

NC STATE

Engineering

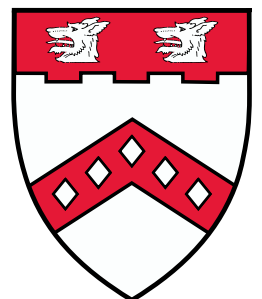
CCEE NEWS

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



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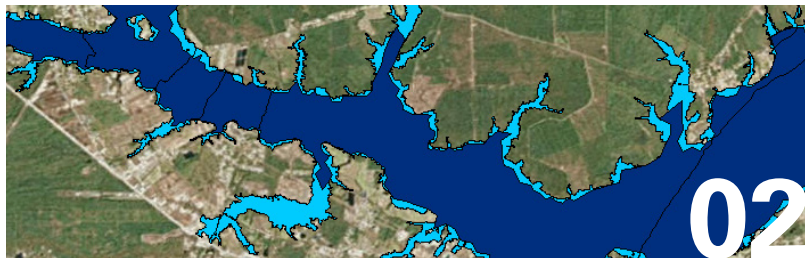
CCEE News is published by the Department of Civil, Construction, and Environmental Engineering to share information among faculty, staff, students, alumni and friends of the Department.



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The Research Internship Summer Experience program provides undergraduate students from NC State and around the globe a chance to do graduate research



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ABOUT THE COVER

Members of the NC State Engineers Without Borders team designed and oversaw the construction of a well that will provide clean water to 700 children and teachers at a school in Sierra Leone.

LETTER FROM THE DEPARTMENT HEAD MORTON A. BARLAZ



Dr. Morton Barlaz congratulates Jennifer Vaughn, who graduated in May 2017 with a B.S. in civil engineering and is currently pursuing her Ph.D. in our department with a focus on geotechnical engineering.

Welcome to the Fall 2017 newsletter. This is an exciting time to update our friends on activity in the department. We welcomed 192 new undergraduates into our degree programs in civil, construction, and environmental engineering this year, as well as over 100 new graduate students. We started the semester with our traditional welcome back ice cream for all of our students. The event provided an opportunity for new students to learn about our student organizations and other programs that make NC State a great university.

We continue to work on the design of our new home in EB-Oval. Faculty are currently working with the architects to develop and review construction drawings, with groundbreaking scheduled for Spring 2018. Please see the article on page 22 for more information.

I am pleased to welcome three faculty to the department. Dr. **Jeremiah Johnson** joins us after completing his Ph.D. at Yale University and six years in a faculty position at the University of Michigan. His expertise is in energy systems analysis, environmental impacts of the power system and industrial ecology. Dr. **Jason Patrick** joins us after completing his Ph.D. and a postdoctoral fellowship at the University of Illinois. His research interests are in multifunctional fiber-reinforced composites and bioinspired structural materials. Dr. **Shane Underwood**

completed his Ph.D. in our department and has been on the faculty at Arizona State University for five years. His expertise is in the development of constitutive and performance models for infrastructure materials and infrastructure resilience. Welcome back!

I am proud of the accomplishments of our student groups. Our steel bridge team competed at the national level in Oregon this past June; students from our ACI chapter participated in a fiber reinforced composites competition; and students in our Earthquake Engineering Research Institute chapter participated in a seismic design competition. Our Engineers Without Borders chapter is working on projects to provide water and electricity in Sierra Leone and Guatemala. There is more information in the Student Chapters section.

This newsletter features research briefs from selected faculty, highlighting contributions to civil infrastructure including research on ocean energy, non-destructive site assessment, forecasting of hurricane-induced flooding, and air emissions from hybrid electric vehicles. These briefs are just a few examples of how civil, construction, and environmental engineers are working to improve public welfare and environmental sustainability.

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. 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 continue, not to mention enhance, our programs. 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. Please let me know if you are in the area and would like to tour our facilities.

Thank you,

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

Morton A. Barlaz
Distinguished University Professor
CCEE Department Head

CCEE AT NC STATE SUSTAINABLE INFRASTRUCTURE FOR SOCIETY

- \$19.9 million** in research expenditures
- 173** ongoing research projects
- 12** winners of CAREER and other NSF young faculty awards
- 49** faculty members
- 338** graduate students
- 762** undergraduate students



RESEARCH UPDATES



Portable emissions measurement system (PEMS) installed on test vehicle. Here we see the exhaust sample probe inserted into the tailpipe. The PEMS unit located in the backseat records the data in real time as the vehicle is driven.

Do hybrid cars cut down on air pollution?

There are plenty of studies, both laboratory and real-world, that demonstrate that hybrid electric vehicles (HEVs) outperform conventional vehicles in fuel efficiency. But there are few studies of how real-world emission rates for HEVs compare to conventional vehicles in terms of emissions of carbon dioxide (CO₂) and other noxious tailpipe gases that affect air quality.

Dr. **Christopher Frey**, Glenn E. Futrell Distinguished University Professor, and a team of researchers from CCEE collaborated with a team from the Instituto Superior Tecnico in Lisbon, Portugal, to analyze a range of vehicles including HEVs, conventional gasoline vehicles, conventional diesel vehicles, and flex fuel vehicles that can burn either gasoline or ethanol. The study also included factors related to driving, including driver behavior and driving conditions like road grade. Lisbon is more compact but more hilly than Raleigh, meaning that the vehicles tested in Lisbon spent more time at higher power because they had to climb hills. "We suspected that hybrids are more sensitive to road grades than traditional cars when going uphill," Frey explains.

Using portable emissions measurement systems,

measurements were made for 39 vehicles, including 13 HEVs, ranging from small cars common in Europe to large sport utility vehicles common in the U.S. It is the most extensive evaluation of the real world emissions of HEVs to date. The study confirmed that HEV emissions were more sensitive to

road grade than conventional vehicles.

For example, HEV fuel energy use and tailpipe emissions were much higher when climbing than descending a hill. However, HEVs were consistently lower emitting than conventional vehicles by 30 – 70 percent depending on the pollutant measured.

There are implications from the findings for policy makers since it is clear that HEV emissions over a road network

are more variable than for conventional vehicles. Additionally, the findings could have consequences for automobile manufacturers who must meet fuel economy standards. "By 2025, manufacturers must offer a fleet that has an overall 54.5 miles per gallon fuel efficiency," Frey said. "While they may still manufacture and sell large SUVs that require more fuel, they may increase their offerings of hybrids, or even make hybrids more affordable." ■

"There are a lot of assumptions about what the real-world emissions of hybrids are in comparison to conventional vehicles. A lot of assumptions, but not a lot of data."

– Dr. Christopher Frey

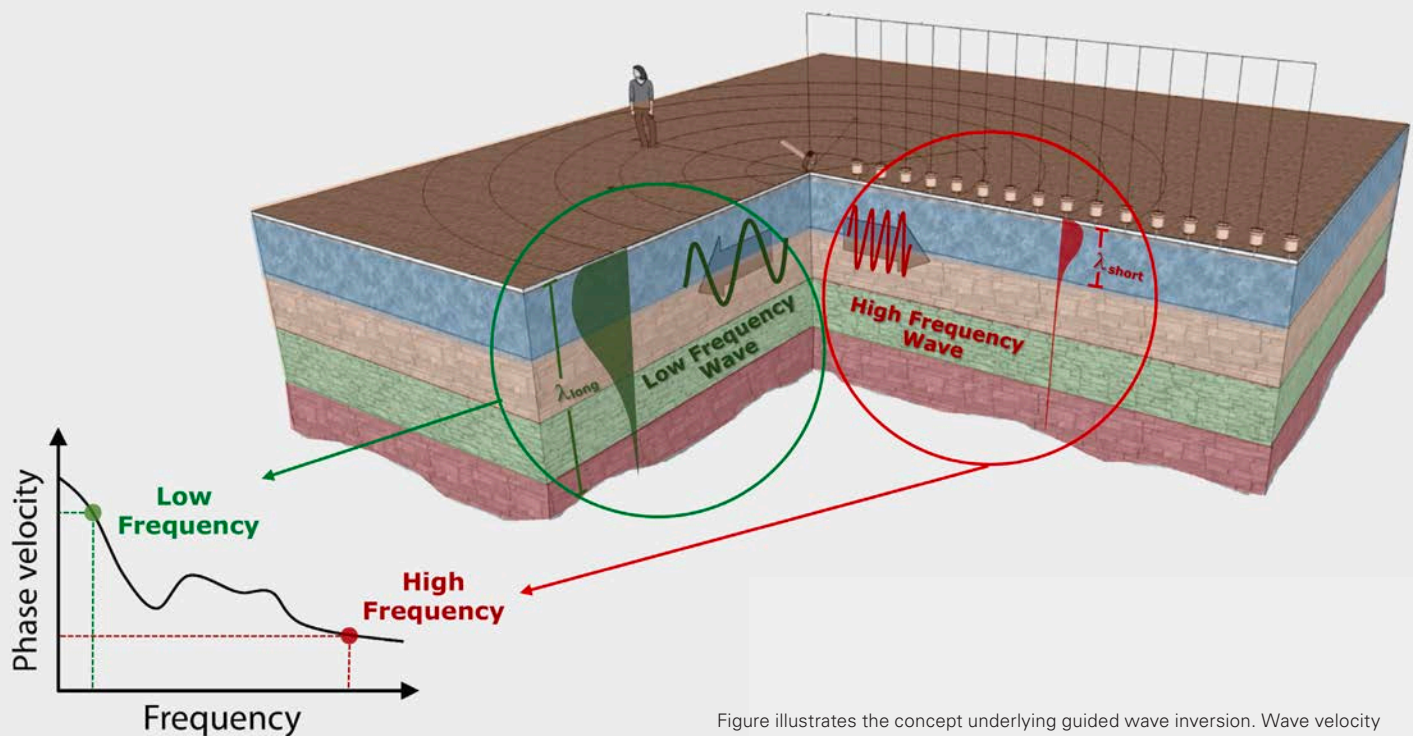


Figure illustrates the concept underlying guided wave inversion. Wave velocity in layered media depends on the wavelength/frequency and is affected by the material properties. The variation in wave velocity with respect to frequency is used to estimate the unknown material properties.

Can soundwaves take the place of destructive drilling?

What if instead of having to drill down through the earth to obtain a core soil sample, you could guide sound waves into the ground and measure their propagation and dispersion, and from that develop a near instantaneous understanding of the material properties of the layered soil? Funded by the National Science Foundation, Drs. **Murthy Guddati** and **Ali Vaziri Astaneh** (Ph.D. 2016) have developed a technique utilizing guided wave inversion that does just that. It can be used to characterize layered systems present in pavement, pipes, soils, airplane wings, and even human arteries.

"This technique is non-destructive, it's faster, and it's more efficient," says Guddati. "It has applications in everything from road construction and maintenance, to earthquake engineering, to biomedical imaging, where it can be used to measure the stiffness of arteries." Other applications include non-destructive evaluation of laminated layers on planes or rockets, or the thin films on substrates used in the electronics industry.

The technique is based on using computational mathematics to measure the dispersion of guided waves that propagate outward when a material that is layered is struck with an instrument, such as a hammer – or, in the case of biomedical applications, when ultrasound waves are guided into the human body.

The initial driving application for the technique is in geotechnical site characterization, which is important for determination of seismic loads on buildings. "Using existing data, we created dispersion curves, and were able to accurately estimate physical properties," Guddati explained. "The success in the geophysical arena is a clear indication that the technique can be extended to testing the large pavement infrastructure of our nation."

In collaboration with researchers from the Mayo Clinic and Duke University, Guddati is also applying the technique to estimate the stiffness of carotid arteries. Being able to estimate arterial stiffness in real time could have significant benefit in clinical settings because it is an early indicator of many cardiovascular diseases. ■

Every infrastructure project – including buildings, roadways, dams and bridges – begins with engineers characterizing the underlying soil. The depth of drilling depends on the size of the infrastructure. For roadways, it could be 10 to 20 feet deep, but dams or very large structures may call for drilling hundreds of feet below the surface.

A saltwater recipe for making micropiles supporting offshore energy devices



Ph.D. student Mohammed Ahsanuzzaman records the displacement of the top of the micropile at different loading conditions, as well as the strains at different depths of the micropile.



The ocean is a new frontier of renewable energy. Can a saltwater grout recipe be used to create strong underwater foundations for new energy generating equipment?

North Carolina's Renewable Energy Efficiency Standards require that private electric utilities in NC generate 12.5 percent of their retail sales from renewable energy by 2021.

There is great potential for harnessing the wind, waves, and offshore currents along North Carolina's coast for renewable energy. Most of us are familiar with wind turbines but there are many other instruments and technologies being developed to convert the power of waves and ocean currents into energy. Collectively they are referred to as Marine Hydrokinetic Devices or MHKs. Deploying these ocean-based renewable energy generation devices requires the installation of cost-effective anchoring systems to hold them to the sea floor.

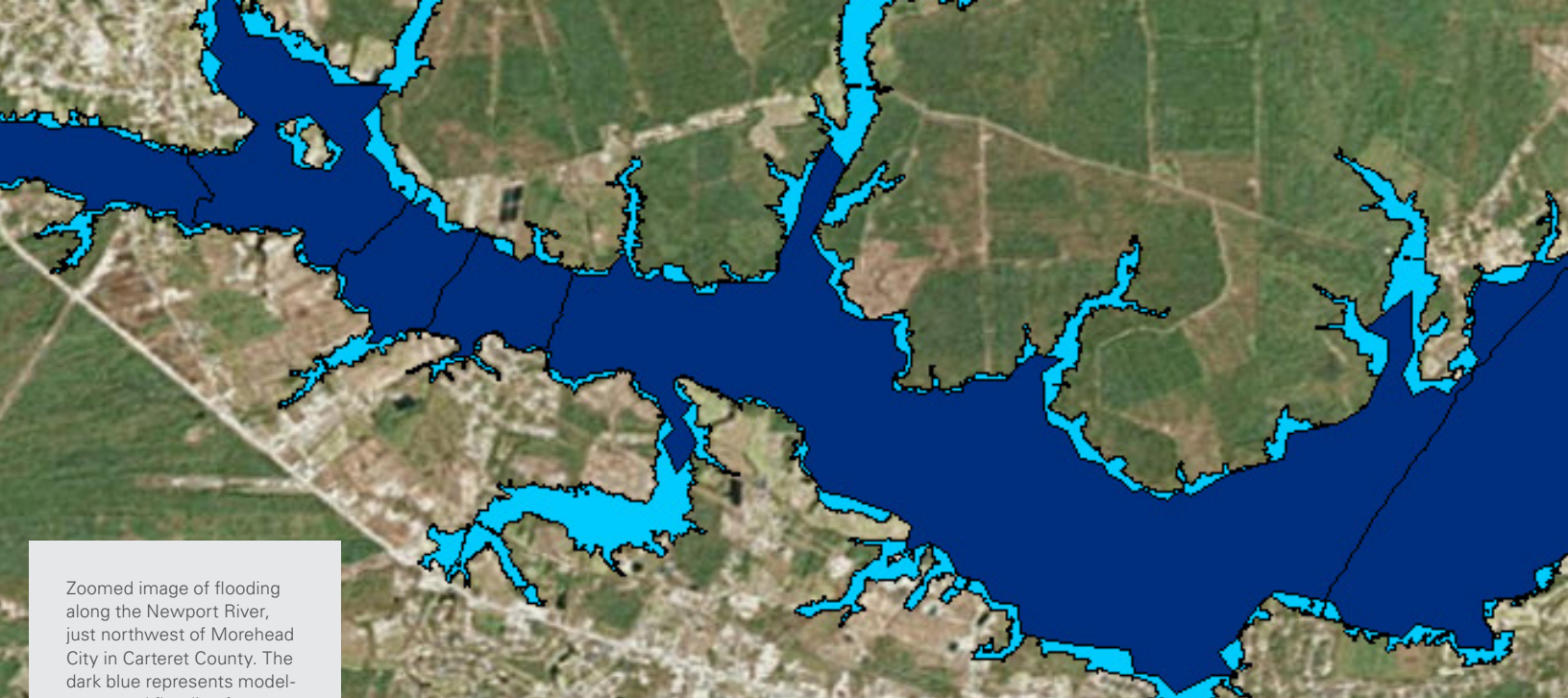
Unlike large offshore platforms used by the oil and gas industry, these newer technologies are typically smaller and require less foundational strength to hold them in place; yet the anchoring and mooring costs can be as much as 25 – 40 percent of the total cost. Small diameter foundational columns underneath the soil or seafloor are known as micropiles, and they have potential as a cost-effective alternative for anchoring MHKs.

A team led by CCEE professors Drs. **Mohammed Gabr**, **Roy Borden** and **Mohammad Pour-Ghaz** is studying the best construction approach and the optimum size of micropiles for supporting MHKs. The team examined installation methods as well as the long-term effects of seawater on the cement grout for the formation of micropiles.

Field tests were conducted 25 yards from the shoreline of the Roanoke Sound near the University of North Carolina's Coastal Studies Institute (CSI) in Manteo, NC. Since it is known that seawater has an effect on cement grout, working near the Sound provided a similar environment to what would be present in ocean installations.

Initial findings indicate that a seawater mixture combined with cured cement grout performed well. The research team also showed that they could improve the strength of the micropile system by reducing the rate at which grout is pumped into the ground. "Long term performance is yet to be investigated, but these findings could lead to substantial cost savings, and ease of construction as we avoid the need to haul freshwater miles offshore," Gabr said

The research was funded by CSI's Renewable Ocean Energy Program with contributions from Subsurface Construction Company. ■



Zoomed image of flooding along the Newport River, just northwest of Morehead City in Carteret County. The dark blue represents model-computed flooding for Matthew Advisory 27, while the light blue represents the flooding boundary produced by the enhanced resolution.

Connecting forecasts of hurricane flooding with NC emergency managers

North Carolinians, especially those living near the coast, know that hurricane season brings the potential for flooding, erosion, property damage, and loss of life. CCEE professor Dr. **Casey Dietrich** is working closely with North Carolina Emergency Management (NCEM) to provide forecasts of coastal flooding using computational storm surge models that he develops. The forecasts are used to aid decision makers about evacuations and resource deployment, including where to focus recovery efforts after the storm.

Dietrich is a Data Fellow at the National Consortium for Data Science (NCDS), which is a collaboration involving the State of North Carolina, the University of North Carolina at Chapel Hill (UNC-CH), Duke University, and NC State University. With partners at the Renaissance Computing Institute (RENCI) and Seahorse Coastal Consulting, Dietrich is developing methods to visualize forecasts of coastal flooding, and to connect them with datasets for roadways and infrastructure.

"There is a need for more-detailed models that will help predict effects of a storm further inland," Dietrich said. Existing flood guidance is limited by the resolution of the numerical models, which compute water levels at every 200 to 500 feet along a state coastline. The goal now is to develop techniques to extend that guidance to finer resolution and further inland in North Carolina. "NC Emergency Management has invested in surveys of the coastal areas that are accurate down to very small scales. They know where all the buildings are, and

how high the dunes are. In the past, we were not able to model at that level of detail, but we are now working to create models that can extrapolate our forecasts. Instead of providing information at every 500 feet, our guidance will now show flooding down to every 50 feet," Dietrich relays. "We can now see each street in a coastal community," he continues.

Dietrich and MS student Nelson Tull have integrated the new guidance into the forecast workflow for the 2017 hurricane season, so the high-resolution flood forecasts will be available to NCEM.

Dietrich's storm surge models have been used by the U.S. Army Corps of Engineers, the Federal Emergency Management Agency, and the Department of Homeland Security, as well as NC Emergency Management. ■

In October of 2016, Hurricane Matthew hit the coast of North Carolina causing 22 deaths, and \$1.5 billion in damage to 100,000 homes, businesses and government buildings. Dietrich's storm surge models were used to create flooding guidance for 20 advisories over a seven-day period. Dietrich continues to work closely with NC Emergency Management during the 2017 hurricane season.

NEW RESEARCH PROJECTS

In the first part of 2017, CCEE Faculty contributed to efforts that resulted in over \$5 Million dollars of new research support from state, federal, and private sources. This support will enable 17 CCEE faculty members and their teams of graduate, undergraduate and postdoctoral researchers to address a diverse range of problems to help improve infrastructure and the environment in North Carolina and across the US and globe.

Dr. **EMILY BERGLUND** will work with collaborators at the University of Texas, and the Urban Watersheds Research Institute based in Colorado, to establish the Center for Infrastructure Modeling and Management. The center is funded by the Environmental Protection Agency (EPA) to preserve, promote and extend EPA software applications and tools for assessing watershed hydrology and flows in pipe networks. Dr. Berglund will provide guidance on advanced modeling tools, building on existing software applications to improve security of municipal water infrastructure systems.

Dr. **JOE DECAROLIS** is part of an NC State team led by Brendan O'Connor (Mechanical and Aerospace Engineering) that received NSF funding to develop a Solar Powered Integrated Greenhouse (SPRING) system. The SPRING system will include solar cells on a greenhouse roof that utilizes sunlight at wavelengths unusable by plants. The solar cells generate electricity and allow the remaining sunlight to pass through to the plants.

Dr. **CASEY DIETRICH** and collaborators at the University of Notre Dame received funding from the National Science Foundation (NSF) to develop, test, and implement methods to embed fine-scale information into models used to predict storm surge using high-resolution elevation maps. The resulting models will improve predictions of water levels and currents during hurricanes and provide better information to policy makers, emergency management personnel, and coastal residents.

Dr. **ANDREW GRIESHOP** received funding from the United Nations (UN) Office for Project Services to conduct field measurements of air pollutant emissions from advanced, wood-pellet-fueled cookstoves in Rwanda. Grieshop and his team will work with Inyenyeri, a Rwandan social enterprise selling the stoves and pellets, to measure particulate matter, black carbon and other pollutants emitted during in-home use by households.

Dr. **MERVYN KOWALSKY** received funding from the National Cooperative Highway Research Program to work with the firm Modjeski and Masters on the development of new seismic design procedures for bridges to be implemented into the bridge seismic code. The new methods will directly consider bridge performance during earthquakes. The new methods should result in better informed engineers who will be empowered with tools to achieve more efficient designs.

Dr. **CASSIE CASTORENA** received funding from NCDOT for two projects. In the first, NC State researchers will work with NCDOT to implement a test to improve the quality control of asphalt emulsion placement, called the Tack Lifter. The Tack Lifter enables the measurement of the amount of asphalt emulsion applied to a roadway at specific locations. In the second project, she will investigate ways to improve the performance of chip seals applied to aged pavements. Chip seals are cost-effective pavement surface treatments but can fail when applied to aged pavements.



Spraying a tack coat on a North Carolina roadway. Image by R. Kim.

Dr. **RICHARD KIM** has been awarded funding from the NCDOT to develop a comprehensive tack coat quality control (QC) program to mitigate debonding distress in asphalt pavements. The implementation of an effective tack coat QC program will lead to improved monitoring of pavement construction and verification of pavement strength, leading to long-term savings in pavement maintenance and rehabilitation costs.

Dr. **H. CHRISTOPHER FREY** received funding from NCDOT to measure and model the activity, energy use, and emissions of passenger trains that operate between Raleigh and Charlotte. Dr. Frey's team will quantify the effects of alternative fuels and emission control technologies. They will use these data to quantify energy use and emissions, and identify opportunities for improving energy efficiency and reducing emissions.

Dr. **BRINA MONTOKA** received funding from NCDOT for research on the use of biologically induced cementation to reduce erosion that damages coastal highways. The project will develop a treatment process to be implemented within a NCDOT right-of-way. Biologically induced cementation is a novel method to reduce erosion, and the treated soil will be monitored in the field over an extended period to assess its long-term performance.

Dr. **WILLIAM RASDORF** received funding from NCDOT to assess roadway sign replacement strategies and to benchmark their costs so that sign performance is maintained or enhanced while lowering costs. The project seeks a lower-cost, systematic sign replacement strategy.

Drs. **MORTON BARLAZ** and **JAMES LEVIS** received support from RTI International to develop life-cycle models for informal waste collection and landfills in developing and transition countries. The models will be implemented in the Solid Waste Optimization Lifecycle Framework (SWOLF, go.ncsu.edu/swolf), which was developed by CCEE researchers to evaluate sustainable future solid waste management systems.

Dr. **JAMES LEVIS** also received funding from the Eastman Chemical Company to develop life-cycle assessment tools to compare wastewater disinfection processes using peracetic acid with chlorination, ozonation and ultraviolet light. The analysis will compare the costs, environmental emissions and impacts, and resource use associated with each alternative to help identify cost-effective and environmentally beneficial disinfection methods.

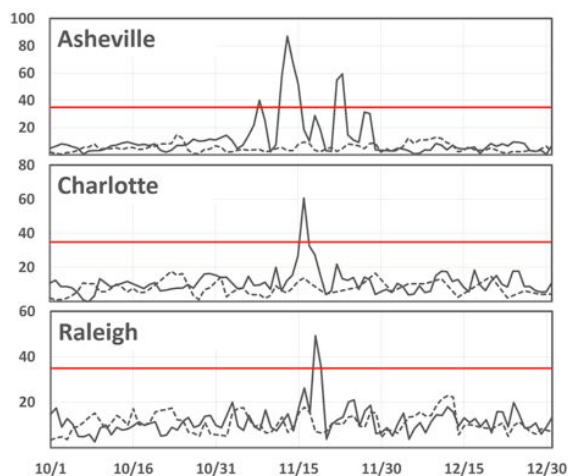
Dr. **FLORENTINO DE LA CRUZ** received funding from the

Environmental Research and Education Foundation to study the treatment of landfill leachate. Leachate can be problematic to treat in municipal wastewater treatment facilities due to high levels of ammonia and UV-absorbing compounds. This research will determine the effect of diverting food waste from landfills on leachate properties, and characterize UV-absorbing components in leachate.

Dr. **ABHINAV GUPTA** received funding from the NC State Center for Nuclear Energy Facilities and Structures (CNEFS) to support experimental and analytical studies of the response of electrical systems and control panels in nuclear power plants to high frequency seismic motions. The research will result in a simplified method for rapid and accurate evaluation of seismic performance requirements for electrical equipment in nuclear plants.

Dr. **DETLEF KNAPPE** and colleagues received funding from the NC State Research Innovation and Seed Funding (RISF) program to develop appropriate, low-cost treatment methods for water co-contaminated with arsenic, cadmium, and fluoride. An interdisciplinary team of engineers, environmental chemists, and public health experts will develop, test and design effective treatment systems for rural areas in developing countries.

Dr. **FERNANDO GARCIA MENENDEZ** received funding from the Center for Human Health and the Environment at NC State to investigate the impacts of smoke from southeastern regional wildfires during fall 2016 on public health in North Carolina. The project, a collaboration with Dr. **JOSEPH ROISE** of the Department of Forestry and Environmental Resources, will use regional-scale air quality modeling to simulate health outcomes associated with last year's historic wildfire season. ■



PM_{2.5} concentrations (µg/m³) observed during 2016 wildfires (solid black lines) and the same period the previous year (dashed lines). Red lines indicate the 24-hr National Ambient Air Quality Standard. Image by F. Garcia-Menendez.

Shane Underwood brings expertise in transportation infrastructure



Dr. Shane Underwood

Dr. **Shane Underwood** joined the CCEE faculty in August as an associate professor. His primary area of expertise is in transportation infrastructure, where he applies experimental mechanics and constitutive models to evaluate and characterize asphalt concrete. More broadly, his research focuses on materials and their interaction with society and the natural and built environments. The goal of his research is to engineer infrastructure to consume less energy, maximize material resources, reduce environmental impacts, and increase societal productivity.

Underwood is interested in forming multidisciplinary collaborations across traditional technical boundaries to evaluate how future uncertainties in climate, freight movement,

urbanization, and other factors will affect infrastructure systems. This includes examining the impacts of autonomous vehicles on the manner in which pavement degrades.

Underwood completed his B.S. (2003), M.S., (2006) and Ph.D. (2011) in civil engineering at NC State. Prior to returning, he was an assistant professor of civil engineering in the School of Sustainable Engineering and the Built Environment at Arizona State University. Most recently he spent the summer on the teaching faculty at the Polytechnico de Torino in Italy, where he lectured on resilient and sustainable pavements.

Underwood is teaching CE 413, Principles of Pavement Design, this Fall. In the future, he plans to offer a graduate course on pavement resilience and life-cycle sustainability, incorporating statistical based quality control procedures and multi-criteria decision making under uncertainty. Underwood seeks to introduce students to concepts of future uncertainty, adaptation, and risk and vulnerability assessment.

Underwood grew up in North Carolina and is happy to be returning to his personal and academic home.

Jason Patrick brings expertise in structural composites



Dr. Jason Patrick

Dr. **Jason Patrick** joined the CCEE faculty in August as an assistant professor. His research expertise is in fiber-reinforced polymer composites. These are strong and lightweight materials that find application in an array of civil, aerospace, automotive, and naval structures, including the latest Boeing 787 Dreamliner and Formula One race cars. Patrick's interdisciplinary research is concerned with infusing these high-performance materials with multifunctional attributes to sense, respond and adapt to their environment. Motivated by natural phenomenon, Patrick is focused on creating bio-inspired

composites that achieve life-like functions such as thermal regulation and self-healing.

Patrick grew up in North Carolina and received both his B.S. (2004) and M.S. (2007) in Civil Engineering at NC State, followed by a Ph.D. (2014) in structural engineering from the University of Illinois at Urbana-Champaign. He was a postdoctoral fellow at the Beckman Institute for Advanced Science and Technology on the Illinois campus before returning to NC State this fall. At the Beckman Institute, he conducted research on the structural repair, regeneration, and remodeling of synthetic vascular materials.

Patrick is teaching CE 325, Matrix Analysis of Structures, this fall. He plans to offer an advanced, graduate-level matrix structural analysis course in the future. He also intends to develop a series of mechanics and manufacturing related courses on advanced fiber-composite systems for next-generation engineering applications.

Jeremiah Johnson brings expertise in sustainable energy systems



Dr. Jeremiah Johnson

Dr. **Jeremiah Johnson** joined the CCEE faculty in August 2017 as an associate professor. Johnson is part of a cluster that includes four new professors across the university who will be conducting interdisciplinary research on Sustainable Energy Systems and Policy. His research

uses systems analysis and life cycle assessment to evaluate the environmental impacts of changes to the power system, including those driven by new technologies and energy policies.

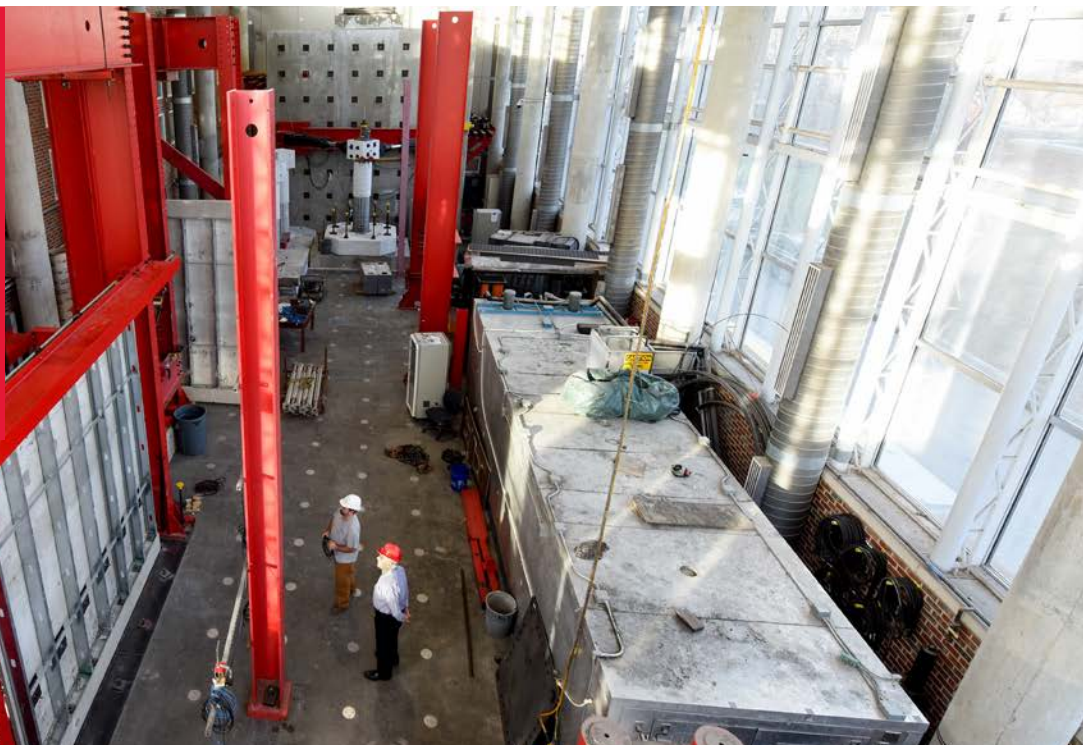
Johnson moved to CCEE from a faculty position in the University of Michigan's School for Environment and Sustainability, where he was involved in the creation of case-based instructional materials for sustainability education.

Currently, Johnson serves as the principal investigator for a National Science Foundation (NSF) grant to study emissions impacts of distributed energy storage used in reliability applications. In addition, Johnson is co-investigator of an NSF project examining the urban food-energy-water nexus, using Detroit and Beijing as case studies.

Johnson will be co-teaching CE 297, Introduction to Sustainable Infrastructure, this fall, and plans to offer courses related to life cycle assessment and energy system analysis in the future. He earned his M.S. (2004) and Ph.D. (2007) from Yale University in environmental engineering. Johnson's dissertation on material flows and energy use in anthropogenic metal cycles earned the Association of Environmental Engineering and Science Professors (AEESP) Outstanding Doctoral Dissertation Award. Johnson holds a B.S. (2001) in chemical engineering from Clarkson University. He is originally from the foothills of the Adirondack Mountains in New York and is looking forward to exploring North Carolina's mountains, forests, and coastline. ■

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Members of a clean water team worked in Guatemala with community members during an initial assessment trip over spring break 2017.

CLEAN **WATER** AND RENEWABLE **ENERGY**

From a school in Sierra Leone, to a remote Mayan village in Guatemala, the work of the NC state student chapter of Engineers Without Borders (EWB) will soon culminate in clean water and renewable energy for hundreds of people. The chapter has three teams - two working in water supply and one working in renewable energy. The scope of their projects includes initial assessment, implementation, monitoring and evaluation. The teams use their holiday breaks to travel to the project locations.

A multi-disciplinary team of five students and two mentors traveled to Sierra Leone during the 2016/2017 winter break. The team oversaw the drilling of a well and installation of a hand pump to provide clean water to 700 students and teachers at the Dele Village School in Lower Allentown, a small city close to the capital of Freetown. Assessment trips were taken in 2010 and 2013 to understand the school's water needs and discuss potential designs with community members. Unfortunately, travel to Sierra Leone was restricted between 2014 and 2016 due to an outbreak of the Ebola virus.

While the school is currently taking advantage of the well, it is difficult to hand pump enough water to meet their demand, and after pumping the water has to be transported. So, current plans call for returning during the 2018 winter break to install a solar powered submersible pump, treatment system, storage tank and distribution lines, as well as two hand-washing stations for the school. "Our team also plans to return one more time in 2019 to evaluate the functionality of the system, and determine whether any modifications are necessary," said John Merrill, a senior studying environmental engineering.

At the same location in Sierra Leone, a renewable energy team has also been working for several years. During the team's 2011 assessment trip, they found that because the electrical grid in Sierra Leone is in disrepair, the school had turned to a diesel generator. "The generator was disruptive, polluting, expensive, and did not meet all of the school's power need," said co-lead Dustin Soutendijk, a senior studying civil engineering. After a second assessment trip, the team is now finalizing design of a solar photo voltaic and battery storage



TEAM 1 CLEAN WATER FOR A SCHOOL IN SIERRA LEONE

Members of the EWB water resources team in Sierra Leone with a hydrologist from World Hope International (3rd from right).

TEAM 2 RENEWABLE ENERGY SYSTEM FOR A SCHOOL IN SIERRA LEONE

Members of the EWB renewable energy team working in Sierra Leone climb the hill near the school where they plan to install a solar photovoltaic system during the winter break.



TEAM 3 WATER SUPPLY FOR A RURAL MAYAN VILLAGE IN GUATEMALA

Members of the clean water team visited all 54 families within the village to assess the community's water needs.



Three NC State Engineers Without Borders teams travel during holiday breaks to further their international projects.

system. "We plan to return during the 2017/2018 winter break to install the system," Soutenkijk added.

During spring break of 2017, a team traveled to Guatemala to begin a water supply project for Caserio Panhux, a rural Mayan village. This was their first trip, and was spent meeting with community leaders, and visiting each of 54 families within the village. "We walked to every single house," reports co-lead Tabitha Benbow, a senior in the Department of Chemical and Biomolecular Engineering. "Often it was muddy, very steep, and there was not much of a path. We were not sure how we would be received, but the families were welcoming and

grateful." Carter Rucker, a senior in civil engineering, made the trip in the spring of 2017, and hopes to be able to return.

"Seeing the differences between the services and infrastructure available in the city of San Cristobal where we were staying, versus the village, was interesting," Rucker observed. The team is currently planning for water catchment systems for each house, and is using rainfall data to project water needs for the community and to determine storage tank sizes for each home. The storage tanks represent one of the largest costs for the catchment systems. ■

The NC State EWB chapter has approximately 80 active members representing several departments within the College of Engineering. Each of the three multi-disciplinary teams has about 20 students. For logistical and financial reasons, the group that travels typically includes five to seven students and two mentors. The teams are responsible for raising the funds for each project, including the costs associated with design, materials, and installation, as well as the costs for traveling to the sites. NC State EWB holds an annual fundraising dinner each spring, and also seeks funding from grants and donors.

AWARDS



Dr. Eleni Bardaka

Dr. **ELENI BARDAKA** received the Best Paper Award for a Junior Researcher at the 2017 International Transportation Economics Association Annual Conference and School on Transportation Economics. Her paper was titled "Causal Identification of Gentrification and Local Spatial Spillover Effects of Urban Rail Infrastructure."

Dr. **MORTON BARLAZ**, professor and head of CCEE, has been named a Fellow of the Association of Environmental Engineering and Science Professors. Dr. Barlaz was one of six faculty to join the fifth class of Fellows. AEESP Fellows are selected based on their accomplishments in environmental engineering and science research, teaching and professional service.



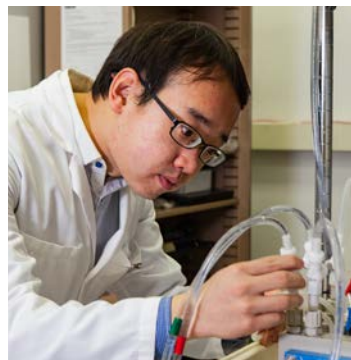
Dr. Ashly Cabas

Dr. **ASHLY CABAS** was selected as a 2017 American Society of Civil Engineers Excellence in Civil Engineering Education (ExCEED) Fellow. Cabas was selected based on her commitment to excellence in education and her willingness to serve as a future role model for effective teaching. Cabas participated in a six-day practicum that provides engineering educators with an opportunity to improve their teaching abilities.



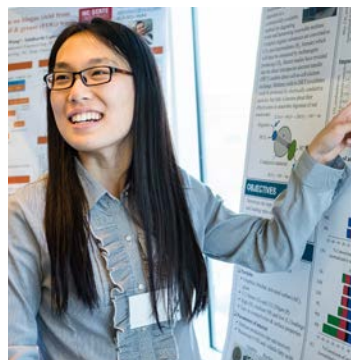
Dr. Cassie Castorena

Dr. **CASSIE CASTORENA** was one of 17 faculty across the NC State campus to receive a 2017 Outstanding Teacher Award. This award recognizes excellence in teaching at all levels and provides lifetime membership in the Academy of Outstanding Teaching at NC State. Castorena also received an American Association of State Highway and Transportation Officials High Value Research Award for her project, titled "In-Situ Determination of Emulsion Application Rate for Tack Coats and Surface Treatments."



Dr. Fei Liu

Two members of Dr. **DOUGLAS CALL'S** research group received poster awards. Dr. **Fei Liu**, a postdoctoral associate, was recognized at the 11th International Congress on Membranes and Membrane Processes for his poster titled "Effect of Natural Organic Matter and Ionic Composition on Electricity Generation from Five Natural

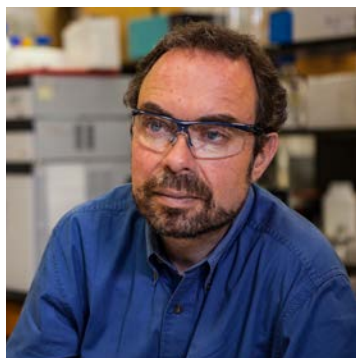


Dr. Qiwen Cheng



HONORS

Salinity Gradients using Reverse Electrodialysis.” **Qiwen Cheng** (Ph.D. candidate) was awarded the first place poster award at the 19th annual Water Resources Research Institute Conference in Raleigh, NC. Her poster was titled “Influence of Electrically Conductive Particles on Methane Generation in Swine Wastewater Fed Anaerobic Digesters.”



Dr. Detlef Knappe

Dr. **DETLEF KNAPPE** received a “Best Paper” award from the journal *Environmental Science and Technology Letters*. The paper titled “Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed

of North Carolina” is the first to document the importance of emerging per- and polyfluoroalkyl substances (PFASs) as drinking water contaminants in the U.S. Emerging PFASs were present at high concentrations in the lower Cape Fear River watershed, and a drinking water treatment plant equipped with advanced unit processes was unable to remove the newly discovered contaminants. The work was led by Knappe’s postdoctoral researcher, Dr. **Mei Sun** and graduate student **Elisa Arevalo** (M.S. 2014).

Drs. **JOEL DUCOSTE**, **FRANCIS DE LOS REYES**, and **TAREK AZIZ** received an Honor Award from the American Academy of Environmental Engineering and Science. The team received the award in the University Research category for their significant works in fats, oils, and grease fate and transport in interceptors, sewers, and energy recovery through anaerobic digesters.

Drs. **EDWARD JASELSKIS**, **WILLIAM RASDORF**, and **MIN LIU**

received the Joint Conference on Computing in Construction Best Paper Award given by the International Council for Research and Innovation in Building and Construction. Their paper was titled “Factors Affecting Bid Let Dates on Transportation Mega Projects.”

Dr. **YOUNGSOO RICHARD KIM**, Jimmy D. Clark Distinguished University Professor and Alumni Association Distinguished Graduate Professor, was awarded a Chang Jiang Scholarship in recognition of his outstanding research achievements in asphalt pavement engineering. The scholarship is the highest academic award issued to an individual in higher education by the Ministry of Education of the People’s Republic of China, and Kim is one of the 50 recipients for 2017. Typically, this award is given to China’s top scholars; however, a few renowned international academics are chosen each year. Dr. Kim will work with faculty members at Chang’an University, Xi’an, China between 2017 and 2019 to introduce his research in innovative test methods, mechanistic models, and performance-related specifications and design methods to Chinese transportation agencies, contractors, and researchers.



Dr. Francis de Los Reyes

Dr. **FRANCIS DE LOS REYES** received the 2017 Steven K. Dentel Award for Global Outreach from the Association of Environmental Engineering and Science Professors. This award honors a faculty member who has made outstanding contributions and demonstrated

leadership through involvement in environmental engineering and science outreach activities to the global community.

AWARDS & HONORS

Dr. de Los Reyes was recognized for his research and education collaborations in the Philippines, South Africa, Malawi, China, India, the UK, and Brazil. His passion for developing low-cost, sustainable solutions to sanitation challenges in developing countries has helped improve public health and human dignity for underserved communities around the world.



Haniyyah Chapman

HANIYYAH CHAPMAN (BS 2017) was one of 15 NC State undergraduates awarded a 2017 NSF Graduate Research Fellowship. This Fellowship is amongst the most prestigious awards to graduate students. Chapman is currently pursuing a Ph.D. at Virginia Tech. She plans

to study how the chemistry and microbiology of reclaimed water change with time. Two other CCEE students, **Conner Murray** (BS 2017) and **Kate Mueller** (BS 2017; current MS), received honorable mentions.

CHRIS PINKUS (BS 2017) was awarded the NC State College of Engineering Faculty Senior Scholarship. The award is given to a full-time student who exemplifies academic excellence, intellectual breadth, and depth of character. Pinkus is currently working as a structural engineer at Lynch Mykins Structural Engineers in Raleigh, NC.

Ph.D. student **SHAHIN SAFAVIZADEH** was selected by the Association of State Dam Safety Officials Committee on Education Outreach as a winner of the 2017 Student Paper Competition. His paper was titled "Effect of Microbial Induced Calcium Carbonate Precipitation on the Performance of Ponded Coal Ash."



Shahin Safavizadeh

earned the Humanities Award. They received their awards at the College of Engineering Senior Awards Banquet in May, and were also honored with a luncheon and a stipend sponsored by Freese and Nichols.

Family, friends, and faculty were present at the CCEE Graduate Awards Reception held in May when several outstanding master's and Ph.D. students were recognized for their achievements. **HANA CHMIELEWSKI** received the Freese and Nichols Graduate Fellowship Award, **ANA GABRIELA HARO** received the Thomas G. Coffey Graduate Fellowship Award, **ASHTAD JAVANMARDI** received the David Johnston Graduate Award in Construction Engineering, and **JEFFREY THOMAS** received the Charles Smallwood Graduate Fellowship Award.

Graduate students from the CCEE Pavement Management Systems course won the Aramis Lopez Challenge Category Award at the ASCE Long-Term Pavement Performance (LTPP) International Data Analysis Contest. The team included **MICHAEL ELWARDANY, KANGJIN LEE, JUNG HWA LEE,** and **COLEMAN BROWN**. Their winning paper was titled "Proposed Performance Prediction Equations and Threshold Triggers for Thin-Overlay Treatment Using LTPP Database." ■

Four exemplary seniors received the CCEE Department's most prestigious awards.

MEREDITH BULLARD won the Citizenship and Service Award, **SHANE ESTRIDGE** won the Leadership Award, **JIAWEN LEE** won the Scholarly Achievement Award, and **ERIC POLLI**

Graduation speaker touts the power of imagination

Wayne Stocks, P.E. (BSCE 1986) addressed a full house on May 13, 2017, at the Department's Spring Diploma Ceremony. Ninety-nine undergraduates, 51 master's students, and 5 Ph.D. scholars crossed the stage to receive their hard-earned degrees. Hundreds of family members proudly watched, including many who traveled internationally to attend the ceremony.

Stocks reminded the crowd that when he received his degree in 1986, the graduates and their families would still fit in the lobby of Mann Hall. He said that on that day, he could not have imagined where his degree and his career would lead him. He now leads the Mid-Atlantic South region for Thornton Tomasetti from its offices in Washington, D.C. He has more than 25 years of experience in structural design, construction, and project management for new buildings and renovations of historic structures, including the Washington Monument. Before joining Thornton Tomasetti, Stocks spent two years in Nepal volunteering with the Peace Corps. While there, he designed and constructed aquatic farm structures.

Stocks cited the influence of Dr. Jim Nau, who had arrived at Mann Hall as a new CCEE professor in 1982, the same year Stocks entered as a freshman. Stocks remembers Nau's enthusiasm, and said that attitude of loving what you do left a lasting impression on him. He urged the graduates to be passionate about their work and find something that excites them.

Stocks also suggested to the graduates that giving back is a foundation for a well-lived life and cited creativity, confidence, and staying connected with peers in the industry as other values he believes contribute to a successful career and life. ■



Wayne Stocks shakes hands with Shane Estridge, who received the 2017 Outstanding Senior Award for Leadership.



Jiawen Liu, who received the 2017 Outstanding Senior Award for Scholarly Achievement, delivered a heartfelt and uplifting valedictory speech. She included a short address spoken in her native language for her parents who were watching the ceremony in China via a live internet stream.

Shown here are eight of the 15 students who received master's degrees in 2017 through the Engineering Online distance learning program.

In 2017, **15** of the **51** master's degrees awarded went to students who had completed their coursework online. Since the inception of the distance degree program in 2002, CCEE has awarded **236** Master of Civil Engineering degrees and **14** Master of Environmental Engineering degrees to online students. The Environmental Engineering track was added in 2010.



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.

AIR & WASTE MANAGEMENT ASSOCIATION (A&WMA)

Members of NC State's student chapter of the A&WMA traveled to Pittsburgh in June to attend the A&WMA's annual conference and exhibition. Ph.D. student Shams Tanvir was awarded second place for his poster titled "Near-Road Air Quality Monitoring at Urban Arterial Intersection." He is advised by Dr. Nagui Rouphail.

AMERICAN CONCRETE INSTITUTE (ACI)

At the ACI Convention held this past March in Detroit, 16 CCEE students participated in the Fiber Reinforced Polymer Composites Competition.

Two teams, each consisting of four undergraduates and four graduate student advisors, had to design, construct, and test an FRP beam with the goal of achieving the lowest cost-load ratio. A total of 65 teams representing national and international universities participated in the competition. CCEE's teams did well, placing 5th in one competition, and 13th in the other. The teams were advised by Roberto Nunez. New at this year's

convention was a student-run forum at which master's student Lauren McCauley (BSCE 2014) highlighted the chapter's activities and achievements. She spoke predominantly about the chapter's trip to the Panama Canal in 2016. It's also become a tradition for students to have dinner with CCEE alumni in attendance at the event.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

For the second year in a row, the ASCE Steel Bridge Team earned an invitation to participate in the ASCE National Competition, held in May 2017 at Oregon State University in Corvallis. The invitation came after an outstanding performance in April at the Carolinas Conference where the team earned the top ranking in several individual categories including construction, speed, stiffness, economy and display.

Khiya Armstrong, a senior studying construction engineering was one of six students on the team who traveled to Oregon in late May. "Going to nationals was very inspiring and we learned a lot from the other teams. I'm proud of our hard

work and effort that our team invested this year. Qualifying for nationals was a huge accomplishment and I hope we can achieve it again next year," Armstrong relayed.

CCEE Lecturer Steve Welton, P.E. advises the NC State student chapter of ASCE, along with CCEE Lecturer Ben Smith, P.E.

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE (EERI)

Six students from EERI traveled to Portland, Oregon in April to compete in the Undergraduate Seismic Design Competition. Teams must submit a design proposal to be accepted into the competition, and this year 33 of the 46 entrants were accepted.



ASCE Steel Bridge Team following their successful competition at the Carolinas Conference. Left to right: Colby York (co-captain), Khiya Armstrong, David Zabel, Shane Estridge (co-captain), Sanders Rohs, and Caleb Sawyer.

"In preparation for this event and building our model, we had eight seminars to cover earthquake engineering concepts including geotechnical, architectural, structural, and economic aspects," Ariande Palma Parra said. Palma (BSCE 2017), who was co-captain of the team, is now a master's student studying earthquake engineering.

The competition demands a large time commitment. Ten students spent more than 100 hours designing and building the model in preparation for "shake day" at the event. The conference lasts a week and includes presentations of posters and architectural renderings, as well as oral presentations. "This year we kept our team and our work almost exclusively in the civil engineering department," said Graham Gatwood, a junior studying environmental engineering. "I think to be more successful next year we need to outsource some of the design components to the Design School, and perhaps turn to students in Materials Science to help us with some of the work," Gatwood said at a follow-up meeting. The team was advised by Dr. Mervyn Kowalsky.



Dr. Billy Edge explains differences in sand sediments at Kitty Hawk Beach.

the U.S. Army Corps of Engineers Field Research Facility in Duck, NC. "Many of the graduate students in COPRI who are doing coastal and ocean research are involved in computational modeling, so we don't get much opportunity to be in the field," said Ph.D. candidate Liliana Velasquez Montoya, who serves as president of COPRI.

COASTS, OCEANS, PORTS AND RIVERS INSTITUTE (COPRI)

The COPRI student chapter, with support from Drs. Billy Edge and Elizabeth Sciaudone, organized a two-day field trip to the Outer Banks area of North Carolina. The trip included visits to the Bodie Island Lighthouse; Jennette's Pier in Nag's Head which is used as a field research site; Jockey's Ridge; the terminal groin built to control the migration of Oregon Inlet; beaches in Kitty Hawk to examine sand sediments; the Pea Island Wildlife Refuge; and the Bonner Bridge construction. Additionally, the group spent time with researchers at UNC Coastal Studies Institute in Manteo, and with engineers at

PROFESSIONAL ENGINEERS OF NORTH CAROLINA (PENC)

The student chapter of PENC assisted with Boy Scouts Engineering Day, which is hosted annually each spring by the College of Engineering. About 60 young Scouts chose activities in Mann Hall that were designed to help the Scouts achieve their Engineering Merit Badge. "We divided them into smaller groups, and allowed them to rotate through learning activities that demonstrated engineering topics such as structural design, engineering processes, and ethics of engineering," said Ph.D. student Amie McElroy, who serves as the chapter's professional liaison. ■



Members of the Seismic Design team at the competition in Portland, Ore. Left to right: Sean Casady, Michael Cerjan, Ariande Palma Parra, Ana Lancaster, Graham Gatwood, Zakariya Bourara.

CCEE'S RISE PROGRAM COMPLETES SECOND YEAR

RISE participant Adriana Dacres was mentored by Dr. Francis de los Reyes during 8 weeks of summer research. She explored three protocols for extracting DNA from protective clothing. The research is related to a project to mitigate health risks faced by workers in Malawi who empty pit latrines.



Adriana Dacres, from Jamaica, is a rising junior at Claflin University in South Carolina. She spent her summer at NC State assisting Dr. Francis de los Reyes with research as part of the second annual RISE (Research Internship Summer Experience) program. Dacres was one of 16 students who participated in the program, which is designed to attract talented undergraduate and graduate students interested in graduate research.

RISE was begun in 2016 by Director of Graduate Programs Dr. Ranji Ranjithan as a way for potential graduate applicants to get to know NC State and CCEE. "We are always looking for ways to increase the quality and the diversity of the applicants to our graduate programs," Ranjithan said. Many of the 16 participants in this summer's program were from groups that have traditionally been under-represented in engineering. They included students from Jamaica, Sri Lanka, Paraguay and Columbia; and individuals from other universities across the U.S.; as well as five NC State undergraduate students interested in pursuing graduate level study and research.

"I learned that research is not a straight and narrow road. When things don't go as you expected, you have to be willing to go back to the drawing board and come up with another creative approach."

– Adriana Dacres, RISE participant

RISE is conducted as a partnership between the CCEE Department, the College of Engineering, and participating faculty researchers. The program offers selected participants a research stipend, travel expenses, and university housing. In 2017, 14 professors and a dozen Ph.D. students and post-doctoral researchers worked closely with RISE participants.

In addition to their research, the participants shared their progress in weekly group meetings. There were other common activities including sessions aimed at developing research skills such as reviewing literature, and preparing and presenting a research poster. One workshop focused on preparing a National Science Foundation Graduate Research Fellowship application. Additionally, the participants shared social activities including a 4th of July cook-out, Raleigh Food Truck Rodeo, and a trip to a Durham Bulls baseball game. The 8-week RISE program culminated with the 16th Annual Summer Undergraduate Research Symposium, which showcased the work of 284 summer researchers from across the university. ■



Zoe Gobetz is a senior in the Department of Chemical Engineering at NC State. She worked closely with Dr. Douglas Call and post-doctoral researcher Dr. Fei Liu to study the impact of seasonal variability in salinity gradients along the coast of North Carolina. Salinity gradients hold potential for power generation using reverse electrodialysis. Gobetz is seen here presenting her research at the Annual Summer Undergraduate Research Symposium.

Andy Jiang is a rising senior in the CCEE department. He was involved in research at the Constructed Facilities Laboratory to assess the strength and durability of grout for bridge construction in cold climate seismic regions. Ph.D. student Christopher Price was one of the mentors who worked with Jiang during the RISE program.



Genele Tulloch, from New York, is a rising senior at Saint Augustine's University in Raleigh. Ph.D. student Joseph Weaver was one of her RISE mentors. Her summer research focused on wastewater treatment options.



CCEE Alumnus James Dalton says he just wanted to make a difference. He does.

James C. Dalton, a native of North Carolina, received his Master of Civil Engineering from NC State in 1992. In the 25 years since, his distinguished career has taken him around the globe. He was recently promoted to director of civil works for the U.S. Army Corps of Engineers (USACE) in Washington, D.C. He was also chosen for the 2017 Government Civil Engineer of the Year Award by the American Society of Civil Engineers.



Twelve thousand miles of inland waterways. Seven hundred dams. One quarter of U.S. hydropower production. Almost 19,000 square miles of real estate. Twenty-five thousand civilian employees. These are enormous responsibilities. James Dalton was one of only a handful of people that were even qualified to interview for the job he now performs.

Dalton admits it was not an easy decision to move from his previous position as chief of the USACE Engineering and Construction Division. There, he was responsible for policy, program, and the design and construction programs for the U.S. Army, Air Force, Department of Defense, and other federal agencies in more than 60 foreign nations. Dalton held that position from 2007 through August 2016. The job he holds now oversees his previous position and several more like it. Dalton's career path illustrates dedication to the profession and unequivocal leadership.

James Dalton earned his bachelor's degree in architectural engineering in 1978 from North Carolina Agricultural & Technical State University. He accepted an opportunity with the Corps of Engineers (COE) in Wilmington, NC, where he met many NC State CCEE alumni. "My supervisor at the time was an NC State graduate and he was a real champion for the school," Dalton recalls.

From Wilmington, Dalton's next stop was Saudi Arabia. "I had lived in Atlanta briefly after graduating from A&T and I felt like I'd moved to the edge of the world," Dalton recalls. Yet he asked for an assignment in Saudi Arabia because he felt he could advance his career faster. There he was named project engineer for a crude oil facility and he learned that he loved construction. He also gained some confidence. "After that I felt like I could take on anything," he says.

The responsibilities and opportunities kept coming while he was overseas. But it was a failure, not a success, that led him to seek

more training. While overseeing the construction of a new city in the desert, Dalton ran into a pavement problem when large jets began sinking in the airport runway. "It was a nightmare. I knew when the Corps finally agreed to invest in me with some more training that I was going to study pavement design at NC State, and enrolled in 1991."

Dalton's career has taken him to Iraq, Korea, and Egypt. He also served five years in Alaska. When asked what he's most proud of, he cites events from his time in Egypt. He was the senior COE representative in high-level meetings with the U.S. Ambassador and was troubled that local engineers were often looked upon as second to COE engineers. "It was important to me that the local engineers rise to higher levels of prominence. I also began to understand the political environment and that there were things that had to be considered in addition to just the technical aspects of a project."

Developing deeper levels of expertise was also a goal when he created design production centers within the COE. They are referred to as Centers of Expertise, and Dalton says it was a paradigm shift from the traditional way of approaching projects. "In the past, the COE had an 'in my backyard' mentality. Meaning that if you needed a dam, you designed a dam, but you might not design another dam for 10 or 20 years, so you never developed deep expertise. The Centers of Expertise offer a way for people to develop more depth and rise to their fullest potential."

As part of the nomination process for the ASCE Government Civil Engineer of the Year, Dalton received resounding praise from his peers. One colleague described him as having "unparalleled passion for mentoring," while another wrote "he invests in the profession and passionately recruits others because of his interest in our nation's civil engineering future."

James Dalton continues to make a difference. ■

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 contribute toward scholarships and awards at both the graduate and undergraduate level, support for our advancement fund, and professorships that enable us to provide ongoing funding to our very best faculty who are pursuing new research in promising areas.

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 allow 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 16), 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. Our Firm of the Month 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. Our most recent Firms of the Month include Calyx, JE Dunn, and McDonald York.



2017 Corporate Donors

The firms listed here have provided endowments or made contributions from January through July of 2017.

AECOM	Dewberry	John R. McAdams Company	SteelFab of Virginia
American Institute of Steel Construction	DPR Construction	Kimley-Horn & Associates Inc.	Stewart Engineering, Inc.
American Society of Civil Engineers	Dragonfly Pond Works LLC	Lane Construction Corporation	Structural Engineers Association of NC
ASCE - NC Section	Draper Aden Associates, Inc.	Law Offices of Perry R. Safran	The Community Foundation of Western North Carolina, Inc.
Air and Waste Management Association, RTP Chapter	Energy Land & Infrastructure, LLC	Lysaght & Associates	Thomas Concrete
Balfour Beatty Construction	Engineered Concepts	McKim & Creed	Tindall Corporation
Barnhill Contracting Company	Environmental Research and Education Foundation	Metrocon, Inc.	Trisure Corporation
Bernhard MCC, LLC	Fidelity Bank	Metromont Corporation	United Forming
Black & Veatch Corporation	Fluor	Myers Professional Insulation	Virginia Carolina Structural Steel Association
Brasfield & Gorrie LLC	Freese and Nichols, Inc.	NC Licensing Board for General Contractors	WithersRavenel, Inc.
Bridgepoint General Contracting Inc.	Geosyntec Consultants	Norfolk Southern Foundation	WSP/Parsons Brinckerhoff, Inc.
Carolinas Chapter of American Concrete Institute	Hazen and Sawyer	Ramey Kemp & Associates, Inc.	
Criser Troutman Tanner Consulting Engineers	Inland Construction Company of NC	Russo Consulting, Inc.	
	IQ Contracting, LLC	Stantec Consulting Services, Inc.	
	J.E. Dunn Construction Company	Shelco, LLC	
	Jarco Supply, LLC	Smith Gardner, Inc.	

This list includes all companies that have made a contribution in the 2017 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.



Planning for EB Oval: three 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 will occupy about 59,000 assignable square feet of the 225,000 gross square foot, four story structure. The building will allow us to bring much of the department together in one place. EB Oval will be certified as LEED silver or higher.

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. Beyond the improvements and expansion to all of our space, we are excited by the opportunity to design for 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, we are expected to raise a substantial portion of the building's cost. Of the 60 million dollars to be raised, more than 25 million has been committed to date. We need financial partners to achieve our goal and

"The building will serve as a teaching tool, demonstrating sustainability and engineering components throughout its envelope, structure and control systems."

– Doug Morton (*BSCE 1983*)

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 Louis Martin-Vega established the "Dean's EB Oval Club" in January and the "Young Alumni EB Oval Club" in June. 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. ■

Here is where we are so far

- Schematic design was completed in January 2017
- Design development documents were issued for review in July 2017
- Construction documents are being prepared in Fall 2017
- Groundbreaking is planned for Spring 2018
- Doors open for the Fall 2020 semester

ALUMNI NEWS

JAVON ADAMS (Ph.D. 2014) is now the coordinator of transfer academic advising for the College of Engineering at NC State. Adams will also serve as an engineering lecturer with the First Year Engineering Program.

SUZANNE M. BECKSTOFFER (BSCE 1982) retired from Newport News Shipbuilding in 2016. She is currently chairman of the board of BayPort Credit Union, a member of the Accreditation Board for Engineering and Technology (ABET) Industry Advisory Council, and a Council member of the Society of Naval Architects and Marine Engineers.

ROBERT T. BURLINGTON (BSCE 1997) is currently the president of SteelFab, Inc. (Virginia Division). He has served on the Tammy Lynn Center for Developmental Disabilities Board and was board chair from 2013-2014. He has also served on the Greater Raleigh Chamber – Young Professional Executive Committee and was board chair in 2008. He currently serves on the WakeEd Partnership Board.

RHETT FUSSELL (MSCE 1996) senior technical principal, WSP, was awarded the 2016 North Carolina Section of the Institute of Transportation Engineers (NCSITE) Presidents Award for his exceptional support and guidance to the NCSITE president.

BRANDON GRAVER (MSENE 2011, Ph.D. 2016) recently joined the International Council on Clean Transportation (ICCT) as an aviation researcher. The ICCT is an independent nonprofit organization founded to provide unbiased research and analysis to environmental regulators. Based in San Francisco, Brandon's research identifies, refines, and promotes policies to reduce the environmental impacts of commercial aviation.

CHRISTINE N. HERRICK, P.E. (BSCE 2011, MSCE 2012) is a structural engineer for Kimley-Horn in Raleigh. Specializing in parking structures, retaining walls, foundations, reinforced concrete, and steel structures, Christine has enjoyed living near NC State and working on projects for the University, including the recent demolition of Harrelson Hall.

HARRY L. MASHBURN (BSCE 1964) recently retired from Mashburn Construction, which he founded in 1974. His sons now run the commercial contracting firm headquartered in

Columbia, SC. Mashburn is a past national president of the Associated General Contractors of America (AGC) and was recently inducted into the Carolinas chapter Hall of Fame.

RES ORGUT (Ph.D. 2017) is a project controls specialist for Fluor Corporation in Clayton, NC. In this role, he is responsible for cost control and change management procedures on a life sciences project. Since his recent graduation, Orgut is volunteering on the Student Leadership group that works alongside the CCEE Industry Advisory Board. He is also serving on the Zia Lecture Committee. He lives in Raleigh, with his wife and son, who just turned one in September.

GREG S. PEELE (BSCE 1988) was recently promoted to executive vice president and general manager for the North Carolina and Virginia markets for Skanska USA Building. Peele has been with Skanska for 16 years. He spent the past eight years leading operations in Virginia.

JIM ROBINSON (BSCE 1974, MCE 1976) is North Florida engineering director for Bowman Consulting Group, Ltd. Robinson returned to private consulting following his tenure as director of public works for the City of Jacksonville, Florida.

CLAY E. SAMS (BSCE 1963, MSCE 1965) retired in 2017 after 52 years of service with Law Engineering Testing Company, now Amec Foster Wheeler, in Charlotte, NC. He retired as senior principal geotechnical engineer with the firm.

MITCHELL C. TAYLOR (MCE 2010) successfully completed the 16-hour Structural Engineering exam and has been promoted to senior engineer at Andrew Consulting Engineers in Wilmington, NC.

DAVID S. WEBB (BSCE 1999) joined Freese and Nichols, Inc. in July 2017. He is an associate with the firm and specializes in stormwater management and transportation engineering.

BRIAN T. WHITE, P.E. (B.S. 2002) recently began a new position as hydraulic modeling unit leader with McKim & Creed and is working to build a new modeling division within the company. White oversees modeling projects across multiple offices along the East Coast and in Texas.

A. BATTLE WHITLEY, IV, P.E. (BSCE 1992) was recently hired by RKA as a senior transportation engineer. Prior to joining RKA, Mr. Whitley served as the division maintenance and operations engineer for NCDOT's Division 5. He previously served as an engineer for the State Road Maintenance Unit.

HAIBO ZHAI (Ph.D. 2008) was recently promoted to associate research professor in the Department of Engineering and Public Policy at Carnegie Mellon University. His current research focuses on electric power generation systems, carbon capture and storage, and the energy-water nexus. He lives in Pittsburgh with his wife and daughter. ■

CCEE bids farewell to two long time professors



Dr. Roy H. Borden

After 37 years of service, Dr. **Roy H. Borden, Jr.**, retired in June of 2017.

Borden's scholarly contributions in the area of experimental and theoretical soil mechanics include notable innovations related to grouting, excavations, support approaches, and deep foundation systems. Within CCEE's geotechnical group, Borden consistently demonstrated leadership and provided valuable mentoring

to younger academics and practitioners. Borden is a member of the committee that established and has led the Raleigh Geotechnical Group (RGG) over the past five years; a community of local geotechnical engineers and engineering students that meet quarterly to discuss technical and professional matters of interest to the industry, with the goal of increasing the quality of engineering practice.

Borden's many research accomplishments have been documented in journals including those published by the American Society of Civil Engineers (ASCE). It is also well established within the ASCE Geo-Institute that methods and approaches developed by Borden and his students in the areas of soil improvement and foundation support systems have been implemented in national and international codes of geotechnical engineering practice and are taught at top universities worldwide.

Dr. Borden was selected for the Academy of Outstanding Teachers in 1990 and received the Outstanding Extension Award in 1995. Dr. Borden served on the NC State Faculty Senate from 2011-16 and represented NC State to the UNC Faculty Assembly through 2016.



Dr. Narendra Paul Khosla

After 36 years of service, Dr. **Narendra Paul Khosla** retired in June of 2017.

Dr. Khosla's research has been in the area of asphaltic pavement and materials. Amongst his notable research was a 10-year field project in Siler City, NC that culminated in a Mechanistic Pavement Design for North Carolina. In addition, he conducted research on the use of waste materials in asphalt including ground

rubber tire and roofing shingles, which resulted in a standard specification for recycling of asphaltic materials in North Carolina.

Dr. Khosla served as a member of the Faculty Senate from 2003-07 and again from 2010-12. He received an Outstanding Teacher Award in 1984 and an Outstanding Extension Award in 1983. Both Drs. Borden and Khosla were mentors to hundreds of undergraduate and graduate students throughout their careers. ■

Department Advisory Board

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

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Past Chair
BSCEC 1995
McDonald-York Building Company

Joe Hines

BSCE 1991
Timmons Engineers

Jonathan Holtvedt

BSCE 2015
Balfour Beatty

Tyler Highfill

BSCE 1992, MSCE 1994
Highfill Infrastructure Engineering, P.C.

Glenda Gibson

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Hazen and Sawyer

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Hans G. Warren, Jr.

BSCEC 1984
Warco Construction, Inc.

Mick Ways

Freese and Nichols, Inc.



NC State Researcher Zachary Kirsch takes in the view at Mount Roberts in Alaska. In May of 2017 a group of researchers specializing in earthquake engineering presented a four day workshop in Juneau, Alaska. Find out more about this and other CCEE news online at www.ccee.ncsu.edu/news.

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