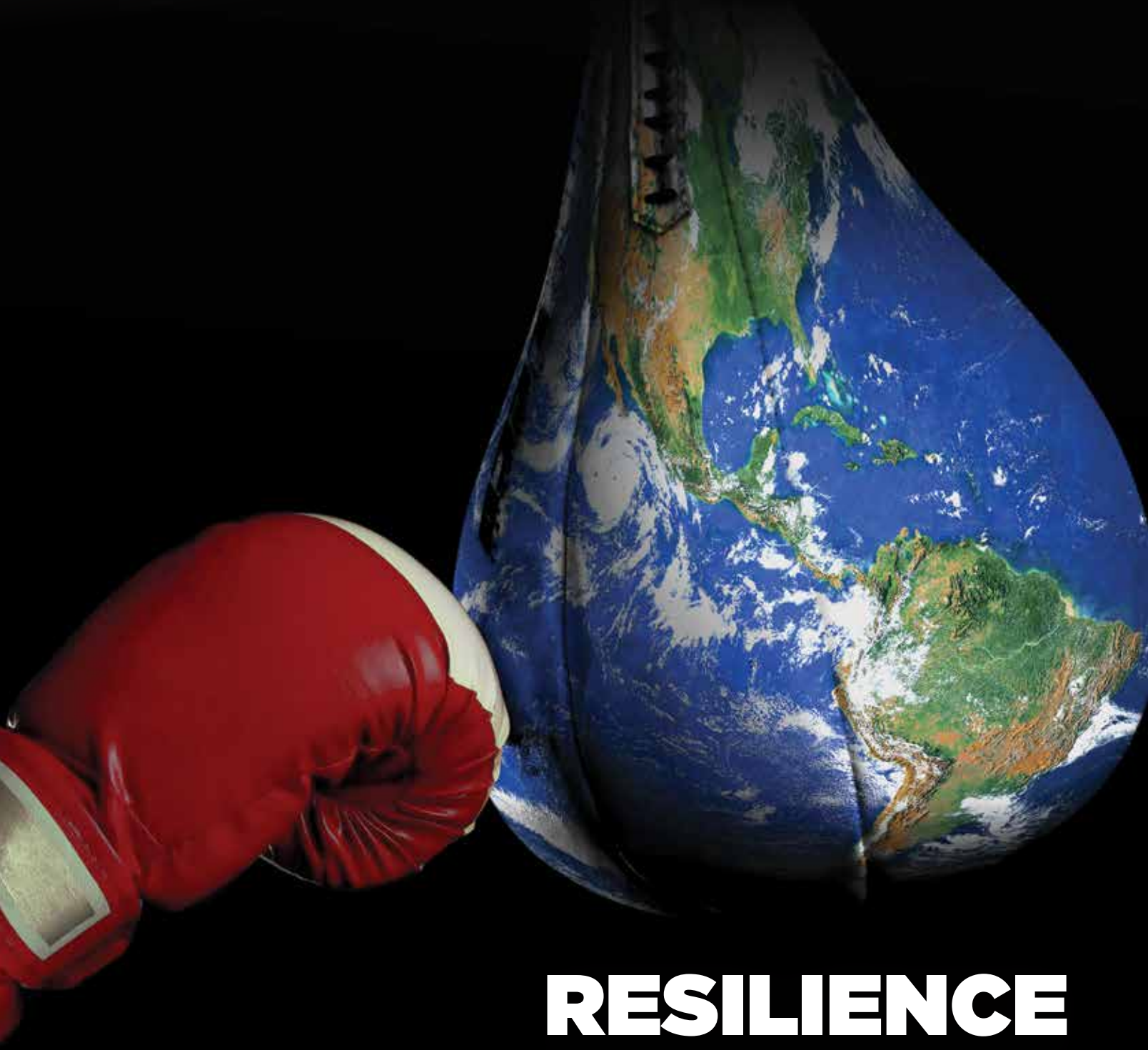
FALL 2019 | THE A. JAMES CLARK SCHOOL OF ENGINEERING

CIVILREMARKS

CIVIL AND ENVIRONMENTAL ENGINEERING AT MARYLAND



RESILIENCE

Civil and environmental engineers respond to the challenges of a world in flux

Chair's Message

In the minds of many, civil and environmental engineers wear hard hats, use surveying equipment, and pore over blueprints and diagrams. We aren't often accorded superhero status. Yet our field has a critical role to play in addressing the environmental and sustainability challenges that face our society, nation, and planet.

While policymakers can point to problems and set goals, an engineer's skill set is very often required to devise actual solutions. Survey after survey points to intense concern about environmental and sustainability issues among Generation Z, which includes many of those now attending or preparing to attend college. To that generation, I say: "Want to save the world? Become a civil or environmental engineer!"

In this issue of *Civil Remarks*, you'll learn about some of the ways our profession is helping to address the challenges of an environment in flux. With a faculty that includes internationally renowned experts on water resource management, disaster resilience, and infrastructure, the Department of Civil and Environmental Engineering—and, more broadly, the A. James Clark School of Engineering—is a hub for the research, innovation, and technological ingenuity that will be needed to meet these challenges.

I am particularly delighted to welcome our newest faculty member, Deb Niemeier, who joined us this summer as our inaugural Clark Distinguished Chair. She is the first of several chairs endowed by the Clark Foundation as part of a $220 million investment designed to strengthen our capacity for Fearless Ideas. When it comes to environmental issues, it is just such ideas—rather than superhero costumes or capes—that will make all the difference.

Charles W. Schwartz, Ph.D.
PROFESSOR AND CHAIR
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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Please send letters to the editor and alumni notes to ceenewsletter@umd.edu.

RESILIENCE

Perhaps Sir William Halcrow, a renowned builder of tunnels, said it best. Soon after World War II—during which he helped design air raid shelters as well as portable harbors used during the landing at Normandy—he gave an address to the Institution of Civil Engineers, of which he was president. "The well-being of the world largely depends upon the work of the engineer," he declared.

Today, as the world grapples with problems such as climate change, extreme weather, social inequities, and decaying infrastructure, Halcrow's words ring no less true. From devising green technologies to harnessing computers to better gauge environmental impacts, civil and environmental engineers contribute their skills and know-how to what may be the gravest imperative our species has yet faced: that of ensuring a livable future. Their work, more than ever before, is carried out with an eye to resilience and sustainability: crucial concerns in a time of environmental upheaval.

And the challenges are many. (CONT. PAGE 2)

Civil and environmental engineers respond to the challenges of a world in flux

Researchers in the lab study how nutrients and metals can be removed from stormwater before they impact the local waterways.

PHOTO: THAI NGUYEN

Ph.D. student Dylan Owen (front) and undergraduate student Daniel Reise conduct tests in an environmental engineering lab headed by Allen P. Davis, Charles A. Irish, Sr. Chair in Civil Engineering at UMD.

Take bridges, for instance. Standing up a bridge is a costly investment, so the structure must be able to endure for decades, even centuries. Once built, a bridge not only supports the flow of traffic across it, but underpins economic activity in the areas that it connects. With sea levels rising, engineers may have to reconsider the height margins needed to protect a bridge from storm surges. The parameters relied on before may, in the coming decades, no longer suffice.

Or consider stormwater management. To prevent pollutants from washing into bodies of water such as the Chesapeake Bay, states install treatment and water systems. Changes in the regional climate, in combination with anticipated sea level rises, can impact the capacity of these systems.

"Stormwater discharges are meant to go from land into the water, and if sea level rises continue, then they can inundate some of the outfalls and the water starts going in the opposite direction," notes Allen P. Davis, Charles A. Irish, Sr. Chair in Civil Engineering at the University of Maryland (UMD). "That's not good."

"On the other hand, some systems function better in warmer temperatures. There could be a mix of positives and negatives," adds Davis, who heads a laboratory dedicated to the study of inorganic pollutants. Among other areas, researchers in the lab study how nutrients and metals can be removed from stormwater before they impact the local waterways.

Exactly how environmental conditions will change in the coming decades remains uncertain—and the uncertainty becomes greater the farther ahead we look. Thus the challenge for civil and environmental engineers becomes even steeper. They must plan not only for today's conditions, but for the projected conditions 50 or 60 years from now.

And those projections could be well off the mark.

GOODBYE, STATIONARITY?

In recent years, many engineers have begun to question the adequacy of an influential assumption. Simply put, it's the assumption that past observations of natural systems yield reliable estimates of future behavior.

This assumption is known as *stationarity*. As United States Geological Survey researcher Paul C.D. Milly and his co-authors put it in an influential 2008 paper, it's the "idea that natural systems fluctuate within an unchanging envelope of variability."

To be clear, stationarity does not imply that things don't change, but rather that the pattern of change is predictable. Nature fluctuates, but in ways that are known—and can be anticipated by studying the recorded data.

But climate change has made stationarity untenable, Milly argued. Precipitation rates are altering dramatically, as are runoff patterns; atmospheric humidity is increasing, while melting glaciers create springtime floods and summer droughts. Taken together, the changes are bringing about degrees of variability that exceed historically observed parameters.

"In view of the magnitude and ubiquity of the hydroclimatic change apparently now under way…we assert that stationarity is dead," Milly wrote.

Michelle Bensi, a former Nuclear Regulatory Commission (NRC) engineer who joined the UMD civil and environmental engineering (CEE) faculty in 2017, goes a step further: not only has the concept run into problems now, but the mindset it reflects has been questionable all along.

In reality, Bensi argues, we have never had sufficient data to understand natural processes as fully as we would like. Gaps exist in our understanding of how nature behaves—including climate—and engineers, planners, and policymakers make decisions each day based on incomplete knowledge. "We may act as though we have all the information," she says. "Very often, we don't."

In assessing flood hazards, for instance, planners often make calculations based on historical data, using it to determine how often floods of a certain magnitude are likely to take place. That data might show that a flood event has a 1% chance of being equaled or exceeded in any given year, in which case it is deemed a "100-year flood." But that assessment is limited by the available information, Bensi says. With better numbers and models, we might discover that so-called 100-year floods aren't as rare as we'd thought.

That's why it's potentially hazardous to design structures that depend too heavily on a "known" variable, such as expected flood hazard. Instead, Bensi says, resilience-conscious engineers seek to include sufficient margins of safety—that is, by not building too close to a figurative cliff's edge, and by looking beyond conventional engineering strategies. "Just because the calculations show you can build at a certain elevation doesn't necessarily mean you want to build at exactly that elevation," she says. "You might want to go a little higher, or have additional measures in place to address uncertainty in hazard assessments."


PHOTO: AL SANTOS

UMD Assistant Professor of Civil and Environmental Engineering MIchelle Bensi.

CRITICAL INFRASTRUCTURE AT RISK

Bensi's interest in uncertainty stems in part from her past work at the NRC. The nuclear power industry, she says, has "a very strong safety culture and low risk tolerance," and the reasons are multiple. Building a nuclear plant requires an enormous capital investment that can take decades to recoup. And nuclear accidents, while rare, can have significant consequences.

Case in point: the 2011 Fukushima Daichi nuclear disaster, in which waters from an earthquake-generated tsunami overtopped a sea wall meant to protect the plant, flooding generators needed to cool its reactors and ultimately causing three meltdowns. For the global nuclear industry, the disaster served as a wake-up call, spurring a reassessment of the threat posed by natural hazards. Plants now incorporate a greater number of mitigation measures designed to factor in the unexpected.

But nuclear facilities aren't the only ones that require careful thinking about severe hazards; the energy sector in general is potentially vulnerable. The city of Houston, for instance, is a hub for petroleum and gas production. Intense rainfall and flooding could potentially compromise storage tanks at these facilities, creating leaks and leading to the release of hazardous materials.

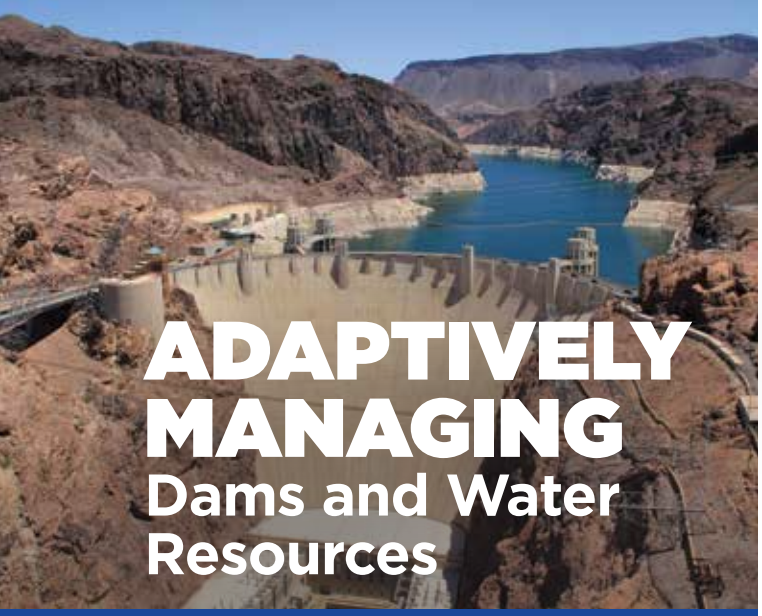
TWO TYPES of Uncertainty

When considering how unknowns can affect projections, it can be important to specify what kind of unknown we're dealing with. Statisticians distinguish between two broad types of uncertainty: *epistemic* and *aleatory*.

The first type arises as a result of insufficient data or knowledge; a classic example is the Tacoma Narrows Bridge collapse in Washington state. During its construction, the giant suspension bridge had already earned the nickname "Galloping Gertie" because of its tendency to oscillate during windy conditions. The bridge opened in July 1940, and then, on a blustery day in November, gyrated wildly until the main span finally broke loose and dropped into Puget Sound, carrying along with it an unlucky dog (all humans had evacuated to safety). The engineer who designed the bridge, Leon Moisseiff, suffered public blame and an end to his distinguished career—yet his design had adhered to industry standards. Eventually, engineers attributed the collapse to torsional flutter, a phenomenon poorly understood at the time.

The second type, aleatory uncertainty, refers to the inherent unpredictability in natural processes. Weather forecasters deal with unknowns like these on a regular basis; for instance, as they try to provide accurate information about the track of a storm.

Climate change involves both kinds of uncertainty: some of the variables have yet to be understood fully, and the phenomenon of climate change may be introducing additional variability into some natural processes, such as precipitation patterns.



ADAPTIVELY MANAGING
Dams and Water Resources

While new engineering projects can be designed to adapt to changing conditions, much of the major water infrastructure in the United States is already in place. The nation's most important dams, including Hoover and Grand Coulee, were constructed during the New Deal era, notes UMD's Gregory Baecher, a leading dam expert and member of the National Academy of Engineering. During World War II, they powered America's aluminum production—so crucial to toppling the Axis powers. Decades later, they are still important drivers of economic activity.

Dams such as these won't be replaced any time soon, Baecher says, and they don't need to be. But shifting climate patterns have presented the U.S. Army Corps of Engineers, which operates the big dams, with some difficult dilemmas.

In 2019, for example, spring floods inundated the Midwest. With warmer temperatures melting snow in the Rockies more quickly, water levels on the Missouri River rose. Higher-than-normal precipitation swelled them further. To prevent the Missouri's dams from overtopping, the Army Corps of Engineers opened the floodgates—and inundated farms located downstream.

The farmers were not happy. But neither were conservationists who worry about threats to river species, such as the plovers nesting in sidebars: their young can wash away if water levels are too high or die from dehydration if the levels become too low.

Dam operators, as well as federal, state, and local authorities, will continue to face problems like these in the future and will need to devise water management practices that can mitigate the impact.

"With water resources generally, we're very often dealing with operational rather than design challenges." Baecher notes. "The infrastructure is there, and it's not feasible to rebuild it. So the focus is on adaptive management."

The Department of Homeland Security has identified 16 sectors that constitute "critical infrastructure" for the United States: the chemical sector; communications; critical manufacturing; dams; the defense industry; emergency services; the energy sector; financial services; food and agriculture; government facilities; healthcare and the public health sector; information technology; the nuclear reactors, materials and waste sector; transportation and transportation systems; and waste and wastewater systems.

Many of these sectors directly involve civil and environmental engineers. All are vulnerable to environmental hazards, including risks specifically associated with climate change.

THE BUSINESS COST OF ENVIRONMENTAL UNCERTAINTY

Improving resilience is costly; failure to do so can, in the long run, be much costlier.

That's a lesson borne out by an apparent uptick in extreme weather events affecting the North American continent: in 2018, for instance, the United States experienced no fewer than 13 weather and climate-related disasters costing more than $1 billion each, according to Geostrata, a publication of the American Society of Civil Engineers (ASCE). The previous year, a succession of major storms—including Hurricanes Harvey, Irma, Jose, and Maria—drained more than $200 billion from the U.S. economy.

About 10% of the nation's gross domestic product (GDP) could be lost to climate change by the end of the century, combined with more frequent power outages, fuel shortages, and disruptions to transportation and critical services, according to data from the U.S. Global Change Research Program and the National Climate Assessment.

Even without climate change, America's infrastructure is in worrisome shape: ASCE famously gave it a D+ grade in its landmark 2016 study, *Failure to Act: Closing the Infrastructure Investment Gap*. Our already aging, insufficiently maintained infrastructure is now being strained further by extreme weather events, including intense precipitation, coastal flooding, summer heat waves, and wildfires.

Disrupted weather patterns impact infrastructure in a number of ways. Rising temperatures can alter a structure's physical properties and undermine its bearing capacity. More intense precipitation can cause structures to erode more rapidly, in addition to heightening the risk of floods, mudslides, or other calamities. Droughts, on the other hand, mean an increased risk of wildfires. Architects and engineers, in the coming years, will need to design structures with such threats in mind.

PHOTO: THAI NGUYEN

UMD Civil and Environmental Engineering Professor Bilal Ayyub.

Mindsets and long-established practices can be hard to change, especially when added costs are involved. To help spearhead change within the engineering profession, ASCE established a committee and tasked it with developing a Manual of Practice for climate-resilient engineering. Chairing the committee was CEE professor Bilal Ayyub, a Distinguished Member of ASCE and an honorary member of the American Society of Mechanical Engineers (ASME). Ayyub directs UMD's Center for Technology and Systems Management and was an official reviewer for the National Academies of the 2018 Fourth National Climate Assessment.

The Manual of Practice, *Climate-Resilient Infrastructure: Adaptive Design and Risk Management*, was published in 2018. It covers a wide range of guidance on how to design for uncertain environmental conditions—for example, by utilizing computational methods to determine probable flood loads.

The manual has provoked considerable enthusiasm among ASCE members. "We are seeing a sense of urgency among industry leaders," Ayyub said. "Here in the United States alone, we're building about $1.3 trillion in new infrastructure each year, and anything we build might be with us for the next 50–100 years. If we fail to change our practices to account for a changing climate, our massive investments could turn into catastrophic losses."

Undergirding the new Manual of Practice are two principles: non-stationarity and adaptive design. Non-stationarity is a radical departure from the long-held assumption described earlier in this article: in essence, it means recognizing that a physical process may have different attributes in the future than it had in the past. Therefore, recorded observations cannot be taken as a sure guide to future behavior.

The second principle, adaptive design, refers to a design philosophy that both factors in a greater degree of uncertainty—in other words, refrains from the "cliff's-edge" approach noted by Bensi—and bakes in more flexibility, allowing a structure to be modified as needed instead of having to be torn down and replaced at steep cost.

"As engineers, we have a professional and ethical responsibility to align what we do with the demands of an uncertain future. We need to change our practices to account for climate-related phenomena," Ayyub said.

"We have to lead the profession in the direction of change."

Green Contracting... with Incentives Baked In

Green technologies help protect the environment, but are they a boon to business? In the past, many companies and organizations balked at the cost. But not all planet-friendly practices dent the bottom line; indeed, some can save costs and yield added revenue.

An example, says Associate Professor Qingbin Cui, is the use of recycled highway materials to build or replace pavement. It's not only cheaper than hot-mix asphalt, but generates less emissions. The lowered emissions earn credits that can then be traded on the carbon emissions market.

"It's one way to move green technology from the 'cost' to the 'revenue' side of the balance sheet," Cui says.

Cui has collaborated with a Maryland-based business leader, Harold Green, to test the methodology and develop a framework for quantifying the emissions reductions. Their work, carried out over several years, has borne fruit: earlier this year, the framework was officially accepted by Verified Carbon Standard (VCS), the world's largest greenhouse gas reduction program. VCS has certified almost 1,500 projects to date, leading to the reduction or removal of more than 200 million tons of carbon and other emissions from the atmosphere.

Manufacturing hot-mix asphalt—the traditional method that contractors have relied on since the dawn of the automobile era—is a messy, complex procedure. Not only does it create pollution, but the mix must be transported from the plant to the worksite, thus releasing more carbon dioxide into the atmosphere and racking up fuel costs.

Recycled pavement, by contrast, is manufactured on site through a non-thermal process that uses foamed asphalt—a mix of air, water, and bitumen—to bind together the reclaimed material. Green, who runs multiple companies, including Chamberlain Contractors and GRR Engineering, believes it will win widespread acceptance as more and more organizations see the benefits. "It's environmentally friendly and a lower cost material, and it's equal to many conventional hot-mix asphalts," he says.

Not that it will happen overnight. "Changing the way we engineer our parking lots and road systems takes time," Green acknowledges. "People have to change their mindsets and look beyond the methods they're used to, and that can be a lengthy process. But in 20 or 30 years, I believe, this will be the standard."

Cui, meanwhile, sees harnessing market forces as a way to change mindsets and behavior, to a degree that is hard to accomplish through regulation alone.

"Environmentally friendly practices are often seen as expensive. You have to pay fees to obtain green certification, and you're adopting different methods and materials that cost more than what you're used to paying. Use of recycled materials is different. It's an example of a technology that not only helps the environment, but can provide savings and even be a source of revenue," he notes.

"That's important, because most organizations are worried about the cost factor," Cui says. "When there's a significant economic incentive, then we can expect to see changes start to take place."

RECYCLE, REUSE, REPAVE!

From full-depth reclamation to cold in-place recycling, there's more than one way to salvage worn-out asphalt pavement. A method known as Foamed Asphalt Stabilized Base (FASB) has been the focus of research by Charles W. Schwartz, professor and chair of the CEE department. At the request of the State Highway Administration, Schwartz has conducted studies designed to assess whether a specific type of FASB could be introduced successfully in Maryland.

"Most of the experience with FASB has been in regions that differ greatly from Maryland in terms of their climate and traffic conditions," Schwartz explains. "Maryland also has specific design standards that must be met."

FASB uses foamed asphalt to bind a combination of reclaimed asphalt pavement, recycled concrete, and graded aggregate base. Schwartz's study included field evaluation of the pavement's performance over time, factoring in weather effects, compaction, and other parameters.

Through his research, Schwartz was able to compare how the properties of FASB pavement—such as stiffness—compare to conventional pavement. The SHA is using data from the report to develop pavement design recommendations, mix procedures, guidelines for production and placement, and quality assurance procedures.

"We found that pavement can indeed be constructed in this way and meet our state's rigorous design standards," Schwartz said. "There are differences in the way it behaves compared to hot mix asphalt, and those differences have to be factored in. But it's clearly a viable approach, one that will work here in The Old Line State."

It was an opportunity to experience another part of the world—and build expertise about engineering solutions that could be crucial to our planet's future.

Just after spring semester classes wrapped up at UMD, a group of students traveled to Iceland to begin their summer studies under the guidance of civil and environmental engineering faculty member Natasha Andrade and Michael Galczynski, an instructor in the Clark School's Keystone program. They would spend the next two weeks based in Rejkjavik, with day trips to a variety of other locations.

Why Iceland? The small, northerly island country holds particular significance for those with an interest in renewable energy: except for small diesel generators used to power fishing boats, it meets all its energy needs through renewables, particularly thermal and hydroelectric.

"Iceland makes very good use of its resources," Andrade explains. "They don't have coal or oil, so they use what they have—which is water and geothermal energy. Seventy-five percent of Iceland's electricity comes from hydroelectric power plants, and the rest comes from geothermal power plants. About 98% of its heat comes from geothermal power plants."

During their stay, students conducted in-depth research on Iceland's past, present, and future energy needs, and they capped off the program by coming up with designs for hydropower and geothermal power plants in specific locations around the country. These were not rough concepts, Andrade says, but detailed proposals that required the students to delve deeply into the technical aspects of plant design.

And they did so with the larger issue—sustainability—in mind. "If we are aiming to achieve sustainable development, then we have to be looking at renewables," Andrade says. "But the solutions are not always simple. Hydropower, for example, can have an impact on ecosystems, as well as on people living in the areas that need to be flooded in order to build the dams. Sustainability has three pillars—environmental, economic, and social—and all three need to be considered."

All in all, the Iceland experience "was everything I wanted: hands-on research in sustainable power, plus the most stunning landscapes and natural features I've ever seen," said Sam "S.C." Giedzinski, a junior studying mechanical engineering.

He added: "Icelanders have a deep understanding of comfort foods, so our meals were fantastic!"

STUDYING SUSTAINABLE INFRASTRUCTURE IN CATANIA, ITALY

While Andrade and her students were exploring energy sustainability in Iceland, another summer program—led by Civil and Environmental Engineering Associate Professor Dimitrios Goulias—was heading southwards, to Catania, Italy. Sustainability was the overarching theme for their program as well, but with a different focus: rather than designing plants, they were examining infrastructure—buildings, roadways, or entire communities—with an eye to introducing sustainable practices.

Take roadways, for example. "Roads have to be maintained and repaved, but there are options for doing this in a more environmentally-friendly manner," notes Goulias. "You can recycle the entire roadway, taking the asphalt layer, rejuvenating it with new materials, then putting it back in place [Related article: "Recycle, Reuse, Repave!", page 6]. It's possible to make use of glass or even the rubber from recycled tires. However, we have to consider not only the technical side of the problem, but also the costs and benefits."

Students in the program "worked together with their counterparts from the University of Catania to study particular situations—buildings or roads, for instance—and look at sustainable alternatives," Goulias said. "They then drew up presentations in which they showed how their alternatives compare to conventional methods, as well as to other sustainable solutions."

PHOTO: SAM "S.C." GIEDZINSKI

Program participants lauded the blend of engineering collaboration and cultural immersion.

"Studying in Catania alongside Italian engineering students was unforgettable, and exploring the city and immersing ourselves into the culture and cuisine helped to create an enriching experience overall," said Nathan Collahuazo.

For fellow sophomore Abby Bollinger, the program was "a truly enlightening experience…I was able to witness a different culture and gain confidence in myself by stepping out of my comfort zone."

Summer study abroad programs are offered each year by multiple departments within the A. James Clark School of Engineering, in coordination with Education Abroad and the Office of Global Engineering Leadership.

PHOTO: SPECIAL COLLECTIONS, UNIVERSITY OF MARYLAND LIBRARIES

Civil engineering students pictured with surveying equipment and a professor at Maryland Agricultural College, circa 1890–1910.

EVELYN BARSTOW HARRISON, '32

THE FIRST WOMAN TO EARN AN ENGINEERING DEGREE AT MARYLAND

As she pursued her chosen major—civil engineering—Evelyn Barstow Harrison (1916–2000) not only mastered a rigorous field but overcame widespread preconceptions about its suitability for women. A Washington Post reporter who interviewed her in June 1932 could hardly conceal his incredulity. "How on earth did you happen to select civil engineering for a profession?" he asked. Nearby, a group of male friends waited for Harris to finish the interview and attend a swimming party. "It was just a chance," she replied. "I wanted a scientific career, and before I knew it I had signed up for a course in civil engineering. What was there to do but to go through with it?"

Harrison's can-do spirit took her far. After graduation, she landed a job with the federal government and served through four successive administrations, participating in numerous endeavors aimed at advancing gender and racial equality. In 1955, she became a deputy director of the Civil Service Commission; in 1962, she was honored with a Federal Woman's Award, presented to her in person by President John F. Kennedy. She retired in 1971.

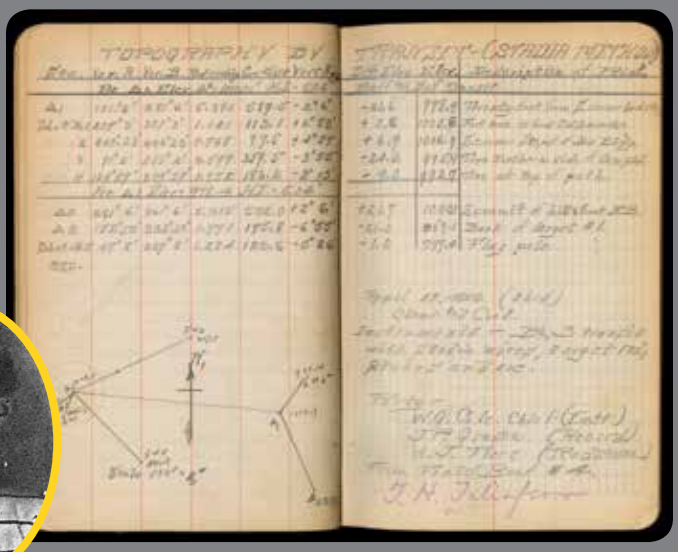
Honors student, salutatorian, track and field star, and military Oswald Hurt (O.H.) Saunders used this field notebook in the spring of 1909, during his junior year at the Maryland Agricultural College. As a civil engineer, Saunders conducted much of his lab work outdoors, mapping and surveying. He recorded observations and field work in this journal, now preserved by University Archives.

Daring Vision, Lasting Impact:

Over a Century of Civil Engineering at Maryland

It's been 125 years since the establishment of an engineering program at what was then known as Maryland Agricultural College. The predecessor institution has since transformed into today's University of Maryland—and engineering has burgeoned along with it, building a rich and enduring legacy of research, learning, and achievement. Join us as we celebrate 125 years of daring vision and lasting impact.

Civil engineering was not the first engineering program established at the school that eventually became UMD—that honor goes to mechanical engineering, introduced in 1894. But it wasn't far behind. Fourteen years later, in 1908, the Department of Civil Engineering was established, followed soon after by the Department of Electrical Engineering. Early curriculum focused on "ag-adjacent" coursework appealing to the Maryland farmstead. From the outset, the civil engineering program was known for its intense rigor: students shouldered roughly 150 credit hours in environmental, geotechnical, structural, transportation and water resources engineering, surveying, and project management.



A. James Clark School of Engineering 125 Years 1894 2019

In the 1920s, the department established a "learning laboratory" on Route 1, where students and faculty examined chunks of pavement, known as road cores, in order to understand the properties of different road materials and their interactions with subsoil. While the Route 1 facility is long gone, the department's contribution to road and highway engineering continues, with researchers now developing new, more efficient, and environmentally friendly methods of pavement construction. Beyond research on roads and highways, the department has become a major center for transportation studies, with some of the world's most gifted researchers and students investigating ways to make travel safer, faster, and more efficient.

The growth of the department over the past century has coincided with the ongoing expansion of urban areas, including not only cities and towns but newer arrivals such as suburbs, exoburbs, and planned communities such as Columbia and Reston. And graduates of the department have been pivotal in engineering the structures found in this growing urban landscape. Look around you: very likely one of the buildings you'll see is the work of Clark Construction, one of the largest commercial and civil contractors in the nation. Its founder, A. James Clark, is a '51 alumnus, and the engineering school—now known as the A. James Clark School of Engineering—honors his legacy.

The world has changed during the 75 years since the civil engineering program was established, and the field has changed as well. While engineers still strive to design high-quality new structures, they are increasingly also concerned about resilience and sustainability. Many now focus their attention on aging roadways, bridges, dams, and other building types, while engineering new materials and methods for the future. Many specialize in areas such as water resource management, disaster mitigation, sanitation, and environmental preservation. A name change in 1999 reflects the broader scope: the Department of Civil and Environmental Engineering, as it is now known, draws students with a keen interest in the long-term well-being of the natural as well as the built environment.

Concrete Canoe, 1977.

COMPETITIONS HAVE LONG BEEN A DRAW FOR UMD ENGINEERING STUDENTS. In 1976, a group of enterprising students formed a successful team of engineers and constructors of concrete canoes to participate in local competitions. The UMD team has advanced to the national competition, hosted by the American Society for Civil Engineers, 13 times beginning in 1988. The team has paddled their way to victory by placing within the top five of national competitions four times and has also won the Mid-Atlantic Regional Competition numerous times.

Early course descriptions were wordsmithed to appeal to Maryland farmers.

The 1920–1921 catalog identified ways that the civil engineering student gained practical experience: "Information and advice is given [by civil engineering students] to farmers... concerning drainage, sanitation, water supply, lighting, farm machinery... whenever possible."


PHOTO: AL SANTOS

ALTERRA

UMD RESEARCHER SHEDS LIGHT ON SORPTION

Microplastics—tiny fragments of plastic—regularly end up in our drains. They can include small bits of plastic shed from a scrubbing brush while we're washing dishes, fibers from polyester clothes, or the microbeads found in toothpaste, cleansers, and exfoliants.

Chemicals spill into our drains as well, often as a result of using pharmaceutical and personal care products (PPCP). When microplastics and chemicals mix, they become multiple stressors to the environment: that is, they pose a greater risk to organisms together than they would alone. The microplastics act as carriers for pollutants, transporting them much farther than they could go on their own, explains Alterra Sanchez, a civil and environmental engineering doctoral candidate conducting research through the Marine Estuarine and Environmental Sciences program program.

"These tiny plastic fragments and the pollutants they carry are flowing into our rivers and oceans, and can end up in the seafood we eat," she explains.

Working with Dr. Alba Torrents and co-advisor Dr. Lance Yonkos, Alterra has been conducting research that sheds new light on the interaction between microplastics and PPCP chemicals—and suggests gaps in the way it is currently being studied.

At the core of her investigation is a process that resembles dirt or oil trapped in a sponge. When organic pollutants come in contact with microplastics, they adhere and do not want to come off. Environmental scientists refer to this bonding as *sorption*, and it creates a hidden environmental hazard, Alterra notes.

"The microplastics, carrying the pollutants, can travel from wastewater treatment plants into rivers, and then the ocean, where they may release these pollutants in pristine waters that previously have not been exposed to these chemicals. Fish and marine birds like to eat microplastics, especially red and orange pieces that look like shrimp, so they will be exposed to PPCPs," she says.

Scientists seeking to measure the extent of this problem have investigated how different microplastics interact with chemicals and how they may increase exposure to wildlife. However, Alterra says research up until now has not always considered all the important variables involved.

"The amount of sorption is influenced not only by plastic type, but also size and surface area," she says.

Alterra reached this conclusion by closely studying the interaction between triclocarban—an antibacterial chemical widely used in soaps and lotions—and simulated weathered microplastics of the kind that can end up in the water supply.

Harvesting microplastics isn't easy to do, so she used a different approach: she created her own collection. "The particles I made are pitted and deformed, like the plastic pieces you would find in the environment," she says.

Because she studied a variety of plastic types, sizes, and surface areas, she was able to show that, when it comes to sorption, particles vary sometimes in unexpected ways. Testing two types of plastic—polypropylene (PP), which is used in plastic food wraps; and high-density polyethylene (HDPE), used to make most reusable water bottles—she found triclocarban stuck to PP much more.

"It turned out that PP is a much better sorbent for this chemical, compared to HDPE," Alterra said. "PP also has a greater surface area. That means not only a greater tendency for sorption, but that there is much more space for the sorption to occur. As a result, PP could present more of a hazard in terms of toxicity for chemicals like triclocarban."

The finding is a surprise, Alterra says. "It challenges the current understanding that polyethylene is usually a better sorbent for organic pollutants. The discovery was possible because I used different sizes and types of microplastics, each with a different surface area," she says.

"In the future, scientists will need to consider particle size and surface area, not just plastic type, when testing microplastic toxicity."

Alterra Sanchez prefers to be addressed by her first name; no mistake has been made by the author.

CONGRATULATIONS TO ALL CEE STUDENTS WHOSE ACADEMIC AND RESEARCH ACHIEVEMENTS WERE RECOGNIZED IN 2018–19, INCLUDING:

YAO CHENG, ELHAM SHAYANFAR, MICHAEL WHITEMAN, ANN G. WYLIE, Dissertation Fellowship, University of Maryland Graduate School

MARIA COELHO, ERICA FORGIONE, JONGMIN PARK, GAOHONG YIN, Future Faculty Fellowship, A. James Clark School of Engineering

BRYAN CROCE, International Student Award, A. James Clark School of Engineering

KRISTEN CROFT, Clark Doctoral Fellowship, A. James Clark School of Engineering

MICHELLE HUFFERT, 2019 Master's Award, Department of Civil and Environmental Engineering

RAYMOND RAN JING, 2019 Ph.D. Award, Department of Civil and Environmental Engineering

LIANG LIANG, Three-Minute Thesis Award, University of Maryland Graduate School

AMANDA O'SHAUGHNESSY, Hollings Undergraduate Scholarship, National Oceanic and Atmospheric Administration

ZHIJIANG "RIVER" YANG, 2019 Education Award, American Chemical Society Agro Division

ZHENG ZHU, Outstanding Graduate Assistant Award, University of Maryland

RUSSELL BUMANGLAG

"I LIKE LEARNING…HOW WE CAN IMPACT PEOPLE'S LIVES."

Russell Bumanglag is a senior in the CEE department, where he is pursuing the geotechnical and structures track. Born in the Philippines, Russell moved to the U.S. with his family at age 10, and has lived in Maryland, Massachusetts, and Michigan (where his family currently resides). He has been very involved in the department while at UMD. Last semester, he was awarded the Civil and Environmental Engineering Department Chair's Award, presented to a student for the most significant contribution to the department.

Russell says he was drawn to the CEE department because of his interest in infrastructure and "building big things." However, a course outside the department that he took as a freshman was the first to confirm his passion for civil engineering; it was a geography course about problems in developing countries, and Russell noticed that the solutions to these problems often involved building infrastructure. For him, this reinforced the importance of the civil engineering profession.

Russell says his favorite thing about being a civil engineering major is "learning the technical aspect as well as the social aspect of what being a civil engineer means, and learning how we can impact people's everyday lives." He cites ENCE215, "Engineering for Sustainability," as an example of a course that emphasizes the profession's social impact.

Russell has enjoyed many of his courses in the department. He says that ENCE305, "Fundamentals of Engineering Fluids," is his favorite of the courses he's taken, as it is "challenging but the concepts are interesting." The same is true, he adds, of two other courses he's found especially valuable, ENCE340, "Fundamentals of Geotechnical Engineering," and ENCE353, "Introduction to Structural Analysis," both of which were also applicable to his career interests.

Russell has been the department's peer tutor for ENCE305 for successive semesters, and sees this as perhaps the most meaningful opportunity he's been given here. "Being on the other side of things, teaching, you see that teaching really is the best form of learning," he says, adding that tutoring has given him a stronger grasp of the material, as well as the opportunity to meet other people in the major and connect with them. He also finds it satisfying to help people in a challenging class.

Russell is also involved in research in the department, working with Associate Professor Dimitrios Goulias on data analysis of the properties of concrete. He says this hands-on experience has been "eye-opening." He also went to Greece in April for Dr. Goulias's spring break course, ENCE489G, "Sustainability and Infrastructure."

This summer, Russell completed his first internship, working with the Chicago-based design firm Kimley-Horn as part of a land development team. He found the internship through an event hosted by Chi Epsilon, the civil engineering honor society, of which he is a member.

Russell is an active member of Engineers without Borders (EWB). He is part of EWB's Nicaragua project and the distribution sub-team, and he observes that concepts from ENCE305 have been useful in designing a water distribution system for the project. Russell has also been involved in a boxing club and with the WMUC radio station on campus. In his free time, he likes to go to the gym, read, and listen to music.

After graduation, Russell hopes to get a job in design or construction. He hopes to have plenty of time to travel, and is also considering graduate school. No matter what path he takes, this dedicated student is sure to use the skills he has learned here, as well as his own hard work, determination, and problem solving abilities, to improve others' lives.

The A. James Clark School of Engineering at the University of Maryland is proud to announce the appointment of Deb Niemeier to an endowed chair established as part of *Building Together: An Investment for Maryland*, the A. James & Alice B. Clark Foundation's nearly $220 million commitment to transform UMD and the Clark School through investments in students, faculty, programs, and infrastructure.

Niemeier is the first of many endowed Clark Distinguished Chairs to be appointed through the Clark Foundation investment. The Clark Distinguished Chairs will directly address the most critical research areas set forth by the 2020 Strategic Plan for the Clark School, including additive and advanced manufacturing, autonomy and robotics, and energy and sustainability. These faculty leaders will open new frontiers, creating a community of collaboration and excellence that gains momentum with every achievement in research and innovation.

A National Academy of Engineering (NAE) member, Niemeier has helped spur policy and regulatory changes through her groundbreaking research in the areas of vehicle emissions, air quality, affordable housing, and infrastructure funding. At UMD, her research will target aspects of the built environment that give rise to structural inequality, particularly within the context of climate change. Niemeier will also be a faculty affiliate of the Maryland Transportation Institute, an interdisciplinary research hub that brings together expertise from across Maryland universities.

Q&A

Deb Niemeier

Clark Distinguished Chair of Civil and Environmental Engineering

YOUR CURRENT RESEARCH INVESTIGATES, AMONG OTHER THINGS, THE INTERSECTION BETWEEN ENVIRONMENTAL ISSUES—NOTABLY CLIMATE CHANGE—AND SOCIAL ISSUES, PARTICULARLY PROBLEMS OF INEQUITY. WHAT ARE SOME OF THE SPECIFIC WAYS IN WHICH CLIMATE CHANGE CAN EXACERBATE SOCIOECONOMIC GAPS?

As engineers, we have designed wondrous infrastructure with a very long life. This is good but it also presents problems. It's good in that we are able to increase society's benefits. But it is problematic because the ways infrastructure has been designed and attended to over the last 70 years reflect how society was structured in the past. For example, people of color have less access to good schools, to good transportation. They often have to fight for clean water. Over time, the lack of these basic necessities robs people of opportunity, which produces inequality.

As our society undergoes increasing economic imbalance, these structural inequalities begin to affect even greater swaths of the population. Owning your own home has become increasingly hard, while finding jobs near where you live or accessing a good transportation system is difficult for more and more people. And with climate change, these kinds of barriers will become bigger. People in high risk areas can't afford to move and the state can't afford to create the kind of infrastructure needed to protect their assets. Right now, we are in a cycle of reduce risk and rescue. But this is not sustainable. With climate change, not all risk can be reduced to an acceptable level and rescues are very expensive. We need a more sustainable vision. Once society has a vision, I am confident that civil and environmental engineers can help to achieve it.

YOUR MPACT LECTURE AT UMD IN APRIL 2019 FOCUSED ON THE CAMP FIRE DISASTER IN PARADISE, CA, AND HIGHLIGHTED HOW MULTIPLE FACTORS—INCLUDING CLIMATE CHANGE, URBAN DEVELOPMENT, LOCAL POLITICS, AND THE ACTIONS OF A STATE UTILITY—COMBINED TO CREATE THE DISASTER. TO WHAT EXTENT IS THE PARADISE SITUATION SYMPTOMATIC OF A LARGER PROBLEM? WHAT ARE THE LESSONS LEARNED?

The population of Paradise exploded from around 8,000 to 24,000 during the 1970s. It was a place where you could own your own home on a fixed income at a time when California's real estate values were skyrocketing. Some of the growth came in the form of a standard subdivision layout, with non-gridded streets, cul-de-sacs, and limited entry/exitways. These suburban design features are similar to design standards that are still actively used. This design hinders evacuation and once embers entered subdivisions, it was nearly impossible to stop the structure to structure ignition forward progress.

Growth also came in the form of mobile home parks. There were around 33 different mobile home parks located in the area, several of which were large; the fire leveled around 20 of them. Most of the mobile home parks were occupied by seniors on fixed incomes; a lot of them were women and frail. It's been reported that most of the people who died in the fire were elderly.

Nearly a quarter of Paradise residents had a disability (this is double the statewide rate) and 25 percent of the population was over the age of 65, compared to 14 percent statewide.

In short, Paradise had an aging, high disability population living in areas with urban design features that were not particularly conducive to fast evacuation. And the city was surrounded by aging power infrastructure. There are elements of this story that apply to nearly every at-risk community. We have affordable housing issues in urban areas, forcing people to move further from services. We have climate change making weather events that much more intense, and finally we have an aging infrastructure that we also need to rethink.

CONCERN OVER SUSTAINABILITY AND ENVIRONMENTAL ISSUES RANKS HIGH AMONG THE GENERATION THAT IS CURRENTLY PREPARING TO APPLY TO COLLEGE. FOR YOUNG PEOPLE WHO ASPIRE TO MAKE A DIFFERENCE, WHAT DOES THE FIELD OF CIVIL AND ENVIRONMENTAL ENGINEERING HAVE TO OFFER?

Civil and environmental engineers are the ones who design and build infrastructure. We have the knowledge and understanding of how things in the built environment connect, and it is the built environment that enables individuals and populations to thrive and succeed in the world. If young people really want to reduce poverty, ensure human rights, and tackle inequality, they should study civil and environmental engineering and learn how to create a built environment that serves everyone equitably.

WHAT DREW YOU TO UMD, AND WHAT ARE SOME OF THE ATTRIBUTES OF THE CLARK SCHOOL THAT YOU FIND MOST APPEALING?

I like the emphasis on service for public good. UMD is a large, public institution with a deep commitment to education. I also found the level at which the state supports the university to be inspiring and forward-thinking. Many states have reduced funding to the degree that the institution can longer serve the most aspiring students. The cost of attending is simply too high. We—my generation and those before us—had the advantage of attending a university with low tuition and we emerged with low debt. It is wrong to saddle future generations of college students with high tuition and high debt. Maryland supports their college system at a level that other states should aspire to.

The Clark School is also in an exciting period, especially for civil and environmental engineers. The gift from the Clark Foundation allows students who might not be able to afford a college education to have a to become an engineer. The dean is viewed as visionary and dedicated to public service and a diverse college. All of these factors make coming to Maryland very exciting.

IN 2006, YOU WERE AMONG THE HIGHLY-ACCOMPLISHED FEMALE SCIENTISTS AND ENGINEERS HIGHLIGHTED IN A NEW YORK TIMES FEATURE STORY ON THE CHALLENGES FACING WOMEN WHO ENTER SCIENTIFIC FIELDS. MORE THAN A DECADE HAS PASSED SINCE THAT ARTICLE WAS PUBLISHED. TO WHAT EXTENT DO YOU SEE IMPROVEMENT, ESPECIALLY IN ENGINEERING?

I think it is a mixed bag. We have more women and people of color in leadership positions, but in some engineering disciplines we still struggle to attain acceptable levels of undergraduate women. If you look at national statistics, the needle on the percentage of undergraduate women attending an engineering program hasn't really moved much. Fields like mechanical, electrical, computer science, and civil engineering are still way behind the curve in terms of women and people of color. We all need to work harder.

DEFINING THEIR FIELDS: CLARK DISTINGUISHED CHAIRS

The generosity of the A. James & Alice B. Clark Foundation has enabled the Clark School to create seven key faculty positions that directly address engineering's most critical areas, such as additive and advanced manufacturing, autonomy and robotics, and energy and sustainability. These eight Clark Distinguished Chairs will open new frontiers, creating a community of collaboration and excellence that gains momentum with each achievement in research and innovation.

» LEARN MORE, VISIT
buildingtogether.umd.edu

A Nationwide Concern

UMD RESEARCHERS CO-AUTHOR MAJOR STUDY OF URBAN FLOODING

Urban flooding is a growing source of significant economic loss, social disruption, and housing inequality throughout much of the United States.

PHOTO: ANDREA BOOHER/FEMA, PENSACOLA , FLORIDA

The sound of a flood alert coming over the phone has become a familiar one for many in Maryland and other states that are prone to bouts of torrential rainfall. In early July, for instance, floods during the morning rush hour inundated dozens of roadways in and around Frederick, stranding at least 11 vehicles that got stuck in the rising waters.

> **Many of the urban wastewater and stormwater systems that provide the backbone of urban flood mitigation are in poor condition and—in some locations—are inadequate and in need of strong support.**

Even more seriously, heavy rains set off floods that ravaged historic Ellicott City in 2016 and again in 2018, inflicting tens of millions of dollars in economic losses and cleanup costs. In general, flooding in urban areas has become a serious problem nationwide—and it's getting worse, according to the authors of a landmark new study.

The report, *The Growing Threat of Urban Flooding: a National Challenge*, was produced by the Center for Disaster Resilience (CDR), part of the University of Maryland's civil and environmental engineering department, in collaboration with the Center for Texas Beaches and Shores at Texas A&M University, Galveston Campus. The CDR team included Gerald Galloway and Allison Reilly.

It is the first study to deliver a comprehensive assessment of the national impact of urban flooding, highlighting consequences that include economic losses, social disruption, and housing inequality.

The report demonstrates that urban flooding is not a problem that occurs only in a handful of major cities, but one with much wider scope, notes Galloway, who received a Newsmaker of Year designation from Engineering News-Record for his contribution to the project. "Communities across the country are in fact facing similar—and escalating—challenges," he said.

Indeed, the National Oceanic and Atmospheric Administration's flood loss database from 1993 to 2017 includes more than 3,600 events nationwide, with more than 25% of claims coming from outside the 100-year flood zone. Much of the flood damage incurred over the last several decades can be linked to development, which often alters natural drainage patterns.

Nine recommendations are offered by the UMD and Texas A&M researchers. Among them: the development of "appropriate mechanisms at the federal, state, and local level to fund necessary repairs, operations, and upgrades of current stormwater and urban flood-related infrastructure." The authors also stressed the need to factor in social inequities and ensure that mitigation efforts cross all social levels.

"The message of this pioneering study is that we cannot wait for someone else to fix this worsening problem," said University of Maryland President Wallace D. Loh. "Cooperation between communities, local governments, and universities can help begin the process of adapting to the new realities of urban flooding."

EILEEN SIEN

CAN A MAJOR AIRPORT CARRY OUT UPGRADES WITHOUT INCONVENIENCING PASSENGERS? A CEE ALUMNA HAS MADE THAT HER MISSION.

Airports are dynamic places, with modifications and improvements constantly underway. A traveler might find the route between terminals streamlined by a new connector, or enjoy the food options at a recently opened concession area. Even the smallest changes at an airport require skillful planning and coordination—and that's where expert program managers like Eileen Sien ('95) come in.

Through her work with Airport Design Consultants, Inc. (ADCI), an Ellicott City-based firm, Eileen ensures projects at Baltimore Washington International Thurgood Marshall Airport stay on track. Her goal, she says, is to minimize the impact on the more than 74,000 passengers who fly in and out of the airport each day. She wants them to notice the improvements, without being inconvenienced by the construction or installation, while always maintaining safe and efficient operations.

"Ideally, the traveling public won't even notice what we're doing—until the project is completed and they can enjoy the results," Eileen said. "That's what we aim for."

Among other upgrades at BWI Marshall, Eileen and the program management team have overseen design and construction of a variety of development projects, including the Terminal D/E Connector, an extension to the International Concourse, and millions of dollars in airfield rehabilitation efforts. The team is currently managing projects that include the addition of five new gates to the airport's Concourse A, as well as developing new cargo facilities. Eileen is personally managing a site development project for a new airline maintenance hangar.

"An airport is like a little city," she said. "And that makes projects very complex, involving many participants—from initial planning to design, engineering, construction, operations, and maintenance. Every one of these phases is critical. All the parties involved have to be looped into the conversation so that their ideas can be conveyed and their concerns captured."

For example, a construction crew or operations team might need access to areas that are normally off limits. Security personnel will need to know why they are there, and measures must be put in place to prevent any breaches. "Safety and security are by far the highest priorities," Eileen said.

Over the last three years, BWI Marshall has required collaborative partnering for all construction projects over $10 million. Eileen has become the onsite resource for this effort and in 2018 became a certified facilitator.

The work she does may seem far removed from her undergraduate studies: Eileen majored in civil engineering, with a concentration on water/wastewater design. And she spent 20 years working on utility design projects for RK&K, a civil engineering firm in Baltimore. She moved up in the company, taking on project and program management roles that broadened her professional scope. Yet even today, she draws on skills—such as communication and teamwork—that she built during her undergraduate major.

"The capstone course that I took during my senior year really nurtured those capabilities," she said. "The class as a whole was assigned a particular project, and then we were grouped into teams that brought together students with different concentrations—for example, geotechnical, structural or, in my case, the water/wastewater concentration. We had to work together to solve the challenge that was put in front of us, and then to present our solution in a formal paper and presentation that was evaluated by industry professionals."

A proud Terp, Eileen is also a Terp parent, with one child who graduated from UMD in May 2019 and another enrolling this fall. Active in the alumni community, she is a member of the Engineering Alumni Network's (EAN) Board of Directors and was recently elected EAN president.

She also takes pride in her involvement with WTS International, which provides professional development, mentoring, and networking opportunities to its worldwide membership. Eileen is currently president of its Baltimore chapter, having served in a variety of roles since 2010. The organization, she says, is distinguished by its inclusiveness, representing the full spectrum of transportation-related careers as well as the different modes of transportation.

Eileen values being able to advance the careers of women in transportation and, in so doing, build a stronger and more diverse industry.

"I welcome the opportunity to help others build their networks because I know, from personal experience, how important these can be," she said. "For me, it's a way to give back."

Project Management Symposium Fosters "Thriving Community of Practice"

The Project Management Center for Excellence hosted its sixth annual two-day Symposium, with project managers from the Baltimore-Washington metro area and abroad gathering to share best practices, discuss lessons learned, and discover the latest advances in the field. Held from May 9–10, the event set a new record for attendance, with more than 450 participants this year.

"The Project Management Symposium does not disappoint! This is my third year attending and each year it gets better," said Elena Bozylinski of Tessco Technologies. "There is a diversity of tracks to attend, from managing people to the federal government to construction. You will find a topic that relates to your work and the speaker(s) will provide you with information that you can take with you and implement."

PHOTO: WILLIAM DAVIS

"The UMD Project Management Symposium provided the excitement of seeing project management being used in all different industries while providing the perfect atmosphere to meet and network. It truly felt like a growing, thriving community of practice the entire two days," said Keisa Hudson of the Raleigh-Durham Airport Authority.

Join us for next year's event, to be held May 7–8, 2020.

» LEARN MORE, VISIT pmsymposium.umd.edu

FACULTY ACHIEVEMENTS

BILAL AYYUB, professor of civil and environmental engineering and director of the Center for Technology and Systems Management, was the 2018 recipient of the Alfredo Ang Award on Risk Analysis and Management of Civil Infrastructure. This American Society of Civil Engineers award recognizes technical contributions of national and international significance in risk analysis, risk management, and lifecycle economics of civil infrastructure. Ayyub has dedicated his roughly 30-year career to the design and management of complex systems throughout their lifecycle.

AYYUB also edited a new ASCE Manual of Practice, *Climate-Resilient Infrastructure: Adaptive Design and Risk Management*, which was published by ASCE's Committee on Adapting to a Changing Climate in January 2018. Ayyub, an ASCE Distinguished Member, received the ASCE President's medal in 2018 for his effort "to bring adaptive design to the profession to help address a changing climate." He is also a 2019 recipient of ASCE's Le Val Lund Award.

In addition to his work with ASCE, **AYYUB** has been named to a National Academies committee board on infrastructure and constructed environment. During 2019, Ayyub was also named an honorary member of the American Society of Mechanical Engineers (ASME). A sought-after speaker at conferences worldwide, Ayyub delivered a Distinguished Lecture at the University of Virginia in September 2018, on the subject of disaster resilient infrastructure. He was also a keynote speaker at numerous conferences and events in the U.S. and internationally.

Professor **GERALD GALLOWAY** was named a Top 25 Newsmaker by Engineering News-Record for his leadership in the field of water and floodplain management, including co-authorship of the first major study of urban flooding. The recognition honors individuals from diverse sectors for their service to the construction industry and the public.

Associate Professor **DIMITRIOS GOULIAS** has been elected head of the Athens Institute for Education and Research's (ATINER) civil engineering unit. Goulias also chairs ATINER's annual International Conference on Civil Engineering.

Post-doctoral researcher **DEVRIM KAYA** received the 2018 Peggy Cotter Travel Award from the American Society for Microbiology. Kaya has also been selected by the National Science Foundation (NSF) as am ACADEME Fellow for 2019.

BIRTHE KJELLERUP, who leads the Biofilms Laboratory at the Department of Civil and Environmental Engineering, received a promotion to Associate Processor with Tenure. In announcing the news, CEE Department Chair Charles W. Schwartz noted Kjellerup's "sound research, creative teaching, and quality mentoring." Kjellerup joined the CEE faculty at UMD in 2015. She is co-editor of the journal *Biofilm*.

Assistant Professor **GUANGBIN LI**, who heads the Nutrient-Energy-Smart (NES) Laboratory at the Department of Civil and Environmental Engineering, received a $75,000 award from the Minta Martin Research Fund to support research into the recovery of nitrogen and phosphorus from urine as plant-available fertilizer for space gardens. During 2019, Li also presented a

MORE THAN 60,000 ENROLLMENTS IN ONLINE AGILE PROJECT MANAGEMENT PROGRAM

An Agile Project Management Professional Certificate program launched in September 2018 by the Department of Civil Engineering's Project Management Center of Excellence has garnered an overwhelming response. As of early September 2019, the five-part series has 62,376 enrolled learners worldwide.

The series provides participants with the opportunity to learn the mechanics of how to design and facilitate projects using "pure" Agile Scrum and Lean Kanban techniques. They also learn the trade-offs of using hybrid techniques such as Lean Startup, Scaled Agile For the Enterprise (SAFe), and Disciplined Agile Development. Beyond these frameworks, the courses cover the essential principles needed to achieve the greatest benefits of Agile Project Management methods: Speed, Innovation, Leadership, and Kaizen (Change for the Better).

Hosted through edX, a nonprofit, open-source learning destination that offers online educational programs and courses in alliance with more than 130 member institutions, the Agile Project Management Professional Certificate courses are free and self-paced. Learners can also choose to verify their work and gain a Professional Certificate from UMD and edX that grants unlimited time to revisit the materials after the course is complete.

"We are honored to work with The University of Maryland to offer a Professional Certificate program in Agile Project Management," said Anant Agarwal, edX CEO and MIT professor. "We've heard from our global community of learners that they are seeking courses to help them advance their careers. Professional Certificate programs on edX deliver career-relevant education in a flexible, affordable way, by focusing on the critical skills industry leaders and successful professionals are seeking today."

» **TO LEARN MORE ABOUT THIS PROGRAM, PLEASE VISIT THE UMD PROJECT MANAGEMENT CENTER FOR EXCELLENCE WEBSITE AT https://pm.umd.edu/**

paper, "A pilot-scale study: Application of Anaerobic Ammonium Oxidation (Anammox) for Side-stream Nitrogen Removal in the Pima County Wastewater Reclamation Facility (WRF)," at the AEESP Research and Education Conference at Arizona State University. In addition, he was a steering committee member at the 2018 WEF Nutrient Removal and Recovery Symposium in Minneapolis, where he presented his paper, "Performance of Pilot-scale Anaerobic Ammonium Oxidation (Anammox) Reactors in Treating Ammonium Rich Wastewater for Pima County Wastewater Reclamation Facility (WRF)."

A team of UMD researchers led by assistant professor **ALLISON REILLY** received a $750,000 National Science Foundation (NSF) grant to explore and improve how infrastructure operators make recovery decisions in the wake of disasters. The research team also includes Melissa Kenney and Mike Gerst from UMD's Earth System Science Interdisciplinary Cemter and Co-operative Institute for Climate and Satellites—Maryland.

REILLY is also the recipient of an Early-Career Gulf Coast Research Fellowship from the National Academy of Sciences (NAS).

Professor **PAUL SCHONFELD** delivered a presentation on Selection and Scheduling of Interrelated Improvements in Transportation System at the COTA International Conference of Transportation Professionals in Beijing, which took place in July 2018. Schonfeld was also a presenter at the annual Transportation Research Board (TRB) meeting in January 2019.

Professor **MIROSLAW J. SKIBNIEWSKI**, together with Budapest University of Technology and Economics professor Miklos Hajdu, organized the 8th annual Creative Construction Conference, held in Budapest.

SKIBNIEWSKI has also been invited as a keynote speaker and workshop leader at the Organization, Technology, and Management in Construction conference in Zagreb, Croatia; the 36th CIB W-78 Conference on Information and Communication Technologies in Design, Construction, and Management in Newcastle, England; the second International Conference on Sustainable Buildings and Structures in Suzhou, China; amd the CISGOS 2019 Congress on Innovation for Sustainable Infrastructure in Hanoi, Vietnam.

Assistant research professor **CHENFENG XIONG** won the International Association of Public Transportation's Young Researcher Award for his work on incen-Trip, a smartphone app technology that uses personalized, real-time multimodal traveler information and incentives to influence daily commutes and reduce congestion in Washington, D.C. and Baltimore. His work, in collaboration with Herbert Rabin Distinguished Professor and Maryland Transportation Institute Director Lei Zhang, leverages the latest big data, machine learning, and computing technologies to optimize travel behavior for reduced congestion, energy use, and emissions in a cost-effective way.

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'60s CIVIL HI-TECH

A STUDENT PRESSES BUTTONS on a data processing system switchboard during the late 1960s. In the ensuing decades, computer technology would radically transform the tools used to collect, process, and analyze data.

Learn more about the history of the Clark School, visit clark125.umd.edu.

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