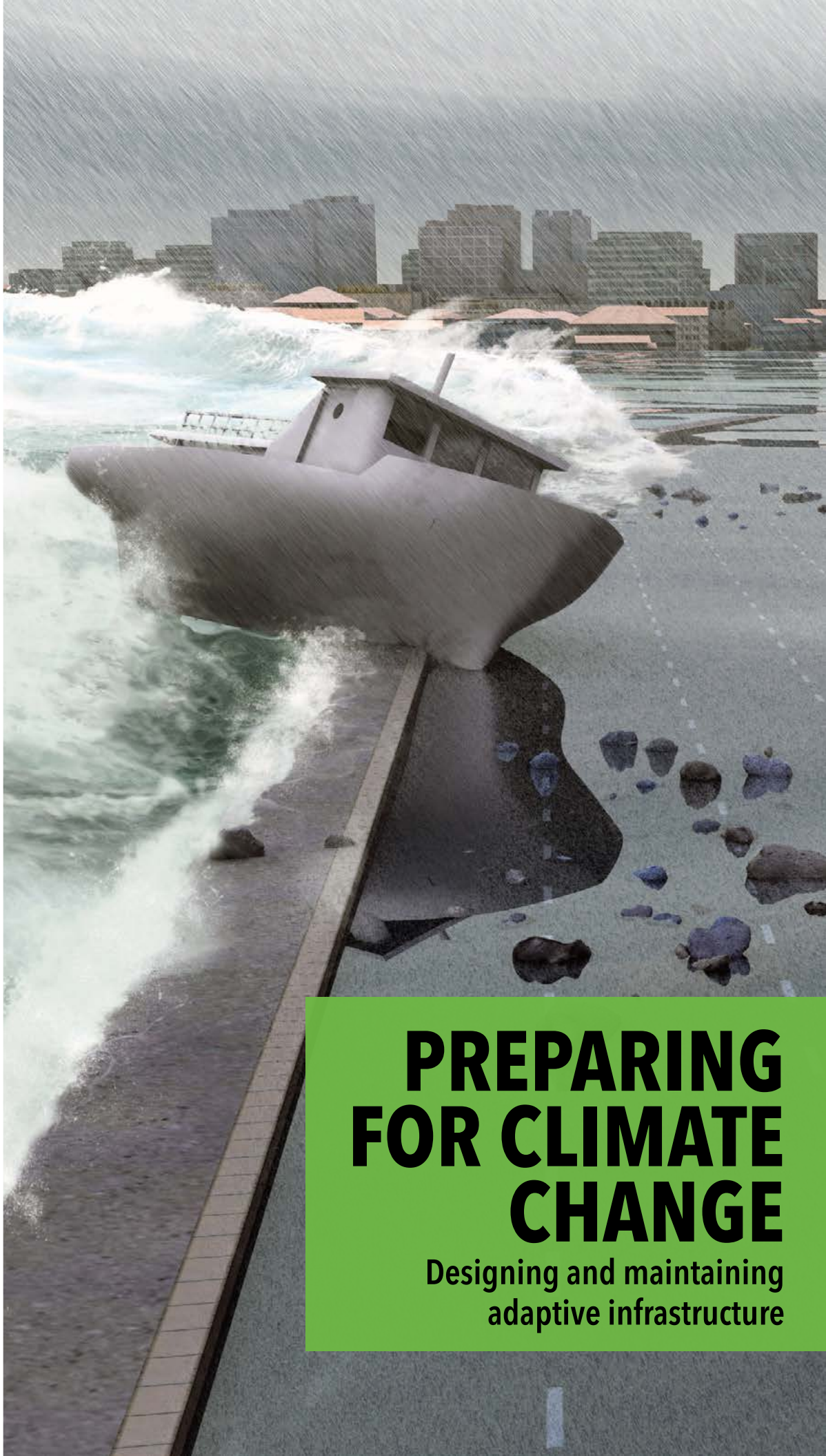
Civil and Environmental
ENGINEERING

CEE

2022 EDITION



PREPARING FOR CLIMATE CHANGE

Designing and maintaining adaptive infrastructure

PennState
College of Engineering

Photo credit: Gordon Warn

Civil and Environmental Engineering Newsletter

2022 EDITION, VOLUME 38

Civil and Environmental Engineering, a newsletter for CEE alumni and friends, is published by the College of Engineering's Department of Civil and Environmental Engineering.

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This publication is available in alternative media on request.

Greetings from the Department Head

Dear alumni and friends:

Welcome to the 2022 annual report for the Department of Civil and Environmental Engineering at Penn State. We send warm greetings and best wishes for good health to you, your family, and your friends and colleagues. Despite the difficulties we have all faced in recent years, our department continues its strong upward trajectory. We are charting an exciting future, providing leadership to the civil and environmental engineering profession and beyond.

The department has made many significant advancements this year. First, we have hired five outstanding new faculty members, with another soon on the way: **Andisheh Ranjbari** in transportation engineering, **Sayed Soleimani** in structural engineering and mechanics, **Ahmed Khalafallah** in construction engineering and management, **Roberto Fernandez** and **Christine Kirchhoff** in water resources engineering (Christine with a primary appointment in the School of Engineering Design, Technology, and Professional Programs), and **Kaleigh Yost**, who will join us in January in geotechnical and materials engineering. We have an additional faculty search ongoing in our environmental engineering area, which will be a co-hire appointment with the Penn State Institutes of Energy and the Environment. Our Undergraduate Program Committee is completing a multi-year effort to modernize the undergraduate curriculum to better serve both students and faculty. At the graduate level, the department is working with Penn State World Campus to create new online master's degree programs and make advanced Penn State degrees available to distance learners. Many new research grants have been received by our faculty, particularly from the National Science Foundation, and the Larson Transportation Institute continues to conduct outstanding research on transportation infrastructure and integrated asset management though our University Transportation Center.

Additionally, the department is completing a fundraising campaign to create a $3 million endowment to reestablish and permanently support a program in construction engineering and management (CEM). We have made great progress with over $2.5 million raised, including a large gift from The Beavers Charitable Trust and Allan Myers, Inc., and commitments from fourteen other construction companies as stakeholders. As mentioned above, we hired Ahmed Khalafallah as the area's new faculty member and began the CEM program on schedule this fall semester. The first meeting of the stakeholder companies as the new CEM advisory board was held in State College in October. This CEM program is a true university-industry partnership and will strongly contribute to the impact of our department.

Thank you for your interest and support of the Department of Civil and Environmental Engineering. The following report provides more information on these and other exciting developments, including several new and promising research areas that highlight the many strengths in our department.

The CEE Department is doing well here in Happy Valley, proudly celebrating its 141st year of excellence at Penn State!

Patrick J. Fox, Ph.D., P.E., D.GE, F.ASCE
Department Head and John A. and Harriette K. Shaw Professor
Department of Civil and Environmental Engineering

CEE Department Faculty

Construction Engineering and Management
Area Coordinator: Thomas Skibinski
Ahmed Khalafallah
Thomas Skibinski

Environmental Engineering
Area Coordinator: Nathaniel Warner
Rachel Brennan
William Burgos
Christopher Gorski
Li Li
Bruce Logan, Director, Inst. for Energy & the Envir.
Wei Peng
John "Jay" Regan
Nathaniel Warner

Geotechnical and Materials Engineering
Area Coordinator: Aleksandra Radlińska
Patrick Fox
Tong Qiu
Aleksandra Radlińska
Farshad Rajabipour
Shelley Stoffels, Associate Dean for Faculty
Ming Xiao

Structural Engineering and Mechanics
Area Coordinator: Kostas Papakonstantinou (fall), Gordon Warn (spring)
Pinlei Chen
Ali Memari
Kostas Papakonstantinou
Sayed Soleimani
Gordon Warn

Transportation Engineering
Area Coordinator: Vikash Gayah
Eric Donnell, Director, Larson Transportation Inst.
Vikash Gayah
Ilgin Guler
Xianbiao "XB" Hu
Brian Naberezny
Andisheh Ranjbari

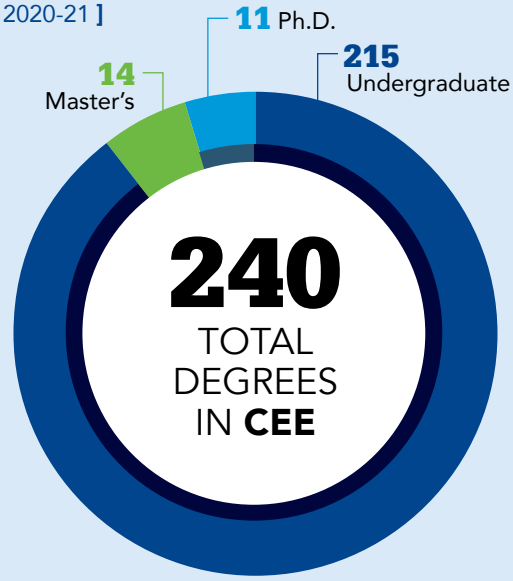
Water Resources Engineering
Area Coordinator: Chaopeng Shen (fall), Xiaofeng Liu (spring)
Roberto Fernandez
Christine Kirchhoff
Xiaofeng Liu
Lauren McPhillips
Alfonso Mejia
Cibin Raj
Chaopeng Shen

1 [MEMBER] **National Academy of Engineering**

[RANKED] **23** **NSF total research expenditures in science and engineering**

$21.1 MILLION **2020-21 Research Expenditures**
Research expenditures include subcontracts, externally, and internally funded projects.

Degrees Awarded
[2020-21]



CEE rises in U.S. News & World Report graduate rankings

All of the Penn State civil and environmental engineering graduate and undergraduate programs were ranked highly in the latest U.S. News & World Report rankings. These rankings reflect the department's leadership and commitment to providing a world-class education and research environment for engineering students at Penn State.

The civil engineering undergraduate program came in at **No. 13**, the third consecutive year the program has held this ranking. The environmental engineering program ranked **No. 17**.

The civil engineering graduate program ranked **No. 17**, advancing three spots from last year's report, and the environmental engineering program came in at **No. 21**, advancing one spot.

Research Areas
Environmental Engineering
Geotechnical and Materials Engineering
Structural Engineering and Mechanics
Transportation Engineering
Water Resources Engineering

34 Faculty

U.S. News and World Report Rankings
UNDERGRADUATE
Civil: 13
UNDERGRADUATE
Environmental: 17
GRADUATE
Civil: 17
GRADUATE
Environmental: 21

Enrollment
400
Undergraduate
(third- and fourth-year students)

41 Master's **108** Ph.D.

NSF CAREER Award Recipients **12**

Starting fall 2022: New undergraduate program in construction engineering and management

The CEE department is excited to announce the launch of a new construction engineering and management (CEM) technical focus area within our undergraduate academic degree program.

CEM focuses on the construction process to provide high safety, quality, and cost effectiveness for a wide variety of projects including buildings, highways, railroads, bridges, tunnels, ports, and airports. Construction engineers and managers engage in planning, design, scheduling, materials procurement, equipment selection, labor negotiations, cost estimating, and quality control. Most projects require the management of subcontractors for specific parts of the job.

This new technical area joins the other CEE areas of environmental engineering, geotechnical and materials engineering, structural engineering and mechanics, transportation engineering, and water resources engineering.

Like the other areas, the CEM curriculum will include core, technical elective, and capstone courses. The CEM technical area is financially supported through a permanent endowment contributed by The Beavers Charitable Trust and fifteen stakeholder companies. These stakeholders form an advisory board to provide a unique educational experience for the department's CEM students.

Courses in CEM are taught by Teaching Professor **Ahmed Khalafallah** and Assistant Teaching Professor **Thomas Skibinski**, both with significant industry experience. Courses include:

- CE 332: Professionalism, Economics, and Construction Project Delivery
- CE 397: Construction Cost Estimating
- CE 397: Construction Scheduling
- CE 432: Construction Project Management
- CE 497: Construction Equipment and Methods
- CE 438W: Construction Engineering Capstone

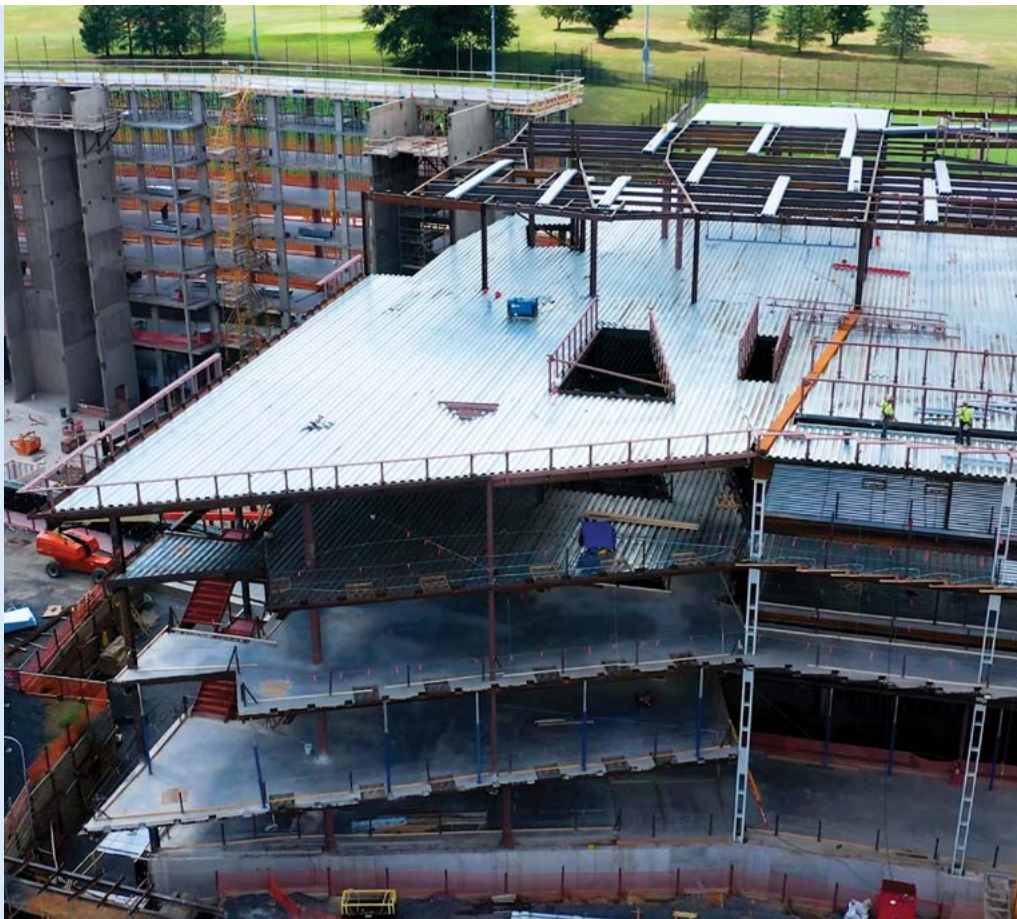
> "We have an absolute need for this type of education in the heavy civil construction field. When we canvassed the students, a huge percentage of them wanted this option, but it was not available. We need to bring these fantastic Penn State graduates into our profession."
>
> — **Robert Alger**, president of infrastructure projects at SNC-Lavalin and member of the fundraising campaign team

West 1 construction continues

Work continues on the soon-to-be new home for CEE, West 1. This 290,000-square-foot building will hold nine active learning, general purpose classrooms, and 51,000 square feet in support of research.

In addition to CEE, the building will include the academic unit offices, research space, and teaching labs of aerospace engineering, architectural engineering, and acoustics, as well as the student support offices of the Center for Engineering Outreach and Inclusion, the Center for Global Engineering Engagement, and the Engineering Advising Center. Move-in is expected during spring/summer 2024.

Watch the construction progress through livestream video here.



Welcome to our new CEE faculty members

Roberto Fernández joined Penn State as a teaching professor of civil and environmental engineering on August 17. Fernández received his bachelor's degree in civil engineering from the Universidad de Costa Rica. He earned his master's degree and doctoral degree in civil engineering from the University of Illinois at Urbana-Champaign.

Before joining Penn State, Fernández worked as a postdoc at the University of Hull in the United Kingdom. His research focuses on ways in which flowing water interacts with the built environment and shapes the landscapes around us, specifically focusing on erosion.

Ahmed Khalafallah joined Penn State as the Beavers Charitable Trust & Allan Myers Endowed Teaching Professor on August 15. Khalafallah received his bachelor's degree in civil engineering and his master's degree in construction engineering and management from Cairo University. He earned his doctoral degree in civil engineering from the University of Illinois at Urbana-Champaign.

Before joining Penn State, Khalafallah served as the civil engineering program coordinator at the American International University of Kuwait and the director of the construction management program at Western Kentucky University. His research focuses on developing intelligent automated systems to optimize the design and sustainable construction of buildings and civil infrastructure.

Christine Kirchhoff joined Penn State as an associate professor in the School of Engineering Design, Technology, and Professional Programs and in CEE on August 1. Kirchhoff is also serving as the associate director of the Law, Policy and Engineering Program. She earned her bachelor's degree in civil engineering and master's degree in environmental and water resources engineering from the University of Texas at Austin. She received her doctoral degree in resource policy and behavior from the University of Michigan, Ann Arbor.

Before joining Penn State, Kirchhoff was an associate professor in the Department of Civil and Environmental Engineering and an affiliated faculty member at the Connecticut Institute for Resilience and Climate Adaptation and in the Department of Natural Resources and Environment at the University of Connecticut. Her research focuses on advancing the fundamental understanding and practice in the areas of the human dimensions of engineering, especially for resilient infrastructure; water governance, planning and management under stress and change; and the production and use of science in policy and decision making.

Andisheh Ranjbari joined Penn State as the Tracy Early Career Assistant Professor of Civil and Environmental Engineering on January 1. She received a bachelor's degree from the Ferdowsi University of Mashhad in Iran, a master's degree in transportation engineering from the Iran University of Science and Technology, and a doctorate in transportation engineering from the University of Arizona.

Prior to joining Penn State, Ranjbari was a postdoctoral research associate at the University of Washington, where she served as the director of the Urban Freight Lab, a public-private research partnership focused on developing and testing solutions around urban freight management and operation problems. Her research interests include urban freight, public transit, shared mobility, and curbside management.

Sayed Soleimani joined Penn State as a teaching professor of civil and environmental engineering on August 1. Soleimani received his bachelor's degree in civil engineering from Sharif University of Technology in Iran. He earned his master's degree and doctoral degree in civil engineering from the University of British Columbia in Canada.

Before joining Penn State, Soleimani was the head of the civil engineering department at the Australian University in Kuwait. His research focuses on the repair and rehabilitation of concrete structures, bridge engineering, structural health monitoring and sustainability in civil engineering materials, and engineering education.

Kaleigh Yost will join Penn State as the L. Robert and Mary L. Kimball Early Career Assistant Professor in the Department of Civil and Environmental Engineering in January 2023. Yost received her bachelor's degree in civil engineering from the University of Notre Dame in 2015, and she received her master's degree in civil engineering from the University of Texas at Austin in 2017. She is currently earning her doctoral degree in civil engineering from Virginia Tech and will graduate in 2022.

Before starting her doctoral education, Yost worked at Langan Engineering and Environmental Services as a geotechnical engineer. Her research focuses on improving earthquake-induced liquefaction hazard assessment for complex geologies.

PREPARING FOR THE STORMS AHEAD

$2 million NSF grant awarded for climate-adaptive infrastructure design

Gordon Warn

Lauren McPhillips

Kostas Papakonstantinou

By Tim Schley

The U.S. experienced a record number of billion-dollar disaster events in 2020, with damages totaling approximately $95 billion. It was the sixth consecutive year the National Oceanic and Atmospheric Administration recorded at least ten such events.

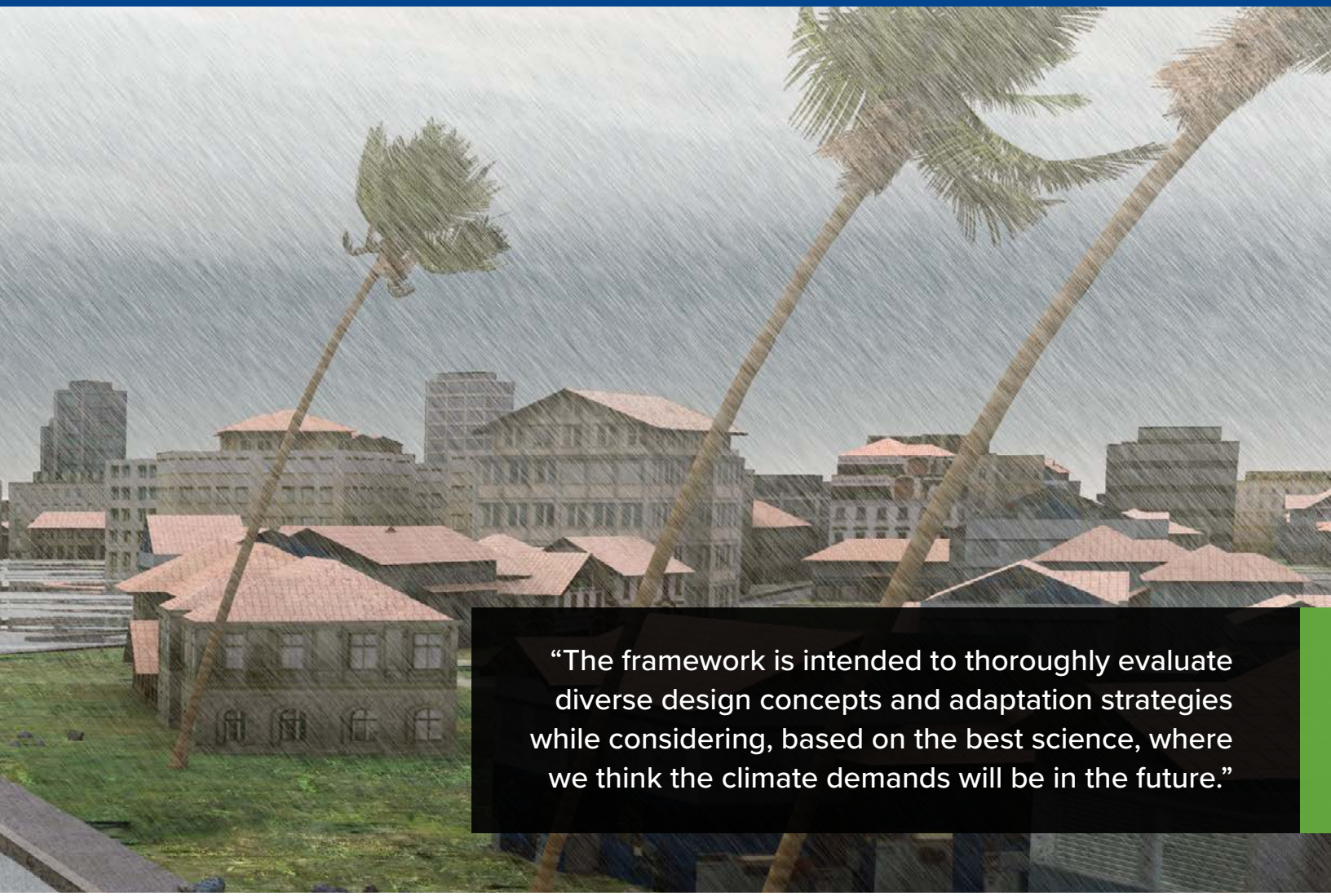
In 2021, severe weather events such as Hurricane Ida took their toll once again on the nation's infrastructure, continuing a decades-long rise in frequency and intensity. Yet, much of the new infrastructure designed today does not account for the intensification of future climatic hazards, according to Professor **Gordon Warn**.

"When loads and demands are calculated in order to design the infrastructure—a bridge, a building, or a culvert—those loads come from historical data," Warn said. "Part of the problem is that the historical data no longer reflect what we can expect in the future."

Warn leads a four-year, $2 million National Science Foundation project using climate projection models and artificial intelligence (AI) to evaluate the likely long-term cost and environmental impacts of infrastructure design choices.

"Typically, the design, construction, and maintenance of infrastructure are handled by different teams with little integration, and this can translate into high life-cycle costs," Warn said. "The proposed framework addresses this by simultaneously integrating the design, maintenance, and adaptation phases, while considering significant future uncertainties, to optimally satisfy life-cycle objectives."

The team proposed that climate model predictions could be incorporated into computational frameworks for life-cycle assessment, which account for future potential hazards while determining the optimal way to construct, adapt, repair, and maintain an infrastructure through its intended lifespan. This is achieved through deep reinforcement learning, a form of AI where an autonomous "agent" intelligently learns to achieve certain objectives over time, such as minimizing life-cycle cost.



> "The framework is intended to thoroughly evaluate diverse design concepts and adaptation strategies while considering, based on the best science, where we think the climate demands will be in the future."

In this approach, the design team evaluates multiple design alternatives using low-fidelity, or less detailed, models. When they identify the more viable alternatives based on their life-cycle priorities—keeping to a specific budget while minimizing environmental impacts, for example—these designs are evaluated again using higher-fidelity data, leading to more precise life-cycle estimations.

This "multi-fidelity" framework saves computational resources while allowing designers to identify certain decision-making trade-offs between safety, resilience, resource consumption, and environmental impacts, according to Warn.

"For example, a designer could choose to 'over-design' bridge piers by making them exceptionally large in size to account for rising river flood levels," he said. "But this adds cost and uses extra materials like concrete that contribute more carbon dioxide emissions."

Instead of over-designing the infrastructure, the designers could consider an alternative to include provisions to adapt the structure in later years, or they might look to restore a nearby wetland to help mitigate flood height.

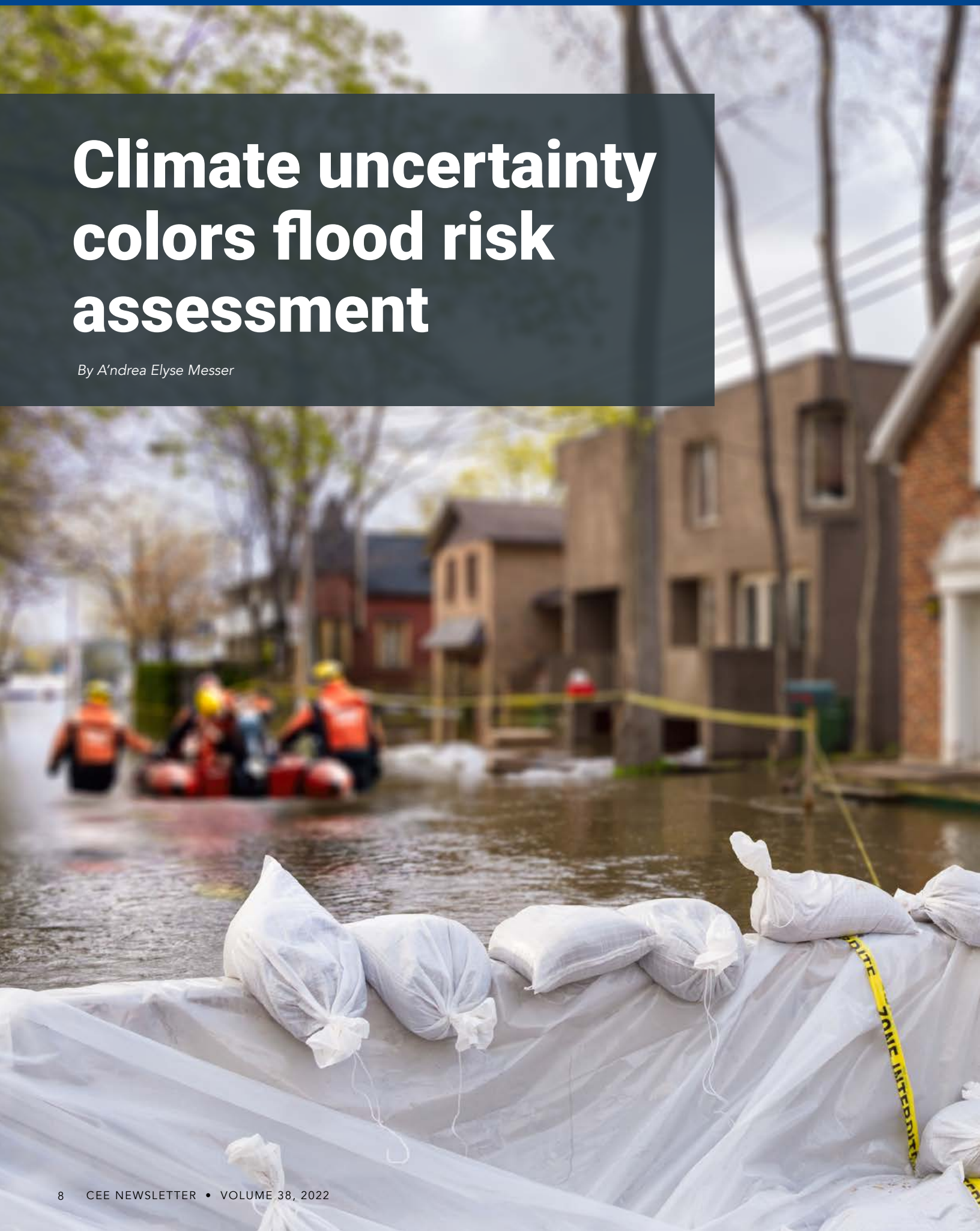
The researchers plan to demonstrate their approach through a variety of practical design scenarios, including a riverine bridge vulnerable to flooding and deterioration; an urban mid-rise building stressed by increasing temperatures; and a port system threatened by sea level rise.

"If you want to mitigate sea-level rise for a port, there are various options," Warn said. "For example, should the existing wharfs be elevated? If so, how tall should they be? What is the storm mitigation strategy? Should there be coastal armoring or a managed retreat to higher ground because it is too costly to build? Overall, the framework is intended to thoroughly evaluate diverse design concepts and adaptation strategies while considering, based on the best science, where we think the climate demands will be in the future."

Co-principal investigators include CEE researchers Assistant Professor ***Lauren McPhillips*** *and Associate Professor* ***Kostas Papakonstantinou****; Chris Forest, professor of climate dynamics at Penn State; and University of Pittsburgh researcher Melissa Bilec, William Kepler Whiteford Professor of Civil and Environmental Engineering and co-director of the University of Pittsburgh's Mascaro Center for Sustainable Innovation.*

Climate uncertainty colors flood risk assessment

By A'ndrea Elyse Messer




Alfonso Mejia

Understanding how climate change will affect the flooding of rivers may become easier with a new framework for assessing flood risk developed by an interdisciplinary research team from Penn State, led by Associate Professor **Alfonso Mejia**.

"New home builders want to know how high they have to put their buildings to be safe for the future," Mejia said. "They want to know how the flood zones are going to change in the future."

The Federal Emergency Management Agency (FEMA) issues flood maps for areas near rivers, but according to the researchers, FEMA does not update its maps frequently, nor does it project the future potential impact of climate change on how areas will flood. FEMA flood maps are based on historically observed flood records, not future possible events.

"FEMA does a good job in mapping flood hazards, but the part we are incorporating is the future climate so we can understand the impact of climate on flood hazards and exposure," Mejia said.

The researchers, who published their results in the *Journal of Hydrometeorology*, considered a wide array of variables in their framework, including meteorological, hydraulic, hydrologic, topographic, and others.

"The data and models required to project flood hazards and exposure come from diverse academic disciplines, and they must be integrated and compatible," said Sanjib Sharma, assistant research professor in the College of Earth and Mineral Sciences' Earth and Environmental Systems Institute.

Flood maps are usually drawn to show the 100-year flood inundation boundary, a flood that has a 1% chance of hitting an area in any given year. The researchers note that while they are producing 100-year maps, they also can produce 500-year maps. They also say that as time and climate change progress, the 100-year flood maps change as well. The map for 2050 is different from the map for 2100.

The researchers did a regional analysis to assess flood hazards and exposure across all the cities and boroughs in Pennsylvania.

"It's a really complicated process and the geoscientists and engineers need to link with the policy and insurance people at all levels," said Mejia.

The framework combines climate model outputs for a hydrologic model that creates streamflow projections.

The streamflow projections are joined with a hydraulic model and a statistical model to map the uncertainty of flooding during extreme flooding events.

The researchers report that climate uncertainty dominates the overall uncertainty surrounding the flood inundation projection chain. The combined hydrologic and hydraulic uncertainties account for as much as 37% of the total uncertainty.

*Also on the project from Penn State were **Michael Gomez**, postdoctoral fellow in civil and environmental engineering; Sanjib Sharma, assistant research professor in the College of Earth and Mineral Sciences' Earth and Environmental Systems Institute; Klaus Keller, professor of geosciences; and Robert Nicholas, associate research professor of atmospheric sciences.*

This work was supported through the Penn State initiative for resilient communities by a strategic plan seed grant from the Penn State Office of the Provost, with co-support from the Center for Community Design, and by the National Oceanic and Atmospheric Administration through the Mid-Atlantic Regional Integrated Sciences and Assessments program.

"It's a really complicated process and the geoscientists and engineers need to link with the policy and insurance people at all levels."

Bridging the gap to better infrastructure

Study compares models for predicting bridge deterioration

By Mariah Chuprinski

Ilgin Guler

Aleksandra Radlińska

Bridge failures are a reality for states with aging infrastructure, including Pennsylvania. In February, the Forbes Avenue Bridge in Pittsburgh collapsed due to structural failure; unfortunately, this kind of event isn't unique. According to the American Road and Transportation Builders Association, about 14% of Pennsylvania's bridges are structurally deficient, meaning at least one of their key structural elements is in poor condition.

In two recent papers, Associate Professor **Ilgin Guler** compared statistical modeling and machine learning to monitor and forecast the conditions of bridge decks, the topmost surfaces of a bridge. Her results are published in the *Journal of Bridge Engineering* and the *Transportation Research Record*.

"Both methods have their advantages," Guler said. "The statistical method provides insights on the factors that contribute more or less to a bridge's deterioration, while the machine learning method offers a more accurate prediction."

For their dataset, researchers used a list of 25,000 state-owned bridges in Pennsylvania.

In the *Journal of Bridge Engineering*, researchers used an estimation method called the Markov chain Monte Carlo to write code in Python to represent the bridge data in statistical modeling. Then, they identified the coefficients or parameters, which told them everything they needed to know about the data, according to researchers.

"In the statistical distribution method, we were able to analyze explanatory variables, or the future impacts of different characteristics of the bridge, such as the types of materials, beams, and rebars used to build the bridge," said **Muyang Lu**, a CEE doctoral student and first author on both papers. "The data address how likely it is that a factor may contribute to a bridge's deterioration."

In the *Transportation Research Record* paper, researchers used a machine learning method known as random survival forest, which creates data trees by splitting items into similar groups for analysis.

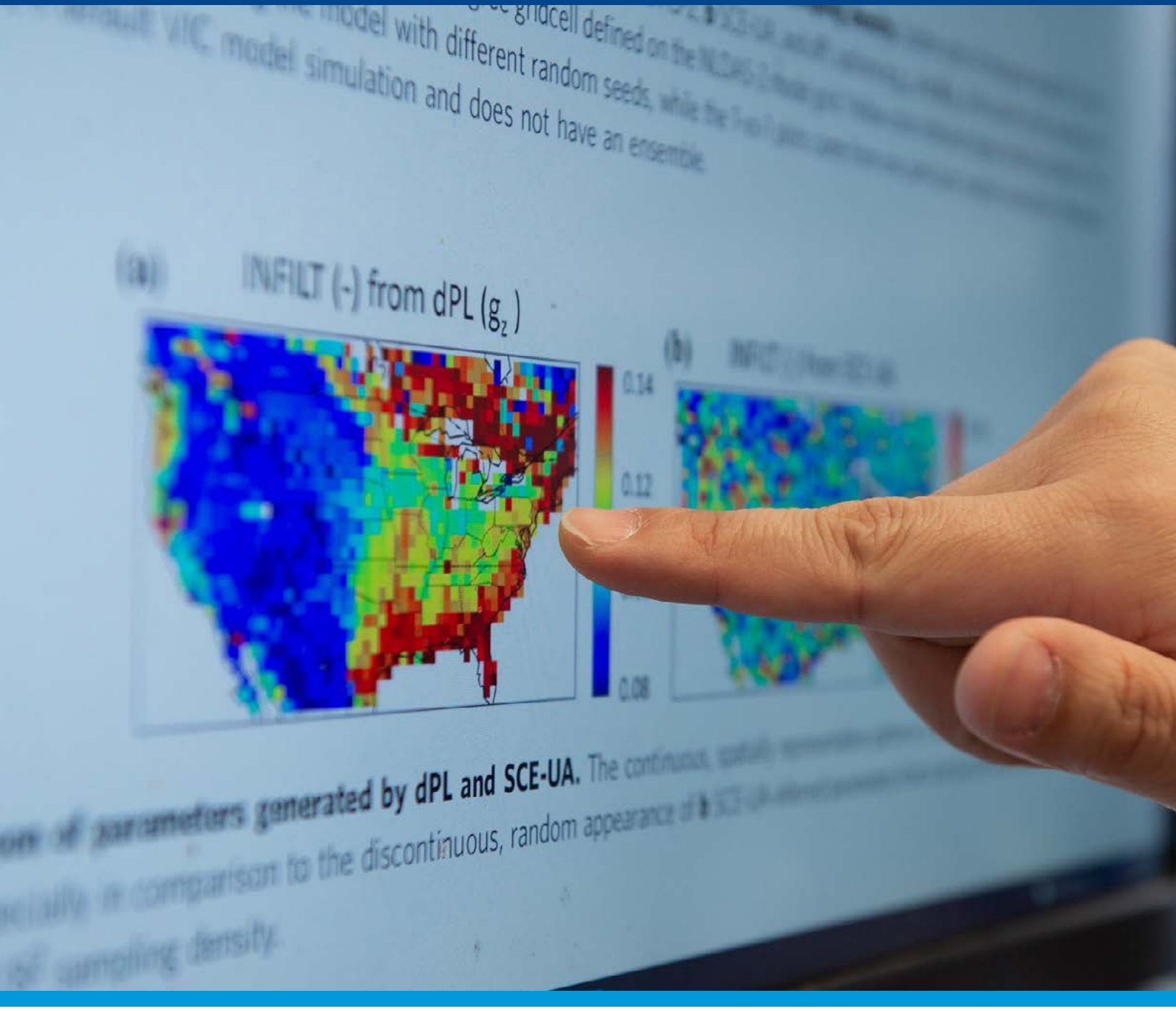
"Using machine learning, we created a prediction model using the 25,000-item dataset," Guler said. "Over time, we trained the algorithm to 'learn' from the existing data to make assumptions about similar data."

Machine learning methods have been used in the past to determine bridge deterioration for a given year, according to Guler, but they have not been used to predict the duration a bridge will stay in a certain condition or how long it will take to deteriorate.

"Both these methods can improve decision-making when stakeholders are designing bridges or deciding whether to make repairs and when," Guler said. "With these data-driven models, we have a better estimate of what will deteriorate and when. This can drastically improve how bridge management is done."

*In addition to Guler and Lu, Associate Professor **Aleksandra Radlińska** and **Jonathan Hydock**, a CEE undergraduate student, contributed to the Journal of Bridge Engineering paper.*

The Center for Integrated Asset Management for Multimodal Transportation Infrastructure Systems: Region 3 University Transportation Center supported this work.



New geoscientific modeling tool gives more holistic results in predictions

By Sarah Small

Geoscientific models allow researchers to test scenarios with numerical representations of the Earth, from predicting large-scale climate change effects to informing land management practices.

Chaopeng Shen

Estimating parameters for traditional models, however, is costly and calculates results that are difficult to extrapolate, according to Associate Professor **Chaopeng Shen**.

Shen and other researchers developed a new model known as differentiable parameter learning, published in *Nature Communications*, that combines elements of process-based models and machine learning for a broadly applied method that results in more aggregated solutions.

Traditional process-based models, such as evolutionary algorithms, evolve across many iterations of operating to tune parameters that cannot be observed directly, according to Shen, but they are not able to handle large scales or be generalized to other contexts. Rather, applying evolutionary algorithms solves problems for different areas without communication between them, leading to inconsistent solutions. Shen's model takes in data from all locations to get one comprehensive solution.

"Our algorithm is more holistic because we use a global loss function," Shen said. "During the parameter estimation process, every location's loss function—the discrepancy between the output of your model and the observations—is aggregated together. The problems are solved together at the same time: one solution to the entire continent."

Shen noted his method is more computationally cost-effective than traditional methods. What would normally take a supercluster of 100 processors two to three days now requires only one graphical processing unit one hour.

> **"The problems are solved together at the same time: one solution to the entire continent."**

Pure machine learning methods can make good predictions for extensively observed variables, but their results can be difficult to interpret because they do not include causal relationship assessment. Shen's approach organically links process-based models and machine learning at a fundamental level to leverage all the benefits of machine learning as well as the insights that come from the physical side.

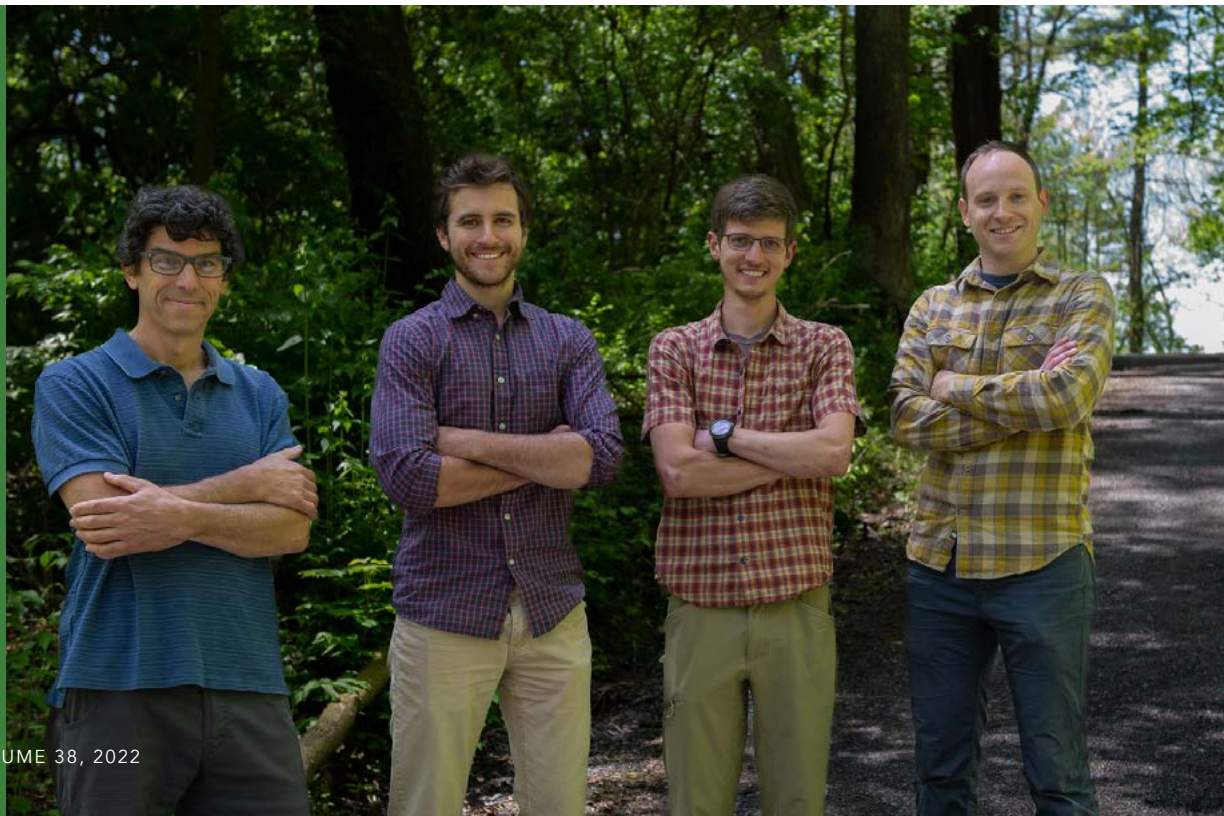
*Other authors of the paper include graduate students **Dapeng Feng** and **Jiangtao Liu**, postdoctoral scholar **Wen-Ping Tsai**, and research associate **Kathryn Lawson**, all in CEE; Ming Pan of the Scripps Institution of Oceanography at the University of California San Diego; Hylke Beck of GloH20, the Netherlands; and Yuan Yang of Tsinghua University and China Three Gorges Corporation, both of China.*

The U.S. Department of Energy and the National Science Foundation funded the research.

Associate Professor Chaopeng Shen (seated, right) and other researchers in his laboratory study a map that displays information that was derived from their new geoscientific modeling tool. Credit: Kelby Hochreither/Penn State.

Above: The laboratory rainfall-runoff experiments were conducted on a roadbed test frame with a discharge chute to capture runoff. Credit: Bill Burgos / Penn State

Right: The practice of spreading wastewater from conventional oil and gas wells is unsuitable for dust suppression on unpaved roads, according to CEE researchers. Their findings will be considered as the Pennsylvania Department of Environmental Protection reviews its policies toward the practice, halted in Pennsylvania in 2018. Pictured here, from left to right: Bill Burgos, professor of environmental engineering; Andrew Kearney, environmental engineering research assistant; and James Farnan and Andrew Eck, both environmental engineering graduate students. Credit: Kelby Hochreither / Penn State



Oil and gas brine control dust 'no better' than rainwater, researchers find

By Tim Schley and Ashley J. WennersHerron

Bill Burgos

Nathaniel Warner

Xiaofeng Liu

Spreading wastewater, or brine, from conventional oil and gas wells on unpaved roads is a longstanding practice for suppressing dust, which can become a breathing and visibility hazard during warmer months. Common in several other states, the practice was halted in Pennsylvania in 2018 and is under evaluation by the Pennsylvania Department of Environmental Protection (DEP).

The Pennsylvania DEP commissioned a study by CEE researchers, who found that the brine is about as effective as rainwater at controlling dust but worse for the environment. The DEP finalized the report in May.

Using oil and gas wastewater from conventional wells to control dust was considered a beneficial use of the residual waste on the state's 25,000 miles of dirt and gravel roads, since it was thought to have a chemical composition and behavior similar to commercial dust suppression products. This study, partly funded by the DEP, indicated otherwise while also finding that the rain runoff from roads treated by any dust suppression method contained contaminants that could pollute nearby water sources.

"We know that road dust poses both a safety hazard for people driving through it and a health hazard for people breathing it in, so dust suppressants are absolutely needed," said Professor **Bill Burgos**. "While we must be willing to accept the tradeoffs between the benefits of dust suppression and the drawback of the environmental impacts, this research has found that oil and gas wastewaters only provide drawbacks."

The report summarized the results of two laboratory-scale studies comparing samples of oil and gas wastewater from conventional wells to the commercially available calcium chloride dust suppressant and the organic alternative of soybean oil.

In one set of laboratory experiments designed to study the impact of rain runoff after dust suppression, researchers found that every suppressant tested leached contaminants in proportion to its chemical composition. The runoff from roadbeds treated with calcium chloride, a commercial suppressant, contained the highest concentrations of chlorides and other potential contaminants related to the salinization of freshwater resources. The runoff from roadbeds treated with oil and gas wastewater also contained chlorides, as well as high concentrations of sodium and even radium—a known carcinogen that is often pulled to the surface through wastewater when oil and gas is extracted from the Earth.

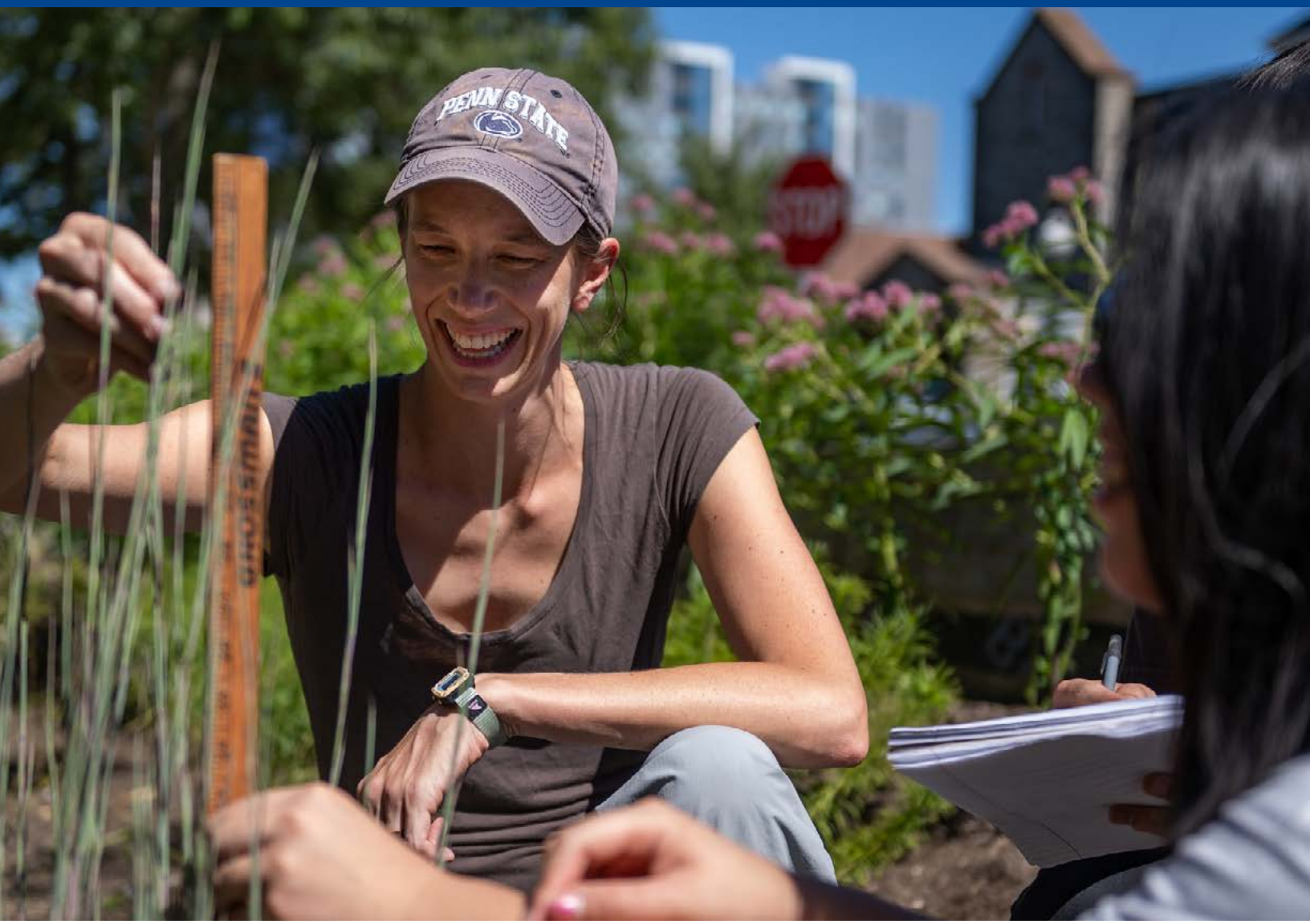
"After a dust suppressant is applied to a road, the first rainfall begins to wash it off the surface," said Associate Professor **Nathaniel Warner**. "The research found that the runoff contains high concentrations of whatever is put on the road and could cause problems in nearby water—the sodium, chlorides, and particularly the radium are all of serious concern."

In experiments testing dust generation, conducted with compacted "pucks" of gravel road material subjected to a laboratory analogue of traffic abrasion, calcium chloride and soybean oil were shown to be highly effective at suppressing dust. The oil and gas wastewater performed "essentially no better than rainwater," likely due to its high concentration of sodium.

*Additional contributors included Associate Professor **Xiaofeng Liu**; **Eric Chase**, research assistant with Penn State's Center for Dirt and Gravel Road Studies; **Hassan Ismail**, postdoctoral research associate, and **Andrew Kearney**, research assistant, both in CEE; and environmental engineering graduate students **James Farnan** and **Andrew Eck**.*

The DEP funded the runoff experiments. Penn State funded the brine-efficacy experiments.

"While we must be willing to accept the tradeoffs between the benefits of dust suppression and the drawback of the environmental impacts, this research has found that oil and gas wastewaters only provide drawbacks."



Grey to green: Managing urban stormwater

By Tim Schley

Lauren McPhillips

Assistant Professor **Lauren McPhillips** is leading two projects—one supported by the Chesapeake Bay Trust and the other by the Pennsylvania SeaGrant Program—to explore the use of green stormwater infrastructure (GSI) for mitigating urban flooding and water quality issues. GSI integrates nature into engineered solutions for stormwater management, a deepening issue as climate change increases the frequency and severity of severe weather events.

Field testing for both projects is in Lancaster, Pennsylvania, a city awash with small, vegetated areas installed as GSI. The bioretention basis, tree trenches, rain gardens, and more fit seamlessly into the community while also managing the city's stormwater.

"Lancaster has extensive GSI implementation, making it an ideal site for the work we're interested in," McPhillips said. "They use rain gardens a lot, which are located between the street and the sidewalk. The water comes off the street into these contoured bowls with diverse vegetation where the water accumulates and percolates through the soil, allowing plants to take it up and treat it."

Chesapeake Bay Trust

Plants in GSI are chosen for their tolerance to a wide range of moisture conditions. They often have deep roots, which allow them to retain water and contaminants.

But, according to McPhillips, a barrage of salt—used to melt snow and ice in the winter and spring—can severely affect the vegetation's health, including how well it retains the contaminants.

In the project sponsored by the Chesapeake Bay Trust, she is collaborating with Penn State researchers Shirley Clark, Hong Wu, and Margaret Hoffman, as well as Sybil Gotsch from Franklin and Marshall College in Lancaster to better understand the impact salt has on GSI.

"All northern areas with freezing precipitation deal with it," McPhillips said. "What are ways we can better design GSI so the salt doesn't impact its ability to treat other contaminants?"

Pennsylvania SeaGrant Program

In addition to controlling the flow of stormwater and retaining contaminants, GSI appears to help to moderate city temperature, promote ecological biodiversity, sequester carbon, and improve community aesthetic, McPhillips said.

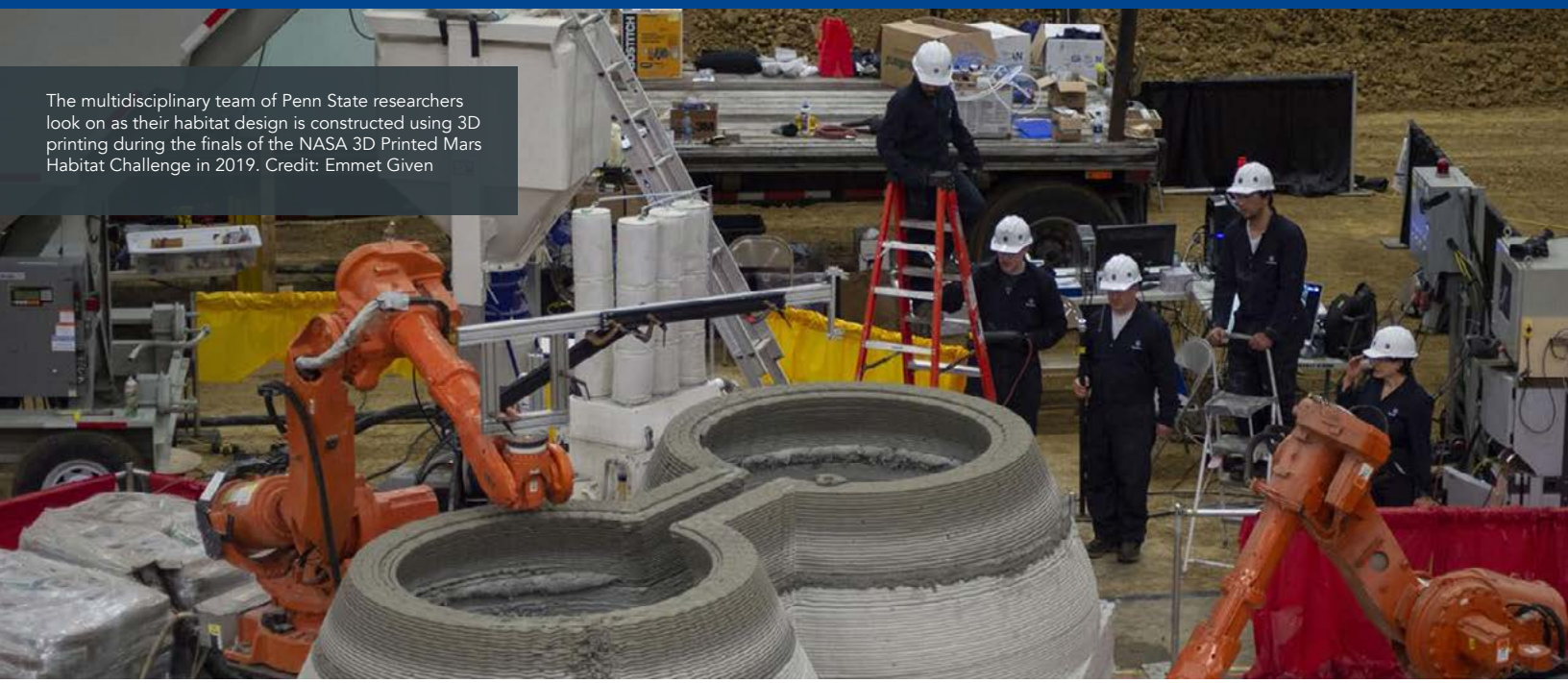
Prior academic research has mostly focused on GSI's water quantity and quality services, she explained, so there is still much to learn about these other advantages. Thanks to the Pennsylvania SeaGrant College Program grant, McPhillips is leading a project to quantify the additional benefits, which she hopes will give cities actionable data to help inform their community members and increase GSI use.

"There seems to be a lot of interest in the other benefits of green stormwater strategies," McPhillips said. "Community members might even be more excited about them than the primary water quality goals."

Co-investigators on the project include Clark, Wu, Hoffman and Gotsch, as well as Daniel Brent, assistant professor of agricultural economics at Penn State, and Jennifer Fetter and Tyler Groh, both from Penn State Extension.

Students in McPhillips' lab collect stormwater samples at a green stormwater infrastructure site. IMAGE: Kelby Hochreiter/Penn State

Watch the video to learn more about the potential for green solutions to mitigate worsening urban stormwater issues.



The multidisciplinary team of Penn State researchers look on as their habitat design is constructed using 3D printing during the finals of the NASA 3D Printed Mars Habitat Challenge in 2019. Credit: Emmet Given

FROM THE GROUND UP

Taking 3D-printing technology to the next level

Aleksandra Radlińska

Ali Memari

Ming Xiao

This is a small segment from the Research Penn State *magazine story, "From the ground up: Taking 3D-printing technology to the next level." The story, featuring three CEE faculty, details efforts across Penn State's College of Engineering in the field of additive manufacturing, addressing pressing problems in human health, housing, transportation, and more.*

While 3D printing of biological materials has the capability to transform healthcare, the technique may also overhaul the way we design and build our living structures—not only on Earth, but perhaps even in space.

Recently, Jose Duarte, Stuckeman Chair in Design Innovation, and Shadi Nazarian, associate professor of architecture, co-led an interdisciplinary team of students and faculty that took second place in a NASA competition. The goal? To design an autonomous system capable of creating a human shelter on Mars using 3D-printing technology. With their entry, the team managed to build the world's first fully 3D-printed structure to include a roof built in place without formwork or molds, Duarte said.

"The other teams printed the roof separately and raised it to its position afterward, or else used formwork to avoid its collapse during printing," added Duarte.

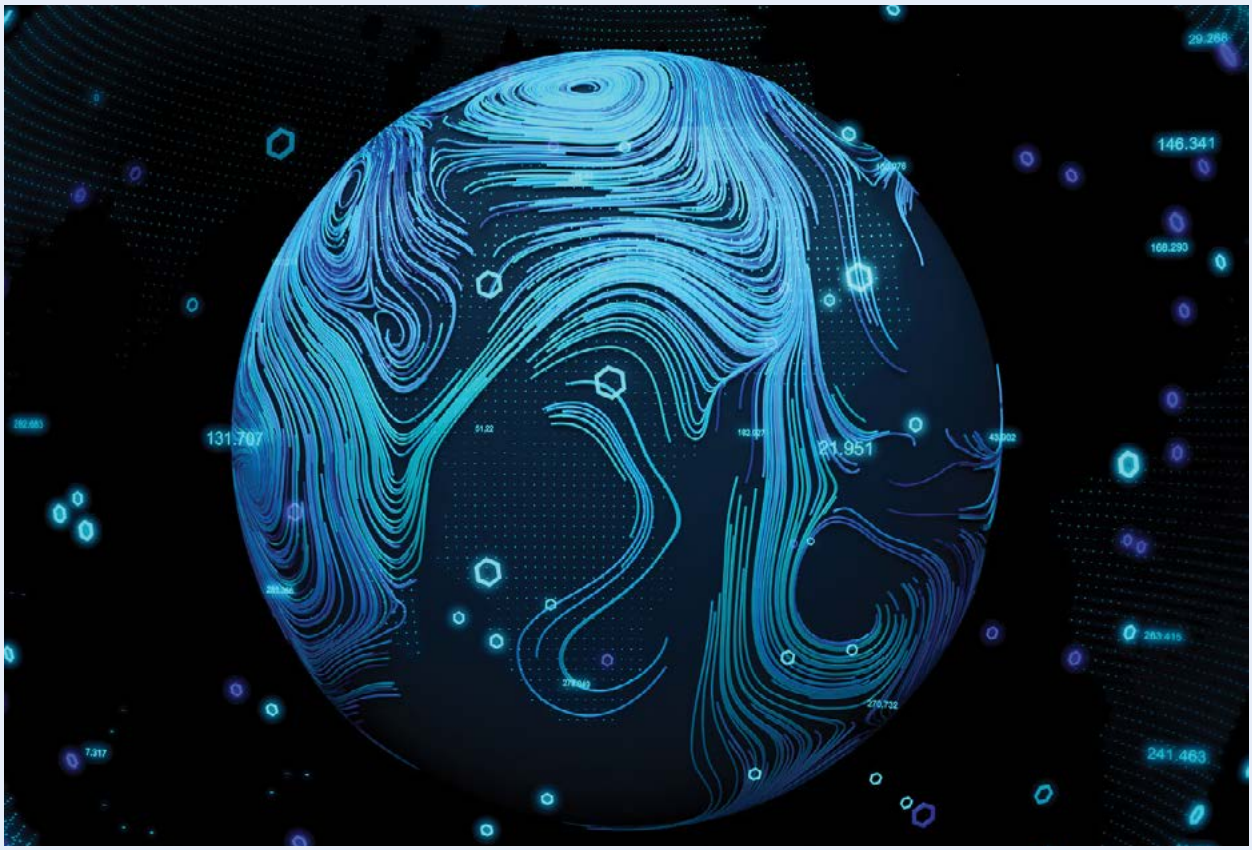
Another challenge of the competition was to 3D print with a specialized concrete that can withstand extreme environmental conditions as a finished structure. CEE Associate Professor **Aleksandra Radlińska** brought to the team her expertise in cement and concrete behavior. 3D printing with concrete can be tricky, Radlińska explained, because the mixture needs to be fluid enough to be extruded through a printing nozzle, but afterward stable and strong enough to support additional layers. When done right, researchers have shown, 3D printing with concrete can result in structures that are equally strong to those traditionally built, while using less material.

Although the Mars shelter competition took place entirely on Earth, the team's final product could feasibly be built in space. The knowledge gained, however, will be used to create sustainable, low-cost housing options here, by simplifying and speeding up construction processes and saving on materials, Duarte said. He and his colleagues are already developing the technology to deploy structures in remote areas of Alaska, where temperature extremes rival those on Mars.

Coordinated by CEE Professors **Ali Memari** and **Ming Xiao**, as well as Nathan Brown, professor of architectural engineering, the team is designing an Alaska-ready 3D-printed model that includes a foundation, walls, and a roof.

"The model is essentially a room, and you can combine rooms to build unique houses with a variety of configurations," said Duarte. "By doing this, you can build a large house with a small printer, one room at time. You can print the entire thing on site."

Read the full story on Penn State News.



Shen chairs NSF-funded machine learning symposium on water resources

By Ashley WennersHerron

Chaopeng Shen

Penn State hosted the first National Science Foundation-funded symposium on how machine learning can contribute to the field of hydrology, on May 18-20 at University Park and online. Associate Professor **Chaopeng Shen** was the chair of the organizing committee for the event titled "HydroML Symposium on Big Data Machine Learning in Hydrology and Water Resources."

"This symposium emphasizes building a community that has common goals and shared resources," Shen said. "We are attempting to demystify machine learning for those new to the field, build up machine learning expertise, encourage collaboration among those already involved, and build a machine learning community for all participants."

The event included plenary and lightning talks, poster presentations, machine learning tutorials, hackathons, networking opportunities, and social events. The discussed research topics covered all sub-areas of hydrology and a variety of machine learning approaches.

HydroML SYMPOSIUM

Three years ago, machine learning was already developing rapidly in the sub-field of artificial intelligence as applied in hydrology, according to Shen, but there was a lack of communication between the people using it.

"There wasn't a conference or meeting focused in this area, where we could come together to share findings or approaches and make the networking connections needed to move research forward," Shen said. "There are so many people working on so many topics in this field, and nothing to pull us together, so I applied for a grant from NSF to fund the first symposium in this area."

CEE in the News

Tribune-Review, June 18: "Fern Hollow Bridge inspection troubling but did not suggest imminent danger, experts say"

Associate Professor **Kostas Papakonstantinou** discussed the collapse of Pittsburgh's Fern Hollow Bridge, as well as the results of a routine inspection that took place before the collapse. Papakonstantinou noted that the overall inspection score of the bridge did not indicate the bridge was in imminent danger of collapse.

Chesapeake Bay Journal, June 30: "Study: Drilling waste on Pennsylvania roads bad for health, land"

Professor **William Burgos** discussed his research into the effectiveness of conventional oil and gas brine as a dust suppressant. Burgos and other CEE researchers submitted a study to the Pennsylvania Department of Environmental Protection, in which they found that the brine is not an effective dust suppressant and could have negative environmental impacts. Read more about this project on page eight.

Vox, July 7: "What the Supreme Court's EPA ruling means for air pollution — and your health"

Assistant Professor **Wei Peng** provided commentary on the Supreme Court decision *West Virgina v. EPA*, and how it could potentially change regulation on air pollution.

ASCE Civil Engineering Magazine, August 18: "Concrete mix for lunar applications is one step closer"

Associate Professor **Aleksandra Radlińska** discussed a project she leads to develop new concrete mixes for construction use on the moon. Peter Collins, a civil engineering doctoral candidate, was also mentioned in the article for his work on the project testing simulants of materials found on the moon.

Academic Minute podcast, August 30: "Improve traffic flow in cities by banning left turns"

Associate Professor **Vikash Gayah** was interviewed in Inside Higher Ed's "Academic Minute" podcast, where he discussed how eliminating left-hand turns improves overall traffic safety and efficiency.

New Penn State President Neeli Bendapudi meets with students in Penn State's Women in Engineering program.

2021-2022 CEE Seminar Series

Featuring distinguished guests in both academia and industry, as well as our own renowned faculty, the CEE Lecture Series brought together researchers working in all areas of civil and environmental engineering to share the latest advances of the field.

- **Kyle Delwiche**, postdoctoral researcher, University of California, Berkeley
- **Ilgin Guler**, associate professor of civil and environmental engineering, Penn State CEE
- **George Deodatis**, professor of civil engineering, Columbia University
- **Laura Lautz**, program director for hydrologic sciences, National Science Foundation
- **Chandra Bhat**, professor and Joe J. King Chair in Engineering, the University of Texas at Austin
- **Ming Xiao**, professor of civil and environmental engineering, Penn State CEE
- **Alyssa Findlay**, editor, Nature Climate Change
- **Kyle Frischkorn** and **Laura Zinke**, editors, Nature Geosciences and Nature Reviews Earth & Environment
- **Prannoy Suraneni**, assistant professor of civil and architectural engineering, University of Miami
- **Ning Lin**, associate professor of civil and environmental engineering, Princeton University

Harleman Distinguished Lecture

In the department's annual honorary Harleman Lecture, Stanley Grant, professor at Virgina Tech presented "Reversing the Freshwater Salinization Syndrome: A Call to Action for the Water Resources Research Community." Grant discussed the underlying causes, unknowns, and critical research needs of rising local and global freshwater salinity, which threatens drinking water resources and affects the structure and function of soil, stream, and riparian ecosystems.

The yearly lecture, named after outstanding engineering alumnus Donald R.F. Harleman (B.S. CE '43), is intended to enrich the faculty and students in the water resources area of Penn State CEE by providing contact with outstanding researchers and practitioners in the field from outside the University.

2022 Women Advancing River Research Seminar Series

The "Women Advancing River Research" lecture series, now in its second year, features an international lineup of speakers covering a variety of topics related to the study of rivers. The series, co-led by Professor **Li Li**, is hosted in collaboration with the Warner College of Natural Resources at Colorado State University and Wiley Research.

The lecture series is free and open to the public. Registration is required prior to each event. For more information, including dates and times, visit bit.ly/3jZnuE7.

Hankin Distinguished Lecture

Amanda L. Reddy, executive director of the National Center for Healthy Housing, delivered the 2021 Hankin Distinguished Lecture, hosted by Penn State's residential construction program and the Pennsylvania Housing Research Center. In her talk, "Florence Nightingale Was Right: The Central Role of Housing for Ensuring Health and Well-Being in a Changing World," Reddy referenced Florence Nightingale, who wrote, "The connection between health and the dwelling of the population is one of the most important that exists," and discussed the importance of housing and health, especially during the COVID-19 pandemic.

The Hankin Distinguished Lecture series was established in 2006 to honor the late Bernard Hankin and his family for their continuous and dedicated support of the residential construction program at Penn State.

Professor Li Li named first holder of Barry and Shirley Isett Professorship

By Mariah Chuprinski

Professor **Li Li** was named the first Barry and Shirley Isett Professor in Civil and Environmental Engineering. The professorship was established in 2019 as a $1 million gift by Barry and Shirley Isett. Barry graduated from Penn State in 1958 with his bachelor of science in civil engineering.

"We could not be prouder of Dr. Li's world-class leadership in teaching, research, and service, and I am delighted to appoint her as the first Isett chair, in honor of Barry and Shirley," said Department Head Patrick Fox said. "She is the first woman in our department to serve as a chaired full professor."

"I am very grateful for the award, which is a wonderful recognition of my achievements in academia," Li said. "In a broader sense, it is really a recognition for women engineers like me and offers resources to empower others and build the research community."

Li's research centers on the future of water resources, including water availability and quality, in the face of climate change and human impacts, such as agriculture and urbanization.

Faculty Awards & Recognitions

Rachel Brennan was promoted to full professor. A faculty member since 2004, Brennan received a doctoral degree in environmental engineering from University of Illinois at Urbana-Champaign. She is the director of the Water-Energy-Food Nexus Initiative and the Drawdown Scholars Experiences for Undergraduates Program and chairs the College of Engineering Sustainability Council. Brennan's research interests include ecological wastewater treatment, bioremediation of soil and groundwater contaminants, and nutrient recovery for the production of fertilizers and fodder.

Associate Professor **Vikash Gayah** received the Premiere Teaching Award from the Penn State Engineering Alumni Society (PSEAS). The award recognizes an individual with excellent contributions to engineering education at Penn State. Gayah teaches a number of courses in transportation engineering at Penn State, including CE 321: Highway Engineering, CE 423: Traffic Operations, CE 522: Traffic Flow Theory and Simulation, CE 525 Transportation Operations, and CE 528 Transportation Safety Analysis, as well as CE 597, a seminar course that prepares senior graduate students to enter the job market.

Ilgin Guler was promoted to associate professor. A faculty member since 2015, Guler received a doctoral degree in civil and environmental engineering from the University of California, Berkeley. Her research interests include multi-modal urban transportation, public transportation, transportation safety, statistical modeling, and infrastructure management. Guler was also recently recognized with reviewer awards from the Transportation Research Board's Traffic Flow Theory and Characteristics Committee and the International Journal of Transportation Science and Technology.

Assistant Professor **Xianbiao Hu** was named excellent associate editor of the International Journal of Transportation Science and Technology. The journal covers research and activity related to automotive engineering; civil and structural engineering; management monitoring, policy, and law; and transportation. Hu's research focuses on smart mobility systems, investigating how technology can be used to create safer and more efficient ways to travel, especially behind the driver's seat.

Suresh Iyer was promoted to research professor. Iyer has been an affiliated faculty member with the Larson Transportation Institute since 2005 after receiving a mechanical engineering doctorate from Penn State in the same year. Research interests for Iyer include optical methods for the determination of soot characteristics in flames and particulate and gaseous emission measurements of heavy duty engines.

Bruce Logan, Evan Pugh University Professor and Kappe Professor of Civil and Environmental Engineering, was appointed to the Novo Nordisk Foundation CO2 Research Center's advisory committee. The center focuses its research on carbon capture, storage, and reuse. Logan's term on the seven-member committee

began May 1 and will continue for three years. As a committee member, Logan will advise leadership on the performance, strategies, international reputation, and competitiveness of the center; assess its progress by attending annual meetings and reviewing annual progress reports; and serve as an international ambassador.

Logan was also named a Web Science Group 2021 Highly Cited Researcher. He was recognized for his contributions in the environmental and ecological category, the eighth consecutive year he was named to the list.

Assistant Professor **Lauren McPhillips** was named an outstanding reviewer by the American Society of Civil Engineers (ASCE)'s Journal of Sustainable Water in the Built Environment. The journal presents activity and research developments in water issues, challenges, and opportunities throughout the developed landscape. McPhillips' primary research interests explore the linkages between hydrology and biogeochemistry, especially in urban and suburban landscapes.

Associate professor **Alfonso Mejia** was named the director of research of the Penn State Water Council. In this role, he will work closely with Andrew Warner, the director of the emerging Water Consortium, as well as the elected Water Council and faculty across the University to enhance existing research and identify and advance new interdisciplinary water-related research initiatives. The director of research for the Water Consortium serves a two-year term.

Associate Professor **Chaopeng Shen** received the Outstanding Research Award from PSEAS. The award recognizes engineering researchers for their accomplishments in advancing the frontiers of knowledge at Penn State. Shen leads the Multi-scale Hydrology, Processes, and Intelligence Group, which focuses on large-scale hydrology, computational hydrology, land surface processes, water-carbon-nutrient interactions, and high-performance computing. He is the recipient of a number of prestigious grants and awards, including from the Google AI Impact Challenge.

Professor **Ming Xiao** served as the chair of the tenth annual International Conference on Scour and Erosion, sponsored by the ASCE Geo-Institute. The conference, held virtually in 2021, brought together researchers and practitioners from geotechnical and hydraulic engineering to tackle the complex challenges of scour and erosion.

Gordon Warn was promoted to full professor. He has been a CEE faculty member since 2008. Warn's research interests include high-performance structural systems for hazard mitigation, modeling and diagnostic assessment of complex systems, many-objective optimization and visual analytics, and structural monitoring for the health assessment of structural components and systems. Warn recently received a $2 million grant from the National Science Foundation (NSF) to develop a new climate-adaptive approach to infrastructure design and maintenance (read more on page six).

Nathaniel Warner was promoted to associate professor. A faculty member since 2015, Warner received a doctoral degree in earth and ocean sciences from Duke University. His research interests include water quality, hydraulic fracturing, salinization, and isotope geochemistry. In 2020, Warner received an NSF Early Career Award for his work developing new ways to monitor and analyze sources of salt pollution.

Explore the CEE Graduate Programs at Penn State

Participants in our graduate programs join an outstanding group of current students, visiting scholars, and scientists from all over the globe who have gained access to our world-class and award-winning faculty.

BROADLY BASED EDUCATION AND RESEARCH PROGRAMS TO FIT YOUR GOALS

Our focus areas include:

- Environmental engineering
- Geotechnical and materials engineering
- Structural engineering and mechanics
- Transportation engineering
- Water resources engineering

Our graduate degree programs include:

- Master of Engineering (M.Eng.) in Civil Engineering
- Master of Engineering (M.Eng.) in Environmental Engineering
- Master of Science (M.S.) in Civil Engineering
- Master of Science (M.S.) in Environmental Engineering
- Doctor of Philosophy (Ph.D.) in Civil Engineering
- Doctor of Philosophy (Ph.D.) in Environmental Engineering

HIGHLY RANKED GRADUATE PROGRAMS

Our graduate program in civil engineering is ranked No. 17, and our graduate program in environmental engineering is ranked No. 21. Additionally, our civil engineering program is currently ranked No. 21 nationally by the National Science Foundation for total research expenditures.

SUCCESSFUL GRADUATES WORLDWIDE

Many of our alumni are now world-class leaders in their field and can be found in top offices around the globe. Students have also accepted highly competitive positions as post-doctoral researchers and tenure-track faculty at leading universities.

STATE-OF-THE-ART FACILITIES

Our Civil Infrastructure Testing and Evaluation Laboratory (CITEL) is a state-of-the-art laboratory that utilizes advanced testing and computational systems. Housed within a 45,000-square-foot facility, CITEL is used to examine various issues related to the performance of the world's civil infrastructure. The Kappe Environmental Engineering Laboratories cover an area of approximately 16,000 square feet, including a 2,000-square-foot laboratory at the University Wastewater Treatment Plant and a Water Quality Lab where contract analyses for research projects are performed.

For more information about our graduate programs, contact Christine Woytowich at 814-863-3085 or cxw17@psu.edu.

PennState College of Engineering | CIVIL AND ENVIRONMENTAL ENGINEERING

Shelley Stoffels named associate dean of faculty

Since becoming the first woman to earn tenure in the Department of Civil and Environmental Engineering, **Shelley Stoffels** has been making her mark on Penn State's College of Engineering for more than thirty-four years. Now, the professor of civil and environmental engineering has a new role as the associate dean for faculty in the College of Engineering.

Stoffels began in the newly created position on May 15. She has primary responsibility for tenure-line and professional-track faculty affairs and will provide collaborative leadership for faculty development, assessment, and enhancement of faculty experiences. She will also serve as a liaison for faculty governance, ombudspersons, and the vice provost for faculty affairs.

"We have so many great faculty in this college, and their impacts on various sectors—health care, artificial intelligence, energy—are incredible," Stoffels said. "At this point in my career, I realized that leadership and faculty mentorship is a strength of mine, and I can make a bigger difference by supporting other faculty in their research and teaching goals."

Stoffels has served as chair of the Faculty Senate Committee on Curricular Affairs, chair of the Engineering Faculty Council, and faculty ombudsperson for the College of Engineering. As assistant dean for faculty equity, she worked to better understand the needs of engineering faculty and assisted in the creation of the college's Equity Action Plan. Stoffels said she is eager to continue supporting equity goals and making the college a place where the faculty are excited to work.

"In working for the College's Office of Equity and Inclusion and collaborating with the Center for Engineering Outreach and Inclusion, I have gained a good understanding of the many challenges faculty face as they advance their careers and engage with students and staff," Stoffels said. "I want all faculty to feel valued and included. Inclusion is for everyone, and I want to encourage and support faculty both as a group and individually."

Bruce Logan named director of the Institutes of Energy and the Environment

Professor **Bruce Logan** was named the new director of the Institutes for Energy and the Environment (IEE). Logan succeeds Thomas Richard, professor of agricultural and biological engineering, who is returning to a faculty role and pursuing other activities after fifteen years as director.

"Bruce's role is vital for Penn State as our world is in the midst of multiple global energy and climate crises," said Senior Vice President for Research Lora Weiss. "From ecosystem change and energy shortages to water resourcing and urban development, Penn State is at the cutting edge of contributing essential solutions to these serious societal emergencies. Bruce's experience, mindset, and vision are well-aligned to take our programs to the next level."

Logan's current research focuses on the development of an energy-sustainable water infrastructure, renewable energy production, including green hydrogen gas production using microbial- and direct-water electrolysis, and novel methods of water desalination. He is the author or co-author of several books and more than 550 refereed publications, and he is one of the most highly cited faculty members at Penn State (100,000 citations for his research).

"I am pleased to take on this new role at IEE because it is unique among many of our peer academic institutions in that it combines both energy and environment into the same research and solutions framework," Logan said. "This broader role enables our research teams to simultaneously explore complex technical issues for energy technologies while at the same time being sure that solutions also address relevant societal and environmental concerns."

Larson Transportation Institute

Optimal decision making for deteriorating roadway system

A team of researchers from Penn State, George Mason University, and the University of Delaware explored how advances in ubiquitous sensing and artificial intelligence (AI) could be used to enhance decision making regarding the nation's aging roadway system.

The team created a model for assessing when to inspect, maintain, and repair roadway pavements and bridge decks. Even limited maintenance decisions have system-wide traffic impacts and are made with restricted budgets in mind, according to the researchers. Managers need both information about the state of the roadway system and a system for decision-making that optimally weighs the options of taking or postponing actions, including costs and construction downtime, while also considering the benefits of an improved roadway system.

To this end, the researchers collected crowdsourced vehicle response data, a potentially low-cost and high-volume data source to detect roadway conditions, especially in high-volume traffic areas. AI then identified deviations in the data, indicating roadway defects.

With this information, the team created their decision-making framework using deep reinforcement learning, a form of AI where an autonomous "agent" discovers the optimal sequential path of actions over time. The model accounted for randomness in deterioration processes while also capturing the benefits of improvements or costs of action postponements and how they relate to traffic impacts and the larger roadway system, allowing the researchers to consider many aspects of this complex problem.

"The developed techniques aid in making cost-effective investment decisions over integrated roadway asset classes while explicitly recognizing traffic impacts to the public and scheduling with them in mind," said Elise Miller-Hooks, professor and Bill & Eleanor Hazel Chair in Infrastructure Engineering at George Mason University.

A full list of contributors to this project can be found in the report.

Annual conferences return to in-person delivery

The fourth annual **Transportation Asset and Infrastructure Management (TAIM) Conference** returned to an in-person delivery in 2022. The event was held on October 17-18 at the Wyndham Garden State College. Designed for federal, state, and local transportation agency representatives, contractors and material suppliers, engineering consulting firm professionals, faculty, and students, TAIM features a variety of topics.

The twenty-seventh annual **Transportation Engineering and Safety Conference (TESC)** was held virtually on December 8-10, 2021. More than 600 participants attended four workshops and forty-eight technical sessions. TESC is the mid-Atlantic's authoritative source of information on pressing issues from some of the foremost experts in transportation today. Continuing education units are offered to conference participants.

Registration is now open for The twenty-eighth annual **Transportation Engineering and Safety Conference (TESC)**. TESC is the Mid-Atlantic's authoritative source of information on pressing issues from some of the foremost experts in transportation today. More than 600 participants attended virtually last year.

For the most efficient and secure registration, all attendees, exhibitors, and sponsors are encouraged to use the online registration portal. Registration deadlines vary. More information, including the schedule, is available on the TESC website.

CIAMTIS
U.S. DOT Region 3 University Transportation Center

Webinars build awareness around a broad array of research and industry practices

The Center for Integrated Asset Management for Multimodal Transportation Infrastructure Systems (CIAMTIS) continues to host its 2022 webinar series. Held every other month, the series focuses on topics that align with the CIAMTIS mission of improving the durability and extending the life of transportation infrastructure.

The webinars—designed for research faculty, university students, and transportation industry professionals—help build awareness around a broad array of research and industry practices.

For a full list of scheduled dates and additional details about fees and registration, visit the workforce development page of r3utc.psu.edu.

New research projects selected

CIAMTIS has selected new research projects.

Research teams from Penn State, George Mason University, Lehigh University, Morgan State University, University of Delaware, Virginia Tech, and West Virginia University will examine a host of transportation topics and issues as they relate to bridges, pavements, rail, and transit.

Current research projects include:

- Using Advance Refunding of Federal Loans to Support Transportation Infrastructure Asset Management and Delivery: Lessons from the Covid-19 Pandemic
- Roadway Rehabilitation, Improvement, and Protection with Equitable Services in a Future with Climate Change—AI-Based Learning and Optimization
- Field Deployment and Verification of an AI-Based Crowdsensing Bridge Condition Assessment Platform
- Quantification of Railroad Ballast Performance Using Advanced Sensor Network & Big Data
- Ballast and Soil Performance Separation by Using Instrumented Geo-grid & Machine Learning
- Field Demonstration of Advance Landslide Warning Index for Railroad Tracks on Amtrak's Harrisburg Line in Pennsylvania
- Quantifying the Impact of Data Unavailability, Inaccuracies and Uncertainty on Deterioration Modeling and Infrastructure Asset Management Policies
- Beneficiation of High Sulfur Fly Ashes and Quarry Fines for Sustainable Ternary Concrete Mixtures
- Improving Freeze-Thaw Resistance and Fatigue Resistance of Recycled Aggregate Concrete
- Design of Anchors for Rapid and Durable Strengthening of Bridges with Externally Bonded Carbon Fiber Reinforced Polymer Composites—Phase 2
- Determination of Bridge Element Weights based on Data-driven Models
- Multi-robot Teaming for Inspection of Hydraulic Structures
- Developing Metadata for State DOTs from Complex Optimization Problems to Support Asset Management
- Development of a Rollable Polymer Pavement Overlay
- Prediction of Pavement Performance via Integrated Pavement Health and Traffic Monitoring with Deep Learning and Predictive Modeling
- CIAMTIS Lehigh Research Experience for Undergraduates (REU) Program – Year 4
- Investigation of Self-Healing Characteristics of Bacteria-Based Concrete
- A Direct Design Method of Hybrid High Strength Steel Web-tapered Members
- MSU Outreach Activities
- Development of a Fatigue Testing Protocol for Asphalt Mixture Using Hamburg Wheel Tracking Device
- Artificial Intelligence for Building a Landslide Inventory and Advanced Landslide Warning System in Pennsylvania
- Economic Impacts of Transportation Infrastructure Investments
- Continuously Enhancing Transportation Engineering Education in the Fundamentals of Engineering Program
- Holistic Digital Twins for Transportation Infrastructure

A full list of current and past competitive research projects and core research projects may be found on r3utc.psu.edu.

Northeast Center of Excellence for Pavement Technology provides training and certification programs for aggregate, asphalt, and concrete

The **Northeast Center of Excellence for Pavement Technology (NECEPT)** has been providing technical leadership and assistance to ensure that the promise of more durable pavements becomes a reality. A useful resource for research and outreach activities in the areas of pavements and materials, NECEPT has been an important source of hands-on training for engineers and technicians at a local and national level. The center also uses state-of-the-art asphalt materials and testing facilities to perform all the conventional and specialized binder and mixture tests.

The center provides training for asphalt field and plant technician certification to approximately 800 technicians and engineers annually under the PennDOT certification program. Since the center was established in 1999, more than 18,000 technicians have been certified or recertified under the asphalt certification program. NECEPT has also been the administrator of the Concrete Field Testing Technician Certification since 2006 and has administered certification or recertification of over 12,000 concrete technicians since that time. Similarly, since 2018, NECEPT has administered certification or recertification of more than 500 technicians through its Aggregate Testing Technician Certification Program. For more information, visit superpave.psu.edu.

Bus Research and Testing Center ensures safety and efficiency of nation's buses

Established in 1989 by the Pennsylvania Transportation Institute with funding provided by the Federal Transit Administration, the **Bus Research and Testing Center (BRTC)** performs a variety of tests each year, including safety, structural integrity, durability, emissions, and fuel economy. Tests are performed at both the main facility in Altoona and the test track in Bellefonte.

Since the program was started in 1989, 529 buses have been tested. The BRTC completed testing on fifteen buses since September 2021, eight of which were 2021 contract buses and seven that were 2022 contract buses. The BRTC continues to test one 2021 contract bus and three 2022 contract buses.

Center for Dirt and Gravel Road Studies wraps successful year

As the environmental research and outreach arm of the Larson Transportation Institute, the **Center for Dirt and Gravel Road Studies (CDGRS)** provides education, outreach, and technical assistance to public road-owning entities throughout Pennsylvania. CDGRS is funded by the Pennsylvania State Conservation Commission and Bureau of Forestry under the Commonwealth's Dirt, Gravel, and Low-Volume Road Maintenance Program.

For the 2021-22 fiscal year, CDGRS provided an array of trainings and technical assistance services for state and local public road-owning entities. The center's two-day Environmentally Sensitive Maintenance for Dirt, Gravel, and Low Volume Roads training course was attended by 730 road maintenance professionals from around the state. CDGRS staff also provided on-site technical assistance on more than 371 road projects aimed at addressing environmental issues, such as sediment and dust pollution. Staff also visited more than fifty quarries to perform aggregate testing and discuss aggregate quality and placement. CDGRS worked closely with the Pennsylvania State Conservation Commission to develop and publish a new stream crossing replacement standard and comprehensive guidance manual. These documents are intended to guide the installations of culverts and bridges that promote stream connectivity and are more resistant to erosion and washout from large storm events. The standard and manual were enacted starting July 1 for any stream crossing replacements funded by the Commonwealth's Dirt, Gravel, and Low-Volume Road Maintenance Program and will likely provide a template for other state agencies to follow.

The Pennsylvania Housing Research Center (PHRC), housed within CEE, collaboratively engages with the residential construction industry to catalyze advancements in homebuilding through education, training, innovation, research, and dissemination. The PHRC envisions a residential construction industry equipped with the knowledge, skills, and technology to build better homes. More information available at phrc.psu.edu.

2018 International Residential Code in effect for Pennsylvania Uniform Construction Code

After a two-year review period, the Pennsylvania Uniform Construction Code (UCC) brought changes to the construction process on February 14.

At the core of these changes is a switch from the 2015 ICC building codes to the 2018 ICC building codes. For residential construction, the 2018 International Residential Code (IRC) and the 2018 International Energy Conservation Code (IECC) now serve as the new baseline for projects in Pennsylvania. Additionally, there continue to be a series of legislative amendments along with RAC amendments that will deviate from the published code. The PHRC continues to offer live webinars, recorded webinars, on-demand continuing education courses, and in-person training for the residential construction industry to understand the latest building codes.

2021 Pennsylvania Alternative Residential Energy Provisions now available

The PHRC developed the 2021 Pennsylvania Alternative Residential Energy Provisions (PA-Alt) for consideration by the Pennsylvania Department of Labor and Industry to meet their legislated mandate to consider the development of alternative prescriptive methods for energy conservation that account for the various climatic regions within the Commonwealth per Act 45 of 1999. The PA-Alt was developed with the intent of being simpler to build to and easier to enforce, more rational and flexible, focused on Pennsylvania in terms of climatic and other conditions, and equivalent to the provisions of the IECC. The 2021 PA-Alt is equivalent to the 2018 IRC and the 2018 IECC. The development of the 2021 PA-Alt was led by the PHRC with guidance from a subcommittee of the PHRC Industry Advisory Council. The 2021 PA-Alt can be downloaded from bit.ly/2021PA-Alt. The 2021 PA-Alt Compliance Worksheet can be downloaded from bit.ly/2021PA-Alt_Worksheet.

In-person PHRC Housing Conference returns to State College

On March 2-3, the thirtieth annual PHRC Housing Conference highlighted best practices, regulation, and innovation in the residential construction industry. Attendees enjoyed gathering again after a virtual conference in the prior year due to the COVID-19 pandemic. The event brought together all sectors of the industry, including builders, design professionals, remodelers, code officials, educators, factory-built housing manufacturers, and product manufacturers. Invited speakers presented on a wide range of topics, including codes and construction; high-performance and offsite construction; weatherization and building science; and land development and planning.

Save the date for the 2023 PHRC Housing Conference on March 1-2, 2023, at The Penn Stater Hotel and Conference Center. More information is available at bit.ly/PHRCHousingConference.

The sixth biennial Residential Building Design and Construction Conference remains virtual

The Residential Building Design and Construction Conference (RBDCC) provided a forum for builders, design professionals, educators, manufacturers, and researchers to discuss the latest advancements in the field by sharing their research findings and innovations related to residential buildings. Due to the international scope of the conference during the COVID-19 pandemic, the event was held virtually in 2022. Sessions highlighted a variety of topics including affordability, disaster resilience, retrofits, building in Alaska, occupant behavior, mechanical and lighting systems, building science education, and innovative materials like hemp and mass timber. More information about the RBDCC can be found at bit.ly/PennStateRBDCC.

Welcome Darrin Wright to the PHRC team

Darrin Wright has been named the new PHRC high-performance housing specialist and joined the PHRC team on July 11. Wright brings a substantial breadth of professional experience in the residential construction industry, including time as a commercial and residential building inspector, an extensive background in both residential and commercial project management and site supervision, and direct building experience. Additionally, he has taught secondary and post-secondary students in central Pennsylvania focused on a variety of residential-related topics, including solar panel installation and other emerging energy systems.

Tracy Dorman receives the Pennsylvania Builders Association Affiliate of the Year Award

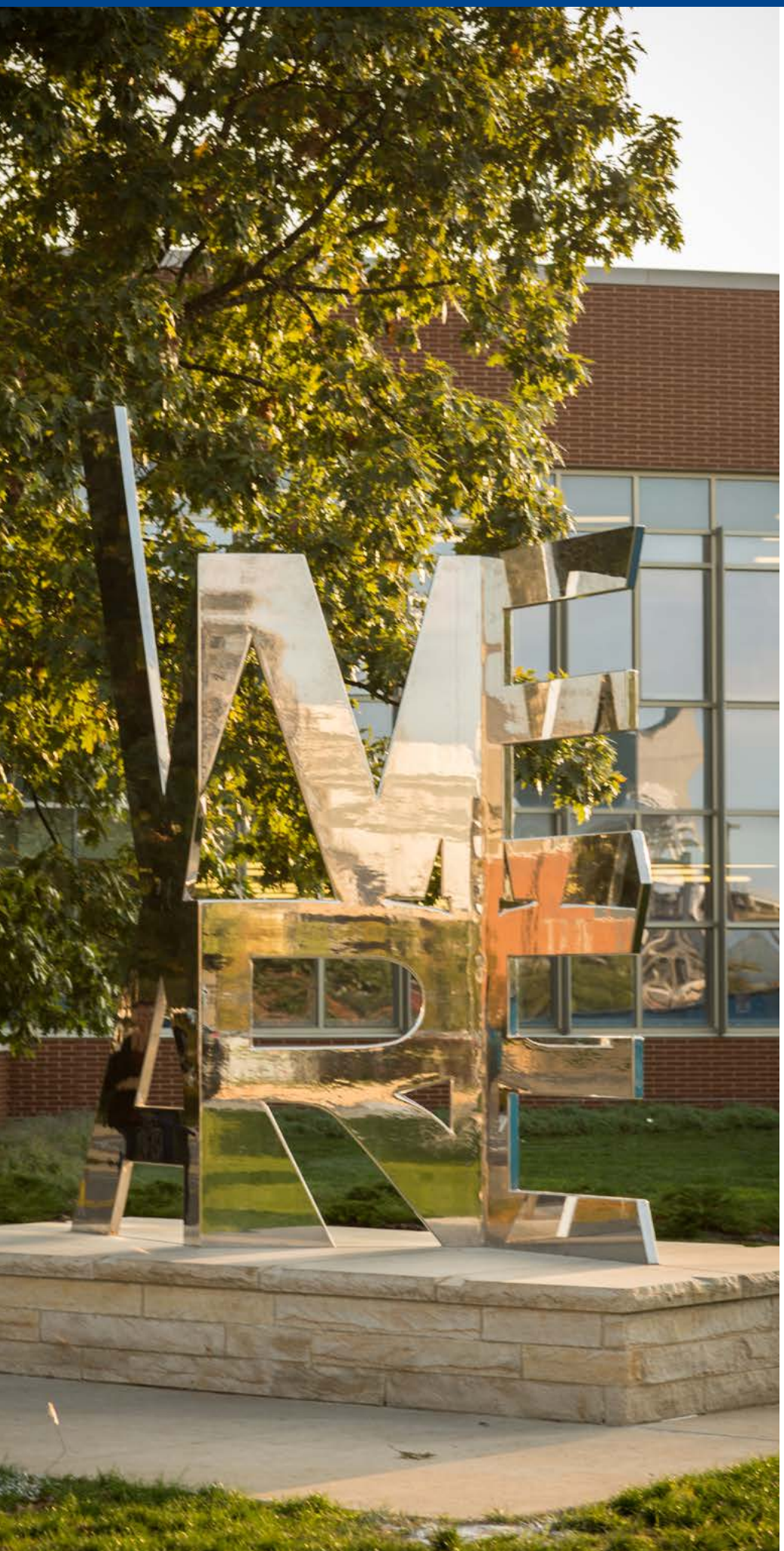
Congratulations to **Tracy Dorman**, the PHRC meeting and events coordinator, for winning the Pennsylvania Builders Association (PBA) Affiliate of the Year Award. Dorman has served the home building industry for more than twenty years at the PHRC. During that time, she has served as a liaison with PBA, executive officers, local, state, and federal government agencies, consultants, code officials, builders, and the public. She was instrumental in chartering the Central PA Professional Women in Building (PWB) Council and serves as chair. Additionally, she is the secretary of the PBA PWB Council.

Thank you to our construction engineering and management program donors!

Through the generous support of fifteen leading construction companies, as well as a $750,000 gift from The Beavers Charitable Trust and an additional $150,000 gift from Allan Myers, Inc., the department has established **The Beavers Charitable Trust and Allan Myers Endowed Professorship in Civil Construction Engineering and Management**.

"CEE is truly grateful for the generous support of The Beavers and our many stakeholder companies to provide this valuable educational opportunity for our students. We are delighted to reestablish the CEM program and make it even better than before. This is a true university-industry partnership."

— **Patrick Fox**, John A. and Harriette K. Shaw Professor of Civil Engineering and head of the department



Giving Opportunities

For more than 140 years, the Department of Civil and Environmental Engineering at Penn State has grown and evolved into one of the finest programs in the country. Today, our graduates span the globe, transforming the very nature of their fields through cutting-edge research and innovative design. Your generous gift allows us to continue this tradition of excellence by supporting future civil and environmental engineering pioneers. Our donors include alumni, friends, corporations, foundations, and other organizations, and their gifts range from modest one-time cash donations to the creation of permanent endowments. There are so many ways to give to the department, and every donation, no matter how big or small, makes a great difference.

Make a gift online

Penn State's secure giving portal can be found on our website: **cee.psu.edu/department/giving-opportunities.aspx**.

Mail your gift

Please make your check payable to Penn State and mail to:

Director of Development
Penn State College of Engineering
101 Hammond Building
University Park, PA 16802

* Be sure to indicate where you would like to direct your donation by writing "Civil and Environmental Engineering" on the memo line of your check.

Other giving options

For other giving options, including planned giving, endowments, in-kind donations, and scholarships, please contact the College of Engineering Development Office at giving@engr.psu.edu.

Thank you for your support!

Mazyck named head of SEDTAPP, professor of engineering design

"The skills I learned at Penn State helped me be successful in my career, and now, I get to pay it back."

David Mazyck (Ph.D. EnvE '00), a three-time Penn State CEE alumnus, became the head of the college's School of Engineering Design, Technology, and Professional Programs (SEDTAPP) on May 16. In addition to his position as head of SEDTAPP, he also serves as a professor of engineering design with a courtesy appointment in CEE.

Mazyck earned his bachelor of science in civil engineering in 1995 and his master of science and doctorate in environmental engineering in 1996 and 2000, respectively. He then joined the University of Florida and has spent the last 22 years rising through the ranks to full professor and director of the Herbert Wertheim College of Engineering Electronic Delivery of Gator Engineering, University of Florida's online engineering program for master's degrees, certificates, and professional courses.

"I am humbled, grateful, and excited to return to where I became an engineer," Mazyck said. "The skills I learned at Penn State helped me be successful in my career, and now, I get to pay it back."

Mazyck will lead SEDTAPP's engineering education and oversee research programs and opportunities designed to facilitate cross-disciplinary partnerships. He will also oversee the school's role as connector and facilitator for engineering and engineering technology programs among Penn State's institutes, centers, and campuses across the commonwealth. Mazyck began his own undergraduate degree at Penn State Wilkes-Barre.

"The Penn State campus structure provides unrivaled recruiting opportunities to increase diversity, equity, and inclusion in engineering, including in engineering education," Mazyck said.

Dunzik-Gougar receives 2022 Outstanding Engineering Alumni Award

Mary Lou Dunzik-Gougar (M.S. EnvE '97), professor of nuclear engineering and associate dean of the College of Science and Engineering at Idaho State University, was named one of eleven recipients of the 2022 Outstanding Engineering Alumni Award by the College of Engineering.

Dunzik-Gougar earned her bachelor of science in chemistry from Cedar Crest College. She then earned her master of science in environmental engineering and doctorate in nuclear engineering from Penn State in 1997 and 2004, respectively. Her nuclear career spans 25 years, during which time she has conducted research in various aspects of the nuclear fuel cycle, including waste form development, spent fuel pyroprocessing, spent particle fuel qualification for disposal, fuel and material development and characterization (pre- and post-irradiation), development of a waste minimization plan for a next generation nuclear reactor design, and fuel cycle modeling.

Dunzik-Gougar's research has led to national and international collaborations, including a year-long position with PBMR Ltd in South Africa and a consulting contract with EDF energy of France. She has served as a consultant and subject matter expert for subsequent projects coordinated by the European Commission and the International Atomic Energy Agency. She has led multi-institutional teams of researchers at the Idaho National Laboratory and through ISU.

Bonsted receives 2022 Early Career Award

Brady Bonsted (B.S. CE '06), project director for ENTACT, LLC, was named one of eleven recipients of the 2022 Early Career Award by the College of Engineering.

Bonsted graduated from Penn State in 2006 with a bachelor of science in civil engineering and a minor in environmental engineering. Upon graduation, he joined ENTACT, an environmental remediation and geotechnical construction firm, as an onsite field engineer. After quickly gaining experience and increased responsibilities on projects nationwide, Bonsted was promoted to project manager and oversaw one of the largest multi-year remediation projects in New Jersey. This led to him opening an ENTACT office location in Jersey City, New Jersey, where he managed several other challenging projects regionally.

After the successful completion of numerous high-profile projects, Bonsted earned the title of project director, and continues to tackle large environmental remediation sites nationwide. Bonsted has become a trusted source in the remediation industry, offering constructability and methodology reviews to clients and consultants. His work eliminates environmental impacts and contaminants of concern, and as a result, positively affects local communities and the surrounding environment.

In 2020, Bonsted opened ENTACT's office in Saratoga Springs, New York, continuing to secure and successfully manage remediation projects from coast to coast.

Alumni News

Xavier Harmony (M.S. CE '16) was recognized with a "40 Under 40" award in the July/August edition of *Mass Transit* magazine. Harmony is a senior program manager with the Transit Resource Center at the Northern Virginia Transportation Commission. His expertise includes transit planning, capital and operating financial forecasting and analysis, regional coordination, and grant management.

From the article: "Harmony is proud of how he has been able to advance transportation equity discourse and share it with a larger audience through his award-winning *Eno* essay, 'A New Bus Priority,' that focused on transit service equity, as well has his research on bikeshare equity that he presented to the Transportation Research Board"

Matthew Reese (B.S. CE '11) was promoted to deputy practice leader for site and land development for Urban Engineers. Reese is a licensed professional engineer and American Institute of Certified Planners professional with engineering and design experience. Reese was elevated to the role after serving as project manager with the firm.

Holly Evans (B.S. CE '84) received the Woman Breaking Barriers Award from the Whitaker Center for Science and the Arts at their 2021 Women in STEM Awards Program. Evans founded Evans Engineering, a firm that provides civil and structural engineering services for private commercial and industrial clients, in 1989. She is well known in central Pennsylvania for her dedication to the LGBTQ+ community and for introducing women and other underrepresented minorities to the STEM fields.

From the Whitaker Center: "Evans believes that with time, the stereotypes, misunderstandings, and barriers can be broken down, making it easier for those entering the field to not feel threatened or out of place."

Michael Trettel (B.S. CE '02) was named the director of strategic markets for Tarlton Corp., a St. Louis-based general contracting and construction management firm. Trettel will oversee work acquisition and performance in the firm's heavy civil and industrial markets. He has served in a variety of roles in the construction industry, including project management, estimating, business development, and marketing.

Lt. Col. Joseph M. Fleishman (M.Eng. CE '05) assumed command of the Virginia National Guard's Petersburg-based 276th Engineer Battalion, 329th Regional Support Group, in a change-of-command ceremony on April 10. Fleishman has held a variety of commands, including the 856th Engineer company, where he deployed in support of Operation Iraqi Freedom. His awards include the Bronze Star Medal, the Army Commendation Medal with two Oak Leaf Clusters, the Joint Service Achievement Medal, the Army Achievement Medal, the Army Research Components Achievement Medal with two Oak Leaf Clusters, and the Global War on Terror Expeditionary Medal.

"The 276th Engineer Battalion always delivers," said Col. Michael S. Waterman, the 329th Regional Support Group (Rear) commander, at the ceremony. "Whatever is asked, whenever you are called, I know that you'll get it done."

Hamed Maraghechi (Ph.D. CE '14) joined CalPortland Company as director of the Central Research Laboratory in the CalPortland Center of Technical Excellence in southern California. In this role, Maraghechi will conduct new research and testing related to issues such as carbon reduction and sequestration to help the company achieve its commitment to lowering greenhouse gases. Prior to the role, he was a senior scientist at Fortera, working on the design and development of low-carbon dioxide cement and concrete formations.

Ted Whiton (B.S. EnvE '85) was named executive general manager of the U.S. region at GHD, a global design and engineering consulting firm. Prior to accepting the new role, Whiton spent four years as general manager of GHD's U.S. West region. Whiton has more than thirty years of civil engineering experience.

A Message from the Penn State Civil and Environmental Engineering Alumni Society

The Penn State Civil and Environmental Engineering Alumni Society (PSCEEAS) is an affiliate group of the Penn State Alumni Association. It was established to foster a connection between CEE alumni, students, and faculty.

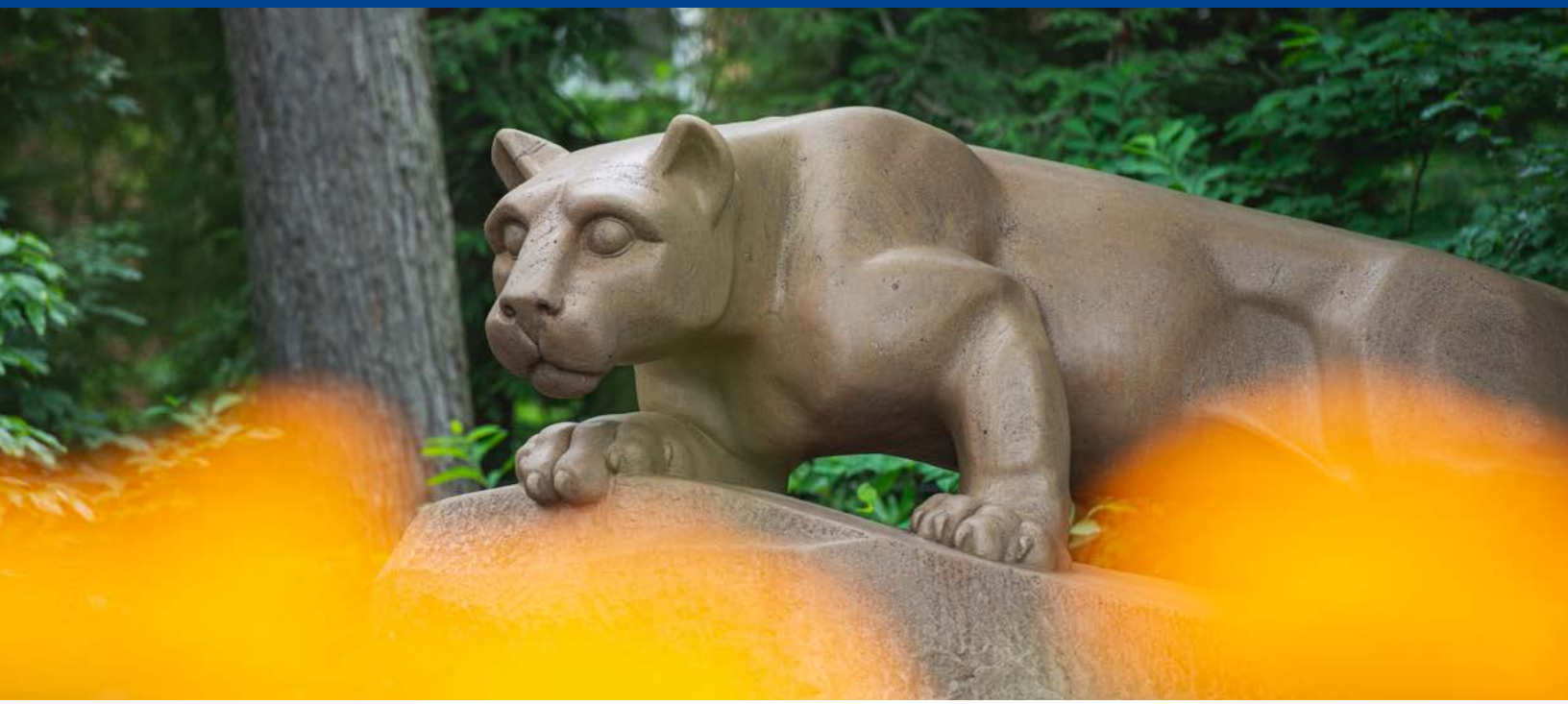
Through PSCEEAS, many of you have taken the opportunity to positively influence the educational experience of students and assist CEE in producing world-class engineers.

- Thank you to the forty CEE alumni who traveled back to campus in April to serve as judges for the senior capstone poster session, held at the Bryce Jordan Center. It was a great opportunity for these practicing engineers to interface with students who were about to enter the workforce.
- Thank you to the alumni who have participated in the CEE Mentoring Program the last several years, introducing hundreds of third- and fourth-year students to the everyday life of a practicing engineer. Alumni from all over the world have been involved with both in-person and virtual mentoring.
- Thank you to the many CEE alumni who collaborated with student organizations and faculty during the past year; coming back to campus to talk about their engineering projects, leadership, and life experiences. And congratulations and thank you to **Bradley Heigel** (B.S. CE '88) who presented the eighth annual Distinguished CEE Alumni Lecture to the ASCE student chapter in March.

As you can see, the success of PSCEEAS is dependent on the active involvement of our CEE alumni. If you are interested in reconnecting with CEE, we would love to hear from you.

Jack Diviney
(B.S. CE '68, M.Eng. CE '77)
President, PSCEEAS
jdiviney@gfnet.com

Information about the CEE Mentoring Program can be found on the CEE website or by contacting **Willy Heisey** at wsheisey@yahoo.com. For questions about capstone judging and speaking opportunities, contact **Tom Lawson** at tlawson@borton-lawson.com.



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Student Organizations

American Society of Civil Engineers

The Penn State student chapter of the American Society of Civil Engineers (ASCE) focuses on the students in civil engineering and improving their social, professional, and work skills for the workforce in the future. The chapter is one of the original seven founded in 1920 and one of the largest student chapters in the country with a current membership of 300 students. Penn State ASCE hosts their own career fair in both the fall and spring semesters, as well as hosting the ASCE Central PA Dinner, which invites four other ASCE chapters to mingle and meet other ASCE chapter students and connect professionally. They hosted many events every day during the first week of classes for students to mingle, meet new friends, and get to know more about what they do as an organization. ASCE also has their own THON organization and has two dancers that will dance at the 46-hour dance marathon in February 2023. The Penn State chapter also organizes events like professional development days, company talks, professional paper presentations, FE Review help, and other social events. For more information, please visit pennstateasce.com. Interested students may contact the chapter at pennstatease@gmail.com.

Penn State's Traffic Bowl team competes at the regional competition.

Institute of Transportation Engineers

The Penn State student chapter of the Institute of Transportation Engineers (ITE) supports undergraduate and graduate students with an interest in transportation in the pursuit of their studies by providing opportunities for learning from guest speakers and networking with ITE's professional membership. The student chapter also competes in the annual ITE Collegiate Traffic Bowl, a Jeopardy-style quiz bowl between student ITE chapters focusing on transportation engineering. This year, the chapter's Traffic Bowl team won the district-level competition held in Baltimore, Maryland, and is advancing to the international competition held in New Orleans in August.

Penn State's SEI chapter tours West 2, one of two new engineering buildings in the College of Engineering's Master Facilities Plan.

Structural Engineering Institute

The Penn State graduate student chapter of the Structural Engineering Institute (SEI) provides its members with opportunities to develop professional and leadership skills by attending conferences, visiting construction sites, and hearing from distinguished speakers. The various activities offered by the chapter uphold SEI's mission to advance and serve the structural engineering profession and community. For information on how to join and upcoming events, please visit sites.psu.edu/seigsc/.

Penn State ASCE chapter receives numerous awards

The Penn State student chapter of the American Society of Civil Engineers (ASCE) received numerous awards in the 2021-22 academic year, including the 2022 ASCE Distinguished Chapter Award by the ASCE Committee on Student Members. The award is given annually to the most outstanding student chapters in each of ASCE's ten regions. Penn State received the award in region 2, which covers schools in the mid-Atlantic region.

Additionally, the organization received recognition for an ethics paper submission at the 2022 ASCE Concrete Canoe and Steel Bridge Competitions. The secretary of the student chapter, undergraduate **Jodi Patterson**, was named a top five finalist for ASCE's National Mead Paper Competition, in which students write essays on civil engineering professional ethics, furthering their professional development.

"This is very exciting news," said Assistant Teaching Professor **Thomas Skibinski**, the chapter's practitioner adviser. "There has never been anyone who went so far in the National Mead Paper Competition since I have been at the University. Jodi should be very proud!"

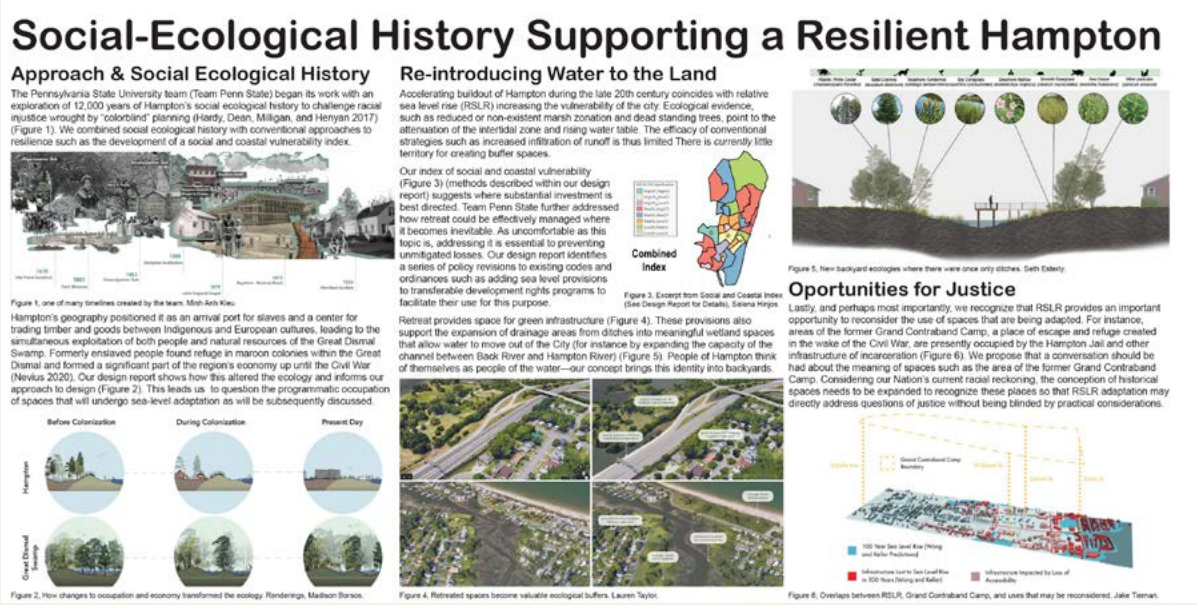
Penn State's student chapter is also advised by Associate Professor **Aleksandra Radlinska**.

Professor Skibinski Pies ASCE President Tyler Barry for THON Fundraiser

Penn State named "outstanding university" by American Concrete Institute

The American Concrete Institute (ACI) recognized Penn State as a 2021 ACI Outstanding University. Universities receive distinctions of outstanding or excellent status based on points received for their participation in select ACI-related student activities and programs. Penn State, one of thirty-three universities named outstanding, was recognized at the ACI Concrete Convention in Orlando, Florida, from March 27-31.

Founded in 1904, ACI has a mission to develop, disseminate, and advance the adoption of its consensus-based knowledge on concrete and its uses. The institute has more than 15,000 student members and more than 260 student chapters around the globe.



Exterior rendering of the back patio for Penn State team's proposed design. Credit: 2022 Penn State Solar Decathlon Design Challenge Team. All Rights Reserved.

Interdisciplinary Penn State team places second in coastal design competition

By Katherine Dietrich

An interdisciplinary team of Penn State civil engineering and landscape architecture was awarded second place in the biennial Coastal and Estuarine Research Federation (CERF) Design Competition, which focused on coastal resilience planning in Hampton, Virginia.

The competition site of Hampton posed a range of historic social and ecological issues, in addition to contending with a sea-level rise severe enough that some streets are regularly flooded during high tides. The design of the studio allowed for students outside of landscape architecture to be involved. A civil engineering student participated in the studio, in addition to three landscape architecture graduate students.

The Penn State team also included historians, who played an integral role in the development of the resilience plan by supporting the students' investigation and interpretation of history.

The historians focused on the history of the region's canals and the nearby Great Dismal Swamp and how history has been interpreted differently at different times.

This approach, according to lead faculty Peter Stempel, associate professor of landscape architecture, allowed for a better understanding of how Hampton, and the team's understanding of Hampton, evolved over time.

"If you, as a designer, show up to a site, and say 'What do I need to know about the past?' You're not going to hear everything that you might need to know, especially if you want to address equity and justice," Stempel said. "Many important aspects of the past are only now coming to light with recent scholarship."

The project was presented to competition judges at the 2021 CERF virtual conference by recent landscape architecture alumna Madison Borsos and landscape architecture graduate student Alex Keim, and supported by civil engineering doctoral candidate **Selena Hinojos**, who constructed a social and coastal vulnerability index as part of the project. These individuals represented all fifteen students from the spring 2021 studio.

The competition site posed unique challenges to students because of the rising sea levels. The resilience strategies that students were familiar with—such as rain gardens—didn't work as well in the Hampton environment due to the high water table at the site, so students had to create a flexible plan that could adapt to change.

"What's different about resilience planning than, say, a design problem that people might be familiar with, is that you have to contend with uncertainty and the fact that the future might not unfold exactly the way you intend. We made our plan to be resilient to uncertainty and change," Stempel said.

The competition entry centered around how equity and justice can be better considered in resilience planning. Students were able to understand the intersection of ecology and culture to create a resiliency plan that addressed both environmental change and social equity. The project allowed students to examine a real-world scenario and discover how their work can impact change.

Penn State wins third place at Solar Decathlon Design Challenge

Exterior rendering of the back patio for Penn State team's proposed design. Credit: 2022 Penn State Solar Decathlon Design Challenge Team. All Rights Reserved.

A team of students from Penn State brought home third place in the Retrofit Housing Division of the U.S. Department of Energy Solar Decathlon 2022 Design Challenge Competition on April 23 at the National Renewable Energy Laboratory in Golden, Colorado. The Penn State team was one of fifty-five finalists representing thirty-eight collegiate institutions.

The Solar Decathlon is a collegiate competition that challenges student teams to design and build highly efficient and innovative buildings powered by renewable energy. In its current iteration, the competition consists of a design challenge with six divisions, as well as a build challenge.

The student team conducted a retrofit proposal for the MorningStar House, which was originally designed and constructed for the 2007 Solar Decathlon Build Challenge. The Penn State Sustainability Institute, which currently operates the house, requested the retrofit for the house to meet an updated standard of technical and renewable energy needs, as well as a design refresh for the house to serve as a permanent structure. Located at the Sustainability Experience Center on the University Park campus, the MorningStar House is used as an immersive learning and research destination for Penn State and the surrounding community.

The retrofit proposal focused on three key areas: modernizing the outdated energy and mechanical systems; refining the building envelope; and updating interior spaces and site design. Since the MorningStar House's construction in 2007, building performance expectations have changed as new materials and systems become available and codes are updated, which necessitates the replacement of outdated systems. The building envelope was refined to ensure air tightness and thermal insulation to maximize energy performance, occupant comfort and environmental quality. Despite its name, the structure operates as a learning space rather than a home, and as such, its interior and site designs were updated to match its current use for visitors to explore sustainable design and observe building science principles in action.

The competition encourages inter- and multidisciplinary collaboration to create a holistic design and features a one-credit course in the spring semester, CE 411: Residential Construction Design Project, to help align student skills. This year's course was taught by Sarah Klinetob Lowe, formerly the high-performance housing specialist of the Pennsylvania Housing Research Center (PHRC) and now operations director of the Global Building Network in the College of Engineering.

Ali Memari, Bernard and Henrietta Hankin Chair of Residential Construction and director of the PHRC, served as the head competition adviser. Additional faculty advisers included Lisa Domenica Iulo, associate professor of architecture and director of the Hamer Center for Community Design in the Stuckeman School; Rahman Azari, associate professor of architecture; and **Brian Wolfgang**, associate director of the PHRC.

Students, faculty, or industry interested in participating in the 2023 Solar Decathlon Design Challenge as a member or adviser of the Penn State team should contact Wolfgang at bmw5014@psu.edu.

Sarah Torhan, a CEE doctoral student, recently received a Department of Defense National Defense Science and Engineering Graduate Fellowship. Credit: Kelby Hochreither/Penn State

Torhan receives Department of Defense fellowship

By Sarah Small

As a Peace Corp volunteer in Paraguay, CEE doctoral student **Sarah Torhan** witnessed the reality of living with food, energy, and water insecurity, as well as the impacts of environmental degradation on local populations. Recently, Torhan received a Department of Defense National Defense Science and Engineering Graduate (NDSEG) Fellowship to continue research inspired by her experience.

The NDSEG fellowship is "awarded in recognition of academic excellence and science, technology, engineering and math (STEM) achievements," according to the fellowship offer letter. The fellowship covers full tuition, mandatory fees, and certain travel and professional development costs for up to three years, as well as a living stipend.

Torhan will use the fellowship to research and evaluate geospatial land use, demographic, and hydrological information and analyze their effects on the access and availability of food-energy-water resources in Paraguay. According to Torhan, her work couples quantitative and qualitative methods to create knowledge on the modeling of natural resources in data-scarce regions with social and political complexities.

"My previous experience in the Peace Corps challenged my worldview and helped me to recognize the importance of coupling modern engineering with education, tangible environmental conservation, and viable economic gains," she said. "Next year, I will travel to Paraguay for fieldwork to survey and interview different stakeholders to understand their relationships with natural resources and the environment. Engaging with my Paraguayan friends and former colleagues to interpret and disseminate results will be fundamental to ensure that we conduct ethical and useful research practices."

Caitlin Grady, assistant professor of civil and environmental engineering, now at George Washington University, said that Torhan's previous experiences have led to her successes as a graduate student, and the NDSEG fellowship will help launch the next stage of her career.

"Since joining Penn State, Sarah has already accomplished tremendous things, including leading an international collaboration that studied climate adaptations to food, energy, and water hazards," Grady said. "This work has resulted in the publication of an article in one of our field's preeminent journals, *Earth's Future*. With the NDSEG fellowship, she will be able to take on important international environmental research, which will further partnerships between the United States and Paraguay."

Collins earns fellowship for extraterrestrial concrete research

By Sarah Small

Peter Collins, a CEE doctoral candidate, was recently named the recipient of the 2022-23 ACI Presidents' Fellowship from the ACI Foundation, a nonprofit subsidiary of the American Concrete Institute. The fellowship is awarded to a student who is enrolled in a graduate program in construction, design, education, or materials, according to the ACI Foundation's website.

"I am very proud of Peter for receiving this recognition, and it is very well deserved," said Associate Professor **Aleksandra Radlińska**, Collins' adviser. "Peter has received numerous awards to date due to his superb work ethic and dedication to research. He is outlining a very successful career trajectory and will be making Penn State proud for years to come!"

The ACI Foundation's mission is to "make strategic investments in ideas, research, and people to create the future of the concrete industry." The ACI Presidents' Fellowship will provide Collins with an educational stipend, recognition in Concrete International magazine and on the ACI Foundation website, and paid travel expenses and attendance fees to two ACI conventions.

Collins researches how to further the use of concrete materials for extraterrestrial infrastructure. According to Collins, his early interests concerned the differences in the solidification of cementitious systems on the International Space Station compared to samples solidified on Earth. He is now focused on developing a concrete-like material out of the resources available on the lunar surface.

Collins earned his bachelor's degree in civil engineering at Utah State University in 2018, where he began his research on concrete materials. In 2020, he was awarded a NASA Space Technology Graduate Research Opportunities Fellowship, which has allowed him to work at NASA's Marshall Space Flight Center for a couple of months every year to collaborate and dive deeper into his research. Collins has published several peer-reviewed papers, and he worked with Radlińska to establish ACI 565–Lunar Concrete, a new committee with the American Concrete Institute.

After graduate school, Collins said he would like to use his knowledge of concrete materials to contribute to the field of lunar concrete.

"Civil engineering historically has not been a heavily represented field in terms of human space exploration, but with NASA's upcoming goals, that is starting to change," he said. "Ultimately, I want to help progress human society and our understanding of the universe by enabling extended-duration missions through the construction of required infrastructure out of concrete materials."

"I want to help progress human society and our understanding of the universe by enabling extended-duration missions through the construction of required infrastructure out of concrete materials."

Ji receives Deep Foundations Institute awards

By Mary Fetzer

Xiaohang Ji, a doctoral candidate studying geotechnical and materials engineering, is the recipient of two scholarships from the Deep Foundations Institute (DFI) Educational Trust.

Ji received a $5,000 award from the Charles J. Berkel Memorial Scholarship Fund and a $2,500 award from the Francis Gularte Civil Engineering Scholarship Fund. Both at-large scholarships are awarded to civil engineering students attending a university or college in the United States.

Ji earned a bachelor of science in civil engineering from Shangdong University in China and a master's degree in geotechnical engineering from the University of Michigan. She joined Professor **Ming Xiao**'s research team in fall 2020.

Ji will use the awards to further her research, which involves using distributed acoustic sensing to examine and forecast long-term geophysical and geomechanical variations in permafrost in the Arctic.

"I am very excited to receive these scholarships," Ji said. "Climate change is accelerating the warming and thawing of permafrost, causing significant damages to foundations and civil infrastructure in the circumpolar regions. If we can better understand and predict the changing permafrost characteristics, we can begin to provide solutions to improve infrastructure."

The DFI is an international association of engineers, contractors, manufacturers, suppliers, project owners, educators, and students who are involved in the design and construction of deep foundations and excavations, according to its website. The DFI Educational Trust supports and encourages individuals in the fields of study related to the deep foundations industry by providing scholarships and opportunities to meet and work with deep foundations industry leaders.

"If we can better understand and predict the changing permafrost characteristics, we can begin to provide solutions to improve infrastructure."

Student News

Jaylen Carr, who recently graduated with a civil engineering bachelor's degree, received a Penn State Homecoming "Guide State Forward" award, given to students who demonstrate leadership and a devotion to community service. The award was established in 2018 as a replacement for the gendered titles of "Homecoming King and Queen."

While at Penn State, Carr was a Millenium Scholar, the social chair for Penn State's chapter of the American Society of Civil Engineers, and treasurer for the National Society of Black Engineers. He also mentored for the BLUEprint Peer Mentoring Group and the Multicultural Engineering Program. Carr is now a capital engineer at ExxonMobil.

Allison Cottle was named the spring 2022 student marshal for civil engineering. A 2018 graduate of Northern Bedford County High School in Loysburg, Pennsylvania, Cottle earned several awards and scholarships while at Penn State, including the Penn State President Walker Award, the Penn State President Sparks Award, the Evan Pugh Scholar Award, the Janet B. Cunningham Scholarship, and the Arthur C. and Mary O. Miller Endowed Scholarship.

As a highway design engineer intern for Dewberry, Cottle completed civil and transportation design work for highway and interchange projects. As an engineering, scientific, and technical intern for the Pennsylvania Department of Transportation, Cottle completed construction management and inspection on roadway and bridge projects. Following graduation, Cottle began her career as a highway design engineer for Dewberry.

Mohammad Saifullah, a doctoral candidate in civil engineering, received the Diefenderfer Graduate Fellowship in Entrepreneurship for the 2022-2023 academic year. This fellowship was established by the late William E. Diefenderfer, a Penn State mechanical engineering alumnus, and his late wife, Francesca. Awards are given to innovative graduate students with a demonstrated ability to combine technical studies with opportunities to learn about business and entrepreneurship. Saifullah's research focuses on developing artificial intelligence-aided decision-making framework for managing complex, large-scale infrastructure systems. He is advised by Associate Professor **Kostas Papakonstantinou**.

The Federal Highway Administration honored **Agnimitra Sengupta**, a doctoral student in civil engineering, and Associate Professor **Ilgin Guler** for their paper, "A State Based Markov Model Approach to Impact Echo Signal Classification," which was selected as the first-place winner in the bridge category of the 2020-21 Long-Term Infrastructure Performance Student Data Analysis Contest. The team received the award in January at the Transportation Research Board Annual Meeting in Washington, D.C. The work was partially supported by a seed grant from the Penn State Institute for Computational and Data Sciences.

Additionally, Sengupta was selected as the 2022 Leo P. Russell Graduate Fellow in Civil Engineering.

David Taglieri was named the spring 2022 student marshal for the Reserve Officers' Training Corps program. Taglieri received his bachelor and master of science in civil engineering. A 2018 graduate of Spring Grove Area High School in Spring Grove, Pennsylvania, Taglieri earned several distinctions and scholarships while at Penn State. As a Schreyer Honors Scholar, Taglieri earned dean's list recognition and completed an honors thesis. He also received the Legion of Honor Bronze Cross for Achievement, the Nancy and Bernard Gutterman Scholarship, Kendlehart Scholarship, and James M. Roberts Scholarship.

Taglieri was a member of the Reformed University Fellowship from 2018-22 and served as career fair chair for the American Society of Civil Engineers Penn State chapter from 2021-22.

As a structural engineering intern for HRG, Taglieri completed bridge inspection and report submittal. Following graduation, Taglieri joined the United States Air Force.

Sarah Torhan, doctoral candidate in civil engineering, was named a Fulbright finalist for the 2022-23 academic year. Each year, the U.S. Department of State works with its 140 partner countries to give graduating college seniors, graduate students, and young professionals the opportunity to work, live, and learn abroad. Torhan is a study and research finalist for Paraguay. Torhan's research focuses on the modeling of food, energy, and water resources in data-scarce regions with social and political complexitites.

CEE Student Highlights on Social

Hatfield Group + Follow
1,262 followers
11mo •

Hatfield Group welcomes Rupesh Yadav to the team! Rupesh joins us from Penn State University, where he recently graduated with an MS in Civil Engineering (Structures). At Penn State, Rupesh was also part of a team researching new structural approaches for protecting buildings against E5F tornados.

#structural #team #engineering #hiring

Kristina Griste · 3rd+ + Follow
Graduate Engineer at Dewberry
3mo •

On May 13th, 2022 I graduated from the Pennsylvania State University with a Bachelor of Science in Civil & Environmental Engineering! I have greatly enjoyed my four years at Penn State and I am excited for what the I ...see more

Abby S. Knapp @GeoAbby · Aug 27

It has been a wonderful first week at **Penn State Environmental Engineering** and the @LiReactiveWater lab-- I am excited to work with new collaborators, learn new skills, and ask new questions! #waterscienceforall #phdstudent

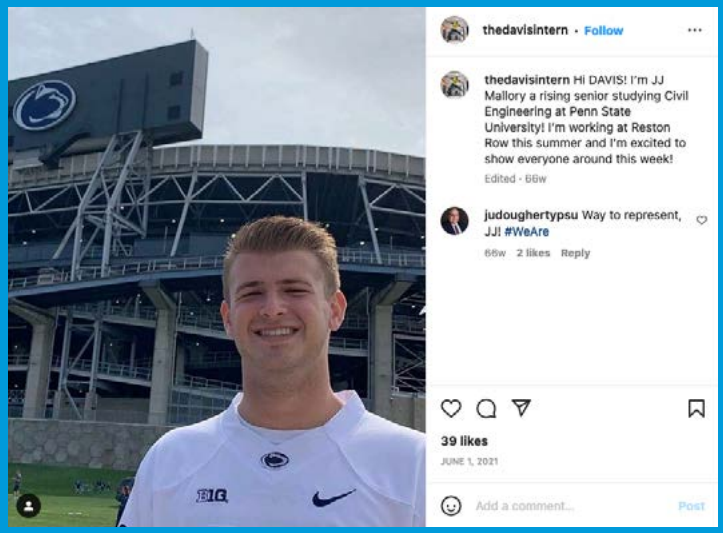
10

Charles Blenko · 3rd+ + Follow
Transtar Engineering Intern and VP of Transitions at Pen...
5mo •

I'm proud to say I have passed my Fundamentals of Engineering exam for Civil Engineering. Having this exam under my belt will allow me to register as an Engineer in Training (EIT) upon graduation from Penn State this fall.

Thank you to my dad Andrew W. Blenko who has always been my role model in civil engineering and in life for inspiring me to pursue the path to becoming a Professional Engineer. I appreciate the many PE role models around me as well such as Bob Dengler and Rob Arnold to name a few.

NCEES



"I Engineer"

"I Engineer" highlights excellence across the Penn State College of Engineering, as well as how the college is made stronger by the diversity of perspectives, experiences, and backgrounds of those in the engineering community.

Follow us on social media to hear more.

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ASCE Civil Engineering Spring 2022 Career Fair

Turtles enjoy the alumni pond behind Sackett building, home of the Department of Civil and Environmental Engineering.

Staff News

Alayna Kilic joined the department in February as an administrative support assistant. Prior to Penn State, she worked for United Airlines as a flight attendant supervisor and for Bellefonte Area School District as an administrative support personnel.

Jessica Wilson joined the department in April as the department head assistant. She previously worked in the Penn State Department of Electrical Engineering and has been with the University since 2018.

Nicolette Diehl joined the department in June as a financial staff assistant. She previously worked in external awards in the Office of the Bursar and has been with the University since 2017.

James Ray joined the department in May as an IT support specialist, after serving four years in the U.S. Navy as an information systems technician.

Gary Meyers joined the department in June as an IT consultant. He has been working at Penn State since 2009.

Dan Fura, supervisor of engineering laboratories in the Infrastructure Testing and Evaluation Laboratory (CITEL) retired in May after twenty years at CITEL.

Vincent Ferraro joined the department in June as an engineering support specialist in CITEL. He previously worked at Office of Physical Plant and has been with the University since 2016.

Amy Long, administrative support coordinator, was recognized for 20 years of service to the University.

David Faulds, supervisor of engineering laboratories, was recognized for twenty years of service to the University.

We'd Love to Hear from You!

We want to know where life has taken you since you left Penn State. Please complete the form below, including any additional comments, or fill it out online at: **bit.ly/cee-connect**

First Name _____ Middle Initial _____ Last Name _____

Degree(s) _____ Graduation Year(s) _____

Home Address _____

City _____ State _____ Zip + 4 _____

Position Title _____

Firm Address _____

City _____ State _____ Zip + 4 _____

Business Phone _____ Email _____

Alumni Updates:

Also, please send the email address of any civil and environmental engineering alumni you know who are not receiving the newsletter.

Please send to:

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PennState
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