

NC STATE

Engineering

CCEE NEWS

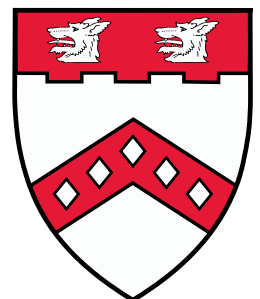
**DEPARTMENT OF CIVIL, CONSTRUCTION,
AND ENVIRONMENTAL ENGINEERING**
NC STATE UNIVERSITY | SPRING 2017

LOOKING TO THE OCEANS FOR UNTAPPED ENERGY

IMPROVING SAFETY WITH PERSONALIZED TRAINING 02

ZIA LECTURE EXPLORES GULF PROJECT 12

DEPARTMENT PLANS FOR NEW HOME 21



IN THIS ISSUE

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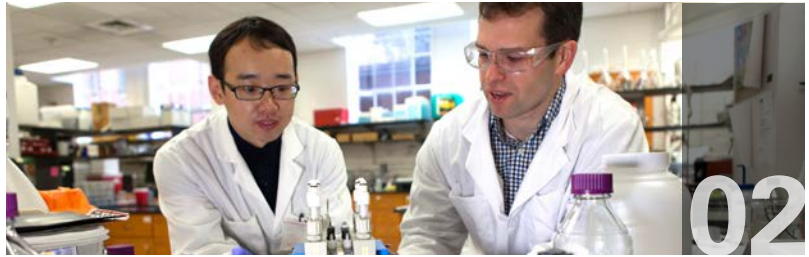


IN THE SPOTLIGHT

KAPPE LECTURER DESCRIBES THE NEXT GENERATION OF WASTEWATER TREATMENT PLANTS

PAGE 11

Dr. Sudir Murthy's lecture touched on new technologies that will reduce the energy footprint of future plants.



DEPARTMENT NEWS PAGE 02

- › RESEARCH UPDATES PAGE 02
- › NEW RESEARCH PAGE 06
- › AWARDS AND HONORS PAGE 10



STUDENT NEWS PAGE 14

- › UPDATES FROM STUDENT GROUPS PAGE 14
- › CCEE LEADS THREE-MINUTE THESIS COMPETITION PAGE 16
- › FALL 2016 GRADUATION PAGE 17



ALUMNI AND DEVELOPMENT NEWS PAGE 18

- › ALUMNA NEVER STOPS ASKING 'WHAT'S NEXT?' PAGE 18
- › ALUMNI NEWS AND UPDATES PAGE 19
- › RECOGNIZING CORPORATE SPONSORS PAGE 22

ABOUT THE COVER

Hannah Palko, M.S. student at the Coastal Studies Institute, collects a water sample as part of research aimed at assessing the potential for harnessing energy along North Carolina's coast.

LETTER FROM THE DEPARTMENT HEAD MORTON A. BARLAZ



Dr. Barlaz is pictured here with Roger Castillo, who graduated in Fall 2016 with a B.S. in Civil Engineering.

Welcome to the Spring 2017 newsletter. It is always a pleasure to update you on happenings in the department. I am writing this letter just after our December graduation where I had the honor to congratulate 127 of the next generation of engineers (*see article on page 17*). Graduation is an uplifting reminder of our mission.

The design process for our new home in EB-Oval is in full swing and we are still on target to move in time for the Fall 2020 semester. Please see the update on page 21 and consider how you can help to support our new home.

I am pleased to welcome two new faculty to the department this Spring. Dr. **Eleni Bardaka** joins us after completing her Ph.D. at Purdue University. Her expertise is in transportation planning and economics. Dr. **Alejandra Ortiz** earned her Ph.D. in a joint program at MIT and the Woods Hole Oceanographic Institution and completed a postdoc at Indiana University. Her expertise is in coastal geomorphology and the evolution of coasts as sea levels rise.

This newsletter features four research briefs from our faculty, highlighting the Department's contributions to many aspects of civil infrastructure. Dr. **Doug Call** and colleagues are improving reverse electrodialysis technology to recover energy from salinity gradients that are present where freshwater and saltwater mix. Drs. **Cassie Castorena** and **Richard Kim** are improving methods to test asphalt mixture performance. Drs. **Alex Albert** and **Ed Jaselskis** are developing personalized training methods to improve work place hazard recognition. Dr. **Dan Obenour** is using data from 70,000 surveys of 33 Gulf Coast estuaries to identify factors that impact biological diversity and ultimately to develop estuary restoration programs.

As all of you are aware, our contributions to civil infrastructure are often taken for granted and are underappreciated until there is an emergency, whether it is unbearable traffic, flooding, drought, aging bridges or water of questionable safety. I continuously look for opportunities to educate students on their role in the design, construction and operation of sustainable infrastructure.

As you read this newsletter, I hope that you get a sense of the tremendous accomplishments in our teaching, research, and extension programs and our contributions to sustainable infrastructure. As state support for our mission continues to decrease, we need your help. Please make a contribution to the department a regular event. Your gifts provide help with the special things that make us strong, whether it is field trips for undergraduates, allowing graduate students to make a presentation at a national conference, student scholarships or helping to recruit and retain the best students and faculty in the world. We need your support as we strive for excellence in all that we do. Please let me know if you are in the area and would like to tour our facilities.

Thank you,

Morton A. Barlaz
Distinguished University Professor
CCEE Department Head

CCEE AT NC STATE SUSTAINABLE INFRASTRUCTURE FOR SOCIETY

- \$18.6 million** in research expenditures
- 167** ongoing research projects
- 12** winners of CAREER and other NSF young faculty awards
- 49** faculty members
- 309** graduate students
- 762** undergraduate students



Revolutionizing construction safety training with personalized interventions

Construction employers invest millions of dollars in safety training, yet desirable levels of hazard recognition have not been achieved using traditional passive classroom lecture-style training. In fact, only 15 – 20 percent of training investments translate to tangible returns.

CCEE researchers embarked upon a collaborative effort to develop personalized training solutions tailored to the specific learning needs of individual workers. Drs. **Alex Albert** and **Ed Jaselskis** and graduate student **Idris Jeelani** from CCEE worked in conjunction with Dr. **Roger Azevdo** from NC State's Psychology Department.

The team based their personalized training approach on methods that have gained popularity in aviation, medicine and the military. Replacing the traditional one-size-fits-all training approach with individualized methods leads to more desirable training outcomes. Participating workers who could identify only 42 percent of work place hazards before the individualized training, were able to recognize 77 percent after the training intervention was introduced.

Instead of randomly scanning the worksite for potential

hazards, participants were given a specific list of visual cues that enabled workers to systematically search the construction environment. Example cues include gravity (e.g. falling objects and trip potential), motion (e.g. vehicular traffic), and electricity (e.g. powerlines and energized equipment). In addition, eye tracking technology recorded their eye movements, allowing the trainers to understand the hazards that captured the attention of workers, and other hazards that did not receive attention. "Next, the psychological aspect of the research was used to help workers understand their own thought processes," Albert relays. "Getting workers to think about why they overlooked certain hazards and giving them feedback about which areas they could improve, was shown to increase hazard recognition levels."

This study utilized work site photographs and eye tracking software. In future work, the researchers plan to repeat the investigation using actual construction workplaces. The training and feedback were conducted individually. "Ultimately, we need to automate the intervention so that it can be implemented on a large scale," Albert says. ■



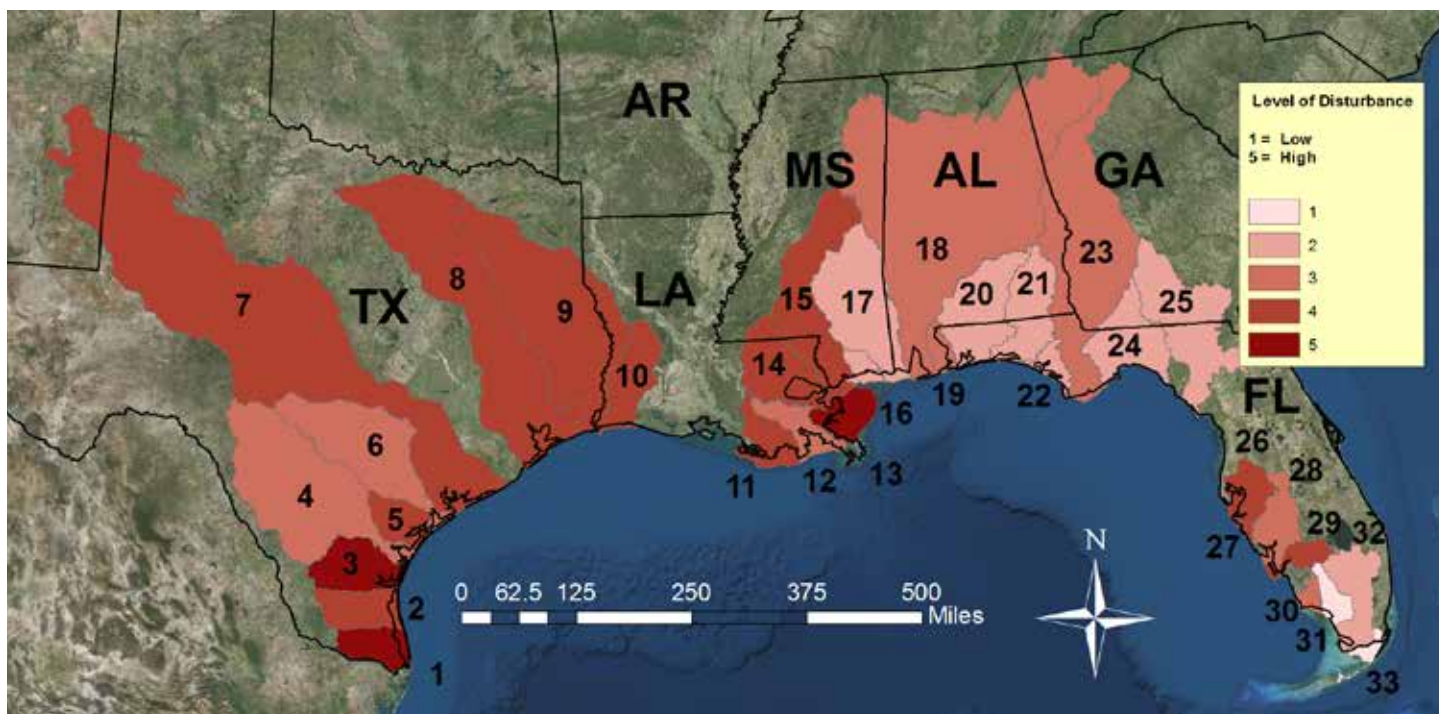
Example of visual attention mapping.

Each year, there are more than **60,000** construction fatalities globally. In the United States, there were more than **900** fatal and **200,000** non-fatal construction injuries in 2015. Construction sites are dynamic, which makes recognizing and managing workplace hazards challenging.

Assessing the impacts of watershed stressors on habitat quality in Gulf of Mexico estuaries

The northern Gulf of Mexico spans five states and includes dozens of coastal estuaries that provide critical habitat for fish and shellfish that are important to commercial and recreational fishing. Assessing the biological condition of these estuaries

is vital to effectively managing watersheds and keeping the overall ecosystem healthy. Nutrient pollution in estuaries can result in harmful algal blooms and depletion of dissolved oxygen, which leads to fish kills that sometimes leave tens of



Gulf estuaries and their corresponding watersheds color-coded to indicate level of disturbance.

thousands of fish dead. Water quality in estuaries is complex, as nutrients are just one of many potential pollutants, making it challenging to understand the overall impacts of watershed development. To address this issue, Dr. **Dan Obenour** and his research team partnered with scientists from the **National Oceanic and Atmospheric Administration** and the **United States Geological Survey** to study 33 estuaries across the US Gulf coast.

The study leverages an unprecedented compilation of fisheries survey data collected by seven state and federal agencies since the 1990s. Incorporating data from more than 70,000 trawl surveys that measure the types and quantities of fish and shellfish, Obenour's group created models to analyze the presence and/or absence of various species over time. The model considers natural factors, such as water temperature and salinity; human-related factors, such as the intensity of

agricultural and urban development; as well as variations in sampling methods used by different agencies.

Study results indicate that total watershed development (both agricultural and urban), the density of toxic releases within a watershed, the area of urban and undeveloped land within coastal areas, and shoreline agriculture all substantially affect the types and quantities of fish and shellfish. These effects are largely harmful but sometimes beneficial, depending on the particular species and stressor in question, which is not surprising given that some species are more tolerant of human-related development activities. The study concluded that land development is having harmful impacts on the biological health of Gulf Coast estuaries. Ultimately, the results of this research will help decision makers identify estuaries where watershed management and other conservation practices would be most beneficial for restoring ecosystem health. ■

How can we improve the efficiency and versatility of asphalt mixture performance testing?

There are almost 3 million miles of paved highways in the U.S. and we spend more than \$90 billion annually to maintain our pavement infrastructure. Initial pavement quality strongly impacts its long-term performance, and the extent of maintenance and rehabilitation needed. Thus, producing quality pavements is critical to minimize the life-cycle costs. Asphalt

mixture performance testing offers a means to assess which materials will produce long-lasting, cost-effective pavements.

Historically, asphalt mixture testing has been conducted using 100-mm (~4") diameter cylindrical specimens with a height of 130-mm or 150-mm, but this size presents challenges. It only allows for acquiring one test specimen per laboratory

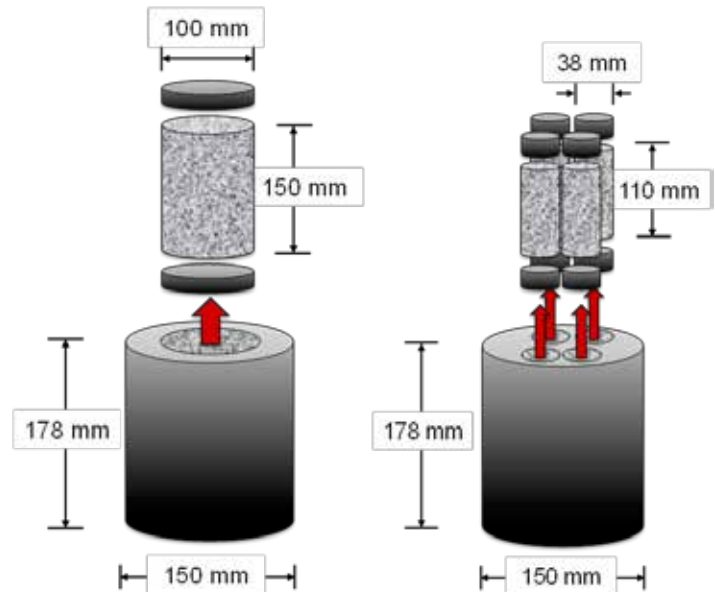


Ph.D. student Kangjin Lee preparing a small specimen for testing.

sample. It takes a lot of time to produce laboratory samples and thus, laboratory testing efficiency would increase greatly if multiple test specimens could be acquired from a single laboratory sample. Additionally, many as-built pavement layers are thinner than 100-mm, making it impossible to extract field samples.

Drs. **Cassie Castorena** and **Y. Richard Kim** are working with Ph.D. students **Kangjin Lee** and **Sonja Pape** to establish small specimen geometries for asphalt mixture performance testing.

Two small specimen geometries have been developed: 38-mm diameter cylinders and 25-mm by 50-mm prisms. These smaller sample sizes offer two advantages. First, they make it possible to assess the performance of asphalt mixtures



Large vs. small specimens extraction from laboratory sample.

placed in the field and hence, learn why some individual pavement layers fail over the course of a pavement's life. In addition, the small specimen geometries allow for the production of four test specimens from a single laboratory sample, which greatly improves laboratory testing efficiency. Asphalt mixture performance testing generally requires three replicate tests to capture representative properties. Thus, the small specimen geometry allows for generating the requisite test specimens from a single laboratory sample whereas the standard geometry requires the production of three samples. Funding for this research is provided by the **National Cooperative Highway Research Program Innovations Deserving Exploratory Analysis**. ■

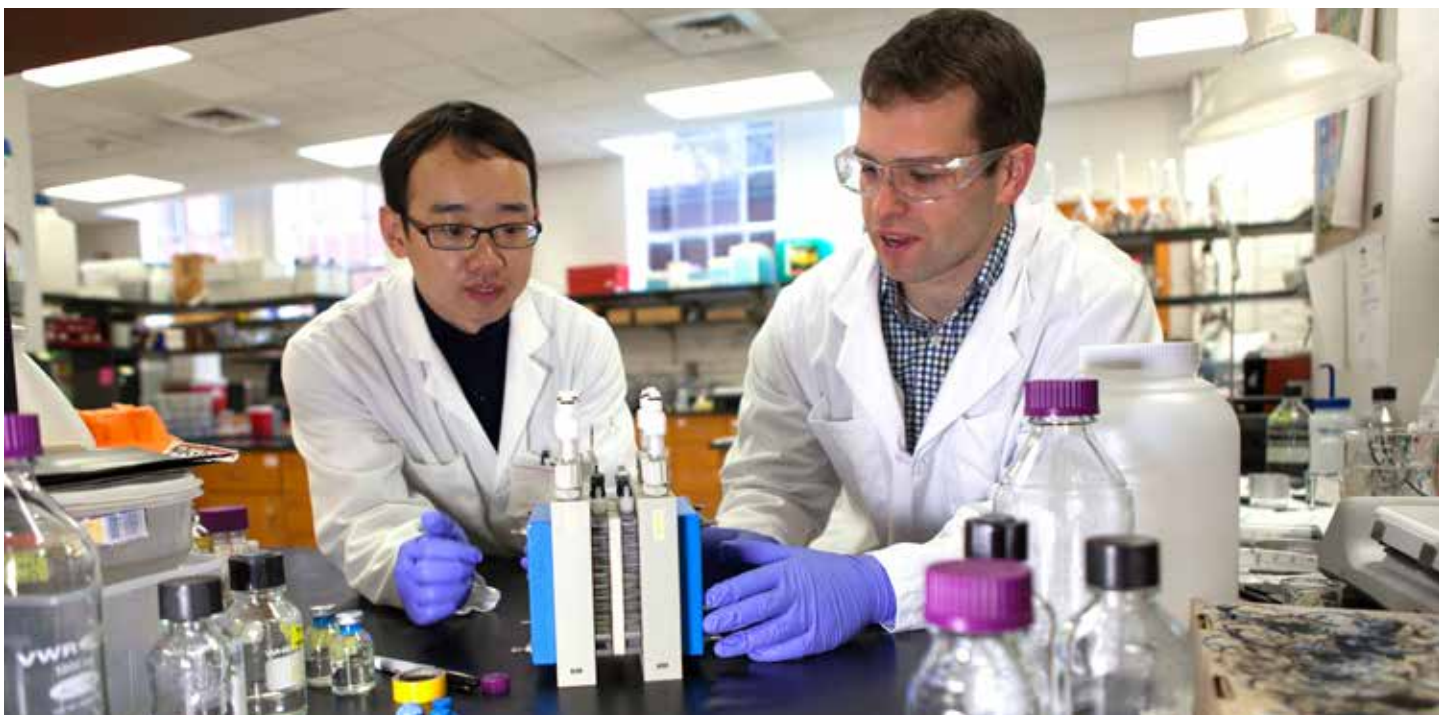
Can we harvest sustainable energy from our coastal waters?

The value of North Carolina's coastline can be assessed in many ways. Thousands of people make their livelihood harvesting the bounty of the sea, and thousands more are supported by tourism. There may be a hidden value along the edge of our state where salt water mixes with river water: energy.

The energy available when seawater and river water mix is substantial. Mixing one cubic meter (264 gal) of river water into the ocean releases energy equivalent to the same volume of water falling from a height of nearly 1,000 feet. Tapping these "silent waterfalls" where rivers and wastewater treatment plants empty into the ocean could yield more than 1 TW (terawatt)

of power production globally, roughly half of current global electricity production.

Most environmental engineers are familiar with the desalination process in which the salt in seawater is removed to make fresh water. Electrodialysis (ED) uses electricity to force saltwater ions through selective membranes, leaving behind freshwater. By running the ED process in reverse and allowing the saltwater ions to selectively travel into the freshwater, electricity can be generated. This process is called reverse electrodialysis (RED). Demonstration-scale units are already up and running in Europe. In the US, a cohesive research effort



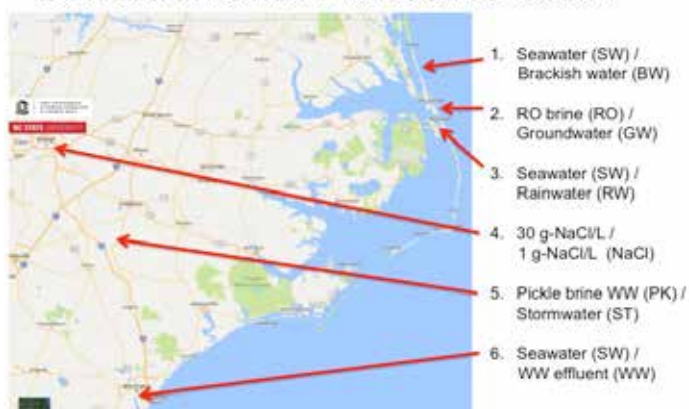
Dr. Douglas Call, right, and postdoctoral associate Fei Liu working with a RED unit.

focused on advancing this technology has been lacking — until now.

Drs. **Douglas Call** and **Orlando Coronell** (UNC-CH) are leading a multi-disciplinary team including CCEE researcher Dr. **Joe DeCarolis** as well as investigators from UNC-CH, East Carolina University, and the Coastal Studies Institute. With funding from the **UNC General Administration's Research Opportunities Initiative**, the team is conducting a holistic economic and environmental assessment of salinity gradient energy generation in NC, along with advancing the RED technology itself. In addition to electricity generation, the team is investigating the potential of this technology to store electricity and assist with wastewater treatment through the integration of waste-degrading microbial fuel cells.

To date, the research team has tested several pairs of water samples with various salinity gradients. In addition to four sites along the coast, the researchers found an unexpected salinity gradient: pickle brine wastewater from the Mt. Olive Pickle Company. Of the samples tested, the Mt. Olive Pickle water samples generated the most power. One of the study's key findings is that the naturally present organic material that is dissolved in water can substantially reduce energy generation, likely by contaminating the membrane surface. Results to date are promising in that food industries across the state, in addition to coastal communities, may benefit from RED, both for power generation and wastewater treatment. With these new insights, Call and Coronell are working to further optimize the RED process to improve power generation. ■

Collection Sites Across NC Coast



Sampling sites along NC's Coast.



Hannah Palko, M.S. student at the Coastal Studies Institute, collects a water sample for testing in the reverse electrodialysis lab units.

NEW RESEARCH PROJECTS

In the last four months of 2016, CCEE faculty contributed to efforts that resulted in more than \$15 million dollars in research support from state, federal, and private sources. This support will enable 12 CCEE faculty members to lead research addressing a broad range of problems that will help to improve infrastructure and the environment in North Carolina and across the US and globe.

Dr. **JOE DECAROLIS** received funds from NC State's **Future Renewable Electric Energy Delivery and Management Systems** (FREEDM) Center, an NSF Engineering Research Center. DeCarolis will develop estimates of the costs and benefits of renewable energy system components to improve decision making. FREEDM is developing critical smart grid technologies that can enable the integration of large-scale renewable energy generation with the electricity distribution network.

Dr. **RICHARD KIM** received funding from the **Federal Highway Administration** (FHWA) to improve sampling and analysis procedures to support the implementation of performance-based specifications for asphalt pavements. The evaluation will include asphalt paving projects in North Carolina, Maine, Missouri, and by the FHWA-Western Federal Lands Highway Division.



Asphalt paving compaction.

Dr. **CASEY DIETRICH** received funding to strengthen an ongoing partnership with the **NC Emergency Management Department**. The partnership started when his research group shared forecasts of coastal flooding during Hurricanes Hermine

and Matthew. This project will better connect weather forecasts to other datasets used for making decisions about evacuation and resource deployment during storms.

Drs. **TASNIM HASSAN** and **GRACIOUS NGAILE** (Mechanical Engineering) were awarded a project by the **Department of Energy** to investigate failure mechanisms of compact heat exchangers that will be used in constructing next generation high temperature nuclear power reactors. CCEE Ph.D. students **Urmi Devi** and **Heramb Mahajan**, and post-doc Dr. **Machel Morrison** will combine high-temperature experiments with comprehensive numerical modeling to develop American Society of Mechanical Engineers Code design methodologies for compact heat exchangers.

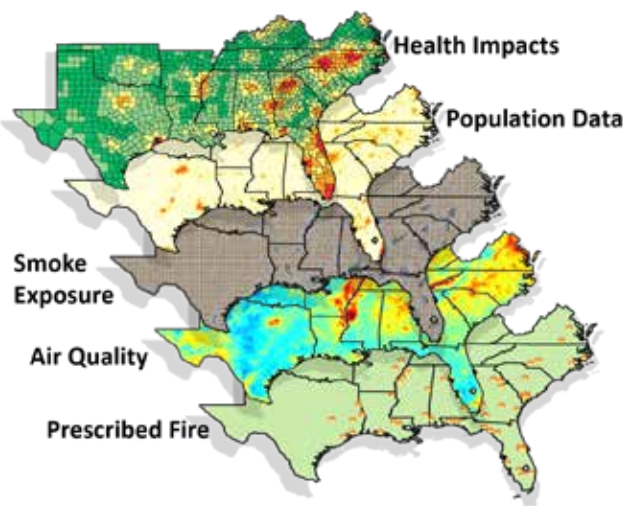
Dr. **MICHAEL BORDEN** received funding from the **Naval Air Warfare Center Aircraft Division** of the **Department of the Navy** to collaborate with **Isogeometrix LLC**. The objective of their research is to develop new computational techniques that can be used to predict fatigue crack growth in aircraft components. The computational techniques will be used to develop new methods to reduce the time and cost associated with the design and development of new aircraft components. The project will explore new computational geometric modeling techniques and analysis models that more accurately represent the physics of fatigue crack growth.

Dr. **DANIEL OBENOUR** received funding from the **National Oceanographic and Atmospheric Administration** (NOAA) to study the northern Gulf of Mexico's hypoxic (low-oxygen) zone, also known as the "Dead Zone." Obenour's team will characterize historical hypoxia events and make predictions of when and where hypoxia is likely to occur. The results will then be coupled with fisheries models developed by researchers at the NOAA Lab in Beaufort, NC to strengthen fisheries and watershed management.

Dr. **O BENOUR** and co-investigators from multiple universities received funding from the **National Science Foundation** to study the management and mitigation of harmful algal blooms in western Lake Erie. The project will predict when and where harmful algal blooms are likely to occur and identify new watershed management measures to control them. The research team will also determine impacts of these algal blooms on water supply, fishing, and recreation, and assess how scientific information is used to support management decisions to control harmful algal blooms.

Drs. **DOUGLAS CALL** and **DETLEF KNAPPE** are part of a multi-institution team that received a three year award from the **Game-Changing Research Incentive Program** of the NC State **Office of Research, Innovation and Economic Development**. The research team will explore nanotechnology-enabled systems for water sustainability. Specifically, the project will focus on developing nanotechnology to reduce membrane fouling during water desalination and on optimizing the recovery of resources from wastewater. The team is led by Dr. **Jacob Jones** in Materials Science and Engineering at NC State and includes researchers from UNC-Chapel Hill, Duke University, the Water Resources Research Institute, and RTI International.

Dr. **FERNANDO GARCIA MENENDEZ** received a grant from the Joint Fire Science Program, which is jointly funded by the **US Departments of Agriculture and the Interior**, to study the effects of prescribed fires on air pollution across the Southeast. The research will develop an integrated information system to assess the air quality, health and societal impacts of prescribed burning. The project includes collaborators from the U.S. Forest Service and Georgia Institute of Technology.



Data layers of the Prescribed Fire and Air Quality Integrated Information System.



The remnants of a prescribed burn in Uwharrie National Forest (Photo: F. Garcia-Menendez)

Dr. **MERVYN KOWALSKY** received funding from the **California Department of Transportation** to investigate use of high strength steel reinforcement for reinforced concrete bridge columns. The project will develop seismic design recommendations through large-scale testing and computational modeling.

Drs. **BILLY WILLIAMS** and **NAGUI ROUPHAIL** are part of a team that was awarded a 5-year consortium grant from the **US Department of Transportation** to continue the **Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE)**. The grant will provide up to \$14 million to support development of novel strategies for reducing traffic congestion. Dr. Williams will be serving as the center's NC State associate director. ■



The STRIDE center is led by the University of Florida Transportation Institute and draws expertise from 11 Southeastern universities.

Alejandra Ortiz brings expertise in coastal engineering



Dr. Alejandra C. Ortiz

Dr. Alejandra C. Ortiz joined the CCEE faculty in January as an assistant professor. Her research expertise is in coastal geomorphology and understanding the evolution of coasts as sea levels rise. Utilizing a mix of computer modeling, remote sensing and field validation, Ortiz is interested in improving

predictions of coastal system behavior, including the response of Pacific island areas to changes in sea-level. She comes to NC State after completing a postdoctoral fellowship at Indiana University in Bloomington. Her work there focused on understanding the processes driving land loss in the Mississippi Delta.

Ortiz completed her Ph.D. in marine geology from the Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program in 2015. Her doctoral work focused on understanding the impact of sea-level rise on coastlines around the world. She also holds a master's degree in civil and environmental engineering from the same institutions. Ortiz completed her undergraduate work at Wellesley College in Massachusetts, where she earned a double major in geosciences and classical civilizations. In her undergraduate honors thesis, she developed a model of the wave climate of Vieques, Puerto Rico.

Ortiz is teaching Coastal Engineering (CE 487) this spring. She plans to offer a course in ecogeomorphology in the future. The course will explore the role of vegetation as well as microorganisms and higher life forms in shaping our coastal landscape.

Eleni Bardaka brings expertise in transportation planning and economics



Dr. Eleni Bardaka

Dr. Eleni Bardaka joined the CCEE Department in January as an assistant professor. Her research focus is on transportation planning and economics. Bardaka is specifically interested in the social impacts of investments in transportation systems, the relationships between urban development

and transportation policies, and overall economic impacts of transportation systems. Through her research, she wants to achieve a more equitable distribution of transportation-related benefits across different socioeconomic groups. She also plans to propose policies to prevent transportation-induced

gentrification, displacement, and segregation. Her long-term goal is to create a research center on transportation and urban economics at NC State.

Bardaka earned a five-year diploma in civil engineering at the National Technical University of Athens in Greece. She recently completed her Ph.D. in civil engineering at Purdue University. Her doctoral work focused on identifying relationships between urban rail and gentrification. She also holds master's degrees in economics and in civil engineering from Purdue University.

Bardaka is co-teaching CE 297, Introduction to Sustainable Infrastructure, with Dr. **Joseph DeCarolis** this spring. In the future, she would like to teach CE 305 Traffic Engineering, CE 701 Urban Transportation Planning, and CE 703 Transportation Economics. She is also planning to develop a graduate-level course on transportation systems evaluation and decision-making, as well as an interdisciplinary seminar series on transportation, and urban and regional economics.

Lessons learned: National seminar created by NC State CCEE Extension and University San Francisco of Quito (USFQ) builds on knowledge and collegial ties



Roberto Nunez speaks in Quito, Ecuador at a seminar examining the lessons learned in the aftermath of the April 2016 earthquake that devastated parts of his home country.

It was April 16, 2016 when a 7.8 magnitude earthquake hit Ecuador. It left nearly 660 dead and caused an estimated \$3.34 billion in damages. When **Roberto Nunez**, P.E., a lecturer and senior construction extension specialist with CCEE, heard of the tragedy in his home country, he was attending an American Concrete Institute convention in Milwaukee along with several CCEE students. Nunez's extension experience and desire to help triggered formation of a coalition amongst conference attendees to facilitate information gathering and assist coordination of emergency response efforts. Dr. **Fabricio Yepez**, vice-dean of engineering at the University San Francisco of Quito (USFQ) and a consultant to the Ecuadorian Ministry of Housing, was also in attendance. Yepez works with one of Nunez's past students as well as a CCEE alumnus, Dr. **Juan Jose Recalde** (CCEE Ph.D., 2010), who is a principal professor and director of the Construction Materials Laboratory at USFQ. Yepez and Recalde also work alongside Dr. **Vinicio Suarez**, a private consultant in Ecuador, who also earned his Ph.D. in 2009 in CCEE. These relationships have proven fruitful in helping Ecuadorians during and after the tragic earthquake.

Yepez, Recalde and Suarez quickly implemented online training for first responder engineers and helped coordinate international aid and technical support to Ecuador. As the urgent response efforts began to subside, they also helped Nunez organize a national seminar to share the knowledge gained from the investigation and reconstruction efforts. "We agreed that one of the requisites would be that all the speakers would be Ecuadorean. We wanted to show that the country is capable and

has the resources to positively build upon the knowledge and experiences gained from such a tragic but potentially repeatable event," Nunez relays.

The national seminar drew 140 participants including government representatives, faculty, engineering professionals, contractors, scientists, and students. Topics covered included geology, vulnerability, soil-structure interaction, seismic risk, structural design and construction for seismic performance, structural evaluation of affected structures, and repair and strengthening methodologies.

"It was a very humbling experience to learn about the current state of infrastructure in my home country" Nunez relays. "At the same time, I'm very proud of the competence and collaborative efforts of our Ecuadorian engineers and scientists." ■

On October 4, 2016 a technical seminar held in Quito, Ecuador focused on lessons learned from the devastating earthquake that ravaged parts of Ecuador earlier in the year. The event was developed by NC State Extension Specialist Roberto Nunez, in concert with the University San Francisco of Quito (USFQ). The events that led to the development of the seminar offer another set of 'lessons learned' and exemplify the importance of maintaining ties with colleagues and students across time and across borders.

AWARDS & HONORS



Dr. H. Christopher Frey

Dr. **H. CHRISTOPHER FREY** was elected as a 2017 Vice President of the Air & Waste Management Association (A&WMA). He will join the A&WMA Executive Committee in addition to continuing to serve on the board. Dr. Frey was also honored by the Transportation and Air Quality Committee

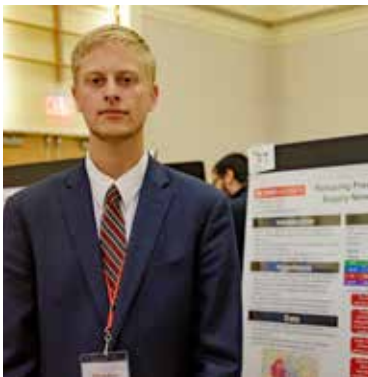
(ADC20) of the Transportation Research Board (TRB) for his paper titled "Real-World Freeway and Ramp Activity and Emissions for Light Duty Gasoline Vehicles." The paper, which included two of his graduate students as co-authors, **Maryam Delavarrafiee** and **Sanjam Singh**, was ranked first among 110 papers reviewed by the ADC20 for the 2017 TRB Annual Meeting.



Dr. Rudi Seracino

Dr. **RUDI SERACINO**, Professor of Structural Engineering, was named the Editor-in-Chief of the American Society of Civil Engineers (ASCE) *Journal of Composites for Construction*.

Five doctoral students were honored at the semi-annual Graduate Awards Reception in December. Two students received the Thomas G. Coffey Graduate Fellowship including **REZA RASHETNIA** and **ATEFEH ZAMANI**. **DOMINIC LIBERA**, **AMIR MAZROOEI**, and **PROVAT SAHA** were awarded the Charles Smallwood Graduate Fellowship.



Henry Ricca

HENRY RICCA, M.S. environmental engineering student, received the third place overall poster award at the 14th annual North Carolina American Water Works Association-Water Environment Federation (AWWA-WEF) conference. His poster was titled "Reducing Pressure Error due to Demand Uncertainty

in Water Supply Networks through Subnetwork Isolation Modeling." Drs. **Kumar Mahinthakumar** and **Jason Patskoski** are his advisors.



Left to right: Amir Mazrooei, Atefeh Zamani, Dominic Libera, Reza Rashetnia. Provat Saha not pictured.



Blue Plains Wastewater Treatment Plant. Photo provided by DC Water.

Back to the future: Dr. Sudir Murthy describes next generation of wastewater treatment plants

Wastewater treatment plants are the single largest energy user in many cities. Dr. **Sudir Murthy, Innovations Chief at DC Water**, believes it doesn't have to be this way. Murthy presented the Kappe Lecture in the Department on November 4th, 2016 and highlighted innovations in the wastewater industry. Like many researchers and practitioners in this field, he believes that going forward, wastewater treatment plants must be designed and operated to become energy neutral.

"In the next 10 years there are going to be more new wastewater treatment plants built than in the history of mankind," Murthy relayed, "and we need to have a paradigm shift in how we do things in this industry." In addition to what Murthy referred to as a "construction frenzy" in Asia, here in the U.S. many existing plants that were built in the 1970s are nearing the end of their life. Murthy predicts "It's going to be back to the future as we build the new generation of plants; we will return to the two-stage approach."

Using DC Water's massive Blue Plains Advanced Wastewater Treatment Plant as an example, Murthy presented information on new technologies that are being explored for the removal of nutrients, specifically nitrogen, from wastewater. Typical biological nitrogen treatment processes use energy and

resources to remove nitrogen-based contaminants. However, there are new technologies that exploit certain types of microorganisms to reduce the resources required for nitrogen removal from wastewater. Through these new technologies, Murthy will be able to reduce the energy foot print of existing wastewater treatment plants and make progress toward the goal of a net energy neutral wastewater treatment facility.

"I was impressed by the fact that Dr. Murthy has facilities to collaborate with a number of researchers from different institutions and companies, all of whom come together and develop transformative new solutions," Dr. **Joel Ducoste** states. "Dr. Murthy has been able to develop new technologies in a very effective manner. In the long run, his innovations will push the envelope in developing new energy efficient and effective wastewater treatment removal processes. It was a great opportunity for our students to hear from an engineer at the leading edge of technology development." ■

The Kappe Lecture series is made available by the American Academy of Environmental Engineers and Scientists.

Protecting New Orleans: 15th Annual Paul Zia Distinguished Lecture

Dr. Paul Zia, second from left seated, catches up with colleagues before the lecture. Left to right: Dean Louis Martin-Vega, Paul Zia, and Zia's daughter, May. Professor Emeritus Dr. Paul Zia is a former professor and department head for CCEE. He's been engaged in teaching, research and consulting for more than 50 years, and during that time has advised more than 60 master's and doctoral students.



On September 12, 2016 Professor Emeritus Dr. **Paul Zia**, NAE sat near the front of Stewart Theatre in the Tally Student Union. Having recently celebrated his 90th birthday, on this afternoon he enjoyed the 15th Annual Paul Zia Distinguished Lecture, a lecture series created in his honor. As several hundred guests arrived, a short film highlighted Dr. Zia's life and career to a new generation of engineers. Preeminent in research, his work continues to be fundamental to modern design and construction techniques in prestressed concrete.

The 2016 lecture "Protecting New Orleans – Gulf West Closure Complex" featured **John Proskovec**, vice president, Kiewit Infrastructure South, and **Walter Baummy**, chief of engineering for the US Army Corps of Engineers in New Orleans. These leaders described the monumental engineering

and project management challenges that came with developing, designing, and building the world's largest pump station and one of the nation's largest navigable floodgates. The project was conceived in the aftermath of Hurricane Katrina, the second costliest natural disaster, and one of the five deadliest hurricanes, in U.S. history.

Mr. Proskovec served as project director for the construction team that had oversight on several major projects in and around New Orleans post Katrina. He worked closely with Walter Baummy, who was with the US Army Corps of Engineers during Katrina and in the years during which the project was developed. The \$1 billion project was designed and constructed in only 20 months. Constructing such a facility in close proximity to the largest volume shipping port in the western



John Proskovec shares aerial views of the West Closure Complex.



Walter Baummy discusses design details of the West Closure Complex.

hemisphere added to the seemingly insurmountable scale of the project.

“Failure is not an option” was the reality and the motto of the project from the beginning. Until the complex was completed, New Orleans, and hundreds of thousands of its residents, remained vulnerable. The project and schedule required unprecedented cooperation and dedication. Early contractor involvement, a highly skilled local workforce, and constant communication at all levels contributed to the success of the project.

During design, more than 62,000 hydrographs were used to account for sea level rise, subsidence, and multiple sources of flooding. The team also relied on redundant systems to protect the city from a flood generated by a storm predicted to occur less than once in a century. The resulting structure is the largest pump station in the world:

Ultimately, this project represents more than a complex engineering challenge; it is a testament to the ingenuity and resiliency of the human spirit.

The Zia Lecture provides funding for the Paul Zia Student Education Endowment. This year awards were presented to CCEE graduate students **Diego Aguirre**, **Payel Chatterjee**, and **Danny Smyl**. Anyone interested in contributing to the Paul Zia Student Education Endowment should contact Lindsay Smith at NC State: lksmith4@ncsu.edu. ■



During program intermission, the Zia Committee presented Graduate Awards to master's students in structural engineering. Pictured here, from left to right, are award recipients Payel Chatterjee and Diego Aguirre with Dr. Paul Zia. Award winner Danny Smyl was unable to attend.

18,300,000 pounds of rebar
121,000 cubic yards of concrete
3,100,000 cubic yards of earth work
Gates weighing 740 tons each
9,000,000 gallons per minute of pump capacity



Cranes finishing work on the Gulf Intracoastal Waterway West Closure Complex, which reduces the flooding risk to communities on the west and south sides of New Orleans. The construction of the pump station and floodgates was the focus of the Zia Lecture in September.

STUDENT NEWS

There are more than a dozen student chapters of professional organizations available for CCEE students. Membership is a way to meet peers, make industry connections, strengthen leadership skills, and engage in community service. Participation offers the chance to attend conferences, compete against peers from other institutions, learn outside of the classroom, and interact with professional engineers.

ASSOCIATION OF GENERAL CONTRACTORS (AGC) AND NATIONAL ASSOCIATION OF HOME BUILDERS (NAHB)

In October, the AGC and NAHB student chapters toured the site of the Novo Nordisk biopharmaceutical facility being built in Clayton, NC by Fluor Construction. The group was hosted by CCEE alumnus **Justin Lamb** (BSCE 2006), the on-site project manager with Fluor. With a budget of \$1.8 billion, this is one of the biggest private investments in the state of North Carolina's history, and one of the largest single biopharmaceutical facility construction projects in the world. Students observed the mass excavation efforts as the guides described the installation of the underground utilities and the setup of support logistics preparing for permanent install activities in 2017. "It was so interesting to see the early stages of a megaproject. Since my research has to do with improving project performance, the site tour was especially beneficial to me in regards to learning how they are measuring progress and managing all the different parts of the project," Ph.D. student **Res Orgut**, president of the Student Chapter of NAHB, reported.



Fluor created a Personal Protective Equipment (PPE) Free Zone on the project that allowed students to observe activities from a safe distance.

In November, a group of students took honors in the Associated Schools of Construction Region 2 competition in Atlanta. The Best Presentation award in the Design-Build category went to NC State's team, which competed against eight other teams. NC State students were praised for their presentation skills, professionalism, and as the only team using the Pull Planning scheduling methodology.



CCEE students at ASC Competition in Atlanta.

AMERICAN CONCRETE INSTITUTE (ACI)

Fourteen ACI student chapter members traveled to Philadelphia for the semi-annual Concrete Convention and Exposition in October 2016. In addition to attending seminars, the team participated in the mortar workability competition. "The goal of the competition is to design a mortar mix that will flow through a mold but will not release a significant amount of excess



Shreepal Patel, left, and Patricia Machado, right, preparing for mortar competition.



ACI student chapter members at convention in Philadelphia.

water after resting,” explained CCEE junior **James Armfield**. “Teams do not know the mold shape in advance which makes practice challenging.” To prepare for the competition, students conducted preliminary trials at the Constructed Facilities Lab. Armfield continued “I came to understand superplasticizers and how they make it possible to reduce the ratio of water to concrete. I had learned of them in class, but I really began to understand them during our preparation at CFL.”

PROFESSIONAL ENGINEERS OF NORTH CAROLINA (PENC)

The PENC student chapter opened the semester with an instructional panel to discuss the process of becoming a Professional Engineer. The panel was made up of representatives from engineering firms throughout the area including Amec Foster Wheeler, ColeJenest & Stone, Kimley-Horn, Stantec and RTI International.

In October, the students joined members from the professional chapter to clean Walnut Creek in Cary. This is an annual event and gives the students perspective on the potential for damage to streams when making infrastructure improvements such as bridges and stormwater outlets.

In November, **Tim Baldwin** with McKim & Creed gave a presentation about the WaterHub project on the Emory University Campus. The Waterhub is an onsite water reclamation facility that converts wastewater into process make-up water in Emory’s steam plant. The project has garnered multiple engineering awards. “One of my takeaways is the importance of design optimization and problem solving,” noted Ph.D. student **Amie McElroy**. “The speaker made it clear that there were design obstacles, such as limited available space and hydraulic factors. Nonetheless, the design team was able to pull together and maximize functionality given the available conditions.”

COASTS, OCEANS, PORTS AND RIVERS INSTITUTE (COPRI)

The newly formed COPRI student chapter will serve as a platform for graduate students interested in coastal and ocean



Members of the recently formed COPRI student group.

engineering and related fields. At a kick-off event, the group organized a screening of “Before the Floods,” a documentary about the impact of climate change. After the screening, the participants, who are mostly graduate students from CCEE and the Department of Marine, Earth and Atmospheric Sciences, shared their thoughts on what appealed to them about the film, and discussed how they can participate collectively and individually in global efforts to address climate change. “We wanted to create an open environment for discussion about the challenges that a changing climate poses for our professional and personal lives, and how through our ingenuity, education and every day practices we can be a part of the solution,” said Ph.D. candidate **Liliana Velasquez**, the COPRI president.

STUDENTS TRAVEL TO NEWPORT NEWS SHIPBUILDING

In November, a group of 12 students traveled to Newport News Shipbuilding (NNS). The site visit was led by **Brandi Smith**, director of construction engineering with NNS. Smith graduated from NC State in 2002 with a B.S. in mechanical engineering. The group observed four nuclear carrier vessels at different stages of their life cycle including construction, commissioning, refueling, and decommissioning. NNS is the sole designer, builder, and re-fueler of U.S. Navy aircraft carriers, and one of two providers of U.S. Navy submarines. “Our group was really impressed with the tour,” says **Roberto Nunez**, NC State Extension Specialist. “It allowed our students to learn about state of the art processes such as additive manufacturing and enhanced virtual reality for design, construction, and maintenance operations.” ■



CCEE students on location at Newport News Shipbuilding.



Resulali Orgut, a fourth year Ph.D. candidate in construction engineering, was awarded second place for presenting his findings regarding improved project management methods for the construction industry.

Three Minute Thesis Competition: four of ten finalists from CCEE

What if you could share the solar energy that you gather with your neighbors instead of being required to sell it back to the grid? What might we learn by studying the gut microbiome of bedbugs, and why has there been a resurgence of bedbugs in recent decades? As populations increase, and clean water becomes even more scarce, how can environmental engineers design systems that serve more people? These are just some of the questions that the audience at this year's Three Minute Thesis (3MT) Competition was asked to ponder.

Ten finalists competed in the university-wide 3MT competition. Of the 10, six were from the College of Engineering and four were students from the Department of Civil, Construction, and Environmental Engineering.

The challenge of the 3MT is to present a compelling overview of research in three minutes or less, using only one slide. The competition encourages Ph.D. students to hone their communication skills, and make their thesis topic accessible and interesting to those not necessarily familiar with their research.

CCEE student **Resulali Orgut** received Second Place for his

presentation entitled "Metrics that Matter." He asked audience members if they'd ever been stuck in traffic because of never-ending highway construction, or if anyone had ever complained about wasted tax dollars on large public projects that never

seem to reach completion? Orgut's research outlines 20 core metrics that can be tracked to significantly reduce cost overruns and schedule delays during construction.

Other CCEE students among the ten finalists included: **Shams Al-Amin**, whose research addresses water management under changing hydro-climatic scenarios. Al-Amin uses simulation and optimization techniques to identify the trade-offs between the long-term sustainability of water supply and improvements in the water supply infrastructure; **Ali Almalki**, who develops models to predict where unpaved shoulders along North Carolina roads will deteriorate so that NCDOT can prioritize road maintenance; and

Atefeh Zamani, whose research investigates natural methods to stabilize sandy soils using compounds produced by bacteria. Unstable sandy soils can lead to foundation failure, especially during earthquakes. ■



Ali Almalki



Shams Al-Amin



Resulali Orgut



Atefeh Zamani

The 3MT originated at the University of Queensland, Australia in 2008. It has since spread around the world and is now held at more than 170 universities in 17 countries. This year marks the second year that NC State University has participated.



Emilee Blount congratulates Brianne Michelle Walker, who graduated Summa Cum Laude with a B.S. in environmental engineering.

Graduation speaker says look for unconventional pathways and be open to change

Graduation speaker and alumna **Emilee P. Blount**, P.E. (BSCE 1985) has an unusually varied career path encompassing civil, construction and environmental engineering. She urged the Fall 2016 graduates to look for unconventional pathways and be open to change.

Recounting her first years in the construction field, Blount said “Your degree will open doors for you but it, in and of itself, will not entitle you to the respect of your peers. You must earn that.” She continued, “Recognize that those tradesmen and women, the plumbers, carpenters, electricians, have been at their crafts for years. You will learn volumes by listening, by watching and by asking relevant questions.”

After several years in construction, Blount moved to a position with the Department of Defense (DOD), where she was responsible for the environmental remediation of fueling sites at military bases throughout the nation. In 2007, she moved to the Pentagon, where she worked on The Pentagon Memorial Project, which encompassed rebuilding the section of the building damaged by the 9/11 incidents of 2001. In 2009, Blount’s responsibilities included supporting energy requirements at 400 DOD sites worldwide.

While with DOD, she was selected for an Executive Leadership Development program created to immerse civilian leaders with their military counterparts. “I spent a week training with the Navy Seals, and after just one grueling day in the frigid waters of the Pacific, I was ready to give up. But I stuck it out, and now I look back with fond memories,” Blount declared. She also climbed obstacle courses with Marine recruits, trained with

Army Ranger sharpshooters, and participated with Air Force Special Forces in a pararescue event.

“What struck me the hardest was sitting inside a tank in Germany with a young 19-year-old soldier from Oklahoma who told me he slept in his tank because it was warmer than his barracks. This is when I understood how the decisions I make as a leader directly impact these brave young men and women.”

Describing her latest job as director of engineering in the Technical and Geospatial Services Unit of the U.S. Forest Service (USFS), she says she was “struck by the vastness of the mission.” Blount explained that with more than 300,000 miles of roads, 6,000 bridges and 40,000 facilities, the responsibilities of engineers with the USFS are diverse.

Blount reminded the graduates that they are lucky to be entering a robust job market. “When I was graduating I recall camping out in hopes of getting one of the 50 interview slots companies were offering. Today, you enter a job market that has a significant shortage of your skill sets. I encourage you to think broadly as to how you can contribute to society and apply your knowledge.” ■

127 Degrees Awarded Fall 2016

Bachelor’s **68** | Master’s **45** | Doctorates **14**

CCEE Alumna Heather Denny Never Stops Asking “What’s Next?”

Alumna Heather Denny is president and CEO of McDonald York Building Company.



Heather Denny enjoys reminiscing about her journey in engineering. She laughs when describing her sixth grade science fair project, which was awarded statewide honors. “Essentially, I built a watershed inside an old aquarium. Of course I didn’t call it that at the time, but that’s what it was. I also used to build bridges out of varying materials to see which one would fail first.” Her propensity toward engineering was almost overshadowed by her love of music and voice lessons. For most of her young life, her mindset was that she would pursue music education as a career. It was an exam in 11th grade that put engineering onto her radar. “I aced an exam on vectors when the rest of the class did not do so well.” Her math teacher suggested a two week nuclear engineering camp at NC State. The nuclear engineering building was across the street from Mann Hall, and one day she wondered in to explore other engineering options. Dr. David Johnston met with her and told her about engineering opportunities in construction. “I knew immediately that’s what I wanted to do.”

Heather Denny’s motto is “What’s next?” As president and CEO of Raleigh-based construction firm McDonald York Building Company, she’s shattered the glass ceiling. Her rapid climb to leadership is a lesson in learning to ask for opportunity.

Denny (BSCE 1995) jokes that she messed up the statistics of the department on the day she graduated. “They liked to be able to say that all the graduates had landed jobs, but I had not accepted a job.” After almost 30 interviews, and several offers, she was conflicted, but eventually accepted an estimator position at McDonald York. She liked the family environment she encountered at her first interview with the president, Jack McDonald. Once hired, she was the youngest employee by 20 years and one of very few females.

In less than a decade, at the age of 30, Denny was tapped to be the chief operating officer. Six years later she was president and CEO. Under her direction, the company has grown from \$20 million to \$55 million in annual revenue.

When Denny looks back she can clearly recount several pivotal moments in her career. After just six months on the job, she made a bold move. Glaxo, a major client, wanted a full-time estimator to be located on their job site. “I had the gumption to walk into Jack McDonald’s office and ask that he give me the chance.” He did.

Denny spent the next eight years on location at the burgeoning pharmaceutical campus, moving from estimating

and budgeting, to cost control, and then to project management. During this time she learned the value of asking for opportunity. Not just for herself, but for the company.

Even as a student at NC State, Denny sought out opportunities. Eventually she was president of the student chapter of Associated General Contractors and the National Association of Home Builders. Denny claims she’s really an introvert operating as an extrovert. “I used to go to events and stand outside the door until I got my nerve to go in. I would tell myself that if I could just hand out two business cards, I could leave.”

Now, it’s not unusual for Denny’s schedule to be full five or six nights a week, often as the featured speaker. Beyond her commitment to McDonald York, she’s active in numerous organizations including the International Society for Pharmaceutical Engineering and the Triangle Area Chapter of the American Red Cross. She is a past chair and currently a member of the CCEE Department Advisory Board. “I’m active because the college has given me so much,” she proclaims. For some years she was the board liaison to the department’s student organizations, which kept her engaged with today’s students. Of that role, she says “You’re right in there with the future leaders. I love keeping them up-to-date about the profession, but it was also a great recruiting opportunity for us.”

There’s that word again. Opportunity. She never stops looking for it. Never stops asking “What’s next?” ■

ALUMNI NEWS

GREG S. BRIGGS (MSCE 1990), principal and office director at Thornton Tomasetti, Inc., established a new office in Seattle, Washington for the firm. He is married with a son aged 12.

MICHAEL E. CROPPER (BSCE 2004), senior project engineer at Thornton Tomasetti, Inc., rejoined the Washington, D.C. office after spending four years in the company's Abu Dhabi, United Arab Emirates office.

CHRISTOPHER R. HART (BSCE 2005; MSCE and Ph.D. University of Illinois), project engineer at Thornton Tomasetti, is designing and constructing a research laboratory for Northwestern University in downtown Chicago. He is responsible for the design and analysis of the lateral system and most of the concrete structural elements.

EDGAR LEVY (BSCE CEM 1996) is celebrating 10 years with NC State Facilities as a project manager this spring. He also invites fellow alumni and friends to follow his part-time adventure "These Old Guitars" on Facebook and Instagram, as well as in the blogosphere at theseoldguitars.blogspot.com.



Hanna K. Rodriguez Morales

HANNA K. RODRÍGUEZ MORALES, P.E. (BSENE 2008) is a lead engineering consultant at Fernando L. Rodriguez, PE & Associates, a consulting firm with more than 35 years of experience in Puerto Rico and the Caribbean region. She serves as a representative of the Solid Waste

Association of North America (SWANA) Caribbean-PR Chapter. Morales also teaches in the Environmental Engineering Technology Program at Dewey University and will soon begin her journey as an adjunct professor at the Polytechnic University of Puerto Rico. She earned master's degrees in waste treatment and management from the Universidad Autonoma de Madrid (2010), and engineering management from the Polytechnic University of Puerto Rico (2014).



Charlie D. Townsend

CHARLIE D. TOWNSEND (BSCE 2015), staff engineer with WithersRavenel in Raleigh, currently serves on the City of Raleigh Parks, Recreation, and Greenway Advisory Board. This past spring he graduated from the bipartisan North Carolina Institute of Political Leadership and was selected by his classmates

to deliver the keynote address. Recently, he was selected to serve as a finalist judge for the upcoming North Carolina Region of the Future Cities Competition, hosted by NC State and the local engineering community.



Dr. Xiaoming Wang

XIAOMING WANG (Ph.D., 2015), is an assistant professor of environmental engineering on the Faculty of Urban Construction and Environmental Engineering at Chongqing University in China. Dr. Wang is leading development of a solid waste management system for Chongqing Municipality, which has

a population of approximately 30 million people. He currently serves as an editorial board member of *Scientific Reports*, a journal from the publishers of *Nature*.



Lauren Wellborn collects sediment samples.

LAUREN S. WELLBORN, P.E. (BSENE 2006, MSENE, 2009) is a project engineer at Geosyntec Consultants, an environmental consulting firm specializing in remediation. She works primarily on contaminated sediments projects and has developed innovative sampling methods for

investigation and remediation of two major Superfund sites in the New York City area.

ELIZA JANE WHITMAN (BSCE 1989, MCE 1991) started her own company, EW Consulting, Inc., in 2012 after working for large civil engineering companies on projects in the U.S. as well as Europe and the Middle East. Her current focus is planning for the City of LA's water needs over the next 25 years (One Water LA 2040), including assisting the regional transportation authority on resilient and sustainable construction approaches. She is the president of the non-profit Efficient Toilets For All. Whitman is married and the mother of three teenagers.

JORGE QUINTAL (MCE 1991) is the associate vice chancellor for facilities at UNC-Greensboro. He received the 2016 Frank B. Turner award presented by AIA North Carolina, the NC Chapter of the American Society of Landscape Architects, the Consulting Engineers Council of NC, and the Professional Engineers Council of North Carolina at the annual State Construction Conference. The award recognizes a state employee who has made an outstanding professional contribution to the built environment, as exemplified by the professional life of Frank B. Turner.

Corporate partners support development of new senior design course

The department has a new course offering, CE 450, a comprehensive, multi-disciplinary, project-based senior design class. It was created in response to feedback from the Departmental Advisory Board and other industry partners who suggested that CCEE graduates could be better prepared for entering the workforce if they had experience with multi-disciplinary design challenges. "Some of our peer institutions offer tracks or specializations in what is commonly referred to as 'land development,'" Dr. **Rudi Seracino**, chair of the Undergraduate Programs Committee, explains. "We realized that we were pushing our students into a single domain, and that by combining the skill sets from within our course offerings, we would better serve our students." In fact, CE 450 combines the previous senior design classes, which alumni will remember as CE 400 (Transportation), CE 440 (Geotechnical), and CE 480 (Water Resources).

CE 450 is taught by **Russell Briggs**, P.E., a principal in B&F Consulting. Briggs, who helped develop the new course, coordinates with local consulting firms to create real-world challenges for the students. Recent semesters have used a portion of the 7,000-acre proposed Chatham Park development as a basis for the design project. Kimley-Horn provided the topographic, planimetric and boundary data. The students produced plans and supporting documentation for about ½ mile

of a 4-lane divided road and a site plan for an office building. Student designs included traffic analysis, comprehensive grading and storm drainage plans, stormwater control measures, waterline design, earthwork analysis, a sanitary sewer lift station, a parking lot design accommodating fire apparatus access, and a sediment and erosion control plan.

"The students learned how to push the project to the finish line, improvise in the face of adversity, work better under pressure – all skills that our clients depend on every single day." Mike Roselli, P.E.

Briggs says that a highlight for students is their presentation to external judges who are practicing engineers and usually Department alumni. "This is a great way to give students the experience we expect them to have out of school," noted a recent judge, **Mike Roselli**, PE with Bohler Engineering. "The students responded well to industry professionals who were ruthlessly questioning methods, assumptions, and budgets. That's exactly what we're looking for."

The following firms have played a significant role in developing and sponsoring CE 450: Stantec, WithersRavenel, McKim & Creed, Dewberry, McAdams and Kimley-Horn. ■



Aerial view of Centennial Campus showing where EB Oval will be built.

Planning for EB Oval: three and a half years and counting to the realization of NC State's vision for engineering education in the 21st century

EB Oval is the fourth engineering building on the Centennial Campus and will be built next to the Hunt Library. The building will serve as the home for CCEE, the Edward P. Fitts Department of Industrial & Systems Engineering and the Engineering Dean's office. CCEE is to occupy about 58,000 net square feet, which will allow us to bring much of the department together in one place. We now use space in Mann, Burlington, Daniels, and Broughton on North Campus in addition to the Constructed Facilities Laboratory (CFL) that is already on Centennial Campus.

EB Oval will unite the department and promote more collaborative opportunities for research and education. The building will provide collaborative workspace for students and faculty and will include a dedicated area for student groups. Engineering on display is a major theme and visitors will learn about the mission of each research laboratory. Many of our faculty are involved in reviewing plans and specifications for new labs and classrooms. It is challenging but exciting. Beyond the improvements and expansion to all of our space, we're mindful of ensuring that we meet the needs of many future generations of aspiring engineers.

The Connect NC bond provided approximately half of the 154 million dollars required for construction. For the first time in the history of NC State and the College of Engineering, we are

Here is where we are so far

Soil testing was completed in December 2016
 Schematic design was completed in February 2017
 Building design will be completed in Summer 2017
 Groundbreaking planned for Spring 2018
 Doors open for the Fall 2020 semester

expected to raise a substantial portion of the building's cost. Of the 60 million dollars to be raised, more than 23 million has been committed to date.

We need financial partners to achieve our goal and have created many ways for alumni and friends to participate. The Cornerstone Society offers naming opportunities for all of our classrooms, offices, student group spaces and research laboratories. In addition, Dean Martin-Vega kicked off the Dean's EB Oval Club in January. Gifts to the Oval project may be pledged over a five-year period. If you are interested in participating, please contact Lora Bremer at **919.513.0983** or **lfbremer@ncsu.edu**.

EB Oval is a truly exciting and forward-looking building with state-of-the-art laboratories and classrooms. It is the future of engineering education. ■

Recognizing our corporate sponsors

There are many ways to support the department including annual contributions, or an endowment that provides ongoing funding for department initiatives. Current endowments include scholarships and awards at both the graduate and undergraduate level, support our department-wide advancement fund, and establish professorships that enable us to provide ongoing funding to some of our very best faculty who are pursuing promising new research.

Our corporate sponsors also provide funds for specific research areas, again enabling a faculty member to pursue a new research idea by funding a graduate research assistant. Sponsorships are also available for this newsletter, the welcome back ice cream social and our graduate symposia. These symposia provide an opportunity for students to prepare a poster to describe their research and make a presentation to the local engineering community. Our corporate supporters have also sponsored the activities of our student groups (see more on page 14), donated their time and materials, and made possible our new undergraduate track in sustainable infrastructure. In fact, many on the list have supported multiple activities in the department.

The Firm of the Month program recognizes corporate partners who have made an ongoing commitment to the department. It allows us to thank and promote our partners while educating our students about current engineering practice. Firms prepare a series of slides for our monitor in the lobby and also display posters throughout Mann Hall to highlight notable projects. Firm of the Month 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. Our most recent Firms of the Month include Brasfield & Gorrie General Contractors, Kimley-Horn, and WithersRavenel.



Founded in 1964, Brasfield & Gorrie is one of the nation's largest privately held construction firms, providing general contracting, design-build, and construction management services for a wide variety of markets. We are skilled in construction best practices, including virtual design and construction, integrated

project delivery, and lean construction. We are best known for our preconstruction and self-perform expertise, as well as exceptional client service. Brasfield & Gorrie has 12 offices and approximately 2,600 employees throughout the Southeast. Engineering News-Record ranked Brasfield & Gorrie 29th among the nation's "Top 400 Contractors" for 2016.

For nearly two decades, Brasfield & Gorrie has been a trusted partner in the local landscape, constructing new office space for emerging businesses, multifamily buildings for a growing community, and innovative healthcare facilities housing the latest technologies. With 37 NC State graduates, our local team is proud to support the Wolfpack.



Founded by three NC State civil engineering alumni in a downtown Raleigh apartment 50 years ago, Kimley-Horn now has 2,800 employees in more than 75 offices nationwide. More than 100 NC State graduates are now accomplished members of our team, working on notable projects such as the Wake County Transit Plan, the Atlanta Braves baseball stadium, the San Diego International Airport, Houston's METRORail Downtown Light Rail Transit, and Albright Way Office Park—Netflix's corporate headquarters.

Always keeping in mind our company purpose—to provide an environment for our people to flourish—Kimley-Horn gives our college graduates career-accelerating opportunities to pursue diverse, challenging projects while finding their passion. We've seen teammates begin their careers in transportation and find their calling managing bike/pedestrian projects. We've seen planners who now oversee urban revitalization efforts. As new professionals, our engineers apply classroom theory to real-life situations while supported and coached by senior staff to become leading professionals in their field. Recognizing the importance of a strong educational background, NC State alumni at Kimley-Horn enjoy being back on campus with our industry's incoming talent. Taking part in the ASCE student chapter, participating in the Steel Bridge Competition, and serving on the CCEE Advisory Board allow us to reflect on our time as college students and remember the significance of a solid education.



WithersRavenel
Our People. Your Success.

Founded in 1983 by two NC State graduates, Tony Withers and Sam Ravenel, we have transitioned to the next generation of leaders with NC State alums Jim Canfield as president and Chan Bryant as senior vice president of operations. We are an ESOP (Employee Stock Ownership Plan) company with each employee sharing in ownership. Our headquarters are in Cary, North Carolina with additional offices in downtown Raleigh, Greensboro,

Wilmington, and Pittsboro. Our Pittsboro office was recently established in the heart of the exciting Chatham Park project. The 7,100-acre Chatham Park is expected to create more than 20,000 residential units and over 20 million square feet of commercial and office space over the next 20 years.

WithersRavenel is a trusted partner to our clients in both the private and public sectors. Our Core Values are Integrity, Respect, Quality, Community, and Sustainability; and our pledge to our clients is "Our People. Your Success." We are proud to have a deeply rooted heritage in NC State University and are continually seeking aspiring professionals to join our team. ■

2016 Corporate Donors

The firms listed here have provided endowments or made contributions during the 2016 calendar year.

ACI Carolina Chapter	CT Wilson Construction	JE Dunn	Scotia Construction Inc.
Advance Concrete	Delta Airport Consultants	Kimley-Horn & Associates	SCS Engineers, PC
AECOM	Dewberry	LHC Structural Engineers	SE Chapter NC Society of Surveyors
American Institute of Steel Construction	DPR Construction	Landmark Builders	Shelco, LLC
American International Group	Duke University	Logan Structural Research Foundation	Simpson Engineers & Associates
American International Group (Jenkins)	ECS Carolinas, LLP	Lysaght & Associates	Skanska USA Building
American Society of Civil Engineers	Engineered Concepts Consulting	McAdams Company	SKA Consulting Engineers, Inc.
American Society of Civil Engineers Eastern Branch	Environmental Research & Education Foundation	McDonald York Building Company	Smith Gardner, Inc.
Andrew Consulting Engineers	Eskridge & Long	McKim & Creed	Stantec
ASCE NC Section	Exxon Mobil Corporation	Metromont Corporation	Steel Technology, Inc.
Ashland Construction	First Touch Disposables of NC Inc.	MI Engineering PLLC	SteelFab
AWMA RTP Chapter	Fluor Enterprises, Inc.	Murphy & Coates LLC	SteelFab of Virginia
Balfour Beatty Construction	Frank L. Blum	Meyers Professional Insulation Inc.	Stewart Engineering, Inc.
Benham, a Haskell Company	Freese and Nichols, Inc.	NC Licensing Board for General Contractors	Stroud Pence & Associates
Bernhard MCC, LLC	Geosyntec Consultants	Newport News Shipbuilding	Structural Engineers Associates of NC
Bordeaux Construction Company, Inc.	GlaxoSmithKline (Stone)	Norfolk Southern Foundation	T.A. Loving
Brassfield & Gorrie General Contractors	Guy M. Turner	Oldcastle Precast	Terracon
CALYX Engineers + Consultants	Harris Rebar North Carolina Inc	Pluris, LLC	Timmons Group
Carolinas Chapter of American Concrete Institute	Hazen and Sawyer	Pope Custom Homes, Inc.	Tindall Corporation
Construction Financial Management Association of the Triangle	HDR Engineering	Professional Construction Estimators Association	Trisure Corporation
CDM Smith	Hilti	Ramey Kemp & Associates	Virginia Carolinas Structural Steel Fabricators Assn. Inc.
Clancy and Theys	Honeywell Aerospace	RS&H, Inc.	Warco Construction, Inc.
Clearscapes, PA	InSinkErator Division	Rodgers Builders	Wetherill Engineering
Cothran Harris Architecture	I L Long Construction	S&ME	WithersRavenel, Inc.
Crowder Construction Company, Inc.	IQ Contracting, LLC	Santec Consulting, Inc.	WSP/Parsons Brinckerhoff, Inc.
	IQ Engineering & Consulting, PLLC	SASHTO	
	J. A. Jones Construction	Schnabel Engineering	
	James R Burris Construction		

This list includes all companies that have made a contribution in the 2016 calendar year. We plan to include this list in every issue. If your company was inadvertently omitted, then please accept our apologies and contact Lindsay Smith at lksmith4@ncsu.edu.

Department Advisory Board

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

Suzanne M. Beckstoffer

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Heather Denny, Past Chair

BSCEC 1995

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Joe Hines

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Timmons Engineers

Jonathan Holtvedt

BSCE 2015

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Glenda Gibson

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John Jenkins,

Chair

BSCE 1990

Stewart Engineering

John Lucey

McKim & Creed

Dan Pleasant

BSCE 1972, MCE 1973

Dewberry

Bill Pope

BSCEC 1983

Pope Custom Homes

Richard R. Rohrbaugh,

Secretary

BSCE 1981

Kimley-Horn & Associates Inc

David B. Simpson

BSCE 1981

Simpson Engineers & Associates

Stacey Smith,

Vice Chair/Nominating Chair

BSCEC 1992, MCE 2004

Smith Gardner, Inc.

Alan L. Stone

BSCE 1987, MSCE 1989

Hazen and Sawyer

Jim Trogdon

BSCEC 1984, MSCE 1990

NC Department of Transportation

Hans G. Warren, Jr.

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Warco Construction, Inc.

Mick Wayts

Freese and Nichols, Inc.

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 Julie Dixon at jwdixon2@ncsu.edu:

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