

Carnegie Mellon University

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CEE NEWS

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Women of CEE

A Look at Ten Women
Shaping and Leading
the Next Generation
of Engineers



CEE NEWS

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Dear Alumni and Friends,

The successes of CEE@CMU have always derived from the skills, diversity, passion, and high level of commitment of our faculty, students, and alumni. Beginning in the 1970s, women have steadily become an increasingly significant fraction of our community. Over the past decade, women have comprised more than 50 percent of our undergraduate student enrollment, and more than 40 percent of our graduate student enrollment. Their accomplishments and leadership have been even more significant than their numbers, as stories in this issue of CEE News attest.

As the number of women students in CEE has increased over the years, so too has the number of women faculty members. As we begin the 2015-2016 academic year, CEE has six women faculty members. Professor **Susan Finger** is the most senior of our women faculty members. Susan, who returned to CEE in 2014 after four years in the Division of Undergraduate Education at the National Science Foundation, leads a group of faculty members in an examination of the design thread across the four years of our undergraduate curriculum. Duquesne Light Company Professor **Jeanne VanBriesen** continues her leadership of our Center for Water Quality in Urban Environmental Systems, and leadership of program assessment and many other activities in CEE. Paul Christiano Professor **Burcu Akinci** continues her co-leadership of the Smarter Infrastructure Institute, and was recently appointed as Associate Dean for Research for the College of Engineering. Assistant Professor **Meagan Mauter**, who holds a joint appointment with Engineering and Public Policy, is conducting both process-oriented and policy research on sustainably meeting water supply needs in an energy-constrained world, with a particular focus on membrane technologies. Assistant Professor **Hae Young Noh** focuses in her research on development of sensors, their deployment in buildings, and rapid analysis of the data for decision-making and control. Assistant Teaching Professor **Sarah Christian**, who was an undergraduate in our department, has returned to us as a teaching professor after completing several years on the faculty at the University of Edinburgh in Scotland. We are most fortunate to have this group of outstanding engineering educators in our department.

Our department is also fortunate to have outstanding student leaders. In spring 2015 our ASCE student chapter received, for the second year in a row, the Distinguished Chapter Award for ASCE Region 2. **Miriam Hegglin**, **Millard McElwee**, **Paige Siefert**, and other officers and members led our group to this distinction. Our Environmental and Water Resources Institute student chapter, led by PhD student **Negin Ashoori**, organized the 7th Annual Sustainability Conference in collaboration with the Pittsburgh EWRI chapter. The conference was held in May in Braddock, an old steel town working to rebuild itself sustainably. Pittsburgh Mayor **Bill Peduto** attended and engaged enthusiastically with our students.

Hamerschlag University Professor **Chris Hendrickson** officially retired at the end of June, though he will continue with research as director of Traffic21, a smart transportation research institute at Carnegie Mellon. We had a beautiful celebration of Chris' career at the start of Spring Carnival weekend with many of his former students present.

Fundraising continues for the Lawrence Cartwright Support Fund for Teaching Professors and for the Dr. Elio D'Appolonia Graduate Fellowship Fund. In addition, it was announced at Professor Hendrickson's retirement celebration that several alumni have initiated the Chris Hendrickson Undergraduate Travel Fund. Please consider directing your annual gift to one of these funds, which will help maintain the long-standing strength of our department.

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.



Dave Dzombak
Hamerschlag University Professor and Department Head



DAVE DZOMBAK

Women of CEE

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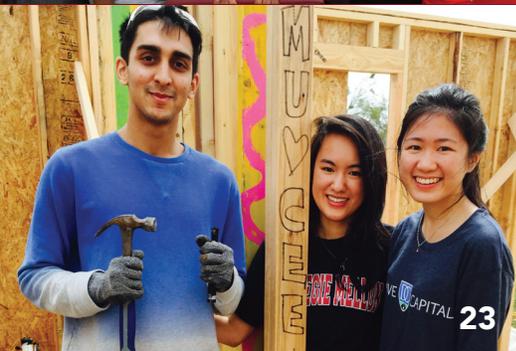
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2016 US News & World Report Graduate Rankings Announced

CEE is proud to announce that our graduate engineering programs have once again achieved high rankings in the U.S. News & World Report's Best Colleges report.

Our Environmental Engineering program was ranked 7th in the nation for programs of its kind, and our Civil Engineering program was ranked 9th.

In addition, the College of Engineering was ranked 4th overall.

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“I got into environmental engineering because I wanted to save the world, and water problems particularly are immediate. There are changes happening to the world that we need to understand in order for our children’s children to see the changing of the leaves in Pennsylvania. Water and climate engineers are deeply dedicated to that understanding.”

- Jeanne VanBriesen

Women of CMU CEE

Ten Engineers Making a Difference

“Because I wanted to save the world,” says Professor **Jeanne VanBriesen** on why she pursued a career in civil and environmental engineering. “And because the people who work in this field want to save the world.”

It’s no secret that the Earth is changing.

From the rising global temperatures and population, to increasing drought and flood conditions, to natural disasters like hurricanes and tornadoes — it’s hard for anyone not to want to save our world.

But in Carnegie Mellon’s Department of Civil and Environmental Engineering, we’re surrounded by others with the same motivation. A cohort of hope, and the tools to make a difference.



Nizette Consolazio

Saving the World

“I believe that we’re mandated to be stewards of the Earth,” says current doctoral candidate **Nizette Consolazio**.

For Consolazio — and for many who study CEE at CMU — humanitarianism is a primary motivator. By studying biocides used in hydraulic fracturing, Consolazio aims to pinpoint the risks associated with these additives and how they can affect drinking water sources.

Many, like Consolazio, began their careers in other fields but were later attracted to CEE.

CEE alumna and Associate Professor **Shonali Laha** (PhD ‘92) of Florida International University, for example, initially studied mechanical engineering — but, shaken by the 1984 Bhopal disaster of central India, in which toxic gas escaped from a pesticide manufacturing facility and resulted in thousands of deaths, she switched her studies to environmental engineering.

“[The Bhopal disaster] made me question the paradigm of using synthetic poisons to kill pests,” she explains, “and whether there might not be less harmful, more sustainable tools available. After exploring the feasibility of switching careers to ecology or forestry, I finally settled on environmental engineering, [as it is a] field that promotes sustainability and explores the role of humans in mitigating some of our adverse impacts on the environment.”

In addition to pursuing sustainability and environmental protection, many go on to design and build infrastructures which, in many cases, save lives.

Commanding Officer **Liz Durika** of the U.S. Navy Civil Engineer Corps (CEC), in

just over a decade since receiving her bachelor’s degree from CMU in 2003, has become a decorated officer recognized for her leadership and humanitarian efforts. Durika currently commands more than 400 Navy Seabees, or members of the United States Navy Construction Forces, and has commanded projects that include digging wells to provide African communities with access to clean water and building an eight-room hospital in Ghana, which included an urgently needed maternity ward.

“In my current position, I work with folks from all walks of life,” says Durika. “Everyone should be afforded the opportunity to be successful by creating an environment that fosters trust, respect, esprit de corps, and responsible decision-making, with room for errors and mistakes, while countering prejudices that stifle initiative and job accomplishment.”

“Over the past 12 years in the Navy, it is the people that make work great. When we all come together for a common goal, we can make great things happen.”

Cutting-Edge Technologies and Techniques

“One of the things that I love about my current job,” says **Judith Hill**, a computational scientist at Oak Ridge National Laboratory, “is that I feel like I have an impact every single day. The amount of science that comes out of a machine like Titan is astonishing.”

Hill, who received her PhD from CMU in 2004, designs algorithms to optimize the output of Titan, the nation’s largest supercomputer. Titan has a peak performance of 27 petaflops, units used to measure enormous amounts of processing power.

Currently, Hill is working with a group of researchers at Princeton University who are interested in the material properties of the Earth’s inner core and mantle. In order to help understand how the Earth is structured, the researchers want to process 30 years of global earthquake data. By employing supercomputers, researchers can analyze these massive amounts of information in a fraction of the time it would take otherwise. With supercomputers like Titan, Hill is able to foster groundbreaking discoveries across



Shonali Laha (PhD ‘92)
Associate Professor of CEE
Florida International University

Laha’s current research interests include physicochemical and microbial processes affecting the fate of organic and inorganic contaminants in natural soil and water systems, hazardous-waste treatment technologies, and environmental protection in developing countries.

“My greatest concerns relate to the environmental deterioration that results because of the increased human population and increased consumption, and many of my efforts are related to teaching and participation in activities that promote information dissemination.”



Elizabeth Durika (BS ‘03)
Commanding Officer
U.S. Navy Civil Engineer Corps
Construction Battalion Maintenance

As a decorated Navy officer, Durika has drilled wells in African communities to provide access to clean water, built an eight-room hospital with a maternity ward in Ghana, and currently commands more than 400 U.S. Navy Seabees.

“With every new job comes more challenges, responsibility and authority. The Civil Engineer Corps has afforded me some amazing opportunities around the globe that I could not have ever imagined.”

many diverse fields, every day.

“The world moves really, really fast. That’s what drives me — and modeling and simulation enable us to keep up.”

The world indeed moves really fast — and so do vehicles. **Ahana Mukherjee**, a master’s student advised by Associate Professor **Mario Berges**, completed a summer research project with Assistant Professor **Sean Qian**, who uses modeling and simulation not only to keep up with cars, but to stay ahead of them.

Using sensors and data mining, Mukherjee used statistical modeling and data analysis to predict how many Pennsylvania car crashes there will be in upcoming years. She had access to all Pennsylvania car-crash data from 2010 to 2014, including additional



Judith Hill (PhD ‘04)
Computational Scientist
Program Manager, INCITE
Oak Ridge National Laboratory

Hill’s job as a computational scientist is to extract mathematical equations and algorithms from a variety of application domains, such as engineering, fluid dynamics, climate science, chemistry, or nuclear physics. One of her many current projects deals with seismology. She is collaborating with Princeton University researchers to collect and analyze global earthquake data using the supercomputer Titan, which is owned and operated by Oak Ridge National Laboratory.

“This is not where I thought I would end up. I’ve had a lot of luck in my career and a lot of good mentors that helped push me in this direction, and I wouldn’t have it any other way now.”

information such as the time of accident, number of individuals present, and road characteristics such as road length and whether it was in a rural or urban area. Mukherjee’s research project, *Mobility Data Analytics*, allowed her to use these large amounts of data to pinpoint which roads require additional safety precautions, making future driving conditions safer.

“The Department of CEE here at CMU is very unique, very different,” says Mukherjee. “This department does not follow traditional CEE structures — concrete is not the focus. It’s more about sensors and data mining, and this project is very relevant to that.”

In terms of nontraditional structures, Assistant Professor **Hae Young Noh** goes a step further, using structures as sensors, specifically focusing on vibrational analysis. By attaching sensors to buildings, infrastructure, or vehicles, Noh is able to use the vibration of the structures themselves to gather information about structural integrity, environmental conditions, and human behaviors. For example, she uses these structures to detect the health of rail lines and to track the movement of patients within hospitals — the building could alert doctors to changes in walking patterns, which could reflect illness, or alert nurses if a patient falls.

Noh’s research has a vast number of potential applications and will serve to further connectivity. Using structures as sensors opens an enormous window, allowing for greater monitoring of systems and behaviors to enable remarkable technological progress — the stuff of science fiction, realized.

“I like the scale and the variety of civil and environmental engineering,” says Noh. “We cannot really live without civil

infrastructure systems. Everyone depends on them.”

Mentorship and Support

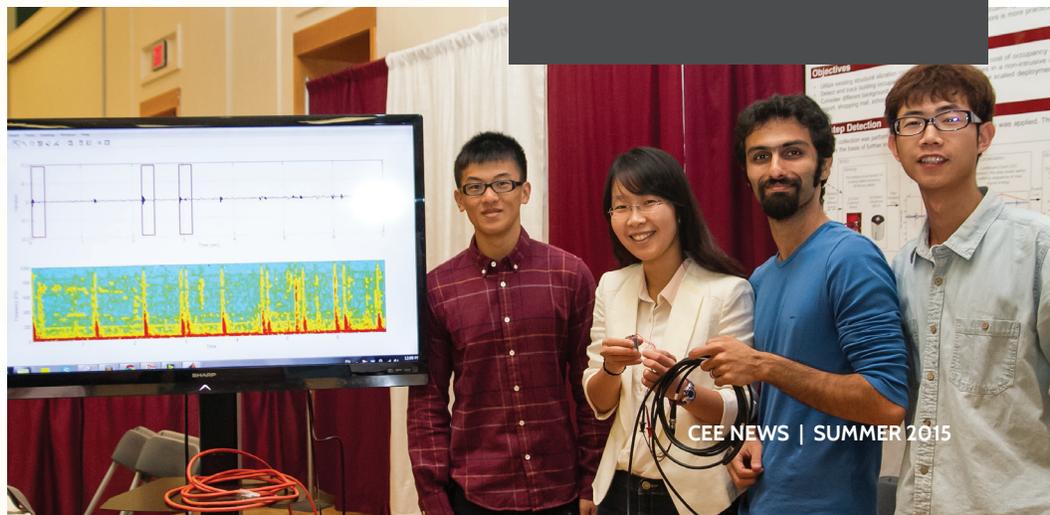
“The support system at CMU is incredible,” says current master’s student **Abigail Cahen**, “especially in the CEE department. Being well-supported enables you to do so much more.”

Cahen, in turn, goes out of her way to support her fellow students. In addition to being a brilliant student — recommended highly by her professors — and a campus resident assistant, Cahen is a teaching assistant and an active member of many CMU student groups, such as Chi Epsilon, the National Civil Engineering Honor Society, and the Society of Women Engineers. In her positions, she is able to work with other students to enhance their experiences at CMU, as well as her own. And students are not the only ones supported at CMU — Christiano Professor, Co-director of the Smart Infrastructure Institute, and Associate Dean for Research **Burcu Akinci** says that, as a recognized female leader in such a male-dominated field, she feels lucky to be in the CEE department.

“There is the department, there is the

“There are many ways to improve people’s quality of life — you could be a medical doctor, for example. I call myself a structural doctor, because I diagnose structures, make sure they’re safe, functional, and sustainable so they can have good impacts on people and the environment.”

- Hae Young Noh





“To this day, I’m fascinated by how many different materials, systems, technologies, and trades come together magically during the construction and operation of large-scale, highly complex facilities and infrastructure systems. Every time I go to a job site, I’m mesmerized by it. There’s no dull moment. Every project is unique, every project has its own challenges and rewards and it’s all very exciting.”

- Burcu Akinci

field and there is the larger community,” she explains. “The larger community is still dominated by men, though it’s changing. But in the recent field conferences I’ve gone to, I’ve seen more women coming up as PhD students or new faculty members, which is absolutely great. And in terms of the university and the department, where my day-to-day interaction is, I am absolutely spoiled.”

The students, faculty, and staff of CEE at CMU support each other, but many are also dedicated to aiming their mentorship outside of the university as well.

Noh, for example, does outreach activities aiming to improve science and engineering education for middle school girls — middle school, she says, is when overall student interest in science and engineering peaks, but also, incidentally, when girls’ interest in it drops — and **Minkyung Kang**, a current PhD student studying Advanced Infrastructure Systems, was a member of a student group through her Korean university which worked with professors and students to improve the inclusion of females in the department early in her education.

“We ended up writing a guidebook for

[WWW.CMU.EDU/CEE](http://www.cmu.edu/cee)

professors and students on how we can improve the engineering education in the engineering school for everyone, male and female, of any age,” says Kang, whose early environmental awareness was influenced by stories — one book in particular that affected her told the story of a boy with a green thumb. Her younger self wanted to make her city greener, like the boy in the story, influencing her decision to go into civil and environmental engineering.

“One of my most important activities is mentoring,” says Professor **Jeanne VanBriesen**, “from junior faculty through undergraduates.”

VanBriesen, in addition to her renowned research into drinking water and river-water-system contaminants, is a principal investigator for the Integrative Graduate Education and Research Traineeship (IGERT) program, a National Science Foundation-funded initiative that builds on students’ knowledge foundations with interdisciplinary training. Her technical leadership and her dedication to mentoring women pursuing engineering careers have attracted much attention and praise. Earlier this year she was awarded with the Barbara Lazarus Award for Graduate Student and Junior Faculty Mentoring. The award recognizes the exemplary contributions of CMU faculty members who work to foster a welcoming and nurturing environment for graduate students and young faculty.

“Mentoring enables future generations of scientists and engineers,” says VanBriesen, “to ask good questions and search for the answers, to think deeply about how things are now and how we want them to be in the future.”



Minkyung Kang
PhD Student

“When I came here from Korea, I started to work on building with an energy perspective. I feel like I’ve found my ultimate goal. I didn’t want to stop urbanization, but I wanted to make the environment better, the city healthier and greener. Now I have the perfect puzzle right here. CMU is where I have to be.”



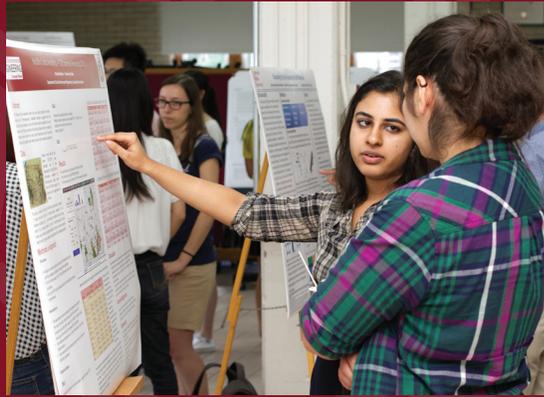
Abigail Cahen (BS ’15, MS ’16)

“I enjoy learning about how big things work (like water infrastructure or freight rail), and the satisfaction that comes with knowing that something’s been done right, when calculations fall perfectly into place or the last tie has been placed on a section of track. There’s something really wonderful about creating something useful that positively and visibly impacts society.”



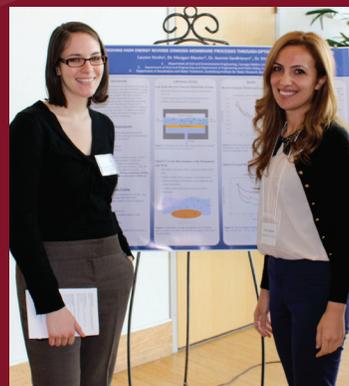
Ahana Mukherjee (MS ’15)

“Apart from the fact that I had to learn how to code, I think what I learned the most was to not be afraid. The first class that I took, I didn’t really know coding and wasn’t sure I could take it. But what CMU and CEE have taught me is that you can pick it up if you want to. There are all these online materials, and people who will help you out. But if you think you can’t do it, then you won’t.”



#ILookLikeAnEngineer, an effort to redefine the way engineers are defined, has swept social media this summer.

At CEE we have a diverse and brilliant group of women in engineering who are leading projects and companies across the globe. Here are a few of the women who are the future of engineering.



Engineering the Infrastructure of the Future

You don't have to look far to see that our nation's infrastructure systems are in need of rejuvenation. Many of the roads, bridges, waterways, and energy systems that surround us are fast approaching the end of their life cycle. After years of neglect, CEE Assistant Professor **Costa Samaras** says the time has come for us to not only reinvest in these networks, but also bring them up to a state in which they will be prepared to withstand a future of uncertain weather conditions.

"We're entering a new world where climate conditions in the future will look very different," says Samaras. "Here at CMU, we're developing the research and the education initiatives necessary to advance engineering methods to figure out ways to make our infrastructure future-proof."

Samaras' research focuses on a major confluence in our nation's network of infrastructure: the nexus of energy and transportation. By evaluating the current state of these systems, he and his research group can determine which investments would best prepare them to withstand the effects of climate change, while simultaneously minimizing emissions in both sectors.

"We think about focused areas where we could make a difference right now," says Samaras. "So we're looking at how individual power plants are vulnerable to climate change impacts, as well as how strategic roadway and other transportation networks are vulnerable — and more specifically, what can we do about it?"

According to Samaras, smart investments would consider how much it not only would cost to build new systems, but how much it will cost to operate them over the long term. He says that by making strategic investments upfront, we can help ensure that our infrastructure is efficient and resilient to climate change, which will minimize cost and maximize performance in the long run.

"It's kind of like putting energy-efficient appliances in your house," explains

Samaras. "They might cost a little bit more, but over the life of those appliances, it's going to save you more than enough money to make up for that initial investment."

To that end, Samaras has been analyzing how to incorporate climate-change adaptation into engineering designs. He's also investigating how renewable fuels and autonomous vehicles might change energy use and emissions, while providing benefits

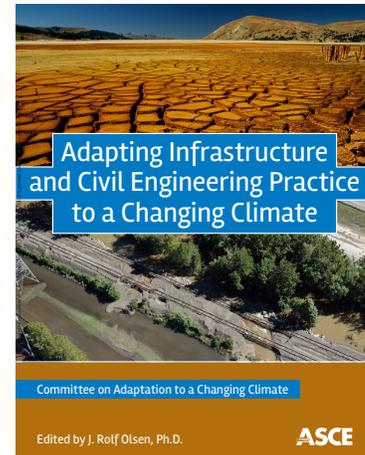
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to the customer.

After earning a joint PhD in CEE and Engineering and Public Policy (EPP) from CMU, Samaras joined RAND Corporation in 2008. From his work there, and after his return to CMU in 2013, he has published numerous studies examining plug-in and autonomous vehicles, renewable electricity, and low-carbon fuels. Recently, he was part of the American Society of Civil Engineers (ASCE) Committee on Adaptation to a Changing Climate, which produced an e-book, *Adapting Infrastructure and Civil Engineering Practice to a Changing Climate*.

Samaras says it's CMU's culture of interdisciplinary collaboration that influence his desire to join the faculty in the first place — after all, this is the birthplace of the autonomous car, and the collaborative fabric of the university enables joint efforts that unite CEE with the Robotics Institute, the School of Computer Science, Heinz College, and private companies.

"We are able to bring together researchers



across departments and schools who are used to working together to find new creative solutions," he says. "Nobody's afraid to work with anybody, and students and faculty are encouraged and rewarded for breaking new ground across disciplines."

Moving forward, Samaras is confident that CMU will continue to lead the way in ensuring the future success of our nation's infrastructure systems. Last fall, he helped design and teach an innovative new course, Climate Change Adaptation for Infrastructure, making CEE the first engineering program in the country to offer a course focused on this crucial topic.

"What we're trying to do here at Carnegie Mellon is conduct research on the frontiers of engineering and train the next generation of professionals that will develop solutions to address climate-change impacts," says Samaras. "It's very important that we focus our attention on the nexus of energy and transportation, because it's an area where there's a lot of work that needs to be done."

FACULTY NEWS



Hendrickson Leads Experts in Study of Locks and Dams



Hammerslag University Professor Emeritus **Chris Hendrickson** led a committee of experts and industry leaders tasked with assessing the condition of the inland waterway transportation network. The culmination of the committee's 18-month consensus study is a special report for policymakers: *TRB Special Report 315: Funding and Managing the U.S. Inland Waterways System: What Policy Makers Need to Know*. The report is intended to inform policymakers how this small yet necessary component of the national freight system is managed and maintained, and how future policy would best benefit and preserve it.

In selecting CMU to host this study, the Transportation Research Board (TRB) chose the perfect setting in which to observe and evaluate our nation's inland waterway system, says Hendrickson. The committee was able to visit the Emsworth Lock on the Ohio River to gain firsthand experience about how the inland waterway commercial freight traffic actually works.

"You see railways all the time, people use airports, but many people never use or even see the locks and dams," says Hendrickson. "They are a vital, but often overlooked, part of our nation's infrastructure."

In the report, Hendrickson and his fellow TRB committee members call for a sustainable and well-executed plan for maintaining system reliability and performance that would encourage more efficient use of limited navigation resources. They propose greater reliance on a "user pays" funding strategy for commercial navigation of the system, and recommend that most of that funding be allocated toward system preservation, rather than reconstruction.

"Freight transportation is really important, and it's important to keep it working," says Hendrickson. "We need some good policies in place to preserve the dams and locks that make navigating this system possible."

Cartwright Honored by ASEE



American Society for Engineering Education (ASEE) selected Professor Emeritus **Larry Cartwright** as the recipient of the 2015 ASEE Robert G. Quinn Award.

This award recognizes his distinguished accomplishments and outstanding commitment to and influence on the undergraduate civil engineering students of Carnegie Mellon University over a 38-year career, his development of imaginative senior capstone design projects, and his unique design and construction course that yielded many permanent improvements on the Carnegie Mellon campus.

Akinci Named Next Associate Dean for Research



Congratulations to Paul Christiano Professor **Burcu Akinci**, who has been named Associate Dean for Research for the College of Engineering. Akinci's primary responsibilities

will be to facilitate research collaboration among the college's faculty and with colleagues across campus, identify major research opportunities for the college, and develop and implement a college-wide strategy to address them.



Associate Professor **Mario Berges** was awarded a Dean's Early Career Fellowship in recognition of his work in the development and application of building sensors, particularly in the fields of building energy management and other civil infrastructure monitoring. His goal is to utilize cost-efficient sensors to gather data on the behavior of infrastructure, in order to better plan for the future. In addition to his groundbreaking research, Berges is often recognized by his colleagues for his willingness to collaborate and his strong involvement in and commitment to national and international organizations.



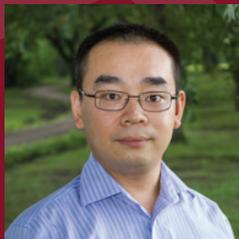
Duquesne Light Company Professor Jeanne VanBriesen receives the 2015 ASCE Margaret S. Petersen Award, given to outstanding women in environmental and water resource engineering.

CEE Welcomes New Faculty



Assistant Professor **Sean Qian** applies advanced information and sensing technologies to help develop intelligent transportation systems. Qian is committed to discovering the efficiency and resilience of transportation infrastructure by studying how travelers behave in various transportation networks, and how those networks interact with other urban systems, such as energy and water.

Qian, who in 2011 received his Ph.D. in civil engineering from the University of California, Davis, focuses his research on the planning, operation, and maintenance of urban infrastructure systems, especially transportation systems. He previously was jointly appointed as an assistant research professor at the Heinz College and Institute for Complex Engineered Systems (ICES) with a courtesy appointment with CEE. Qian will maintain an appointment in the Heinz College.



Assistant Research Professor **Pine Liu** specializes in software requirement engineering, building information modeling (BIM) and automation systems, and software project management and risk analysis. His research focuses on improving the sustainability and efficiency of managing urban infrastructure systems.

Liu earned his PhD from CEE in 2012, with a focus on Advanced Infrastructure Systems (AIS). Liu served for the past three years as asset preservation manager with CMU's Facilities Management Services (FMS) to gain an industry perspective on these systems. During his time in FMS, Liu maintained a presence in the CEE department by teaching several graduate courses related to computer-based approaches for search and decision support in civil infrastructure, and BIM for engineering, construction, and facility management.



Sarah Christian rejoined the faculty as an assistant teaching professor. Christian, who taught courses in CEE 2009-2011, says, "Students are my passion. I want to do whatever I can do to make their educational experience the best it can be to help them become the complete package. Carnegie Mellon is a great place for that."

For the last two years, Christian served as a lecturer at University of Edinburgh in Scotland.

Christian completed her undergraduate studies at CMU in Civil and Environmental Engineering in 2003 and went on to earn her master's in civil engineering from Johns Hopkins University. In 2009, she earned her PhD in civil engineering from Stanford University.



Jim Thompson has recently been appointed as an assistant teaching professor after several years in a visiting appointment, ensuring that CEE undergraduate students will continue to benefit from his expertise in structural engineering.

He began his career in the U.S. Navy Civil Engineer Corps, working in Alaska and Florida, and has worked in China, Kazakhstan, Azerbaijan, Indonesia, and New Zealand as an engineering consultant.

Thompson says these experiences allow him to provide his students with valuable firsthand knowledge. "I can talk to them about things that are beyond the textbook," he says. "I can make it more real. I can talk about what works, and what doesn't work, because I have actually seen these structures go up."



ResearchTube

The College of Engineering has produced a number of videos discussing faculty research. While more videos are in development, visit the college's YouTube channel today to learn more about:

- Air Particulate Research - Peter Adams
- Using Waste Heat at Power Facilities - Meagan Mauter
- Smart Infrastructure Techniques - Burcu Akinci
- Using Structures as Sensors - Hae Young Noh
- Understanding Energy Consumption - Mario Berges

youtube.com/user/CMUEngineering



Testing the Tracks

Using Vibrations to Spot Weaknesses in Train Rails

On a night in November three years ago on Pittsburgh's light-rail system, a passenger train needed to switch tracks to navigate around maintenance work. However, it couldn't complete the maneuver and came off its rails, shutting down the nearby Wood Street Station for the night. While a failure to switch tracks caused that derailment in 2012, other more normal factors such as wear and tear on tracks can lead to derailment too.

To prevent future accidents, Carnegie Mellon Civil and Environmental Engineering Assistant Professor **Hae Young Noh**, with Professors **Jacobo Bielak** (CEE) and **Jelena Kovačević** (ECE), Dean of the College of Engineering **Jim Garrett**, and **Piervincenzo Rizzo** of the University of Pittsburgh, and in collaboration with the Port Authority of Allegheny County, are testing new technology to spot possible dangers for trains on tracks before they become problems. The light-rail system, also called the "T," is their testing ground.

Noh's range of research focuses on implementing sensors into structures to improve daily life. In addition to her work with trains, she is using sensors within buildings to detect people for safety and security purposes, and to identify how they use resources and spaces.

This project is part of Carnegie Mellon's Technology for Safe and Efficient Transportation University Transportation Center (T-SET UTC), which is dedicated to making transportation safer and more efficient by improving roadway infrastructure and technology. The T-SET UTC is funded by the Department of Transportation.

The sensors, fitted to passenger cars that run the length of the T, pick up vibrations

that occur along the track. The vibrations are then collected and analyzed. The measurements, which are a mixture of vibrations from the train itself and vibrations from the interaction between the train and track, can be used to determine where possible danger lies.

"Typically, what people do to monitor rail structures is to have individual inspections," Noh says. "They send out people who walk around the entire rail system, but it's very labor intensive and it could be very dangerous. It's also very subjective because people can see different things." Compared to typical railway inspections, the vibration-collecting sensors present a more uniform and objective way to spot defects.

Two years ago, Noh and her collaborators fitted one of the passenger cars on the T with their sensors. They chose to fit a train, and not the entire track, with the sensors to make the technology more affordable. The T's train has now been collecting data for two years. Earlier this year, the researchers fitted a second train on the system with their technology.

From the collected data, Noh identified irregular vibrations and found out where those vibrations occurred in order to pinpoint areas that could be problematic.

In one scenario, the wheels of a rail car were chipping. If the train kept running the same way, a wheel could have eventually cracked and the train could have derailed. Normally, it would be difficult to determine where on the track the wheels were being chipped. After all, it could be have been occurring anywhere on the track. With the sensors, though, the researchers identified a handful of areas that affected the train more than they should have.

At one of those locations, Port Authority found a metal piece on the track that was disturbing the train's path. They were able to remove the piece to prevent it from further chipping the wheels.

Not only can the sensors pick up on deterioration in trains and the tracks they run along, but they can also spot deterioration in supporting structures such as bridges that the tracks are laid over.

"When a train crosses a bridge, vibration characteristics will be different than when the train is just moving along the ground," Noh says.

The technology can also be used to ensure that repairs have successfully fixed a problem on a track by comparing vibrations before the repair to vibrations collected after. In this way, the technology can even help to estimate how a track will deteriorate over time.

Noh has also used sensors like the ones that monitor the T to check for deterioration in roadways. She and her collaborators have used the sensors in cars for travel through Oakland and in Palo Alto, California. The U.S. Geological Survey has also tested the sensors with the researchers in vehicles around a levee at Sherman Island, California.

This advancement comes at an exciting time for Carnegie Mellon and the city of Pittsburgh, both of which are helping to lead the MetroLab Network, a new initiative announced by the White House. The MetroLab Network includes more than 25 universities and 20 metro areas that will develop technologies to confront challenges in urban areas.

Small Honored with Steven J. Fenves Award for Systems Research



The College of Engineering announced that Professor **Mitch Small** has been honored with The Steven J. Fenves Award for Systems Research in recognition of his significant research contributions in developing novel risk-assessment methods for drinking water systems.

Small is widely recognized as a national leader in the development of integrated assessment for civil-environmental engineering decision-making. His path-breaking research has focused on building and applying models that link contaminant fate and transport, human behavior, exposure, and risk to inform engineering decisions as well as policy and regulation formation.

Small's work has significantly advanced stochastic approaches in environmental engineering modeling, where the need is great because of the variability in

the natural and engineered systems of interest. Further, he has linked the results of stochastic modeling directly to civil and environmental engineering decision-making.

Small has been teaching at Carnegie Mellon University since 1982. He has been recognized for his teaching style, which includes showing students, in an engaging way, how quantitative analysis can bring deep insight and predictive ability in analysis of engineering problems, design, and policy formulation and analysis. He equips students with quantitative tools in statistical modeling and process modeling that enable them to excel in practice, academia, and government.

Small advises an average of 10 undergraduates and 10 graduate students each year; his 50 PhD and thesis-MS students have gone on to excel in diverse career paths.

As an additional contribution to education in civil and environmental engineering, Small's book, entitled *Integrated Environmental Modeling: Pollutant Transport, Fate and Risk in*

the Environment, has been adopted by instructors in graduate programs across the United States.

The Steven J. Fenves Award for Systems Research is named in honor of CEE University Professor Emeritus **Steven J. Fenves**. Fenves joined Carnegie Mellon University in 1972, serving as head of the Civil Engineering Department (1972-75) and director of the Design Research Center (1980-84), attaining the position of university professor in 1984. He retired from active teaching in 1998.

Fenves devoted his research to computer-aided engineering to understand, model, and improve the processes that civil and environmental engineers use in the planning, design, construction, and operation of engineered facilities. His research has dealt with design standards, engineering databases, knowledge-based systems, machine learning, and comprehensive design environments.

Samaras Awarded Wimmer Faculty Fellowship



Assistant Professor **Costa Samaras** was awarded a 2015 Wimmer Faculty Fellowship from The Eberly Center to develop digital, open-source instructional materials for climate-change adaptation classes.

The course materials will be a hybrid instructional collection with a syllabus, reference readings, flipped classroom modules, and sample in-class exercises. Samaras' materials will take the form of an individual module for each of the 14 classes in a mini course. Each class module

will contain a learning objectives, required and recommended readings and videos, some flipped class material, and a sample exercise.

The majority of class time can then be spent extending the lesson, reinforcing concepts, and completing an in-class activity that builds student confidence on these topics while they are fresh in their minds.

Once Samaras has developed the materials, they will be openly available with a Creative Commons license with the goals of collaborating with educators, globally, to develop readings, content, and examples.

The Wimmer Faculty Fellowship is

made possible by a grant from the Wimmer Family Foundation and are designed for junior faculty members interested in enhancing their teaching through concentrated work designing or re-designing a course, innovating new materials, or exploring a new pedagogical approach. Samaras will work in close collaboration with Eberly Center colleagues.

The Eberly Center will assist Costa in the development and implementation of each course module, especially regarding learning objectives, instructional methods, and assessments.



Celebrating Chris Hendrickson

Dozens of faculty members and former students gathered on April 17, 2015 to celebrate the career of Hamerschlag University Professor **Chris Hendrickson**, who has been named emeritus professor after 37 years of teaching.

At the ceremony, Department Head **Dave Dzombak** praised Hendrickson's dedication to the profession, citing his nearly four decades of service to the department. Several of Hendrickson's colleagues also came forward to express their admiration for his shrewd yet sensitive approach to the learning process.

"Chris is renowned for being a great organizer and time manager of student research," says fellow CEE faculty member Professor **Scott Matthews**. "Even now when one of our students is struggling to put everything together, I'll get Chris involved. He somehow manages to be the master of efficiency, while remaining incredibly warm and personable."

In 2012, Hendrickson was named university professor at Carnegie Mellon, the highest academic distinction a professor can achieve at the university. The previous year, he received one of the highest professional distinctions in engineering when he was elected to the National Academy of Engineering for leadership and contributions in transportation and green design engineering.

Outside the classroom, Hendrickson is known for the generosity and support he extended to his colleagues and students. Over the years, he and his wife Kathy, who he met in the U.K. when he studying at Oxford, have hosted countless dinners, parties, and picnics that have helped to foster collaborations and friendships among the CEE community.

"When you're one of Chris' students, you become a member of his family," says **Don Coffelt** (PhD '08), director of Facilities Management Services at CMU and one of Hendrickson's nearly 40 former PhD advisees. "He and Kathy have created an ever-expanding family unit that includes all of Chris's current advisees, all of his former





advisees. It's really special experience that has had a huge influence on all of our careers, and on our lives."

"He's a mentor's mentor," agrees CEE Assistant Professor **Costa Samaras** (PhD '08), another of Hendrickson's former advisees. "He's got that rare combination of selflessness, vision, and brilliance. The arc of my career has been indelibly shaped by Chris, and I'm forever grateful."

Hendrickson also felt strongly that his students should seek out and pursue opportunities to share their work beyond the walls of CMU, and participate in the wider academic community.

"I have always appreciated how Chris supported and promoted his students

traveling to conferences and workshops," says **Amy Nagengast** (PhD '12), another of Hendrickson's former PhD students. "He strongly encouraged multi-disciplinary collaboration on research."

To honor Hendrickson's commitment to providing his students with the richest possible learning experience, the Chris T. Hendrickson Undergraduate Travel Fund was created to provide CEE undergraduate students with the opportunity to travel for the purposes of professional development, such as attending a conference to present research or class projects. CEE made the first donation to the fund in Hendrickson's honor.

According to Coffelt, who not only worked with Hendrickson during his PhD, but

has co-taught with him for the past five years, there could be no better tribute to Hendrickson's legacy.

"Chris has been tremendously generous throughout his career," Coffelt says. "Giving something to the university itself is the perfect way to honor his philanthropy."

In recognition of his commitment to supporting and mentoring CEE alumni, in 2009 the Alumni Association honored Hendrickson with the Faculty Service award. His nearly-20-year membership in the Andrew Carnegie Society is a further testament to his investment in the university community. As emeritus professor, he will continue to influence the CEE community for years to come.



Mauter Awarded NAMS Young Membrane Scientist Award

CEE/EPP Assistant Professor Meagan Mauter was recently named one of the three recipients of the 2015 North American Membrane Society (NAMS) Young Membrane Scientist Award. The award, which will be presented this summer at the NAMS annual meeting in Boston, Massachusetts, is given to individuals within the first two years of their first academic appointment in recognition of their achievements to date as well as their outstanding potential in membrane science and technology.

At CMU, Professor Mauter runs the Water and Energy Efficiency for the Environment (WE3 Lab). Her present research seeks novel approaches to sustainably meet water supply in an energy constrained world by re-thinking the policies surrounding water treatment, re-defining the inputs to the treatment process and re-envisioning the membranes in membrane-based water treatment processes.



CEE welcomed Chancellor Dan Larson of Universidad de Investigación de Tecnología Experimental Yachay, Ecuador to campus this spring. Earlier this year Dave Dzombak, along with Jim Garrett, Dean of the College of Engineering, visited Yachay Tech to continue planning a partnership with CEE. Yachay Tech is a fascinating new university with ambitious plans to be a center of technology development and commercialization in northern South America.



ASCE Honors CMU Chapter



Left to right: Jim Thompson, Ahmad Khazada (BS '16), Miriam Hegglin (BS '15, MS '16), and ASCE Region 2 Governor Jack Raudenbush

The CMU ASCE Student Chapter was awarded the 2015 ASCE Distinguished Chapter Award for Region 2. This award is in recognition of the chapter's activities, programs, participation, and outreach on and off campus. This is the second year that ASCE has recognized the CMU student chapter with this award.

The chapter aimed to strengthen ASCE's relationships for the 2014-2015 academic year by collaborating with peer student organizations such as Society of Women Engineering (SWE), Engineers Without Borders (EWB), Chi Epsilon, and the CEE Graduate Student Association (GSA). Together, the groups hosted a number of social events and outreach programs that increased both the amount of programming for the community and overall attendance.

The chapter, advised by Assistant Teaching Professor **Jim Thompson**, also strove to increase first-year engagement by creating a student-mentoring program. Working with Chi Epsilon, the chapter paired first-year students with seniors, which resulted in an increase in participation in ASCE and department events, projects, and programs.

In addition to its 2015 Distinguished Chapter Award, the CMU chapter was also awarded a 2015 Letter of Recognition for Community Service in recognition of the chapter's exemplary community service projects.

"We are very proud of the accomplishments of our ASCE Student Chapter in 2014 and commend the student chapter leaders and members," Professor Thompson says. "Earning both the Distinguished Chapter Award and the Letter of Recognition for Community Service is an outstanding achievement."

The chapter's services events included outreach activities at area high schools, participation in the Engineer's Week event at the Carnegie Science Center, and creating valentines to thank veterans for their service. The student chapter also partnered with the EWB student chapter to clean up a local park and construct a boardwalk to improve accessibility.

Recent PhD Theses

Engin Anil

Utilization of As-is Building Information Models Obtained from Laser Scan Data for Evaluation of Earthquake Damaged Reinforced Concrete Buildings

Advisors: Akinci and Garrett

Nicholas Azzolina

Statistical Approaches to Quantifying Uncertainty of Monitoring and Performance at Geologic CO₂ Storage Sites

Advisors: Nakles and Small

Tajin Biswas

Towards a Framework for Supporting Sustainable Building Design: A Case Study of Two Credits Over Evolving Rating Standards

Advisor: Akinci

Matineh Eyb Poosh

A Data-Driven Framework Based on Sparse Representation of Ultrasonic Guided-Waves for Online Damage Detection of Pipelines

Advisors: Berges and Noh

Suman Giri

A Framework for Estimating Energy Consumed by Electric Loads Through Minimally Intrusive Approaches

Advisor: Berges

In-Soo Jung

Anomaly Detection of Piezometer Data Collected from Embankment Dams

Advisors: Garrett and Berges

Zan Wang

Characterization and Monitoring of Geochemical and Geophysical Effects of CO₂ Leakage from Sequestration Reservoirs

Advisors: Karamalidis and Small

Xiaohan Zhang

Field Dislocation Mechanics with Applications in Atomic, Mesoscopic and Tectonic Scale Problems

Advisor: Acharya



The CMU chapter of ASCE organized an in-depth tour of Frank Lloyd Wright's iconic Fallingwater. In addition to the tour, the Western Pennsylvania Conservancy organized a special lecture about earlier structural renovations.



CEE Summer Spotlight: Leslie Abrahams

Leslie Abrahams, a joint PhD student in Public Policy and Civil and Environmental Engineering, spent her summer in Santa Monica as a summer associate with RAND Corporation, an international research organization that seeks to influence public policy. Leslie sat down with us to talk about her research project, which studied the quality of life and how the military uses fuel on American military contingency bases abroad.

Please explain the project.

The Army is trying to implement improvements to quality of life for the soldiers when they are deployed on these bases, and one of the key factors in how soldiers perceive their quality of life is the type of housing they have. We were looking at how improvements to soldiers' housing influence energy consumption on the bases. That's important because all of the fuel for the electricity on the bases has to be delivered by the Army. Depending on where the base is located that can be pretty costly, and it's a source of vulnerability for both soldiers and civilian contractors.

To answer these questions, we first modeled how different types of shelters influence energy consumption. Next we looked at different strategic choices in power systems, such as different types of generators and micro grids, to try to understand how enhancing fuel efficiency can balance out some of the increases in electricity demand associated with quality-of-life improvements.

What did your research show?

Quality-of-life improvements, especially changes to soldiers' housing, can as much as double the electricity demand. However, we found that there are cost effective investments that could be made to successfully increase fuel efficiency to ensure the increased electricity demand

does not dramatically increase the fuel demand. This is important because delivering fuel to military bases is very expensive and the convoys that transport the fuel face hazards from environmental conditions and enemy fire.

How will your research be incorporated into the operation of Army bases?

My work contributed to a larger project for the Army G-4 (Deputy Chief of Staff for Logistics), which focused on helping to prioritize quality of life support while balancing the other challenges, such as avoiding unsustainable logistics burden. This work will be incorporated into broader regulations being developed by the Army to increase self-sufficiency, reduce supply demands, and reduce waste on contingency bases.

What skills have you gained from this project with RAND?

From working at RAND this summer I advanced my communication skills and learned to think about energy issues from a different perspective. When you get thrown into a project that's already well underway, you have to independently get up to speed quickly and figure out how you can use your skills to meaningfully contribute to the project. To be successful as a summer associate, it was important to clearly communicate what I knew from my own research here at Carnegie Mellon and how I was thinking about this

project's research challenges to people who had different backgrounds. This type of interdisciplinary communication was interesting and an important skill to develop.

I also had to translate my results to people who didn't have a background in energy, and then I had to take it a step further and refine the results to a few sentences for a larger briefing to our clients. They didn't have time for all the details but needed enough information to understand our results and their implications. Having this practice distilling my research into a meaningful but high-level overview for a decision maker will help me make my own research here at CMU more impactful and influential.

What was one of your favorite aspects of this project?

I really enjoyed getting to interact with the other summer associates whose backgrounds were very different from mine, such as history, economics, psychology, and sociology. I got to hear about a wide variety of projects and I learned new research methods from different fields. RAND really focuses on interdisciplinary work, so that type of environment is pretty reminiscent of CMU, especially in CEE and EPP. It was really interesting to see the types of interactions that we try to cultivate here at CMU successfully resulting in meaningful research out in the real world.



CEE PhD students Argha Namhata and Kenneth Sears

Carbon-Conscious: Mitigating the Effects of CO₂

It's no secret that carbon dioxide emissions are a problem—because they increase the amount of carbon dioxide in our atmosphere, they are one of the largest anthropogenic contributions to climate change. By reducing carbon dioxide emissions, we can start to mitigate the greenhouse effect that is causing temperatures to rise. But figuring out how to do that isn't as easy.

“Carbon dioxide is being emitted by many, many processes and activities today,” explains PhD candidate **Argha Namhata**. “By developing alternative energy sources, we can try to reduce it. But we can't stop carbon dioxide emissions all of the sudden. So it's very important to think about how to deal with the carbon dioxide that is already present in our environment.”

One way of dealing with carbon emissions is to store the excess underground in geological reservoirs to significantly reduce the amount of greenhouse gases being emitted. However, this method is yet to be executed on a large industrial scale and engineers are still unsure of the risks involved.

To aid the industry and the research community in making more informed decisions about where and how to store carbon dioxide, Namhata is developing an engineering tool to assess the risks involved. Specifically, his research is centered on predicting the fate of the injected carbon dioxide in the subsurface environment, ensuring that it can remain in the storage reservoir without affecting the overlying groundwater resources.

“This will be an important piece in the research because industry doesn't really have the engineering tools they need to

assess the risk to the atmosphere and the groundwater,” he says. “So I'm trying to fill that gap.”

Like Namhata, PhD candidate **Kenneth Sears** is developing smarter, more efficient ways of dealing with carbon dioxide emissions. Carbon Capture and Sequestration (CCS), which separates carbon dioxide from the mixture of gases that are emitted by power plants and factories and stores the carbon dioxide

“We're going to have an altered climate with a lot of uncertainties, like unpredictable precipitation and temperature. So we want to have the most efficient power plant-cooling systems possible,” he says. “I'm hoping this project will be a part of the solution.”

in the subsurface, can go a long way in mitigating the effects of carbon dioxide in our atmosphere. However, Sears explains that operating these systems comes with a cost — especially for thermoelectric power plants, the most common type of electric power production in the country and one of the biggest CO₂ emitters and consumers of water on the planet.

When these plants burn fuel, the heat emitted boils water, producing the steam that powers the plant. The plants then use water to condense the steam back into water, which is then used to make more steam. This process, known as the Rankine cycle, is by far the largest use of water in a plant. And as Sears explains, because CCS systems demand more power, plants will need to produce more steam, and will therefore require more water for cooling.

According to Sears, the one way to mitigate this strain on water supply is to develop carbon capture technologies that also will allow plants to reclaim some of the water that escapes as steam along with the flue gas. Capturing water along with carbon dioxide will allow plants to use their water more efficiently, thereby reducing the strain they pose on local water supply.

“Many power plants already strain regional water supplies, and increases with carbon capture could dangerously lower these water sources,” he says. “My research encourages carbon capture technologies to consider water capture separation and reuse.”

Ultimately, Sears wants to ensure that we are well-equipped to deal with the challenges associated with climate change. “We're going to have an altered climate with a lot of uncertainties, like unpredictable precipitation and temperature. So we want to have the most efficient power plant-cooling systems possible,” he says. “I'm hoping this project will be a part of the solution.”



2015 COMMENCEMENT

ASCE Outstanding Civil Engineering Student Award
Millard McElwee

H. A. Thomas, Sr. Distinguished Service Award
Dolly Hsu
Michelle Couste

H. A. Thomas, Sr. Scholarship Award
Miriam Hegglin

James P. Romualdi
Civil and Environmental Engineering Award
Michelle Krynock

Outstanding Teaching Assistant Award
Dana Peck
Matineh Eybpoosh

Paul P. Christiano Distinguished Service Award
Duygu Altintas

Mao Yisheng Outstanding Dissertation Award
Chang Liu



Worldwide, 780 million people lack access to clean water, according to estimates from the World Health Organization. Armed with sheets of paper and an expert knowledge of nanoparticles, **Theresa Dankovich**, a Civil and Environmental Engineering postdoctoral researcher at Carnegie Mellon University, is working to solve that problem with support from CEE students.



Women in the village focus group test various designs against traditional methods of cleaning drinking water.

Turning the Page on Unsafe Drinking Water



Seated with Angela Ng, Theresa Dankovich holds up a test sample indicating the potability of the water sample, post filtration.

This summer, CEE student **Angela Ng** (BS '16) traveled to Bangladesh to help test Dankovich's innovative technology called pAge drinking paper—thick pieces of paper embedded with silver and copper nanoparticles that are lethal to bacteria.

In an August 2015 talk at the 250th American Chemical Society National Meeting & Exposition, Dankovich presented results from these and other field trials showing that when you pour contaminated water through a sheet of pAge drinking paper, the paper removes more than 99percent of bacteria in the water. This simple process produces filtered water that is not only safe to drink, but also very similar to tap water consumed every day across the United States.

This paper is the technology behind the *Drinkable Book*, a collection of pAge drinking papers presented as a book

in which each page is printed with information about water sanitation and safety. More importantly, each paper can be easily torn from the book, placed in a filter holder, and used to clean water whenever needed. As a whole, one *Drinkable Book* could provide its owner with up to four years of clean drinking water.

"I had always wanted to work on the *Drinkable Book* project. It was actually the reason I chose my major," explains Ng, who recalls watching a video about the project several years before Dankovich joined the department.

Naturally, Ng jumped at the chance to join the project and travel to Bangladesh, applying for and receiving several grants, including a CIT Travel Grant, to fund the trip.

In Bangladesh, Ng and fellow team members worked with International Development Enterprises to create a design that would allow pAge drinking paper to filter water directly into jugs called kolshis, which are commonly used to collect water throughout the country.

To gather information and water samples, the group traveled to various cities and rural areas, asking about which designs people preferred and how they collected their water. Learning from the designs that didn't work, they created and tested various models before identifying the most successful design, which Ng describes as similar to a coffee filter. "The designs that failed ultimately led us to the designs we

are now using," Ng says.

For Ng, this experience was a chance to combine her education with her love of international travel and helping others. "I've been to Rwanda, Colombia, Kenya and a bunch of other places in the last couple of years, but that was all volunteering," says Ng. "Now, for the first time, I was able to connect all of the dots from what I had been learning and use my education to really make a difference."

As part of her senior honors thesis, Ng will continue her work with Dankovich this fall. "There's a lot more to discover and to do before we go into production—for example, figuring out the longevity of this new design and seeing if it doesn't only kill bacteria but also key species like Giardia, Microsporidia, and other waterborne pathogens," explains Ng.

To Ng, the *Drinkable Book* and the kolshi filters are just the beginning. "I see us working with different countries to adapt pAge drinking paper to respond to how they currently collect water. We don't want to drastically change their water practices, but instead help them to get cleaner, safer water in the way that they already know how. The paper may evolve in many different forms and shapes and designs, but the technology will still be the same."

When asked about her own future, Ng does not hesitate. "This is the type of work I want to do for the rest of my life — to create solutions that better communities around the world."



Dale Wins Graduate Research Award

CEE/EPP PhD candidate Amy Dale was awarded the 2015 Graduate Research Award in Computational Hydraulics & Hydrology for her work on the fate and transport of nanoparticles in rivers. The award is given annually by the American Academy of Environmental Engineers and Scientists to recognize a student whose research contributes to the knowledge pool of in the area of computational hydraulics and hydrology. Dale is advised by Dr. Elizabeth Casman (EPP) and Dr. Greg Lowry (CEE).

Her work focuses on the movement and transformation of potentially toxic nanoparticles once they are released to the environment upon treatment of wastewater containing waste from products such as antibacterial paints, soaps, textiles, and cosmetics.

“As researchers,” Dale says, “our understanding of nanoparticle fate and effects in the environment is constantly changing. There are so many different kinds of nanomaterials, and they undergo such complex and disparate behaviors under different environmental conditions, that it is often difficult to see how it all fits together.”

Noack Wins AEESP Best Student Presentation



CEE PhD student **Clint Noack** won a Best Student Presentation award at the Association of Environmental Engineering and Science Professors (AEESP) conference held at Yale University, New Haven, Connecticut.

Noack’s presentation, Measurement and Recovery of Rare Earth Elements from Hypersaline Brines, explores the potential of recovering rare earth elements from brine sources such as geothermal fluids. These elements have unique and irreplaceable properties which have resulted in innumerable technological advancements.

His presented work is part of a larger research effort related to extraction and recovery of critical materials from alternative resources led by Associate Research Professor Thanasis Karamalidis. Noack is co-advised by Karamalidis and David Dzombak.

2015 Ohio Valley Student Conference - University of Cincinnati



Competition Highlights

Geotechnical Competition

Applying skills from soil mechanics, the team had up to 30 minutes to build a soil mound with points awarded for highest pile, least reinforcing material used, and shortest construction time.

The CEE team designed two plans for the competition. However, the paper reinforcer was much thinner than anticipated, resulting in the team making a new design, on the spot. With quick thinking and a team effort, they completed the design quickly and obtained a height of over 13 inches. Team members **Michelle Krynock, Chris Kim, Ahmand Khazada, and Maskana Adedjouman** earned second place.

Steel Bridge

Maskana Adedjouman, Andrew Bakert, Stephanie Emore, Dolly Hsu, Dylan McDermott, and Paige Sieffert formed the CEE Steel Bridge team. Unfortunately, the team was disqualified during post-construction inspection, due to the decking support surface being too tall. The CEE team, however, did report a new team personal best for build time.

Environmental Competition

Teams designed, constructed, and operated a small-scale flow-through water treatment apparatus to produce three liters of treated water from five liters of simulated raw intake water.

The CEE team, **Michelle Krynock, Yuchuan Lai, and Jessica Guo**, were awarded third place for the overall category and placed second for their poster and display. Their filter also earned third place for Most Creative Apparatus.



Peck Named CMU T-SET UTC Student of the Year



CEE/EPP PhD student **Dana Peck** received the 2014 CMU T-SET UTC Student of the Year Award in recognition of her accomplishments, scholarship, and contributions to transportation technologies.

Peck is funded by the University Transportation Center with a focus on vehicle safety and is advised by Professors **Scott Matthews** and **Chris Hendrickson**. She is analyzing a large data set of vehicle safety inspection results and examining failure rates from the state of Pennsylvania in order to evaluate the impact the program has on continued vehicle maintenance.

Peck is also assessing the effectiveness of vehicle safety inspections nationwide using the Pennsylvania data and the national crash database, FARS. Her aim is to compare fatal crashes in states with versus those without vehicle safety inspections to determine whether the safety inspection program is effective and worthwhile, both on the state and user levels. In addition to research, Peck also organizes the Green Design Apprenticeship program at CMU, which introduces secondary students in Allegheny County to sustainable engineering.

Consolazio Awarded Third Place in Trinidad and Tobago National Competition



PhD Student **Nizette Consolazio** and her advisor Associate Research Professor **Athanasios Karamalidis** were recently awarded third place in the Scientific Creative Solutions Competition in the Prime Minister's Awards for Scientific Ingenuity in Trinidad and Tobago.

In their entry, *The Fate of Biocides in Produced Water*, Consolazio tackles the need to understand the fate of chemical additives used for the extraction of oil and natural gas. Models currently used by the industry assume that these compounds do not react with the lithologies of the oil and natural gas formations, or that the reactions are the same as those observed at ambient conditions. Instead, the team proposed a process to determine the chemical reactions between additives and formation minerals for a specific drilling site. Their proposed process predicts whether chemical additives and their reaction products may contaminate air, water, or sediment.

In their 15th year, the Prime Minister's Awards for Scientific Ingenuity recognize outstanding accomplishments in science and technology focused on innovative and creative solutions to commonplace issues facing the people of Trinidad and Tobago. Consolazio, a citizen of Trinidad, studies the fate of hydraulic fracturing fluid additives in the Marcellus Shale, and is co-advised by CEE Professors Karamalidis and **Greg Lowry**.



EQUINOX

Carnegie Involvement Association (CIA) scored big at this year's Buggy. The Women's team – with a large CEE presence – took the first-place title for the first time since 1985!

The Men's team placed third and the team won the overall design competition.



The CMU Intramural Softball Championship winners! The two-time champs and CEE-stacked team were led by PhD student Eric McGivney. Congratulations!

Top: Shelly Hagerman (EPP), Brian Fisher (MechE), Patrick Sheehan, Erin Dauson, Chelsea Kolb, Rachel Browne. Bottom: Derrick Carlson, Andrew Hamann (EPP), Casey Caslin, Adam Cadwallader, Eric McGivney (Team Captain), Sam Markolf.



Giving Back at the Crossroads of South Texas

Over spring break, **Jessica Guo** (CEE '16) coled a team of 14 undergraduate volunteers, including two fellow CEE students, on CMU's Habitat for Humanity spring break trip to Victoria, Texas, where they helped to construct a one-story house for a local single mother and her family. The week-long experience offered students the opportunity to gain hands-on experience at a real construction site, while building connections across majors and disciplines.

"The thing I like about construction is that you go from having a plan, to seeing the final structure realized," says Guo, whose concentration is in Project and Construction Management. "I think getting a general sense of [this], and getting experience doing hands-on work in teams, was incredibly beneficial. It was great to be able to apply theory we've learned in the classroom to a real-life situation."

As co-leader of the trip, Guo was responsible for helping to assemble the project team, and was actively involved in fundraising prior to the trip. The team arrived on site during the early phases of construction; for five days, they built and moved trusses, cut and fit beams, and worked on waterproofing the house.

Joining Guo were CEE undergraduates **Amhad Khanzada** (BS '17) and **Stephanie Tian** (BS '17). The Texas project was their first trip with Habitat for Humanity but their classroom experience in CEE made it easy for them to quickly adapt to the construction site.

"The weather wasn't cooperating the week we were down there, and that directly affected the process and chain of events in terms of construction," says Khanzada. "In CEE, we talk a lot about how things have to be a process, and we saw that firsthand in Texas."

"I think just textbook learning can only go so far, and you have to bridge the gap in some way by getting out into the industry, and seeing what it's like in the field," adds Tian. "But even in the classroom, CEE is very team-based. We've learned how important it is to communicate. And there was a lot of group effort and communication that had to go on on the construction site."

For Khanzada, the experience also helped him to achieve greater focus in his own career.

"Before we went to Texas, I wasn't really sure what concentration I was interested in," he says. "I thought being directly involved in a construction project would help me understand this branch of civil engineering more." Now, he says that, like Guo, he too plans to concentrate in Project and Construction Management.

Founded in 2000, CMU's Habitat for Humanity chapter leads domestic winter and spring break trips, as well as local Saturday trips, to help fulfill Habitat International's goal of providing low-cost housing to those in need. Though construction isn't Tian's main focus, she sees the value in these kinds



Amhad Khanzada (BS '17), Jessica Guo (BS '16), and Stephanie Tian (BS '17)

of volunteering experiences from an engineering perspective.

"It's actually what inspires me as a civil engineer," says Tian. "I want to be able to serve the community in some way. I want to be able to create more beneficial and sustainable solutions for humanity. This was one small way to do that."

"I think that giving back is really important," Khanzada agrees. "As engineering students, we have this great technical knowledge. We have the opportunity to learn something beyond what most people are able to learn, so you are able to give back in ways beyond what most people can. And it's really important to share that with the community."



EWRI AT THE ESCAPE ROOM

Kang Awarded FAA Research Funding



PhD student **Minkyung Kang** was recently awarded a research grant as part of the Graduate Research Award Program on Public-Sector Aviation Issues for the 2015-2016 academic year.

This program, sponsored by the Federal Aviation Administration and administered by the National Academies, encourages applied research on airport and aviation issues. Her research is co-advised by Christiano Professor **Burcu Akinci** and Associate Professor **Mario Berges**.

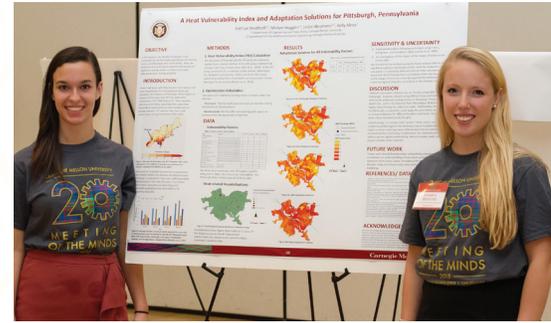
Kang's project, *Towards Robust Demand Response at Airports*, will look at how airport facility managers can capitalize on demand response, a voluntary program in which facilities better control energy costs by reducing their energy consumption during peak times. When energy grid reliability is threatened by heavy usage, non-essential systems can be switched into an energy-saving mode or turned off to lessen demand and reduce energy costs.

"We are very excited by the work that Minkyung is carrying out with the Pittsburgh International Airport and Honeywell," says Berges. "This award is further proof that her ideas are valuable and have the potential to impact the industry."

Her project will utilize machine learning techniques to evaluate demand response opportunities and develop optimal operation strategies for airports while also maintaining a comfortable environment for occupants. This research will not only bring energy cost savings from demand response programs, but also enable airports to prepare for higher electricity demand peaks caused by a growing number of passengers every year.

CEE/EPP Seniors Win Environmental Research Award at MoM

Katie Bradford (BS '15) and **Miriam Hegglin** (BS '15, MS '16) were awarded first place in the Meeting of the Minds (CMU undergraduate research conference in May) Environmental Research category. Their project, *A Heat Vulnerability Index and Adaptation Solutions for Pittsburgh, Pennsylvania*, sought ways to protect Pittsburgh's citizens from the heat.



Above: Hegglin (left) and Bradford (right)

most vulnerable populations.

The project started during an Engineering and Public Policy capstone class on Climate Adaptation for Pittsburgh taught by Dr. **Kelly Klima** (EPP) and was continued during the summer by Bradford as part of a Summer Undergraduate Research Fellowship (SURF) grant at CMU. The project team also included CEE/EPP PhD candidate **Leslie Abrahams**.

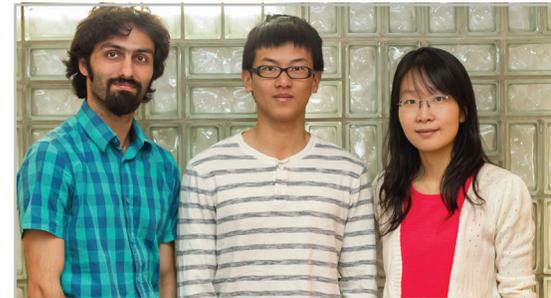
The research group focused on Pittsburgh's emergency response to expected increases in extreme heat events from climate change. Bradford and Hegglin predominantly focused on using GIS to map Pittsburgh's heat vulnerability in each census tract using an index retrofitted from various state's emergency plans. The heat vulnerability index included factors such as socioeconomic level, education level, age, disabilities, ethnicity, and living conditions. They then used the index to map potential cooling center locations for Pittsburgh's

CEE Research Team Awarded Conference Best Poster

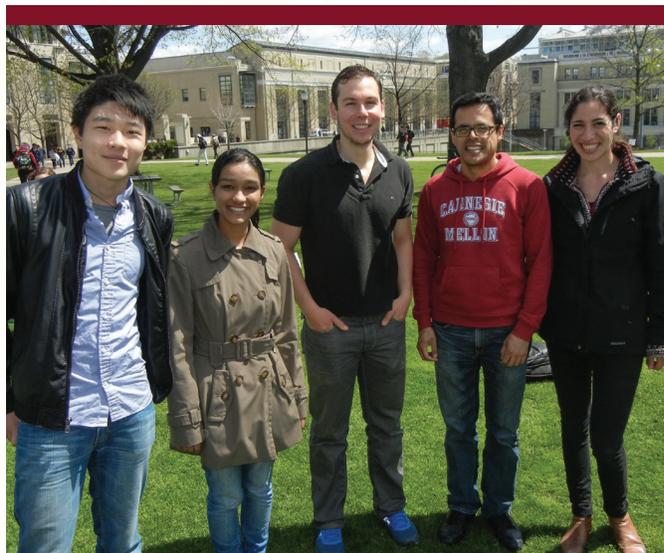
CEE PhD students **Mostafa Mirshekari**, **Shijia Pan**, **Adeola Bannis**, and **Yan Pui Mike Lam** with Professors **Pei Zhang** and **Hae Young Noh** were awarded a Best Poster Award at CPS Week 2015: Cyber-Physical Systems Week 2015 in Seattle, Washington.

Their research, *Step-Level Person Localization Through Sparse Sensing of Structural Vibration*, looks at how accurate indoor localization has the potential to transform the way people navigate indoors in a similar way that GPS transformed the way people navigate outdoors.

Their structural sensing-based indoor localization system utilizes the



measurement of ground vibrations from footsteps to locate a person. It is a non-intrusive and device-free system that will make it more suitable for smart structure applications, such as resources arrangement optimization and patient/customer tracking.



EARTH DAY 2015



Assessment Process Improves Wind-Turbine Maintenance

The operation of wind farms is an important consideration in the development of more sustainable forms of energy. The costs of operating and maintaining a wind farm, which account for 25-30 percent of the life cycle costs of the facility, can keep it from being a competitive option. This is because wind turbines are made up of highly instrumented electro-mechanical components that are subject to fatigue-induced degradation and aging.

Carnegie Mellon researchers — Assistant Professor **Matteo Pozzi**, Assistant Professor of Computer Science **Zico Kolter**, and CEE doctoral student **Milad Memarzadeh** — are working with Pennsylvania-headquartered EverPower Wind Holdings to overcome this challenge.

EverPower Wind Holdings is a developer, owner, and operator of utility-grade wind projects with four wind holdings in Pennsylvania. The team focused its research on the company's Highland Wind Farm in Cambria County, Pennsylvania, which operates 25 Nordex N-90 wind turbine generators that create enough electricity to power more than 15,000 homes annually.

The CMU team has developed an assessment tool to process the monitoring data of a wind farm, at the system level, that detects anomalies and predicts

the residual life of the components that are used in wind turbines. The goal is to eventually reduce the overall costs of manufacturing, operations, and maintenance. Their approach is based on probabilistic analysis using a Dynamic Bayesian Networks probability model and also using a partially observable Markov decision process.

“Being able to predict the residual life of mechanical components and to detect damages is of key relevance for wind farm operation,” explains EverPower Regional Asset Manager Kevin Wigell. “Downtime due to malfunctioning is a cause of relevant economic opportunity losses in the wind power industry. The Carnegie Mellon research team is helping us improve the effectiveness of our detection process.”

They focused specifically on developing a model that uses monitoring data for the turbine gearbox and yaw system (the component that helps orient the wind turbine rotor toward the wind), both of which have failure problems.

“We intentionally focused on wind farm systems because they are comprised of very similar components, so their information can be processed at the system level,” says Pozzi. “This allows us to now work on adapting the process we have created for assessing the gearbox to also assess other turbine parts.”

McNeil Elected as ASCE Distinguished Member



CEE alumna **Sue McNeil** (PhD '84) has been honored by ASCE for contributions as an outstanding leader in the engineering profession by being named to the 2015 Class of Distinguished Members. McNeil is a professor of civil and environmental engineering and of urban planning and public affairs at the University of Delaware and studies how people make decisions about building, rebuilding, or renewing infrastructure such as roads, bridges, and wastewater management systems – and how natural disasters and hazards impact those decisions.

McNeil was an early leader in sustainable thinking and brownfield development, and a pioneer in the field of infrastructure systems asset management. Her election as a Distinguished Member of ASCE recognizes this work and her work with brownfield development in Pittsburgh, which has become a model for revitalizing aging cities around the world.

Alumna Joins Newly Formed Oil and Gas Technical Advisory Board



The Pennsylvania Department of Environmental Protection (DEP) has named CEE alum **Barbara Kutchko** (PhD '08) to its Oil and Gas Technical Advisory Board (TAB). TAB's mission is to increase transparency and communication about regulating the unconventional oil and gas drilling industry and will be helping the DEP draft regulations for the oil and gas industry.

Kutchko is a senior research scientist with the National Energy Technology Laboratory (NETL) specializing in wellbore isolation, oil well cementing, and subsurface materials characterization. She works with oil and gas companies, government agencies, and universities to evaluate current cementing practices and research needs to ensure the safe placement of cement related to offshore drilling, shale gas production, and carbon storage. This includes leading and collaborating with teams of diverse researchers, professors, students, and industry experts to plan, manage, and execute research related to energy production.



The Award for Distinguished Career in Engineering Sciences was presented to Ram D. Sriram (r) by Steven Fenves. (Photo by Al Teich)

Sriram Honored by Washington Academy of Sciences

CEE alum **Ram D. Sriram** (PhD '86) was awarded the Distinguished Career in Engineering Sciences award from the Washington Academy of Sciences. This award was presented to Sriram at the academy's annual awards banquet by CEE University Professor Emeritus **Steven Fenves**.

Sriram has extensive experience in developing knowledge-based expert systems, natural language interfaces, machine learning, object-oriented software development, life-cycle product and process models, geometrical modelers, object-oriented databases for industrial applications, health care informatics, bioinformatics, and bioimaging.

He is currently the chief of the Software and Systems Division, Information Technology Laboratory, at the National Institute of Standards and Technology (NIST). Before joining the Software and Systems Division, Sriram was the leader of the Design and Process group in the Manufacturing Systems Integration Division, Manufacturing Engineering Laboratory, where he conducted research on standards for interoperability of computer-aided design systems. He was also the manager of the Sustainable Manufacturing Program.

Prior to joining NIST, he was on the engineering faculty (1986-1994) at the Massachusetts Institute of Technology (MIT) and was instrumental in setting up the Intelligent Engineering Systems Laboratory.



Several CEE alumni got together and sent us this great photo of themselves at their Clark Construction Group, LLC meeting in Washington, D.C.

Alan Vurgait (BS '14), Michelle Cousté (BS '15), Jared Maurer (MS '15), Kyle Waltersdorf (BS/MS '14), Hannah Leavenworth (BS '13), and Rachel Browne (BS '14, MS '15)

Eye on the Prize: Alum Engineers His Future

When **Chris Watts** (BS '08) enrolled in Carnegie Mellon University's College of Engineering as an undergraduate in 2004, he had no idea that in less than 10 years he'd be sitting on the President's Council on Fitness, Sports & Nutrition. But that's just one of the high-profile appointments he's had since breaking into the social sector of the sports industry.

"I wanted to take the thought process and the values that make you a successful engineer, and apply those to something that I was passionate about and that would make a positive impact on society," he says.

For Watts, a former member of the CMU varsity soccer team, that something was sports and fitness.

Deciding to explore this passion in the business sector, he applied in 2010 for an MBA in Strategy, Entrepreneurship, and Social Responsibility at George Washington University. Immediately, the director of the program invited him to South Africa to study the impact of Fédération Internationale de Football Association (FIFA) and its sponsors during the World Cup.

Though he had no experience in the field, his passion drove him to take the leap. "I realized, I just have to do it," he says. "I knew what I wanted. I had to just start."

The risk paid off.

When the President's Council reached out to the university in search of fellows, Watts' advisor recommended him for the appointment. Before he started his first semester of graduate school, he was named a consultant on the President's Council on Fitness, Sports & Nutrition and in May he was named the new executive director of the National Foundation on Fitness Sports & Nutrition.

Watts is now the managing director of 4POINT4, a sportswear and technology start-up that offers customized sports apparel and equipment to teams and organizations, while donating a percentage of every sale to programs committed to supporting healthy communities. "We want every athlete to play for a cause, to play more than the game," Watts explains.

This work may seem a far cry from the world of engineering, but Watts says his experience as a CEE student was integral to his success.

"The reason I'm in this field now I attribute 100 percent to my time at CMU," he says. "That idea they instill in every student, to put your heart in your work. It's a major part of whatever school you're involved in, whether it's drama or business. And that's what inspired me to make the transition to pursue the career I'm in today."

Now based in Washington, D.C., the Pittsburgh native says he tries to make his



Watts pictured with Michelle Kwan — former Olympic figure skater, U.S. State Department senior adviser for public affairs, and member of the President's Council on Fitness, Sports & Nutrition — and former Secretary of State Condoleezza Rice.

hometown a part of everything he does. Through 4POINT4, Watts has connected with several Pittsburgh-based start-ups, including Athlete Tracks, an organization that creates team management software, and THREAD, a social enterprise that employs Haitians to collect used plastic bottles and turn them into fabric.

He's certainly come a long way, but Watts says that his CEE background still informs his professional life on a daily basis. "I may not be mapping out groundwater solutions anymore, but it's still the same process," he says. "Understanding and evaluating a situation, identifying the problem, and breaking down steps to solve it."

Dominioni to Direct DRBA Environmental and Safety Efforts



The Delaware River and Bay Authority (DRBA) has named CEE alumna **Silvana Dominioni** (MS '99) as the new DRBA superintendent -- environmental compliance and safety.

"The Authority is a diverse and complex organization with a unique combination of facilities, operations, and assets," Dominioni says. "I appreciate the Authority's confidence in my ability to review current policies and procedures, identify areas for improvement, and develop new programs that will enhance workplace safety and ensure

environmental compliance. I look forward to using my knowledge and expertise in this field to have a positive influence here at the Authority."

Dominioni will develop and implement DRBA's safety and environmental policies, procedures, and programs to address workplace hazards and ensure environmental regulations and standards compliance.

Prior to joining the DRBA, Dominioni served as the safety, environmental and security manager for Mars Drinks North America and as the environmental and IH manager for AstraZeneca Pharmaceuticals.

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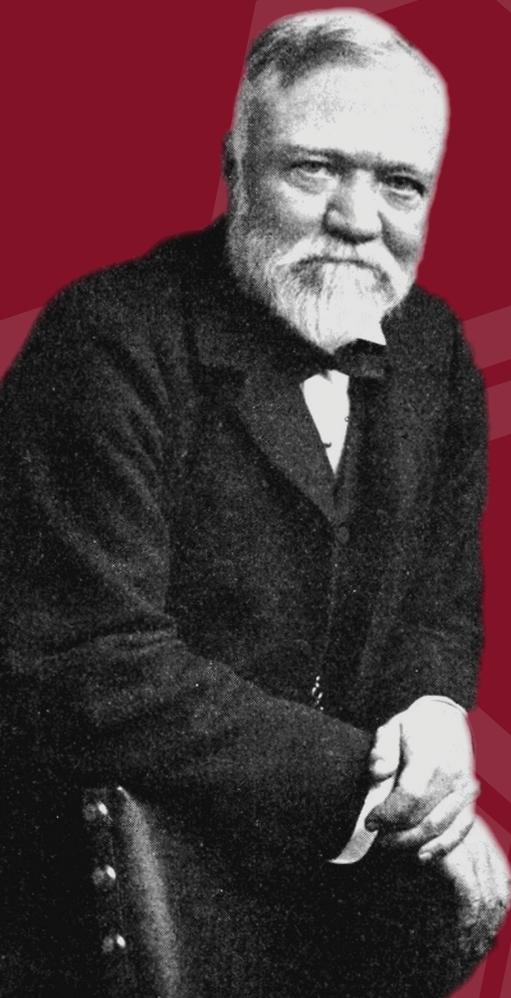
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