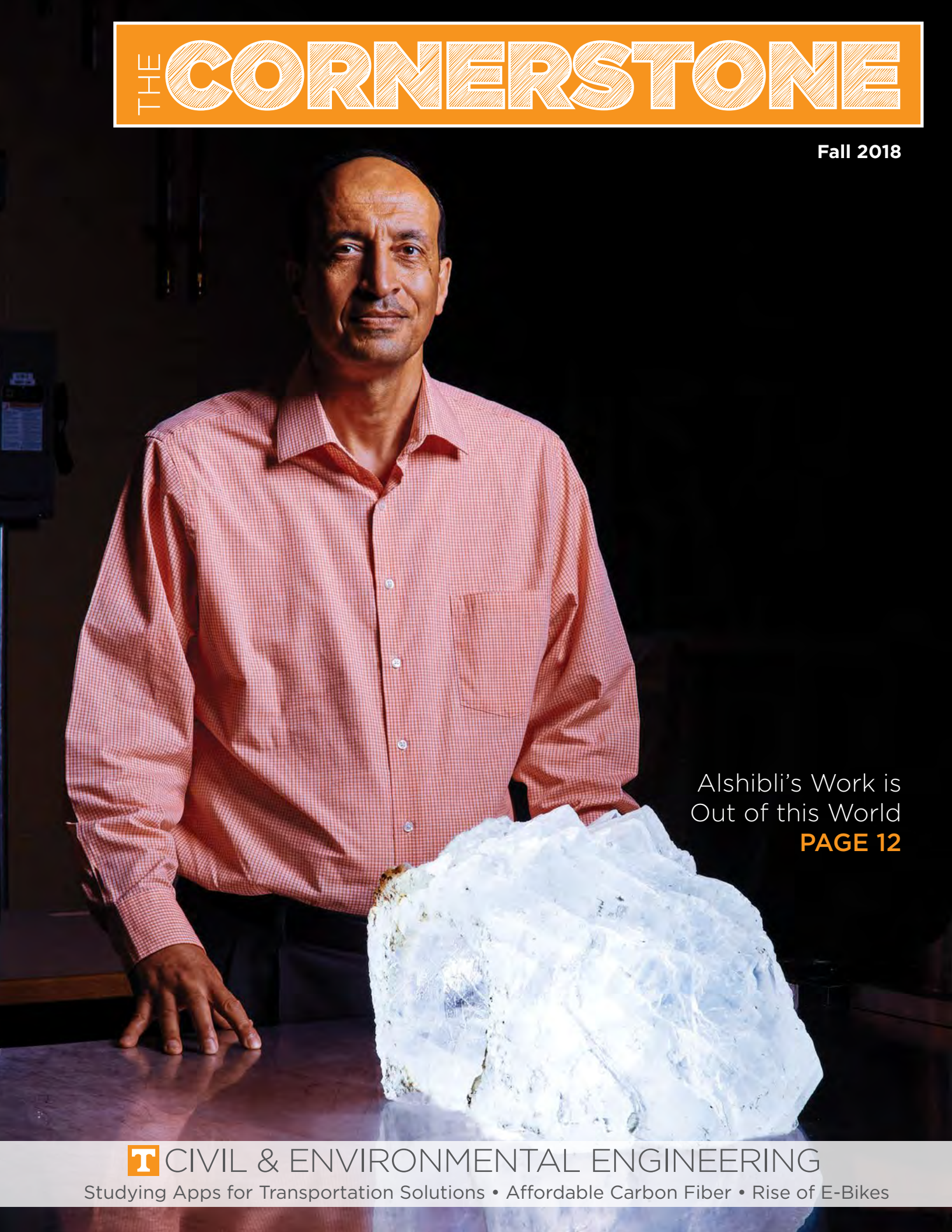
THE CORNERSTONE

Fall 2018



Alshibli's Work is Out of this World

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CIVIL & ENVIRONMENTAL ENGINEERING

Studying Apps for Transportation Solutions • Affordable Carbon Fiber • Rise of E-Bikes

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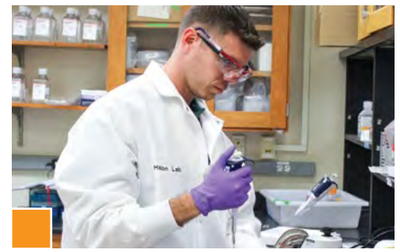

On the Cover: Khalid Alshibli works with salt inside his lab in the John D. Tickle Engineering Building. *Photo by Shawn Poynter.*

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From the Department Head

Legacy. It is a word that signals the highest level of achievement and lasting impact. Much of the work performed by civil and environmental engineers—buildings, bridges, roadways, and environmental protection—carries with it the expectation of legacy. As an educational institution, our foremost legacy is our students and alumni and the impact they have on the world. No one understood this better than our departed colleague Ed Burdette who left a substantial legacy as a teacher, colleague, and friend. So, at this time, I want to extend a word of thanks to all of you for extending the legacy of the Department of Civil and Environmental Engineering at the University of Tennessee through your work as professionals.

Our mission is to extend the department's legacy through the current generation of students. I hope that you will take a few minutes to read in this issue of *the Cornerstone* about new ways we are engaging students with real-world problems, the research carried out by our faculty and students that drives engineering knowledge forward and seeks to improve people's lives, and our outreach to the communities we serve.

We are looking forward to hosting the ASCE Southeast Student Conference on March 28–30, 2019. More than 800 civil engineering students representing 28 schools will be competing in civil-engineering-related competitions that emphasize hands-on learning, teamwork, leadership, and fun. We'll be reaching out to seek volunteer and financia support from our engineering community that will be essential for a successful conference.

Our confiden e to hold a successful conference is founded on your strong history of engagement and support to the department. I would like to express my deepest gratitude to those of you who have supported us through your time, financial and in-kind ontributions, and partnerships. Your engagement and generosity makes a tremendous impact on our students and on our ability to educate them. Thank you.

All the best, and Go Vols!

Chris Cox
R.M. Condra Professor
Department Head,
Civil and Environmental Engineering

GOING PLACES

By Whitney Heins.

If you are meeting Candace Brakewood somewhere, there's a good chance she may ask you how you got there.

"I have a genuine interest in how people travel," explained the assistant professor of civil and environmental engineering. "I think what makes me different from most civil engineers is that I'm most fascinated by the human aspect of transportation."

This fascination was sparked during a study abroad semester in Zurich, Switzerland. The mechanical engineering major at Johns Hopkins University was introduced to the country's robust rail system. It was easy for people to use, comfortable, efficient, an almost always on time.

"I started to wonder why we don't have systems like this in the US that people can use."

Upon graduation, Brakewood changed her engineering area of focus from mechanical to civil, pursuing a master's degree in transportation at MITand later a PhD in civil engineering at Georgia Tech. Today, the professor is covering new ground in transportation-related behavior research while teaching the fundamentals and planning of transportation to UT students.

As a millennial with a "smartphone attached to my hand," Brakewood is particularly interested in how mobile phone applications influence behavior. Apps that reveal real-time public transit vehicle location information, enable travelers to buy tickets, and make it easy to hail a ride are disrupting people's transportation habits.

"We want to know how using these apps impacts people's travel behavior," she said. "For example, if you have an app that says when the bus is going to arrive, are you more likely to take the bus?"

In one of her studies of New York City Transit, the answer was a resounding "yes!"

Brakewood obtained three years of data from the city's transit authority and, through statistical analyses, uncovered the impact the city's new bus time app had on ridership. Controlling for factors such as fares, local socioeconomic conditions, and weather she found an increase of almost two percent in ridership—which is a lot considering upwards of a million people use buses in New York City each day.

"That's a lot more people using public transportation each day," said Brakewood. "And, public transportation is a sustainable and environmentally-friendly mode, so it is a good thing if more people are using it."

Brakewood is currently collaborating with people at a popular app, simply called "Transit," to study how users interact with it (the UT community can thank Brakewood for adding Knoxville to its 125-city roster). The app shares the GPS location of buses and trains and/or their schedules. If a user makes an inquiry—such as for a specific bus oute—the app stores that inquiry as data, and Brakewood is tapping into it to investigate, in particular, how people use it to travel between cities. For instance, if a New York City resident moves to Los Angeles, will they use the same modes of transportation?

Transit is adding new features like the ability to reserve a bike in a bike share program or request a ride with ride-hailing companies like Uber or Lyft, and Brakewood plans to explore how people use these shared modes as well.

In another study, the researcher conducted a study of regulations of such ride-hailing companies in major US cities, providing useful information to policymakers.

In yet another project, Brakewood is examining the usefulness of mobile apps where travelers can purchase tickets. She surveyed New Jersey transit mobile app users to see if they would be okay with the app using their location to customize information, also known as geo-targeting. Preliminary results show most travelers responding favorably to the practice with a high interest in alerts when rides were delayed or could be impacted by special events.

The common thread through all these projects is Brakewood's hope that they arm city planners with information to design better transportation systems.

"We need to be thinking towards the future," she said. "As we become increasingly more reliant on our devices as we travel, we need to understand the implications for this on infrastructure."

The use of mobile apps is drastically changing the way many of us travel. And, as these changes continue, Brakewood will only become more interested in the way we get from place to place.

LOWERING THE CO$T

By Élan Young.

Carbon fiber has long held promise in manufacturing due to its ability to serve as a replacement for steel and other metals, yet with far reduced weight.

Those properties make it important for vehicles—where fuel economy is greatly improved without sacrificing strength—all the way down to sporting goods manufacturers who value those properties for use in golf clubs, ski equipment, and helmets, among other things.

The problem has long been the cost associated with it as compared to other materials, but that could soon change.

Dayakar Penumadu, the Fred N. Peebles Professor and JIAM Chair of Excellence in the department, is part of a newly created team that is out to prove that production of low-cost carbon fiber is easible.

"Low-cost carbon fiber omposites have the potential to transform structural and functional materials," said Penumadu. "They provide materials or structural designers and manufacturers with a material whose stiffne s is higher than steel with weight lower than aluminum."

Penumadu said that the other major advantage of carbon fibers is th t they perform better in harsh environments than traditional metals since their corrosion rates are negligible in comparison.

The project will be led by the 4M Carbon Fiber Corporation and includes Oak Ridge National Laboratory and RMX Technologies LLC.

One of the key steps in producing carbon fiber is a p ocess known as oxidation.

Currently, convection heat is used to speed that process, but 4M's plan is to use plasma oxidation technology instead, which would require less space and energy, all while speeding the production process. The technology was developed by ORNL and RMX Technologies and exclusively licensed to 4M.

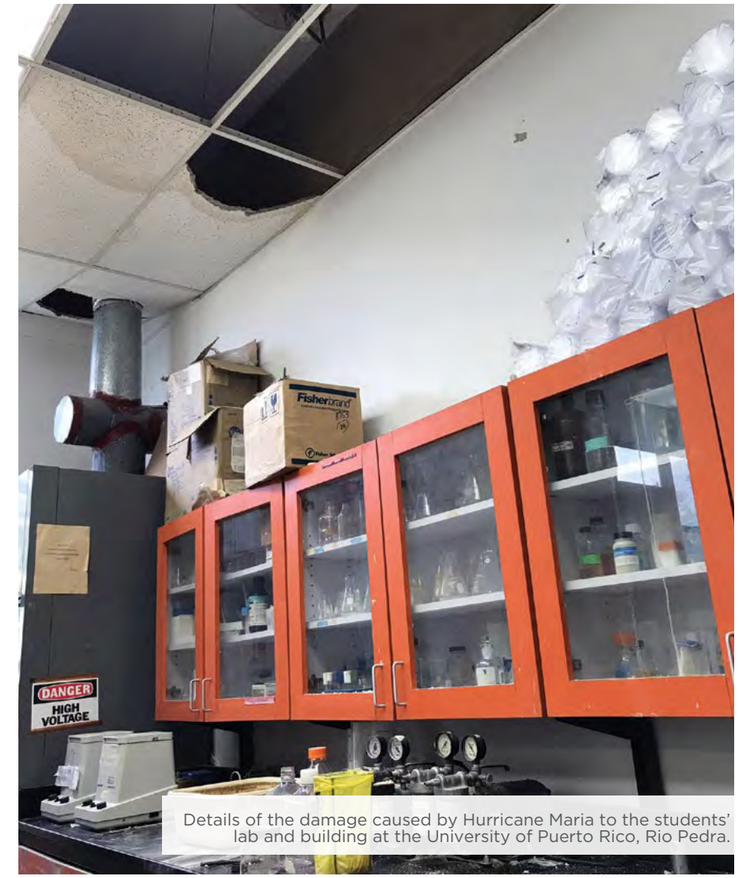
Penumadu will use the facilities at the Joint Institute for Advanced Materials and Science and Engineering Research Facility laboratories to study the effects of that process and its viability as a production method.

4M noted that half of the price of producing carbon fiber is the conversion process, which would be improved enough by the new plasma method as to cut carbon fiber manufacturing costs by 50 percent.

> "With low-cost fiber an manufacturing methods, we have the prospect of bringing aerospace materials to civil and mechanical infrastructure for the next generation."
>
> **—Dayakar Penumadu**

Such a drastic reduction in price would help areas where carbon fiber is al eady being used, such as the aerospace industry, but could also open up new avenues for manufacturing.

(L-R) Jelissa Reynoso, Cesar Perez, Yadeliz Serrano, and Benjamin Mercado.



Details of the damage caused by Hurricane Maria to the students' lab and building at the University of Puerto Rico, Rio Pedra.

Weathering the Storm

By David Goddard.

Jelissa Reynoso works inside the Hazen Lab.

Hurricane Maria was the 10th most powerful storm on record when it tore through the Caribbean last fall, leaving behind nearly $92 billion in damage and changing lives forever.

Higher education felt an intense impact, with wrecked infrastructure forcing many students off the islands and into institutions in the mainland United States to continue their educations.

"I've never experienced a storm so strong, never seen anything like that," said Puerto Rican student Benjamin Mercado. "No one has experienced that since the San Felipe hurricane [of 1928]. It was the kind of thing you only heard stories about from your grandparents."

Now, six months later, Mercado and six other students from the University of Puerto Rico, Rio Piedra, are continuing their careers at UT, thanks in large part to joint UT–ORNL Governor's Chair for Environmental Biotechnology Terry Hazen.

Mercado, Jelissa Reynoso, Cesar Perez, Alfredo Gonzalez Cintron, Rosana Wiscovitch Russo, Yadeliz Serrano, and Luz Serrato-Diaz have resumed their research in microbiology as part of the Hazen Lab.

Their path to UT came about because Hazen taught at their university from 1979 to 1988 and still serves as an adjunct faculty member.

One of his former postdoctoral students, Gary Toranzos-Soria, currently serves as a professor and was mentoring Gonzalez Cintron and Wiscovitch Russo.

"I have a lot of good memories of my time there, and I maintain a strong connection to the university," said Hazen. "Right after Maria hit I tried to contact Dr. Toranzos. It took more than a week, but I finally got in touch with him by cell phone and told him I was more than happy to help in any way I could."

Gonzalez Cintron said that the help of Hazen and Associate Vice Chancellor for Research and Research Integrity Robert Nobles has been immeasurable, connecting the students with everything from housing to scheduling, making them all feel welcome at UT.

Wiscovitch Russo said the loss of electricity was a major setback to the island's researchers and scientists. Since a lot of the University of Puerto Rico's work in biology and microbiology depends on a steady supply of power, destruction of the power grid brought activity to virtual standstill. While her work was not lost, Wiscovitch Russo said that coming to UT was a great opportunity to continue her research without delay. Temporarily relocating to Rocky Top has also provided some new experiences for the students outside the classroom.

"It's the fir t time most of us have seen snow," said Wiscovitch Russo. "When it fir t snowed here, we ran outside and made snow angels, tried to make snowballs, snowmen—all the things we've only seen on TV or movies but never experienced."

Proof once again that even the most powerful storms cannot stop the human spirit.

LOOKING small to solve BIGGER ISSUES

By David Goddard. Photography by Randall Brown.

If you can build it, it can break.

From a paper clip to a jumbo jet, if you use something enough times, it will eventually wear down to the point of failure. Such breakdowns are often caused by what is known as fatigue cracking.

Those cracks start small, but forces ranging from weather to changing weight loads can add to stresses that begin to break the materials further apart.

Gaining an understanding of how these stresses play out at the smallest level may help researchers develop better materials by being able to predict where such stresses are likely to occur.

Assistant Professor of Civil and Environmental Engineering Timothy Truster is playing a leading role in that undertaking by using the novel approach of applying computational methods to crack the code on material interactions at granular levels.

With almost no limit to the number of things impacted by such destructive forces, both materials science and civil engineering have made it a major area of research.

Truster identified di tribution as a key area of concern early load on, leading him to try to develop his new approach, the fir t in the field o use computing in such a way.

"The ways loads distribute between regions within the microstructure were not fully understood," Truster said. "Gaining a knowledge of those correlations will allow us to come up with specifically tailo ed material design."

By using advanced mathematics to study zones of influen e within materials at both large and small scales, he hopes to gain insight into why some fl ws within objects lead to cracking while others do not.

That, in turn, holds tremendous potential for developing more reliable materials to be used in everything from energy production, to infrastructure, to the defense industry.

While Truster has made a career out of cracking the code of where such failures occur, the National Science Foundation recently backed his work with a prestigious Early CAREER award.

"This [award] is a great honor, and I'm happy that it reflects ell on the work that my students and I have been doing," Truster said. "I am encouraged that others see the need for studying fatigue behavior and developing new methods to help design better materials."

Part of the CAREER program is making sure awarded projects include an outreach program.

To that end, Truster plans on introducing high school juniors and seniors to an enhanced curriculum based on simplifying physics, helping better prepare them for college and beyond.

E-Bikes on the Rise

The Role of E-Bikes in the Transportation Outlook

By Élan Young.

Professor Chris Cherry's research on e-bikes has been gaining momentum.

He and Portland State University Research Associate John MacArthur published an e-bike survey funded by the National Institute for Transportation and Communities called "A North American Survey of Electric Bicycle Owners," that has been cited by *Bicycle Retailer* and the *Washington Post*.

Bicycle Retailer covered the survey in depth for an article entitled "Survey says: E-bike users love the things...and use them often," in the *E-Bike Market Report*.

The *Washington Post* article entitled "As e-biking grows, US cities consider easing rules on where the machines may be used," cites the survey's findings th t people buying e-bikes are using cars less frequently.

The survey of nearly 1,800 e-bike users in the US and Canada identified some eme ging trends among users, most notably that having access to an e-bike can overcome many barriers to biking. Common barriers include hills, lengthy distances, and not wanting to arrive at destinations sweaty.

Respondents also reported being able to transport children by bike more easily, and reported that they also felt safer on e-bikes.

One of the survey questions asked riders to describe their last three e-bike trips, and what they learned was that e-bike users averaged 9.3 miles per trip. This amounts to approximately 1,778 motor vehicle trips and marks a significant th eshold for policymakers. For decades, fi e miles was considered the threshold that determines whether someone will ditch their bike for a car.

Additionally, while on professional development leave, Cherry spoke at the Africa Clean Mobility Week Conference, hosted by the UN Environment program in Nairobi, Kenya. The subject of his talk was about policy opportunities to electrify motorcycles to reduce air pollution in African cities based on lessons learned from experiences in Asia.

"As African nations motorize in an era of rapidly advancing technologies, there are great opportunities to leap-frog conventional transportation fuels and technologies and skip some of the growing pains that other countries have faced," said Cherry. "I'm fortunate to help bridge policy and technology development to advance sustainable mobility in this region."

The Africa Clean Mobility Week provides a platform for participants to discuss cleaner mobility and its impacts on health, environment, and economic growth in Africa.

Don Yarbrough

by Élan Young.

Engineering with Confiden e

Don Yarbrough is a confident man.

Confident enough o stand under newly-bolted signage at Nissan Stadium as the crane lets go and the connections are tested for the fir t time.

While everyone else steps back in case the sign were to fall, Yarbrough knew the sign wasn't going anywhere, and so neither was he.

He cited an old wive's tale from Russia that the engineer who built a railroad bridge must stand under it as the fir t train drives over it. Perhaps a bit cheeky, but it's the inner core of confiden e that Yarbrough emphasizes is critical.

> *"If you don't really know what you're doing then you need to ask for help," Yarbrough says. "People's lives are depending on you to know what you're doing. If you don't understand the basics, you must first strive to do that."*

This inner core of confiden e in his work is not the same as over-confiden e.

Yarbrough, former president and senior principal of Ross Bryan Associates Inc., is the most recent inductee into CEE's Hall of Fame. At his induction in May, he spoke to students about confiden e and how it factors into being a successful engineer. With over 35 years of experience, he has quite a bit of wisdom to share on the subject.

He says that a greater level of confiden e comes with experience and urges young grads not to be intimidated or afraid to attempt a difficult tructure under supervision.

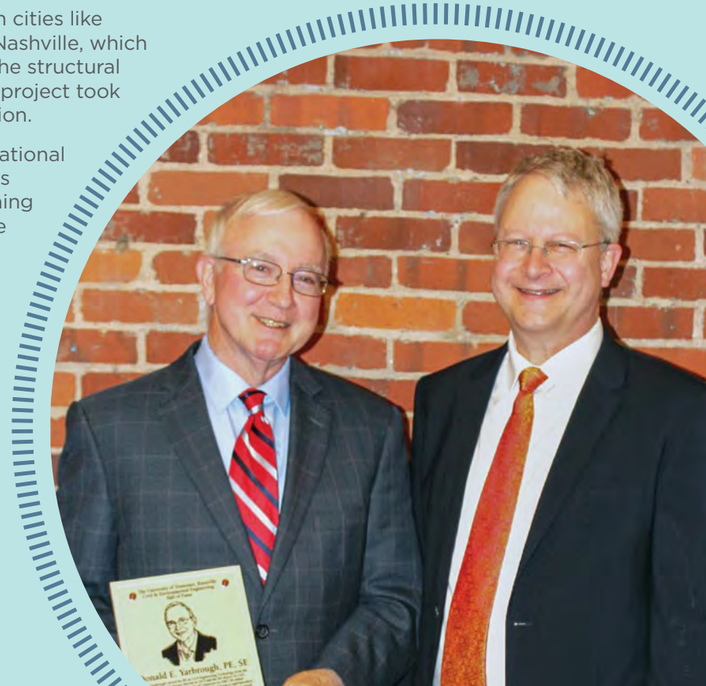
"I worked for people who were not afraid to take on difficult tasks and omplicated buildings," he says. "Don't be afraid of complicated structures because the basic foundation for all structures is essentially the same. The same physics in a simple building can be applied to a complicated building."

Most of his work has been convention center design in cities like Philadelphia, DC, Raleigh, Knoxville, and Opryland in Nashville, which all led up to the pinnacle of his career in supervising the structural design of Music City Center in Nashville. This massive project took fi e years to complete and had a budget of $500 million.

To those starting out, he recommends doing an educational co-op if they can, which is another reason why he was able to apply his knowledge immediately after obtaining his master's degree. The seven quarters of experience he gained even before getting his bachelor's degree allowed him to get his hands dirty early in his career. He also says to be prepared for travel, since engineers have to go to the site of the project, and that is not always where you live.

The late CEE Professors Ed Burdette and David Goodpasture were mentors during Yarbrough's time at UT, and they gave him a strong foundation to build on. He credits them for helping him be able to use his knowledge the day he hit the ground running with Ross Bryan in 1982.

"I still apply those basic theories to everything we design," he says. "In fact, I've been applying what I've learned in school every day for 35 years."



REACHING FOR THE MOON

by Élan Young.

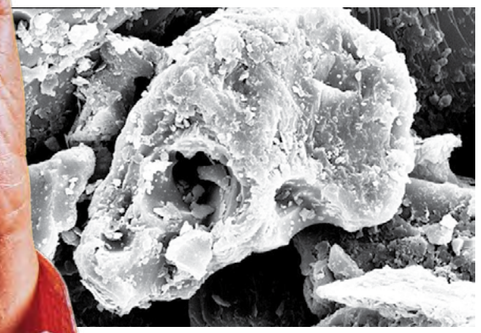
Work done by Professor Khalid Alshibli is going to outer space.

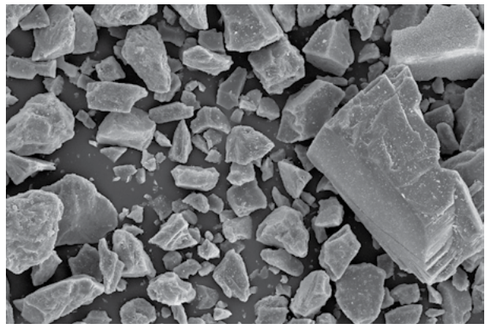
Well, almost.

Geotechnical research photos taken by Alshibli have been collected as part of a permanent visual display at a world-class space museum currently under construction in the Al-Sha'ab district of Kuwait City, Kuwait.

Photos are a macro-scale image of regolith simulant, or lunar soil simulant.

The museum will be one of four that will cover Arabic Science, Space, Natural History, and Science, which together will make up the Sheikh Abdullah Al Salem Cultural Centre. Specificall , The Arabic Science Museum will be an interactive exploration of Islamic civilization, examining the people and innovations that played a crucial part in the development of intellectual thought in the world.





Alshibli Wins Croes Medal

A group of faculty and students, led by Alshibli, recently won ASCE's prestigious J. James R. Croes Medal for their paper "Influen e of Particle Morphology on 3D Kinematic Behavior and Strain Localization of Sheared Sand."

Other contributors included former graduate students Maha Jarrar (MS, 2016) and Andrew Druckrey (PhD, 2016) and Collaborator Riyadh Al-Raoush, Qatar University.

Alshibli's research answered fundamental questions about certain properties that affect the behavior of granular materials.

Known as dilatancy properties, this research focuses on material behavior that is best illustrated by a walk on a beach.

While the impacting of sand and transport of liquid might not be important as you make a sandy stroll, unravelling the secrets of such behavior holds great importance in industries such as construction.

"This increased understanding will spur the development of new theories dealing with predicting the materials' behavior," said Alishibli. "Those results can be used to develop models which will result in a more economical design of structures supported on such materials and development of systems that handle and process granular materials."

The paper was published in the February 2017 issue of ASCE's *Journal of Geotechnical and Geoenvironmental Engineering*. The research is funded by NSF.

Designing for **Elephants**

Class teams with CEC to help Zoo Knoxville's Elephants

Photos Courtesy Zoo Knoxville.

Civil Engineering 481 is an environmental engineering class focused on water and wastewater engineering. The students learn how to design water and wastewater treatment processes for municipal and industrial waters.

This year, a unique project appeared for James Tomiczek and Ivan Cooper at CEC, a civil and environmental consulting company in Knoxville.

Zoo Knoxville needed to restructure the way water is provided to and disposed of for the elephant bathing, drinking and playing ponds.

Department Head Chris Cox set up a meeting, and after approval from Zoo Knoxville President and CEO Lisa New, my class got to work.

First, they began doing research on elephant enclosures, taking the opportunity to do a behind the scenes tour of the elephant enclosure to look at the pond and get a better understanding of the project.

While at the zoo, they also got to see the water and wastewater treatment techniques for the new tiger and gibbon exhibits, as well as the beaver exhibit.

They were all very excited to get a look at multiple treatment techniques currently employed by the zoo.

The class was divided into three groups of fi e, with each group only given very basic information.

A water sample from the pond was processed by the Civil Engineering 482 class—environmental engineering lab—which all students in CE 481 take concurrently, allowing them to get an idea of the water quality that they would need to treat and provided additional real-world applications to this project.

This is a real project that CEC will begin designing within the year in conjunction with Zoo Knoxville. We were able to provide CEC with some preliminary ideas for their future design choices that will likely be made within the year, with students presenting their final designs o CEC on April 26.

This project would not have been possible without the help of CEC's Tomiczek and Cooper, our department head, Cox, and Zoo Knoxville's New and Shane Chester. The students were very excited to have a real-life problem to use for design work, and greatly appreciate the opportunity provided to them.

This story originally appeared as a blog detailing the project by lecturer Kristen Wyckoff. It has been edited for content and clarity.

FACULTY NOTES

Assistant Professor **Shuai Li** has been awarded ASCE's Collingwood Prize for his paper, "Integrating Natural Language Processing and Spatial Reasoning for Utility Compliance Checking," on which he was the lead author when he was a doctoral student at Purdue. His research is concerned with improving the safety of underground infrastructure to prevent such incidents as natural gas pipeline explosions.

Professor **Richard Bennett** has directed the Engineering Fundamentals program in the Tickle College of Engineering since 2008. On September 29, at the Tennessee Section ASCE (American Society for Civil Engineering) meeting, it was announced that he is this year's recipient of the Peter G. Hoadley Award for Outstanding Engineering Educator.

Assistant Professor **Candace Brakewood** recently won the Transportation Research Board's 2017 Fred Burggraf Award. This international award recognizes the year's best research papers by researchers 35 years of age or younger, and is one of the highest honors presented by the Transportation Research Board. Additionally, she was recently interviewed by Sidewalk Labs—an organization reimagining how cities can improve quality of life—about the benefits of eal-time transit data.

PUBLISHED

Assistant Professor **Nicholas Wierschem** and graduate student **Abdollah Javidialesaadi** published "Optimal design of rotational inertial double tuned mass dampers under random excitation" in *Engineering Structures* and "Three-element vibration absorber-inerter for passive control of single-degree-of-freedom structures" in the *Journal of Vibration and Acoustics*.

Professor **Thanos Papanicolaou** and his team have published a new study entitled "Flow Resistance Interactions on Hillslopes With Heterogeneous Attributes: Effects on Runoff Hydrograph Characteristics" in *Water Resources Research*.

Professor **John Schwartz** published, "Clean Water, Clean Life: Promoting Healthier Accessible Water in Rural Appalachia" in the *Journal of Contemporary Water Research & Education*.

UT-ORNL Governor's Chair for Environmental Microbiology **Terry Hazen** contributed to newly published research in the journal *Nature Ecology & Evolution*. The research, entitled "Community proteogenomics reveals the systemic impact of phosphorus availability on microbial functions in tropical soil," shares results from a 17-year fertilization experiment in a tropical forest.

IN PICTURES

CEE Assistant Professor **Jon Hathaway** is heading up an investigation of nutrient pollution in Baker Creek in South Knoxville, which is currently listed on the Clean Water Act Section 303(d) list for impaired waters. The project, which is funded by EPA's Urban Waters Small Grants program, also includes UT faculty and students from the College of Social Work and the Department of Geography. The team has partnered with South Doyle Middle School in South Knoxville and Boys and Girls Clubs in the area to engage urban youth in collecting geo-located water quality data that can be used by city planners.

Fu Receives Ripperton Award

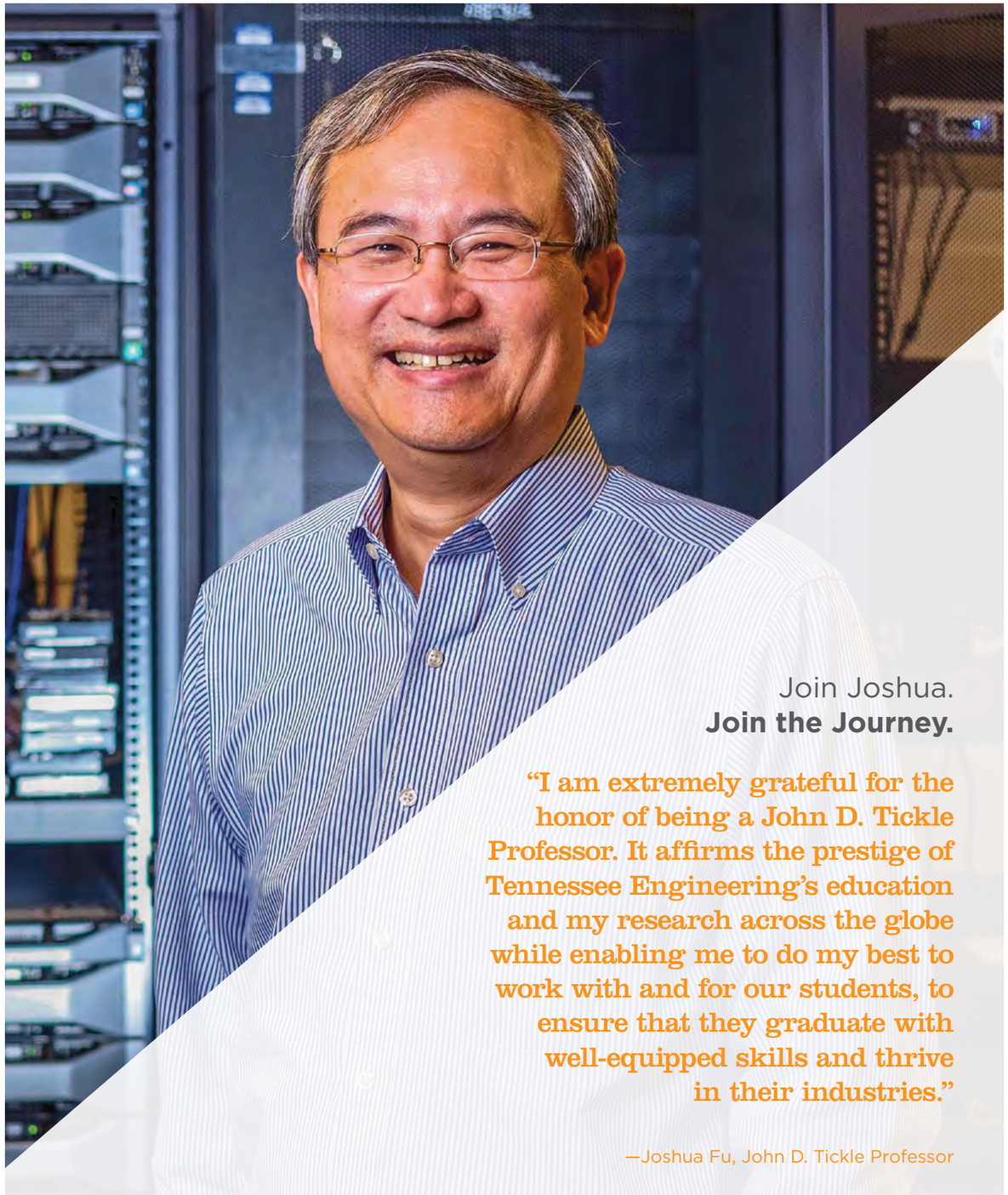
Professor **Joshua Fu** received the 2018 Lyman A. Ripperton Environmental Educator Award at the 111th Air and Waste Management Association Annual Conference and Exhibition in Hartford, Connecticut, on June 28. The award recognized Fu's education efforts related to controlling air pollution, and is named after Ripperton, a landmark researcher in environmental engineering.

Fu is a leading environmental researcher whose study of carbon released by burning oil fla es helped NASA solve a riddle about black carbon in the Arctic. Additionally, his modeling of black carbon has helped the United Nations Economic Commission for Europe and the Arctic Council speed up research on ground-level pollution.

The Arctic Council's Arctic Monitoring and Assessment Programme also recently invited Fu to take part in a study on short-lived climate pollutants.

"Earning recognition from within your research focus is always a special feeling," said Fu, the John D. Tickle Professor of Engineering in the Department of Civil and Environmental Engineering. "It's validation of your work, your methods, and of the students that have come through your classes and research projects."

Fu has directed projects for the US Department of Energy and Department of Homeland Security, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and NASA.



Join Joshua.
Join the Journey.

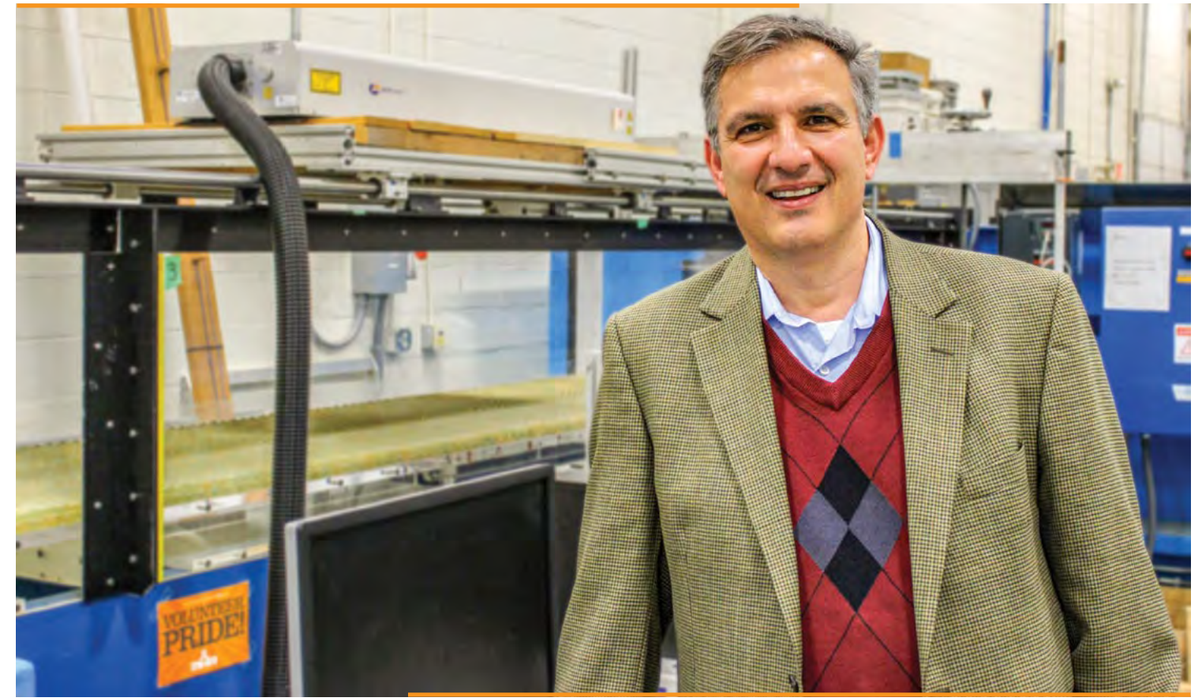
"I am extremely grateful for the honor of being a John D. Tickle Professor. It affirms the prestige of Tennessee Engineering's education and my research across the globe while enabling me to do my best to work with and for our students, to ensure that they graduate with well-equipped skills and thrive in their industries."

—Joshua Fu, John D. Tickle Professor

Join the journey to help other faculty like Joshua Fu provide experiences for engineering students. Call **865-974-8890** or visit **giving.utk.edu/cee**.

Future Proofing Our Water

By Élan Young.



Access to clean water is an area of critical importance around the world, including across vast portions of the south.

In fact, the National Academy of Engineering has named it one of the 15 Grand Challenges facing civilization this century.

Tennessee Governor Bill Haslam saw the potential to get ahead of the problem, establishing the TN H_2O program to better prepare the state.

Officials, xperts, and researchers from around the state have been tasked with working together to develop an overall plan to secure Tennessee's water future, with subgroups focused on select areas of importance.

Professor Thanos Papanicolaou—the department's Henry Goodrich Chair of Excellence and Director of the Tennessee Water Resources Research Center—will lead one such group, the surface water task force.

"Changes in water usage and needs, population growth, things like these will greatly impact Tennessee in the coming years," said Papanicolaou. "It isn't just that more people means more water needed for consumption, but also for agriculture, for power production, even for recreation.

"We need to project out what will be needed and make sure we're using our water resources the right way."

Papanicolaou's group will look at the future of lakes, streams, rivers, and wetlands in the state, studying their overall health and use.

Localized issues such as water rights claims from other states, recurring drought cycles in West Tennessee, and the aging of water-related infrastructure are other special areas of interest where groups are putting increased emphasis.

The steering committee will submit a draft of TN H_2O to the governor and will make it available for public input by October 2018.

"One of our main tasks will be not only to quantify what the water usage will be, but also take into account budgeting and construction of new infrastructure to support the increased demand," said Papanicolaou.

He said that one of the toughest challenges is that they are having to identify and solve problems before they've even occurred, but added that he thought the formation of the TN H_2O program was a bold step in that direction.

Papanicolaou is one of the foremost water resource researchers, having recently received the prestigious Hans Albert Einstein Award for his advancements in the field. He has orked with NASA, the US Department of Agriculture, the National Science Foundation, and the National Oceanographic and Atmospheric Administration, among others.

ROCKIN' IN THE SMOKIES

2019 ASCE Southeast Regional Conference

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TICKLE COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

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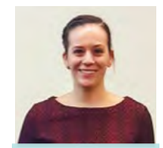
STUDENT NOTES

Alexandra "Ali" Boggs and **Meng Zhang** were named 2018 Traffic S ety Scholars (TSS) and received an award of a $1,000 scholarship at the 36th Annual National Lifesavers Conference on Highway Safety Priorities, held in San Antonio, Texas, April 20–24.

Additionally, **Boggs**, received one of three scholarships awarded by the Middle Tennessee Chapter of American Society of Highway Engineers (ASHE). She was awarded a memorial scholarship of $2,000 in John R. Harper's name.



Katherine Manz, doctoral student studying water quality related to fracking, is this year's winner of the departmental Three Minute Thesis competition. Manz's presentation entitled "The Impact of Chemical Additives on Water Quality in Hydraulic Fracturing" was selected out of 13 contestants. As the department's winner, she advanced to the university level round of the 3MT competition.

Doctoral candidate in Water Resources Engineering **Whitney Lisenbee** is one of 100 doctoral students in the US and Canada selected to receive a $15,000 Scholar Award from the P.E.O. Sisterhood. She was sponsored by Chapter AH of Knoxville, Tennessee.

Micah Wyssmann, doctoral student whose research is in water resources, won fir t place at the 6th Annual UT Watershed Symposium last September. Wyssmann's poster was entitled "Modeling the Stream Restoration Impacts of Boulders: Applying the Bedload Virtual Velocity Concept," which focused on a numerical model that he is developing with his advisor, CEE Professor Thanos Papanicolaou.

Four alumni, **Kelli Spradling**, **Katie Gipson**, **Sharon Counts,** and **Stina Sanford**, completed a project for the CE400 Senior Design class as students and then took time out of their post-graduate lives to compete at the Water Environment Federation Technical Exhibition and Conference (WEFTEC) for the fir t time. Three from the team traveled to Chicago for the competition and took second place in the Water/Environment Division of the WEF Student Design Competition out of six other teams in their division.

Environmental engineering doctoral student **Jiani Tan** was awarded one of two A&WMA (Air & Waste Management Association) Southern Section PhD Scholarships for the 2017–18 academic year. Tan was invited to speak at the Southern Section Annual Conference in Nashville on September 20–21 and gave a brief summary of her current and past research on air pollution modeling.

IN PICTURES

Doctoral students in transportation engineering **Mohsen Kamrani** and **Behram Wali**, along with Professor **Asad J. Khattak**, recently won the 2017 Transportation Research Board Outstanding Paper award by the Safety Data, Analysis, and Evaluation Committee for their paper entitled "Can Data Generated by Connected Vehicle Enhance Safety? Proactive Approach to Intersection Safety Management."

Environmental engineering graduate student **Yongchao Xie** presented at a Unisense workshop in Aarhus, Denmark, March 14–16. Unisense is a world-leading manufacturer of microsensors and instrumentation for microscale measurements in the medical and environmental fields. ie presented his experience designing a bioreactor that could monitor denitrifying microorganism activity by measuring nitrogen oxide with Unisense microsensor/electrodes.

Remembering **Ed Burdette**

Edwin G. Burdette, beloved professor emeritus in the Department of Civil and Environmental Engineering, passed away Friday, May 18.

Burdette was a true teacher, having served the University of Tennessee for more than 50 years. He retired in 2016 but could often still be found on campus encouraging yet another generation of engineers and researchers.

His time at UT was filled with a colades. He was twice named an Engineering College Teaching Fellow and twice received an Alumni Outstanding Teaching award from the university. He was granted the fir t Fred Peebles Professorship in 1981, a title he held until his retirement. He was named Macebearer—the university's highest faculty honor—in 1991 and received the university's Alexander Prize in 2001. In 2017, Burdette received the Nathan W. Dougherty Award, the Tickle College of Engineering's highest faculty honor.

Tributes and memories poured into the department upon the announcement of his death. Here are some of those stories:

> *"I am blessed for having a mentor such as Dr. Burdette and can only hope my children will find a similar experience when the day comes for them to go to college."* —Andrew Tinsley

"What a great person, great teacher, and great mentor who shaped the lives and careers of so many folks. Dr. Burdette certainly was all of these for me. He guided me through my Masters, my work at TVA, my consulting work and adjunct teaching after TVA, and then most importantly guiding me on a major career change at age thirty-six from practitioner to academia. Not only did he guide me through all of this but he took the time to be a member of my PhD committee at the University of Texas. What an absolutely fantastic individual."

Ron Cook and Kathy Caldwell
From remembrance page

"Dr. Burdette was the best professor I had. He was always willing to help engineers understand technically complex problems. No matter your knowledge level, he was able to go down to your level and when finished our knowledge level always was better. However, his best asset was his compassion for all people he encountered. His smile and grace will be missed. He was a giant of a man."

Rick Cutsinger
From remembrance page

"What a great man and educator he was. He was thorough, intelligent, and a great motivator. I am a better person for having known him during my education at UT. May he rest in peace."

John R. Cockrell
From Facebook

"Dr. Burdette was truly an inspiration to where I wound up in my career. He was the chair of both my MS and Ph.D. Committees. I think I was one of the last Ph.D. candidates he shepherded through the process and his guidance was always spot on. He was actually the chair of my father's MS committee as well. When I fir t started classes as an undergrad, I stopped in to introduce myself. He pulled a folder out of a fil cabinet that had information on my dad, newspaper clippings, etc. He literally tracked all of his students like this. I spent a LOT of time in college and I never ran across a professor who cared like that. God bless you sir. And God bless the family he left behind."

Andrew Tinsley
From remembrance page

"Dr. Burdette meant so much to so many. He was a great family man, a leader in his church and a teacher that served as an inspiration to us all. I just had one class with Dr. Burdette. I remember that he bounced into the room, full of energy and with a plan for us to master certain specific oncepts before the end of each and every class. He was truly amazing, organized and energetic and interested in each student. I am sure that Dr. Burdette had research projects but it never took his focus away from teaching. It is fitting th t in the end he is revered not for some groundbreaking research but by all his students because of his interest in and commitment to teach and do it exceptionally well. We will never forget him."

David Reece, class of 1975
From remembrance page

"UT helped me to build a well-rounded portfolio of practical skills including leadership, communication, problem-solving, project management, and cross-disciplinary teamwork."
—Liam Weaver, 2016 grad

A Conversation with Alumnus **Liam Weaver**

Cornerstone *recently sat down with CEE alum Liam Weaver to learn about his new position with the California Public Utilities Commission. Weaver graduated from UT in 2016 and earned an MS degree from the University of California, Berkeley.*

What does your job entail?
I am an engineer working for the state of California to advocate for California ratepayers and help achieve California's renewable energy and electric vehicle goals. My day-to-day is extremely varied. I do everything from technical engineering analysis to presenting my recommendations to decision makers and testifying in hearings.

There is also a lot of reading and writing, articulating technical concepts to non-technical people, deciphering acronyms, cost estimating, and elements of negotiation. I represent the citizens and ratepayers of California and advocate for the most societally beneficial and ost-effective decisions.

Can you give an example of a recent project that posed a unique challenge or is otherwise notable?
A recent, long-term challenging project I've been working on is Vehicle Grid Integration (VGI). The goal of VGI is to ensure the electric grid can accommodate the governor's planned 5 million electric vehicles on the road by 2030. Electric vehicles use a lot of energy, and an increasingly renewable grid dictates when energy is readily available. I help oversee billions of dollars in potential funding for EV charging infrastructure projects and the communications pathways and load management plans for those vehicles.

The goal is to enable EVs to consume energy when it's being produced by the sun and the wind without disrupting transportation. There's even a potential to store this energy in the EV batteries when the sun is shining and then discharge back to the grid when people come home at night and ramp up their energy use. What makes this ongoing project so challenging is there's no clear black-and-white solution; it's often not clear what the exact problem or solution will be since this has never been done before.

What do you love most about your position and where you work?
What I love most about my job is the impact and significan e of this work. Much of the world is watching and learning from us to see if we can achieve a clean energy system of 100% renewable energy and zero emission vehicles—something that has literally never been done before in the history of humankind. As a result of this unique grand engineering challenge, I am able to work alongside experts and have the potential to influen e the outcome of important decisions regarding the future of our energy system.

How did UT set you up for both landing the job and being successful in your position?
I owe a lot to UT's professors. I was fortunate to have some amazing mentors throughout my time at UT that pushed me and advised me to land my graduate school position at UC Berkeley and then jumpstart my career afterwards. UT helped me to build a well-rounded portfolio of practical skills including leadership, communication, problem-solving, project management, and cross-disciplinary teamwork, skills which are transferrable to any career. All of these aspects of practical, problem-solving thinking, excellent mentorship, and well-rounded communication I experienced at UT have supported my career success.

Find us on **Instagram**

The department is now on Instagram! Follow us **@cee_utk**.

cee_utk Students at South Doyle Middle School collect water samples at Baker Creek for Asst. Professor Jon Hathaway's research.

cee_utk Whitney Lisenbee was one of 100 doctoral students to receive the prestigious $15,000 Scholar Award from P.E.O. Sisterhood.

cee_utk CEE students took on the concrete canoe at this year's ASCE conference at University of Florida.

cee_utk Senior Design students showcased their community projects before graduation.

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big orange. big ideas.

E-Bikes Gaining Momentum
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