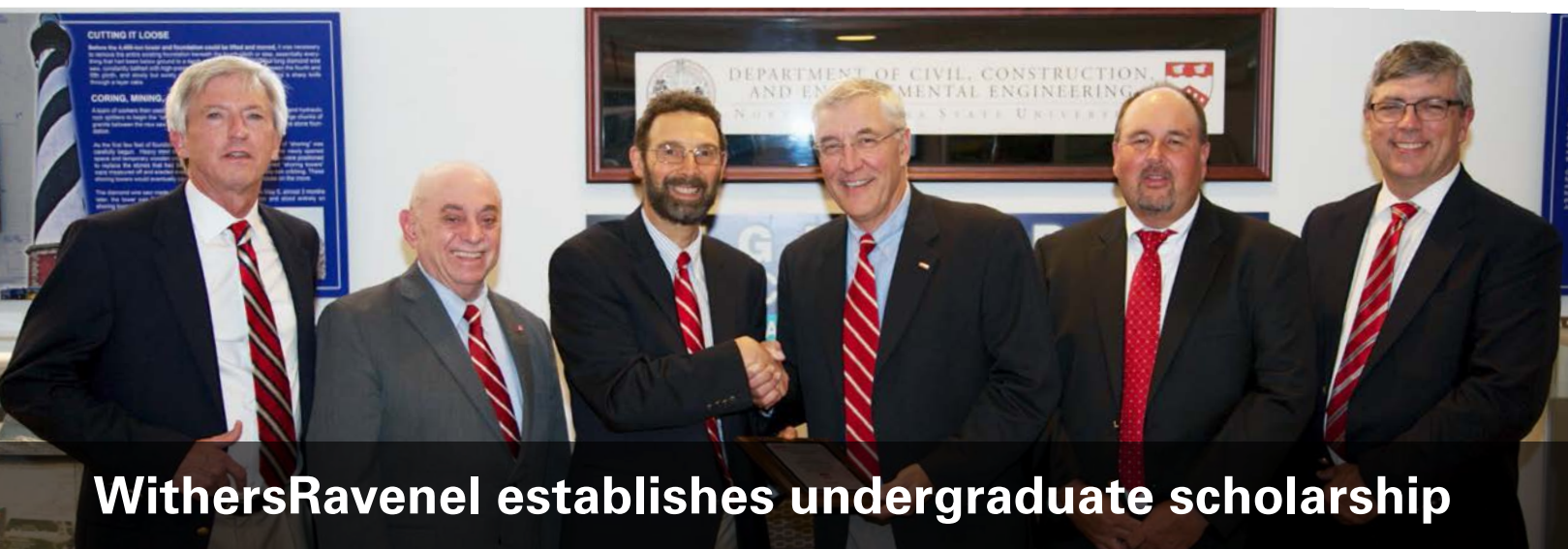
Spring 2015 Graduation

The Department's 119th class of graduates was recognized at this spring's graduation ceremony with family and friends coming from as far away as India to celebrate our students' accomplishments. The CCEE department awarded 170 B.S. degrees, 78 M.S. degrees and 25 doctoral degrees for the 2014-15 academic year. Three students achieved a perfect 4.0 grade point average and were recognized as class valedictorians - **Mitchell S. Otis**, **Miranda L. Beshears** and **Sara C. Troutman**. Otis is from Indian Trail, NC and will be working for Caterpillar Inc.; Beshears is from Boone, NC and will be working for W.K. Dickson; and Troutman is from Aberdeen, NC and will attend the University of Michigan to pursue a Ph.D. in environmental engineering. Otis delivered the valedictory and Chi Epsilon address. He reminisced about Mann Hall and thanked the faculty members who encouraged him to take the most challenging courses. Mr. **David Simpson** (BSCE 1981), president and CEO of **Simpson Engineering**



From left to right, class valedictorians Mitchell S. Otis, Miranda L. Beshears and Sara C. Troutman

and Associates, Cary, NC, was the baccalaureate speaker. Simpson described how his engineering education helped him build his career. He shared his journey of hardship and struggle in founding his company and emphasized the importance of paying attention to "small" details and long-term learning. Among his valuable career lessons was that "no" is not the end but rather the beginning of a conversation. ■



WithersRavenel establishes undergraduate scholarship

From left to right, Sam Ravenel, Dean Martin-Vega, Morton Barlaz, Tony Withers, Jim Canfield and Chan Bryant

WithersRavenel has established a \$100,000 endowment to support a new undergraduate scholarship in CCEE. This scholarship is intended to support a student concentrating in the department's new track in sustainable urban infrastructure, which is part of the curriculum for the B.S. civil engineering degree. WithersRavenel is an employee-owned full-service land planning, civil and environmental engineering firm founded in 1983 by **H. E. "Tony" Withers** (BSCE-Construction Option, 1975) and **Sam Ravenel** (BSCE 1974). Withers has served on the NC State Engineering Foundation board of directors and is currently president elect of the NC Society of Engineers, among other

community service activities. Ravenel recently stepped down as company president after more than 20 years of service. In addition to the firm's founders, WithersRavenel's contribution was presented by newly elected president and CEO **Jim Canfield** (BSCE 1986, MCE 1990) and senior vice-president **Chan Bryant** (BSMSE 1989). Each collectively expressed their gratitude for the engineering education they obtained at NC State and the opportunity to help future students in the department. "We are particularly pleased that the department has chosen to develop a track in urban infrastructure. There is tremendous growth occurring in North Carolina creating great opportunity for engineers in this field," Withers said. ■



Class in mechanical drawing from 1892 catalog (courtesy NCSU Libraries, Special Collections)

Curriculum history: 1889-1899 the formative years

by David W. Johnston

This article is one of a series to describe the department's history. Previous articles were presented in earlier newsletters, which can be accessed at www.ce.ncsu.edu/news

The North Carolina College of Agriculture and Mechanic Arts (A&M) first enrolled students on October 3, 1889. Eight A&M faculty members offered two degrees: the Bachelor of Science in agriculture and the Bachelor of Engineering. The latter including the fundamentals of civil and mechanical engineering. The 1889-1890 freshman class had 72 students. Of those, 31 returned for the sophomore year and only 19 graduated, all in the first commencement in spring 1893. Five received the B.S. in agriculture and 14 received the Bachelor of Engineering. It was not unusual at the time for individuals to seek only one or two years of college education.

From 1893 to 1899, there was only one civil engineering professor. The B.E. curriculum technical content started as a mix of civil, mechanical and electrical engineering topics and some agriculture. Initially, the freshman year was common for all A&M students. However, gradually through the decade, the B.E. curriculum evolved, providing more opportunity for engineering specialization and no longer requiring the agriculture courses.

Starting in fall 1899, a common engineering freshman year was in place and separate curricula were defined for civil, chemical, electrical and mechanical engineering. Contact averaged 32 hours per week with a total of 381 quarter hours required (equivalent to 254 semester hours). The number of contact hours appears very high compared to today's curricula; however, in addition to lectures, a significant portion of the time was devoted to completing assignments and projects in class or shops with instructor guidance rather than as homework.

Courses were graded on a numerical scale of 100 with 60 being the minimum passing grade. Term, year, and overall averages weighted each course equally, regardless of contact hours.

The 1899 civil engineering B.E. course requirements were about 5 percent humanities, 8 percent English, 10 percent military science and drill, 14 percent mathematics and book-keeping, 14 percent science, 23 percent mechanical engineering and 26 percent civil engineering. The mathematics ranged from algebra to calculus. Sciences included geography, physiology, physics, and inorganic and industrial chemistry. The mechanical engineering exposure included engineering mechanics, steam engineering and valve gears, but also trade skills such as mechanical drawing, and carpenter, forge, lathe, machine, turning and pattern shops. Civil engineering courses, many lasting multiple terms, included architecture, architecture drawing, graphical statics, surveying, railroad and municipal engineering, roofs and arches, bridge design and hydraulics.

Post-graduate education for the degree of civil engineer, requiring one year of additional coursework, was first offered in 1895 and the first degree was awarded in 1896. The 96 quarter hours of guided practice coursework involved advanced topics in mechanics, surveying, construction, hydraulics, sanitary engineering, road making, bridge design, English and a thesis requiring a special design or investigation.

Course content reflected perceived educational needs of the time and practical constraints of the faculty and facility resources available. The curriculum would continue to evolve, but a recognizable foundation had been laid. ■

Firm of the Month: views from participating firms

The idea for the Firm of the Month was suggested by the CCEE Departmental Advisory Board. The Firm of the Month program is our way of thanking and promoting our corporate partners while educating our students about current engineering practice. This program provides participating firms with name recognition for recruiting and business opportunities, demonstrates to students the ways that they can use their degrees after graduation and provides information on employment opportunities.



Stantec Consulting Services Inc. is honored to be named "Firm of the Month" by the Department of Civil, Construction, and Environmental Engineering. The Stantec community is a proud supporter of the Wolfpack. Stantec has more than 15,000 employees working in over 250 locations. It's no surprise that of the 100+ Raleigh employees, more than half are NC State alumni. We know firsthand the quality of education your University offers and how you prepare graduates for the challenges waiting for them after college. That's why we hire NC State alums year after year. Since 1954, our local strength, knowledge, and relationships, coupled with our world-class expertise, have allowed us to go anywhere to meet our clients' needs in more creative and personalized ways. With a long-term commitment to the people and places we serve, Stantec has the unique ability to connect to projects on a personal level and advance the quality of life in communities across the globe. Our work—professional consulting in planning, engineering, architecture, interior design, landscape architecture, surveying, environmental sciences, project management and project economics—begins at the intersection of community, creativity and client relationships.



Balfour Beatty Construction was honored to be chosen as the "Firm of the Month" by the Department of Civil, Construction, and Environmental Engineering. John Wilkins (BSCE, 1988), operations director at Balfour Beatty Construction, was a recipient of the N.C. State Outstanding Senior in Construction Award as an undergraduate student at NC State. Wilkins said, "I was fortunate enough to have a construction job while I was in school and it was priceless for me to be able to practice exactly what I was learning every day." Wilkins further explains, "my civil engineering education in conjunction with my construction background has helped me enjoy a long and successful engineering career." In a move some may consider as coming "full circle," Wilkins distributed pizza in the lobby of Mann Hall, a building where he had once spent so many hours as a student himself. As providence had it, Wilkins was able to give a reference to one of the pizza-partaking students in Mann Hall that ended in the successful employment of the soon-to-be N.C. State grad.



Dewberry is honored to be chosen as Firm of the Month by the Department of Civil, Construction, and Environmental Engineering (CCEE). A leading, market-facing firm with a proven history of providing professional services to a wide variety of public- and private-sector clients, Dewberry has long relied on the university as an institute of top-notch talent. Dewberry's relationship with the university goes back more than 45 years. COO Dan Pleasant, PE (BSCE, 1972; MCE, 1973) is a member of the CCEE Advisory Board. Senior Vice President Pam Townsend, PE (BSCE, 1984; MSCE, 1987) formerly served on the CCEE Advisory Board and now sits on the university's Engineering Foundation Board. These long-lasting relationships have attracted more than a dozen NC State alumni who graduated within the past 10 years to the firm. Dewberry designed the mechanical, electrical, and plumbing services for the 550,000-square-foot Wolf Ridge at Centennial Student Housing Complex with energy efficiency in mind. "I look forward to a long-lasting partnership between this renowned university and our firm," says Townsend. "We are humbled by the opportunity to adorn Mann Hall with samples of our projects and with words of wisdom from our own NC State graduates."

Letter from the **Chair of the Department Advisory Board**



Heather Denny

It is hard to believe that by the time you read this letter, my term as chair of the CCEE Advisory Board will have been completed. It has been an honor to serve in this capacity. In December it will be 20 years since I graduated from the department. My education at NC State provided me with the foundation on which I have built my career and the department continues to be an integral part of my work as many of my employees are CCEE graduates. The impact that the department has had on my company and me drive me to continue to support the department with my time and money.

The Advisory Board supports the department in many ways. We help the department to continuously assess the curriculum and how it relates to the needs of the civil, construction, and environmental engineering industries, we serve as a sounding board for the students and meet with the student group leaders regularly, and we represent the department to the university administration, the public and policymakers. Board members serve as committee chairs and provide connections to their network of peers who can become involved with the department. We are proud to help such a dynamic department in its mission of research, education, and extension.

The Advisory Board is also part of a larger group of donors that support the department financially. Monetary support is critical for the department to enhance its programs and maintain excellence. Contributions provide the department with the ability to recruit and maintain the very best faculty and students and insure that our students have the opportunities that they need to excel. As public funding for higher education decreases, external contributions are more important than ever.

Often I have written about opportunities for your involvement in the department. In addition to the Advisory Board and financial support, there are many ways for you to get involved:

- Volunteering to speak at student group meetings
- Hiring interns
- Becoming involved in mentoring programs
- Providing site visits for students
- Participating in the department's Firm of the Month program
- Sponsoring specific events such as the "Welcome Back" ice cream
- Sponsoring the newsletter

While my role as chair of the Advisory Board may be complete, my support for this department will continue. In addition to the remainder of my term on the Advisory Board, I will also work with the Departmental Fellows. The Fellows are a group of CCEE supporters that stay connected through a yearly luncheon, web based meetings and email updates. We continue to search for ways to connect alumni and friends with the department; if you have an idea please reach out.

Let me close by thanking my fellow board members for their service and for the privilege of serving as chair. It has been rewarding. Finally, thanks to the department and all of the hard working faculty and staff. You provide the opportunities for the next generation of civil, construction, and environmental engineers and we in the engineering industry are looking forward to working with your fresh graduates.

Heather Denny

President and CEO

McDonald York Building Company

The following distinguished alumni and friends of the Department currently serve on the Board:

Suzanne M. Beckstoffer,
BSCE 1982, Newport News
Shipbuilding

Thomas W. Bradshaw, Jr.
Formerly Secretary of
Transportation
NC State Ports Authority

Heather Denny,
BSCEC 1995 (Chair)
McDonald-York Building Co.

Barry Gardner, BSCEC 1975
Shelco Construction Co.

John Jenkins II, BSCE 1990
Stewart Engineering

Christopher Murphy,
MSCE 1999
FDH Engineering, Inc.

Dan Pleasant, BSCE 1972
Dewberry

Bill Pope, BSCEC 1983
Pope Custom Homes

Richard Rohrbaugh, BSCE 1981
Kimley-Horn and Associates

David Simpson, BSCE 1981
Simpson Engineers & Associates,
P.C.

Stacey Smith, BSCEC 1992, MCE
2004, Smith Gardner, Inc.

Alan Stone, BSCE 1987
Hazen & Sawyer

Hans Warren, BSCEC 1984
Warco Construction, Inc.

ALUMNI NEWS



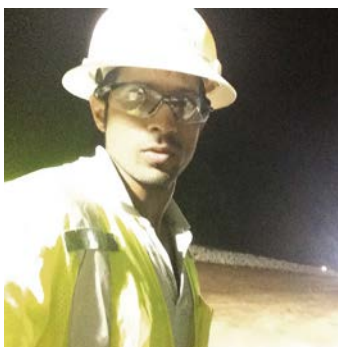
Benjamin Buskirk

BENJAMIN T. BUSKIRK, PE, LEED AP, Esq. (BSCEM 2005) worked as a construction project manager with Bovis Lend Lease, Inc. (now Lend Lease) and McDonald York Building Company as a construction project manager from 2005 to 2011. Since graduating from Campbell Law in 2014, Buskirk has been practicing law with Lewis & Roberts, PLLC in

Raleigh focusing on construction and surety law.

TRAVIS COX (MCE 2012) is working as a field manager for Brasfield & Gorrie General Contractors. He works in the company's Healthcare division and his current project is a renovation and addition to the Emergency Department at Caromont Medical Center in Gastonia, NC.

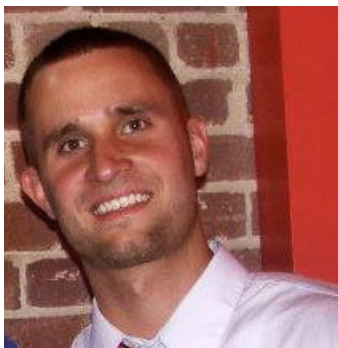
CRAIG FISHER (BSCE 1993, MSCE 1995) was recently appointed to vice president of Stewart by its board of directors.



Venkatesh Jagarlamudi

JOHN T. JENKINS II (BSCE 1990) and member of the CCEE Advisory Board was recently appointed to senior vice president of Stewart by its board of directors.

VENKATESH JAGARLAMUDI (MCE 2013) is an engineer at Granite Construction. He is working on the I-40/440 rebuild project for the N.C. Department of Transportation.



Heath Kent

HEATH KENT (BSCEM 2012) is currently serving as the territory safety lead for North and South Carolina for Lithko Contracting, Inc. He was hired as a project engineer upon graduation in May 2012 and is in the Raleigh area.

SAMUEL MCCACHERN, PE, (BSCE, 1985) was named Engineer of the Year for Private Practice by the Georgia Society of Professional Engineers in February 2015. He is the president and CEO of Thomas & Hutton. He helped develop Thomas & Hutton University, which puts an emphasis on extensive training and skill development for staff.

DR. MOHAMED SH. OMER (Ph.D. 1984) is a professor at the University of Tripoli, Libya. Dr. Omer was the dean of engineering of the University of Tripoli (1990-1995) and the director of the Roads and Bridges Authority of Libya (2008-2010). He is experienced in pavement design.

CAMILA PEREZ, EI. (MCE 2013) is a project engineer with JE Dunn Construction at the company's Charlotte office. She is working on a commercial construction project, The Encore, which is a 280-unit luxury apartment building in Charlotte. Perez is also a safety trainer and assists with the recruiting of new hires.



Chintan Shah

CHINTAN SHAH (MCE 2014) is with The Beck Group as a project engineer. He is working on the Duke University Wallace Wade stadium renovation project.

SASHI KANTH TADINADA (M.S. 2009, Ph.D. 2012) joined American International Group (AIG) in April 2015 as a senior research scientist. She develops models of catastrophic risk to understand risks to buildings, properties and global supply-chains from natural hazards.

SMEDES YORK (BSCE 1963) collaborated on a book published in 2014, *Growing Up With Raleigh: Smedes York Memoirs and Reflections of a Native Son* (authored by John L. Sharpe, 436 pages). From 1979 to 1983, he served two terms as mayor of Raleigh. He has held positions in several Raleigh organizations, including the Chamber of Commerce and the Raleigh Durham Airport Authority. He was inducted into the Raleigh Hall of Fame in 2007 and inducted into the NC Business Hall of Fame in 2009. York has served on the N.C. State Board of Trustees and is a former president of the NC State Alumni Association and a member of the Watauga Club. ■

Support the Department

There are many ways in which you can help advance our mission to maintain excellence in research and education as we educate the next generation of civil, construction, and environmental engineers to build sustainable infrastructure for society. We invite each of you to become a regular supporter.

An annual gift to the CCEE Enhancement Fund gives our students the same life-changing opportunities that you enjoyed. Contributions to the department's enhancement fund allow us to respond immediately to emerging needs and exciting challenges. Your donations fund recruitment and retention efforts to attract the best and brightest faculty in the world, all of our student organizations, field trips to complement classroom instruction, graduate student recruiting and assistantships, and opportunities for faculty members and students to make presentations at conferences in their fields of study.

In addition to annual support, there are a number of events throughout the year for which specific sponsorships are available, including graduate student symposia in which students present posters to describe their master's and Ph.D. research, the We are WE (Women in Engineering) recruiting event, the Zia Symposium, the welcome back ice cream social and perhaps most immediate – we need a sponsor for the semi-annual newsletter. If you would like to discuss an annual donation, sponsorship opportunities or other ideas, please contact us.

Whether an annual gift, an endowed gift or a one-time gift, your support will have a significant impact on current as well as future students and faculty at NC State University.

Thank you for supporting CCEE.

Morton Barlaz, Department Head
barlaz@ncsu.edu | **919-515-7212**

Lora Bremer, Executive Director of Major Gifts and Campaign Planning
lfbremer@ncsu.edu | **919-515-0983**

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Visit **www.engr.ncsu.edu/foundation**.

Share Your News

Keeping your contact information current enables us to keep you up to date on events in the department and elsewhere. Have a professional or personal update? We would like to hear from you!

Please send us your latest news (e.g., career accomplishments, awards, recognitions, marriage, births, retirement) so we may share your news in

future issues. Send the following information and/or news stories to **lfbremer@ncsu.edu**:

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