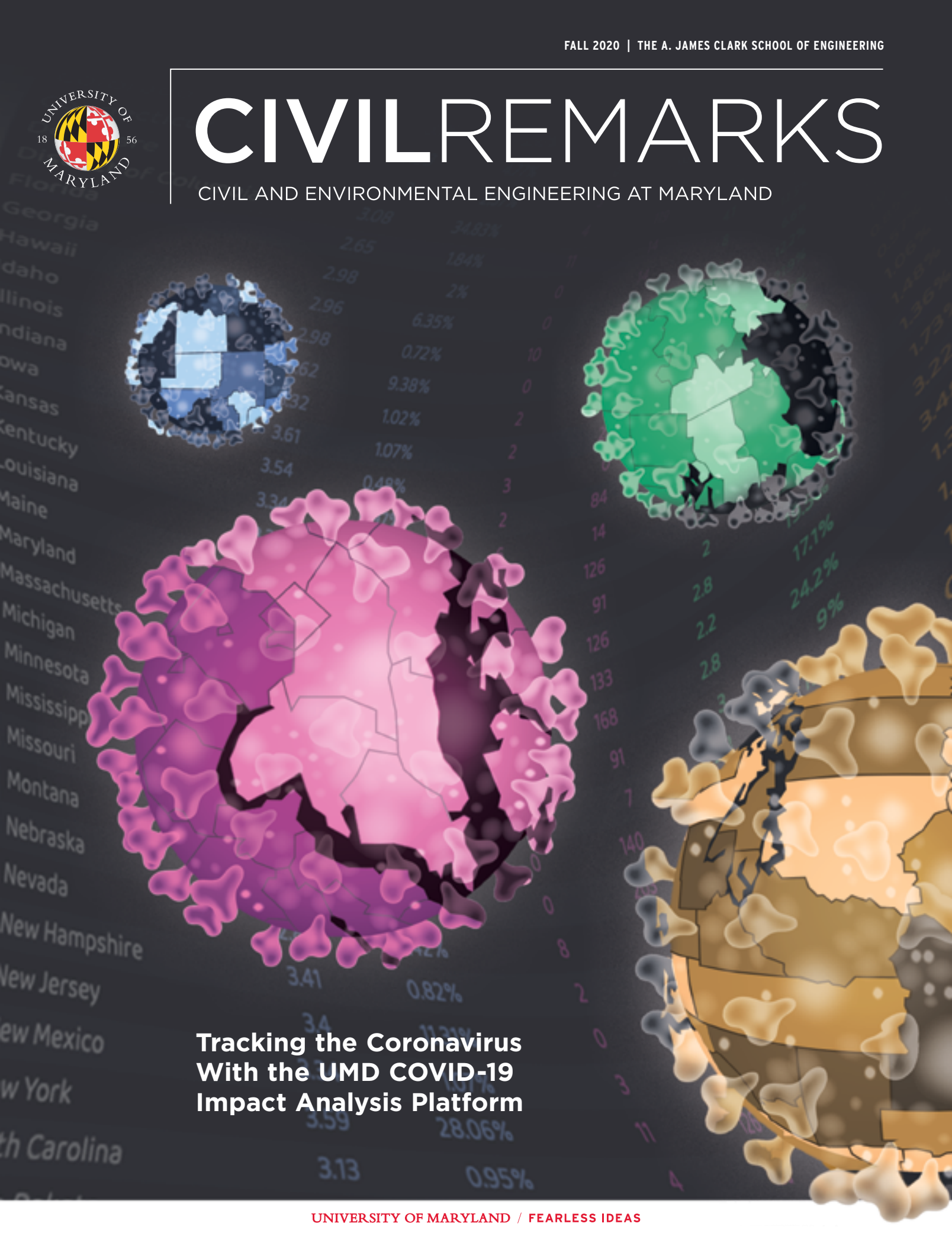
CIVILREMARKS

CIVIL AND ENVIRONMENTAL ENGINEERING AT MARYLAND



Tracking the Coronavirus With the UMD COVID-19 Impact Analysis Platform

Chair's Message

A year ago, when we published our previous issue of *Civil Remarks*, few of us would have anticipated the very different circumstances of 2020. COVID-19 has had a broad impact on society, the economy, and individual lives, disrupting nearly everything that we do.

Engineering is a hands-on discipline, or should be; lab activities are crucial to the training of engineers, and the profession places a high value on the kind of on-site experience obtained through internships. Among our most pressing concerns, then, is to continue providing practical, hands-on experience for our students—while at the same time prioritizing health and safety.

Even as we chart the way forward for our programs, many of us have also sought to assist the response to this global crisis by contributing our skills and expertise. One of our defining traits as engineers is our ability to **do**—that is, to bring about concrete results through the application of science. Moreover, as a state university, we have an imperative to benefit the public good. That mandate didn't begin with COVID-19 of course; far from it. But the pandemic has given it a specific focus.

In this issue of *Civil Remarks*, we highlight notable endeavors being undertaken by our faculty in support of COVID-19 containment and socioeconomic recovery. One project with a particularly broad impact is the COVID-19 Impact Analysis Platform, developed by research teams at the Maryland Transportation Institute and the Center for Advanced Transportation Technology Lab. This unique resource continues to serve a wide spectrum of stakeholders, from state and federal agencies to research institutions.

You'll also learn about additional COVID-related projects at our department, focusing on areas such as pandemic modeling and early warning of virus outbreaks through wastewater monitoring. We also highlight some of the other innovative work being done by our faculty, from improving triage procedures to measuring snow.

While this has by no means been an easy year for anyone, it has not been without occasions for optimism, even celebration. I hope you'll join me in congratulating our new University of Maryland president, Darryll J. Pines. As many of you know, Dr. Pines provided transformational leadership to the A. James Clark School of Engineering for 11 years; he now brings his capabilities and vision to leadership of the university as a whole. He is the fifth engineer to serve as UMD president or chancellor, after Nariman Farvardin, C.D. "Dan" Mote, John Slaughter, and Robert L. Gluckstern. President Pines is a changemaker. Challenging as the times are now, we can be confident that great things are in store.

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

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AS THE WORLD REELED FROM THE CORONAVIRUS PANDEMIC, TRANSPORTATION RESEARCHERS AT THE UNIVERSITY OF MARYLAND'S CIVIL & ENVIRONMENTAL ENGINEERING DEPARTMENT KNEW THEY HAD TOOLS AND EXPERTISE THAT COULD HELP

Challenging Times, Unique Resources

It started with elbow bumps, in place of the familiar handshake. By mid-March, schools were sending their students home; businesses that could move their operations online did so, while many others shut down. As COVID-19 cases mounted, states moved to flatten the curve and secure a critical window of time for hospitals and clinics to boost their capacity.

At the University of Maryland (UMD), a team of transportation researchers pivoted from their ongoing projects to assist with the pandemic response. "We knew we could help policymakers—and the general public—better understand what was happening as a result of COVID-19, and make informed decisions," explains Lei Zhang, Herbert Rabin Distinguished Professor and co-director of the Maryland Transportation Institute (MTI), an interdisciplinary research hub based at the civil and environmental engineering department. "We were determined to marshal these resources in a way that could advance the public good during this time of crisis."

In particular, the Maryland Transportation Institute and the affiliated Center for Transportation Technology (CATT Lab) had access to streams of real-time, location-based data—and unparalleled expertise in handling such data, acquired over several years. "We're the leaders in mobility analytics," said CATT Lab Director Michael Pack. "There are companies out there that provide black-box analytics in some form or another, but with a limited focus—on retail, for instance. We have the ability to look at broader aspects, such as the social dimension—are people listening to public messaging, and are they behaving in ways that help or hinder the COVID-19 response? We're able to quantify the answers to questions like these and do so in a more open and transparent way."

The MTI and CATT Lab teams worked days, nights, and weekends to stand up an integrated tool that would pull in location data from cell phones and apps across the nation, run it through MTI's computer algorithms, and deliver the information that states and counties need to monitor COVID-19 trends, identify emerging hotspots, assess their response capacity, and gauge the effects on the economy.

The result of their work—a metrics engine fronted by a publicly accessible COVID-19 Impact Analysis Platform (data.covid.umd.edu)—has become a go-to source for federal, state, and county agencies, as well as for think tanks, university researchers, and journalists covering the pandemic. Its users include the Center for Disease Control (CDC), the U.S. Department of Transportation (USDOT), and the Federal Reserve.

"What's unique about this platform is that it doesn't just provide information about COVID-19," said Luisa Franzini, a professor at UMD's School of Public Health and chair of Health Policy and Management. "It also tracks the things we are doing to contain the pandemic. For instance, it provides data on testing capacity and contact tracing. It provides insights into the economic impact—what's happening with goods consumption, what the employment trends are, how many people are working at home."

"There are many sources of information about COVID-19, but this puts together data from different dimensions: the numbers of cases, the hospital capacity, people's behavior, and economic impact. It's all there in one easy-to-access portal," she said.

Lei Zhang, MTI Co-director and Herbert Rabin Distinguished Professor of civil and environmental engineering

INSIGHTS TO SUPPORT DECISION MAKING

The UMD platform provides four broad sets of metrics: mobility and social distancing, health, economic impact, and vulnerable populations. Within these categories, users can drill down to more specific variables. The health variables include testing capacity, hospital and ICU bed utilization, ventilator needs, and the percentage of contact tracing workers per 1,000 people. The economic impact metric includes variables such as unemployment, inflation, and consumption of goods. Included in the platform is a Society and Economic Reopening Assessment (SERA) tool, which provides an at-a-glance indicator of states' and counties' readiness to move forward with reopening and economic recovery.

One strength of the MTI project is its ability to hone in on specific questions of concern. In March and April, for example, many states had imposed stay-at-home orders, and public messaging stressed the importance of social distancing. But were Americans following the guidance? A Social Distancing Index (SDI) provided on the platform showed the levels of compliance in each state—and flagged some worrisome trends. "Starting in mid-April, the numbers showed evidence of what became known as 'quarantine fatigue,'" Zhang said. "After weeks of lockdowns, people started losing patience and began to go out again." Warmer weather, along with protests against the restrictions, may have contributed to the lower SDI, he added.

MTI's social distancing and mobility metrics continue to be important because they provide early warning of possible outbreaks. "This allows us to plan," Franzini said. "When we see more mobility, we can expect more cases, and then we can prepare for that in terms of having the hospital beds available, ICU beds available, and so on. It gives a really complete picture, and that's something quite unique."

Franzini and other epidemiologists at UMD's School of Public Health have been providing weekly reports to counties across Maryland, using the MTI data. "They use these reports to really understand the situation in the field, and to see if there are case increases that need to be contained," she said.

THE UMD COVID-19 IMPACT ANALYSIS PLATFORM (DATA.COVID.UMD.EDU) TRACKS 38 METRICS IN FOUR CATEGORIES

MOBILITY AND SOCIAL DISTANCING

- Social distancing index
- % staying home
- Trips/person
- % out-of-county trips
- % out-of-state trips
- Miles/person
- Work trips/person
- Non-work trips/person
- Transit mode share

COVID AND HEALTH

- # days: decreasing COVID cases
- # days: decreasing ILI cases
- Testing capacity gap
- # contact tracing workers/1000 people
- % hospital bed utilization
- % ICU utilization
- New COVID cases
- New cases/1000 people
- Active cases/1000 people
- Imported COVID cases
- COVID exposure/1000 people
- Tests done/1000 people
- Hospital beds/1000 people
- ICUs/1000 people
- Ventilator needs

ECONOMIC IMPACT

- Unemployment claims/1000 people
- Unemployment rate
- % working from home
- Cumulative inflation rate
- % change in consumption

VULNERABLE POPULATIONS

- % people older than 60
- Median income
- % Black
- % Hispanic
- % Male
- Population density
- Employment density
- # hot spots/1000 people
- COVID death rate
- Population

Niemeier, Kaushik Work to Develop More Precise Modeling

DURING THE EARLY MONTHS OF 2020, A NEW PHRASE ENTERED THE PUBLIC VOCABULARY: "FLATTENING THE CURVE"

As the COVID-19 crisis escalated, countries around the world—including the United States—took steps to prevent a rapid spike in the number of cases. Graphs published in the online magazine *Vox* helped mobilize public opinion in favor of social distancing and, later, stay-at-home orders.

Since the pandemic was still in its early stages, however, modeling the curve involved relying on simulated data. Months later, that is no longer the case. Researchers now have an abundance of data about the actual impact of COVID-19 on public health, and can use this data to revise and refine their models.

"The more we can understand about the actual public health situation as it unfolded, the better prepared we will be for future outbreaks, not only of COVID-19, but of other dangerous viruses, and these kinds of projects require a multi-disciplinary team," said Deb Niemeier, Clark Distinguished Chair of civil and environmental engineering at the University of Maryland and co-director of UMD's Maryland Transportation Institute (MTI).

Niemeier and Kartik Kaushik, assistant professor and assistant director of data and informatics at the University of Maryland School of Medicine and the Shock, Trauma and Anesthesiology—Organized Research Center (STAR-ORC) are launching a new project aimed at modeling pandemic curves more precisely by quantitatively examining the impact of COVID-19 and better identifying how social distancing affected hospitalization. The multidisciplinary team will make use of data from electronic medical records as well as location-based data from mobile apps.

The goal will be to support outbreak-minimizing responses by optimizing resources and efforts, including medical, quarantine, and public messaging.

The Maryland Transportation Institute, which launched an interactive COVID-19 Impact Analysis Platform in April, has access to a massive, nationwide, near-real-time data set of anonymized, aggregated, location-based data gathered through the use of apps.

Medical records from the University of Maryland Medical System (UMMS), affiliated hospitals and the Maryland Department of Health (MDH), contain COVID-19 test results as well as information on comorbid conditions, diagnostics, procedural and prognostic data of patients admitted to any of UMMS hospitals.

Such data equips researchers with crucial tools that can assist in future responses not only to COVID-19 but other public health crises, Kaushik said.

"COVID-19 is a new disease," he said. "We don't really understand a whole lot about how the disease evolves at the community scale. With a better understanding of areawide transmission and the effects of policy interventions (like social distancing), we can ensure adequate care is available when it is needed."

"And the need doesn't stop with COVID," Kaushik said, "The changing climate is creating favorable conditions for the spread of new viruses generally. It's critically important to understand how to quickly model mobility, public health facility capacities, and the effects of public messaging."

PG CO. Exec. Angela Alsobrooks

PARTNERSHIPS WITH LOCAL GOVERNMENT

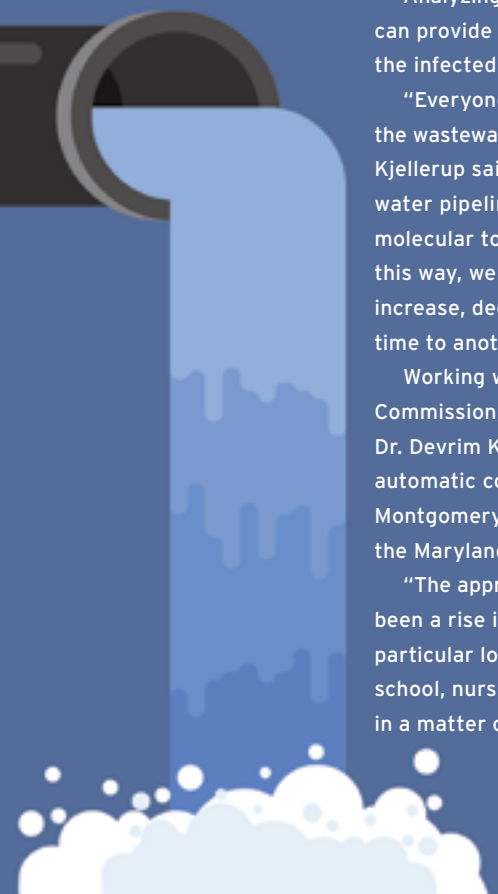
Maryland's Prince George's County is home to the University of Maryland's College Park campus. Among the counties hardest hit by the pandemic, it has partnered with MTI in order to help maintain situational awareness, obtain early warning about emerging hotspots, and identify vulnerable populations.

"There are many building blocks involved in recovery and reopening," says David Sloan, director of policy, planning, and public affairs at the office of County Executive Angela Alsobrooks. "One critical component is understanding how Prince Georgians and others are moving through the county as we reopen. The MTI data is helping us to go beyond being partially blind, in this respect, to fully seeing the county as a living, breathing organism that is fighting a virus."

The specificity of the information provided by the platform is a boon because it allows the county to know where to allocate staff and resources, Sloan said. "What we have learned, over the past months, is that not only do you need a comprehensive response to this pandemic, or to any event like this, but you do your best by concentrating your energy where you need to concentrate it the most."

"When you can't fully see the picture in order to make the proper diagnosis, you're going to make some mistakes. You're going to deploy resources where you don't need to, because you simply don't know or understand the full problem," he said.

TRACKING THE SPREAD OF COVID-19... THROUGH WASTEWATER



In the effort to contain COVID-19, the earlier an outbreak can be detected, the better. Birthe Kjellerup, Pedro E. Wasmer Professor in in the Department of Civil and Environmental Engineering, has been testing a promising new approach.

Analyzing wastewater samples, Kjellerup observes, can provide a red flag about outbreaks days before the infected people show symptoms.

"Everyone who has COVID-19 sheds the virus into the wastewater system when they use the bathroom," Kjellerup said. "We can gather samples from wastewater pipelines and treatment facilities and use molecular tools to track the presence of COVID-19. In this way, we can determine whether there's been an increase, decrease or no change from one sampling time to another."

Working with the Washington Suburban Sanitary Commission, Kjellerup and post-doctoral researcher Dr. Devrim Kaya have been collecting samples from automatic collection devices in six locations around Montgomery and Prince George's Counties—two of the Maryland counties hardest hit by COVID-19.

"The approach has the potential to detect if there's been a rise in the virus content of wastewater from a particular location, such as an apartment building, school, nursing home, or prison. If so, we'll know that in a matter of days people there will start testing positive. In this way we get some lead time to implement social distancing measures," Kjellerup said.

In addition, the wastewater data can be mapped onto other layers of information—including socio-economic, demographic, and transportation data—to obtain a more comprehensive view of the pandemic's impact, including on vulnerable or disadvantaged populations. In a follow-up project, Kjellerup plans to collaborate with Clark Distinguished Chair and Maryland Transportation Institute co-director Deb Niemeier and Professor of Epidemiology and Public Health Soren Bentzen to create such mapping.

This fall, Kjellerup's work will also help UMD with early detection on campus. As part of an initiative spearheaded by the Office of the Provost and in conjunction with the School of Public Health and Office of Facilities Management, sampling will take place strategically near high concentrations of students—wastewater pipes coming from the dorms, for instance—to monitor presence of COVID-19 and determine when and where to ramp up testing and tracing.

"I'm trying to think about how I can use my education and skills to help out Maryland and people in general," Kjellerup said. "We're not doing this for fame. We're doing it to help, because we have expertise that we can offer."

UNIQUE CAPABILITIES

With its color-coded numbers and clickable maps, the MTI platform is easy to use—and looks deceptively simple. In fact, operating and updating the site involves an immense behind-the-scenes effort, with more than 30 MTI and CATT Lab staff, post-docs, students, and external collaborators involved in the process.

"Part of the uniqueness of this platform lies in the huge amount of data computation that drives it," explains MTI assistant director Sepehr Ghader, who manages the project. "In order to produce the metrics, we have to process a huge amount of daily location feeds that are coming to us—not only that, but we have to process them every day. We also collect data from various public sources, census, the health care system, and the economy."

Standing up such an enterprise, let alone sustaining it over the long-term, is a Herculean endeavor—and might well have been an impossible one, had it not been for MTIs and CATT's prior experience with location-based data. When the pandemic hit, Ghader explains, the MTI team had already worked on multiple projects for federal and state agencies that centered around the use of such data. "Through these projects, we've learned what sorts of data sets are out there, and what we need to do to process the data efficiently and accurately," Ghader said. "It's not something that just started during the pandemic. Rather, when the pandemic hit, we said to ourselves 'we have the data, we have the capability, let's do something for the community.'"

A similar spirit has driven other post-COVID projects at the department and, more generally, UMD's A. James Clark School of Engineering. Since the onset of COVID-19, Clark School engineers have used 3D printing to manufacture respirators, tested sterilization techniques that could enable reuse of protective equipment, pioneered wearable sensors that can detect airborne COVID-19 particles, and harnessed the power of statistical modeling to better predict COVID-19's impact.

"The academic community in general has felt a strong imperative to contribute its expertise. It's an extension of the commitment many researchers have to bringing their work into the real world, and to addressing societal needs," said Charles W. Schwartz, chair of the civil and environmental engineering department. "At UMD, serving the public good is a part of our mandate—in 2016, we launched the Do Good Initiative to further boost the connection between academic research and societal benefit."

"In engineering, of course, the real-world impact of what we do has always been front and center; it's in the nature of what we do. What's changed is the scope of the challenges we address, and the tools we have for addressing them," Schwartz said.

SEVERAL FEDERAL AGENCIES USE THE MTI PLATFORM TO ASSIST IN COVID-19 RESPONSE AND ECONOMIC PLANNING

United States Department of Transportation (USDOT) and Bureau of Transportation Statistics (BTS)

Tracks the daily number of trips by distance bands across the United States at states and counties using daily travel monitoring product

Center for Disease Control and Prevention (CDC)

Integrates mobility and social distancing data into epidemic models for prediction of future cases and number death

United States Department of Veterans Affairs

Uses the SERA tool and its metrics to help determine when to reopen certain facilities in specific states and counties

United States Department of Treasury and Federal Reserve System

Uses mobility and economic metrics available on the COVID-19 Impact Analysis Platform for economic and financial impact analysis

Real-time Transportation Data Can Improve Triage, Save Lives

NEW RESEARCH COULD HELP ENSURE VICTIMS GET THE RIGHT CARE, QUICKLY

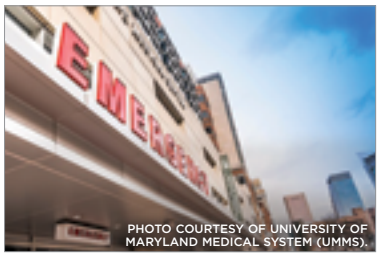


PHOTO COURTESY OF UNIVERSITY OF MARYLAND MEDICAL SYSTEM (UMMS).

When a road accident occurs, many variables affect the outcome, including weather, speed, crash angle, and vehicle type. Being able to access information about these variables in real-time could help emergency personnel provide the needed care—and save lives.

A project being led by Chenfeng Xiong, assistant research professor at the University of Maryland, aims to make this possible.'

Xiong, who holds joint appointments at UMD and the University of Maryland's Center for Shock, Trauma, and Anesthesiology Research, is building an integrated platform that can pull together real-time crash data, along with data about weather, road conditions, and the vehicles involved, and enable emergency personnel to make quicker, more accurate determinations about the crash severity, the equipment and type of care needed, and the likelihood of critical injuries.

Traffic accidents continue to be one of the leading causes of death nationwide, even as vehicles become safer and smarter.

Xiong's platform combines data from mobile apps, vehicle systems, and highway sensors with information from hospitals—including data on injuries, treatment, and patient outcomes—as well as from weather services and the Center for Advanced Transportation Technology Lab's (CATT Lab) Regional Integrated Transportation Information System (RITIS). The data is then run through computer algorithms in order to generate metrics that can be used by medical personnel to assess cases.

"Let's say it's a rainy day and there's been a crash on I-95. Even before the police reach the crash scene, our model can calculate the likely severity and alert hospitals to the need for ICU beds and equipment," Xiong said. "First responders, meanwhile, can determine which nearby hospitals are best equipped to care for the patient, thus avoiding the risk of delays because of rerouting."

Xiong and his collaborators, including Rosemary Kozar of the Shock Trauma Anesthesiology Research (STAR) Center at the University of Baltimore, have tested the approach and demonstrated that it can improve triage accuracy by more than 10%. For those involved in severe crashes, that could mean a higher chance of survivability. Many lives could be saved in Maryland alone, were around 100 fatal crashes occur each year, Xiong said.

Advances of this kind are particularly important because traffic accidents continue to be one of the leading causes of death nationwide, even as vehicles become safer and smarter.

"With some kinds of traffic fatalities, such as those involving pedestrians and bicyclists, we're actually seeing an increase," Xiong said. "We need to do all we can to reverse this trend, including streamlining emergency processes and leveraging the benefits of big data."

UMD'S BART FORMAN LEADS DEVELOPMENT OF A SIMULATION TOOL THAT CAN HELP DETERMINE THE BEST CHOICE OF SENSORS

A new simulation tool will help identify the best combination of satellite sensors to detect snow and measure its water content from space.

Snow's water content, or snow water equivalent (SWE), is a "holy grail for many hydrologists," said Bart Forman, a University of Maryland (UMD) civil and environmental engineering professor and principal investigator who is developing the tool with with NASA's Earth Science Technology Office, or ESTO, funding.

Forman's team, which includes Goddard remote-sensing and modeling researcher Sujay Kumar and ESTO Technical Manager Jacqueline Le Moigne, is developing a tool that uses machine learning—the process of training algorithms to detect patterns in data—and physical models to simulate the performance of different satellite sensors to pinpoint how best to combine them to measure SWE and get the most "scientific bang for your buck," said Forman, who is Deborah J. Goodings Professor in Engineering for Global Sustainability at UMD's A. James Clark School of Engineering.

WHY MEASURE?

This data is critical to people around the globe. Those living in the western U.S., for example, get 70-90% of their drinking water from snow and its availability can affect hydroelectric generation and agricultural production, Forman said.

"We would love to have a global map of SWE," which can be obtained from Earth-orbiting satellites, said Edward Kim, a Goddard research scientist who has helped organize SnowEx, a NASA-led campaign that gathers snow data with aircraft instruments. However, there is no single technique that can measure SWE globally because snow looks different depending on where it lands, Kim said.

It often forms a deeper layer in forests, where it's sheltered from the Sun, but maintains a shallower profile in the tundra and prairie, where it's exposed to wind and higher temperatures. Snow also changes its shape as it falls to the surface and then continues to change in its resting place. Its shape can specify which sensor is able to observe it, Kim said.

"The simulation tool will show us the kinds of tools we need to be able to make intelligent choices about how to combine sensors," Kim said.

A TALE OF DIFFERENT SENSORS

Given the fact that one technique can't effectively gather snow data to calculate SWE across the globe, the simulation tool includes data gathered by three different types of microwave-sensitive instruments: radiometer, radar, and lidar. So far, only radiometers and radar instruments have flown in space as part of a snow-centric observing mission to measure snow.

Scientists have limited lidar snow-specific measurements to aircraft campaigns, including NASA's SnowEx. However, Forman's team can use this airborne information to hypothesize a range of errors that might result from using lidar onboard a satellite, and then use the tool to run experiments with those assumptions, he said.

The simulation also uses a constellation simulator called TAT-C that Le Moigne and her team at Goddard and other institutions developed. "TAT-C helps us locate where the satellite would be and what part of the Earth it would see," Forman said.

Once all the sensors are together in the simulation tool, the team is able to run different experiments that include different scenarios, like putting a satellite into one orbit versus another or having a satellite look at a wide swath of Earth versus a narrow one. With this suite of experiments, they can gauge the "scientific bang" based on a common benchmark scenario. "We're really trying to systematically narrow down the pool of options we might want to consider," Forman said.

"In order to do all this, you have to use supercomputers," Forman said, adding he's using the Discover Supercomputer at the NASA Center for Climate Simulation at Goddard and the Deepthought2 High-Performance Computing cluster at the University of Maryland.

As sensors evolve and satellites change, the tool's creators plan to stay in the game. The team intends to continue working on the tool and tweak it so that it represents the current mix of satellites in orbit, Forman said. The tool "will continue to ask questions of what should be next and how we should be planning in 20 years or more out into the future," Forman said.

Measuring Snow from Space

THIS ARTICLE FIRST APPEARED IN CUTTINGEDGE, PUBLISHED BY THE OFFICE OF THE CHIEF TECHNOLOGIST AT NASA'S GODDARD SPACE FLIGHT CENTER. PHOTO BY BILL HYRBYK/NASA.

FAA Extends Funding for NEXTOR Aviation Operations Research Consortium

A University of Maryland-led, Federal Aviation Administration (FAA)-funded research consortium that addresses aviation operations issues on behalf of the federal government, the airline industry, and the flying public has received renewed funding at a time when the air travel industry faces tough challenges due to the COVID-19 pandemic. The FAA has announced a new $24 million contract for the National Center of Excellence for Aviation Operations Research (NEXTOR) extending its mission for an additional seven years. This marks the second extension of the NEXTOR program, first established in 1996.

Under the direction of professors Michael Ball (Robert H. Smith School of Business/Institute for Systems Research) and David Lovell (Civil and Environmental Engineering/Institute for Systems Research), the University of Maryland will continue spearheading this third iteration of NEXTOR ("NEXTOR III"). Other consortium member universities include George Mason University; the Massachusetts Institute of Technology; the University of California, Berkeley; the Virginia Polytechnic Institute and State University; the Georgia Institute of Technology; the Ohio State University; and Purdue University.

Being a NEXTOR partner has allowed the Civil and Environmental Engineering (CEE) department to flesh out its portfolio in the transportation domain, Lovell says. "While the Maryland Transportation Institute and the Center for Advanced Transportation Technology tend to focus more on surface transportation and, to some extent, public transit, rail, and inland waterways, NEXTOR is the primary home for research and instruction related to aviation."

"CEE students can blend their interests in aviation with other modes of transportation—or other areas of concern in CEE such as the environment—to construct holistic courses of study that better prepare them for their careers," he said.

A ONE-STOP SHOP FOR INFORMATION ON HIGHWAY, P3 PROJECTS

UMD RESEARCHERS CREATE A COMPREHENSIVE DATABASE COVERING MAJOR PROJECTS SINCE 2003

Agencies involved in the decision-making process for highway contracts have a valuable new tool at their disposal, allowing them to see the outcomes of past projects, make at-a-glance comparisons, and base their decisions on a wealth of relevant data.

Earlier this year, a team of researchers, programmers, and engineers at the University of Maryland's civil and environmental engineering department completed work on a massive new database covering major highway projects undertaken across the United States since 2003.

The platform incorporates implementation and outcome data from existing repositories, such as the Federal Highway Administration's Highway Performance Monitoring System and National Bridge Inventory, the Electronic Municipal Market Access (EMMA) website, project websites and archives, and documents provided by state agencies.

The result is a "one-stop shop" for analysts, policymakers, agency officials, and lawmakers, says the project's PI, Qingbin Cui, associate professor of civil and environmental engineering at UMD and a faculty affiliate of the Maryland Transportation Institute (MTI). "They can not only see how well various projects have fared in terms of cost and schedule, but they can examine the request for proposals, contracts, and project reports," he said.

Among the benefits: a ready way to assess the suitability of public-private partnerships (P3) for specific highway needs, as compared to traditional methods of project funding.

State transportation departments are increasingly turning to P3s to modernize and expand the nation's network of roads, bridges, rail, and ports. The financing model was also at heart of the White House infrastructure proposal unveiled in 2018.

"One of our goals is to be able to document P3 performance in comparison with other kinds of projects," Cui said. "The database will provide inputs into the FHWA's Alternative Contracting Method toolkit, which is intended to aid state department of transportation officials in selecting the best-fit delivery methods for their highway projects."

THE PRICE OF BOOTLEG GOLD

UMD RESEARCHERS ASSISTED AMAZON RECOVERY EFFORTS BY MEASURING THE EFFECTS OF MERCURY ON SOIL PRODUCTIVITY CAUSED BY ILLEGAL GOLD MINING OPERATIONS

Catastrophic wildfires that have ravaged parts of the Amazon rainforest represent only one of the numerous threats facing a region that some dub "the world's lungs." Maria Rodriguez, a doctoral candidate in environmental engineering at UMD's A. James Clark School of Engineering, has been studying the impact of mercury contamination caused by illegal gold-mining operations—responsible, she says, for destroying large swathes of rainforest.

Local gold-seekers, many of them small-scale entrepreneurs operating without a permit, apply mercury to soil in forest and river sandbanks, then burn the mix in order to isolate the treasured metal. The mercury is emitted into the atmosphere and casts deposits over the vegetation. But the technique also brings about deforestation and long-term contamination that has turned once-verdant rainforest into a desert landscape.

"More than 100,000 hectares have been deforested in Peru alone over the past 20 years" as a result of artisanal gold mining. In addition to the loss of rainforest—a phenomenon linked to global warming—the use of mercury poses health hazards to local people who ingest the affected plants. It also impacts farmers, because the exposure of plants to mercury can lower crop yields.

In 2019, Rodriguez and her faculty mentors, Natasha Andrade and Alba Torrents, traveled to Peru to assist the environment ministry and a regional non-profit, Centro de Innovación Científica Amazónica (CINCIA), which is working to counter deforestation and bring about environmental restoration. Repairing the damage requires scientific analysis of the impact, and that's where Rodriguez—who was awarded an International Graduate Research Fellowship that supported her initial on-site research—hopes to make a difference. Although planned fieldwork in the Peruvian Amazon has been postponed due to the COVID-19 pandemic, she plans to resume when the circumstances allow.

Reforestation efforts up until now have been hampered by insufficient data, she explains.

"There's a program under way to reclaim the contaminated areas using a number of indigenous plant species that provide ecosystem services, like food or CO2 capture. But we don't know enough about the level of contamination in the soil and air and how it affects these particular species. We can't determine if the concentration of mercury in the soil will harm the plants unless we know the levels at which mercury becomes toxic for them. No studies currently exist with regard to these indigenous plants," she said.

Rodriguez aims to fill in these gaps in the research by determining the toxicity reference value—in simple terms, a way of measuring the threshold for harmful exposure—of several local species, including the plants commonly known as achiote, cocona, and yuca.

Her endeavor has the potential to shed light on a number of specific questions that are important for conservation and recovery efforts.

"Through tests and analysis, we can determine, for instance, which plant species are more likely to grow in the degraded soil. We can determine the extent to which the soil needs to be cleared before replanting, and we can make predictions about tree growth," Rodriguez said.

"By obtaining this information and sharing it with CINCIA and the environment ministry, we hope to assist in strengthening the conservation effort," she said. "The political will exists to take action to recover these areas, but data is needed for the effort to be successful."

SCHWARTZ TO DELIVER MONISMITH LECTURE

Charles W. Schwartz, chair of the UMD civil and environmental engineering department, will be the next lecturer in the ASCE Geo-Institute's Carl L. Monismith Lecture Series. The annual series honors the important contributions made by Monismith—a professor at the University of California, Berkeley, for more than 50 years—to the field of pavement engineering.

Schwartz, an expert on pavement design and analysis and geomechanics, has been instrumental in development of a mechanistic-empirical design model that applies both theory and empirical testing. "With this approach, we apply theoretical rigor, but also use empirical approaches to fill in the gaps," he said.

"I am very honored to have been selected for the Monismith Lecture Series," Schwartz said. "Carl Monismith has been one of the most influential figures in bridging geotechnical and pavement engineering, and this series reflects the importance of his legacy."

UMD's Reilly Lands Gulf Research Program Fellowship

A UMD civil and environmental engineering professor whose research examines bottlenecks in disaster relief and emergency response—including built-in mechanisms that foster unequal allocation of resources—has been awarded an Early-Career Research Fellowship from the Gulf Research Program of the National Academy of Sciences.

With support from the fellowship, assistant professor Allison Reilly is now poised to advance her research into multiple resilience-related topics, including coastal infrastructure in rural areas and inequities arising out of incentives and disincentives that exist within the federal disaster relief system.

Discussion about protecting coastal infrastructure has often centered on large urban areas and on locations perceived as high-value, Reilly observes. "We hear a lot about how to protect New York City or Washington, D.C., but we don't hear so much about the need to protect rural areas," she said.

In her research so far, Reilly has examined what can be done to better mitigate the threats faced by communities along Maryland's Eastern Shore; she now hopes to connect this research with similar challenges in the Gulf Coast region. "Many of the lessons are transferable between the two regions," she said. These include insights into more effective and efficient emergency management during flood conditions, when roads may be blocked and access to affected areas hampered.

Equitable allocation of federal disaster aid is another area of concern for Reilly, who sees imbalances built into the current system. For one thing, aid is distributed to those who apply for it—meaning that communities that are good at the application process, or can hire personnel to handle the paperwork, stand to receive more aid.

Moreover, aid is allocated to communities based on the extent of damage—a formula which, paradoxically enough, can discourage communities from taking proactive steps to mitigate risks.

"We have to look more carefully at some of the unintended consequences of policymaking," Reilly said. "My hope is to see disaster policy that isn't unintentionally disproportionate or inequitable."

FACULTY ACHIEVEMENTS

Professor **BILAL AYYUB** has been named an honorary member of the American Society of Mechanical Engineers (ASME) for his distinguished leadership and contributions to risk analysis for the protection and lifecycle management of infrastructure systems using quantitative methods.

In September, **AYYUB** delivered the 2019 Kececioglu Memorial Lecture on the Resilience of Infrastructure Systems: Quantification and Valuation at the University of Arizona. In November, he delivered the Le Val Lund Lecture on Lifeline Infrastructure and Community Resilience. His lecture was titled "Climate-Resilient Infrastructure: Adaptive Design and Risk Management."

Assistant Professor **MICHELLE BENSI** was awarded a grant of nearly $800,000 from the U.S. Department of Energy for a project on identifying and prioritizing sources of uncertainty in external hazard probabilistic risk assessments. Bensi is the PI, with co-PIs from multiple institutions.

JOHN CABLE, director of the Project Management Center for Excellence, conducted a webinar for the Project Management Institute entitled "Teaching & Learning at a Safe Distance: Moving your PM Courses online" with a global audience of 850 participants.

BIRTHE V. KJELLRUP, associate professor and Wasmer Professor in Engineering, was selected by the NASA Space Life and Physical Sciences to serve on the Biophysics Definition Team to construct a roadmap for prevention of microbiologically related issues at the International Space Station.

Assistant Professor **ALLISON REILLY** is co-Pi of a National Science Foundation (NSF)-funded endeavor to study how climate change and related phenomena, such as storms and rising sea levels, are impacting bays and estuaries. The project is being led by University of Maryland Center for Environmental Science (UMCES) oceanographer Ming Li.

RICHARD MCCUEN

A Lasting Legacy as Educator, Scholar

University of Maryland (UMD) civil and environmental engineering graduates are known for being well-prepared—thanks, in no small part, to the rigorous standards set by Ben Dyer Chair Richard McCuen, who retired this summer after a career spanning nearly five decades.

"He held us to the same standard that I am held to in my workplace, thus helping to prepare me well for the real world of engineering," wrote John Groeger (B.S., '15) in response to the news. "I realize how great a teacher he was because I remember so much of his course. He was tough, but a legend of the Clark school of Engineering for good reason."

"He was hands-down the toughest professor at Maryland for civil engineers," agreed Hala El-Erian Flores (B.S., '95). "He was also the professor that cared the most." She also noted his commitment to breaking down gender barriers: McCuen "progressively, professionally, and brilliantly supported young female engineers" at a time when women in the field were a rarity, she recalled.

McCuen's impact on the CEE department and the A. James Clark School of Engineering has been multifaceted: among other roles, he has led the department's combined B.S./M.S. program, directed the Clark School honors program, and served as associate dean of undergraduate education. He also mentored the UMD branch of the Chi Epsilon honor society and helped spearhead high school outreach activities. In 2008, the Clark School honored McCuen with a Faculty Service Award; it is one of many accolades McCuen received during his long and distinguished career.

Impactful as his teaching has been, McCuen is also lauded for his work as a scholar. A member of the American Society of Civil Engineers (ASCE), the American Water Resources Association, and the American Association for the Advancement of Science, he has authored nearly 200 professional papers and 23 books. In 2014, ASCE honored him with the Ven Te Chow Award, citing his "prolific, innovative scholarship in engineering hydrology; benchmark contributions to hydrologic practice; cultivation of rigor, communication, and professionalism at all levels; tireless, generous mentorship of students and colleagues; and unwavering dedication to ethics and diversity in the profession."

UMD's Baecher Receives the ASCE Terzaghi Lecture Award

The Geo-Institute of the American Society of Civil Engineers (ASCE) has selected UMD civil and environmental engineering professor Gregory B. Baecher to receive the 59th Karl Terzaghi Lecture Award for "advancing the field of geotechnical risk through research, education, and practice."

The lecture will be delivered at the International Foundation Congress and Equipment Expo, May 10-14, 2021, in Dallas, Texas.

"I am honored to have been selected for this award," Baecher said. "The Geo-Institute is the most important organization involved in promoting geotechnical engineering practice. It has made an outsized contribution to improving the safety and reliability of our built environment."

Baecher directs the Center for Disaster Resilience, a research hub based at the CEE department, which is part of the A. James Clark School of Engineering at UMD. A member of the National Academy of Engineering, he has authored more than 16 National Academy reports on water re-source management, risk analysis, and national security, as well as five books on risk, safety, and civil infrastructure protection, and more than 200 technical publications. He has been recognized for his work with numerous awards and honors, including the USACE Commander's Award for Public Service and the GEOSnet Distinguished Achievement Award.

Ayyub Receives ASCE President's Medal

Professor Bilal Ayyub, who led the development of an American Society of Civil Engineers (ASCE) manual of practice on adaptive design, has been awarded the ASCE President's Medal for his contribution to the endeavor.

The medal recognizes Ayyub's efforts "to bring adaptive design to the profession to help address a changing climate," the organization said.

Ayyub is the recipient of three additional awards from ASCE. He received the Le Val Lund Award for Practicing Lifeline Risk Reduction for his contributions to resilience enhancement and risk reduction for lifeline networked systems, as well as the Alfredo Ang Award for Risk Analysis and Management of Civil Infrastructure and an award for his service as chair of the executive committee of ASCE's Infrastructure Resilience Division.

Galloway Briefs Congress on Improved Flood Management

Congress should act to remove barriers to interagency co-operation and authorize the U.S. Army Corps of Engineers (USACE) to use updated Principles, Requirements, and Guidelines (PR&G) in making project decisions, an internationally known water resources expert told lawmakers.

Dr. Gerald Galloway, who heads the Center for Disaster Resilience (CDR) at the A. James Clark School of Engineering, addressed the House Subcommittee on Water Resources and the Environment as it mulled ways to incorporate resiliency principles into a new Water Resources Development Act (WRDA). Galloway, a retired Army brigadier-general, is a member of the National Academy of Engineering and holds an appointment as Glenn L. Martin professor in the civil and environmental engineering program at UMD.

The WRDA, originally adopted in 1974, has been upgraded eleven times, with the most recent legislation passed in 2018. USACE is responsible for meeting most WRDA requirements.

The Corps, however, is currently barred from utilizing an updated PR&G that includes environmental and social factors among the criteria for authorizing a project. As a result, Galloway said, low-income populations and agriculture-heavy areas of the country do not receive adequate flood protection, since efforts are channeled into areas deemed to be of higher economic value.

"Congress must remove its restrictions on USACE's use of the more modern and broader-based principles requiring guidelines for project justification," Galloway said. "These restrictions ... do not make sense any more, restrict full consideration of social and flood risk reduction benefits, limit project innovation, and fail the economically less fortunate."

In addition to freeing up restrictions on the Corps, better integration is needed among federal agencies and departments, including the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), and the National Oceanic and Atmospheric Administration (NOAA), as well as among federal, state, and local agencies.

While multiple governmental agencies are involved with disaster prevention and recovery, bureaucratic obstacles often stand in the way of a co-ordinated effort, Galloway said.

"We've gone around Washington, and we've gone around communities where it is a problem. We're told the same thing by state agencies: we would like to help, but we can't. We'd like to get together, but we can't," he said. He urged institutions at all levels to embrace a "culture of resilience" in which stakeholders actively work to identify and clear up bottlenecks that impair needed cooperation.

"I believe that these are solvable because the people who are doing this work really want to do it," Galloway said.

His recommendations formed part of a broader call to replace outdated water resource management and flood prevention strategies with a newer approach based on principles of resilience, entailing "an ability to identify the growing risks that face us, to plan and prepare to deal with these risks, and to absorb the impact of a major hazard event without collapse."

> "We face a turning point ... changes in climate and weather place major challenges in front of us."

A succession of natural disasters—including 2005's Hurricane Katrina, the subsequent hurricanes Sandy, Irma, Harvey, and Maria, and floods that inundated the Midwest in 2019—have demonstrated the urgency of a revamped approach to water resources, Galloway said. Meanwhile, the nation faces a growing—though less publicized—problem of urban flooding, detailed in a 2018 report co-authored by Galloway, other civil and environmental engineering faculty at UMD, and colleagues at the Center for Texas Beaches and Shores at Texas A&M University, Galveston Campus.

The time to act is now, Galloway stressed.

"We face a turning point as a combination of pressure from development, deteriorating infrastructure reaching the end of its usable life, failure to complete flood damage reduction projects that are waiting in line, and changes in climate and weather place major challenges in front of us," he said.

DAVID LITTLE

IT'S A QUINTESSENTIAL STORY OF SUCCESS BORN OF DETERMINATION: growing up in the rowhouses of Baltimore City with early family hardship, Baltimore native David Little (B.S. '76) had few means available with which to pursue his aspiration of becoming an engineer. But he persisted. The A. James Clark School of Engineering's co-operative education program provided financial support in addition to valuable on-the-job experience, enabling Little to complete his degree at the University of Maryland.

In 1986, Little and two fellow UMD civil engineering graduates—Dave Weber (B.S. '77) Carl Gutshick (B.S. '75)—founded the engineering, planning, and surveying firm Gutschick, Little, and Weber. Through rigorous attention to quality and detail, their company secured a foothold in a highly competitive marketplace and has continued to thrive, with projects that include commercial and town centers, parks, and residential communities.

The hardship of Little's early days has made him particularly responsive to the uphill battles that many students face when it comes to financing their education. It's part of the reason why he and his wife, fellow Terp Linda H. Little, have established The Little Family Maryland Promise Scholarship, which will support need-based scholarships at UMD. Preference will be given to undergraduate students enrolled in the A. James Clark School of Engineering.

The scholarship has been established under the auspices of the Clark Challenge for the Maryland Promise program, under which UMD and the A. James and Alice B. Clark Foundation—donors of a historic, nearly $220 million gift to UMD engineering—each provide matching funds.

"It means a great deal to help students who have the aptitude and work hard, but face financial obstacles," Little said. "Knowing that the scholarship can provide many such opportunities warms my heart."

The scholarship caps the Littles' ongoing involvement with UMD and the Clark School; including support for the Cooperative Education Program. For the past several years, David Little has served on the CEE department's Board of Visitors. The firm that he co-founded has regularly hired UMD students and graduates at levels ranging from internships to senior-level executives.

"The University of Maryland provides a top-notch education in engineering, and that's reflected in the caliber of its graduates," Little said. "We can hit the ground running with every UMD student that we hire."

Jessie Yung Joins Board of Visitors

Jessie Yung, Deputy Director of Field Services-North, Federal Highway Administration (FHWA), joined the civil and environmental engineering department's Board of Visitors this fall, following a vote among members. She has served the FHA since 1998, taking on successively greater responsibilities.

Yung has a long-standing connection to the University of Maryland's (UMD) A. James Clark School of Engineering; growing up she attended engineering summer camps at UMD and went on to complete her bachelor's degree (1996) and master's (1999) at the university, both in civil engineering. Several of her family members are Terps, including her husband, infrastructure consulting firm executive Ben Asavakarin, who she met while an undergraduate.

She has won numerous awards and honors during her career, including a 2018 Woman of the Year award from the WTS Central Virginia Chapter, an FHWA Administrator's Award for Superior Achievement, and an FHWA Administrator's Excellence in Teamwork Award.

She is interested in potentially mentoring students—especially women—for careers with the federal government and in civil engineering.

The distinguished members of the CEE Board of Visitors serve in an advisory capacity to the department to help identify needs, plan for the future, and develop fundraising strategies to enhance our endowment. The volunteers meet twice a year with the department chair and select members of the faculty and staff.

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Center for Advanced Transportation Technology Lab (CATT Lab) Director Michael Pack discusses the lab's unique capabilities with TRB attendees.

UMD PRESENTS NEW RESEARCH AT TRB ANNUAL MEETING

Researchers from the Maryland Transportation Institute (MTI), the Center for Advanced Transportation Technology (CATT), and the CATT Lab tackled critical transportation-related challenges and presented innovative solutions at the Transportation Research Board (TRB)'s 99th Annual Meeting, held in Washington, D.C. from January 12-16.

MTI and CATT Lab's booth at the event showcased a new addition to CATT Lab's Regional Integrated Transportation Information System (RITIS) Trip Analytics toolkit: a route analysis tool that provides at-a-glance information on the predominant routes between two locations, using data from mobile devices and 3rd-party connected vehicles to generate visualizations and other resources. The route analysis tool—a unique addition to the transportation analytics space—is now being offered to public agency users across the country, to enable planners and operators to assess the impact of, say, an emergency bridge closure, decide where to invest in technologies to smooth the flow of traffic, or even improve computer models to more accurately assess the impacts of vehicle emissions on air quality.

Several researchers presented work relating to new technologies and services that are transforming the way we get around, including bikeshare and dockless scooter-share. CATT experts also showcased novel approaches incorporating big data, machine learning, and automation.

STUDENT AWARDS AND HOHORS

Congratulations to all CEE students whose academic and research achievements were recognized in 2019-20, including:

SAMANTHA ARENBERG, Chi Epsilon Outstanding Senior Award

NICOLETTE CORRAO, ASCE Outstanding Senior Award

AZIN AL KJAHBAF, 2020 University of Maryland Outstanding Graduate Assistant Award and Society for Risk Analysis (SRA) Travel Award

AREF DARZI, **YEMING HAO**, 2019 WDCSITE (Institute of Transportation Engineers D.C. Section) Student Scholarship

HILLARY GRIFFIN, Bechtel Award for Outstanding Leadership

ANDREW GRUPP, CEE Outstanding Junior Award

SHILAN LIN, 2020 Master's Award, Department of Civil and Environmental Engineering

OLUWASEUN OLUWATIMI, Chair's Award

AMANDA O'SHAUGHNESSY, CEE Outstanding Senior Award

SAI THEJASWINI PAMURU, National Science Foundation (NSF) Global Stewards 2020 fellowship

YALDA SADAAT, 2019 Stanley R. Zupnik fellowship, University of Maryland College Park, and 2019 NSF Travel Grant to attend Great Minds in STEM

ERIN STEWARTSON, Robert L. Morris Award in Environmental Leadership

ZIJIANG YANG, 2020-2021 Ann G. Wylie Dissertation Fellowship, UMD Graduate School and 2020 Ph.D. Award, Department of Civil and Environmental Engineering, and 2020 Education Award, American Chemical Society Agro Division

BINYA ZHANG, 2019 Intelligent Transportation Society Maryland Student Scholarship and 2019 Women in Transportation, Washington, D.C. Chapter Doctoral Scholarship

UMD's Project Management Symposium Goes Virtual

BY KATHLEEN FRANKLE

Inspiring speakers. Practical insights. A chance to earn Professional Development Units (PDUs). These are some of the reasons that UMD Project Management Symposium participants have lauded the annual event.

And the same was true this year, despite a change in delivery.

Due to the COVID-19 pandemic, the 2020 Project Management Symposium had to be converted from an in-person event to a virtual one in only five weeks. That didn't stop it from being a success, however—indeed, thanks to the new, online format, attendees from faraway locations could attend without the cost or time required to travel.

The Symposium featured four keynote speakers: Knowledge Strategies CEO Ed Hoffman; Clark Construction Executive Vice President Barbara Wagner; Mark Brown, U.S. Department of Education Chief Operating Officer, Federal Student Aid; and Josh Ramirez, Founder & President, Institute for Neuro & Behavioral Project Management. Fifty-five individual sessions were held in five concurrent tracks. A total of 64 different speakers presented on trending topics, best practices, lessons learned and case studies to five hundred and sixty project management professionals representing 273 different organizations from government, non-profits, industry and academia.

"I was a little concerned about the virtual experience," said Laura Sharps, an Engineering Supervisor for Jacobs. "However, UMD pulled it off exceptionally. The content was awesome and I have lots of new ideas to take back to my team!"

For Meisha Watkins, Strategic Initiative Project Manager for the U.S. Postal Service, the 2020 Symposium was "the perfect intersection of practical industry application & theory. Despite being online, I felt connected and 'in the room' with all of the speakers and moderators."

So how did the experience actually work? All registered participants received instructions on how to access a password-protected online version of the virtual schedule. That schedule included a description of each session, speaker photos and bios plus the WebEx links needed to participate in each session. Attendees were able to review the schedule and select which session they wanted to join. Participants were able to earn up to 11.25 PDUs during the two-days of the live symposium sessions.

The UMD event has always drawn participants from around the globe—but this year they didn't have to endure jet lag or other inconveniences of travel. In all, Project Management Professionals from 28 states and 11 countries registered for the symposium. "It's the best project management symposium that I never attended" said Shane Perkins, Director of Investment Realization at Aurelius Group in Sydney, Australia. "Going virtual meant I could sit half-way around the world in my pajamas, and still participate and hear the latest ideas."

The 2021 Project Management Symposium, scheduled for April 22-23, will also be virtual.

> "I was a little concerned about the virtual experience, however, UMD pulled it off exceptionally."
>
> **LAURA SHARPS**
> ENGINEERING SUPERVISOR, JACOBS

BRIANNA MURPHY

ALUMNA BRINGS ENGINEERING BACKGROUND TO CAREER AS DATA ANALYST

BY ISABELLA COOPER, PH.D.

In times of crisis, an engineer's adaptability, innovation, and ability to quantify risk become even more crucial, notes UMD alumna Brianna Murphy ('17), whose career has allowed her to pursue her passions for infrastructure and data analysis.

"Every single day, we rely on and are impacted by civil engineers," Murphy said. The centrality of civil engineering to our lives is one of the reasons she was drawn to the field.

Before enrolling in civil engineering at UMD, Murphy worked in the insurance industry for four years, and she credits this experience with teaching her about risk management, a central concept for civil engineers. At UMD, she pursued the geotechnical/structural track in the civil engineering department, and minored in actuarial mathematics.

In the CEE department, she says, "the professors were phenomenal." Her mentors, including Professors Charles W. Schwartz and Richard McCuen, not only helped her by discussing her coursework with her, but by showing her that abundant career prospects were open to her. She also credits her time at UMD with teaching her the importance of interdisciplinarity.

Murphy was involved in American Society of Civil Engineers (ASCE) as a student, and planned its annual networking event, Suit Up & Be Civil, in her last year. Above all, she says the defining inspiration she took from her time at UMD was to "think bigger."

After UMD, Murphy pursued her master's degree in civil engineering with a focus in data analytics at Carnegie Mellon. She received this degree in just a year. While there, she worked part-time for Atkins Global Consulting, with whom she had interned in summer 2016. With Atkins, she consulted with Federal Emergency Management Agency on a quality assurance project. The aim of this project was to analyze the National Flooding Insurance Program (NFIP) by utilizing various data sources. This gave her experience using large and diverse data sets to assess risk and identify trends.

Murphy now works for DPR Construction as a data scientist. She is also a member of its data leadership team. She describes the company as "ever forward," one of its core principles, and notes that DPR's passion for data and innovation allows it to continue to produce great projects, great teams, great relationships, and great value for its customers. DPR is "on the cutting edge of using data in the construction industry," she says. Her current work projects focus on making job sites safer and using data to avoid risk.

Due to COVID-19, she is currently working from home. As a self-described "people person," Murphy misses being in the office, but appreciates how flexible the company has been. DPR is responding quickly to the changes mandated by the pandemic, she says; it changed its safety protocols starting in early March and has deployed new technologies and analytics to enhance the safety of its jobsites.

Though COVID-19 has presented dire challenges, Murphy sees promise in the use of new technologies and innovation in infrastructure. The pandemic "highlighted the need to be agile and respond quickly," compelling companies to be proactive, not just reactive, she said. "The construction industry has had to adapt overnight. It's incredible to see."

Murphy maintains ties with UMD, having assisted the Clark School's Engineering Alumni Board. She plans to continue that involvement, as a way of showing her appreciation for the education and experiences she received here.

ERIN STEWARTSON

ENGINEERS "ALWAYS DEAL WITH REAL-WORLD PROBLEMS"

BY ISABELLA COOPER, PH.D.

Erin Stewartson has always liked building and designing things. At one point, she considered majoring in architecture; ultimately, however, she decided that civil engineering was a better fit.

This past May, she earned her B.S. in civil and environmental engineering from UMD, where she also minored in sustainability. A Banneker Key Scholar, she credits receiving this scholarship as one of her reasons for her choice of school. She also has family ties to the Clark School; her brother is also a UMD graduate, with a major in electrical engineering.

Both in high school and college, Stewartson has worked to encourage more women and minorities to go into STEM fields. In high school, she founded a chapter of the National Society of Black Engineers; at UMD, she has been a Clark School Ambassador.

The Ambassador role, Stewartson says, provided an opportunity to show others, particularly those who are underrepresented in engineering, how passionate she is about the field. "People truly listen to what you have to say if you're passionate," she says. She adds that it has been especially gratifying for her to see women of color whom she met as prospective students return as freshmen in the department. She emphasizes how important it is for retention for underrepresented students to feel they have support.

Stewartson has also been active with the American Concrete Institute, seeing it as a valuable way to network. As a sophomore, she was also part of the Concrete Canoe team, where she worked on designing mixes; she says she appreciated the way it taught her things about trial and error, data analysis, and teamwork that translated to her classes. She is a member of the Black Engineers Society, and also enjoys going on site tours with ASCE.

Her favorite part of the CEE field? Everything has practical application. "We always deal with real-world problems," she said. At UMD, her favorite classes included ENCE305 (Fundamentals of Engineering Fluids) and ENCE215 (Engineering for Sustainability).

Also valuable, she says, were here summer engineering internships at Turner Construction. She worked as a field engineer on the DC United and City Center Hotel projects, and helped revise progress reports to focus on what she calls "lean construction" and was an active team member that led foremen meetings every morning on site.

Outside of engineering, Stewartson has been a member of the Maryland Gospel Choir, the Adventist Student Fellowship, and the Caribbean Student Association. In her spare time, she likes to sing and to bake. She attributes her ability to balance all her activities with her academics to very careful scheduling. "Because I do a lot, I know I can't waste time," she says.

Stewartson isn't taking a break: this fall, she began her doctoral studies in civil engineering at Ohio State University. Long-term, she hopes to go to underserved places and help them build or rebuild using sustainable materials. To engineering students who are just beginning their journey, she has this advice: "claim your ideas. Modesty is good, but credit yourself for your ideas."

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PHOTO: THAI NGUYEN

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