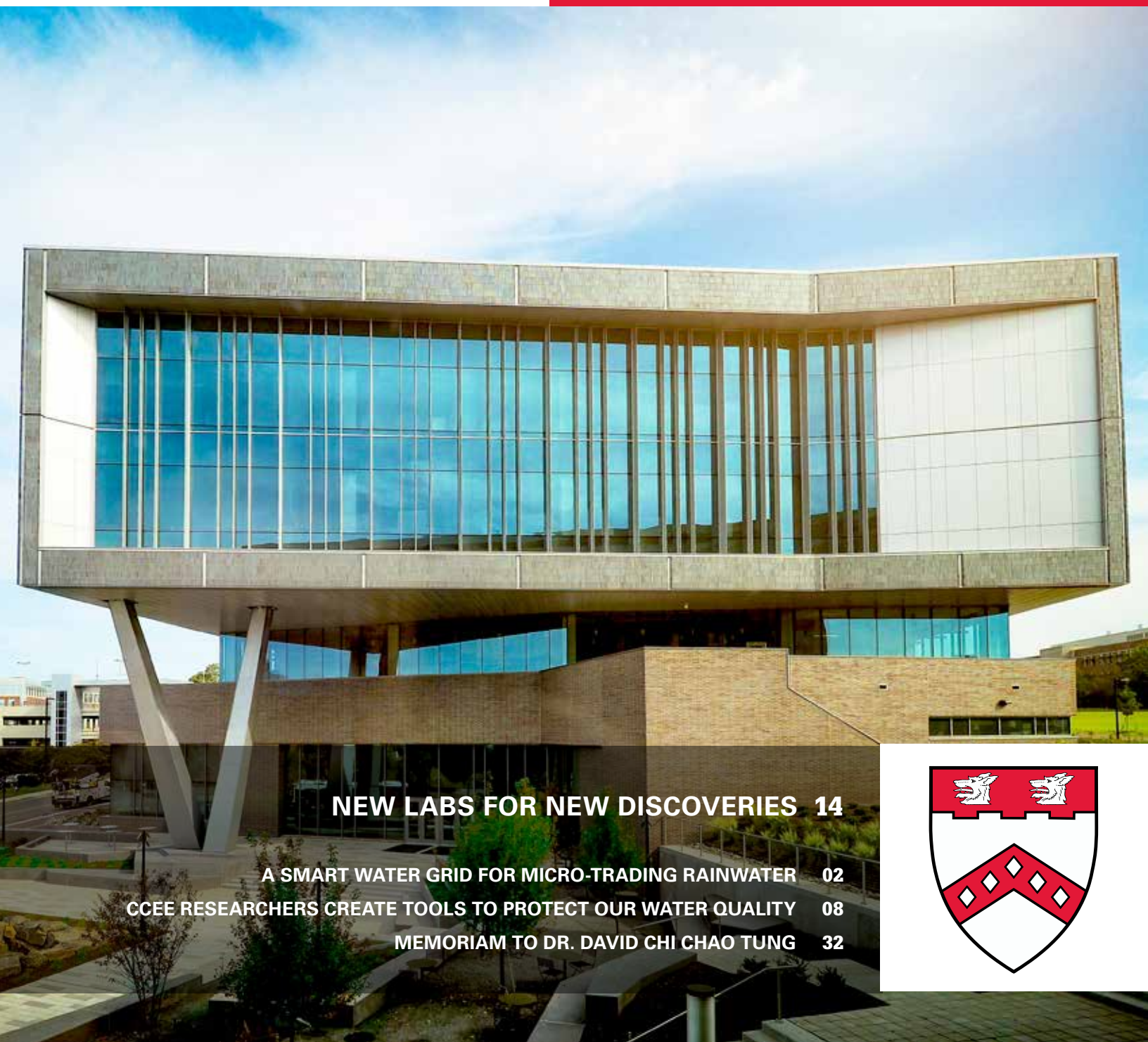
NC STATE
Engineering

CCEE NEWS

DEPARTMENT OF CIVIL, CONSTRUCTION, AND ENVIRONMENTAL ENGINEERING
NC STATE UNIVERSITY | SPRING 2021



IN THIS ISSUE

EDITOR
Julie Williams Dixon

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OTHER CONTRIBUTORS TO THIS ISSUE
Amy Alexander, Emily Berglund, Downey Brill, Mohammad Gabr, David Johnston, Mervyn Kowalsky, Min Liu, Daniel Obenour, Giorgio Proestos, Francis de los Reyes III, Steve Welton, Paul Zia.

PRODUCTION STAFF
Jacob Fremderman, Danielle Herman, Candice Wallace.

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

IN THE SPOTLIGHT

CCEE RESEARCHERS CREATE TOOLS TO PROTECT OUR WATER QUALITY

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CCEE researchers are part of a multi-year study to clean up Falls and Jordan Lake watersheds in central North Carolina. Both lakes continue to suffer from nutrient over-enrichment, which leads to occasional algal blooms that kill fish as well as make it more expensive to treat the water.

DEPARTMENT NEWS

STUDENT NEWS

ALUMNI AND DEVELOPMENT NEWS

ABOUT THE COVER

A view of our new home in Fitts-Woolard Hall on Centennial Campus.

Dr. Morton Barlaz

LETTER FROM THE DEPARTMENT HEAD

Welcome to our spring 2021 newsletter. It is a pleasure to update our friends on activities in the department. I am writing this letter just after our virtual December graduation, in which we recognized **57 B.S.**, **33 master's** and **8 Ph.D**. **graduates**. The year 2020 was difficult in many ways, and it is nice to be able to share some accomplishments and student news as we had many positive events in 2020 as well.

We officially closed our doors in Mann Hall in mid-December and have now fully occupied our new home in Fitts-Woolard Hall, which is next to the Hunt Library on Centennial Campus. Our research and teaching labs are functional and everyone is getting used to the new building. Because most classes are being offered online and we are focused on maintaining a safe and therefore physically distanced work environment, I expect that it will be the fall before the building is fully used as we envision. Nonetheless, we are glad to be in a new building with the facilities that one would expect of a top engineering program in the 21st Century. The university is working on a virtual tour that I will share on our website as soon as it is available.

This newsletter features stories on some of the cutting-edge research led by our faculty, highlighting the department's contributions to the well-being of society. **Dr. Ali Hajbabaie** describes a transition to a future in which connected and automated vehicles communicate with each other to ensure the safe passage of vehicles through intersections. **Dr. Dan Obenour** is conducting research to develop efficient and cost-effective watershed management strategies as applied to nutrient loading in Falls and Jordan Lakes, which are major water supplies for the Triangle region. **Dr. Emily Berglund** is leading research to extend the concept of a smart grid from energy management to water supplies. **Drs. Mohammad Gabr** and **Roy Borden** are conducting research on efficient ways to secure marine hydrokinetic devices for energy generation in the ocean. Finally, **Dr. Min Liu** is conducting research to improve collaborative scheduling of construction projects to improve project coordination.

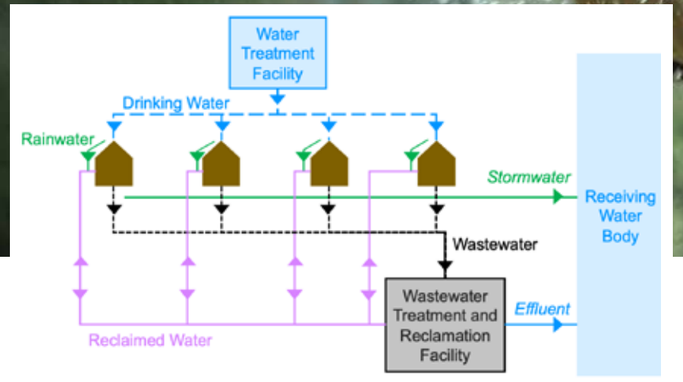
Thank you as always for your financial support. I am grateful for the confidence that you have placed in the department. Your support provides help with field trips and special projects for undergraduates, allows graduate students to make presentations at national conferences, and helps us recruit and retain the best students and faculty in the world. We need your support as we strive for excellence in all that we do. Please make a contribution to the department a regular event.

I always enjoy meeting and speaking with people interested in the department. 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 and CCEE Department Head

CCEE AT NC STATE SUSTAINABLE INFRASTRUCTURE FOR SOCIETY

$23 million in research expenditures
234 ongoing research projects
15 winners of CAREER and other NSF young faculty awards
54 faculty members
289 graduate students
799 undergraduate students



A smart water grid increases water efficiency in the urban water cycle by allowing households to contribute rainwater to a non-potable water reclamation system. Wastewater effluent and stormwater flows are reduced.

A smart water grid for micro-trading rainwater

Water availability is increasingly stressed in cities across the world because of population growth, which increases demand, and climate change, which can decrease water supply. Advanced technologies, novel management strategies and diverse water sources are needed to increase the efficiency of urban water supply and use. **DR. EMILY BERGLUND** and graduate students **ELIZABETH RAMSEY**, **JORGE PESANTEZ**, **MOHAMMAD ALI**, **KHAKSAR FASAEE**, **MORGAN DICARLO** and **JACOB MONROE** explored a new water supply system that would reduce demand for fresh water in cities.

This research borrows the idea of a smart grid from energy management. To reduce demand in energy systems, households can sell excess energy generated through solar photovoltaic cells to their neighbors by putting electricity back on the grid.

The NC State research team extended this idea to conceptualize a smart water grid as a non-potable water distribution system that is shared by multiple diverse households, who can either produce or consume water. Households generate water through rainwater harvesting, put rainwater "back on the grid" by pumping water into a non-potable water pipe network, and purchase water from neighbors by withdrawing water from the pipe network for irrigation. Smart technologies, such as smart meters, coupled with blockchain, smart contracts and automated infrastructure, would provide the necessary capabilities to allow real-time trading within a smart water grid. The research team built a model of a virtual city to explore how a smart water grid would perform. They found that increased participation of households producing rainwater leads to both water savings and energy efficiency in delivering water to households.

"I'm very excited about this research because we proposed a novel water savings program and, by developing a simulation of the system, we found that it is also energy efficient. It was gratifying to see all the Ph.D. students in my group working together on a shared project."

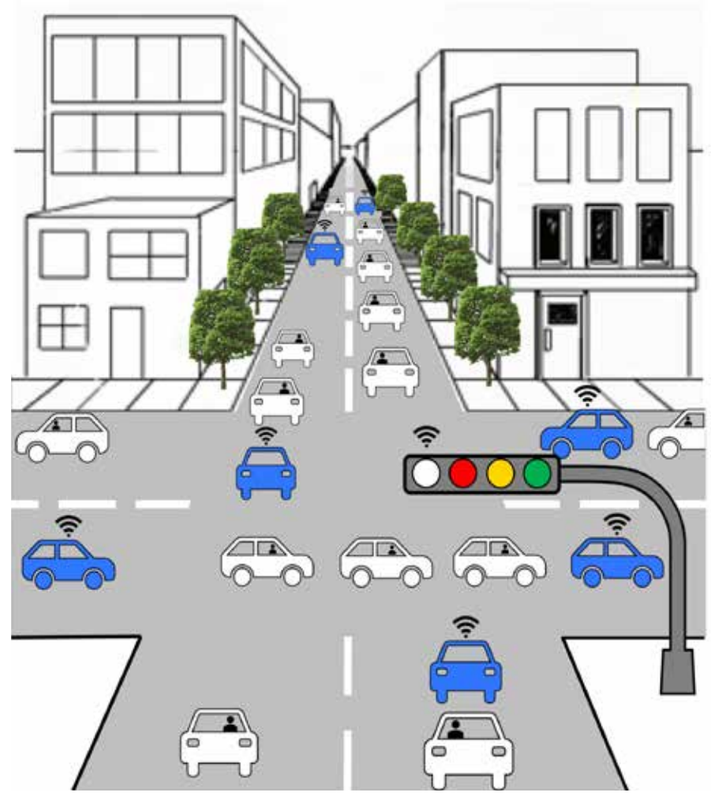
DR. EMILY BERGLUND

This research was supported through an NC State – University of Adelaide Starter Grant. Australia faces pressing water and energy scarcity. The city of Melbourne, Australia, has proposed a rainwater micro-trading program that would be enabled by blockchain technologies to protect a water sensitive community. Creative solutions for urban water management are needed to ensure a sustainable future, and the NC State research demonstrates a novel concept for urban water management. New modeling tools developed through this research can be used to design other water supply systems that convey traded water through groundwater aquifers instead of a water pipe network or allow virtual trading of water rights.

The team's finding were published in the journal *Water* in November 2020. ▪

How will traffic lights operate in the automation era?

Introducing the white phase.



Intersection Control with White Phase

Connected automated vehicles are expected to bring significant changes to how we travel and how traffic control devices operate. Traffic lights may become obsolete and removed from intersections when all vehicles are connected and automated, as they can communicate with each other and go through the intersection, but how about when only some vehicles are automated? How about disruptions in communications between automated vehicles?

Some changes in traffic light systems may be necessary to accommodate the transition to a road system in which all vehicles are automated, and this means changing a technology that has been around for more than 100 years. Let us think about how existing traffic lights work: they stop all conflicting movements except for one to allow vehicles to travel through an intersection and, after a period of time, stop a different movement to allow another set of vehicles to travel. As a result of this concept, the green time is switched between movements. This transition of green time from one movement to the next requires yellow and red signals, which lead to some lost time in each cycle and delays experienced by drivers.

The white phase.

DR. ALI HAJBABAIE and his team, in collaboration with ISE faculty **DR. LEILA HAJIBABAI**, are working on a new traffic control paradigm: using automated vehicles as mobile traffic controllers in cooperation with the traffic signal controller. In this concept, automated vehicles can create groups of human-driven vehicles, negotiate the right of way with each other, and navigate human-driven vehicles through the intersection during a new phase called the white phase. This happens only when enough automated vehicles are present in the intersection neighborhood, otherwise, typical green, yellow and red phases are used. The simulation analysis has been very promising and the new paradigm resulted in total delay reductions ranging from 7 percent to 96 percent when the automated vehicle market penetration rate increases from 10 percent up to 100 percent.

Hajbabaie and his team have published two papers on this concept as well as papers on controlling the movement of automated vehicles in intersections and roundabouts. For more information, please visit Dr. Hajbabaie's website at **ccee.ncsu.edu/people/ahajbab**. ▪

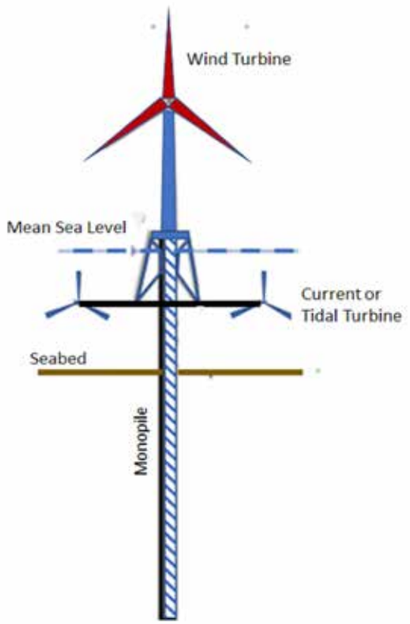
Offshore wind turbine infrastructure offers opportunity to deploy additional devices that use waves, currents and tides to create renewable energy

Wind turbines in the ocean.

In mid-2020, NC Governor Roy Cooper approved a study to assess North Carolina's ability to develop ports and manufacturing facilities to receive shipments of the required blades and towers to build wind turbines. Avangrid Renewables, the developer of the project, estimates that the Kitty Hawk offshore wind project is expected to generate $2 billion in economic impact between 2021 and 2030. The research being conducted by Gabr, Borden and Vo is funded by the North Carolina Renewable Ocean Energy Program.

There is a lot of potential for renewable energy from wind turbines off the North Carolina coast. The Department of Energy estimates that Kitty Hawk and Wilmington offshore wind lease areas have the potential to generate nearly 4 gigawatts (GW). According to *Energy News Network*, "[o]ffshore wind turbines in the North Carolina sites combined could create enough electricity to power more than 1.5 million homes."

CCEE researchers **DRS. MO GABR** and **ROY BORDEN** with Ph.D. student **LONG VO** are exploring how to expand this resource — by deploying other renewable energy devices alongside the infrastructure of commercial offshore wind facilities. Marine hydrokinetic devices (MHKs) that create energy from waves, currents and tides could use the same foundations that are used to support offshore wind turbines. The researchers say this is a common-sense approach for efficient use of expensive infrastructure that includes not only monopiles (foundations), but also subsea cables, transmission boxes and grid connectivity, with the additional benefits of minimizing environmental impact and increasing the energy yield per unit area of marine space.



A concept of hybrid system — wind turbine with current turbines sharing monopile.

"With wind energy projects in the U.S. including the Vineyard project off the coast of Massachusetts, the Virginia wind project at the state's offshore northern boundary and the recently announced 800 MW wind farm offshore of Kitty Hawk, there is an opportunity to deploy commercial-scale arrays of marine hydrokinetics devices by piggybacking on the support system and infrastructure of the offshore wind farms."

DR. MO GABR

The research team is focused on the impact of additional loading imposed by the MHK devices, while these devices are sharing capacity of the wind turbines' monopiles. Preliminary modeling results indicate that, by careful design of monopile thickness, the monopile will have the required support capacity and more. These monopiles can support three to six MHK devices each, depending on the device type and whether it functions to generate power through the use of waves or currents. ▪

Is there a better way to schedule construction projects?

Four critical factors drive every construction project: cost, schedule, safety and quality. The critical path method is a commonly used method of scheduling. But it does not provide a platform to facilitate collaborative scheduling for all participants. To address this, **DR. MIN LIU** led a research project sponsored by the Construction Industry Institute (CII) to study the challenges and opportunities to promote collaborative scheduling in construction projects. Collaborative scheduling (CS) is a comprehensive process that aligns and engages all stakeholders throughout the life cycle of the project to coordinate activities and resources.

A nationwide survey resulted in 241 usable responses to study practitioners' perceptions about CS practices in real-world projects and to gauge the impact of these practices on key performance indicators (KPIs), such as cost, schedule, quality, safety and teamwork. In addition, the research team developed an interview protocol and conducted 30 in-depth interviews to collect contextual information about how schedules are developed in the industry.

Liu and Ph.D. student **CHUANNI HE** used the information theory approach to study the pattern between CS behavior and KPIs. This innovative approach developed practical paths leading to the next level of CS when construction companies have to plan and monitor with limited resources. The research findings enable an organization to benchmark itself against CS practices, gauge its progress toward the development and implementation of CS, and / or understand how specific CS-related practices are perceived to impact specific KPIs.

"Our results will help construction companies learn how they compare with their peers in the industry and how they can improve collaborative scheduling given tight schedule and budget constraints."

DR. MIN LIU

The research team included a group of 15 construction industry leaders and practitioners, as well as Dr. Thais Alves from San Diego State University and Dr. Natalie Scala from Towson University. In October 2020, the research findings were reported in a webinar, "From Behavior to Results — Finding the Path to Collaborative Scheduling Success." The webinar attracted over 500 participants, a record for CII. ▪

NEW RESEARCH PROJECTS

In the Multifunctional Composites Lab, Ph.D. student Zach Phillips (left) and Dr. Jason Patrick are using an optical microscope to examine a fiber-reinforced composite cross-section containing an internal microchannel.

During the latter half of 2020, CCEE launched numerous new research projects with funding from federal and state agencies, foundations and industry sponsors. This support will enable CCEE faculty members, their research teams and their collaborators to address problems facing infrastructure and the environment in North Carolina and around the world.

DRS. KEVIN HAN and **JASON PATRICK,** with support from the National Science Foundation, are improving undergraduate programs in civil engineering. Real-world problems related to civil engineering systems will be brought into undergraduate classrooms through interactive digital visualizations. Students will control engineering systems through affordable sensing technologies, such as smartphones and Internet of Things (IoT) sensors. The resulting educational tools will promote active learning and introduce students to innovative sensors for smart infrastructure.

DR. JASON PATRICK will collaborate with Dr. Soheil Soghrati (The Ohio State University) and **DR. JAMES LEVIS** on an interdisciplinary project sponsored by the Department of Defense's Strategic Environmental Research and Defense Program to accelerate the development of self-healing structural composites. The research will employ a recently developed technology to repeatedly heal 3D-printed plastic interlayers, *in situ* using embedded heaters, while retaining structural integrity of the host composite. The project will leverage numerical simulations and machine learning to optimize the design of multi-material microstructures. This three-year project aims to benefit the environment and Department of Defense fiber-composite assets, such as jet fighters and rotorcraft, by eliminating the need for costly inspection, reducing overall maintenance and replacement while enhancing structural reliability and performance.

DR. TASNIM HASSAN and eight investigators from four departments in the College of Engineering received a grant from the Department of Energy to develop a unique In-Situ Testing Laboratory (ISTL). A scanning electron microscope will be acquired and integrated with a miniature mechanical test system developed in previous research. The ISTL will allow investigations on failure mechanisms of critical high temperature structural components that are used in next-generation nuclear and solar power plants, improving their safety while reducing their cost.

DRS. SHANE UNDERWOOD and **RICHARD KIM** received funding from Applied Research Associates, in collaboration with the Federal Highway Administration, to improve fatigue testing standards for asphalt concrete mixtures. A large number of pavements fail because they experience excessive cracking. This project will improve a standard test method for measuring asphalt concrete fatigue resistance, the American Association of State Highway and Transportation Officials (AASHTO) test method TP 133. It will do so by incorporating a more reliable test temperature selection procedure. The project will also improve the modeling tool that engineers use to evaluate the impact of asphalt mixture fatigue properties on long-term performance.

DR. MERVYN KOWALSKY and Ph.D. student **ARIADNE PALMA** were awarded a project that aims to develop new seismic hazard definitions for bridge structures that are based on risk of collapse. The project is funded by AASHTO and includes researchers and engineers from across the country. NC State researchers will assess the impact of the new seismic hazard definition on the design of bridges.

DRS. ABHINAV GUPTA and **GIORGIO PROESTOS** received funds from Project Electricite de France for their research to develop modern statistical tools for seismic risk assessment. The goal of the project is to develop a consistent approach to quantify uncertainties from diverse sources in order to allow a robust risk assessment for safety of structures against natural hazards such as earthquakes.

DR. WILLIAM RASDORF received funding from the North Carolina Department of Transportation (NCDOT) to determine the true lifespan of LED traffic signals and to assess traffic signal maintenance and replacement procedures to benchmark their costs. This study will explore the performance of LED signal lights and whether a systematic signal replacement strategy could be developed and used by any division within North Carolina to enhance performance, reduce waste, reduce cost and be implemented in an efficient manner.

DR. WILLIAM RASDORF received funding from the NCDOT to assess the constructability of diverse, modern and unconventional intersections and interchanges (DMUII), some of which are unfamiliar to designers, inspectors and contractors. These intersections and interchanges present a significant possibility for construction cost overruns and schedule delays because of their complexity and their location in physically constrained areas. This research will determine how to avoid cost and schedule problems, and to identify and mitigate problems quickly if they do occur.

DRS. MO GABR, **SHAMIM RAHMAN** and post-doctoral researcher **DR. AMIN RAFIEI** received funding from the NC Renewable Ocean Energy Program to assess the stability of anchoring foundation systems used to support marine renewable energy devices and associated infrastructure placed on the nearshore seabed. The research aims to evaluate the effectiveness of three protective measures to mitigate seabed instability that could result in damage to the foundation systems and threaten the operation of renewable energy devices.

DR. SANKAR ARUMUGAM received funding from drinking water utility Tampa Bay Water to study how expected changes in climate and hydrology will impact the agency's ability to provide drinking water over its service area. The research will develop a number of potential scenarios of hydroclimate, including precipitation, temperature and streamflow, to evaluate how Tampa Bay Water could manage various water sources including reservoirs, groundwater and desalination plants to meet the continued increase in demand.

DR. MOHAMMAD (MOE) POUR-GHAZ received funding from the Indiana Soybean Alliance to understand and measure the effect of a chemical derived from soybeans, soy methyl ester (SME), on the service life of reinforced concrete structures. SME is used as a concrete admixture and as a penetrating sealant to reduce the rate of ingress of chlorides, from deicing salts or seawater, into concrete. Advanced X-ray and neutron tomography methods are being used to measure and quantify the effect of SME on reducing the rate of chloride ingress. When chlorides penetrate into concrete, they can corrode the reinforcing steel, which then requires significant maintenance, repair and replacement of infrastructure. ▪

CCEE RESEARCHERS CREATE TOOLS TO PROTECT OUR **WATER QUALITY**

With support from the NC Policy Collaboratory and Water Resources Research Institute, a team of CCEE researchers is involved in a multi-year study to help clean up the Falls and Jordan Lake watersheds. Led by Dr. Dan Obenour, the team includes Dr. Jonathan Miller, Ph.D. student Kimia Karimi and Dr. Sankar Arumugam. Their multi-disciplinary approach combines hydrology and pollutant transport processes with multi-decadal geospatial data and computer modeling.

NUTRIENT LOADING IS A MAJOR CAUSE of water quality problems in lakes and reservoirs across the globe, including in central North Carolina. Elevated nutrient loading (both nitrogen and phosphorus) stimulates excessive algal production, and some of these algae (cyanobacteria, in particular) can produce dangerous toxins, as well as compounds that negatively impact the taste and odor of water. Excessive algae can also lead to discolored and turbid waters that affect the aesthetic appeal of our lakes, while diminishing light penetration and altering ecosystem function. Furthermore, as algae decompose, oxygen is depleted in portions of the reservoir, reducing fish habitat and releasing chemicals from the bottom sediment (e.g., manganese). These water quality problems diminish the value of reservoirs as recreational attractions and wildlife habitats, and can greatly increase the cost of treating water for human consumption.

In the Triangle region of North Carolina, Falls and Jordan Lakes serve as major water supplies and recreational attractions. However, since their construction in the early 1980s, these reservoirs have suffered from high levels of nutrient loading. Excessive algal concentrations typically occur in summer and fall, especially where nutrient-laden streams enter the reservoirs. To protect these reservoirs, the state of North Carolina and local stakeholders have focused on reducing watershed nutrient loading. However, over the last three decades, few of the reservoirs' tributary streams have exhibited consistent decreases in nutrient loading. Instead, nutrient loading appears to be increasing in some streams.

Jordan Lake

Data-driven watershed modeling to assess nutrient export and retention in central NC

To manage nutrient pollution, it is critical to understand how loading varies over space, time and among different source types. It is well known that natural lands release nutrients at lower rates than developed (agricultural and urban) lands due to fertilizer use, pet and livestock waste, and sometimes leaking sewage infrastructure. However, considering the heterogeneity of developed landscapes, there is considerable uncertainty and variability in nutrient export.

"We are advancing a 'hybrid' approach for watershed modeling and nutrient source characterization. The model combines simple mechanistic nutrient loading and transport relationships with an advanced statistical (Bayesian) framework for data-driven discovery and uncertainty quantification. The approach leverages 35 years (1982-2017) of United States Geological Survey (USGS) streamflow records and North Carolina Department of Environmental Quality (NCDEQ) nutrient sampling to quantify source-specific export rates. Moreover, we're exploring the year-to-year variability in nutrient export to reservoirs due to changes in precipitation, while also accounting for nutrient losses, including sedimentation and denitrification in streams and large impoundments."

DR. DAN OBENOUR

Findings support benefits of improved watershed development requirements

"Our results show that urban land is the greatest exporter of nutrients per unit area. Urban lands export about 10 times more nutrients per year than natural lands. However, not all urban lands are created equal. We find that urban lands constructed before 1980 export twice the nitrogen and phosphorus of more recent development. This is likely due to improved watershed development practices, such as the installation of stormwater detention ponds."

DR. JONATHAN MILLER

Urban lands developed since 1980 have nutrient export rates that are about the same as agricultural lands, but still much higher than natural lands. Thus, conversion of agricultural land to urban land will have a much smaller impact on overall nutrient loading than urban development of natural lands. Because a majority of lands in the Falls and Jordan Lake watersheds remain forested with little development, conversion of this land to either urban or agricultural land will dramatically increase nutrient loading to the reservoirs. Additionally, wastewater treatment plant effluent accounts for a large portion of nutrient release to the lakes (e.g., 50 percent of nitrogen and 25 percent of phosphorus to Jordan Lake; less for Falls Lake). Finally, streams and small reservoirs were found to remove (or retain) a small but significant portion of the nutrient source loading within the watershed.

Many questions remain. What are our next steps?

While these results provide data-driven estimates of nutrient export rates from key sources over time, many questions remain. What aspects of older urban development result in such high nutrient export rates, relative to newer development? Why does the model tend to over- or under-predict nutrient loading in particular sub-watersheds? To help answer these questions and provide more detailed management guidance, the researchers (with assistance from the Center for Geospatial Analytics) are looking to create new and better information on stream buffers, urban density, stormwater control measures and other landscape features that may influence nutrient loading throughout the study area. These new data will be incorporated into the hybrid model to evaluate which factors best explain the variability observed in both time and space, leading to improved predictive capabilities. Overall, the researchers expect these modeling results to provide a data-driven foundation for developing efficient and cost-effective watershed management strategies that will help protect our region's critical water supply reservoirs. ▪

This study is part of a larger effort to develop a "new comprehensive nutrient management regulatory framework" with a focus on Falls and Jordan Lakes. The study also includes modeling of in-lake water quality conditions by Dr. Obenour's team and others. This modeling shows how nutrient loads from particular streams (e.g., Morgan and New Hope Creeks) exert a disproportionately large influence on reservoir water quality, and also how nutrient storage in reservoir bottom sediments make water quality improvement a long-term (multi-decadal) proposition. For more on this and other aspects of the study, see nutrients.web.unc.edu.

AWARDS & HONORS

Dr. Alex Albert

DR. ALEX ALBERT, associate professor of construction engineering, was recognized as one of the **Top Young Professionals** in 2021 by *Engineering News-Record (ENR) Southeast*. The honor recognizes young design and construction professionals who have made notable contributions through industry leadership and community service. This honor recognizes Albert's evidence-based safety research and relevant outreach efforts that continue to benefit workers in the construction industry. Albert was featured in the January 2021 print edition of *ENR Southeast*.

Dr. George List

DR. GEORGE LIST, professor of transportation systems, was elevated to the grade of senior member of the Institute for Electrical and Electronics Engineers (IEEE) this year. This recognition is the **highest professional grade of IEEE** for which a member may apply. This honor recognizes extensive experience in an IEEE designated field and reflects the professional accomplishments that only 10 percent of the more than 400,000 IEEE members achieve.

Dr. Min Liu

DR. MIN LIU, associate professor and Edward I. Weisiger Distinguished Scholar, was **promoted to chair** of the American Society of Civil Engineers (ASCE) Construction Research Council (CRC) in March 2020. CRC is the international community of researchers who advance engineering knowledge and practice related to construction. The CRC's mission is to advance engineering knowledge and practice, to disseminate knowledge, to assist members in educational professional development initiatives, to enhance the practice and research in Construction Engineering, and to mentor professionals who aspire to be researchers.

Dr. Gregory Lucier

DR. GREGORY LUCIER, research associate professor and manager of the Constructed Facilities Laboratory (CFL), and Dr. Dana K. Gulling, associate professor in the College of Design, were awarded the **Educator of the Year** award by the Precast / Prestressed Concrete Institute. The award recognizes the development of a unique interdisciplinary graduate-level studio course, Creations in Concrete, for architectural and engineering students. The course offers students technical knowledge and hands-on experience working with precast concrete systems, solutions and technologies. The course encourages collaboration and creativity, and it leverages the latest design and construction technologies.

Dr. Beth Sciaudone

DR. BETH SCIAUDONE, research assistant professor, was awarded the **2020 Unsung Hero Award** by the American Shore & Beach Preservation Association (ASBPA). The award recognizes Sciaudone's role and contributions as the managing editor of *Shore & Beach*, a quarterly, peer-reviewed journal of ASBPA. The award also recognizes her behind-the-scenes efforts to maintain a successful publication and her role as a webmaster for the ASBPA website.

Dr. Brina Montoya

DR. BRINA MONTOYA, associate professor of geotechnical engineering, was awarded the **2021 Early Career Researcher Award** by the U.S. Universities Council for Geotechnical Education and Research. The award is given once every two years to researchers who have made significant and innovative contributions to research, creative accomplishment and scholarship in the field of geotechnical engineering. Montoya's area of expertise is focused on characterization of geomaterials improved with the microbial

AWARDS & HONORS
continued

induced carbonate precipitation (MICP) process. Her contributions range from the fundamental understanding of the constitutive behavior of MICP cemented soil to the practical applications related to engineering performance of the improved material for hazard mitigation and infrastructure resilience.

Leo Barcley

Dr. Mervyn Kowalsky

Former MS student **LEO BARCLEY** (MSCE 2018) and **DR. MERVYN KOWALSKY** received the American Concrete Institute's (ACI) **Wason Medal for Materials Research** for their article titled "Critical Bending Strain of Reinforcing Steel and Buckled Bar Tension Test." The award will be given at the ACI spring convention in Baltimore in spring 2021. The ACI Wason Medal is given at most once per year for the best materials-related research paper in the *ACI Journal*.

Morgan DiCarlo

MORGAN DICARLO, Ph.D. candidate advised by **DR. EMILY BERGLUND**, has earned several awards in the past few months including winning the **Overall**, **Most Creative**, **Most Humanitarian** and **Most Gross Student Poster** in a contest organized by the NC section of the American Water Works Association and the Water Environment Federation (NC AWWA-WEA). DiCarlo's poster was titled "Agent-based Model of Social Media Behaviors During Hurricane Florence." DiCarlo also won the **AGU Water and Society Technical Committee Twitter contest** with the following tweet: ***"Did you know that, according to USGS, daily U.S. water use per capita is lower now than in 1970? Applying "demand-side management", engineering & policy merge to create efficient technology, smart monitoring & conservation approaches that help decouple water use and societal growth."***

Most recently, she won the **Graduate Voices of the Future Award** presented at the American Geophysical Union Hydrology Section business meeting. The award recognized her thoughtful recommendations in an essay titled *"Envisioning a Future of Water-Human Networks: Digital solutions to link water management and human behavior."* Her essay describes emerging digital solutions to integrate information about human behavior into water resources management approaches, and presents a vision for diverse and inclusive job creation at the intersection of water and information communication technologies.

Siddharth Banerjee

SIDDARTH BANERJEE, Ph.D. student advised by **DR. EDWARD JASELSKIS**, won the **Stephanie L. Spencer Ploeger Scholarship** awarded by the Raleigh chapter of the American Society for Quality (ASQ). The scholarship recognizes Banerjee's work on applying the concepts of quality to real-world problems, specifically his research toward developing the CLEAR (Communicate Lessons, Exchange Advice, Record) program maintained by the North Carolina Department of Transportation (NCDOT). The CLEAR program creates a robust knowledge repository with a specific focus on gathering lessons learned and best management practices from NCDOT personnel.

Liz Ramsey

LIZ RAMSEY, Ph.D. student advised by **DR. EMILY BERGLUND**, was awarded **second place** for the NC AWWA-WEA Students and Young Professionals Instagram Contest. The contest showcased social media content that celebrates the water / wastewater industry. Ramsey shared a picture of one of the water tankers that is used to supply water to over a third of the city of Jaipur in India. The photograph was taken while she spent time in Jaipur as part of her Fulbright Student Program.

Ph.D. student **ASMITA NARODE** received a Floyd Hasselriis **educational support award** from the ASME Materials Energy Recovery Division. This award is presented to support students in solid waste management and related fields, and to support colleges and universities that offer curriculum or courses in solid waste management and related fields.

Asmita Narode

Narode is working on the development of methods to measure the heat potential of calcium-containing wastes (i.e. ash) when buried in a landfill. The objective of her research is to develop methods to measure heat release from hydration and carbonation reactions under both ideal- and landfill-relevant conditions. She is advised by **DR. MORTON BARLAZ**.

Ph.D. student **TUHIN ROY**'s e-poster, *"Multimodal Inversion for Shear Modulus and Thickness of Arteries"* won **Honorable Mention** at the flagship conference on medical ultrasound, the IEEE Ultrasound Symposium, held in September 2020. A separate presentation by Roy on related work was selected to be highlighted to the press at the 179th meeting of the Acoustical Society of America (ASA) held in December 2020. Roy is a Ph.D. student working with **DR. MURTHY GUDDATI**.

Tuhin Roy

Johnathan Woodruff

JOHNATHAN WOODRUFF, a third-year Ph.D. student in the Coastal and Computational Hydraulics Team (CCHT) advised by **DR. CASEY DIETRICH**, was awarded the **2020 ASBPA Student Educational Award**. This award is given annually to an undergraduate or graduate student who, through his or her research, is furthering the state of science of coastal systems as it relates to the goals and mission of the ASBPA. Woodruff presented his work titled "Improving Predictions of Coastal Flooding via Sub-Mesh Corrections" at the ASBPA National Coastal Conference in November.

Leah Weaver

LEAH WEAVER, a Ph.D. student working with **DR. TAREK AZIZ**, was awarded the **NC Water Resources Research Institute's Graduate Fellowship** to study the fungal biodegradation of a concerning class of pesticides in water (neonicotinoids). Fungal bioreactors show promise for the degradation of a host of emerging contaminants due to their production of non-specific extracellular enzymes. Weaver's research will advance the application of fungal bioremediation to real waters.

Minerva Bonilla

Laura Dalton

Elizabeth Ramsey

Afrin Sadia

Ph.D. students **MINERVA BONILLA**, **LAURA DALTON**, **ELIZABETH RAMSEY** and **AFRIN SADIA** were selected to participate in the **2020 Rising Stars Workshop** hosted at Carnegie Mellon University. This program is tailored to outstanding women doctoral students and postdocs who are interested in pursuing academic careers. It is designed to enable graduate students to network with faculty from research institutions, meet scholars in the field and receive advice for advancing in an academic career.

Savanna Smith

SAVANNA SMITH, a Ph.D. student in the environmental engineering program, won this year's **NC Safewater Fund Scholarship**, sponsored by the NC AWWA-WEA. The award recognizes rising stars working in water quality and public health. Smith is mentored by **DR. FRANCIS DE LOS REYES**. ▪

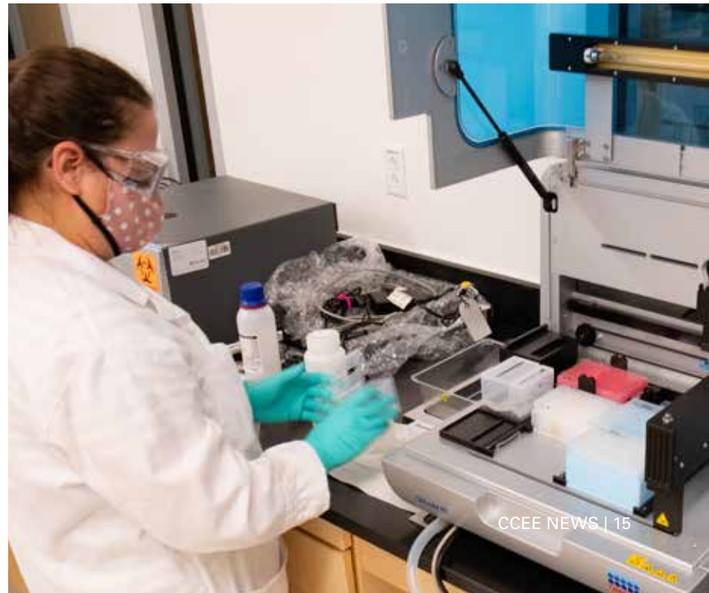
The new Environmental Engineering Lab supports the research programs of five faculty members in global water and sanitation, microbial ecology, water and wastewater treatment and solid waste decomposition. The lab complex includes dedicated rooms for analytical instrumentation, electrochemistry, molecular biology and a pilot room for larger-scale studies.

New Labs for New Discoveries

In this photo essay, we share a few scenes from the new laboratories in Fitts-Woolard Hall. These photos represent just seven of the 28 laboratory spaces in the new state-of-the-art building. These CCEE labs, which encompass more than 35,000 square feet, are home to dozens of cutting-edge research projects.

In the **AGGREGATE PROCESSING LAB**, Ph.D. student **Samrin Ahmed Kusum** is processing limestone aggregates to prepare concrete samples. Her research is focused on reducing or eliminating sewer line blockages caused by the accumulation of fat, oil and grease (FOG) related solid deposits.

Judy Kays, research technician, is using the QiaCube HT instrument to perform automated RNA extraction from wastewater samples in the **MOLECULAR BIOLOGY LAB**. This research is part of a project funded by the National Science Foundation and the NC Policy Collaboratory to quantify SARS-CoV-2 in wastewater as a method for predicting trends in COVID-19 infections in a community.



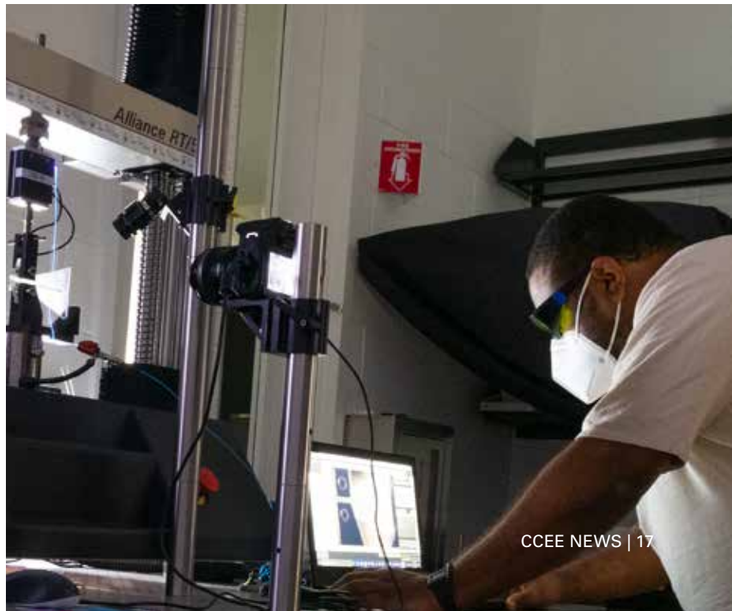
Francisco Wladimir Jativa Valverde is programming the environmental chamber that is used for testing concrete materials in the **CONCRETE TECHNOLOGY LAB**.

In the **SENSING AND MATERIALS RESEARCH TEAM (SMART) LAB**, Ph.D. students **Francisco Wladimir Jativa Valverde** (left) and **Hyunjun Choi** prepare a sample of CO_2 sequestering concrete materials to quantify its air void size distribution. The SMART lab is developing a method to sequester CO_2 within concrete during the concrete production process. This process could offset a portion of the carbon footprint of concrete production while resulting in a more durable concrete.

In the **ASPHALT MULTI-SCALE TESTING LAB**, Ph.D. student **Kazuo Kuchiishi** calibrates the load cell of the Asphalt Mixture Performance Tester (AMPT). This instrument is used to measure the stiffness, cracking resistance and deformation resistance of asphalt mixes. Kuchiishi is conducting research to improve the test method used to measure the dynamic modulus of asphalt mixes.

In the **HYDRAULICS TEACHING LAB**, Ph.D. student **Leah Weaver** prepares to record an instructional video for use in a virtual course. Leah is making adjustments to the “Minor Loss” apparatus on a hydraulic bench where students will study the pressure drop across several common pipe fixtures to help better understand losses in pipe design.

In the **MULTIFUNCTIONAL COMPOSITES LAB**, Ph.D. student **Sherif Aboubakr** is performing a mechanical test to assess the ability of embedded optical fibers to restore fracture properties to a structural epoxy via a liquid healing agent. This state-of-the-art self-healing approach is much faster than prior techniques and provides a spectroscopic conduit to see inside materials for structural health monitoring. ▪



GRADUATE STUDENT **SPOTLIGHTS**

Our research and teaching is only possible with the assistance of our more than 200 on-campus graduate students, each of whom has a strong personal history and a promising future. We shine a spotlight on a few students.

ANDREW FRIED

ANDREW FRIED (BSCE 2016, MSCE 2018) is a 3rd year Ph.D. student with a concentration in transportation materials. He grew up in Charlotte, North Carolina, and moved to Raleigh when he began his undergraduate degree at NC State. He is advised by **Dr. Cassie Castorena** and is studying the effect of recycling agents on the ability to increase recycled asphalt usage in pavements without compromising long-term performance.

What were the influences for your interest in engineering?

Andrew Fried: Even though I'm the first person in my family to pursue an engineering degree, I've known since elementary school that I wanted to be an engineer because of my interest in math and science, and a true enjoyment of problem solving. My passion for pavement materials started while working in the asphalt materials laboratories under Dr. Castorena as an undergraduate.

What problem(s) are you trying to solve? Why was NC State / CCEE a good fit for you?

AF: I am working on a research project concerned with asphalt's long-term performance after being mixed with reclaimed asphalt pavement (RAP). The goal is to see if the additions of different recycling agents or rejuvenators are capable of improving the long-term performance of mixed asphalt surfaces. NC State is a good fit for me due to the extremely knowledgeable/experienced faculty and the connections offered with the transportation industry as a whole. Being located in the Triangle, I am close to both NCDOT and the contractors responsible for the construction/inspection of roads. Thus, I see how my research results have real-world impacts.

Current thoughts about where you might be or what you might be doing in five years?

AF: I am hoping to be working as a professional engineer at a DOT, hopefully helping with other research projects or continuing to examine the impact that recycling agents have on performance. I believe there are ways to help reduce waste/environmental impact from roadway construction. ▪

ASHLEY BITTNER

ASHLEY BITTNER is a 4th year Ph.D. student with a focus on air quality engineering. She grew up in Virginia Beach, Virginia. Ashley is advised by **Dr. Andrew Grieshop** and has been part of the Grieshop Atmosphere and Environmental Lab (GAEL) since the summer of 2017. She's spent the last four summers before COVID restrictions collecting field data in several African countries as part of a study measuring and characterizing air pollutant emissions from biomass-burning sources such as traditional cookstoves.

What were the influences for your interest in engineering?

Ashley Bittner: My father is a mechanical engineer. He has worked for multiple private engineering firms, focusing on defense and military services. I have always been interested in science and math, and I originally went to college to pursue a degree in astrophysics. But during my senior year of undergrad I realized I had become increasingly interested in environmental and public health issues. I worked for a year as a post-baccalaureate research assistant and spent several months in east and west Africa with a research team that was collecting health symptom and air pollution exposure data for fish smokers working on the coasts of Ghana. Through this work I met Dr. Andy Grieshop and applied to graduate school at NC State to work with him.

What problem(s) are you trying to solve? Why was NC State / CCEE a good fit for you?

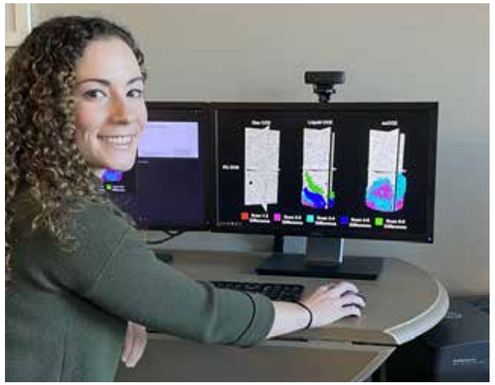
AB: The project I'm working on with Dr. Grieshop is based in Malawi and the goal is to better understand how widespread reliance on biomass for household energy in Sub-Saharan Africa impacts deforestation, air quality, health, and regional and global climate change. There is a lack of data and research on these topics, especially in remote, rural southern Africa. This project seeks to provide a novel and much needed data set for atmospheric modelers, local policy-makers and air quality researchers. In the future, we hope this research will improve global access to affordable and sustainable energy sources, reduce the burden of disease due to exposure to air pollution and limit climate impacts from deforestation and biomass emissions.

Current thoughts about where you might be or what you might be doing in five years?

AB: I will continue to pursue air quality and environmental research and I hope to have the opportunity to research other niche topics under this umbrella. I think a fresh perspective can be crucial to problem solving, and I hope that interdisciplinary research continues to become more mainstream. I hope to start my own family, spend more time with loved ones, pursue my hobbies, and build a long-term home right here in the Triangle. My time at NC State has confirmed that my 'home' is in North Carolina! ▪

ASHLEY BITTNER

GRADUATE STUDENT **SPOTLIGHTS**
continued



LAURA DALTON grew up in Fairmont, West Virginia. She is a 3rd year Ph.D. student studying mass transport and carbonate formation in cement-based materials using 3D imaging techniques. She is advised by **Dr. Moe Pour-Ghaz**.

What were the influences for your interest in engineering?

Laura Dalton: My siblings and I participated in competitive gymnastics as children, which I believe taught us hard work and responsibility at a relatively early age. My brother is now a chemical engineer for DOW Corning and my sister is an outpatient pharmacist at a hospital. While they both started college knowing the career they wanted to pursue, it took me completing an undergraduate degree in graphic arts before I discovered my passion for engineering and research. In 2014, while completing my second undergraduate degree, this time in civil engineering, I participated as a Mickey Leland Energy Fellow at the U.S. Department of Energy's National Energy Technology Laboratory. Here I learned to use X-ray computed tomography scanning to look at pore size distributions in foamed cements. In other words, I was using graphical images to analyze data and solve problems. Once I discovered this type of career existed, I knew this was the path for me as it combines both my analytical and creative inclinations.

What problem(s) are you trying to solve? Why was NC State / CCEE a good fit for you? Where did your passion for this particular focus come from?

LD: I research how carbon dioxide (CO_2) reacts with cement-based materials and how carbonate formation can influence transport properties. While I study this topic to better understand the long-term integrity of underground carbon capture and storage wells, this research also assists in solving additional engineering challenges. Society's dependence on cement-based materials will not change in the foreseeable future. As a civil engineer, I believe it my responsibility to develop innovative ways to offset the high levels of CO_2 emitted during cement production. Understanding how CO_2 interacts with cement-based materials may enable life extension of existing infrastructure or contribute to new applications to improve infrastructure.

The NC State CCEE department was a perfect fit for me because of the collaborative nature, the facilities available and the countless external opportunities provided through the university.

Current thoughts about where you might be or what you might be doing in five years?

LD: My goal is to obtain a tenure-track academic position at a research-focused university where I can run my own multiphase-flow imaging laboratory. Ideally, I hope to advise a research group which focuses on using and developing various imaging techniques to better understand multiphase flow through both cement-based materials and geological formations. ▪

MINERVA BONILLA VENTURA (MSCE 2019) is a 1st year Ph.D. student with a concentration in construction and transportation engineering. She grew up in El Salvador, completed her undergraduate degree at Texas Tech University, and came to NC State to pursue her master's degree in our department. Ventura is advised by **Dr. William Rasdorf** and is studying the enhancement of constructability of transportation infrastructure.

What were the influences for your interest in engineering?

Minerva Bonilla Ventura: Throughout my childhood, I always wanted to be a physician but as the years went by, that interest changed. I realized that I have a passion for designing, and became interested in construction engineering based on an internship experience. During the summer of 2017, I interned with a South American non-governmental housing construction organization called TETO in Curitiba, Brazil. I was exposed to construction engineering work in vulnerable areas. I felt pleased that I was making a difference in people's lives and that I was learning so much in the process.

What problem(s) are you trying to solve? Why was NC State / CCEE a good fit for you? Where did your passion for this particular focus come from?

MBV: I am currently interested in solving problems related to the construction of sustainable infrastructure, especially transportation infrastructure. There is a need for both restoration and the creation of new sustainable infrastructure to enhance transportation capacity and promote safety. This can be achieved, in part, through the construction of what's known as diverse, modern and unconventional intersections and interchanges or DMUIIs. However, contractors are reluctant to build these types of intersections. To overcome this, my research goal is to study DMUII constructability challenges so that future DMUII projects can be selected for implementation.

The curriculum in our CCEE department is broad and will allow me to learn how to productively design, build and manage both small-scale and mega projects. Even though I am interested in a narrowly focused area of our infrastructure, I will graduate with knowledge that will enable me to have a broad understanding of the entire transportation infrastructure, design, development, funding and management processes.

Current thoughts about where you might be or what you might be doing in five years?

MBV: I plan to pursue a career in academia and my area of research interests includes constructability, modern unconventional intersection and interchanges, funding allocations, risk management and project success. These research areas could be implemented on transportation and other types of construction projects (buildings, bridges, dams, etc.) and in the long run help deal with housing, clean water, waste disposal and other critical infrastructure problems. ▪

STUDENT GROUPS

There are more than a dozen 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.

Ashton Stuart and her Mr. Potato Head creation.

CHI EPSILON

The Chi Epsilon National Convention was hosted virtually by Boise State University on October 21-24. **ASHTON STUART**, the president of Chi Epsilon at NC State, attended the convention as the chapter's representative. The convention consisted of meetings to pass new bylaws and work towards improving the future of Chi Epsilon. Since the host university was Boise State, to incorporate Idaho being "the potato state," one of the social events during the convention was a Mr. Potato Head competition. "I really enjoyed interacting with other chapters' officers and hearing about their experiences and how their chapters operate," Stuart said. "The experience gave me ideas to bring back to our chapter and it was encouraging to connect to fellow civil engineering students across the country. We started planning for future conventions and talked about ideas for improving membership and recruitment. We set a goal for Chi Epsilon to increase local community involvement by creating honorary memberships for civil engineering professionals who are no longer students."

COASTS, OCEANS, PORTS, AND RIVERS INSTITUTE (COPRI)

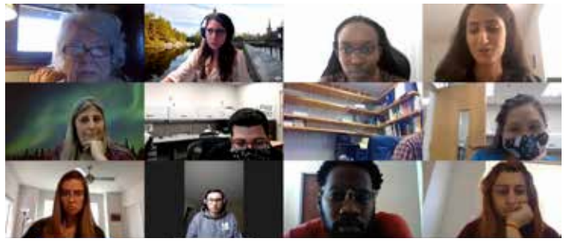
The COPRI student chapter at NC State aims to bring together students interested in coastal engineering and related fields, and foster their academic and professional development. Although COPRI's main field trip had to be canceled in the spring of 2020 due to the pandemic, COPRI members have participated in several physically distant stream and shoreline cleanup events. "These events, including two local Raleigh Greenway cleanups, brought chapter members outside and gave them some much-needed social interaction in a responsible way," said **JOHNATHAN WOODRUFF**, president of COPRI. "Future plans are highly dependent on the state of the pandemic. We would love to take a field trip to either Wilmington, North Carolina, or Norfolk, Virginia, to tour coastal facilities and research projects. We plan to continue doing our stream cleanups in the Raleigh area throughout the spring."

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE (EERI)

The EERI undergraduate team traveled to San Diego in March of 2020 (just before COVID-19 restrictions were implemented) to compete in the Seismic Design Competition (SDC). After months of designing and building their structure, the team's balsa wood structure survived the most severe ground motion pulse in competition history, which caused 23 of the 46 structures to collapse. The SDC team placed in the top 5 in the presentation category and included **DIEGO BRYAN**, **BRAYDEN GOALS**, **MAX RANDALL**, **JACOB SEATE** and **AUDREY WARNER**. EERI officers and graduate students **VICTOR CALDERON**, **ARJUN JAYAPRAKASH**, **DIEGO SOSA** and **JESSI THANGJITHAM** presented their respective earthquake engineering research during the SDC event. The 2021 competition will be held virtually in March and will include a seismic design and retrofit project.

EERI SDC team from left to right, Brayden Goals, Diego Bryan, Audrey Warner, Jacob Seate and Max Randall with their balsa wood structure "Alta Tower."

From left to right, EERI Officers Jessi Thangjitham, Victor Calderon and Diego Sosa at the research poster session of the EERI Annual meeting in March 2020.



EERI members participate in a virtual seminar on the Sparta, NC earthquake.

In November, the EERI chapter hosted a virtual seminar with Geo-Institute Graduate Student Organization (G-I GSO) on structural and geological reconnaissance following the 5.1 magnitude earthquake that occurred this past August in Sparta, NC. This earthquake was the largest recorded earthquake to strike North Carolina. The earthquake reconnaissance findings were presented by researchers **ARIADNE PALMA** and **DR. PAULA FIGUEIREDO**.

ENGINEERS WITHOUT BORDERS (EWB)

The Guatemala Water Systems team of NC State's EWB chapter completed a remote implementation of their ongoing rainwater catchment system project in early October, marking the fourth implementation for the team. After postponing their travels planned for May 2020 due to the COVID-19 pandemic, the team coordinated with their in-country partner, Centro Comunitario Educativo Pokomchí (CeCEP), to continue the project remotely. During this phase, eight rainwater catchment systems were installed on individual houses in the community of Caserio Panhux in Guatemala, and two systems were installed on the back of the school to connect to a community kitchen. The rainwater catchment systems will collect water that the families can use for cooking, cleaning and hygienic purposes.

GLOBAL WATER, SANITATION AND HYGIENE (WaSH)

The Global WaSH student chapter helps create connections between students, professors and professionals through a WaSH Wednesday speaker series and monthly chapter meetings. In October, the guest speaker was Dr. Joe Brown,

Members of the community helping to unload the 2500L tanks. (Photo by Abelino Caal)

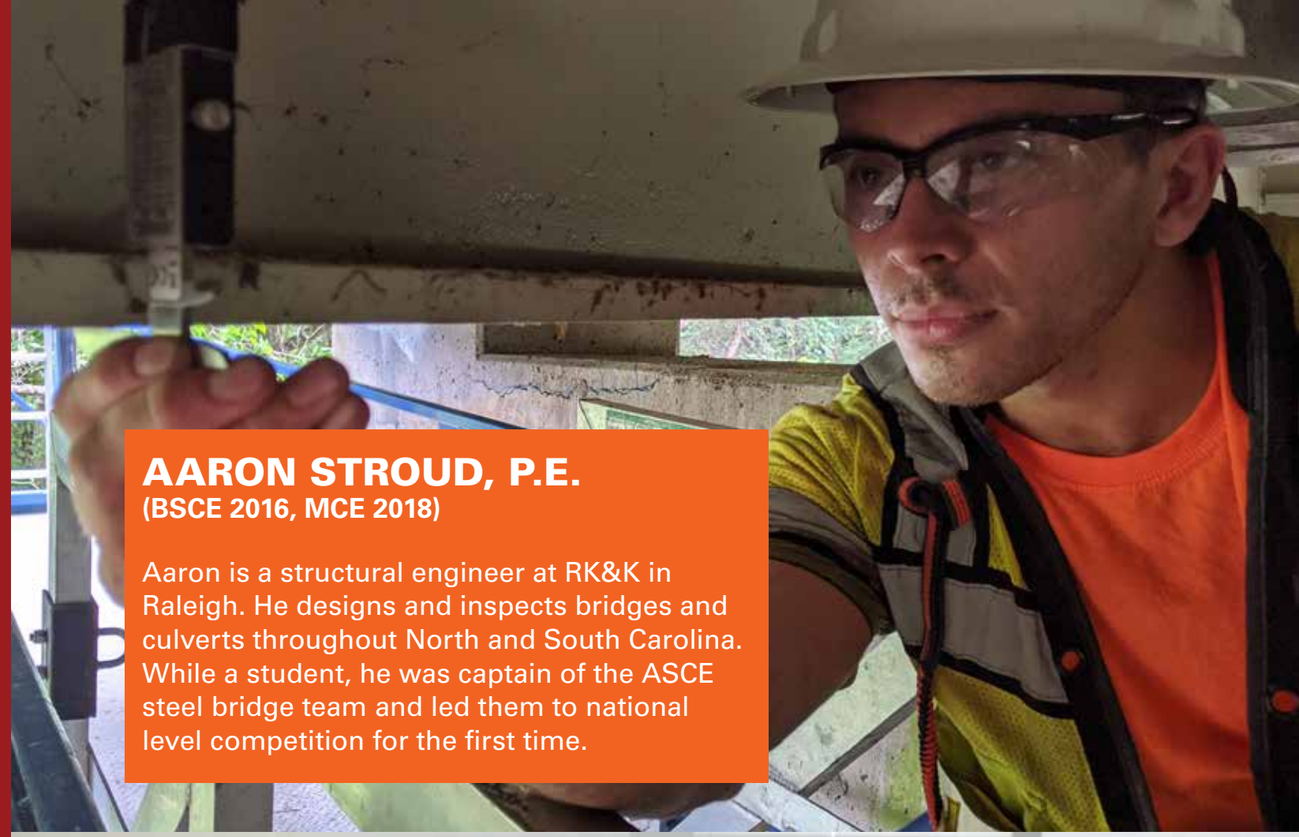
Screen shot from the virtual event featuring Dr. Joe Brown.

an environmental engineering professor at UNC-Chapel Hill. During the virtual event, Brown gave an insightful presentation on the role of engineers in supporting global public health advancements. "When working on sanitation and water supply problems in underserved communities, Dr. Brown reminded us that engineers need to think of questions such as: how to make sure that piped water supplies are really safe? How safe does water need to be to protect against endemic diseases? How will technologies work in challenging conditions? He reminded us that in order to answer these questions and come up with solutions, a well trained engineer not only needs technical skills and creativity, but also knowledge of society and cultural awareness," said **VIE VILLATUERTE PATINO**, president of the Global WaSH chapter. ▪

ALUMNI FEATURE

FACES OF CCEE

In place of our regular alumni feature, we share examples from a media project we are creating for display in Fitts-Woolard Hall. **FACES of CCEE** will celebrate outstanding alumni while also illustrating to current students the many varied careers they can pursue with a degree from our department. This is an ongoing project, so if you'd like to bring someone to our attention (*including yourself!*), send an inquiry to **jwdixon2@ncsu.edu**. We are always interested in keeping up with what our alumni are doing!



AARON STROUD, P.E.
(BSCE 2016, MCE 2018)

Aaron is a structural engineer at RK&K in Raleigh. He designs and inspects bridges and culverts throughout North and South Carolina. While a student, he was captain of the ASCE steel bridge team and led them to national level competition for the first time.

ANA GABRIELA HARO BAEZ
(Ph.D. 2017)

Ana is director and professor of earth sciences and construction engineering at Universidad de las Fuerzas Armadas Ecuador. She researches the seismic assessment and retrofitting of historic and existing buildings, and develops new ways to prevent out-of-plane buckling behavior of reinforced concrete structural walls.

JON HOLTVEDT, P.E.
(BSCE 2015, MCE 2017)

Jon is a land development manager at Lennar, one of the country's largest homebuilders. He also serves on the CCEE Department Advisory Board as a valuable industry liaison.

SUZANNE McGEE BECKSTOFFER
(BSCE 1982)

Suzanne spent 34 years at Newport News Shipbuilding, rising to leadership positions including director of engineering and director of technology development. Her career responsibilities included hull technical, design build, process & tools, steel fabrication installation of robotic cutting and welding equipment, and research and development. She is president of the Society of Naval Architects and Marine Engineers, and a champion of engineering education and financial literacy.

JACOB BOWES, P.E.
(BSCE 2016)

Jacob works at McKim & Creed in construction administration for water / wastewater projects. He is involved in the design and construction phases of municipal projects and works as a consultant engineer liaison between clients and general contractors. Jacob serves on the Young Alumni Advisory Board for the College of Engineering and is an active volunteer with the CCEE department.

DANIEL FINDLEY, P.E.
(BSCE 2005, MSCE 2006, Ph.D. 2011)

Daniel is a senior research associate at NC State University Institute for Transportation Research and Education (ITRE). He studies the economic impacts of transportation, the safety of horizontal curves on roads, and how changes in the transportation system impact society. He studies many modes of travel including airports, bicycles, ferries, highways, pedestrians, ports and railroads. He's also an adjunct professor in CCEE and has led several study abroad experiences.

How Your Support Makes A Difference

Inside the newly opened Fitts-Woolard Hall.

ENDOWED FACULTY SUPPORT
Faculty members are the heart and soul of the Department of Civil, Construction, and Environmental Engineering, which is home to more than 50 dedicated scholars and educators. Endowments and named professorships are an essential part of our effort to recruit and retain the very best faculty and then provide them with opportunities to explore new research ideas with the involvement of graduate and undergraduate research assistants. Relative to our peer institutions, the department has a low number of endowed professorships.

ENDOWED GRADUATE FELLOWSHIPS
We strive to attract the best and brightest graduate students from the U.S. and around the world. Departmental rankings, faculty recruitment, research success and undergraduate education all depend on the presence of talented graduate students. Competition for the best graduate students is intense, and finances can be a deciding factor for students when choosing a graduate program. To recruit the best students, and to create a vibrant learning environment for undergraduate students, CCEE must be able to recruit students and provide competitive graduate fellowships.

ENDOWED UNDERGRADUATE SCHOLARSHIPS
Undergraduate scholarships enable us to prepare tomorrow's leaders in civil, construction, and environmental engineering. Students are drawn to NC State and CCEE by our reputation for excellence. Cost is a major consideration for students and their families. Scholarships represent a mechanism to support and reward our top students.

CCEE ENHANCEMENT FUND
An annual gift to the CCEE Enhancement Fund makes it possible to provide students the best possible education and extracurricular experiences. The enhancement fund allows us to respond to emerging needs and exciting challenges. For example, this year we deployed teams to the field for time-sensitive monitoring of SARS-CoV-2 before external funding was available. Your support enables recruitment and retention of the best and brightest faculty and students, support for our student organizations, field trips to complement classroom instruction and opportunities for faculty and students to present at conferences. Our enhancement fund is critical to the department as we strive to continue to provide opportunities for students and faculty.

RECOGNIZING OUR CORPORATE SPONSORS
Our corporate sponsors may opt to provide support for specific research areas, enabling faculty to pursue a new research idea. Sponsorships are also available for this newsletter, the welcome back ice cream each fall 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. The activities of our student groups (see page 22) are also dependent on external financial support. ▪

2020 CORPORATE DONORS

The firms listed here have provided endowments or made contributions from mid-August 2020 through the end of December 2020. Many on the list have supported multiple activities in the department. We would like to extend our sincere appreciation.

Ashland Construction Company
ASCE - NC Section
Beam Construction Company, Inc.
CDM Smith
CT Wilson Construction Company
Dewberry
East Coast Engineering Services, Inc.
ECS Carolinas
FDH Engineering, Inc.
Fluhrer Reed, PA
Greasecycle, LLC
Gregory Poole Equipment Company
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IQ Contracting, LLC
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Kimley-Horn & Associates
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Mead & Hunt, Inc.
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Smith Gardner, Inc.
Smithson, Inc.
Stantec Consulting Services, Inc.
Stewart Engineering
Tindall Corporation
TM Engineering, Inc.
Trisure Corporation
Wetherill Engineering, Inc.

The department has a wide variety of programs that are made possible by private financial support. For more information on opportunities to help, please contact **Lindsay Smith**, our Director of Development, at **lksmith4@ncsu.edu** or **919.515.7738**.

ALUMNI BRIEFS

BOBBY LEWIS, P.E. (BSCE 1995) joined HNTB Corporation as vice president, national practice consultant, in the firm's new national advisory practice, focusing on work with state departments of transportation. Most recently, Lewis was chief operating officer at the North Carolina Department of Transportation, where he was responsible for overall operations and strategy for the department, managing an 80,000-mile highway network and an annual budget of $5.8 billion.

CHRIS BOSTIC, P.E. (BSCE 2002) is a Senior Associate at Kimley-Horn and was named to the *Triangle Business Journal*'s "40 Under 40" Leadership Awards list for 2020. Bostic is a senior associate within the development services group in Kimley-Horn's Raleigh office. He is a licensed engineer working with both public and private sector clients on site design and development projects.

DR. JIMMY C.M. KAO, P.E. (MSENE 1989, Ph.D. 1993) was recently named as a 2020 International Honorary member by the American Academy of Environmental Engineers and Scientists. He is currently a chaired professor and the director of the Institute of Environmental Engineering at the National Sun Yat-Sen University, in Kaohsiung, Taiwan. Kao has previously held leadership roles at the Environmental Engineering Program at the Ministry of Science and Technology, The Chinese Institute of Environmental Engineering and the Taiwan Association of Soil and Groundwater Environmental Protection.

JASON QUINTER (BSENE 1999) has been serving on active duty as a Marine Officer since graduating from NC State. After graduating from the U.S. National War College this past summer, he was assigned to the Joint Staff J6 in the Pentagon. He currently works on elements of National Strategy and supports the Joint Requirements Oversight Council. Previously, Quinter commanded Region 7, Marine Corps Embassy Security Group (MCESG) at the U.S. Consulate in Germany, where he was responsible for the safeguarding of U.S. Mission personnel, property and classified material at 23 U.S. embassies and consulates in North Africa, West Africa and the Sahel.

DR. FUAD AKIL RIHANI (MSCE 1964, Ph.D. 1974) passed away on June 26, 2020. Rihani was born in Jordan in 1937, and in 1954 received a full US AID scholarship to study civil engineering at the American University in Beirut, Lebanon. In 1963 he came to Raleigh, NC, to pursue his master's degree in transportation engineering at NC State. Afterward, he went back to the Middle East to work on road and airport projects for a few years, and then in 1968 he returned to the CCEE department at NC State and earned his Ph.D. He was an associate professor in CCEE for several years before returning to the private sector, where he had a 40-year career in Saudi Arabia.

DR. RAMI RIHANI (MSCE 1992, Ph.D. 2006) was recently promoted to managing director with Accenture, a global management and technology firm, where he has been working since 1998. Rihani works with Accenture's Intelligent Cloud and Infrastructure practice, helping clients with their mission-critical information technology and infrastructure. He resides in Washington, D.C. with his wife and two daughters.

KELLIE RENZI (BSCON 2011, MCE 2012), director of preconstruction and estimating at McDonald York Building Company, was recently named to *Triangle Business Journal*'s "40 Under 40" Leadership Awards list. Renzi manages the day-to-day preconstruction and estimating activities for the McDonald York Preconstruction Team. She also participates in industry organizations and several community outreach activities including serving as treasurer for the IFMA (International Facility Management Association) Greater Triangle Chapter. Renzi and her husband, Adam, live in Garner with their three dogs, and you just might see them at the next sporting event "Backing the Pack."

DR. AJIMON THOMAS (Ph.D. 2020) started a job as a senior scientist at AON in their Chicago offices in November. He will be working on flood modeling for the Impact Forecasting group, which is AON's catastrophe model development center of excellence. His work will help insurers and reinsurers to analyze the financial implications of catastrophic events and to have a better understanding of their risks. ▪

SHARE YOUR NEWS

There are thousands of alumni of the Department of Civil, Construction, and Environmental Engineering working throughout the nation and around the globe. We invite you to provide us with updates about career accomplishments, awards or recognitions, as well as other news. We aspire to create a community of alumni who remain connected to the department and to each other. We also want to keep your contact information current so we can keep you up-to-date on department events. Send your information to Julie Dixon at **jwdixon2@ncsu.edu**.

Name, Mailing and Email Address
Company Name and Address
Degree, Major and Class Year
Announcements

Also, we invite you to connect with us on social media to keep up with the latest news.

facebook.com/ccee.ncsu
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@ncstateccee
go.ncsu.edu/cceelinked

DEPARTMENT ADVISORY BOARD

The following distinguished alumni and friends of the department currently serve on the board:

Jennifer Brandenburg
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If you prefer to make your donation online, you can use your credit card with our online feature at **www.engr.ncsu.edu/alumni-and-giving/ways-to-give**. Drop down menus will allow you the chance to specify that you want your gift to be directed to our department or to the Fitts-Woolard Hall Building Project Fund.

For more information contact:

Lindsay Smith, CCEE Director of Development
Phone: **919.515.7738**
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IN MEMORIAM to Dr. David Chi Chao Tung

DR. DAVID CHI CHAO TUNG, a long-time faculty member in our department, passed away on January 11, 2021. He is survived by his wife June, his children Mark and Rosann, son-in-law Dan French, granddaughter Ai Zhen, sister Xue Chao and niece Xiao Yi Yang.

Tung was born in China in 1932 and received his bachelor's degree from Tonji University in Shanghai, China in 1953. He earned a master's degree from the University of California at Berkeley in 1961, and a Ph.D. from that same institution in 1964. The events that brought David Chi Chao Tung from China to California, and eventually to our department, are wrought with determination. A fuller account by Tung's daughter Rosann can be read here: **herstryblg.com/theme/2020/12/24/family-reunion-of-urns**.

In 1957, Tung's father fled Communist China to Hong Kong. David Chi Chao Tung faced persecution also, and his father was able to pay smugglers to bring Tung out of China in the belly of a boat. After being delivered safely to Hong Kong, Tung worked in construction for a few years before gaining admission to UC Berkeley to pursue graduate degrees in engineering.

Tung conducted research on the analysis of complex fixed and movable structures that are subjected to highly irregular loadings such as wind, earthquakes and ocean waves. Such loads are described by probabilistic and stochastic methods. He developed analytical methods for highway overhead signs under severe winds; the interaction between structures and ocean currents; effects of tsunamis on coastal structures; and equipment safety in nuclear power plants against earthquakes.

Tung held leadership roles in professional societies including the American Society of Civil Engineers (ASCE) and the American Academy of Mechanics. He chaired the ASCE Engineering Mechanics Division in 1991 and 1992. He also served on the publications committee of the Structures Division of ASCE from 1995-98. He received the NC State College of Engineering Alcoa Foundation Distinguished Engineering Research Award in 1990 in recognition of his excellence in research.

Our department wishes to offer deep condolences to Tung's family, and remember him with love and respect for all that he accomplished. ▪

"I was deeply saddened when I received the news in the morning after his passing. He was a scholar, always with humility and modesty. He was a stellar member of this department and served as a mentor to many younger members of our faculty. He also served our professional societies in several different capacities for many years. We will miss him dearly."

Dr. Paul Zia
Professor Emeritus and Former CCEE Department Head

"David was one of the nicest people to work with as well as a brilliant scholar. He used his wise counsel and talents in innumerable ways to help his colleagues and the department in general, whether it be in leading groups of faculty, or probing difficult technical issues as part of the critically important process of hiring and developing the department faculty."

Dr. Downey Brill
Professor Emeritus and Former CCEE Department Head

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