



2015 VOL. 14

# CIVIL REMARKS

THE DEPARTMENT *of* CIVIL & ENVIRONMENTAL ENGINEERING

A. JAMES CLARK SCHOOL *of* ENGINEERING

[www.cee.umd.edu](http://www.cee.umd.edu)

## Making Our Lives Safer:

How UMD Civil Engineers Are Working  
to Improve U.S. Infrastructure

5 "It Only Takes  
One Storm"

8 An Inside Look at  
Forensic Engineering

19 ASCE Maryland

21 CEE Lab Renovations

# CHAIR'S MESSAGE



Charles W. Schwartz

The University of Maryland Department of Civil and Environmental Engineering (CEE) celebrated many accomplishments over the past year.

In early 2015, the department launched a major Infrastructure Engineering Laboratories renovation initiative. This multi-million dollar effort will modernize our physical and virtual infrastructure engineering laboratories and expand their capacity to accommodate our doubling of undergraduate

enrollments over the past decade. These enhanced laboratories will expose all CEE students to state-of-the-art material testing techniques, infrastructure health monitoring, construction monitoring, and countless other hands-on aspects of civil engineering. As we look forward to this highly anticipated renovation, the department extends its gratitude to The Whiting-Turner Contracting Company for its \$1.5 million commitment to our initiative.

In the spring of 2015, the department welcomed two new faculty members: Assistant Professor and Pedro E. Wasmer Professor in Engineering Birthe Kjellerup and Lecturer Natasha Andrade, a CEE alum. We also applauded our American Society of Civil Engineers' (UMD ASCE) Concrete Canoe and Steel Bridge teams as both earned trips to their respective 2015 national competitions. UMD ASCE also hosted its first-ever "Suit Up & Be Civil" networking event and reception, which brought together more than 150 civil engineering professionals, students, alumni, and faculty under one roof.

Every day, we are proud to see examples of how members of our CEE community are developing solutions to society's most pressing engineering challenges.

In the past year, CEE researchers contributed insights to both local and national discussions on factors impacting today's infrastructure – an area in which the U.S. invests approximately \$20 trillion each year.

Our own Chung Fu, Director of the University of Maryland's Bridge Engineering Software and Technology (BEST) Center, led a research team focused on enhancing the sustainability of U.S. infrastructure by reducing the life cycle costs of our bridges. His

team partnered with North Carolina State University and AECOM to develop a smart bridge condition monitoring system capable of remote health monitoring of large complex highway structures.

Our National Transportation Center at Maryland (NTC@Maryland) continues to raise awareness about how traffic congestion contributes to both economic challenges and undue wear and tear of our nation's roadways. Research from NTC@Maryland has shed light on how active traffic and demand management can help mitigate congestion, even in our country's most densely populated areas. Similarly, our Center for Advanced Transportation Technology (CATT) Laboratory is working to translate data collected from roadside sensors, GPS equipment, and other sources into visualizations used to help first responders understand the proper modes of response to traffic incidents.

On the environmental front, CEE Assistant Professor Barton Forman and Ph.D. student Yuan Xue are working to develop techniques to better quantify the mass of water in large snowpacks across North America and other regions around the world. Recognizing that snowpacks are a primary source of drinking water for more than 1 billion people worldwide, Forman and Xue's research offers key insights on how snow must be preserved and managed as a viable freshwater resource.

Our Center for Disaster Resilience researchers helped spark a campaign to develop a national resilience assessment for analyzing the health and vulnerability of our nation to natural and manmade disasters. The center's objective is to provide a numerical basis for measuring the ability of communities and infrastructure to withstand or recover from hazards.

Such initiatives are just a few examples of how our CEE researchers are shaping U.S. and global infrastructure development, sustainability and efficiency efforts, environmental policies, and resilience assessment. These efforts impact countless lives in our communities and will continue to make the world a better place for generations to come.

Charles W. Schwartz, Ph.D.

Professor and Chair

Department of Civil and Environmental Engineering

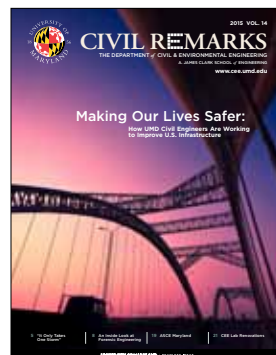
**CIVIL REMARKS** IS A NEWSLETTER PUBLISHED FOR ALUMNI AND FRIENDS OF THE DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING AT THE A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND.

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2015

ON THE COVER

*CEE researchers are working to develop a smart bridge condition monitoring system with remote sensing capabilities suited for fatigue condition assessment of highway steel bridges.*

## CONTENTS

- 2 Safer Travels
- 5 "It Only Takes One Storm"
- 8 Forensic Engineering
- 11 The Real Costs of Congestion
- 13 Graduate Student News
- 15 Undergraduate Student News
- 16 Faculty News
- 18 Alumni News
- 19 ASCE Maryland
- 21 Infrastructure Lab Renovations

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DEPARTMENT NEWS,  
RESEARCH UPDATES,  
ALUMNI INFO, MORE



## Safer Travels: How Civil Engineers are Working to Improve U.S. Bridges, Roadways

In 2009, the San Francisco-Oakland Bay Bridge made national headlines when fatigue cracking caused damage to the very same eye-bars that had received emergency repairs a month prior. The damage sent pieces of steel falling onto the roadway during peak-hour traffic.

The incident – and countless others involving bridges across the country in recent years – happened without any warning and jeopardized the safety of drivers, including many who were simply following their normal day-to-day commute.

Structural engineers throughout the country are nevertheless faced with a hard truth: fatigue-induced cracking is an all-too-common failure mode in many steel bridges reaching their original design life. After all, many of today's aging bridge structures have endured increasing traffic volume and weight, which contribute to deterioration of bridge components.

The U.S. invests approximately \$20 trillion in infrastructure, yet the magnitude

of the societal challenges associated with aging facilities – particularly, bridges – is daunting. Despite years of research in overcoming common infrastructure challenges, failures still occur. Funding challenges and increased freight transport make it difficult for local agencies to keep up with maintenance demands. Even factors such as climate change – and resulting extreme weather events – can place added burden on roadways and bridges.

Recognizing this, a joint team of University of Maryland (UMD) and North Carolina State University (NCSU) researchers partnered with the URS Corporation – now AECOM – to develop a smart bridge condition monitoring system known as the Integrated Structural Health Monitoring (ISHM) system. The ISHM system features a number of technology innovations including remote sensing capability particularly suited for fatigue condition assessment of highway steel bridges. The project researchers also hope to extend this technology for use in evaluating

other types of bridge damage, such as breaks and corrosion of steel strands of pre-stressed concrete bridges.

Led by Department of Civil and Environmental Engineering (CEE) Research Professor and Director of the Bridge Engineering Software and Technology (BEST) Center Chung C. Fu, along with CEE Professor Yunfeng Zhang, the research team developed the ISHM system based on wireless sensor networks with self-sustained power supplies, which make the system scalable for remote monitoring of large complex highway infrastructure. In addition to Fu and Zhang, NCSU Department of Mechanical and Aerospace Engineering Professor Fuh-Gwo Yuan, and Y.E. Zhou of the URS Corporation are co-principal investigators on the project.

Backed by funding from the U.S. Department of Transportation's Office of the Assistant Secretary for Research and Technology, the research team worked to integrate recent advancements in civil, aerospace, and electrical disciplines to produce

*Continued on next page.*



Continued from page 2.

a transformational system that quantifies damage and degradation at an early stage, thereby reducing operating and maintenance costs in the long run.

After an ISHM system is installed on a structure, researchers can use its sensor data to update the deterioration models for future condition forecasting, Fu said.

“Condition rating data based on periodic inspection of bridge components to provide an overall characterization of the general condition of a bridge has been routinely used by inspection engineers,” he said. “Combining visual inspection and ISHM system data, failure conditions can be detected earlier, even in some hard-to-detect areas, and catastrophic bridge failures can be prevented.”

The research team’s overarching mission is a crucial one: enhance the sustainability of U.S. civil infrastructures by reducing the life cycle costs of bridges.

In the state of Maryland alone, 317 bridges are considered structurally deficient, according to a recent U.S. Department of Transportation National Bridge Inventory database report. While this number may be jarring to the countless drivers who commute through the Free State each day, it represents just under 6 percent of Maryland

bridges and pales in comparison to states like Rhode Island and Pennsylvania, where more than 20 percent of bridges are considered structurally deficient.

But, it is important to note that structural deficiency does not automatically deem a bridge unfit for travel, Fu noted.

“Structural deficiencies are determined by poor condition ratings or from low load ratings,” he said. “Bridges are considered structurally deficient if significant load-carrying elements are found to be in poor or worse condition due to deterioration or damage.”

As common practice to keep structurally deficient bridges in service, the State Highway Administration often posts weight limits to restrict the gross weight of vehicles using the bridges to less than the maximum weight typically allowed by statute, Fu said.

Still, all structurally deficient bridges eventually require rehabilitation or replacement.

“With hands-on inspection and field testing, unsafe conditions may be identified and, if a bridge is determined to be unsafe, the structure must be closed,” Fu said.

That is where Fu’s research team can make a world of difference. The ISHM system incorporates recent innovations that could transform remote sensing and management of highway infrastructures in two ways. First, ISHM uses wideband acoustic

emission (AE) signals to evaluate localized damage, even in areas where traditional sensors cannot be placed due to geometry and structural constraints. Second, ISHM incorporates smart wireless sensor networks that can self-power using wind or solar power, self-calibrate, and automatically scan and diagnose problem sites.

This enables early detection of structural damage, which is critical given that, in states such as Maryland, most structurally compromised bridges are on the Interstate Highway System – and among the most heavily traveled bridges in the state, according to American Road and Transportation Builders Association (ARTBA) analysis of the DOT bridge report. The ARTBA analysis underscores the challenges many states face with federal highway and transit funding.

### Are Fuel-Efficient Vehicles Posing Challenges for Bridge, Roadway Maintenance?

Adding another layer to the problem of bridge and roadway maintenance is the current rate of the federal gas tax – a major funding mechanism for the Highway Trust Fund, which holds the purse strings for highway and bridge maintenance. For more than two decades, the federal gas tax rate has held steady, even as environmentally driven


The cover of the Maryland National Transportation Center Annual Report 2014. It features a collage of images related to transportation, including a bridge, a train, a map, and the U.S. Capitol dome. The text on the cover includes "THE UNIVERSITY OF MARYLAND", "National Transportation Center", "ANNUAL REPORT 2014", and "National Center for Strategic Transportation Policy, Investment and Development". At the bottom, there are logos for various organizations including ASU, UMD, and others.

Download a copy of the National Transportation Center at Maryland's Annual Report.  
<http://go.umd.edu/ntc2014>



consumers are opting for eco-friendly cars or other modes of transportation, and are thereby purchasing less and less gas.

“One of the challenges to the funding issue is the fact that modern cars are more fuel-efficient than older cars,” said Mark Franz, Assistant Director of Outreach and Technology Transfer for the National Transportation Center at the University of Maryland. “From an environmental perspective, fuel-efficient cars are obviously a great thing. But, if people are not buying as much gas nowadays, they might not be contributing their share of the cost toward the system they’re using. If more and more drivers are going home and plugging in their cars overnight, those drivers are essentially using roads without contributing direct funding for those roads.”

But, while everyday consumers may purchase less fuel than in years past, consumer behavior remains a factor behind the deterioration of some of the nation’s most heavily traveled roadways and bridges.

As Americans continue to take on lengthy commutes to work, the burden on highways, bridges and even local roads increases. Additionally, while the popularity of online shopping has reduced the need for consumers to drive to and from local stores, it has, in turn, increased demand for the transport of

goods by freight vehicles. And, according to a recent DOT report titled, “Beyond Traffic 2045: Trends and Choices,” in 2012, trucks moved 13.2 billion tons of freight throughout the U.S. – compared to second-place rail transport, which accounted for just 2 billion tons of freight the same year.

“When you think about what is contributing most to wear and tear on the roads, freight vehicles prove costly,” Franz said. “The irony is, in many ways, the Highway Trust Fund counts on everyday travelers to use those same roadways so that more dollars will funnel in via the state and federal gas taxes to help fund both road and bridge maintenance.”

Incidents like the February case of fallen concrete from the I-495 Suitland Bridge in Prince George’s County, Md., have directed a spotlight onto highway maintenance issues, and many directly impacted by the bridges or roadways in question hope that such incidents will drive government to direct more funding to support road and bridge maintenance and repair projects.

Highway and bridge construction funds are a mix of state and federal dollars, Fu noted. At the federal level, the Highway Trust Fund is the main source of support; however, there has not been an increase in the tax on gasoline since 1994.

Read the U.S. Department of Transportation “Beyond Traffic 2045” report.  
<http://go.umd.edu/beyondtraffic>

In fact, the federal Highway Trust Fund ran dry in 2008 and again in 2015 and had to be subsidized by Congress, Fu said.

“The difference between the funds available and the system’s needs represents the funding gap,” Fu said. “The only other source available is the state funding. Lack of state resources to fill any gap in federal funding is a cause for concern because it would cripple road and bridge construction in Maryland.

“Bridges are aging year by year,” he continued. “The average age of Maryland state bridges is about 50 years. As bridges age, their abilities to handle the loads they are designed for are gradually reduced. As a result, some bridges have to be posted with weight restrictions and then more bridges are put into the deficient bridge category. With an aging infrastructure system, shortage of funding will only increase needs in the future.”



# “It Only Takes One Storm” Caution UMD

## Despite Below-Average Hurricane Forecast, Questions of Community Resilience Remain

Recent hurricane forecasts over the past few years have projected fewer named storms than the historical average. However, Department of Civil and Environmental Engineering (CEE) researchers within the University of Maryland Center for Disaster Resilience (CDR) warn that any storm could expose infrastructure vulnerabilities and emergency response challenges.

“It should matter little to communities what the number of named or major hurricanes expected for a given season might be,” said Dr. Gerry Galloway, CDR Associate and CEE Glenn L. Martin Institute Professor of Engineering. “It only takes one storm to expose a community’s or region’s vulnerabilities. Even more, some of the nation’s costliest hurricanes – including Hurricane Sandy – were Category 2 or lower when they made landfall in the U.S.”

In fact, a direct hit by a storm of Sandy’s caliber could spell calamity even for the Washington metropolitan area, CDR researchers warn.

“Many people in the D.C. area do not realize that they’re actually in a tidal zone and that they are subject to coastal inundation,” said Dr. Sandra Knight, CDR Director, CEE Research Professor

and FEMA’s former Deputy Associate Administrator for Mitigation. “Often, they feel like they are far away from the beach so they are not at risk, but D.C. is certainly impacted by tides and coastal storms. The first step toward building resilience is raising awareness to the fact that this is a coastal region, subject to many of the same risks shoreline communities face.”

Even with the recent completion of Washington’s 17th Street flood levee – designed to reduce risk to human safety and critical infrastructure downtown from Potomac River flooding – floods pose a major concern throughout the capital area.

“The largest flood ever recorded in Washington, D.C., reached 79 feet [relative to sea level] in the early 1930s,” Knight said. “But, unprecedented storm surge could threaten billions of dollars’ worth of property, including critical infrastructure, national icons, and national security interests. When you factor in the impact of climate change and rising sea levels, you realize that a direct hit from even a Category 2 hurricane could carry a significant amount of risk in the nation’s capital.”

Knight and Galloway noted that, while the 17th Street levee



CDR Associate and Glenn L. Martin Institute Professor of Engineering Gerry Galloway pictured at the D.C. flood wall. Galloway said the levee and the wall on the National Mall are essential to protecting southwest D.C. from a major river flood, but they do not provide sufficient protection to prevent downtown flooding from a significant combined hurricane and river event, especially as sea levels continue to rise.

# Disaster Resilience Experts

PHOTO CREDIT: INTERNATIONAL SPACE STATION

serves to protect downtown Washington in the event a 100-year storm should hit the Potomac region, interior flooding – such as that resulting from heavy rainfall – is still a major concern. Even more, a significant weather event in the nation's capital could have a spillover impact on other areas across the East Coast.

“Washington presents a unique scenario,” Knight said. “In addition to concerns over human safety and property, residents, emergency responders, and policymakers must also consider how a major weather event in the capital region could impact government operations, national security, transportation systems, and the economy. For instance, a direct hit from a major hurricane could put military bases and Department of Defense facilities at risk. A major weather event in D.C. could also impact travel and the transport of goods and force a government shutdown that could cause a ripple effect on the national economy.”

Still, it is important to remember that Washington, D.C., is not the only area in the national capital region that experiences flooding, Knight and Galloway noted.

“As sea levels continue to rise, unprecedented flooding could threaten more than \$40 billion worth of property in Maryland, Virginia, and Delaware,” Galloway said.

With this in mind, CDR researchers are setting out to educate both the general public and policymakers about the actions that need to be taken to ensure communities are resilient – even if a “worst-case scenario” weather event hit.

“Until the right measures and structural safeguards are in place, the odds a hurricane or summer storm could make a historical impact on the D.C. area – or another riverine or coastal community – will continue to rise,” Galloway said.

## Working Toward a National Resilience Scorecard

In spring 2015, CDR led a Department of Homeland Security Science and Technology (DHS S&T)-sponsored workshop aimed to identify and characterize the steps needed to develop a national resilience assessment for analyzing the health and vulnerability of the nation to natural and manmade disasters.

The “Building Blocks for a National Resilience Scorecard” workshop brought together more than 40 resilience experts across government, industry, and academe, including DHS S&T, the Federal Emergency Management Agency (FEMA), the U.S. Army Corps of Engineers (USACE), the Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), the National Institutes of Standards and Technology (NIST), Maryland state government, and District of Columbia government.

Co-led by CDR Director Sandra Knight and CDR Associate Ed Link, with senior support from Gerry Galloway, workshop participants outlined best practices, user perspectives and examples of key resilience tools, and broke into discussion groups to identify desired outcomes for a resilience scorecard.

“The very fact that we are all gathered here is, in and of itself, an outcome of the hours and resources devoted toward generating discussions about resilience and what it means,” said CEE Department Chair and Professor Charles Schwartz during his opening address. “We are helping to draw big-picture solutions and open lines of communication that transcend bureaucratic barriers in order to provide decision-makers the information they need to plan for and respond to emergencies.”

*Continued on next page.*

Read the Center for Disaster Resilience's “Building Blocks for a National Resilience Assessment” online.

<http://go.umd.edu/buildingblocks>

CDR Associate and CEE Senior Research Engineer Ed Link leads a group discussion on best practices for measuring resilience during the “Building Blocks for a National Resilience Scorecard” workshop.





A national resilience scorecard would provide communities with a foundation through which to assess resilience and monitor progress over time. While scorecards have long been used at national and local levels, there are currently no national, quantitative standards for measuring the ability of communities and infrastructure to withstand or recover from hazards.

“Without some numerical basis for assessing resilience, it will be impossible to monitor change or show that community resilience is improved,” Galloway said.

“Resilience exists at the intersection of social systems, natural systems and the built environment,” said Susan Cutter, University of South Carolina Professor and Director of the Hazards and Vulnerability Research Institute. “Why should communities measure resilience? To understand the potential impacts of adverse events and to evaluate the capacity of a community to respond to, recover from, and adapt to such events.”

The workshop kicked off with a panel session focused on national assessments and best practices and featured insights from Bill Dennison, University of Maryland Center for Environmental Science Vice President for Science Applications, Jennifer Rivers, Vice President, Institute for Sustainable Infrastructure, Emily Feenstra, Director, Infrastructure Initiatives at the American Society of Civil Engineers, and Bill Lesser, National Flood Insurance Program Community Rating System Coordinator, FEMA.

“Part of the journey you need to take in developing report cards is to engage the right people in the process,” Dennison said, noting that report cards create a unique opportunity for public dialogue.

“A resilience scorecard could also generate excitement and further

general public knowledge about why much of our infrastructure needs to be replaced,” Feenstra added. “It is not about rebuilding infrastructure as it once was; rather, it is about building sustainable solutions with the future in mind.”

Recognizing that no community could ever achieve 100 percent resilience, workshop participants drove home the idea that a scorecard would serve as the framework for discussions about resilience and provide communities with a means through which to compare and contrast different communities’ levels of resiliency.

“Organizations have only survived and done well because they are resilient,” Galloway said. “They have been able to adapt to changing situations, and they have been able to get better. Any book written by a CEO or leader of an organization discusses how to improve with time and how to plan for the unknown – and that is similar to the message we are trying to convey through discussions about resilience.”

“The level of expertise that has been applied to conversations about resilience, and the level of enthusiasm we have seen underscores how important this topic really is,” Link added.

Workshops like those hosted by CDR help to further convey the impact of resilience similar to the way in which the words “risk” and “sustainability” resonate with people today.

“CDR consists of a network of some very experienced senior experts who have been involved in resilience, risk, policy, and engineering for a very long time,” Knight noted. “We’re excited to start seeing some of the efforts of research units coming our way. We have some big ideas about our center and the areas we might cover in the months and years to come. In terms of education, topics like resilience and sustainability carry a value that softens the engineering perspective, allowing researchers to look at the world through different lenses.”



CDR Director Sandra Knight with ABC Washington's Sam Sweeney and Glenn L. Martin Wind Tunnel Director Jewel Barlow.

## National Media Highlights CDR Hurricane Research

The Center for Disaster Resilience teamed up with University of Maryland Department of Atmospheric and Oceanic Science (AOSC) experts to accompany national and local media to the A. James Clark School of Engineering's Glenn L. Martin Wind Tunnel to explain why “it only takes one storm” to expose a region's infrastructure vulnerabilities and emergency response challenges.

Joined by the TODAY Show's Dylan Dreyer, as well as reporters from USA TODAY and D.C. metropolitan area broadcast outlets, UMD researchers set out to demonstrate how hurricane-force winds – as well as flooding and storm surge – could spell trouble for coastal and riverine communities, and even the nation's capital.

With the help of Glenn L. Martin Wind Tunnel Director and Department of Aerospace Engineering Associate Professor

Jewel Barlow and his researchers, Dreyer and others experienced up to 115 MPH wind speeds, demonstrating for viewing audiences just how powerful a Category 2 storm can be.

Wearing a harness strapped into bolts in the tunnel floor, one at a time, each of the reporters experienced how even sustained tropical storm force winds would make it very difficult for a person to stand, walk or even speak. As Barlow and his team slowly raised the wind speeds, each of the daring media personnel illustrated why a storm not classified as a “major hurricane” can still pack a serious punch—one that would cause significant damage and risks to human life.

View videos and media coverage of the Center for Disaster Resilience's trip to the Wind Tunnel. <http://go.umd.edu/hurricanecoverage>



# DIGGING DEEPER:

How Forensic Engineers Are Working to Uncover Solutions for Many of Today's Most Pressing Engineering Challenges



Forensic engineers take on varied challenges ranging from investigative work to involvement in court proceedings. Dr. Kenneth O'Connell, CEE adjunct professor and president of O'Connell & Lawrence, Inc., was hired to investigate the failure of a drinking water reservoir in Florida. Here he is seen inspecting the failure of the soil cement facing of the reservoir.

Time and again, Department of Civil and Environmental Engineering adjunct professor and alumnus Kenneth O'Connell (B.S. '81, M.S. '82, Ph.D. '91) echoes a mantra made famous by Bill Gates: "It's fine to celebrate success but it is more important to heed the lessons of failure."

As president of O'Connell & Lawrence, Inc., a multidisciplinary engineering and consulting firm based in Olney, Md., O'Connell has seen firsthand how engineers serve a critical role in uncovering the hows and whys behind project failures to equip project managers with lessons learned moving forward.

Many such men and women work in the realm of forensic engineering – the "application of engineering principles to the investigation of failures or other performance problems," according to the American Society of Civil Engineers (ASCE).

To those unfamiliar with the field, the word "forensic" may call to mind scenes from popular crime investigation television shows; but, according to O'Connell, a forensic engineer's role can be most accurately condensed into one word: "expert."

"What best prepares [an engineer] for forensic engineering is a lot of experience," O'Connell said, noting that acquiring a degree is only the first step. "What a person needs to do is go out and practice engineering and develop his or her craft for 10 or 12 or 15 years to acquire the expertise needed to become a forensic engineer."

This holds true largely because forensic engineers take on varied challenges and roles ranging from investigative work to involvement in court proceedings, O'Connell said.

"Sometimes, we get involved with a project while it is still in progress and we have an opportunity to identify and correct problems that have surfaced," he said. "And then, sometimes, we are brought into projects long after they are done – even years after – and asked to identify what went wrong. In these

*Continued on next page.*



In 2014, Kenneth O'Connell and Donald Vannoy were appointed to an independent advisory committee on the Silver Spring Transit Center, based in Silver Spring, Md. The experience provided them with opportunities to hone their investigational skills, handle media inquiries, and give back to their home state through their service.

Rendering of the south view of the Paul S. Sarbanes Silver Spring Transit Center.

PHOTO CREDIT: MONTGOMERY COUNTY GOVERNMENT

Continued from page 8.

cases, we are looking for what happened, why it happened, what went wrong and, sometimes, who is responsible for the mistakes.”

Recognizing this, O'Connell & Lawrence employs architects, civil surveyors, construction professionals, project managers, and other area experts who are well-positioned to analyze both in-progress projects at risk of failure and completed projects in which a failure has occurred. Even more, their findings directly benefit public safety by serving to ensure that past mistakes are never repeated.

“Following some of the larger cases involving failures there have been changes made to codes to improve public safety,” said Donald Vannoy, CEE Professor Emeritus, and principal of Trident Engineering Associates, Inc. A forensic engineering business based in Annapolis, Md., Trident boasts a team of engineers across nearly all disciplines, including civil and environmental engineering, mechanical engineering, aerospace engineering, and fire protection engineering.

Along with the company's forensic, accounting and business valuation experts, all of Trident's engineers support subrogation and litigation activities, Vannoy said.

“Studying the cases of failures can be valuable to the education process,” he said. “These instances of failure and non-performance provide information that can make a positive impact on human life.”

Although experts from all disciplines of engineering have worked in forensic

engineering, from the perspective of a civil engineer, there are specific characteristics that define a project failure, Vannoy said.

“Failure is an unacceptable difference between expected and observed performance,” he said. “It includes total collapse, as well as serviceability problems such as distress, excessive deformations, and premature deterioration of materials. Not all failures are news-making catastrophic failures. In fact, most investigations deal with in-service problems such as deteriorated parking decks, bulging exterior walls, and cracked concrete walls.”

For many forensic engineers, the responsibilities associated with identifying a project failure are twofold. First, the engineer must analyze what went wrong such that the appropriate corrective – or even litigious – measures are taken. Second, the engineer has an inherent responsibility to help clients avoid such mistakes down the road.

“If forensic engineering is looking at failures, what then can you learn from those instances?” O'Connell asked. “I think that's such an important step in engineering – to take the time to identify what we are learning when things don't go right. There are a lot of opportunities when something doesn't go the right way with materials, contracts, or how someone approaches a project. I think sophisticated project owners and the good engineers and contractors learn from their mistakes and improve their craft because of them.”

Although so much of the work done at O'Connell & Lawrence involves investigating and analyzing project failures, the thing

O'Connell loves most about his job might not coincide with what is best for business.

“My favorite aspect of what we do is what we call ‘claims avoidance,’” he said. “We train both owners and contractors involved in construction on how to avoid litigation. That's where the lessons learned really come into play... when we conduct seminars and training sessions and basically say, ‘Here's how you can do things to prevent having to hire us.’”

In this and many other ways, a forensic engineer often takes on an educator role, O'Connell noted.

“One of the responsibilities of a forensic engineer – especially when you become involved with a court proceeding – is to be instructive,” O'Connell said. “It is your job to convey what happened, and that sometimes means explaining complicated technical or contractual issues or construction processes to non-technical people like lawyers, judges, juries, or arbitration panels. Your responsibility is, ultimately, to be impartial and to apply the engineering knowledge, survey knowledge, or construction materials knowledge you have to determine exactly what went wrong and who's responsible.”

Doing so often presents a communication challenge, but O'Connell and his colleagues employ a variety of useful methods to convey their findings ranging from PowerPoint presentations and formalized reports to animated timelines and the construction of scale models.

Nevertheless, for both O'Connell and Vannoy, their work as forensic engineers has



helped them develop the skills needed to serve as educators for the Department of Civil and Environmental Engineering, and vice versa.

"In forensic engineering, often we're faced with the task of explaining the technical elements of an engineering project to people who don't do what we do every day," O'Connell said. "Sometimes, trying to explain a very complicated problem to an audience that doesn't have that technical background can be a big challenge – but, that's also what makes life as a forensic engineer very interesting."

In the classroom, both Vannoy and O'Connell have provided countless students with a first look at life as a forensic engineer – a career route many still consider nontraditional, despite its growing popularity.

Beginning in the 1990s, Vannoy taught a CEE graduate-level course in forensic engineering, which covered the application of the art and science of engineering in the jurisprudence system. The course addressed topics such as the investigation of the physical causes of accidents and other sources of claims and litigation, preparation of engineering reports, testimony at hearings and trials in administrative or judicial proceedings, and the rendition of advisory opinions to assist the resolution of disputes affecting life and property.

Once a student who first learned about forensic engineering as an undergraduate in Vannoy's class, O'Connell now teaches both graduate and undergraduate courses in scheduling.

And, while courses in forensic engineering serve to pique student interest in the field, there are a number of reasons the field continues to grow, O'Connell said.

"In some ways, the reasons [for the growth of forensic engineering] are unfortunate because they represent an outgrowth of litigiousness in our society and industry," he said. "There is unfortunately a lot of litigation in construction and engineering, and in industry in general. Also, there is the forensic side of projects in which engineers are brought in to identify and develop solutions to problems while the project is in progress. I think that need will always be there. Dollar values of projects go up, contracts get more

complicated, the risks get more complicated, and people are trying to build projects faster and faster while using more sophisticated materials. All of this contributes to a need for forensic engineers."

As such, both O'Connell & Lawrence and Trident have established a long list of local, national and even international projects for which the firms have provided forensic support. Collectively, their client list includes the U.S. Army, Department of Commerce, Department of Justice, U.S. Postal Service, the Maryland State Highway Administration and countless other public and private entities.

In 2014, both O'Connell and Vannoy were appointed to an independent advisory committee on the Silver Spring Transit Center (SSTC), based in Silver Spring, Md. Together with Norman Augustine, retired chairman and CEO of the Lockheed Martin Corporation and current member of the University System of Maryland Board of Regents, and Algynon Collymore, construction supervisor for DC Water, O'Connell and Vannoy helped issue a report on the project's shortcomings and potential solutions. The experience provided them with opportunities to hone their investigational skills, handle media inquiries, and give back to their home state through their service.

"We take pride in the work we do for Maryland," O'Connell said. "That's home to us, and we're pretty proud of our ability to help our own state."

As in the case with the SSTC project, forensic engineers often find themselves taking on different roles. After all, it is not

unusual for reporters to field questions to forensic engineers working on high-profile cases. Even more, it is important for forensic engineers to develop the skills needed to properly document any investigational work or evidence collected.

"One of the challenges of forensic engineering is the process of documenting the case by photographs, video and other means," Vannoy said. "Other challenges include collecting and preserving evidence, analyzing the event, and determining what were the major contributing factors in the collapse or non-performance of the item under investigation."

"It's all about having that desire to do investigation work," O'Connell said. "There are certain people who have a knack for that, or a real desire to do investigations, and that is important because some of it can be tedious. A lot of engineers just want to be out on a construction project building things, and the investigation work doesn't interest them so much. But, for those of us drawn to forensic engineering, it's all about finding solutions to the puzzles we encounter."

And, in doing so, forensic engineers can help resolve project failures or shortcomings, which in turn benefits whole communities, O'Connell said.

"Whenever we can apply what we've learned and have a client benefit from that and not end up in a failure situation – not end up in court, but instead, fix whatever is going wrong in a project – that's my favorite aspect of this line of work," he said. "That's when people win."



PHOTO CREDIT: MARYLAND TRANSPORTATION AUTHORITY (MDTA)

# THE REAL COSTS OF CONGESTION:

CEE Researchers Evaluate Impact of Traffic Jams

When metropolitan area drivers hear the word, “traffic,” most often another word comes to mind: congestion.

According to a study issued earlier this month by the U.S. Department of Transportation (DOT), congestion will no longer be a headache confined to areas surrounding the country’s largest cities. In fact, “Beyond Traffic: Trends and Choices” states that, “short of land use plans that expressly curtail it, sprawl is likely to remain a dominant development pattern and, if we do not act, congestion will be much more widespread.”

While this trend could spell more headaches for everyday commuters, congestion also poses a major economic problem, according to Mark Franz, Assistant Director of Outreach and Technology Transfer for the National Transportation Center at the University of Maryland (NTC@Maryland).

In response to the challenges associated with traffic congestion, a UMD research team led by NTC@Maryland Director and Associate Professor of Civil and Environmental Engineering Lei Zhang was awarded in August 2015 a competitive grant from the U.S. Department of Energy’s (DOE) Advanced Research Projects Agency - Energy (ARPA-E) to develop technology to deliver personalized, real-time travel information to users and incentivize energy-efficient travel. The funding includes \$3.78 million from DOE and \$700,000 in cash cost-sharing from various public and private sector partners.

The UMD research team will conduct behavioral studies to predict travelers’ responses and identify incentives to encourage drivers to alter routes, departure times, and driving styles, or take mass transit or ride-sharing services.

Their efforts - as well as those of the University of Maryland’s Center for Advanced Transportation Technology (CATT) Laboratory - serve to mitigate

traffic congestion and its associated costs.

“What people might not realize as they’re sitting in traffic is the number of commercial vehicles also impacted by congestion and jams,” Franz said. “When you’re thinking in terms of a passenger vehicle versus a commercial freight vehicle, the cost for the freight vehicle sitting in traffic is significantly higher. To start, the person driving that vehicle is working on the clock. Second, the material he or she is transporting is being delayed, which means final delivery could be impacted. As such, there’s a cost associated not only with the person in the vehicle, but also the goods that are being transported by that vehicle.”

Although freight movement is multimodal, trucking is the primary mode. According to “Beyond Traffic,” in 2012, trucks moved 13.2 billion tons of freight, compared to second-place rail transport, which accounted for just 2 billion tons of freight the same year.

That is why NTC@Maryland is conducting research in freight fluidity in an effort to better understand ways commercial vehicles can efficiently transport goods through the capital region.

“Not only is it important to know where congestion occurs and when, but also, how predictable congestion is,” Zhang said. “We understand, for instance that, if you’re driving on the inner loop coming from northern Virginia through I-270 during peak hours, you’re likely to hit congestion – so, you can plan around that. But, if we want to drive that same route during an off-peak period and an accident or other incident causes it to become congested, there’s an added cost to that. Both passenger vehicles and freight vehicles are unable to predict or plan for such events.”

As for minimizing the costs of congestion, there are a number of strategies both travelers and businesses can adopt, Franz said.

“One option is to implement active traffic management systems, which use real-

time data to adjust or change some of the demand patterns and traffic flow patterns on certain roads,” he said.

Some examples of active traffic management systems in the metropolitan region include freeway ramp metering, whereby red and green lights are used to control travelers as they enter a freeway; and hard shoulder running, whereby signs above a shoulder indicate when passengers can use the shoulder as a normal lane during peak travel hours.

“Other ways to minimize congestion come from the demand management strategies,” Franz said. “Flexible start and end times allow workers to avoid peak periods of congestion. Similarly, if more organizations allow their people to telework, we would likely see fewer cars on the roads during peak periods.”

Despite the fact that these strategies offer potential solutions for increased congestion, yet another factor is leading to more cars on the road each day, Franz said.

“The number of people who commute to work alone is actually on the rise,” he said, referencing “Beyond Traffic.”







**“Not only is it important to know where congestion occurs and when, but also, how predictable congestion is.”**

**- Dr. Lei Zhang,  
NTC@Maryland Director**

This is the trend despite the fact that High Occupancy Vehicle (HOV) lanes and High Occupancy Toll (HOT) lanes are designed largely to encourage carpooling. Additionally, HOT lanes require solo drivers unwilling to forfeit use of the extra lane to pay a fee to drive in the HOT lane without transporting additional passengers. Although this money often goes toward construction and maintenance of roadways or other transportation projects, many of the benefits of HOT lanes skew to higher-income drivers, and highly congested travel areas might even see congestion in the HOT lanes as well.

Washington, D.C., offers the perfect case study for the drawbacks of HOT lanes, Franz noted. To start, several counties in the greater Washington, D.C., metropolitan area consistently rank among the highest-earning median household income counties in the U.S. And, the higher-than-average salaries in the D.C. region likely impact the number of drivers who are willing to pay a toll to reduce travel time.

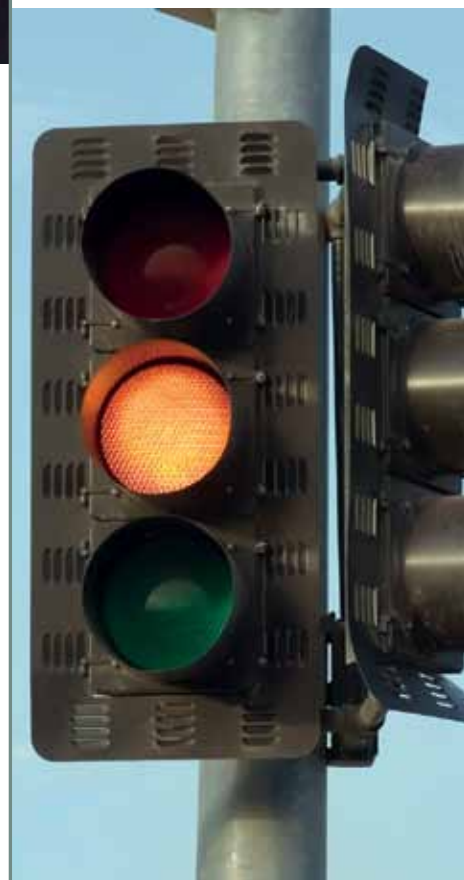
In fact, in the greater D.C. area, so many drivers may be willing to pay a toll that HOT lanes may also become congested, despite the

efforts of dynamic tolling, Franz said.

“One potential solution to alleviate congestion in the HOT lanes is to raise the HOV threshold from HOV2 to HOV3,” he said. “However, this policy may create equity issues as it only removes non-paying restricted lane users. Thus, the decreased congestion in the HOT lanes may disproportionately benefit higher income earners – those who can afford to pay the tolls on a regular basis.”

According to the DOT “Beyond Traffic” study, for consumers representing the lowest 20 percent of income earners, “transportation costs account for approximately 32 percent of their after-tax income.”

“And, as our country continues on the path of increased sprawl – due in part to the high cost of living in cities – congestion will likely impact areas thus far immune to many of the headaches that plague capital-area commuters,” Franz said. “While public transportation offers a solution for some, the DOT study reveals that only a quarter of jobs in low- and middle-skill industries in major metropolitan areas are accessible via a transit ride of under 90 minutes.”





## Xue Awarded NASA Earth and Space Science Fellowship



Yuan Xue

Department of Civil and Environmental Engineering (CEE) first-year Ph.D. student Yuan Xue was recently awarded a prestigious three-year NASA Earth and Space Science Fellowship (NESSF) in recognition of her efforts to develop a

more accurate estimate of the mass of water in large snowpacks across North America.

Advised by CEE Assistant Professor Barton Forman, Xue received the fellowship based on her proposal entitled, "Advancing Atmospheric and Forest Decoupling in Passive Microwave Observations over Snow Covered Land Using the Advanced Microwave Scanning Radiometer (AMSR-E) and the NASA Catchment Land Surface Model." Her proposed study addresses two significant sources of uncertainty - atmo-

spheric and overlying forest effects - in remotely-sensed passive microwave observations for use in estimating the mass of water in large snowpacks.

This mass - known as the Snow Water Equivalent (SWE) - represents the depth of water that would theoretically result in the instance a snowpack melted. The ability to measure SWE is significant to environmental engineers because snowpacks serve as the primary source of drinking water for much of the world's population. Unfortunately for researchers, atmospheric and overlying forest effects often confound efforts to measure SWE from space. As such, it is essential for researchers to first decouple the atmospheric and forest-related signals from the snow-related signal to accurately measure SWE.

In efforts to combat this challenge, Xue is working to integrate different sources of information - such as an advanced land surface model with the space-borne measurements - to provide a more accurate estimate of SWE across North America. Such

knowledge could be used to help mitigate the effects of droughts and floods, as well as better enable water resource managers to preserve and protect this vital natural water supply.

## Sun Awarded AREMA Scholarship



Yanshuo Sun

Third-year Ph.D. student Yanshuo Sun was named the 2015 recipient of the American Railway Engineering and Maintenance-of-Way Association's (AREMA) Electric Energy Utilization Scholarship.

A 2014 recipient of an AREMA Rail Transit Scholarship, Sun was recognized for his work on the project, "Efficiency and Reliability in Freight Transportation Systems," funded by the National Transportation Center at Maryland. His research experience includes estimating transit riders' route choice behav-

## CEE, Landscape Architecture Researchers Awarded 1st Place in EPA Campus RainWorks Challenge



The U.S. Environmental Protection Agency (EPA) named a University of Maryland team of civil engineering and landscape architecture researchers first-place winners of the third-annual EPA Campus RainWorks Challenge, Demonstration Project category.

Created to engage university students in reinventing water infrastructure, the RainWorks Challenge recognizes students who show how managing stormwater at its source can benefit the campus community and environment.

Second-year CEE graduate student Jaison Renkenberger and CEE Ph.D. candidate Yan Wang joined Landscape Architecture students Jonathan Gemmell, Penny Jacobs, Harris Trobman, and Nick Yoder on a mission to redesign a prominent site next to UMD's Memorial Chapel. The group was advised by Dr. Victoria Chase, an assistant professor in the Department of Plant Science and Landscape Architecture (PSLA).

The research team - known as UMD Team D9 - centered their project on a 71-acre basin located directly south of Memorial Chapel. The team members proposed a system to gather runoff from surrounding impervious surfaces and collection points and treat the water in multiple stages before returning any treated overflow back into the storm system located at the low end of the site. The team's collection system involves replacing the traditional lawn with a series of meadow ecologies while capturing and treating stormwater from two adjacent parking lots and surrounding rooftops through a series of bioretention terraces, bioswales, and rain gardens.

"Compacted and fertilized lawn is arguably just as bad as a parking lot. Getting rid of lawn is a good thing," Renkenberger said, noting that the landscape architecture students chose regionally



ior, evaluating transit travel time reliabilities, developing algorithms for optimizing ride-share services and designing phased development plans for all rail transit lines.

## LSAMP Fellowship Helps CEE Student Pursue Dream Career in Structural Engineering



Ryan McCullough

Ryan McCullough's (B.S., '15) first connection to civil engineering traces back to his grandfather, who worked for Clark Construction. Today, the CEE graduate student is working toward his own long-time goal of estab-

lishing a career in structural engineering, with support from the Louis Stokes Alliances for Minority Participation (LSAMP) Bridge to the Doctorate Fellowship.

"Throughout my undergraduate career, the study of structures always interested me the

most," McCullough said. "Looking at the interaction of smaller components as they relate to a greater system has always reminded me of a puzzle."

McCullough is particularly interested in learning more about the effects of different loading cases on a structure, and the measurable physical responses of structures' components.

A Clark School Ambassador and an active member of the University of Maryland chapter of the American Society of Civil Engineers (ASCE), McCullough also served as a university resident assistant for three years as an undergraduate. Today, he is developing hands-on skills as a second-year intern with Network Building + Consulting (NB+C), a company that specializes in telecommunication network design and engineering.

Established to encourage and support graduate student participation in the STEM fields, the LSAMP Bridge to the Doctorate Fellowship provides \$30,000 per school year for two years to cover education costs and some living costs. Throughout the fellowship

program, McCullough will be paired with a professor and will take part in a number of events and meetings with fellow award recipients.

"The Bridge to the Doctorate Fellowship will help me grow as a young professional in the engineering field," McCullough said. "The opportunity to attend national and professional conferences will assist me in networking. Academically, the fellowship will give me the opportunity to do research in the field of structural engineering, which may influence my professional and academic future."

Prior to entering the University of Maryland as an undergraduate in 2010, McCullough enjoyed his first learning experiences in engineering as a student at the Western School of Technology and Environmental Science in Baltimore, Md. Throughout his high school years, he studied plumbing and gas fitting and learned about a variety of aspects of civil engineering.

native plants that are hardy and low-maintenance.

The team also redesigned the site's stormwater system by disconnecting existing storm pipes and directing stormwater flow from two adjacent parking lots into a low-impact development treatment drain into the meadows. This design would treat 55 percent of a five-year storm event and 100 percent of a one-year storm event, Team D9 noted.

"These storm events are, statistically, the most frequent," Renkenberger said. "Reducing impervious area, increasing land-holding capacity, and increasing infiltration for these events reduces erosion from peak flows and pollutant transport. We are in the Chesapeake Bay watershed, so intercepting these volumes trickles benefits downstream and eventually to the Bay itself."

In addition to offering a practical solution for stormwater management, the proposed project would also enhance aesthetics of the site, which is often used for commencement, academic functions, and weddings.

"I think that beautiful designs like this go a long way to show the public that sustainability is a thing, and that it can be really cool," Renkenberger said. "In addition to aesthetics, this design is functional from a sustainability point of view as well as recreational. Fishing from clean streams, kayaking through restored wetlands and farming Blue Crab are all supported by sustainability. If enjoying the outdoors isn't your thing then maybe eating fresher and cheaper bay



food is. There is a very strong economic argument for sustainability."

By joining together area experts from civil engineering, landscape architecture, environmental science and technology, and facilities management, Team D9 also demonstrated the value and importance of cross-disciplinary research. Additional advisers to the team included Mr. Dennis Nola (PSLA), Dr. Lea Johnson, Dr. Peter May (Environmental Science

and Technology), Dr. David Myers (College of Agriculture and Natural Resources), and Karen Petroff, UMD Facilities Management Assistant Director, Arboretum and Horticultural Services.

"Every interdisciplinary project I [have worked] on further shows the importance of collaboration to meet environmental challenges," Renkenberger said. "Everything is so interconnected and complex. To do things right and get the most benefit, we need to understand that watersheds are composed of both physical and social elements. Both are critical to sustainability."

The team, which presented a site plan, renderings, and maintenance schedule for implementation of their design, was formally recognized by the EPA during an Earth Day awards ceremony at the Chapel site on April 22. The students of Team D9 will split \$2,000 in prize money; faculty from the PSLA will also receive money to go towards furthering green infrastructure research.

## Engineers Without Borders Returns to Peru

Three students from the University of Maryland Engineers Without Borders (EWB-UMD) Chapter teamed up with two students from UMD's Public Health Without Borders (PHWB-UMD) to travel to Compone, Peru to assess how years of the chapters' involvement in the region has made a difference and to look ahead to new initiatives.

In the seven years since EWB-UMD started its Peru program, the team has worked on supplying clean water to the community. Beginning 2013, PHWB has made the trek to the region to educate residents on general health and safety practices.

Following the early successes of EWB-UMD and PHWB-UMD's clean water initiatives, both teams have shifted the Peru program focus from engineering solutions for water quality to resolving the town's issues with traffic accidents. Additionally, both teams are looking to develop alternatives for community members who frequently walk along high-speed roadways to take their livestock to and from pasture.

By building a bridge to cross waterways that typically impede community members' transport of livestock, engineers could connect two dirt paths, enabling residents to use the paths instead of the main roadways, EWB-UMD noted. This could make a world of difference in terms of pedestrian safety and traffic mitigation.

During the January 2015 assessment trip, EWB-UMD developed ideas for a project to address this need, following suggestions from leaders and members of the community. While EWB-UMD worked to collect information on the materials and space needed



for the bridge, PHWB-UMD held workshops on improving road safety practices.

After determining the bridge's exact specifications and materials and the appropriate construction process, EWB-UMD will continue working to construct the bridge and will support PHWB-UMD's efforts to educate community members on road safety and general health practices.

## STUDENT SPOTLIGHT

### Carmel Named among ASCE's New Faces of Civil Engineering – College Edition



CEE undergraduate Alana Carmel was named to the American Society of Civil Engineers' (ASCE) New Faces of Civil Engineering – College Edition.

In addition to being an active member of ASCE, Carmel is also a procurement officer for the University of Maryland's Concrete Canoe team, a former field work and project management intern with Cianbro Corporation, a volunteer with Friendship Circle International, and past Philanthropy and Community Service chair for Alpha Epsilon Phi.

"ASCE has become my support system for both my studies and [my] friendships at the university," Carmel told ASCE. "I have learned to value the reciprocal relation-

ship I have with fellow society members. From giving or receiving homework help, to advice about career paths, I can always count on my peers to lead me in the right direction."

Carmel told ASCE her interest in civil engineering is growing.

"As a child, I surpassed the normal by building towers up to the high heights of my basement ceiling," she said. "In the future I want to build to higher heights [and] eventually lead a team of engineers building the most efficient highway, the longest bridge, or the tallest building to amaze the world."





## Brubaker, ENCE200 Take on Campus Creek Stormwater Mapping Project with Support from a CEE Alum

Associate Professor Kaye Brubaker teamed up with CEE alumnus and founder of Mapistry Ryan Janoch (M.S., '08) to provide a unique opportunity for the 57 students enrolled in ENCE200, "Civil Engineering Computation" in spring 2015.

In support of the University of Maryland (UMD) Campus Creek restoration initiative, students took part in a project called "Collaborative On-Line Mapping Using Mapistry," through which they used Mapistry's stormwater mapping software with location-enabled phones and tablets to map the right and left banks of Campus Creek, between where the creek flows under University Boulevard and where it enters Paint Branch.

In addition to geolocating the banks of the stream, the students' mission was to mark locations where they observed ponds, pools, bridges, tributaries entering Campus Creek, storm drain outfalls, evidence of erosion, and more. They were also asked to photograph the stream banks and use Mapistry's software to create hyperlinks between points on the shared map and their photos.

"The idea was to get a very detailed pre-restoration understanding of the location and state of the stream and its banks," Brubaker said. "We also wanted to identify locations where water flow is entering Campus Creek. Such locations might not show up on official maps and drawings – features like little streams following deer paths, or erosion below storm drain outfalls."

Janoch and his wife Allie, Mapistry CEO and a UMD computer science alumna, generously donated Mapistry's software to the class in hopes that students would see how sustainability projects evolve from the very beginning, the data collection stage.

"Civil engineers occasionally work on public works projects that might impact them personally, but often times they are working on projects that do not affect them," Ryan Janoch said. "By working on a project on campus, the students get to shape something that impacts them personally. The information that the students gather will be used to shape the design and ultimately the outcome of the project, which is on their own campus."

## Kjellerup, Andrade Join CEE Faculty



Birthe Kjellerup

The Department of Civil and Environmental Engineering (CEE) and the A. James Clark School of Engineering welcomed two new faculty members, Assistant Professor and Pedro E. Wasmer Professor in Engineering Birthe Kjellerup and Lecturer Natasha Andrade, a CEE alumna (B.S. '05, M.S. '08, Ph.D. '12).

Much of Kjellerup's research focuses on how biofilms relate to either the external environment, such as in instances of clean-up of contaminated soil and sediments, or the human environment, such as in the study of infections and disease. Kjellerup also has expertise in aerobic and anaerobic degradation of polychlorinated biphenyls (PCBs) and biocorrosion in drinking water and oil distribution pipelines.

As Lecturer, Andrade teaches various undergraduate courses in environmental engineering and maintains a heavy focus on research and online curriculum development. Her recent projects have focused on environmental remediation of sediments and soils, and the production of stabilized biosolids, with a focus on their impact on environmental pollution.



Natasha Andrade

## Davis Named EWRI Fellow



Allen Davis

Department of Civil and Environmental Engineering (CEE) Professor Allen Davis was named a Fellow of the Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE).

Recently named the inaugural editor of the EWRI Journal of Sustainable Water in the Built Environment, Davis was bestowed Fellow status in recognition of his contributions to the advancement of water resources and environmental engineering, and his dedication to mentoring students.

"It is an honor to be recognized by my peers as a leader in water resources and environmental engineering, and to join the other Fellows, who I greatly respect," Davis said.

To be eligible for advancement to the grade of Fellow, EWRI members must have been a member for 10 or more years and have contributed to the advancement of education and understanding of engineering and science related to the EWRI mission.

## UMD Launches Undergraduate Minor in Construction Management

The University of Maryland's Project Management Center for Excellence, housed within the Department of Civil and Environmental Engineering, joined forces with the School of Architecture, Planning and Preservation to establish an undergraduate minor in construction management, with the first courses available beginning fall 2015.

Generously funded by the Colvin Family Foundation, the new minor offers foundational knowledge in sustainable construction and design through experiential learning and a professionally guided curriculum, forwarding the university's continued mission to support student innovation and entrepreneurship. Along with a minor in construction management, UMD also established an undergraduate minor in real estate development.

"The kind of responsibility we have as a land grant institution is reflected in the values of John and Karen Colvin and the Colvin Institute of Real Estate Development," said University President Wallace Loh at the signing of the Letter of Agreement at the School of Architecture, Planning and Preservation. "We are very fortunate to celebrate this magnificent gift from the Colvins that will expand this program to undergraduates."

The interdisciplinary minors are jointly administered by the School of Architecture, Planning and Preservation and the A. James



Clark School of Engineering. Available to undergraduate students campus-wide, the minors offer a mix of existing and new coursework to match and anticipate industry trends.

The Colvin Family Foundation, under the guidance of John and Karen Colvin, has pledged \$1 million to support the initiative. The university anticipates the new gift will not only support the new minors, but also seed the study for a future undergraduate major in Real Estate Development.

17

## Second Annual Project Management Symposium Features NASA, U.S. GAO Keynotes

June 8-9, 2015, the University of Maryland's Project Management Center for Excellence welcomed nearly 150 project management professionals for the Baltimore-Washington region's only symposium to bring together academics with project management professionals under one roof.

Held at the Stamp Student Union at the University of Maryland, the event featured more than 55 esteemed speakers and covered topics ranging from public-private partnerships and sustainability, to risk and big data and agile and IT. Keynote speakers included Jocelyn Davis, President and CEO of Nelson Hart; Chip Hastie, Vice President of Clark Construction Group, LLC; Ed Hoffman, NASA Chief Knowledge Officer; Dr. Harold Kerzner of the International Institute for Learning; and Karen Richey, Assistant Director for the Applied Research and Methods Team at the U.S. Government Accountability Office.

"It is so exciting for us, year after year, to welcome some of the brightest minds in project management for the capital region's only symposium to bring together project management professionals and academics,"



said John H. Cable, Director of the Project Management Center for Excellence. "Building on the tremendous success of our inaugural symposium, this year's event was tailored to meet the needs of 21st-century project managers of all career levels and sectors."

"We are proud to think that our Project Management Center for Excellence is different," said A. James Clark School of Engineering Dean and Nariman Farvardin Professor of Engineering Darryll Pines. "Not only is it the first in an engineering school to be accredited by the Project Management Institute's Global Accreditation Center, but our center is uniquely positioned to foster cross-industry education and the open



exchange of lessons learned in project management. The Center's tagline, 'Academically Rigorous and Practically Applied,' illustrates how our project management program lays the groundwork for a one-of-a-kind partnership between academe and industry, benefiting the fields of project management and engineering at large."





The 2015 CEE Alumni Cup team paid homage to environmental engineering with their entry in the annual design competition. Started in 2012 by the University of Maryland Alumni Association, Engineering Chapter, the Alumni Cup takes place each year during National Engineers Week, a weeklong celebration held to increase awareness of the field for the general public, students, educators and parents.

**John L. D'Angelo, Jr.** (M.S., CEE '95) was named vice president for facilities at Northwestern University, effective Feb. 16, 2015. D'Angelo brings to the position more than 27 years of experience in capital improvement management, facility design and construction, facility and campus master planning, operations and maintenance, and environmental and policy development.

**Dr. Ryan Hurley** (B.S., CEE '11) has accepted a faculty position in the Department of Mechanical Engineering at Johns Hopkins University, where he will work in affiliation with the Hopkins Extreme Materials Institute. Prior to his slated summer 2017 start date, Hurley will complete a two-year postdoctoral appointment with the Computational Geosciences Group at the Lawrence Livermore National Laboratory in Livermore, Calif.

**Dr. M. Dianne Leveridge** (M.S., ENPM '08, Ph.D., CEE '14) was named the director of Technical Programs for Academic Affairs for the Kentucky Community and Technical College System (KCTCS). After retiring from Lexmark International Inc., Leveridge served as director of Project Lead the Way, a science, technology, engineering and math (STEM) program affiliated with the University of Kentucky that focuses on K-12 students.

**Dr. Amir Mirmiran** (M.S., CEE, '86, Ph.D., CEE, '91) was named the provost and vice president for academic affairs at The University of Texas at Tyler, effective July 1, 2015. Mirmiran will also hold the UT Tyler Sam Lindsey Chair in Civil Engineering. Prior to his role at UT Tyler, Mirmiran served as dean of the College of Engineering and Computing for Florida International University in Miami. His research in bridge engineering has led to two U.S. patents and more than 110 journal publications.

**Robert H. Morro** (M.S., CEE, '91) was named Vice President for Facilities Management for Villanova University. Morro arrived at Villanova in 2002 following 20 years in the Navy Civil Engineer Corps.



## Schneider Receives Inaugural Carapace Award

CEE alumnus Jonathan Schneider (B.S., '15) was awarded the University of Maryland Alumni Association inaugural Carapace Award. Established to honor a graduating student who has done great work for the campus community, the Carapace Award also seeks to foster Terp pride post-graduation.

Schneider had a tremendous impact on the UMD community throughout his undergraduate career, having served as president of the University of Maryland American Society of Civil Engineers (ASCE) Chapter, a peer mentor, and president of his Living & Learning community. Schneider also helped the Engineering Alumni Network raise more than \$6,500 for student outreach programming, and helped establish ASCE Maryland's first-ever Suit Up & Be Civil networking event.

## ASCE Maryland Achieves Milestones in 2015



### Concrete Canoe, Steel Bridge Teams Take First Place in ASCE Mid-Atlantic Competitions

The Department of Civil and Environmental Engineering's (CEE) Concrete Canoe and Steel Bridge teams took the 2015 American Society of Civil Engineers (ASCE) Mid-Atlantic Regional Competitions by storm, placing first overall in both team competitions and second in the technical paper competition.

Held at the Pennsylvania State University's Stone Valley Recreation Area, April 10-12, the competition showcased the University of Maryland ASCE's competitive spirit and incredible attention to detail as both teams received great praise for their technical presentations and displays.

In commemoration of the 140th Preakness Stakes, the Concrete Canoe team's showcase was unlike any other – from the artwork on the canoe itself to the iconic University of Maryland "M" floral display on which it was affixed during portions of the competition. Under the leadership of project managers Phil Izzo (B.S., '15), Craig Lampmann (B.S., '15), and faculty advisor Assistant Professor Brian Phillips, and with technical support from Structural Group, the team

celebrated a strong performance in the races, but even higher marks in the technical and presentation categories.

The Steel Bridge team also went to great lengths to make sure no workmanship details went unnoticed. The team earned first place in both the construction economy and structural efficiency categories, which measure how quickly the team can build their bridge and how well the bridge can handle loads, respectively.

Perhaps most impressive of all is how far both teams have come in such a short period of time.

2015 marked only the fifth year in which the University of Maryland had an official Steel Bridge team, said Ross Jespersen (B.S., '15), one of the team's project managers. Fall 2014 graduate Emily Krizz (B.S., '14) and CEE undergraduate Adam Healey served as the team's other two project managers this academic year.

"Winning our region this year has definitely cemented our presence here on campus and in the Mid-Atlantic Region," Jespersen said. "We're a strong contender,

and our team is made up of some incredibly smart students."

While UMD's Concrete Canoe team can be traced to earlier years, the team celebrated a restart in 2008-09 following a hiatus.

"We aren't the newest team on campus, but we have certainly seen the team evolve quickly in recent years to what it is today," said ASCE Maryland President Jonathan Schneider (B.S., '15). "We also have a large contingent of underclassmen, and Concrete Canoe is certainly a great way for underclassmen to get involved in student groups and network with upperclassmen."

Schneider himself celebrated an impressive win at Pennsylvania State as he took home second place in the technical paper and presentation competition, which this year focused on whether or not the Engineer of Record "should be held responsible, to any degree, for injury or death to builders or bystanders that occurs during the construction of his/her design." Schneider is no stranger to the competition, endowed by Society past president Daniel W. Mead and established to provide an opportunity for





alert young civil engineers to further their professional development and gain national attention. Schneider took first place in last year's competition for his paper and presentation about a civil engineer's responsibility in natural disaster planning.

Schneider stressed the fact that there are many benefits to participation in the Concrete Canoe and Steel Bridge teams that stretch beyond competitions.

"Both teams offer time for students to come by after class and, even if some students might not realize it, they have a unique opportunity to apply lessons from class to the work they do for these teams," Schneider said. "These students are learning lab skills and finding out firsthand how to use certain tools and manage projects. They're also developing invaluable people skills."

In fact, Steel Bridge team leaders even encourage as many members as possible to gain experience with welding, Jespersen said. This is made possible, in part, by the support of Steel Bridge sponsor Earlbeck Gases & Technologies, which offers a class through which UMD Steel Bridge team members can get their first taste of welding experience.

"Perhaps more important than the skills and lessons learned is the fact that both the Concrete Canoe and Steel Bridge offer opportunities for engineering students to make new friends and develop relationships with both underclassmen and lower classmen," Schneider added.

Both the 2015 Steel Bridge and Concrete Canoe teams participated in their respective national competitions in late spring. Steel Bridge's competition took the team to the University of Missouri-Kansas City, May 22-23, while Concrete Canoe's brought the team to Clemson University, June 20-22.



### ASCE Maryland Hosts Inaugural "Suit Up & Be Civil" Event

On Monday, March 2, 2015, nearly 160 civil engineering professionals, students, alumni, and University of Maryland (UMD) civil engineering faculty gathered under one roof for the inaugural "Suit Up & Be Civil" event, organized by UMD's chapter of the American Society of Civil Engineers (ASCE Maryland).

The near-capacity crowd kicked things off with an opening networking reception featuring a dozen sponsor organizations, many of which currently employ UMD Department of Civil and Environmental Engineering (CEE) alumni and students. Following the reception, attendees were served dinner as they heard from ASCE Maryland President Jonathan Schneider and Event Coordinator Jamie Richardson, as well as representatives of Archer Western, Clark Construction, Forrester Construction Company, O'Connell & Lawrence, Inc., and Whiting-Turner.

Keynote speaker, David S. Thaler, President of DS Thaler & Associates, Inc., then enthralled the crowd with a presentation on what he refers to as "Sprawlburbia" in America.

"The current model of suburban development [in America] is unsustainable," Thaler cautioned. "Suburbia is no accident, but it is the result of manifest public policy embodied in our zoning codes, our road codes, and our other regulations and laws."

Thaler, a Fellow in both the American Society of Civil Engineers and the National Society of Professional Engineers, opened his presentation by sharing his experiences traveling up and down I-95 along the East Coast, noting that much of the development he saw is common across the country, and can be described as "sprawling" and "car-dominated."

"What, after all, is so wrong with sprawl?" he asked, revisiting a question posed during one of his recent lectures. For many outside the realm of engineering, sprawl – a process whereby the spread of development across a landscape outpaces population growth – would seem to carry a solution for traffic congestion and gridlock. Instead, Thaler stated, "The most damning case against sprawl is that it actually creates traffic."

"It's almost a miracle that gridlock can be created from such low-density zoning and development," he continued. "It's because, the further things are spread out from each other, the more each of us must drive to get back and forth. And, so, the number of vehicle miles driven per year grows far beyond our ability to build new roads. Anyone who thinks that transportation in the next 25 years will be the same as it was in the past 25 years is dreaming."

The increase in traffic will create more congestion and gridlock, thereby forcing area residents to drastically alter the way they live – requiring civil engineers to rethink the model of development, Thaler said.

"We aren't stuck in a traffic jam – we are the traffic jam," he said. "New roads are justified to relieve congestion; however, you cannot spend your way out of traffic problems. New roads actually create congestion. Sooner or later, if the diet of suburban development doesn't change, the roads will clog up again."

Enter, today's budding engineers.

"Communities should be designed at least as thoughtfully for humans as they are for cars," Thaler said. "We need public policies that, at least, permit narrower roads, mixed uses, parallel parking, and communities worth caring about. And it's the young members of the civil engineering profession who I believe should lead the way."



21

## CEE Launches Infrastructure Engineering Laboratories Renovation Initiative

In spring 2015, the Department of Civil and Environmental Engineering (CEE) kicked off its Infrastructure Engineering Laboratories renovation initiative.

The initiative will support efforts to equip CEE students with the resources needed to develop comprehensive understanding of the engineering science behind the systems and structures on which society relies.

As part of the renovation initiative, the department will redesign its physical and virtual facilities to provide students greater

exposure to modern laboratory- and field-based infrastructure engineering techniques. Students will develop better hands-on understanding of the behaviors of steel, timber, concrete, asphalt, soil composites, and other materials employed in infrastructure design. Additionally, students will master Quality Assurance testing techniques for infrastructure construction and learning cutting-edge nondestructive evaluation approaches for monitoring the structural health of bridges, buildings, and other criti-

cal infrastructure assets.

The renovation initiative marks a new era for the department, which has seen student enrollment double in the past decade.

“Generations of civil and environmental engineering students to come will benefit from both hands-on and virtual learning opportunities made possible by the University of Maryland Infrastructure Engineering Laboratories renovation initiative,” said Darryll J. Pines, Clark School Dean and Nariman Farvardin Professor of



Engineering. “With improved access to cutting-edge equipment and engineering software, our civil and environmental engineering students will develop the skills needed to design novel solutions to critical engineering challenges impacting society.”

“Direct interaction with the materials, testing techniques, and instrumentation used in the design, construction, and performance monitoring of infrastructure facilities is a critical component of our civil engineering curriculum,” said Charles W. Schwartz, CEE Professor and Chair. “Laboratory and field work complement and strengthen the engineering science concepts that our students learn in their design and analysis courses. The modernized and greatly enhanced facilities in our new Whiting-Turner Infrastructure Engineering Laboratories will help position our graduates as leaders in the engineering of the buildings we inhabit, the roads and bridges on which we drive, the airports via which we travel, and the ports through which our goods are shipped. These all contribute to a better quality of life for all of society.”

The renovated and enhanced Infrastructure Engineering Laboratories will be the home to ENCE 300 Fundamentals of Engineering Materials, a required course for all CEE undergraduates, and to ENCE 444 Experimental Methods in Geotechnical and Structural Engineering, a required course for all CEE undergraduates in the Infrastructure track. The faculty for these courses – Drs. Ahmet Aydilek, Dimitrios Goulas, Sherif Aggour, Yunfeng Zhang, and Brian Phillips – played a major role in the development of the conceptual design for the renovation and enhancement of the laboratories.



## Whiting-Turner Contributes \$1.5 Million to Renovation Initiative

The Whiting-Turner Contracting Company has committed \$1.5 million in support of the Department of Civil and Environmental Engineering Infrastructure Laboratories renovation initiative.

Whiting-Turner’s donation will span five years and will help bring to life the department’s vision for new, state-of-the-art facilities and laboratory equipment.

“We are proud to partner with the University of Maryland and

the Clark School in support of the Infrastructure Engineering Laboratories renovation initiative,” said Timothy J. Regan, President and CEO of Whiting-Turner and a University of Maryland civil engineering alumnus (B.S., ’77). “We believe our support will help further the Department of Civil and Environmental Engineering’s mission to prepare graduates to be proficient in both analysis and synthesis aspects of civil engineering design and practice.”



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