

Carnegie Mellon University

CEE NEWS

CMU.EDU/CEE

Spring 2018

Crossing Borders

CEE Undergraduates
Experience Life Abroad



CEE NEWS

Spring 2018

Editor & Designer
Mireille Mobley

Writers
Emily Durham
Adam Dove
Rachel Mohr Handel
Mireille Mobley
Georgia Schumacher

For more news and information about CEE please visit us at: cmu.edu/cee

Something to share?
We want to hear from you!

Please email news to mmobley@andrew.cmu.edu

Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex, handicap or disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status or genetic information. Furthermore, Carnegie Mellon University does not discriminate and is required not to discriminate in violation of federal, state, or local laws or executive orders.

Inquiries concerning the application of and compliance with this statement should be directed to the vice president for campus affairs, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-2056.

Carnegie Mellon University publishes an annual campus security and fire safety report describing the university's security, alcohol and drug, sexual assault, and fire safety policies and containing statistics about the number and type of crimes committed on the campus and the number and cause of fires in campus residence facilities during the preceding three years. You can obtain a copy by contacting the Carnegie Mellon Police Department at 412-268-2323. The annual security and fire safety report is also available online at <http://www.cmu.edu/police/annualreports/>.

Carnegie Mellon is a global university. Our students and faculty come from all over the world, we have education and research programs and partnerships in many countries, and we have physical campuses on four continents. Carnegie Mellon, the College of Engineering, and CEE have fully embraced the importance of international perspectives and experience for advancement of education, knowledge, and societal advancement in the 21st Century.



A long-standing international experience opportunity for CEE undergraduate students has been through study-abroad programs, and our students are pursuing this opportunity in new and creative ways. In addition to traditional study-abroad experiences at international universities, our students are undertaking international internships and engaging other experiences outside of academia. In some cases these experiences are for academic credit, with related requirements, while in other cases they are for building personal skills, a professional portfolio, tolerance for risk, and other goals. This issue features accounts of some recent study-abroad experiences of our creative CEE undergrads, including that of senior **Renee Rios**, shown on the cover.

A strength of the CEE undergraduate and graduate programs is the breadth of our educational offerings and research in water engineering, science, and policy. Two examples of that breadth are provided with stories in this issue. PhD student **Chelsea Kolb** is studying the effect of climate change on groundwater quality in coastal regions, where sea level rise is affecting salinity of groundwater resources in many areas. With support from a Fulbright fellowship, Chelsea was able to spend 10 months in Costa Rica to collect valuable data for her research. PhD student **Kerim Dickson**, who is studying interbasin transfers in the U.S., was fortunate to be selected for the 2017 Summer Institute at the NOAA-sponsored National Water Center. There he joined a team of other graduate students from across the U.S. for work on a project to help advance the National Water Model.

Other research highlighted in this issue includes the work of PhD students **Eilis Rosenbaum** and **Lauren Cook**. Eilis is studying the design and performance of foamed cement for use in oil well construction. Lauren is investigating how hydrologic engineering design standards should be revised to account for climate change.

We will be holding our annual CEE Alumni Awards event and also a celebration of the career of Professor **Jacobo Bielak** on Friday, April 20, beginning at 5 pm in the Singleton Room, Roberts Hall. All alumni are welcome. Please plan to join us if you will be on campus for Carnival Weekend.

The faculty, students, and staff of CEE thank all of our loyal and generous alumni who support the Department in so many and much appreciated ways. We send our best wishes to all of you.


Hamerschlag University Professor
CEE Department Head

Inside this Issue

8 Creating a Water Management Plan in Costa Rica

PhD student Chelsea Kolb spent 10 months in Costa Rica working alongside a hydrologist to study water quality and aquifer levels along the coastline.

11 Providing Leadership Opportunities

The National Society of Black Engineers (NSBE) has given Pierce Sinclair the chance to realize his leadership potential and strengthen his appreciation for how impactful a sense of community really is.

12 Moving Upstream

PhD student Kerim Dickson works on the National Water Model.

14 Making Climate Models Simple

In order to save future lives, as well as our cities, civil and environmental engineers need to incorporate climate change information into their design standards moving forward. But this is much easier said than done.

16 Safety and Environmental Impacts in Petroleum Industry

PhD student Eilis Rosenbaum studies how foaming cement can be more economical and environmentally friendly for petroleum industry wells

22 Building Bridges to Success

Alum W. Logan Dickerson (BS '48) gives back to Carnegie Mellon.



Crossing Borders

4

Spending time in an unfamiliar country can teach us a lot—about others and ourselves. For CEE students, the opportunities to go abroad are vast, from Spring Break trips to summer programs to entire semesters.

This month's feature story focuses on six students whose experience abroad has shaped their personal and professional goals.

CEE FAST FACTS

2018 Program Rankings *

Civil	Environmental
12th - UG	8th - UG
10th - Grad	8th Grad

* Source: U.S. News and World Report

Enrollment AY 2017-2018

Bachelors	96
Masters	197
Doctoral	78

44% of CEE Students are Women

59% Undergraduate Women
39% Graduate Women

Our Faculty & Research

13	Full Professors
4	Associate Professors
5	Assistant Professors
4	Faculty with Active NSF Career Awards

\$5.9M Annual Externally Funded Sponsored Research in FY17

Crossing Borders

CEE Undergraduates Experience Life Abroad

Spending time in an unfamiliar country can teach us a lot—about others and ourselves. For CEE students, the opportunities to go abroad are vast, from spring break trips to summer programs to entire semesters. “Wherever they want to go, they can find a way to make it work with their studies,” says CEE Director of Undergraduate Programs Andrea Francioni Rooney.



Obianozo Chukwuma with new friends

Exploring a Newfound Independence

“I always knew I wanted to study abroad,” says CEE senior **Obianozo Chukwuma**. “I thought it’d be exciting to go to a university in a new country with all new people and essentially re-live into everything.”

To realize this goal, Chukwuma worked closely with CEE to schedule her trip around her required courses and with the university’s study abroad coordinator to finalize her plans and paperwork.

In January 2017, she flew to London for the spring semester. “On the flight, I started getting so nervous,” she admits. “Once you’re there though, it’s absolutely worth it.”

From navigating the nuances of cross-cultural communication with an international group of friends to taking weekend trips across Europe, the experience was everything Chukwuma expected and more. Challenges became valuable lessons. “I’ve gotten a lot better at not stressing when things go wrong,” she says. “It’s taught me to relax and figure it out.”



Amanda Soyk spends time with children in Haiti

For example, searching for internships was a bit more complicated for Chukwuma in London than it would have been if she were back in the U.S. attending job fairs on campus. Knowing she wouldn't meet with anyone in person, Chukwuma was diligent in finding and connecting with potential employers as well as contacting her CEE professors for references and advice. That persistence paid off, and Chukwuma landed a summer internship at WSP USA.

"It's made me more independent in everything," she says. "I've learned to just go for it, to motivate myself and get things done."

Creating Lasting Connections

CEE senior **Amanda Soyk** is currently preparing to spend her fourth consecutive Spring Break in Haiti. A member of the group CMU in Haiti, Soyk has spent much of the year raising funds to benefit grassroots Haitian organizations. Once in Haiti, she and fellow students will meet with each organization to learn their current needs and what's been accomplished since their last visit—information that influences how CMU in Haiti members allocate their funds among the organizations.

"You really get to know the people down there," says Soyk, who was the group's secretary in 2016

and president in 2017. "Our organization is built on these relationships."

Among the organizations supported is the SOPUDEP school, which recently opened its second school building and provides a free education and daily meal to children who otherwise couldn't afford schooling. Other CMU in Haiti partners include orphanages and a micro-credit organization that helps women to gain economic independence. In past years, they've also held mobile health clinics that deliver basic vitamins and medicines.

"You see how very little can make a big difference," says Soyk. "That's the biggest takeaway for me. The average salary of an adult in Haiti is one to two dollars a day. Many of us waste way more than that every day. Every dollar really does count."

As Soyk envisions her life after graduation, returning to Haiti, she says, would be "a dream come true." No matter what, she asserts, "I'll definitely do something with a nonprofit."

Discovering Different Perspectives

When CEE senior **Renee Rios** was in high school, she visited her older sister who was studying abroad in Europe. It was that experience that inspired her to do the same. "It was incredible to get to travel and see the world," she says.

Coming from a Puerto Rican family, Rios grew up around Spanish speakers, so when deciding where to spend a semester abroad, she jumped at the opportunity to study in Barcelona and learn more Spanish. "The practice with the language was amazing," says Rios.

More important than the language, for Rios, however, was learning about other cultures. "I stayed with a family who had three young girls, so I got to see how their education system differs from ours. The ideals that they teach to kids are different than what we teach here," she reflects.

Even things like when they ate dinner or when shops closed made an impression. "While you're there, you sometimes wonder, why don't they do

things like we do?" says Rios. "It's interesting to adjust to these differences and then, coming back, you see some things in their society that they do a lot better than we do. You start to ask, why don't we do things like they do?"

Rios already has her next trip planned; this Spring Break she's returning to Barcelona and then going on to Amsterdam. She says, "Studying abroad taught me to see other people's perspectives. Learning how to see things from more perspectives and connecting with people from different cultures, that was invaluable to me."

Solidifying a Desire to Give Back

CEE senior **Roseanne Usnay** had two goals: to explore another culture and contribute to the global good. The Carnegie Mellon Global Water Brigades chapter, with its mission to increase access to clean water, offered the perfect opportunity.

Over Spring Break 2017, Usnay and other Carnegie Mellon students visited rural northern Nicaragua to help build a gravity-based water supply system. "Without that system, community members have to walk five miles to the nearest source of fresh water," explains Usnay. "Of course, in a week, you can't finish the entire project. Every week different chapters come and continue where the last chapter left off."

For this project, Usnay spent most mornings digging trenches for PVC pipe. Later in the week, her group also helped to build outdoor sanitation stations and concrete flooring. The afternoons, however, were saved for community interaction and exploration.

"One day we walked to a coffee farm up in the mountains. The owner gave us a tour and talked about how he makes coffee and how much he makes. Afterwards, he played guitar while we sat in his home sipping coffee that he had given us," recalls Usnay. "It was amazing."

For Usnay, her experience in Nicaragua has shaped how she sees life back in the U.S. and has reinforced her desire to work on environmental projects abroad.

"Staying in this community was eye-opening," she says. "These water projects are so important, and this experience has brought home how privileged we are and how we can do so much more to help others."

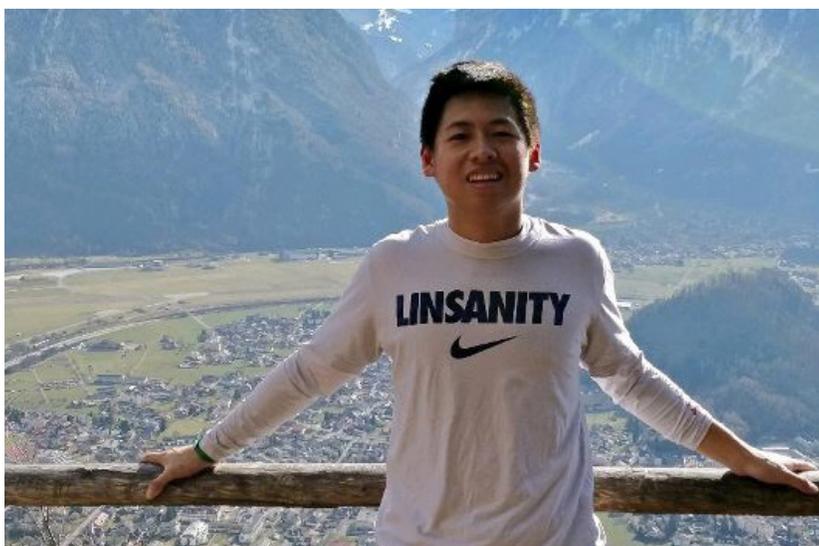
Living in Another Language

"My goal has always been to experience as much as possible in college," says senior **Keval Gala**.

It's a goal that's clear from his studies. He's double majoring in Civil and Environmental Engineering and Engineering and Public Policy, with minors in Global Engineering and French and Francophone Studies. It's also reflected in his travels over the last four years. He's gone on Spring Break service trips to both Haiti and Honduras and spent part of one summer in Ethiopia for a program called Engineering for Developing Communities. Most recently, Gala went to Paris for a full semester in 2017.

An experienced traveler, Gala didn't experience culture shock abroad, but he was surprised by the difficulty of switching languages. "All of a sudden, French was my living

Austin Lin



Roseanne Usnay (right)





Renee Rios connected with Keval Gala in Paris

language,” he explains. Every day, he was taking classes, reading, arguing, navigating grocery stores, and even telling jokes—all in French.

Since he’s considering joining the Peace Corps or working in international engineering and development, Gala had chosen France specifically to practice his language skills. Still, as he tried to express himself or his sense of humor, he often wished for the ease of his native language. Yet, somehow, over the semester, Gala says speaking French began to feel more natural.

“When you use a language that much, it becomes a part of you. I started to even think in French,” he says. “It became personal to me in a way that it wasn’t before, and that wouldn’t have happened if I hadn’t been living in France.”

Discovering New Points of View

As an underclassman, CEE junior **Austin Lin** wasn’t interested in studying abroad, despite his family encouraging him to give it a chance. When a close friend went abroad and also sang its praises, Lin began considering it more seriously, but he still wasn’t sure. After all, he was focused on his engineering studies and he’d miss part of his golf season and the Spring Carnival while abroad.

Lin weighed the pros and the cons, and the benefits won out. Now in Barcelona for the semester, he’s surprised by how much he’s enjoying the city, with its affordable travel, scenic hikes, and architecture that appeals to his interest in civil engineering. “After class every day, I just get lost in the city and somehow make my way back home,” he explains.

While in Spain, Lin is devoting the mental energy typically spent on engineering courses to learning Spanish instead, something he plans to continue after returning to CMU. “It’s tough, but it’s going well,” he says. “There’s a lot of opportunity to practice.”

Interacting with others from around the world has also been a highlight. “At school, you’re mainly talking with students or friends back home who have shared experiences. Talking with people here about their experiences makes you think a little differently,” Lin says. “I can have a hard time getting out of my comfort zone, taking a wider view, and not being narrow minded. For engineering, I can be too focused on a particular solution. After this, I think it’ll be easier to see different angles and possibilities.”

Shared Experiences

Wherever our students go, they all return changed in some way, with a deeper understanding of themselves and the world in which we live. Despite the unique nature of each individual’s travels, they share a common refrain: going abroad is a valuable life experience made possible with help from CEE and the university.

“No matter what, you should take advantage of this opportunity,” says Usnay. “As we are young, it’s important for us to learn more about the world and the things we don’t always see in our day-to-day lives. It’s something I think everyone should experience.”



Chelsea Kolb: Creating a Water Management Plan in Costa Rica

Costa Rica, the “rich coast,” is known for its rainforests and agricultural exports including coffee and bananas. But an ongoing drought along the coast, climate change, and tourism growth are putting pressure on the country’s groundwater systems—the means by which most residents access fresh water. More wells are becoming saline and irrigation is a challenge for farmers.

PhD student **Chelsea Kolb** of Cloquet, Minnesota, recently returned from the city of Santa Cruz, located in the northern region of Costa Rica's Nicoya Peninsula. She spent 10 months in the region working alongside a hydrologist to study water quality and aquifer levels along the coastline.

Kolb received a Fulbright U.S. Student Program fellowship award to support her research in Costa Rica.

on creating a model that we can use to predict outcomes given changes in climate."

The Costa Rican government has positioned itself as an environmental steward, according to Kolb, adopting policies and practices to protect the environment and the country's ecotourism industry. In response to a potential agricultural irrigation crisis, the government approved construction

reached out to the university research group to discuss the possibility of collaborating on a research project. We developed a research proposal that eventually led to winning the Fulbright fellowship."

While her work is ongoing, it fits into a larger project within Costa Rica's Ministry of the Environment. "The Costa Rican government is implementing strategies to reduce the effects on

“As the project continues, we are looking at strategies related to improved permitting and monitoring processes, particularly with the real-time salinity sensors installed by the Ministry of the Environment.



Chelsea Kolb

"Even without my work, we knew there were effects on drinking water due to drought because many wells along the coast were already becoming saline," Kolb states. She adds that she's working to determine the relationship between air temperature and drought on water quality. "The extent of contamination depends on many factors—it's this multidimensional relationship that we are trying to manage better."

Kolb worked alongside hydrologist Andrea Suarez Serrano of the National University of Costa Rica, Liberia's Center for Hydraulic Resources for Central America and the Caribbean. "Serrano was very helpful in the data gathering process and facilitating meetings with the Ministry of the Environment," says Kolb. "We are now primarily focused

of a new aqueduct to transport water from the rainy mountainous region to the coast.

In addition to the government, Kolb worked with stakeholders including residents, farmers, universities, and environmental groups. "It was really interesting to learn about these different perspectives and try to keep them in mind while thinking about potential solutions to this problem," she says. "It was one of the more challenging aspects of the project."

Kolb mentions that she chose to work in Costa Rica because her CEE advisors, professors Jeanne VanBriesen, **Matteo Pozzi**, and **Costa Samaras**, had contacts within the country. "I knew that would be a great resource for me," she says. "I

aquifer salination," adds Kolb. "As the project continues, we are looking at strategies related to improved permitting and monitoring processes, particularly with the real-time salinity sensors installed by the Ministry of the Environment."

The Fulbright U.S. Student Program provides grants for individually designed study/research projects. During their projects, student researchers will meet, work with, live with, and learn from the people of the host country, sharing daily experiences in an atmosphere of openness, academic integrity, and intellectual freedom, thereby promoting mutual understanding.



12-401 CEE DESIGN PROJECT



For the Lava Pipes and Shrooms: Amid a Plumber's Night Dreams

Seniors in the capstone design course 12-401 were tasked in Fall 2017 with helping the aging brothers, Mario and Luigi, cross the lava pit in the Tung Au Castle so they could rescue Princess Toadstool from Bowser.

The teams designed, constructed, and erected various types of bridges that met specific criteria, such as height of attachment points, construction method, and extra points for sustainability.

You can find out more and see how one team approached their project: tinyurl.com/12-401-final-2017.





Pierce Sinclair

NSBE

Providing Leadership Opportunities

The National Society of Black Engineers (NSBE) has given Pierce Sinclair the chance to realize his leadership potential and strengthen his appreciation for how impactful a sense of community really is.

Pierce Sinclair (CEE/EPP BS '17) honed his leadership skills through involvement in the National Society of Black Engineers (NSBE) during his undergraduate studies at Carnegie Mellon.

In addition to motivating black leaders, NSBE aims to increase the number of culturally responsible black engineers who excel academically, succeed professionally, and positively impact the community.

The organization accomplishes this through leadership training, professional development activities, mentoring, career placement services, and community service opportunities, among other things.

NSBE has more than 500 chapters and nearly 16,000 active members in six geographic regions. CMU resides in Region II, which stretches from Pennsylvania to South Carolina.

Sinclair became involved in NSBE after meeting with a mentor who was also CMU's chapter president. He applied to become a freshman representative for the group and was accepted. As a freshman representative, Sinclair was responsible for interacting with first-year engineering students. He would find out what their interests were and determine how to motivate their engagement with NSBE.

"We noticed that, over the years, our chapter was having a larger presence at the regional and national conferences. It was becoming more of a common name, and we wanted to increase that by being on the regional board," Sinclair says.

Sinclair served as the Region II finance chair, a position that involves fundraising, corporate philanthropy, and marketing the benefits of corporate investment in NSBE.

"The big selling points are the Regional Leadership Conference and the Fall Regional Conference," Sinclair says. "If a company puts \$15,000 into the society, what benefits do they get from it? What is the exposure they'll get?"

Sinclair says the experience gives him a leg up professionally.

Ty Walton, a staff member in the Center for Student Diversity and Inclusion and the advisor for CMU's NSBE chapter, says when students become involved in regional and national events, they discover new perspectives.

"You start to think of yourself as a global person. The struggles and challenges you're having here are similar to people on other campuses, and you start to see yourself in a much larger capacity," Walton says.



Moving Upstream: PhD Student Works on National Water Model

Every hour, the National Water Model (NWM) simulates flow conditions across 2.7 million U.S. streams and rivers, using data on area precipitation, snowmelt, water infiltration in the soil, and more.

Before this model's release in 2016, the National Oceanic and Atmospheric Administration had water flow forecasts for a mere 4,000 river locations. Now, in addition to hourly simulations, the NWM produces nationwide 10-day forecasts and an updated 30-day forecast daily, enabling forecasters to predict flash flooding and drought conditions better than ever before.

As part of the National Water Center Innovators Program 2017 Summer

Institute, Carnegie Mellon CEE PhD student **Kerim Dickson** spent seven weeks working alongside graduate students and faculty from across the U.S. to continue improving this important national model.

"The National Water Model is still in its infancy," explains Dickson.



Kerim Dickson with his PhD advisor, Dave Dzombak, at the National Water Center

“As a group, we designed a framework for statistically analyzing the accuracy of the National Water Model’s results. What we produced is an efficient way to test the model against known data and identify discrepancies between what the model says should be the flow at a particular location, and what it actually is.”

Organized to foster the rapid development and exchange of new ideas, the Summer Institute included the opportunity for Dickson and his peers to present their findings to some of the field’s top academics along with members of the National Water Center, the U.S. Geological Survey, the National Center for Atmospheric Research, and the National Weather Service. The group also presented a poster at the 2017 Hydroinformatics Conference in July at the National Water Center, which is located in Tuscaloosa, Alabama.

Within CEE, Dickson’s PhD research focuses on a different hydrology topic—interbasin transfers, or the process of using human-constructed systems to move water from one basin to another, typically from an area of abundance to one in need. After first creating an inventory of all U.S. interbasin transfers, he is now researching why each specific location was selected.

“Nobody’s really looked at the drivers of these types of transfers. This is a niche that is important, but simply hasn’t been studied on a national scale since the 1980s,” says Dickson, who hopes that his work will provide a basis for additional study on U.S. water scarcity and the impact of interbasin transfers.

His work has also attracted the interest of people he met at the Summer Institute, who are considering collaborating with Dickson to turn his national data set into a tool for local agencies to locate and study interbasin transfer in their areas. The Summer Institute also benefited Dickson by allowing him to take a step back from his PhD research, before returning to it with fresh eyes and a different perspective.

“For me, it was worthwhile to get out of my bubble and interact with people who are as invested in water research as I am, but who approach it from completely different angles,” says Dickson. “When I came back to my PhD project, I was able to reevaluate my research using the approaches that I’d learned from others at the Summer Institute. It was an extremely valuable experience for me both personally and academically.”



Michigan Ditch flowing across Cameron Pass on the border between Jackson and Larimer counties, Colorado. The ditch takes water from the Michigan River, which is part of the North Platte River watershed.

Photo: Jeffrey Beall



Making Climate Models Simple

There has been a big increase in weather and climate disasters with damages in the billions of dollars in the U.S. over the last few years.

For many years, climate change has been a looming threat on the minds of infrastructure engineers. But recently, this threat has become much more apparent to the general public. Many effects of climate change can be damaging to infrastructure: changes in extreme temperatures, variations in precipitation, severe weather, increased sea levels, and in some areas, a decrease of clean water availability.

“Record-breaking rainfall has triggered more than 20 severe flood events in parts of Texas, Oklahoma, Louisiana, Arkansas, Missouri, Iowa, Florida, North Carolina, and South Carolina in 2015 and 2016,” reports Professor **Costa Samaras**. “These events have led to the closure of two airports, flooding of more than 200 homes, numerous evacuations, cars stalled in high water requiring rescue, and deadly flash flooding.”



These numbers will only continue to rise as the climate worsens and our civil infrastructure becomes more and more overloaded. In order to save future lives, as well as our cities, civil and environmental engineers need to incorporate climate change information into their design standards moving forward. But this is much easier said than done.

This is what prompted Samaras, along with CEE graduate research assistant **Lauren Cook** and Iowa State University Research Assistant Professor Christopher Anderson, to develop an approach for improved prediction of precipitation for use in engineering design.

In their paper, *Framework for Incorporating Downscaled Climate Output into Existing Engineering Methods: Application to Precipitation Frequency Curves* published in the Journal of Infrastructure Systems, the team lays out a five-step framework to guide the revision of design standards through the use of publicly available climate model outputs of future precipitation. This will help engineers define the relevant aspects of the existing standards that need to be updated, then select the relevant climate data to update the standards appropriately.

“The problem lies in how to use the output from many different climate models,” Samaras says. “Most agree on the direction

of temperature change, but trend and magnitude of precipitation vary by location, leading to uncertainty on exactly how much rain to expect. This makes models and data on climate change hard to apply to infrastructure design, which requires very specific and concrete instructions.”

Because climate models can't provide highly location-specific information, it is very difficult for infrastructure designers and other stakeholders to implement these models into their decision-making. But because infrastructure design standards are so widely used, the potential public consequences of ignoring the future effects of climate change can be widespread and devastating.

So far, the team has tested its new model by applying it to a common input of stormwater infrastructure design: depth-duration-frequency curves. These curves and their application will determine the performance and resilience of stormwater infrastructure during future extreme events.

“The research being done here at Carnegie Mellon can lead to big advances in how cities and communities prepare and design for the impacts of climate change,” Samaras says. “It's our duty as engineers to consider how infrastructure performs both now and in the future.”



*Professor Costa Samaras and
PhD candidate Lauren Cook*

Safety and Environmental Impacts in Petroleum Industry



Eilis Rosenbaum

When you fill up your car with gasoline, you probably don't stop to think about the process that the fuel took to get to you. Before fuel goes through the refining and distribution process, it's extracted via complex wells constructed to great depths—a labor-intensive process that involves drilling and securing the well to prevent leakage. PhD student **Eilis Rosenbaum**, who is advised by Professor **Kaushik Dayal**, is researching foamed cement, which is used in wells all over the world, with the goal to improve safety practices in petroleum industry wells.

"I became interested in this project because it has immediate applications to industry," Rosenbaum says. "The information we provide to the American Petroleum Institute is being implemented into their recommended practices to improve safety."

Foaming the cement can be more economical and environmentally friendly compared to other methods to reduce cement density. Cement is used to seal the gap between a drilling well casing and a rock formation. While the equipment used to produce foamed cement is generally higher in cost, long-term cost savings and environmental advantages are seen with reduced material use. Other benefits of foamed cement include better ductility, which is especially important in geothermal wells, because it improves drilling mud displacement and better controls gas from migrating into the unset cement.

Adding gas bubbles to cement—usually nitrogen—lowers its density. But if the bubbles align in a string or cluster, channels could form in the cement. Rosenbaum's research has shown that the cement flow affects the arrangement of the bubbles. Using simulations, she's working to determine the conditions that cause the bubbles to structure in a manner that could form channels or lead to cracks in the cement.

"To determine properties such as viscosity, the forces between each bubble and all surrounding bubbles are calculated and summed together," she says. With the large number of bubbles included in these simulations, a supercomputer must be used to run the simulations. Complicated interactions, called lubrication interactions, have been modified to be more like bubbles.

While her research is focused on the petroleum industry, the interactions she's developing can be used to simulate any soft particles or bubbles in a suspension. "They will be incorporated into LAMMPS and may be used by anyone," she adds. LAMMPS, the Large-scale Atomic/Molecular Massively Parallel Simulator, is an open-source classical molecular dynamics code developed by Sandia National Laboratories.

Berges Named ASCE-Pittsburgh Section Professor of the Year



Dave Dzombak and Mario Berges

Professor **Mario Berges** was recently named the ASCE-Pittsburgh Section 2017 Professor of the Year. Berges was recognized for his outstanding work in the classroom and for being an excellent mentor for undergraduate and graduate students. He has also made significant contributions to the

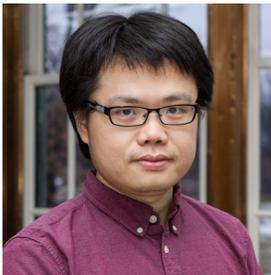
advancement of civil and environmental engineering through his research.

Berges's research centers on the development and application of information and communication technologies (ICT) to increase the autonomy and resilience of infrastructure systems.

With his students, he has developed automated approaches for building energy management and anomaly detection, and has formalized approaches to support sharing sensing and actuation resources at Internet scale. While much of his work focuses on buildings, Berges has also worked on infrastructure systems such as dams and pipelines.

Berges has advised or co-advised 15 doctoral students, 22 masters students, and 10 undergraduate students in a research capacity. He has also made several important educational contributions within the university by developing new courses on topics such as energy and data acquisition.

Berges is an outstanding educator, researcher, and professional who is passionate about the application of information and communication technologies in civil and environmental engineering and has designed his courses to ensure our students are well-equipped for the increasing role that ICT is having in operation and management of infrastructure.



Sean Qian
Greenshields Prize

Professor Sean Qian was recently awarded the prestigious Greenshields Prize from the Transportation Research Board. for his paper, *Traffic State Estimation for Urban Road Networks Using A Link Queue Model*.

The paper discusses traffic state estimation in complex urban networks. Using different data sources that may be available, such as cell phones, GPS, and probe vehicles, Qian and his co-authors created a robust framework for data fusion and were able to

estimate traffic flow and update model parameters in real time to adapt to unknown traffic incidents such as lane closures.

Qian's methodology was applied to estimate travel speed in a small-scale urban network in the Washington DC area, resulting in satisfactory estimation results with a 8.5% error rate.



Scott Matthews
Steven J. Fennes Award for Systems Research

Professor **Scott Matthews** was awarded the Steven J. Fennes Award for Systems Research Award by the

College of Engineering. This award is in recognition of his research contributions to systems research at the interfaces of engineering, economics, management and policy aspects of environmental and energy systems, especially in data analytics and life-cycle assessment, and including open-access textbooks and tools that have supported and stimulated systems research globally.

Matthews's research and teaching focuses on valuing the socioeconomic implications of social systems, such as energy and transportation infrastructure. His work aims to facilitate economic and social decision-making under uncertainty via large data sets, computation, and visualization methods.

STUDENT NEWS



Tania Lopez

UCAR Next Generation Fellow

Tania Lopez completed her bachelor's in engineering physics at Monterrey Institute of Technology and Higher Education (ITESM) in Mexico and finished her Civil and Environmental Engineering masters in 2017 at CMU.

Advised by Professor Costa Samaras, she is researching engineering design standards and the impact of climate change on stormwater infrastructure. She is interested in developing more expertise in computational and statistical tools for analyzing precipitation data and understanding changes in current and projected future patterns. In 2018 and 2019 she will complete summer internships with NCAR that will provide collaboration opportunities in this area.



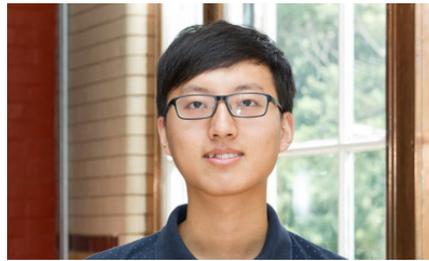
Susu Xu

*2017 Dowd Fellowship
CMU College of Engineering*

Susu Xu earned her undergraduate degree at Tsinghua University in China before coming to CMU to continue her studies. Her research focuses on developing an information-theoretic approach for building vibration signal analysis to help structural health

monitoring and built environment monitoring.

Advised by Professor Hae Young Noh, she designs new modeling frameworks to extract information-theoretic-based features from structural vibration signals induced by environmental events (e.g. earthquakes), data from previous events, and other buildings to diagnose structural damage states.



Zhuoran Zhang

CEE Dr. Elio D'Appolonia Graduate Fellowship

Zhuoran Zhang completed his undergraduate studies in 2017 at the Tsinghua University, China, with a bachelor of engineering degree in construction management. He is currently advised by Professors Burcu Akinci, Sean Qian, and Daniel Armanios (EPP) and is researching quantitative approaches to enhance better planning and investment of infrastructure systems by considering costs associated with construction, traffic management, and social aspects.



Houriyeh Majditehran

*Julia and Michael Ellegood
CEE Strategic Graduate Fellowship*

Houriyeh Majditehran received her bachelor's degree in civil engineering

from Sharif University of Technology in Iran. She joined CEE in Fall 2017 and is co-advised by professors Kaushik Dayal and Carmel Majidi (MechE).

Her PhD research is focused on developing soft multifunctional composites—specifically modeling the mechanical properties and dielectric breakdown of liquid metal embedded elastomers. These composites have applications in emerging fields of soft bio-inspired robotics.

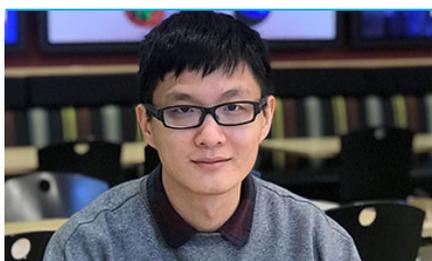


Eilis Rosenbaum

*Bradford and Diane Smith
Graduate Fellowship
CMU College of Engineering*

Ellis Rosenbaum, from Stoystown, Pennsylvania, joined the department after earning her bachelor of science in chemical engineering and bachelor of engineering in mechanical engineering at Geneva College and her master of science in chemical engineering at University of Pittsburgh.

Advised by Professor Kaushik Dayal, Rosenbaum is researching the rheological properties of specialized low-density wellbore cement that is produced by injecting a pressurized inert gas into cement to produce foamed cement. The results will lead to better cement design and laboratory testing procedures of foamed cement.

**Wei Ma**

Liang Ji-Dan Fellowship
CMU College of Engineering

Wei Ma graduated with honors from Tsinghua University in Beijing, China, where he received bachelor's degrees in civil engineering and mathematics.

His research is focused on exploring the statistical features from both static and dynamic traffic networks and building optimization strategies for recurrent and non-recurrent traffic conditions. With his advisor, Professor Sean Qian, he is aiming to reduce the amount of time vehicles and passengers spend on congestion, improve air quality, and enhance sustainability through the most efficient use of infrastructure, services, and big data investments.

**Tim Bartholomew**

Bradford and Diane Smith Graduate Fellowship
CMU College of Engineering

Tim Bartholomew is advised by Professor Meghan Mauter and joined the department in 2015 after completing a bachelor's degree in chemical engineering at Washington University in St. Louis.

His research addresses water management challenges in the energy sector, specifically focusing on managing high-salinity brines for shale gas production and carbon capture and sequestration. In his research, he is developing process-based and supply-chain optimization models with the goal of increasing treatment technology performance and water management efficiency.

**Wailong Wang**

CEE Mao Yisheng Graduate Fellowship

Wailong Wang completed his undergraduate studies in 2016 at Fudan University, China, with a bachelor's degree in physics.

Advised by Professor Alexander Jacquillat, Wailong's research is focused on using game theory, stochastic models, and optimization methods including integer programming and queuing theory to build a more sufficient transportation system. Currently he is looking at the issues of assignment allocation with capacitated central system, specifically in the air transportation industry.

Recent PhD Theses

Nizette Consolazio - *Chemical Interactions of Hydraulic Fracturing Biocides with Natural Pyrite*
Advisor: Karamalidis

Ke Gai - *Effect of Mercury Speciation on its Transport in Soil and Removal from Produced Water*
Advisor: Lowry

Jingkun Gao - *A Metadata Inference Framework to Provide Operational Information Support for Fault Detection and Diagnosis Applications in Secondary HVAC Systems* - Advisor: Berges

Kyle Gorkowski - *The Morphology and Equilibration of Levitated Secondary Organic Particles Under Controlled Conditions* - Advisors: Adams, Donahue, and Sullivan

Eric McGivney - *Understanding the Relationship Between Nanoparticles and Bacterial Group Behavior: Autolysis and Quorum Sensing* - Advisors: Gregory and VanBriesen

Avi Mersky - *Environmental and Policy Implications of Vehicle Automation and Electrification* - Advisor: Samaras

Joe Moore - *Probing Nano-specific Interactions Between Bacteria and Antimicrobial Nanoparticles Using Microbial Community Changes and Gene Expression* - Advisors: Gregory and Lowry

Chiqun Zhang - *Theory and Computation of Line Defect Fields in Solids and Liquid Crystals* - Advisor: Acharya

In Their Words: Biggest Challenge for Civil and Environmental Engineers

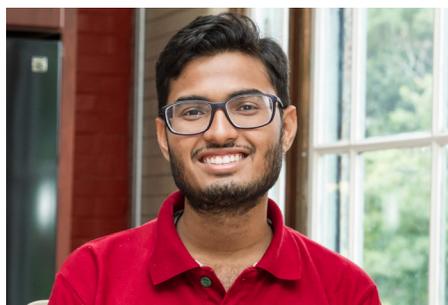
We asked students to give us their view of what some of the greatest challenges will be for civil and environmental engineers in the next 10 to 20 years.

"Water management is the most important challenge that we will have to face. As fresh water becomes more scarce and climate change causes more droughts around the world, we will be responsible for solving water issues and managing water usage and distribution."



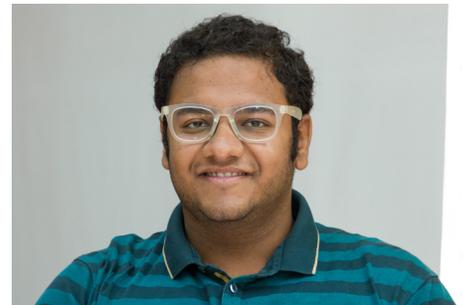
*Veronica Seward-Aponte
Undergraduate Student*

"The greatest challenge would be to successfully merge emerging technology into an engineering field which requires a good margin of safety due to its applications. CMU, due to its unique focus area, seems well perched to understand and apply these things."



*Arnav Choudhry
Masters Student*

"The most important issue faced will be managing the load on the electricity grid. This will be caused due to the increase of electric vehicles which are going to flood the transit system in the next 10 years."



*Aamod Garg
Masters Student*

"Climate change will be the most important challenge civil/environmental engineers face because there are still so many strides to be made. We still have a lot to do with regards to climate change: from adapting infrastructure, implementing progressive climate policy, to understanding all of the possible effects."



*Kelsey Hall
Masters Student*

"Our nation's infrastructure has definitely seen better days. Getting our highways, bridges, and pipes back in shape is one of the most critical tasks civil engineers are taking on."



*Kenan Danon
Undergraduate Student*

"Many infrastructure systems in the U.S. are in need of repair or upgrade. On top of this, engineers must deal with issues resulting from climate change and uncertainty about future conditions. I think integrating climate change and upgrading our systems for future resiliency is one of the greatest challenges engineers will face."



*Chelsea Kolb
PhD Student*

Forging a Path Through Service



Just months away from earning his bachelor's degree, James Crnkovich is already looking to the future—working towards a master's degree in Civil and Environmental Engineering and continuing his community service work in Pittsburgh.

A St. Paul, Minnesota, native, **James Crnkovich** grew up in Phoenix, Arizona—the city he refers to as his hometown. While in high school, he noted that fellow students seldom ventured into the city. When he moved to Pittsburgh to attend college, he recalled wishing he'd done more in Phoenix. It led him to become active in community service.

As the Residential Programming Chair for Partners Allied in Civic Engagement (PACE) on campus, Crnkovich created the “Stop Hunger Now” event. It brought together over 500 student, faculty, and staff volunteers to package 126,000 meals in just 90 minutes.

His passion to build a stronger Pittsburgh community echoes his connection to the professors and fellow students in the CEE department. “The school does a fantastic job of creating a sense of community and family,” Crnkovich says, adding that he’s enjoyed learning alongside students with diverse interests and backgrounds. “My classmates are involved in music, art, school drama productions, and being active outside of the classroom.”

Crnkovich’s time at Carnegie Mellon University has not only expanded his personal interests, it led to a new educational pursuit. He’d originally intended to major in history—until he took the classes America’s Environmental History and Introduction to Civil and Environmental Engineering. “In those courses, we talked about role of engineering with climate change adaptation and learned how civil engineers are preparing for integration with technology,” he states. “That is what got me hooked.”

Crnkovich mentions that his professors are approachable and care about students’ well-being and success. He credits his Senior Design class with bringing everything

full circle. “We used what we’d learned over the past four years to develop solutions to ill-defined problems—and learned the importance of not being overwhelmed but instead approaching problems from a process-oriented framework.” Crnkovich says that it can be easy to get lost in the abstraction of a problem, but his professors guided students to help them create a solid implementation plan.

Recently, he was awarded the 2018 George Washington Prize, given to a College of Engineering senior who demonstrates qualities of academic excellence, service, and leadership. Crnkovich was also a finalist for the American Society of Civil Engineers—Pittsburgh Section Italo V. (Ody) Mackin Achievement Award.



Dave Dzombak, James Crnkovich, and Jim Thompson at ASCE awards ceremony

“Winning the George Washington Prize reinforced my belief that attending Carnegie Mellon University was a very good decision,” Crnkovich says. “The school offers an incredible support network and I’m grateful for the connections I’ve built as a student.”

Crnkovich plans to remain in the department to complete his master’s degree, then move into cutting-edge civil or transportation engineering disciplines such as climate change adaptation, smart sensors, or smart infrastructure. He knows that his education has prepared him for the transition to the industry, stating that Carnegie Mellon University has a strong focus on the future on civil engineering. “The university is very forward-thinking. I’m having an incredible experience here.”

Building Bridges to Success

Accomplished Alum Gives Back to Carnegie Mellon



Civil Engineering alumnus **W. Logan Dickerson** always imagined building bridges would be in his future. His father had founded a bridge construction business in 1929, and Dickerson knew from the start that he wanted to earn a degree that allowed him to follow in his father's footsteps.

"I was looking for the institution that offered the highest level of learning, and that's what I found here. I also think studying civil engineering opens up a lot of opportunities, because you can use it in different ways, from bridges to highways to buildings," says Dickerson, who has made annual contributions to Carnegie Mellon each year for over three decades.

For Dickerson, the decision to give back

to the school where he got his start was a straightforward one. "If you can help, you should," he states. It's a philosophy and a tradition that he hopes others will continue, so that generation after generation of alumni also give back to support others in achieving educational and professional success.

Dickerson's own accomplishments started soon after he graduated with his bachelor's degree in 1948 and started building bridges within his father's business. During his 47 years in bridge construction, his company built more bridges than any other contractor in Pennsylvania, including many of those along Interstate 376 coming into Pittsburgh.

"We built over 800 bridges and culverts, mostly across Pennsylvania and West

Virginia. I'm proud of all of them," says Dickerson, who later took over company management and leadership. "I think I've built almost every type of bridge—concrete, steel, wooden, even a covered bridge."

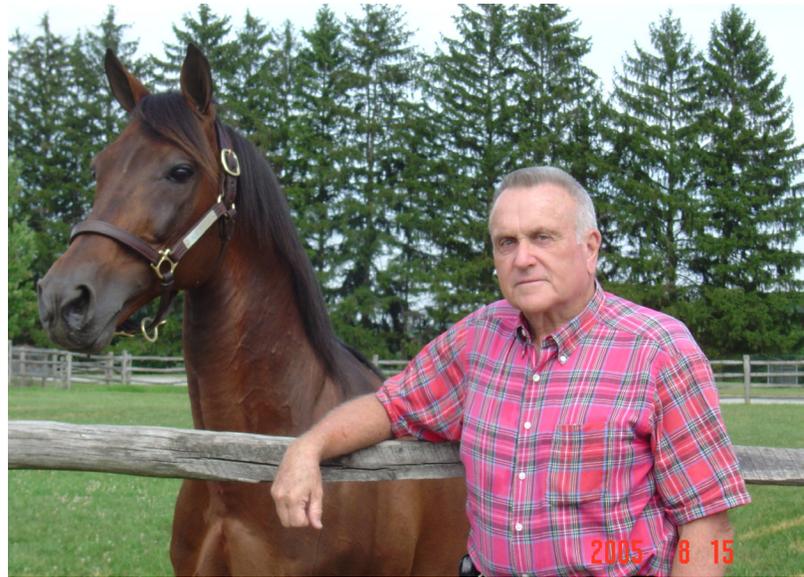
Being at the job site was one of Dickerson's favorite parts of his work. Before bidding on a project, Dickerson spent time down by the river envisioning the bridge that would one day connect the two banks, and what it would need to withstand the seasons. Later, as the bridge went up, he would often be found a hundred feet up in the air on the steel girders surveying the land and the work in progress.

"I enjoyed being outside and doing something that not everyone got to do," he recalls.

Outside of bridges, Dickerson also founded two pioneering concrete companies and was among the first in the United States to develop and use prestressed and precast concrete, helping his company to save both both time and money. The concrete they manufactured was put to use in industrial buildings, high rises, airport terminals, bridges spanning major rivers and valleys along roads like I-79, and even the facade of Pittsburgh's Three Rivers Stadium. During this time, he also became president of the Associated Pennsylvania Constructors and the Constructors Association of Western Pennsylvania.

In the 1970s, while still working in manufacturing and construction, Dickerson bought a farm and began breeding Standardbred horses and Charolais cattle, with help from his wife Ann. With a herd of over 1,000 cattle, the couple ran one of the premier Charolais cattle farms east of the Mississippi for nearly 20 years.

Never low on new ideas, by the 1990s, the couple had phased out their prize-winning cattle, reduced their focus on breeding racehorses, and started



raising ostriches instead. By 1995, Dickerson had retired fully from construction and manufacturing. In the following year, he established Protos Foods, a company that offers high-protein snacks made from ostrich, beef, turkey, elk, and chicken—and whose products quickly became the number one sports nutrition meat snack in the U.S.

Despite his many ventures and a busy schedule, Dickerson has always maintained a close relationship with Carnegie Mellon, including previously serving as Carnegie Mellon Alumni Association president, becoming an emeritus life trustee member of the Carnegie Mellon Board of Trustees, and earning the Carnegie Mellon Alumni Service Award in 1987.

Though less visible than his bridges, buildings, and companies, Dickerson's time and monetary donations to the university over the years are not to be overlooked when weighing his most important or influential societal contributions.

"Carnegie Mellon gave me the education to do very well in my career," Dickerson reflects. "There are other students who may need assistance to afford a degree, but if they too can get the proper education, those students can in turn go on to help improve the country. That's why I give back."



Using Expertise to Assist California's Policymakers

Jeffery Song (CEE/EPP PhD '17) is utilizing his research expertise to help legislators in California make better-informed policy decisions. Through the California Council on Science & Technology's Science & Technology Policy Fellowship, he has gained training, access to decision-makers, and an opportunity to dive into public service for a year.

Song began the Sacramento-based fellowship in November 2017 in the state's Senate Transportation and Housing Committee as a consultant—a role that allows him to gain hands-on experience working in the legislature. His fellowship concludes in October 2018.

"I was interested in this fellowship because it provides an opportunity for scientists who are interested in policy to work directly with members of the state legislature," he says.

One of the policy areas Song is currently working on in the Transportation and Housing Committee is the topic of autonomous vehicles. "California is thinking about how it wants to handle serious technology," he explains. "It can provide incredible benefits, but it needs to be balanced with public safety." Song mentions that learning how to balance interests while helping the legislature to make strong policy has been a fascinating challenge.

Song enjoys providing research expertise to policymakers and believes that long-term, he will work in an advisory role with either the legislature, in academia, or through a social organization.

He adds that one of the great perks of his fellowship is working inside of the prestigious State Capitol building. "Every day I get to walk in, hear kids excitedly taking field trips, and rub elbows with state legislators and other interesting people."



New Book Outlines Transforming Healthcare

Dr. Tony DiGioia (CE/BME BS '79, MS '82) recently co-authored *The Patient Centered Value System: Transforming Healthcare through Co-Design*. DiGioia incorporates design experience from his time as a student here and uses a simple approach to put the patient at the center of care to improve outcomes and experiences, while reducing costs.

"I wrote this book to serve as a simple guide to allow patients and families to partner with providers to transform care delivery systems," DiGioia explains. "My goal is to share Patient Centered Value System in order to establish it as the new operating system for healthcare."

DiGioia is an orthopedic surgeon and has been in practice for over 25 years. After years of working to develop and advance technology in the field of healthcare, resulting in numerous patents and extensive publications on the subject, DiGioia develops innovative methods to improve processes that dramatically improve patient outcomes while delivering exceptional care experiences.

Krepsik named ASCE-Pittsburgh Section 2017 Young Civil Engineer of the Year



Michael Krepsik, Mario Berges, and Dave Dzombak

Michael Krepsik (BS '03) was honored by the ASCE-Pittsburgh Section for his professional, leadership, and volunteer service. He has been involved with ASCE for over 15 years, serving on various boards positions within the

Jacksonville, Florida and Pittsburgh, Pennsylvania ASCE chapters.

With the Pittsburgh chapter, Krepsik became involved with the Continuing Education Committee, which plans and hosts educational dinner seminars. He currently is the chapter treasurer as well.

In 2009 Krepsik was the founding president of the Jacksonville Professional Chapter of Engineers Without Borders. He applied for, managed, and designed the initial EWB project which brought, improved water projects to rural Guatemala. The group designed and implemented a pump house, tank, and water distribution network to the 40 homes

of one village. A secondary project included the installation of hand-washing stations and pit latrines at schools in two villages.

Krepsik has also served in leadership positions with organizations that raised funds for water improvement projects in Guatemala, Ghana, and Ecuador.

In addition to the leadership roles in his career and ASCE service, Krepsik also volunteers with the local Boy Scouts of America and as a hockey coach for children ages 5-8.

He currently works as a Geotechnical Department Manager with ECS Mid-Atlantic, LLC in Pittsburgh.



Deanna Matthews (MS '95, PhD '01)
Benjamin Richard Teare Teaching Award
CMU College of Engineering

EPP Associate Teaching Professor **Deanna Matthews** was awarded the Benjamin Richard Teare Teaching Award by the College of Engineering.

This award was in recognition of her work in transforming the teaching of the Introduction to Computer Systems courses nationally and internationally by using the perspective of the software programmer. A widely adopted textbook and the Autolab autograding software allows the scaling of the course to large numbers of students.



Michelle Tom (PhD '15)
Safety Award for Leadership in
Emergency Response
U.S. Forest Service

Michelle Tom, the civil engineer ESWP transportation manager for the Eldorado National Forest, recently received a Safety Award for Leadership in Emergency Response at the annual Region 5 Regional Forester's Honor Awards.

This award was in recognition of efforts in maintaining a safe roadway system in the forest after major storms hit the region in the winter of 2016-2017.



J. Fred Graham (BS '58)
William Metcalf Award

Engineers' Society of Western Pennsylvania honored **J. Fred Graham** with its highest honor, the William Metcalf Award.

His engineering career spanned decades in Western Pennsylvania and included managing the design and construction of hundreds of bridges and 500 miles of roadway in Western Pennsylvania. Graham has been a strong proponent of engineers serving in leadership positions in all branches of local, state, and federal government as well as in business and industry.

Sensing and Filtering Impurities

Eric Li (PhD '11) Develops Ecomo Smart Bottle



Waterborne illness is a major problem in many countries around the world. Even now, over 750 million people lack access to clean water. But despite the prevalence of this problem, there has yet to be developed a simple, effective way to detect and measure water pollution, which leaves individual consumers to guess and hope: Is my water clean enough to drink? What will happen if I give it to my children?

Eric Li (PhD '11) heard this question a lot. Friends and family were constantly asking him to recommend water filter treatments for their home, or when they should replace their filters.

"I have seen people around me who have contracted cancer from drinking the polluted water," he says. "And as water pollution problems began to occur more frequently, I started to feel a sense of mission. I wanted to provide a potential solution."

For Li, this solution came in the form of Ecomo. Ecomo is a microfluidics mini spectrometry sensor designed to assess water quality in real-time. Not only can it measure the total dissolved solids in the water—including minerals, salts, and other impurities—it also can detect pesticides, pharmaceuticals, petroleum products, silt, rust, cloudiness, water temperature, and more.

In order to bring this technology to a consumer-friendly level, Li designed the Ecomo Smart Bottle—a portable water bottle with Li's patented sensor system inside. The bottle can be filled anywhere, whether it's a public water fountain or a mountain stream. To test the water quality, the user simply has to shake the bottle, and a digital readout at the bottom will tell you whether the water is "bad," "moderate," or "great." Then just twist the base to manually swirl the internal filter, making the water perfectly safe to drink.

"My experiences in machine learning and programming classes at CMU opened my eyes to a much bigger world," says Li. "CMU gave me a vision—that we can make the environment better, cut costs, and provide better protection for more people by using the latest, innovative technologies."

Li launched the product on Kickstarter in 2016, and before long it received over 900 percent of its funding goal. Ecomo is currently taking pre-orders and will soon be available to consumers.

"Our mission at Ecomo is to digitize our healthy lives," Li says. "Clean water is the first step. We are partnering with water filter and purifier manufacturers around the world to transform traditional water filters into smart devices powered by Ecomo sensing technology. This is just the start for Ecomo."

Setting a Forward Path

As the CEE Department continually strives for excellence in education and research, an outside eye can often offer a fresh perspective and new ideas. In this quest for ongoing growth and development, the self-study and external review processes at Carnegie Mellon can serve as valuable tools for reflection and measurement.

With a new departmental review process introduced university-wide in 2016, the CEE Department recently became the first within the College of Engineering to undergo a review within the revised system.

To begin the process, Hamerschlag University Professor and Head of the CEE Department **Dave Dzombak** led the development of a self-study report to be shared with those who would be conducting the external review. This report detailed CEE's recent education, research, service, and outreach

activities, comparing them to those of similar institutions. The report also assessed the department's strengths, challenges, and future opportunities as well as provided information on faculty and students, department finances, facilities, curricula, research and teaching performance measures, and professional interactions.

Consisting of five leaders from peer academic institutions, the external review committee visited CEE in November 2017. The group spent two days on campus touring the facilities; learning about the department, its programs, and its research activities; and meeting with CEE students, faculty, and staff.

Following its visit, the committee developed a report featuring its key takeaways and recommendations, including an evaluation of CEE's strengths and opportunities for growth.

Review Committee:

Jerome Hajjar - Committee Chair
Northeastern University

Robin Autenrieth
Texas A&M University

Dorota Grejner-Brzezinska
The Ohio State University

Arpad Horvath
University of California at Berkeley

Andrew Whittaker
University of Buffalo



Please Join Us for the
2018 ALUMNI AWARDS
and Celebration of
Professor Jacobo Bielak's Retirement
Friday, April 20, 5-8pm, Singleton Room, Roberts Hall
For More Information: dlange@cmu.edu

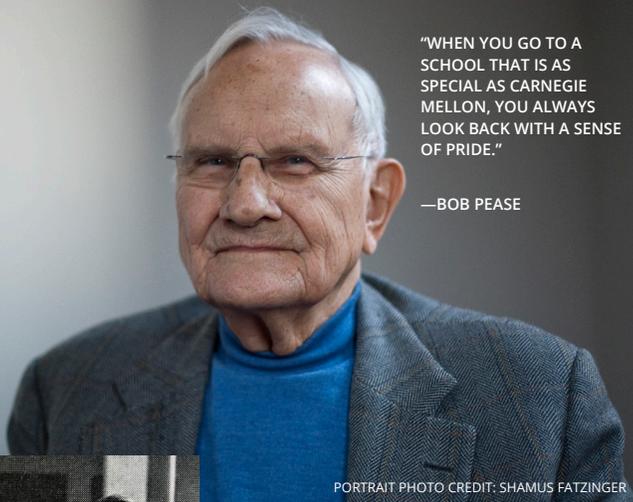
Carnegie Mellon University
Civil & Environmental Engineering
5000 Forbes Ave
Pittsburgh, PA
15213-3890

Presorted
First Class Mail
U.S. Postage
PAID
Pittsburgh, PA-
Permit #251

www.cmu.edu/cee
#cmucee

CarnegieMellonUniversityCEE 
@cmu_cee 
bit.ly/linkedin-cmu-cee 

Give strategically, Support generously.

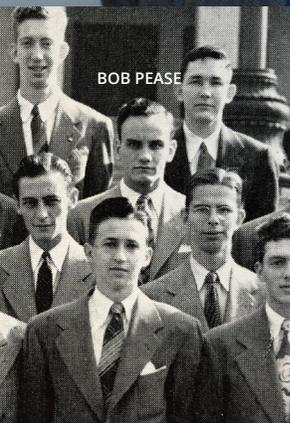


"WHEN YOU GO TO A SCHOOL THAT IS AS SPECIAL AS CARNEGIE MELLON, YOU ALWAYS LOOK BACK WITH A SENSE OF PRIDE."

—BOB PEASE

PORTRAIT PHOTO CREDIT: SHAMUS FATZINGER

Bob Pease (CE '49) knows how to make a mark. With a 60-year career in urban redevelopment, he has shaped cities around the world, including participation in redesigning Pittsburgh after World War II. At Carnegie Mellon University, Bob has created a lasting legacy through a gift in his estate plan that will create new opportunities for students and faculty in the Department of Civil and Environmental Engineering. Bob's gift will also fund undergraduate student scholarship support throughout the university.



Learn how easy it is to achieve your philanthropic vision through a planned gift by visiting giftplanning.cmu.edu.

Contact the Office of Gift Planning today at 412.268.5346 or askjoebull@andrew.cmu.edu.

Carnegie Mellon University
College of Engineering