FALL 2018 | THE A. JAMES CLARK SCHOOL OF ENGINEERING

UNIVERSITY OF MARYLAND 1856

CIVILREMARKS

CIVIL AND ENVIRONMENTAL ENGINEERING AT MARYLAND

A BETTER VIEW

How CATT Lab has transformed the way we manage our nation's transportation network.

Chair's Message

This has been a monumental year for the Department of Civil and Environmental Engineering (CEE) and the A. James Clark School of Engineering. In October 2017, the Clark School announced a nearly $220 million investment from the A. James and Alice B. Clark Foundation, continuing the generous legacy of CEE alumnus A. James Clark '50. This spring, we celebrated the launch of the Maryland Transportation Institute with agency and university leaders. And in August, we opened the doors to our state-of-the-art Whiting-Turner Infrastructure Engineering Laboratories.

These landmark events are shining examples of CEE's dedication to leading transformational changes in our field. The same dedication can also be seen in the work of our faculty, who continually develop and harness novel methods to shape the future of civil and environmental engineering.

In this edition of *Civil Remarks*, you'll read about our work in big data and data analytics. I'm particularly pleased to feature the unmatched ingenuity and technical expertise of our Center for Advanced Transportation Technology Laboratory—better known to alumni and friends as CATT Lab. From transportation system management to building safety to water supply forecasting, CEE advances using big data are addressing pressing global challenges.

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

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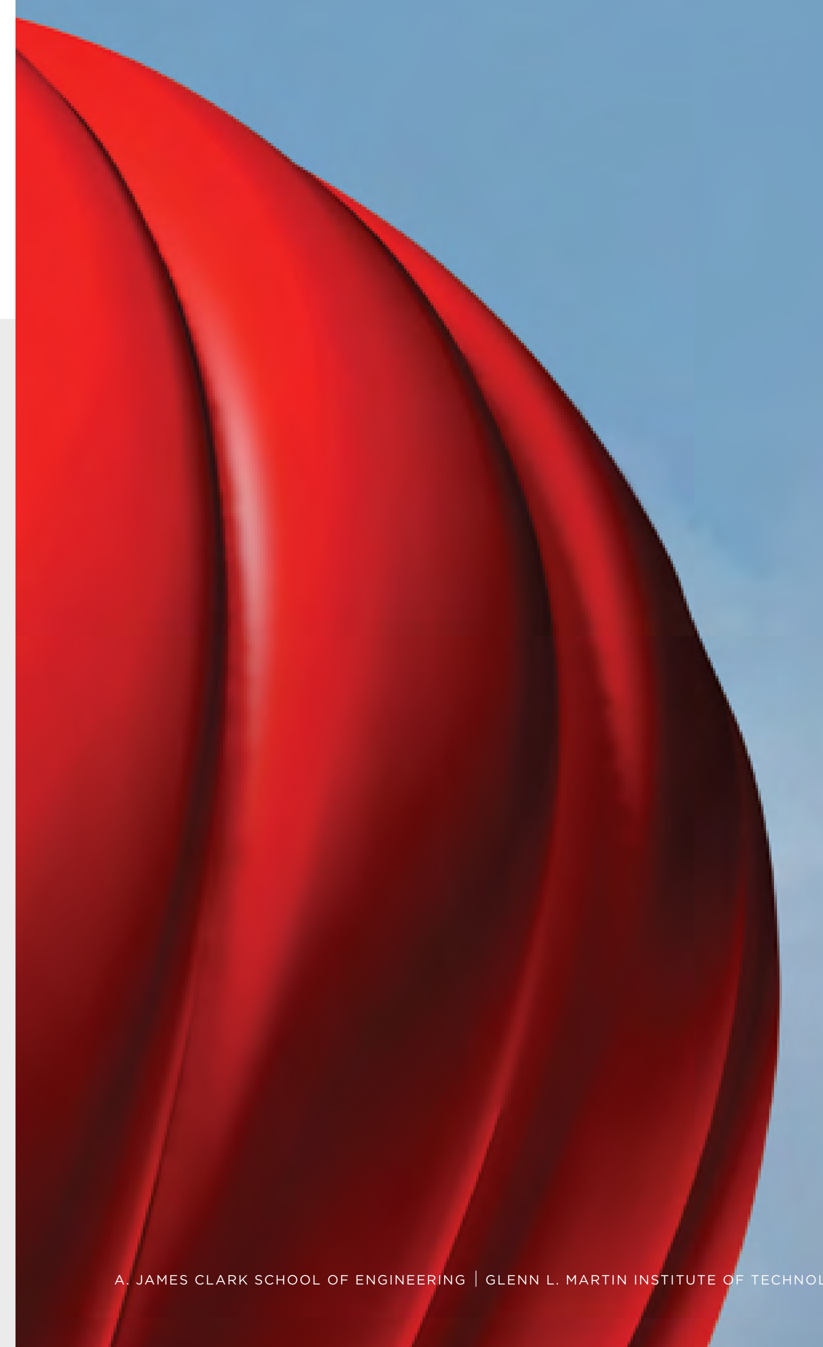
Civil Remarks is published annually for alumni and friends of the Department of Civil and Environmental Engineering at the A. James Clark School of Engineering, University of Maryland.

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

CATT Lab Turns DATA to DECISIONS



Dark gray plumes wafted over the nation's capital on June 20, 2018, a foreboding sign for the more than 200,000 drivers who traverse the Maryland-Virginia border each day on the Woodrow Wilson Bridge. Those closer to the source could see the tractor-trailer set ablaze after plowing into construction vehicles—trapping three workers in the bucket of a boom truck and backing up traffic for miles in both directions.

The bridge would not fully reopen for 12 hours. During that time, police, fire, and hazmat crews coordinated rescue efforts. Transportation officials set up detours and managed spillover congestion on nearby roadways. Television and radio stations broadcasted frequent updates. And travel apps like Google Maps and Waze pushed route changes for the lucky ones not already on the bridge.

All thanks to analytics and public information channels created by the Center for Advanced Transportation Technology Laboratory (CATT Lab) at the University of Maryland (UMD).

(CONTINUED ON PAGE 2)

“TWENTY YEARS AGO, I WOULD NOT HAVE PREDICTED THE THINGS WE CAN DO NOW WITH CATT LAB.”

World’s Largest Archive, Visualized

Every day, CATT Lab collects, fuses, and analyzes more than 8 billion measurements from sources like roadside sensors, GPS-enabled devices, computer-aided dispatch systems, CCTV cameras, and weather stations. From their unassuming offices roughly a mile from UMD’s main campus, a team of more than 100 engineers, software developers, artists, and researchers manage the largest big data transportation archive in the world.

For 30 states and counting, this archive means access to higher-quality data faster and at significantly lower costs—some states see annual savings in the millions.

“As late as 2008, we sent three cars out every week in the spring and fall to collect GPS data for speeds and travel time in our region,” said Ed Stylc, a transportation planner with the Baltimore Metropolitan Council. “It was a time consuming process.”

If an elected official or community group had a question about the congestion on this highway bend or the accident rate at that intersection, the state’s department of transportation or a metropolitan planning agency (MPO) would often have to launch a new study of the area. These could take months, and they told transportation managers little about the root cause of complex problems.

“CATT Lab offers an opportunity to answer questions that we were often asked but could never provide a credible answer to. Twenty years ago, I would not have predicted the things we can do now with CATT Lab,” said Metropolitan Washington Council of Governments Department of Transportation Planning’s Patrick Zilliacus.

? DID YOU KNOW

RITIS DATASETS GO BACK AS FAR AS 25 YEARS. THE ARCHIVE ALSO INCLUDES CONTINUOUS TRAFFIC SPEEDS AND TRAVEL TIME DATA BEGINNING IN 2010 FOR OVER 1 MILLION MILES OF ROADWAY.

METROPOLITAN AREA TRANSPORTATION OPERATIONS COORDINATION

Coordinating regional incident management

$18 million approximate annual savings in reduced emissions, fuel consumption, and traffic delays in the National Capital Region.

TOOLS in Action

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

Conducting a regional travel time survey

BEFORE

$225,000

AFTER

$20,000*

? DID YOU KNOW

RITIS SIGNIFICANTLY REDUCES THE COST OF TRANSPORTATION RESEARCH, PLANNING, AND OPERATIONS WHILE DRAMATICALLY INCREASING CAPABILITIES. EMAIL INFO@CATTLAB.UMD.EDU TO REQUEST ACCESS.

NEW JERSEY DEPARTMENT OF TRANSPORTATION

Evaluating the impacts of an interchange improvement

BEFORE	AFTER
$13,650*	$440*

*Estimated

However, it's not data that Director Michael Pack points to when asked what sets the lab apart. The real heart of CATT Lab, part of the Maryland Transportation Institute, is a suite of around 40 online analysis and visualization tools.

"Even with the data, I don't know where I would have started or how much time and energy it would have taken to create what CATT Lab tools give me," said Kelly Wells, mobility project manager for the North Carolina Department of Transportation.

Available on a platform known as RITIS—Regional Integrated Transportation Information System—CATT Lab tools are used by over 8,000 transportation professionals and researchers around the country to plan for a major forecasted snow storm, monitor the impacts of incident response efforts on congestion, meet federal reporting requirements, and tackle other pressing transportation safety and mobility issues.

"Regardless of your technical background, our tools make it easy to answer complex questions quickly and effectively," said Pack, who's led CATT Lab since it opened in 2002.

Imagine for instance that you needed to understand evening rush hour traffic in the nine counties of the Delaware Valley Regional Planning Commission (DVRPC). Before CATT Lab released their Probe Data Analytics Suite, that required hundreds of staff hours.

"We had an intern who spent the entire summer analyzing a year's worth of data for the 5-6 p.m. peak travel hour on just a few of our limited-access highways," said Jesse Buerk, senior capital program coordinator at DVRPC.

Today, DVRPC uses RITIS to get a detailed picture of traffic conditions on the region's entire road network in minutes.

DID YOU KNOW

CATT LAB OVERSEES THE NATIONAL PERFORMANCE MANAGEMENT RESEARCH DATA SET, WHICH IS USED BY EVERY STATE AND MPO IN THE COUNTRY TO IDENTIFY HIGH CONGESTION AREAS AND TIMES.

Real Time to Reflective

The full power of RITIS lies in the soup-to-nuts insights it provides. Using the Work Zone Performance Monitoring Application, for example, work zone managers can determine in real time if work needs to be put on hold or a lane needs to be reopened to keep traffic moving steadily.

"Traditionally, these decisions would be made by a manager driving to as many work zones as they can to see what's going on," explained Nikola Ivanov, CATT Lab's director of operations. "If a bottleneck happened to be at a location they didn't visit, they wouldn't know there was a problem until it was too late to address."

Once the work is complete, officials can conduct a before-and-after study with RITIS tools that quickly measure and visualize congestion reductions, safety improvements, and economic benefits to travelers and commercial vehicles from construction projects.

"These tools are really helpful for evaluating projects and demonstrating their benefits to decision makers and the public," said John Allen, who relied on RITIS during his tenure with the New Jersey Department of Transportation to create project assessment factsheets.

Those charged with long-term planning can at the same time leverage other tools that automatically rank the most congested locations in a state, ensuring that limited resources go to solving the most pressing problems.

Usability First

Ask a transportation official why they rely on RITIS and you'll hear a lot about the platform's analytic power and ease of use. But one almost unanimous answer stands out.

"If we're ever having a problem with the tools," Zilliacus explained, "the team at CATT Lab is very responsive. They want the tools to work for us."

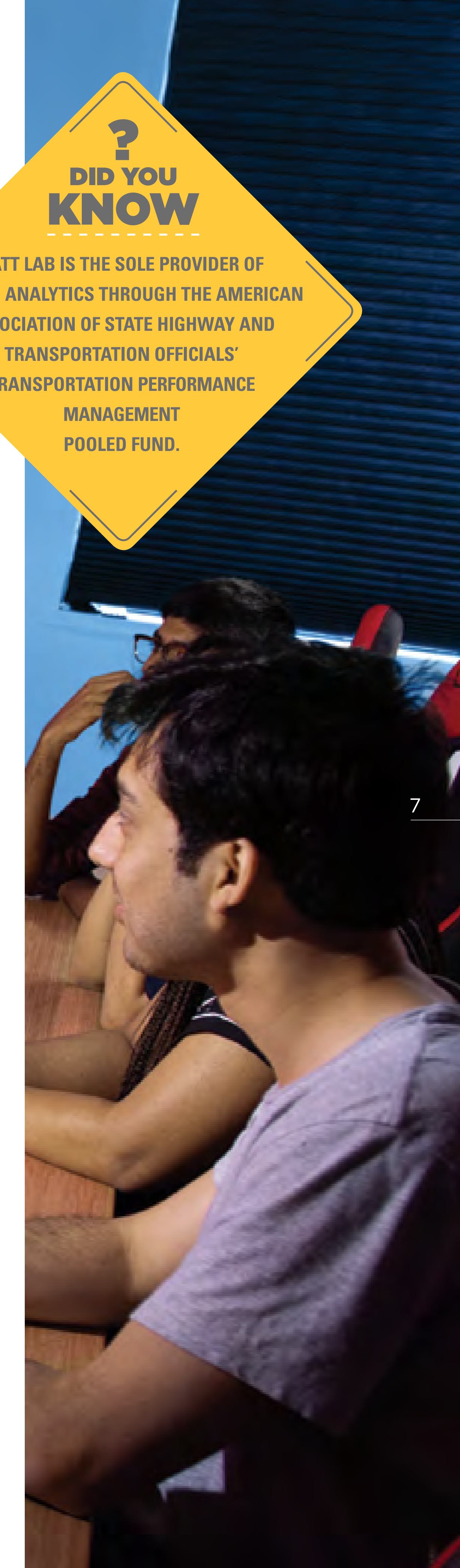
CATT Lab tools are created with a focus on user needs, and their support team fields thousands of requests throughout the year. Pack and his team also host regular user group meetings where transportation officials can get updates on new or upcoming features, hear how other agencies are using the tools, ask questions, and provide feedback on what is working for them or not.

Perhaps the best examples of this user-centered approach are the MAP-21 Analytics Tools.

The Moving Ahead for Progress in the 21st Century Act (MAP-21) requires state and regional agencies to report to the federal government on travel times, reliability, delays, and other transportation performance measures. For most states and MPOs, meeting these new requirements would have meant hiring outside consultants or additional staff, adding potentially millions of dollars to their management costs over the coming years.

MAP-21 Analytics Tools make it easy to compute, visualize, and download all required metrics at a fraction of the cost and in less than five minutes. Users can also output performance measures as charts, maps, and data files ready for reporting.

"The fact that we can calculate these new required federal performance measures with relative ease is so significant for us," Stylc said.



DID YOU KNOW

CATT LAB IS THE SOLE PROVIDER OF MAP-21 ANALYTICS THROUGH THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS' TRANSPORTATION PERFORMANCE MANAGEMENT POOLED FUND.

Driving **Forward**

The holy grail for transportation planners is what's known as trip data: the when, where, why, how, and for how long of traveler movement. It may sound simple, but state and metropolitan agencies have never had the means to easily collect or analyze trip data. Until now.

Through CATT Lab's new Origin-Destination Analytics Suite, planners and researchers can easily trace and analyze trips taken throughout the country. Data for the tools is provided by long-time CATT Lab partners like INRIX and HERE.

"The GPS data we previously received could only tell you that some stretch of road, for example, had an average speed of 43 mph during a specific time of day," said Michael Pack, director of CATT Lab. "With this new data, we can see individual vehicle movements—like where the vehicle enters the roadway, how fast it's going, where it turns, and where it stops."

The massive size and complexity of the data would make it extremely difficult and time intensive for planners to work with directly. Using CATT Lab's highly interactive, web-based analytics, though, they can extract actionable information that dramatically improves traffic safety and regional economies.

"Planners can see when people go to the grocery store, how they get to work, and what they do if a collision blocks the roadway," Pack said. "With this information, they can take steps like adjusting traffic signals, encouraging legislators to make strategic investments in infrastructure, or doing any number of other things to keep traffic flowing."

Trip analysis is just one of several new frontiers Pack and his team are advancing. CATT Lab recently teamed up with the Maryland Transit Administration and the Washington Metropolitan Area Transit Authority to develop powerful analytics for bus and rail that could dramatically change transit.

Looming large on the horizon are also connected and automated vehicles.

"That is a whole new data challenge," said Pack. "We are beginning to mine the data from these autonomous and connected vehicles to see if there are new insights we can gather about roadway performance and safety."

? DID YOU KNOW

CATT LAB IS ALWAYS HIRING. SEND YOUR RESUME TO CATTLAB-JOBS@UMD.EDU TO JOIN THE TEAM DESIGNING LEADING-EDGE SOLUTIONS IN TRANSPORTATION AND BIG DATA SCIENCE.

SHALLY DENG

ANYONE WHO'S BOOKED A SEAT ON A PLANE KNOWS THAT LANDING THE BEST AIRFARE IS A MATTER OF TIMING.

What travelers don't see, though, are the teams of statistical analysts working behind the scenes to help pinpoint the optimal price for an exit row seat from Reagan National to O'Hare in early July.

Qianli "Shally" Deng M.S. '11, Ph.D. '16 is one of those analysts.

From the United Airlines headquarters in Chicago, Deng probes more than 10 years of company data for clues about future demand.

"We're looking for drivers and patterns that correlate with people's travel choices—like origin and destination, price, season, or travel purpose," explained Deng, who works on a team in United's Continuous Improvement and Enterprise Optimization department.

The results are shared with IT staff, who convert the findings to software that enables members of the pricing team to arrive at the best price for both travelers and United.

"There's a lot of back-and-forth between our teams," she said. "That's one of the things I enjoy most."

Deng and her colleagues also check their models against actual sales—a process that can yield unexpected discoveries. They were surprised to see, for example, that flights from Tokyo to San Francisco were in higher demand in May 2018 than projected.

"It turned out there was a tech conference in the area that drew a lot of Japanese participants who wanted to fly first class," she explained.

Her day-to-day duties may not be what some would expect from a person with a doctoral degree in civil engineering, but Deng sees a connection. In College Park, she was also searching for patterns in complex data sets.

As a project management student working with Professor Gregory Baecher, Deng developed a framework for quantifying the risks of rare, catastrophic events. Here too she delved into historical data, this time to fuel a hybrid simulation technique that accounts for the infrequency of catastrophic events and the computing demands of complex simulations.

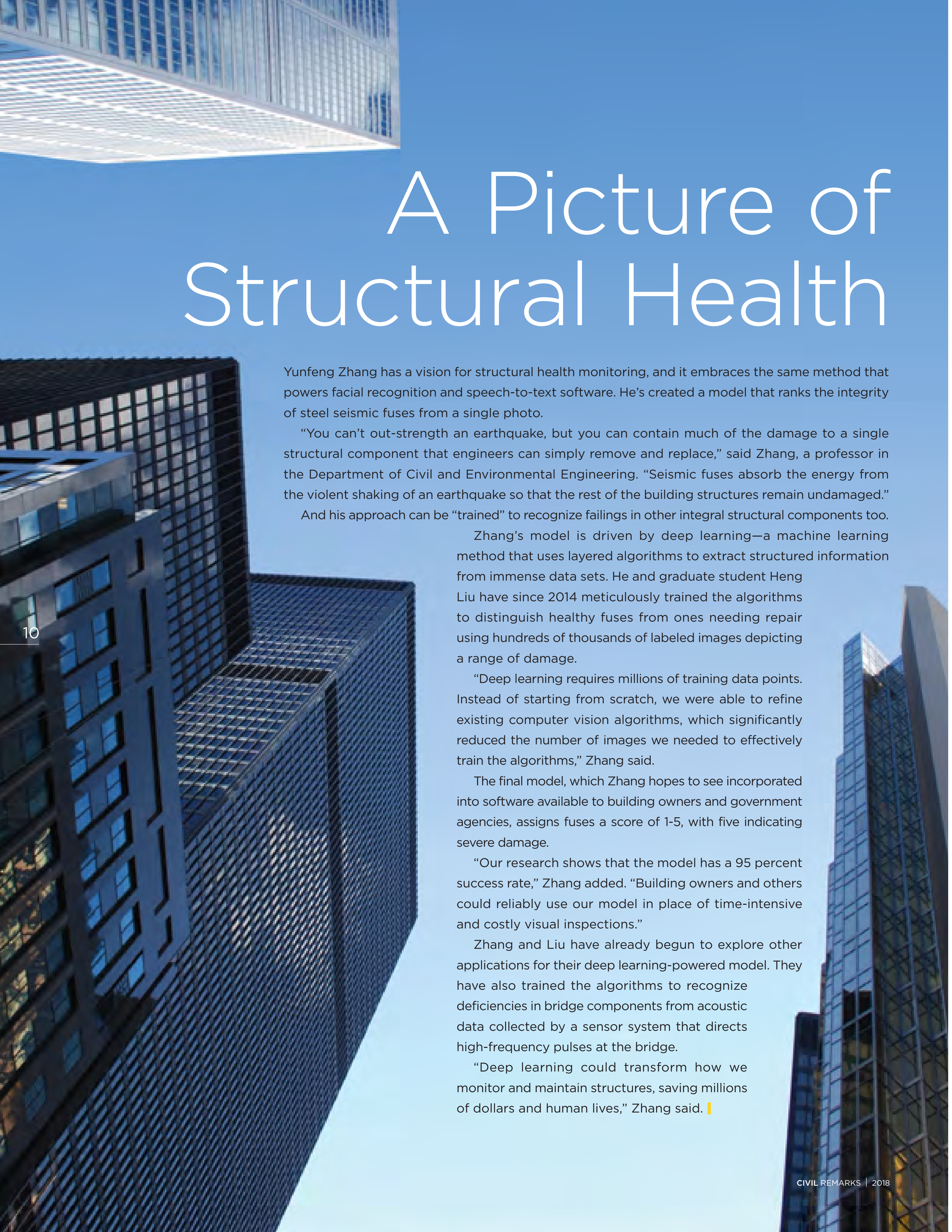
Deng agrees there are notable differences between her work in College Park and Chicago.

"All the analysis I do is driven by a need to help the company earn a profit and meet their organizational goals. That's very different from academia, where one challenge was finding a meaningful question to work on in the first place," said Deng, whose academic career began at China's Tianjin University.

But she's always been one to embrace diverse professional experiences. While pursuing her Ph.D. in civil engineering, Deng completed a second Master of Science in applied mathematics. She also held data science and model development internships at the Institute of Operations Research and Management Sciences and Risk Management Solutions. And since graduating, she's earned a nanodegree in machine learning engineering.

It all comes back, though, to making sense of data.

"I just really love working with data," she said.



A Picture of Structural Health

Yunfeng Zhang has a vision for structural health monitoring, and it embraces the same method that powers facial recognition and speech-to-text software. He's created a model that ranks the integrity of steel seismic fuses from a single photo.

"You can't out-strength an earthquake, but you can contain much of the damage to a single structural component that engineers can simply remove and replace," said Zhang, a professor in the Department of Civil and Environmental Engineering. "Seismic fuses absorb the energy from the violent shaking of an earthquake so that the rest of the building structures remain undamaged."

And his approach can be "trained" to recognize failings in other integral structural components too.

Zhang's model is driven by deep learning—a machine learning method that uses layered algorithms to extract structured information from immense data sets. He and graduate student Heng Liu have since 2014 meticulously trained the algorithms to distinguish healthy fuses from ones needing repair using hundreds of thousands of labeled images depicting a range of damage.

"Deep learning requires millions of training data points. Instead of starting from scratch, we were able to refine existing computer vision algorithms, which significantly reduced the number of images we needed to effectively train the algorithms," Zhang said.

The final model, which Zhang hopes to see incorporated into software available to building owners and government agencies, assigns fuses a score of 1-5, with five indicating severe damage.

"Our research shows that the model has a 95 percent success rate," Zhang added. "Building owners and others could reliably use our model in place of time-intensive and costly visual inspections."

Zhang and Liu have already begun to explore other applications for their deep learning-powered model. They have also trained the algorithms to recognize deficiencies in bridge components from acoustic data collected by a sensor system that directs high-frequency pulses at the bridge.

"Deep learning could transform how we monitor and maintain structures, saving millions of dollars and human lives," Zhang said.

TRAVEL APP COMBATS CONGESTION

Commuters in the D.C.-Baltimore region have a new weapon in the fight against gridlock. Available in the Apple and Android app stores, incenTrip rewards users for decisions that reduce traffic for everyone.

The app uses predictive modeling and real-time information from the Maryland Transportation Institute (MTI) and Center for Advanced Transportation Technology Laboratory to provide a range of departure times, routes, and travel modes that cut the time from A to B.

With each trip, users earn points redeemable for Amazon and Apple Store gift cards. Driving from College Park to D.C. on a Friday evening, for instance, may be worth four points, while Metro users could earn 90 points.

Lei Zhang, Chenfeng Xiong, and Ya Ji developed the app with the goal of cutting congestion and energy use by 10 percent over the next few years.

"That's something we haven't been able to accomplish with billions of dollars in infrastructure investments," said Zhang, MTI director and Herbert Rabin Distinguished Professor. "This is a very different way of managing travel demand."

To reach their goal, Zhang estimates they'll need just 160,000 active users in a region with nearly 4 million commuters.

"Our research indicates that when an incenTrip user saves just one minute in traffic, there's a five to 18 minute travel delay savings systemwide for other travelers," Xiong, an MTI assistant research professor, explained, adding that the Metropolitan Washington Council of Governments is expected to add incenTrip to the Commuter Connections accounts of tens of thousands of members.

incenTrip was developed with a $4.5 million grant from the Department of Energy's Advanced Research Projects Agency-Energy TRANSNET Program. In June 2018, the development team won the D.C. Department of For-Hire Vehicles' Transportation Challenge.

"Our next step is to deploy the technology beyond the D.C.-Baltimore area in collaboration with government agencies and private partners," said Ji, MTI's software development program manager.

It's Not (Just) About the Destination

Experts at the Maryland Transportation Institute (MTI) have received $1.5 million from the Federal Highway Administration (FHWA) to chart the nation's travel demand and develop products for predicting future changes. Funded through FHWA's Exploratory Advanced Research Program, the three-year project will culminate in public domain origin-destination tables that shine a light on how travelers move between and within metropolitan areas.

As the name suggests, origin-destination tables—better known as OD tables—reveal how many trips travelers take between any origin and destination pair.

Transportation planners have long used these to understand travel demand. But MTI experts will propel the method to new heights by creating OD tables for trips between and within the nation's more than 300 metropolitan statistical areas using comprehensive location data from mobile devices.

"This project will revolutionize the way we collect, analyze, and predict travel behavior and demand," MTI Director and Herbert Rabin Distinguished Professor Lei Zhang said.

Zhang, along with Ph.D. student Sepehr Ghader and others, will also tap into 2017 location data provided by companies like AirSage, INRIX, and StreetLight Data to develop innovative methods to fill information gaps in traveler demographics, travel modes, trip purposes, and more.

The OD tables will serve as the foundation of a microsimulation model that officials could use to predict future national travel demand and determine how well a proposed project will meet that demand before investing in it.

Throughout the project, the MTI team will work closely with partners at the University of Maryland Center for Geospatial Information Science, the Maryland State Highway Administration, the Baltimore Metropolitan Council, and a number of data providers.

Snow Is More Complicated Than You Think

And That's Where The Trouble Begins

The old adage that no two snowflakes are alike may not be wholly true, but it captures the complexities scientists grapple with when quantifying just how much water is stored in the ice crystals blanketing earth. That measurement is known as snow-water equivalent (SWE), and on it turns global climate models, water supply projections for more than a billion people, and policies in areas like sustainable agriculture and energy production.

"Despite its importance, we still do not really know how much snow exists in the world," said Barton Forman, an associate professor in the Department of Civil and Environmental Engineering (CEE) and the Deborah J. Goodings Professor of Engineering for Global Stability.

Snowpacks vary substantially by location and across time. They can be powdered or packed, thin or dense, coarse or smooth, dry or slushy—and each characteristic interfaces with sensors and models differently. What's worse, the expansive range of snowpacks makes measuring them with land-based tools alone nearly impossible.

> "Despite its importance, we still do not really know how much snow exists in the world."

So Forman and his research team have taken to space. Through partnerships with NASA's Ames Research Center and Goddard Space Flight Center, the eight-person team is scrutinizing an array of existing and potential satellite sensors for a combination that will together lead to more accurate SWE measurements.

"There are pros and cons to every sensor," explained Yonghwan Kwon, a CEE postdoctoral associate, adding that no one sensor can measure SWE directly. "Passive microwave sensors, for example, can detect energy emissions from snow through cloud cover and give useful information if the snow is cold and dry. But its accuracy drops significantly when the snowpack becomes wet or if it is covered by forest or near lakes and rivers."

Forman, Kwon, and the rest of the team are focused first on stress testing the remote sensing method lidar for a potential satellite launch.

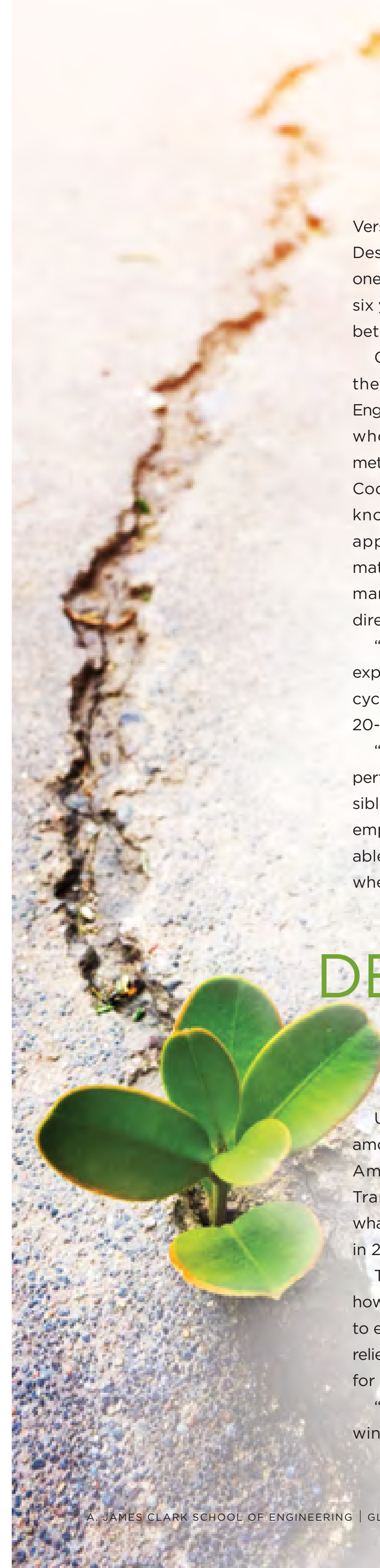
Lidar instruments reveal the distance to an object by calculating how long it takes a series of laser pulses to bounce back. By comparing readings taken when the ground was snow free and snow clad, lidar allows scientists to measure snow depth with greater accuracy than other remote sensing technologies.

"The problems are that lidar performs badly in cloudy conditions and loses accuracy the farther the sensor is from the object being measured," Kwon said.

Over the next year, the researchers will continue to run computational experiments to pinpoint the design, flight path, and overpass rate a lidar satellite would need to deliver scientifically usable results. They plan to conduct similar experiments with passive microwave and radar instruments.

The team's long-term goal is to develop prediction tools—similar to those used for weather forecasting—that climate scientists and decision makers can employ to develop more robust water models and policies.

"Predicting the future is incredibly powerful," Forman said. "But before we can confidently predict the future, we have to be able to accurately describe the present."



DESIGNED TO FAIL, Better

Version 2.5 of the nationally used Pavement ME Design software was released in July 2018, but one of its most significant updates was initiated six years before during a hallway conversation between colleagues in College Park.

Charles Schwartz, professor and chair of the Department of Civil and Environmental Engineering (CEE), was one of several researchers who in the early 2000s introduced a new method for pavement design under the National Cooperative Highway Research Program. It's known as the mechanistic-empirical (ME) approach because of its blend of mathematical models that predict pavement performance based on theoretical modeling and direct observations.

"Pavements are designed to fail," Schwartz explained. "It's more cost effective over the life cycle of a road to design the pavement to last 20-50 years and then do a major renovation.

"However, we can't empirically test the performance of every product under every possible load and weather condition. By combining empirical and mechanistic approaches, we are able to more accurately and efficiently predict when a particular pavement design will fail."

Use of the ME method has become routine among pavement design engineers since the American Association of State Highway Transportation Officials originally released what is now the Pavement ME Design software in 2008.

There was just one problem. To compute how a proposed pavement design will respond to environmental effects, the original software relied on weather data from the National Centers for Environmental Information.

"We needed data on hourly temperature, wind speed, percent sunshine, precipitation, and relative humidity, but the data set provided only some of these values," said Jonathan Groeger, principal engineer at Wood Environment & Infrastructure Solutions Inc., the prime contractor for the project. "And none of the values were available at the hourly interval needed for the software."

"It was the best we had at the time," Schwartz added.

That was until Schwartz mentioned the limitations to Barton Forman, a CEE associate professor and former NASA researcher who works extensively with satellite data.

Forman introduced Schwartz to NASA's Modern-Era Retrospective Analysis for Research and Applications (MERRA) dataset. MERRA's continuous satellite data dating back to 1979 fuels a global climate model capable of predicting hourly weather conditions at a spatial resolution of roughly 50 by 65 kilometers. The model is calibrated every six hours with millions of weather readings collected from satellites, weather balloons, and weather buoys across the world.

Schwartz, Forman, Groeger, and others on the research team would spend a few years ground truthing the data to ensure it met standards set by the Federal Highway Administration Long-Term Pavement Performance (LTPP) program. The information was added to the LTPP database in 2016 before being integrated into the Pavement ME Design software earlier this year.

"The higher quality weather data provided by MERRA will allow us to do a better job designing pavements, predicting their field performance, and reducing the nearly $100 billion the nation spends each year on highway maintenance, repair, and construction," Schwartz said.

SIQI CAO

COLLECT. REFINE. REVIEW. It's not just a process Siqi Cao follows for research in the Environmental Engineering Laboratories. The jocular Ph.D. student employs the same procedure when making videos in and outside the lab.

"Back when I lived in China, my friend and I would film experiments, cut them in a very funny way, and make them interesting for people to see," Cao said. "My followers would enjoy them, and it's something I've kept up over the years."

Cao had 436 followers on the Chinese website Bilibili as of July 2018—a number reached without self-promotion. And such organic growth seems fitting for a student enthralled by the source and spread of organic pollutants.

Since joining the Department of Civil and Environmental Engineering (CEE), Cao has focused her research on polychlorinated biphenyls, better known as PCBs.

Historically used in electrical equipment, plastics, dyes, and other industrial materials, PCBs have been shown to cause cancer and disrupt hormone and reproductive systems in animals. The U.S. Environmental Protection Agency banned the manufacture of PCBs in 1979, but the contaminants are still carried to waterways in stormwater that flows over old buildings and roads.

Cao is helping the Maryland State Highway Administration locate these sources and evaluate how well bioretention basins placed along highways protect waterways from new infusions of PCBs.

Her research career began, however, with a different organic chemical.

"My master's project dealt with bisphenol S (BPS), which is used in plastics and considered a good substitute for the potentially hazardous bisphenol A," said Cao, whose interest in environmental sciences began as a high school student in China's Jiangsu province. "I wanted to understand how the compound breaks down. That's the first step in understanding how it will impact the environment."

She would dedicate the bulk of her three-year study to synthesizing BPS.

"In order to trace its chemical and biochemical reactions in a complex environment, I needed a version of BPS with carbon-14 atoms in place of nonradioactive carbon," she explained. "That specific compound isn't commercially available, and most of the related research and patents were specific to mass production. It took a lot of trial and error to synthesize the compound at the low quantities I needed."

Cao's change in research focus was driven by a move to the United States.

"In China, we focus more on new pollutants, such as plastics," she explained. "It wasn't until I came to Maryland that I realized how important it is to study legacy pollutants like PCBs."

Relocating to the United States also triggered a refocusing on environmental engineering. For that she credits CEE faculty members Allen P. Davis and Birthe Kjellerup.

"I knew I wanted to work in an area where I could help protect the environment," Cao said. "When I saw the work being done by Drs. Davis and Kjellerup, I knew this would be a place I could do that."

She'll also admit that the title "engineer" carries weight.

"It feels good when someone calls you an engineer," she said with a laugh.

Grenfell Tower Inquiry Releases Expert Report from José Torero

José Torero, left

The Grenfell Tower Inquiry in June published a report by José Torero on the circumstances leading up to and surrounding the 2017 fire at Grenfell Tower. Torero, the director of the Center for Disaster Resilience and John. L Bryan Chair in the Department of Fire Protection Engineering, is one of five expert witnesses called by the Inquiry in 2017.

» LEARN MORE, VISIT go.umd.edu/inquiry

BUILDING A BETTER FUTURE

ENGINEERS WITHOUT BORDERS | MARYLAND SUSTAINABILITY ENGINEERING

PROJECTS

Bridge Infrastructure
PERU

Solar Energy
SIERRA LEONE, GHANA, PUERTO RICO

Water Supply
SIERRA LEONE, GHANA, NICARAGUA

Information Systems
SIERRA LEONE, GHANA

PEOPLE

132 STUDENT MEMBERS

2,300 APPROXIMATE NUMBER OF GLOBAL RESIDENTS DIRECTLY AFFECTED

TRIPS

1 ASSESSMENT TRIP

8 IMPLEMENTATION TRIPS

JUNE 2017–AUGUST 2018

Fifth Annual Project Management Symposium Draws Record Crowd

Project management professionals came together May 10-11, 2018 to share best practices, discuss lessons learned, and discover the latest advances in the field during the University of Maryland Project Management Symposium. More than 400 people attended, a new record for the annual event.

Hosted by the Project Management Center for Excellence, the symposium featured six keynote speakers and 47 technical sessions on a broad range of topics.

» LEARN MORE, VISIT go.umd.edu/symposium18

Keynote speaker Lauren Alexander Augustine of the National Academies.

PHOTO: BROOKS CLARKE

Maryland Transportation Institute Unites 10 Disciplines to Spur Innovation

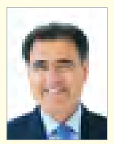
Agency and University of Maryland leaders gathered at the state capitol April 3, 2018 for the launch of a research and education institute that unites engineering, planning, social sciences, computer sciences, business, public policy, and public health experts. The Maryland Transportation Institute (MTI) coordinates more than $20 million in annual research expenditures to spur innovation in the transportation sector.

Led by Herbert Rabin Distinguished Professor Lei Zhang, MTI focuses on transportation big data, connected and automated transportation, congestion mitigation, freight and logistics, infrastructure planning and policy, transportation safety and security, smart cities and communities, and future mobility systems.

» LEARN MORE, VISIT go.umd.edu/transportationinstitute

FACULTY ACHIEVEMENTS

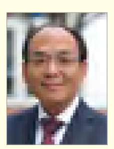
Professor **AMDE AMDE** was presented the 2017 John B. Scalzi Research Award by The Masonry Society for outstanding, lifetime contributions to masonry research.

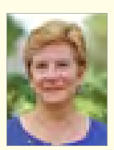


Professor **BILAL AYYUB** was named a Top 25 Newsmaker by *Engineering News-Record* for his leadership on a new manual of practice that will help engineers design infrastructure to be more resilient to extreme weather.

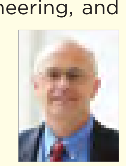
AYYUB was also named a fellow of the American Society of Civil Engineers Structural Engineering Institute.

AYYUB was also selected for a National Academies committee charged with reviewing the Fourth National Climate Assessment.





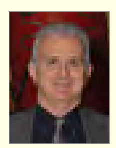
Associate Professor **QINGBIN CUI** and Adjunct Professor **JOCELYN DAVIS** were awarded the Emerald Research Methodology Award at the Association of Researchers in Construction Management Conference. Along with CEE alumna Clara Cheung M.S. '10, Ph.D. '16, they were recognized for their investigation of the relationships between organizational factors, personal resources, and project manager happiness.



Professor and Charles A. Irish Sr. Chair **ALLEN P. DAVIS** was selected by the National Academies of Sciences, Engineering, and Medicine to chair a new study committee charged with advising the U.S. Environmental Protection Agency on needed improvements to the national industrial stormwater permitting program.

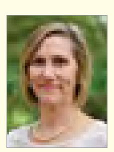
Glenn L. Martin Institute Professor of Engineering **GERALD GALLOWAY** was recognized by the American Water Resources Association with the Henry P. Caulfield Jr. Medal for Exemplary Contributions to National Water Policy. The award honors those who have achieved a status of eminence in shaping national water policy.

GALLOWAY also received the 2018 Engineering Excellence and Leadership Award from the Civil Engineering Institute at George Mason University. The award recognizes outstanding members of the civil engineering practice community.

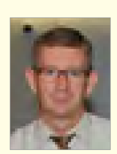


Associate Professor **DIMITRIOS GOULIAS** chaired the Athens Institute for Education and Research 8th Annual International Conference on Civil Engineering and has been selected to chair the 2019 conference.

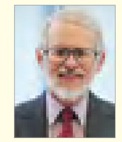
GOULIAS was also elected committee research coordinator for the Transportation Research Board Quality Assurance Management Committee.



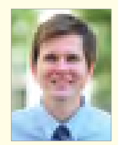
Senior Research Engineer **SANDRA KNIGHT** was selected by the Transportation Research Board to chair the planning committee for the Fifth Biennial Marine Transportation System Research and Technology Conference.



Professor **DAVID LOVELL** and coauthors received Best Paper awards at the 2018 International Conference on Research in Air Transportation for "Predicting Aircraft Trajectory Choice–A Nominal Route Approach" and "Selecting Parameters in Performance-Based Ground Delay Program Planning."



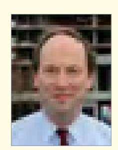
Professor and Ben Dyer Chair **RICHARD MCCUEN** received the 2017 President's Award for Outstanding Service from the American Water Resources Association. The award was established in 1979 to recognize those who have made significant contributions to the association.



Assistant Professor **BRIAN PHILLIPS** received the 2017 E. Robert Kent Outstanding Teacher Award for Junior Faculty from the A. James Clark School of Engineering.

PHILLIPS also co-chaired the 2018 International Conference on Electrorheological Fluids and Magnetorheological Suspensions.

Professor **PAUL SCHONFELD** was awarded the 2018 James Laurie Prize by the American Society of Civil Engineers (ASCE). The award bears the name of ASCE's founding president and recognizes significant contributions to the advancement of transportation engineering.



A. James Clark Endowed Chair Professor **MIROSLAW SKIBNIEWSKI** was appointed co-editor-in-chief of *Frontiers of Engineering Management*, an international scholarly research journal sponsored by the Chinese Academy of Engineering.

SKIBNIEWSKI was also named chair of the International Advisory Board for the 7th Creative Construction Conference.

STUDENT ACHIEVEMENTS

CONGRATULATIONS TO ALL CEE STUDENTS WHOSE ACADEMIC AND RESEARCH ACHIEVEMENTS WERE RECOGNIZED IN 2017-18, INCLUDING:

YAO CHENG, Ann G. Wylie Dissertation Fellowship, University of Maryland Graduate School; Future Faculty Fellowship, A. James Clark School of Engineering

SERGIO GARCIA, Fulbright Foreign Student Program award, Foreign Fulbright Guatemala

AARON LEININGER, Dean's Master's Research Award, A. James Clark School of Engineering

MARIA J. RODRIGUEZ, Dean's Fellowship, University of Maryland Graduate School

SUNG RYOO, ASPIRE Award, A. James Clark School of Engineering; GSI Fellowship, Geosynthetic Institute

YALDA SAADAT, Future Faculty Fellowship, A. James Clark School of Engineering

ELHAM SHAYANFAR, Outstanding Graduate Assistant Award and Ann G. Wylie Dissertation Fellowship, University of Maryland Graduate School

ZHONGXIANG WANG, Future Faculty Fellowship, A. James Clark School of Engineering

ZIJIANG "RIVER" YANG, Outstanding Graduate Assistant Award, University of Maryland

YIFAN ZHU, Future Faculty Fellowship, A. James Clark School of Engineering

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Learn more, visit go.umd.edu/SERDP

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