

# CIVILREMARKS



## Fast Track to the Future

**UMD OPENS NEW DIGITAL AND CYBER  
RAILWAY ENGINEERING AND OPERATIONS CENTER**  
RESEARCHERS STUDY HOW BLOCKCHAIN AND OTHER  
NEW TECHNOLOGIES CAN BOOST SAFETY, RELIABILITY

**DEAR FRIENDS,**

The University of Maryland's (UMD) civil and environmental engineering department has a well-established track record in transportation engineering, with multiple labs, centers, and institutes dedicated to data-driven research in the field. In this issue of *Civil Remarks*, we introduce you to a

new research hub at the department, the Digital and Cyber Railway Engineering and Operations Center (DCREOC).

Railroads are an enduring and vital part of our transportation infrastructure, supporting a \$14 billion industry in the United States. It's an industry that continues to grow, with a nearly 18% rate of increase in 2022. That should be no surprise, since rail transportation continues to be one of the most efficient means for delivering goods and materials. Of course, today's rail systems are very different from their iconic forebears. Among other advances, they increasingly make use of digital technologies that can streamline operations and reduce human error. Just as we have smart cars and smart aviation, we also have smart rail systems. These moves towards digitalization and autonomy necessitate a new type of railway engineer, one as well-versed in areas such as machine learning and blockchain as in the more traditional aspects of the field. Cybersecurity is becoming of paramount importance, as bad actors look for ways to weaponize rail systems or exploit them for personal gain.

The new center at UMD meets these challenges by fostering advanced research, providing opportunities for collaboration and exchange of ideas, and educating the next generation of railway engineering professionals. The three prongs of the center's mission—fundamental research, applied research, and education/outreach—combine to form an incubator for advances in this quickly evolving field.

Also in this issue of *Civil Remarks*, we update you on other impactful research in progress at our department—research that, in many cases, breaks the traditional engineering “silo” and engages societal and global concerns. Recently, for instance, the Environmental Protection Agency awarded \$1.35 million in funding to a multi-institutional, UMD-led team that is studying the effects of climate-induced sea level rise on septic systems, which are often relied on by Black and other populations that have historically lacked access to municipal sewers. Environmental monitoring, meanwhile, could benefit from NASA-funded research being undertaken by UMD's Barton Forman, who has been experimenting with the use of AI to better predict floods. Also during this past year, the department was selected by the USDOT to establish the Center for Multi-Modal Mobility in Urban, Rural, and Tribal Areas, a Tier 1 University Transportation Center with a focus on improving the mobility of people and goods, particularly among disadvantaged populations. We are also partnering with Howard University and Morgan State University as part of two additional UTCs. These are only a few examples of the forward-looking, socially responsible research being carried out by faculty in our department.

Such research amply demonstrates that civil and environmental engineering continues to be a field with outsized and tangible impact on individuals, communities, and the globe as a whole.

Best regards,

**Nii Attoh-Okine**  
PROFESSOR AND CHAIR  
DEPARTMENT OF CIVIL AND  
ENVIRONMENTAL ENGINEERING

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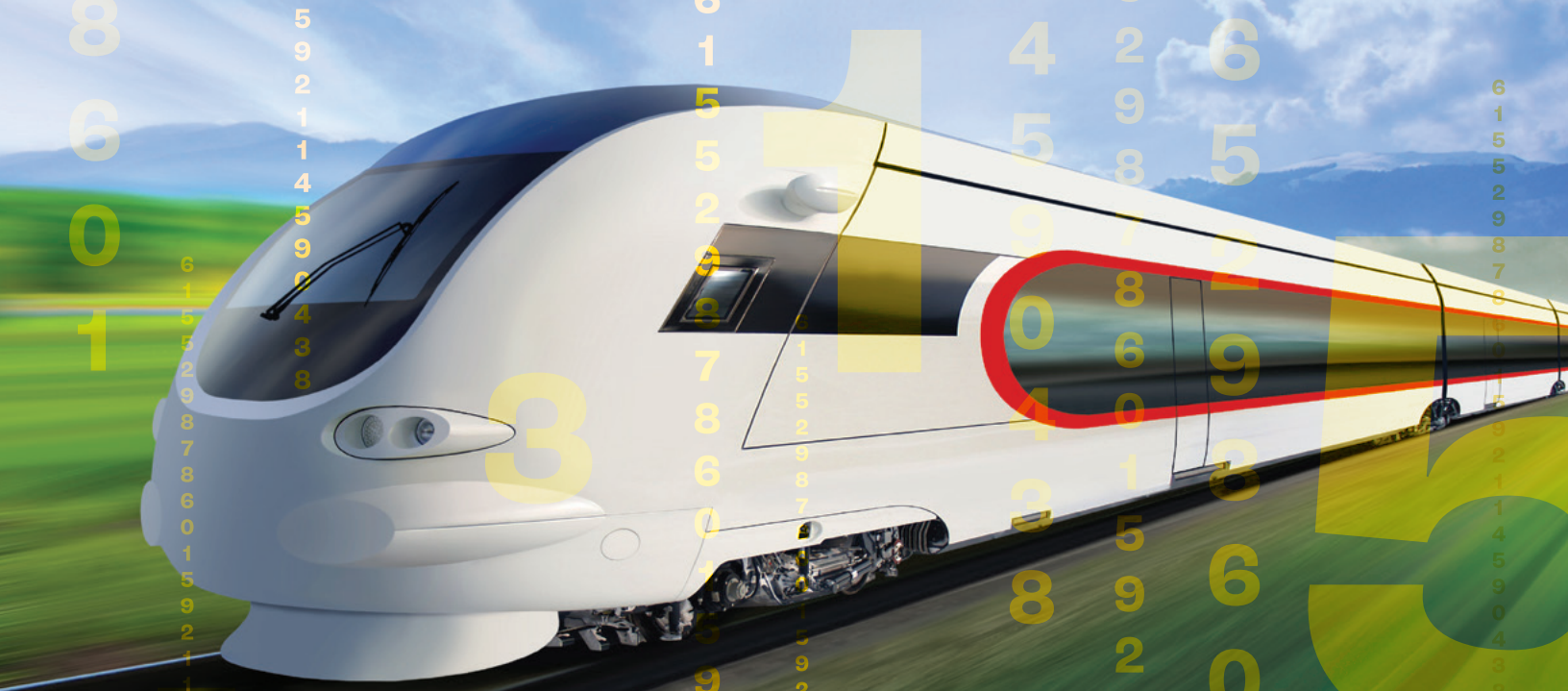
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# Reimagining Rail Systems

**A NEW CENTER AT UMD AIMS TO SPUR HIGH-TECH ADVANCES IN RAILWAY ENGINEERING AND OPERATIONS.**

When hackers hit the Italian state railway system in March 2022, the results were mostly a nuisance: passengers had trouble buying tickets, and the departure boards at stations didn't work. Similarly, hackers later that year infiltrated computer systems used by a subcontractor of the Danish rail system, forcing a several-hour stoppage as authorities scrambled to contain the risk.

Though both incidents had only modest impacts and were contained quickly, they provided a sobering reminder of potential vulnerabilities. With the railway industry increasingly reliant on digital technologies to handle everything from ticketing to operations, the need to safeguard those systems from cyberattacks has become more pressing.

(CONT. ON PAGE 2)



“Digital technology can be a double-edged sword,” said Nii Attoh-Okine, chair of the University of Maryland’s civil and environmental engineering department and an internationally-recognized expert on railway cybersecurity. “It can lead to enormous improvements in operational efficiency and safety. But along with those benefits comes a new and evolving set of risks.”

“We need research expertise to better understand these risks and how to address them,” Attoh-Okine said. “We need personnel who have been trained and educated in areas such as cybersecurity and AI, in addition to traditional engineering subjects.”

Since becoming chair of the UMD CEE department in 2022, one of Attoh-Okine’s priorities has been to establish a hub for research on advanced railway systems and the technologies needed to secure them. The new Digital Cyber Railway Engineering Operations Center (DCREOC) at UMD, launched in April 2023, aims to advance the use of high-tech tools to secure this crucial part of the nation’s infrastructure.

In addition to tapping the expertise available at UMD’s highly regarded transportation engineering program, the new center will leverage the quantum technology resources currently

available at UMD, which is home to several labs and centers dedicated to quantum-related research. These include the Joint Quantum Institute, the Joint Center for Quantum Information and Computer Science, the Quantum Technology Center, and the NanoCenter. Quantum computing and technology, Attoh-Okine believes, has the potential to become a major tool for addressing operational, logistical, and maintenance issues in railway engineering.

The DCREOC is partnering with two external institutions—the Center for Artificial Intelligence at Japan’s University of Tsukuba and the railway engineering program at Delft University, Netherlands. Research will cover a gamut of resilience-related topics, from blockchain applications to track geometry modeling.

“We seek to maximize the benefits of digital technologies in providing safe and secure railways,” Attoh-Okine said. “We envisioned the center as a leader in this area.”

“Our aim is to support industry through research, education, and policy. Our center will work with a diverse range of specialists and partners to facilitate changes that will address appropriate maintenance techniques, operational efficiency, and security

## Dr. Nii Attoh-Okine

**Chair, UMD Civil and Environmental Engineering and Director, DCREOC**

### WHY IS THERE A NEED FOR SUCH A CENTER?

Rail transportation is vital to the U.S. transportation system and contributes to the nation’s economy. As the federal government invests more in railway engineering, there is a critical need to look at future development and determine what types of improvements should be made to the rail network and operations.

The passenger railway network and its infrastructure rely heavily on the Internet of Things and communication to provide seamless operations. The same is true of freight transport, including transportation of chemical products. A new breed of engineers and researchers is needed who can handle the complex environment in the railway industry. The objective of this center is to prepare students, researchers, local residents, and state and federal officials to obtain knowledge of the state of art knowledge within railway operations and engineering.

### HOW WILL THE CENTER ADDRESS THIS NEED?

The center will perform research and provide instruction to undergraduate and graduate students in various aspects of railway engineering. It will provide an annual short course and conference directly to railway professionals, addressing the current state of practices and emerging technologies. The center will also act as an advisory entity to various rail organizations.

The center will bring advances in artificial intelligence (AI), machine learning (ML), and cyber issues to the forefront of railway research and operations. Past projects from the center have demonstrated how AI/ML applications, including cybersecurity, can help ensure safe and secure rail operations.

# “We seek to maximize the benefits of digital technologies in providing safe and secure railways.”

and safety in railway engineering and operations,” he said.

Dean Samuel Graham, Jr. of the Clark School welcomed the launch of the new center, saying it would further enhance Maryland Engineering’s role in supporting critical societal needs.

“Our nation needs a safe and secure logistical supply chain, which is strongly dependent on our rail system. To ensure the efficient delivery of goods through this supply chain, it’s essential we continue to modernize and protect our infrastructure involving trains, railways, and other assets needed in their operation. With our leading capabilities in AI, machine learning, quantum, and data analytics, we’re uniquely positioned to advance the country’s rail infrastructure and enable the employees who manage it. We’re excited to bring this new center online.”

## WHO WILL BE ABLE TO BENEFIT FROM THE CENTER’S RESEARCH?

The center’s research and operations will benefit local, state, and federal governments in various railway operations and engineering aspects. Also, most private railway operators, especially in freight transportation, will benefit enormously from the center.

## WHAT RESOURCES, EQUIPMENT, AND FACILITIES WILL BE AVAILABLE AT THE CENTER?

The center will have advanced computational resources. It will work with the federal government and private railway operators to collect data for research and training. The center is partnering with the Delft Institute of Technology’s Railway Engineering Program to share actual railway data that can be used for both research and teaching. In addition, the center is partnering with the University of Tsukuba’s Artificial Intelligence Center.

## WHAT OPPORTUNITIES WILL BE PROVIDED FOR STUDENTS, BOTH UNDERGRADUATE AND GRADUATE?

The center will provide both undergraduate and graduate curricula to train future students, preparing them to work in the railway industry and to address the use of digital information and cyber issues in railway operations and engineering.

## DCREOC Research Areas

Track engineering

Railway operations  
(including ticketing)

Safety and security

Blockchain in railway  
operations

Quantum information

Math algorithms/  
machine learning

Big data/  
cybersecurity

Quantum  
information/human  
technology

Safety

Society

Mobility







Rising sea levels are causing more flooding and threatening a sanitary crisis driven by failure of the septic tank systems used by tens of thousands of Marylanders living in coastal areas or near tidally influenced water bodies.

# Under Pressure

## \$1.35M GRANT FUNDS UMD-LED TEAM'S STUDY OF CLIMATE CHANGE AND SEPTIC TANK FAILURE

As rising sea levels increasingly strain septic tank systems used by tens of millions of households nationwide, a new \$1.35 million grant from the U.S. Environmental Protection Agency (EPA) will fund a University of Maryland-led team's investigation of ways to head off a looming sanitation crisis that could disproportionately harm the state's Black residents.

The multi-institutional project headed by civil and environmental engineering Assistant Professor Allison Reilly includes several other UMD researchers in addition to partners at George Mason University and nonprofits focused on natural resources and environmental justice.

They're focused on the more than 52,000 Maryland homes within 1,000 feet of tidally influenced water that rely on septic systems. Rising water levels create hydrostatic pressures that can cause septic tanks to fail by literally popping out of the ground, and the saturated soil causes effluent in septic drain fields to rise rather than sink into the ground for absorption and purification. This presents opportunities for human exposure to disease-causing pathogens and causes nutrients like nitrogen and phosphorus to seep into area waterways and potentially harm aquatic life, Reilly said.

Historical inequities in coastal communities' access to public utilities makes the potential for widespread failure of septic systems an environmental justice issue as well as a threat to public health and ecosystems, said Reilly, the Pedro E. Wasmer Professor in Engineering.

"Historically, Black communities are more likely to rely on septic systems rather than on sewer systems, in part because of past racist perceptions about ability to pay and 'deservedness' for municipal sewer infrastructure," she said. "Also troubling

is the fact that federal or state resources are often made available when municipal sewer infrastructure breaks. But when a septic tank fails, the homeowner is on their own. And counties can levy fines or even order evictions if the homeowner fails to fix it quickly."

Communities of color are also disproportionately exposed to sea-level

rise and flooding because of a history of racist housing and land-use policies—which, along with sanitation inequality, constitutes a "one-two punch," she said. "The compounded risk here is staggering."

Possible long-term solutions include enabling states to use EPA water infrastructure funds to finance sewer system expansion or the construction of newer, less hazardous types of septic systems, or increasing use of "green banking" mechanisms that could provide low-interest loans to septic system users, Reilly said.

Other UMD team members include biofilms expert Birthe Kjellerup, associate professor of environmental engineering and the A. James Clark School of Engineering's diversity, equity and inclusion committee chair; Rachel Goldstein, assistant professor in the School of Public Health's Maryland Institute for Applied Environmental Health; and Andrew Lazur, a water quality specialist with the College of Agriculture and Natural Resources. George Mason coastal hydrologist Celso Ferreira and economists Yanjun "Penny" Liao and Margaret Walls from Resources for the Future, a D.C.-based research institution, round out the team.

Each will apply their specific domain of expertise to the interdisciplinary problem; Ferreira, for instance, will examine flooding patterns and how they are likely to evolve over time, while Goldstein will study the particular health risks posed by failing septic systems. "We know that raw sewage can contain disease-causing microorganisms," she said. "If a septic system fails, people could be exposed to these microorganisms and the infections that they cause."

Kjellerup and her students, meanwhile, are taking samples from drain fields in Anne Arundel County and Maryland's Eastern Shore that are at risk of saltwater exposure.

The team is also partnering with the Southeast Rural Community Assistance Project (SERCAP), which works with lower-income local homeowners to address problems with their homes, including repairing failing septic systems. Jean Holloway, Maryland and Delaware state manager, will represent SERCAP on the project.

"We need to better understand the risks, and then we need to develop practical, affordable solutions," Reilly said.



With EPA funding, an interdisciplinary team of researchers will study how sea level rise could affect septic systems—and the quality of life of the communities that rely on these systems.

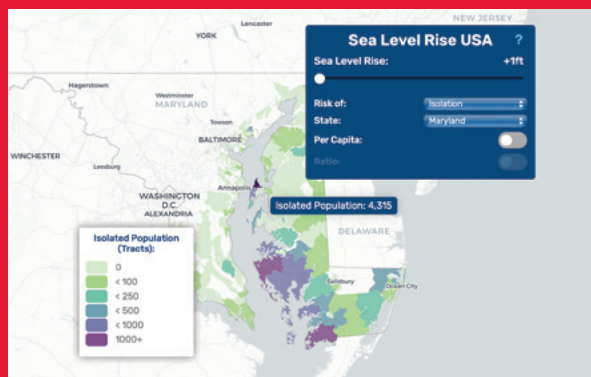
# SEA LEVEL RISE COULD LEAVE MANY MAROONED

In addition to her septic tank research, UMD's Allison Reilly is a contributor to paradigm-busting new research that could help change the way we prepare for expected sea level rise. Until now, planners have relied mainly on inundation of properties as their benchmark.

But residents can experience isolation long before that, with flooded roads restricting access to essential services like hospitals, shopping, and schools. To quantify the risk, Reilly and colleagues at the University of Canterbury in New Zealand applied sea level scenarios developed by NOAA to the OpenStreetMap mapping tool, factoring in variables such as mobility behavior (where people access shopping, work and education), road elevation and travel routes. It turns out that isolation could pose a problem for many communities that were previously considered low-risk, while communities that face displacement could find themselves uprooted far earlier than previously believed.



Allison C. Reilly



The team's findings were published recently in *Nature Climate Change*, with T.M. Logan of the University of Canterbury as the lead author. In conjunction with the study, the researchers have also set up an online dashboard (<https://research.uintel.co.nz/slr-usa/>) that allows users to see how different amounts of sea-level rise could impact particular communities. It shows, for example, that one foot in Maryland would likely isolate around 5,000 people on Kent Island, Md. without significant infrastructure modification.

The dashboard and study will supply policymakers and local officials with easily accessible, actionable information that can be used to manage access issues, whether by elevating roadways or armoring them against saltwater damage, or by decommissioning them as the communities they serve migrate elsewhere.

"Many state agencies just don't have the data they need to understand what their isolation risks are, and we'd like to start that conversation," Reilly said. "We hope our research will encourage state departments of transportation to think about how to best manage road assets, given these risks."



An artist's rendering shows the U.S.-European Surface Water and Ocean Topography (SWOT) satellite in orbit. Prediction and forecasting tools developed by UMD's Barton Forman could leverage data from SWOT, launched in December 2022 to help researchers understand how much water flows into and out of Earth's freshwater bodies.

## UMD Researcher Uses AI to Predict Floods

Fires have been on the rise in recent years, often because of shifting climate patterns. And where there are fires, there is also an increased risk of flood damage—particularly since intense precipitation is also on the rise.

"We have more fires and they are becoming more extensive," says Barton Forman, associate professor of civil and environmental engineering at UMD. "At the same time, we're seeing that precipitation events are also becoming more intense. When you take a fire-burned area and couple it with intense precipitation after the fire, you get a really dangerous flood."



Barton Forman

Novel methods are needed in order to better track and forecast such hazards. And Forman is developing such methods by leveraging machine learning as well as the growing array of imagery available from small, agile commercial satellites—imagery that, taken together, allows for monitoring the entire globe at once.

"The idea is to develop an autonomous, artificially intelligent system that can predict where flood events may occur, with particular relevance to fire-driven change preceding the floods," said Forman, who received support for the endeavor through a NASA grant. "The system autonomously collects satellite imagery and uses this imagery to make predictions. It's also pulling in data from actual events and comparing it to the predictions, so it can adjust itself as needed. And it keeps doing this day after day, in a 'rinse and repeat' process that leads to an increasingly refined model."

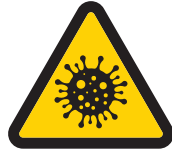
"Conceptually, what we're building here is similar to the Internet of Things (IoT), where you have any number of devices that communicate with each other and share data," Forman said. "We envisage UAVs, ground based instruments, and space based platforms all communicating through the same computer-based network."

Together, the various data sources support what is known as a "Bayesian merging process," which starts with an informed estimate of probability that can be brought into ever-sharper focus as more and more data comes.

For end-users such as disaster recovery and emergency management personnel, that could mean greater lead time as well as more efficient and effective allocation of resources.

"If we think that in four days there will be a big flood event, then we can start moving people away from that watershed and bring in supplies," Forman said. "We can be better prepared to mount an effective response and save lives."





# Early Warning

## WASTEWATER SURVEILLANCE HELPS PREDICT COVID-19 ON UNIVERSITY CAMPUSES

*The research was summed up in a paper that was selected for the 2022 Water Environment Research (WER) Outstanding Paper award.*

Wastewater surveillance, also known as wastewater-based epidemiology (WBE), has emerged as a novel and effective tool in the fight against the COVID-19 pandemic. By monitoring microorganisms in wastewater, WBE can effectively determine the presence and abundance of a pathogen within a community.

SARS-CoV-2 is an excellent candidate for WBE because it is easily detected in wastewater. The virus is also highly transmissible and, especially in the early days of the COVID-19 pandemic, it was crucial to control its spread, making WBE an important public health measure.

"It's a guidance tool that has the potential to give early warning and early documentation for what is going to happen in a group setting," says UMD civil and environmental engineering associate professor Birthe Kjellerup.



In an effort to monitor SARS-CoV-2 cases at UMD, Kjellerup and her interdisciplinary team of researchers, including Andrea Crabb, the director of the Department of Residential Facilities within the Division of Student Affairs, applied a WBE strategy during the fall of 2020

and spring of 2021. The initial goal was to create a pilot study that covered the on-campus student body at UMD. WBE was chosen as an aid in detecting pre-symptomatic and asymptomatic individuals, where the information gathered was then compared to clinical testing. Kjellerup's team aimed to establish a framework for the detection of COVID-19 clusters on campus to prevent the spread of the virus within the campus community.

The research was summed up in the paper, "Implementing wastewater surveillance for SARS-CoV-2 on a university campus: Lessons learned," which was selected for the 2022 Water Environment Research (WER) Outstanding Paper award.

"It was a tremendous effort and it's wonderful to have that acknowledged," said Kjellerup. Building off of the methods used in the research, she and her collaborators are now working with Maryland's Montgomery County on WBE for COVID-19, RSV, and influenza.



## STUDIES SHED LIGHT ON GENDER IMBALANCE IN CONSTRUCTION

### MORE BARRIERS, PERVERSIVE BIAS SUPPRESS WOMEN'S REPRESENTATION IN INDUSTRY



For women, advancing in the architecture, engineering and construction industry generally means having to climb career ladders with more rungs than men of similar status—working more jobs, earning more advanced degrees and being stereotyped as less likable—according to three new studies by University of Maryland researchers.

To arrive at their findings showing pervasive bias throughout the industry, they combed through the websites of the top 400 U.S. engineering contractors, as well as their financial statements, pinpointing just how many women were represented on their leadership teams. In subsequent work, the team looked further down the corporate ladder, tracking female representation at levels ranging from directors to executives.

"Those of us who have worked alongside women in civil engineering and related fields have heard the stories," said UMD doctoral student Paul Hickey, who led the studies while working under the supervision of civil and environmental engineering Professor Qingbin Cui. "Until now, however, there hadn't been any real quantification of the problem. A scientific approach was needed in order to drill down and identify what's been going on."



# Better Roads, Safer Driving

**UMD RESEARCHERS HAVE PARTNERED WITH MARYLAND'S STATE HIGHWAY AGENCY TO DEVELOP AN IMPROVED PAVEMENT MIXTURE DESIGN PROCEDURE.**

A smooth and safe drive depends on good-quality pavement. If the roadway is cracked, rutted, bumpy, or pothole-infested, the result can be damage to vehicles. It can also cause accidents, as rain-water pools in the ruts and hollows, increasing the risk of hydroplaning.

Pavement quality depends on the materials being used and how well they perform over time. Measuring that performance, however, isn't an easy task. For close to two decades, state agencies have used different methodologies, with varying degrees of success.

"The approaches tend to be either too simple or too complicated," said Dimitrios Goulias, associate professor of civil and environmental



Dimitrios Goulias

engineering at the University of Maryland. Too simple means not enough variables are being monitored to produce accurate results. Too complicated means so many variables are measured that the

process becomes cumbersome and creates as much noise as it does information.

With support from the Maryland State Highway Administration and the Federal Highway Administration, Goulias and UMD civil and environmental engineering doctoral student Anjuman Akhter have set out to develop a more workable approach—one that locates the happy medium between the simplistic and the overly complex. As Goulias explains, "we're looking for a balance. Our goal has been to identify which specific variables and processes will work in measuring the performance of these mixes, and then to incorporate these measurements into the design. This is called "Balanced Mix Design."

"We look at the volume, density, and mass of the different ingredients, and then we factor in the critical performance criteria that can result in failures. We then identify an appropriate testing process," he said. Using this approach, Akhter and Goulias have tested and evaluated more than eighteen types of pavement mixtures.

Work on the project was conducted at the civil and environmental engineering department's Whiting-Turner Infrastructure Laboratory, with additional tests at SHA facilities. The team's balanced mix design approach is being considered for adoption by several agencies in the US for asphalt mixtures for roadway construction.

Shadow construction projects are being currently examined for assessing the methodology and fine-tuning the acceptance threshold criteria.

Meanwhile, Goulias and Akhter will present their findings at the Transportation Research Board annual meeting in January 2023. A lecture session is organized and chaired by Goulias showcasing the lessons learned around the U.S. with the balanced mix design.

Drivers can expect a number of tangible benefits in the future as pavement performance is measured more accurately, Goulias said. "Roadways will last longer and be in better condition, with little or no cracking and rutting. Less maintenance will be required, so you'll see fewer work zones and closed-off lanes. Less required maintenance also means lower costs to the state, and ultimately the taxpayer," he said.



Hickey points to a personal reason for undertaking the research: he's dedicated it to his late wife, Bonnie, a Maryland Engineering grad whose career was in civil engineering.

"I saw firsthand the kinds of obstacles she faced because of her gender," he said. Those included being routinely passed over for roles she was qualified for—sometimes in favor of less-experienced men whom she had trained—and working in companies where cosmetic commitments to diversity allowed women into the C-suite, but limited them to secondary or non-engineering-focused roles, Hickey said. While working on projects, she was subjected inappropriate behavior, included being targeted with foul language, and frequently discovered male contractors trying to circumvent her authority by asking her male supervisors for project approvals, he said.

To more clearly understand how such treatment affects women in the industry, fellow CEE doctoral student and co-author Abdolmajid Erfani, a data science specialist, used AI and machine learning tools to analyze thousands of LinkedIn pages and develop predictive models showing how gender affects career paths.

The studies show that 53% of women who achieve leadership roles have advanced degrees, compared to 31.2% of men, the researchers found. Their careers are more varied, too, with LinkedIn profiles of successful women leaders in construction showing that they typically work for 56% more companies, hold 19% more job titles, and are 73% more likely to hold a graduate degree, compared to men.

Meanwhile, as a woman's perceived level of competence rises, her perceived likeability diminishes—a finding gleaned from computer analysis of the language used in LinkedIn recommendations, comments and posts.

Men and women have such markedly different experiences that computer algorithms can readily be trained to predict an anonymous executive's gender based on career path data, said Erfani. "Our machine learning tools were able to achieve around 90% accuracy," he said.

Said Cui: "The bottom line is that women have to work harder to make it. And when they get to the boardroom, they still have to prove themselves in a way that is less true of their male colleagues."

# UMD Tapped to Lead Tier 1 University Transportation Center

**THE UNIVERSITY OF MARYLAND WILL LEAD A MULTI-INSTITUTIONAL CENTER AIMED AT IMPROVING THE MOBILITY OF PEOPLE AND GOODS ACROSS THE COUNTRY AND WILL PARTICIPATE IN TWO OTHERS FOCUSED ON TRANSPORTATION SAFETY AND EQUITY.**

UMD and partner institutions—Morgan State University, North Dakota State University, San José State University, and White Earth Tribal and Community College in Minnesota—will receive \$10 million over five years for the Center for Multi-Modal Mobility in Urban, Rural, and Tribal Areas through the U.S. Department of Transportation's University Transportation Centers (UTC) Program. The center is among 34 new UTCs funded by the federal agency.

"Together with our partners, we'll be working to expand the transportation options for communities across the United States that have had only limited choices in the past," said UMD civil and environmental engineering Professor Cinzia Cirillo, who is serving as interim director of the university's Maryland Transportation Institute (MTI). "We're excited about this opportunity to make a tangible difference."

The new Tier 1 center will be housed at MTI, a research hub that brings together interdisciplinary expertise from across the University System of Maryland.

The center will focus on three strategic goals identified by USDOT: economic strength and global competitiveness, equity, and climate and sustainability. Among other topics, researchers will study the potential of unmanned and autonomous vehicles—both ground and air—to streamline the movement of people and goods, investigate ways to incentivize greater use of public transit, identify the key contributing factors to transportation-related inequity, and explore the potential of modalities such as rideshares, vanpools and microtransit.

While vital both to the economy and quality of life, transportation in the U.S. poses equity and environmental issues. A significant minority (8.5%) of American households do not own a car, according to census data, while a report from the National Equity Atlas indicates that as many as 18% of Black households lack access to a vehicle. In rural areas, public transit is often limited or nonexistent due to low population and a limited tax base. In part because of a heavy reliance on gas-powered vehicles, transportation is the single largest contributor to U.S. greenhouse gas emissions.

UMD is also a partner institution in a regional UTC, the Sustainable Mobility and Accessibility Regional Transportation Equity Center, which is being led by Morgan State University (MSU). "This will continue to strengthen our long-standing relationship with MSU," Cirillo said.

In addition, UMD is a partner in another Tier 1 University Transportation Center announced this month, the Research and Education in Promoting Safety Center, which is being led by Howard University. Nii Attoh-Okine, chair of the UMD civil and environmental engineering department, is part of the consortium in that grant.

"We're thrilled to be involved in three new UTCs that are dedicated to ensuring America has a transportation system that provides secure and safe operations, and supports our economic needs while addressing long-standing problems of access and equity, as well as climate impacts," Attoh-Okine said. "These new centers will further cement our strong reputation as a top-line transportation program, one that is not simply resting on past achievements but moving forward."



UMD civil and environmental engineering professor Cinzia Cirillo will direct the new center.





The Workshop on U.S.-Japan Digital Innovation and Advanced Technology, hosted by the UMD CEE department in November 2022, brought together representatives from several Japanese academic institutions—including Nagoya, Sophia, Tohoku and Tsukuba Universities—and U.S. counterparts.

# A Boost for International Research Collaboration

Researchers from several Japanese universities joined U.S. counterparts in November 2022 at UMD's A. James Clark School of Engineering with the goal of laying out paths for collaboration in areas involving advanced technologies.

Hosted by the UMD civil and environmental engineering department, the Workshop on U.S.-Japan Digital Innovation and Advanced Technology brought together representatives from several Japanese academic institutions—including Nagoya, Sophia, Tohoku and Tsukuba Universities—and U.S. counterparts.

Ben Wu, special advisor to Maryland Governor Larry Hogan, Maryland Engineering's Dean Samuel Graham, Jr., and Shuzaburo Takeda, special advisor to the University of Tsukuba and Nagoya University, welcomed participants to the event, which was being held for the first time since the COVID-19 pandemic. It also marked the first time that UMD has hosted this international workshop. Koji Aribayashi, Chief of Science section, Embassy of Japan welcomed the participants on behalf of the Japanese Ambassador.

"We are in a strong position to advance collaboration across several cutting-edge fields," said UMD Civil and Environmental Engineering Chair Nii Attoh-Okine. "We are

acknowledged leaders in the use of location-based data for objectives that range from managing public health crises to improving transit networks. We're also building up our capabilities in the area of railroad cybersecurity, a key component of critical infrastructure. In addition, UMD engineering is a leading hub for quantum-related research."

Presentations by UMD faculty underscored the university's capabilities. Assistant Professor Avik Dutt, a quantum computing and photonics expert, provided an overview of UMD resources such as the Joint Quantum Institute, the Maryland Nanocenter, the Joint Center for Quantum Information and Computer Science, and the newly-launched FearLess Optics, Quantum Engineering & Technology (FLoQuET) Lab.

Other speakers from Maryland Engineering included Attoh-Okine, who discussed digital and cyber railway systems; Clark Distinguished Chair and Center for Disaster Resilience director Deb Niemeier, who spoke about engineering's role in addressing climate-related and other risks, and Eric D. Wachsman, director of the Maryland Energy Innovation Institute, which explores clean energy solutions that can help achieve the goal of carbon neutrality, and Victor Albert, UMD Physics department.



Kyosuke Nagata, president of Tsukuba University, was among the high-level university officials who attended the event.

*"We are in a strong position to advance collaboration across several cutting-edge fields."*

NII ATTOH-OKINE, PROFESSOR AND CHAIR, UMD DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING



# Niemeier Selected for Bower Award



**D**eb Niemeier, Clark Distinguished Chair of Energy and Sustainability at UMD's Clark School of Engineering, has helped bring about needed change in the way engineering decisions are made that can impact health and well-being, particularly in disadvantaged communities. This year, the Franklin Institute conferred prestigious recognition of her achievements, awarding Niemeier the 2023 Bower Award and Prize.

The award, which comes with a \$250,000 cash prize, honors Niemeier for "pioneering the advancement and application of knowledge at the intersections among infrastructure, environment, public health, and equity through groundbreaking research on transportation systems and climate-related hazards."

*"Well deserved recognition of the transformative influence that Dr. Niemeier has had on her field."*



Speaking on behalf of the Clark School, Dean Samuel Graham, Jr. described the award as "well deserved recognition of the transformative influence that Dr. Niemeier has had on her field." Niemeier, he said, "is a paradigm-changer. When it comes to equity in engineering design, her work has helped us all understand the impact of decisions on placing transportation and other infrastructure, and how this impact still affects communities and the people who live in them today. The broadening of scope that Niemeier has helped bring about is crucial as engineers grapple with the grand challenges of our time—and solutions to them that benefit everyone."

Nii Attoh-Okine, chair of the UMD civil and environmental

engineering department, stressed Niemeier's role in mentoring a new generation of engineers. "She has a deep and abiding commitment to educating students at both the undergraduate and graduate levels. Her unwavering support for our underrepresented students is beyond words," he said. "We are indeed fortunate to have her on our faculty."

A National Academy of Engineering (NAE) member, Niemeier joined the UMD civil and environmental engineering faculty in 2019. She was named to the first in a series of distinguished chairs endowed by the Clark Foundation as part of a \$219.5 million gift to UMD. In 2022, she became director of the Center for Disaster Resilience, based at the civil and environmental engineering department.

Over the course of her distinguished career, Niemeier has helped spur policy and regulatory changes through groundbreaking research in the areas of vehicle emissions, air quality, affordable housing, and infrastructure funding both nationally and internationally. More recently, she has focused on aspects of the built environment that give rise to structural inequality, particularly within the context of climate change. She is a Guggenheim Fellow, a AAAS Fellow and a recipient of the Perry McCarty AEEPS Founders' Award for her exceptional and tireless leadership in research, education, and service. In 2021, she was elected a member of the American Philosophical Society.

Expressing her gratitude at being selected for the Bower Award, Niemeier drew attention to the importance of a community focus.

"Much of the STEM culture at universities is focused on entrepreneurship, so the societal contributions faculty make on ways to repair and strengthen communities can be underappreciated," she said. "This award reflects an understanding of the value of useful knowledge, in Franklin's perspective, for making lives better. I am very honored to have been chosen."

# CHANG, STUDENTS HONORED WITH MICKLE AWARD

A team of University of Maryland (UMD) transportation researchers led by Professor Gang-Len Chang has won the D. Grant Mickle award, given each year by the Transportation Research Board National Academy for the best paper in the area of operation, safety, and maintenance of transportation facilities.

Corresponding author Yen-Lin Huang, Yi-Ting Lin, and Chang officially received the award for their paper, “Extending the I-95 Rule-based Incident Duration System with an Automated Knowledge Transferability Model,” at the 2023 Transportation Research Board annual meeting in January. Their work won the TRB Freeway Operations Committee’s Best Paper award and was then selected for the Mickle award from among 90 papers nominated by TRB committees.

In their paper, the UMD researchers presented a method that can help expand the scope of a model used in highway incident response without a large increase in cost and resources.

Accidents and other highway incidents can lead to long delays for commuters and increase congestion. To mitigate these effects, many state highway agencies utilize Traffic Incident Management (TIM) systems, which allow them to detect, respond to, and clear traffic incidents with greater efficiency. An effective TIM system can reduce the clearance duration of detected incidents, and minimize the resulting impacts on traffic delay and safety.

As part of its TIM system, the Maryland Department of Transportation has made successful use of a rule-based incident duration prediction model (IDPM) that covers Interstate highways I-95, I-495, and I-695. In brief, the model draws from incident records to make predictions which can then be used in response planning and resource allocation.

With the model having proved effective, MDOT is now planning to extend it to cover highway systems throughout the state. Doing so, however, requires obtaining sufficient incident

data to properly calibrate the model’s parameters—and harvesting that data can be both time and labor-intensive.

The method proposed by Huang and his colleagues could help overcome that challenge. In their paper, the researchers put forward a knowledge transferability analysis (KTA) method, making use of an automated process that can assess, select, and transfer existing prediction rules in order to estimate incident durations on a new target highway.

Tests of this approach with two different data sets yielded accuracy levels of 82% and 87%, respectively. According to the authors, these rates are comparable to the current IDPM’s performance, but require far fewer records for model calibration.

“Most real-world transportation problems face insufficient data,” Huang said. “Our study sheds light on the power of such precious and hard-earned data. That is its main contribution.”

“It was an honor for us to receive the award and we feel grateful for being recognized. It motivates us to continue high-quality work and help solve additional transportation issues, thus helping to bring about a better transportation environment,” he said.

Professor Chang, likewise, emphasized the importance of building on the team’s success. “We are certainly pleased with the award, but I also remind my students that we should be humble and committed to doing further high quality work to bridge the gap between state of the art and state of the practice,” he said.

***“MOST REAL-WORLD TRANSPORTATION PROBLEMS FACE INSUFFICIENT DATA. OUR STUDY SHEDS LIGHT ON THE POWER OF SUCH PRECIOUS AND HARD-EARNED DATA.”***

YEN-LIN HUANG, RESEARCH ASSISTANT, TRAFFIC SAFETY AND OPERATIONS LAB, UNIVERSITY OF MARYLAND



From left: TRB Executive Committee Chair Nathaniel P. Ford, Sr.; Professor Gang-Len Chang; Yi-Ting Lin; Yen-Lin Huang, and TRB Executive Director Victoria Sheehan. Chang, Lin, and Huang received a Certificate of Award at the TRB meeting’s Thomas B. Deen Distinguished Lecture and Presentation of Awards on January 9.

# Project Management Symposium Marks Anniversary

Celebrating ten years, the UMD's annual Project Management Symposium, held April 20-21, 2023, was back in-person with a record 802 participants. The symposium continued its tradition of offering five featured speakers plus forty-five individual sessions in five concurrent tracks covering a variety of Project Management topics, including People in Projects, Agile/DevOps, Performance Management, Stakeholder Engagement, Federal Programs, the Future of Project Management and many more.

***"There were 5 different tracks that were available depending on your needs/interests, and I appreciated the flexibility to jump from one session's track to another. The topics discussed were relevant and timely and the speakers were knowledgeable in their fields."***

MARIANNE MUSNI

"One of the reasons our Symposium is able to cover such a wide range of topics year after year is because so many leading minds in the Project Management industry are willing to share experiences and lessons learned with their colleagues and peers," said John Johnson, Professional Programs Manager at UMD's Project Management Center for Excellence.

"Our event enhances engagement, encourages networking, addresses a broad range of topics, and ultimately ensures that attendees gain valuable insights and knowledge to enhance their project management skills and practices," Johnson said.

***"This was my first PM symposium and it will not be my last! It was a great opportunity to learn from insightful professionals. I am re-energized to return to my work and apply this knowledge and energy to my Agency's mission."***

HEATHER FARBER-LAU

Project management is a dynamic field, continuously evolving with new methodologies, technologies, and practices. The UMD symposium offers a variety of presentations that showcase innovations, best practices, case studies, lessons learned and academic research. This not only keeps attendees informed about the latest developments but also encourages them to explore new ways of approaching their projects.

New for the 2023 event was a featured speaker debate on the topic of "Process vs Principles, Which Approach is Better?" The session highlighted two speakers answering moderated questions; one in favor of process with the other in favor of principles. Participants loved the new format and want to see this session style continued.

The next Project Management Symposium is being held April 18-19, 2024 at the Adel H. Stamp Student Union. Registration opens in September!



Should project managers start with process or principles? Crystal J. Richards (left) and Laura Barnard advocated for different sides of the topic during a featured speaker debate at the Project Management Symposium.

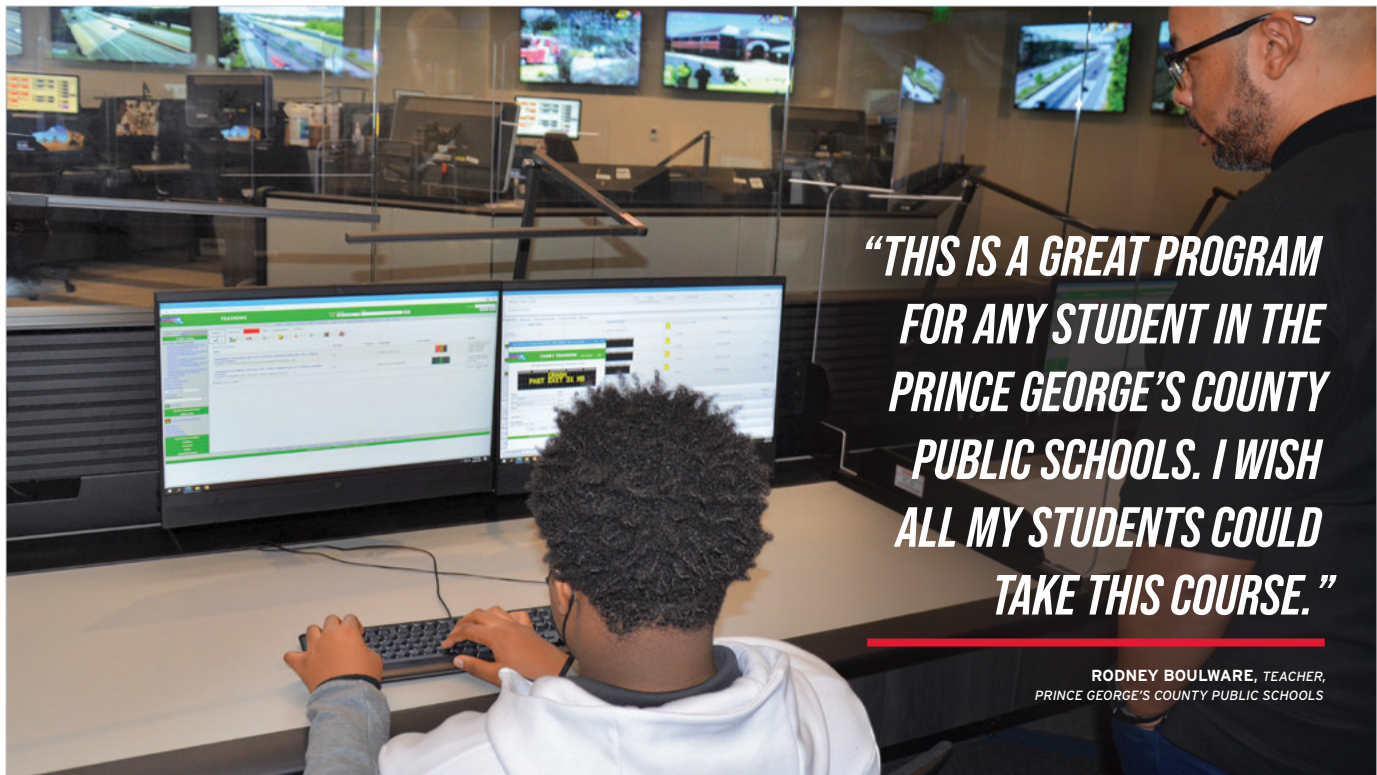


## World's Top-Ranked Civil Engineering Journal is Edited at UMD

*Automation in Construction*, an international research journal with the world's highest Impact Factor in the Civil Engineering category in the coveted Web of Science database, is edited by UMD Professor Miroslaw J. Skibniewski. This monthly peer-reviewed periodical, featuring original research and review articles on the latest advancements in construction-related and allied information technologies, has been published by Elsevier since 1992.

A member of the UMD faculty since 2005, Skibniewski specializes in automation and IT for economically and environmentally sustainable construction applications, and teaches courses in construction automation and robotics; selection and utilization of construction equipment; and in legal aspects of architecture, engineering and construction. Author/co-author of over 400 technical publications, Skibniewski has served as Editor-in-Chief of *Automation in Construction* since 1994.





***“THIS IS A GREAT PROGRAM  
FOR ANY STUDENT IN THE  
PRINCE GEORGE’S COUNTY  
PUBLIC SCHOOLS. I WISH  
ALL MY STUDENTS COULD  
TAKE THIS COURSE.”***

**RODNEY BOULWARE, TEACHER,  
PRINCE GEORGE’S COUNTY PUBLIC SCHOOLS**

## Advancing Transportation Operations Education in High Schools

**A CATT INITIATIVE OPENS UP OPPORTUNITIES FOR STUDENTS IN MARYLAND’S PRINCE GEORGE’S COUNTY**

With a grant from the Maryland Department of Education, the University of Maryland’s Center for Advanced Transportation Technology (CATT) has completed a pilot project with the Prince George’s County Public Schools Department of Career and Technical Education (CTE) to launch the Transportation Infrastructure Management Education and Simulation (TIMES) initiative.

Led by CATT Director Tom Jacobs and supported by Kathleen Frankle and Rhea Anderson, the initiative aims to integrate transportation systems management and operations into high school Career Technical Education curricula, with programs designed to equip students with the skills and knowledge needed to excel in traffic management and emergency preparedness.

The specific focus of the pilot project was to introduce students to the critical relationship between transportation management and homeland security. Participating students gained a baseline understanding of civil engineering and critical infrastructure, learning how transportation management plays a pivotal role in ensuring public safety during emergencies.

They also learned about the diverse range of career opportunities in transportation operations, with roles that include police, fire,

medical personnel, service patrols, traffic management center operations, and more.

Students in the program “explore transportation systems management and operations (TSMO) and its significance in coordinating various stakeholders, including federal, state, and local agencies,” Jacobs said.

Jason Diciembre, Director of the Office of Transportation Mobility & Operations for the Maryland State Highway Administrations (SHA), said the initiative will help meet a growing need for personnel.

“I have a critical need to staff my operations centers and service patrol units,” he said. “I love that this TIMES initiative has the potential to help create a diverse pool of future operations personnel who can fill job vacancies and give these students an opportunity for a real career in transportation.”

A future highlight of the TIMES initiative will be the utilization of a virtual traffic incident management simulation tool. This tool is being developed by Jacobs Engineering with support from the Eastern Transportation Coalition. The simulation tool will allow teachers and their students to interactively engage in setting up incident scenes and practicing various response scenarios.

During the pilot project, teachers and students also had the opportunity to do a field visit to the Maryland Statewide Operations Center (SOC). This experience allows students to witness real-world traffic management operations and gain hands-on exposure to the field. The use of the traffic incident simulation tool and field trips enhances the practical application of classroom knowledge, reinforcing the concepts taught in the curriculum.

“This is a great program for any student in the Prince George’s County schools,” said teacher Rodney Boulware. “I wish all my students could take this course.”

## Spotlight: Marc Barone

UMD ALUM ADVOCATES A 'CARPE DIEM' PERSPECTIVE.

Marc Barone's career has taken him places, both figuratively and literally. The '88 graduate has overseen civil infrastructure projects in the United Kingdom and Middle East and served as CEO for AECOM's Continental Europe operations. Currently, he is COO for the London-based engineering consultancy Buro Happold. Having moved to the U.K. in 1996 for his MBA, he continues to make his home there, living in a house originally built during the reign of the Plantagenets.

Being willing to move when opportunities arise has been critical to his professional success, Barone believes—and he encourages early-career engineers to embrace a similar flexibility.

"Learn to say yes," he said. "Opportunities don't come up often, so when they do come up, think about how you can make it work for you. Take advantage of the fact that early in your

career you're not tied down with other commitments, You learn a lot by engaging with different cultures and approaches."

Being able to understand different perspectives is a vital leadership trait, Barone said. After all, any major firm is going to employ people with diverse personal backgrounds and viewpoints, and they must be able to work together constructively and with mutual respect. That's one of the reasons he's excited to see UMD, his alma mater, become a national leader in fostering campus diversity. This summer, in fact, UMD was named the number one college nationwide for LGBTQ+ students, an accolade that Barone cites with enthusiasm.

Engineering education has changed since his undergraduate days, Barone said. It's no longer a subject that exists in a vacuum, isolated from broader societal and environmental concerns—and that's a good thing, because engineers are being called upon to help societies adapt to pressing challenges. "The fundamentals, such as learning fluid dynamics or how to deal with reinforced concrete, will always be important," he said. "But students learn these fundamentals in the context of delivering infrastructure, and nowadays infrastructure is increasingly viewed in relation to the social benefits it provides, for example its potential to revitalize an area. There are technical components to engineering, but also societal components."

At the same time, Barone said, students also need to keep abreast of disruptive technologies, such as AI and automation, that are transforming the way the job of engineering is done.

Barone's interest in shaping the education of tomorrow's engineers has led him to become more closely involved with the UMD CEE department, notably by joining its Board of Visitors. He delivered a Kirilin Lecture at the department in 2022.

He has also provided generous support to the department through the CEE Chair's Fund, building on a long family tradition of philanthropic gifts to UMD, including by sister and fellow Terp Sapienza Barone, who served as executive assistant to three UMD presidents during a 41-year career at the university.

"I've been looking for ways to give back other than just financially, by participating in the development of the CEE program," Barone said. "There are massive changes going on in the world and we need to train students and engineers to participate in these changes."

*"There are massive changes going on in the world and we need to train students and engineers to participate in these changes."*



# CIVIL EMPOWERMENT SEMINAR

## KEVIN EDWARDS LEADS BECHTEL'S COMMITMENT TO DEI PRACTICES

As Chief Diversity and Inclusion Officer at Bechtel, Kevin Edwards is responsible for developing a vision, strategic Diversity, Equity, and Inclusion (DEI) roadmap, and enterprising a plan to implement key program actions to support progress in Bechtel's DEI efforts.

Edwards discussed those efforts in more detail during his presentation this past spring as part of the CEE department's Civil Empowerment Seminar Series, an ongoing program run by the department's DEI committee.

His seminar presentation commented on the importance of DEI in modern workplaces and how organizations can support talent from underrepresented backgrounds.

"The world is changing, and the dynamics of representation are changing, and our traditional ways of reaching out and thinking about talent really need to change," said Edwards. "We have to make sure we expand our reach and network and become an employer of choice on a broader spectrum of dimensions."

Edwards, who himself is from an underrepresented background, received assistance from different school programs while a student. He was involved in a Gifted and Talented Program, and before his freshman year of college, he took part in a "bridge" program, which helped him acclimate to university life before starting his undergraduate degree. These experiences helped Edwards in his education and career path. He went on to earn a bachelor's degree in industrial engineering from Rutgers University, and then a master's degree in environmental engineering from the Stevens Institute of Technology.

However, many individuals don't have access to the same opportunities that helped Edwards. His personal experiences have assisted him in his understanding of DEI practices

and how to best help diverse groups of students reach success. Now, in his position at Bechtel, he aims to make sure that diverse talent is given the opportunities to succeed in their education journey and careers.

"Traditionally people like me would have a hard time getting out of the community and into a program where they can actually make some movement and have a particular career," said Edwards. "Knowing the struggles and challenges that I had going through engineering allowed me to think about multiple pathways for future talent with more insight and understanding on key things they can do to be successful."

For instance, Edwards helps facilitate Bechtel partnerships with different groups such as the Society of Women Engineers (SWE), Society of Hispanic Professional Engineers (SHPE), the American Indian Science and Engineering Society (AISES), and more. He also works on promoting Engineering Week and is the chair-elect for the National



*"Traditionally people like me would have a hard time getting out of the community and into a program where they can actually make some movement and have a particular career."*

Action Council for Minorities in Engineering (NACME). Edwards is passionate about approaching DEI from a future-proof standpoint—he wants these efforts to be long lasting and sustainable.

"Not only is it about talent for us now, but it's also about securing our future in the industry so that we have a broader reach of more talent going into STEM. We're positioning ourselves so that Bechtel is actually leading, driving, and progressing a roadmap for DEI," said Edwards.

### CIVIL & ENVIRONMENTAL ENGINEERING BOARD OF VISITORS

Marc Barone	Kim Jones	Charles Nmai	Erika Spissu
Scott Greenhaus	Jim Kinkad	Camilo Restrepo	Dena Volovar
Chris Hendrickson	David Little	Jason Spicer	Monica Watkins
Stephen T. Houff			



# Annushka Aliev



***“A LOT OF OUR INFRASTRUCTURE HERE IN THE UNITED STATES WAS DESIGNED BASED ON RAINFALL DATA FROM THE MID-20TH CENTURY, AND THOSE PATTERNS HAVE CHANGED.”***

The need to protect communities from natural disasters has long been a concern for UMD senior Annushka Aliev. In high school, she decided to become a civil and environmental engineer after learning about the Haiti water crisis—and the role played by the 2010 earthquake.

Today, as she sets her sights on a professional career and eventual graduate degree, Aliev continues to explore the intersection between environmental hazards and infrastructure. Her generation of engineers, she says, will be tasked with coming up with solutions to the challenges posed by a changing climate, including droughts in some areas and flooding in others.

“A lot of our infrastructure here in the United States was designed based on rainfall data from the mid-20th century, and those patterns have changed,” she said. “What do we need to do to ensure that the infrastructure we’re building today can keep up with these changing conditions? How do we take what we have and make it safe for tomorrow? There are a lot of unknowns.”

“It’s a very salient area given its impact on people’s lives and livelihoods,” she said.

While completing her bachelor’s degree, the Frederick, Maryland native has honed her skills and expertise through her

involvement with two major projects related to environmental impacts. Working with Clark Distinguished Chair Deb Niemeier and postdoctoral researcher Kelsea Best, she contributed to a study of air quality in Texas and its environmental justice implications. Among other work for the project, Aliev used spatial analysis to identify major emitters and track their impact on different demographic populations around the state.

More recently, she has assisted UMD CEE faculty members Allison Reilly and Birthe Kjellerup as part of a multi-institutional endeavor that aims to shed light on the risks posed by sea level rise to septic tank systems, which are widely used in rural, underprivileged, and often historically Black parts of Maryland.

Aliev is gaining valuable experience outside the classroom, as well, including

leadership opportunities—she’s currently president of Engineers Without Borders (EWB), having previously served as social media tech chair and as the water systems sub-lead for an EWB project in Nakifuma, Uganda. She herself has traveled to Uganda to assist with the project, which aims to improve water supply and sanitation at a local school. As president, she has been working to launch workshops for EWB members who want to gain hands-on experience but aren’t able to travel overseas.

It’s the hands-on aspect of environmental engineering, in fact, that really cinched her decision to major in the field. “I knew I wanted to do something related to the environment, but policymaking isn’t where my heart lies,” she said. “Policy is tremendously important, but I’m more drawn to the technical side of things.”

“I like creating tangible solutions,” she said.

## STUDENT ACHIEVEMENTS

**CONGRATULATIONS TO ALL CEE STUDENTS WHOSE ACADEMIC AND RESEARCH ACHIEVEMENTS WERE RECOGNIZED IN 2022-23 INCLUDING:**

Graduate School Summer Research Fellowship:  
**KHASHAYAR AGHILINASROLLAHABADI**

Bechtel Graduate Award:  
**ANJUMAN AKHTER**

Lieutenant General John W. Morris II Graduate Fellowship:  
**MOHAMMAD AL-KHASAWNEH**

Maryland Transportation Institute Student Competition, Carnegie Mellon University Interdisciplinary Transportation Engineering, Economics, and Policy PhD Fellowship:  
**LEVAN TEJA BURRA**

Graduate School Summer Research Fellowship: **XIAOJUE CHEN**

Outstanding Graduate Assistant Award:  
**KRISTEN CROFT**

Best Doctoral Research Award:  
**SONGHUA HU**

# Kristen Croft

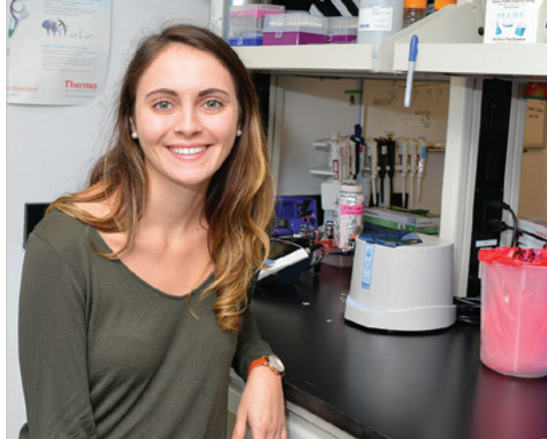
By Joanna Avery

Civil and environmental engineering (CEE) Ph.D. candidate Kristen Croft recently won the 2023 Outstanding Graduate Assistant Award in the category of Outstanding Research Assistant. Croft won for her contribution to faculty research, mentoring other graduate and undergraduate students, having evidence of promise as a researcher, and having evidence of scholarly achievements. Croft is co-advised by Drs. Birthe Kjellerup and Allen Davis.

"It was an honor to first be nominated for this award by my advisors and then to receive this award. It was a reminder of all the hard work I've done over these past 4+ years and the achievements I've made along the way," said Croft. "This award came at a time where I had several rejections from other such things, and for me personally just felt like, 'wow I needed a win!'. I am grateful to be recognized with this award for my efforts and achievements as a GRA."

Currently, Croft is working to complete her Ph.D. dissertation focused on the evaluation of stormwater management practices for the treatment of organic and inorganic pollutants from industrial stormwater. Mainly, she is concentrating on heavy metals such as copper and zinc. These metals aren't necessarily toxic to humans, but they have a heavy impact on aquatic environments. As an example, the salmon population near Washington state is a large part of the local economy. However, copper and zinc negatively impact the population of salmon, which then affects communities in the area.

Croft has turned her attention toward bioretention systems as a possible solution to remove these metals from aquatic environments. These systems layer soil, biochar, activated carbon, and even some plants that have the potential to absorb undesirable metals, therefore, removing them from the larger ecosystem.



***"I FEEL THAT AS LONG AS I CAN MAKE SMALL CHANGES, EVEN IN A SMALL COMMUNITY, THAT WOULD BE ENOUGH."***

"These systems act like a huge filter. They are really good at removing particulates, and some of the metals might be attached to soil particles. Many of these metals are already getting removed really well with these systems," said Croft.

Even as an undergraduate, Croft felt driven toward her area of research. She started off as an industrial engineer, but an undergraduate class on environmental geology motivated her to put her mind toward solving environmental problems and making a difference, after which, she switched her major to environmental engineering.

"I was really motivated by the class and motivated to work on those kinds of problems. I feel that as long as I can make small changes, even in a small community, that would be enough," said Croft.

In addition to her research, Croft has led an involved extracurricular life at the University of Maryland. She served as a TA for two classes, mentored undergraduates in their research in the lab, and even mentored a high school student. She has been named a Clark Doctoral Fellow, a UMD Global STEWARDS Fellow, and served as the President of the CEE Graduate Student Council.

American Society of Civil Engineers "New Faces of Civil Engineering" Award, HNTB Community of Minority Transportation Officials (COMTO) National Scholarship, Intelligent Transportation Society of Maryland Scholarship:  
**LIVINGSTONE IMONITIE**

Lieutenant General John W. Morris II Graduate Fellowship: **ALIAKBAR KABIR**

Dr. Matthew W. Witczak Graduate Award:  
**ERIN KAYA**

Stanley R. Zupnik Fellowship:  
**CAITLIN KENNEY**

Compost Research & Education Foundation Scholarship: **SAI THEJASWINI PAMURU**

Clark Doctoral Fellowship, UMD Global STEWARDS NSF NRT Fellowship:  
**CAMILA PROANO**

Clark Doctoral Fellowship:  
**ARTURO RAMIREZ**

Harkins Group Fellowship: **POOYA REZVAN**

UMD Global STEWARDS NSF NRT Fellowship:  
**AMIR RIHAYI**

Ann G. Wylie Dissertation Fellowship:  
**MARIA RODRIGUEZ**

UMD Alumni Association Scholarship, American Public Transportation Association Nat Ford Scholarship Award, Clark Doctoral Fellowship Mid-Career Award, Community of Minority Transportation Officials (COMTO) Julie Cunningham Legacy Scholarship:  
**NNEOMA UGWU**

Best Master's Research Award, Lieutenant General John W. Morris II Graduate Fellowship, NSF Natural Hazards Engineering Research Infrastructure (NHERI) Hackathon:  
**LINDA WATERS**





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### LIGHT RAIL IS COMING

to the University of Maryland (UMD) campus as construction of the Purple Line continues. The line, linking several Maryland suburbs, will provide new transit options for UMD students.

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